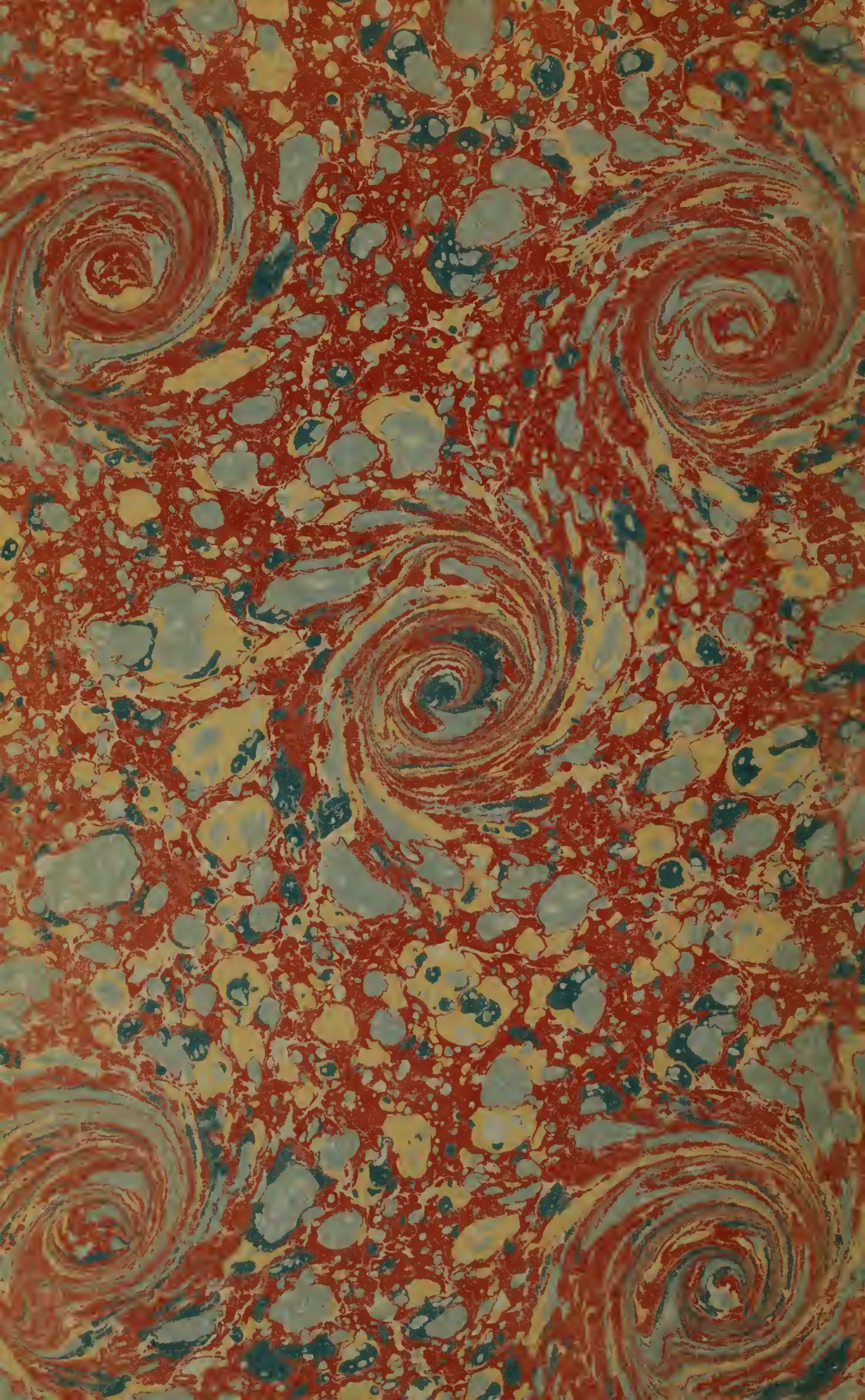

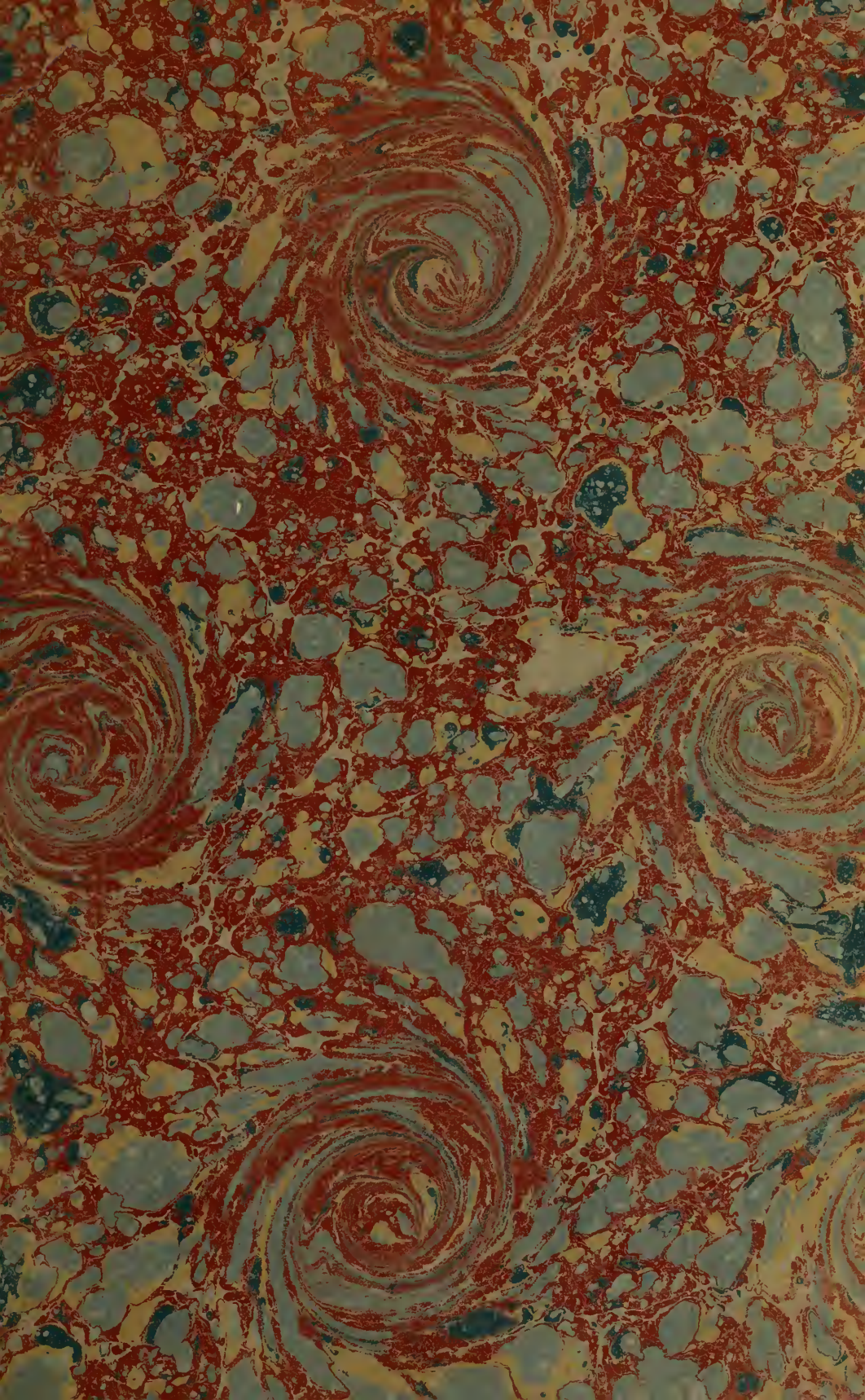

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W. S. Millard

1923

JOURNAL
OF THE
BOMBAY
Natural History Society.

Vol. XVI. BOMBAY. No. 4.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

ILLUSTRATED BY COLOURED PLATES AND DIAGRAMS.

BY CAPTAIN F. WALL, I.M.S., C.M.Z.S.

Part I.—With Plate I and Diagrams I, II and III.

This and the succeeding articles with their accompanying plates and diagrams are designed to acquaint our readers with the common snakes of India. There is no book on the subject written in popular language and the few that show coloured plates are very expensive, while accuracy of detail seems to have been largely sacrificed for pictorial effect.

If our object can be achieved, and normal specimens easily recognized, we hope that many lovers of natural history may be encouraged to make and record observations on the habits of these creatures, for the letter-press will, I fear, only too soon reveal the dearth of knowledge in this direction even with regard to the commonest kinds.

The descriptive parts of the best works are couched in terse and scientific language, and though excellently written by experts in museums the authors have had no facilities for observing the habits of creatures they only see in spirit on museum shelves. We must, therefore, rely upon those who actually come into contact with living snakes to supply such information.

It will be my aim to word these articles in unscientific language, especially with reference to the important matter of identification. Here, if technical terms must be used, they will be explained by outline drawings. The final description cannot be so treated, and being incorporated for the sake of completeness, is intended for those conversant with the subject.

I shall not attempt to treat the subject exhaustively, as it seems to me a more useful purpose will be served by dealing with the commonest and most widely distributed species. Where a resemblance exists between two or more species, especially where one is poisonous and the others harmless, they will be shown together and an attempt will be made to frame easy rules whereby they may be distinguished, but here I must repeat what I have said in previous papers in this Journal, *viz.*, that of all fallacious methods of identifying snakes, the usual one adopted with relation to colour and markings is the most unreliable. Attention must be given to the arrangement of the scales and shields.* We must again appeal to our readers to render every assistance by procuring living specimens without which the true colouring cannot be shown by our artists.

The plates will show only a few inches in the middle of the body, in preference to a full-length drawing which would necessarily be on too small a scale in many cases to show the detail required for identification. Our first plate represents the common green pit viper (*Lachesis gramineus*), and the common green whip snake (*Dryophis mycterizans*).

Before describing our first snake I think it advisable to make a few remarks on vipers in general so as to indicate their position in the snake world, and the relationship of this to other vipers.

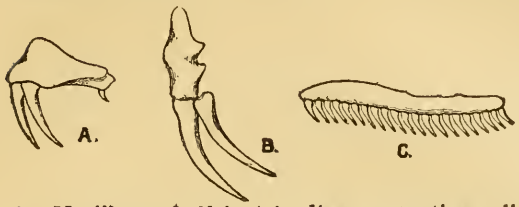
The word viper is derived from the Latin *vivus* alive and *pario* I bring forth, in reference to a method of birth unusual among ophidians, but not peculiar to this family.† Among our Indian representatives the true fresh water snakes (*Homalopsidæ*) and the sea snakes (*Hydrophiidæ*) also produce young.

It is probably this viviparous habit which has led to the belief still hard to dispel from credulous minds, that vipers protect their young by swallowing them. A pregnant mother approaching parturition is killed, and living young found within her, or observed to escape from her: the erroneous conclusion is drawn that these must have been swallowed, especially as it is popularly understood that snakes produce eggs.

* Every scale of sufficient size and constancy to deserve a special name is called a *shield* technically. The word *scale* is used technically to designate small and numerous forms such as those on the back.

† The rule that vipers are viviparous is not absolute. Two African species are known to be oviparous, *viz.*, *Atractaspis irregularis* and *Causus rhombeatus*, and one South American species, *viz.*, *Lachesis mutus*. It is quite possible, too, that some Indian representatives may evince a similar habit. (Since writing the above Mr. G. A. Miller has conclusively shown that *Lachesis monticola* is oviparous in habit.—*Vide* B. N. H. S. Journal, Vol. XV, p. 729.)

I am not infrequently asked what is a viperine and what a colubrine snake.* The distinction lies in the shape of the maxillaries, or upper jaw bones, which in all vipers are shorter in their antero-posterior than in their vertical direction. They thus resemble short stumpy pillars set up on end in the front of the mouth on each side (see fig. B) and form part of an arrangement, governed by simple and beautifully devised muscular apparatus which permits the maxillary and fangs as a whole to be swept forwards and backwards. The fangs of vipers which like all fangs are situated in the maxillary only, are long and pierced by a minute canal which opens anteriorly near the tip. They are curved backwards, and when the jaws are closed, the maxillaries are inclined backwards, so that the fangs lie along the plate with their points sloping upwards. In the act of striking, the jaws are widely opened, and the maxillary is swung so far forwards that the fang or fangs (for they may be multiple) fixed in it may assume a forward direction. It will easily be seen how this range of movement augments the facility with which a penetrating wound is inflicted. In addition to these peculiarities in shape and mobility, a third point may be mentioned, *viz.*, that the viperine maxillary supports fangs only, and never any ordinary solid teeth. In all colubrine snakes, *i.e.*, all snakes non-viperine, the maxillary is firstly so shaped that the antero-posterior axis (or in the blind snakes *Typhlopidæ* the transverse axis) is much longer than the vertical (see figs. A and C), secondly it is immovable, and thirdly in the poisonous colubrine snakes (cobras, kraits, etc.) its armament is supplemented with one or more solid teeth.†



A.—Maxillary of *Naia tripudians* supporting solid tooth behind fangs.
B.—Maxillary of *Vipera russellii*.
C.—Maxillary of *Coluber radiatus*.

All vipers are poisonous, but not to an equal degree, for though some inflict a wound which is usually fatal, others do not cause death, and in some the effects of the poison are trifling.

There are at least 105 kinds of vipers known to science which are grouped together into one large family (*Viperidæ*). This is divided into

* Gray in his work Snakes of the British Museum, 1849, divided snakes into two suborders viperine and colubrine, and these terms have remained in use.

† Except in the two genera *Callophis* and *Doliophis*.

two sub-families distinguished by the presence or absence of a pit in the side of the face between the eye and nostril, a trait in the physiognomy too conspicuous to overlook, though the casual observer may mistake it for the nostril, which latter should be sought for as a minute orifice on the side of the snout in advance of the pit. This opening is called the loreal pit owing to its being located in that region which in birds and other creatures is called the lore. It leads into a blind rounded chamber in the maxillary, and is lined with the same covering which overlies the scales on the face, so that when the creature sheds its skin, a perfect cast of the chamber is thrown off with the slough. Its function has not yet been determined.

Vipers having no such pit are classed under a separate sub-family, *Viperinæ*, and may be called pitless vipers in contradistinction to the *Crotalinæ* or pit vipers. This latter sub-family derives its name from the Greek word "*krotalun*," a rattle, its prototypes being the world-renowned rattlesnakes of the American continent. It comprises four genera, two of which are peculiar to America, and two *Lachesis* and *Ancistrodon*, though not peculiar to, are well presented in India and its dependencies. *Lachesis*, to which our first snake belongs, is separated from *Ancistrodon* by having on the head mainly small shields similar to those on the creature's back.

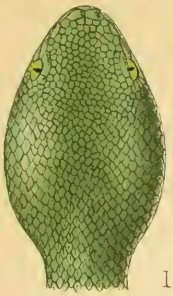
THE COMMON GREEN PIT VIPER.

Lachesis gramineus. [1]

The genus *Lachesis* is a large one comprising forty-one known species which inhabit Asia and America. Of these eighteen are peculiar to Asia, and ten come within our Indian limits.

Nomenclature (*a*) *Scientific.* Lachesis, from whom the generic name originated, was one of the Parcæ or Fates of Grecian mythology who with Clotho and Atropos controlled man's destiny. Our readers who are conversant with ophiology may be more familiar with the genus under its older title *Trimeresurus.**

* This name was introduced by Lacépède. He divided land snakes into three groups, according to the arrangement of the shields beneath the tail. In some these pass uninterruptedly from side to side exactly like those on the belly. In the majority of snakes, however, they are divided in the median line by oblique alternately directed sutures so as to form a zigzag line. Rarely it happens that some of the first and some of the last shields are divided, whilst some intervening ones are undivided. To this category he applied the name *trimeresurus* from the Greek words "*treis*" three, "*meros*" part, "*oura*" tail. The name once created was perpetuated, and as time went on, and snakes were classified differently, it became applied to this genus to which it is quite inappropriate, for the shields beneath the tail are divided throughout.



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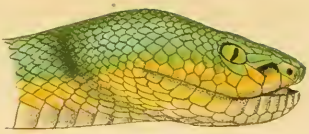

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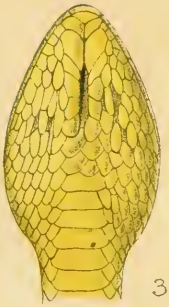

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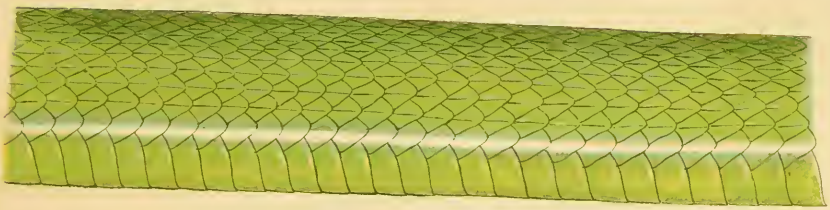

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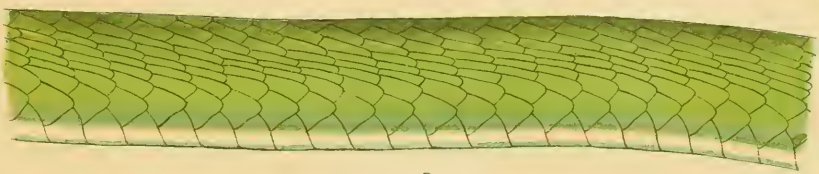

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J. G. del. J. Green, Chromo.

TWO TREE-SNAKES.

Lachesis grammeus (poisonous) Nos 1 to 4.
Dryophys mycterizans (harmless) Nos 5 to 9.

Gramineus, the specific name, is derived from the Latin "*gramen*" grass, in reference to its verdant coloration.

(*b*) *English.*—The common green pit viper is, I think, the best English name for it, but bamboo snake as used in Hongkong, and I believe in Assam, seems to me very appropriate.

(*c*) *Vernacular.**—Russell makes mention of it under the name of "bodroo pam" which natives at Vizagapatam on the East Coast of India call it. The Burmese call it "mywé sein," meaning "green snake." Mr. S. S. Flower† says it is called in Siam "ngu kheeyo," which means "green snake," and Cantor says the Malays know it as "ular daun" "leaf snake."

Dimensions.—The largest specimen is, I believe, that recorded by Veterinary Captain (now Veterinary Major) Evans and myself from Burma. It taped three feet eight inches but was quite a phenomenal specimen. Average adults vary from about two to two and-a-half feet.

Bodily configuration.—The head is flattened, and appears unduly broad behind owing to the pronounced constriction of the neck.[2] The body is stouter than in most snakes, and the tail tapering rather rapidly is short and prehensile, measuring usually about one-sixth to one-fifth of the total length. The females, as is the rule with snakes, have shorter tails and fewer shields beneath (sub-caudals).

Colour.—This is usually a dull uniform verdant green above, rather darker on the head and in old specimens. Underparts glossy white, yellow or green. Upper lips, chin, and throat enamel white, or bluish, or buff, or yellow, or greenish, these colours variously distributed in different individuals, and in different parts of the same individual. A well-defined white or bluish or yellow narrow line runs along flanks from neck ending some distance along the tail. Tail yellowish or reddish often mottled with darker hues. The eye, which is lateral and has a very slight inclination forwards, exhibits a beautifully golden iris, in the centre of which is a black vertical pupil. Sometimes there are black or blackish markings on the back with a tendency to arrange themselves into indistinct crossbars. Sometimes the prevailing colour is yellowish or olivaceous rather than green. Mr. W. S. Millard in a letter to me mentions one such specimen from the vicinity of Darjeeling. "It was warm, yellowish, olive-brown above, and bright yellow beneath."

* Ind. Ser., Vol. 1, p. 13, plate IX.

† Proc. Zool. Soc., Lond., May 16th, 1899, page 695.

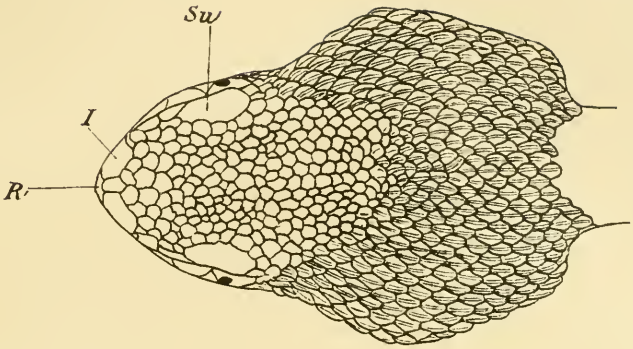
It was sent to the British Museum, and identified by Mr. Boulenger as a colour variety of this species.[3] Sometimes the flank line is inconspicuous or even wanting. The green colour is imparted to the spirit in which specimens are preserved, and accounts probably for the change of colour which they undergo in this medium, approaching blue rather than green.

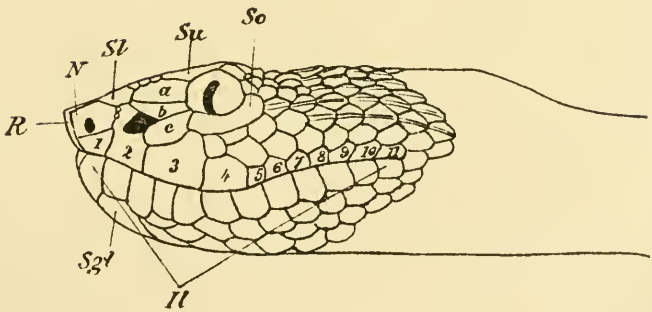
Identification.—This is easy. Any grass green snake with a vertical pupil like the domestic cat's must be either *Lachesis gramineus* or *L. purpureomaculatus* or *L. macrolepis*. The loreal pit will confirm this diagnosis. To distinguish between these snakes count the rows of scales over the back in the posterior part of the body. In *gramineus* they number fifteen normally, sometimes seventeen ; in *purpureomaculatus* they are nineteen normally ; and in *macrolepis* eleven or ten. (To do this, turn the creature on its back, and seek for the vent, a transverse aperture in the hinder parts. This marks the junction of the body and tail. Count at a spot two heads lengths in front of this.)[4]

Haunts.—It usually frequents low vegetation, selecting a hedgerow or tangle of bush, but shows a marked preference for bamboo in localities where this flourishes. Sometimes it is encountered in grass, and Theobald mentions having found one in the caves near Moulmein in Lower Burma, and another on limestone rocks on the ground. Mr. S. S. Flower* records one coming into a house, and Captain Evans and I have known a similar intrusion in Burma where one was killed found lying, along a beam in a native hut having swallowed a sm all rat. Günther † mentions it hanging from branches of trees, but I think it is more usually to be seen reclining among branches close to the ground (say nearer four than eight feet). Mr. Hampton tells me that in captivity they spend most of their time on the branches provided for them, and seldom descend except at night. During the winter a few retired under blankets, but the majority remained huddled together on branches. Whether in grass or in bush its colour harmonises so perfectly with its environment that it is usually not discovered until seen to move.

Disposition.—Günther ‡ speaking of the genus alludes to their sluggish habits, and says they sometimes make no attempt to move out of one's way. Later the same author says: "When roused these snakes are extremely fierce, striking at everything within their reach." Mr. Gerhardt in a letter to me writes: "They are very sluggish, and allow

* Proc., Zool. Soc., Lond., May 16th, 1899, page 696. † Rept., Brit. India, p. 386(1863-64).
‡ „ „ „ p. 384.





I.	*Internasal*	*Sgl.*	*Sublingual*
Il.	*Infralalabials*	*So.*	*Subocular*
N.	*Nasal*	*Su.*	*Supraocular*
R.	*Rostral*	*a.b.c.*	*Praeoculars*
Sl.	*Supraloreal*	*1-11.*	*Supralabials*

LACHESIS GRAMINEUS.

THE COMMON GREEN PIT-VIPER.

× 1½

CORTEZ & CO. LITH BOMBAY.

one to take them off the bush with a stick." Russell* says of one brought in to him "it looked fresh, and lively, and was very alert, hissed and snapped at everything opposed to it." Mr. Hampton says in a letter: "I consider it to be a very sluggish, harmless poisonous snake." He continues: "When a match is struck in front of the cage at night, or a lamp is suddenly brought in front of the cage, they will strike at it. They seem to be very hardy in captivity; some presented to the Zoological Society in 1886 by Mr. Bligh of the P. W. D., Burma, are still alive and well, I hear from two sources." Stoliczka says, speaking of specimens he had encountered near Moulmein: "All were very sluggish and did not make the slightest attempt to escape when approached, and even allowed themselves to be removed from the top of the plant. Neither did they offer to bite unless when pressed to the ground with a stick; but when thoroughly aroused they turned round and bit furiously."

Food.—Its diet consists of small vertebrates, but some partiality is shown towards mammals.

Günther† observes that it feeds on small birds and frogs. Mr. S.S. Flower‡ mentions lizards, and Cantor says it preys on small birds and tree frogs, but occasionally descends to the ground in search of frogs and toads. Mr. Gerhardt writes to me he has only known them eat musk rats (*i.e. Crocidurœ*). Major Evans, A. V. D., in a letter to me says he has known them eat a musk rat or shrew, a field mouse, a field rat and a lizard (*Calotes mystaceus*). Mr. Hampton writes to me: "Rats are its principal food in captivity," but he has known them eat a tree shrew (*Tupaia*), and on one occasion two moles. When hard up, he says, they eat frogs, and he has known a snake (*Lycodon fasciatus*) to have been eaten on two occasions. I have records of a musk rat being ingested once, also a rat, and I saw a specimen in the Hongkong Museum in the act of swallowing a small bird. Mr. Millard writes to me: "We find them feed readily in confinement on small rats, mice, birds, and lizards."

Breeding.—The only information I can get in this direction is from Mr. Hampton, who says they produce from seven to twelve young at a time. I have examined a specimen which contained 11 eggs, 6 in one ovary and 5 in the other. They were immature, showing no trace of embryos, and were closely packed so that their longest diameters lay vertically.[5]

* Ind. Serp., Vol. 1, p. 13. † Rept., Brit. India, p. 386.
‡ Proc. Zool. Soc., Lond., Pt. III, 1899, p. 696.

Striking.—When provoked to strike this viper attaches itself firmly by wrapping its tail and hinder body round a branch, and then with retracted head, the forebody freed, and thrown into a broad S it thrusts vehemently forward with open jaws as far as the straightening of the body permits. Mr. Millard in a letter says: "They always retain a hold of their prey after once striking it." Mr. Hampton writes to me that in captivity they wait until their prey passes beneath them, then strike and hold it in the air until dead, or haul it on to the branch and then swallow it.

Mr. Millard in another letter writes: "I cannot find any one who has ever heard them hiss." Possibly the hiss is too subdued to attract much attention, for Russell in a passage already quoted mentions this snake hissing, and Gunther speaking of the genus says "that they vibrate the tail, and utter a faint hissing sound."

Poison.—Accounts of the virulence of its poison all agree in ascribing to it a decidedly feeble action on man. Gunther*speaking of the genus says: "Numerous cases are on record which show that the symptoms indicating a general effect on the system were of short duration extending only over the space of from two to forty-eight hours, and confined to vomiting, nausea and fever. After the pain and swelling of the bitten member or spot have subsided, the vicinity round the wound becomes discolored, mortifies, and is finally thrown off as a black, circular slough, after which health is speedily restored. The bite of larger specimens from 2 to 3 feet long is more dangerous and has occasionally proved fatal." Nicholson† says of the genus "their bite produces local pain and swelling, but no toxic symptoms."

Russell ‡ says the peasants who brought it in, affirmed that its power of killing extended only to the smaller animals, not to dogs or sheep; and that to man its bite caused various disorders, but never death. He substantiates this by experiment: a chicken died, but a dog and a pig, though very ill, did not succumb. Mr. Millard told me that the Revd. F. Dreckman, S.J., who is well acquainted with these snakes, was bitten in the finger by one, and suffered very little pain and inconvenience. Major Evans, A.V.D., gives me three instances in his knowledge where men were bitten, and in all cases they recovered. The Burmans, too, assured him when he narrowly escaped being bitten by one in jungle, that its bite would not have proved fatal. Mr. Hampton has also

* Rept., Brit. Ind., p. 384. † Ind. Snakes, pp. 144-5.
‡ Ind. Serp., Vol. 1, p. 14.

known cases of men bitten by this snake, but never a death in consequence. On making enquiries at the Civil Hospital in Hongkong in 1901 I ascertained that no case of snake-bite had ever been treated in that institution, and as this snake is quite one of the commonest in that locality, this circumstance adds weight to the accuracy of the above remarks.

Distribution: (*a*) (Geographical).—Its range of distribution is a large one, extending from the Western Ghats of India through Burma, the Malay Peninsula (including Siam and Cochin China), the whole Malayan Archipelago to Southern China and Formosa on the one hand, and from the Himalayas through the peninsula of India as far South as the Cauvery river. The most southern record I can find is the Wynad (Madmailey). It is not recorded from Ceylon, and Mr. Ferguson, who has collected reptiles for fifteen years in Travancore, writes to me that it is unknown in that territory. I can find no record of its occurrence in the Nilgiris, Anamallay, and Palneys.

(*b*) (Local).—In India it is, I believe, not found in the actual plains, except in the Sunderbunds, but always at some altitude about 1,500 feet and upwards, and is generally regarded as a hill snake in the Peninsula. In Burma and Further East it is met with frequently at or near sea level, as well as being found in upland regions.

(*c*) (Numerical).—Though it cannot be considered a common snake in the sense that the dhâman (*Zamenis mucosus*) and paddy-field snake (*Tropidonotus piscator*) are, it is by no means uncommon in many localities. From Mr. Millard and Mr. Gerhardt I gather it is plentiful on the Western Ghats near Bombay (Karli and Khandalla), and Mr. Millard remarks that though common thereabouts up to the end of October, they are not seen after the middle of November. Anderson* says: "It appears to be a common snake in the tropical valleys below Darjeeling, where it is usually found at an elevation of 2,000 feet." Stoliczka says it appears common in the Khasi Hills and Assam, and also near Moulmein in Lower Burmah. He mentions he never observed it in the interior of the North-West Himalayas. Mr. Hampton, writing from Burma, says he has had scores of them. Out of 694 snakes collected by Captain Evans and myself from all parts of Burma in 1899-1900, 18 were of this species. Mr. Flower describes it as being fairly numerous about Bangkok, and both he and Stoliczka record it as the commonest *Lachesis* in Penang and the Province Wellesley, but say it is rare

* Proc. Zool. Soc., Lond., 1871, p. 194.

at Singapore. I found it a common snake about Hongkong, but it appears to be a rare snake as far north as the Yangtse Valley in China.

Description.—Rostral in contact with 5-7 shields, the sutures made with the nasals being three to four times those made with the first supralabials. *Internasals* one pair, sometimes in contact behind the rostral, sometimes separated in front by one or two scales. *Supraocular* a single well developed shield each side. *Nasal* normally undivided; frequently more or less confluent with the first supralabial; frequently more or less separated from second supralabial by one or more minute intercalary scales. *Supraloreals* usually single, and not in contact with the internasals. *Præoculars* three. The two lowest, divergent forwards, bound the loreal pit. *Suboculars* crescentic, may or may not touch the third supralabial, one or two rows of scales between it and fourth supralabial. *Temporal* smooth or shaped like the carapace of a tortoise, never truly keeled. *Supralabials* nine to twelve; the second with a groove in the upper half sloping into the loreal pit; none touch the eye. *Sublinguals* one pair. *Infralabials.*— The first form a suture behind the mental; first, second, and usually the third also, touch the sublinguals. *Scales* two heads lengths behind the head 21 (rarely 20—19); midbody 21 (rarely 23 or 19); two heads lengths in front of vent 15 (rarely 17 or 13). Apices very acuminate. Last row much largest. Keels narrow towards tips of scales, and present in all the rows, except the last, for a variable extent anteriorly. *Supracaudals* in even numbers of rows, keels faint till lost in the sixes. *Ventrals* 145—175 (Boulenger). *Anal* entire. *Subcaudals* 53—75 (Boulenger) divided.*

THE COMMON GREEN WHIPSNAKE.

Dryophis mycterizans.

Nearly all the snakes that enjoy an arboreal existence are conspicuous for their beauty. Their graceful bearing, shapely proportions, and the richness and combination of the colours that adorn them combine to amply justify their being ranked among the most beautiful of living creatures.

The common green whipsnake, which may be taken as the type of the genus, forms no exception to this rule. In colour and markings it very closely resembles the green pit viper, and is on this account shown with it in the first plate; however in most other characteristics the two

* Stoliczka in J. A. S., Ben. Vol. XXXIX, (3), 1870, p. 217, mentions a specimen with the 5th and 6th entire, and another in same paper, p. 221, with 3rd and 7th entire.

are widely different, and if proper attention is directed to the arrangement of the shields and scales no confusion of the two is likely to be made.

Nomenclature: (*a*) *Scientific.*—The generic name is derived from the Greek "*drus*," a bush, and "*ophis*," snake. The specific designation is from the Greek "*mucterizo*," I turn up the nose, and refers to the character of its snout.

(*b*) *English.*—The common green whipsnake is the name it is familiarly known by, and is very appropriate.

(*c*) *Vernacular.*—In India it is known by the Tamils as "kānkūttee pamboo," meaning "eye-poking snake"; and "pachai pamboo" or "green snake."

On the Malabar Coast it is called "pāchola pāmbu," which means cocoanut leaf snake. In Telegu it is called "pasarika pāmoo," meaning green snake, "botla pasarika," spotted green snake, and "pastiletti" (Russell). In Ceylon the Singhalese call it "ehetula" or "esgulla," which Mr. E. E. Green writes me means eye-plucker, *i.e.*, "ehe," plural "es" = eye, and "ugulanawa" = to pluck out. In Burma it is known as "mywé sein," *i.e.*, green snake, and "mywé sein myé she," long-tailed green snake. Mr. Flower says it is called "nga kee-o pah-king-kop" by the Siamese. Both Burmese and Siamese apply these names equally to *Dryophis prasinus*, and the Burmese also to *Coluber prasinus* and *Lachesis gramineus*.

Dimensions.—My largest specimen taped 5 feet 7½ inches, but a more usual length for adults is between 4 and 5 feet. Gunther and Theobald say it grows to more than 6 feet. Günther* says it appears to remain smaller in Ceylon, and mentions 40 inches as the largest measurement known to him from that island. The young when born, according to a note by Mr. Ferguson † at Travancore, taped 17 inches. Mr. E. E. Green,‡ however, speaking of a Ceylon specimen, said that its young were 350 mm. (*i.e.*, 13⅞″) at birth. These measurements seem to substantiate Günther's observation.

Bodily configuration.—The head, which is long and narrow, ends in a fleshy pointed snout, and a prominent elevated ridge extends from this to the eyebrow. The eye, which is set laterally, has also a decided inclination forwards. The iris is a beautiful bright golden colour throughout. The pupil is horizontal and elongate in outline with a

* Rept. Brit. Ind., p. 306. † Bom. N. H. Soc. Jour., Vol. X, p. 6.
‡ Spolia Zeylanica, Vol. I, Pt. II, June 1893, p. 1.

slight constriction near its middle. This horizontal outline endows this snake with a very remarkable range of vision. The forward setting of the eye, together with its elongate pupil, and the pronounced furrow in the face in front permit an unrestricted range of vision anteriorly, and the elongation forward of the pupil also admits of rays of light impinging upon the retina from a point far behind the eye. Proximately I estimate the range of vision as extending through an arc of 330°.

The neck is markedly contracted, and the body, which is very slender throughout, exhibits a maximum calibre about its middle, and attenuates in both directions. It is smaller in its lateral than in its vertical measurement (*i.e.*, compressed). The tail tapers very gradually, and is longer relatively in this snake and its allies than in any other varieties, measuring more than a third of the total length. The whole snake in its tenuity of outline resembles the lash of an English carriage whip; hence its familiar name.

Colour.—The upper parts of head, body, and tail are bright verdant green, the surface of the scales dull. The ridge from the eyebrow to the snout is usually pale-green or yellow. Under ordinary circumstances no other colouration is apparent, but when under excitement the creature expands its body it brings into view alternate streaks of black and white (bluish in young specimens), which are directed obliquely downwards and backwards from the vertebral region. These are most apparent in the anterior two-thirds or so of the body, and upon close inspection are seen to be mainly produced by the colour of the skin between the scales; however the lower borders of the scales themselves are also narrowly tipped. A well defined narrow white or yellow line runs along the entire body flank on the sides of the ventrals, and ends at a variable distance along the tail. The chin and throat are white or blue, sometimes mottled yellow to a variable extent. The belly is an intensely brilliant green, of a hue distinctly lighter than on the back, and resembles the delicate shade seen in some freshly opened foliage, such as the mango or bamboo. A greenish colour is imparted to the spirit in which the specimen is preserved. Very rarely specimens are met with in which the colour is khaki, or olive brown. Another rare colour variety is mentioned, and figured by Russell,* in which the belly is cinereous grey between the flank lines, the rest of the snake being

* Ind. Serp. Vol. I, Pl. XIII.

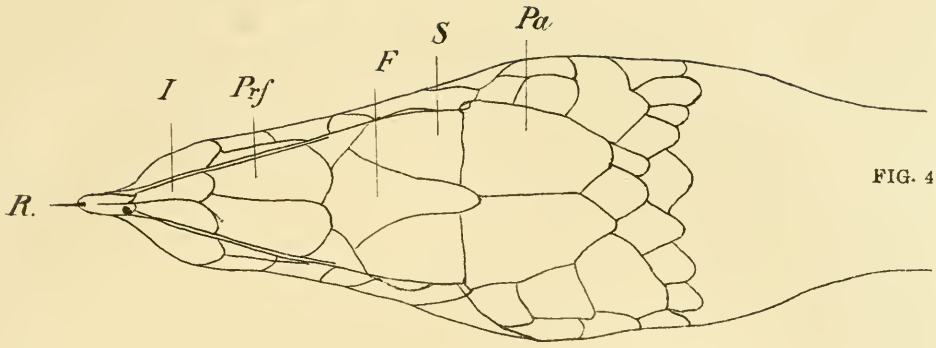


FIG. 4

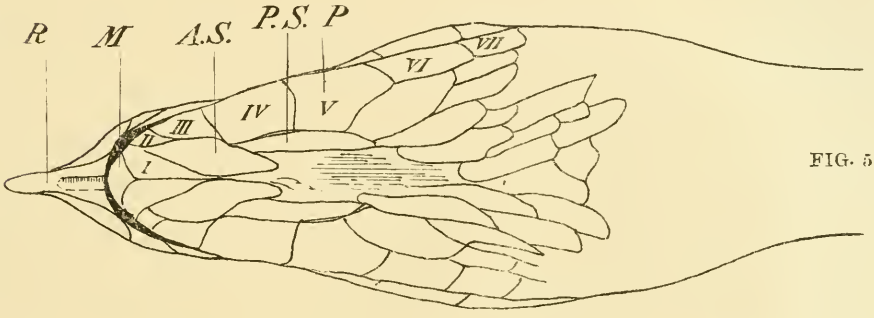


FIG. 5

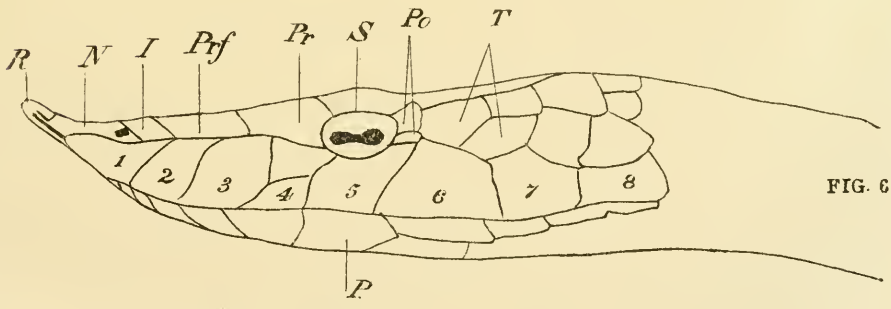


FIG. 6

A. S.	*Anterior sublinguals.*	*Pr.*	*Praeoculars.*
F.	*Frontal.*	*Prf.*	*Praefrontals.*
I.	*Internasals.*	*P.S.*	*Posterior Sublinguals.*
M.	*Mental.*	*R.*	*Rostral.*
N.	*Nasal.*	*S.*	*Supraoculars.*
P.	*Pentagonal infralabial.*	*T.*	*Temporals.*
Pa.	*Parietals.*	*1-8.*	*Supralabials.*
Po.	*Postoculars.*	*I. VII.*	*Infralabials.*

DRYOPHIS MYCTERIZANS.

THE COMMON GREEN WHIP-SNAKE.

× 2

CORTEZ & CO. LITH. BOMBAY.

Fig: 1

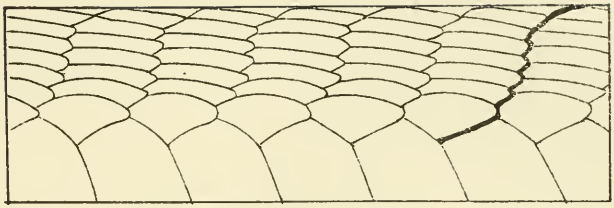


Fig: 2

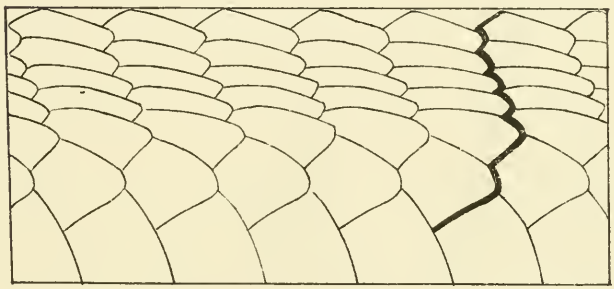
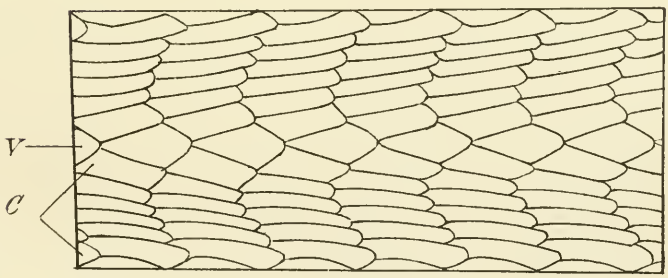


Fig: 3



C. Costals.

V. Vertebrals.

DRYOPHIS MYCTERIZANS.

THE COMMON GREEN WHIP-SNAKE.

× 2

CORTEZ & CO. LITH

a normal green. I procured one such specimen some years ago in Trichinopoly.

Identification.—This snake belongs to a genus comprising six members, all bearing singularly pronounced features which readily distinguish them from all other snakes. Of these it is only necessary here to mention the pupil, which is horizontal in direction.

A fleshy elongated nasal appendage is peculiar to two only of the six, *viz.*, *D. mycterizans* and *D. pulverulentus*, and these are easily distinguished. The former is a common snake widely distributed, green with very rare exceptions, and marked with a white or yellow flank line always; whereas the latter is a rare snake peculiar to Ceylon and the Anamallay Hills in Southern India, brown in color, and with no flank line. To sum up, any snake with a horizontal pupil, an elongated fleshy appendage at tip of snout, and a white or yellow flank line must be *Dryophis mycterizans*.

Habits—Haunts.—It may be met with in high grass, but far more frequently on bushes, and will climb occasionally to a considerable height. I have known toddy collectors encounter it among the foliage of lofty cocoanut trees in Colombo on more than one occasion.

Disposition.—It is commonly reputed to be a very gentle snake (Boulenger, Flower, etc.) and Mr. Ferguson* implies the same thing when he says that in Travancore it is the only snake the ordinary native is not afraid to handle. His next sentence, however, runs as follows: "Boys often bring them in, having first taken the precaution to tie up the head in a bundle of rags," and my experience compels me to think that the boys fully understand the vicious nature of this creature. I am very familiar with this snake, and have at the present time nearly one dozen specimens in captivity. It is very frequently brought in to me alive, and in the manner described by Mr. Ferguson. I do not find it, when freshly caught, at all the gentle, docile creature I have been taught to believe. When moderately alarmed it emits the tongue (which is a pale yellowish or pinkish organ) with closed jaws, keeping it out for a second or two or longer. If watched closely the two points are often seen to vibrate tremulously. The tongue is rarely protruded, and retracted repeatedly in the manner so common in other snakes. Whilst the tongue is maintained rigidly protruded in a forward direction the snake rears its head and

* Bom. Nat. Hist. Journ., Vol. X., p. 6.

forebody, and dilates the body so that the black and white interstitial skin becomes plainly apparent. If further excited it opens the jaws widely, and by a peculiar power widely separates the lower jaws, stretching the intervening skin very considerably, even so much as to double the lateral expense of the floor of the mouth and make it shovel-shaped. The tongue is in the meantime kept retracted and invisible, but the opening of the windpipe is made conspicuous by the alternate dilatation and contraction of its orifice. Seen under these conditions with head retracted and upper body thrown into sigmoid curves, the snake presents a most formidable aspect. Even a small specimen will not hesitate to bite viciously, and will draw blood as I have occasion to know. I have been struck at most vehemently when my face has been opposed to the windows of the vivarium, and the act has been repeated several times by the same specimen after a lengthy term of captivity. Mr. Green says when pressed it will strike out blindly, often in the direction of the face of its opponent. Mr. Millard writes to me : "It is when freshly caught, very fierce and bites freely." It is certainly true that in captivity a very few days will serve to materially alter this pugnacious spirit in some specimens and then the snake will frequently permit itself to be handled with impunity. Natives in India and Ceylon believe that it strikes at the eyes of persons and cattle : hence the Tamil and Singhalese names for it. This idea has received support from the experience of Mr. Finn,* who whilst holding two specimens in his hand, was bitten by one which darted at his eye. Two punctures were subsequently observed on the upper and one on the lower lid, and in rubbing his eye he removed a tooth from the wound in the lower lid. Among foliage it can move with great alacrity, but on the ground its movements are tardy. At rest it is always seen lying more or less extended on the branches, never coiled like members of the *Dipsadomorphus*. Its body is so slender and so light that by distributing its trifling weight, it is capable of moving among the minutest twigs.

Food.—Günther† says it feeds on birds and lizards. Green‡ says it feeds readily upon young lizards of the genus *Calotes* and *Geckonidæ*. Mr. Millard tells me geckoes, blood-sucker lizards, sparrows and mice have been eaten by specimens in captivity. I have known one in

* Reported in the Jour. As. Soc. Ben., Vol. LXVII., 1898, pp. 66-67.

† Rept. Brit. Ind, p. 306.

‡ Spolia Zeylanica, Vol. I., Pt. II., June 1903, p. 2.

captivity eat a frog, but in its native haunts my observations show that lizards of the genus *Calotes* are preferred to any other creature. Mr. Primrose* mentions a case of cannibalism practised by this snake, the victim being *Tropidonotus stolatus*. On investigating the dung of specimens I have frequently found it contain the scales of what were probably lizards, since no vestige of ventral shields were found such as would result from snakes being ingested. There have been frequently fragments of the cases of insects, such as cockroaches, and once I recovered a large black ant almost intact. After one in captivity had eaten a *Calotes versicolor* I isolated it, and examined the resultant excrement. From this I extracted, by softening the mass in water, the scales of the lizard which floated up, and also fragments of insects. In this case, I think, I am justified in supposing the insect remains to have emanated from the alimentary system of the lizard, as I never saw insects in the vivarium. Günther† and Boulenger‡ mention insects as the food of young *Dryophis prasinus*, a very closely allied member of the genus, and I wonder whether these observations were the result of direct experiment, or if conjectured from the examination of the dejecta.

Green§ remarks: "Its manner of capturing its prey is invariable. When a lizard is introduced into the cage, the snake slowly frees the fore part of its body and coils itself in a zigzag fashion. Then suddenly darting forward, it seizes the victim unerringly just behind the head, drags it from its support, and keeps it dangling without shifting its hold, but gradually tightening its grip, until the lizard is suffocated. * * * The snake never commences to swallow its prey until all signs of life have ceased." The Revd. F. Bertram, S.J., ‖ says: "It does not even always wait for its prey to be paralysed before eating it." And I agree with this remark, though it certainly does hold on to its victim till its struggles are of little avail. In this respect it differs from the dhâman and cobra, which commence to swallow as soon as their prey is seized. When the victim has passed through the jaws, the snakes rears itself vertically for nearly or quite half its body length, and then practises a series of contortions during which the

* Bom. N. H. Journ., Vol. XV., p. 347.

† Rept. Brit. Ind., p. 303.

‡ Faun. Brit. Ind. Rept. & Batrach., p. 399.

§ Spolia Zeylanica, Vol. I, Pt. II, June 1903, p. 1.

‖ Snakes and their Venom, Trichinopoly, 1897, p. 11.

forebody is thrown into shallow lateral undulations. The curves of the undulations are rhythmically reversed, and by this manœuvre carried out with much muscular effort the mass is propelled onwards to the stomach in a surprisingly brief interval of time.

Breeding.—This is one of the very few snakes whose breeding habits have been observed. The young are born alive, having previously burst their egg envelope within the mother's abdomen (ovoviviparous).

Ferguson * records one giving birth to twelve young on September 27th, 1891, in the public gardens at Trevandrum in Travancore. It had been in captivity since June 30th of the same year, so that the period of gestation was, at the very least, 59 days. I suspect it will prove to be much longer, for a specimen of an allied species (*D. prasinus*) which had been received in the London Zoological Gardens from Java on the 15th of August 1885, gave birth to eight young on January 9th, 1888, having had no male companionship during this whole period.†

Green ‡ mentions another instance from Ceylon when one in captivity gave birth to five young on the 16th and 17th April 1903. The fifth hampered by its egg envelope, succumbed two days later. All the brood sloughed on the eighth day after birth. A specimen received by Captain Evans and myself from Tadoungoo, Lower Burma, on the 23rd of May 1900 (with other snakes recently collected) contained three young with no vestige of egg envelope to be discovered within the mother. Evans has recorded another specimen in this Journal, Vol. XVI., p. 169, killed (Rangoon?) on the 4th May containing five young, and Blanford (J. A. S. B., Vol. XXXIX., p. 373) mentions a specimen from Korba (Bilaspur C. P.) containing four large eggs.

Dentition of *Dryophis mycterizans* (after Boulenger).

Poison.—This species for practical purposes is usually considered to be innocuous. It is furnished with grooved fangs situated at the hinder extremity of the maxillary. Its bite is reputed to be quite harmless to man, as the following quotation will exemplify. The Revd. F.

* Bom. Nat. Hist. Jour., Vol. X, p. 6.

† P. Z. S., 1886, p. 124.

‡ Spolia Zeylanica, Vol. I., Pt. II, June 1903, p. 1.

Bertram,* S.J., records the testimony of a friend of his, who experimented on himself, in the following terms :—" I hold the fact from his own mouth. One day a lively green snake was brought to him, and he was assured that it had not spent its venom in any way previously. He put his finger into its mouth, took care to place it under the fangs, and then squeezed the jaws together, so as to drive the fangs into the flesh. * * * Well, no result followed, not the slightest ache of any kind." This substantiates in a very conclusive way the experiences of others. However, a *sampwallah* employed by me in Bangalore came to me on the 5th September this year, and produced two green whipsnakes, male and female, which, he declared, he had observed " in copulâ." In capturing them he was viciously bitten on the left hand by one of them, at about noon that day. At 4 p.m. when I saw him the hand and forearm were greatly swollen, and he said felt numb. He was in no pain. I saw him again a week later, and he told me the swelling subsided in about two days and that he had felt none the worse in his general health. Russell† says : " Its bite on chickens tried repeatedly produced no other effect than pain." The poison gland is rudimentary, and my dissections and observations lead me to believe that it is solid like a mammalian salivary gland, and incapable of storing poison. Whatever truth may lie in this assertion, the potency of the poison must be admitted to be extremely feeble when Green‡ says that young lizards will sometimes take 20 minutes to die in the grasp of its jaws, and on such a statement one may reasonably believe that the victim succumbed to mechanical influences alone. I lately witnessed one specimen in captivity seize and devour a frog. It grasped the frog's body close behind the forelimb, and held on tenaciously in spite of the frog in its struggles turning the snake over and over. After more than 20 minutes the snake began, through the agency of the jaws alone, shifting its grasp towards its victim's snout, and then commenced swallowing. Thirty-six minutes elapsed before the frog was wholly swallowed, and it was kicking feebly to the end. It has nevertheless been proved that the secretion of the parotid (salivary) gland has toxic properties. Major Alcock, I.M.S., F.R.S., and Captain Rogers, I.M.S., have conclusively demonstrated§ that mice die when injected subcutaneously with a saline

* Snakes and their Venom, Trichinopoly, 1897, p. 11.

† Ind. Serp., Vol. 1, p. 17.

‡ Spolia Zeylanica, Vol. 1, Pt. II., June 1903, p. 1.

§ Proc. Royal Soc., Vol. 70, p. 451.

extract from this gland, and they sum up the results of their experiments in the following words : "No one who has experimented with minimal lethal doses of Cobra venom can fail to be struck with the close resemblance of the symptoms caused by it with those recorded in the above experiments with the parotid secretion of *Dryophis* and its Opisthoglyphous allies.

The gradual quickening of the respiration, the drowsiness and nodding of the head, with jerky recovery every now and then, followed by gradually increasing paralysis, and a rapid failure of the respirations after they have become laboured in character, by convulsions, and finally by stoppage of the heart some little time after the breathing has ceased, form a sequence of events that except for a difference in intensity, are common to both, as also is the *post-mortem* picture of subcutaneous extravasation."

Distribution :

(*a*) *Geographical.*—India, Ceylon, Burma, Siam.

(*b*) *Local.*—It is essentially an inhabitant of the plains and low uplands but I have records of its occurrence at an altitude above 3,000 ft. (Salween, Burma). It frequents gardens and groves in populated quarters, as well as jungles far removed from habitations.

(*c*) *Numerical.*—Its frequency varies much in different localities. It is a common snake about Colombo, and a very common one in Travancore (Ferguson). It is extremely common about Cannanore, more so I think than is usual in other Southern Indian parts. It was by no means so plentiful about Trichinopoly. Russell* says "this snake is very common about Vizagapatam, and I believe, in the Circars, as well as in the Carnatic." Sclater† says "this snake, like many other Southern Indian species, extends north-westwards as far as Mount Aboo in Rajputana." In Burma it is hardly to be considered a common snake. Captain Evans and I procured 14 specimens out of a total of 694. One was found in Rangoon, and nine others came from other parts of Lower Burma, two reached us from Upper Burma, and two from East Salween. Mr. Hampton writing from Mogok, Upper Burma, says : "I do not think it is found about here. Its place is taken by *D. prasinus*." Flower‡ mentions having seen five specimens from Bangkok. The brown

* Ind. Serp., p. 17.

† Journ. As. Soc., Ben., Vol. LX., Pt. II, 1891.

‡ Proc. Zool. Soc., Lond., 1899, p. 682.

variety is very rare. Werner* mentions one, and Mr. Millard tells me the first received by the Bombay Natural History Society was recently obtained from Malabar Hill, Bombay. The variety with the ash-grey belly is also very rare.

Description.—*Rostral* very narrow, projecting. A furrow above, and two laterally on each side. Undersurface slightly arched, and produced backwards twice as far as upper. Contact with six shields. *Internasals* two. Suture between them $\frac{2}{3}$—$\frac{4}{5}$ that between the præfrontals. In contact with 1st and 2nd supralabials. *Præfrontals* two. In contact with internasals, 2nd and 3rd supralabials, præoculars, and frontal. (2nd labial only, if loreals present, which rarely happens.) *Frontal.*—Length $\frac{1}{3}$—$\frac{1}{4}$ larger than supraoculars. Breadth $\frac{1}{2}$ each supraocular or less. Contact with eight shields; the supraocular sutures at least three times as large as each of the rest. *Parietals* contact with one postocular. *Nasals* single, lateral, elongate, pierced at extreme posterior angle by a small nostril; in contact with one supralabial, *viz.*, the first. *Loreal* absent normally, rarely one or two present. *Præoculars* one, † in contact with frontal. *Postoculars* two, small. *Temporals* one normally, rarely two.

Supralabials normally 8, the 4th divided into one or two upper and one lower part, the 5th only touching the eye. Sometimes there are 9, and then the 6th only touches the eye. *Infralabials.*—The first meet behind the mental to form a suture about equal to that between the anterior sublinguals; 4th and 5th largest; 5th pentagonal, 2 or 3 times as broad as posterior sublinguals and in contact with two scales behind. *Anterior sublinguals* subequal to, or rather smaller than, the posterior; normally in contact with the first 4 infralabials. *Posterior sublinguals* have no intervening scales; come into contact with the 4th and 5th infralabials normally. *Scales.*—Two heads lengths behind head 15; midbody 15; two heads lengths before vent 11-9. At both steps, where the scales reduce from 15-13 and 13-11, it is the 5th row above the ventrals that disappears, being absorbed into the row above or below. The vertebral row is enlarged, and its scales different in shape from the costals, which are elongate, and set obliquely. The scales of the last row are much the largest, those in the superjacent rows have their anterior-superior and posterior-inferior borders far the shortest. The scales in all snakes

* Verh. Ges. Wien, Vol. XLVI., p. 362.

† The upper divisions of the 4th supralabial may be considered by some as præoculars, in which case there are two or three.

overlap in two directions, *viz.*, from above downwards and below upwards, but the shape of the costals in this genus makes the overlapping from below upwards far the more evident. The relationship of the vertebral and the last row with their contiguous rows remains the same in the whole length of the body, but the intermediate rows alter in a remarkable way, peculiar, I believe, to this genus. The intermediate rows, *i.e.*, 2nd from the ventrals to the 7th, when looked at in a transverse direction, are seen to be placed one behind the other from below upwards in the front of the body, but this alters, and these rows gradually acquire a contrary relationship which is seen in the middle and posterior parts of the body. The thickened lines in figures 1 and 2 are intended to illustrate this point. *Keels.*—Carination is indistinct, and confined to a few median rows about the anal region, the keels being nodulated in character. *Supracaudals* are in even numbers; four in the middle of the tail. They decrease at each step by the fusion of the two uppermost rows on each side. *Ventrals* 168-206 rounded; if the specimen is laid on its back, barely a portion of the last costal row can be seen on each side simultaneously. *Anal* divided. *Subcaudals* 127-174, divided. *Dentition.*—Maxiliary teeth 12-15, one or two in the middle much enlarged, fang-like, and followed by an interspace, after which the teeth are very small; one or two posterior grooved fangs, situated below the posterior border of the eye; mandibular teeth increasing in length to the third or fourth, which is very large and fang-like; the posterior small (Boulenger). Pterygoid about sixteen, subequal, and small.

ADDENDA.

This paper was written eighteen months ago since which time I have acquired information which calls for some additions and modifications.

1. Here I follow Boulenger. All herpetologists have expressed very different views with regard to this snake. The fact is the characters upon which the classification of snakes is based, are very variable in this genus, and it is therefore almost impossible to draw hard and fast rules to separate some of the species, and especially this one. I think from the specimens I have examined, it is more than likely that Boulenger's conception of this species will require further modification.

As it stands now he includes under the same title the *albolabris*, *elegans*, and *viridis* of Gray; the *gramineus*, and *erythrurus*, of Günther, Cantor, and Theobald; and the *gramineus*, *erythrurus*, and *mutabilis* of Stoliczka.

2. The shape of the head is variable. There are two distinct forms. In one the broadest part is at a point close behind the eyes, behind which it decreases so as to resemble the shape in the genus *Dipsadomorphus*. This form is shown in our plate. In the other the greatest breadth is at the angles of the jaws, the head then exhibiting that triangular shape which is popularly considered characteristic of a poisonous snake. There is no greater fallacy than to suppose a poisonous snake can be recognised by the shape of its head.

3. In the Andamans and Nicobars a very distinct variety occurs, in which the prevailing colour is brown. In some of these the hue is uniform, in others it is variously mottled, spotted, or barred with darker or lighter shades. In this locality the brown specimens are more plentiful than the green.

4. Though these remarks are true of the uniform green specimens, some modification is required to include all the colour varieties, and makes the recognition of the species much more complicated. The following points must coexist:—(1) Head covered with small scales throughout; (2) Scales in 19 to 23 rows in the middle of the body; (3) Supraocular undivided; (4) Presence of subocular; (5) 9 to 12 supralabials, of which the second in its upper half is furrowed into the loreal pit.

5. Father Dreckman once captured a female specimen, which gave birth to seven young, while he held her in his grasp. This is the only authentic record I know of to prove that this species is viviparous. One youngster of the brood I examined measured 9½ inches.

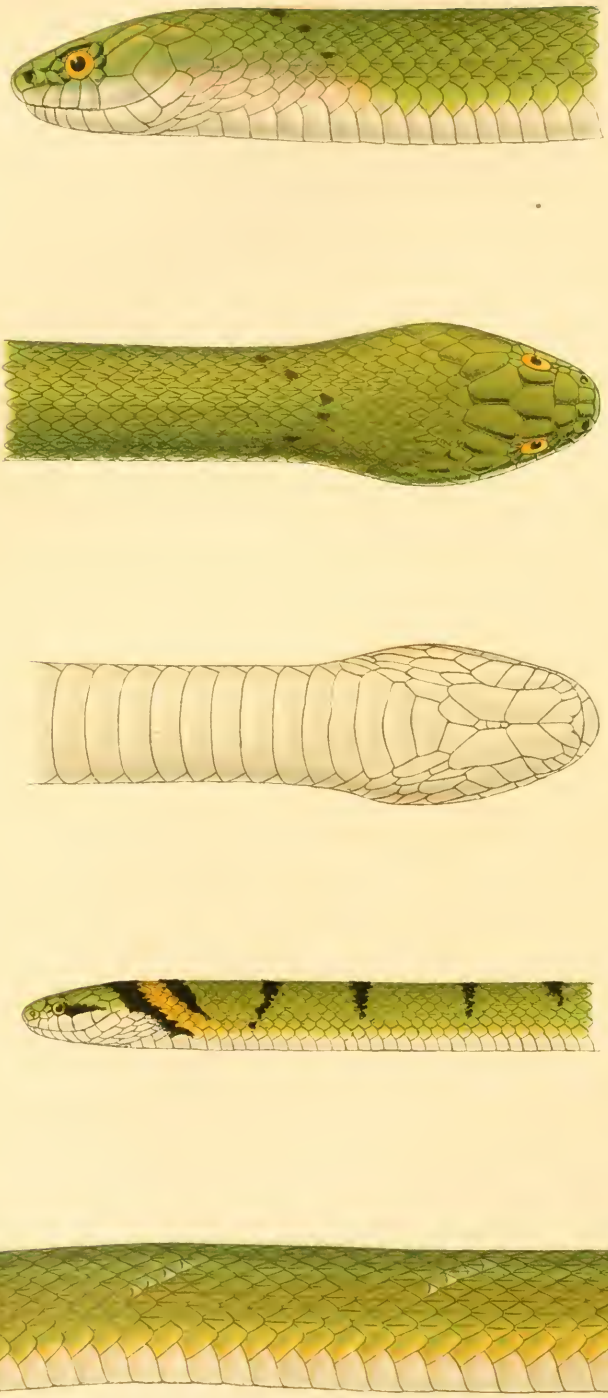
6. Mr. Thurston, the Superintendent of the Madras Museum, tells me that he once received a specimen from Nellakota in the Nilgiri Hills.

7. I have since received a specimen 6 feet and ½ an inch in length.

I may here remark that the figure of this snake by Frohawk in the Encyclopædia Brittanica: and that by Smit in the Fauna of British India, Reptilia, Boulenger, 1890, are to my mind purely fanciful and inaccurate. The snake does not wrap itself round branches in the intricate fashion depicted, at least not in a state of nature. I very much suspect these drawings were made from museum specimens, and arranged thus by the artists who had never seen them in life.

Our plate is from life. Mr. Green painted them from specimens in the London Zoological Gardens, and his work is excellent. In figure 8 the infralabial shields are abnormal. Only 4 (not 5) normally touch the anterior sublingual shields, and the 5th (not the 6th) is normally the largest of the series.

(To be continued.)



J. G. del. J. Green, Chromo.

Macropisthodon plumbicolor (harmless)

JOURNAL

OF THE

BOMBAY

Natural History Society.

Vol. XVII. BOMBAY. No. 1.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

ILLUSTRATED BY COLOURED PLATES AND DIAGRAMS.

BY CAPTAIN F. WALL, I.M.S., C.M.Z.S.

Part II.—With Plate II, and Diagrams IV, V and VI.

(*Continued from page 554 of Vol. XVI.*)

THE GREEN KEELBACK.

Macropisthodon plumbicolor.

Nomenclature. Scientific.—The generic name is derived from the Greek words "*makros*" great, "*opisthe*" back, "*odous*" tooth, and calls attention to an unusual feature in the dentition of this snake inasmuch as the maxillary at its hindmost extremity is provided with a pair of very large teeth separated by a short interval from the normal array met with in other snakes (see Fig. 1). These teeth may be very easily mistaken for poison fangs, but a careful scrutiny will show that they possess neither canal nor groove. Until recently this snake was included with the genus *Tropidonotus*, several members of which have enlarged teeth similarly situated (see Fig. 2) notably among familiar kinds the common buff-stripes (*Stolatus*), and the painted Keelback (*Subminiatus*). None, however, exhibit a development of these teeth to the degree which has led Mr. Boulenger to separate this snake with its two Malayan congeners under the generic title of *Macropisthodon*.

The specific name is derived from the Latin words "*plumbum*" lead, and "*color*" colour, a title for which Cantor is responsible, but it is a most inapt and misleading one, since its prevailing colour is a dark foliage green.

English.—The Green Keelback is, I think, the best name for it, closely allied as it is to the genus *Tropidonotus*,* and manifesting in its scales a degree of keeling in no way inferior to any representative of that genus.

Vernacular.—I know of none.

Dimensions.—The largest specimen I have heard of is one obtained by Col. Light at Poona which measured 3'1". Boulenger† gives 2'6', but I think the majority of adult specimens range nearer 2'.

Bodily configuration.—Head subovate. The eye is set laterally with a very slight inclination forwards, the iris exhibiting a bright golden pupillary margin which clearly reveals the rounded contour of the pupil. The body is stoutish, subcylindrical, and thickest near the middle from which spot the snake attenuates in both directions. The tail which is short and tapers rather rapidly, measures from one-seventh to one-ninth of the total length, being longer in males than females. The upper surface is rough with ridges in its whole length formed by the pronounced keeling of the dorsal scales.

Colour.—The prevailing colour is grass-green (often dull olive-brown in spirit specimens). Young specimens have a well defined, lamp-black, chevron-shaped collar with the point directed towards or on to the frontal shield. Behind this is a broad gorget of bright yellow or orange (dirty whitish in old spirit specimens) abruptly defined behind by a lamp-black bordering. A black fillet extends from the eye to the gape, and usually some black or blackish spots or markings are present in the forebody with a tendency to a transverse distribution. With age the green acquires a more dusky tone, but I have never seen a specimen that deserved the cognomen plumbicolor. Many of the black marks become obscured, or lost with age, but the fillet from the eye to the gape is, I think, always more or less in evidence. The belly which is usually uniform in colour may be whitish, yellowish, plumbeous green, or even blackish. The throat and chin are yellow or buff.

* *Tropidonotus* is derived from the Greek "*tropis*" signifying keel and "*notus*" back.

† Fauna of Brit. Ind., 1890, p. 351.

Fig: 1

Fig: 1, Maxillary of Macropisthodon flaviceps. (After Boulenger.)

Fig: 2

Fig: 2, Maxillary of Tropidonotus tigrinus. (After Boulenger.)

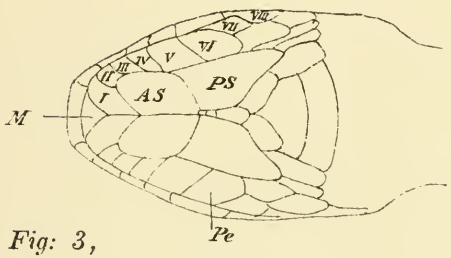


Fig: 3,

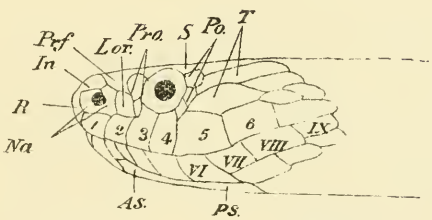


Fig: 4

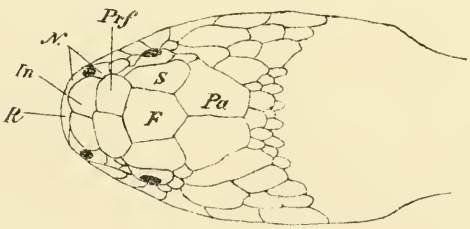


Fig: 5a

Fig: 5b

Fig: 3, 4, 5. Macropisthodon plumbicolor (× 1½)

Identification.—Any grass-green snake which has 17 rows of scales in the hind body (*i.e.*, two heads lengths in front of the vent), and has a frontal shield in contact with 6 shields only must be *Macropisthodon plumbicolor*. With a very little attention to scale characteristics and shape of pupil it could never be confounded with either of the foregoing snakes discussed in this series. The round pupil serves to distinguish it as readily from all the Green Pit-Vipers, as it does to separate it from all the Green Whip-Snakes. The appended remarks at the conclusion of this paper will serve to differentiate this from all other green snakes in which the pupil is round.

Habits.—Haunts.—Its prasinous coloration indicates a foliaceous environment, but it is not in the foliage of either bushes or trees that it is met with, but among low terrestrial vegetation, and especially grass. It not infrequently, however, strays from the kindly protection which verdure offers it. Mr. Kinlock says that about Kotagiri (Nilgiri Hills, 5,700′) he usually finds it in grass among scrub jungle, and not necessarily in a marshy vicinity. Mr. Gray tells me that at Coonoor (Nilgiri Hills, 6,000′) he has now and then known it wander into his rooms, and has frequently seen it about habitations. Günther,* too, remarks that it frequently enters houses.

Disposition.—The formidable armature of its upper jaws (see Fig. 1) belies its disposition, for not only is it a perfectly harmless snake, but it possesses a singularly gentle and inoffensive nature. Mr. Kinloch remarks on its gentleness, and says it never attempts to bite. A remarkable feature in the behaviour of this snake and one hardly likely to escape observation is its habit of crouching on the ground when molested. The whole body down to the vent is involved in this flattening effort, the object of which does not seem clear. It appears to be a manifestation indicative of fear. I have noticed the same behaviour to an equal degree in the Himalayan Viper (*Ancistrodon himalayanus*), the common Chinese Viper (*A. blomhoffii*) and to a lesser degree in Siebold's Water-Snake (*Hypsirhina sieboldii*) and the common Burrowing Snake (*Eryx conicus*). In several other snakes a muscular effort akin to this is evinced locally but whilst the creature is in an attitude of menace with the forebody erect. The cobra displays this peculiarity in a very pronounced degree, in the production of its so-called hood and the hamadryad does too, to a lesser degree. Many others behave

* Rept., Brit. Ind., 1864, p. 272.

similarly to these last two under excitement, but the flattening is far less pronounced. Among these may be enumerated the common Pond Snake (*Tropidonotus piscator*), the common Buff-stripes or Robed Snake (*Tropidonotus stolatus*), and several others of this genus, also *Helicops schistosus*, and *Pseudoxenodon macrops* which last Günther has figured* so as to emphasise this peculiarity.

Food.—Both Mr. Phipson and Mr. Kinloch tell me it feeds on toads. Mr. Gray mentions frogs, and says he knew one eat a small earth-snake on one occasion.

Breeding.—Mr. Phipson tells me it breeds during the S.-W. monsoon about Nasik (Deccan), and produces eggs which he has found, and kept till they hatched out.

Distribution.—Geographical.—It is found throughout the Peninsula of India, including Ceylon. Its northern boundary may be taken roughly as the 30th parallel, and its western and eastern limits are comprised roughly between the 70th and 85th meridians.

Local and numerical.—It is not nearly so abundant in the plains as in certain uplands, in fact my own experience teaches me to regard it as an uncommon snake in the plains. Russell's work, which may be taken as dealing with a fairly representative collection of the common snakes of India, makes no allusion to this species. Mr. Kinloch and Mr. Gray tell me it is quite a common snake in the Nilgiris (Kotagiri and Coonoor 5,700-6,000′). Mr. Phipson says it is perhaps the commonest snake about Nasik in the Deccan (1,900′). Col. Light mentions it as fairly common around Poona (1,800′). Nicholson† says it is a very common snake about Bangalore (3,000′), and Ferguson mentions it as fairly common in Travancore both on the hills and in the plains.

Description.—*Rostral* contact with six shields, of which the anterior nasals form the longest sutures (see Fig. 5*b*). *Internasals* a pair. Suture between them subequal to, or rather shorter than the suture between the præfrontal pair, subequal to or rather shorter than the suture between the internasal and præfrontal of each side. *Præfrontals* a pair. In contact with the internasal, postnasal, loreal, upper præocular, supraocular, and frontal, on each side. Suture between them subequal to or rather less than the suture

* Rept., Brit. Ind., Pl. XXII., C.

† Indian Snakes, p. 94.

between the præfrontal, and frontal on each side. *Frontal* in contact with six other shields of which the supraoculars form the largest sutures. Length subequal to the supraoculars. Breadth opposite centres of eyes twice or nearly twice each supraocular. *Parietals* a pair. Each in contact with one postocular. *Nasals* two placed laterally on each side, and completely divided by a suture in which the nostril occupies the upper two-thirds to three-fourths. In contact with the 1st and 2nd supralabials. *Loreal* single. Sometimes continued backwards to touch the eye, more usually not. *Præoculars* two. *Postoculars* three or four. *Temporals* two. The lower in contact with the 5th and 6th supralabials, the suture made with the 5th being about $\frac{2}{3}$ that with the 6th. *Supralabials* 7 of which the 3rd and 4th touch the eye. *Infralabials.* The first meet behind the mental to form a suture about half the length of that between the anterior sublinguals. 6 (rarely 7) come into contact with the sublingual shields, 4 or 5 with the anterior pair, the rest with the posterior pair. The pentagonal is usually the 6th (rarely the 7th) of the series. It is about as broad as the posterior sublinguals of the same side, and touches 3 scales behind.* *Posterior sublinguals* are longer than the anterior, and are quite separated by one or two small scales succeeded by a pair. *Dorsals* anteriorly in 23-25 rows; midbody 25-27; posteriorly 17.† The vertebral row is similar to its contiguous rows in size and form. The last row is largest. The scales are longer than broad, have straight margins, rather acute apices set pointing directly backwards, and are keeled‡ and facetted. Lines drawn across the apices of alternate rows are about vertical. The keels are pronounced in all rows except the last where they are absent for a variable extent anteriorly. They extend completely from base to apex of each scale. Apical facets are present in pairs, but often are difficult to see. *Supracaudals* are in even numbers of rows numbering six in the middle of the tail, and ending in a very few twos. Keels are present in all rows from base to tip of tail, also apical facets as in dorsals. *Ventrals* 144—160

* This does not appear so in Fig. 3, as the posterior sublinguals are overlapping the inner part of the pentagonal.

† Wherever reference is made to anterior and posterior parts of the body in this paper it is to be understood that the former refers to a point two heads lengths behind the head, and the latter to a point two heads lengths in front of the vent. Midbody is to be reckoned exclusive of the tail.

‡ The presence of a ridge on the scale similar to the midrib on the underside of a leaf is technically called a keel.

(Boulenger). Evenly rounded from side to side and so broad that when the snake is laid on its back, only part of the last dorsal row is visible on each side simultaneously. *Anal* usually divided. *Subcaudals* 35—50 (Boulenger) are in pairs. *Dentition.* The maxillary supports 12—13 small teeth anteriorly which are succeeded after an interval by a pair of large teeth behind. Mandibular teeth subequal (Boulenger).

The grass-green snakes that inhabit India and its Dependencies are thirteen in number. Three of the commonest of these have been discussed, and figured in this, and a preceding paper. A few remarks will now be made about the remainder so as to facilitate their recognition.

Three of this number are pit-vipers and differ from all the rest in having a loreal pit, a vertical pupil, no labial touching the eye, and only one pair of sublingual shields which touch 3 infralabials. In two of these (viz., *Purpureomaculatus* and *Gramineus*) the head is covered in front with small scales about the same size as those on the body and in the third (*Macrolepis*, see Fig. 13) the enlarged shields are a modification of the arrangement normally seen in colubrine snakes. Should, however, a specimen be brought with the head so mutilated that none of these characters can be discerned, the following additional points mentioned with each will differentiate them.

(1) *Lachesis gramineus* has been described in a preceding paper. The arrangement of the dorsal scales which number 21 normally (rarely 19) in the anterior and middle parts of the body, and 15 in the posterior part of the body will suffice to distinguish this from the rest.

(2) *Lachesis purpureomaculatus.*—The green variety of this snake (*bicolor*) is extremely like *gramineus*, in fact it is probable the two have been frequently confounded. The arrangement of the dorsal scales which number normally 25 (rarely 23 or 27) in the anterior and middle parts of the body, and 19 in the posterior part will distinguish this from the rest. This snake is as far as I know similar to the last in habits, rarely exceeds three feet in length, and within our limits has been recorded from the Himalayas, Bengal, Assam and Burma.

(3) *Lachesis macrolepis.*—In this the scales number 18-15 anteriorly, 14-12 in mid-body, and 11-10 posteriorly. The ultimate (or lowest) row is much the smallest, and this feature alone will, I believe, distinguish this from every other snake in India. It is arboreal in habit, grows to two feet, and inhabits hills in Travancore (Ferguson), Malabar, and S. India, *i.e.*, Anamallays and Pulneys.

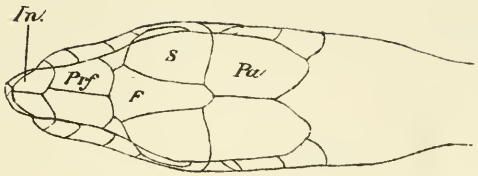


Fig: 6.

Dryophis prasinus. (× 1½)

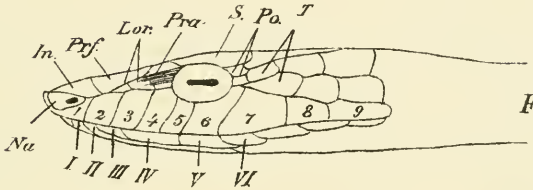


Fig: 7.

Dryophis prasinus. (× 1½)

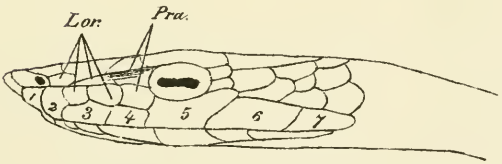


Fig: 8.

Dryophis fronticinctus. (× 2.)

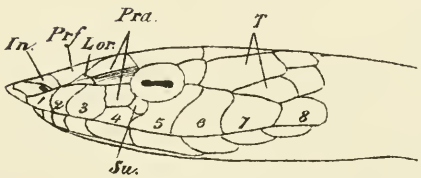


Fig: 9

Dryophis dispar. (× 2.)

CORTEZ & CO. LITH.

Of the remaining ten, five are Whip-Snakes, and distinguished from all other snakes by their horizontal pupil (see Figs. 7, 8 and 9). Their tails are extremely long and slender, measuring more than a quarter and in some species (*mycterizans* and *prasinus*) even more than a third of the total length of the snake. Should the head be damaged, the dorsal scales which number 15 in the anterior, and middle parts of the body, and 13 to 11 in the posterior part will suffice to proclaim the specimen a whip-snake, and the species may often be guessed at from the habitat.

(4) *Dryophis mycterizans.*—Has been already described.

(5) *Dryophis fronticinctus* (see Fig. 8).—Has like the last only one labial (the 5th or 6th) touching the eye, but has 3 or 4 loreals, and no nasal appendage. It grows to about 3 feet, takes readily to water, and is found on trees and bushes about rivers in Assam and Burma where it is often locally abundant (Moulmein and Rangoon rivers).

(6) *D. dispar* (see Fig. 9).—Resembles the preceding in having only one labial (the 5th usually) touching the eye, but differs in the absence of a nasal appendage and in having one or two loreals. It grows little more than two feet and has been recorded from hills in Travancore (Ferguson), and the Anamallays in S. India.

(7) *D. perroteti.*—Is distinguished from the rest of the Whip-Snakes in that two labials (the 4th and 5th) touch the eye. It grows to about 2 feet, and inhabits the Nilgiri Hills and N. Canara.

(8) *D. prasinus* (see Figs. 6 and 7).—This differs from the other Whip-Snakes in having three labials (the 4th, 5th and 6th) in contact with the eye. Its length exceeds 5 feet, and it is found in the Eastern Himalayas, Hills of Assam, and also in Burma where it is more abundant in the upper than the lower part of the Province, and is not confined to uplands.

The remaining five snakes agree in having the pupil rounded in contour, they are—

(9) *Macropisthodon plumbicolor* (see Figs. 3, 4, 5) which has been dealt with in this article. If the head is intact the labials which number 7, of which the 3rd and 4th touch the eye, will suffice to separate this from all the rest. The frontal is in contact with 6 shields. Should the head be too mutilated to observe these, the dorsal scales must be counted and will be found to number 23 to 25 in the anterior and middle parts of the body, and 19 to 17 posteriorly. If in addition the median

rows of scales in the anterior part of the body are boldly keeled, its identity will be established.

(10) *Coluber oxycephalus* (see Figs. 10 and 11) has 8-10 upper labials, three of which usually (rarely two) touch the eye, and a frontal in contact with 8 other shields. It may be identified by the co-existence of two characters which are (i) the dorsal scales number 23-27 anteriorly, 23-25 in the middle of the body, and 17-15 posteriorly; (ii) the median scales in the anterior part of the body are not keeled. It grows to 7 feet, and is known from the Eastern Himalayas, Tenasserim, Burma, Andamans and Nicobars, extending into the Malayan region. It is, says Dr. Stoliczka, generally seen on bushes near brackish water creeks, and is always ready to take to water.

(11) *Coluber frenatus* (see Fig. 12) is peculiar in having no loreal, its place being occupied by the extension of the præfrontal so as to meet the 2nd or 2nd and 3rd labials. This in itself would distinguish this from all the other snakes, but if the head is mutilated the dorsal scales should be counted, and will be found to number 19 in the anterior, and middle parts of the body, and 15 posteriorly. It grows to 3 feet, appears to be rare, and is peculiar to the Khasi Hills in Assam.

(12) *Coluber prasinus*.—Like the last two, has three labials touching the eye, usually the 4th, 5th and 6th, and has a frontal which is usually in contact with 8 other shields. The dorsal scales number 19 in the anterior and middle parts of the body, and 15 posteriorly. It appears to be uncommon, grows to 3 feet, and has been recorded from the Eastern Himalayas, Khasi Hills and Burma.

(13) *Ablabes doriæ* is easily distinguished from all the rest by the dorsal scales numbering 15 throughout the body. This is a rare snake, until recently only recorded from the Kachin Hills in Burma. I discovered a young specimen in 1901 in a Museum in Shanghai, which has extended its known habitat into China (Yangtse Valley). It grows to 3 feet.

(*To be continued.*)

Fig: 10

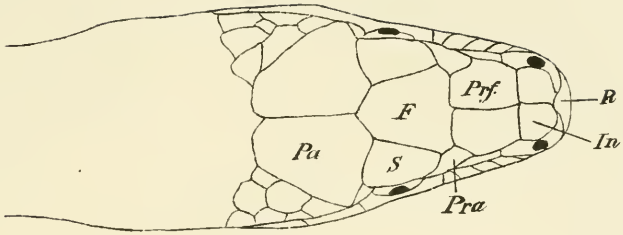
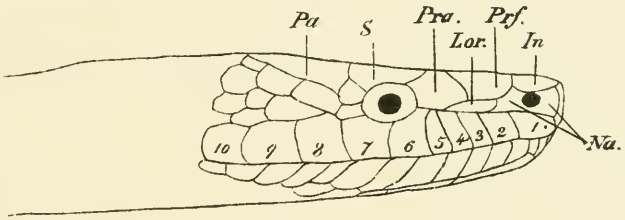
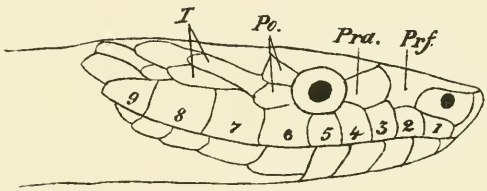


Fig: 11



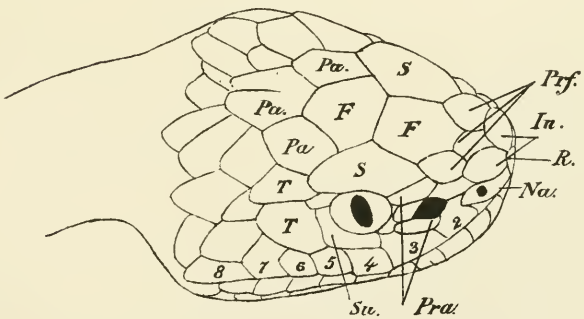
Coluber oxycephalus (Life size.)

Fig: 12



Coluber frenatus (×2). (After Boulenger.)

Fig: 13



Lachesis macrolepis (×2). (After Gunther.)

INDIAN SNAKES (WALL)

COLLE & CO. LITH. BOMBAY.

EXPLANATION OF THE ABBREVIATIONS USED IN DIAGRAMS IV, V AND VI.

A.S.	Anterior sublinguals.
F.	Frontal.
In.	Internasals.
Lor.	Loreal.
M.	Mental.
Na.	Nasals.
Pa.	Parietals.
Pe.	Pentagonal.
Po.	Postoculars.
Pra.	Præoculars.
Prf.	Præfrontals.
P.S.	Posterior sublinguals.
R.	Rostral.
S.	Supraoculars.
Su.	Suboculars.
T.	Temporals.
1, 2, 3, etc.	Supralabials.
I, II, III, etc.	Infralabials.

JOURNAL
OF THE
BOMBAY
Natural History Society.

Vol. XVII. BOMBAY. No. 2.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

ILLUSTRATED BY COLOURED PLATES AND DIAGRAMS.

BY CAPTAIN F. WALL, I.M.S., C.M.Z.S.

Part III—With Plate III and Diagram VII.

(*Continued from page 9 of this Volume.*)

THE DHAMAN OR COMMON RATSNAKE (*Zamenis mucosus*).

Nomenclature. (*a*) *Scientific.*—The generic name is from the Greek ζα "great" and μενος "strength," and the specific from the Latin *mucosus*, "slimy," which I need hardly remark this snake no more deserves than any other of the suborder *Ophidia*. It appears to be a popular notion that a snake is slimy, and even in these enlightened days writers of travels, etc., frequently expose their ignorance by using this inappropriate adjective to them. Some of our readers may be more familiar with its older generic title *Ptyas*, also a calumnious epithet derived from the Greek, πτυας a "spitter."

(*b*) *English.*—The name by which it is generally known is the "common ratsnake," but "dhaman," a name borrowed from the vernacular, is almost as frequently in use.

(*c*) *Vernacular.*—In Bengali, Hindi, and Marathi, all languages derived from Sanskrit, it is called "dhaman," the Sanskrit word being "dhamana." It is also called sometimes "dameen." Russell makes mention of this latter name*, and I have heard it often. Woodrow in his

* Ind. Serp., Vol. I, plate XXV.

book on botany mentions both these names "dhaman" and "dameen" as being applied to a tree, the *Grewia tiliæfolia*, which is commonly grown by the natives in Southern India about their habitations. Mr. A. M. Jackson tells me "dharmani" is the Sanskrit name for this tree and the Cyclopædia of India (Vol. II, page 14) gives "damoni" as the Ooriah name for it. From its wood, hafts are derived for various tools, and the inner bark furnishes bast which Birdwood says is used in Bombay for making ropes. The connection between the tree and the snake has been suggested to me by Father Dreckman, who says in Sanskrit "dharma" means a "binding", either in the sense of duty or of wrapping one thing round another. Those of us who have handled living specimens, must frequently have experienced the force with which this snake wreathes itself round one's legs, or arms. On the Malabar Coast it is called "chavra." The Tamils in S. India call it "Sarey pamboo," but a Tamil of the Tigala caste in Mysore told me locally (Bangalore) they called it "Jair potoo," which I am informed signifies "centipede animal." This appears to be the same as the "Jeri potoo" of Russell.* Rice† says the Canarese name for it is "Kere." The Burmese call it "Mywé' let pât," which is literally "hand-coiling snake," and according to Theobald‡ "Lim-bwi."

Dimensions.—The great majority of adults vary from 5½ to 6½ feet, but much larger specimens are to be met with. Evans and I obtained two in Burmah measuring 7 feet 4½ inches, and 7 feet 8½ inches respectively. One specimen brought to me in Trichinopoly was the largest I ever saw in the flesh, *viz.*, 8 feet 2 inches. I measured the slough of one just cast in the Bangalore Museum which was 9 feet 1½ inches. Mr. Millard tells me of one killed near Mahim Station which was 11 feet 9 inches. This was a veritable Goliath of its kind. I have measurements in my notes of 54 specimens, and only 3 of these exceed 7 feet. I have notes of a host of others where the measurement is not recorded, but it is certain that had they been large this would not have been omitted.§

Physiognomy, and bodily configuration.—The head is rather elongate. The eye, large and lustrous, exhibits an iris speckled with gold, especially densely at the pupillary margin and a pupil which is slightly ovate hori-

* Ind. Serp., Vol. I, plate XXXIV. † Mysore, Vol. I, p. 188.

‡ Jour. As. Soc., Bengal, 1868, p. 46.

§ Mr. Pearless has in a recent letter reported that he has on four occasions killed this snake in Ceylon exceeding 10 feet in length.

zontally. The nostril is large, and placed laterally. The neck is slightly constricted. The body of somewhat robust proportions is flattened in a lateral direction (*i.e.* compressed), and is from 3½ to 4 times the length of the slowly tapering, and cylindrical tail.

Colour.—The prevailing hue on the head and body, including the tail, is dorsally an olivaceous-green or olivaceous-brown. In the anterior half or three-fifths of the body length this is uniform or nearly so, but in the posterior part many scales are irregularly margined with black, so as to form a reticulate pattern with a tendency to form crossbars. Individuals differ in colour: I have seen some as yellow as a batter pudding, and others of a hue as dark as sepia. The shields bordering the lips, the scales at the side of the throat, and the scales beneath the body, and tail are more or less margined posteriorly with black; in fact, these marks form a very characteristic trait in the physiognomy. On the belly the regularity of these marks forcibly reminds one of a tape measure, but in individuals, they may be absent in whole or in part. The belly is greyish-white, dirty-white or yellowish, the latter hue often more pronounced about the throat. The skin is blackish, mottled with fawn or whitish in irregularly transverse streaks, but is usually not seen owing to the overlapping of the scales. The overlapped margins of the scales, however, partake of this cutaneous coloration, and in young specimens light bluish-grey irregular crossbars are usually conspicuous, especially anteriorly. In young the prevailing colour is often more greyish or bluish than one sees in the adult, but the markings and general appearance are very closely similar.

Identification.—Here I must digress, to emphasise a very interesting and important peculiarity in this snake. The scales of snakes counted across the back will be found, with very few exceptions, to be arranged in odd rows varying from 13 in the *Callophids*, etc., to as many as 75 in *Python reticulatus*. The exceptions to this rule which concern us are *Zaocys dhumnades* and *Z. nigromarginatus* in which they number 16 in the middle of the body, and *Stoliczkaia khasiensis* where they are 30.* Further, in some snakes the same number of rows is maintained in the whole length of the body, but in others they

* In the two families *Typhlopidæ* and *Glauconudæ* where the scales appear to be in even numbers, if the median row on the belly (which in these snakes is not specialised, but is exactly like the rows of scales on the back and sides) is considered in its true light, *viz.*, as the analogue of the belly scutes, then the scales are in reality odd in number.

reduce by 2, 4, 6 or even more rows from before backwards, but the odd number is preserved on the body—(Caution—I do not include the tail),—with one notable exception, *viz.*, the species under discussion, *Zamenis mucosus*. In this the scales number 17 in the front of the body, but reduce to 14 or 12 posteriorly. This point in itself is sufficient to distinguish this from all other snakes in our region.* Another feature characteristic of this snake is the triple loreal. (See I, fig. 1 B). In almost all snakes possessing a loreal, this is a single shield interposed between the præocular, and the nasals. In a few species there are two, but in this there are three normally, one anterior, and two superposed behind. Occasional aberrant specimens may be seen with only 2 loreals, or even with 4 or 5.

In colour, and markings which I have already represented as faulty guides in the identification of all snakes, both the species of *Zaocys* already referred to, as well as *Xenelaphis hexagonotus* and *Zamenis korros*, closely resemble it, and all are of very similar proportions.

Haunts.—There is scarcely a situation, whether in hill or dale, forest or maidan, arid, swampy or cultivated tract, tree, bush, or habitation in which it may not take up its abode. It is quite at home in the proximity of man, and is to be met with in the gardens of populated areas within our largest cities almost as plentifully as in the more tranquil quarters of the Cantonment. In such localities, in deference to man's hostile inclinations, it is forced to retire during the day into some secure retreat, commonly taking up its abode in an ant-hill, drain or other convenient hole in the compound, or even in the out-houses, or bungalow itself. Like other snakes it loves old masonry, and is often flushed from or seen retiring into the crevices and crypts furnished by old walls or brick wells. In Rangoon with the aid of a bicycle lamp to illuminate the gloom of the little galleries left for drainage purposes in the faces of the fort walls I frequently found one coiled up, and provoked it to a speedy exit. In the bungalow it may tenant the basement, but not infrequently finds its way up into the roof where it may reside above the ceiling cloth, and though few may deem it as such it is certainly entitled to the consideration of a welcome friend. The late Chaplain of Cannanore, the Reverend R. B. Redding, told me that once when in conversation with a lady, upon whom he was calling, a scurrying was heard overhead on the ceiling cloth, and a rat fell

* In Zaocys the scales reduce, but they are maintained in even rows.

through a hole on to the floor. It was closely followed by the head and much of the body of a large snake, which, however, managed to withdraw itself. It is more than probable that this was a rat-snake.

Removed from man's immediate environment I believe it realises there is no occasion for such prison accommodation as populous localities thrust upon it, and here it has free scope to indulge its diurnal inclinations. In Cannanore snipe-shooting I very frequently encountered it in broad daylight leisurely pursuing its quest for luncheon, and when not actually on the move I often found it coiled asleep in the paludal vegetation, or beneath a bush. Again, on two or three occasions when stepping into paddy fields at dawn I have seen it coiled on the heaps of decaying vegetable matter which represent the remnants of last year's crop, and weeds, suggesting that it had taken up these quarters over-night.

It shows a decided partiality for the vicinity of water for reasons very obvious when we come to consider its diet. It will take readily to water should occasion demand, and swims vigorously, and well, carrying its head above the surface for choice, but diving when the necessity is urgent.

I have seen it at some height in a tree (ten or fifteen feet), also on the roofs of houses, so that its scansorial abilities are not inferior to those of most of its kind.*

It appears to be very fleet in its movements, but its speed is deceptive, for on one occasion, when I chased one using its full endeavours to escape, I found I had traversed 38 yards while the reptile covered 18. It measured 5 feet 9¼ inches.

Here I may remark that this snake enters into the dietary of several natives of India, who hold it in great esteem. A Tamil of the Tigala caste in Bangalore told me his caste while despising all other snakes as food or medicine, relished the flesh of the dhaman which when cooked was white, and fish like. The taste he compared to that of chicken. It appears to enjoy a reputation in wasting diseases. In Fyzabad recently a cooly came, and begged the body of one that had been sent in to me dead to eat. The Burmese and Karens eat it with avidity, but are by no means bigoted with regard to the species of snake they eat. The Chinese use it in medicine among other ophidian brethren, and I doubt not eat it too. I saw many preserved on the shelves of the local medicine men in Hongkong.

* See addenda (1).

Sloughing.—Miss Hopley* mentions one casting its skin about once a month on an average. This specimen was caged in Regent's Park, London, I believe.

Disposition.—It is undoubtedly when provoked a very fierce snake, and if brought to bay will assume the offensive with great courage and determination ; but this side of its nature is rarely exhibited, as, like other snakes, it prefers to acknowledge man's supremacy by seeking swift escape when this offers. I have many times jumped into the middle of its coils when I have seen it enjoying a siesta, but have never been menaced, or struck at once, the reptile's acknowledgment of the rude awakening being manifested by speedy disappearance. On occasion, however, and especially if reasonable chances of escape are denied it, it will attack with great malice. Father Dreckman once chased a specimen nearly eight feet long, and managed to place his foot over the hole it was making for. Baulked in its attempt to escape, it coiled itself up and jumped straight at his face. Luckily Father Dreckman drew back his head in time to evade a blow in the face, but the reptile fastened itself on to his shoulder with such purpose that its teeth penetrated not only his clothes, but actually lacerated the skin beneath. On another occasion when the same observer was rendering assistance to a hatchling which was trying to emerge from its egg, the vicious little creature resenting interference bit him in the finger, and actually drew blood. Mr. Hampton tells me that once when attempting to capture one he found in a drain it struck viciously at him, and inflicted a wound beneath one of his eyes. In Bangalore I saw one belonging to a sampwallah, strike most vehemently at, and bite a mongoose, also one of the stock-in-trade. Mr. Millard tells me it is a difficult snake to tame when fairly grown, and will attack freely when cornered.† Nicholson‡ remarks how it will fight for its freedom, and says it is always a little uncertain to handle in captivity. Gunther§ says: "It is of fierce habits, always ready to bite, and old examples brought to Europe never become tame."

In Rangoon I had one brought to me which, it was reported, was attacking a full-grown fowl. The few specimens I have had caged,

* "Snakes," p. 332.
† See addenda (2).
‡ Ind. Snakes, p. 133.
§ Rept., Brit. Ind., p. 249.

exhibited a very nasty temper, and struck out most maliciously at me whenever I approached the glass of the cage: often two or three strokes were delivered in rapid succession, and with such force that the creature must have hurt itself considerably. The stroke is delivered upwards, as though to wound the face, a peculiarity also noticed by Mr. Millard. When infuriated, prior to delivering its stroke, it retracts the head and forebody into an S, slightly erects itself and gives vent to a peculiar sound which I have heard no other snake produce, and which reminds me of a cat at bay. Cantor likens it to the sound of a vibrating tuning-fork. During the production of this warning note the snake compresses itself anteriorly (*i.e.*, flattens itself in a direction contrary to that manifested by the cobra), the spine being arched about the neck, and the throat markedly pouched.

Food.—The dhaman is very catholic in its tastes, devouring almost anything that chance brings within its reach, but it displays a very marked partiality to a batrachian diet, doubtless because toads, and more especially frogs, are extremely plentiful, easily captured, and too defenceless to offer much resistance. The possibility of taste influencing its selection may be dismissed, since flesh, however toothsome, must fail to impart its relish when clothed in feathers, fur, or integuments.

Perhaps though, the texture of these vestments may gratify the mouth or gullet as keenly as the flesh may conciliate the peptic glands. When hunger presses it is stimulated to make full use of its courage, vigour, and speed in shikaring the object of its gastric affections. The incident of the rat falling through the ceiling cloth demonstrates this. Blanford* mentions one he saw pursuing a lizard (*Calotes versicolor*) at full speed, which it caught, and then throwing its body over its victim speedily devoured. This practice of holding down its prey when troublesome to manage, or seized in a position unfavourable for swallowing, is characteristic, and it can exert a very considerable strength in this manner. Mr. Hampton tells me he has seen it hold a rat down with its body, pressing it tightly on the ground, and Mr. Millard gives me a very striking example of this behaviour. He says: "One of these which we were keeping in the same cage as our python recently caught a rat (which was put in for food) by the tail. The rat turned, and bit the dhaman severely, and the dhaman killed it by holding on to the tail, and pressing the rat against the body

* Jour. As. Soc., Bengal, Vol. XXXIX, p. 372.

of the python and the floor of the cage. Severe pressure must have been brought to bear, as the rat—a full-sized one—was dead in 3 or 4 minutes."

Here I may draw attention to the frontispiece of Lyddeker's Royal Natural History, Volume V., which shows this snake entwined in a most unnatural manner round a perpendicular bamboo stem, a large part of its body free, and holding a large rat with a serenity and facility very unreal. I doubt whether this acrobatic performance is possible for more than a few seconds apart from the manner in which it is shown bolting its meal. It is regrettable that the inaccuracies of a skilled artist should pass the censorship of so great a naturalist. The quarry once captured is swallowed at once, so that in the case of inoffensive creatures, such as frogs, it is no unusual circumstance for them to reach the stomach sufficiently alive for their suppressed cries to be distinctly audible; and moreover remarkable as it may seem, when rescued from their engulfment it is a fairly common event for them, after the lapse of some minutes, to recover sufficiently to hop away. I have witnessed this on several occasions, and Kelsall has recorded such an experience in this Journal.

Rats, though sometimes preyed upon, are not nearly so staple an article of diet as suggested by its name. Mr. Hampton tells me that in captivity in Regent's Park, London, he was familiar with this snake and saw it seizing, and devouring good-sized rats with avidity, but that his specimens in Burmah, far from liking rats, seem to be afraid of them, preferring an exclusively batrachian fare. Lizards, birds and other small vertebrates form a welcome supplement to its voracity. Recently, in Fyzabad, a three-footer was found in a shrub attacking a nest of young birds. It had already swallowed a gecko (*Hemidactylus gleadovii*), and was in the act of devouring one fledgling. That it must be considered both gourmand and gourmet may be inferred from the following bills of fare. A specimen brought to me in Cannanore had eaten a large frog (*Rana tigrina*), a large toad (*Bufo melanostictus*), and a half-grown lizard (*Calotes versicolor*); another lately acquired in Fyzabad with a very tight-fitting waistcoat was found to contain a large toad (*Bufo andersoni*), a lizard of the skink family (*Mabuia dissimilis*), and a young tortoise (*Trionyx*), and as though dissatisfied with this 3-course luncheon, had endeavoured to include a large lizard, probably of the genus *Calotes*, since some 5 inches or more of its

tail had been devoured. The specimen alluded to above which bit Mr. Hampton subsequently disgorged six frogs. Ferguson* comments upon the gluttony of this species, and says its favourite food is a medium-sized frog, of which a fair-sized snake will eat about twenty-two at a meal.

Mr. Hampton says if at all hungry it will not disdain the meal afforded by another snake, including even its own species. This I know to be true, and quite a common event in captivity, which is vouched for by Mr. Millard, Ferguson and others, but I think it is a rare exhibition of depravity in its natural state; however, Assistant Surgeon Robertson told me he once cut open a large dhaman, and found it contained another dhaman, 3 feet 11 inches in length, in its stomach. Flower† mentions one eating a snake (*Chrysopelea ornata*). Mr. Green tells me of one which disgorged several snakes of the genus *Rhinophis* in its death throes, and Lightfoot‡ has lately presented a specimen to the Bombay Natural History Society preserved in the act of swallowing a *Psammophis condanarus*. The stomach, as will be seen if distended with a meal, lies more in front of the middle point of the body, than in some other snakes, notably the Krait, and *Hemibungarus*, where it lies wholly behind this point.

Breeding.—It is the rule with snakes that the female exceeds the male in length. Darwin, on the authority of Gunther, makes this statement.§ Whilst fully agreeing with this remark, in this species I have no doubt that the converse obtains. An average taken from the largest males and females my notes record shows a disparity decidedly in favour of the male. Again, of specimens over 6 feet 6 inches, twelve are males and only two females. The longest female is 6 feet 7¼ inches.‖ Though usually met with singly, they are sometimes found in pairs at times other than the breeding season. On January 5th, 1900, in Rangoon, a male and female were found coiled together beneath a flooring. This date is one later than the normal hatching season. The male was 6 feet 1¼ inches and the female 5 feet 8½ inches. Again, in Fyzabad a pair was found disporting themselves in a small pool of water some three or four yards across. The female, 6 feet 7¼ inches in

* Bombay Natural History Journal, Vol. X, p. 4.

† Proc. Zool Soc. 1899. p. 684.

‡ Bombay Natural History Journal, Vol. XVI, p. 530.

§ Descent of Man, p. 538.

‖ See addenda (3).

length, contained eggs far advanced towards maturity. The male measured 6 feet 9½ inches. This latter incident implies a conjugal attachment on a par with that of the higher animals, since sexual gratification had not dissolved the marital tie.*

The following is a list of the breeding notes I have been able to collect, arranged in tabular form :—

Eggs.			Degree of maturity.	Length of mother.	Locality.	Authority.	Reference.
Date.	Number.	Size.					
May ...	9	?	In abdomina	?	Bangalore .	Nicholson ..	"Indian Snakes" p. 127.
May ..	13	?	Do. ..	?	Do. ...	Do. ...	Do.
20th June '05	14	$\frac{17}{20}$" long	Do. ..	6′ 3″	Fyzabad ...	Self ...	Not recorded.
Do. ..	10	$1\frac{9}{10}$" „	Do. ...	5′ 8″	Do. ..	Do. ...	Do.
6th July '05	14	$1\frac{17}{20}$" „	Do ...	5′ 7¼″	Do. ...	Do. ...	Do.
11th July '05	9	$1\frac{15}{20}$" „	Do. ...	6′ 1¼″	Do. .	Do. .	Do.
19th July '06	12	?	Do. ...	6′ 3½″	Rangoon ..	Evans and Self.	Do.
1st Aug. '04	13	$1\frac{3}{20}$" to $1\frac{1}{20}$"	Do. ...	5′ 9½″	Cannanore .	Self ...	B. N. H. S. Jourl. Vol. XVI, p. 301
14th Nov. '03.	11	Nearly mature.	Do. ...	?	Do. ...	Do. ...	B. N. H. S. Jourl. Vol. XVI, p. 300
September .	12	2″×1¼″	Hatched ..	...	Bangalore ...	Nicholson ...	"Indian Snakes", p. 127.
Do. ..	12	?	Do. ...	...	?	Dreckman ...	Private letter
9th Dec. '9.	13	$1\frac{5}{8}$" to $1\frac{3}{4}$" long.	Do. ...	...	Rangoon ..	Evans and Self.	B. N. H. S. Jourl. Vol. XIII, p. 189.

From the above it appears that the mating season is during the hot weather, and that eggs are voided in August and September, and hatch between September and December.

The periods of gestation and incubation are unknown to me.

The most juvenile mother, if one is to judge from measurement I have records of, was 5 feet 8 inches, and I believe, therefore, that the female is sexually mature at about 4½ years of age.† Both sexes appear

* See addenda (4).

† See addenda (5).

to grow about a foot a year, but as usual I have to regret gaps in my notes that prevent me speaking more positively.

The eggs are laid in adherent clusters, and deposited, I believe, in holes in the earth. They are white, glossy, and parchment-like, with the poles equally domed. In the clutch recorded by Nicholson one egg measured $2'' \times 1\frac{1}{4}''$. The eggs from which young hatched in Rangoon observed by Evans and me measured from $1\frac{5}{8}$ to $1\frac{3}{4}''$ in length.

The youngsters we witnessed hatching in Rangoon measured from $14\frac{1}{2}$ to $15\frac{1}{4}$ inches. They found exit at any convenient spot, and some, even when they had broken the shell sufficiently to admit of easy exit, appeared to quit their cradles reluctantly, as they often peeped out, or extended themselves to a considerable length, and then retired sometimes for hours before evacuating them. They were very active even at this early age, and seemed to know instinctively whom to regard as enemies, for they exhibited anger when molested; and that they can make good use of their teeth, Father Dreckman's experience related above seems to exemplify.

Those observed by Evans and me had the navel perforate, and through this I passed a bristle into the abdominal cavity. Nicholson,* however, says they emerge from the egg with the navel closed. We found two ventral shields usually perforate, and from 21 to 24 ventral shields intervened between these and the anal shield.

Legends.—There are various legends connected with this snake. In some parts it is addicted to sucking cows, and apropos of this it is very remarkable that a feat so manifestly impossible when the snake's mouth is examined, should have received credence in many countries in relation to several species of snakes. It would be impossible for a grasp to be maintained upon the teat without driving home many of the needle-pointed teeth, and inflicting an amount of pain no animal could passively tolerate upon so sensitive a structure. Others attribute to it the curious practice of putting its tail up the cow's nostril, and suddenly withdrawing it. What originated this strange belief, and what possible end it might fulfil, is hard even to speculate upon.

Again, it is very generally believed among natives that the ratsnake mates with the cobra, and is in fact the male cobra, and it is surprising to me that even some educated English people seriously contemplate such an absurdity, and still further so firmly believe it, as to attempt

* "Indian Snakes", p. 128.

to indicate the truth of their assertions. I have more than once engaged in a heated discussion on this subject, but after listening to many assurances, the confession has been invariably elicited that the sexes of the supposed engaging parties had never been investigated!

I think the most convincing argument in disproof of this fable lies in the fact that there are beyond dispute both male and female cobras, and both male and female dhamans. One may assume they breed true, since no hybrid, as far as I am aware, has ever been recorded. The possibility of a hybrid I am not prepared to doubt in face of the fact that hybrids have been produced in captivity, the progeny of parents of different ophidian genera, but if the outrageous attachment between Mr. Dhaman and Mrs. Cobra were true, our museums should be well stocked with evidences of their guilt. It is satisfactory to note, when reflecting upon this alleged flagrant laxity of morals, that one never hears even a whispered imputation breathed by these scandalmongers against the characters of Mr. Cobra and Mrs. Dhaman.

The Revd. Mr. John appears to have originated the idea of an attachment between the cobra and the dhaman, for Russell says, Mr. John told him, speaking of the dhaman, that it was often found in company with the cobra. The fact is these snakes are of similar habit, and seek out similar quarters, but companionship is merely a matter of accident.

Russell* says: The natives say it is not dangerous, but assert that its bite occasions blindness in persons over forty! Again he says the Revd. Mr. John tells him that the sharpness of its scales sometimes does harm to rice grounds!

Distribution.—Its range of distribution is very extensive. It is found throughout the whole Indian Peninsula, from Ceylon in the south to the Himalayas in the north. On the west it extends through Rajputana, and Sind to Afghanistan, and Transcaspia. In the east it ranges through Burma, and the whole Malayan Continent to Southern China and Formosa. In the Archipelago it has only been recorded from Java. In almost every locality it is to be reckoned as one of the commonest snakes, at any rate in the plains. In upland regions it becomes scarcer as one ascends. It is common at moderate elevations (5,000 ft.), and has been found up to 7,000 ft. (Sutlej Valley †) but is probably rarely met with much above this altitude.

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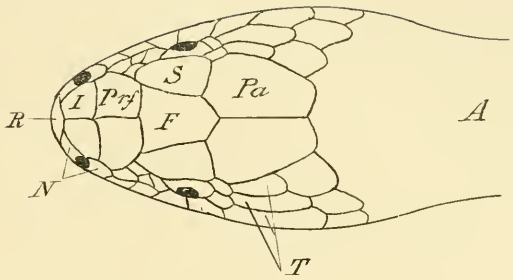
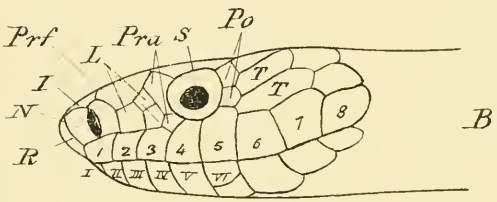
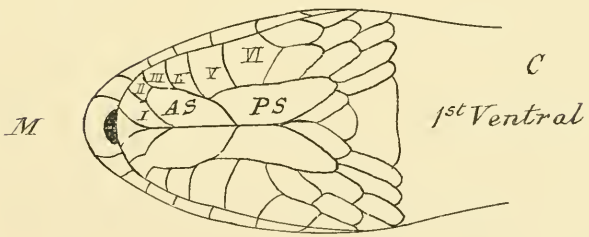
* "Ind. Serp.," Vol. II. p. 21.

† Stoliczka "Journ. As. Soc., Bengal," XXXIX, p. 185.







A. S.	Anterior sublinguals.	Prf.	Praefrontal.
F.	Frontal.	Po.	Postocular.
I.	Internasal.	P. S.	Posterior sublinguals.
L.	Loreals.	R.	Rostral.
M.	Mental.	S.	Supraocular.
N.	Nasal.	T.	Temporal.
Pa.	Parietal.	1 to 8	Supralabials.
Pra.	Praeocular.	I to VI	Infralabials.

ZAMENIS MUCOSUS. (NAT SIZE)

INDIAN SNAKES. (WALL)

Blanford* remarks that it appears much less common in the Deccan proper, west of Nagpur, than it is to the eastward.

Description.—Rostral, touches 6 shields, of which the anterior nasal sutures are largest, and about $\frac{1}{3}$ greater than the internasals.

Internasals.—A pair. The suture between them $\frac{1}{2}$ to $\frac{2}{3}$ that between the præfrontal fellows ; $\frac{3}{4}$ the internaso-præfrontal suture.

Præfrontals.—The suture between them rather greater than the præfronto-frontal suture. In contact with the internasal, posterior nasal, two loreals, præocular, supraocular, and frontal. *Frontal.*—In contact with 6 shields, of which the supraocular sutures are the largest, and twice or more than twice the parietal sutures. Length subequal to supraoculars. Breadth subequal to or rather greater than the supraoculars. *Parietals* in contact with one postocular usually (rarely two). *Nasals.*—Two, lateral, completely divided. In contact with the 1st and 2nd supralabials. The nostril occupies the full depth of the suture, and is situated almost entirely in the posterior shield. *Loreals.*—Three, normally $1+1$. (rarely 2 4, or 5). *Præocular.*— Two normally (rarely one), the lower wedged between the 3rd and 4th supralabials. *Postoculars.*—Two. *Temporals.*—Two ; the lower touching the 6th and 7th supralabials (sometimes the 5th also). *Supralabials* 8, the 4th and 5th touching the eye normally (sometimes 9 with the 5th and 6th touching the eye). *Infralabials* 5 touch the anterior sublinguals (rarely 6), the first forming a suture together about half the length of that between the anterior sublinguals. The 5th and 6th touch the posterior sublinguals. The 6th is the largest of the series, and is as broad or broader than the posterior sublinguals, and in contact with 2 scales behind. *Scales.*—Two heads lengths behind the head 17 ; midbody 17 or 16 ; two heads lengths before the vent 14 or 12. All subequal except the last row which is largest. A pair of apical facets at the apex of each scale. *Keels* antoriorly (two heads lengths behind head) none ; midbody in from 0 to 6 or 7 rows ; posteriorly (two heads lengths before vent) in 2 to 10 rows. *Absorption* †—In this snake two steps occur, the first in which the scales reduce from 17 to 16, and this is brought

* Jourl. As. Soc. Bengal, Vol. XXXIX, p. 372.

† I have already referred to the fact that in some snakes the same number of rows of scales persists throughout the body length ; whilst in others it decreases Now the manner in which this reduction is effected is one of much interest from its variation in different species, and it is surprising to me that this feature should have been altogether overlooked by other herpetologists.

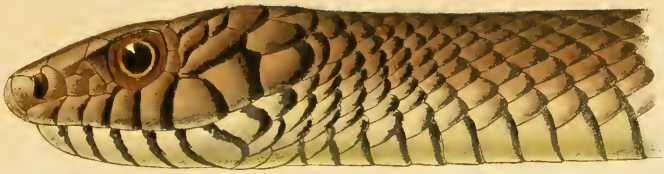
about by the absorption of the vertebral row into that adjacent to it on the left side. This occurs about the middle of the body, usually behind the midpoint, sometimes however in front of it. Very shortly afterwards a further reduction takes place to 14, and this is brought about by the absorption of the 3rd row above the ventrals on both sides, into one of the adjacent rows (*i.e.*, the 2nd or 4th). Should another reduction take place, as sometimes happens in the posterior part of the body, the 3rd row is again absorbed into the one above or below, and 12 rows are established. It rarely happens that the first two steps occurring closely together as they do are reversed. *Supracaudals* are in even numbers. 6 rows in the middle of the tail, and dwindling to 2 at the tip. The absorption of these rows follows the rule, and the two uppermost or each side, keep on coalescing at each step. Keels end where the rows count 6 or 8. Apical facets are present in all rows to the tail tip. *Ventrals.*—190 to 208 (Boulenger), somewhat angulate laterally. Only a part of the last row of scales visible on each side when the specimen is laid on its back. *Anal* divided. *Subcaudals* 95 to 135 (Boulenger), divided throughout.

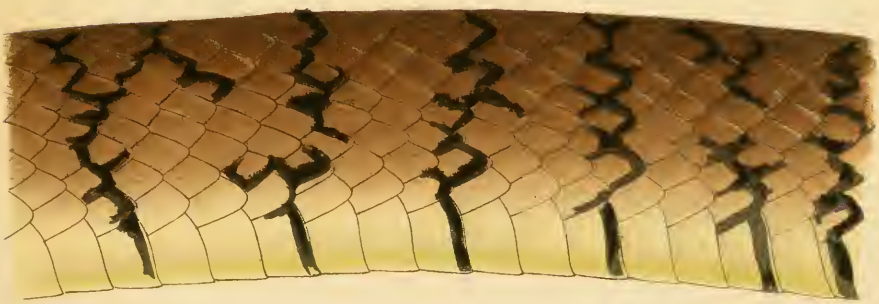
Our plate is excellent. The only remark I have to make is that the chin is shown too receding, and is probably to be explained by some distortion from pressure against the glass in the specimen selected in the Museum.

ADDENDA.

Since writing the above I have acquired some additional information with which I can supplement my original remarks.

(1) Mr. Millard tells me he once saw a large dhaman up a wild date palm tree on Malabar Hill, Bombay, and from the excitement shown by the small palm squirrels there was no doubt what it was after. Recently in Fyzabad a specimen 6 feet 8 inches was brought me which was discovered high up in a tree, the attention of a passer-by having been called to it, by the noisy demonstrations of several birds. I found it contained two large chicks each 3½ inches long in the stomach, and a larger one 4 inches long in the gullet. They were partially enveloped in their shells, which were of a uniform bright blue colour. They appeared to me to be much too large for crowchicks, and the colour of the eggs was not corvine.





J.G. del. J. Green, Chromo

THE DHAMAN OR INDIAN RAT-SNAKE (Harmless)

Zamenis mucosus.

(2) Mr. Millard further tells me that in the Society's cages in Bombay large specimens are so restless when captive, and strike so frequently at the wire netting, that they do not live long.

(3) This receives abundant confirmation from this year's specimens. I find from my notes that whilst I have had 14 males measuring 6 feet 6 inches and over, my largest female was only 6 feet 3 inches. In fact only 4 females reached the limit of 6 feet.

(4) Another instance of this kind occurred this year. The baboo at the Fyzabad Club on the 2nd July sent me word there were two snakes in the garden close by. I went to investigate, but unfortunately a hue and cry had been raised among the tennis chokras, and they had taken shelter in some brushwood. The baboo told me that for many minutes he had been watching two large snakes, which, as he expressed it, "were playing very nicely." He described them as facing one another, and swaying their erected bodies to and fro. I made no doubt that this was a little love passage I had unfortunately missed, and I instituted a search with the result that I observed one dhaman glide from the spot indicated, and killed the other before it could escape me in the same spot. This proved to be a male 6 feet 9 inches long. The next day at the same spot the female was killed and brought to me, and I found she contained 12 large eggs, one typical of the rest, measuring $1\frac{1}{2}$ inches, and therefore nearly mature. She was 6 feet 1 inch in length. This again seems to show cohabitation long after impregnation, and if so establishes a bond of union one would hardly expect to find among reptiles. Another possible solution to this episode, however, may be that the male was pressing attentions upon the female, which her condition forbade her reciprocating and that in consequence she was really fighting, and not playing. This was suggested to me recently by a similar incident on the part of two buff-striped Keelbacks (*Tropidonotus stolatus*).

(5) I have had two gravid females this year, 5 feet $2\frac{1}{2}$ inches, and 5 feet $5\frac{1}{2}$ inches, respectively.

(*To be continued.*)

JOURNAL
OF THE
BOMBAY
Natural History Society.

Vol. XVII. BOMBAY. No. 4.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plates and Diagrams.

By Major F. Wall, I.M.S., C.M.Z.S.

Part IV—With Plate IV.

(*Continued from page* 273 *of this Volume.*)

TROPIDONOTUS PISCATOR, THE COMMON POND SNAKE OR CHEQUERED KEELBACK.

Nomenclature. (*a*) *Scientific.*—The generic name is from the Greek "*tropis*" a keel, and "*notos*" the back, in allusion to the ridges formed by the keels on the costal scales which, though a very characteristic feature, is by no means one peculiar to this snake and its allies.

The specific name "*piscator*" of Latin origin is not to my mind appropriate, since it seems to imply the practice of some art by which it is able to capture fish. Though aquatic in habit, its diet is usually batrachian; and though it does evince piscivorous tastes sometimes, it is in no way better endowed with the capability to catch fish than is any other water-snake. It is difficult therefore to see in what respect it resembles the fisherman. It certainly prefers the exercise of its natatory powers to imitating the patient inaction at the water's brink so commonly manifested by those who favour the piscatorial art. Its older and better known name "*quincunciatus*" from the Latin "quincunx"

is more fitting, for the commonest varieties bear spots or blotches arranged in longitudinal lines, so that those of one series alternate with those of the adjacent rows. The creature is thus beset with quincunxes (like the 5 on dice), and when the spots and intervals are alike in size, a veritable chess board pattern is the result.

Vernacular.—The more I strive to acquire the native names for snakes, the more hopeless it becomes. It is rarely that any two members of a crowd will give the same name to a snake, and it is almost as certain that the professional snake-catcher, with a huge local reputation, will call a snake by one name to-day and another to-morrow. In Cannanore the common types of this snake were called "Neer Kolee" and "Neer Mandallee", the former meaning "water-fowl" and the latter "water spotted snake"; but I was never able to discover by what means the one was discriminated from the other. The former was usually applied to small specimens, and the latter to large examples, especially the boldly spotted ones. In most languages it is simply called water-snake, as, for example, the Burmese "Yé mywé", the Tamil "Thanee pamboo", the Canarese "Neeru havu" and the Hindi "Pani ka samp". Doubtless, these names are applied also to many of the Homalopsids.

The Canarese also call it "holay havu" or stream-snake, and Russell's various colour varieties are "Dooblee", "Paragoodoo", "Naugealled Keaka", "Neeli Kœa", "Dora", and "Ourdia". (*See* addenda.)

Dimensions.—Nicholson* records a specimen 4 feet 3 inches, and Blanford† another of the same length. These are exceptional, for I have the measurements of 55 specimens, and the largest taped 3 feet 10½ inches. My notes refer to a host of other specimens in which the length is not noted on account of their meagre proportions. Of the 55 specimens referred to above, only 10 exceed 3 feet in length.

Physiognomy and bodily configuration.—The head is ovate, rounded from side to side, and the front narrow. The nostrils by their slitlike form and superior position approximate to those of the true fresh-water snakes (Homalopsids) and marine snakes (Hydrophids), as do also the eyes which are set with a decided inclination upwards; but the tail has not been modified to a corresponding degree towards the true

* "Indian Snakes," page 90.

† Journ., Asiat. Soc., Bengal, XXXIX, page 371.

aquatic type as one might expect, in adaptation to its natatory proclivities, but preserves the rounded contour typical of the terrestrial forms. The eye is moderately large, the iris flecked with gold or golden green, and a dense zone of gold demarcates the pupillary margin, and reveals the rotund conformation of the pupil. The neck is constricted sufficiently to be evident. The body closely ridged by the carination of the costal scales, is robust, rounded, and reduces in girth decidedly before the vent. The tail is ample in both sexes, being one-fourth to one-third the total length, and tapers gradually, the dorsal ridges being preserved almost to its extreme tip.

Colour.—The colour and markings of this snake are exceedingly variable, as a glance at our plate will, in some measure, serve to indicate.

The ground colour may be dull green, olive-green, olive-brown or brown of almost any shade, light or dark.

Some specimens are uniform, or almost uniform, in colour, but the majority show some chequering, and usually of black which may occur in specks, spots, or blotches, and vary from a few marks confined to the sides of the neck and forebody, to a wholesale distribution chequering the entire body and tail. These marks are usually arranged quincuncially in 5 or 6 longitudinal rows, and the blotches in some examples are confluent, and so large that black becomes the prevailing colour.

Some specimens are decorated with a similar draught board pattern, but sombre hues replace the black, and sometimes buff or whitish tints form the most conspicuous chequering.

Again, some are specked, spotted, or blotched with red which may vary from salmon or rose pink to a brilliant scarlet like sealing-wax.

This lively ornamentation is as capricious in its distribution as the black above alluded to, and may vary from a few marks on the side of the neck and forebody to a profuse adornment of the whole dorsum. All these decorative hues are almost entirely confined to the basal half of each scale, and especially to their margins, where the scales overlap one another, so that they are seen to their best advantage when the snake under excitement dilates itself.

The crown of the head is similar to the dorsal ground colour and two black oblique streaks are almost always in evidence proceeding

from the eye (Günther says they are inconspicuous or absent in some specimens from Nepaul and Ceylon). The anterior passes as a subocular between the 5th and 6th or 6th and 7th supralabials to the margin of the lip. The posterior crosses the temporals, and the 8th supralabial to the gape or beyond. A more or less distinct black chevron, or a modification of such, is usually borne upon the nape.

Ventrally the colour is usually uniformly dull white or yellow, but many specimens, and especially those heavily blotched with black dorsally, bear black subterminal transverse bars, more or less complete on each scale. Where the ventrals meet the ultimate costal row in the flanks, may be seen a black, pink, or brilliant crimson streak. The throat and forebody are sometimes bright yellow or orange.

These brilliant colours are not seasonal, though Stoliczka * inclines to this belief, nor are they the prerogative of either sex. I have satisfied myself that they are present in the hatchling. To the best of my belief, I have only met with these gaudily attired specimens on the Malabar Coast of India and in Burmah. Our artist has shown the markings in the two bottom figures too regular, so that they are more suggestive of the conventional or wall-paper style of decoration than that bestowed by Nature. So numerous are the colour varieties of this species that it is most perplexing to know how best to describe and group them. Russell † figured no less than 7 examples, all of which he named differently and evidently considered distinct. Similarly, Daudin described as 5 different snakes, specimens which at the present day are merely considered varieties of a single species. Boulenger ‡ recognises 3 varieties, but includes all those from our Indian Region under one heading. At the time he wrote (1893) the British Museum collection contained only 17 specimens of this snake, and it is not surprising therefore that our most notable varieties escape mention. I have seen and examined, at the lowest computation, fully 200 of this species, and from many and distant parts of the Empire, and propose the following grouping of our numerous varieties:—

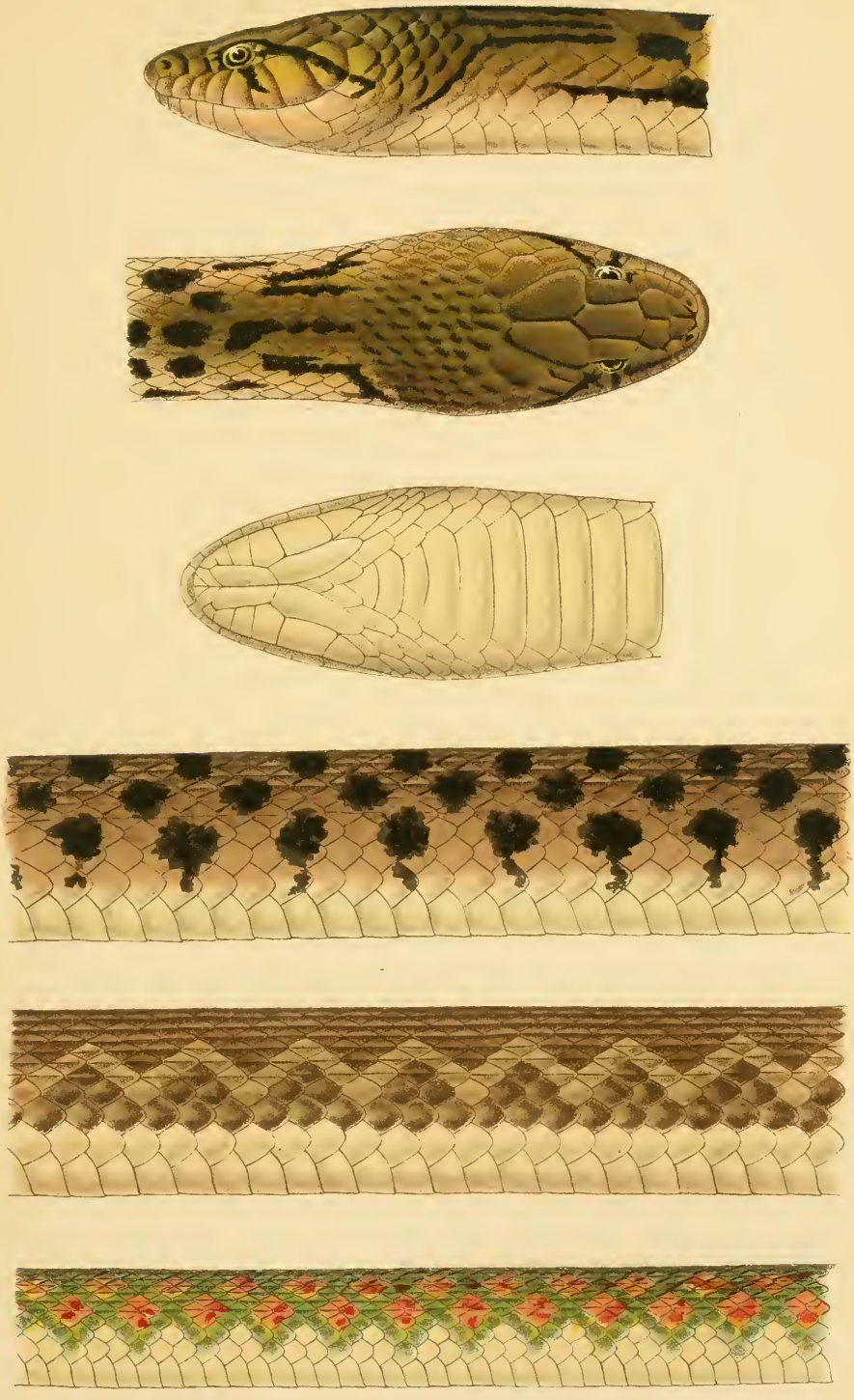
(*a*) *Unicolor.*—Without dorsal marks. Blanford § mentions such a specimen from Ajmere which he described as uniform olive-grey.

* Jourl., Asiat. Soc., Bengal, Vol. XL., page 431.

† Indian Serpents.

‡ Cat., Snakes, Brit. Mus., Vol. I, page 23).

§ Jourl., Asiat. Soc., Bengal, Vol. XLVIII, p. 126.



J. G. del. J. Green, Chromo.

THE CHECKERED WATER SNAKE (Harmless).

Tropidonotus piscator.

I would place Boie's *Melanozostus* * here which he describes as "olivaceo pallide fuscus," making no allusion to dorsal marks or spots. This cognomen has reference to the black ventral bands, which may or may not be present in this type. I have seen many uniformly coloured, and think such specimens are to be found everywhere.

(*b*) *Lateralis.*—Without marks in mid-dorsum, but variously mottled, marbled, or spotted in the flanks. Fig. 2 of our plate shows such a specimen. Blanford † alludes to two males he obtained in the Central Provinces, which he describes as "olive without any dark mark, but with a row of well-marked buff spots down the sides." It is in my experience a common variety which, I believe, is to be found everywhere.

(*c*) *Punctatus.*—With small black or blackish spots. Russell ‡ figures one such specimen, but I have usually seen them with the spots arranged quincuncially, and not irregularly scattered as in his specimen. Günther's § variety $^{\delta}$ would, I think, come into this category. It is common everywhere.

(*d*) *Quincunciatus* (Schlegel).—With large black spots, often as large as the interspaces, or even larger, but arranged quincuncially so as to form a regular chess-board pattern. Fig. 1 in our plate shows a good example. Nicholson's ¶ variety "$^{\alpha}$" and his figure on Plate XIV refer to this type. It is one of the commonest varieties and to be found, I think, everywhere.

(*e*) *Anastomosatus* (Daudin).—Marked with a network pattern. Daudin ‖ thus describes it: "Supra cinereo flavescens, maculis parvis rotundis ingris lineis obliquis junctis, et reticulatus." With this I would unite the "braminus" of the same author, the only difference being that in the latter the spots are contained within the meshes of the reticulation, whereas in the former the spots are at the junction of the lines, and leave empty spaces. Russell ** shows both these types in his large volume. Günther †† describes it under his variety $^{\beta}$ as

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* Isis, p. 206.

† Journ., Asiat. Soc., Bengal, Vol. XXXIX, p. 371.

‡ Indian Serpents, Plate XV*a*, Vol. II.

§ Rept. of Brit. Ind., p. 261.

¶ Indian Snakes, p. 90.

‖ Nat. Hist. Rept., VII., p. 140.

** Loc. cit., Plates XX and XXXIII, Vol. I.

†† Loc cit., p. 261.

follows :—"The spots are, as it were, dissolved into a network of black lines with intermixed white dots."

(*f*) *Obscurus.*—Obscurely spotted, dappled, or chequered with sombre hues. Blanford * thus describes a specimen I refer to this type : "Almost uniform brown, having the dark spots nearly quite obsolete." I feel disposed, too, to place Günther's † *flavipunctata* here. It is a common form.

(*g*) *Mortuarius* (Daudin).—Quincuncially marked with sagittate black and cinereous grey marks. I am not sure that I have seen this type, but Russell ‡ figures a good illustration.

(*h*) *Umbratus* (Daudin).—Heavily blotched with black without quincuncial arrangement. Daudin thus describes it :—"Colare atro maculis dorsalibus obsolete flavescentibus." With this I would include the same author's *dora*. I see no difference between them. Russell § gives three good examples of the type. Blanford ¶ alludes to a female he captured in the Central Provinces which was evidently of this variety. I think Günther's ‖ variety γ from Ceylon should be included here, as it only differs in the tendency to form transverse bands. The type is a common one.

(*i*) *Ornata.*—Specked, spotted, or blotched with pink, orange, or vermilion. A good example is shown in Fig. 3 of our plate. Günther** mentions it as his variety α. Nicholson †† alludes to it as his variety *b*. Anderson ‡‡ mentions it from Yunnan. Stoliczka §§ refers to it too, as does also Theobald ¶¶. Günther says it occurs in almost every part of India, but I think I have only met with it on the Malabar Coast and in Burma, and Theobald remarks that the bright colouring, he thinks, is more developed in Burmese specimens than in those from Bengal. I obtained a modified example in Cannanore which demands special remark as the adornment was not in spots. The specimen was uniform

* Jourl., Asiat. Soc., Bengal, Vol. XXXIX, p. 191.

† Loc. cit., p. 270.

‡ Loc. cit., Plate XXVIII, Vol. I.

§ Loc. cit., Plates III, V and XIV, Vol. II.

¶ Jourl., Asiat. Soc., Bengal, Vol. XXXIX, p. 371

‖ Loc. cit , p. 260.

** Loc. cit , p. 259

†† Indian Snakes, p. 90.

‡‡ Ann. Zool. Yunnan, p. 821.

§§ Jourl., Asiat. Soc., Bengal, Vol. XL, p. 431.

¶¶ Cat., Rept., Brit. Burma. 1868, p. 47.

olive-green in the median dorsal region, but the flanks were ornamented with a deep continuous band of brilliant sunset crimson. These lively hues fade so rapidly in spirit that it does not surprise me that Boulenger makes no special reference to them.

(*j*) *Tytleri.*—Distinguished by longitudinal white, black-edged lines anteriorly. Both Blyth * and Theobald † allude to it, the latter under the title *Striolatus*. It appears to be peculiar to the Andamans.

Distribution. (*a*) *Geographical.*—I am not aware of any locality in our Indian Dominions below, say, 3,000 feet, except Sind, where it does not exist plentifully, and in most parts it must be conceded the distinction of being the commonest of all species. To the East it extends throughout the whole Malayan region, continental and insular, to Southern China, and Formosa. To the West its range appears to cease before Sind, since Murray does not mention it in his Vertebrate Zoology of that region.

Local.—It frequents the neighbourhood of water, and abounds in rivers, jheels, marshes and pools. During the hot weather, or in localities where the nature of the soil is arid and open, it is little in evidence, but clings to its favoured element. As soon as the rains burst, it becomes disseminated broadcast, and may be found wherever the vegetation offers convenient hiding at some distance from water, and it occasionally strays into the bungalow.

Breeding.—*The Sexes.*—Females average a greater length, and have shorter tails than males.

The shortest female to demonstrate her fertility, of which my notes bear record, was 2 feet $7\frac{7}{8}$ inches, and was obtained in Cannanore. This length, I think, establishes the sexual maturity of this species at 4 years of age. This agrees with the age I have estimated in some other Indian snakes, but the observations of Lenz on snakes in Europe led him to suppose they were sexually matured at 3 years of age. As this is an interesting point, I furnish my reasons for this statement. Taking the month of July, which I select because my notes in this month furnish me with the largest material upon which to make deductions, it will be seen from the annexed table that the lengths of many specimens which are closely approximate, leave gaps which seem clearly to demarcate the broods of successive years.

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* Jourl., Asiat. Soc., Bengal, 1863, p. 88.

† Cat., Rept. Asiat. Soc. Mus., 1868, p. 55.

Table showing length of specimens collected in July. (*See* Addenda.)

Number.	Length.	Locality.	Year.
6	$8\frac{3}{4}''$ to $10\frac{5}{8}''$	Fyzabad	1905.
2	1′-3″ to 1′-$4\frac{1}{4}''$	Burma	1899.
3	1′-$3\frac{1}{4}''$ to 1′-5″	Cannanore	1904.
2	1′-$8\frac{1}{2}''$ to 1′-$10\frac{3}{4}''$	Burma	1899.
1	1′-9″	Fyzabad	1905.
1	2′-$4\frac{3}{4}''$	Burma	1899.
1	2′-$5\frac{1}{2}''$	Cannanore	1904.
1	2′-$3\frac{1}{2}''$	Fyzabad	1905.
4	2′-$7\frac{1}{2}''$ to 2′-$9\frac{1}{2}''$	Burma	1899.

The rate of growth will thus be seen to be about 4 to 6 inches a year.

Season.—The sexes seek one another's society for mating purposes during the cool season. Father Dreckman wrote to me of a pair he found "in copula" in the month of October at Khandalla, and my own female was captured under similar circumstances on the 3rd of January in Rangoon. The period of gestation in this specimen proved to be 55 days, the eggs being deposited at intervals between the 9th and 23rd of March; 14 of the 24 eggs, however, were voided between 9 and 11 a.m. on the 55th day (March 9). The protracted period of deposition I attribute to the enfeebled health of the parent consequent upon her captivity. Another specimen I captured at Cannanore close upon term discharged all her 57 eggs within a few hours.

On both occasions the eggs were extruded into water, and sunk in that element. The females were both found coiled above them, and Nicholson* mentions having noticed the same behaviour, but repudiates any idea that this was an attempt to incubate them, for the parent continued to remain so after the ova had shrivelled. I am of opinion that the mother probably incubates her eggs in a state of nature. Begbie† found 24 eggs of this snake in a big grass nest at the end of an adit bored in a canal bank, but I think the nest was prob-

* "Indian Snakes," p. 128.

† Bombay Nat. Hist. Journ., Vol. XVI, p. 516.

ably a water rat's which the reptile chanced upon, and appropriated to her own use. Notes of this character are of the utmost interest and importance. Information on the habits of snakes is extremely hard to elucidate.

Eggs.—Those I obtained in Cannanore were all much alike in size, shape, and tension, but those I acquired in Rangoon varied considerably. Some were tense, others flaccid, and they varied much in size, as may be inferred from their weights, which ranged from 1 drachm 28 grains to 2 drachms 37 grains. These variations were probably the result of impoverished health. Normally they are soft and white without gloss. When voided they are evidently surrounded with a glutinous pellicle, for they adhere firmly at any points where chance has placed them in apposition. The poles are isomorphous, the shape elliptical, and tension much like that of a ripe grape. In length they vary from $1\frac{5}{20}$ to $1\frac{11}{20}$ inches, and in breadth from $\frac{15}{20}$ to 1 inch.

Period of incubation.—How long these eggs take to hatch I have been unable to ascertain, as all attempts to incubate them have proved futile.

Deposition.—They are laid in the months of January, February and March usually, but Major Evans tells me he has killed some examples egg-bound as late as April in Burma. (*See* Addenda.)

Young.—When hatched, the young measure about $7\frac{3}{4}$ to 8 inches, or about one-sixth the length of a large adult.

This is one of the most prolific snakes I know, and ranks with the pythons and the Russell's viper in this respect.

Blanford describes a pair which he dislodged from beneath a large stone in a stream. They had evidently made their home there, and he remarks that they showed a disinclination to quit the spot. It is remarkable that though they were evidently cohabiting, the female was in an advanced state of egg-bearing, and this is on a par with the case of the two rat snakes alluded to in my last paper. This with other cases of a similar kind leads me to think that snakes possess a mutual love and attachment in no way inferior to that exhibited by many warm-blooded animals which preserve their conjugal relationship long past the term of sexual gratification. A history of the events known to me relative to the breeding of this snake is herewith appended in tabular form.

Table of Breeding Events. (*See* Addenda.)

Stage of Development.	No.	Date.	Locality.	Authority.
Sexes "in copula"...	...	October ...	Khandalla (Western Ghats).	Dreckman.*
Do. ..	...	3-1-00 ...	Rangoon ...	Self.
Impregnated follicles.	...	14-11-03...	Cannanore ...	Do.
Do. ...	...	18-11-03...	Do. ...	Do.
Do. ...	...	24-11-03...	Do. ...	Do.
Ova "in abdomina"...	85	? ...	Central Provinces.	Blanford. †
Do. ...	20	4-1-04 ..	Cannanore ..	Self.
Do. ...	61	29-1-00 ...	Rangoon ...	Evans and self.
Do. ...	41	1-2-00 ...	Do. ...	Do.
Do. ...	36	1 to 16-3-00	Mandalay ...	Do.
Do. ...	47	20-2-06 ...	Fyzabad ...	Self.
Ova deposited ...	20	? ...	Ceylon ...	Tennent. ‡
Do. ...	24	9 to 23-3-00	Rangoon ...	Self.
Do. ...	57	14-1-04 ...	Cannanore ...	Do.
Young hatching ...	24	14-5-05 ...	Cawnpore ...	Begbie. §
Hatchling killed ...	...	23-3-04 ...	Cannanore ...	Self.
Do. ...		?-6-99 ...	Rangoon ...	Evans and self.

Identification.—The foregoing remarks on colour should convince one that this will not aid the identification of this snake, especially too when it is a fact that several of the other species of the genus are singularly like some of the many colour varieties of this species.

There is no single scale characteristic peculiar to this snake upon which to rely in determining its identity, so that a combination of features must be looked for to indicate the species. First of all the rows of scales at midbody must number 19; next 2 supralabial shields must touch the eye; the anal shield must be divided, and there must be a pair of internasal shields. Should these 4 points co-exist, its identity may be considered established.

Disposition.—With the exception of the *Echis*, I think it is the most vicious snake I know. It is ever ready to bite, and strikes with great determination and rapidity, fastening itself with such tenacity that I have known it necessary to prize apart the jaws to disengage its hold. Even hatchlings exhibit this ill-temper, and I remember well on one occasion being bitten several times before I effected the capture of an 8-inch baby. (*See* Addenda.)

* In epistola.

† Journl., Asiat. Soc., Bengal, Vol. XXXIX, p. 371.

‡ "Ceylon," p. 197.

§ Journl., Bombay Nat. Hist. Soc., Vol. XVI, p. 516.

Sometimes, but by no means always, this snake, when irritated, erects itself, and while dilating its body, very markedly flattens its forepart in cobra fashion. It is strong and active, and its movements brisk and rapid on land and in water. This is one of the snakes that I have seen actually jump clean off the ground. *Apropos* of this remarkable feat, I interrogated a Bangalore *sampwallah* with a view to ascertaining the identity of a snake made mention of in a Canarese Dictionary as "Haramandalatha havu" or jumping snake, which I thought might prove to be the hamadryad. To my surprise and satisfaction, however, the next day he reproduced a "piscator" which he assured me was the jumping snake, and he was most assiduous in provoking the snake to exhibit its saltatory powers for my benefit, but though I have seen this snake jump and actually clear the ground, I cannot say that I did so on this occasion. However, it erected itself in an amazing manner, and, literally, threw itself forward in a manner that could only be described as a series of jumps.

Food.—Its main diet is batrachian, usually frogs being ingested, doubtless because they are so plentiful and so easy of capture. Fish, however, are frequently taken. (*See* Addenda.) I have found as many as 8 or 9 tadpoles in the stomach of a young specimen. They seem to feed voraciously, and in Cannanore on several occasions one was brought to me wriggling at the end of a fish hook which had been baited with a frog by native urchins. I have never seen one attempt to constrict its victim, nor does it wait till they are dead ; but if advantageously seized, it commences to swallow at once, so that the frog, when this happens to be the unfortunate, continues to squeal piteously for some time after engulfment."

Description.—Rostral.—Touches 6 shields, making 6 sutures, of which those formed by the anterior nasals are twice or nearly twice the length of those made by the internasals. *Internasals.* (*See* Addenda.)—A pair. The suture between them equal to or nearly equal to that between the præfrontal follows ; subequal to the internaso-præfrontal suture. *Præfrontals.* (*See* Addenda.)—A pair. The suture between them rather larger than the præfronto-frontal. In contact with internasals, postnasal, loreal, præocular, supraocular, and frontal. *Frontal.*—Touches 6 shields, of which the supraoculars make sutures fully twice those formed with the parietals ; breadth subequal to the supraoculars ; length rather more than supra-

ocular. *Nasals* two, the slitlike nostril meets the dividing suture at an angle to form a γ, and is thus contained wholly in the anterior shield. In contact with the 1st and 2nd supralabials. *Loreal* one, as high as broad. *Præoculars* one. *Postoculars* 3 normally (rarely 2 to 5). *Temporals*—Two anterior, the inferior touching the 7th and 8th supralabials. *Supralabials* 9. The 4th and 5th touching the eye. *Anterior sublinguals* smaller than the posterior. *Infralabials* 7. 5 touch the anterior sublinguals; the 5th, 6th and 7th touch the posterior. The 6th is the largest; the 7th pentagonal, and in contact with 3 scales behind; the suture between the 1st is one-third to one-fourth that between the anterior sublinguals. *Scales*—2 heads lengths from head 19, midbody 19, 2 heads lengths before vent 17. The step where the 19 becomes 17 occurs behind the midpoint of the body, and the 4th row from the ventrals disappears, being absorbed into the row above or below. Keels are present on all scales but the lowest 2 to 5 rows anteriorly, and 1 to 2 rows posteriorly, and end after the supracaudals have become four. They are present in all the supracaudals at the base of the tail. Apical facets present in pairs. The last row is the largest, and the vertebral row is not enlarged. *Ventrals*—Rounded 125 to 150 (Boulenger). *Anal* divided. *Subcaudals* 70 to 90 (Boulenger), paired.

Dentition.—In a specimen recently acquired this is as follows :—

Right side.—Maxillary 22. Palato-pterygoid 12 + 26. Mandibular 25.

Left side.—Maxillary 23. Palato-pterygoid 13 + 27. Mandibular 24.

These numbers include, of course, the gaps in the various arrays, which are seldom perfect at any one time. This is the only correct way of numbering the teeth, for as one drops out, its place is soon re-occupied by another from the reserve tracts. These are very interesting. One runs along the base of each row, and contains a very large number of teeth of various sizes lying loosely attached in the mucous membrane, the largest closest to the teeth they are destined to replace. The maxillary and mandibular tracts lie along the inside of their dental series, but the palato-pterygoid along the outer aspect.

The teeth are all vertically compressed and convex on two faces, which meet to form ridges, so that in section they are exactly like a deep lens. The ridges lie laterally in all the teeth excepting those situated at the back of the maxillary and mandibular arrays where the teeth are turned

on their own axes so that the ridges lie anteriorly and posteriorly. The teeth in the maxillary series are directed backwards, and present a slight inclination inwards. The palato-pterygoid are directed straight backwards, and the mandibular at first directed backwards, gradually acquire a strong inclination inwards. Further, the maxillary array is isodont in its greater length (*i.e.*, has teeth of equal size). A few of the most anterior are, however, progressively smaller, and the two last occurring after an interval are very much enlarged. These enlarged teeth have been already figured in the second of these papers (Vol. XVII, facing page 2), and are in this species intermediate between those shown in figs. 1 and 2 of that paper. The palato-pterygoid series are isodont, as are also the mandibular, excepting a very few in the extreme forefront, which are shorter.

(*To be continued.*)

ADDENDA.

Since writing the above I have the following remarks to add :—

(1) Willey says it is called "Diya polonga" in Ceylon (Spol. Zeylan. April 1906, p. 233).

(2) My notes in Fyzabad last year are wonderfully similar for this month. Of specimens actually measured, I had 16 varying from $9\frac{1}{2}$ to $12\frac{1}{4}$ inches, 2 measured respectively $1'-3''$ and $1'-5\frac{5}{8}''$, 2 others were $1'-9\frac{1}{2}''$ and $2'-0\frac{5}{8}''$, and 1 was $2'-4\frac{1}{2}''$.

(3) I am able to confirm this so far as Assam is concerned, for I have had 6 females heavily eggbound this month (April) containing respectively in abdomina 39, 44, 51, 53, 21 and 34 eggs of dimensions showing that they would very shortly have been discharged.

(4) In the administration report of the Government Museum, Madras, for 1896-7 I notice a female laid 36 eggs in captivity on the 26th of February 1897.

(5) *Apropos* this remark I quote from last year's experiences in my note-book 19th July 1906—"I have had two hatchlings to-day, and both moved very rapidly, did their utmost to escape me, struck out viciously and repeatedly at a stick, and both literally jumped so as to clear the ground without doubt more than once." Again 20th July 1906—"Another hatchling to-day jumped, and was most ferocious. I got badly bitten in my endeavours to grasp it. Its incessant contortions,

great activity, and the antics it indulged in to avoid capture, including jumping, made it a most difficult snake to manage."

(6) I notice Annandale (in Memoirs of the Asiatic Society of Bengal, Vol. 1, No. 10, p. 195) says: "Their food consists wholly or chiefly of fish, and they do not, as a rule, molest the large tank frogs (*Rana tigrina*) which may sometimes be seen sitting side by side with them on stones in the water." This statement has caused me to refer to my notes again. I find 5 specimens last year in Fyzabad had fed: two of these contained a single frog each, another a single toad, another two frogs (*Rana tigrina*), and another one frog and three toads, so that these records support my former observations.

(7) Mr. E. E. Green writes to me that he recently obtained a specimen with the internasals confluent into one shield.

(8) I have once seen four præfrontals in a single row across the snout.

JOURNAL

OF THE

BOMBAY

Natural History Society.

Vol. XVIII. BOMBAY. No. 1.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

ILLUSTRATED BY COLOURED PLATES AND DIAGRAMS.

BY MAJOR F. WALL, I.M.S., C.M.Z.S.

Part V. with Plate V.

(*Continued from page* 870 *of Vol. XVII.*)

THE RUSSELL'S VIPER (*Vipera russellii*).

Nomenclature.—Scientific.—The generic name is from the latin *vivus* alive, and *pario* I bring forth. It was first used scientifically by Laurenti in his work published in 1768. Daboia, another generic name for a long time in use, and perhaps more familiar to many of an older generation, was introduced by Count De La Cépède in his work published in 1789.* The name "Le Daboie" was applied by him to a West African viper of uncertain identity marked somewhat similarly to Russell's viper, in that it had 3 series of large oval spots. "Daboie" was, I believe, the local vernacular name for this snake. Later, Gray in 1842 applied the same term, only latinised, to Russell's viper, which, it may be remarked, does not occur in Africa.

Specific.—This title commemorates the name and fame of Dr. Patrick Russell, a distinguished savant, and the pioneer of all snake

* P. 255.

research work in India, both in its zoological and toxicological aspects. He was born in Edinburgh in 1726, and came out to India in 1781. Four years later the Honourable the East India Company appointed him their naturalist. He is responsible for a monumental work on the Indian snakes with excellent coloured plates, in two volumes published in 1796 and 1801.

The association of his name with this common snake, renowned as much for the beauty of its colour and ornamentation as for the deadly character of its bite, is a fitting tribute to his classical work.*

English. The usual name among the Anglo-Indians is Russell's viper, but Daboia is almost as frequently in use. It is also occasionally called the Chain viper.

Vernacular.—It would be a matter of surprise if so well known, and justly dreaded, a creature had not been christened in almost every vernacular. That mysterious creature the "Cobra monil" of the natives, whose indentity, if ever appreciated by them, has become obscured by the lapse of time, is probably this snake as suggested by Jerdon.† The name probably originated with the Portuguese, "monil" or "moulla" in their tongue signifying a necklace, and "cobra" or "copra" a snake.

In Ceylon it is universally known as "Tic polonga," which means, I am informed, "spotted snake." In Southern India it is known as "Mandalli" and "Kanardi virian." The former, Nicholson says, implies a ringed or decorated pattern. The latter, which I have heard used chiefly about Madras, is from "Kanardi," glass, and the allusion, I think, is to the spots which suggest to the fanciful native mind the appearance of the small mirrors used by them in their tawdry decorations, and frequently seen attached to cloths used as curtains, etc.

On the Malabar Coast (Cannanore) "Mandali" and "Rutheram mandalli" are in use, the former being also applied to the sand snake (*Eryx conicus*), and the latter used to discriminate between these species. "Rutheram" meaning "bloody" emphasises one of the most obvious effects of its bite, *viz.*, bloody discharges.

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* It may be of interest to note here that an elder brother of his, Alexander, has also left his name in this country to be handed down to posterity. The beautiful little garden shrub, *Russellia juncea*, with its curious foliage like casuarina and its vermilion flowers, which scarcely any Indian garden is without, is named in his honour.

† Journal, Asiatic Society, Bengal, Vol. XXII, p. 524.

In Mysore a Canarese Dictionary I referred to gives "Mandalatha havu" as the local name. "Havu" means snake. Rice in his work on Mysore * gives the Canarese name for it as "Kolaku Mandala." On the Coromandel Coast about Vizagapatam Russell gives its local name as "Katuka rekula poda," which I am told is Telugu, and refers to blackish spots.

About Bombay and in the Konkan it is known as the "Ghanas." In Guzerat Mosse says it is called "Chitar," and Fenton in the Dantra District "Khad chitra." "Khad," according to the latter, signifies "grass" and "Chitar" or "Chitra" recalls to mind other native names for spotted creatures.†

In Sind I am told it is called "Koraile."

In Bengal it is known as "Bora," "Chandra bora," "Uloo bora," "Jessur," and "Siah chandra amaiter" according to Fayrer. "Bora" probably implies spotted.‡ "Chandra" = moon, and refers as usual to the spots. "Uloo" is the name for "grass." The Burmese call it "Mwé bwé," meaning ringworm snake, its marks suggesting a skin disease.

Dimensions.—The largest specimen I have measured was a stuffed one in Trichinopoly 5 feet 3 inches in length. Lieut.-Colonel Fenton recorded one in this Journal¶ 5 feet 4½ inches long, and Mr. Brook Fox§ two measuring 5 feet 6 inches each. This is the largest record known to me. Specimens exceeding 5 feet are exceptional.

Bodily configuration.—The girth is remarkable. I think this viper is of stouter build than any other Indian snake, and its capability of inflating itself under excitement, premonitory to its violent hiss, accentuates this peculiarity.

The head is flat, and broadens considerably posteriorly so as to make a moderate neck appear unduly small. A pronounced ridge (*canthus rostralis*) runs from the supercilium to the top of the snout. The eye is moderate in size, the iris golden, and the pupil vertical. The nostril

* Vol. I., p. 188.

† Blanford in his Fauna of British India, Mammalia, gives "Chita" and "Chitra" as local native names for the hunting Leopard (*Cynælurus jubatus*). Again he mentions native synonyms as "Chital" and "Chitra" for the spotted deer (*Cervus axis*). "Chita" is also applied to the Leopard (*Felis pardus*).

‡ I notice the spotted deer, according to Blanford, is called in Bengal "Boro khotiya".

¶ Vol. XVI, page 173.

§ Vol. VIII, page 565.

is remarkably large and open, larger than in any other Indian snake. The tail is relatively short, and unusually apparent, owing to the rapid decrease in girth which occurs about the region of the vent.

The whole snake is remarkably rough, owing to the pronounced ridges (keels) on its scales.

Colour.—The ground colour is brown of varying shades, most specimens being a sandy, or cocoatina tint. The markings vary much in detail and intensity as well as in hue. Sometimes they are so obscure as to attract little attention, and this is especially so just before desquamation. The sloughing process over however, the same snake may reveal a definition of adornment, and brilliancy of colour, which may renovate it as completely as a mess uniform transforms an officer when exchanged for his khaki. The head has a more or less distinct dark patch on each side behind, a dark streak sometimes picked out with white, pink, or buff, behind the eye, and a dark stripe from the eye to the lip. A conspicuous light line, sometimes white, buff, or pink, runs from above the gape, through the temporal region to the supercilium on to the ridge just referred to on the snout. These lines converge, and sometimes meet on the snout to form a V. The lips are white, whitish, or pink variegated with spots, specks, or streaks.

The dorsal adornment consists of a triple series of large ovate spots, forming a vertebral, and two costal necklaces or chains, hence the term "Chain viper." Davy remarks*: "In some specimens the marks are oval, and in some more pointed, and rather trapezoidal; in others surrounded by a white margin; in a fourth lightest in the middle." It is not infrequent to see some of these spots more or less confluent, in fact, it is rarely one sees a perfect rosary. The costal spots are frequently interrupted at their lower margins, and sometimes taper, reminding one of a balloon.†

Each spot may be of uniform colour throughout, but more often exhibits a light central zone, similar to the ground colour, which merges into a deep Lincoln-green, purple, or black, around which again may be seen a narrow zone of buff or pure white, the latter

* "An Account of the Interior of Ceylon," p. 85.

† Since writing this I have seen a specimen sent to this Society by Mr. Kinloch from Kotagiri (5,700 ft.) in the Nilghiris in which the three series of spots are completely confluent into bands. The sinuous outlines of these bands indicate the number of spots, which however are broadly blended, in the entire length of the snake. It is the only one I have seen so marked.

especially enhancing the beauty of the specimen, as may be judged from our plate. Mr. Millard tells me that about Bombay adult specimens do not have this white definition to the spots, and he is inclined to regard it as a distinct variety. I have satisfied myself that specimens are to be met with in most parts, including Bombay, with and without this white adornment. To begin with, I found in some hatchlings of the same brood born in this Society's Museum, and preserved in spirit, some individuals with and some without the white delineament. Davy, already quoted, remarks that white margins, to the spots may or may not be evident in Ceylon specimens. In a mother I referred to in a note in this Journal* from Saugor, the spots had no light margins, though the single embryo had spots picked out with pale buff. Again, a specimen figured by Russell† obtained from Bombay has no suspicion of a light outline to the spots.

The belly is white, whitish, or yellowish, with darkish semilunes distributed sparsely, and disposed at the margins of the ventrals, especially in the fore body.

Identification.—Consideration must be given to the following points, all of which must coexist :—

(1) Head covered above with small scales throughout, similar to those on the back.
(2) No aperture between the eye and the nostril.
(3) Subcaudals divided.
(4) No ridges on the ventrals.
(5) 3 series of large dorsal spots.

It may seem unnecessary to many to insist on this method of identification. Many I know who consider themselves knowledgeable on snake matters, would take it as a reproach to their intelligence to suppose they cannot rely on colour and marks alone; however I have known mistakes occur, and very positive opinions expressed erroneously with regard to this species. More than one officer in China was very positive that they had captured Russell's viper in their camp at Shanghai, publishing letters with some heat in the local paper when their opinions were repudiated. The specimen which I subsequently examined proved to be the common Chinese Viper (*Ancistrodon blomhoffii*). I have seen a young python (*molurus*) identified as a daboia, and failed to convince

* Vol. XVI, p. 374. † Ind. Serp., Vol. II, plate XXXII.

another positive gentleman of his mistake. The sandsnake *Eryx conicus* I have several times known taken for this viper, and, incredible as it may seem, the Burmese tree snake *Dipsadomorphus multimaculatus*. This latter is a very slender little snake which has two series of ocelli, or ovate spots costally, these latter misleading its captor. Many specimens of *Zamenis diadema* are marked somewhat like the Daboia.

Habits, haunts.—It may be met with almost anywhere except, I believe, in dense jungle, but it prefers open country into which the sun can penetrate and shed its agreeable warmth. Here it lies by day amongst the vegetation, in lazy apathy, apparently oblivious to its surroundings, but never, however, relaxing a vigil, which has for its reward the capture of the incautious animal that chances to stray within reach. In the evening it bestirs itself, and roams abroad whilst darkness prevails.

Its movements are slow, and consistent with its corpulent habit. When disturbed it prefers usually to maintain its ground, and frequently will contest the right of way with heaving sides, and angry hiss. When it does retire, it does so in a leisurely manner befitting its dignity and figure.

Fayrer* remarks on the authority of his snakeman that it will take to water, and Haly† mentions one swimming in the middle of a backwater. These are exceptional instances. Tennent‡ says that it will climb trees, and I can confirm this as a rare event, having known one in a low hedge. Its ungainly proportions, however, do not favour scansorial achievements. It is no uncommon event to find it in close proximity to and even in habitations, and its partiality to a murine diet sufficiently explains such intrusions. I remember one captured in Rangoon beneath the steps of the Cantonment Magistrate's Court during the day, with crowds of natives all about. Bassett-Smith§ mentions it as frequently coming into the precincts, and into the Naval Hospital at Trincomalee, and Tennent¶ says the Judge's house at this same station became so infested with this species, that the family had to quit.

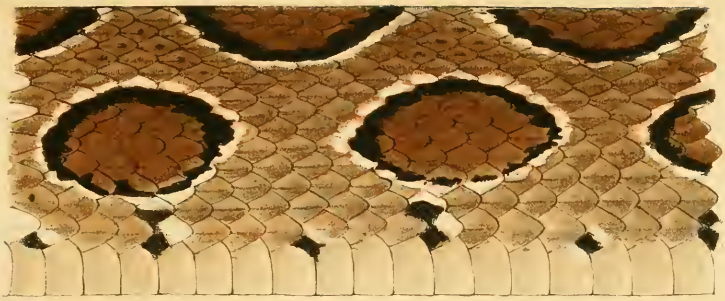
Disposition.—No observer can speak with greater authority than

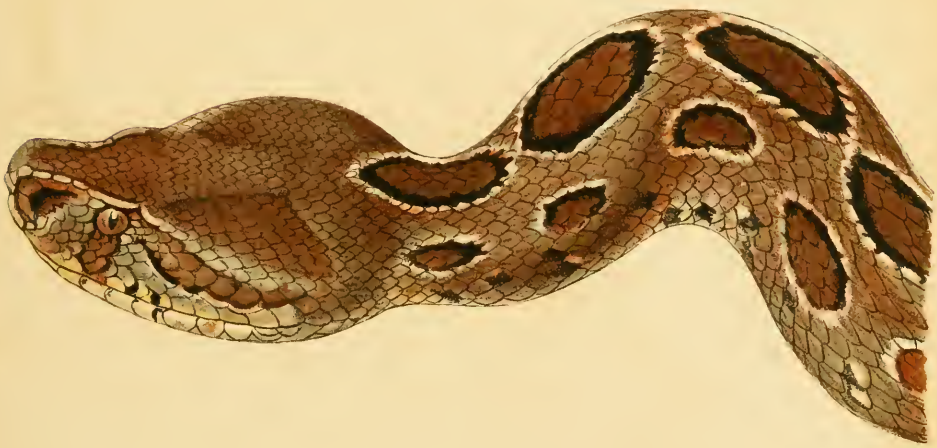
* Loc. cit., p. 15.

† First report on the collection of snakes in the Colombo Museum, 1886, p. 18.

‡ Loc. cit., p. 305.

§ Jour., Bom. Nat. Hist. Soc., Vol. XI, p. 546. ¶ Loc. cit., p. 296.





P. Girhardt del. J. Green Chromo lith.

THE DABOIA, CHAIN-VIPER, TICPOLONGA,
OR RUSSELL'S VIPER.

Vipera russellii. (poisonous).

Fayrer, and he says of the Daboia: "In confinement it is sluggish, and does not readily strike unless roused, and irritated, when it bites with great force, and determination. When disturbed it hisses fiercely, and when it strikes does so with much vigour." This is entirely my own experience. It is a creature slow to wrath, contenting itself under moderate provocation, with a loud sustained and warning hiss, reminding one of a leaking foot-ball bladder. It will not strike till considerably irritated, when it hurls itself at the offending object with determined malice. I have known one spring with such a powerful muscular effort that I believe it actually left the ground in its endeavour to strike me.

The hiss once heard is not easily forgotten; no other snake emits such a volume of sound, to the production of which two factors contribute. Firstly the size of the lung which is developed to a degree commensurate with the remarkable body girth, and secondly the large size of the nostril, for it is through this aperture that the sound is produced.

In Bangalore I experimented with a large adult belonging to a snakecatcher. Among his stock in trade he carried the familiar gourd pipe used by this fraternity. This was sealed up in places with cobbler's wax which I removed, rendered pliable by heat, and packed into the Daboia's nostrils. This done the snake was unhanded, and irritated. It was then noticed that the lung expanded with difficulty, and very imperfectly, and hissing was no long feasible.

A good example of its disinclination to bite is related by Blanford*; a friend of his once carrying one home under the belief that it was a python until undeceived by its biting, and killing one of his dogs. It made no attempt to bite or injure him, though apparently he did not take any precautions in his manner of handling it. Again Fayrer† says he always during his experiments had the greatest difficulty to get this snake to bite voluntarily. I can fully confirm this; frequently rats put in as food into its cage remain there alive and unmolested for days. In making these remarks, however, I think one must expect many exceptions to this attitude of indifference. Young specimens especially seem more on the alert, more easily alarmed, and are correspondingly more easily provoked to bite than many adults.

The bite is sometimes inflicted by a snap, the creature relaxing its hold

* Jourl., Asiat. Soc., Bengal, Vol. XXXIX, p. 374.

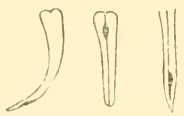
† Thanatoph. Ind., p. 64.

at once. On the other hand it is not unusual for Russell's viper to bite, and maintain a tenacious grasp for many seconds In the case of a gunner who succumbed to the bite of this snake at Thayetmyo (Burma) in 1862, Nicholson* mentions that it was with difficulty shaken off. Elliot† mentions a dog bitten by one, dragging the snake many yards before disengaging it, and one might quote many more similar experiences.

Poison apparatus.—The fangs.—These attain their maximum development in this the largest of the Indian vipers. There may be a single one in each maxilla, or two fixed side by side. In a depression at its base, and on the outer side, as many as 5 or 6 reserve fangs may be seen lying loosely in the mucous membrane, progressively diminishing in size from within outwards. When one of the fixed fangs is shed, the reserve fang best developed, and lying nearest to it, becomes cemented in a few days into the jaw.

The fang is tubular, being formed by the folding over of two lateral expansions of the tooth, which blend on its anterior face, in the major part of its length. A groove which is feebly discernible, but always present, marks the line of junction of these two expansions. At its base the expansions fail to meet, and the imperfect blending is marked by an aperture. The canal terminates near the point of the tooth in a minute opening.

The fangs in vipers are very mobile or to speak more correctly, the maxillæ are, for the fangs are fixed into these bones. Russell's viper, like other vipers, when it yawns, frequently rocks its maxillæ forwards and backwards.



A. *B.* *C.*

A. Inner aspect of fang (life size) the lower orifice of the canal is inclined slightly inwards.

B Anterior aspect (life size) showing seam where the two edges have been welded.

C. Tip (enlarged) showing lower orifice and point, closely resembling tip of hypodermic needle.

Glands.—These sacs compared with the cobra's are small, and present a corrugated appearance unlike the smooth retort-shaped glands of the cobra. Elliot‡ obtained 11 drops from the 2 glands of an adult. Wall¶

* Ind. Snakes, p. 146.

† Trans Brit. Med Association, S. Ind. br. 189, p. 7.

‡ Loc. cit., p. 53.

¶ Indian Snake Poisons, p. 113.

(A. J.) mentions a supplementary gland in this viper, globular in form, which completely surrounds, and empties itself into the ducts draining the major sac.

Poison.— Physical qualities.—Lamb* tells us that this venom is clear, with a small quantity of undissolved material in suspension. Its reaction is acid. The taste resembles gum acacia. In drying it cracks into longitudinal fissures yielding needle-shaped fragments. The dried product retains its toxic properties indefinitely, and is readily soluble in water.

Effects internally.—When swallowed, daboia venom has no more deleterious effect on the system than cobra poison, but of course one must postulate a healthy and unbroken surface in the mouth, and further passages. Elliot† gave 11 drops to a goat, and a larger quantity to a dog without noticing any ill effects.

Toxicity.—As every one in this country is doubtless fully aware, Russell's viper ranks among our deadliest snakes. The action of its poison is so different from that of cobra venom, that one can hardly compare their relative degrees of virulence. The poison appears to be as fatal in the doses usually injected during a bite, but death, except experimentally, is not so rapidly produced in large animals including man. Russell saw a fowl die in 36 seconds, Fayrer a fowl in 34 seconds, and Millard a rat die in 35 seconds. Lamb, however, has shown that these cases of precipitate death are attributable to relatively very large doses, and that in the case of large animals the dose necessary to produce such rapid death is larger than a Russell's viper could inject at one bite. A dog mentioned by Davy died 58 minutes after a bite in the leg. The dog Elliot saw succumb to a bite, died in less than 3 hours. Another dog which Traill saw bitten in four places died in 8 hours. The gunner referred to by Nicholson succumbed in 27 hours. In a case cited by Fayrer, an adult man died in 7 hours.

As in the case of other poisonous snakes it does not, however, in the least follow, that a serious bite will cause death if left untreated. There is abundant evidence to show that a percentage of cases, hard to determine, do not die even though the local injuries are such as to warrant the gravest apprehension. No more instructive record on

* Jour., Bom. Nat. Hist. Soc., Vol. XIV., p. 222.

† Loc. cit., p. 33.

this score is to be found in snake literature than that quoted by Elliot*. He says: "I myself saw a large powerful daboia (3 feet 8 in. long) "strike fairly at a dog, hold it, shake it, and only let go when the dog "had fled yelping several yards, dragging the snake along the ground. "The part bitten was soft, and fleshy, the bite was apparently a fair "one, the glands of the snake when dissected, though emptier than "usual, both proved to contain poison. From one gland alone I "obtained more poison than another daboia emitted through a "leaf in a vigorous bite. Add to all this that there was a well marked "subcutaneous extravasation round the bite, and the case seems perfect, " . . . . . though it became rather ill, did not die." "Eight "days later the same animal was fairly struck by a vicious daboia "(3 feet 4 in. long), the bite being almost instantaneous in its short-"ness, and this time the victim died in less than three hours."

Haly† mentions a bite from this snake, from which the man suffered no ill effects.

In a recent number of this Journal‡ Colonel Bannerman expresses the belief that the young daboia is not provided with poison in its earliest days, or at any rate that the poison if secreted is too weak to kill even small creatures. This does not accord with my own observations, which convince me that they enter the world with a sufficiently abundant and active poison to thoroughly equip them in their struggle for existence. In confirmation of my own opinion I find that Dr. Shortt§ had a gravid daboia in captivity. On the production of its brood, a young one, measuring only $8\frac{1}{2}$ inches when 6 hours old, killed a young partridge weighing $9\frac{1}{2}$ tolas in 10 seconds! The failure of Colonel Bannerman's experiments must be attributed to the uncertainty of the effects of the bite already alluded to.

Further comments upon the poison of this snake are beyond the scope of this paper.

Food.—All my observations go to show that small mammals, and especially rats, constitute the main diet of the daboia. but it is not so bigoted in gastronomic matters as to be disdainful of other fare. Mr. E. E. Green found one that had eaten a green lizard (*Calotes*

* Loc. cit., pp. 7 and 36.

† First report on the Collection of Snakes in the Colombo Museum, 1886, p. 18.

‡ Vol. XVII., p. 811.

§ Cyclopædia of India, Vol. V., p. 433.

ophiomachus) as well as a rat. Major Evans knew one in captivity eat two frogs, and a specimen in captivity in the Madras Museum* ate during its incarceration 5 squirrels besides 27 rats, whilst the young ate 67 mice, 5 squirrels, 4 frogs and 2 small rats.

In captivity as a rule they refuse food,† and it is surprising how they can keep health and vigour after months of deprivation from food and drink. Davy‡ had a specimen he kept for 146 days without food, and then allowed to bite a fowl which succumbed in a few seconds. Fayrer§ had one which lived for a whole year without food or water, and it was "vigorous and venomous to the last." I know of no snake-eating tendencies in adults, but cannibalism seems a common offence among the young. Major Dawson writes to me that on one occasion when young daboias were born in the gardens at Trevandrum, "the young commenced to devour each other," and on another occasion in the same place "one of the young swallowed one of its fellows, and in about a quarter of an hour disgorged it," and both at the time of writing were alive, and well. Father Dreckmann, too, told me of a similar experience among a brood born in captivity; he says "when I inspected the young family one morning, I found one of its members dead, and another one missing, and on examining the dead one I found the missing one inside him."

Breeding.—The literature on this snake affords more records of breeding than any other snake, I might almost say than all other Indian snakes taken together.

In spite of Colonel Bannerman's opinions expressed in a recent article in this Journal, and already referred to by me here, I think there can be no question that the daboia is viviparous in habit.

I am of opinion that the word "egg" as applied to the offspring and their envelope by this observer is misleading. The term "egg" is, it is true, a very indefinite one, which strictly speaking might be applied even to the human infant born in a caul. Its use, however, is restricted, at any rate in the popular mind, to the female cell impregnated or otherwise contained within a maternal envelope of chitinous,

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* Administration Report of Madras Govt. Mus., 1896-7.

† Mr. Spence, however, informs me that in his 7 years' experience in the Bombay Society's rooms this snake has fed better than any other species.

‡ Loc. cit., p. 85.

§ Loc. cit., p. 15

coriaceous, or cretaceous material. At a certain stage of embryonic development in viviparous snakes, eggs in the sense just referred to are to be found within the mother, invested with a leathery covering similar to that which is characteristic of the eggs in oviparous snakes. In viviparous snakes, however, the egg undergoes a metamorphosis never seen in the eggs of an ovipara. At a certain stage the leathery investment disappears, and the embryo as it approaches full term is found to be suspended in a limpid oily fluid, contained within a delicate, transparent sac, which I take to be the amnion, a fœtal not a maternal structure. At this stage it appears to me to be exactly comparable to the condition of a human infant born in caul.

Even supposing that a snake discharges fertile ova, it by no means follows that it is to be considered oviparous. Emotional and other causes are known to operate upon many gravid animals so as to cause in some cases the premature discharge of the fruits of generation, and it is no unreasonable assumption to suppose that similar causes may operate in the same direction in snakes. That they are susceptible to nervous influences is certain, or how otherwise can one explain the disagreeable habit so frequently evinced by captured snakes even when quite unscathed, of disgorging the contents of their stomachs, even when the rejectamenta are so far digested as to be unrecognisable.

Period of gestation.—From one of Colonel Bannerman's interesting domestic occurrences at Parel, it appears that the period from conception to discharge of the young exceeds six months.

Breeding season.—From this last statement it appears that these vipers are mating in the cold months. This receives confirmation by a note of mine dated Cannanore 28th December 1903: a male specimen was brought me said to have been in copula; the female escaped capture. In cold climates this implies that they mate during the season of hibernation. This, if true, appears most remarkable for at this season a snake's vitalities are at their lowest ebb and not one would think favorable to the consummation of so important a function.

Fecundity.—It is a prolific snake producing sometimes more than 60 young at a time. Some mothers, however, are more modest in their estimate of matrimonial duty, contenting themselves with a family of less than 20. One recorded by me in this Journal contained but one

solitary fœtus. I am inclined to think from observations on other snakes that the oldest mothers are the most fecund.

On two occasions at Trevandrum Major Dawson tells me that the mother died on the 3rd day after parturition, but this must be considered a coincidence. It is certain that the mother usually survives the advent of her brood, and one may presume lives to produce others.

Genital organs.—The ovaries are long, and the follicles loosely strung together. In one mother 4 feet 9 inches in length the ovaries were 6½ inches long.

The male genitals are peculiar. The clasper on each side is bifid, a character I believe to be found in all vipers. I have also observed the same condition in the sea-snakes, but not in any other colubrines. In a male 3 feet 7 inches in length, the main stem of each clasper was about half an inch long.

Hatchlings.—The young at birth vary from about 8½ to 11 inches. I very much suspect that the living embryos referred to by Stoliczka as 3 or 4 inches long* were not actually measured by him but their length guessed at.

The young usually rupture the sacs in which they are developed, before birth, that is, whilst still within the maternal abdomen. They then enter the world perfectly free. It is not unusual, however, for some or all of a brood to be born in cauls which they subsequently rupture. In a case alluded to by Mr. Phipson the hatchlings did not effect their escape till the day after deposition, a circumstance extremely remarkable, and to me inexplicable. Drowning would appear the inevitable consequence of any delay in such cases. According to Colonel Bannerman under these conditions the sac is split into 2 halves like a mussel shell. The young frequently cast their skins shortly after birth, often within a few hours. After birth they congregate, and lie together in a confused heap in captivity, but in nature very soon disperse. Their food is probably the same as adults. A young one I caught in Cannanore on a pot plant in a verandah, 10¼ inches in length, had just swallowed a mouse.

I have collected 21 breeding notes from various sources which I append in tabular form.

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* See accompanying schedule of breeding events.

Date.	Locality.	Number.	Authority.	Remarks.	Reference.
April 1896 ...	Trichinopoly ...	36	Self ...	Eggs in abdomina with no trace of embryo.	My notes.
May 1896 ...	Do. ...	24	Do. ...	Do. do. ..	Do.
March 1902 ...	Guzerat ...	55	Mosse ...	Do. do. ...	Bom. Jourl., Vol. XV., p. 134.
June 1906 ...	Bombay ...	9	Bannerman ...	4 born alive in membrane; young about 9 inches long. 5 non-fertile eggs.	„ „ „ XVII, p. 808.
July 1906 ...	Wardha ...	15	Do. ...	7 born alive in membrane; fertility of rest not recorded.	„ „ „ „ „
September 1875	.....	...	Miss Hopley ...	Young born in Regent's Park, London Some free, some in membrane.	"Snakes", p. 436.
June 1903 ...	.....	14	Millard ...	3 young born alive and free; the rest dead hampered by membrane.	In Epistola.
June 1904 ...	Howrah ...	25	Bannerman ..	Young deposited. Some ruptured membranes found on floor of cage.	Loc. cit.
July 1872 ...	.....	39	Shortt ...	Young born 8½ inches long; no further details.	Cyclopædia of India, Vol. V, p. 433.
.....	.....	40	Richards ...	Young born; no details...	Landmarks of Snake Poison Literature, p. 21.

Date.	Locality.	Number.	Authority.	Remarks.	Reference.
.....	.....	9	Dreckmann ...	Young born ; no details	In Epistola.
July 1904 ...	Burma ...	62	Evans ...	Do.	Do.
May 1899 ...	Trevandrum ...	18	Dawson ...	Do.	Do.
May 1905 ...	Do. ...	21	Do. ...	Do.	Do.
June 1902 ...	.....	33	Millard ...	Young born ; 3 dead ; 10½ to 11 inches long.	Bom. Jourl., Vol. XIV, p. 614.
June 1899 ...	Indore ...	63	Cholmondeley ...	Young born, no details ; length 9 to 10 inches.	„ „ „ XII, p. 765.
November 1904	Saugor ...	1	Self ..	Young in membranous sac in abdomina.	„ „ „ XVI, p. 374.
.....	.....	40	Anderson ...	Young in abdomina	Fayrer, Thanatophidia of India, p. 14.
.....	Umritsar ...	18	Stoliczka ...	Young 3 to 4 inches long ; alive in membranous sacs in abdomina.	Fayrer, Loc. cit., p. 55.
July 1893 ...	.....	40	Traill ...	Young in abdomina, fully developed ...	Bom. Jourl., Vol. VIII, p. 316.
.....	.....	...	Phipson ...	In Society's Museum ; in one case the embryos did not escape from membranes till the day after deposition.	„ „ „ VI, p. 420.

Distribution.—Throughout the whole Indian Empire from Ceylon in the South to the Himalayas in the North. In the West it extends into Sind, and in the East to the furthest borders of Burma. Its distribution within these limits is, however, capricious. Irrespective of moderate altitudes it is extremely common in certain parts whilst it is extremely rare or absent in others.

In some parts of the Punjab it is very abundant. Fayrer tells us that at Umritsar in 1866 as many as 471 specimens were brought in for rewards in a single day.

Mr. Millard tells me it is very common about Bombay. I found it so on the same coast at Cannanore, and Ferguson still further south at Travancore. Haly and Ferguson say the same as regards Ceylon, and Tennent and Bassett-Smith especially mention Trincomalee in that Island. I found it abundant about Trichinopoly, and in the Central Provinces. Judging from the plethora of local names for it in Bengal mentioned by Fayrer, Ewart, Richards, and others it is probably common in parts of that Province. I am inclined to think, however, it is chiefly so in the Eastern parts of Bengal.

In Burma, Theobald remarks on its abundance in the Tharrawaddy district, and about Rangoon, and I can fully confirm this statement. In some parts of Upper Burma, notably Mahlaing, Magwe, and Myo-thit, it is so abundant in the crops that the natives make themselves special grass shoes as a protection.

It is by no means confined to the plains, occurring plentifully in many upland regions, and has been met with up to 7,000 feet. From Ceylon I obtained specimens from Hakgalla (5,700 feet). Ferguson says it is not uncommon in the hills of Travancore. Mr. Henderson tells me he met with it in the Nilgiris at 6,000 feet, and that it was fairly common in the Palneys at 7,000 feet. Father Gombert writes to me that it is common at certain seasons in the Palneys up to 6,300 feet. Stoliczka records it from Kashmir up to 6,000 feet.

On the other hand Nicholson says it is rare in Mysore, Richards in Bengal, referring, I think, to the Western Parts. In two years in the United Provinces (Fyzabad) out of many hundreds of specimens of snakes I never saw one daboia. Colonel Pratt and Mr. Oakes, both for many years familiar with these Provinces, had never seen or heard of it except at Sitapur. About Delhi I never saw or heard of one, though I have good authority for stating that it is very common about

Karnal. Murray says it is not common in Upper Sind, and Blanford makes a similar observation of South-Eastern Berar. Mr. Miller tells me that about Darjeeling he has only known one specimen in many years' residence, *viz.*, from Kurseong (4,600 feet).

Description.—Head covered with small keeled scales similar to those on the back. *Rostral.*—As high or nearly as high as broad; in contact with 6 shields, of which the nasals make much the longest sutures. *Supraoculars* well developed, not divided. *Nasals.*—In contact with the rostral and the 1st supralabial. These are complicated in structure, consisting of a single shield pierced by a large unusually patent nostril. A vertical pillar-shaped portion demarcates this orifice anteriorly. This pillar bifurcates above to receive the anterior extremity of a crescentic scale. Two fissures demarcate the nostril, one above and the other below, but neither extend to the margin of the shield. *Supralabials* 10 to 12, the 4th largest; separated from the eye by 2 or 3 series of subocular scales. *Sublinguals.*—One pair only, touching 4 or 5 infralabials. *Infralabials* 5. The 5th largest, and in contact with 2 scales behind. *Scales.*—Two heads lengths behind the head usually 25 or 27; midbody 29 to 31 (rarely 33); two heads lengths before vent usually 21 to 23. Keels present on all the head-scales, and all rows of body scales even to the tip of the tail. In the last costal row they are oblique and less pronounced than in other rows. *Ventrals.*—153 to 176, very broad, rounded, not ridged. *Anal* entire. *Subcaudals* 41 to 64, all divided.

Our plate is in every particular excellent, and is the work of Mr. Gerhardt.

(To be continued.)

JOURNAL

OF THE

BOMBAY

Natural History Society.

Vol. XVIII. BOMBAY. No. 2.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

ILLUSTRATED BY COLOURED PLATES AND DIAGRAMS.

BY

MAJOR F. WALL, I.M.S., C.M.Z.S.

Part VI., with Plate VI., Diagram and Map.

(*Continued from page* 17 *of this Volume.*)

THE GOLDEN TREE-SNAKE (*Chrysopelea ornata*).

Nomenclature.—Scientific.—The generic name is from the Greek *chrysos* gold, and *peleios* black. The specific is from the Latin *ornatus* adorned.

English.—The golden tree-snake or the gold and black tree-snake.

Vernacular.—"Kalla Jin" the name given by Russell for a specimen probably obtained in Bengal, is probably Urdu implying "black saddles" with reference to the black cross bars. Its name in Ceylon according to Ferguson is "pol mal karawala."

Dimensions.—The largest specimen I know of is the one obtained by Evans and me in Rangoon, which taped 4 feet 5½ inches. Specimens over 4 feet are unusual.

Physiognomy and bodily configuration.—The snout is broad, blunt, and rounded, the head flattened and the neck moderately constricted. A moderately well developed eye with golden iris (Cantor says black)

gives a vivacious expression to a not unpleasing countenance. The pupil is round. The nostril is moderate in size, and placed entirely or almost entirely in the anterior nasal shield. The body though rather slender is far less so than in other tree snakes, notably *Dendrophis, Dendrelaphis* and *Dryophis*. It is rather depressed. The belly is peculiar in the ridges on the lateral aspect of the ventral shields. The tail is long, and tapers very gradually. It is about one-fourth the total body length and it is ridged beneath on either side similarly to the belly.

Colour.—Mr. Boulenger* divides this species into eight colour varieties, many of which I have not seen. I quote therefore from him, supplementing the habitats he records, from my notes, and other sources. Many of the references of other authors, however, to this snake make it impossible to refer the specimen to any of these varieties, for want of precise information regarding the colour.

"*A.*—Black above, each scale with a round greenish-yellow spot : usually with larger coral-red spots on the back, resembling a series of tetrapetalous flowers ; ventrals greenish-yellow, edged with black."

South India (Anamallays), Malay Peninsula, Malay Archipelago (Sumatra, Borneo).

Stoliczka† mentions this as common at Penang, and Flower‡ alludes to it from Penang and Singapore. Annandale§ records it from Narcondam Island.

"*B.*—Like the preceding, but ventrals not black edged."

S. India (Malabar), Malay Archipelago (Java, Sooloos, Philippines).

I examined one in the Siccawei Museum, Shanghai, from the Yangtse Valley, S. China.

"*C.*—Like the preceding, but vertebral spots confluent into a stripe, at least on the anterior part of the body."

Borneo.

"*D.*—Greenish-yellow or pale green above, each scale edged, and mesially streaked with black, with more or less distinct black cross-bars : ventrals yellow, with a small black spot on each side."

S. India (Anamallays), Burma, Assam, Siam, Lao Mountains.

* Catalogue, Brit. Mus., Vol. III, 1896, p. 197.

† Jourl. Asiat. Soc. Bengal, Vol. XXXIX, p. 194.

‡ Proc. Zool. Soc. Lond., 1899, p. 682.

§ Jourl. As. Soc. Bengal, 1905, p. 176.

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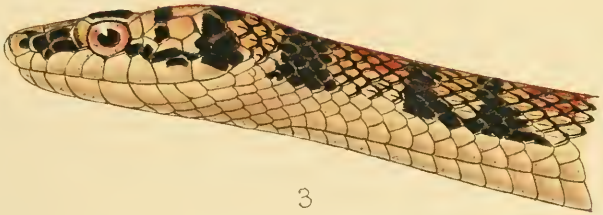

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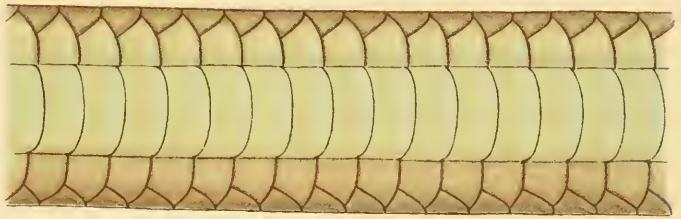

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THE GOLDEN TREE-SNAKE.

Chrysopelea ornata. (harmless).

J. Green. Chromo lith.

Flower mentions it as fairly abundant in Siam and records it as far south as Kedah in the Malay Peninsula, where he says it is replaced by variety *A*.

"*E*.—Like the preceding, but with a series of large coral-red, or orange blotches along the back."

Ceylon, Bengal.

The plate in Russell's work is evidently this colour variety. Evans and I met with this in Burma, but it is decidedly scarcer than type *D*, which is the common one in that Province. The orange spots are not nearly so brilliant as I have seen in Ceylon specimens.

Figures 1, 2, 3 and 4 are taken from a good example from Kulhatty. (Nilgiri Hill).*

"*F*.—Pale olive above, with regular black cross-bars ; some of the black scales with yellow shafts : whitish olive beneath, with a small black spot on the side of each ventral."

Ceylon.

"*G*.—Black above, with narrow yellowish cross-bars : whitish olive beneath, with a small black spot on each side of each ventral."

Philippines.

"*H*.—Olive above, with the markings much effaced : pale yellowish beneath."

Celebes, Philippines.

To these I would add another—

I.—Similar to variety *E*, but differing in the vertebral spots being yellow instead of red, and in the absence of cross-bars.

This variety is figured in our plate figs. 5 and 6. The specimen was captured at Barisal in the Gangetic Delta, and is in our Society's collection in Bombay.

Identification.—This is an easy matter if attention be directed to scale characters.

The ridged (keeled) condition of the ventral shields taken with a vertebral row of scales in no way different from its adjacent rows, establishes the diagnosis. The ridged character of the ventral shields demands some qualifying remarks. It must be impressed upon the student that the keels in *Chrysopelea* are *sharp and pronounced,*

* Figure 4 is represented unduly broad in order to show the whole breadth of the ventrals with their keels ; these latter however are not made conspicuous enough. The outline drawing shows them better.

with a minute notch on the free edge of the ventral corresponding to the keel.

This character of keel is only seen in two other genera, *viz.*, *Dendrophis* and *Dendrelaphis*, both of which are tree snakes also. In both these genera however the vertebral row of scales is enlarged, and hexagonal as in the kraits (*Bungarus*). It is to be noted that several other snakes have what may be called false keels on their ventrals, that is, the ventrals are laterally angulated. False keels are rather rounded (obtuse), and have no notch at the free edge of the ventral. The outlines in section may be compared roughly to those of a punt, and a dinghy (see Diagram I, fig. 1, A and B).

It is interesting to note that these false keels are to be seen chiefly in those snakes which manifest a climbing habit. For instance, in the genus *Lycodon*, witness the species *aulicus*. In the genus *Zamenis*, observe the ventrals in *mucosus*. In the genus *Coluber* are notably the arboreal species *prasinus*, *frenatus*, and *oxycephalus*.

In some other snakes however not conspicuous climbers the same may be seen, as for instance, many of the genus *Simotes*. In addition obtuse ventral keels are to be seen in the water snake *Hipistes hydrinus*. In McMahon's viper (*Eristocophis mcmahoni*) the ventrals are rather acutely keeled, but there is no enlargement of the vertebral row.

The only snake I know at all like *Chrysopelea* is Jerdon's pit viper (*Lachesis jerdonii*). In this the colouration is very similar, but any resemblance between these two snakes ends here. They are substantially different in almost every scale character. We do not give a plate of Jerdon's viper owing to its rarity, and restricted Indian distribution, viz : Khasya Hills (Assam.)

Haunts.—Very opposite opinions prevail as to its haunts. Cantor says it is seldom seen in trees, but more frequently on the ground in the grass. Stoliczka supports this observation, and says though he caught several specimens in the grass, or between low bushes, he but once saw one actually on a bush. Flower on the other hand says his experiences are very different in this as in other matters from those related by Cantor, and he agrees with Günther's suggestion that the reason it is not more often seen in trees is because it makes a too rapid retreat.

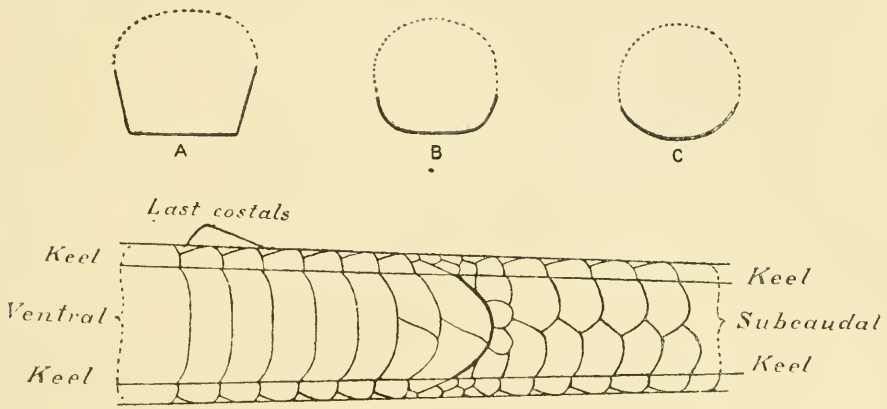


Fig. 1

A. Punt like ventrals of Chrysopelea

B. Boat like ventrals of Lycodon aulicus

C. Rounded ventrals of Cobra

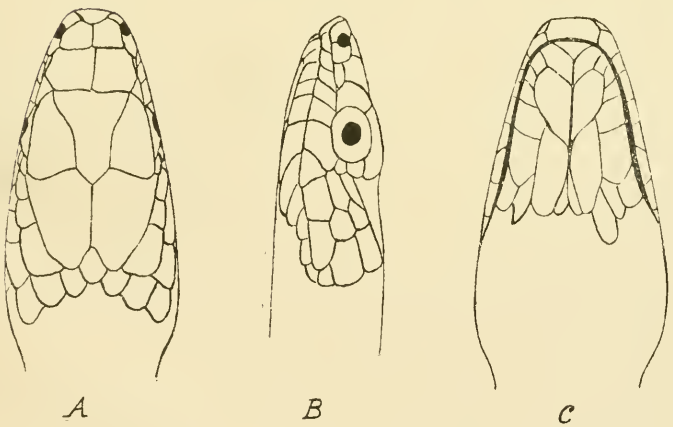


Fig 2

Chrysopelea ornata

(× 1½)

INDIAN SNAKES *(Wall)*

I am able to support both parties, for I have seen it high in a tree on a naked limb, and on several occasions on bushes, or on the trellis work about tennis courts and verandahs. I never met it on the ground myself, but many of the specimens brought me were reported on the ground. I have not the least doubt that the species is essentially arboreal in habit, but this does not prevent it making frequent excursions to the ground either in search of a fresh feeding area, or in the pursuit of the incautious quarry which its keen vision has detected from its exalted station amid the branches overhead.

It is only natural that it should be more frequently encountered on the ground, because the eyes of the pedestrian are directed below the level of his head, even at his feet. Men other than birds-nesters, fern and orchid hunters, and such like do not gaze much aloft, and the snake reclining along a branch or on the top of a trelliswork even about one's own height, will frequently escape detection though but a few feet or even inches away.

The very fact that Cantor and Stoliczka in unison with other observers mention that geckoes are the principal food seems to me to refute their suggestion that *Chrysopelea* is terrestrial in habit, for geckoes are eminently arboreal. It is to be noted also that all the food partaken of, other than geckoes, is of a nature to be obtained by climbing only. Cantor's inclusion of frogs in their dietary does not vitiate this remark, for though he does not say so, the species taken may have been arboreal forms only.

Chrysopelea is not infrequently found about, and actually inside habitations. Flower mentions this, and Evans and I had similar experiences in Burma. I well remember in Colombo, too, one that had taken up its quarters in an old packing case which was full of straw and other packing material. A cooly was ordered to clear this out, and stepped into the box to carry out his orders. His exit reminded one of an incautious bather who has stepped into over-hot water. The alacrity of movement so foreign to the cooly's nature was explained by the subsequent discovery of a snake of this species.

Disposition.—Very divergent views again have been expressed on this point. Cantor remarks on the gentleness of the species, whilst Flower on the other hand says " *Chrysopelea ornata* is the fiercest snake I have met. Under circumstances when most snakes, harmless

and poisonous alike, would try to glide away quietly, this one will turn to attack the person who disturbs it, and will attempt to resist capture to the uttermost, striking, and biting ferociously. * * * Individuals I have at various times tried to keep in captivity showed no signs of becoming tamer, and would always bite my hand when I put it in the vivarium, and being also an annoyance to the other inmates of the cage, I have only kept them for a few days at a time."

I must say I can abundantly confirm Flower's experiences. There is no doubt that this snake is decidedly plucky, and on occasions fierce, but I would not suggest that all are equally vicious. I think that snakes, like other creatures, exhibit individual character.

I well remember my servant in Rangoon trying to effect the capture of a large specimen in a hedge adjoining my compound. I arrived on the scene when the excitement was at its height and discovered that all the menial establishment amounting to ten or more had been pressed into service. The snake had fought most courageously to elude capture, and struck at any-one who ventured to attempt to grasp it. My boy, confident of master's solatium in the form of a rupee if the creature was captured alive, had been struck at and bitten, and I hardly knew which to admire most, the servant's determination and courage or the snake's vigorous endeavours to retain its liberty.

Flower mentions one in a fit of rage biting itself with such vigour that its teeth were fixed into the side of its body, and I can remember recapturing one which had escaped from my vivarium and had taken refuge between some boards in my house. When extricated after some difficulty, and with the employment of some force, it struck at and buried its teeth in its own body.

The fact that this snake will even face, much less try conclusions with a tuctoo (*Gecko verticillatus*) is eloquent proof of its intrepidity. Flower says : " I have known it eat *Hemidactylus frenatus* and *Gecko verticillatus ;* the latter may give battle to the snake for some hours before being finally swallowed." In a recent issue of this Journal I gave two instances of the indomitable courage of this giant gecko. In one instance it was clearly the aggressor, and not only confronted but actually drove back a large rat snake (*Zamenis mucosus*), a species whose courage is well established, and actually during the retreat snapped and bit off part of its tail. In the other

instance witnessed and recounted to me by Captain Lloyd, I.M.S., on Sandoway Island when this gecko was in conflict on the ground with a *Chrysopelea ornata*, it would be difficult to say which was the aggressor, but it is probable that the snake engaged the lizard, not expecting to meet a foeman of such prowess.

Food.—*Chrysopelea*, whilst showing a decided partiality towards lizards of the family Geckonidæ, accepts with avidity many other creatures that chance has to offer.

Members of the genus *Hemidactylus* are most frequently found to have furnished the meal, obviously from the relative abundance of the species in this genus and the numerical strength in individuals of many of the species which frequent trees. Many other lizards, however, fall victims to its voracity. Cantor mentions frogs as well, but I have never known one taken, have known them refused in captivity where lizards were accepted, and Mr. Millard tells me also he found frogs were not acceptable. Among other lizards Cantor found *Ptychozoon homalocephalum* taken once, and Evans one of the flying lizards (*Draco tæniopterus*). I have known *Calotes versicolor* taken, and Flower the giant gecko or tuctoo of Burma (*Gecko verticillatus*). Evans and I reported one in this Journal that had eaten a bat (*Taphozous longimanus*), and Evans has since recorded two instances where bats were devoured. Mr. Millard tells me that in captivity it "feeds freely on bloodsuckers, sparrows, geckoes, and mice, but never eats frogs." He also says it kills by crushing in its folds.

It is interesting to note that Richards* mentions one of his boys having a pet *Chrysopelea ornata* which he fed with milk out of a saucer. He held the snake near the head and put the saucer to it, when it readily drank the milk, and in comparatively large quantities.

Habits.—The striking beauty of this snake, whether seen reclining or moving in its native haunt, could hardly fail to arouse the keenest admiration in the breast of the most unappreciative and phlegmatic disposition.

I watched with admiration recently the adroit, though stealthy, manner in which one in captivity in the Colombo Museum balanced itself, and moved along my walking stick though this was more slender than the snake itself.

* Landmarks of Snake poison, p. 14.

Dillwyn describes this snake clinging to the trunk of a tree, head downwards, in a very extraordinary manner, and I have seen it under almost exactly similar circumstances. My specimen was stationary, clinging (one could not say reclining) head downwards, about 30 feet from the ground, to a large bare trunk, which rose almost perpendicularly. I marvelled at the tenacity of its grip in such a situation. It had thrown its body into a very wide S across the limb, and it strikes me now very forcibly, after reading Flower's and Shelford's observations, that it may have been " gathering itself " for a leap. The enraptured observer will be even more captivated with the grace and agility attending its movements from branch to branch, and the consummate ease with which it will scale a perpendicular trunk. Its flash-like disappearance aloft without apparent effort must be witnessed to be fully appreciated. I very much doubt whether any snake moving along the flat displays greater speed than this species in its arboreal environment.

But its marvellous attainments do not end here, for this snake is endowed with the capability to spring, or " fly " as some prefer to call this jactatory effort. Here one is forcibly reminded of the eulogistic terms in which the late Professor Owen summed up the athletic performances of these limbless creatures.

He says : " They can outclimb the monkey, outswim the fish, outleap the jerboa, and suddenly loosing the coils of their crouching spiral, they can spring into the air and seize the bird upon the wing."

One has only to be acquainted with *Chrysopelea* to realise that Owen's words convey no fulsome flattery.

That it actually can spring is vouched for by more than one reliable observer. Flower* in 1899 reported having seen " a small one, about 2½ feet long, take a flying leap, from an upstairs window, downward and outward on to a branch of a tree and then crawl away among the foliage. The distance it had jumped was measured, and found to be nearly 8 feet."

Curiously enough in the very month (May) and year (1899) when this record of Flower's was published, Mahon Daly wrote from Siam reporting his having witnessed a similar feat. His letter appeared in Vol. XII, page 589, of this Journal, and though he could not

* Proc. Zool. Soc. Lond., 1899, p. 684.

identify the snake he said that he and his Kareen interpreter saw a snake, "about 2½ feet long, sail from a very high tree on one side of the road to a lower one the opposite side."

In confirmation of these very extraordinary acrobatic feats which I have no doubt many might be inclined to disbelieve is the report made by Shelford of similar performances * This observer relates that three native witnesses in Sarawak made a similar statement on three different occasions independently of one another, and at considerable intervals of time.

This was to the effect in each case that the snake had been seen to "fly" from some height to the ground beneath. In all cases the snake was reported to have kept its body rigid during this feat, and to have met the ground at an oblique angle. In one case the snake proved to be *Chrysopelea ornata*, in the second instance a snake of the same genus, *viz.*, *C. chrysochlora*, and in the third *Dendrophis pictus*.

Shelford calls attention to the fact that all these snakes are alike in the peculiar ridged condition of their belly shields, and he made experiments to ascertain the truth of these reports. He says: "A specimen of *Chrysopelea ornata* was taken to a height of fifteen to twenty feet, and allowed to fall several times; after one or two false starts the snake was felt to glide from the experimenter's hands, straightening itself out, and hollowing in the ventral surface as it moved, and it fell not in a direct line to the ground, but at an angle, the body being kept rigid the whole time * * *. If the snake was thrown up into the air, it seemed unable to straighten itself out; it had to be launched, so to speak, from the hands in order to induce it to assume the rigid position."

He implies therefore that these "flights" are not accidental falls but deliberate voluntary efforts, and suggests that the hollowing of the belly between the two ventral ridges may act mechanically after the manner of a parachute, impeding the action of gravity, and buoying up the creature so as to reduce the momentum with which it would strike the ground. He illustrates this point by comparing the fall of a piece of bamboo bisected longitudinally, and the concave face downwards, with that of a piece of bamboo in its cylindrical form.

* Proc. Zool. Soc. Lond., 1906, p. 227.

In the former case the descent is retarded. I prefer the use of the term "springing" to that of "flying" in describing these feats. Its only rivals in acrobatic and scansorial achievements are the tree snakes of the genera *Dendrophis* and *Dryophis.**

Breeding.— Our information on this point is scanty. Evans and I obtained one in May with ovarian follicles impregnated, one in June with 9 eggs in the abdomen, and a small specimen, length not noted, believed to be a hatchling in June. These were all obtained in Rangoon. Since these specimens were recorded in this Journal†, Evans acquired a specimen from Hanthawaddy, Lower Burma, in June containing 11 eggs: and a brood of 6 young in June in Rangoon.

It is clearly from the above notes not a very prolific species.

The measurements of the eggs were not recorded.

The young in the brood recorded by Evans‡ measured from 4½ to 6 inches in length.

It is not known whether this snake is oviparous or viviparous. Without being too positive I am inclined to think that the eggs I extracted "ex abdomina" contained embryos in a very early stage of development.

This snake grows 9 or more inches each year, so that the specimens reported by Evans 13½ and 14 inches long in August were the previous year's production.

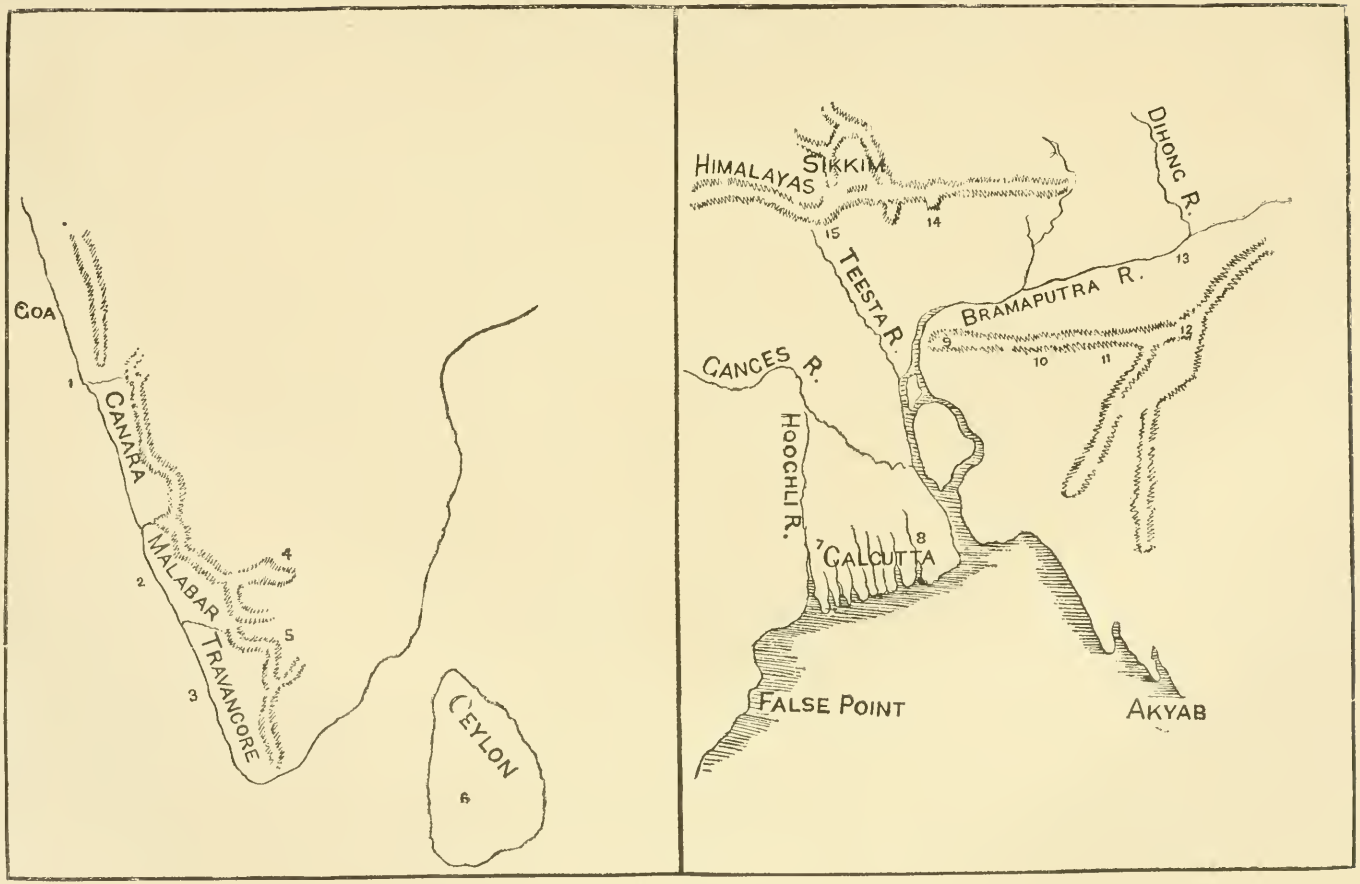
My smallest prospective mother was 3 feet 7 inches long in June and therefore in her 5th year.

Distribution.—This is very extensive, ranging as it does between the western shores of India on the extreme West, through the Malayan regions (continental and insular), South China to the Philippines in the extreme East.

So far as the Indian Peninsula is concerned its distribution is peculiar, and very interesting. It is only found in a small tract of country in the southern part of the Malabar Coast, and in Eastern Bengal. The accompanying maps show the exact localities where it has been met with.

In Ceylon it is not very uncommon, I met with more than one specimen in a four years' residence though not at that time a collector of

* For further remarks on flying snakes see post-script. † Vol. XIII, p. 614.
‡ Vol. XVI, p. 170.



DISTRIBUTION OF THE GOLDEN TREE-SNAKE (*CHRYSOPELEA ORNATA*) WITHIN INDIAN LIMITS.

snakes. It is referred to by Ferguson, Haly, and Willey from the plains. Mr. E. E. Green tells me he has never heard of it in the hills in that Island, *i. e.* above about 1,500 feet.

It is a fairly abundant species throughout the Malayan Region, and extends throughout Burma. In many parts of Lower Burma it is a common snake (Rangoon, Pegu, etc.). In the extreme south of this Province it has been recorded from Mergui and Tavoy Island (Sclater). Captain Lloyd, I.M.S., captured a specimen on Sandoway Island which I have already referred to. To the east of this Province Sclater has recorded it from Moulmein, and Evans and I had specimens sent to us by Colonel Bingham from the Southern Shan States. The British Museum has a specimen from the same donor from the Ruby Mines, but it appears to be uncommon in that part, for at Mogok Mr. Hampton tells me he has had no specimen in a 9-years' residence.

From Burma it extends to the North, through Assam, and across the Brahmaputra into the Eastern Himalayas, and in a westerly direction into Eastern Bengal, where its exact limits are somewhat uncertain.

It occurs within the Gangetic Delta (Calcutta and Barisal) and it is probable that its western boundary is defined by the Hoogly and Teesta rivers.

It has not as yet been recorded from the Andamans or Nicobars, but Annandale refers to a specimen taken on Narcondam Island by Major Anderson.*

Explanation of Map.

1. Karwar.—Phipson. Bombay Nat. Hist. Soc. Collection.
2. Malabar.—British Museum and Jerdon. (Jourl., Asiat. Soc., Bengal, Vol. XXII, p. 529.)
3. Travancore.—Ferguson. Plains and Hills. (Jourl., Bom. Nat. Hist. Soc., Vol. X, p. 74.)
   Millard. Courtallan in the Hills. (In epistola.)
   Sclater. List, Snakes, Ind. Mus., Calcutta, 1891.
4. Nilgiri Hills.—Kinloch. Kotagiri, 5,700 feet, rare ; Kulhatty,† 5,400 feet. Bombay Nat. Hist. Soc. Collection.

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* Jourl., As. Soc. Bengal, Vol. XL, p. 422.

† Mr. Kinloch tells me there are two places called Kulhatty in the Nilgiris—one near Kotagiri, 6,500 feet; another, 5,400 feet.

5. Anamallay Hills.—Thurston. In Madras Museum. (In epistola.) Beddome. In British Museum Collection.
6. Ceylon.—Haly, Ferguson, Willey. British Museum Collection.
7. Calcutta.—Sclater. In Indian Museum, Calcutta.
8. Barisal.—Bombay Nat. Hist. Soc. Collection.
9. Garo Hills.—Sclater. Indian Museum, Calcutta.
10. Khasya Hills.—Sclater. Indian Museum, Calcutta.
11. North Cachar.—Annandale. Indian Museum, Calcutta.
12. Naga Hills.—Sclater. Samaguting, 2,000 feet. Indian Museum, Calcutta.
13. Nazira.—Sclater. Indian Museum, Calcutta.
14. The Dooars.—Millar. (In epistola.) Specimens in St. Joseph's College Museum, Darjeeling.
15. Darjeeling.—Stoliczka. (Jourl., As. Soc., Bengal, Vol. XL, p. 422.)

Description.—Rostral. Touches 6 shields; the sutures formed with the anterior nasals are twice or nearly twice those formed with the internasals. *Internasals.*—A pair; the suture between them about two-thirds the suture between the præfrontal fellows; subequal to or rather less than the internaso-præfrontal suture. *Præfrontals.*—A pair; the suture between them subequal to, or rather greater than the præfronto-frontal suture; in contact with internasal, postnasal, loreal, præocular, supraocular (usually) and frontal. *Frontal.*—Touches 6 shields; the supraocular sutures about three times the fronto-parietals, and about twice the fronto-præfrontals. *Supraoculars.*—Length equal to, or nearly equal to frontal; breadth one-third or more greater than the frontal, at a point opposite middle of eyes. *Nasals.*—Divided; in contact with the 1st and 2nd supralabials. *Loreal.*—One; longer than broad. *Præoculars.*—One; sometimes touching the frontal. *Postoculars*—Two. *Temporals.*—Two small anteriorly; the lower in contact with the 7th and 8th supralabials (sometimes 6th also). *Supralabials.*—9 or 10; the 5th and 6th touching the eye usually (in Burmese specimens), sometimes the 4th also. *Sublinguals.*—Two pairs; the posterior rather larger, and in contact with the 5th and 6th infralabials usually. *Infralabials.*—The first meet to form a suture, half or less than half that between the anterior sublinguals; the 6th largest usually (rarely 5th or 7th) broader than the posterior sublinguals and

in contact with two scales behind. *Scales.*—Two heads lengths behind head 17; midbody 17; two heads lengths before vent 13. Absorption from 17 to 15, the 4th row above the ventrals is absorbed into the adjacent row above or below; from 15 to 13 the two rows below the vertebral coalesce. Vertebral row not enlarged, or modified. Costals not oblique. The last row enlarged. Keels absent, or very faint in a few median rows at back of body only; when present cease in the sixes or fours of the supracaudals. Apical pits present. *Ventrals.*—200 to 238 (Boulenger), broad, the last costal row only partially seen on each side when specimen laid on its back. A sharp keel on each side and corresponding notch in the free edge of the shield. The last ventral divided like the anal (Boulenger says sometimes, but I have never seen an exception), and occasionally the penultimate also. *Subcaudals.*—97 to 144. Keeled and notched similarly to the ventrals. *Anal.*—Divided.

Dentition.—Maxillary teeth 20 to 22, subequal, the last three a little longer, and grooved; anterior mandibular teeth longest. (Boulenger.)

FLYING SNAKES.

A Postscript.—At the present day there is a great tendency to discredit any strange stories handed down to us from our forefathers.

A certain section of the public, not without some reason however, openly scoffs at improbable stories, especially in connection with snakes, the size of tigers, and other game, fish, etc., knowing the tendency of men to exaggerate.

Many a truth is repudiated, mentally if not verbally, tacitly scoffed at and relegated to the level of a "good story" or a "traveller's yarn".

Certainly many travellers in the past and sportsmen of to-day are to blame for this incredulity. There is no doubt, however, that Nature is abundantly more subtle, and prolific in manifestations which are little short of miraculous than is man's inventive genius, which is dwarfed by comparison.

Many of the incredulous school upon enlarging their minds have to acknowledge themselves in error. A quotation such as that I have

made use of in my paper from the late Professor Owen, emanating from a less worthy source, would, I feel sure, evoke scepticism, and derision from many.

The fact that we must acknowledge that there are such creatures as "flying snakes" at the present day will doubtless make many who learn this for the first time recall allusions to such beings in the Bible, and it may interest them to discuss the belief in such among the ancients, and subsequently.

The two allusions to "flying serpents" in the Bible occur in Isaiah.

In the original the Hebrew word used is "saraph" in both places, and it is translated as "fiery flying serpent".

The same word occurs in Numbers* (Chap. XXI, verse 6) in its plural form "seraphim," but is here translated simply as "fiery serpent."

The first allusion (Chap. XIV, verse 29) reads as follows:—"Rejoice not thou, whole Palestina, because the rod of him that smote thee is broken: for out of the serpent's root shall come forth a cockatrice, and his fruit shall be a fiery flying serpent."

The second reference (Chap. XXX, verse 6) reads as follows:—"The burden of the beasts of the South: into the land of trouble and anguish, from whence come the young and old lion, the viper and fiery flying serpent, they will carry their riches upon the shoulders of young asses, and their treasures upon the hunches of camels, to a people that shall not profit them."

Isaiah describes the seraphim as follows (Chap. VI, verse 2):—"Each one had six wings: with twain he covered his face, and with twain he covered his feet, and with twain he did fly."

Chamber's Encyclopædia says of them that they were "celestial beings on either side of the throne of Jehovah, seen in prophetic vision by Isaiah, and by him alone." The first allusion (Chap. XIV) refers obviously to these mythical celestial beings, in association with and in fact the progeny of another fabulous being, the cockatrice which the late Canon Tristram says was a creature supposed to be hatched by a cock from serpent's eggs and so represented as a dragon with a cock's head. It was called also "basilisk," or crested serpent. The second reference (Chap. XXX) has far greater interest to the

* Encyclopædia Britannica.

naturalist, because the passage refers to other creatures known to exist, which have been identified with familiar present day forms.

The context (*viz.*, the first 7 verses of Chapter XXX) shows that the country referred to as "the land of trouble," etc., is Egypt. The lion (*Felis leo*) is a typically African animal, and doubtless occurred in Egypt in the days when Isaiah wrote.

The viper referred to, there is little doubt, is the *Echis carinata*, so common in India, and ranging into Egypt among other parts of Northern Africa. The Hebrew word in the original is "Epheh" which the late Canon Tristram identified as *Echis arenicola* of the present day, an earlier name for *E. carinata*.

The resemblance between this Hebrew word and "Afæ", which is in common use in parts of India for the same snake (Delhi), is noteworthy.†

The "Saraph" used in a passage, which clearly refers to present-day well-known forms like the lion, and the echis, leads one to infer that the creature made reference to was an equally well-known inhabitant of Egypt.

Now the fact that the word "Saraph" in both references in Isaiah is translated in the present version of the Bible as "fiery flying serpent," whilst the same word in Numbers is translated as "fiery serpent," raises the question which of these two renderings is correct.

The Encyclopædia Brittanica says if it has a Hebrew etymology it must signify "burning ones" ("consuming" not "fiery"), and again "in Num. XXI, 6, the word "Seraphim" is used of a kind of serpents not "fiery serpents" but burning, *i.e.*, "poisonous ones." From this it appears that there is no confirmatory evidence of the existence of flying snakes in the Hebrew version of the Bible.

It appears probable that the fiery serpent referred to was a poisonous snake so called from the burning pain attending its bite.

It is extremely interesting in the discussion of flying snakes to read what Herodotus wrote nearly 500 years before Christ.

Herodotus (born between 490 and 480 B.C.) wrote: "Arabia is the last inhabited country lying to the southward, and the only region which produces frankincense, myrrh, cassia, and redenum. All those things the Arabians gather with some difficulty, myrrh only excepted.

† I notice that the Cyclopædia of India (Vol. V., page 227) gives "Aphah" as Hebrew and "Afa" and "Afai" as Arabic words for a "snake" without specifying further.

They collect the frankincense by burning styrax, which the Phœnicians export into Greece, for flying serpents, small of body and with variegated skins, guard the trees which bear the frankincense, a great number round each tree ; as for vipers they are found in all parts of the world, but flying serpents are found in thick swarms in Arabia, and nowhere else, and therefore they appear to be very numerous."

Pliny the Elder (born A.D. 23, died 79) mentions serpents that twirl themselves by the tail to a branch of one date tree, and so spring to the branches of another ; and says the Arabs call them " flying serpents." This seems to me quite likely in the face of what we know at the present day, if we allow for a certain inaccuracy in the observation. A snake that jumped to another branch would largely depend upon its tail to secure its hold. It would certainly wreath it round the branch upon which it alighted, if in any danger of falling, pending having regained its " foothold." This use of the tail might easily have been misunderstood, and conceived in the light of a spring, and its recoil. Calmet (Augustine) the Benedictine (born 1672, died 1757) refers to the " Seraph" a " flying serpent, the only one that has wings." " Its wings are not feathers, like the wings of birds, but rather like those of bats", and he says " when the Arabian goes to gather the aromatic reed, or cassia, of which these serpents are very fond, they cover all their heads, except their eyes, with skin, to secure themselves from the bite of the serpent, which is very dangerous."

This reads very like a distortion of the truth in a zealous attempt to reconcile fact with dogma. The detailed anatomical peculiarities given by Calmet refer to some creature obviously not a snake, though it might be a flying lizard. It is to be noted, however, that the flying lizards (*Draco*) do not occur as far West as Arabia.

Admiral Lord Anson (born 1697, died 1762) mentions " flying serpents in the Island of Quibo, which darted themselves from the boughs of trees upon man and beast but were without wings."

Niebuhr (born 1733, died 1815), who published the Natural History notes of his friend and fellow-traveller P. Forskal, refers to " flying snakes" in a strain similar to that of Pliny ; and Parkhurst, the great biblical scholar (born 1728, died 1797) suggested that the snakes alluded to by these authorities might be the same, or allied forms to

those mentioned in the Bible in Isaiah. I think however my foregoing remarks show the first reference purely metaphorical, and the second though obviously literal, a hyperbolic and unwarrantable misinterpretation. What the snakes are or were which were known to the Arabians as flying snakes must remain a matter of speculation. None of the genera which furnish the "flying snakes" of the present day that are known as such, occur in Arabia, but I see no reason why similar saltatory feats should not be performed by other tree snakes known to inhabit that region.

JOURNAL

OF THE

BOMBAY

Natural History Society.

Vol. XVIII. BOMBAY. No. 3.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

ILLUSTRATED BY COLOURED PLATES AND DIAGRAMS.

BY

MAJOR F. WALL, I.M.S., C.M.Z.S.

Part VII with Plate VII, with 3 Maps and 2 Diagrams.

(*Continued from page 243 of this Volume.*)

THE SAW-SCALED VIPER OR ECHIS (*Echis carinata*).

Nomenclature.—(*a*) *Scientific.*—The generic name is from the Greek ἔχις an adder, and was introduced by Merrem in 1820. *Carinata* is from the Latin *carina* a keel, and was applied originally by Schneider in 1801 on account of the ridged (keeled) condition of the scales.

(*b*) *English.*—One rarely hears an English name. It is usually spoken of as "the Echis". In many parts, however, the English population have adopted the local native name for it as "phoorsa", "afai", etc. It might be appropriately called the "common saw-scaled viper" in reference to the serrate condition of the keels on the oblique scales referred to hereafter, which when rubbed across one another produce a hissing sound.

(*c*) *Vernacular.*—In Southern India it is called "viriyan pamboo" by the Tamils, but I have also heard it called "soorootai pamboo" which I understand means "coiling snake", and about Trichinopoly "ratta pamboo". Russell * gives the local name for a specimen he acquired from Arni near Vellore as "horatta pam". Perhaps the

* Ind. Serp., 1796, Plate II., p. 2.

word is "korattai", the Tamil for "snoring" I am told, but which might also be applied to the hissing sound made by the scales rubbing against one another. In Mysore according to Rice* it is called "kallu havu". In the Bombay Presidency it is almost universally known as the "phoorsa". In and about Delhi it is the "afai", a word apparently closely connected with the Arabic names for snake, *viz.* "afa", and "afai", and possibly to the "epheh" † of the Hebrew Scriptures. It is the "kuppur" of Sind, and according to Mountford ‡ known as "janndi" in the northern part of that Province. Sir A. H. McMahon tells me it is called "phissi" on the North-West Frontier. Dr. J. Anderson § says it is known to the natives of Egypt as "ghariba", but Lyddeker ‖ gives the name in that country as "eja".

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* Mysore, Vol. I, p. 188.

† The word "epheh" I believe occurs only three times in the Hebrew version of the Bible, twice in the book of Isaiah, and once in Job. The passages are translated as follows in the present English Bible :—(1) Isaiah XXX—6. "The burden of the beasts of the south : into the land of trouble, and anguish from whence come the young, and old lion, the viper (epheh) and fiery flying serpent." (2) Isaiah LIX—5. "They hatch cockatrice eggs, and weave the spider's web : he that eateth of their eggs dieth, and that which is crushed breaketh out into a viper" (epheh). (3) Job XX—16. "He shall suck the poison of asps, the viper's (epheh) tongue shall slay him".

The late Canon Tristram identified the "epheh" in the first passage as *Echis arenicola* of Boie which is now considered identical with the *Echis carinata* of Schneider, but the accuracy of his opinion is vitiated by his identification of "epheh" in the other two passages just quoted with *Daboia xanthina* of Gray, a viper now recognised as identical with *Vipera libetina* of Linné. In the two last passages it appears to me that "epheh" is used in a general sense, and is not intended to allude to a distinct species of snake.

On the other hand the first passage which refers to Egypt as "the land of trouble and anguish" seems to refer to some special kind of snake, and one may infer a very well known one characteristic of the country in the same way that the lion was among mammals. Although the Echis occurs in Egypt it is evidently not common there, for Mr. S. S. Flower has favoured me with valuable information on this score. He writes : "Personally I have spent over 9 years in Egypt and the Sudan, but have never seen *E. carinatus* alive, nor met any natives who knew of it. It is probably, therefore, of local distribution. In the collection under my charge (Egyptian Government Zoological Gardens) I have had only two specimens of *E. carinatus*, one from Khartoum and the other from west of Mazrub. Kordofan, both collected and preserved in spirit by Mr. A. L. Butler. These specimens are now in Vienna, having been sent to Dr. Franz Werner * * Dr. Werner and I constantly exchange herpetological notes, and to the best of my recollection he has never been able to obtain *E. carinatus* himself in the Nile Valley, though he has made three collecting expeditions here on behalf of the Vienna University." Canon Tristram's association of the Echis with the Epheh of the Scriptures is, it must be admitted, open to serious objections.

‡ Bomb. Nat. Hist. Journal, Vol. XI, p. 74.

§ Zool. of Egypt, Vol. I.

‖ Royal Nat. Hist. 1896, Vol. V, p. 238.

Dimensions.—Adults vary from about 18 inches to two feet in length, but larger specimens are sometimes met with. Dr. Imlach* speaking of Sind says the average length of the kuppur is 15 inches. Elliot† in Madras says he has not seen a specimen larger than 16 inches. I am certain I have seen them larger than this in Southern India. Colonel R. Light has written to our Society of examples he has seen in Bhuj (Cutch) which measured 26½, 27½, and 27¾ inches. The late Mr. L. C. H. Young‡ recorded a specimen in this Journal from Andheri near Bombay 2 feet 6 inches long. These are the largest measurements known to me.

Bodily configuration, etc.—Its figure is typically viperine, that is to say, the body compared with that of colubrine snakes is relatively stout for its length, and reduces perceptibly anteriorly and posteriorly. The anterior attenuation makes the neck conspicuous behind the broader head. Dorsally the whole body is rough from the keeled condition of the scales, especially so laterally, where the keels are serrated. The roughness and lustreless character of the scales on the back and flanks are in marked contrast to the beautifully smooth and polished surfaces of the ventral shields, and both doubtless greatly assist colouration in rendering the creature inconspicuous amid its desert environment. The head is subovate or roughly pear-shaped seen from above, and the snout rounded. The muzzle is rounded from side to side unlike many of the pit vipers in which a more or less sharp ridge (*canthus rostralis*) separates the face from the crown. The nostril is placed rather high, and between two shields, and is notably small in comparison with Russell's viper. The eye is large, the iris golden yellow, and the pupil vertical in shape as in all other vipers. The commissure of the mouth is truly viperine, the upper lip presenting a downward rounded prominence situated below the anterior margin of the eye, and corresponding with the position of the fang as placed when the mouth is shut. Our plate shows this very well in figure 6, which should be compared with figure 2. The tail is very evident owing to the great attenuation in calibre which occurs at the anal region, and it tapers very rapidly as in other vipers. It is short, being about one-tenth to

* Trans. Medl. and Phys. Soc. of Bombay, 1855 to 1856, p. 80.

† Trans. S. Ind. Br. of Brit. Medl. Assoctn., 1895, p. 13.

‡ Vol. xvi. p. 504.

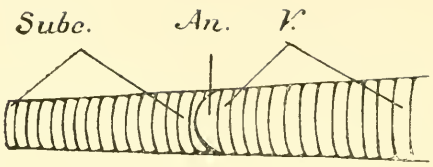
one-eleventh the total length of the snake and is about equally short in both sexes.

Colour.—As in nearly all the vipers the colouration and markings are very variable. Mr. Boulenger* speaking of another viper (*Vipera ursinii*) says "I must observe that vipers generally vary so much, both individually and according to localities, that little reliance is to be placed for specific distinction on that character."

Usually the ground colour in *Echis carinata* is a light shade of brown, buff, or tawny, and the markings are darker brown, or even blackish. In sandy places, where I have usually met with it, it harmonises wonderfully with its surroundings. Sir A. H. McMahon writes to me: "The Echis adapts itself to the colouring of the locality. I have found them of all shades of colour, from the lightest fawn in sand to almost black in dark rocky country." The body dorsally is more or less mottled or blotched with darker shades sometimes with a decided regularity of pattern as in our plate, more frequently I think irregularly distributed with no special arrangement. These marks may be so obscure as to be hardly noticeable in light specimens, or so heavily abundant that they form the predominating colour when the specimen appears umbery or blackish. A light undulatory line in the flanks is nearly always more or less evident. The head often bears a light patch on the middle of the crown, which is frequently shaped like a dagger, a broad arrow, or the imprint of a bird's foot and there is often a more or less conspicuous streak behind the eye. The belly is light, often whitish, and is more or less sparsely or profusely specked, mottled, or spotted with darker, and often rufous, bistre, or ruddy tints. I have sometimes seen a pinkish band down the middle of the belly.

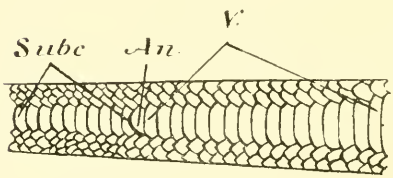
Identification.—The undivided condition of the subcaudal shields, taken with (2) the small scales on the whole of the top of the head and (3) broad ventrals stretching right across the belly, distinguish this from all other Indian snakes. These characters are shared by the only other member of this genus, *viz. Echis colorata*, a much scarcer and more local species inhabiting Arabia, and Palestine, and also recorded from Socotra. The two are separated chiefly on the nasal shield which in *carinata* touches the rostral, but in *colorata* is separated from it by small scales.

* Proc. Zool. Soc., Lond., 1893, p. 598.



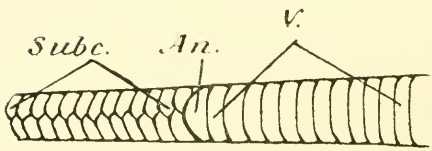
Echis carinata

To show broad ventrals and subcaudals



Eryx conicus

To show narrow ventrals and subcaudals



Dipsadomorphus trigonatus.

To show broad ventrals and divided subcaudals.

V. = *Ventrals.*
An. = *Anal.*
Subc. = *Subcaudals.*

INDIAN SNAKES. *(Wall.)*

Attention to the points above mentioned should admit of no confusion between this and other forms that bear some superficial resemblance to it. Among these may be mentioned *Eryx conicus* and *Dipsadomorphus trigonatus*. I have seen a very old and faded spirit specimen of the former which bore a marked resemblance to *E. carinata*. This species possesses the first two points mentioned above, but the ventrals are peculiarly narrow, several rows of costals (instead of the last only) being visible on either side simultaneously when the specimen is laid on its back. As a matter of fact, there is very little resemblance between the two in colouration in life though I have known the two confused.

As regards *Dipsadomorphus trigonatus* which I have also known confused with the Echis, the resemblance is, I consider, extremely superficial, affecting colour and markings only, the relatively slender and elongate body being very markedly in contrast, and the first two shield characters noted above absent.

Haunts.—It is essentially a desert snake, but occurs plentifully in semi-desert tracts where the soil, though sandy and poor, supports some sparse vegetation, so long as open patches intervene. In Delhi it appeared to be most plentiful on the Ridge where the broken and rocky nature of the ground afforded special facilities for concealment, or retirement in the face of danger, but there are many waste sandy tracts where rocks do not occur where it thrives in great numbers. Blanford* obtained 2 or 3 specimens in thin jungle about Ellore, and expressed surprise at finding a desert form like the Echis in wooded country. It is not found in dense jungle, for the reason I suppose that its colouration in such an environment would no longer be protective, added to which it does not appear to need shade, enjoying as it does the fiercest rays of the tropical sun, and at the hottest seasons of the year. It may be seen lying in the sand exposed to the full force of the sun, or may retire beneath stones, or into clefts and crannies of rock so baked with the sun's rays that the hand cannot bear contact with them. Yet even under such conditions it seems to rely solely on the juices of the animals it eats for the moisture necessary to assuage its thirst. It sometimes takes refuge in holes in the ground as I have good reason to know when digging along the burrows leading to the nests of the green bee-eater (*Merops viridis*).

* Jourl. Asiat. Soc., Bengal, Vol. xlviii, p. 116.

The sudden and unexpected introduction to this or any other snake under such circumstances detracts much from the pleasures of birds' nesting in this country.

I have occasionally known it come into the house. The late Mr. L. C. H. Young reported one in this Journal* which he found moving round his dinner table, and in Trichinopoly I once found one which had climbed on to the top of my verandah chick.

Mr. Millard writes to me: "It moves very rapidly when it wishes to escape by almost throwing itself from its tail." I have not seen the Echis manifest such activity, but believe that most snakes can do so when making their utmost endeavours to escape. I have certainly seen the Russell's viper do so, and many other snakes. I can find no better way of describing the muscular effort than as a jump. As a rule I have found the Echis maintain its ground, and when closely approached start rubbing its flanks together with great assiduity.

Disposition.—This is the most vicious snake I know. Not only is it extremely apt to bite on the smallest provocation, but strikes out without hesitation, and with great malice. These disagreeable traits in its character and the extreme velocity with which it delivers its stroke combine to make it a most dangerous reptile to meet unawares, or to have any dealings with when fully on the "*qui-vive*" either in effecting capture, or whilst in captivity. The lightning-like rapidity with which it strikes, delivers its bite, and regains its former attitude, must be witnessed to be fully appreciated. The manner in which it exactly resumes the position it occupied before striking, which is characteristic, has left me sometimes wondering whether a stroke had been delivered at all, or my senses had deceived me.

Theobold † calls it "a very active, and irascible snake," and Mr. F. Gleadow ‡ says "it is the smartest striker I know when it means business." Fayrer § says: "The Echis is very fierce and aggressive—it is always on the defensive, ready to attack: it throws itself into a double coil, the folds of which are in perpetual motion, and as they rub against each other they make a loud rustling sound very like hissing* * * . It is very active, and can dart a considerable distance—a foot or more—to strike its prey: it is by far

* Vol. XVI, p. 504.

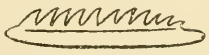
† Rept. Brit. Ind., 1876, p. 219. ‡ In Epistola. § Thanotoph. Ind., p. 16.

the most active, and aggressive poisonous snake I have seen." Again he says (p. 137): "I may remind the reader that the *Echis carinata* is a very active and fierce little viper, very aggressive, minaceous and irascible * * * in striking the head was always erect, and the whole aspect and attitude was that of intense malice, and mischief."

Habits.—The curious rubbing movement alluded to by Fayrer is probably peculiar to the genera *Echis*, and *Cerastes*, at least one may presume that *Echis colorata* and the two species of horned viper of Africa behave similarly since they all have the same saw keels and oblique costal scales. *Echis carinata* is the only one of the four that occurs in India.

Mr. Millard alludes to the peculiar movement adopted by this viper in causing the friction of its scales, thus: "It has a curious habit of revolving in almost the figure 8 with its head always in the centre." Fayrer's* plate shows the attitude referred to by Mr. Millard very well.

The hissing noise, and its production are among the most interesting features connected with this snake. From four to seven of the costal series above the penultimate row are peculiarly oblique as seen in our plate. In these rows and these only the keels are serrated, and when the sides of the body rub against one another, the teeth on the opposing faces scrape together, producing a noise so like hissing that the onlooker ignorant of the method in which the sound is really produced may well be deceived. The volume of sound is doubtless very greatly intensified by the habit this snake possesses, in common with many others, of inflating itself under excitement. The result is the production of a column of imprisoned air within, which in this case acts as a resonant chamber. Fayrer remarks that he thinks this viper does not hiss. Whether it does so or not, no ordinary hissing except perhaps that of the Daboia would be likely to be audible during the production of this loud false hissing sound. In Delhi I frequently saw a heap of these



Side view of oblique costal scale to show serrated keel. (After Boulenger.)

* Loc. cit., pl. XII.

creatures alive in a ghurrah brought to Major Dennys when he was collecting poison for the Indian Government some years ago. When the lid was lifted, several of these creatures, perhaps all, would excite themselves, and begin rubbing their flanks, with the result that the sound produced reverberating within the pot sounded not at all unlike that of a boiling kettle, the effect being distinctly uncanny as no issue of steam accompanied it, and the chatty was cold.

Poison apparatus.—The *fangs* in the Echis are very large for the size of the snake. In a one and a half footer they are probably as long or longer than the fangs in a four foot Krait. The maxillæ are very mobile as in all vipers, allowing the fangs to be rocked forwards and backwards, a trick it is very fond of exercising when yawning, or when grasped by the neck. Fayrer* removed the fangs from a specimen on the 7th October " and noticed particularly that there were no other fixed fangs." On the 11th October he found a fang firmly anchylosed on each side and ready for use. Similar experiments on this and other snakes by the same authority showed the lapse of time to be in most instances considerably longer, but the fact that in one instance only four days was necessary to re-establish this important structure, should impress those who handle poisonous snakes, with the importance of frequently inspecting the jaws if they rely upon the extraction of the fangs for their safety.

Glands.—The poison glands that I have dissected out are perhaps relatively small, but of this I am not sure. They are corrugated externally, not smooth like the glands of the cobra.

Poison.—Physical qualities.—I know of no special observations in this direction. On the few occasions that I have seen this poison in the fluid and solid state " in vitro " without making any special examination it has appeared to me much the same as Daboia venom, the characters of which were given in a previous article dealing with that snake.

Quantity.—I am not certain what the yield of a single gland is, but at a rough guess think it capable of storing, at least, 2 or 3 drops of venom. The actual quantity is difficult to determine, as the glands are so small. When Major Dennys, I.M.S., was collecting poison for the Indian Government in Delhi some years ago, it was found very

* Loc. cit., p. 140.

difficult to collect Echis venom : the yield of many specimens made to bite one after the other into a watch glass gave very meagre results. The method of collecting it was evidently wasteful, for the secretion is free on excitement, sufficiently so at any rate for the venom to trickle down, and form a drop which is ejected when the creature strikes. Thus Miss Hopley* says : " When the poison gland is full and the snake angry, you may see the venom exuding from the point of the fang, and by a forcible expiration the reptile can eject it. I have seen this in the little *Echis carinata.*"

Toxicity.—The virulence of the venom is very great, as may be judged from its effects experimentally on the lower animals. A very few instances will suffice to exemplify this. Fayrer† (p. 138) records the death of a pigeon in less than 60 seconds after being bitten by an Echis, (p. 138) of a fowl in 70 seconds, (p. 138) another fowl in 2 minutes, (p. 15) of a dog in about 4 hours, and (p. 136) a cobra 3 feet 8 inches long succumbed to the bite of an Echis 23 inches long, 30 hours later. In the last instance Fayrer remarks that there could be no doubt that the cobra died from the effects of the poison. Dr. Imlach ‡ says that the poison introduced into the system of a fowl induces death in about three-quarters of a minute.

Lamb, § as a result of most careful experiments with many snake venoms, says that Echis venom has " considerably greater toxicity " than that of Russell's viper.

Physiological effects.—Lamb,¶ whose researches with this venom are not completed, says that, as far as he has been able to ascertain, the physiological action of Echis venom is similar tothat of Daboia venom. He shows that very profound alterations in the quality of the blood result.

Effects of Echis bite on man.—Very conflicting views have been expressed by various authors with regard to the dangers to man of this snake. There are some who deny the lethal effects of its bite, such as Gunther ‖ ; others think a fatality a very rare sequel, such as Elliot**, who says he thinks " it just possible that an Echis might kill a child, or a very weakly adult."

* Snakes, p. 351.

† Loc. cit.

‡ Loc. cit. p. 80 *et seq.*

§ Scient. Memoirs by Officers, Medl. and Santy. Dept. Govt. of India, No. 10, p. 8.

¶ Loc. cit.

‖ Rept., Brit. Ind., 1864, p. 397.

** Loc. cit., p. 13.

There is abundant evidence, however, to show that the bite of the Echis may produce not only the most alarming symptoms, but frequently death. How far the fatal issue may have been contributed to by fright, it is impossible to conjecture; but in the face of the many opinions expressed by those who have experimented with the poison as to the extraordinary virulence of Echis venom, compared with that of other venomous snakes, I see no reason to specially invoke the assistance of fright to account for Echis fatalities.

Dr. Imlach in 1856 wrote : * "The Kuppur is, without exception, the most deadly poisonous snake in Sind." He substantiates the remark by showing that in Shikarpur alone there were 306 cases of snakebite from May to October with 63 deaths, *i.e.*, a mortality of 20·58 per cent. He goes on to say : "a reference to police returns will show that in by far the greatest majority of cases, serious injury and death have been caused by the bite of this species." In 1874 Fayrer,† quoting Gunther's opinion above alluded to, expressed doubts as to its accuracy, remarking on the great virulence of the venom on the lower animals. Further, ‡ he quotes from a letter written to him by Major McMahon from Delhi, who, speaking of this snake, said "they have the reputation of being very deadly, and certainly my old snake man died from the bite of one of his specimens." Later in 1883 Wall § (A J) placed the Echis as the third most dangerous snake, giving the fourth place to the Daboia, the fifth to the banded krait (*Bungarus fasciatus*), and the sixth to the Hamadryad (*Naia bungarus* syn. *Ophiophagus elaps*). He remarks, too, that "there can be no doubt that it contributes very largely to the mortality from snakebite, especially in Northern and Western India."

In 1890 Vidal wrote to this Journal ¶ recording 62 fatalities from this snake in the Civil Hospital at Ratnagiri in the year 1878.

He estimated that about 20 per cent. of the cases of Echis bite proved fatal, and remarks that the poison is slow, death occurring on an average in 4½ days, but that some cases lingered on for 20 days.

He shows later that the Echis is a far more potent factor than any other venomous species in swelling the mortality of the Bombay Presidency. He substantiates the assertion by the very significant

* Loc. cit., p. 80.

† Thanatoph. Ind., p. 15.

‡ Loc. cit., p. 123.

§ Ind. Snake Poisons, p. 159.

¶ Vol. V, p. 64, *et seq.*

observation that in Echis ridden tracts the mortality from snakebite far exceeds that in districts where this snake is comparatively less plentiful. Thus in a table compiled from official returns for 8 years (1878 to 1885) for the districts of the Bombay Presidency, he shows that in the districts of Hyderabad, Thar and Parkar, Karachi and Ratnagiri where the Echis abounds, one man in 5,000 dies per annum from snakebite, whereas in Bijapur, Nasik, Ahmednagar, and Sholapur, where this snake is but little in evidence, only one death from snakebite is recorded for 100,000 of the population.

Murray* says "this little viper is very venomous; although the action of its poison is not so quick as that of the cobra, it is equally as potent, and numerous deaths annually occur from its bite."

Mr. Millard has informed me by letter of the case of an attendant in this Society's rooms in Bombay who in October 1903 was bitten by an Echis in the temple. He was taken off at once to hospital, admitted that he felt no fear, but in spite of prompt treatment died 24 hours later.

On the other hand I could quote a large number of cases of Echis bite which (mostly under treatment) recovered after effects of varying severity.

Symptoms of Echis poisoning in man.—The symptoms produced by Echis venom are almost, if not completely, due to the profound alteration the poison works on the constitution of the blood, reducing its coagulability, so that hæmorrhages are most prone to occur. In a case reported by Fayrer† of a woman of 30 bitten in the finger at Kotree (Sind), bleeding occurred from the eyes, gums, tongue, nose, vagina, and from beneath the nails of the thumbs, and great toes. In a case reported by Nicholson‡ a servant bitten at Arconum bled from a cut he had sustained some days before "but which appeared all right" at the time of the bite. Sudden bleeding came on two days after the bite, presumably from the tender scar.

In this Journal Mr. Heath§ described his symptoms after a bite from this snake. He was seized with violent and repeated vomiting of blood, and had fever also. In two cases which occurred during the Seistan Mission, the notes of which made by Major Irvine, I.M.S., were forwarded to me by Sir A. H. McMahon, profuse bleeding

* Reptilia of Sind, p. 57.
† Loc. cit., p. 59.
‡ Ind. Snakes, p. 187.
§ Vol. XII, p. 784.

occurred from all mucous surfaces and lasted in one case for a week.

In a case under the care of Major Browning, I.M.S., reported by Elliot* a woman of 25 was bitten in the finger by a 10-inch specimen at 2-15 p.m. At 8 p.m. she had a sharp hæmorrhage from the bitten part which recurred at 1 a. m. In almost all these cases no constitutional symptoms other than those attributable to the blood were observed. In one case reported by Major Irvine the man almost died on two occasions of fright alone, but eventually recovered. In a case reported by Russell† the man is said to have had delirium and spasms, and in Browning's case there was frontal headache. In most cases severe burning pain, and varying degrees of swelling, sometimes very pronounced, occurred locally.

Food.—For information on this subject I am much indebted to Mr. Millard, who has had ample opportunities of ascertaining the character of food preferred by the many specimens kept in captivity in the Society's rooms in Bombay. He tells me they feed readily on mice, centipedes, and scorpions. He has also known them eat frogs, and on one occasion a locust. He also mentions an instance, in this Journal‡, of one Echis eating another which it subsequently disgorged.

Mr. Thurston writes to me that in the Madras Museum two specimens between the 29th October 1896 and 31st March 1897 ate 8 frogs.

Miss Hopley§ mentions seeing this snake in captivity in London kill and eat a mouse on two occasions, and remarks that on both occasions it waited till its victim was dead before swallowing it.

Gunther ¶ says he never found anything but scolopendræ (centipedes) in the stomach of this species.

Foes.—Though such a truculent little reptile it is sometimes overpowered by creatures one would expect it to vanquish, or at least to hold its own with. Mr. Boulenger in this Journal ‖ says on the authority of Mr. Mountford that the Sind Krait (*Bungarus sindanus*) is reported to frequently eat the Echis. Jerdon** records a sand snake (*Psammophis condanarus*) having eaten one, and Elliot reports a case where the common house rat killed three Echis

* Loc. cit., p. 40.
† Ind. Serp., 1896, Vol. I, Part II, p. 78.
‡ Vol. XVI, p. 757.
§ Snakes, pp. 579 and 580.
¶ Rept. Brit. Ind., 1864, p. 397.
‖ Vol. XI, p. 74.
** Journ. Asiat. Soc., Bengal, Vol. XXII, p. 529.

without suffering in any way. He says. "The snakes each time struck at the rat savagely and repeatedly, but no trace of blood could be seen on the animal." These creatures were all in captivity at Guindy near Madras.

Breeding.—Though so common a snake the records of its breeding are very meagre. Miss Hopley tells us * that in the London Zoological Gardens in 1875 one gave birth to 3 young in July, and mentions that they changed their coats at an early date, but ate nothing.

The only gravid specimen I have had in captivity gave birth in Trichinopoly on the 7th August 1896 to 12 young. These coiled themselves up into a confused heap in one corner of their box, and apart from the mother, who evinced no special concern in her progeny even when they were rudely stirred up with a stick. All of them cast sloughs on the day of birth. The one individual that was measured was $4\frac{7}{8}$ inches long. †

Sir A. H. McMahon writes to me that he once came across a lot of little ones 3 or 4 inches long at the end of August, and has heard of some more baby Echis being found about Quetta in August. No mother was present on either occasion.

Candy in this Journal‡ says that in Ratnagiri he made special enquiry, and ascertained that the young are born in April, May, or June but they were reported difficult to find.

Much the most important record of this nature is that reported to me recently by Major O. A. Smith, 27th Punjabis, who witnessed the birth of 3 young on the 6th of August 1907 in Multan. The mother had been 3 weeks in captivity. The first snakeling was born in membranes at 10-40 a. m., and took "a long time" to burst them and force its way out. The second born in membranes at 11-12 took four minutes getting free. The third also born in membranes was discharged at 11-25 a.m., began struggling at 11-50 and was free at 11-53. It was observed that in trying to free themselves they exerted pressure with their snouts against the membrane. After their birth "a lot of jelly-like substance whitish in colour was passed out," which I think may have been a non-fertile egg. During birth it was noticed that a globular bag containing orange-coloured fluid first

* Snakes, pp. 440 and 579.

† Referred to in this Journal, Vol. XIII, p. 184.

‡ Vol. V, p. 85.

gained exit, increasing in size, and expanding the cloaca till the rest of the bag containing the coiled embryo escaped. The young were "proximately 4½ inches long." They drank water given them at the end of a penholder. The mother died a week or so later.

Sloughing.—Fayrer* says, referring to some specimens he had had in captivity, "it is a remarkable thing that none of these Echis have shed their epidermis since they came here three months ago: not a trace of a slough is found in their cage." The remark was made on the 15th October.

Distribution (*a*) *Local.*—It is essentially a creature of the plains but may be met with up to probably 6,000 feet elevation. I have seen a specimen from Suleik (Aden Hinterland 2,000 feet) in our Society's Collection. Nicholson† records a single example among 1,225 poisonous snakes brought for rewards in 1873 at Bangalore (circa 3,000 feet). I met with it about the Malakand (2,000 to 3,000 ft.). Mr. C. H. Whitehead sent me a skin from Parachinar, N.-W. F. (5,760 feet), and says they are common there.

(*b*) *Geographical.*—I attach two maps to indicate the habitat of this snake. In Map 1, I have shown the limits of its distribution as at present known in Africa and Asia. The red lines are the boundaries of regions (uninterrupted) and subregions (dotted) as laid down by Blanford in 1866 and 1880. In making a comparison, however, one must bear in mind that his delimitations were based upon the distribution of mammals, and that the knowledge derived during twenty-eight years since he wrote may have modified the confines of these boundaries, but of this I am not in a position to speak authoritatively.

So far as Africa is concerned, Boulenger ‡ records the habitat as follows:—Desert, and sandy districts north of the Equator. The most southern record on this continent is Somaliland on the East Coast (British Museum specimen): the southern boundaries elsewhere are, I believe, not exactly known.

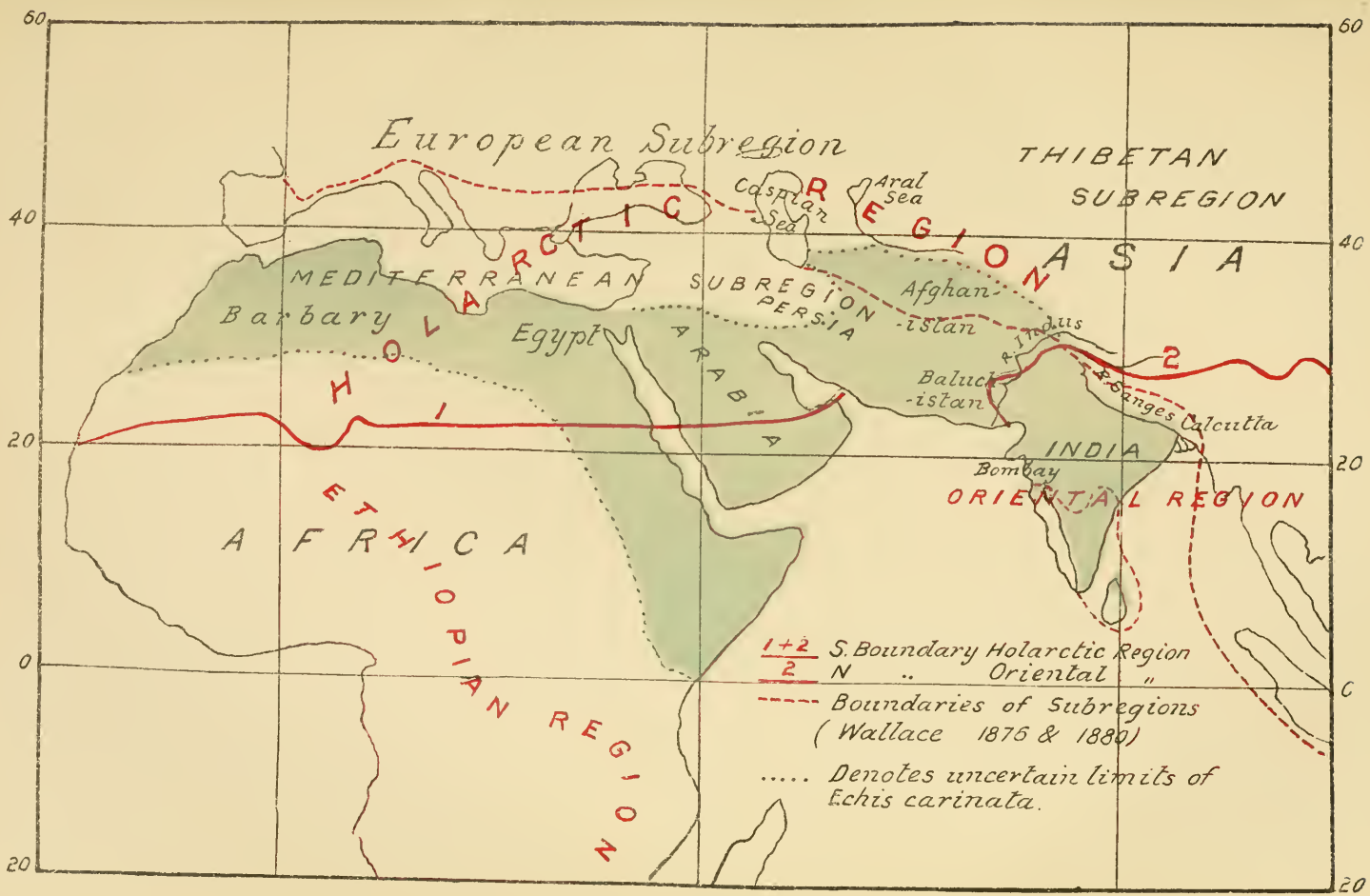
In Asia it occurs in Arabia, Persia, Afghanistan, Baluchistan, and India. It is probably found throughout Arabia, as Günther § records specimens from Midian on the north-eastern shores of the Red Sea,

* Loc. cit., p. 141.

† Loc. cit., p. 173.

‡ Cat. Snakes, Brit. Mus., Vol. III, 1896, p. 505.

§ P. Z. S., 1878, p. 978.



MAP 1 — Distribution of Echis carinata

our Society has a specimen from Aden Hinterland, the British Museum has examples from the south (Aden and Hadramaut) and the east coast (Muscat). The exact northern boundary is as yet not known. It probably occurs throughout Persia, its north-western limits being, I believe, not precisely demarcated. It extends beyond Persian limits to the north, a specimen in the British Museum having come from Askabad in Transcaspia.

It occurs throughout Baluchistan and Afghanistan, the northern limits in the latter country being uncertain.

In India its distribution is shown in Map 2, and it will be observed that in the northern part of the Punjab the boundaries are not clearly defined. Again, the Ganges appears to be the boundary in North-Eastern India. It does not appear to inhabit the southern part of the Malabar Coast. The northern boundary of this tract is conjectured by Blanford to be the Tapti River, but the Echis occurs plentifully well below that river (Ratnagiri).

So far as Ceylon is concerned, though Boulenger makes no special reference to this island in its habitat, I think there is little, if any, doubt that it occurs in the Northern Province, the fauna of which, according to Blanford and others, agrees with that of Southern India to the east of the Western Ghats. Ferguson * says: Mr. E. Wytealingam of the Medical Department, an industrious and excellent collector of our reptiles, has recently sent about a dozen specimens of this small viper from Mullaitivu, thus proving that it is a common snake in that part of the island. Haly † notes against this species: "Two specimens (very bad state) from Mullaitivu, presented by W. Ferguson, Esq." Mr. W. Ferguson, with whom I was personally acquainted for some years, was an excellent observer and not likely to make a mistake about a snake so easy to identify. I have given in Map 2 all the localities with which I am acquainted in Indian limits from which it has been reported.

Its abundance in various parts of India differs considerably. In many localities it is specially common, but probably nowhere more so than in and about Ratnagiri, where it exists, according to Vidal and Candy, in numbers almost incredible. The former in this Journal ‡ says that in the Ratnagiri District alone during 6 years

* Rept. Fauna of Ceylon, 1876, p. 25.

† First report of the Collection of Snakes in the Colombo Museum, 1886, p. 18.

‡ Vol. V, p. 64.

Government rewards were paid on an average of 225,721 phoorsas per annum. Later he remarks that when the Government reward was raised tentatively from six pies to two annas per head, 115,921 were paid for in 8 days (December 2nd to 18th, 1862). Again Candy in the same issue (page 85) says that in Ratnagiri, in August and September, the Mhars go out with long sticks to which forks are attached, and catch them in thousands for Government rewards. I doubt whether any other snake or perhaps even this one abounds in such prodigious numbers in any other part of India. Vidal shows that in the Districts of Hyderabad (Sind) and Thar and Parkar (Sind) it is also specially numerous. Alcock and Finn reported it common along the line of march to the Persian Frontier when delimiting the Afghan-Baluch boundary. Sir A. H. McMahon tells me that it is common throughout the N.-W. Frontier, extending up the Indus Valley as far as Chilas. He also says it is very common in Baluchistan and Seistan. Mr. C. H. Whitehead writing from Parachinar on our N.-W. Frontier says (at 5,760 feet) it is quite common. Colonel R. Light * reported several casualties from this viper in Bhuj (Cutch), so that it is evidently common there. Fayrer † remarks "it is common in the North-West Provinces, Central Provinces, and generally in the South of India." Jerdon ‡ says it is very common in the Carnatic. Personally I have known it very common about Trichinopoly and Delhi, and met with several specimens in Malakand.

Description.—Rostral. Touches 6 shields; the rostro-nasal sutures two or three times longer than the rostro-internasals: height about half the breadth. *Internasals.* A pair of small shields, the fellows in contact. *Supraoculars.* Usually present, sometimes more or less divided. *Nasals.* Divided into an anterior and posterior shield or semi-divided; touching the 1st supralabials; nostril small, placed in the upper, and posterior part of the nasals. *Supralabials.* 10 to 12, the 4th largest usually (sometimes the 3rd). *Infralabials.* 4 (3), the 4th (3rd) largest. *Sublinguals.* One well developed pair touching 3 or 4 infralabials, andf our scales behind. *Costals.* Two heads-lengths behind head 23 to 29, midbody 26 to 35, (37 Boulenger) two heads-lengths before vent 21 to 27; all rows except

* In Epistola. † Loc. Cit., p. 16.

‡ Jourl., Asiat. Soc., Bengal, Vol. XXII., p. 324.

MAP 2 – *Distribution of Echis carinata.*

the ultimate keeled, the penultimate faintly, and in the 4 to 7 oblique rows above this the keels are serrate.

The ultimate row is the largest, the penultimate rather smaller, the oblique rows narrow, and remaining dorsal rows subequal and small. *Supracaudals.* Keeled to tail tip. *Ventrals* 132 to 192 (Boulenger) : broad, stretching right across belly, so that when the specimen is laid on its back, only part of each ultimate costal row can be seen on each side : not keeled. *Anal.* Entire. *Subcaudals.* 21 to 48 (Boulenger) : entire.

Details of Map 2.

Distribution of Echis carinata.

1. Mullaitivu.—Ferguson. Rept. Faun. Ceylon, 1877, p. 25.
   Haly. First Report Snakes. Colombo Mus., 1886, p. 18.
2. Ramnad.—Dr. Annandale. Indian Museum.
3. Tinnevelly.—Millard. Bombay Collection.
4. Anamallays.—Boulenger. British Museum.
5. Trichinopoly.—Wall.
6. Arni.—Russell. Ind. Serp., Vol. 1, p. 3.
7. Madras.—Boulenger. British Museum.
8. Bangalore.—Nicholson. Ind. Snakes p. 173.
   Sclater. List 1891. Indian Museum.
9. Karwar.—Millard. Bombay Collection.
10. Deogad.—Candy. Bombay Jourl., Vol. V, p. 85.
    Liston. Parel Laboratory (In epistola).
11. Ratnagiri.—Vidal. Bombay Jourl., Vol. V, p. 70.
12. Mahableshwar.—Boulenger. British Museum.
13. Poona.—Millard. Bombay Collection.
14. Andheri.—Young. Bombay Jourl., Vol. XVI, p. 504.
15. Deccan.—Boulenger. British Museum.
16. Ellore.—Blanford. Jourl. Asiat. Soc., Bengal, Vol. XLVIII, p. 116.
17. Singbhum.—Anderson. Jourl. Asiat. Soc., Bengal, Vol. XL, p. 37.
18. Rajmahal.—Sclater. Ind. Museum.
19. Nowgong.— ,, ,, ,,
20. Allahabad.— ,, ,, ,,

21. Agra.—Sclater. Ind. Museum.
22. Delhi.—Wall. Fayrer. Thanatoph., 1872, p. 123.
23. Mhow.—Millard. Bombay Collection.
24. Rutlam.—Heath. Bombay Jourl., Vol. XII, p. 785.
25. Guzerat.— ,, ,, ,, Vol. XIII, p. 340.
26. Ajmere.—Blanford. Jourl. Asiat. Soc., Bengal, Vol. XLVIII, p. 127.
27. Mount Abu.—Sclater. Ind. Museum.
28. Deesa.—Boulenger. British Museum.
29. Bhuj.—Col. Light (In epistola).
30. Shikarpur.—Dr. Imlach. Trans. Medl. and Phys. Soc. of Bombay, 1855, No. III, p. 80.
31. Karachi.—Sclater. Indian Museum.
32. Dasht.—Sclater. Indian Museum.
33. Jask.—Boulenger. British Museum.
34. West of Bampur.—Boulenger. British Museum. (Persia not Baluchistan as given by Boulenger, Cat. Vol. III, 1896, p. 507.)
35. Ashkabad.—Boulenger. British Museum.
36. Tirphui.—Sclater. Indian Museum.
37. Seistan.—Boulenger. British Museum.
Annandale. Indian Museum.
38. Perso-Baluch Frontier.—Alcock and Finn. Jourl. Asiat. Soc., Bengal, Vol. XLV, p. 565.
39. Quetta.—Mc Mahon (In epistola).
40. Rajanpur.—Sclater. Indian Museum.
41. Multan. Major Smith (In epistola).
42. N.-W. Frontier, Malakand—Wall. Parachinar, Whitehead (In epistola.) "Common throughout", McMahon (In Epistola).
43. Chilas.—McMahon (In epistola).
44. Salt Range.—Sclater. Indian Museum.
45. Between Nuskhi and River Helmand.—Boulenger. British Museum.

I have not been able to exactly locate the following :—

Patchia in Rajputana. Sclater. Ind. Museum.
Chilgez in Afghanistan. Boulenger. British Museum.
Muckerabad in Persia. Boulenger. British Museum.
Kalagan in Baluchistan. Sclater. Ind. Museum.

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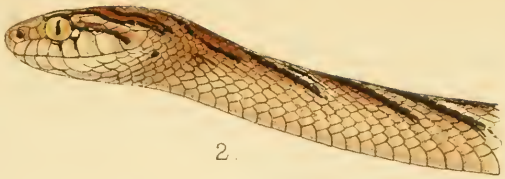

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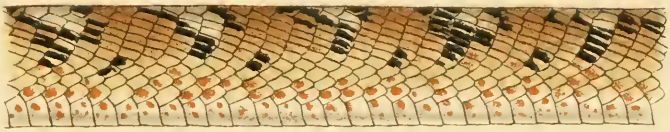

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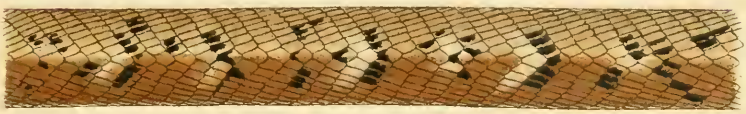

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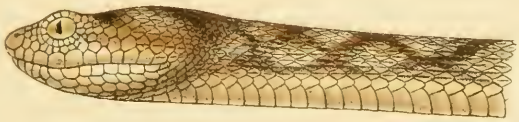

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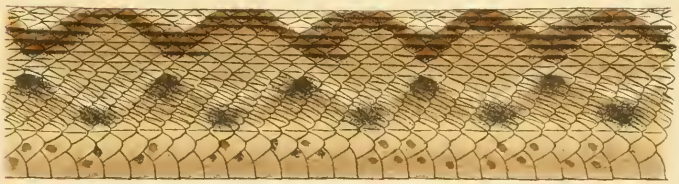

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J. G. del.

J. Green Chromo lith.

THE BROWN TREE-SNAKE.

1—4. Dipsas trigonata. (harmless)

THE "PHOORSA" OR "KUPPER"

5—8. Echis carinata. (poisonous).

The Gamma, or Common Brown Tree-Snake.

(*Dipsadomorphus trigonatus.*)

(*Dipsas trigonata*).

Nomenclature.—(*a*) *Scientific.*—The generic name is from the Greek "Dipsas", a species of snake, and "morphe" form, implying a similitude in form to that of the Dipsas. Under the name Dipsas* many snakes were included by the older writers, which modern herpetologists consider separable into many distinct genera. The name is now retained to designate the genus of the original snake to which it was applied by Laurenti in 1768, a South American species, *viz.*, *Dipsas bucephala.* The other forms now considered distinct have had to be rechristened, and among them the genus to which the species under discussion belongs.

The title now retained for it by Mr. Boulenger originated with Fitzinger in 1843, and was applied by him to this species. It is very doubtful, however, whether this name will stand, as the same authority gave the name *Boiga* to the species *irregularis* of this genus in 1826 as shown by Stejneger † recently.

There seems little doubt that the name of the genus will have to be changed to *Boiga*, but I refrain from doing so here, as I follow in Mr. Boulenger's footsteps in nomenclature in these papers.

The specific name *trigonatus* is from the Greek "tri" three, "gonia" angle, and is applied to the peculiar markings on the body, which often very obscure appear to me to much more resemble the Greek letter χ than triangles. The name was introduced by Schneider for this species in 1802.

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* This name was evidently borrowed from the ancients who applied it to some snake, the identity of which is at the present day probably not known. It was reputed to be venomous and according to some, one of the effects of its bite was an insatiable thirst (Gr. "Dipsa" thirst), though Lucan makes it appear that it was the creature itself that was afflicted with thirst. Thus in his Pharsalia written in the first century A. D. he alludes to it on the occasion when Cato was leading his army across the desert. The passage has been thus translated :

> And now with fiercer heat the desert glows,
> And midday gleanings aggravate their woes,
> When, lo ! a spring amid the sandy plain
> Shows its clear mouth to cheer the fainting train.
> But round the guarded bank in thick array
> Dire aspics roll'd their congregated way,
> And thirsting in the midst the Dipsas lay.

† Proc. Biol. Soc. Washington, XV., 1902 p. 16.

(*b*) *English.*—I know of no English name in general use but have seen it alluded to as the Common brown Tree-Snake in some books. This title is too long and it is doubtful whether it might not be equally applicable to its larger brother species *D. forsteni*. I would suggest the name Gamma snake, the markings on the body in a typical specimen are very like the Greek letter γ and specially those on the left side. On the right, however, the long stroke of the letter is sloped the wrong way.

(*c*) *Vernacular.*—The name quoted for it by Russell* about Vizagapatam is "Tar tutta". In Malabar it was frequently called "Choorta".

Dimensions.—It grows to two-and-a-half feet.† The longest of some 25 measurements made by me were 2'-7", 2'-6½", 2'-6½" and 2'-6", and all of these specimens were females. The largest ♂ of some 20 examples in which I have recorded the sex was 2'-1¾". I had another ♂ 2'-0¾".

Physiognomy and Bodily Configuration.—The head is subcordate or subtriangular in shape, being widest at a point about midway between the eyes and the neck, and is flattened (*i.e.*, depressed). The snout is rounded: the laterally placed nostrils occupy the second and third-fifths from above downwards of the suture between the nasals and are wholly or almost wholly contained in the anterior of these shields. The eye is large, the iris copiously flecked with mustard yellow, and the pupil vertical. The neck is very constricted, probably (in common with others of this genus) more so than in any other colubrine snake within our limits. The body is slender throughout: it increases gradually in girth from the slender neck, and as gradually attenuates towards the vent. Its vertical markedly exceeds its lateral measurement (*i.e.*, the body is compressed). The tail is evident, especially so in females, a considerable reduction in girth occurring at the vent. It is of moderate length, varying from rather more than one-seventh to one-fifth the total length, and is distinctly longer in females than males, a peculiarity I have not noted in the

* Ind. Serp., 1796, p. 20, and Plate XV.

† Blyth (Journal Asiatic Soc., Bengal, Vol. XXIII, p. 294, footnote) says that it attains to about 6 feet, but this is obviously a mistake, probably a printer's error, for his record of the length of the young, *viz.*, about 9 inches, is in accord with my own supposition, and in consonance with the proportions of hatchlings in other snakes of dimensions similar to that given by me for this species, *viz.*, two-and-a-half feet.

species of any other genus, but which will probably be found to be the same in others of this genus. In all other snakes where a sexual disparity is noticeable I have found the length greater in the males.

I may here remark upon the very striking resemblance this snake with others of this genus bears to some vipers. The shape of the head, the vertical pupil, and the constricted neck are typically viperine, to which may be added the method of striking, to which I shall refer hereafter. On the other hand, it is noticeably different from vipers in the large plaque-like shields of the head, in the profile outline of the commissure of the mouth which does not show that marked downward curve corresponding with the position of the viperine fang, and in the slenderness, length, and compression of the body. The tail, too, is relatively longer in *Dipsadomorphus*. The viperine similarities affect the very features which most readily attract the eye ; the dissimilarities on the other hand are far less noticeable to one unfamiliar with these creatures.

Colour and Markings.—The ground colour is usually of a light yellowish-brown, sandy, or fawn hue which may be uniform, or, more or less mottled with darker shades, specially low in the flanks or sparsely scattered with black spots. Dorsally a series of dark more or less distinct ϒ shaped marks occur on each side, which fade posteriorly, ending at or before the vent. The shade between the arms of each ϒ is lighter, often indeed whitish. Where the series of one side exactly meets the fellows of the other on the spine, as frequently happens in part if not the whole length of the body, these marks resemble arrowheads. Blyth* says the very young are pale with but slight traces of the adult marks, but I cannot say that my young specimen was much, if at all, different from adults. I have noticed that the skin between the scales is dun, and somewhat darker in the gamma marks, and in sloughs these marks are obscurely traceable.

A specimen I got in Delhi was much the colour of tea and milk, and was copiously specked with very fine punctiform dark spots, the gamma marks being very obscure.

The head bears a pair of large lung-shaped brown patches, often delineated with black, and a narrow dark streak passes from behind the eye towards the gape. Annandale † mentions a variety from the

* Loc. cit. † Journ. Asiat. Soc. Bengal, Vol. LXXIII, p. 209.

Perso-Baluch frontier many specimens of which were collected by Sir A. H. McMahon in which the head was sooty black, especially in the young, and suggested the name *melanocephalus* for it.

Breeding.—My own notes supply all the information on this point, and though the incidents within my experience are few, a good deal may be inferred from the scanty material available.

My smallest prospective mother was 1 foot $8\frac{3}{8}$ inches in length in June. This length would be attained in the third year of age, and from an ophidian point of view the age is an unusually early one for breeding. My other gravid specimens were four years old at least.

It is fairly obvious that the species is not a very prolific one from the snake stand point. 10 was the largest number of eggs found in abdomina, and in three other cases there were 3, 5 and 6 respectively. The eggs are probably discharged as such in August and September. I am fairly certain the species is ovoviviparous, and have good reason to believe that at the time of deposition the eggs contain embryos in a very early stage of development, but of this I cannot speak positively yet. The eggs are long white ovals, the poles of each equally domed, the shell white and leathery. I have measured them in one case $\frac{7}{8}$ inch long by $\frac{1}{2}$ inch broad, in a Bangalore specimen; date of capture not known. In another killed in August they were $\frac{17}{20}$ of an inch, and in a third in August $\frac{18}{20}$ of an inch. Both the last were obtained in Fyzabad. In the Bangalore specimen, which had been preserved in spirit, the 10 eggs lay in a single string, which occupied $8\frac{1}{2}$ inches of a body 2 feet and $\frac{3}{4}$ of an inch long (*i. e.*, exclusive of tail). The poles of each were flattened against one another from pressure. The young it may be presumed from analogy emerge from the egg two months or so after deposition, but of this I can only speak hypothetically. If I am correct in my belief that the embryo is partly developed when the eggs are extruded, the usual term of incubation may be curtailed. Hatchlingsare, I believe, about 9 inches in length. Blyth, too, gives this measurement for the young. It is perhaps remarkable that of more than 30 specimens collected by me I have only had one young one. This measured $9\frac{3}{8}$ inches on the 13th March in Trichinopoly. My next largest specimen was 1 foot $3\frac{1}{2}$ inches.

The young appear to grow about 6 inches a year.

Identification.—Attention must be directed to the following. The scales are in 21 rows anteriorly, *i.e.*, two heads lengths behind the head, 21 in mid body, and 15 posteriorly, *i.e.*, two heads lengths before the vent. This arrangement is only to be found in certain species of this genus and some pitvipers, *Lachesis gramineus*, etc. The enlarged plates on the head will eliminate all the vipers which share the scale peculiarities just noted, and thin the diagnosis down to 5 species of *Dipsadomorphus*,* viz., *trigonatus*, *hexagonotus*, *ceylonensis*, *cyaneus* and *multifasciatus*. *Trigonatus* has the vertebral row of scales feebly enlarged in the middle of the body, and fewer subcaudal shields, *viz.*, 75 to 92. In the rest, excepting *multifasciatus*, the vertebrals are as broad as long in the middle of the body, and in *multifasciatus* the subcaudals vary from 96 to 114.

To sum up diagnosis rests on—

(1) The scales being 21, 21, 15.

(2) The head covered with large plates.

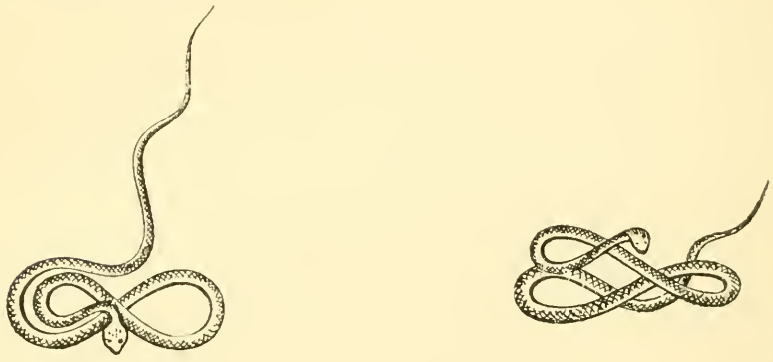
(3) The feeble development of the vertebrals in midbody.

(4) The subcaudals 75 to 92.

Disposition.—This with others of its genus is one of the most intrepid snakes I know. Often with no further provocation than being suddenly disturbed or confronted, it will assume an attitude of defiance and with little hesitation boldly act on the offensive. The attitude it adopts at these times is very characteristic. The head and forebody are erected well off the ground, and the latter thrown into loops of which two overlapping one another are thrown to one side and one on the other, the head being poised in the middle of the figure of 8 so formed. The rest of the body lies variably disposed in sinuous extension. Prior to its hasty stroke the erected part is swayed slightly forwards and backwards, whilst the body is inflated and deflated with agitation, and the tail briskly vibrated with emotion. Poised thus, intently watching the object of its alarm for a favorable

* Many of the species in this genus are so closely alike in scale characters that it is difficult to separate them, consequently some have been much confused by some authors. After the number of scale rows, the development of the vertebrals, and the number of the subcaudals, the next most important point to demand attention appears to be the posterior sublinguals the fellows of which are in contact in some of the species, separated completely by small scales in others. Whether this will be found quite constant in the various species remains open to question. The reflection of the præocular on to the top of the head or otherwise, appears to me of uncertain value, being subject to variation in individuals of some species. The actual contact of this shield with the frontal is also variable.

opportunity to deliver its thrust, the little creature reminds one of the behaviour of a wrestler seeking with the utmost vigilance to engage his adversary advantageously. The stroke is delivered with great malice, the jaws opening widely in the act of striking, and the forward thrust is no sooner accomplished than the creature retracts itself to reassume its former attitude, and strikes again and again—in fact, will sometimes do so till its energies are spent. During the thrust the loops are straightened to their utmost, and a two-foot snake may dart at and strike an object six inches or even more in front of it.



A. B.

Fig. 3

A. D. trigonatus seen from above poised before striking.

B. do seen from in front poised before striking.

I have several times tried to get this and others of this genus photographed in the peculiar attitude just referred to. The last occasion was in Fyzabad, but in my attempts to get the right pose I was struck at again and again until the specimen lay over on its side completely exhausted, and I picked it up with no more fight in it

and restored it to its box. The next day it repeated the same performance with a similar climax. Such determination and courage in so small a creature are worthy of the greatest admiration.

Its attitude before striking is very similar to that displayed by the pit vipers *Lachesis gramineus* and *L. anamallensis*. I have tried to show this in the accompanying diagrams.

Food.—Like other ophidians the Gamma snake takes almost anything it can get, but it shows a strong partiality in its natural haunts for lizards, especially those of the genus Calotes and other Agamoid forms. Gunther* says it feeds on mice, but I have known it do so on only one occasion. In captivity Mr. Millard tells me "it feeds freely on small birds, lizards, and mammals, killing them by constriction in the same manner as the Python." It would appear to be capable of utilising its tail to some purpose in the same direction, for Russell † relates the following experience:—"In the month of December, a vigorous subject of this species was made to bite a chicken which he did very fiercely and repeatedly in different parts * * *. The chicken at first fluttered, and screamed with pain, but soon became quiet. In about half a minute, greatly to my surprise, she let fall her head, and shut her eyes as if dead. The position of the wing prevented the cause of this being at first discovered. The snake imperceivedly had wreathed its tail round the chicken's neck, and the bird, had it not been rescued, would inevitably have been strangled. Soon after being disengaged, it recovered perfectly."

Distribution.—(*a*) *Geographical.*—The distribution of this species is very similar to that of the Echis, as will be seen by the accompanying map. In India it will be noted that it inhabits that little tract of territory on the Malabar Coast in which the Echis appears to be absent, and also extends to the north of the river Ganges unlike Echis. It probably reaches the base of the Eastern Himalayas, but its exact limits to the East beyond Assam are unknown. Anderson‡ records it from Assam and the Naga Hills, and there are two specimens in the Indian Museum from the Khasi Hills (Shillong). Compared with the range of Echis its more extensive eastern distribution is compensated for by a more restricted habitat to the west. In the Mediterranean sub-region it extends like Echis into Transcaspia, but its limits to the west are doubtful. I can find no

*Rept. Brit. Ind., 1864, p. 312. † Ind. Serp., Vol. I, p. 21.

‡ Journ. Asiatic Soc., Bengal, Vol. XL., p. 35.

record west of the Perso-Baluch frontier. There appears to me no doubt that it occurs in Ceylon, though Boulenger* does not mention this locality, and Willey† does not include it among the ophifauna of that island. Ferguson‡, however, says "of specimens sent to be named by Dr. Gunther, he is returning one named *Dipsas trigonata*, Boie." It is possible that like Echis it may be confined to the north-eastern part of the island. Were it universally distributed one would expect the Colombo Museum to have representatives on their shelves. The specimen referred to by Ferguson has been apparently lost sight of.

(*b*) *Local.*—It appears to be essentially arboreal in habit, frequenting bushes, scrub, or trees usually in close proximity to the ground, though it will climb to considerable elevations at times. I have frequently come across its sloughs low down in lantana and similar tangled vegetation. It often descends to the ground, and I have several times met with it at night in the open, on the road, or a garden path. At this time it always appeared to be on the move, but I have had several examples brought to me found coiled up on the ground beneath a bush during the day time apparently asleep.

In bushes it coils itself into a little heap, unlike the tree snakes of other genera which recline with the body extended in graceful curves distributing their weight on many points, unless they are actually resting in their major or full length along a suitable branch.

In this Journal § Nurse reports having frequently seen it in Guzerat, where it appears to be very abundant, curled up on the top of cactus hedges.

It sometimes takes up its abode (perhaps for the deposition of eggs) in a hole in a tree trunk, and in one instance one had evidently recently tenanted a crypt in the crevices of a wall, as its slough was seen partly issuing from a hole in the face of the brickwork.

After the foregoing observations it will appear remarkable that such a creature can adapt itself completely to a desert environment, but such is undoubtedly the case, for Blanford ‖ records one from Gwadar in Baluchistan which he says is merely a fishing village on a barren spit of sand between a rocky promontory and the mainland where there is not a single tree and scarcely a bush to be found.

* Spol. Zeylan., April 1906, 233.
† Cat. Vol. III, 1896, p. 63.
‡ Reptile Fauna of Ceylon, 1877, p. 21.
§ Vol. XIII, p. 340.
‖ Jourl., Asiatic. Soc., Bengal, Vol. XLVIII, p. 131.

It appears to be a particularly common snake about Vizagapatam according to Russell,* as many as half a dozen being found in a night crossing the road. At Berhampur a little to the north of this I met with it fairly often, but never in such numbers, nor have I found it as common in any other part of India as Russell reports it from Vizagapatam.

Description of lepidosis.—Rostral.—Touches 6 shields, the sutures it makes with the anterior nasals twice or three times those made with the internasals. *Internasals.*—A pair; the suture between the fellows from three-fifths to two-thirds that between the præfrontal fellows and about two-thirds to three-fourths the internaso-præfrontal sutures. *Præfrontals.*—A pair; the suture between the fellows, subequal to the præfronto-frontal sutures: touching the internasal, postnasal, loreal, præocular, supraocular, and frontal. *Frontal.*—Length subequal to the supraoculars, breadth in a line connecting the centres of the eyes about one-third to one-fourth greater than supraoculars: touching six shields, the fronto-supraocular sutures about one fourth longer than the rest. *Nasals.*—Completely divided; touching the 1st and 2nd supralabials. *Loreal* small, squarish. *Præoculars.*—One just reaching the top of the head but not meeting the frontal. *Postoculars.*—Two. *Temporals.*—Small, scale-like, anteriorly usually two, sometimes one or three. *Supralabials* normally 8 with the 3rd, 4th and 5th touching the eye. *Infralabials.*—Usually 7, the last 3 or 4 touching the posterior sublinguals; the 1st meeting to make a suture subequal to that between the anterior sublingual fellows; the 7th much the largest, and in contact with three scales behind. *Sublinguals.*—Two pairs of subequal size or the posterior rather longer; the posterior fellows in contact anteriorly usually. *Costals.*—Two heads lengths behind the head 21, midbody 21, two heads lengths before the vent 15. The absorption of rows is peculiar; at the step from 21 to 19, which occurs shortly after the midpoint of the body, the uppermost lateral row disappears and is almost always absorbed into the vertebral, with the result that at this spot the vertebral becomes suddenly larger, and especially so if the absorption occurs on both sides simultaneously. I have known it absorbed into the row below. At the second step from 19 to 17, which occurs very close to the first, the 4th row above

* Ind. Serp., Vol. I, p. 21.

the ventrals fuses with either the 3rd or the 5th. At the third step from 17 to 15 the uppermost lateral row is absorbed into the vertebral, and again a sudden enlargement in the vertebral row results. Steps one and two are occasionally reversed. The vertebral row is enlarged throughout, but anterior to the first absorption the shield are but slightly enlarged whereas later they are relatively much broader. This enlargement ceases above the vent where the rows of scales reduce, and become redisposed, even numbers of rows replacing the odd number seen in the body. This arrangement is in strong contrast to that seen in the Kraits (*Bungarus*) where the vertebral row also enlarged is continued as such along the whole of the tail. The last three rows above the ventrals are all enlarged, the ultimate most so. This is a peculiarity I have only seen in members of this genus. The outline of the transverse series of scales is as a result characteristic as shown by the thick lines in figure 2A. Keels are absent everywhere, but each scale bears a single apical pit. Where the vertebral row is but feebly enlarged, a single pit is in evidence, but where through absorption it becomes broad, two or rarely three pits may be seen. *Ventrals* 206 to 238, rounded, and reflected unusually high in the flanks, to about one-third the body depth. *Anal* entire. *Subcaudals* 75 to 96 divided.

Explanation of abbreviations used in lepidosis, fig. 1, Diagram II, (D. trigonatus).

A. S.	Anterior sublingual.
F.	Frontal.
Int.	Internasal.
L	Loreal.
M.	Mental.
N.	Nasal.
Pa.	Parietals.
Po.	Postocular.
Prf.	Præfrontal.
R.	Rostral.
S.	Supraocular.
T.	Temporal.
V.	Ventrals.
1 to 8.	Supralabials.
I to VII.	Infralabials.

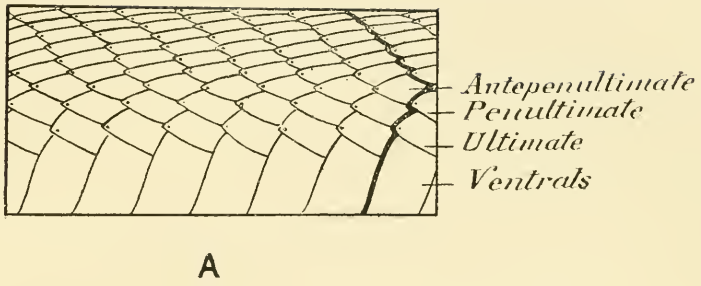
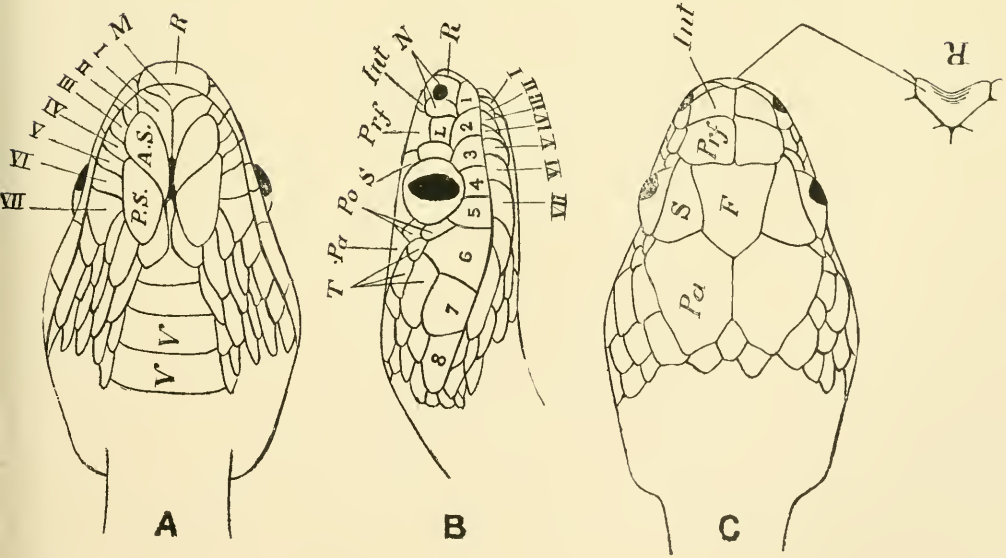


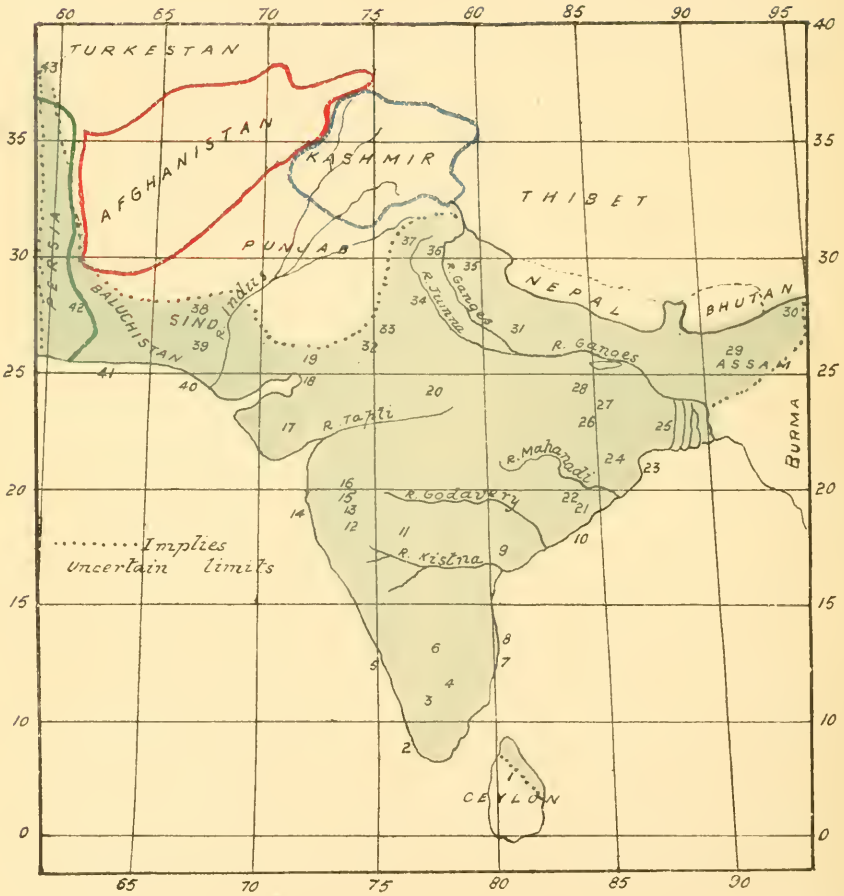
Fig. 2.



Dipsadomorphus trigonatus. (×3)

Fig. 1.

INDIAN SNAKES *(Wall).*



MAP 3 — Distribution of Dipsadomorphus trigonatus.

Key to Distribution Map of Dipsadomorphus trigonatus.

1. Ceylon.—Exact locality not specified. Ferguson Rept. Fauna, Ceylon, 1877, p. 21.
2. Trevandrum.—Ferguson. Bomb. Jourl., Vol. X, p. 73.
3. Anamallays.—Boulenger. British Museum.
4. Trichinopoly.—Wall.
5. Cannanore.—Wall.
6. Bangalore.—Sclater. Indian Museum.
7. Pondicherry.—Boulenger. British Museum.
8. Madras.— ,, ,, ,,
9. Ellore.—Blanford. Jourl. Asiat. Soc., Bengal, Vol. XLVIII, p. 115.
10. Vizagapatam.—Russell. Ind. Serp., Vol. I, p. 21.
11. Sholapur.—Millard. Bombay Collection.
12. Poona.— ,, ,, ,,
13. Khandala.— ,, ,, ,,
14. Bombay.— ,, ,, ,,
15. Igatpuri.— ,, ,, ,,
16. Nasik.— ,, ,, ,,
17. Guzerat.—Bombay Jourl., Vol. XIII, p. 340.
18. Karaghora.—Millard. Bombay Collection.
19. Ahmedabad.— ,, ,, ,,
20. Nowgong.—Sclater. Indian Museum.
21. Berhampore.—Wall.
22. Aska.— Sclater. Indian Museum.
23. Balasor— ,, ,, ,,
24. Manbhum.— ,, ,, ,,
25. Calcutta.— ,, ,, ,,
26. Chakardapur.—Annandale. Indian Museum.
27. Purnea.—Sclater. Indian Museum.
28. West of Barakhar.—Anderson. Jourl. Asiat. Soc., Bengal, Vol. XL, p. 35.
29. Shillong.—Annandale. Indian Museum.
30. Naga Hills.—Anderson. Loc. cit.
31. Fyzabad.—Wall.
32. Ajmere.—Sclater. Indian Museum.
33. Jaipur.— ,, ,, ,,

34. Delhi.—Wall.
35. Kumaon.—Boulenger. British Museum.
36. Mussoorie.—Wall.
37. Sabathu.—Sclater. Indian Museum.
38. Sehwan.—Murray. Rept. of Sind, p. 51.
39. Kotri.— ,, ,, ,, ,,
40. Karachi.— ,, ,, ,, ,,
Boulenger. British Museum.
41. Gwadar.— ,, ,, ,,
42. Perso-Baluch Frontier.—Annandale. Indian Museum.
43. Puli Hatun. Transcaspia.—Boulenger. British Museum.

(*To be continued.*)

JOURNAL

OF THE

BOMBAY

Natural History Society.

Vol. XVIII. BOMBAY. No. 4

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

ILLUSTRATED BY COLOURED PLATES AND DIAGRAMS.

BY

MAJOR F. WALL, I.M.S., C.M.Z.S.

Part VIII with Plate VIII and Diagram 1.

(*Continued from page 554 of this Volume.*)

The genus *Bungarus* as considered by Professor Boulenger in his Catalogue* includes but six species. Since the publication of this work he has added another to the list entitled *sindanus*, and I have added one to which I attached my own name.

I have for a long time tacitly dissented from Mr. Boulenger's views with regard to the forms he describes under the name *candidus*, believing that under that title at least three well marked species are included. To two of these he has conceded the minor rank of "variety" under the names *cæruleus* and *multicinctus*. Another very distinct form is that to which Evans and I applied the name *magnimaculatus*† and recorded as a variety of *cæruleus*.

Now all of these forms are very distinctive in colour and markings, are not connected by intermediate forms, inhabit very definite geographical areas, and show differences in lepidosis, so that I feel there is every justification for each being recognised as a distinct species.

My recent collections in Assam and Darjeeling have further revealed to me the occurrence of two distinct kinds of black krait which hitherto have been included under the title *lividus*.

* Snakes in the British Museum, 1893 to 1896.

† Journal, Bombay Natural History Society, Vol. XIII., p. 611.

The total number of recognisable species now amounting to twelve, I think a brief review of the different forms is called for before discussing the common Indian form *cæruleus* with which this paper deals.

The easiest way to approach the subject is I feel by appending a table indicating at a glance the main points made use of in differentiation.

The key which follows is added to still further simplify the process of identification.

Some brief remarks on each of the species follow.

Name of species.	2 heads lengths behind head.	Midbody.	2 heads lengths before vent.	Vertebrals in midbody broader than long.	Ventrals.	Subcaudals.	Some subcaudals at end of tail divided.	2nd supralabial decidedly narrower than 3rd.	Body compressed.	Number of bands on body.	Number of bands on tail.	Habitat.
flaviceps ..	13	13	13	Yes	193-226	42-55	Yes	?	?	None.		Malay Archipelago and Peninsula, Cochin China and Tenasserim.
bungaroides ..	15	15	15	,,	220-238	44-51	,,	Yes	No	Many equidistant white lines. Belly white.		E. Himalayas, Khasi Hills, N. Cachar.
lividus	15	15	15	No	209-215	35-42	No	,,	,,	None.		The Brahmaputra Basin South of the Himalayas.
cæruleus ..	15	15	15	Yes	200-218	38-50	,,	No	,,	Many white lines in pairs.		Indus and Ganges Basins, Peninsular India and Ceylon.
ceylonicus ..	15	15	15	,,	219-235	33-40	,,	Yes	,,	15 to 20 bands surrounding belly.	2 to 5	Ceylon.
fasciatus ..	15	15	15	,,	200-234	23-39	,,	,,	,,	16 to 27 complete yellow and black bands.	2 to 3	Brahmaputra Basin South of the Himalayas; Mahanadi Basin, Irrawaddy-Salween Basins.
magnimaculatus.	15	15	15	,,	218-229	42-49	,,	,,	,,	11 to 14 Bands not surrounding belly.	2 to 3	Irrawaddy Basin.
multicinctus ..	15	15	15	,,	194-218	45-53	,,	,,	,,	31 to 45 Bands not surrounding belly.	11 to 13	From S. China to the Irrawaddy-Salween Basins and Andamans.
niger	15	15	15	,,	216-231	47-57	,,	,,	,,	None.		BrahmaputraBasin South of the Himalayas.
candidus ..	15	15	15	,,	210-222	40-50	,,	?	,,	20 to 25 Bands not surrounding belly.	7 to 9	Malay Peninsula and Archipelago.
sindanus ..	19	17or 19	17	No	218-237	48-52	Yes	No	,,	Many white lines in pairs.		Sind.
walli	17 or 19	17 or 19	17	Yes	192-207	48-55	No.	Yes	Yes	Many equidistant white beaded lines.		Ganges Basin.

KEY TO THE KRAITS (Bungarus).

SCALES IN 13 ROWS IN MIDBODY..... *flaviceps.*

SCALES IN 15 ROWS IN MIDBODY.

A. Shields at tip of tail divided..... *bungaroides.*

B. Shields at tip of tail entire.

(a) Vertebrals narrow, longer than broad, not as broad as last row in midbody..... *lividus.*

(b) Vertebrals as broad or broader than long in midbody.

(a^1) 2nd supralabial as broad as 1st and 3rd ..... *cæruleus.*

(b^1) 2nd supralabial decidedly narrower than 3rd and often than 1st also.

(a^2) Belly banded with black. Subcaudals 23 to 40.

(a^3) Tail tapering to a point. Banded with black and white. Peculiar to Ceylon..... *ceylonicus.*

(b^3) Tail blunt and fingerlike at end. Banded with yellow and black ..... *fasciatus.*

(b^2) Belly not banded. Subcaudals 40 to 57.

(a^3) 11 to 14 streaked white bands on body, 2 to 3 on tail ..... *magnimaculatus.*

(b^3) 20 to 25 pure white bands on body, 7 to 9 on tail ..... *candidus.*

(c^3) 31 to 45 pure white bands on body, 11 to 13 on tail ..... *multicinctus.*

(d^3) No bands. Back quite black ..... *niger.*

SCALES IN 17 OR 19 ROWS IN MIDBODY.

A. Vertebrals longer than broad in midbody. Ventrals 218 to 237. Peculiar to Sind..... *sindanus.*

B. Vertebrals broader than long in midbody. Ventrals 192 to 207. Peculiar to the Basin of the Ganges ..... *walli.*

Flaviceps (Reinhardt).—This is the only one of the group with 13 scale rows. It is really a Malayan snake extending into our Territory only in Tenasserim, which is a part of the Malayan Sub-region.

Bungaroides (Cantor).—This shares with *flaviceps* and *sindanus*, the peculiarity of having some of the terminal subcaudals divided. It differs from both in having 15 scale rows. It is a rare snake known only from the Eastern Himalayas in the vicinity of Darjeeling, the Khasi Hills in Assam and North Cachar.*

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* Annandale, Jourl. As. Soc., Bengal, Vol. LXXIII.,.p. 210.

Lividus (Cantor).—This is peculiar in having the vertebrals but slightly enlarged. They are narrower than the last costal row, and longer than broad in the middle of the body. This peculiarity it shares with *sindanus* alone, but differs from that species in the scale rows being 15. It is quite black dorsally, not banded ventrally, and in these particulars like *niger* differing in the narrow vertebrals and in having fewer ventrals and subcaudals. There are four specimens in the British Museum which I have examined. Three are from Assam and one from India, precise locality not on record. I have lately received one from the Jalpaiguri District, two from Tindharia and one from near Tezpur, Assam, and examined another in the Museum of St. Joseph's College, Darjeeling, precise locality not known. The specimen from Saidpur recorded by Sclater* is probably of this species. All the localities from which it has been recorded are within the Basin of the Brahmaputra River.

Cæruleus (Schneider).—This is dealt with in the paper which follows.

Ceylonicus (Gunther).—This snake has alternate black and white bands which encircle the body and is peculiar to Ceylon.

Fasciatus (Schneider).—A very well marked form with black and yellow bands which completely encircle the body. The tail is peculiar in being blunt and fingerlike, and the back is ridged in a manner not seen in any other krait. It extends from South China and the Malay Sub-region through Tenasserim, to the Irrawaddy-Salween Basins, thence to the Brahmaputra Basin and the Eastern part of the Ganges Basin. (I have lately seen a skin from Bettiah, N.-W. Behar.) It is also common in a restricted area of the north-eastern part of Peninsula India, corresponding roughly to the Mahanadi Basin.†

* J. A. S., Bengal, LX., p. 246.

† A single specimen in the British Museum labelled Anamallays and presented by Colonel Beddome is the solitary record of this snake from Peninsula India outside the area above specified. This record I discredit for the following reasons. A study of Boulenger's Catalogue and Sclater's list of snakes in the Indian Museum (Journal Asiatic Society of Bengal, Vol. LX) reveal the fact that no less than seven other species are recorded by Colonel Beddome alone from various parts of Southern India, all well-known inhabitants of other parts. These are *Tropidonotus himalayanus*, *T. subminiatus*, *T. parallelus*, *Lycodon jara*, *Simotes splendidus*, *S. octolineatus*, and *Dendrelaphis candolineatus*. That Colonel Beddome received snakes from the Himalayas, Burma and Tenasserim, the localities from which these species are otherwise known, is certain, for there are specimens in the British Museum presented in his name from these areas, viz., *Simotes albocinctus*, *S. violaceus*, *S. cyclurus*, *S. cruentatus*, and *Dipsadomorphus hexagonotus*. It seems certain that all of the species above alluded to including a *B. fasciatus* were received from the localities just enumerated, and by an oversight mixed up with Colonel Beddome's S. Indian collections.

Magnimaculatus (Wall and Evans)*.—This form was first specially remarked upon by Evans and me who proposed the above name for it as a variety of *cæruleus*. Sclater had in 1891 made allusion to two specimens in the Indian Museum which I have now examined. I saw no specimen in the British Museum when I examined the kraits there some five years ago. There are 11 to 14 broad streaked bands on the body and 2 to 3 on the tail. These are white with black streaks in the length of the snake. The black intervals are rounded off near the ventrals, so do not embrace the belly. I have seen 5 specimens.

It is only known from a limited area in the Irrawaddy Basin, Meiktila and Monywa (Wall and Evans), Meiktila (Sclater), and Colonel G. H. Evans has written to me that he has met with it in Hmawbi, Myingyan, and the Shwebo District.

Multicinctus (Blyth).—This considered by Boulenger but a variety of *candidus* differs by its very distinct colouration, and its habitat. It has from 31 to 45 pure white bands over the back on the body, and 11 to 13 on the tail. The black intervals do not surround the belly. It appears to be uncommon in the whole of the area it inhabits which ranges from Southern China to the Irrawaddy-Salween Basins†. Within our limits it is known from Insein and Rangoon (Wall and Evans), Toungoo (Boulenger), and an example in the Indian Museum is from the Andamans. Fig. 4 of our Plate is from an excellent example. I have examined 10 specimens.

Candidus (Linne).—This is the form originally described by Linné from Java. It is black with from 20 to 25 broad light bands on the body, and 7 to 9 on the tail. These bands may be pure white as shown in figure 7 of our Plate, or may be more or less subdivided by a mottling of black. It is only known from the Malay Peninsula and Archipelago.

Niger (Wall).—This has been confused until now with *lividus*, from which it differs in having the vertebral row of scales broad (broader than long in midbody) and a greater number of ventrals and subcaudals. It appears also to grow to a larger size, my largest specimen being 4 feet and half an inch, whereas I do not know of

* Bombay Natural History Journal, Vol. XIII., p. 611.

† I think the locality of one given as Purneah in the Indian Museum, *viz.*, No. 13738 (or 9 ?), calls for confirmation.

a specimen of *lividus* exceeding 3 feet 2 inches. I have had within the last year 7 specimens from Dibrugarh and Sadiya (Assam), and more recently eight from Tindharia and Pashok, 1,000 to 4,500 ft. (Eastern Himalayas). Sclater (Journal, Asiatic Soc. of Bengal, Vol. LX., p. 246) under the title *lividus* mentions three specimens in the Indian Museum from Sibsagar and the Garo Hills (Assam), and Saidpur in the Dinajpore District. The latter I could not find, but the two Assam specimens are *niger*. I have seen 16 examples.

Sindanus (Boulenger).—Until 1897 the only specimen known had been regarded by Professor Boulenger as an aberrant *cæruleus*. It differs however in having the costals in 17 or 19 rows in midbody, the vertebral row of scales longer than broad in midbody, and in having a larger number of ventrals. It is also peculiar to Sind. The specimen recorded by Annandale as such from Midnapore* is the next species.

Walli (Wall).—This very distinct form agrees with the last in the possession of from 17 to 19 scale rows in midbody but differs in having far fewer ventrals, the vertebral row of scales broader than long, the subcaudals entire throughout, the 2nd supralabial markedly narrower than the 3rd, and usually than the 1st also, a markedly compressed body, and in colouration and habitat. There are many white, equidistant arches across the back, composed of ovate white spots which have no tendency to be arranged in pairs. The tail is more or less mottled beneath especially towards the tip. It is only known from the Ganges Valley. I obtained 8 specimens in Fyzabad and have seen two more in the St. Joseph's College Museum, Darjeeling, which formed part of the collection of the late Dr. Vincent Richards: the locality not known but probably Bengal, also four others in the Indian Museum from Purneah and Midnapore.

The Common Krait (*Bungarus cæruleus*).†

Nomenclature.—(*a*) *Scientific.*—Bungarus was applied originally by Daudin in 1803 and is derived from "bungarum pamah," a vernacular name applied according to Russell‡ to the banded Krait (*Bungarus fasciatus*) in Bengal.

* J. A. S., Bengal, 1905, p. 213.

† My conception of this as a species is based upon an examination of well over 200 specimens.

‡ Ind. Serp., 1796, Vol. 1, p. 3.

The specific name *cæruleus* (Latin, meaning blue) was given by Schneider* in 1801 to this form. (Figure 5 of our plate.)

(*b*) *English.*—The Krait, or common krait, is borrowed from the vernacular name for this snake in certain parts of Northern India.

(*c*) *Vernacular.*—The plethora of native names shows that the snake is abundant, and well known everywhere. Some names appear very local. It is probable there has been confusion between this and other snakes as one must expect with natives especially.

Nicholson† says it is called "Anali" about Madras, a word, he says, implies "ringed" or "decorated" in Tamil and kindred languages, and is somewhat loosely applied.

I have known it called "kattu viriyan" about Trichinopoly, the Tamil for "banded viper." Father Bertrand also writes me it is known under this name in S. India, as also is *Lycodon aulicus*; "viriyan" too, he remarks, though meaning "viper," is applied to many non-poisonous snakes.

Jerdon‡ says it is the "yenna vyrien" of the Tamils: "yenna" is the Tamil for "oil," and must refer to the oily polished surfaces of the scales. I have also known it called "kutti pisarshi" "bad devil," and "panna viriyan" or "palmyra viper" in South India.

In Mysore Rice§ gives the Canarese name for it as "godi nagara" which appears to me very doubtful from the English interpretation "wheat cobra."

In Cannanore it was called "valla pamboo" which is Malayalam signifying "bangle snake."

Colonel Dawson tells me that in Travancore it is known as "yettadi veeren" (Malayalam) and "yettadi virien" (Tamil), "yettadi" means "eight feet" and implies that the snake is so venomous its victim dies within eight paces: "veeran" and "virien" he suggests may be derived from the Tamil "visham" "poison."

Russell¶ says the Tamils call it "karu walalay": "karu" is the Tamil for "black," and "walalay" I am told means "polished."‖ Again he says the snake he figures on Plate XXI in his second

* Hist. Amph. II, p. 284. † Ind. Snakes, pp. 133 and 134.

‡ Jourl., Asia. Soc., Bengal, Vol. XXII., p. 522.

§ Mysore, Vol. I, p. 188.

¶ Loc. cit., Vol. II., p. 36.

‖ I am indebted to Dr. J. R. Henderson of Madras for many of the translations of vernacular names in use in S. India.

Volume (clearly a krait though peculiar in colouration) is called "Seu walaley." "Seu" or "Sew" means "brown." The same authority* says this snake is called "gedi paragoodoo" further north about Vizagapatam. Mr. J. M. Turing, Deputy Commissioner at Vizagapatam, to whom I lately appealed for information, says the words are Telugu, "gaddi" meaning "grass," and "parugudu" a "runner." He suggests that this is the same snake known about there as "tutte purugu," the Telugu for "rubbish reptile." Russell's other name for this species in this locality, *viz.*, "pakta poola" he can throw no light on.

I have frequently heard it called "krait" or "karait" by natives but am not sure whence these names emanate. Sampwallahs journey far from their own homes, and coolies and some of one's household servants too, and many will consequently make use of these names in a locality where they may not be known. Kallan, the snake catcher, I knew in Delhi always called this species "krait," but Major McMahon† says "krait is I presume merely an English corruption of the Urdu word kalgundait. If not it must be a Bengali corruption of it, as no native of Delhi would understand you if you spoke of the karait or krait." I have had "kálgundait" given me by a native of Karnal in the Punjab for the *Zamenis diadema*, but there seems little doubt it is the Urdu name for the krait. I find Baboo Awmoola Ruttum Bysach in his work on medicine written in Urdu gives the name for this krait which he mentions by its scientific name *cœruleus* and describes, as "kala gandait." He says the "kala" means black, and that "gandait" refers to the white lines across it. I cannot however find confirmatory evidence of such a word in Urdu. He also gives as one of its names "dhaman chitti," "chitti" I find means speckled or variegated. These names "chitti" and "dhomun" or "dhomna chitti" are also mentioned by Fayrer‡ and Ewart§ as being used in Bengal. It must be noted that "chittee" is the name applied according to Russell to a very different snake in Bengal, *viz.*, *Helicops schistosus*.¶ A European subordinate who had been many years in

* Loc. cit., Vol. I., p. 2.

† Fayrer's Thanatoph. Ind., p. 11.

‡ Loc. cit., p. 122.

§ Ind. and Australn. Snake Poisoning, 1874, p. LXXVII.

¶ Loc. cit. II., plate IV.

the Kheri District (U. P.) and knowledgeable in discriminating snakes told me that it is known locally there as "goohooan."

Colour and marks.—In this form there are closely set white linear arches thrown across the back, arranged more or less distinctly in pairs. These are much more perfect and conspicuous in the posterior part of the body, and tail. At midbody or further forward they gradually fade especially laterally, and may become replaced more anteriorly by white vertebral spots, or may even completely disappear. The black on the back is lustrous, and if the light be allowed to glance on it appears even bluish, hence the name *cæruleus*. The top of the head is black, fading to white on the lips. The belly is white like mother of pearl in its entire length including the tail to its extreme tip. The young of *cæruleus* show more white. Not only are the arches posteriorly more conspicuous than in adults but they are often unusually apparent in the anterior half of the snake, and there is often a partial or complete white collar, and some white on the top of the head. Two white bands too pass upwards from the 2nd and 5th supralabials, the former in front of, and the latter behind the eye.

In adults specimens occur in which the black is tinged more or less deeply with brown, and I have seen one specimen from Fyzabad in which the black had a metallic lustre, resembling that of black lead on a grate compared with the purer black on a polished boot.

Russell* figures a curious specimen from Tranquebar, in which the body is dark-brown, the anterior six or eight inches uniform buff, and the linear arches bluish. It suggests to me the possibility of having been preserved in some chemical, or that the specimen was an old spirit one. I have in many small collections and museums seen specimens in which the spirit had been allowed to evaporate, and the specimens kept in a strong light. In such a case the black of the krait fades to brown, and where left dry as often happens when the head is suspended to the cork or stopper the colour fades to a tint very like that shown in this illustration. Quite light specimens are occasionally heard of which may be regarded as albinos. One such is in our Society's collection, and Mr. Phipson drew my attention to it in 1904 when I was in Bombay.

It must be emphasized, however, that though the ground colour is

* Loc. cit., Vol. II, plate XXXI.

occasionally modified, the number, disposition, and character of the white arches remain distinctive.

About the form depicted in figure 6 of our Plate I am very uncertain. The double white bands suggest that it may be merely a variety of the last form though I cannot think so. I am very familiar with typical *caeruleus* from many parts of India, and have always found it the same, with no suggestion of forms intermediate between those shown in figures 5 and 6 of our Plate.

I speak with doubt but my impression is that No. 6 is a form peculiar to Bengal. I am not aware that I have seen it except in the Zoological Gardens in Calcutta where it is usually, if my recollection serves me, represented by several specimens. This recollection makes me incline to the belief that it may be a local form. I trust some of our members may assist in clearing up any doubts as to its distribution and relationship with the last.

Distribution.—I have seen examples from Ceylon*, Trichinopoly, Cannanore, Bangalore, Madras, Berhampore (Ganjam), Bilaspur, and Saugor (C.P.), Sitapur, Fyzabad, Gonda, Agra, Delhi, Godda (Behar), Umballa, Bannu and Sind.† All of these specimens are alike in possessing paired linear arches. Figure 5 of our Plate shows these arches rather too stiff and conventional, but the figure otherwise is good.

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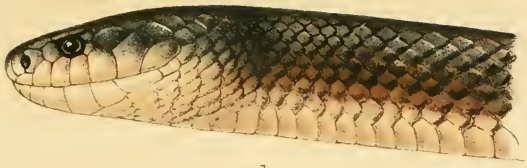
* Spol. Zeylan., Vol. IV, Part XVI, p. 174.

† The only observer who has recorded this form East of Calcutta is Cantor, who referred to it from the Malay Peninsula, and sent five specimens from this locality to the British Museum. I think I can show good grounds for doubting the accuracy of these records. It is to be noted that the same authority stands alone in recording at least six other well known Indian species from the Malay Peninsula, all otherwise not recorded outside Indian limits. These species are *Typhlops bothriorhynchus*, *Polyodontophis sagittarius*, *Xenochrophis cerasogaster*, *Helicops schistosus*, *Zamenis fasciolatus*, and *Hypsirhina sieboldii*. (Vide Cat. Snakes Brit. Mus., 1893 to 1896, *Vol.* I, pp. 23, 188, 191, 274, 405, and Vol. III, p. 12). It will be noticed that all of these species are to be met with in Western Bengal, where indeed many are common. Now it is certain that Cantor received snakes from Bengal among other parts of India, for there are specimens in the British Museum presented by him and labelled from Bengal. These include *Polyodontophis sagittarius*, *Xenochrophis cerasogaster*, *Lycodon jara*, and *Hypsirhina enhydris*. (Vide Cat. Vol. III, p. 598, Vol. I, p. 191, Vol. III, pp. 618 and 7.)

From these facts it is difficult to escape the conviction that all the five specimens of *caeruleus* sent by Cantor to the British Museum (labelled, Penang) were received with the other snakes just enumerated from Bengal, and inadvertently mixed with his own local collections.



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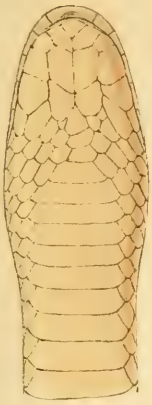

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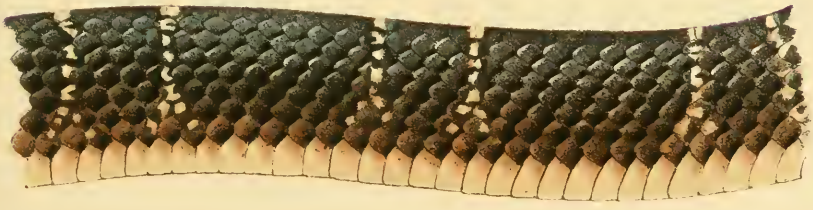

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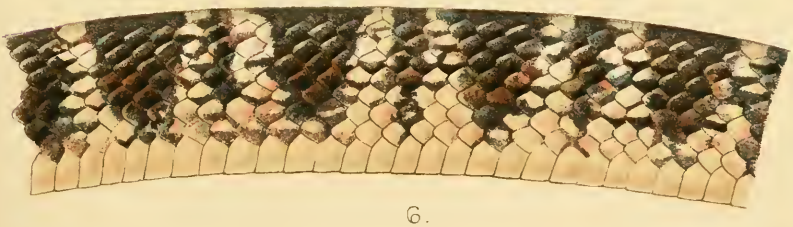

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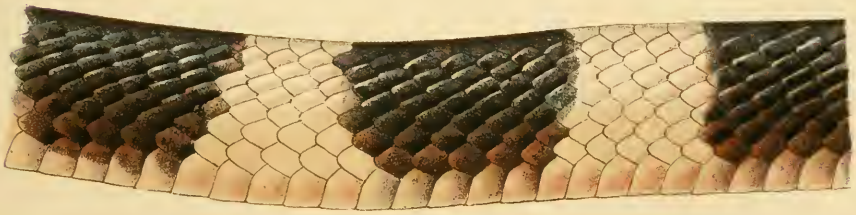

7.

J. G del.

J. Green Chromo lith.

THE COMMON "KRAIT"

Bungarus candidus. (poisonous).

Dimensions.—The krait grows to 4½ feet. I have measured the skin of one from Bannu 4 feet 6½ inches, and seen half a dozen others over 4 feet, but specimens of this size are rare. Murray* gives the length as 5 feet, but of this I have doubts. I think he probably referred to the Sind krait (*B. sindanus*), a larger form which was confused with *cæruleus* for some years, and only recognised as a distinct species by Boulenger in 1897.†

It would appear that this snake in common with many other attains a greater length in the North than in the South. The only specimens over four feet in length I have seen were in Orissa, in Fyzabad, and on the North-West Frontier. Colonel Dawson, who reports the krait a very common snake about Trivandrum, says the largest record there he is aware of was 3 feet 4 inches. The largest specimen known to Dr. J. R. Henderson in Madras was 3 feet 8 inches. Again a hatchling I obtained in Cannanore was 10½ inches, whilst specimens from Fyzabad varied from 11½ to 11¾ inches.

Physiognomy, bodily configuration, etc.—One noticeable feature, which some of our vernacular names show has not escaped observation, is the highly polished and glistening character of the scales. The black in which some see a bluish tinge is thus lustrous like a highly polished boot, and the white almost enamel-like. The head is less flattened than in many snakes, the snout rounded, and the neck but little evident.

The eye is peculiar in that the iris is not coloured, and as a result the shape of the pupil, which is round, cannot be discerned in life. The organ as a whole looks like a jet bead, and in this respect the snakes of this genus are nearly unique among the Colubridæ. The Lycodons alone, as far as I am aware, share this peculiarity. Figure 1 of our Plate does not clearly illustrate this. The nostril is rather large, occupying the full depth of the suture between the nasal shields. The tongue is pinkish and in having white tips presents a peculiarity I can only recall having seen in *Dipsadomorphus trigonatus*. The body is round, and of very even girth in its whole length. The tail tapers evenly and rapidly, and is short, being about one-eighth to one-ninth the total length of the snake.

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* Rept. of Sind, p. 55. † Bomb. N. H. Journ., Vol. XI, p. 73.

Breeding.—The krait is known to be oviparous. The exact mating season I have not been able to ascertain with certainty, but it is probably during the months of February and March.

Period of gestation.—This is not known.

Incubation.—The female, after discharging her eggs, remains coiled up with them, at any rate until they are well advanced towards incubation. In the case reported in this Journal by Bannerman* the eggs which were found with the mother contained embryos "about six inches long." In another instance eggs unearthed with the mother in Bannu and sent to me were found to contain young embryos.

Eggs.—Specimens from two clutches that I have examined struck me as being unusually large for the size of the snake. The measurements in each case were the same, *viz.*, $1\frac{3}{8}$ inches in length and $\frac{3}{4}$ inch in breadth. When freshly discovered they were reported "like pigeon's eggs and plump." They were white, the poles equally rounded, the shape elongate, and the shell soft, yielding, and of a leathery texture.

This species is not very prolific as snakes go. In the gravid female reported by Blanford† from Bilaspur there were 9 eggs. With the specimen reported by Bannerman only 6 eggs were found. In one clutch sent me from Bannu last year there were 10.

Season of deposition.—The eggs are deposited probably in April and May in holes in the ground a foot or two from the surface. Two clutches were found in June last year at Bannu when removing the old stopbutt. In Bannerman's example they were unearthed at Parel on the 24th May.

Period of incubation.—This is not known.

Embryos.—The embryos hatch out in May, June and July and measure about $10\frac{1}{2}$ to $11\frac{3}{4}$ inches as they emerge from the egg. One in Cannanore measured $10\frac{1}{2}$ inches in June, and four in Fyzabad varied from $11\frac{1}{2}$ to $11\frac{3}{4}$ inches in June and July. From this it would appear that specimens in the South run smaller than those in the North of India. They grow nearly a foot in the first year of life, and a foot or more in the second and third years as may be judged from the annexed table.

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* Vol. XVI, p. 743. † Jourl. Asiat Soc., Bengal, Vol. XXXIX, p. 374.

The sexes.—The sexes are of similar length when hatched, and remain so apparently till the fourth year. In the fifth year, if one is justified in judging from such meagre figures as appear in the attached table, the males appear to outstrip the females, as the four specimens over four feet in length in which I have recorded the sex were all males.

The longest females I have records of were 3 feet 6 inches, 3 feet 6½ inches, and 3 feet 7¾ inches, all from Fyzabad.

Males appear to be more numerous than females, for of 67 specimens in my notebook where sex is recorded 40 were males.

Maturity.—Judging from the table appended, the gravid female reported by Blanford in Bilaspur as 2 feet 11 inches long in June, must have been beginning her third year of life.

Anal glands.—The anal or scent glands secrete a blackish material of the consistency of a soft ointment. This has a peculiar, rather disagreeable, but not very penetrating, odour. The glands in both sexes are active at all seasons, and at all ages from the time of hatching, so that I am inclined to question the popular belief fostered by Darwin * among others that they are concerned with the sexual functions.

The following table gives the growth of the krait as shown by my records extending over several years. The specimens have been collected in various parts of Peninsular India, North and South. July and August are selected as the months furnishing the largest material.

July.				August.			
Number.	Sex.	Range of lengths.	Average length.	Number.	Sex.	Range of lengths.	Average length.
3	♂	1′ 1″ to 1′ 2½″ ...	1′ 1¾″				
5	♀	11¾″ to 1′ 1¾″ ...	1′ 0⅝″				
3	♂	1′ 8¾″ to 1′ 11½″ ...	1′ 10½″				
4	♀	1′ 11½″ to 2′ 3⅝″ ...	2′ 0½″	3	♀	1′ 5¼″ to 1′ 11¾″ ...	1′ 8″

* Descent of Man, p. 539.

July.				August.			
Number.	Sex.	Range of length.	Average length.	Number.	Sex.	Range of length.	Average length.
3	♂	3′ 0½″ to 3′ 3¼″ ...	3′ 2″	3	♂	2′ 6″ to 2′ 8¼″ ...	2′ 7½″
3	♀	2′ 11⅛″ to 3′ 1¾″ ...	3′ 0⅜″	3	♀	2′ 6″ to 2′ 10¾″ ...	2′ 8⅜″
2	♂	3′ 7¼″ to 3′ 9½″ ...	3′ 8⅜″	4	♂	3′ 5″ to 3′ 7″ ...	3′ 6½″
2	♀	3′ 6″ to 3′ 6½″ ...	3′ 6¼″	1	♀	3′ 7¾″	3′ 7¾″
2	♂	4′ 0⅛″ to 4′ 1¼″ ...	4′ 0⅝″	2	♂	4′ 0′′ to 4′ 4¾″ ...	4′ 2⅜″

Identification.—It is a matter of surprise to me and worthy of special remark how very few of the European population in this country are able to identify the krait in spite of its wide distribution, numerical strength, its extremely deadly nature, and the fact that it possesses exceptionally distinctive and easily recognisable characters. With the exception of a very few medical officers, and a still smaller number of naturalists, I have scarcely met a soul who has any idea what the krait looks like, with the result that I get almost every variety of common harmless snakes sent in to me as such. It is difficult to account for such lack of interest in a country where poisonous snakes abound. The popular idea is that the krait is a small snake which haunts our habitations, and any small snake has merely to enter a house to be set down forthwith as a krait. The first essential in diagnosis is the enlargement of the vertebral row of scales. This peculiarity is found in only a few other snakes besides the genus *Bungarus* notably the genera *Dipsadomorphus*, *Dendrophis*, and *Dendrelaphis*, some species of *Amblycephalus*, *Xenelaphis hexagonotus* and *Elachistodon westermanni*. The second point to look for concerns the shields under the base of the tail (subcaudals). These shields in most snakes are divided by oblique sutures into pairs, but in most kraits they resemble the shields beneath the belly in that they pass right across the tail. These two points taken together are sufficient to declare the snake a krait. 11 of the 12 known species can be

thus distinguished.* So it only remains to separate the species under discussion from its closely allied forms. Attention must be paid to the following points:—(1) The costals are arranged in 15 rows. This excludes *flaviceps*, *sindanus* and *walli*. *Cæruleus* is the only one of the remaining species in which the 2nd supralabial is as broad as the 3rd. The number and character of the white arches is distinctive, and its distribution will assist where any doubt may arise.

It is to be noted that it is the only krait inhabiting the Indian Peninsula South of the Ganges if we exclude *fasciatus* which occurs in the basin of the Mahanadi only. In Sind it is associated with *sindanus* and north of the Ganges with *walli*.

It does not occur in the Brahmaputra Basin where it is replaced by *bungaroides*, *lividus* and *niger*.

In Ceylon it is associated with *ceylonicus*.

It does not occur in Burmah but is replaced by *magnimaculatus* and *multicinctus*.

There should be no difficulty in recognising any snake as a krait, however mangled the specimen may be.

Several snakes bear some superficial resemblance to the krait, and these we are figuring in our next two Plates. I reserve comment upon the resemblances, and the further characters to be relied upon in distinguishing between them, till discussing each form separately, but it is to be noted that none of them share either of the peculiarities affecting the vertebral row of scales, and the subcaudals given above as characteristic of the kraits.

Disposition.—The krait is one of the most inoffensive snakes I know. I have had numerous living examples brought to me, and have kept several in captivity, so that my opportunities for studying its nature have been abundant.

Time after time I have recorded the singular timidity of this snake in my notebooks, often under the greatest provocation, and only once have I seen one bite at anything in anger. This specimen had been impaled through and through by a trident and could only

* In one rare species inhabiting the Eastern Himalayas and Assam Hills, *viz.*, *bungaroides*, some specimens have all the subcaudal shields divided, so that the diagnosis here given for *cæruleus* though holding good for nearly all the kraits, breaks down as an absolute generic test. I have therefore in a previous paper (Vol. XVII, pp. 57-68) had recourse to additional points when dealing with the kraits as a group.

move a few inches of its body behind the head. It must have been enduring the most fearful torture but even in this predicament though alert and lively, moving its head and quivering its tongue, it refused to bite things thrust at, or held up to it. In trying to remove it from the rusty prongs that pierced its body, it endured the suffering for some time, but finally buried its teeth into a mass of fat that had escaped from its wounds. When freed it did not repeat the act, or betray any further vice. I noticed that two specimens I had caged together used periodically to grasp one another's bodies in their jaws, one shifting its grasp down the length of the other, as though seeking a favourable spot to commence devouring its mate.

Many specimens I played with or teased, simply hid the head beneath coils, and refused to move. Some I noticed flattened the hinder part of the body and inflated and deflated themselves anteriorly like many other snakes under excitement, and it is remarkable how expansive the lung must be, for in one specimen, in which marked inflation was noticeable from the 3rd to the 18th twin white arches, it was found upon subsequent dissection that the lung only reached as far back as the 7th twin arches. It very frequently emits the tongue in a leisurely fashion when provoked. Its placid disposition banishes all fear, and tempts one to disregard any precautions in handling it, at least this is my experience.

I noticed especially in Delhi years ago that Kallan the most intrepid snakecatcher I have ever seen, who collected scores of poisonous snakes every week, treated the krait with supreme indifference, though he exercised the greatest caution in dealing with *Echides*.

Fayrer* says: "In my experience I had always the greatest difficulty to get the cobra, krait, and daboia to bite voluntarily." Nicholson† calls it a "very inoffensive" snake. Gleadow‡ says "I have always found it quiet, and not pugnacious." Millard‡ remarks that it is "very shy." Colonel Dawson ‡ says, "It is a very shy snake, and rarely bites except in self-defence or when hurt." This is fully exemplified by the behaviour of the snake which

* Loc. cit., p. 64.
† Ind., Snakes, p. 147.
‡ In Epistola.

caused the fatality, in the case of the keeper reported herein. The krait was unearthed while the man was digging. He picked it up, and tied a piece of cloth round its head, which the snake got rid of several times on the road from his house to Trivandrum Gardens. Arrived at the gardens the snake again freed its head, and it was whilst trying to bind it on again that the bite was inflicted. Dr. J. R. Henderson writes to me: "I have frequently kept this species living but could make little of it, except that it appeared sluggish, and not easily irritated."

The behaviour of a specimen placed by Russell with a cobra bears out the above opinions. He says, "The next subject opposed to the cobra, was a Gedi Paragoodoo" (common krait) "which, in all its movements, was much tamer than either of the former two" (*i.e.*, *Zamenis fasciolatus* and *Vipera russellii*), "and seemed solely intent on escaping out of the room, or retreating into a dark corner. When pushed roughly on the cobra, and consequently struck by him, he made no resistance, nor snapped in return; he did not even offer to retreat, but laid himself close to the cobra, whose body he often touched in his convolutions, without any apparent offence being taken." Colonel Dawson tells me that at Trevandrum when given a pot of sand or earth he has seen them trying to bury themselves.

Food.—This species, like others of this genus, is in the main ophiophagous in habit, but in a state of nature as well as in captivity will partake of most other things offered. I have on eight occasions found snakes eaten, once *Bungarus walli* and once *Lycodon aulicus* and on the other occasions *Typhlops braminus*. In every case where young examples had fed *Typhlops* had been taken. Mr. Millard tells me that "those kept in the Society's Rooms refused all food but snakes." Dr. J. R. Henderson tells me, "I have frequently given a captured specimen a living snake to eat, and in most cases the latter was inside the krait by next morning. On one occasion one disposed of a *Dryophis* longer than itself." Father Dreckmann writes to me, "their food, as far as I can judge, consists exclusively of other snakes. I have never found anything else in their stomachs, and a very fine specimen disgorged three other snakes in different stages of digestion during the first night of its captivity." There are at least 7 other records reported in this Journal where other snakes had been devoured.

On the other hand I have twice known frogs eaten, and Fayrer * records a similar experience. In the Administration Report of the Madras Museum, 1896 to 1897, one specimen is reported to have eaten 2 frogs, and another 18 frogs during incarceration. I have twice found toads (*Bufo andersonii*) in the stomach, and once a monitor lizard (*Varanus flavescens*). Small mammals too are occasionally devoured. I once found a muskrat (*Crocidura cæruleus*) in gastro, and Assistant Surgeon Robertson told me he found 5 young muskrats taken on one occasion. I have twice seen a brood of young mice which had been swallowed, and in Bannerman's escaped specimen, when ultimately recovered, the meal consisted of 6 newly born rats. Captain Liston, I.M.S., tells me that at Parel they have lately found that both kraits and Russell's vipers readily eat the young fœtus from rats in an advanced state of pregnancy.

Sloughing.—The krait casts its skin probably every month. One in captivity in the Madras Museum, captured on the 7th November 1896, sloughed on the 7th December 1896, the 13th January, and 27th February 1897.†

Haunts.—Fayrer says, "It is found in the fields, grassy plains, rice khets, low scrubby jungle, and among debris of wood and buildings. It sometimes insinuates itself into houses, in the verandah, bathrooms, on the ledges of doors or jhilmils, into book cases, cupboards, etc." Millard writes to me, "It is very fond of living in the roofs of bungalows." Theobold‡ speaking of kraits as a group says, "They delight in water and its vicinity," an observation which receives support among others from Father Castels, S.J., who writes to me that in Trichinopoly "small specimens have been brought to me in bundles of 20 or more caught, as they said, in water." I have had several specimens brought to me that were captured in water. These were, I think, always captured in the hot weather, which seems to show that they grow very thirsty and for this reason they frequently get into places from which they cannot extricate themselves, such as wells, and the little pukka tanks connected with the irrigation arrangements so commonly seen in Indian Gardens.

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* Loc. cit., p. 121.

† Administration Report, 1896 to 1897.

‡ Journ. Asiatic Soc. Bengal, 1868, p. IV.

They appear to me to be commonest in the precincts of man, and to actually domicile themselves in human habitations for choice. Thus the krait may usually be reckoned as one of the commonest snakes to be found about cantonments and even in the bazaars, and its numerical strength is probably little dreamt of by even the most nervous residents. In Fyzabad for instance I obtained 47 specimens in June, July, and August 1906, all caught or killed in cantonments. Judging from the weekly bags brought in by the snake-catcher Kallan at Delhi it was probably as common in that station. A very large number of my specimens were encountered inside bungalows, outhouses, bazaars and about jails. As a rule they have been found on the ground, or floors, far less commonly in the roofs, or situations necessitating clambering efforts. It appears to be decidedly nocturnal in habit, most of my specimens have been killed at night. Mr. Millard mentions in a letter to me that in captivity it likes to get away from the light, and Colonel Dawson informs me that "in captivity they never move as a rule during the day time but become very active about dusk."

Poison.—Authentic records of krait bite are rare although the species is so abundant in man's immediate environment. This is partly due no doubt to the inoffensive nature of the snake already remarked upon, but must also be largely attributed to the incompetency of many medical men to recognise it. There can be no doubt, from what is known of the virulence of krait venom, that a fatal issue usually attends the bite of this snake.

Fayrer* quotes the remarkable homicidal case originally reported by Chevers where four credulous men allowed themselves to be bitten by a krait about three feet long under the assurance that no evil effects would follow. They were bitten one after another at night, the sampwallahs goading the snake to fulfil their purpose by administering blows with a cane. The first man bitten died before dawn, having complained of thirst and foamed at the mouth. The second and third died about noon the next day, and the fourth recovered after suffering from giddiness, perspiration, pain in the stomach and unconsciousness. Fayrer† reports another case where a chowkidar died six hours after having been bitten in the forefinger. He suffered burning pain locally, later in the head, and then in the

* Loc. cit., p. 51. † p. 54.

whole body. He grew weak till he could hardly articulate and a drowsiness supervened which culminated in death. A third case recorded by Fayrer died three hours after a bite in the finger. Here again great pain was experienced locally, and swelling. His respiration became short and hurried, he complained of constriction round the chest, became increasingly drowsy till death. Elliot records the death of a sepoy thirty-one hours after being bitten on the ankle. No symptoms were recorded. He was treated with ligature, and incision, and $1\frac{1}{5}$ grains of strychnia were administered hypodermically.

Another case was recorded in the *Indian Medical Gazette* of February 1874. The subject, a Hindu male, aged about 60, was bitten in the left index finger, at 9 p.m. one evening. At 5 a.m. the next morning he was admitted into hospital with giddiness, drowsiness, incoherent speech, difficult breathing and a choking sensation in the throat. He could not walk or sit up unsupported. The hand was livid, swollen, and painful. An hour later his parotid glands were noticed swollen, he vomited, and had severe shooting pain in the left thigh. Later vomiting was repeated, breathing became more oppressed, and he became very restless. At 7 a.m. he was unable to speak or swallow, his eyelids had drooped, and he was constantly putting his hand into the mouth as though to attempt to remove some obstacle. His leg muscles twitched. The symptoms increased, and he died at 9 a.m. in convulsions. He was treated with six intravenous injections of liquor ammonia, amounting in all to three drachms.

I am indebted to Colonel F. W. Dawson for the following :—A keeper in the Trivandrum Museum was bitten on the right index finger by a small krait, one and-a-half feet long, at about 1-30 p.m., 13th August 1907. The bite felt like a pinprick, there was no bleeding, and indeed no mark whatever of a puncture. He went home having declined all persuasions to go to hospital, and apparently stayed in his house till about 3 p.m., when he began to feel a burning pain, in the bitten finger. He walked to a hakim's house without any difficulty, and soon after arriving suffered intense pain in the abdomen. At 5-30 his neck became rigid so that he could not turn his head, and his body became rigid so that he could not stoop. He was unable to talk. His respirations became laborious and coma

set in. Frothy matter, and a quantity of phlegm-like mucous passed with great difficulty from the mouth and nostrils. Towards the climax he had two convulsive seizures, and he died apparently from suffocation at about 7 p.m. the same day. It was observed that the heart pulsated some time after breathing had ceased. Further Colonel Dawson says, "There have been several cases of death from bites of the krait here lately, in all of which the prominent symptoms were burning pain of the bitten part, rigidity of the neck and pain in the abdomen." He was informed by his head-keeper that a neighbour's boy of 6 or 7 years of age had awaked one morning recently with an intense pain in the abdomen. He was treated in hospital for stomach-ache, and sent home. On moving the mat on which the child had slept a krait was discovered. A train of symptoms very similar to those experienced by the keeper who died followed, and the child died. No mark of a puncture could be found on the body.

Lieut-Colonel Dimmock, I.M.S., has kindly communicated the following interesting case : A Hindu male, aged 35, was bitten on the dorsum of the right foot at 11 p.m. on the 29th November 1907 by a small krait "about two feet long" identified as such at the Parel Laboratory. At the Railway Hospital, Bombay, two punctures half an inch apart at the seat of the reported bite were slightly incised, and permanganate of potash applied. He was transferred to the Jamsetjee Jejeebhoy Hospital where the punctures were freely incised, and permanganate crystals rubbed in. On admission he was reported as "suffering from fright, pretended to be insensible but is quite conscious." . . "In the night his pulse became slow and feeble, and respirations shallow, and hurried. Next morning he was quite well and went home at noon." Internally he was treated with ammonia, and hypodermically with strychnia. The dose of poison injected may have been small, but whatever the dose it certainly appears as if the permanganate had very completely neutralised its action as no symptoms occurred other than those directly referable to fright. Ammonia and strychnia have both been proved powerless agents in snake bite, though, of course, they are powerful restoratives in combating fright.

Poison apparatus. Fangs.—These structures are relatively small when contrasted with those of vipers, and even perhaps with that of the

cobra. In a well grown adult I have measured the fangs one-eighth of an inch along the straight, and I think in the largest specimens they will be found scarcely to exceed this length. They are canaliculate with a very obvious seam on the anterior face where the circumflexed margins of the walls forming the canal meet. Often two fully operative fangs occur side by side in the same jaw. Behind these the maxilla is hollowed to receive the sac in which the reserve fangs develop, and behind this again it gives origin to four small teeth, which are grooved though in no way connected with the poison apparatus.

Glands.—These structures, as far as I can judge, are relatively about as well developed as in the cobra. They are smooth, somewhat retort-shaped, and when cut into reveal a cancellous structure similar to the appearance of a sponge.

Poison. Physical properties.—I have rarely seen the poison "in vitro" either in the liquid or dried state, and can find no special references to its re-action, taste, and appearances, etc. To the naked eye it appears, when fluid, much like cobra venom, a clear fluid, with the consistency and colour of pale salad oil.

Quantity.—I have no records of the yield of a single gland nor can I find any in literature, but the yield is, I think, very considerably less than that of a cobra of the same size.

Poison.	Subject.	Minimal lethal dose per kilogram weight in milligrammes.	Authority.	Reference.
Krait ...	Pigeon ...	·25	Rogers... ...	Phil. trans. Royal Soc. London, 1904, Series B., Vol. 197, pp. 137 and 147.
Cobra ...	„ ...	·4 to ·5	„	
Krait ...	Rat ...	1·00	Elliot, Sillar and Carmichael.	Loc. cit. p. 327.
Cobra ...	„ ...	·04 to ·07	Lamb	Scient. Mem. Officers Med and Sanitary Department. No. 7, p. 19.
„ ...	White rat..	·25	Fraser... ...	Nature, 16th April 1896.

Toxicity.—As will be seen from the annexed table it is impossible from the present available research work to draw a comparison between the relative virulences of krait and cobra venoms. The investigators quoted are all men of the greatest ability, their work when critically studied is convincingly careful and precise, and yet their results vary enormously. Rogers makes it appear that krait venom is about twice as deadly as cobra venom. Fraser's results compared with Elliot, Sillar and Carmichael's show that cobra venom is four times as potent as krait venom, and Lamb's results compared with the same trio's concedes to cobra venom a toxicity twenty times that of the krait. Lamb,* however, from his own researches with both poisons on rabbits, shows that krait venom is proximately four times as virulent as cobra venom. In considering the question it must be borne in mind that samples of venom from individuals of the same species vary somewhat, thus Lamb fixed the minimal lethal dose of cobra venom for rats with one sample at ·04 milligrammes per kilogram weight, and with another sample found it was ·07 milligrammes.† Again animals vary in their susceptibility to different venoms, thus Lamb found a rat more susceptible to cobra venom than a rabbit, but a rabbit more susceptible than a rat to *Enhydrina* venom. ‡ It is reasonable to suppose that the quality of the secretion may be affected by health, in fact we know it is, for Lamb has remarked with others on the decrease in quality and quantity of venom in snakes kept in captivity. Doubtless season, and possibly youth, and old age similarly affect the poison secreted. Further there are the conditions affecting the animals experimented upon. Not all individuals of the same species are equally susceptible, and health and age doubtless modify their susceptibility. Again I have shown, I think, good reason to suppose that the snake *Bungarus candidus* as hitherto understood includes 3 or 4 forms which may be distinct species. If all these forms are mixed up, and their poisons which may be very different in toxicity, collected together as krait venom, this alone might account for the conflicting results. In future experiments I think every care should be taken to keep the poisons of the various forms apart.

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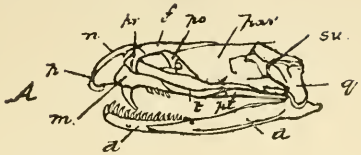
* "*Snake poison and Snake bite*," p. 8. This reference is the same as that appearing in Clifford Allbutt's System of Medicine (Lamb and Martin).

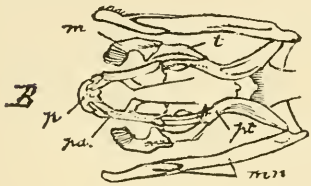
† Memoirs officers. Govt. of India No. 5, p. 14. ‡ Loc. cit., p. 7.

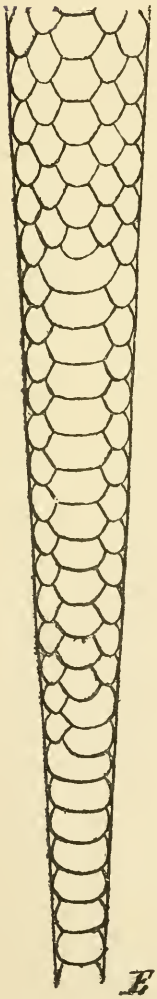
The possible factors which may contribute to a want of uniformity, other than the supposition that the venom of several species has been mixed, are each taken by itself trifling, and one would expect a more proximate agreement in results than that actually obtained.

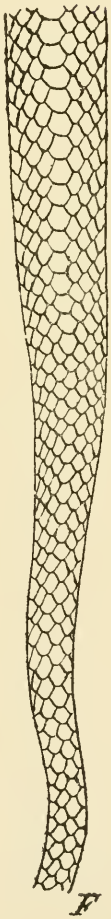
Lepidosis. Rostral.—Touches 6 shields; the rostro-nasal sutures longest and about twice the rostro-labial which are shortest. *Internasals.*—The suture between the fellows about half that between the præfrontal fellows: two to three-fifths the internaso-præfrontal. *Præfrontals.*—The suture between them greater than the præfronto-frontal; touch the internasal, postnasal, præocular, supraocular, and frontal. *Frontal.*—Touches 6 shields; which are subequal or the fronto-parietals largest. *Supraoculars.*—Breadth about half, length about two-thirds the frontal. *Nasals.*—Touch the 1st and 2nd supralabials, the suture from the nostril passing to the 1st. *Præoculars*—One. *Postoculars.*—Two. *Temporals.*—One anterior touching the 5th and 6th supralabials. *Supralabials* 7; the 2nd as broad as the 3rd, the 3rd and 4th touching the eye. *Infralabials.*—The 4th is much the largest of the series, and touches 2 scales behind. *Sublinguals.*—Two pairs: the anterior largest, the posterior touching only the 4th of the infralabial series. *Costals.*—Two heads lengths behind the head 15, midbody 15, two heads lengths before the anus 15, the last row deeper than the rest; keels absent; apical pits absent. *Vertebrals.*—Broader than long in almost the whole body length, about twice as broad as the uppermost costal.* *Ventrals.*—200 to 218. *Anal.*—entire. *Subcaudals.*—38 to 50; all entire. *Dentition and Jaws.*—*The maxilla* extends forward as far as, and is as long as the palatine. Anteriorly it supports two fangs which are placed side by side. The fangs are canaliculate and the seams where

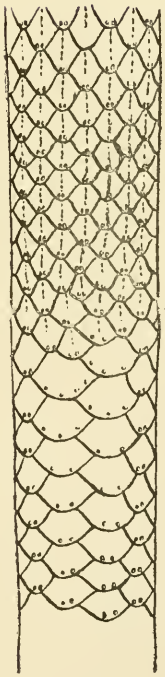
* The enlargement begins gradually in the neck, and usually without a coalescence of scales. In this respect it differs from the species of *Dendrophis* and *Dendrelaphis* where the enlargement is due to a fusion of the 3 median rows, and begins therefore suddenly. Posteriorly the enlargement persists along the whole length of the tail, a peculiarity seen in the kraits alone of all the snakes that exhibit enlarged vertebrals. Here the vertebral row gradually reduces in breadth, and suddenly enlarges at intervals owing to an absorption into it of the rows on each side (Fig. E., Diagram I.). In other snakes with enlarged vertebrals the enlargement ceases above the anus (Fig. F., Diagram I.). In these as in most other snakes the scales which have been in an odd number of rows become arranged above the anus in even rows, and the absorption of rows is brought about by a fusion of the two uppermost supracaudals on each side, at each step (Fig. G., Diagram I.).











INDIAN SNAKES (WALL).

the walls of the canal meet on the anterior face are much more apparent than in viperine fangs. Behind the maxilla supports four small subequal teeth which are strongly grooved on their outer faces.

Palato-pterygoid.—The palatine bone equals the maxilla in length and supports 10 or 11 subequal teeth all of which are grooved on their inner faces. The pterygoid bone is more than twice as long as the palatine, but bears teeth only anteriorly, in rather more than one-third of its length. The teeth numbering about 11 slightly decrease in size posteriorly, and are feebly grooved on their inner faces. The *transpalatine* bone is rather longer than the tooth-bearing part of the pterygoid.

The Mandible equals the skull in length. It bears about 15 teeth in the dentary bone which is about two-fifths the length of the entire mandible. The teeth are subequal in size except the 2nd, 3rd and 4th which are rather the longest. All are grooved on their outer faces. The accompanying figures illustrate these remarks, and show most of the bones of the skull.

Our Plate is good. Figures 4 to 7 are all taken at midbody, and from specimens in the British Museum. Figures 1 to 3 are from the specimen whose body marks are represented in Figure 5.

EXPLANATION OF DIAGRAM I.

A. Skull of *Bungarus cæruleus* profile.
B. „ „ „ basal aspect to show jaws and dentition.
C. Maxilla of „ „ profile } enlarged.
D. „ „ „ from below }

(*a*) Articular bone of mandible.
(*d*) Dentary „ „
(*f*) Frontal, (m) Maxilla, (mn) Mandible, (n) Nasal.
(*p*) Præmaxilla, (pa) Palatine, (par) Parietal.
(*po*) Postfrontal, (pr) Præfrontal, (pt) Pterygoid.
(*q*) Quadrate, (sn) Supratemporal, (t) Transpalatine or Ecto-pterygoid.

E. Supracaudals of *Bungarus cæruleus.*
F. „ of *Dipsadomorphus hexagonotus.*
G. „ of *Zamenis korros.*

The dotted lines in figures E., F., G. show the site of the anus.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plates and Diagrams.

BY

Major F. Wall, I.M.S., C.M.Z.S.

Part IX with Plate IX and Diagram 1.

(*Continued from page 735 of Volume XVIII.*)

The Common Wolf-Snake (*LYCODON AULICUS*).

Nomenclature (*a*) *Scientific.*—The generic name (Gr. λυκος wolf and οδους tooth) originated with Fèrrusac* in 1826, and has reference to the long teeth in the upper and lower jaws which, from their situation and superior length, resemble the canine teeth of wolves and dogs. It is these long teeth which mislead many who inspect the mouth carelessly, into supposing the snake a venomous one. As a matter of fact they are solid, nor canaliculate.

The specific title (Latin=a house dweller) was introduced by Carl Linné in 1754, and emphasises the fact that it is usually met with inside habitations.

(*b*) *English.*—The Common Wolf-Snake seems to me the best name for it.

(*c*) *Vernacular.*—Though so common I know very few names for it. It is frequently confused by natives with the krait, and known by the same name locally as its poisonous relative. Thus Mr. DeAbreu tells me it is called "krait" in Behar, Willey† says it shares with the Ceylon Krait (*B. ceylonicus*) the name "tel karawala" in Ceylon. Baboo Awmoola Ruttum Bysack gives "kaurialla" as one of the names for the common krait (*B. cæruleus*), but I think it is more correctly applied to the common wolf-snake. I have heard this name given several times, and it appears to refer to the marks on the back resembling the little cowry shell, "kaurialla" or "kauriwalla" implying a wearer of cowries. A European subordinate with some knowledge of snakes told me that the common name in the Kheri District (U. P.) for it is "garar". In S. India Father Bertrand tells me it is one of the snakes called "Soovar pambu" or "wall

* Bull. de Science, Nat., p. 238.

† Spol. Zeylan, 1906, p. 229.

snake". Colonel Dawson informs me that in Travancore, this and *L. travancoricus* with other species are called "shunguvarian," the Malayalam word for conch shell being "shungu" alludes to the marks on the back. I heard it called "choorta" in Cannanore, but again here the term was loosely applied.

Colour and Varieties.—I cannot do better than first quote from Boulenger (Cat., Snakes, 1893, Vol. 1, p. 353).

"*A.*—Labials without spots; a triangular whitish blotch on each side of the occiput, the two sometimes confluent and forming a collar: back with whitish cross bands bifurcating on the sides (*L. aulicus*, Linné).

B.—Labials without spots: a whitish collar and a few (2—5) whitish cross bands on the anterior part of the body.

C.—Labials without spots; no collar: no dorsal spots or bands.

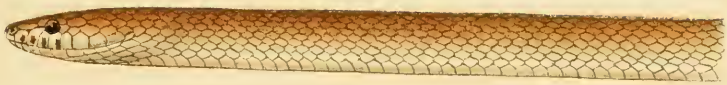
D.—Some or all of the labials with a brown spot; a whitish collar or a triangular whitish blotch on each side of the occiput: back with whitish cross bands bifurcating on the sides, or with a dorsal series of quadrangular blotches, or with white lines disposed irregularly or forming a wide-meshed net work (*L. capucinus*, Boie).

E.—Each upper labial with a brown spot: no collar; no light spots or lines (*L. unicolor*, Boie)."

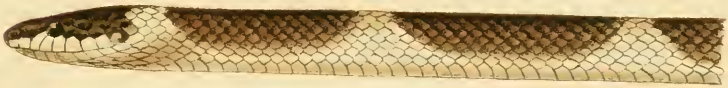
Boulenger's variety *D.* includes three varieties the β, γ, and δ of Günther*. I cannot see the justification for recognising any of the above varieties, which appear to me completely connected, unless var. *B.*, about which I am not certain, deserves special mention.

I find on referring to my note books that I have examined, and remarked upon 191 specimens from widely separated localities in India, Burma, and Ceylon. Between specimens that have yellow or yellowish cross bars in the whole body-length extending often on to the tail, and those with no marks at all I find every degree of variation. In some not even the occipital band is to be seen, in others it alone may be obscure or distinct, in others two, three, four, or many cross bands may be visible, the anterior always most so. Varieties *A.* to *E.* therefore appear to me completely connected. I find that the colour of the lips to which Boulenger attaches importance varies too. Often the upper is uniform yellow or yellowish, often

* Rept., Brit. Ind. 1864, p. 316



1.



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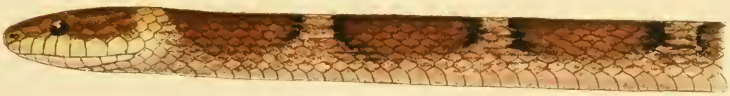
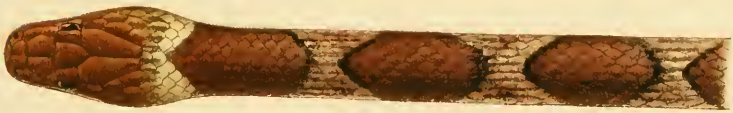
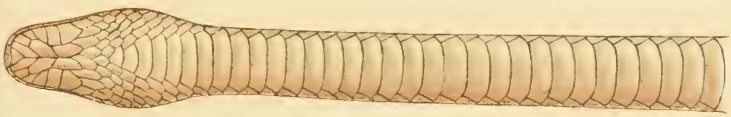


3a.



3b.



3c

3d

4

J.G. del.

J. Green, Chromo

THE COMMON INDIAN SNAKES, (Wall).

1, 2, 3. Lycodon aulicus, *harmless, nat. size.*

4. Lycodon striatus, *harmless,* × 1.

again more or less mottled with brown especially anteriorly, or some of the labial shields bear a single median brown spot.

There appear to me to be but two varieties and these are so marked that I am inclined to think they must breed true "inter se."

In variety *typica* the brown varies from the light hue seen in figure 1 to the dark-brown of figure 2. The bars are yellow or yellowish never quite white in life, though the yellow becomes white rapidly in spirit. They broaden laterally and dissolve into a network pattern in which the scales involved are outlined with yellow. This reticulation is not clearly shown in figure 3 of our plate. It so often happens that the cross bars fade away posteriorly, that in a large number of specimens one cannot count them in the whole body-length. I have therefore noted in a large series the bars that can be counted in the anterior *half* of the body (not including the tail), and find that they usually vary from 9 to 18. In some uncommon examples they may be very few, or even absent, the latter rarities conforming to the types of *unicolor* (Boie), and *hypsirhinoides* (Theobald). Further, the scales involved in the interval between the first and second bars (not the bar on the back of the head) vary from 5 to 10, and this is of importance in determining the uncommon specimens in which but two or three bars are visible. *Typica* is the common variety distributed throughout Indian and Burmese limits. In the second variety for which I propose the name *oligozonatus* the ground colour is always dark as in figure 2 of our plate or darker still approaching black. The bars are white, not yellowish. Laterally they dilate without dissolving into a net-work. They are distinct in the *whole* body-length numbering from 11 to 19. They are thus about half as numerous as in variety *typica*. The number of scales involved vertebrally in the interval between the 1st and 2nd bars varies from 12 to 19. The lips are white not yellow. Of this I got several specimens in Cannanore and have seen one from Bellary, but no others. It probably occurs only in S. India where it is far less common than *typica*.

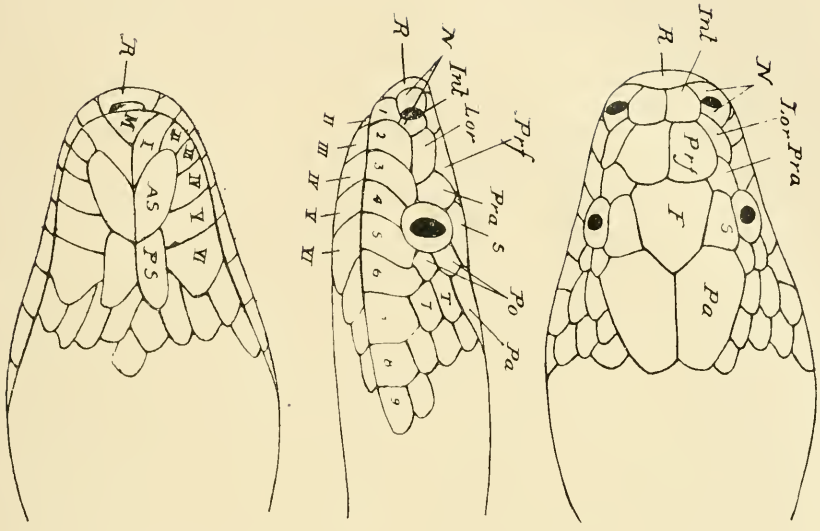
In both varieties the underparts are pearly-white, with in *typica* sometimes a pinkish tinge.

Dimensions.—It grows to about two-and-half feet, but specimens over two feet are uncommon. I have records of only 19 over that length, and all my largest are females. My largest ♂ record is 2

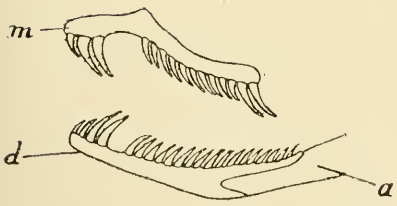
feet 3⅛ inches, and I have had four ♀ ♀ larger, the maximum length being 2 feet 5 inches. Mr. Millard, however, gives me two records in excess of my figures. One is 2 feet 7½ inches, and another 2 feet 9 inches, the sex in both cases was not noted.

Bodily configuration, physiognomy, etc.—The Wolf-Snake is rather slender in form, the body cylindrical in outline or slightly flattened ventro-vertebrally and of much the same girth in the whole body length. The head is decidedly flattened, the snout broad, and rounded with an obtuse transverse ridge in front. The neck is sufficiently constricted to be distinctly evident. The nostril is moderate and occupies the full depth of the suture between the nasal shields. The eye is rather small and quite black so that no idea of the shape of the pupil can be discerned in life : but shortly after death when the lens becomes opalescent from post mortem changes, or after immersion in spirit the pupil is seen to be vertical. The tongue is pinkish with white tips. The belly is obtusely keeled on each side, a feature favorable to clambering efforts. In this snake as in the dhaman, and many other species the "angulation" as it is usually called reminds one in section of a boat (see figure 1 B, Diagram 1, facing page 230 of Volume XVIII of this Journal). The tail is rather short being about one-sixth the total length of the snake. The whole snake is glossy owing to the smooth and polished surfaces of the scales; a circumstance which has not escaped the Singhalese whose name for it "tel" karawala, implies "oily."

Identification.—The first thing to look at is the loreal which in this snake in common with a few others touches the internasal (see figures A and B of Diagram). This relationship of these two shields is only to be seen in 5 of the 11 known species of this Genus, in all the species of the Genera *Amblycephalus* and *Trachischium*, in *Xylophis perroteti* and in certain specimens of some *Hypsirhina*. In all the species of *Lycodon* that concern us the scales are in 17 rows in midbody, whereas this number of rows is not met with in any other species and genera just referred to. In *L. aulicus* and *striatus* the 1st and 2nd labials touch the nasal shields in the other three species the 1st only. It now remains to distinguish *aulicus* from *striatus*. In the former there are normally 9 supralabials, in the latter only 7 or 8. In the former the præocular frequently but by no means always touches the frontal, in the latter it never does so. In the

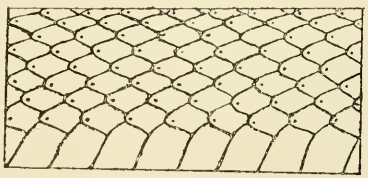


LYCODON AULICUS (+2). ♀



E

(*m*) maxilla, (*d*) dentary and (*a*) articular parts of mandible of *L. aulicus* (enlarged).



To show scales with apical pits.

COMMON INDIAN SNAKES (WALL).

former the belly shields (ventrals) are angulate, in the latter they are not. The former grows to 2½ feet, the latter to less than 1½. Whilst both are common in Peninsula India and Ceylon, the former extends East beyond the longitude of Calcutta, the latter does not. To sum up, the essential points in identification are (1) a loreal touching the internasal, (2) scale rows 17 in midbody, (3) nasal touching the 1st and 2nd labials and (4) 9 supralabials.

Haunts.—Of all the snakes that seem to seek out, and profit by a human environment the Common Wolf-Snake is the most conspicuous. I should think that fully half the snakes met with inside habitations throughout India would prove to be this species, and it certainly is far more frequently encountered inside bungalows, and outhouses than outside them. Not only is it a very frequent tenant of houses such as those occupied by the European population in Cantonments, but it frequently obtrudes itself into densely populated parts, such as bazaars, native towns, jails, etc., and is no rarity in the business quarters of our large Indian cities. I not infrequently have one brought in from the regimental lines, bazaars and jails, and have had it from inside regimental and Cantonment hospitals. Mr. Millard tells me he has "frequently had specimens sent to the Museum which have been killed in houses in the Fort at Bombay." Like many other snakes it likes to insinuate itself into the crevices of loose brickwork such as the foundations and walls of buildings. Here it conceals itself during the day emerging at nightfall in quest of food. Along the outer walls skirting the jail at Cannanore I rarely passed without finding the sloughs of this snake issuing from holes in the face of the masonry, and have often found it in similar situations elsewhere.

In houses it very frequently climbs into the roof, and I have several times known or had specimens sent me which had dropped on to the floors of rooms, verandahs, barracks, etc.

Disposition.—The Common Wolf-Snake is a very lively little customer, which usually on being discovered slips away hastily if circumstances permit. If pursued, or any attempt made to catch it, or obstruct its path it strikes out boldly without hesitation planting its teeth into whatever thwarts its progress, and I have been bitten many times in trying to effect its capture. If in the open, and baulked in its endeavours to escape it will frequently coil itself

into a heap and remain stationary: and if worried will hide its head beneath its coils. Often too while lying thus it fixes its coils rigidly so that one can toss it into the air without it releasing its folds, as one might do a piece of knotted cane. A visit paid to such a specimen in its cage an hour or so later will probably show its courage restored, and it will inflict or endeavour to inflict a wound. Like most other snakes however it soon gets accustomed to being handled and will then suffer itself to be withdrawn from its cage without anger though it usually struggles to elude one's grasp. Mr. F. Gleadow tells me he "saw one in a climber in his verandah one night, and while examining him to see whether it was a *Lycodon* or a *Bungarus* with the aid of a hurricane lamp, he let out at me like lightning, and scratched my nose. It was a very smart stroke indeed. Nobody had touched him." Gunther* says of it: "It is of fierce habits and defends itself vigorously." Mr. Millard writes to me: "It is of a somewhat fierce disposition, and when first caught will usually turn and bite freely." Colonel Dawson too in a letter to me remarks on the fierceness of its nature.

Mice not infrequently fall victims to this snake, a fact which in itself speaks more eloquently than any remarks can do for the intrepid nature of such a diminutive reptile. Mice or at least individuals amongst them are most formidable antagonists for small creatures to encounter and I have collected several interesting records showing that a single one will not only defend itself against the snake or snakes into whose cage it has been put as food, but will sometimes actually turn the tables, fight, overpower, and devour the snake.

There is no doubt that this snake is responsible for a large number of cases of snake bite in India every year, a circumstance to which its commonness, courage, irascibility, nocturnal habits, and predilection for man's environment all contribute.

As the snake is nearly always pronounced a krait by Europeans and natives alike it is one of those snakes which has helped most to swell the list of reputed antidotes to snake poison, for anything given internally, or applied locally under the circumstances gets the credit of having averted the otherwise supposed inevitable fatality.

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* Rept. Brit. Ind., 1864, p. 316.

In a nervous subject, such as the native frequently is, a bite even from this harmless wolf-snake may prove fatal. Thus Dr. Willey* records a case in Ceylon of a woman who was bitten on the right forearm by a snake of this species one night, and who died in consequence, no doubt from fright.

In the *Indian Medical Gazette* of November 1st, 1870, Dr. Ewart reports the following case:—

"This morning, August 22nd, on visiting the General Hospital, I was informed that one of the punkah-coolies had been bitten, about 8-30 the night before, by a krait, whose venom is virulently poisonous. The man, it appears, had been sleeping, and on awaking he found something crawling over the right shoulder, and immediately experienced a stinging sensation about the middle of the acromion process. He was then under the impression that he had been bitten by a snake, and on procuring a light, a very lively snake was captured.

"The site of the bite was examined by Mr. Knight, the Assistant Apothecary, who declares he discovered a small puncture, on which there was a small quantity of coagulated blood. He is also positive that the tissues around, to the size of a two-anna piece, were puffed and swollen. Patient's pulse was irregular, and he was much alarmed and agitated: the surface of the body was cold; countenance anxious; pupils normal: quite conscious and intelligent; no dimness of vision, or vertigo.

"About four minutes after the man had been bitten, the part was freely scarified, and the cupping glass applied. Ammonia was given repeatedly at short intervals. Rum was also freely administered, and means were taken to prevent sleep.

"When the patient was presented to (us) as a specimen of snake-bite cured by cupping, ammonia, and rum, I expressed my doubts, after an examination of the seat of scarification, whether he had been bitten at all; and if he had been bitten, whether the snake was poisonous.

"I submitted the snake to Dr. Fayrer, C.S.I., who pronounced it to be the '*Lycodon aulicus*' perfectly innocent. It is something like the Krait (*Bungarus cæruleus*), and often gets blamed accordingly."

It is in such a case as this that the stimulating remedies which have

* Spolia Zeylan. 1906, p. 228.

enjoyed so great a reputation in the treatment of snake-bite are of real benefit, such for instance as brandy, ammonia, and strychnia. These agents have no influence in reducing or destroying the poisonous properties of snake venom, they are useless agents in the treatment of snake *poisoning*, but invaluable remedies in snake *bite*, a very different condition—where they act by counteracting the depressing influence which fright exerts upon the heart.

Habits.—The two most obvious traits in its character are its nocturnal habit, and its clambering propensities. It is seldom or never seen abroad in daylight unless disturbed. Mr. E. E. Green from his experiences writes to me : " It is quite nocturnal in its habits. In captivity it sleeps all day and refuses food." When not established in the safe quarters offered by masonry, or a hole in the ground, it coils itself during the day in any convenient dark shelter, beneath the boxes or stores, or among the packages on the shelf in one's storeroom, beneath the discarded bucket or basket behind the stable, beneath one of the flower pots standing in the verandah, in a heap of kunkur beside the road, or stack of bricks or wood, behind or beneath the piles of plant stored in the Supply and Transport godown or the Telegraph Office compound, anywhere in fact that offers a convenient refuge. In such situations, besides enjoying the semi-darkness so grateful to its tastes, it is brought into convenient association with the very creatures upon which it is wont to prey, the agile, but incautious mouse, the slippery skink, and the defenceless little gecko. At night the wolf-snake emerges from its fastness, and actively pursues its quest for food. The servants are apt to encounter it in the verandah when serving dinner, the inmates of a house in any of its rooms, the sepoy in his lines, the soldier in barracks, and the warder going his rounds in the Jail. Often too it will drop from the roof into the verandah amid the family circle, from the covered way to the kitchen, or from the disused punkah-pole, or cross-bar supporting curtains in the drawing-room.

Its climbing accomplishments are very remarkable, for it often puzzles one to know how it can have got on to some of the places from which one dislodges it. The top of a window ledge, the jilmils of a door, the top of the lintel of a door which has become loosened from the masonry, a punkah-pole, or curtain rod. I have frequently had opportunities of observing this snake climbing and find that it

can do so with comparative ease even on a vertical plane, especially if the surface is a little rough. Thus I have many times witnessed it climb up the perpendicular wooden faces of its box, the boards being rough from the saw. It clambers with ease, throwing itself into an S shape, and appearing to balance itself on its tail. As one watches this performance one wonders at the support derived from the tail expecting every moment to see the snake fall, but no! the caudal extremity resting on the horizontal surface grows less and less, and finally follows the rest of the snake which adheres vertically wholly unsupported. Now some observers would have us believe that the force which operates in this acrobatic performance, is brought about by a muscular effort on the part of the snake which retracts its abdomen in such a way as to create a vacuum in its body-length opposed to the surface it is climbing. This, as in the case of an india-rubber cup which has been pressed to exhaust the air, adheres mechanically by the production of a vacuum. I happen on more than one occasion to have seen *Lycodon aulicus* moving up the glass face of its cage, it can do so in a wonderful manner till nearly all the body-length has left the floor, but though I have specially looked for it I have never been able to see the slightest indication of the muscular action referred to above, but have noticed that the whole surface of the abdomen lay pressed against the glass. I have never seen the snake succeed in scaling a face of glass except in the case of two hatchlings that I put into spirit. To my amazement I found one of these still wet from its immersion lying along the face of the jar above the level of the fluid, and here it maintained a firm attachment, so firm indeed that it almost supported the second one in its endeavours, to reach a similar position, and escape its fate. In this case also I specially noted that there was no attempt at any retraction of the abdomen. The jar in which this scene was exacted is some 5 inches in diameter, so that the curvature of the glass can have been little assistance to a creature little over 7 inches in length. The wolf-snake appears to me to climb by the aid of its ribs, and the free borders of its belly shields, and with these alone. Mr. Sinclair in this Journal (Vol. IV, p. 310) remarked upon one he saw scaling a chick stretched vertically and lashed in position. He says: "The snake evidently climbed by hitching the edges of the ventral shields on to those of the bamboo lattice of the blind, and not by winding his

body which was entirely on the side of the blind next to me, round the bamboos." As already stated it will frequently climb up into the roofs of houses, but perhaps the most remarkable example of its scansorial achievements is that mentioned by Haly*, a specimen having been caught in the lantern of the Minicoy lighthouse in Ceylon.

Food.—*L. aulicus* whilst showing a preference for lizards of the gecko family accepts with avidity other small creatures that cross its path. I have on 13 occasions known it take geckoes always of the genus *Hemidactylus*, usually *frenatus* but also *coctaei*. On 8 occasions a mouse had furnished the meal, and on 6 other occasions skinks had been devoured. In the United Provinces *Mabuia dissimilis*?, in Burma *Lygosoma cyanellum*, and once another *Lygosoma* too digested to determine. Mr. E. E. Green tells me in Ceylon he has known it take a *Lygosoma* in captivity. Willey says its staple food in Ceylon consists of the brahminy lizard, *Mabuia carinata*.

Foes.—I have known it fall a victim to the common krait, and the habits of the two snakes are so alike that I suspect the wolf-snake very frequently meets an untimely death at the jaws of its ophiophagous relative.

Breeding. The Sexes.—As already remarked the ♀ appears to grow to a greater length than the ♂. The sexes, as regards numbers appear to be equally balanced, thus my note books show that of 73 specimens sexed, 36 were males, 37 females.

I have known the sexes in company in November in Cannanore by report. In this case the native who brought the ♂ assured me it was united with another which escaped. In January in Fyzabad two were found in company in a bottlekhana, and in Dibrugarh two pairs were killed in company one in June and one in July. The June ♀ was heavily egg-bound at the time, but only the anterior half of the July specimen which I assume to have been a ♀ was brought in, the ♂ being perfect. It is evident that they do not dissolve partnership after sexual congress for a long time, if they do so at all, but this is a point upon which I am very uncertain and a very difficult one to elucidate. The smallest gravid females I have known were both 1 foot 6¼ inches long, a length probably attained at the beginning of the third year of life.

* First Report Snakes, Colombo Mus. 1886, p. 15.

Anal glands.—I have found these glands which are supposed to be connected with the sexual functions active in both sexes, and at most parts of the year. The secretion is custard-like in colour and consistency. The copulatory male organs are beset with many minute recurved spines.

In a previous paper dealing with Russell's Viper (Vol. XVIII, p. 13) I remarked that I was inclined to think that the oldest mothers were the most fecund. My notes on the wolf-snake certainly make it appear so, for the smallest females, 1 foot 6¼ inches in length, contained 3 and 4 eggs, and the largest 2 feet 5 inches in length, 11 eggs. Further 5 of the 6 egg-bound specimens over 2 feet in length contained from 7 to 11 eggs, whilst in 8 others where the length is recorded, all less than 2 feet, only from 3 to 6 eggs were found "in abdomina." My figures are as follows :—

Length of ♀.	No. of Eggs.	Length of ♀.	No. of Eggs.
1′-6½″ ..	3	1′-10¾″ ...	4
1′-6¼″ ...	4	2′-0″ ...	8
1′-8½″ ...	3	2′-0⅝″ ...	7
1′-8⅜″ ...	4	2′-2⅛″ ...	9
1′-8½″ ...	5	2′-2¼″ ...	5
1′-9″ ...	5	2′-4″ ...	7
1′-10¼″ ...	6	2′-5″ ...	11

Eggs.—I have had many females brought to me gravid all with one exception during the first 7 months of the year. The one exception was egg-bound in Rangoon on the 20th December. Of the rest, one in Cannanore was gravid on the 20th January ; three in Cannanore in February ; one in Cannanore, and two in Fyzabad in March ; one in Cannanore, two in Fyzabad and five in Dibrugarh in April ; one in Cannanore and three in Dibrugarh in May ; one in Cannanore, and one in Fyzabad in June, and three in Fyzabad in July.

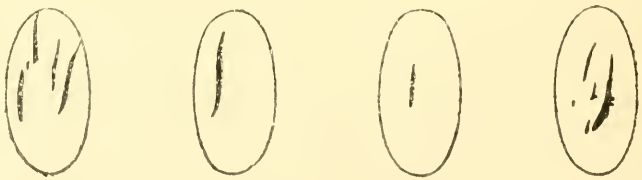
The eggs are deposited in the months from February to July. They vary in number from three to eleven but are usually from four to seven. They are elongate white ovals, equally domed at each pole, and soft to the touch, the shell resembling white kid, until vacated when it dries and hardens into a somewhat crisp parchment-like envelope. When seen "in abdomina" they are frequently but by no means always particoloured—grey and white. The grey colour appears to me to be due to absorption of colouring matter

from the intestine, for it is always seen on that part of the shell which lies in contact with the gut, is absent when the gut is empty, and present in some eggs in the string corresponding to a loaded part of the intestine. It may be originally derived from the pigment in the skins of the creatures ingested. When laid the grey colour is never visible as far as I am aware.

When deposited the eggs measure from rather less than one to one and-a-quarter inches and are rather more than twice as long as their breadth. They contain no trace of an embryo. The periods of gestation and incubation are not known to me.

Hatchlings.—These escape from the egg doubtless by means of the fœtal tooth, though I have failed to find it in the many examples I have examined. The appearance of the eggs after evacuation is similar to that seen in other species. A clutch of five was brought to me on the 18th July last year found in a Planter's bungalow. A single hatchling was present with the eggs, all of which, except a non-fertile one, were empty. I give a drawing of these eggs to show the cuts in the shells through which the young had gained their liberty. Each cut was as clean as if done with a sharp knife.

The young when they escape from the egg vary in length from $6\frac{3}{4}$ to $7\frac{3}{4}$ inches, or about one-third the length of a large adult. They are exactly like most adults in colour and markings. I have seen two of the same brood, one with very distinct yellow bars in the whole body-length, whilst the other had a few rather obscure bars anteriorly only. One of these was very vicious, and bit me more than once when handling it. It attacked, killed, and soon swallowed a young gecko I gave it.



EGGS OF *LYCODON AULICUS*.

To show incised apertures of exit made by hatchlings.

(nat. size).

Growth.—It is very difficult to follow the growth after the 2nd year from the figures to hand in my note books. It is certain however that when one year old the young have at least doubled their length being over 1 foot 1½ inches long but they hatch over such a long period of the year that the lengths become hopelessly mixed, leaving no gaps to indicate successive broods. An unusual number of specimens between 1 foot 6 inches and 1 foot 8 inches in length at the same period of the year, seems to indicate that this length is reached at the end of the 2nd and beginning of the 3rd year. Again a large number measuring from 1 foot 9 inches to 2 feet, seems to point to the termination of the third year's growth.

Distribution. (*a*) *Geographical*—Its range of habitat is very extensive. It occurs throughout Peninsular India to Ceylon and the Maldives. Westward it extends throughout the Punjab, to the lower slopes of the Himalayas. I can find no record of it from Sind however. To the East it ranges through the Bramaputra, and Irrawaddy-Salween Basins (including the Andaman and Nicobar Islands), to the Eastern limits of Indo-China in the continental part of the Malayan sub-region, and through the Malayan Archipelago to the Philippines.

(*b*) *Local.*—It is essentially an inhabitant of the Plains. I have known it fairly common on the lower slopes of both Western, and Eastern Himalayas up to about 2,000 feet, but it appears to rarely wander above this altitude. Ferguson* in this Journal says though common in the low country in Travancore he has not recorded a single specimen from the Hills. Flower† remarked on a specimen he obtained at Penang at an altitude of 2 200 feet. Willey‡ too says that though common in the low country in Ceylon it does not appear to ascend to 3.000 feet.

In the Plains it is common everywhere, and hardly a collection of snakes amounting to half a dozen specimens made anywhere will fail to show at least one representative. I cannot recall ever having seen or heard of a specimen in or close to water, or in damp places.

Lepidosis. Rostral.—Touches six shields, the rostro-nasal sutures largest. *Internasals.*—Two, the suture between them one-half to three-quarters that between the præfrontal fellows, equal to or rather

* Vol. X, p. 71. † P. Z. S., 1899, p. 664. ‡ Spol., Zeylan., Vol. I, p. 117.

greater than the internaso-præfrontals. *Præfrontals.*—Two, the suture between decidedly greater than the præfronto-frontal sutures; in contact with internasal, loreal, præocular, (sometimes the supraocular) and frontal. *Frontal.*—Touches 8 shields usually, (sometimes 6 only, when the præocular fails to meet it) the sutures sometimes subequal or more often the supraoculars rather longest. *Supraoculars.*—About two-thirds the length, and half the breadth of the frontal. *Nasals.*—Two, subequal, in contact with the 1st and slightly with the 2nd supralabial. *Loreal.*—One, twice as long as high, longer than the two nasals. *Præocular.*—One, usually meeting the frontal. *Postoculars.*—Two. *Temporals.*—Two, the lower touching the 6th and 7th labials. *Supralabials.*—9, the 3rd, 4th and 5th touching the eye. *Sublinguals.*—Two pairs, subequal or the anterior rather largest, the posterior in contact with the 5th and 6th infralabials. *Infralabials.*—6, the suture between the 1st as long as that between the anterior sublinguals; the 6th much the largest, twice as broad as the posterior sublinguals, and in contact with three scales behind. *Costals.*—Two heads-lengths after the head 17, midbody 17, two heads-lengths before the vent 15. The reduction from 17 to 15 which occurs well behind the middle of the body is due to an absorption of the 3rd row usually into the 4th, rarely into the 2nd above the ventrals. The vertebrals are not enlarged, and the ultimate row but little if at all. Keels absent; apical pits present, and single (see D. of diagram). *Ventrals.*—177 to 212, Trichinopoly 188 to 202, Cannanore 177 to 203, Burma 180 to 200 Fyzabad 193 to 208, Dibrugarh 197 to 210, E. Himalayas 197 to 212, (178 to 224 Boulenger); angulate laterally. *Anal.*—Divided usually (rarely entire). *Subcaudals.*—56 to 80 (Boulenger); divided. *Anomalies.*—Very rarely the loreal is subdivided into two, an anterior and a posterior. Commonly the præocular fails to meet the frontal. The postoculars and temporals are sometimes three. Not infrequently, the supralabials are abnormal in number, *viz.*, 8 or 10, and the 3rd, 4th, 5th and 6th may touch the eye, either two, three, or all four of them. Rarely the nasal fails to touch the 2nd supralabial. Not infrequently the anal is entire, and rarely some of the subcaudals at the base of the tail. I have lately seen one from Tindharia in which the first 3 were entire, and Flower mentions one from Penang with the 4th and 5th entire.

Freaks are apt to occur among all animals, but that rare condition known as axial bifurcation or dichotomy, which gives rise to dual heads developed forkwise on the same body has been recorded at least three times in this species. I wrote* of one such specimen in this Journal and two others are reported as being in the Indian Museum by Sclater†. *Dentition.*—The *maxilla* supports an anterior and a posterior series of teeth. The anterior set number 5, the first 3 progressively increasing in size ‡, the last 2 about twice the length of the 3rd. An arched toothless gap intervenes between the anterior and posterior sets. The posterior set numbers 10 or 12, the last 2 are about twice the size of the preceding 8 or 10 which are subequal in size.

The *palato-pterygoid* array form an uninterrupted series of which the palatine numbering 11 to 13 are rather longer, the pterygoid numbering as many as 29 progressively and very gradually diminish in length from before backwards.

In preparing a skull the minute teeth at the back are very difficult to preserve and dissect out intact, so that usually a number considerably less than 29 are evident.

Mandibular.—Consist of two series, an anterior and a posterior, separated by a short gap. The anterior contains 5 teeth, the 3 first progressively increasing in length, the 4th and 5th equal and about twice as long as the 3rd. The posterior set numbers from 16 to 20.

These figures are given from an examination of 4 skulls lying before me.

Günther's§ statement that "Each maxilla is armed with two fangs in front, placed in a transverse line, the outer being much larger than the inner" is incorrect. The two fang-like teeth are subequal, and placed one behind the other. Similarly, the last *two* teeth in the posterior maxillary set are enlarged, not only the last as stated by him. Boulenger¶ says the maxillary teeth increase in size posteriorly which seems to imply a gradual increase. This does not clearly describe the condition. It is the last two teeth which are suddenly and distinctly enlarged.

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* Vol. XVI. p. 387.

† List. Snakes, Ind. Mus., 1891, p. 14.

‡ Only one is seen in my figure, the first two are not noticeable owing to the bending inwards of the maxilla.

§ Rept. Brit., Ind. 1864, p. 316. ¶ Cat., Vol. 1, p. 348.

Shaw's Wolf-Snake (*Lycodon striatus*).

Nomenclature—(*a*) *Scientific.*—The specific name *striatus* (Latin = striped) originated with Shaw in 1802. Russell had figured the snake prior to this in his work published in 1896.*

(*b*) *English.*—The English rendering of the specific title is not distinctive enough as it applies equally well to many others of the genus, so that I think "Shaw's Wolf-Snake" the most appropriate name for it.

(*c*) *Vernacular.*—The only names I know of are those given by Russell, *viz.*, Gajoo Tutta and Karetta the latter in Hyderabad, Deccan.

Dimensions.—The longest of 14 specimens measured of my own collection was 1 foot 3½ inches, and I know of no greater length.

Bodily configuration, etc.—Very similar to *aulicus*, the main difference being that the belly is not angulated on either side but evenly rounded from flank to flank. Boulenger calls the head of *aulicus* spatulate but not that of *striatus*. I cannot see much difference between the two, that of *aulicus* is perhaps rather flatter, and the snout more rounded. The eye is jet-black as in *aulicus*, the scales as glossy and the tips of the tongue white.

Colour.—Varying shades of dark-brown or black above with from 11 to 18 white cross bars on the body (not including tail) usually very distinct in the whole body length, the anterior ones specially so. The anterior ones again are more widely separated than the posterior. These bars are divided more or less distinctly at the sides to include a somewhat deltoid patch of the ground colour, very nicely shown in our plate. The belly is pearly-white, and unspotted. The head is brown or black above except the upper lip which with the lower lip, and chin is pearly-white. Most of the specimens I have seen have been a deep chocolate or pure black, and the cross bars pure white. Many writers, however, say that the bars or bands are yellow at any rate sometimes. Colonel Light in a letter mentions one caught at Bhuj with bright yellow cross bands, and says several in that locality have yellow bands. He mentions another from the same locality with the bands white. Stoliczka speaks of one from the Lower Hills of Simla with 58 broadish-yellowish cross bands. I have never seen a specimen with anything approaching 58 bands which in itself suggests *aulicus* rather than *striatus*. The ventrals 182 and subcaudals 57 would equally

* Ind. Serp. I., Vol. I, Plates XVI and XXVI.

well agree with *aulicus*. Annandale* says that those from the Malakand are reported to have yellow marks. Green† mentions one from Peradeniya, Ceylon, with some of the median scales in the anterior white bands yellow, and Annandale* speaks of a similar specimen from Pamban in S. India ‡

In 5 Ceylon specimens collected in Peradeniya, I found the bands far less distinct than in Indian forms, the colour being dirty white, and the ground colour brown rather than black.

Identification.—The remarks on *aulicus* under this heading apply also here. Attention must be given to the following: (1) a single loreal touching the internasal, (2) scale rows 17 in midbody, (3) nasals touching the 1st and 2nd supralabials and (4) supralabials 7 or 8.

Haunts.—I have known this snake in the house, like its commoner ally *aulicus*, one in Fyzabad came into the Cantonment Hospital, and another was encountered in the Officers' Mess of the 85th K. S. L. I. Three or four were unearthed at different times during digging operations. It hides away during the day time in holes in the ground, heaps of debris, crevices of brickwork, stacks of wood, etc.

Disposition.—All the specimens I have seen alive exhibited a very timid disposition. I never knew one strike no matter what the provocation. Usually it made no endeavour to escape but coiled itself, and if touched or teased, hid its head beneath its coils, looking out cautiously from time to time to see if the danger apprehended had disappeared. It sometimes flattens itself to the ground in a remarkable way.

Habits.—Like the common wolf-snake it is decidedly nocturnal. I met with two at different times at night on the road between the Mess and my house at Berhampore (Orissa), and on both occasions there was no endeavour to retire from the situation, no attempt at

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* Mem Asiat Soc, Bengal, I. 10, p 194.

† Spol. Zeylan., March 1905, p. 2 5.

‡ I know that *aulicus* and *striatus* are frequently confused one with the other, and I have found several specimens in various museums incorrectly identified. If one refers to the abnormalities in scaling that I have remarked upon in the two species in this paper, it will be apparent how easily a mistake may arise, since the points made use of in the separation of the two species are subject to some variation. Moreover, a mistake, I not infrequently committed in days gone by, may occur with others. It is very easy to miscount the upper labials in the *Lycodons*, and to omit to count the last which is often not so evidently one of the series as one sees in other snakes. In all cases the mouth should be opened, and these shields then counted to the gape.

menace. Except the specimens encountered while digging nearly all were killed at night. It does not appear to share the acrobatic attainments of *aulicus*, at least I have never known one leave the ground.

Food.—Three of my specimens contained skinks in Fyzabad, of the species *Mabuia dissimilis*. I have no knowledge of its gastronomic tastes otherwise.

Breeding—All I know of this is from my notes in Fyzabad.

The Sexes.—On two occasions in August pairs were found in company. In a small heap of kunkur by the side of a road a gravid female was dislodged one evening, and a male dislodged the next morning when the heap was broken further into. On the other occasion two snakes were seen together (not united) a little way beneath the soil during digging operations. Several coolies vouched for this, one of the snakes escaped in the excitement their discovery aroused, the other the male was captured, and in the hole were 4 eggs. It is remarkable I think that the partnership had not been dissolved even after the deposition of the eggs. The male organs are beset with numerous minute claw-like appendages.

The length of a gravid female of mine was 1 foot and $\frac{1}{2}$ an inch. Mr. E. E. Green wrote to me some years ago of a gravid specimen which he identified as *aulicus* obtained by him at Peradeniya, Ceylon. I feel pretty certain that the specimen was not a Common Wolf-Snake, but Shaw's Wolf-Snake, for it was only 12 inches long, a length far more in keeping with what we know of *striatus*, and opposed to what we know of *aulicus*, the smallest gravid record of which is 1 foot $6\frac{1}{2}$ inches. Of specimens I have sexed 7 were ♂ and 4 ♀, the longest specimen 1 foot $3\frac{1}{2}$ inches being a female. The periods of gestation and incubation are not known.

Season.—Shaw's Wolf-Snake breeds at about the same season as the Common Wolf-Snake. I have known a gravid female with small eggs in July, one gravid with large eggs in August, and the deposited eggs alluded to above were found in August. Mr. Green's specimen was also gravid on the 30th August.

Eggs.—This species is not so prolific as *aulicus*, the eggs numbering from 2 to 4. They are very large for the size of the snake, and much elongate, I think, more so than those of *aulicus*. They vary from 1 to $1\frac{1}{5}$ inches in length, and are about $\frac{7}{20}$ of an inch in

breadth. Otherwise they are just like those of the common wolf-snake.

Distribution—(*a*) *Geographical.*—This species extends further West than the Common Wolf-Snake, but not nearly so far East, its limit in this direction being proximately the longitude of Calcutta. It occurs throughout Peninsular India and Ceylon. On the West it extends through Sind and the Punjab, Baluchistan, and Persia to Transcaspia.

(*b*) *Local.*—Appears to be chiefly a snake of the Plains, extending to low hills to about 2,000 feet.

(*c*) *Numerical.*—Though I think it has claims to be considered one of the common snakes of India, it is not nearly the common snake that its ally *aulicus* is. In Fyzabad I got 13 specimens out of a total of 704, but whether it is more plentiful there than in other parts, I cannot say. I saw 3 or 4 specimens in the few months I was stationed at Berhampore (Orissa).

Lepidosis. Rostral.—Touches 6 shields; the rostro-nasal suture longest *Internasals.*—Two, the suture between them $\frac{1}{2}$ to $\frac{2}{3}$ that between the præfrontal fellows, about equal to the internaso-præfrontal sutures. *Præfrontals.*—Two, the suture between them distinctly greater than the præfronto-frontal; touch the internasals, loreal, præocular, supraocular and frontal. *Frontal.*—Touches 6 shields, the supraocular sutures longest. *Supraoculars.*—$\frac{2}{3}$ the length, $\frac{1}{2}$ or less than $\frac{1}{3}$ the breadth of the frontal. *Nasals.*—Quite divided by the nostril: touch the 1st and 2nd supralabials. *Loreal.*—One, about as long as the nasals taken together; in contact with the internasals. *Præocular.*—One, not touching the frontal. *Postoculars.*—Two. *Temporals.*—Two anterior. *Supralabials.*—8 normally, the 3rd, 4th and 5th touching the eye. *Sublinguals.*—Two pairs, the posterior rather shorter and in contact with the 5th and 6th infralabials. *Infralabials.*—6; the 6th largest, twice or nearly twice as broad as the posterior sublinguals, in contact with 3 scales behind; the suture between the 1st about equal to that between the anterior sublinguals. *Costals.*—2 heads-lengths from head 17, midbody 17, 2 heads-lengths before vent 15; the reduction from 17 to 15 occurs well behind the middle of the body and is due to a confluence of the 3rd and 4th rows above the ventrals usually, sometimes the 4th and 5th; keels absent; apical pits present, single; the vertebral row not

enlarged; the ultimate not or barely enlarged. *Ventrals.*—Not angulate: 153 to 178 (Boulenger) one of my Fyzabad examples 179, one in the Indian Museum from Malakand 179, another from the Perso-Baluch Frontier 196. Stoliczka's specimen from below Simla with 182 I consider an *aulicus*. *Anal*—Divided. *Subcaudals*—Divided, 42 to 66 (Boulenger). In two Ceylon specimens I count 35 and 39. Russell's two specimens 40 and 41, the latter from Hyderabad Deccan.

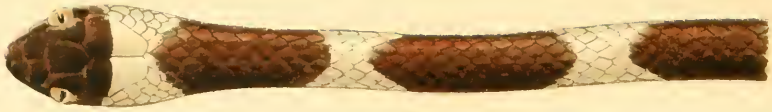
Anomalies.—In a specimen in the Indian Museum from Malakand the loreal is dual on both sides, the anterior small shield touching the internasal and make these shields appear as four. The nasals occasionally touch the 1st only of the supralabial series. The anterior temporal is rarely a single shield. The supralabials are rarely 7 with the 3rd and 4th touching the eye, 8 with the 4th and 5th touching the eye, or 9 with the 3rd, 4th and 5th touching the eye. I have found the anal entire in one Ceylon specimen, and in Russell's Plate (XXVI) this shield is shown entire.

Dentition.—Very similar to that of *aulicus*. *Maxilla.*—This supports an anterior and a posterior set separated by a considerable edentulous interval. The anterior has 2 (3?) progressively increasing teeth, followed by two large subequal teeth as in *aulicus*. The posterior set has 4 subequal small teeth followed by two large subequal ones.

Palato-pterygoid.—The palatine bone supports 11 teeth, the pterygoid I cannot give, believing my only skull to be imperfect. Both sets are small and subequal. *Mandibular.*—Anteriorly 3 progressively increasing small teeth followed by two subequal large ones, then a short gap sufficient to accommodate one tooth, followed by 13 small subequal teeth.

In this species the *maxilla* is distinctly shorter than in *aulicus*, supporting 4 small teeth in the posterior set instead of 8 to 10. The two enlarged posterior teeth are situated beneath the middle of the eye, and at a point well in advance of the optic foramen in the cleaned skull. In *aulicus* these two large teeth are exactly opposite the optic foramen, and beneath the back of the eye. In the mandible there are fewer teeth (13) than in *aulicus* (16 to 20.)

(*To be continued*).



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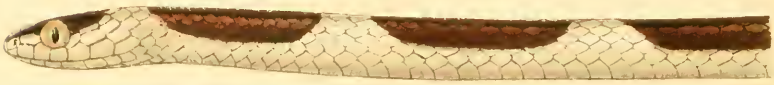

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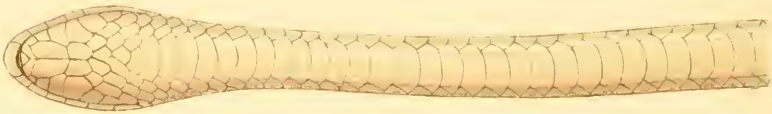

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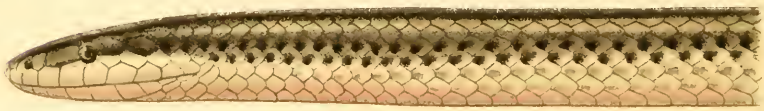

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J G del J.Green,Chromo

THE COMMON INDIAN SNAKES.(Wall).

1,2,3. Hydrophobus nympha, *harmless*. X 1.

4,5,6. Xenopeltis unicolor. *harmless*. X 1.

ERRATA.

Vol. XIX, page 130, for "*Andrena punjabensis*" read "*Andrena argada.*"

„ 133, line 18, for "*M. albibrons*" read "*M. albifrons.*"

„ 191, for "*Capra falconeri megaceros*" read "*Capra falconeri jerdoni.*"

„ 257, line 7, for "(*C. frugilens*)" read "(*C. frugileus*)."

JOURNAL
OF THE
BOMBAY
Natural History Society.

Vol. XIX. BOMBAY. No. 2.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

ILLUSTRATED BY COLOURED PLATES AND DIAGRAMS.

BY

MAJOR F. WALL, I.M.S., C.M.Z.S.

Part X with Plate X and Diagram 1.

(*Continued from page* 106 *of this Volume.*)

THE BRIDAL SNAKE (*DRYOCALAMUS NYMPHA*).

Synonym, *Hydrophobus nympha.*

Nomenclature. (*a*) *Scientific.*—The generic name from the Greek δρυς a tree and καλαμος a reed, was first applied in 1858 by Günther to one of the species known from the Malayan Archipelago, *viz.*, *tristrigatus.* *Nympha* introduced by Daudin in 1803, is from the Greek νύμφη a bride, probably owing to the light coloured heads of the two specimens figured by Russell* in his first volume suggesting to his mind the nuptial veil worn by a bride.

(*b*) *English.*—The Bridal snake suggests itself to me as appropriate.

(*c*) *Vernacular.*—The only name I can find is that used by Russell, *viz.*, "Katla vyrien."

Dimensions.—I have seen two specimens measuring 1 foot 8 inches and this is the greatest length known to me.

* Ind. Serp. Plates XXXVI and XXXVII.

Bodily configuration.—The body is cylindrical, slender for its length, and very uniform in girth throughout, perhaps suggesting the form of a reed used in the generic title. The head is moderately flattened, the snout moderately rounded, and the neck evident. The eye is rather large and the iris colourless, so that during life the shape of the pupil which is vertical cannot be seen. The nostril is small. The tail is rather short, being about one-fifth the total length. The belly is strongly angulated on either side. The whole snake is smooth and glossy.

Colour.—Dark-brown or black above, fading somewhat posteriorly with from 35 to 50 conspicuous white or yellowish cross bars in the whole length of the snake. These are most conspicuous anteriorly where they involve 2 or 3 scales vertebrally and are more widely separated there than behind. Frequently they are not pure white or yellow, but sullied more or less with a brownish mottling or speckling. In the young they are usually yellow, and often but not always tend to grow whiter with age ; those shown in our Plate being remarkably white. The head in the young is yellow or suffused with yellow which tends to become more localized with age and form a more or less conspicuous band on the back of the head. The under parts are pearly-white, creamy, or yellowish throughout and unspotted. It is a very handsome and graceful little snake, the specimens marked with pure white as in our plate being remarkably attractive.

Identification.—(1) The scales are in 13 rows in midbody. (2) The præfrontal besides touching its fellow and the frontal is in contact with 5 (or 6) other shields, *viz.*, the internasal, postnasal, loreal, one or two præoculars and supraocular. (3) The loreal touches the eye. There can be no doubt of its identity if these points are sought for in the order above given and are found to co-exist.

Haunts.—My knowledge of the Bridal Snake, though very limited, points to haunts and habits closely akin to that of the Common Wolf-Snake. The first I encountered was in a house on the banks of the Chilka Lake. Sitting after dinner in a room on the ground floor I saw it moving beneath the chair of a friend. I ran for a stick and tried to kill it, believing it to be a young krait. Had the stick been a flexible cane I would probably have despatched it with the first blow, but I made several ineffectual attempts to strike it, the stick making an angle with the floor passing over it each time. The

reptile thoroughly scared added to my difficulty by its agile movements. When at length it was wounded I would not pronounce upon its identity by lamp light, the gloss on its scales making their detail uncertain, but I felt sure I had been dealing with a krait until the morning light showed me mistaken.

Disposition.—My knowledge of this species is so limited that I cannot speak of its disposition, habits, food or breeding. The smallest specimen I know of is one mentioned by Günther which was 6¼ inches (75 lines) and I should think probably a hatchling.

Distribution. (*a*) *Geographical.*—South India, Orissa, and Ceylon. All the British Museum specimens are from Ceylon and South India. Jerdon speaks of it from Madras, Ferguson from Travancore and I have had two specimens from Orissa (Rumbha and Berhampore), two from Trichinopoly, and one from Madras. The exact localities in Ceylon of the British Museum specimens except Trincomalee are not noted. Haly* says that 5 specimens in the Colombo Museum are from Jaffna, and Willey† only mentions Jaffna and Anuradapura. Ferguson‡ speaks of one from the South part of the Island without specifying further. This is in the British Museum now, *viz.*, specimen *T* of Boulenger's Catalogue (Vol. 1, p. 371).

(*b*) *Local.*—Appears to be chiefly a snake of the Plains, but there are British Museum specimens from the Nallymally, Balarangam, and Cuddapah Hills, altitudes not recorded.

(*c*) *Numerical.*—I would call it rather an uncommon snake in India, having only collected 5 specimens. Ferguson mentions but two specimens in the large collection at Travancore. Jerdon, however, says it is not rare at Madras.

Lepidosis. Rostral.—Touches 6 shields, the rostro-internasal sutures rather longer than the rostro-nasal. *Internasals.*—Two; the suture between them about three-fourths to equal to that between the præfrontal fellows, about half or less than half the internaso-præfrontal sutures. *Præfrontals.*—Two; the suture between them subequal to or rather greater than the præfronto-frontal; in contact with the internasal, postnasal, loreal, one or two præoculars, and supraocular. *Frontal.*—Touches 6 shields; the supraocular sutures longest, twice or nearly twice the parietals which are rather the smallest. *Supra-*

* First report, Snakes, Colombo, June 1886, p. 10.

† Spol. Zeylan, April 1906, p. 233. ‡ Rept. Fauna, Ceylon, 1877, p. 19.

oculars.—Length subequal to, breadth about half that of the frontal. *Nasals.*—More or less divided, or entire and simply perforated by the nostril; in contact with 1st and 2nd labials. *Loreal.*—Single, longer than the nasals, about twice as long as high, touching the eye. *Præocular.*—One, intervening between the loreal and the supraocular. *Postoculars.*—Two. *Temporals.*—Two. *Supralabials.*—7, the 3rd and 4th touching the eye. *Infralabials.*—5, the 5th largest, nearly twice as broad as the posterior sublinguals: in contact with 3 scales behind; the first meet to form a suture half or less than half that between the anterior sublinguals. *Sublinguals.*—Two pairs: the posterior two-thirds to three-fourths the length of the anterior; in contact with the 4th and 5th infralabials. *Costals.*—Two heads-lengths after head 13, midbody 13, two heads-lengths before the anus 13; vertebrals not enlarged, last row not or barely enlarged; not keeled; apical pits present, single. *Ventrals.*—200 to 243* (Boulenger); markedly angulate on each side. *Anal.*—Divided. *Subcaudals.*—65 to 88 (Boulenger), divided. *Anomalies.*—Rarely there are two præoculars. The supralabials are sometimes 6 or 8. In one of my specimens the 10th to the 14th subcaudals were entire.

Two other species of *Dryocalamus*, *viz.*, *gracilis* and *davisoni*, occur within Indian limits. The former should, I think, be noticed here being very like *nympha* in colouration and therefore likely to be confused with the krait. The latter is not like the krait, being striped in a longitudinal direction and is a Malayan snake which just enters our limits in Tenasserim. I shall therefore make no remarks upon it.

The Scarce Bridal Snake (*DRYOCALAMUS GRACILIS*).

Nomenclature. (*a*) *Scientific.*—The specific title (Latin = graceful) was given by Günther in 1864, in allusion to its graceful form. Like its ally *nympha* it is a very attractive little snake, striking in its dainty colouration and slender outline.

(*b*) *English.*—The Scarce Bridal Snake, would, I think, be a fitting designation.

(*c*) *Vernacular.*—It is too uncommon to have been christened in any native dialect.

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* There is a decided tendency for these shields to be more numerous in Indian than in Ceylon specimens. Thus in 6 Ceylon examples they range between 200 and 219, and in 19 Indian examples between 216 and 243.

Identification.—If the following points are sought for in the order herein given, there can be no mistake in recognising it. (1) The scales in the middle of the body are in 15 rows. (2) The præfrontal besides touching its fellow and the frontal meets 5 other shields, *viz.*, the internasal, postnasal, loreal, præocular, and supraocular. (3) The loreal touches the eye. (See outline figure Diagram.)

It is a much more uncommon snake than *nympha*, there being but two examples in the British Museum both of which I have examined. I collected two others at Berhampore in Orissa, and have seen a fifth in the Indian Museum which was referred by Sclater to its ally *davisoni*. This is recorded doubtfully from False Island, Arrakan, a most unlikely locality for it to have been collected in. The British Museum specimens are from the Anamallay and Cuddapah Hills. The only other specimens I know of are two recorded from Ceylon by Haly,* one of which he described as a distinct species under the title *fergusonii*. One of my specimens fell from a verandah roof one evening after dinner into the middle of a family circle. It was captured and sent to me, and at first sight I took it to be a young krait. The longest specimen I know of is one of mine which was 1 foot $11\frac{7}{8}$ inches.

Lepidosis. Rostral.—Touches 6 shields, the rostro-internasal sutures rather longer than the rostro-nasal. *Internasals.*—Two ; the suture between them from three-fourths to equal to that between the præfrontal fellows, equal to or rather less than the internaso-præfrontal sutures. *Præfrontals.*—Two ; the suture between them three-fourths to equal to the præfronto-frontal, in contact with the internasal, postnasal, loreal, præocular and supraocular. *Frontal.*—Touches 6 shields, the supraocular sutures longest, nearly or quite twice the fronto-parietals. *Supraoculars.*—Length subequal to, breadth about half that of the frontal. *Nasals.*—More or less divided, in contact with the 1st and 2nd supralabials. *Loreal.*—One, rather longer than the nasals, twice as long as high ; touches the eye. *Præocular.*—One. *Postoculars.*—Two. *Temporals.*—Two. *Supralabials*— 7 ; the 3rd and 4th touching the eye. *Infralabials.*— 5, the 5th largest, and in contact with 2 or 3 scales behind. The suture between the first about half that between the anterior sublinguals. *Sublinguals.*—Two pairs ; the posterior rather shorter than the anterior, in contact with

* Taprobanian III, 1886, p. 51.

the 4th and 5th infralabials. *Costals.*—Two heads-lengths behind the head 15, midbody 15, two heads-lengths before the anus 15; the vertebrals not enlarged; ultimate row not or barely enlarged; no keels; apical pits present, single. *Ventrals.*—199 to 243, angulate laterally. *Anal.*—Entire. *Subcaudals.*—75 to 87; divided.

Anomalies.—The specimen in the Indian Museum above referred to has the anal divided. The costals vary in individuals. The Anamallay specimen in the British Museum has 13 scale rows for a considerable distance anteriorly, and the Cuddapah Hills specimen in the same Institution 13 for some distance anteriorly and posteriorly. Where the rows are 13 that next to the vertebral is unusually large owing to a confluence of two rows. When the rows reduce again from 15 to 13, the row next to the vertebral coalesces with that below.

The Iridescent Earth Snake (Xenopeltis Unicolor).

Nomenclature. (*a*) *Scientific.*—The name of the genus was introduced by Reinwardt in 1827, and is from the Greek ξένος strange, πέλτη a shield, in allusion to the unusual disposition, and number of the shields on the top of the head, many of which are quite peculiar to this snake. The specific name was also given by Reinwardt and refers to the uniform dorsal colouration.

(*b*) *English.*—The Iridescent Earth-Snake is the best name for it, the beautiful play of colours seen in the dorsal black on reflected light calling for special remark.

(*c*) *Vernacular.*—I know of none.

Dimensions.—It grows to four feet. A specimen which Evans and I collected in Rangoon measured 3 feet 5½ inches, and Colonel Evans has had one 4 feet 1 inch long.

Bodily configuration, etc.—The body is of remarkably uniform girth in its whole length, and broader in its lateral diameter than in the ventro-vertebral. The head is spatulate, the snout broadly rounded, and the head merges into the body without indication of a neck. The eye is remarkably small and the iris very dark so that the pupil is with difficulty discerned in life. When scrutinised closely the iris is seen to be dark-brown in colour, and the pupil vertically elliptical. The nostril is small, the tail is decidedly short, measuring from about one-tenth to one-eleventh the total length of the snake. The whole snake exhibits an unusually high polish to its scales.

Colouration.—One of the most remarkable characters of this snake which is remarkable in so many ways, is the brilliancy of the iridescence seen on its scales when the light is allowed to glance on them. Flower * thus remarks upon it: "The iridescent colours of this snake are most beautiful, and wonderful. As it crawls along, the curves of its body flash brilliant lights of emerald-green, copper, blood-red, purple and electric-blue, while the actual colour is a very dark rich coffee-brown." The specimens I collected in Burma were black or blue-black rather than brown. The last three costal rows are more or less heavily margined with whitish, the last often uniform whitish. The young are coloured similarly except that they have a yellowish or whitish head, or collar, but no indication of either remains during adult life. Reinwardt thought that these white-headed specimens constituted a distinct species to which he assigned the name *leucocephalus*. The upper lip and underparts are whitish (Flower says pale yellow) with sometimes slatish streaks. The tail is streaked or mottled beneath.

Identification.—The shields are so peculiar in this snake, that one might mention several conditions which are unique, or nearly so, by which identification is certain and easy. Perhaps the easiest way to recognise it is by noticing that the frontal touches 9 other shields. Another method is by the fact that the rostral touches 4 shields, *viz.*, the internasals, and first labials only. In all other snakes where it touches 4 shields only these are the nasals, and first labials. Again excepting two vipers, *viz.*, *Eristocophis mcmahoni* and *Pseudocerastes persicus* (both of which have only small scales on the top of the head), it is the only snake within Indian limits in which the nasal does not touch the rostral. Again it is the only snake in which the 3rd labial touches the nasal and not the eye.

Haunts.—As its English name implies it is a burrowing snake, living entirely beneath the soil. It is rarely seen above the surface except when following up its quarry or under accidental circumstances. One captured in the upstairs verandah of the General Hospital in Rangoon had probably been conveyed there in the earth of one of the pot plants.

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* P. Z. S., 1899, p. 657.

Disposition.—I have had very little experience of it in life, but it is obviously a plucky and vicious reptile from an incident recorded by Theobald* who says : "The following illustrates its ferocious nature. I once remarked a *Ptyas* (= *Zamenis*) *mucosus* some five feet in length, in the hedge of the Circuit House of Bassein. On running downstairs, the snake had vanished, but in searching I saw its tail sticking out of a hole beneath a wooden plant-case. Do what I might I could not drag it out, as it seemed held fast within. I therefore with some trouble overturned the plant-case, and then saw that the unlucky *Ptyas* was firmly pinned by a large *Xenopeltis* into whose hole it had unwittingly entered. The *Xenopeltis* seemed about four feet in length, but on perceiving itself uncovered, released its hold of the *Ptyas*, and made its escape." Flower says : "A young snake of this species that I kept alive was fairly quiet from the first, and after one day's captivity never attempted to bite when handled. An adult specimen when excited would twist itself into an irregular pile of tight coils, except the tail, which was held on one side, raised from the ground, and the tip kept vibrating at a great speed." Colonel G. H. Evans tells me of one that flattened itself, drew back, and several times snapped at a stick advanced towards it.

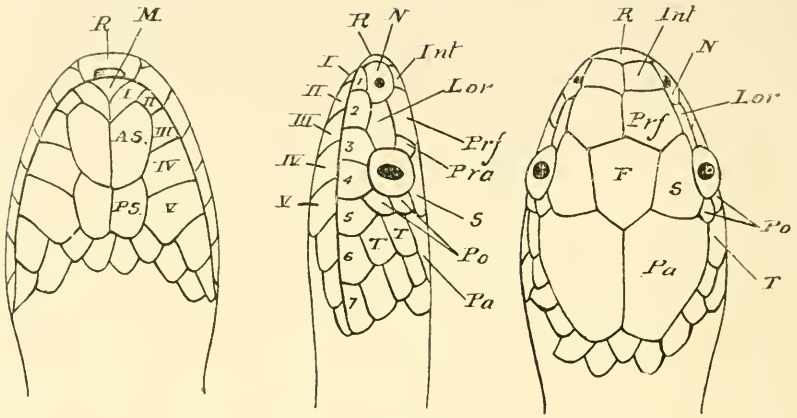
Habits.—The Iridescent Earth Snake is said to be nocturnal in habit. Whether this is strictly speaking true I am not certain. Under cover of subterranean darkness it appears to be very alert during the day judging from the hasty and determined way the one, mentioned by Theobald, attacked and secured its Dhaman intruder. On one occasion in Rangoon one was sent to me in the act of devouring a snake during the day time. The one found in the General Hospital verandah in Rangoon was seen abroad in daylight.

Most of my specimens were met with in the months of July, August and September.

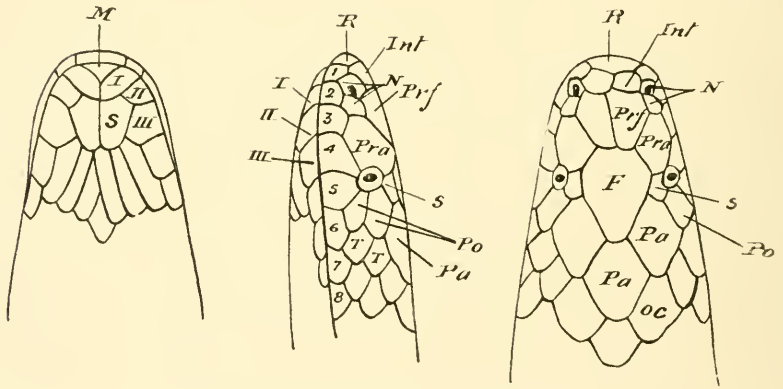
Food.—One in Rangoon had eaten a rat, another a mouse, and a third was eating a snake, the buff striped keel back (*Tropidonotus stolatus*). Günther† says it feeds on small mammals which it hunts for in their subterranean holes. Colonel G. H. Evans tells me the

* Cat. Rept. Brit. Burma, 1868, p. 37.

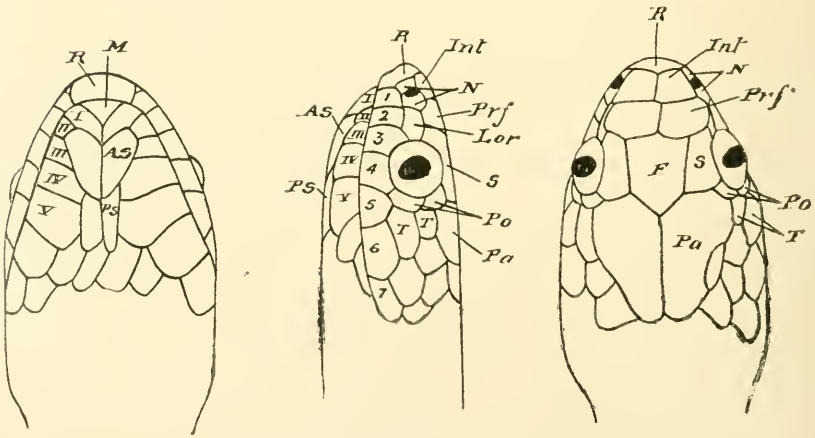
† Rept. Brit. Ind., 1864, p. 181.



DRYOCALAMUS NYMPHA (× 2).



XENOPELTIS UNICOLOR (Nat. size).



DRYOCALAMUS GRACILIS (× 2½).

large specimen referred to above had eaten two fair-sized rats, and he has found a field rat taken on another occasion.

Breeding.—I know nothing of this, and can find no allusion to the subject.

Distribution. (*a*) *Geographical.*—Burma, Indo-China, Malay Peninsula and Archipelago.

It is only found in the lower part of the Burmese Province, probably not above the 20th parallel if indeed it reaches as far North as this. In Indo-China it is only recorded from the South. In the Malayan Peninsula it extends from Sumatra to Celebes.

I do not credit South India as part of its habitat, the authority for which rests on a single example from Trichinopoly now in the Indian Museum. If the specimen came from there at all, I feel confident it had been imported.

(*b*) *Local.*—It is a snake of the Plains and in Lower Burma is quite one of the common species to be met with, about Cantonments and the precincts of men as well as further afield.

Lepidosis. Rostral.—Touches four shields only, *viz.*, the internasals and first labials. *Internasals.*—Two, the suture between them about one-third that between the præfrontal fellows, one-half or less than half the internaso-præfrontal sutures. *Præfrontals.*—Two, the suture between them twice or more than twice the præfronto-frontal suture ; in contact with the internasal, nasal, præocular, and frontal. *Frontal.*—Touches 9 shields, the sutures with the lateral parietals longest, the præocular sutures are longer than the supraocular (another unique character). *Supraoculars.*—About one-third as long, and one-fourth as broad as the frontal. *Parietals.*—Three, a median posterior separating two lateral shields. *Occipitals.*—Two, placed behind the lateral parietals ; not in contact. *Nasals.*—Two, the nostril is quite contained in the anterior, and involves about the median two-fourths of the suture between ; not in contact with the rostral ; touches the 1st, 2nd and 3rd labials. *Loreal.*—Absent. *Præocular.*—One large, extensively in contact with the frontal. *Postoculars.*—Two, the upper larger ; almost unique in being as large or larger than the temporals. *Temporals.*—Two. *Supralabials.*—8, the 1st meets the internasal in front of the nasals, the 4th and 5th touch the eye. *Infralabials.*—8, the 3rd largest and in contact with two scales behind. *Sublinguals.*—One pair. *Costals.*—Two heads-lengths behind the head 15, midbody 15 ; two

heads-lengths before anus 15 : vertebrals not enlarged : last row slightly if at all enlarged ; keels absent everywhere ; apical pits absent. *Ventrals.*—175 to 190 (in my Burmese specimens), 180 to 196 (Flower gives for specimens from Siam), 166 to 193 (Boulenger) : not very broad, being but twice the breadth of the last costal row and at least two of the last costal rows are visible on each side when the snake is laid over on its back. *Anal.*—Divided. *Subcaudals.*—The 1st or 2nd entire followed by from 24 to 31 paired shields.

Anomalies.—The postocular is single in some specimens.

Dentition.—The *præmaxilla* carries 10 small teeth, 5 on each side.

The *maxilla* supports about 38 small subequal teeth.

The *palato-pterygoid* array are largest in the middle—where they are larger and stronger than all the teeth in the other jaws—and diminish in size before and behind. The palatine number 11 to 13, the pterygoid 12, the latter set occupying about three-fourths the length of jaw that the former does.

The *mandibular* number 32 to 33, and are rather smallest anteriorly and posteriorly. This bone demands special remark from the fact that about two-thirds of the posterior part of the dentary bone (*i. e.*, that part supporting the teeth) is not articulated with the articular bone, but is loose. I believe this peculiarity, at any rate to a proximate degree, is not to be seen in any of the Indian Snakes except the genus *Polyodontophis*.

In Plate VIII of this series we figured some of the kraits which have been confused with one another in the past, and in Plates IX and X we have shown some of the harmless snakes that have been confused with the common krait *B. cæruleus*.

I think the first point that will strike many of the readers of these articles is that snakes, which appear so different with regard to their colour and markings, should be mistaken for one another at all, yet the fact remains that all of the harmless snakes we have dealt with have been wrongly considered kraits by many, and too in some cases not only by people little acquainted with ophiology, but by those in the care of Museum collections, who have specimens at hand with which to compare a doubtful snake. In several Museums I have found specimens of *Lycodons* placed with specimens of *Bungarus* and *vice versa*.

The snake which bears the most marked superficial resemblance to the krait is *Lycodon striatus*. Nearly all the specimens I have seen have been black or blackish, not brown as shown in our plate (IX, fig. 4). Its resemblance to a young krait (*B. cæruleus*) is very remarkable. The dimensions of an adult are about the same as a krait in its first year, both are black, and both have very conspicuous white cross bars. It will be remembered that I remarked upon the conspicuousness of the white bars in the young krait anteriorly, although in the adult they are usually obscure or completely absent in front. Both have the lips, and underparts completely white. In both the eye is a black jet-like bead in which the pupil cannot be discerned. In both the beautiful gloss on the scales claims special attention. Both are extremely likely to be met with inside habitations, and especially at night. On the other hand if one comes to notice scale characters it will be seen how very different the two snakes are, so different indeed that attention to one or two of the many differences can admit of no confusion between them. Thus the enlarged vertebrals of the krait are absent in the *Lycodon* and the subcaudals which are entire in the krait are divided in the *Lycodon*. Besides this the scale rows are 15 in the whole body length of the krait and have no apical pits, the anal shield is always entire, there is no loreal, there is only one temporal, there are but 4 infralabials, added to which the pupil is round. In *L. striatus* on the other hand the scales are 17 in the anterior and mid parts of the body, 15 behind, have single apical pits, the anal is usually divided, a loreal is always present, there are two temporals, 6 infralabials, and the pupil is vertical.

In the two *Dryocalami* dealt with the resemblances to the krait affect the same features detailed under *Lycodon striatus* which are those which most readily catch the eye.

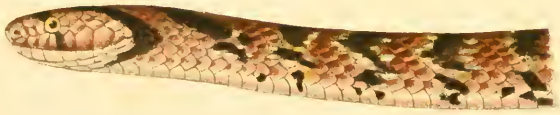
By lamp light I have been deceived as to their identity taking both species at first sight for the krait. The differences in lepidosis between them and the krait are the same as those detailed under *Lycodon striatus*.

It is always a matter of surprise to me that the common variety of the Common Wolf-Snake can be mistaken for the krait. I see very little if any resemblance between the two, still nearly every specimen sent in to me is sent in as a krait. On two or three occasions, however, I have seen a resemblance between the dark variety

(*oligozonatus*) and the krait so striking that I have been very much on my guard in handling it. Once grasped, and its movements controlled all doubts are set at rest at a glance. The resemblances, and differences affect the very points detailed under *Lycodon striatus.*

The Iridescent Earth-snake only resembles the krait (*B. cæruleus*) in being a glossy black. It should never be confused with this snake though for the black is uniform. There might be some justification for its confusion with the black kraits (*lividus* and *niger*), but it only occurs in a geographical area quite distinct from that of these two kraits which are only known from the Brahmaputra Basin, and the low hills in and around it. The absence of enlarged vertebrals, and the divided condition of the subcaudal shields are each sufficient to negative confusion with any krait.

(*To be continued*).



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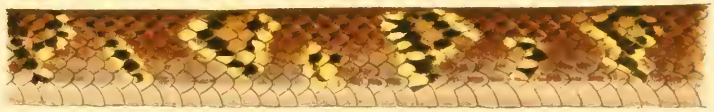

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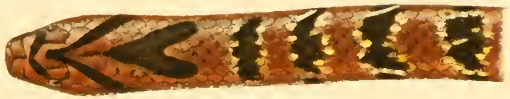

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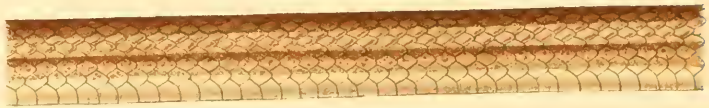
2a



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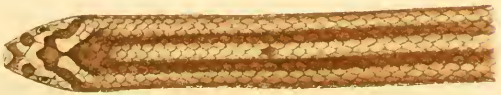

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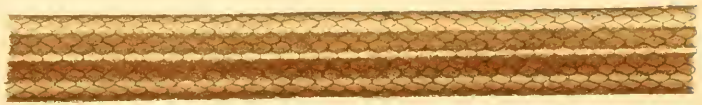


2d

J.G del

THE COMMON INDIAN SNAKES. (Wall).

Oligodon subgriseus, *harmless. nat. size*

J Green Chromo

JOURNAL
OF THE
BOMBAY
Natural History Society.

Vol. XIX. BOMBAY. No. 3.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plates and Diagrams.

BY

Major F. Wall, I.M.S., C.M.Z.S.

Part XI with Plate XI and Diagram and Map.

(Continued from page 299 of this Volume.)

The genus *Oligodon* as regarded by Mr. Boulenger in 1894* comprised 18 species, 17 of which were known to inhabit Southern Asia from Baluchistan in the West to the Philippines in the East; the one exception being an Egyptian snake. Since this date Mr. Boulenger has described two new species, *viz.*, *erythrogaster* from Nepal,† and *herberti* from Mogok in Upper Burma,‡ and given his authority for the inclusion in this genus of the Andaman snake *woodmasoni*§ which he had previously regarded as a *Simotes*.

I have also added three new species, *viz.*, *mcdougalli*¶ from Sandoway, Burma, *melaneus*‖ from Tindharia in the Eastern Himalayas and *erythrorhachis* from Nanwang, Assam, the description of which will

* Catalogue, Vol. II, p. 233. † Records, Ind. Mus., Vol. I, Part. III, 1907.
‡ Bomb. Nat. Hist. Jourl., XVI, p. 235. § Annandale, J. A. S., Bengal, 1905, p. 173.
¶ Bomb. Nat. Hist. Jourl., XVI, p. 251. ‖ Bomb. Nat. Hist. Jourl., Vol. XIX., p. 349.

appear shortly in this journal. The genus therefore as now constructed includes 24 species. It is very closely allied to the genus *Simotes* in fact it remains to be seen whether there is a natural division between the two genera, and if so again whether some of the species as now arranged have not been intermixed.*

THE VARIEGATED KUKRI SNAKE.

OLIGODON SUBGRISEUS (Duméril et Bibron).

History.—There is little if any doubt but that the earliest specimen of *subgriseus* of which we have any record is that collected at Vizagapatam and figured by Russell† 113 years ago, under the vernacular name "wanapa pam." scientific nomenclature in those days not having come into use. It is possible too that the snake from Canara alluded to by Jerdon as *Xenodon dubium* in 1853‡ was this species, as he says the scales were in 15 rows, but he gives no description of it so that his name has been ignored. I cannot however see cause for dismissing the name *tæniolata*§ applied by the same author to this snake in 1853 in favour of Duméril and Bibron's name *subgriseus* in 1854.¶

Nomenclature (*a*) *Scientific.*—The generic name (from the Greek ὀλίγος few, and ὀδους tooth) was given by Boie to a Javan snake (*O. bitorquatus*) in 1827 on account of the paucity of its teeth compared with other ophidians. The specific title is from the Latin "sub" beneath, and "griseus" grey, the original specimen being this hue on the belly, a circumstance due, I think, to the preservative since it is white in life.

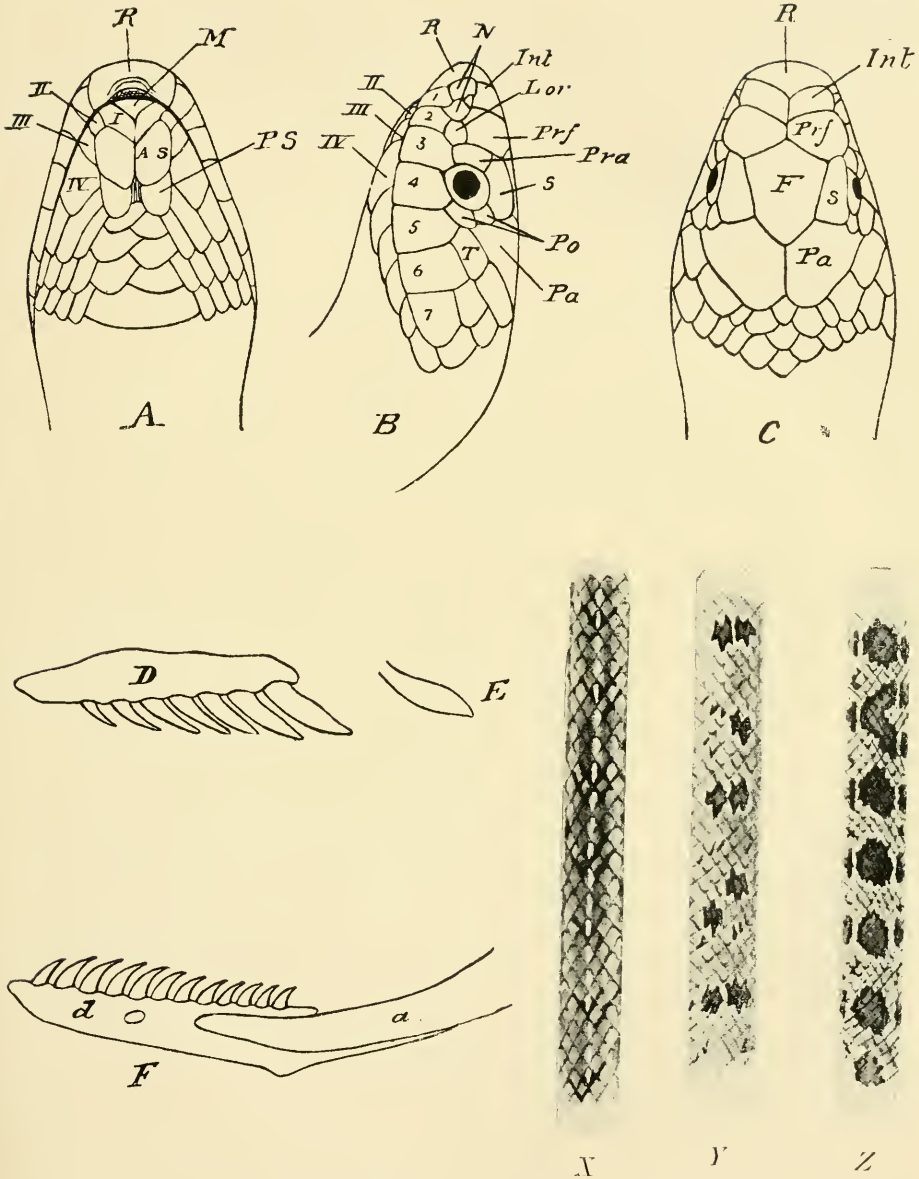
English. (*b*)—The Variegated Kukri Snake. The name kukri snake suggests itself to me as appropriate to the species of the genera *Oligodon*

* My doubts are the outcome of a study of the skulls of 5 species of these genera in my collection. Günther (Rept. Brit. Ind., p. 205) divided the genera on the palatine teeth including as *Simotes* all those species in which these teeth were present, and reserving the name *Oligodon* for those in which they were absent. Boulenger (Cat., pp. 215 and 233) finding that species which he considered *Oligodon* on other grounds possessed two or three palatine teeth, divided the genera on the presence or absence of the pterygoid teeth, conceding the name *Simotes* to the former, and *Oligodon* to the latter, and supplemented this arrangement by the number of the maxillary teeth, 6 to 8 being present in *Oligodon* and 8 to 12 in *Simotes*. As a matter of fact neither arrangement is tenable as both palatine and pterygoid teeth are present in two out of three of the species in my collection which Mr. Boulenger considers *Oligodon*, viz., *subgriseus*, and *venustus*. In the third case (*dorsalis*) their absence is doubtful.

† Ind. Serp., Vol. I, Plate XIX. ‡ J. A. S., Bengal, XXII, p. 528.

§ J. A. S., Bengal, XXII, p. 528 (not to be confused with the *Coronella tæniolata* of Boettger which is the *Rhadinea undulata* of Brazil under present day nomenclature).

¶ VII., p. 59.



OLIGODON SUBGRISEUS.

A, B, C.—Head shields (× 3).

D.—Maxilla.

E.—Outline of blade of kukri.

F.—Dentary (*d*) and part of articular (*a*) bones of mandible (much enlarged).

X, Y, Z.—Colour varieties

and *Simotes*, because the hindmost maxillary teeth are remarkably flattened (compressed) and their outline and blade-like character remind one forcibly of a goorkhas kukri. (See Figs. D and E of Diagram.)

(*c*) *Vernacular.*—According to Russell "wanapa pam" is the name applied to it by the natives about Vizagapatam. In Cannanore I heard it called "choorta" a term under which *Lycodon aulicus* is also confused.

Dimensions.—Adults are usually from 15 to 18 inches in length. The longest I know of is 1 foot 9¼ inches from Hyderabad (Sind).

General characters.—It is rather slender, and graceful in form and noticeable in possessing no indication of a neck. The girth is wonderfully uniform in the whole body length, the trunk round in section and smooth. The head is short, the muzzle truncate, and the eye small with a golden iris, and round pupil. The tail is short accounting for about one-seventh of the total length of the snake.

Identification.—It is the only snake to be found in the Plains of the Indian Peninsula in which the scale rows are 15 in the whole body length, and the anal shield divided with three possible exceptions. In Sind *Contia walteri* has been recorded a snake in which the subcaudals number from 73 to 82; in *subgriseus* they vary from 38 to 56. In the Himalayas from Simla to Darjeeling *Ablabes rappi* occurs, a mountain form which might straggle towards the adjacent Plains. This snake has only 6 supralabials, but *subgriseus* has 7. In Southern India *O. ellioti* may be confounded with it, but in possessing less than 31 subcaudals can be at once distinguished. Farther it is highly probable that this rare snake is a mountain form. It is only known from two specimens, the exact habitat in both instances not being on record.

In Ceylon it may be confused with its allies *O. sublineatus*, and *O. templetoni*. In both these species however the subcaudals number less than 35.

Colour and markings.—Like many of the other snakes I have dealt with in these papers, *O. subgriseus* presents considerable differences in its colour and markings. Of the various forms I think four deserve special mention but the fact that the first three of these are completely connected shows they are all merely variations of a single variety. The fourth form is, I think, probably a distinct species as

Günther originally believed it, however I prefer for the present to leave it as placed by Boulenger.

Variety A.—Body striped longitudinally. The belly unspotted.

Subvariety (*a*).—Striped longitudinally with no variegation, and few and obscure, or no cross-bars. (Fig. 2 of our Plate.)

Subvariety (*b*).—More or less variegated with short, oblique, lighter and darker streaks, which tend to arrange themselves into cross-bars. More or less distinctly striped longitudinally. (Fig. X of Diagram.)

Subvariety (*c*).—Like the last but with twin roundish spots placed side by side on the back. (Fig. Y of Diagram, and Fig. 1 of Plate.)

Variety B.—With a median dorsal series of roundish spots. No longitudinal stripes. Belly spotted near the edge of most of the ventrals. (Fig. Z of Diagram.)

Subvariety (*a*).—We have shown a good example in figure 2 of our plate. The ground colour is buff, and four more or less obvious pale brownish stripes pass down the body. The two upper and broader pass from the nape where they are confluent to the tail tip. On the body they involve the edge of the vertebral, and the two and a half adjoining rows. The lower and narrower stripes pass from the neck to the vent, and are placed on the contiguous halves of the 2nd and 3rd rows above the ventrals. The pale vertebral line is continuous, and confined to the middle of the vertebral row except anteriorly where it expands to the margins of the uppermost costal row. In many of these specimens, and perhaps in all an indication of the cross-bars typical of the next form may be seen if looked for in the anterior part of the body. The belly is pearly-white and unspotted. The head is marked with 3 dark chevrons: of these the anterior passes across the præfrontals, and reappears beneath the eye, the median has its apex on the frontal shield, and its limbs pass obliquely backwards to the gape, frequently blending with the posterior, which is the broadest and situated on the nape, its apex extending forwards to the parietals. These chevrons are usually complete, and discrete but may be more or less incomplete, or confluent. A dark streak (omitted by our artist) is always present on the 6th, or between the 6th and 7th supralabials, and there is frequently a streak in the suture between the 1st and 2nd supralabials. This form appears uncommon, and I only know of it from Ceylon.

Subvariety (*b*).—*Forma Typica*. This is the *tæniolata* of Jerdon

and is well figured by Russell.* It is the variety A of Boulenger. The ground colour is buff, pale brown, cedar-brown, or more rarely a light dun. There is a conspicuous variegation caused by lighter and darker streaks on the anterior-inferior margins of some of the scales. The darker streaks show a marked tendency to congregate at intervals and arrange themselves into cross-bars, which are usually narrowly outlined with buff. These cross-bars narrow or actually break up in the flanks, and are often rather ill-defined. In many specimens an intermediate series of a less distinct character alternate with them. If looked for longitudinal stripes similar to those in subvariety (*a*) are, I think, always apparent, though often obscure, and the vertebral streak is often interrupted. The belly is unspotted, and the head marks as in subvariety (*a*). It is much the commonest form, and the most widely distributed. Russell's specimen was from Vizagapatam,* and Jerdon recorded it from Madras.* Blanford obtained it in Ellore and Ajmere†. In our Society's collection there are specimens from Bombay, Deolali, Karwar, Khandala, Khandesh, and Goa Ghats. I have lately seen a specimen in the Indian Museum from Dhikala (Garhwal District) and have acquired specimens myself from Delhi, Cannanore, Madras, Trichinopoly, Tuticorin, Vizianagram, Hyderabad (Sind), Dehra Dun and Shembaganur. In the British Museum it is recorded from the Anamallays.‡

Subvariety (*c*).—Figure 1 of our Plate. This is the *dubium* of Jerdon and the *spilonotus* of Günther.§ This form is very similar to the last but the cross-bars are modified to form two or four more or less confluent or completely detached roundish spots, the median of which are larger, and better defined, the lateral often being ill-defined or irregular in form. These marks remind one forcibly of a similar ornamentation seen in *O. venustus*, *Simotes splendidus* (Günther) and *S. albocinctus* variety *juglandifer* (Wall). Longitudinal stripes as in the previous forms are usually apparent if looked for. The vertebral streak is often more or less interrupted. The belly is unspotted, and the head marks are as in form (*a*). Jerdon's specimen was from Canara.

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* Loc cit. † J. A S., Bengal, XLVIII, pp. 114 and 125.

‡ Günther, Rept. Brit. Ind., 1864, p. 207 and Plate XIX, fig. F.

§ But not the *binotatus* of Dumeril and Bibron as erroneously supposed by Boulenger (Cat., Vol. II., p. 243) This last is without doubt synonymous with *Simotes venustus* having, it is stated, 17 scale rows.

I have had it from Matheran and there are specimens in our Society's collection from Bombay and Satara.

Our coloured figures are taken from a specimen which does not show the arrangement of the dorsal marks in their most typical form, though the tendency to division in the cross-bars is obvious. Figure 1*b* is most misleading in the arrangement of its spots which are obviously from a very unusual specimen. It is to be regretted too that the longitudinal striping which Mr. Gerhardt showed so nicely in his original sketch has not been reproduced by our London artist, thus detracting from the latter's good work Fig. Y of our diagram is very typical.

Variety D.—Boulenger's variety B.* The *fasciatus* of Günther. The ground colour is buff or pale yellowish-brown. A median series of largish, well-defined, round spots passes down the back, some of the anterior ones being often divided. Outside these are irregularly shaped, ill-defined, smaller, dark marks. There are no longitudinal stripes down the body, and any variegation noticeable is confined to the flanks. There are spots near the edge of most of the ventrals on each side. The head marks are as in the foregoing. The specimens recorded by Günther are from the Deccan and Matheran. Others have been recorded from Bombay† and Poona‡.

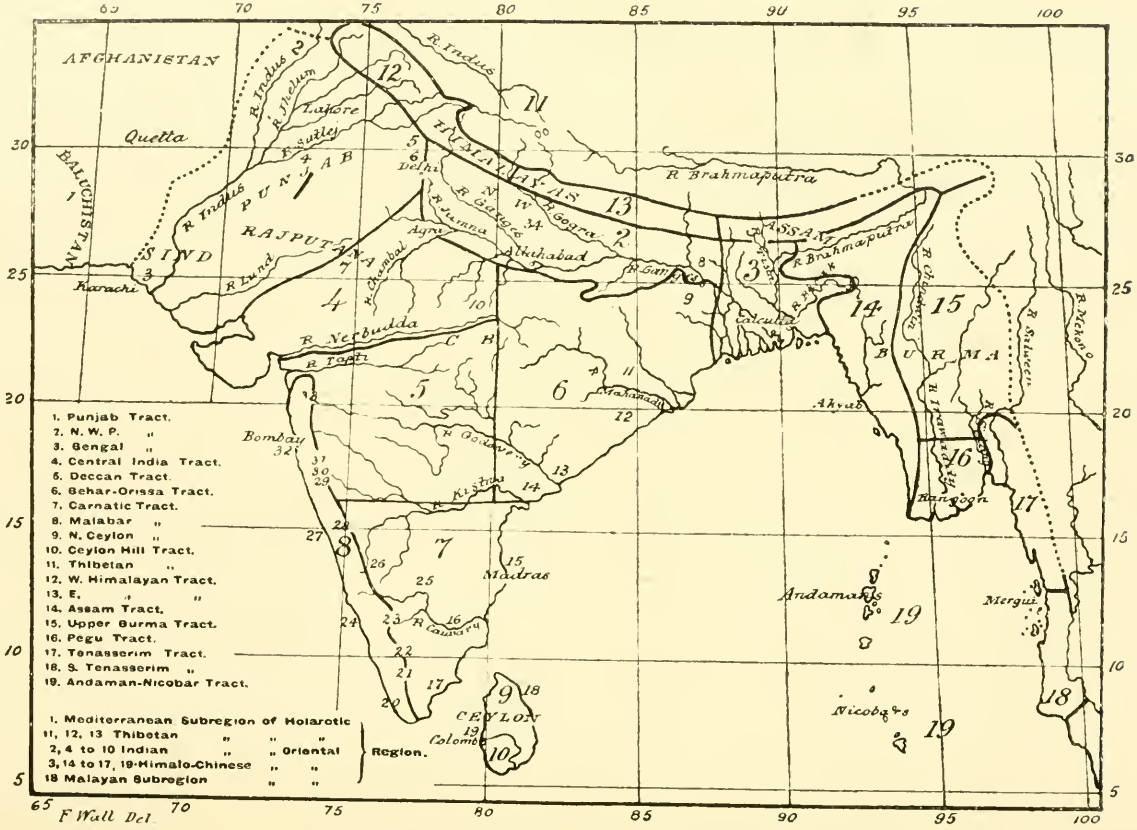
Though *subgriseus* is a common snake it will be seen that the records I have quoted above are rather meagre. This is due to the fact that many writers have not recorded the variety met with nor described the colouration sufficiently to enable me to place them with the above varieties.

Haunts.—I know nothing that calls for special remark, beyond that it is evidently a snake of the Plains, but wanders into the Hills. I have a specimen (var b) from Shembaganur Palney Hills (circa 6,300 ft.) It is, I believe, not a jungle snake, but one that prefers open country where its sombre colouration is in harmony with a barren soil.

Disposition.—The few specimens that have come into my hands alive have all been particularly well behaved, allowing me to handle them freely without attempting to bite. Mr. Gleadow, however, in a letter to our Society mentions one that he wounded and attempted to carry home over a stick, but which repeatedly fell off and in replac-

* Loc. cit.

† Bomb. Nat. Hist. Jourl., Vol. I, Cat. of Snakes. ‡ *Ibid.*, Vol. III, Cat. of Snakes.



Map showing Distribution of Oligodon subgriseus.

(The black numerals show localities it is known from.)

ing it "savagely attacked" him twice. It is a quietly disposed creature with sufficient spirit however to resent interference, and prompt it to ma e active attempts to escape when encountered.

Habits.—My acquaintance with the species in life is too limited to give any information in this direction, but it appears to be diurnal and of a retiring habit.

Food.—I have never found anything in the stomach.

Breeding.—Of the specimens I have collected myself, and sexed only two were ♀, and in neither case was the subject gravid. My smallest specimen which I believe to have been a hatchling measured $4\frac{13}{16}$ inches and was obtained at Cannanore in March. I have had two other small examples one from Dehra Dun measuring $6\frac{1}{4}$ inches in July, the other from Cannanore measuring $6\frac{1}{16}$ inches also in July. These notes seem to indicate that the young appear (probably hatching out from eggs) about March.

Distribution.—As will be seen from the accompanying map it occurs in Trans-Indus, in the Indus Basin, the whole of Peninsular India up to the base of the Himalayas as far East as Purneah, and in Ceylon. Variety A occurs throughout the area noted above, but Variety B appears to be peculiar to the Island of Ceylon, and the hills skirting the Malabar Coast as far North as Matheran. The exact localities are as follows and are numbered in black on the map. 1 Khila Abdullah (I. M.) 2 Malakand (I. M.), 3 Karachi (I. M. and B. M.), and Hyderabad (F. W.), 4 Rajanpur (I. M.), 5 Dehra Dun (I. M. and F. W.) and Dhikala (Garhwal Dist.) (F. W.), 6 Delhi (F. W.), 7 Ajmer (B. M.), 8 Purneah (I. M.), 9 Barrakur (I. M.), 10 N. Godavery District (I. M.), 11 Chota Nagpur (I. M.), 12 Aska (B. M.), 13 Vizagapatam (Russell) and Vizianagram (F. W.), 14 Ellore (Blanford), 15 Madras (B. M.), 16 Trichinopoly (F. W.), 17 Tuticorin (F. W.), 18 Trincomalee (B. M.), 19 Colombo (Haly. Cat. Snakes, Colombo Mus., 1886, p. 8), 20 Trivandrum (Ferguson, Bomb. N. H. Jourl., Vol. X, p. 71), 21 Travancore Hills (Ferguson, Loc. Cit.), and Permade (I. M.), 22 Anamallays (B. M.), 23 Nilgiris (B. M.), 24 Cannanore (F. W.), 25 Bangalore and Koppa (I. M.), 26 Wynad (B. M.), 27 Karwar and Goa Ghats (Bo. M.), 28 N. Canara (Jerdon), 29 Matheran (Bo. M.), 30 Poona (Bo. M.) 31 Deolali, Khandalla, Satara (Bo. M.), 32 Bombay (Bo. M.), 33 Khandesh (Bo. M.), 34 N.-W. Provinces and Oudh (Murray, Zool., Sind, p. 375).

Note.—B. M. implies British Museum ; I. M. Indian Museum ; Bo. M. Bombay Society's Museum.

Lepidosis. Rostral.—Touches 6 shields, the rostro-nasal, and rostro-internasal sutures subequal or the latter longest ; the portion visible from above one half (or nearly) the distance from the end of the snout to the frontal. *Internasals.*—Two, the suture between them, equal to or nearly one half the suture between the præfrontal fellows ; half or less than half the internaso-præfrontal sutures. *Præfrontals.*—Two, the suture between them half or less than half the præfronto-frontal sutures ; in contact with internasal, posterior nasal, loreal, præocular, supraocular, and frontal*. *Frontal.*—Touches 6 shields, the supraocular sutures rather the longest. *Supraoculars.*—Length subequal to frontal, breadth about half that of the frontal. *Parietals.*—Touch one or two postoculars. *Nasals.*—Divided ; in contact with the 1st and 2nd supralabials. *Loreal.*—One, small, as long as high, little longer than half the nasals (rarely confluent with præfrontal, Günther). *Præoculars.*—One. *Postoculars.*—Two (rarely three). *Temporals.*—One, touching the 5th and 6th supralabials. *Supralabials.*—7 (rarely 6 or 8), the 3rd and 4th touching the eye (or 3rd only in rare examples owing to a confluence of two of the normal shields). Rarely the 6th shield just fails to reach the labial margin. *Infralabials.*—4, (rarely 5), the 4th largest, and in contact with two scales behind. *Sublinguals.*—Two pairs, the posterior about two-thirds the anterior, and in contact with the 4th only of the infralabial series. *Costals.*—15 in the whole body length, the last row slightly enlarged ; no keels ; apical pits present, and single. *Ventrals.*—Angulate. In Variety A. ♂ 158 ? to 184, ♀ 158 ? to 218. † In Variety B ♂ 158 to 169, ♀ 174 to 184. *Anal.*—Divided (rarely entire). *Subcaudals.*—Divided. In Variety A they are 38 to 55 in ♂, 37 to 52 in ♀ ; in Variety B 38 to 46 in ♂, 36 to 40 in ♀.

Dentition (*a*) *Maxillary.*—The maxilla has an edentulous space anteriorly which would accommodate about 3 teeth of the size of the foremost of the series. It supports 6 or 7 very compressed teeth of

* In one specimen of Variety B in our Society's collection these shields are completely separated by the frontal.

† The number of the ventrals varies somewhat according to locality. In the Oriental Region they range between 158 ? and 184 in ♂, and 158 ? and 204 in ♀, but in the Indus and Trans-Indus tracts a ♂ has 186, and the range for 4 ♀ is 200 to 218.

syncranterian type (*i.e.* rapidly increasing in size from before backwards). The *palatine* bone supports a single small tooth (sometimes none ?) situated about the middle of its length. The *pterygoid* series number 6 to 10 *, and are preceded by a long edentulous space. The *mandibular* series number about 12, which are compressed, rather small and subequal. A short edentulous space that would accommodate about one tooth precedes the dental array. (See Figs. D and F of Diagram).

* Boulenger says (Cat. Vol. II., p. 233) that there are no pterygoid teeth in the Oligodontides, but he is mistaken. In the three species of which I have skulls (*subgriseus*, *dorsalis* and *venustus*) pterygoid teeth are present.

(*To be continued.*)

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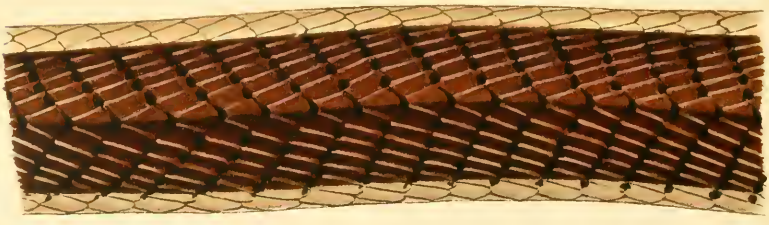

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THE COMMON INDIAN SNAKES, (Wall).

Dendrophis pictus, harmless, nat size

JOURNAL
OF THE
Bombay Natural History Society.

Feb. 1910. Vol. XIX. No. 4.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plates and Diagrams.

BY

Major F. Wall, I.M.S., C.M.Z.S.

Part XII with Plate XII and Diagram and Map.

(Continued from page 563 of this Volume.)

The genus *Dendrophis* as now understood comprises at least 11 species, distributed in Southern Asia between India and Indo-China, through the Malayan Archipelago to Eastern Australia. Of these species 6 occur within our Indian limits, *viz.*, (1) *pictus* (Eastern Bengal, Eastern Himalayas, Irrawaddy-Salween basin, and Tenasserim and further East to Indo-China), (2) *grandoculis* (Hills of Southern India), (3) *bifrenalis* (Ceylon and Travancore Hills, Ferguson), (4) *caudolineatus* (Ceylon), (5) and (6) *gorei*,* and *proarchos*† (Brahmaputra basin).

Until 1890 several other species were included which have now been grouped together on characters affecting dentition under a separate genus called *Dendrelaphis* by Mr. Boulenger. This genus includes 3 species found in Indian Territory, *viz.*, (1) *tristis* (Peninsular India, Eastern Himalayas, Brahmaputra Valley and Ceylon); (2) *subocularis* (Hills of Upper Burma); and (3) *biloreatus*‡ (Brahmaputra Basin).

The species of both genera are very much alike, so much so indeed that some have been much confused. For instance every author

* Described by me in this Journal, Vol. XIX, p. 829.

† Described by me in this Journal, Vol. XIX, p. 827.

‡ Described by me in this Journal, Vol. XVIII, p. 273.

who wrote before Mr. Boulenger's present classification was inaugurated, alluded to *Dendrelaphis tristis*, and *Dendrophis pictus* as one and the same snake under the latter title, and the confusion did not end here, for every writer since has committed the same mistake.

I have heard doubts expressed in some quarters as to the justification for the recognition of the two genera just referred to, but as I have a series of skulls of the types of both, I am in a position to be able not only to affirm that the differences claimed exist, but to add others in support. Mr. Boulenger divided the species on characters affecting the maxillary teeth, grouping together those in which the teeth enlarged posteriorly under the heading *Dendrophis*, and those in which they reduced posteriorly under the title *Dendrelaphis*. Figures A and B, taken from the skulls of specimens of both obtained at Pashok in the Eastern Himalayas, illustrate the differences in dentition, but I find in addition that there are decided differences in the shape of the nasal bones, and also in the ridges for muscular attachment on the parietal bones of each (*see* Diagram and figs. A and B.). The confusion in literature between *D. tristis* and *D. pictus* just referred to makes it difficult for me to speak very positively on the distribution of these species, but I present the facts as they appear to me, with the hope that our readers who are in a position to do so will send me specimens that will enable me to confirm or refute them.

DENDRELAPHIS TRISTIS (Daudin.)

The Indian Bronze-Backed Tree Snake.

History.—The first reference to this snake was made by Russell over a century ago. In 1796* he figured and remarked upon a specimen from Hyderabad (Deccan). In 1801 † he figured and referred to two others from Bombay and Tranquebar.

Nomenclature.—(*a*) *Scientific.*—The generic name from the Greek δενδροι a tree, and ελαφις snake, was introduced by Mr. Boulenger in 1890. *Tristis*, the specific title from the Latin "sad" was conferred by Daudin in 1803 in allusion to its sombre colouration.

(*b*) *English.*—The Common Indian Bronze-Backed Tree Snake or Bronze Back. I have heard it alluded to as the painted tree snake, but since all the species are alike in the cærulean adornment

* Ind. Serp. Vol. I. p. 36 and Plate XXXI.

† Vol. II. pp. 29 and 30 and Plates XXV and XXVI.

which suggested the term painted, this adjective is equally applicable to all.

(*c*) *Vernacular.*—In Ceylon Ferguson* says it is called "haldanda." Mr. E. E. Green interrogated two intelligent Singhalese with respect to this term, and they said they knew a snake of this name which they described as "a very swiftly moving snake of a dark-brown colour," and said it had a yellow belly. The word is from "hal" rice and "danda" a stick or whip. The connection is not very obvious but an observation of Annandale and Robinson's with regard to the snake *D. pictus* suggests itself. They remark that it is often found among bushes at the edge of rice fields. One of the two men above referred to told Mr. Green it is also called "katta-kaluwa," meaning black mouthed, but whether this name is rightly applied to this species seems dubious, as it does not appear appropriate. Ferguson † mentions this term in his list of Singhalese names for snakes, but without specifying the species.

Confusion in vernacular nomenclature with regard to snakes is great, thus we find another Singhalese name, *viz.*, "ahaetulla" wrongly applied to this species. Linné ‡ in 1754, Laurenti § in 1768 and others since have made use of the term in reference to the snake now identified by Boulenger as *D. pictus*, but it is clear that the word emanating from Ceylon refers rather to the Ceylon snake *tristis*. There is, however, now, I think no doubt that "ahaetulla" is the correct Singhalese name for the green whip-snake (*Dryophis mycterizans*), the word implying eyeplucker being synonymous with the "kankotti-pambu" of the Tamils in Southern India. Further confusion has arisen with regard to the name "kumberi-muken." Russell ¶ connects this name with the snake *D. tristis*, and many others subsequently have followed him, but I think there can be no doubt that it is correctly applied to the green whip-snake (*D. mycterizans*). The name meaning "snouted tree snake" obviously suggests the green whip-snake, and is quite inappropriate to the common bronze-back. Moreover, in a printed copy of a lecture on snakes delivered some years ago by the Rev. Fr. Bertram, S.J., of which I have a copy, this authority says "I believe these two different names (kan-kotti-pambu and kamberi-

* Rept. Fauna of Ceylon, 1877, p. 20. † loc. cit. p. 40. ‡ Mus. Ad. Frid. p. 35, Plate XXII, fig. 3. § Syn. Rept. p. 79. ¶ Ind. Serp., Vol. I. p. 36 and Plate XXXI.

mukken) denote the same snake; for, while the kan-kotti-pambu is acknowledged by all to be the green tree-snake, there is no other tree-snake with an elongated snout which would justify the name kamberi-mukken." Further, the Revd. C. Leigh, S.J., who has 13 years' experience of Trichinopoly, recently wrote to me in response to my enquiries that green whip-snakes were frequently kept in captivity at St. Joseph's College, and the students and visitors repeatedly applied the name "kamberi-mukken," "patchai-pambu" and "kan-kotti-pambu" to the species.*

Jerdon† mentions "chitooriki-pambu" as one of the names in use in Southern India, and Dr. J. R. Henderson tells me he has known it called "panaiyeri-pambu" meaning palmyra snake in the same part of India. According to Russell† it is called "rooka" in Mahratti, "goobra" about Hyderabad (Deccan), "maniar" about Bombay, and "mancas" in Guzerat. Mr. E. Muir tells me that at Kalna, Bengal, it is called "bet anchora" which means "lacerated with a cane."

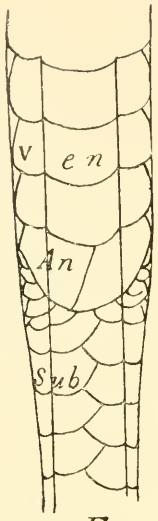
In Cannanore I heard it called "villooni" from the Malayalam villoo a bow (see legends hereafter).

Colour and markings.—Dorsally the body is uniformly purple brown, bronze-brown or rarely ruddy-brown, except for the vertebral region which is usually more or less distinctly lighter, and the last row and a half of scales in the flanks, which are yellowish. The vertebral stripe involves the vertebral and half the next row. It may be conspicuous in the whole body length, or only anteriorly. In the neck and forebody a series of oblique, black streaks, often paired, and usually more or less broken up are always more or less evident. A yellow flank stripe passes from the neck to the vent. It is bordered above by a blackish, somewhat indistinct line, but unlike *pictus* is not bordered below by a black line running along the edge of the ventrals.

When the snake under excitement dilates itself, small oblique patches of light sky blue on each scale on the back are brought into view, especially noticeable and brilliant in the forebody. Each

* The confusion is on a par with the Singhalese "karawella," wrongly ascribed by Günther to the Ceylon pit viper *(Ancistrodon hypnale)*. Subsequent authors repeated the mistake on his authority, but there is now no doubt, I believe, that it is properly applied to the Ceylon krait *(Bungarus cylonicus)*.

† J. A. S. Bengal, XXII. p. 529, loc. cit.



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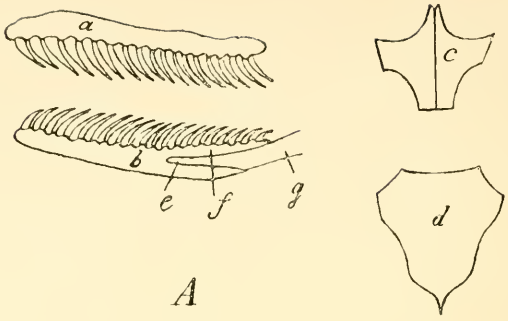

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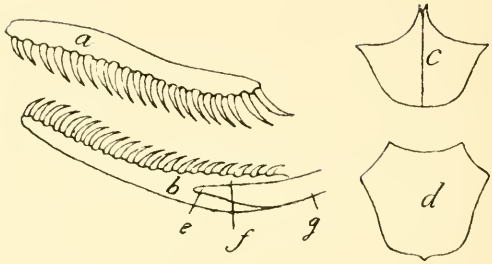

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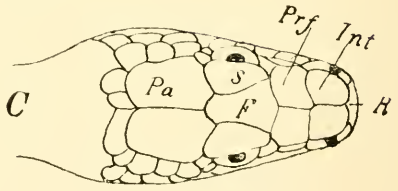

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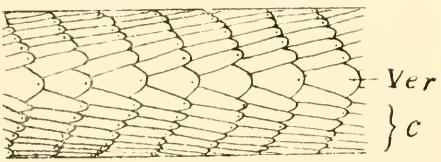

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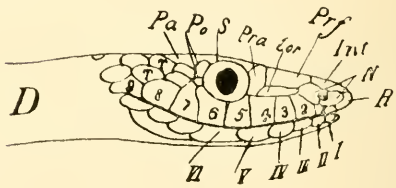

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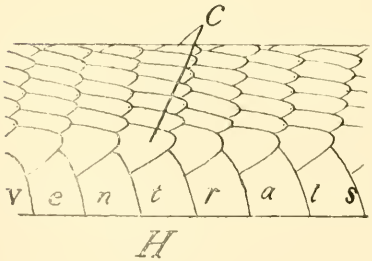

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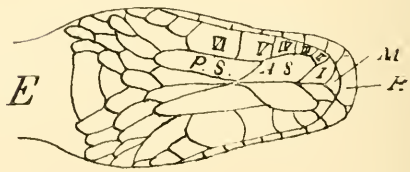


E

COMMON INDIAN SNAKES (WALL).

(Dendrelaphis tristis.)

Explanation of Diagram I.

A.—*DENDRELAPHIS TRISTIS*, jaws.

B.—*DENDROPHIS PICTUS*, jaws.

- (*a*) maxilla.
- (*b*) dentary part of mandible.
- (*c*) nasal bones.
- (*d*) ridges on parietal for muscular attachments.
- (*e*) articular notch.
- (*f*) articular process of dentary.
- (*g*) articular part of mandible.

C. D. E.—Head Shields.

A. S.	Anterior Sublinguals.
F.	Frontal.
In.	Internasals.
Lor.	Loreal.
M.	Mental.
Na.	Nasals.
Pa.	Parietals.
Po.	Postoculars.
Pra.	Præoculars.
Prf.	Præfrontals.
P. S.	Posterior Sublinguals.
R.	Rostral.
S.	Supraocular.
T.	Temporals.
1, 2, 3, etc.	Supralabials.
I, II, III, etc.	Infralabials.

F.—Belly Shields.

Ven.	Ventrals with ridges.
An.	Anal.
Sub.	Subcaudals with ridges.

G. H.—Body Scales.

C.	Costals.
Ver.	Vertebrals

patch of blue is broadly edged with black anteriorly, and posteriorly and placed on the lower half of each scale so that it is usually completely concealed by the overlapping of the scale below it. In our Plate (figures 3 and 4) this ornamentation is not done justice to, the blue being neither bright enough nor broad enough. The head is coloured above like the back, but the upper lip is yellow, creamy-buff, or opalescent abruptly demarcated above. There is a roundish yellow spot in the suture between the parietal shields (not shown by our artist), thin black edges to the 2nd, 3rd and 4th supralabials (sometimes the 1st also), and a somewhat obscure, narrow, black postocular streak not or hardly extending to the neck. The belly is uniform creamy-yellow, pale-greyish, greenish, or bluish green.

The markings to which special attention is to be paid are (1) the interparietal spot; (2) the light vertebral stripe; (3) the black posterior margins to the anterior supralabials; (4) the narrow, short, and often obscure black postocular streak and (5) a more or less obvious black line separating the dorsal brown from the yellow flank stripe. I find these present (except (1) and (2) in a single example from Marmagoa) in all the specimens I have examined from the localities mentioned hereafter under distribution, and none of these are present in specimens of *Dendrophis pictus*. In the Eastern Himalayas where these two species are associated (on slopes below Darjeeling) I saw many specimens last year, and learnt to discriminate between them at a glance, by the marks above referred to.

Dimensions.—The longest measurement I know is 3 feet 9 inches. I obtained a specimen of this length in Trichinopoly.

General characters.—The Indian bronze-back is remarkably elegant in colouration and form. Its head is rather elongate, snout bluntly rounded, nostril small, and the eye large and lustrous with a golden iris and round pupil. The neck is very distinctly constricted, the body long, slender, smooth, and rather depressed (*i.e.*, flattened from above downwards). The belly is conspicuously ridged on either side as in *Chrysopelea ornata*. An usually long tapering tail accounts for nearly one-third the total length of the snake. This appendage is ridged beneath in the same manner as the belly.

Identification.—The dual combination of enlarged vertebrals, and ridged ventrals (*see* Diagram 1, figs. F and G) proclaims any snake either a *Dendrophis* or *Dendrelaphis*, so that it remains to distinguish

the species from others in these two genera. Only 6 of these have 15 rows of scales in midbody, and the differences between them will be seen at a glance at the following table :—

Number of scale rows in midbody	Vertebrals as broad or broader than long.	Ventrals.	Anal.	Subcaudals.	Loreals.	Labials touching the eye	Name of species.
15	Yes ..	177 to 211 ..	2	131 to 153 ..	1	normally 4th, 5th & 6th.	*Dendrophis pictus.*
15	Yes ..	154 to 171 ..	2	144 to 155 ..	2	5th & 6th ..	,, *bifrenalis.*
15	No ..	168 to 197 ..	2	115 to 134 ..	1	5th & 6th ..	*Dendrelaphis tristis.*
15	? ..	167 to 172 ..	2	74 to 105 ..	1	5th ..	,, *subocularis.*
15	? ..	174 to 188 ..	2	117 to 124 ..	1	4th, 5th & 6th..	,, *grandoculis.*
15	Yes ..	184 to 195 ..	1	141 to 153 ..	1	4th, 5th & 6th..	,, *proarchos.*

The most important characters to distinguish *tristis* from its allies are the narrow vertebrals in which the length very distinctly exceeds the breadth, and only two labials touching the eye. To sum up then any snake in which the vertebrals are enlarged, but obviously longer than broad, with ridged ventrals, 15 scale rows in midbody, (*i.e.*, between snout and vent) and two labials touching the eye is *Dendrelaphis tristis.*

Haunts.—The common Indian bronze-back like all its allies lives almost entirely in bushes and trees. I became most familiar with it in Trichinopoly in my early Indian days, when I spent a good deal of my leisure time birdsnesting. During my daily excursions I frequently came across it, and have indeed met as many as three or four in a single outing. I frequently discovered it lying on a branch, when peering through low scrub, and if the snake lay still the chances were it would escape detection, looking extremely like a small branch itself. There is no doubt that its colouration is decidedly protective.

An observation of Mr. E. E. Green in a recent letter exemplifies this. He says—on the 8th of September 1903, he " placed a branch with green foliage in the snake's cage. Formerly all the different snakes coiled up together amongst the dry foliage of a dead branch, but now they have sorted themselves, the green whip snakes (*Dryophis mycterizans*) have moved on to the green branch while the *Tropidonotus* and *Dendrophis* (*Dendrelaphis*, F. W.)—both brown snakes – have remained on the dead branch."

Often gazing up into trees a movement in the foliage twenty or more feet above drew my attention to a snake which when shot proved to be this species. I encountered it more than once in holes in trees, sometimes detecting the snake from the ground level with its head peering forth, or when aloft investigating a likely hole for a bird's nest. Under the latter circumstances a cane thrust into the hole and briskly stirred about effected its exit. Once the snake vacated its quarters so hastily that it fell to the ground. On one occasion in Colombo, I discovered one in the open, and pursued it but it got into grass, and disappeared beneath a log. With some difficulty the log was overturned, but the snake could not be seen, and yet the ground was such that it was impossible for it to have escaped in any direction unseen. After a considerable search a narrow hole was discovered in the log in which the snake proved to have taken refuge. On more than one occasion I have found its slough entwined among the twigs of a crow's nest, which it had evidently visited with the intention of disencumbering itself of a worn-out vestment, as the slough was perfect or nearly so. On one of these occasions I found the snake in a hole in the same tree, and matched it with the slough.

It not infrequently comes to the ground, and I have often flushed one near the base of a tree, and seen it disappear up the trunk like a flash before I had time to recover the start that such an encounter always gives me. Dr. Henderson, too, remarks in a letter to me that he thinks it visits the ground more often than the whip-snake *(D. mycterizans)*. It frequently clambers into the creepers about bungalows, and from here creeps on to the tiles.

Disposition.—Though Günther* says of it "When old it is rather ferocious and bites readily," my experience goes to show that it is a timid snake, usually making off with great despatch when alarmed. I have never been struck at by the specimens I have met face to face, or rudely evicted from holes in trees. The specimens I have handled, too, have never attempted to bite me, but it gives me little chance of ascertaining its temper, for if liberated with the object of being played with, it takes advantage of its release so precipitately, and moves with such speed, that the captive of one minute has regained its liberty the next, and is lost among the branches of the

* Rept. Brit. India. p. 297.

nearest tree. Mr. E. E. Green says that specimens he has kept have always been quite gentle and never attempted to bite when handled. Dr. J. R. Henderson, in a recent letter to me, remarks that in captivity it becomes very tame and inoffensive. Mr. Ingleby quoted by Ferguson says that it is a very lively and plucky snake and the fact that Mr. E. E. Green found one devouring a large blood-sucker lizard *(Calotes versicolor)*, a most truculent creature when brought to bay sufficiently establishes its reputation for courage, when hunger presses.

Habits.—In a former paper of this series I made some remarks upon "flying" snakes (Under *Chrysopelea ornata* in Vol. XIII). It is probable that the common Indian bronze-back can undertake feats of the same nature, for it is endowed with the same peculiar ridges on the belly, that are seen in *Chrysopelea*; further, its close ally *Dendrophis pictus* is one of those snakes that has been reported to spring (fly) from heights. So far as *tristis* is concerned, however, the evidence, though suggestive, is not so well authenticated. Though neither Dr. Willey nor Mr. E. E. Green are aware of any native stories of springing or "flying" snakes in Ceylon, Pridham* speakes of a snake called by the natives "ahedoella," and says: "The movements of this snake are rapid, and from its power of springing it is called a flying snake." The evidence seems pretty clear therefore that a "flying" snake exists in Ceylon, but there would appear to be a mistake in the diagnosis of the species for "ahedoella" is the Singalese name for the green whip-snake. *(Dryophus mycterizans)* a far commoner snake which has no reputation for springing as far as I am aware in any of the Provinces included within its wide distribution, and has an entirely different conformation of belly shields. So far as Southern India is concerned Dr. J. R. Henderson tells me that "There is a common belief that *D. pictus* (by which he means *D. tristis*) can jump, but I have never seen it do so."

Its movements are surprisingly rapid as already remarked. It is truly astonishing with what speed it can ascend an almost bare tree trunk from the ground, and disappear in the branches above. I have seen this several times, and it has always struck me that its speed in ascent is as rapid as its movements along the flat.

* Ceylon and its Dependencies, p. 750.

Mr. E. E. Green has been struck by its restless habit and the quickness of its movements.

The tenacity with which it can maintain its hold in foliage under most disadvantageous circumstances I have more than once been witness to. I managed to hustle one on one occasion to the extreme tips of the branches of a small neem tree, but though the slender twigs swayed boisterously under its weight and movements, it remained firmly suspended until I dislodged it with a stick.

Any opportunities of exhibiting its natatory powers are probably rare, but that these are creditable seems certain, for I once encountered one (unless it was *D. pictus*) on a small island in Chilka Lake fully 2 miles from the main land.

Food.—This tree-snake appears to me to subsist under natural conditions chiefly on lizards, but does not disdain other reptilian fare. Mr. E. E. Green tells me that in captivity "it feeds readily upon small lizards *(Agamidæ, Geckonidæ, and Scincidæ).*" He saw one once take and eat a gecko which it swallowed immediately alive. He also once encountered one eating a full-grown "blood-sucker" lizard* *(Calotes versicolor)* and tells me further that young examples are said to feed on grasshoppers. Ferguson quotes Mr. Ingleby as saying that it is very keen after frogs, and particularly tree frogs. Mr. C. Beadon tells me that he once found one eating a blind snake *(Typhlops* sp.) which returned to its kill after having been once disturbed. On occasion it will attack and plunder bird's nests. I once witnessed an encounter between this snake and a pair of black-backed robins *(Thamnobia fulicata)* in the Borella Cemetery in Colombo. My attention was attracted by the distressed behaviour of the birds, which I approached cautiously, and saw on the ground between a group of gravestones a *tristis* with its head well erected. I was so near that I both saw and heard more than one peck delivered (it appeared to me on the head) by the birds in their agitated flights to and fro. An incautious movement on my part, and the snake had slipped away, and no amount of search could reveal its whereabouts. In a croton bush within a yard or two of the encounter I found the robin's nest with eggs. Specimens in the Madras Museum† have fed freely. One ate 79 toads and 1 lizard between the 12th August

* Spol. Zeylanica, April 1906, p. 220. † Admin. Report, Madras Govt., Mus., 1896-97.

and 31st March; another 94 frogs from the 1st April to the 21st January following; a third 18 frogs between the 13th February and 31st of March; and a fourth 104 frogs, presumably during the year.

Sloughing.—Some excellent notes on this little studied function were made in the Madras Museum some years ago.* During the official year 1896 one shed its skin on the 2nd April, 6th May, 28th June, 27th July and 29th October. Another on the 13th May, 16th June, 21st July and 17th October. In a third instance a specimen which was acquired on the 12th August sloughed on the 24th October. Now it is very curious, and apparently something beyond coincidence, that in all three cases there was no desquamation in the months of August and September, though in the first two cases there had been a regular ecdysis in several preceding months.

Breeding.—My notes are very meagre in this direction, but sufficient to show that the species is ovoviviparous. I received a gravid ♀ on the 29th February 1904 from Mr. Angus Kinloch (Kil Kotagiri, Nilgiris). It measured 3 feet 4½ inches, and contained 7 nearly mature eggs, from 1⅛ to 1¼ inches long, and about $\frac{7}{16}$ inch broad. Mr. E. E. Green had a specimen which laid 4 eggs in its cage on the 11th January 1908, and died next day when 2 more eggs were found in the oviduct. These were all sent to me. The smallest measured 1⅛ × ⅜ inches, and the largest 1⅜ × $\frac{13}{22}$ inches. In cutting open egg I found an embryo coiled up in a spiral fashion, lying in an elliptical chamber situated in the upper part of the yolk substance, and midway between the two poles. The embryo I judged might be an inch and a half long when unravelled. Its head with the primary cerebral vesicle, eye and lower jaw were well developed, as was also the heart, so that it was in just about the same stage of development, that I noted in the case of the Assam species *Dendrophis proarchos*, at exovation.†

Egg showing embryo of *Dendrelaphis tristis* from a specimen from Ceylon. (Natural size.)

* Administration Report, 1896-97.

† Since writing this I have received another gravid ♀ from Mr. Green from Peradeniya (Ceylon) killed at the end of January and containing 7 nearly mature eggs.

Though the species is obviously oviparous it is probable that minute embryo are already in process of formation at the time that the eggs are extruded, for in an allied species in Assam *(proarchos*, Wall*)* I found embryos in the eggs when laid, and noted that I could see the head and eye and rudiment of lower jaw, and could observe the heart beating. Further observations are required to ascertain if *tristis* lays eggs in which the embryos are equally well developed.

Legends.—There is a general belief among the natives of Southern India that the Common Indian bronze-back is fatally poisonous. Russell* records the belief as prevalent in his time, and says that his snake-catcher professed to have known two men killed by it, the bite producing immediate giddiness and death in two days. There is no reason to reject this snake-man's story, for as I have more than once remarked in these papers deaths do occur from the bites of perfectly harmless snakes. Such fatalities are due to cardiac syncope due to fright. In Bengal too as I am informed by Mr. E. Muir (Kalna) the natives say it is very poisonous and attacks without provocation. Russell† also mentions the belief among natives that this snake having bitten a person ascends a tree near the pyre to watch with vindictive satisfaction the smoke rising from the corpse of its victim, after which it descends. I heard this same story in Ceylon, but was never able to discover exactly which snake it was that was credited with this malignant spirit. Dr. J. R. Henderson tells me the belief is still prevalent in Southern India, and he has known a mock funeral with an effigy organised to save the bitten subject, for when the snake descends from the tree the poison it is supposed to have injected leaves the body, and the otherwise doomed person recovers.

In Cannanore there was another strange belief among the natives who said that this snake could thrust its tail into the ground, balance thereon, and assume the form of a bow, hence their name for it " villoonie " from " villoo " a bow. I was never able to understand with what object it is supposed to evince this strange behaviour.

Distribution. (A) *Geographical.*—The evidence at my command points to this being undoubtedly the common species to be found

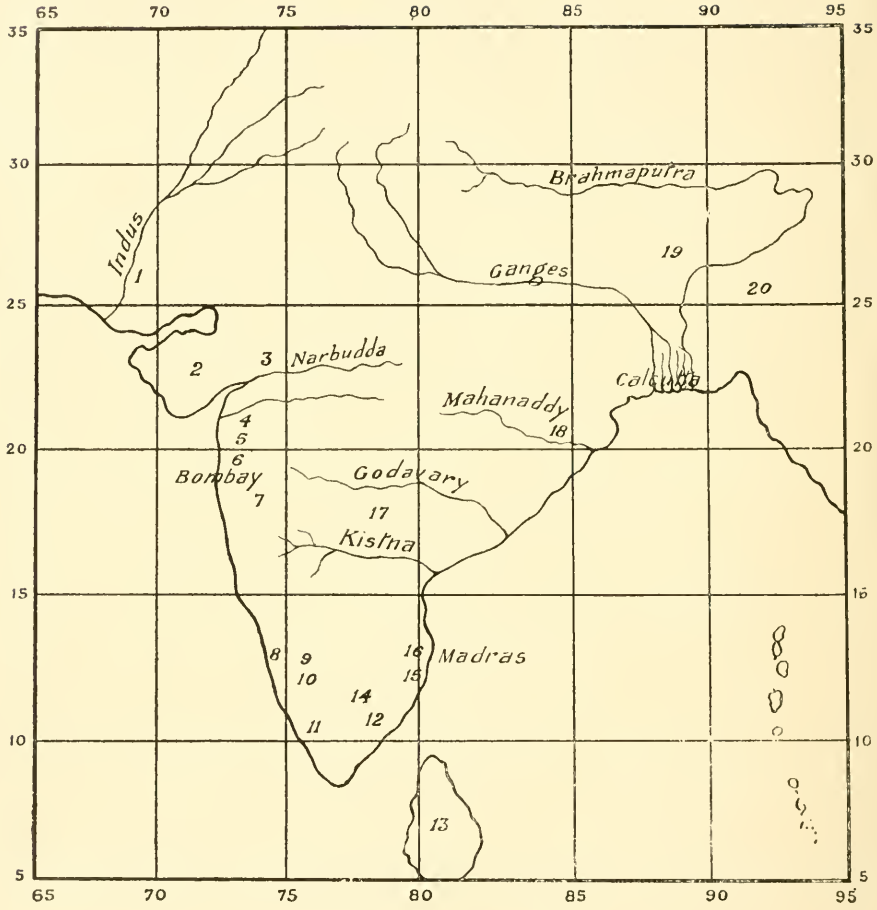
* Loc. cit., Vol. II, p. 30. † Loc. cit., Vol. II, p. 31.

in the Indian Peninsular and I believe it exists here to the exclusion of *Dendrophis pictus* as far East as Bengal. My earlier notes on the species are unfortunately deficient in the matter of precise colour, and markings, but I can say with certainty that this is the snake I was familiar with in Trichinopoly, and I have taken it in Cannanore. It is certain, however, that the specimens taken in the localities mentioned in the attached map are *tristis*, and not *pictus*.

(b) Local.—It is a common snake in Ceylon (Ferguson, Haly). It is very common about Trichinopoly and Cannanore. Ferguson says it is common in the Plains and Hills about Travancore * and Mr. Millard tells me also about Matheran. Mr. E. Muir reports it as one of the common snakes about Kalna in Bengal, and has sent me specimens. Jerdon says it is abundant in all parts of the country, but with this I cannot agree. It appears to me to be uncommon in the plains to the north of the Tapti Rivers. I do not think it occurs in the Indus Basin at all, except near the mouth of that river. Blanford, collecting for 3 years at Ajmer, failed to obtain a specimen. The Ganges Valley is too, I believe, outside its limits, except at the Eastern part near the Delta. It has not been recorded from Central India, nor seemingly from the Central Provinces. It is quite common in the Eastern Himalayas (circa 2,500 to 5,000 feet) in the vicinity of Darjeeling.

Lepidosis. Rostral.—Touches 6 shields; the rostro-nasal, and restro-internasal sutures subequal. *Internasals*—Two; the suture between them equal to, or nearly equal to that between the præfrontal fellows, and rather shorter than the internaso-præfrontal sutures. *Præ-frontals.*—Two; the sutures between them equal to, or rather greater than, the præfronto frontal sutures; in contact with internasal, postnasal, loreal, præocular, supraocular and frontal. *Frontal.*—Touches 6 shields; the fronto-supraocular sutures three to four times the fronto-parietal sutures. *Supraoculars.*—As long as the frontal, and about as broad along a line connecting the centres of the eyes. *Nasals.*—Two, completely divided; the nostril placed almost entirely in the anterior shield; in contact with the 1st and 2nd supralabials. *Loreal.*—One elongate, twice or more than twice as long as high, about as long as the two nasals taken together. *Præocular*—One, barely reaching the top of the head,

* Bombay N. H. Jour., Vol. X, p. 5.



MAP SHOWING DISTRIBUTION OF *DENDRELAPHIS TRISTIS*.

(1) Sind (B.M.). (2) Guzerat (Russell). (3) Baroda (Bo. M.). (4) Surat (Bo. M.). (5) Thana (Bo. M.). (6) Bombay (Russell). (7) Matheran (Bo. M.). (8) Cannanore (F.W.). (9) Kil Kotagiri, Nilgiris (F.W.). (10) Coimbatore (F.W.). (11) Travancore (Bo. M.). (12) Ramnad (I.M.). (13) Ceylon (B.M.). (14) Trichinopoly (F.W.) (15) Tranquebar (Russell). (16) Madras (F.W.). (17) Hyderabad (Russell). (18) Jashpur, Chota Nagpur (Blanford. J. A. S. Bengal, Vol. XL., p. 131). (19) Himalayas below Darjeeling (B.M. & F. W.). (20) Khasi Hills (B.M.).

Postoculars.—Two. *Temporals.*—Two, elongate. *Supralabials.*—Normally 9 with the 5th and 6th touching the eye*. *Infralabials.*—6, the 6th much the largest, as long on the 3 preceding shields, in contact with two scales behind; the 5th and 6th touching the posterior sublinguals. *Sublinguals.*—Two pairs; the posterior decidedly longer. *Costals.*—15 at a point two heads-lengths behind the head, and to well beyond midbody, when they reduce to 13, and then to 11 or even 9, before the vent. The reduction from 15 to 13 is due to the absorption of the 4th scale above the ventrals into the row above or below; that from 13 to 11 results from a fusion of the 5th and 6th rows above the ventrals; and when the number further reduces to 9, the 5th row is absorbed into one of the adjacent rows. The vertebrals are enlarged, but they are very distinctly longer than broad in midbody, they arise in the neck by a fusion of 3 rows, thus differing from the genus *Bungarus*, where they gradually develop from a single row progressively enlarging and unlike the genus *Bungarus* they cease above the anus. The ultimate row is much enlarged considerably exceeding the vertebral in breadth. Keels are absent everywhere. Apical pits are present, and single. *Ventrals.*—168 to 197, varying in number with locality†; sharply ridged (keeled) on each side. *Anal* divided. *Subcaudals* divided, 115 to 146; keeled like the ventrals. *Dentition.*‡ *Maxillary.*—17 to 22: the first 3 or 4 progressively increasing, the posterior, 3 or 4 compressed and progressively decreasing, so that the last is about two-thirds the length of the longest in the series. *Palatine.*—11 to 14, subequal, and as long as the longest mixillary. *Pterygoid.*—19 to 24 (except the Kil Kotagiri specimen which has 28 and 29); smaller than the palatine. *Mandibular.*—20 to 26 (usually 20 to 22); the first 3 or 4 progressively increasing, the posterior gradually decreasing. The length of the articular process equals the length from the articular notch (see fig. A. 6.) to about the 4th tooth.

* This is so in 26 out of 29 specimens I have noted upon. In 2 instances these shields are not recorded, and in a single example the 4th just touches the eye on both sides. In one of the 26, there are 8 shields on one side only, the 4th and 5th touching the eye.

† In 19 specimens from various parts of India other than the Eastern Himalayas, they are 168 to 192. In 9 Eastern Himalayan examples they are 190 to 197

‡ This is based on 10 skulls in my collection from Pashok (Eastern Himalayas), Madras, Matheran, and Kil Kotagiri (Nilgiri Hills).

DENDROPHIS PICTUS (Gmelin).

The Himalo-Malayan Bronze-back.

Nomenclature. (*a*) *Scientific.*—The generic name from the δενδροτ a tree and οφις a snake, was applied by Boie in 1827 ; the specific from the Latin meaning "painted" was given by Gmelin in 1788 in allusion to the sky blue patches on the scales seen in this, and other species of the genera *Dendrophis*, and *Dendrelaphis*.

(*b*) *English.*—In contradistinction to the last I think it should be called the Himalo-Malayan bronze-back.

(*c*) *Vernacular.*—In the Patani-Malay States Annandale and Robinson* say it is called "ular lidi," "ular" snake, and "lidi" the midrib of the cocoanut palm. They remark that the appropriateness of the name is realized when one sees a leaf of this palm from below, with the midrib black against the sky, and an apparent light space on either side of it, due to the comparative narrowness of the leaflets where they leave it.

Colour and Markings.—Dorsally the snake is uniform bronze-brown down to the middle of the penultimate row, where a faint black line abruptly demarcates the dorsal colour from a yellow flank stripe. The costal scales, where overlapped, exhibit a patch of sky blue bordered with black before and behind. These are usually concealed, but when the snake dilates itself become very conspicuously apparent. The head is coloured like the dorsum above, this hue abruptly giving place to yellow on the side of the face. A very conspicuous, broad, black band behind the eye passes back to the side of the body, and is continued in the whole body length as a conspicuous black line on the edge of the ventrals, bordering the yellow flank stripe below and rendering it specially evident. The belly is uniformly yellow, greyish, or greenish.

It will be noticed that many of the distinctive marks seen in *Dendrelaphis tristis* are absent, *viz.*, the light vertebral stripe, the interparietal spot, and the black margins to the anterior supralabials.

On the other hand, a very distinct, broad postocular band is to be seen in *pictus* passing well down the body, and the light flank stripe is bordered below by a black line. These colour differences were noted by me 10 years ago on comparing Burmese with

* Fascic. Malay Batrach. and Rept., October 1903, p. 163.

South Indian examples, and made me think the two snakes probably different, but I was deterred from declaring my conviction, finding but one difference in lepidosis, *viz.*, the contract of the supralabials with the eye. Since this I have learnt that there is a very noticeable difference between the two in the development of the vertebrals, and still more recently in the dentition.

I may mention here that the sky blue adornment just referred to is not of sexual import, since it is to be seen in both sexes from the earliest ages, and at all seasons.

In the Andaman Islands a snake of this genus occurs which has hitherto been considered merely a variety of *pictus*, but which may prove to be a distinct species. It is referred to by Blyth in his book "The Andaman Islanders" (p. 365) as being remarkably rich coloured, green, and variegated, and appears to be common according to this authority. Stoliczka* also speaks of it as being common, and says it is a "beautifully bright yellowish and green during life, each scale blackish in the posterior half." The same authority† says that the usual continental form inhabits the Nicobars, and the Cocos, but the green form is peculiar to the Andamans. It is not however the only form found in this last Insular group, since Dr. Annandale has sent me a specimen very similar to the Burmese form except that the postocular stripe is narrow and obscure, the scales are heavily outlined with black and there is no black line in the flanks at the edge of the ventrals. He remarks that the majority of the specimens from these Islands are of the green variety, *i. e.*, *andamanensis*.

Anderson‡ describes this green variety in greater detail than the other authorities alluded to. He says it is grass-green above, each scale with a broad black margin, and the ventrals with a black margin, as far as the keel. The black margins of the scales are so broad that when body is at rest, by the overlapping of the scales, the whole side of the body appears black. A black line beginning in the lore re-appears behind the eye, and extends to the neck where it becomes broken up into spots.

I have not seen this form in life, but in spirit it appears uniform Oxford blue, acquiring just the same hue that many other green snakes (*Dryophis*, *Lachesis*, *Dipsadomorphus cyaneus*, etc.,) do in

* J. A. S. Bengal XXXIX. p. 193. † J. A. S. Bengal XLII, p. 163.
‡ P. Z. S. 187[illegible], p. 184.

spirit owing, I believe, to the green colouring matter dissolving out. The preservative certainly acquires a distinctly greenish tinge. In the specimen I examined only the 5th and 6th labials touched the eye, and the last ventral was divided. If these two characters are constant there is no doubt that the snake should rank as a definite species. A study of the dentition would decide the point.

Dimensions.—The largest specimen of the typical variety I know of is the one collected by Evans and myself in Rangoon, which measured 4 feet 3 inches.

General characters.—Practically identical with those enumerated under *D. tristis.* I know of nothing special calling for remark; except that the tail appears to be relatively longer than in *tristis*, being usually fully one-third the total length of the snake, and often rather longer. The tongue is red with black tips (Flower).

Identification.—The remarks made under *D. tristis* are applicable here. A combination of the following characters will establish its identity.—(1) Vertebrals enlarged, and as broad as long or nearly so in midbody; (2) Ridged ventral shields; (3) Scales in 15 rows in midbody; (4) Divided annal; and (5) Subcaudal shields 131 to 153. As this snake is by far the commonest of the species in the genera *Dendrophis* and *Dendrelaphis* within the territory referred to hereafter, it is probable that any snake with the first two characters just mentioned will prove to be *pictus.*

Haunts.—Its haunts are precisely those of its common Indian ally *tristis.* That it will leave its arboreal environment in quest of food is shown by Flower who found a marsh haunting frog *Rana macrodactyla* in the stomach of one specimen. In Burma it was found in trees, and bushes, in verandah-creepers, the trellis-work screens around tennis-courts, and similar situations usually, and Annandale remarks that in the Malay States it is more usually found in bushes near the ground than in trees.

Disposition.—I believe it is a timid, inoffensive reptile, much like its Indian cousin *tristis.* A specimen I had in captivity was notably so, for when first caught by the tail it did not venture to menace or bite, but merely struggled to escape. In its cage it retired to the furthest part when the glass was approached, and could not be roused to anger by drumming on the glass or waving objects before it.

Habits.—Its springing ("flying") habit is, I think, clearly established. Shelford, who remarked upon this extraordinary habit* mentioned *Dendrophis pictus* as one of the species credited by the natives of Sarawak with the power of springing, and Dr. Annandale writing to me some time back told me that he had witnessed the flight of a *Dendrophis pictus* between two trees in the Malay States, and caught the snake in his butterfly net.

Food.—The only specimen of eight collected in Burma which had recently fed, contained a tree frog, and Flower has known *Rana macrodactyla*, a marsh frog taken. I suspect that its gastronomic tastes are much the same as those of *tristis*.

Breeding.—I have no breeding events to chronicle from any source.

Distribution. (a) Geographical.—Variety *typica*, occurs in the Eastern Himalayas about Sikkim up to an altitude of about 4,000 feet, probably the plains of Eastern Bengal, but I am not certain of this, Assam probably,† but I am not certain; one specimen I collected I referred with some doubt to this species, the Irrawaddy-Salween Basins (The Andamans, Nicobars and Cocos?),‡ Indo-China, Malay Peninsula, and the Malay Archipelago from Sumatra to the Philippines.

It is impossible to say whether the snake reported by Stoliczka§ as common in the Himalayas, in Kumaon and Sutlej is *pictus* or *tristis*. I have never met with a specimen from the Western Himalayas, and this is the only allusion I can find of such in literature.

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* Prol. Zool. Soc. Lond., 1906, p. 227.

† The common species in this province is *proarchos* (Wall) which is described in a paper appearing in this Number (p. 827) on the snakes of Assam.

‡ I have lately received a specimen from the Andamans from Dr. N. Annandale. In colouration and markings it was very like *tristis*, except that there was no interparietal spot, and no light vertebral streak. Having prepared the skull I find that it combines the character of *pictus* and *tristis*, and this being so, I think one has no course open to one but to concede to it the rank of a very closely allied but distinct species. I await further specimens before describing this in detail.

§ My reasons for doubting this record are that at least six other Himalo-Burmese snakes are recorded from South India on the sole authority of Beddome; these are *Tropidonotus parallelus*, *T. subminiatus*, *himalayanus*, *Lycodon jara*, *Simotes splendidus*, and *Bungarus fasciatus*. Beddome evidently received snakes from the Eastern Himalayas and Burma because he presented the following snakes to the British Museum from these localities: *Simotes albocinctus*, *S. cruentatus*, and *Dipsadomorphus hexagonotus*. It seems probable, therefore, that the six species first enumerated and also a *Dendrophis pictus* were likewise collected in Burma or the Eastern Himalayas, and inadvertently mixed with his South Indian collections.

I think I am justified in doubting the habitat of Colonel Beddome's specimen in the British Museum said to be from the Anamallays. This is the only record of this snake from Peninsular India excluding Bengal, and until another specimen is forthcoming the record is best ignored.*

Variety.—Andamanensis appears to be peculiar to the Andaman Islands.

(b) Local.—Variety *typica* inhabits the plains and low hills ascending to a level of about 4,000 feet (Stoliczka says 6,000 feet). It is fairly abundant in the Sikkim Himalayas. In Upper Burma (Bhamo) Anderson reported it common, but two of the three specimens collected by him are obviously the species, subsequently described by Boulenger as distinct, *viz., subocularis.* Evans and I found it by no means common in Lower Burma, acquiring but 6 specimens out of a total of about 750 snakes. In the Malay Peninsula Flower says it is by no means rare, and Annandale and Robinson refer to it as probably the most abundant snake in the cultivated parts of the Malay States. Variety *Andamanensis* is said to be common in the Andamans.

Lepidosis.—The scale characters are so extremely similar to those of *tristis* that I need not repeat what I have said under that species. The two differences that I have been able to discover are (1) that three supralabials, the 4th, 5th and 6th usually, but by no means always, touch the eye and (2) that the vertebrals are as broad, or nearly as broad as long in the middle of the body.

Dentition. (a) Maxillary.—20 or 21; the first 3 or 4 progressively increasing in length, the posterior 3 or 4 decidedly more compressed, but not longer than the preceding. *(b) Palatine.*—13 or 14, subequal and as long as the maxillary. *(c) Pterygoid.*—20 to 26, subequal, smaller than the palatine. *(d) Mandibular.*—20 to 22; the first 3 or 4 progressively increasing in length, the series then very gradually decreasing posteriorly.

Osteology.—The shape of the nasal bones (fig. B c) is strikingly different from that of *tristis*, so are also the ridges on the parietal bone (fig. B d). The length of the articular process of the dentary (B f) equals the distance from the articular notch to about the 8th tooth.

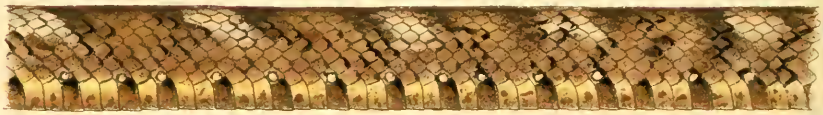
(To be continued).

* J. A. S. Bengal, XL. p. 131.

1a.

1b

1c



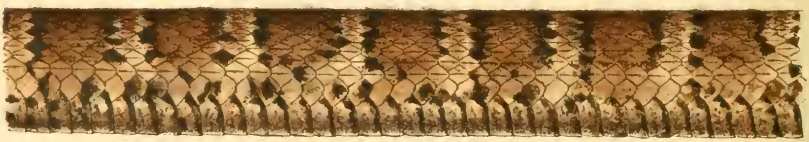
1d

2a.

2b.

2c

2d



2e

J. G. del. J. Green, Chromo.

THE COMMON INDIAN SNAKES. (Wall).

1. Psammodynastes pulverulentus, *harmless, head X 3.*
2. Ancistrodon himalayensis, *poisonous, nat. size.*

THE COMMON SNAKES OF INDIA.

BY

MAJOR F. WALL, I.M.S.

PLATE XIII. (*Aneistrodon himalayanus* and *Psammodynastes pulverulentus*) not having arrived from England, will be published in the next number of the Journal.

EDITORS.

THE COMMON INDIAN SNAKES.

THE ACCOMPANYING PLATE XIII.,

OF

Psammodynastes pulverulentus and *Ancistrodon himalayensis*—was omitted from No. 1, Vol. XV.

The description of these Snakes will be found on pages 65 to 79 of this Volume.

EDITORS.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plates and Diagrams.

BY

Major F. Wall, I.M.S., C.M.Z.S.

Part XIII with Plate XIII and Diagram.

(Continued from page 792 of Volume XIX).

The vipers constitute a family (*Viperidæ*) characterised by the shape of the maxilla or upper jawbone which as shown in a previous paper (Vol. xvi., p. 535) consists of a vertical column bearing a pair of tubular fangs. In all other snakes the long axis of the maxilla is placed horizontally.

The fangs of vipers are relatively much longer than in poisonous colubrines. They are also more curved, and slender, and the seam on their anterior faces—which marks the junction of the circumflexed walls that form the poison canal—is far less obvious than in poisonous colubrines.

The family *Viperidæ* is divided into two subfamilies on the presence or absence of a cavity placed between the eye and the nostril, and known as the loreal pit. The pit bearers are called pit vipers, and are classed together under the name *Crotalinæ*, the pitless vipers under the name *Viperinæ*.

ANCISTRODON HIMALAYANUS.

This viper belongs to one of the four genera into which the subfamily Crotalinæ is divided. The genus is characterised by the possession of large shields of the colubrine type on the top of the head, and the absence of a rattle at the end of the tail. It contains eleven species, seven of which are American, three Asian, and one European.

History.—It was first described by Dr. Günther in 1864.

Nomenclature.—(*a*) *Scientific.*—The generic name from the Greek "agkistron" a hook, and "odous" a tooth was introduced by de Beauvois in 1799.

From the derivation, and the fact that the godfather of the genus spelt the name *agkistrodon*, it seems a pity that the word has been

altered to its present rendering which was introduced by Baird in 1864.

(*b*) *English.*—The brown Himalayan viper is probably the best name for it. The only other brown viper in this mountainous region is *Lachesis monticola* which occurring only in the Eastern Himalayas, and extending to the Malayan subregion may be designated the brown, or spotted Himalo-Malayan viper.

(*c*) *Vernacular.*—The only native name I know for it is "pohur" which is what the Kashmiris call it.

General characters.—The body is rather stout, and heavy for the length of the snake, and round in section. Anteriorly it attenuates so as to make the neck very apparent, behind the broadly expanded angles of the jaws. Posteriorly it suddenly reduces in girth at the anus, so that the termination of the body, and commencement of the tail are far more obvious than in colubrine, and other snakes. The head is rather elongate and remarkably flat above, and especially so on the snout, this being due to the marked ridge (*canthus rostralis*) proceeding forwards from the eye-brow. The muzzle is rather narrow in front, the head broadest midway between the eyes and the neck. The nostril is rather small, and placed near the middle of a shield which is usually quite divided below, and frequently above the nasal aperture. The eye is rather large with an iris beautifully specked with gold, and a vertical pupil. The commissure of the mouth shows an exaggerated curve opposite the fang. The tail is about one-seventh the total length of the snake and ends in an elongate terminal shield. The scales on the upper parts are lustreless, and strongly ridged, the shields beneath smooth, and highly polished.

Identification.—It is a very easy snake to recognise. To begin with the association of a loreal pit, with large shields on the head proclaims the genus, and there are only three species within Indian limits, *viz.*, *himalayanus*, *hypnale*, and *millardi*. Both the last have a more or less well marked boss on the top of the snout—which is absent in the foremost—and inhabit Hills South of Bombay, or Ceylon.

Dimensions.—The largest measurement I know of is that recorded by Stoliczka, *viz.*, 34 inches. I have never seen one more than 25½ inches and I should say that average adults vary from about eighteen inches to two feet.

Haunts.—The brown Himalayan viper favours an altitude between about 7,000 to 10,000 feet though it wanders higher. Within these limits it is a very common snake, perhaps the most common in the Western Himalayas, but East of Nepal is decidedly uncommon. Mr. G. A. Millar writing to me in 1900, told me that during a 13 years' residence in Darjeeling he had only once had this snake brought to him, though he was interested in the collection of snakes now preserved in the museum of St. Joseph's College, and did much to make it what it is. I know of no other authentic record of this viper from this part of the Himalayas (*i. e.*, East of Nepal). Above 10,000 feet the snake becomes increasingly scarcer with the altitude. I found it at about 12,000 feet in Kashmir, and a specimen in the Indian Museum was captured at the foot of the Dharmsala glacier at an elevation of 16,000 feet. This is by far the highest altitude I know of for any snake. The only other proximate elevations known to me are 14,000 feet where the snake discovered by Lieut. F. M. Bailey, inhabiting hot springs in Thibet was captured, which I described in this Journal as *Tropidonotus baileyi*, and 12,500 feet the elevation at which Dr. H. Gadow encountered a rattlesnake in Mexico (*Crotalus triseriatus*). I think it is essentially a forest lover, being rarely found away from the protection offered by vegetation. In Kashmir I had no difficulty in finding specimens whenever I instituted a search for them. It very frequently found refuge beneath fallen timbers, so that I had rarely to turn over more than half a dozen logs before flushing one, and I have found two beneath different parts of the same bole. Of course it finds abundant refuge in other situations such as clefts in rocks, or beneath boulders where it is more difficult to dislodge. In Kumaon it frequently takes up quarters in the walls of terraced fields, or gardens where it is a source of special danger to the inquisitive house dog, that will thrust its nose into any cranny where it has discerned a movement. In camp it is by no means an infrequent visitor to one's tent, a fact which places most people on their guard who know Kashmir, and indulge in the gipsy life which is so attractive in that State.

Habits.—I encountered many in Kashmir when not searching for them. On a warm summer's day it is frequently to be seen coiled up, and basking in lazy enjoyment in the sun. Usually it selects a spot within easy reach of cover, to which it withdraws in a leisurely

fashion when disturbed. In cold or inclement weather it retires to any convenient quarter. Its movements are never what I would call really active, in fact compared with other non-viperine snakes it is a sluggard and it does not appear capable of hurrying itself under any amount of stimulation.

It probably passes a long term of hibernation each year, coming forth like other snakes of temperate climes in the spring and retiring in the late autumn. In spite of this it manages to fatten itself amply, for in the autumn months, its organs are packed with fat to a degree that has made me suspect a gravid condition, but subsequent investigation has frequently proved such a specimen a male. This snake in common with many other will often when provoked flatten itself, or crouch on the ground in a remarkable manner. The flattening is most evident in the hinder part of the body, but what object the snake has in behaving so it is difficult to guess at. Mr. Gleadow has remarked on this peculiarity in this Journal (Vol. xii, p. 577).

Disposition.—The brown Himalayan viper is a lethargic individual, slow to anger, but if sufficiently provoked will bite. It would appear to avoid a disagreeable situation whenever possible rather than provoke an encounter. The specimens I removed into the open and played with, would pass by a stick, or other offending object pushed in their way again and again as if unconscious of the offence offered. If rapped on the tail they shook that appendage with vigour in acknowledgment of the insult, without turning to avenge it. If cover was within easy reach they always strived to get there, rather than show fight, but if baulked, or if severely struck they would coil themselves up, erect the head, quiver the tongue and vibrate the tail tip, and on further provocation would frequently strike out fiercely. I think it probable that they rarely inflict a bite unless trodden upon.

Food.—Stoliczka* says that it feeds principally on mice, but although my observations were made for the most part in the same part of the Himalayas as his, I never found anything in the stomachs of those captured in Kashmir except the little skink *Lygosoma himalayanus*. This beautiful little lizard with its cherry-red waistcoat, is extremely common in Kashmir, where one rarely turns over a stone, without

* Journ. As. Soc., Bengal, Vol. XXXIX., p. 226.

finding one quartered in company with an equally common black scorpion. So many of my brown Himalayan vipers had recently fed on this lizard, that it is evident, that they must contribute largely to checking their numbers. I have found as many as three *Lygosoma* in the stomach of a single *Ancistrodon*. In other parts of the Himalayas I have usually found this same lizard taken, but in Kumaon I have on four occasions known mice devoured.

Breeding.— I do not know the exact mating season, but it is probably in the spring—April or May. The period of gestation is also not known. Like most other vipers this species is viviparous in habit and the young are launched forth probably in August and September. Several specimens I had in July were gravid and contained immature embryos. These were seen to be coiled spirally, in a bath of transparent fluid, which occupied the upper part of the yolk. The investing membrane covering this oval shaped bath was transparent, so that the contained fœtus could be seen clearly in every detail, before the egg investment was ruptured. The embryos I unravelled in July were about two or three inches in length. What the length of the embryo at birth is I cannot exactly state, but it is probably about 5 inches. The species is not very prolific, only from 5 to 7 embryos having been observed in a single brood.

Poison.—Nothing is known about the qualities of the poison and I have never been able to hear of a casualty in the human subject, except that of a cooly employed by Mr. P. W. Mackinnon near Mussoorie who was scratched in the thumb when attempting to capture one. The fact that the injury sustained was very slight and superficial and no ill effects of any sort were evoked makes it fairly certain that no venom had been injected in this case. A dog bitten on the nose this year at Binsar (Kumaon) suffered considerably. The whole muzzle swelled, and the animal was very distressed and affected constitutionally. The wound was not incised, but permanganate of potash was applied locally. One may assume that this reagent had little if any effect in neutralising any poison injected below the surface skin. After one day's serious illness, the dog improved, and in two more days was quite well again. There were no hœmorrhages reported. I did not see the dog, but the snake was referred to me and I learnt the details of the casualty later.

It would seem from this case that the poison is not very virulent,

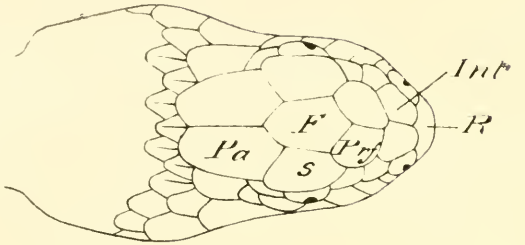
and it is probable that in the human subject a fatality is unlikely to occur, but it seems strange that we should know so little about the effects of the bite of so common a snake. There must be abundant casualties every year in the Himalayas, but so long as people before whom these cases are brought, refrain from publishing details, and omit to refer the offender to some authority for identification, our ignorance of the poison effects will remain what it is.*

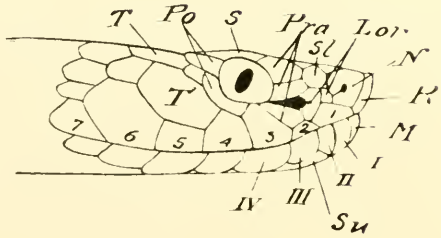
Distribution.—The Himalayas, probably as far as the Indus in the West and the Brahmaputra in the East. The Khasi Hills in Assam is also reported as a habitat, as far as I am aware on the sole authority of Jerdon. I think we should await confirmation of this before accepting it. It is a very easy matter for even the most careful collectors to mix specimens. In at least one instance, *viz.*, *Dinodon septentrionalis*, Jerdon was in doubt as to whether the locality was the Himalayas or Khasi Hills in Assam. I have also shown reason to doubt† the Himalayas as the habitat of the specimens of *Trachischium monticola* in the British Museum collected by Jerdon, this snake being otherwise only known from the Khasi and neighbouring Assam Hills, and it seems to me possible that in the case of *Ancistrodon himalayanus* Jerdon's specimens in the British Museum may have come from the Himalayas.

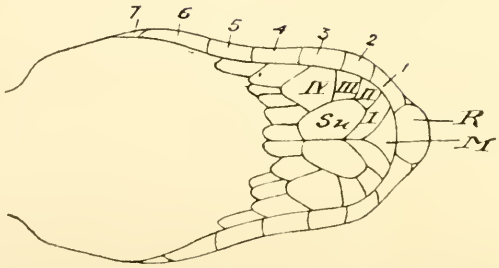
Lepidosis.—*Rostral.*—About as high as broad; in contact with six shields, the anterior nasal sutures being much the longest. *Internasals.*—A pair; the suture between them as long or nearly as long as that between the præfrontal fellows, as long or rather shorter than the internaso-præfrontal sutures. *Præfrontals.*—A pair; the suture between them subequal to the præfronto-frontal sutures: in contact with internasal, supraloreal, uppermost præocular, supraocular, and frontal. *Frontal.*—Touches six shields (exclusive of the small scales so often interpolated at the angles of the head shields): the fronto-supraocular sutures longest. *Supraoculars.*—Length and breadth subequal to that of the frontal. *Nasal.*—Usually incompletely divided by a suture from the nostril to first labial, which, however may be absent; sometimes an additional suture passes from the nostril to the internasal; in contact with the 1st only of the supralabial series. *Supraloreal.*—One, in contact with the internasal. *Loreal.*—

*This was written before Colonel Fenton's notes which appeared in our last Jourl,. p. 1004.

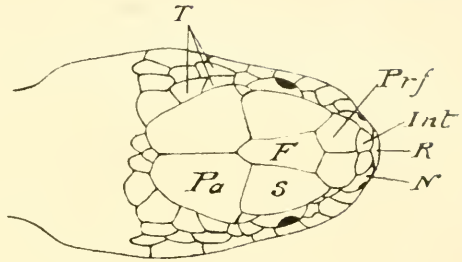
† Bomb. Nat. His. Jourl., Vol. XIX., footnote, page 343.

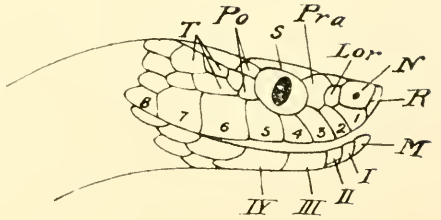


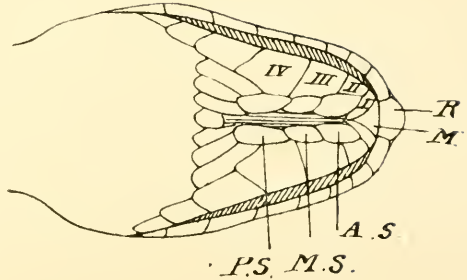




Ancistrodon himalayanus (× 2).







Psammodynastes pulverulentus (× 2).

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

EXPLANATION OF DIAGRAM.

ANCISTRODON HIMALAYANUS and *PSAMMODYNASTES PULVERULENTUS.*

A. S.	Anterior Sublinguals.
F.	Frontal.
Int.	Internasals.
Lor.	Loreals.
M.	Mental.
M. S.	Median Sublinguals.
N.	Nasals.
Pa.	Parietals.
Po.	Postoculars.
Pra.	Præoculars.
Prf.	Præfrontals.
P. S.	Posterior Sublinguals.
R.	Rostral.
S.	Supraocular.
Sl.	Supraloreal.
Su.	Sublingual.
T.	Temporals.
I to 8	Supralabials.
I to IV	Infralabials.

One deeply grooved, and forming the anterior boundary of the loreal pit. *Præoculars.*—Three, the two lowest diverging forwards, and forming the upper and lower boundaries of the loreal pit. *Postoculars.*—Usually two (sometimes three), the lower larger, and somewhat crescentic. *Temporals.*—Two, the lower very large and in contact with the 3rd, 4th and 5th supralabials normally (where the supralabials are 8, it touches the 4th, 5th and 6th). *Supralabials.*—Usually 7, the 2nd touching the eye (sometimes 8 with the 3rd touching the eye) ; the penultimate a very large and high shield. *Infralabials.*—Four, the 4th largest, and in contact with 3 or 4 scales behind. *Sublinguals.*—A single pair. *Costals.*—Two headslengths behind head, 21 usually (rarely 23), midbody 21 (rarely 23), two headslengths before the anus 17 ; all the rows strongly keeled except the last for a variable distance anteriorly : apical facets present in pairs. *Ventrals.*—144 to 166. *Anal.*—Entire. *Subcaudals.*—34 to 52, divided.

Abnormalities.—Small scales are often intercalated between the head shields. Rarely some of the anterior subcaudals are entire. I have never seen a specimen with the scale rows 23 in midbody, but Boulenger mentions such.

Colour.—Very variable. Specimens occur of a nearly uniform light brown, of various tints to blackish-brown. Usually the snake is more or less conspicuously marked with a coarse mottling or blotching, darker than the ground colour, and irregularly distributed. Sometimes more or less obvious short crossbars are apparent, and very frequently a light vertebral line bordered with dark zigzag or sinuous stripes laterally. The flanks are beautifully dappled with various shades of dark brown, and there are often some white mottlings at the side of the neck. The head is often darker than the back, and shows dark marks on the enlarged shields. A conspicuous oblique dark streak bordered with white, runs from the eye to the gape. The lips are enamel-white or pale pink, and so is the chin and throat, and many of the labial sutures pigmented. The underparts are very finely powdered with various tones of brown, sepia, rufous, plumbeous or dirty white. The tail is usually reddish towards the tip.

Dentition and jaws—Maxilla.—Upper half hollowed out into a cup, the external and posterior walls of which are deficient. This cup to which the præfrontal bone provides a roof, forms a spherical chamber—the loreal pit. Below the bone supports two canaliculate fangs.

Palatine.—Very short, about one quarter the pterygoid in length, highly compressed; not extending forwards as far as the maxillæ; a short edentulous space in front, and a longer space behind; supports 3 or 4 subequal well developed teeth. *Pterygoid.*—Highly compressed; from 6 to 9 subequal well developed teeth anteriorly; more than half its length edentulous behind. *Mandibular.*—Dentary bone about half the length of the articular; supports 11 teeth, gradually reducing in length behind.

The family *Colubridæ* according to the present accepted scheme of classification is divided into three large groups or "Series" based upon the absence, presence, and situation of grooved or tubular teeth (fangs). The *aglypha* (Greek "a" without and "glypho" I carve) are characterised by the absence of "carved" or grooved teeth. The *opisthoglypha* (Greek "opisthe" behind), has grooved fangs fixed in the posterior extremity of the maxilla or upper jaw, and the *proteroglypha* (Greek "proteros" before), has tubular fangs situated in the front of the maxilla. The fact that the fangs in the *opisthoglypha* are grooved, and those in the *proteroglypha* tubular has never yet been actually stated in works on ophiology, and in perusing the standard work on the subject, *viz.*, the Catalogue of the snakes in the British Museum by Mr. Boulenger one must of a necessity be misled, for the author repeatedly, if not invariably, speaks of grooved fangs in describing the dentition of the *proteroglypha*. As a matter of fact all the fangs in the snakes of this series are tubular, though there is always a very obvious seam on the anterior face of the fang where the circumflexed walls have united. The subject of this paper belongs to the opisthoglyphous series of colubrines, as will be seen on referring to the figure of the maxillary dentition. (See page 79).

This series is divided into three sub-families *Homalopsinæ*, *Dipsadomorphinæ* and *Elachistodontinæ*, the species of which are all harmless to men. *Psammodynastes* is one of the 69 genera into which the second of these sub-families is further divided.

PSAMMODYNASTES PULVERULENTUS.

The Mock Viper.

History.—This snake was first described by Boie in 1827, and for many years was classified as a *Psammophis*. In 1858 Günther

removed it from this genus on account of its corporeal habit which is much shorter, and stouter than that characteristic of *Psammophis*, and introduced the present generic name. There is no doubt that the two genera are very distinct, for though the maxillary dentition is very similar in both, I notice that there is a short edentulous gap between the 4th tooth, and the succeeding enlarged pair in *Psammophis* which does not occur in *Psammodynastes*. Of much greater significance however are the differences in shape of the præmaxillary, nasal, and frontal bones especially the last. Further the palatine bone in *Psammophis* is unusually short, not extending as far as the 4th maxillary tooth whereas in *Psammodynastes* it extends forwards to the 2nd tooth.

The genus *Psammodynastes* has but two species, one peculiar to the Malayan sub-region, *viz.*, *pictus*, the other also a Malayan snake whose range of distribution extends through a considerable area of our Indian Dominions, *viz.*, *pulverulentus*.

Nomenclature—(*a*) *Scientific.*—The generic name is from the Greek "psammos" sand, and "dunastes" a ruler. The specific title is from the Latin, meaning dusty.

(*b*) *English.*—The mock viper seems to me the most appropriate name for it, for it bears a very marked superficial resemblance to a viper, a fact remarked upon by most previous writers. Its similarity to the Himalayan pit viper *Ancistrodon himalayanus* is especially striking, as will be seen from our Plate, and I know of no more remarkable resemblance between any two snakes of different families, or even genera. The short and rather stout body, contracted tail, flattened head, swollen lips, large eye with vertical pupil, lustreless dorsal scales, and highly polished ventral plates are all very characteristic viperine traits, but the resemblances do not stop here, for its attitude of menace is very like that of vipers, added to which it is viviparous in habit.

(*c*) *Vernacular.*—I know of none.

General characters.—The head is flattened on the top, and rather almond-shaped, the snout narrowed in front, and rather short, and the neck very obviously constricted. The ridge from the eye to the snout (*canthus rostralis*) is very marked, separating the face from the crown. The upper lip is rather swollen giving a forbidding expression to the facies. The nostril is placed in a single shield, and the eye which is large has a vertically elliptic pupil, and an iris specked with gold. The body is rather stout, and short, and markedly compressed.

(Mr. Boulenger says it is cylindrical but this is a mistake.) The tail is short being about one-fifth to one-sixth the total length of the snake. The scales on the back are lustreless and smooth, those on the underparts highly polished.

Identification.—As far as I am aware it is the only Indian snake that has three pairs of sublingual shields, separated by a longitudinal furrow (the mental groove), but it will be wiser to take in conjunction with this the costal rows which are 19 in midbody. Another unusual feature in lepidosis that I should mention here is that the suture which the lower temporal makes with the penultimate supralabial is decidedly shorter than that made with the antepenultimate. In almost all other snakes where the temporal touches two supralabials the anterior suture is much shorter than the posterior.

Dimensions.—Adults usually range between about 1 foot 3, and 1 foot 9 inches. The largest specimen I have measured was a ♀ which was 2 feet and $\frac{3}{4}$ of an inch long.

Haunts.—It is eminently a forest lover. I have always met with it in jungle, or quite close to jungle, and its sombre colouration must offer it considerable protection in the gloom of such an environment. The area of its distribution is one remarkable for the abundance of its forests, and the dearth of anything approaching desert tracts, so that its scientific name " lord of the sands " is unfortunate. I have had several specimens sent to me from tea estates in the Eastern Himalayas and Assam where again there is abundance of cover and shade. Nicholson* mentions having taken one whilst swimming in the Rangoon lake. This was probably an accidental circumstance for it shows no special predilection for an aquatic environment, though like other land snakes it can evidently swim with ease when occasion demands it. It is a much commoner snake in the Hills than in the Plains, and favours especially altitudes between about 3,000 and 6,000 feet. In the Khasi Hills within these limits I found it quite a common snake, and in the Eastern Himalayas below Darjeeling I have had enough specimens sent me to show that it is to be considered one of the common snakes in this locality. Below 3,000 feet in the same vicinity it is decidedly less common, and Stoliczka† even records it as a rare snake there. It occurs in the

* Indian Snakes, p. 131. † Journal, Asiatic Society, Bengal, Vol. XL., p. 422.

Plains in Upper Assam and in Burma, but I would call it, an uncommon species at this level. In Burma Evans and I only got 4 specimens out of a total of considerably over 600 nearly all of which were collected in the Plains. In Assam I got only 5 in the Plains out of a total of 615 specimens.

Habits.—Though a vertical pupil is usually associated with a nocturnal habit, this snake appears to me to be more frequently abroad in the day time than at night, in fact most of my specimens, if not all, have been encountered during the day. It is a lively little creature exhibiting much activity when disturbed, and I have usually found it difficult to capture for two reasons, firstly owing to the agility with which it disappears into cover which is always adjacent, and secondly owing to the caution necessary in dealing with a snake that cannot be distinguished from a viper with any degree of certainty till after capture. I have liberated specimens in the open, on a road or in my verandah and it makes strenuous efforts to escape, even indulging in a series of leaps in order to evade recapture.

A hatchling of $4\frac{3}{4}$ inches that I had in captivity managed to scale, and cling to the face of the glass bottle in which it was incarcerated, the diameter of its prison being about 4 inches, a truly marvellous feat showing that its scansorial powers are little if at all inferior to that of the deftest climbing snakes, but in nature I have never noticed any inclination for it to climb into bushes or trees.

Disposition.—The mock viper is a plucky, and vicious snake. Those I have met with have usually menaced if they have not actually struck at me. One I had in captivity for some time invariably prepared to strike at me, adopting a truly viperine pose with head erect and the forebody retracted into sigmoid curves. Those I have flushed in their native haunts have usually struck viciously at me, and more than one trustworthy informant who has sent me a live specimen appears to have met with a similar experience. Blanford* mentions encountering one in Sikkim that nearly bit him. Even the little hatchling I had in captivity struck out fiercely at me. On the other hand I have had two specimens that refused to strike under severe provocation, though they posed as if intending to do so.

Food.—Its staple diet is of a reptilian order, frogs and lizards being equally favoured. On four occasions I have found frogs in the

* Journal, Asiatic Society, Bengal, 1871, p. 373.

stomach, once in a diminutive specimen only 7½ inches long. The lizards I have known taken are *Ptyctolæma gularis* once, a *Calotes* once in Shillong which was almost for certain *jerdoni* as the scales were of a vivid green colour, and skinks of the genus *Lygosoma* on three occasions, two of these being *L. indica*.

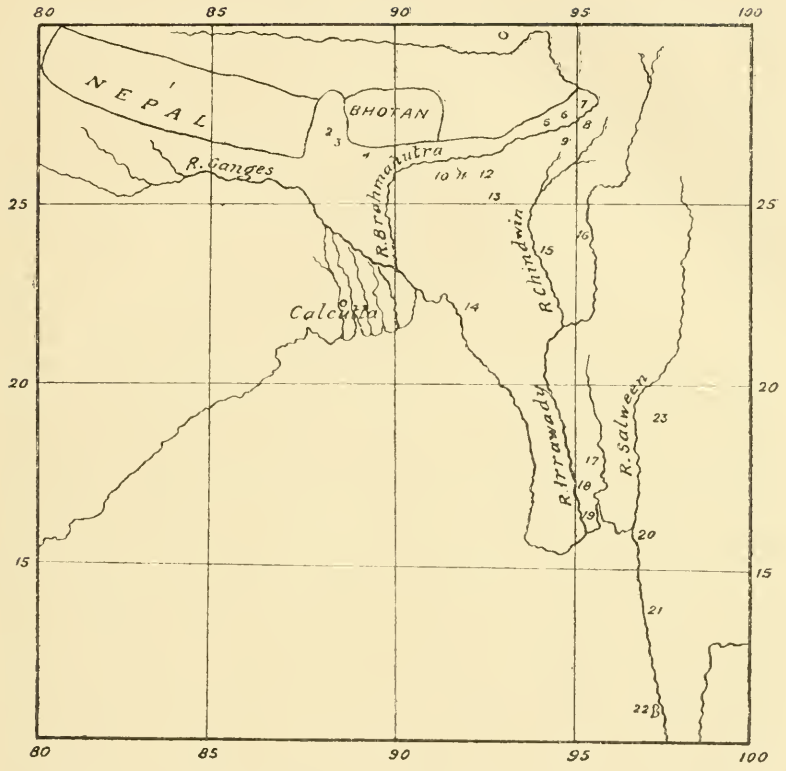
The sexes.—My notes show that the sexes are evenly balanced, and with the exception of one unusually large ♀ my measurements seem to indicate a similar degree of growth between them. Males as a rule have rather longer tails.

Breeding.—I have had opportunities of chronicling but few breeding events, so that I cannot speak with any great certainty of this important function. In the hills the mating season would appear to be in summer, probably about August since I have had two specimens with impregnated ovarian follicles in September in the Khasi Hills (Shillong) and one in the same month in the Eastern Himalayas (Pashok). As regards the Plains I can vaguely suggest that matrimonial intercourse probably occurs in the winter months—December to February—at least so it would appear. The period of gestation is not known, but probably exceeds four months, since the young are discharged alive. The gravid ♀ I kept in Dibrugarh appeared obviously in this state two months before I killed her and eviscerated her unborn progeny. In the Plains the young are born in June and July, for I captured a hatchling 4¾ inches long in Rangoon in June and the almost mature embryos of my captive Dibrugarh specimen just alluded to were expected in July.

The young at birth measure from about 4¾ to 5¼ inches. The species is not very prolific from an ophidian standpoint. I have on two occasions found 10 eggs in the oviducts, once 8, and in my Dibrugarh specimen there were 3 embryos, and 3 non-fertile eggs.

The rate of growth is somewhat difficult to calculate from my records, but it appears to me that the young double their length in the first year, add some 4 to 6 inches in the second, and at the beginning of their third year appear to be sexually mature since my smallest gravid ♀ measured 1 foot 3¾ inches. These deductions are in consonance with my observations on other snakes.

Distribution.—The Eastern Himalayas probably as far West as the Western limit of Nepal, the Assam Hills and Plains, the Burmese



Distribution of *Psammodynastes pulverulentus* within Indian Limits.

1. Butal, Nepal (I.M.). 2 Pashok (F.W.). 3 Tindharia (F.W.). 4 Buxa Dooars (F.W.). 5 Dejao, N. Lakhimpur (F.W.). 6 Dibrugarh (F.W.). 7 Sadiya (F.W.). 8 Jaipur (F.W.). 9 Sibsagar (I.M.). 10 Shillong (F.W.). 11 Cherrapunji (I.M.). 12 Samaguting (I.M.). 13 N. Cachar (I.M.). 14 Chittagong (I.M.). 15 Kindat (F.W.). 16 Katha (F.W.). 17 Wumbezat (Wall and Evans). 18 Pegu (I.M. and Theobold). 19 Rangoon (Nicholson, Wall and Evans). 20 Moulmein (I.M. and F.W.). 21 Tavoy (I.M.). 22 King's Isle, Mergui (I.M.). 23 Tounggyi, S. Shan States (B.M.).

I.M. implies Indian Museum, B.M. British Museum, and F.W. the Writer.

Hills and Plains, Indo-China, Tenasserim, the Malay Peninsula, and the whole Malayan Archipelago to Formosa.

The precise localities from which it has been collected within Indian limits are shewn in the accompanying map.

In the Indian Museum there is a specimen said to be from the Central Provinces of India, but as this seems to me most unlikely it is best to await confirmation of this locality, which is so far removed from its certain area of distribution, before accepting it.

Lepidosis.—Rostral.—Touches 6 shields, the rostro-nasal sutures longest. *Internasals.*—Two, the suture between them $\frac{2}{3}$ to $\frac{3}{4}$ that between the præfrontal fellows, about $\frac{3}{4}$ the internaso-præfrontal suture. *Præfrontals.*—Two, the suture between them equal to or rather greater than the præfronto-frontal suture; in contact with internasal, nasal, loreal, upper præocular, supraocular, and frontal. *Frontal.*—Touches 6 shields, the supraocular suture about three times the length of the parietals, and more than twice that of the præfrontals. *Supraoculars.*—Length subequal to frontal, breadth about twice that of the frontal along an imaginary line connecting the centres of the eyes. *Nasals.*—Single; in contact with the 1st only of the supralabial series. *Loreal.*—One, rather longer than high. *Præoculars.*—One or two (rarely three). *Postocular.*—Two (rarely three). *Temporals.*—Two anterior, in contact with the 6th and 7th supralabials, making a longer suture with the 6th than with the 7th. *Supralabials.*—Eight, the 3rd, 4th and 5th touching the eye; the 6th and 7th subequal, and largest. *Infralabials.*—Four, the 4th largest and in contact with two scales behind; the first three touch the anterior and the 4th only the posterior sublinguals. *Sublinguals.*—Three pairs. *Costals.*—Two headslengths behind the head 17, midbody 17, two headslengths before the anus 15; the row absorbed is the 4th above the ventrals; no keels; no apical pits. Ventrals 146 to 175. *Anal.*—entire. *Subcaudals.*—45 to 68 divided.

Colour.—Theobald speaking of this snake says: "This species is somewhat variable in colour and markings." I would go further, and say it is very variable, as much so as any snake I know. Some specimens are extremely dark, almost black, others very light, the prevailing hue being a pale ochraceous, but these extremes cannot be considered colour varieties for they are completely connected by transitional forms. Moreover one of the embryos I extracted from

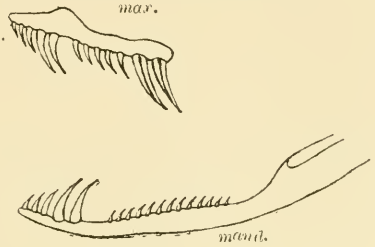
my gravid ♀ was of the light type and the two others of the dark. It must not be understood that in either case the snake is uniformly coloured for this is not so. It is always more or less obviously finely speckled or streaked with hues darker than the ground colour. There is very usually a series of large, oval, rufous or brown spots on each side of the spine, most noticeable anteriorly, and specially in the dark specimens. Sometimes these spots are confluent to form crossbars over the back. In many specimens there is a more or less distinct dark longitudinal band on the back involving the median five rows and half the sixth row above the ventrals, and a similar dark band in the flanks involving the lower half of the fourth, the third and the second, and upper half of the ultimate row. The flanks are often ornamented with white streaks anteriorly which are more or less hidden until the reptile dilates itself, and below these is usually a series of bright ochraceous, yellow streaks or spots, sometimes confluent into a band which are very conspicuous and ornamental. The head is usually streaked longitudinally on the top, and the upper lip is adorned with a white, black-edged mystaceous band. The belly is whitish or yellowish streaked, and finely specked with bright ochraceous-yellow anteriorly and with darker shades of brown further back.

Abnormalities.—I have seen the 1st supralabial divided into two superimposed parts once, and a similar condition of the loreal twice. Three præ and three postoculars less rarely occur. Boulenger says the scale rows are rarely 19.

*Dentition.**—*Maxillary.*—The first 3 (rarely 2) teeth are small but progressively increase in size, and are succeeded without any edentulous gap by two large subequal fang-like, but solid teeth fully twice as long as any of the preceding. Behind these is a short toothless gap, and then a series of 5 (rarely 6) small subequal

* Boulenger's description "Maxillary teeth 9 to 11, third or third and fourth much enlarged fang-like, followed by a short interspace, last enlarged and grooved, anterior mandibular teeth strongly enlarged" is not very accurate, and it is therefore not surprising that as recently as 1905, the snake was redescribed by Mr. Rosen (Ann. and Mag. Nat. Hist. Vol. 15, p. 176), as the type of a new genus under the name *Anisodon lilljeborgi*. It will be seen however that the characters of the dentition as shown by him, prefectly agree with that given by me from my three skulls, and Mr. Boulenger's remarks on Mr. Rosen's paper above alluded to showing that *A. lilljeborgi* is in reality *P. pulverulentus* are undoubtedly correct.

teeth followed by two large, subequal grooved fangs fully twice as long as the immediately preceding teeth.



Maxilla and mandible of *Psam : pulverulentus* (×3.)

Palatine.—8 to 11 small and subequal.

Pterygoid.—21 to 23 small and subequal.

Mandibular.—The first 2 or 3 teeth are small, progressively increasing in size, and succeeded without any gap by two large, subequal teeth fully twice as large as any of the preceding. Behind these is a short edentulous gap, followed by a series of from 13 to 15 small, subequal teeth.

(*To be continued.*)

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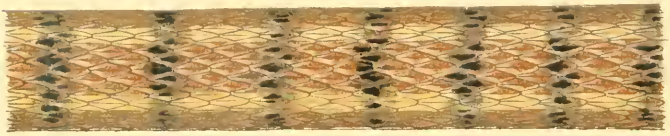

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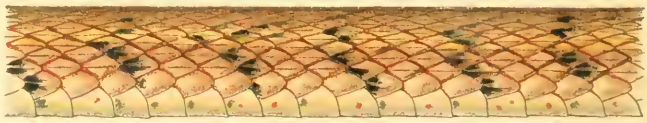

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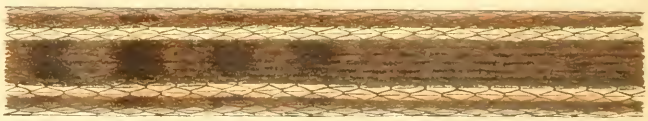

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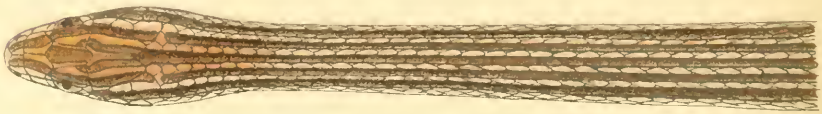

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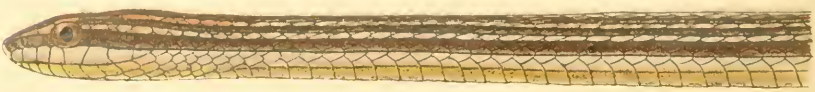


8.

J. G. del. J. Green, Chromo.

THE COMMON INDIAN SNAKES. (Wall).

1–6. Tropidonotus stolatus, *harmless, nat. size.*

7–9. Psammophis condanarus, *poisonous, nat. size.*

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plates and Diagrams.

BY

Major F. Wall, I.M.S., C.M.Z.S.

Part XIV with Plate XIV (Diagrams I and II and Map).

(Continued from page 79 of this Volume.)

The genus *Tropidonotus* is one of 242 into which the family *Colubridæ* is divided, and belongs to that "series" which is characterised by the absence of any grooved, or tubular teeth, *viz.*, *Aglypha.*

It is one of the most widely distributed of all the ophidian genera, representatives occurring in all five Continents.

It is divided into four sub-genera, *viz.*, *Tropidonotus*, *Nerodia*, *Amphiesma*, and *Macropophis* on differences affecting dentition, but these names are not in common use. As the differences are quite as important as those claimed to differentiate many other closely allied genera, such as *Macropisthodon*, *Helicops*, *Pseudoxenodon*, etc., it is difficult to see why the major rank of genus has not been conceded by Mr. Boulenger who includes them all in a single cumbersome genus, *i.e.*, *Tropidonotus.* Of the 80 odd species included under this generic title-no less than 20 inhabit various parts of our Indian Empire.

TROPIDONOTUS (AMPHIESMA) STOLATUS.

The buff-striped keelback.—The species was referred to first by Carl Linnè in 1766 under the name *Coluber stolatus.* Russell figured it three times in his Volumes on the Indian Snakes published in 1796 (Plate X), and 1801 (Plates XV B and XIX).

Nomenclature (a) Scientific.—The generic name from the Greek τροπις a keel, and νοτυς the back was introduced by Kuhl in 1822 in reference to the ridges on the scales of a snake whose precise

identity is not known. Boie in 1826 applied the title to our common English grass snake (*natrix*) which is therefore the type of the genus. *Amphiesma* from the Greek meaning "a garment" was initiated by Dumeril and Bibron in 1854, and applied to the snake under discussion, *viz.*, *stolatus* which is therefore the type. It is difficult to realise that anyone who has viewed the skulls of *natrix* and *stolatus* side by side can doubt the justification for dissociating them generically. In the former the maxillary teeth form an uninterrupted series, the last three or four of which progressively increase in size, but are none of them twice as long as the teeth in the middle of the jaw, see figure A. In *stolatus* there is a gap at the back of the jaw, succeeded by two subequal enlarged teeth fully twice as long as those at midmaxilla, see figure B, in fact the very condition which led Mr. Boulenger to separate three species previously included in *Tropidonotus*, under a new genus which he called *Macropisthodon*. See figure C. The specific name from the Latin meaning "dressed," and implying "decked" originated with Linnè in 1766. There is little doubt that the snake ought to be known scientifically as *Amphiesma stolatus*.

(*b*) *English.*—The "buff-striped keelback," is, I think, the most descriptive name for it, or for brevity "buff stripes."

(*c*) *Vernacular.*—Russell mentions "wanna pam," "wanapa pam," and "wanna cogli," as names by which it is known in South India. These are Telugu names derived from "vana" rain. The first two mean simply "rain snake," the second being the adjectival form of the first. Mr. Millard tells me that about Bombay it is called "wana kukroo" and "nanati." I heard it called "therlian" by the Malabaris about Cannanore. Colonel Dawson tells me it is called "churrutay" in Travancore, a word derived from "churul" a "coil," but the same name is applied to *Lycodon*, *Simotes* and other snakes. In Ceylon* Ferguson says it is called "ahara-kukka" and Mr. E. E. Green confirms this and tells me the words are Singhalese, the latter meaning "dog," and the former "food," but the name thus

* Rept. Fauna, Ceylon, page 20.

interpreted is enigmatical*. In Bengal Theobald† says it is known as "halhalliah," and Mr. D'Abreu whilst confirming this by telling me that this is the name applied to it in Murshidabad, remarks that in Behar it is called hur-hur-ra a local word meaning with a rustle hur-hurra in Bengali means "restless" and is the name by which it is known throughout that Province.

In Burma it is called "mywe shaw" meaning "crawling snake" and "myit shaw" "grass crawler."

General characters.—It is a graceful little reptile with the body rather short, and the tail rather long, *viz.*, about one-fourth the total length of the snake. Anteriorly the body attenuates somewhat to the head, so that the neck is fairly evident, and posteriorly reduces perceptibly in girth to the vent, where in females specially a further reduction marks the commencement of the tail. Dorsally the body and tail are rough with the keeling of the scales, which last are lustreless. The head is rather depressed, evenly rounded from the crown to the side of the face, specially over the muzzle, and has the snout moderately narrowed. The eye is large with a round pupil, and an iris flecked with gold especially at the pupillary margin. The nostril is open, and occupies about two-fifths of the depth of the suture between the nasal shields, leaving about one-fifth of the suture uninvolved above, and about two-fifths below. The tongue is a dull orange colour at the base, and has black tips.

Colour and markings.—The ground colour is olivaceous-brown of various depths of intensity, some specimens being dark, others light. A buff stripe beginning in the neck or forebody, at first obscure but becoming well defined, and conspicuous, passes down each side of

* Further enquiry brings to light the following story from old Ceylon records. It appears that the old Ceylon Kings kept a jester about the Court, and on one occasion at a garden party the King came across a snake called Ahan-kukka (Synonymous with the Pali word for the tame snake man-balla), meaning literally "ahan" I am, "kukka" a dog. He called for the jester, and seeking to have some fun at his expense, asked him before his courtiers and assembled guests the name of the snake, but the jester was quickwitted enough to discover the King's intention and replied untruthfully "ahara kukka" meaning "a dog looking for food" since which the snake has been so known.

† Cat., Brit. India, page 177.

the back to the tail tip. These involve one whole and two half rows of scales, and are separated from one another by five whole and two half rows. The ground colour is further ornamented with black, or blackish somewhat irregular crossbars which are always most obvious anteriorly, and often wholly disappear before the vent. The head is olivaceous-brown fading laterally to pearly-whitish, yellow or orange on the lips. There is I think always a blackish vertical short loreal streak, and generally some of the last supralabials are margined posteriorly with black. The chin is whitish, and the throat pearly-white, pale or bright yellow, or orange, these vivid hues being seen alike in some specimens of both the blue and red varieties. The belly is pearly-whitish with generally some roundish, scattered small, lateral black spots, chiefly anteriorly. Often an ill-defined pinkish or lilac suffusion is to be seen at the edge of the ventral shields. When desquamation is impending much of the beautiful colouring may be obscured but when once the little snake has divested itself of its old and seedy looking raiment, it is just the little dandy that its specific name implies.

Varieties.—Two distinct colour varieties are to be met with, one which may be styled the *forma typica*, and the other for which I propose the name *erythrostictus*.

Variety (A). *Forma typica.*—In this the overlapped margins of the scales, especially towards their bases are adorned with blue-grey or pale-blue often of a shade almost identical with that very beautiful flower *Plumbago capensis*. This ornamentation is concealed by the imbrication of the scales when the snake is quiescent, and only comes into view when the snake under alarm or excitement inflates itself. It is much more conspicuous, or may be wholly confined to the anterior half or third of the body. This is the common type which is universally to be met with throughout the area of its distribution in Plains and Hills alike.

Variety (B). *Erythrostictus.*—In this the far more beautiful variety, bright vermilion, replaces the blue adornment of *forma typica*. The vermilion however is usually if not always more extensively distributed than the blue of the last variety, so that it is usually more or less evident even in the quiescent state of the

snake. Specimens so ornamented frequently have a speckling of the same hue on the belly, and in many though not in all the throat is yellow or orange.

This variety is very local being as far as I am aware confined to the coasts of India, and even here is far less common than *forma typica* with which it is associated. I met with it most commonly on the West Coast in Cannanore where one-third of my specimens (16 in 47) were of this variety and have had specimens sent to me by Colonel Dawson from Travancore. Mr. Millard tells me he has never seen it about Bombay, but for all this I feel sure it must occur, for Murray mentions it in Sind presumably on the coast though he does not say so. I have seen three specimens from Madras sent by Mr. Dwane to our Society from one of which our coloured figure is taken. Dr. Günther* says Mr. Walter Elliot has figured such a specimen from Madras. I also met with it not infrequently in Rangoon. Nicholson † remarks that the varieties of this snake found in Malabar and Burma show the finest display of interstitial colours, by which I think he alludes to the vermilion variety for this is the one he figures. Theobald ‡ also remarks on the vermilion seen in specimens from Burma, and both he and Murray say that this brilliant suffusion is a seasonal manifestation. Whether these observations were made independently or Theobald simply reiterated Murray's words I cannot say, but I am fully convinced that neither the vermilion ornamentation, nor the brilliant yellow and orange gorgets seen in some specimens are seasonal. Dr. Günther's remarks on Mr. Walter Elliot's painting of a ♂ specimen with a yellow throat and vermilion adornment seem to imply that these highly decorative hues are acquired in the breeding season, but this is not the case, nor are they the prerogative of either sex, nor the insignia of maturity.

In Fyzabad I had two ♂ hatchlings on successive days, *viz.*, 25th and 26th October, one of which had a white throat, whilst the other had a bright yellow suffusion extending to the lips. On the 7th of November in the same year (1905) I had a ♀ adolescent $9\frac{5}{8}$ inches

* Rept. Brit. Ind., p. 267

† Ind. Snakes, Plate xv. fig. 1. ‡ Cat. Brit. Burma. p. 47.

long with a bright canary gorget. Specimens with and without this adornment are to be met with of all ages and throughout the whole year, and I had vermilion specimens in Cannanore in the months of November and December.

I cannot say whether vermilion ♂ ♂ mate with vermilion ♀ ♀, or whether the two varieties interbreed. It is very remarkable if as appears to be the case these vermilion specimens are confined to our coasts. I have noted in my article on *T. piscator* in this series that similarly ornamented specimens I had only known from the coast, and I may here mention that in Cannanore I once got a specimen of the Common Indian Toad (*Bufo melanostictus*) with flaming red blotches instead of the usual black spots. I did not recognise the species, but sent the specimen to the British Museum where Mr. Boulenger identified it.

Identification.—In the matter of identification it is as well to remark that the buff-striped keelback is one of the very commonest if not actually the commonest snake to be met with in the Plains of India, Burmah and Ceylon. It is almost certain to be one of the first dozen snakes the novice beginning to collect these reptiles will encounter and it is more than probable it will be included in the first half dozen. The two dorsal buff stripes are almost characteristic of the species and they are always well defined, and conspicuous. Longitudinal striping it may be remarked is unusual among our Indian Snakes and when it occurs, it is usually a dark stripe that occurs in the position occupied by the buff stripes in this species. Among exception with which *stolatus* might be confused must be mentioned *parallelus*, and *modestus*, of the same genus, and *Psammophis condanarus*. In *parallelus* and *modestus* the light stripes are ill-defined, and far less conspicuous and both species are found only in Hills, the former in the Eastern Himalayas, Assam and Burmah Hills, and the latter in the Assam Hills. In *parallelus* the ventrals are more numerous, and in *modestus* the subcaudals more numerous than in *stolatus*. The rows of scales would at once distinguish *Psammophis*, being 17 anteriorly and 13 behind.

As colour, and markings are at least uncertain guides in diagnosis, one should rely on scale characters and the following combination taken in the order herein placed will prove the readiest means I can

suggest:—(1) Scales 19 in midbody, and 17 at a point two heads-lengths before the anus. (2) Nasals not touching the 2nd supralabial; (3) Rostral touching 6 shields and (4) a single anterior temporal.

Dimensions.—I have about 200 recorded measurements in my note-books and find that the length differs considerably in the sexes. Of ♂ ♂ I have only had 8 specimens of 1 foot 9 inches and over, of which only 4 reached 1 foot 10 inches the largest being 1 foot 10½ inches. On the other hand I have had 13 ♀ ♀ exceeding 2 feet in length. Two taped 2 feet 4 inches in Dibrugarh, and another 2 feet 5 inches in Fyzabad. Another specimen from Dibrugarh I judge to have been still larger, for the body was 1 foot 11½ inches, out of a total length of 2 feet 4 inches. In three ♀ ♀ in which the total lengths were 2 feet and ½ an inch, 2 feet 1½ inches, and 2 feet 1¾ inches, the tails measured 6 and 6¼ inches respectively so that at the lowest computation this specimen would have been if perfect two inches longer, and possibly three, making a length of 2 feet 6 or 7 inches.

Disposition.—This is a remarkably inoffensive little creature. Of all the snakes I know, it ranks among the most gentle, for I have picked it up scores of times in its native haunts, and I have never once been bitten or even struck at. Mr. Millard writes to me:—"It is the most gentle snake that I know. I cannot remember one ever having attempted to bite even when caught in the open." This placid disposition is all the more remarkable when one considers that the other common species of the same genus in the Indian Plains, *viz.*, *piscator* is among the most truculent of snakes. Little "buffstripes" is easily alarmed, and when danger threatens, turns, and glides off as rapidly as possible to any protection the nature of the ground may offer, and it is an adept in the art of concealing itself in the smallest patch of scrub or grass, sometimes vanishing in a most uncanny way. Probably it has found a hole and secreted itself therein, but a careful and systematic search sometimes fails to reveal the mystery of its disappearance. When brought into the open, it exhibits a lively activity making repeated attempts to escape.

When irritated some specimens but by no means all erect themselves, flattening the neck and forebody ventrovertebrally. This

flattening process involves a much greater length of the forebody, than is seen in the cobra and I have seen the whole body flattened to the vent. In the cobra the degree to which it is manifested laterally is far greater than is seen in any of the keelbacks and their allies. During this erection, and flattening of the forebody, *stolatus* distends itself by deep drawn inspirations bringing into view those beautiful ornamentations of blue, or vermilion as the case may be to which I have referred in dealing with its colour and varieties. This behaviour is never anything more than a demonstration of alarm, possibly a menace, the snake looking as if it intended mischief, but though I have irritated it as much as I knew how I never had one attempt to bite me.

Haunts.—Its choice of a home of course depends upon its food, but though this consists of frogs and toads I cannot recall ever having met with one actually in the water in marshland, pond or jheel, moat, canal, or rivers. The reason is obvious for during the season when it is in evidence—the rains—the whole country is wet enough to make frogs abundant everywhere, and even when the land is drying, or dry short of drought many species of frogs that do not congregate in collections of water are in hiding, and toads too. I know full well that in captivity water is essential to its well-being, and I have had specimens that were to be seen at times more or less immersed in their basins. Ferguson* says :— "In captivity it is fond of lying in water" and Mr. E. E. Green in a letter to me writes : "it submerges itself in its bath at rare intervals, and remains there for many hours." Nicholson† remarks that "in dry weather the offer of a drink will at once gain their hearts." Though it is not the swimmer, or hydrophile that *piscator* is, it is frequently to be met with in damp situations, such as drying paddy fields, and the banks of canals, and Mr. Millard remarks that in October near Bombay "it is exceedingly common in the rice fields, where one sees them constantly, probably attracted by the crop of young frogs."

During the rains the buffstriped keelback distributes itself broadcast all over the land, and will be found in grassy, and cultivated

* Bombay Natural History Journal, Vol. X, p. 72.

† Indian Snakes, p. 134.

areas of open country, but does not favour arid plains, nor jungle tracts. It is commonly to be met with in gardens, grass farms, golf-links, and similar situations about cantonments, and further afield in "khets" or any waste ground that has some sparse cover, and might harbour frogs.

It sometimes wanders into out-houses and bungalows, and especially in such of the latter where pot plants are available. In Rangoon once I had as many as four sent to me in one morning by a neighbour who flushed them in his verandah whilst re-arranging his ferns, &c.

The crepuscular gloom beneath the foliage of closely congregated pot plants, and the humidity derived from daily watering furnishes an ideal environment for mosquitoes, and other insects upon which frogs subsist, and there are always some pots with a chip out of their basal rims large enough to act as doorways to cosy quarters—from a batrachian standpoint—beneath. The same environment offers effectual concealment for the little buffstripes, and a plethora of its food supply. One of the four snakes above alluded to had swallowed a single frog, and another was replete with three inside. A specimen sent to our Society by Mr. Dwane from Madras was discovered on the horn of a living buffalo, a very curious situation for any snake.

Habits.—The buffstriped keelback is essentially diurnal in habit. It is met with abroad at any hour of the day, but is not usually encountered at night, though its relative *piscator* is frequently on the move under cover of darkness.

Though agile and active its movements are not really rapid. It always appears to me that its progression is much smoother than that exhibited by many snakes. When not roaming about the country, it often secretes itself in holes in the ground, or takes refuge in the masonry of drains, culverts, wells, out-houses, and such situations. I have sometimes detected one with its head issuing from a hole in the ground, but the slightest movement on my part caused a sudden retraction below the surface, followed after a few minutes by its re-appearance, when if satisfied that the coast was clear it emerged, and glided off.

This snake evinces a very marked disposition to æstivate,

disappearing for some months during the drought of a hot weather, to re-appear with the first heavy rains that announce the inauguration of the monsoon. This fact has evidently been noted by the observant native hence the names "wana kukroo," "wanna pam," and "wanna cogli." Only recently too (February) Mr. Millard tells me he has offered rewards for them in Bombay but the natives say they cannot guarantee getting them except in the rains when they are plentiful.

In Rangoon, Evans and I got no single example in 1900 before the 30th of April—the day the rains broke,—but from the 2nd of May to the 2nd of August no fewer than 21 specimens were brought in. Similarly in Cannanore in 1904, during the drought between the 1st of January and the 18th of March I got only 1 specimen out of a total of 60, but from the 19th March to the 4th June between which dates a few desultory showers fell there were 3 out of 71 snakes collected, and from the 5th June—the day the big monsoon burst—to the end of July out of 81 specimens, no fewer than 38 were *stolatus*. In Fyzabad in 1906 during the drought between the 1st of January and the 18th of June—the day the rains broke—I had received a solitary specimen, but after this I obtained 6 out of 21 specimens in June, and no fewer than 87 in July and August out of a total of 485 snakes of all kinds.

In Northern India it disappears during the cold months of the year, hibernating beneath the soil. In December 1904 several were unearthed by the sepoys of the 62nd Punjabis when out in camp near Rae Bareilly in December. They were found singly at a depth of from 9 to 18 inches below the surface, chiefly in the roots of clumps of giant grass, and when dislodged were dull, and inactive. I have never known it climb into bushes, trees, or habitations, though I have seen it in masonry crevices a yard above the ground, and one was found at Chakdara basking in a chink of rock at about the same elevation.

It is very curious studying my notes that so very few hatchlings and young specimens are brought to me. Why nearly every specimen should be mature or nearly so I cannot suggest an explanation for.

Food.—Its diet is almost entirely batrachian in character, and

whilst some show a decided partiality towards frogs, others find toads more attractive. In India it is usually the frogs *Rana cyanophlyctis*, or the young of *R. tigrina* that form its principle sustenance, these being perhaps the commonest frogs to be met with. For the same reason young toads of the species *Bufo melanostictus* are most frequently devoured. I have known *R. breviceps*, and *Microhyla ornata* taken in Fyzabad, and *Oxyglossus laevis*, and a species of *Rhacophorus* probably *leucomystax* in Burma. On several occasions I have found toads ingested, once a young *Bufo andersoni* in Fyzabad having proved the victim. I once found a gecko in a young specimen in Assam, but have never heard of a lizard being taken except on this occasion, and never a mammal. Usually a single frog, or toad satisfies its appetite, but I have more than once found as many as three in the stomach.

Colonel G. H. Evans, whose attention was once arrested by pitiful wails, found on investigation a frog in the jaws of a *stolatus*. It had been seized "a posteriori," and the snake when discovered made tracks without releasing its captive and succeeded in reaching a crevice in the ground some thirty yards away, down which it managed to insinuate itself by some lateral manœuvre head last still retaining hold of the frog. It was dug out, and froggie when released hopped away. Mr. Millard, who has known this species in captivity for over twenty years, tells me that they feed greedily on frogs, in fact he "cannot remember ever having seen it feed on anything else." On the other hand Mr. E. E. Green, who has a very intimate knowledge of the species in Ceylon, tells me that in captivity "it will look at nothing but the toad *Bufo melanostictus*," and he relates how on one occasion two *stolatus* seized the same toad in his vivarium, each proceeding to swallow from opposite points of seizure, till their noses met, when the larger snake began to engulf the smaller, but at this stage of the proceedings he interfered. In the Madras Museum * one buffstriped keelback ate 131 toads in the year, another 130, and a third 91 green frogs. Murray † says that in Sind like *piscator* it lives in pools, and feeds on fish. If this is a fact, its habits in that locality are different from those manifested in other parts of India.

* Administration Report 1896-7. † Vert. Zool. Sind, p. 380.

The Sexes.—It is remarkable that though the sexes are very evenly balanced in many parts of India, in some localities, notably Assam, there is a great disparity in favour of the ♀. Thus out of 37 specimens sexed in Cannanore 20 were ♂ and 17 ♀, and out of 118 sexed in Fyzabad 57 were ♂ and 61 ♀. In Assam—Hills and Plains—females are more than twice as numerous, for out of 89 specimens sexed in Dibrugarh 62 were ♀, and in Shillong in the Khasi Hills no fewer than 16 out of 21 specimens proved to be this sex. In a clutch of 5 eggs brought to me in Dibrugarh there were 4 ♀ ♀ and one ♂. The ♀ is usually at all times longer than the ♂. Starting from the egg it frequently has a slight advantage, it more than maintains this as growth advances, and finally attains proportions considerably in excess of the ♂ as already mentioned under dimensions *q. v.*

The relative proportions of the body and tail are subject to slight variation in individuals of both sexes, but I can discover no disproportion of sexual import.

The scent glands in both sexes furnish a greenish-yellow secretion of the consistency of custard.

The ♂ claspers are beset with numerous horny, claw-like, curved processes, which must function as anchors. The nearly allied species the "grass snake" so common in England *(T. natrix)*, I have more than once encountered "in copula." When disturbed instead of detaching themselves, the larger and more powerful ♀ made for the nearest cover dragging her partner unceremoniously behind.

It seems as if these processes which are recurved so as to oppose any traction efforts serve to maintain attachment during such an emergency. Their development is such, and they are so numerous that they must provide a very firm grip, during a turgid state of the organ, and I can well imagine that if under inordinate strain the parties were pulled asunder the female parts would sustain severe laceration.

Breeding season.—It is a curious fact that though this snake goes into retirement during the hot months in the Plains, this appears to be the season when matrimonial intercourse is for the most part indulged in. This is evidently so in many cases judging from

what we know of the period elapsing between coitus, and the deposition of eggs. The sexes must therefore in many instances retire in pairs, for when the rains burst, and the species reappear, many if not most of the females are already impregnated, and often to an advanced degree.

In Cannanore in 1904 a few showers at intervals of several days fell between the 18th March and 18th May, and frequent showers between the 20th May and 4th June. On the 5th June the monsoon burst, and *stolatus* up to this time a rarity, became abundant. I obtained a gravid ♀ in May, and 4 in June. In Fyzabad in 1906 the rains broke on the 18th June, when *stolatus* up to this date hardly in evidence became numerous. I got one gravid ♀ in June, nineteen in July, and four in August. In Rangoon in 1900 the rains broke on April 30th up to which date I had no specimen of *stolatus*. On the 30th May I got a ♀ with 8 eggs in an advanced stage of development. I have never had the good fortune to meet with a pair in conjunction, and have only had them rarely reported so. In Cannanore a pair was reported "in copula" on the 24th May, and two pairs similarly reported on the 18th June.

In Burma Theobald * reported an egg-bound ♀—precise locality not specified—in May, and Nicholson† a similar specimen in Rangoon in the same month. Evans and I had gravid ♀ ♀ in Rangoon twice in May, twice in June, twice in July, and once in October.

In Cannanore I had one egg-bound ♀ in May, four in June and four in July.

In Fyzabad I had one gravid ♀ in June, nineteen in July, and seven in August.

Nicholson† reported an egg-bound ♀ in Bangalore in August.

In Dibrugarh I had twelve gravid in April, thirteen in May, two in June, and one in July. In Shillong three specimens in an advanced stage of impregnation were brought to me in August.

A specimen from Hakgalla, Ceylon (4,600 feet) was egg-bound in September.

Period of gestation.—This is not exactly known, but it is probable that it will prove to be of the same duration as in the che-

* Cat. Rept. Brit. Burma, page 47. † Ind. Snakes, page 127.

quered keelback *piscator*, *viz.*, about two months. A specimen of mine in Cannanore captured on the 21st June laid five eggs on the 29th July. As the specimen was obviously gravid when caught gestation must considerably exceed five weeks. A specimen in captivity in the Madras Museum whose date of capture was unfortunately not recorded, laid the first of fourteen eggs on the 17th August. As it was noted that the specimen sloughed on the 28th June, at least seven weeks elapsed before the discharge of this egg. The ♀ at full term retires to any convenient refuge in the ground, and there deposits her eggs some few inches below the surface. Unlike some other snakes she does not appear to be attended by her consort at or subsequent to this eventful period. I have only once known a ♂ in company with a ♀ after impregnation. This was in Fyzabad in July. The two snakes were described as confronting one another with reared bodies, and they remained actively engaged in this manner for some minutes. Both were killed, and I sexed them, and found the ♀ in an advanced state of impregnation. It is impossible to know whether this was a chance encounter which seems probable or whether their behaviour was of an amorous, or hostile character.

Oviposition.—In Rangoon I had a specimen that laid eggs in August. In Cannanore a ♀ deposited her eggs on the 29th July, and another laid eggs in August. In Fyzabad a ♀ deposited eggs in August. The Madras specimen already referred to oviposited in August and September.

I have frequently had eggs in clutches brought to me unearthed after deposition under natural conditions. In Rangoon once in June, in Dibrugarh several in May (once as early as the 1st) and June, and in Shillong once in August.

The full complement of eggs is discharged normally within a few hours, but some specimens in captivity have discharged them fitfully at intervals. A specimen I captured in Fyzabad on the 7th July laid one egg that night, and discharged ten more on the night of the 12th of the same month. A specimen in the Madras Museum* laid fourteen eggs as follows:—August—one on the 19th, one on the 20th, two on the 22nd; September—three on the 12th,

*Admin. Report, Madras Museum, 1896 to 1897.

three on the 14th, one on the 15th, and three on the 18th—occupying a full month in the accomplishment of this function.

Snakes are credited with the power to retain their ova, or fœtus when circumstances are unfavorable for their deposition, but of course they cannot do so indefinitely. An unsuitable environment such as is likely to occur under captivity may explain the spasmodic discharge of the eggs in the above instances, but even in the vivarium the ♀ usually deposits her full complement within a few hours.

Eggs.—Inside the parent the ova lie in a single string like the beads of a necklace, their long axes disposed in the length of the body. They do not overlap one another nor lie transversely as is the case with their more prolific relative *piscator*. In their later stages owing to pressure within a contracted space, their poles are strongly flattened against one another, but no suggestion of this flattening is seen after they are discharged.

Immediately after expulsion the egg investment is moist and sticky so that many or all the eggs become firmly adherent to one another to form a cluster. They are pure white in colour, and the ovicular investment pliant like white kid. They are soft to the touch and their tension rather firmer than that of a grape. The poles are equally domed, and the eggs measure from $\frac{7}{8}$ to $1\frac{3}{8}$ inches in length, and $\frac{5}{8}$ to $\frac{3}{4}$ of an inch in breadth. Eggs in the same clutch always vary somewhat in their dimensions, but what one lacks in length is usually compensated for in girth. They sink in water.

When freshly oviposited they contain a custard-like material in which no trace of the developing embryo can be discerned.

It is extremely difficult to place eggs artificially under conditions favorable to their incubation. One of two things usually happens, either they shrivel up or become mouldy within a few hours, according as to whether their environment is too dry, or too wet. It is certain that they require a humid atmosphere, and I believe a light approaching twilight if not darker. After many unsuccessful attempts at incubation I find the best way to treat them is to put them on fresh earth every day under an inverted flower pot. I turn up earth in the morning to a depth depending on the humidity of the soil, and select that which is slightly damp, and

put this to a depth of three or four inches in a gumlah and the eggs on the top. The inverted pot gives them the darkness I think essential, and then the gumlah is placed in a shady place. The following morning the earth will be found already too dry, and if not changed the eggs shrivel very rapidly.

Prolificity.—*Stolatus* is not very prolific as snakes go. I have over 70 records of eggbound ♀ ♀, and clutches of eggs that have been laid, and find that it may lay from 1 to 14 eggs, but from 5 to 10 is the usual number.

Incubation.—The parent having laid her eggs remains with them for some time, perhaps even till they hatch. During hoeing operations on the tea estates around Dibrugarh, on several occasions a ♀ was unearthed, and brought to me with her eggs. Frequently eggs were brought without the ♀, but with the report that a snake had been seen with them. On one occasion eggs brought with the attendant parent were found to contain embryos $2\frac{1}{4}$ to 3 inches long. As there is no trace of an embryo when the eggs are first deposited, this implies that for at least more than half the full period of incubation this ♀ was in attendance.

It seems certain that the parent is not unremitting in her attentions, for on several occasions when eggs were unearthed the cooly upon interrogation denied that there was any snake with them.

Period of incubation.—This almost certainly depends upon temperature, and should therefore be more protracted in the Hills than in the Plains.

In Rangoon a ♀ laid 9 eggs on the 11th of August which hatched a month later, *viz.*, one on the 10th and six on the 11th of September. The remaining eggs were non-fertile. I feel certain from other observations, and the conditions under which these eggs were placed that the incubating period was artificially abbreviated. They were laid on damp cotton wool inside a wide mouthed stoppered bottle, and placed within a couple of yards or so of an earthenware basin containing live embers. These fire receptacles are in ordinary use in Burma in the rains, and are placed beneath a wicker cage on which one's clothes are placed to dry. Though the bottle was stood outside the cage, it must have derived considerable heat from the contained embers.

In Dibrugarh where the climate and temperature is much the same as Burma, I had eggs brought to me on the 21st May containing embryos $4\frac{3}{8}$ inches in length, but they did not hatch out till the 10th of June when they measured 6 and $6\frac{3}{8}$ inches, respectively. In this case the embryos grew about two inches in 21 days, or about one-third the length they attain to within the egg. Allowing a similar rate of growth for the whole of intraoval life the embryos would have been about 40 days acquiring a length of $4\frac{3}{8}$ inches, and the whole period would therefore exceed 60 days. Again in Shillong on the 8th of August I had eggs brought to me which contained embryos. 25 days later, *viz.*, on the 2nd of September, I extracted an embryo measuring $3\frac{1}{4}$ inches, or about half the length of a hatchling. If we allow 10 days for development sufficient to recognise the embryos as such, which is not excessive, we have about two months elapsing from the deposition of the egg to the full growth of the embryo in this case also.

Hatching.—The embryos liberate themselves from the egg by means of an osseous structure which is specially developed for this purpose, and is very soon—a day or two—shed after its function has been fulfilled. This is called the fœtal tooth or egg tooth, and is developed in the premaxillary bone. Unlike the ordinary teeth which are already developed at this stage of life it is flattened, and its cutting edge lies horizontally, projecting forward beneath the arch in the front of the mouth which is formed to admit of the protrusion of the tongue when the jaws are closed.

With this instrument the embryo makes one, or many incisions which penetrate the egg shell, but even when it has established an adequate means of exit, the little snake seems loathe to abandon its cradle, for it sometimes wholly withdraws itself within the shell after having almost vacated it, and often after lying with its head and forebody emerging, many hours elapse before it finally disengages itself, and effects its entry into the world.

In Rangoon I had one lot of embryos hatching out on the 1st and 3rd of August, another on the 10th and 11th of September, and on a third occasion on the 22nd of October (not November as previously reported in this Journal, Vol. XIII, p. 351). In Dibrugarh I had embryos hatching on the 10th of June, and others on

the 5th and 6th July. In Cannanore I had a hatchling $6\frac{1}{4}$ inches long on the 21st November, one in Dehra Dun $5\frac{7}{8}$ inches long on the 8th of October, one in Bangalore $7\frac{1}{2}$ inches on the 29th of September, two in Fyzabad measuring $5\frac{3}{4}$ and $6\frac{1}{4}$ inches in October and two measuring $5\frac{7}{8}$ and $7\frac{1}{4}$ inches in November.

At the time of hatching the ♂ has the genitals ensheathed, and concealed from view, but I have had an embryo of $6\frac{1}{4}$ inches length in which they were extruded, showing that it is only at a very late stage of embryonic development that their invagination occurs.

When the hatchling first leaves the egg it may, or may not have part of the yolk sac adhering to the navel. This orifice, or the recently obliterated remains of it, is very apparent in the hatchling, and remains so for some months, but eventually becomes completely effaced. At exovation from 14 to 18 ventral shields intervene between it, and the anal shield, and the scar itself involves two or even three ventrals.

Growth.—When the hatchling vacates the egg it is from $5\frac{1}{4}$ to 7 inches in length, and there is little difference in the length of the sexes for in one brood two ♂ ♂ were 6, and $6\frac{7}{8}$, and two ♀ ♀ $6\frac{3}{4}$, and 7 inches respectively. In another brood one ♂ was $5\frac{7}{32}$, and four ♀ ♀ $5\frac{5}{16}$, $5\frac{3}{8}$, $5\frac{1}{2}$, and $5\frac{14}{16}$ inches, respectively. In a third case a ♂ was $6\frac{1}{4}$, and a ♀ of the same clutch $6\frac{1}{8}$ inches. It is curious this being the case that all through my notes the average measurements of the ♀ in each month appreciably exceed those of the ♂, and this becomes increasingly apparent till by the end of the 2nd year there is a disparity of two inches or more in favour of the ♀. As far as can judge the young add from 5 to 8 inches to their length in each of the first and second years, which means that they approximately double their length in the first year and have trebled it by the end of the second, by which time they have attained maturity, and any further increase in length is small and slow. The smallest gravid ♀ I have had was 1 foot $5\frac{1}{2}$ inches, but many have been from 1 foot 6 inches to 1 foot 7 inches, all lengths attained at the end of the second year. It is evident therefore from my numerous records that the majority of individuals mate at this early age. It is interesting to note from the measurements of hatchlings given above, all of which were from Dibrugarh, how close the

measurements of individuals in the same brood run, whilst there is an appreciable difference in the average length of members of different broods.

Sloughing,—We know very little about this function, and although many snakes are kept in captivity in various institutions in India very little attention is paid to this curious habit, and seemingly no records kept. Similarly in Regent's Park, London, I failed to get any information.

A specimen I had in Rangoon sloughed on the 27th June, and again on the 24th July. Another cast its skin on the 7th and 25th of May, and again on the 23rd June in Rangoon. Some excellent records were kept some years ago in the Madras Museum,* from which I find that one specimen desquamated on the 29th June, 21st October, 22nd December 1896, and 25th January 1897. Another exfoliated on the 28th June, 6th July, 27th July, 3rd September, 14th December 1896, and on the 18th January, and 27th February 1897. This was the same specimen that laid 14 eggs, between the 17th August and 18th September. In another specimen ecdysis occurred on 17th March, 17th September, 26th December 1896, and 20th March 1897. It is very difficult to explain why in one instance four months elapsed, and in another six months, during the same period of the year in which a third specimen desquamated from every 3 to 5 weeks. All the specimens, judging from the consumption of frogs which I have quoted under food, appeared to have been in vigorous health, all the records were made in the same year, and we may assume that all the specimens were caged under similar conditions. It seems unlikely too that when special attention was being given to this function any of the occasions should have been overlooked.

Foes.—Doubtless so harmless, and diminutive a reptile frequently provides food for predaceous animals and birds. Evans and I once knew it fall a victim to the snake *Xenopeltis unicolor*, and I found one inside a banded krait (*Bungarus fasciatus*) in Dibrugarh. Mr. Primrose† in our journal has recorded one being swallowed by the green tree snake (*Dryophis mycterizans*).

Parasites.—The buff striped keelback harbours many Entozoa.

* Administration Report 1896. † Vol. XV., p. 347.

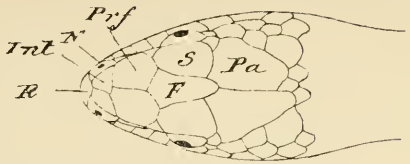
One of these is a maggot-like creature which I have figured in a recent issue of this Journal* and is called *Porocephalus crotali.* It is whitish in colour, about $\frac{3}{4}$ of an inch long, and attaches itself to the tissues about the entrails of the snake, but is not found in the intestine, or solid organs. Several are to be found in the same snake, but always solitary. The head, which is its thickest part, is furnished on its lower aspect with four curved claw-like hooks, yellowish in colour, and placed around the mouth. By these it attaches itself to the mesenteric folds. The body which gradually reduces in girth posteriorly, consists of several subequal segments. It no doubt sucks the blood of its host.

Another parasite, and one which must seriously affect the health of its host is a nematode worm called *Kalicephalus willeyi* after Dr. Willey, the Director of the Colombo Museum (*see* Plate figures G. H. I.) This I have only found in the stomach, attaching itself to the inner coats of that organ, but Von Linstow says it also inhabits the intestine of many snakes. It is of a gregarious habit, and the several members of a single colony vary very much in length, the longest being as much as 5 inches. It is about as thick throughout as the catgut on a tennis racquet, reddish-brown in colour, with a greyish-white caudal extremity. The head as shown by Von Linstow is compressed, and is furrowed dorsally, and ventrally. The mouth is large, and has six papillæ, three on each side situated around its margin. The body appears to be depressed, and its surface smooth. Often more than one cluster of these worms is found to have invaded the stomach. This organ as a result of these parasites becomes knuckled and distorted, and its walls very much thickened, cartilaginous, and rigid, so that it would appear doubtful if it could distend sufficiently to accommodate the relatively enormous bulk that is so often swallowed at a meal.

This worm appears to infest many snakes, for it has been reported from the stomach and gullet of Russell's viper (*Vipera russelli*, from the intestine of *Coluber helena* and from *Typhlops braminus*) by Von Linstow,† and I have found it in the stomachs

* Vol. XIX, p. 837.

† Spol. Zeylan. Vol. I, p. 99, and Vol. III, p. 163.



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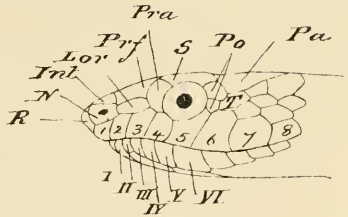

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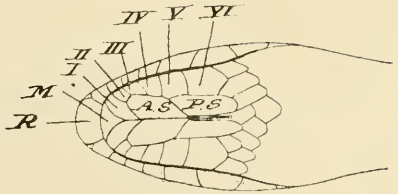
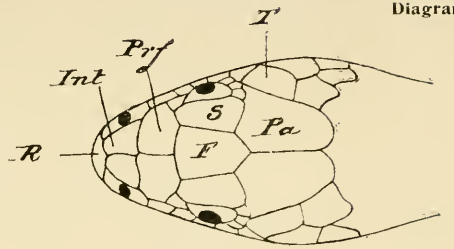


C

Psammophis condanarus.
(Nat. size.)



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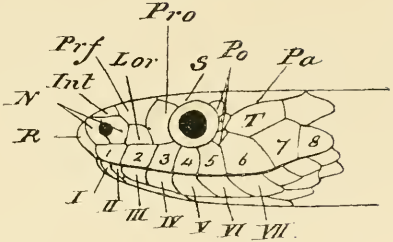

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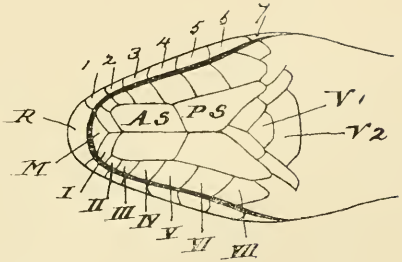


F

Tropidonotus stolatus.
(× 2)

COMMON INDIAN SNAKES. (WALL)

A. B. C. Head Shields of *Psammophis condanarus*. **D. E. F.** Head Shields of *Tropidonotus stolatus*.
A.S. Anterior Sublinguals. *F.* Frontal. *Int.* Internasal. *Lor.* Loreal. *M* Mental. *N.* Nasals. *Pa.* Parietal. *Po.* Postoculars. *Pro.* Præoculars. *Prf.* Præfrontals. *P. S.* Posterior Sublinguals. *R.* Rostral. *S.* Supraocular. *T.* Temporal. 1 *to* 8. Supralabials. *I* to *VII.* Infralabials. *V* 1 & *V* 2. 1st and 2nd Ventrals.

of the banded krait (*Bungarus fasciatus*), and *Tropidonotus piscator* as well as in *T. stolatus*. Von Linstow further states that it occurs in snakes inhabiting South America. A third parasite infesting *stolatus* is a larval form of tapeworm, which though sent to Professor Von Linstow he could not further determine than that it was a species of *Pterocereus*. These parasites are white, and flattened, and locate themselves usually beneath the lining membrane of the abdominal cavity, but sometimes beneath the dorsal integument, where they form flat blister-like swellings. When these are cut into, the parasite is found in a convoluted mass which, when unravelled may measure up to 10 inches in length. They do not seem to invade any hollow or solid organ. They exist in large numbers in some specimens even to the extent of making the host appear gravid. I have found this worm also around the intestine in *Bungarus fasciatus*, beneath the peritoneum of *Tropidonotus piscator*, and beneath the skin of *Coluber radiatus* as well as in *T. stolatus*.

Local Distribution.—This species is a resident in the Plains, but wanders to an altitude in the Hills which varies with the locality. Its relative abundance in various districts in the Plains, and the altitude to which it wanders is interesting. In the low country in Ceylon Dr. Willey* reports it the commonest snake to be met with. Mr. E. E. Green tells me that in Kandy (1,700 feet) it is quite common, and Mr. Pearless† says that at Badulla (2,500 feet) it is very common, but at Hakgalla (5,600 feet) I only got one specimen out of 80 collected.

In Cannanore out of 377 snakes collected, 2 in every 13 were of this species, but at Paralai in the Anamallays (3,500 to 4,000 feet) I got no specimen out of 91 sent me in 1909. I am told, however, by the Revd. E. M. Gombert, S. J., that it is common in the Palney Hills (Shembaganur) between 5,000 to 6,000 feet.

In Fyzabad out of 704 snakes, 2 in every 9 were *stolatus*, but in the Western Himalayas at Almora (5,300 feet) I got only 2 in 38 snakes of all kinds in 1909. In the Bengal Plains it is evidently very common, for I got 7 specimens out of 25 sent me from the Jalpaiguri District, but out of a collection of 778 made in the

* Spol. Zeylan., April 1906, p. 233. † Spol. Zeylan. March 1909.

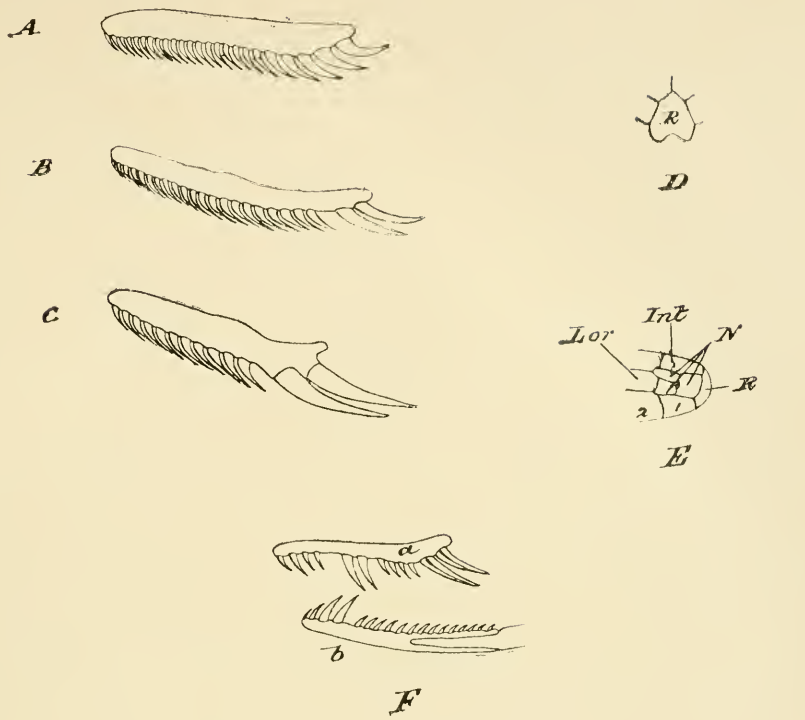
Eastern Himalayas below Darjeeling (1,500 to 7,000 feet) only one *stolatus* came to bag. this being found below 2,800 feet. The difference in the altitude to which it wanders in this, compared with the Western part of the same mountain range, is certainly noteworthy.

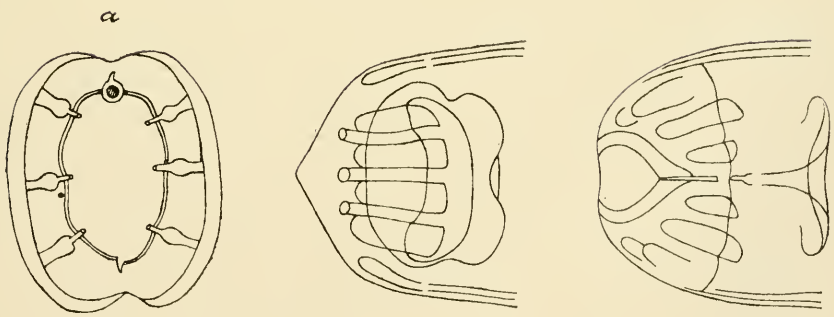
In the Plains of Assam out of 615 snakes collected 1 in every 4 was a *stolatus*, and in the Khasi Hills at Shillong (4,900 feet), it was nearly as common, for among 264 snakes collected 1 in every 7 was this species.

In Lower Burma out of 615 snakes mostly collected about Rangoon 1 in every 15 was a *stolatus*. I have had a specimen from Haka in the Chin Hills (6,500 feet).

Geographical distribution.—The whole of Southern Continental Asia from Sind in the West to China in the East. It also occurs in the Island of Ceylon, probably the Andamans, though I can find no record from this group, the Nicobars, Hainan, Hongkong, Formosa, and the Philippines.

Lepidosis.—*Rostral.*—Touches 6 shields, the rostronasal sutures being about twice as long as the rest. *Internasals*—Two, the suture between them being nearly as long as that between the præfrontal fellows, and subequal to the internaso-præfrontal sutures. *Præfrontals*—Two, the suture between them subequal or rather greater than the præfronto-frontal sutures; in contact with the internasal, postnasal, loreal, præocular, supraocular and frontal. *Frontal*—Touches 6 shields, the fronto-supraocular sutures being twice or more than twice the fronto-parietals. *Supraoculars*—About as long, but not so broad as the frontal along a line connecting the centres of the eyes. *Nasals*—Divided; in contact with the 1st only of the supralabial series. *Loreal*—One, about as deep as long. *Præocular*—One. *Postoculars*—Three usually, not infrequently four. *Temporals*—One, touching the 6th and 7th supralabials. *Supralabials*—7 with the 3rd and 4th touching the eye, or 8 with the 5th also touching the eye. *Infralabials*—7, the 7th usually touching 3 scales behind; 5th, 6th and 7th usually touching the posterior sublinguals. *Sublinguals*—Two pairs, the posterior rather longer, and separated by 1 + 2, or 1 + 2 small scales succeeded by the 1st narrow ventral.





Kalicephalus willeyi (much enlarged).
(After Von Linstow.)

COMMON INDIAN SNAKES. (WALL.)

A. Maxilla of *Tropidonotus natrix*. *B.* Maxilla of *Tropidonotus stolatus*. *C* Maxilla of *Macropisthodon plumbicolor*. *D.* To show rostral from in front *P. condanarus*. *E.* To show the nasals of *Psammophis longifrons*. *F.* Dentition of *Psammophis condanarus*—(*a*) Maxilla, (*b*) Mandible. *G.* Mouth seen in front (*a*) dorsum. *H.* Profile view of head. *I.* Dorsal view of head.

Costals—Two headslengths behind the head 19, midbody 19, two headslengths before the vent 17. The rows diminish by a fusion of the 3rd and 4th rows above the ventrals at a point shortly behind midbody. Keels present and strong in all but the last row usually, which may or may not have faint keels posteriorly. Apical facets present in pairs, but often obscure. *Ventrals*—Evenly rounded from side to side, 136 to 154 (120 to 161 Boulenger). *Anal*—Divided. *Subcaudals*—In pairs. 46 to 86 (89 Boulenger).

Anomalies.—The supralabials and infralabials are subject to frequent variation due to a confluence of shields, usually seen on one side, but sometimes on both. Thus I have seen 6 supralabials on one side in four specimens, the 2nd and 3rd touched the eye in one, the 3rd only in two and the 3rd and 4th in one. I have found 7 supralabials on one side twice of which the 4th alone touched the eye. In thirteen specimens I have found 8 with the 4th and 5th only touching the eye, in four of these on both sides. I once found 9 on one side of which the 4th, 5th and 6th touched the eye. With the infralabials it is not infrequently that one sees but 4 touching the anterior sublinguals instead of the normal 5. On 7 occasions I have seen a double loreal on both sides, one superposed above the other, one specimen was from Rangoon, one from Shillong, two from Trivandrum, and three from Dibrugarh. I have found two anterior temporals on one side in three specimens, and once this shield was confluent with the two supralabials below. In one specimen I have seen two præoculars, and in one other only two postoculars. In three cases I have seen the 2nd supralabial on one side slightly in contact with the nasal shield. I have once seen three pairs of sublinguals, the normal anterior pair being divided.

Dentition.—Maxillary.—22 subequal teeth, separated by a gap behind—that would accommodate a similar tooth—from two subequal, enlarged, and compressed teeth placed one behind the other which are fully twice as long as any of the preceding. *Palatine*—16 or 17, small, and subequal. *Pterygoid*—31 decreasing in length gradually behind. *Mandibular*—31 to 32, subequal except behind where they gradually diminish in size.

Our PLATE is disappointing in its colouring. The striping is

everywhere rather too well defined, and the light stripes should be buff, and not greyish-blue. The underparts shown in figs. 8 and 9 are misleading, as the colour should be pale yellow or pearly white.

The expression, and general form is very faithfully depicted.

Opisthoglyphous colubrines, or snakes which have grooved teeth placed in the back of the maxilla ("opisthe" behind, and "glypho" I carve) are divided into three sub-families : (1) *Homalopsinæ*, (2) *Dipsadomorphinæ*, and (3) *Elachistodontinæ*.

Psammophis is one of the 69 genera into which the second sub-family is divided, and includes 17 species. The genus is principally African, no fewer than 13 species being peculiar to that Continent.

Of the 4 species that are known from Indian limits one, *viz.*, *schokari* extends from North Africa into South-West Asia (Arabia to Sind), one, *viz.*, *leithi* is strictly speaking Holarctic, but just extends within Tropical limits (United Provinces), the remaining two, *viz.*, *longifrons* and *condanarus* are Tropical, the former exclusively so, but the latter extends into the Holarctic area (Western Himalayas, Sind, etc).

PSAMMOPHIS CONDANARUS (Merrem).

The Indo-Burmese Sandsnake.

Nomenclature—(*a*) *Scientific.*—The generic name was introduced by Boie in 1827 and is from the Greek "psammos" sand, and "ophis" snake. The specific name is a latinised version of "condanarouse" the vernacular name by which it is known according to Russell in Ganjam District.

(*b*) *English.*—I think the best name for it is the Indo-Burmese Sandsnake.

(*c*) *Vernacular.*—The only name I know of is that mentioned by Russell above, the meaning of which I have failed to obtain any information upon.

General characters.—It is a graceful snake of rather slender habit. The head is a longish oval with a rounded and somewhat narrow and short snout. The ridge from the eye above the lore is

prominent and the lore grooved horizontally. The nostril is rather small with a cleft proceeding downwards to the 1st supralabial. The eye is moderately small with a round pupil, and a brown iris sometimes edged along its pupillary border with gold. The tongue is red tipped with black. The body is rather slender, smooth and rounded in contour, it attenuates slightly in front to indicate the neck and very gradually behind, where it passes insensibly into the tail, which is unusually long being rather less than one-quarter to one-fifth the entire length of the snake.

Colour and markings.—The dorsum is marked longitudinally with well defined, alternate, nut-brown, and pale greenish-olive or buff stripes, the hues in each case being subject to much variation in individuals. The median pair of light stripes begin about the frontal shield, and end at the vent. They involve the upper half of the 7th and the whole 8th rows of scales above the ventrals at midbody, but are sometimes more or less confluent in the hind body.* The lower and broader light stripes begin on the rostral shield, pass over the eyebrows down the body, to the tail tip. These involve the upper half of the 3rd, the whole 4th, and the lower half of the 5th rows above the ventrals at midbody. The upper lip is creamy-yellow or opalescent and the lower half of the last row of scales and belly are opalescent, sulphur, or primrose-yellow, uniform except for a thin black and carrot-red line (which before desquamation may be modified to blue and rose-pink) on each side of the ventrals. The skin between the scales is blackish throughout.

Dimensions.—The largest specimen I have had was a ♂ measuring 3 feet $3\frac{5}{8}$ inches in Fyzabad, but I have had three others over 3 feet. Günther† mentions one 3 feet 4 inches.

Identification.—First count the scales two headslengths behind the head, at midbody, and two headslengths before the vent, and they will be found to number 17-17-13, respectively. Besides the genus *Psammophis* only three other Indian snakes have the same number of scales, and all are easily distinguished from this

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* Rarely they are absent altogether or present for a short length anteriorly.

† Rept. Brit. Ind., p. 291.

genus by attention to the following points:—(1) *Lachesis trigonocephalus* has no enlarged plate-like shields on the head, a pit in the side of the face. strongly keeled scales, and a vertical pupil; (2) *Chrysopelea ornata* has the ventral shields keeled on each side; (3) *Gerardia prevostiana* has only 5 shields touching the rostral.

It remains now to separate *condanarus* from the other three species of *Psammophis*, and here the nasal shields will suffice.* In *condanarus* there is either a single nasal shield partially divided by a suture running from the nostril to the first labial as shown in Diagram I, figure B, or another suture above the nostril may completely divide the shield into two. In the other three species the shield is not only completely divided vertically into two parts, but the posterior part is further subdivided by a horizontal suture as shown in our Diagram (figure E).

To sum up the points to look for, and in the order here given are—

(1) Costals 17—17—13.
(2) Large plate like head shields.
(3) Rounded ventrals.
(4) Rostral touching 6 shields (see Fig. D of diagram).
(5) Posterior nasal not divided into two parts.

Haunts.—I have very rarely met with this snake myself in its natural haunts, but from enquiries made from those who have brought me specimens it appears to frequent grass land, and rather open jungle. In Fyzabad it came occasionally into the Cantonment, but was more often encountered in the little patches of tamarisk (jhow) outside Cantonment limits. Here it was frequently met with in the branches of the tamarisk shrubs showing a decided arboreal tendency. On one occasion it came into a house in the Cantonment. In Almora it is found usually in the wooded patches in and close at hand. Mr. P. W. MacKinnon, who gave me specimens, told me that it is common about

* The undivided condition of the anal will proclaim the identity of *leithi*. In *schokari* the supralabials are usually 9 with the 5th and 6th touching the eye, and the frontal touches 8 shields. In *longifrons* the frontal touches 6 shields and the supralabials are usually 8, rarely 9, with the 4th and 5th (rarely 5th and 6th) touching the eye.

Mussoorie and in the Dun, and he once shot a serpent eagle (*Circaetus gallicus*) which he saw stoop at something in a patch of grass, and found no less than 7 snakes of this species in its crop showing how plentiful it must be in that part of the Himalayas. Theobald* says that in Burma it inhabits grass land and paddy fields. From these observations it will be seen that it is by no means a desert snake such as its name suggests.

Habits and Disposition.—Very few specimens have reached me alive, but the few I have seen and played with showed me that it is a very active snake, very much on the alert, and quick in movement. It displays much spirit, and I had to treat it with respect and caution to avoid being bitten. One specimen I had lay reclining on a branch, and when I seized it by the tail slipped off, and began a most vigorous corkscrew contortion which had the effect of snapping its tail in my fingers when it immediately made off. This crafty manœuvre is practised by other snakes and particularly by the keelbacks (*Tropidonoti*) which accounts for so many of the specimens brought in to me having imperfect tails. The fact that Jerdon† found one in the act of swallowing so truculent and dangerous a snake as the *Echis* shows that it can be both plucky and vicious. Theobald‡ remarks on the activity of the specimens he saw in Burma. It is obviously of diurnal habit judging from the information I invariably received from its captors.

Food.—I have known a frog taken once, lizards of the genus *Mabuia* twice, and *Calotes* once. Jerdon's record of a viper (*Echis*) being overpowered by this species is indeed very remarkable.

The Sexes.—Females in Fyzabad I found largely predominated over males, 16 of the former coming to bag against 6 of the latter. In Almora too last year the only specimens I got, four in number, were all females. Both sexes grow to about the same length. The male claspers I found peculiar, differing from these organs in other snakes in that when forcibly extruded by digital

* Rept. Brit. Burma, p. 43.

† Jourl., As. Soc., Bengal, xxii, p. 529.

‡ Cat. Rept., Brit. Burma, 1886, p. 43.

pressure behind the vent they were directed downwards instead of forwards. They are thin, long, and spirally twisted reminding me of a black buck's horn. Again they are entirely lacking in asperities or tentacles such as one usually sees on these organs in other snakes. The secretion from the anal glands in both sexes is greenish-yellow.

Breeding.—I can give no precise information in this direction. We do not know yet whether the species is oviparous or viviparous. The breeding season is probably about May. I had young in August 1906 measuring respectively 1 foot $2\frac{3}{4}$ inches and 1 foot $4\frac{3}{8}$ inches which were obviously that year's production. The smallest specimen I have ever had measured $11\frac{3}{4}$ inches from Muktesar, date not known. I believe this was a hatchling, and if so, the two young alluded to above must have probably taken three months to grow to the lengths mentioned. Further of eight adult females collected in July and August none were gravid showing that the production of the young was already past. The length of the young when entering the world is probably about a foot, and my notes make it appear that they grow about eight inches a year.

Distribution.—As will be seen from the accompanying map the distribution of this snake based on the available records up to date is decidedly peculiar.

It inhabits Peninsular India from Sind in the West to Bengal (about 86° longitude) in the East, and from Kurnool in the South to the Western Himalayas in the North. It does not appear to occur in the Eastern Himalayas, nor in the Brahmaputra Basin, nor the Irrawady Basin except near its mouth, but re-appears in the Salween Basin. Beyond this it does not extend to Indo-China nor the Malayan Peninsula.

In the Indian Plains it is common in the Ganges Basin (at least in the United Provinces) but everywhere else is a decidedly uncommon snake. It may however prove to be a commoner snake than available records would make it appear, for it was not known from the United Provinces below the Himalayas before I went to Fyzabad where I found it common. In the Western Himalayas it is one of the commonest snakes at altitudes between 3,000 and 6,000

DISTRIBUTION OF *PSAMMOPHIS CONDANARUS*.

1 Kurnool (Nallamallay Hills) (Beddome). 2 Jalna (Jerdon). 3 Cutch (I. M.). 4 Kotri (B. M.). 5 Jacobabad (Murray). 6 Ajmer (Blanford). 7 Chilianwalla (B. M.). 8 Fyzabad (F. W.). 9 Hurdwar (Stoliczka). 10 Simla (Stoliczka). 11 Dehra Dun and Mussoorie (F. W.). 12 Almora and Muktesar (F. W.). 13 Ganjam (Russell). 14 Sagaing (F. W.). 15 Tounggyi (B. M. and F. W.). 16 Prome (I. M., Wall and Evans). 17 Tharrawady (F. W.). 18 Pegu (B. M.). 19 Manbee (Hmawbi? Theobald). 20 Bassein (I. M.).

I. M. implies Indian Museum, and B. M. British Museum.

feet. In Burma it is rather uncommon, Evans and I only obtaining five out of some 600 odd snakes. Two of these were from Prome, two from the Southern Shan States, and one from Sagaing.

Lepidosis—Rostral.—Touches 6 shields, the rostro nasal suture being much longer than the rostro-internasals. *Internasals.*—A pair, the suture between the fellows about two-thirds that between the præfrontal fellows, and about two-thirds to nearly equal to the internaso-præfrontal. *Præfrontals.*—A pair, the suture between them about one-third greater than the præfronto-frontal; in contact with internasal, postnasal (or nasal), loreal, præocular, supraocular, and frontal. *Frontal.*—Touches 6 shields, the fronto-supraocular suture three times the length of the fronto-parietals and twice the fronto-præfrontals. *Supraoculars.*—Length subequal to breadth; rather broader than frontal. *Nasals.*—Semi-divided or divided, in contact with the 1st and 2nd supralabials. *Loreal.*—One, about twice as long as high. *Præocular.*—One, not touching frontal. *Postoculars.*—Two. *Temporals.*—One, touching one supralabial only, normally the 6th. *Supralabials.*—Normally 8 with the 4th and 5th touching the eye, sometimes 9, the 5th and 6th touching the eye. *Infralabials.*—5 or 6, the last largest and in contact with 2 scales usually behind; 4th and 5th, or 5th and 6th touching the posterior sublinguals. *Sublinguals.*—Two subequal pairs. *Costals.*—Two headslengths behind head 17, at midbody 17, two headslengths before vent 13. The reduction from 17 to 15 is due to an absorption of the 3rd row above the ventrals, that from 15 to 13 to the absorption of the 7th row, but both steps occurring very closely together may be mixed or reversed; apical facets single, obscure; keels none. *Ventrals.*—166 to 188 (156 Boulenger) evenly rounded. *Anal.*—Divided. *Subcaudals.*—71 to 92 (64 Jerdon), from 9 to 12 ventrals intervene between the navel and anal shield.

Anomalies.—I have once seen an inferior loreal wedged between the 2nd and 3rd labials, and once the two last ventrals were divided like the anal.

Dentition—Maxillary.*—In front 4 (rarely 3) small teeth, the

* From 5 skulls from Fyzabad and Burma in my collection.

2nd longest, then a short edentulous gap succeeded by two large ungrooved teeth fully twice as long as the preceding. Behind these is a short edentulous gap, then a series of 4 or 5 small, subequal, teeth followed by a pair of obliquely set, grooved, fang-like, teeth fully twice as long as the immediately preceding ones. *Palatine.*—7 to 10 small subequal teeth. *Pterygoid.*—13 to 16 small and subequal. *Mandibular.*—In front 2 small followed by two ungrooved teeth fully twice as long as the preceding. After a short edentulous gap 12 to 18 small subequal teeth.

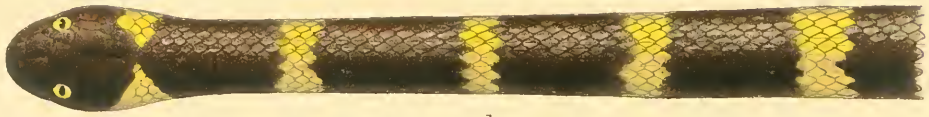
PLATE.—Our coloured figures with one exception are very disappointing. Fig. 6 gives a good illustration of the buff stripes as seen in the posterior part of the body.

Figs. 1, 2, 4, and 5 do not show the beauty of the vermilion ornamentation as seen in life, this true being not only too dingy, but too inconspicuous. In fig. 4 the belly should be pearly-white and the throat a bright yellow.

Fig. 3 is intended to represent a blue variety, but the blue is not well shown. The black bars in figs. 1 and 3 are shown too regular, those of each side more usually alternate, or, are broken up often forming a chequering rather than barring.

(To be continued.)

3



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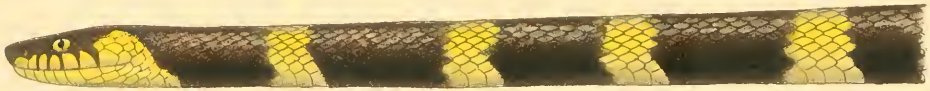

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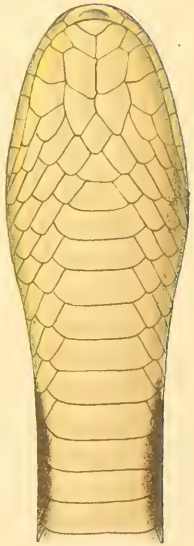

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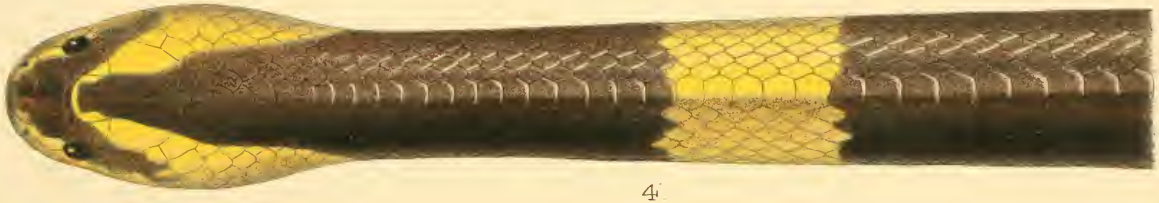

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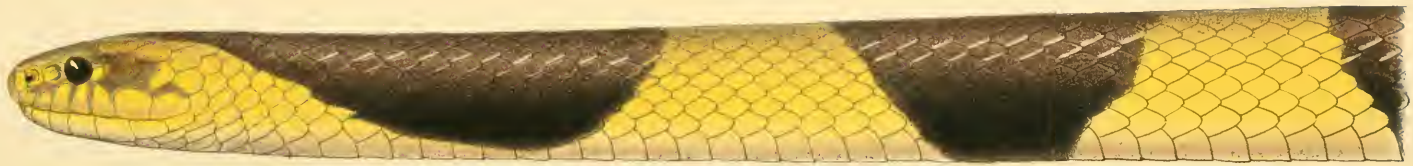

5

J. G. del.

J. Green, Chromo.

THE COMMON INDIAN SNAKES. (Wall).

1–3. Lycodon fasciatus, *harmless, nat. size.* 4–6. Bungarus fasciatus, *poisonous, nat. size.*

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plate and Diagrams

BY

Major F. Wall, I.M.S., C.M.Z.S.

Part XV with Plate XV., Plate A, 2 Diagrams and Map.

(*Continued from page* 633 *of this Volume.*)

BUNGARUS FASCIATUS.

The Banded Krait.

Proteroglyphons colubrines—or colubrines with tubular fangs in the front of the maxilla—are divided into two sub-families, (1) *Hydrophiniæ*—Sea snakes—all of which are poisonous, and (2) *Elapinæ*—poisonous terrestrial colubrines. The latter sub-family is divided into 69 genera, one of which *Bungarus* includes the species which forms the subject of this article. The genus *Bungarus* contains, according to my ideas, twelve distinct species, * but only six were described by Mr. Boulenger in his catalogue in 1896, and one subsequently by the same authority. The type of the genus is *Bungarus fasciatus.*

BUNGARUS FASCIATUS (Schneider).

History.—The first to allude to this snake was Seba who in 1735 figured it. Sixty-one years later it was again figured, and described by Russell. †

Nomenclature (*a*) *Scientific.*—The generic name was introduced by Daudin in 1803, and is a latinised rendering of the name by which it is known according to Russell to the natives in Orissa. The specific title from the latin "banded" was applied by Schneider in 1801.

(*b*) *English.*—To all Anglo-Indians the snake is known by the name of "banded Krait."

* See my article in this Journal, Vol. XVIII, p. 711.

† Ind. Serp. 1796. Vol. I, Plate III.

(*c*) *Vernacular.*—The name applied to it in Orissa—"bungarum pamah" is Telugu and means "gold snake." In Bengal it is usually called "rajsamp," a name probably suggested by the golden belts which encircle it, also "sankni." This latter appears to be connected with the word pronounced like our English "sunk" which is applied to the couch shells blown in Temples. If I am correctly informed these large shells are sometimes cut into several pieces by cross sections so as to make bracelets which are worn by Bengali women, and there is a street in Dacca where many craftsmen engaged in this occupation have congregated, and given to the street the name of "sunkaree." "Sankni" then appears to be a wearer of bracelets. Mr. E. Muir tells me about "kalna" (Bengal) it is usually called "sankni," but by the Hindus "dumukha" or two-mouthed. Also, he says, that the Santhals call it "bangphora" meaning two-mouthed, and "beeng."

In the North-West of Bengal, Fayrer* says it is called "kochlia krait." In Burma it has many names, "mywe min" (king snake), "ngan-wa" (yellow snake), "ngan-daw-ja" (banded royal snake), "nat mywe" (spirit snake), and "ngan-than kwinsyut" (or "ngan-than-gwin-zok" as Theobald has it) which means literally a cylinder with bands or rings on it.

General characters.—The banded krait when adult is a snake of respectable dimensions which attracts attention by its very distinctive, and highly ornamental, colouration. The head is broad and depressed, the snout short, and bluntly rounded. The eye is moderate in size, and blackish throughout, the pupil being usually invisible, but if looked at closely, sometimes an inconspicuous yellowish rim is seen to indicate its outline. The neck is barely apparent, the body smooth and glossy with a conspicuous ridge down the spine, and the tail short and ending abruptly in a finger-like extremity.

Colour.—The whole snake is broadly and alternately banded with canary-yellow and black. These bands involve from 5 to 7 scales in the length of the snake, completely encircle the body, and are of wonderfully even width, like a broad bracelet. The black

* Thanatophidia, p. 11.

are usually rather broader especially in front, and number from 16 to 27 on the body, and 2 to 5 on the tail.* On the nape is a large, elongate, black patch rounded behind, and ogival in front where it reaches the frontal shield, and this does not extend on to the belly. On the top of the head there is a large yellow V, the arms of which diverge backwards and pass over the temples to the throat. Except the lips and lore which are yellow, the rest of the crown is black. The chin and throat are yellow.

Dimensions.—It grows to 6 feet, but specimens over 5 feet are exceptional. I had one of 5 feet 3 inches in Berhampore (Orissa) and Evans and I had one 5 feet 9 inches in Rangoon. Vincent Richards† records one 6 feet long, Talbot Kelly in his book on Burma (1905, p. 110) mentions one just over 6 feet, and Major Leventon, I.M.S., told me of a large gravid ♀ he saw at Sibsagar in Assam that measured 6 feet 1½ inches. Fayrer ‡ says on the authority of Mason that it grows to 8 feet, but I very much suspect there was some guess work in this estimate. I have had over 50 specimens from Bengal, Orissa, Assam, Burma and China.

Identification.—Though the colour and banding is so distinctive those who trust to these only may be deceived by the similarity in this respect shown by some specimens of the harmless snake *Lycodon fasciatus*. It is best in this instance as in every other to identify your snake by scale characters. The enlarged vertebrals, and entire subcaudals will proclaim the snake a Krait for certain, and the ridged spine, blunt tail or the yellow bands will distinguish this from all the other kraits.

Haunts.—It is usually found in open tracts of country, grass land, crops, or low sparse jungle but not, I think, so much in dense jungle. It is no infrequent visitor or inhabitant of Cantonments, and is often to be encountered in well populated localities, getting into the bazaars, native huts, and Cantonment houses. In my early Indian days the rustling of something, one night across the mat in a dak bungalow proved when a lantern had been lit to have proceeded from a large banded krait in the room which was

* In a specimen I killed in Hongkong there was a large black blotch ventrally in many of the yellow bands.

† Landmarks of snake poison, p. 5. ‡ Thanatophidia, p. 11.

duly despatched, and I have heard of other similar experiences. About the Jail at Insein near Rangoon, it was very commonly disturbed by convicts, and I used to get one or two a week with great regularity in the rains. Instead of retiring to some place of security by day, many specimens seem to lie up in grass or shallow depressions in the ground or open drains and are often very badly concealed. Their bright yellow bands make them very conspicuous, and they are not likely to escape the notice of the village urchins at their games, or the chance wayfarer.

Many of them show a special attachment to damp places, and are to be met with in paddy fields, and even in pools of water, or river sides. I had one brought to me in Assam that was reported in the water, devouring a fish. Another in Burma took refuge in a pool of water during the day. Captain Kelsall* encountered one in a hole in a bank which escaped him by taking to the water, and diving. Theobald†, too, mentions its frequenting moist places, and the vicinity of water, and the Revd. E. Muir says the natives of Jalna tell him it is generally found in flooded rice fields in the rains. A specimen in Assam in seeking to escape was reported to have climbed 10 feet high into a tree, but I have never heard of any other clambering efforts.

Disposition.—The banded krait is a sluggard of the most confirmed type. It is lethargic to a degree that is difficult to understand, and one is very apt at first to think that a snake which is really quite unhurt, is suffering from ill-treatment and severe injuries. If encountered coiled up peacefully in the day-time, instead of taking alarm, and trying to escape the probabilities are that it will remain "in situ," and even when stepped upon, or kicked up it will frequently merely shift its position, and take no further notice. I have seen it picked up by a parcel of noisy urchins, and carried over a stick, from which it fell off every few yards to be picked up again and again without endeavouring to escape or show resentment, a treatment too humiliating for even the defenceless and blind little burrowing snake *Typhlops braminus* to submit to without some struggles, and attempts to defend itself. I have known it take refuge in a pool with a howling and excited mob,

* Jour. Asiatic Soc., Bengal 1894, p. 12. † Report, Cat. Brit. Burma, p 62.

assailing it from all sides with stones, sods of earth, etc., and yet seen it lie inactive unless actually struck by a missile, or immersed by a wave from one when it simply re-appeared at the surface, and maintained a dignified unconcern.

I have known it again when discovered swallowing another snake, take no notice of a ring of spectators, but continue engulfing its victim. Many specimens have been brought to me alive and quite unhurt, and I have never succeeded in making one angry, never seen one bite at anything nor raise itself in menace, though provoked in a most outrageous manner. What it usually did was to sulk; sometimes it flattened itself to the ground, but more usually lay still, and hid its head beneath its body. Sometimes if an eye was still visible, and an object pushed towards it, it made a slight spasmodic movement and withdrew its head still further so as to avoid seeing the coming danger. If the tail was smartly rapped, it merely shook it, and moved its position. I have sometimes thought that this singularly apathetic behaviour which strongly suggests that of an animal that has been drugged, is merely evinced during the day-time is, perhaps, due to its being dazed by the sun, or strong light, but an incident which occurred to a friend some years ago shows that, even at night the creature is naturally slothful and stupid. My informant, Colonel Evans, came across one when riding over an open piece of ground. He could clearly see the snake in the moonlight so dismounted, and having no weapon of offence, called to his servants to bring a stick. For several minutes Colonel Evans walked round the snake, which instead of trying to escape, merely altered its direction as he confronted it. It moved in a lazy way, and offered no menace, and was eventually killed.

Its movements are in keeping with its phlegmatic disposition. I have never seen one in the least degree active, and it is doubtless due to these traits in its character that no casualties in the human subject have hitherto been reported.

I have never heard one hiss, but Colonel Evans remarked that the ♀ that was found lying up with hatching eggs did so. The same observer mentioned the intolerance shown by the young brood to the sun.

Habits.—This krait is in the main of nocturnal habit. When encountered at night it is always on the move. In Assam the planters who owned motor-cars frequently saw it by the brilliant light of their lamps crossing the roads, and on most of the occasions when it was killed in or about habitations, it was seen at night. The specimens met with in the day-time were for the most part disturbed from some insecure quarter where they were lying inactive. It evidently, though is sometimes abroad during daylight in quest of food for the specimen reported above as eating a fish, was seen in the day. Mr. Jacob observed one which he shot in the day-time in conflict with a large tree snake, and Major Evans' record of one eating a chequered kulback was also in the day.

It is most frequently about in the rains, in fact, no less than 13 of the 17 specimens, Evans and I collected in Rangoon, were killed in June, July and August. At other times of the year, it was decidedly scarce.

Food.—From my remarks upon its disposition, one might, with reason, expect that it usually preys upon small and defenceless creatures, such as frogs and toads, but this is not so. It shows a very great partiality for an ophidian diet, and in its choice by no means picks out the weaklings, but will attack snakes as large or larger than itself, and overcome such formidable species as the dhaman (*Zamenis mucosus*) and the Himalo-Malayan rat snake (*Zamenis korros*), as I have seen myself. Mr. Jacob, too, found one in conflict with a large tree snake of a very truculent nature, *viz.*, *Dipsadomorphus cynodon*; and Colonel Evans records it having swallowed that vicious reptile the chequered keelback (*Tropidonotus piscator*). Blyth says that its usual fare is cobras, and we must, therefore, assume, that he has observed it swallowing this species. I once found a lizard of the Skink family (*Mabuia multifasciatus*) had been eaten, and once a clutch of snake's eggs, which were probably of the buff-stripped keelback (*Tropidonotus stolatus*). Three of these eggs were intact, and I could discover no injury done to them, though I examined them closely with a lens. This seems remarkable when one reflects that there are two long rows of teeth in the roof of the mouth, and many opposed to them in the lower jaws. On one occasion in Assam, one was reported to

be swallowing a fish. In every other instance where I have found anything in the stomach a snake had been devoured, and in many other examples, where the stomach was empty, an examination of the cloacal contents made it certain that a snake had previously been victimised as the very distinctive ventral shields floated up to the surface after softening the mass in water.

The victim in every instance lay fully extended within the krait, and, even when small, was never folded or collected into a mass. Although the stomach is remarkably elongate in this, and other kraits being $9\frac{1}{2}$ inches long in one which measured 4 feet and $\frac{1}{2}$ an inch, it is not long enough to accommodate most of the snakes preyed upon. Often a considerable length of the victim lies in the gullet, and may even protrude for some distance beyond the mouth; in fact, inevitably must do so when the quarry is of a length nearly equal to its vanquisher, or as sometimes happens even greater. A specimen I had in Assam, probably about 5 feet long, had been pickled in the act of eating a dhaman *(Zamenis mucosus)*, which from the length of its tail must have been about 5 feet long and no less than 1 foot $4\frac{3}{4}$ inches were protruding from the mouth. In another instance, a banded krait measuring 4 feet $2\frac{1}{2}$ inches was killed in the act of swallowing an Indo-Malayan rat-snake (*Zamenis korros*), which measured 4 feet $2\frac{1}{2}$ inches. In such cases, a considerable length of the victim must remain unswallowed until that portion already in the stomach is liquified by digestion, and this organ capable of accommodating a further instalment. It is probable that there is some protrusion beyond the jaws for a day or two, and that the whole length of a relatively large snake is not completely digested for a week.

The victim is at first seized anyhow, often being grasped in the middle of the body, but as its struggles grow feebler under the masterful grip of its captor, and the more powerful influence of its poison, it is released and siezed by the head. It would appear that sometimes the quarry is seized at first by the head, and swallowing commenced forthwith, for the most violent struggles ensue, in which the overpowered snake, although partially swallowed, has wreathed itself around its foe with a strength that refutes any idea of being enfeebled by the paralysing action of the krait's venom.

These conflicts are very disagreeable to watch, the strenuous though futile contortions which are to be seen even to the last inch or two of the victim's tail, must arouse the sympathy of the most callous spectator.

It is rather a pleasing reflection to my mind that the tables are sometimes turned, and the banded krait has itself to suffer from the same treatment it has probably meted out to scores of its weaker relatives. Mr. Primrose has recorded an encounter in this Journal, Vol. XII, p. 589, in which a banded krait had been overcome, and swallowed by its more powerful rival the hamadryad.

The Sexes.—My notes in Assam show that the sexes are evenly balanced, for out of 11 specimens sexed, 5 were males and 6 females. There appears to be no difference in the relative lengths of the body or tail of sexual import. The anal glands in both sexes secrete a blackish material reminding one of the blackened oil caused by machinery in motion.

Breeding.—Although over 50 specimens have passed through my hands I have been singularly unfortunate in gaining any information about the breeding, never having had a gravid ♀. All that is known on the subject is contained in the most interesting record furnished by Colonel Evans which appeared in this Journal.* The ♀ which measured half an inch less than 4 feet had retired beneath the ground where some elephant tusks had been buried, and had here deposited 8 eggs which she had evidently incubated as she was still in attendance when on the 19th of May 4 of them had hatched. She was thin as the result of her self-imposed imprisonment, but though she evidently possessed strong maternal instincts, it is curious that she showed no concern when her young brood were tampered with. The average dimensions of 3 eggs was 2·3 inches in length, and 1·5 in breadth. The young measured from $11\frac{3}{4}$ to $12\frac{1}{2}$ inches but as only two were taped, it is probable that these were not the extremes of length. They are reported as having more pointed tails than adults, and a modified colouring, the yellow being replaced by a dirty-white and the black by a leaden-hue. It is noteworthy, too, that they were remarkably active. Judging from the time of year when those young

* Vol. XVI. p. 519.

appeared it is probable that the mating season is in January or February. A young specimen of 1 foot 2 inches was sent to me last year by Mr. Frere from Tharrawady (Lower Burma) killed in June.

Growth.—It appears from my notes that the young grow about a foot during each of the first three years of life and the female reported above would therefore be completing her third year.

Poison.—Though this snake is a poisonous one, and common in many districts there is no authentic case of toxæmia in the human subject arising from its bite,* and it even seems doubtful if it would prove fatal to man. Rogers by direct experiment on birds fixed the lethal dose as 14 times that of cobra poison. Lamb, however, estimated that it is but 7 times that of cobra poison. In any case since we know that an adult cobra sometimes bites a man severely without injecting a lethal dose of poison, it would seem improbable that a lethal dose would be delivered in the bite of a snake of very similar proportions whose poison is 14 times or even 7 times less virulent. This conclusion seems to receive confirmation by the Burmese who are a very observant race, and knowledgable in Natural History matters. Most of them affirm that the banded krait is not poisonous. If it were otherwise, I think the Burmese of all people would be aware of it, for the snake is very common in their Province. Although it is not an evily-disposed snake it is difficult to believe that it is never the cause of a casualty, and if it ever occasioned loss of life or even serious symptoms, it is not likely to have escaped an evil reputation. Mr. Muir tells me that the natives about Kalna too are very doubtful

* Fayrer records the case of a woman at Tavoy (Thanatophidia, p. 45) who was bitten on the dorsum of the foot by a snake identified as the banded krait by Dr. Paul. The accident happened at 8 p.m. and beyond some local tingling and swelling at the time no ill-effects were noticed, and she was discharged from the hospital next day as recovered. We may assume that if any poison gained access to the wound, the dose was insignificant as no toxic symptoms were noted. The case quoted as such by Calmette (Venoms, Venomous animals, etc., p. 336) is obviously a fallacious record as this snake does not occur in Central India, the locality where the casualty occurred! The fact, too, that the original reporter says that the snake which was 28 inches long was full grown, and talks of a single mark made by an *incisor* tooth, proclaims a lamentable ignorance on his part of the snakes of India, and snakes in general, since no snake has incisor teeth.

as to its poison as it seems very seldom to bite. Mr. C. Gore told me of a bullock he once saw struck at and injured by this snake which succumbed 20 minutes later.

Poison apparatus.—The fangs are like those of other poisonous Colubrines, being much stouter, and shorter than those of a viper of similar length. There are usually two operative fangs placed side by side in each maxilla. The poison glands are relatively smaller than those of the cobra. I know of no special remarks made upon the physical properties of the poison.

Toxic symptoms.—To my namesake A. J. Wall we owe most of our knowledge of the poisonous properties of banded krait venom, indeed since his day further investigations have done little more than confirm his work. As no human records are available, the only picture we can present of the clinical manifestations of the toxæmia is as a result of experiment in the lower animals.

Wall says the local condition produced is the same as that seen in cobra bite. The part becomes swollen and painful, and later discoloured blood or bloody serum oozes from the punctures for some hours, and inflammation sets in later. He says the discolouration is much less than that seen in cobra bite, but if the tissues are cut into the same pinkish effusion of serum is to be observed in the areolar tissue. Lamb says the local reaction is much less than that seen in cobra bite; in fact little or nothing is to be observed at the side of the bite. Constitutionally two very distinct types of disturbance occur, both equally fatal, but each differing in the manner in which death is brought about, and the time that elapses before the fatal issue.

In the first the symptoms are exactly those of cobra poisoning being due to a principle in the venom (neurotoxin) that acts upon the brain and cord. Within an hour or two, or perhaps longer, the bitten subject is prompted to assume a sitting or even a lying posture from a feeling of weakness. This is the beginning of a paralysis that creeps on, affecting first the legs, then the trunk, and last the head, and as time advances the weakness, and loss of control of certain muscles becomes more and more pronounced. Breathing becomes increasingly difficult and hurried, the face

growing livid in proportion to the embarrassment of this vital function. The head droops, the lower lip falls away from the teeth, so that the saliva, which cannot be swallowed owing to paralysis of the throat, dribbles from the mouth. Movements of the tongue become impaired so that speech is rendered difficult, and the eyelids droop. Finally, death is brought about by asphyxia owing to the complete paralysis of the respiratory centre, and the final issue is frequently ushered in by convulsions. Consciousness is retained till the end. The heart is also affected in this form of snake poisoning owing to a synchronous paralysis of the vaso-motor centre, hence fainting with a feeble pulse may occur, directly attributable to the poisoning process quite apart from fright, or pain. In this last respect this poison differs in its effects from those of the common krait, and the cobra in both of which there is an element that by stimulating the heart muscle, and contracting the arterioles, counteracts the effects on the vaso-motor centre. Death may not occur till the 2nd or 3rd day from this type of toxæmia.

In the second type of disturbance symptoms are not evoked till the 5th day or later, and are then the result of a chemical destruction of cells in the central nervous system (due to neurolysin). Though the toxic element responsible for this form of disturbance is met with in common krait and cobra venoms, it only occurs in quantities insufficient to make its presence evident, but in banded krait venom, and in this only of the snakes whose poison has been investigated, serious symptoms are evoked by its presence. There are serious depression of spirits, loss of appetite, high fever, and very rapid and extreme emaciation. The kidneys become diseased, so that the urine contains albumen, and diminishes in quantity. Discharges from the eyes and nose and other mucous surfaces accompany the above, and death occurs in a few days from exhaustion.

Treatment.—In considering the treatment of a bite from this snake it is best to begin by recalling the various methods which have been tested experimentally in animals, and found futile, as well as other orthodox measures. Both Lamb and Rogers have tested the efficacy of Calmette's antivenene, and proved it useless, thereby falsifying Calmette's claims in this direction.

Drugs, such as Ammonia, Strychnia, and Alcohol, are not likely to do any good, but on the contrary harm. They all act on the central nervous system, and to administer them is like adding oil to flame, as they can only accentuate the paralysing effects of the snake venom. In addition Calmette has shown that Alcohol by neutralising any antitoxin that the subject may be forming in his own person, in response to the toxic absorption, acts in opposition to nature's attempts to subdue the toxic process.

It is extremely dubious if ligature, the orthodox measure recommended in every text book, is of the slightest avail, in this or any other snake poisoning process.*

Finally, artificial respiration is quite useless in this form of ophitoxæmia as shown by Lamb and Rogers as the heart shares in the general embarrassment, and tends to fail unlike what occurs in cobra and *cæruleus* poisoning.

The only method, which appears to afford a rational means of success, is the application of permanganate of potash locally. This salt is known to completely destroy the toxicity of all snake venoms. In practice, however, its merits have not met with the success one would expect. It must be remembered that the poison on absorption becomes intimately connected with the tissues at the bitten part, and whether this locking-up is merely a mechanical or a chemical process, it is extremely difficult to dissociate the venom from the tissues so as to allow the permanganate to come into antagonistic relationship with, and destroy it. The success of the treatment, therefore, must depend upon the degree to which the tissues are cut into, and the extent of surface opened up, into which permanganate can be introduced.

The surgeon should excise the bitten parts freely and dissect up all tissues, that show where poison has been absorbed, and then introduce permanganate crystals, and moisten them with water. If the non-professional man uses the knife at all he should cut a series of parallel incisions (as he would operate on a ham) close together, deeply and freely in the *length* of the limb, or member, and then introduce permanganate. As free use of the knife to a

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* *See* Trans. Bombay Medl. Congress 1909, p. 249.

degree that is really necessary seems to me a dangerous proceeding for the layman to adopt, a better plan is to destroy the bitten part freely with red hot iron, or nitric acid and subsequently to apply permanganate.

Fables.—Mr. E. Muir tells me that about Kalna it is said to have two mouths, one at the caudal extremity, and is reputed to be able to move forwards or backwards. Also that it is said to make a noise like the bellowing of a cow, which reminds me of the traveller Chateaubriand's description of a S. American snake he had met which when approached became flat, appeared of different colours, hissed like a mountain eagle and bellowed like a bull!

Uses.—The same informant says that the bones are sometimes made into necklaces, and worn by Hindus.

Parasites.—Entozoa of several kinds infest this snake. I have found two distinct nematode worms in the stomach which were identified by Professor Von Linstow* as *Kalicephalus willeyi*†, and larval and immature forms of an *Ascaris*. One of these, I forget which, anchors itself to the coats of the stomach and is found attached there after death, but the other is free, and though I believe inhabits this organ exclusively in life is often found to have wandered into the intestine after death, or into the gullet, and mouth. The *Pterocercus* or larval form of a tape worm, which Von Linstow suggests may be harboured in its adult form by birds of prey that devour snakes, is a very frequent parasite in the intestine. A fourth parasite is the linguatulid *Porocephalus crotali*‡, a maggot-like, whitish animal half to three-quarters of an inch long, which attaches itself by four hooks to the mesenteric tissues, and does not enter organs.

Distribution.—The Mahanadi Basin, Eastern half of the Ganges System, Brahmaputra, and Irrawadi-Salween Basins, through Indo-China to South China in the East, and through the Malayan Peninsula to the Archipelago as far East as Java. Within our Indian Dominions it is a common snake in Burma, Assam and

* Record, Ind. Mus., Vol. II, Part 1, p. 109.

† Spol. Zeylan, Vol. I, p. 99.

‡ Bombay N. H. Journal, Vol. XIX, p. 837.

Eastern Bengal, less common in Bengal and Orissa, and not rare, I believe, in the Central Provinces.*

A specimen of Colonel Beddome's collecting said to be from the Anamallays is now in the British Museum, but I do not credit the locality, and have shown good cause to doubt the accuracy of this record.† It is an inhabitant of the Plains, and rarely ascends to any Hills, and then probably not above 3,000 feet. Thus in the Eastern Himalayas in 1908, out of 778 snakes collected between 500 and 7,500 feet, no specimen came to hand. In 1909 Mr. Wright of Tindharia sent me a single specimen collected somewhere between 500 and 2,800 feet, but he had forgotten the exact locality. In the Khasi Hills, Assam, out of 264 snakes collected in Shillong (4,900 feet) I got no banded krait, but saw a dead one on the road somewhere near Nongpho (1,900 feet) which I guessed might have been about 3,000 feet elevation. Mr. Hampton writing from Mogok, Ruby Mines (3,800 feet), though an industrious collector of snakes for many years, had, he told me, never seen this snake there.

Lepidosis—Rostral.—Touches 6 shields, the rostronasal sutures longer than the rostro-internasal, and the latter about twice the length of the rostro-labial. *Internasals*—Two, the suture between them equal to or rather less than that between the præfrontal fellows, and about two-thirds the internaso-præfrontal. *Præfrontals*—Two, the suture between them rather greater than the prœfronto-frontal: in contact with internasal, postnasal, præocu-

* A member of our Society addressed the Secretary about February last year asking if he could name a snake which he had killed in Chanda, and he described as being completely banded with broad belts of yellow and black, and with a finger-like tail. I mislaid the letter which was handed to me, and cannot quote the writer's name. Mr. E. H. Young wrote to me last year, and told me he had killed a banded krait in the Sal forest, 40 miles North of Bilaspur. Two Officers told me of a banded krait killed at Raipur some years ago. When on Famine duty in 1897, a friend told me of a yellow and black banded snake he had killed in his verandah the night before near Bilaspur, which I had no doubt at the time was a banded krait. Colonel Bannerman tells me he has known it from Raipur and Sambalpur.

† Terr. snakes, Brit. Ind. Dom. 1908, p. 17.

The Banded Krait (*Bungarus fasciatus*).

lar, supraocular, and frontal. *Frontal*—Touches 6 shields, the fronto-supraocular sutures rather longer than the rest. *Supraoculars*—About half the breadth, and three-fourths the length of the frontal. *Nasals*—Quite divided by a nostril that is nearly as deep as these shields; in contact with the 1st and 2nd only of the supralabial series. *Loreal*—Absent. *Præoculars*—One. *Postoculars*—Two. *Temporals*—One. *Supralabials*—7 with the 3rd and 4th touching the eye. *Infralabials*—4, the 4th much the largest and in contact with 2 scales behind; the 4th (or 3rd and 4th) touching the posterior sublinguals. *Sublinguals*—Two subequal pairs. *Costals*—Two headlengths behind head 15, midbody 15, two headlengths before the vent 15. Smooth with no apical facets. *Vertebrals*—Enlarged, broader than long, hexagonal. *Supracaudals*—In odd rows with enlarged vertebrals. *Ventrals*—200 to 234,* rounded. *Anal*—Entire. *Subcaudals*—23 to 39, entire.

Anomalies.—I have once seen the upper postocular confluent with the supraocular, and once two temporals on one side.

Dentition.†—The maxilla has a pair of tubular fangs placed side by side, behind which are 3 teeth grooved on their outer faces, about one-third the size of fangs.‡ *Palatine*—11 to 13, subequal, about as large as the postmaxillary, and grooved on their inner faces. *Pterygoid*—10 to 12, the anterior as large as the palatine, the posterior slightly diminishing, grooved on their inner faces. *Mandibular*—16 to 17, abruptly decreasing in front, and more gradually behind, the median about as large as the palatine; grooved on their outer faces.

Our coloured plate is good but does not do justice to the glossiness of the scales in life. Plate A is taken from a photograph of a specimen in Parel that came from Raipur, C. P. We are indebted to Sub-Assistant Surgeon C. R. Avari for the photograph which is a good one.

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* In my Rangoon specimens 208 to 221, in Assamese 221 to 231.

† From 4 skulls in my collection.

‡ Similar except in the number of the postmaxillary teeth, to those of *caeruleus* (*See* this Journal, Vol. XVIII., figures C and D of Diagram).

The genus *Lycodon* is one of many into which the Aglyphous series of the family *Colubridæ* is divided. This series is characterised by an absence of either grooved, or tubular fangs, in the maxillæ, and all the representatives are, therefore, non-poisonous.

When treated by Mr. Boulenger in 1893 * it included 15 species. Since this time he has described another, *viz.*, *butleri* from Perak in this Journal†, and I have described two, *viz.*, *mackinnoni* from the Western Himalayas ‡, and *flavomaculatus* from the Deccan.§ Of the 18 species now grouped together under this title, 11 occur within our Indian Dominions.

As shown by Stejneger,¶ the title *Lycodon* is a misapplication to this genus, for the type of *Lycodon* is the S. American snake, now wrongly known as *Lycognathus cervenus* (*i.e.*, the *Coluber andax* of Daudin).

Lycodon then being clearly preoccupied should give place to Wagler's name *Ophites* of which the Malayan *subcinctus* is the type.

In spite of this I adhere to the name with which we have all grown familiar. This is an instance where in order to avoid confusion, custom, whether right or wrong, should be allowed to overrule the ethics of nomenclature. If American systematists, however, adopt the title *Lycodon* to designate their present *Lycognathus*, we have no alternative but to change our generic name to *Ophites*.

LYCODON FASCIATUS (Anderson).

Anderson's Wolf-snake.

History.—The species was discovered by J. Anderson during his expedition to Western Yunnan, and was subsequently in 1879 described, and figured by him.**

Nomenclature (*a*) *Scientific.*—The generic name from the Greek "lukos" a wolf and "odous" tooth was given by Ferrusac†† in 1826, on account of the teeth in the maxillæ, and mandible which

* Catalogue, Vol. 1, p. 348.

† Vol. XIII, p. 336.

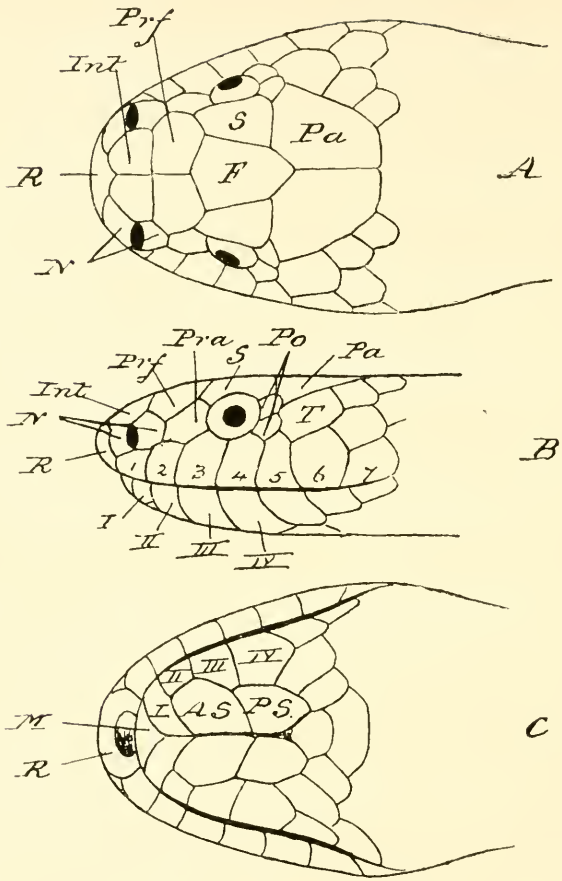
‡ Vol. XVII, p. 29.

§ Vol. XVII, p. 612.

¶ Herp. of Japan, 1907, p. 356.

** An. Zool. Res. Yunnan, p. 827, and fig. 4, Plate LXXVIII.

†† Bull. de Science Nat., p. 238.



Bungarus fasciatus (× $1\frac{1}{2}$).

SHIELDING OF FIGURES A, B & C OF DIAGRAM.

A. S.	Anterior Sublinguals.
F.	Frontal.
Int.	Internasals.
M.	Mental.
N.	Nasals.
Pa.	Parietal.
Po.	Postoculars.
Pra.	Præocular.
Prf.	Præfrontal.
P. S.	Posterior Sublinguals.
R.	Rostral.
S.	Supraoculars.
T.	Temporal.
1 to 7.	Supralabials.
I to IV.	Infralabials

from their superior length, and position resemble the canine teeth of dogs and wolves. "*Fasciatus*" is from the Latin meaning banded.

(*b*) *English.*—I think the best name for it is Anderson's Wolf-snake, a literal reference to its specific name being equally appropriate, to many of the species.

(*c*) *Vernacular.*—Mr. Hampton tells me that about the Ruby Mines in Upper Burma it is called Ngan-do-ja. This is the same as one of the Burmese names for the banded krait, and implies "banded royal snake."

General characters.—It is a snake of moderate dimensions, and rather slender proportions, very strikingly and handsomely marked, and on this account likely to attract attention. The head is markedly flattened, and the snout broadly rounded. There is no ridge from the eyebrows forwards. The nostril occupies the whole depth of the suture dividing the nasal shields, but is nevertheless moderate in size, as the suture occurs at the lowest depth of these shields. The eye is rather small, and the iris, unlike all the other species of the genus that I have seen, is heavily flecked with grey so that the vertical shape of the pupil is very apparent. The neck is fairly evident, the body long, round in section, and with glossy scales, and the tail is long, being about one-fourth the total length of the snake. The belly is somewhat abruptly turned up on either side of the ventral shields, *i.e.*, angulate.

Colour and markings.—The head is quite black above, and the edge of the upper lip, the lower lips, and chin are yellow, more or less mottled with black. The body and tail are alternately banded black, and yellow or dove colour with very jagged outlines. The black bands completely encircle the snake anteriorly and posteriorly, but may be more or less incomplete ventrally in the middle of the body. They are broader anteriorly than posteriorly, and number 23 to 33 on the body and 14 to 18 on the tail in my Burmese specimens, 32 to 38 on the body and 15 to 20 in Shillong specimens, the anterior involving 9 to 10 scales vertebrally in the length of the snake. The intermediate bands are yellow, wheat, or dove-coloured, and often more or less subdivided by narrow or broad black crossbars. Such a specimen probably accounts for Ander-

son's description of the type which had 55 bands, or twice the number as counted in my specimens.

The snake should never be confused with the banded krait, even when attention is only paid to colour, but evidently some Burmese confuse the two as already mentioned. Again, Mr. Hampton himself sent me several specimens as kraits, probably being misled by his Burmans. It is for this reason that the two snakes are shown together on our Plate, and discussed together in this article.

Identification.—The dual combination which follows will suffice to distinguish it from all other Indian Snakes up to the present time known, *viz.*, (1) scales two-headslengths, behind the head 17, in midbody 17, and two-headslengths before the vent 15. (2) Loreal touching the eye (*see* fig. D of diagram).

Dimensions.—Specimens over $2\frac{1}{2}$ feet are unusual, but I have had 7 such, the largest being a ♀ 3 feet and $\frac{3}{4}$ of an inch in which the tail was slightly imperfect, and a ♂ 3 feet and $\frac{1}{4}$ of an inch, both captured in Shillong. One 3 feet long I got from Burma. I have seen in all 31 specimens. Mr. Hampton tells me the largest he has seen was 3 feet 7 inches in length.

Haunts.—It appears to frequent jungle tracts in hilly situations for choice. Shillong where I got so many is heavily wooded, and it was common inside the station, and more than one was encountered inside a bungalow. Mr. Hampton tells me that they do well in captivity and will live for years. When they died they appeared to be in excellent condition but, perhaps, too fat.

Habits.—From Mr. Hampton I learn that it is essentially a nocturnal snake, never appearing during day light, but he has often noticed them in captivity visible, at 5 and 6 a. m. When people began to move about the house they retired under their blankets unless they were in their bath where they remained in the water until mid-day. He tells me further that they are very quiet, but very quick, striking right, left, or centre without the slightest warning.

The few specimens I have seen alive were active, and plucky resenting interference, and showing it by assuming an offensive attitude.

Distribution of *LYCODON FASCIATUS.*

1 Tezpur (I.M.). 2 Shillong, Khasi Hills, 4,900 feet (I.M. and F.W.). 3 Haka Chin Hills, 6,500 feet (Wall and Evans.) and (F.W.). 4 Mansi, Katha, Upper Burma (Bom. M.). 5 Ponsee (Anderson). 6 Mogok, Ruby Mines, 3,800 feet (B.M., F.W.). 7 Maymyo (Evans). 8 Taounggyi, Shan States (B.M., Wall and Evans).

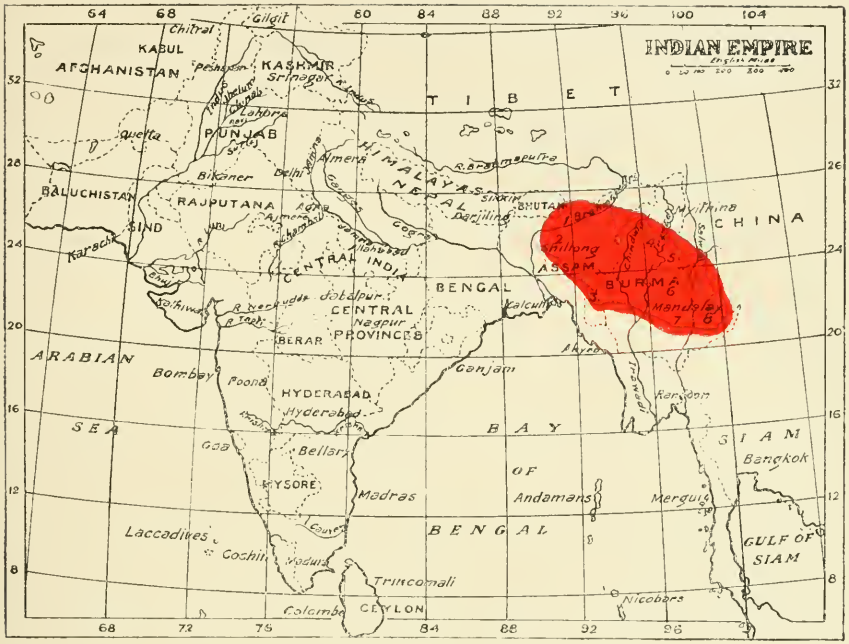
B.M. implies British Museum, I.M. Indian Museum, Bom. M, our Society's Museum, F.W. the author.

Distribution of *B. FASCIATUS.*

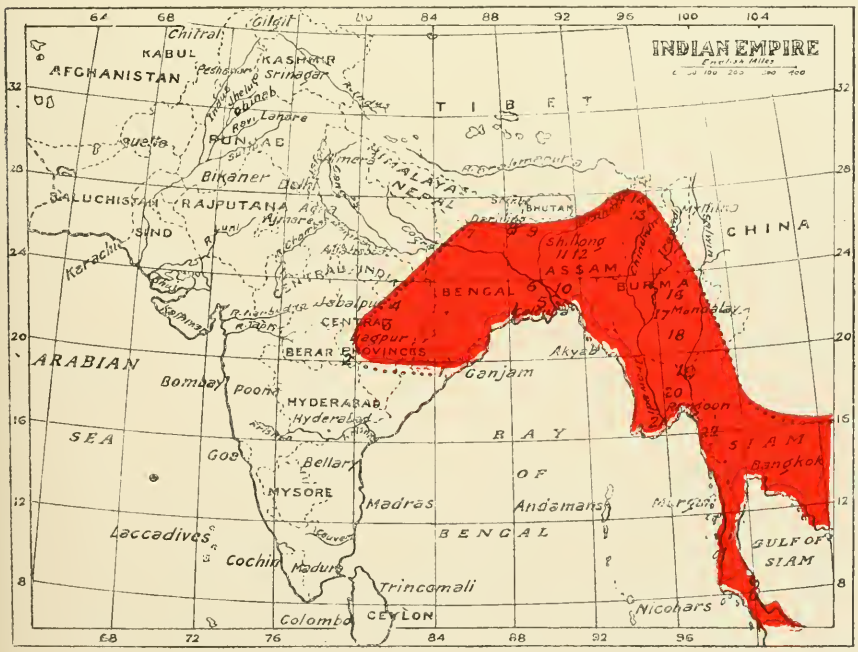
1 Aska (I. M.) and Berhampore (F. W.). 2 Chanda (Record received by letter to Secretary of our Society). 3 Raipur (Information from two Sources received by me). 4 Near Bilaspur (F. W. and E. J. Young). 5 Calcutta (I.M.). 6 Raniganj (I. M.). 7 Bettiah (F. W.). 8 Below Tindharia (F. W.). 9 Jalpaiguri (Information from Mr. W. A. Jacob). 10 Dacca (I. M.) and Silchar (Primrose in this Journal, Vol. XII, p. 589) 11 Near Nongpho, Circa, 3,000 ft, Khasi Hills (F.W.). 12 Samagnting Circa, 2,000 ft., Naga Hills (I.M.). 13 Sibsagar (I. M.). 14 Dibrugarh Tinsukia, Doom Dooma (F. W.). 15 Near base of Daffla Hills, N. Lakhimpur. (F W.); 16 Ruby Mines (B. M.). 17. Mandalay, Sagaing (I. M.). 18. Pyawbwe and Meiktila (Wall and Evans). 19 Toungoo (B. M.). 20 Tharrawaddy (F. W.). 21 Rangoon (Wall and Evans). 22 Moulmein (F.W.)

I. M. implies Indian Museum, B. M. British Museum, and F. W. the author.

The dotted lines in the map imply that the exact limits of its distribution are here uncertain.



Distribution of *Lycodon fasciatus*.



Distribution of *Bungarus fasciatus*.

I found the slough of one in a pine wood adhering some 5 feet nigh to the trunk of a tree that was fully 18 inches in diameter. This shows that it can climb deftly like its near relative *aulicus*, for the irregularities in the bark were very slight, and there were no branches to aid it.

Food.—I have found the skink *Lygosoma indica* in the stomach once, and on another occasion a skink of similar dimensions and probably of the same species. Mr. Hampton says his specimens in captivity readily devoured lizards of the same species, and also the Burmese slow worm *Ophisaurus gracilis*, but took no notice of young rats or sparrows. Further, they evinced serpentivorous tastes, being specially fond of the blind snake *Typhiops diardi*, but if nothing else was handy the big ones practised cannibalism, eating younger specimens of their own species. Another snake which they devoured eagerly was *Coluber porphyraceus*.* On one occasion he saw one in captivity endeavouring to swallow a green pit viper *Lachesis gramineus* not quite so long but far more bulky than itself. It had swallowed half of it, but had to give up the attempt, the victim which was dead proving too large. There were plenty of lizards in the cage when this happened. It wreathes its body round its victim I am told.

Foes.—Mr. Hampton says one of his was eaten by a cobra (*Naia tripudians*). Recently I had one sent to me which had been removed from the stomach of a hamadryad (*Naia bungarus*) by Mr. Venning in Haka (Chin Hills, Upper Burma).

Sexes.—Males and females appear to be equally abundant. Out of 13 sexed in Shillong, 6 were ♂ ♂, and 7 ♀ ♀. I can discover no differences of sexual import. The relative lengths of the body and tail seems to be the same in both, and so are the numbers of ventral and subcaudal shields. The secretion from the anal glands is yellowish and custard-like, and as abundant in a young specimen (a hatchling), as in mature examples.

Breeding.—The species is oviparous, for Mr. Hampton has had eggs laid on two occasions, once 10 and once 14. Unfortunately the dates of deposition were not noted. A small example which I

*As Mr. Hampton was uncertain of the identity of the snakes herein referred to he sent me specimens.

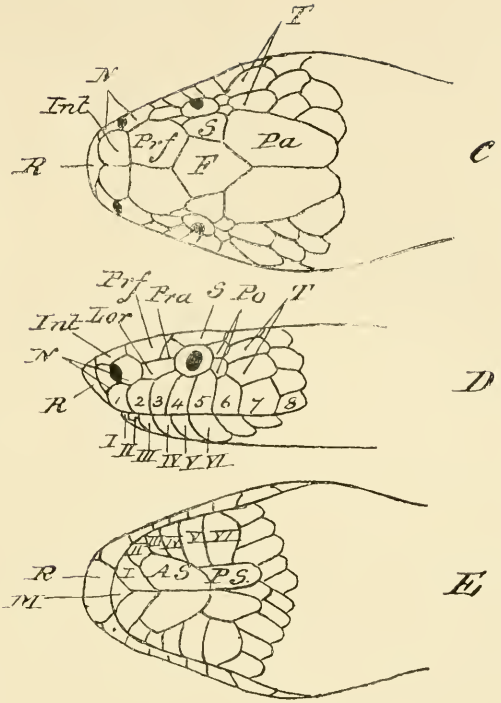
am nearly sure was a hatchling and which measured 8½ inches was found in a child's nursery on the 19th of September in Shillong, and seems to indicate that the breeding season in these Hills is considerably later than in the snakes of the adjoining Plains. I have had two other specimens of similar length—8⅛ and 8¼ inches—from Burma, the dates unknown.

Growth.—The young appear to grow about 6 to 8 inches during the first 4 years of life, when they are about 3 feet in length.

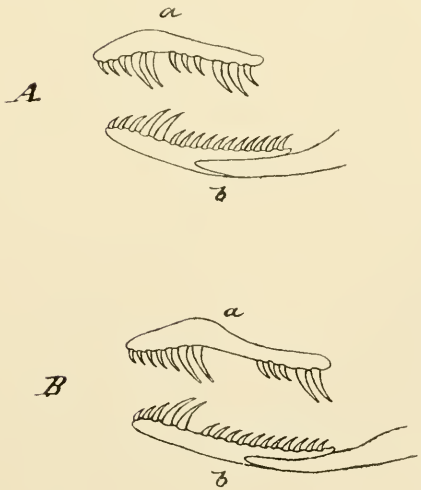
Distribution.—It inhabits Hilly Districts between the Brahmaputra and Salween River Systems, but has once been reported from Tezpur, Assam.* I presume this is the Tezpur on the North bank of the Brahmaputra, but since it was taken by Godwin Austen on the Duffla Hills Expedition it appears to me possible there may be another Tezpur in those Hills, especially as the snake with this exception has always been collected in Hills. It is common in the Khasi Hills about Shillong at an altitude of 4,500 to 5,500 feet, also in the North Shan Hills about the Ruby Mines (Mogok 3,800 feet), and may prove to be equally common in intervening Hills when those have been thoroughly exploited.

Lepidosis—Rostral.—Touches 6 shields, the rostronasal rather greater than the rostro-internasal sutures. *Internasals*—Two, the suture between them about ½ to ⅔ that between the præfrontal fellows, and ½ to ⅔ the internaso-præfrontals. *Præfrontals*—Two, the suture between them rather greater than the præfronto-frontal: in contact with internasal, postnasal, loreal, præocular, supraocular and frontal. *Frontal* touches 6 shields, the fronto-supraocular subequal to or rather smaller than the rest. *Supraocular*—Length about ⅔, and breadth along a line connecting the centres of the eyes, less than ½ the frontal. *Nasals*—Divided, in contact with the 1st and 2nd labials. *Loreal*—One, elongate, not touching internasal, touching eye beneath the præocular. *Præocular*—One. *Postoculars*—Two. *Temporals*—Two, the lower touching the 6th and 7th labials. *Supralabials*—8, the 3rd, 4th and 5th touching the eye. *Infralabials*—6, the 6th largest, and touching 3 scales behind, the 5th and 6th touching the posterior sublinguals. *Sublinguals*—Two pairs, the

* Lately reported from Kerseong in the Eastern Himalayas (Journ. Bomb. N. H. S. Vol. XX. p. 857.)



Lycodon fasciatus (× 2).



A. Maxilla (*a*) and
Mandible (*b*) of *Dinodon rufozonatus*.

B. Maxilla (*a*) and
Mandible (*b*) of *Lycodon fasciatus*.

posterior rather smaller. *Costals*—Two-headslengths behind the head 17, midbody 17, two-headslengths before vent 15. In the step from 17 to 15 the 4th row above the ventrals disappears, being usually absorbed into the 3rd, sometimes into the 5th. Keels present but rather indistinct, in all rows but the last one or two posteriorly. Apical pits present, in pairs, but often obscure. *Ventrals*—200 to 213, angulate laterally. *Anal*—Entire. *Subcaudals*—74 to 88 (90 Boulenger), divided.

Dentition†—*Maxillary.*—From 3 to 5 progressively increasing teeth followed without a gap by 2 enlarged and subequal which are about twice the length of the last preceding. A gap that would take about 3 small teeth, then 2 (rarely 3), small subequal teeth, followed by 2 large and subequal which are about twice as long as the last preceding. ‡ *Palatine*—13 to 15 subequal, and about the size of the smallest maxillary. *Pterygoid*—19 to 29, small, subequal to smallest maxillary. *Mandibular*—3 or 4, small, progressively increasing teeth followed by two large and subequal, about twice the size of the last preceding. A short gap that would take one small tooth, then from 10 to 12 small subequal teeth.

Anomalies.—I have seen the præfrontal touching the eye below the præocular once, 9 supralabials with the 4th, 5th, and 6th touching the eye once, and the præocular touching the frontal once.

Our coloured Plate might be better. The yellow is too bright, but I have seen examples nearly as bright. The iris is shown much too bright.

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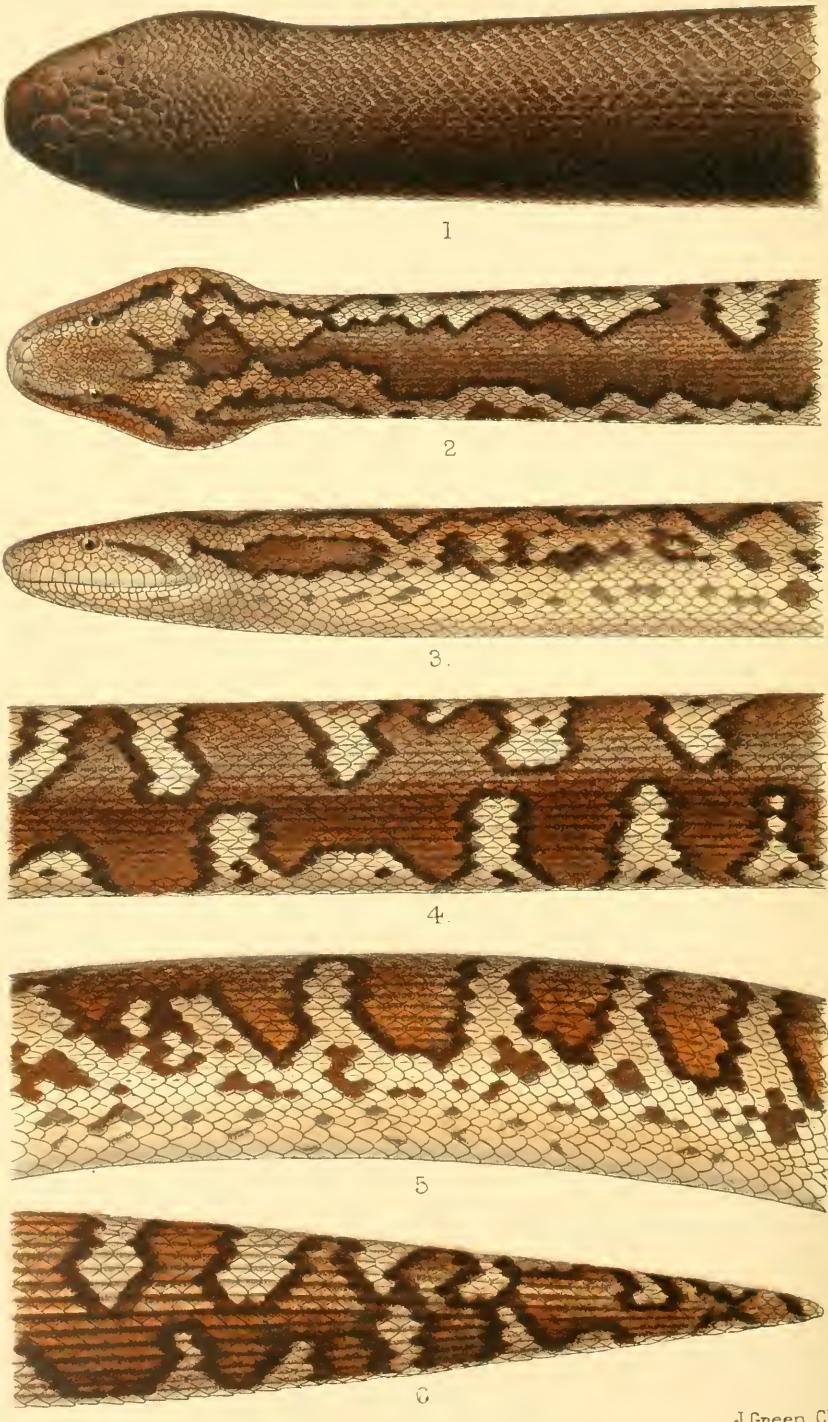
† From 4 skulls in my collection.

‡ The distinction made by Mr. Boulenger between the genera *Lycodon* and *Dinodon* (Catalogues Vol. I pp. 348 and 360) is not tenable. I find that in my skulls of *Dinodon rufozonatus*, *D. septentrionalis* and *D. semicarinatus*, there is no greater gap just before the last enlarged teeth than there is in any of the 5 species of *Lycodon* of which I have skulls. The figure of the dentition of *Dinodon rufozonatus* on page 360 is not correct. On examining my two skulls it is obvious that a tooth has dropped out where the gap is shown in Mr. Boulenger's figure, and has so escaped his notice. I think, however, that the two genera deserve recognition as such on other grounds, for I find in my three species of *Dinodon* there is a smaller tooth behind the last two enlarged ones, and this is represented in Mr. Boulenger's figure. This small third tooth is not present in any of my *Lycodon* skulls, viz., *aulicus*, *striatus*, *fasciatus*, *travancoricus*, *jara*, and *flavovmaculatus*.

To be continued.



J G del. J. Green, Chromo.

THE COMMON INDIAN SNAKES. (Wall).

1. Eryx johnii, *harmless, nat. size.* 2–6, Eryx conicus, *harmless, nat. size.*

JOURNAL
OF THE
Bombay Natural History Society.

Oct. 1911. Vol. XXI. No. 1.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plates and Diagrams.

BY

Major F. Wall. I.M.S., C.M.Z.S.

Part XVI with Plate XVI and Diagram and Maps.

(*Continued from page 953 of Volume XX.*)

Introductory remarks.—The subjects of this paper belong to the *Boidæ*, a family comprising the boas, and the pythons. There are many representatives scattered over all five Continents. These snakes are characterised by the possession of rudimentary hind limbs, and a rudimentary pulvis, the termination of the former being more or less visible as claw-like processes situated on each side of the body in a fold or dimple above the anus.

The family is divided into two sub-families, *viz.*, *Pythoninæ* in which there is a bone (the supraocular) distinct from the frontal forming the roof of the orbit, and *Boinae* in which the frontal alone forms the orbital roof. The latter includes 13 genera of

which *Eryx* is one. The genus *Eryx* of which *jaculus* is the type has seven species inhabiting North and East Africa, and Central and Southern Asia. Three of these, *viz.*, *jaculus*, *conicus*, and *johni*, occur within Indian limits.

ERYX CONICUS (Schneider).

Russell's Earth Snake.

History.—* The first certain reference to this snake was made by Russell who described and figured it unmistakeably in 1796. It is not certain, whether the *Vipera orientalis* referred to by Seba in 1734, or the *Serpens indica* of Boiquatraza, are identical with *E. conicus*, though this may be the case.

Nomenclature—(*a*) *Scientific.*—The generic name appears to be derived from the Greek "erno" I drag along, probably in allusion to the feeble powers of progression of the type *jaculus*. Daudin introduced the name in 1803. *Conicus* from the Latin conical, suggested itself to Schneider in 1801, on account of the peculiar short and conically shaped tail.

(*b*) *English.*—The Common Earth Snake suggests itself, but the fact that John's Earth Snake (*E. johni*) is also common, deters one from accepting this as appropriate. I think Russell's name should be associated with it, and Linné's name with its close ally *jaculus*.

(*c*) *Vernacular.*—It is confused by natives so frequently with John's Earth Snake, that many of the names in use apply to both species. Russell says about Vizagapatam it is called "padain cootoo," "mondi poda," and "manooli pampoo" (pamboo?). The last is certainly one of its commonest names in S. India, and is the Tamil for "earth-dweller." Other common names are "manoo pamboo" or earth snake, "mannary," "mannooly," or mannooni" malayalanm words meaning "sand or earth eater." "Mandally" is another, and the one in frequent use about Malabar. I have known it called "kuley pamboo" or mud snake and Russell also mentions "pedda poda." In Mysore its Canarese name is "itallay havu" or "two-headed snake." Mr. Millard tells me that at Ratnagiri it goes by the name of "kander." and about

* Ind. Serp., Vol. I, p. 5, pl. IV.

Bombay as "kakria." Mr. D'Abreu tells me the Hindi name is "thut-thur-samp" or "snouted snake." In the Punjab, and in Bengal it is often called "do muha" or "two-mouthed" (Hindi, and Punjabi), but this is more appropriately the name for *Eryx johni.*

General characters.—It is of a markedly stout habit, the body being short and heavy, and the tail short. The body is broader in its transverse direction than its vertical, and stoutest about the middle. It attenuates somewhat, and very gradually in both directions, passing almost insensibly into the head so that there is but slight indication of a neck. It is rough dorsally owing to the keeled condition of the scales, and this roughness becomes more pronounced posteriorly. At each side just above the vent is a small curved claw-like process directed downwards in the ♂ and a small pointed process directed backwards in the ♀, which indicate the termination of the rudimentary hind limb. This is far more developed in males, and is frequently supposed to be the male copulatory organ by those not conversant with ophiology. In females the development of this process is so small that it is usually overlooked* leading to a popular belief that, it is the male only that bears it, hence the idea, no doubt, that it is the male sexual organ. Most of the limb is concealed within the muscular tissues but if dissected out by competent observers, the analogues of many of the bones seen in the limbs of other vertebrates can be traced up to its origin in the rudimentary pulvis. The head is moderately elongate, rounded evenly from side to side, and has a more or less pronounced temporo-occipital eminence, on either side. The snout is long, rounded laterally owing to a complete absence of any canthus rostralis, and broadly rounded in front. It overlaps the chin, to an extent often equalling the diametre of the eye and is not provided with the transverse ridge in front, which is seen in both the other Indian representatives of this genus, nor has it the groove beneath the chin, (mental groove) which is characteristic of these two species (*jaculus* and *johni*). The eye is very small, its diametre being only about one-third the length of the snout. Its

* Nicholson (Ind. Snakes, p. 3.) says the ♂ alone has them.

pupil is vertically elliptical, and its iris beautifully speckled with gold. The nostril is slitlike, and placed high on the snout. The tongue is pale at the base, but blackish at the tips. The tail is short, and tapers very rapidly so that it is conical in shape. It is even rougher above than the hinder part of the body.

Colouration.—The under parts are buff, uniform, or with but little trace of mottling. In the flanks there is a mottling of brown, sometimes of a light shade, sometimes as deep as chocolate. At first very fine this mottling becomes coarser as it ascends the flanks, and then vertical bars of the ground colour pass up to the spine. These bars are much narrower than the intervals. When they meet over the back large somewhat irregularly squarish blotches are formed which proceed from the nape to the tail tip. More often the bars of the two sides alternate, and an irregular dark patchy confluent pattern results. The head is light above with sometimes dark speckling especially about the lips, and a dark irregular stripe passes from the eye to the gape. Dr. Annandale*, who captured a mother and young, says the latter are more brilliantly coloured.

Identification.—Russell's earth snake is very like Linné's earth snake (*jaculus*), so much so that I have no doubt the two have been confused repeatedly in the Punjab where they are associated. It was only in 1909 in this journal that I reported the occurrence of *jaculus* for the first time within Indian limits, the specimen being captured at Jhelum. Whether it is as rare as this single record might lead one to suppose, remains to be seen.

The dual association of small head scales, with ventrals so narrow that they are only twice or little more than twice the breadth of the last costal row, suffices to pronounce the snake an *Eryx*. *Conicus* differs from the other two Indian species (*johni* and *jaculus*) in having no groove beneath the chin, and no angular transverse ridge on the rostral shield, so that the identification is extremely easy. A similar specimen with a conical tail, mental groove, and angular ridge on the rostral would prove to be *jaculus*.

Dimensions.—The largest specimen I know of was a gravid ♀

* Mem. As. Soc., Bengal. Vol. I, 10, p. 193.

killed in Trichinopoly by the Revd. C. Leigh, S.J., which he said taped 2 feet 9 inches. I saw another large specimen (not of local origin) in the St. Joseph's College collection, Darjeeling, that measured 2 feet 7 inches. The largest I have had myself were 2 feet $4\frac{3}{4}$ inches, 2 feet $3\frac{1}{4}$ inches, and 2 feet $1\frac{1}{2}$ inches. Specimens over 2 feet are not common.

Haunts.—It is generally stated to be a desert snake, but it is by no means confined to desert tracts. It was a very common snake in Malabar, where the annual rainfall was about 150 inches, and the soil supported a particularly luxuriant vegetation. Father Dreckman tells me he has frequently seen it in the Western Ghats at an elevation of 2,000 feet (Khandalla), a locality favoured with 200 inches annual rainfall and a flourishing forest growth.

Like the rest of its genus it is an earth snake, but though it does not possess even a rudimentary indication of the transverse ridge which all the other members of the genus have developed, and which they use for digging purposes, it does not appear to me to suffer from the want of it, for it burrows into loose soil quite as easily, and expeditiously as *Eryx johni*, the species which exhibits this ridge in its most exalted state of development. Possibly were it to test its powers in harder soil against John's earth snake, the latter would show its superiority.

Though an earth snake its life is by no means completely subterranean. Were it so, doubtless by now it would have acquired, or be acquiring the condition of ocular degeneration seen in the blind snakes (*Typholidæ*), a family in which the eyes have undergone a devolution process brought about by a protracted residence in darkness.

From what I know of *conicus* I feel confident that a considerable period of its life is spent either above the soil, or in the most superficial layers, into which light is admitted and by its stimulus the function of the eye has been preserved. As a result this organ beyond being small, is quite as well developed, and vision seemingly quite as good, as in colubrines, and other highly organised representatives of the order.

The specimens I have kept myself, and that I have seen in captivity elsewhere I have frequently noticed are often to be seen

above the soil which has been provided for them to conceal themselves beneath, and in some cases where no earth was given it appeared to thrive just as well without it, and for long periods. The only specimen I remember not having seen for many days was missing when I came to investigate! It had evidently contrived to reach the top of the sides of the box in which I had placed it and so effected its escape. A large number of those brought in to me were reported above the ground, and many of those were discovered in broad daylight. It is also evident that it must have been above ground, and in daylight in the instances where it had managed to capture squirrels. On the other hand I have frequently had specimens brought in that were found beneath the soil, their refuge being disturbed by human earth operations. In these cases it appeared to have retired from active life. In Cannanore it was in the hot and dry weather that it was most often abroad, being as common in that season, as it was scarce in the monsoon.

Disposition.—Russell's Earth Snake is a dull, phlegmatic creature, and a most uninteresting occupant of the vivarium. The ones I had in captivity were generally to be seen lying above the earth, or only partially buried, and remained motionless for hours together. They were not easily roused, except when the food was offered them, and then they showed an interest in life not seen at other times. I have played with many specimens, but it has a nasty uncertain temper, and one has to handle it with caution to avoid being bitten. It will lie on the ground motionless, take little notice of teasing, and just when one begins to think the reptile has no vice in its composition, and will submit to a touch, it suddenly springs forward, and implants its teeth into one's hand, and it can bite with considerable force. Although careful in my dealings with it, I have been bitten several times, the suddenness of the assault giving me no chance to withdraw my hand, as one can do with so many other snakes, when familiar with their ways. Russell remarks of one he had sent him that it bit ferociously. Mr. Boulenger* says the one he kept had a fierce temper, and Father

* Faun. Brit. Ind. Rept., p. 247.

Dreckman tells me that he thinks it is one of the most vicious members of all snakedom, ready to snap at anything at a moment's notice. He was bitten by the first snake that he ever encountered in this country which happened to be a *conicus*. Dr. Henderson says that in his experience it is a sluggish snake, but occasionally it strikes out fiercely when irritated. Mr. D'Abreu tells me he kept a pair for a long time. He says when first captured it is very fierce, biting readily when touched, but after a little handling it gets quite tame, and never bites no matter how much it is handled. Certainly the specimens which accompany many jugglers allow themselves to be handled without betraying any malice. I have known some specimens when irritated, sulk in a most determined manner, remaining quite motionless, and refusing to offer any malice. Sometimes indeed it hides its head beneath its body, and remains so for many minutes. It will often flatten its body to the ground when alarmed, like many other snakes do.

Habits.—Whether this snake is in the main nocturnal I do not know. At any rate it is very frequently abroad by daylight, and even in the midday glare of the hot weather, frequently establishes itself beneath trees in S. India where it lurks for the purpose of catching the squirrels (*Funambulus palmarum*) when they descend. With this object I believe it partially buries itself, and patiently awaits the chance of a squirrel coming within reach, and the chances are not so remote as one might imagine who does not know Southern India, for the squirrels there almost amount to a pest. They are always on the move, and frequently descend, and wander about beneath the trees. In this connection I believe whatever the original function of the keels on the scales of snakes and lizards may have been, that they are of material advantage to a snake like *Eryx conicus*, for they undoubtedly assist its effectual concealment. As the snake noses its way through the surface soil, the particles of earth lodge in the grooves formed between the keels on its back and serve to conceal its serpentine form. Were the body smooth the particles would roll off, and expose more or less of the snakes body, unless buried so deeply as to hamper its movements when the quarry came within reach. This function

of the keels in snake's, is also seen in desert snakes like the horned vipers (*Cerastes*) that lie partially concealed in the sand. The movements of Russell's Earth Snake are laboured, and slow, and it is impossible for the creature to proceed at any pace other than a crawl. The reason for this is apparent when the snake is laid on its back. The shields on the belly are very narrow compared to those of colubrines and vipers. They only occupy some two-fourths of the middle of the belly breadth, and as the ribs are attached to them, those bones are very much bowed, leaving one-fourth of the body on each side, without a support.

As a snake moves on its ribs, the body which in this snake is unusually massive has only half its breadth supporting it during progression.

Food.—Its food is almost exclusively of a mammalian order. Those I had in captivity in Trichinopoly persistently refused frogs, and lizards, and my servant told me their usual fare was squirrels (*Funambulus palmarum*). Following his advice I gave them squirrels whenever I could get them, and they were always taken eagerly.

The distension of a snake about 20 inches long after swallowing a squirrel may well be imagined, but although the process of incorporation was a protracted one, no misadventure occurred. On two occasions in Cannanore specimens were brought to me that had been discovered in the act of devouring full grown squirrels, in one case the snake was only 1 foot 4½ inches long! A third specimen contained a relatively large mammal in its stomach which appeared to be a squirrel. Mr. D'Abreu fed his specimens on mice which they ate with avidity, and grew very fat upon. A captive specimen in Madras Museum ate in one year 57 mice, another 65 rats, and a third 51 mice, and 1 rat in the year. A specimen brought in to me at Cannanore had eaten a large frog (*Rana tigrina*), but reptiles are not usually acceptable. Mr. D'Abreu says that a lizard of the genus *Calotes* was very promptly despatched by one of his captive specimens but no attempt was made to eat it subsequently. Mr. Millard tells me that one in our Society's room tried to eat a young snake (*Tropidonotus piscator*), and the Revd. J. Castels, S.J., told me of one he had in

captivity that killed a green whipsnake (*Dryophis mycterizans*) with which it was quartered.

Like other boas it kills its victims by constriction, and the strength of its body is such that the life is crushed out of a squirrel or mouse in a few seconds, and until life is extinct it does not commence swallowing.

The sexes.—Of the 18 specimens I sexed in Cannanore 9 were ♂ ♂, and 9 ♀ ♀, showing that the sexes are evenly balanced. The ♀ appears to grow distinctly larger than the ♂. I never had a male reaching a length of 2 feet, though I have had 3 ♀ ♀ exceeding that length. The largest record I have already alluded to was also a ♀ Mr. Leigh's 2 foot 9 inch. specimen. The development of the tail differs in the sexes, the length being in favour of the ♂, in which this appendage accounts for from one-eleventh to one-fourteenth the total length of the snake. In the ♀ it is from one-fourteenth to one-seventeenth the total length. There appears to be another sexual difference judging from my notes, and this is in the costal rows which number in midbody 47 to 51 in the ♀, and from 43 to 48 in the ♂.

Breeding.—Our knowledge of the breeding is not what it ought to be when one considers what a common snake it is, and how well it thrives in captivity. In Southern India the season of matrimonial intercourse is about November, but we do not know whether the snake is oviparous or viviparous. I had a gravid ♀ killed in camp on the 7th of December at Cannanore within which were 6 largish eggs, perhaps an inch long. Mr. Leigh told me of one he had in Trichinopoly that contained 16 eggs about half an inch in length, in early January. Dr. Annandale* however mentions a ♀ specimen said to have been found with 3 young ones at Ramanad in August. The smallest specimen I know was a ♂ $8\frac{7}{8}$ inches long in November, but whether a hatchling or not I could not say. One noticeable feature in the young is that the navel is placed very much further away from the anus than is the case with colubrine snakes. I have counted no less than 43 ventrals intervening.

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* loc. cit.

Sloughing.—A few notes were made in Madras a few years back. One specimen desquamated on the 18th of April, 18th of May, 6th of August, and 9th of October in 1895. Another (perhaps the same snake) shed its skin on the 30th of April, 4th of June, 22nd of July, and the 4th of October 1896. Another (perhaps the same specimen) cast its slough on the 13th of June, 23rd of September, and 24th of December 1897.* Like our other Indian representatives of its family, its ecdysis occurs about 4 times a year at rather irregular intervals.

Parasites—I have paid very little attention to this subject, but it is almost certainly infested with Entozoa like the python, and most other snakes. I have found ticks attached to its skin, and those though not identified are almost certain to prove a species of *Aponomma*. A blood parasite the *Hæmogregarina cantlici* has been discovered inhabiting the blood cells.†

Distribution—Peninsula India from the base of the Himalayas to Cape Comorin, and Northern Ceylon. In the North-West it extends to Sind and Baluchistan, and in the North-East to Behar and Lower Bengal. Major H. H. Magrath sent me a fragment of a skin of an *Eryx* from Bannu that might be this species or *jaculus*, more probably the latter.

It is a snake of the Plains, but like many other species ascends some distance into hilly regions. There are specimens in the British and the Indian Museums of Colonel Beddome's collecting from the Anamallays, altitude not specified. Father Dreckman has met with it in Khandalla. (*circa* 2,000 ft.) and there is a specimen from Poona (*circa* 3,000 ft.) in our Society's collection. In the Indian Museum there is a single example from Palair in the Naini Tal District, but the altitude is not recorded. Von Schlagentweit's specimen in the British Museum is reported from Sikkim—a most improbable locality—though of course it is possible it may have been acquired from a juggler, this snake being seen so frequently in the possession of this nomadic class.

The accompanying map shows the precise localities from which it has been reported.

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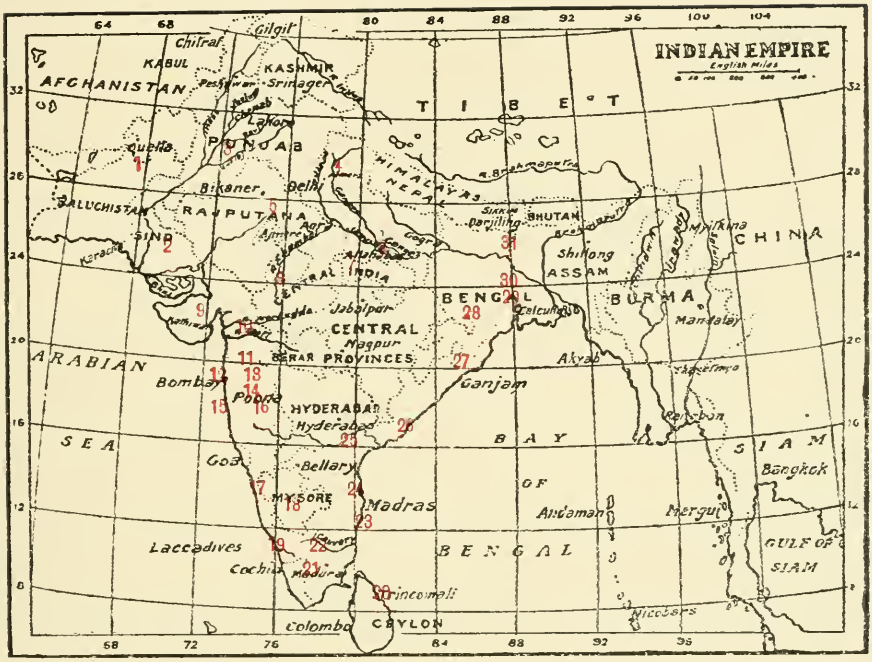
* This valuable information was communicated to me by Dr. J. R. Henderson.
†Manson. Trop. diseases 1907, p. 819.

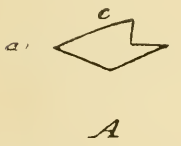


Distribution of *Eryx conicus*.

B. M. implies British Museum, I. M. Indian Museum, Bo. M., Bombay Society's Collection, F. W., the Writer.

1. Fort Munro, Baluchistan (Bo. M.). 2. Sind (Murray & B. M.). 3. Multan (Bo. M.). 4. Palair, Naini Tal District (I. M.). 5. Gwalior (B. M.). 6. Allahabad (I. M.). 7. Saugor (Bo. M.). 8. Neemuch (Bo. M.). 9. Rajkot, Kathiawar (F. W.). 10. Khandeish (Bo. M.). 11. Nasik (Bo. M.). 12. Bombay (Bo. M.). Khandalla (Dreckman). 15. Ratnagiri (Millard). 16. Hingoli, Deccan (Bo. M.). 17. Malabar (Dumeril et Bibron & F. W.) 18. Anamallays (B. M. & I. M.). 19. Travancore (Ferguson). 20. Trincomalee, Ceylon (Bo. M.). 21. Ramnad (I. M.) 22. Trichinopoly (F. W.). 23. Pondicherry (Dumeril et Bibron). 24. Madras (Russell & B. M.). 25. Godavary (Blanford). 26. Vizagapatam (Russell). 27. Chandbatty, Cuttack District (I. M.). 28. Chota Nagpur (I. M.). 29. Singbhum (I. M.). 30. Manbhum (I. M.). 31. Behar (D'Abreu *in epistola*).

Lepidosis.—*Rostral* much broader than high, not ridged transversely. Touches six shields, the anterior and posterior nasals and 1st labial. *Internasals.*—Absent. The small scales on the top of the head become first mammillated, and then carinate as they proceed backwards. *Nasals.*—Two, an anterior and a posterior with the nostril between. The eye is surrounded by small scale only, and one or two rows of scales intervene between it and the supralabials. *Supralabials.*—12 to 15, the anterior largest, and distinctly higher than broad. *Mental.*—Small. *Infralabial.*—17 to 20, the anterior largest, much deeper than broad, the first do not meet behind the mental. *Costals.*—Two heads-lengths behind the head 38 to 46, midbody 40 to 53, two heads-lengths before vent 24 to 35; keeled (except the 7 to 10 lowest rows anteriorly, 9 to 13 in midbody, and 2 to 6 posteriorly). The keels are peculiar, seen in profile they gradually incline upwards from the base of the scale to a point about one-third from the apex when they decline to the apex. In the most posterior scales they suddenly decline from the summit, so that they appear in outline as shown in our diagram. The dorsal scales are a shade longer than broad, those in the last 3 subcostal rows progressively increase in size, and their breadth exceeds their length, the last being ½ or a shade less than ½ the breadth of the ventrals. *Ventrals.*—Narrow, 162 to 186. *Anal.*—Divided into 3 parts, a larger median, and two small lateral portions. *Subcaudals.*—17 to 24, frequently entire, but usually some, often many divided.



A

Dentition.—The *maxillary* teeth number from 13 to 15, the first 3 progressively increase, and the posterior gradually decrease in length. The *palatine* are 5 in number, and the *pterygoid* 14 to 15. The *mandibular* array number 20, the anterior are largest, and these progressively decrease to about the 7th tooth, after which they are subequal.

Our plate is good except that the neck is shown far too evident and the nasal shields are shown in contact, whereas they are really separated by a pair of internasals. The irregularity of the pattern is well rendered, and in no two specimens will this be found quite

the same. In many specimens in life so much mud or earth adheres to the skin, that the pattern is often much, if not completely, obscured. In spirit specimens, consequently, the marking is much better seen.

ERYX JOHNI (Russell).

John's Earth Snake.

History.—This was first described and figured by Russell* in 1801, from an adult specimen sent to him by the Revd. John of Tranquebar. The same author figured a young example† (from a painting given to him by Captain Hardwick taken from a specimen collected in Bengal. ?)

Nomenclature.—(*a*) *Scientific.* The specific name was given by Russell in honour of the Missionary who presented him with the original of Plate XVI of his work.

(*b*) *English.*—I think John's Earth Snake, or John's boa, the most appropriate name to apply to it.

(*c*) *Vernacular.*—Russell tells us on John's authority that it is called "erutaley nagam" about Tranquebar. This name, and "eruthally pamboo," both of which are Tamil, meaning "two-headed snake," are in common use in Southern India. It is also called "manooli" or "earth dweller" in the same part of India. On the Malabar Coast, and also in other parts of S. India it is sometimes called "mandalli," and in Mysore the Canarese name for it is "itallay havoo" which also means "two-headed." In Lower Bengal the Hindi name for it is "do muha" or "two mouthed," and the same application is in use in the Punjab generally. A well educated native told me that about Peshawar it is known as "landai," the Pushtu word for "short," but I am very dubious about this, believing that this name is correctly applied to either of the two little blind snakes, *Typhlops braminus*, or *Glauconia blanfordi*, both of which are very diminutive, and sometimes also called two headed snakes.

General Characters.—The snake is of remarkably even calibre in its whole length, showing little if any constriction at the neck.

* Ind. Serp., Vol. II. Plate XVI. † Loc. Cit., Plate XVII.

The body is very stout, heavy, and muscular. Its transverse diameter very appreciably exceeds the vertical, and there is a groove along the spine. It is covered with numerous, small, smooth or nearly smooth scales. The claw-like termination of the rudimentary limb is situated as in *E. conicus*. The head is covered with scales little larger than those on the back. The broad muzzle is furnished with an angular horizontal ridge with which the creature burrows, and this ridge is more pronounced in this than in any other species of the genus. The upper jaw projects beyond the chin to an extent equal to the diameter of the eye. The eye is very small, its diameter being about one-third the length of the snout. The pupil is vertically elliptical, and the iris is spotted with ruddy gold. The nostril is slit-like, and is placed between two enlarged shields rather high on the snout. The tongue is yellowish basally, black at the tips. Beneath the chin there is a longitudinal furrow (the mental groove). The tail is short and stumpy, its extremity rounded, and general form very similar to that of the head, hence the almost universal belief among natives that the snake is two-headed. Indian jugglers, who so frequently have this snake among their stock in trade sometimes improve upon nature, and mutilate this stumpy appendage, making marks to suggest eyes, and cutting a transverse incision at the extremity which leaves a scar suggesting a mouth. The public, who for the most part prefer to keep a respectful distance from any snake, fall easy victims to their own credulity, and too often go away under the firm conviction that they have seen a head at each extremity.

Colour.—The adult specimens I have seen have been either uniformly coloured, of a lightish brown, ruddy-brown, or dark olivaceous-brown, or marked with fine dark reticulations arranged so as to form cross bars. The cross bars are ill defined, but when present at all most conspicuous posteriorly, and on the tail especially. Many specimens in life are so sullied with earth adhering to their scales, that any marks are obscured till the snake is washed. Immersion in spirit makes any marks very apparent. The belly is of a lighter shade than the back, and often more or less mottled with blackish.

The young are very different, so much so that many people who

are quite familiar with the adult fail to recognise the most juvenile specimens as of the same species. According to Russell the young one figured by him was coral red, but Dr. Annandale uses the expression brick-red for his specimens. A young specimen, about 14 inches long from Multan in our Society's collection, is sandy-red and when looked at closely the scales are seen to be pale buff with ruddy outlines forming a very fine reticulation. In Russell's specimen there is a dorsal series of large black blotches from the nape to the tip of the tail. In the Multan specimen there are broad cross-bars of a ruddy-brown hue, on the tail, and posterior body which disappear anteriorly. The belly is buff heavily dappled with darker tones.

Identification.—The snake once seen should never be mistaken, however both Europeans and Natives confuse it with *E. conicus*. As mentioned under *conicus* the genus is very easily recognised. *Johni* differs from the other species in its blunt tail. It also has a larger number of scale rows at midbody, *viz.*, more than 53.

Dimensions.—Adults rarely exceed 3 feet. The largest I know of is in the British Museum and measures 3 feet 3 inches.

Haunts.—Like Russell's earth snake John's boa is described as a desert snake, but the remarks I have made under the former apply equally here. Father Dreckman tells me it is by no means uncommon about Khandalla in the Western Ghats (circa. 2,000 feet). He tells me further that he has always found it close to water, though not actually in that element, and that it is a very thirsty creature he having counted more than 120 gulps taken at a single drink.

It is probably much commoner than Museum specimens would make it appear, for it is one of the usual subjects of exhibition in an Indian juggler's stock in trade.

It is called an earth snake, and is frequently found beneath the soil, but how much of its life is spent beneath the ground it is impossible to know. Though the eye is small it is in other respects as perfectly developed as in Colubrine, and other snakes. This leads one to infer that the subterranean life is one that has been acquired in recent times, or that it spends part of its life above the surface soil. There is no doubt that it is frequently

encountered above ground, and I am inclined to think this is the result of its own inclination rather than from force of circumstances, such as a water logged soil in the rains, or the desire for water to assuage its thirst in long drought.

The remarks made upon Mr. John's captive specimen makes it appear that it was usually lying above the earth, and it has certainly frequently been my experience to see other caged specimens lying visible, though they were supplied with earth, in which they might have concealed themselves. It would be interesting to note in future, the climatic and other conditions when a specimen is met with either above or beneath the soil.

Habits.—I know very little of this snake in its natural haunts, so that most of my observations have been made from specimens in the hands of jugglers, or in captivity elsewhere. I always found it a particularly inoffensive creature, but thought that its gentle disposition might merely be the result of its captivity, and a reconciliation to the repeated handling it had received. However more than one good observer, who is better acquainted with the snake in nature, has remarked to me on its extremely placid nature at all times. Russell tells us that Mr. John kept one for a year in a chatty of earth. It generally lay coiled up with its head under its belly, was not easily roused, and never showed a disposition to bite. Father Dreckman, who has encountered many, tells me that he has never met with a more harmless creature, even freshly caught, he says, it never attempts to bite, and although he has handled many under natural conditions none ever used its teeth. Dr. Henderson too remarks that it is the gentlest of snakes allowing itself to be handled without any attempt at self defence. One I found in Trichinopoly lying on some loose soil, took no notice of me, allowed me to move it about with a stick without showing any signs of annoyance or attempting to escape, and was altogether so lethargic that I thought it must have been mortally damaged though I could find no trace of an injury. Those in the possession of snake men usually lie where they are placed on the ground, or make aimless movements without any attempt to conceal or bury themselves. From what has been

already said, one will readily imagine that it is a very uninteresting reptile in captivity. Perhaps its chief interest lies in the deft and speedy manner in which it can bury itself in the earth when so disposed, but one is lucky if one witnesses this performance. It noses its way into the earth, by using the transverse ridge on its snout as a digging implement. The præmaxillary bone which has to bear the strain of these operations is extraordinarily developed, surpassing in size and strength that of any other snake that I know. The only other interest attaching to the snake in the vivarium is its method of killing its prey.

Its movements are in keeping with is phlegmatic disposition, and clumsy corporeal habit. Progression is slow, and laboured and under no degree of stimulation even amounting to cruelty, does the creature seem capable of bestiring itself. The reason seems to be on account of its very narrow ventral shields and I have already remarked upon the handicapping influence these must have upon progression when dealing with the last species (*conicus*).

Food.—I have no knowledge of its tastes in a state of nature, but from the avidity with which it devours squirrels, rats and mice in captivity one may assume that it is very partial to a mamalian fare. One in Madras ate in one year 16 rats and 3 mice, another 4 squirrels, 28 rats and 4 mice, and another 17 rats. How it manages to capture such creatures under natural conditions it is difficult to understand unless as I think most probable it burrows into and invades their subterranean abodes where it can effectively bring them to bay. Once captured, it employs the same means of killing its victim as the python, encircling it, and crushing the life out of it. Its massive, and muscular body makes the accomplishment of this object an easy matter, and a speedy one. Major O. A. Smith tells me that he had one in his vivarium in company with a saw-scaled viper (*Echis carinata*). The *Echis* one day was observed to be particularly lively, and it is possible may have molested the *Eryx*. At any rate the *Eryx* wound itself round the viper's neck and constricted with such force that the viper succumbed next day to the injuries received.

Breeding.—Practically nothing is known of the breeding. We

do not even know whether it is oviparous, or viviparous though it is probably the former. The season when mating occurs, and the time of year when the young appear are similarly unknown. The smallest specimen I know of is the one mentioned by Russell, $9\frac{1}{3}$ inches long, probably a hatchling, which came from Bengal, but no date of capture is given.

Observations on the breeding habits are badly wanted, and with so common a snake, and one that thrives so well in captivity these observations should not be difficult to collect.

Sloughing.—In the Madras Museum some years ago attention was directed to this function with the following results:—One desquamated on 1-4-95, 3-5-95, 22-10-95 and 21-2-96. Another (if not the same) on 24-4-96, 28-6-96, 18-9-96 and 14-1-97. A third (if not the same specimen) on 2-8-97, 10-11-97 and 17-3-98. It thus appears to slough about four times annually at intervals varying from one to five months, and at no special season of the year.

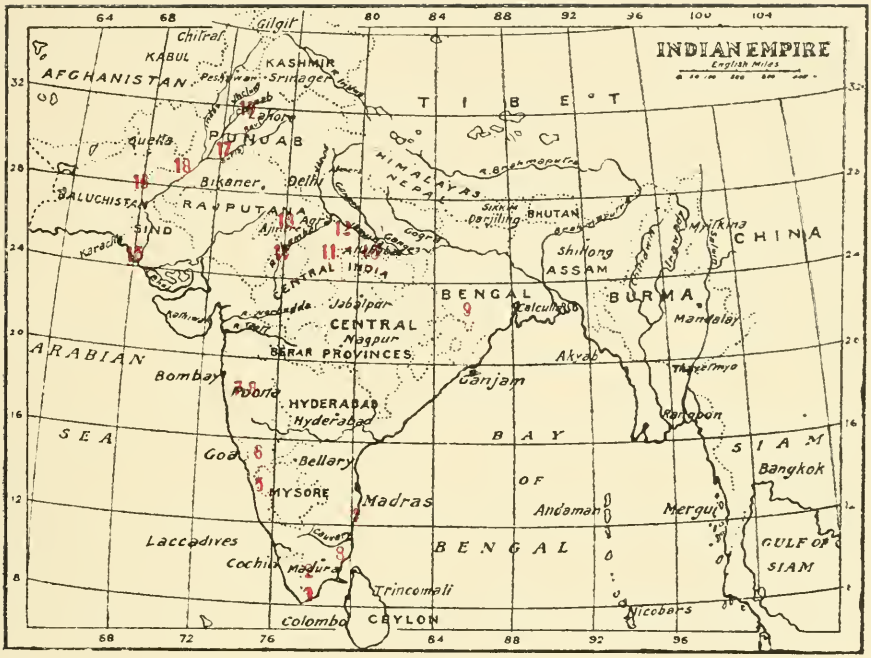
Legends.—Russell tells us that in his day the natives in Southern India declared that the bite of this snake produced leprosy. The belief is still as firm there now, even a lick from its tongue being, natives declare, sufficient to cause that terrible malady. The Rev. C. Liegh, S.J., and Dr. Henderson have both written to me to this effect. In the Punjab they say that if it once bites any one, the bitten subject will be again bitten on each succeeding anniversary of the accident by the same snake, which however is quite invisible to everyone, but its victim.

The belief that it has two heads, one at each end seems to be universal. The natives in Southern India, Lower Bengal, and the Punjab all say the same, and their names for it are founded on this assumption. In Lower Bengal and in the Punjab they say that the reptile uses each head alternately for six months. The obstinacy of the native in crediting fabulous stories of this description is most extraordinary. Even if one takes the trouble to demonstrate the true character of the tail, and a native has been prevailed upon to look attentively, he prefers to allow his imagination to override his common sense, and to discredit the evidence of his own eyes.

Distribution.—Its distribution is probably the same as *conicus*, but records of the snake are very meagre. I have lately seen specimens from Baluchistan, but this is the furthest record I am aware of in the North-West. I am doubtful if it occurs in the Ganges Valley, and there appear to be no records from Central India, the Central Provinces or Upper Bengal, but with these exceptions it is known to occur throughout Peninsula India. It has not been recorded from Ceylon. It is an inhabitant of the Plains but wanders into the lower slopes of hilly regions. In the Western Hills it has been met with at Khandalla and Belgaum (about 2,000 feet), but I do not think it occurs in the Himalayas anywhere. The specimen in the British Museum collected by Von Schlagentweit said to have come from Sikkim (9,800 feet) is discredited by Mr. Boulenger, and his doubts must be certainly shared by all Indian herpetologists.

It is possible the specimen may have been in the possession of a juggler, and I know from personal experience how untruthful these people are when questioned. In Fyzabad I interrogated a juggler about a typical monocellate cobra he had, and which he assured me he had got in the Cantonment Gardens a day or two before, but he finally confessed that the statement was untrue, and he had captured it in Bengal near Calcutta somewhere. The precise localities from which it has been recorded are shown in the accompanying map.

Lepidosis.—*Rostral*—A very large shield, with an angular transverse ridge. Touches six shields, the anterior and posterior nasals and the 1st labial. *Internasals*—Absent. *Nasals*—Two, an anterior, and a posterior, with the nostril between; the anterior meeting behind the rostral in contact with 1st and 2nd labials. Eye surrounded by small scales, one or two rows intervening between it, and the labials. *Supralabials*—10 to 13, the anterior largest, and higher than long. *Infralabials*—3 or 6, behind which a series of marginal scales borders the lip; the 1st do not meet behind the mental. A mental groove bordered by small scales. *Costals*—54 to 65 in midbody as long or rather longer than broad, except the last 3 rows which progressively increase in breadth, and are much broader than long, the last being about



Distribution of *ERYX JOHNI*.

I. M. implies Indian Museum, B. M., British Museum, Bo. M., Bombay Society's Collection, F. W., the Writer.

1. Ramanad (I. M.). 2. Trichinopoly (F. W.). 3. Tranquebar (Russell). 4. Madras (B. M.). 5. Malabar (Dumeril et Bibron). 6. Belgaum (B. M.). 7. Khandalla (Dreckman). 8. Poona (Bo. M.). 9. Bengal (Russell). 10. Allahabad (D'Abreu *in epistola*). 11. Dholpur (F. W.). 12. Agra (I. M.). 13. Jeypore (I. M.). 14. Ajmere (I. M.). 15. Karachi (I. M. & B. M.). 16. Hanna and Duki, Baluchistan (F. W.) 17. Multan (Bo. M.). 18. Rajanpur (I. M.). 19. Pind Dadun Khan (I. M.).*

* We trust our readers will take every opportunity to send specimens of *E. johni* and *conicus* to our Society's Collection, especially from the Punjab and Bengal, to throw more light on their exact limits.

$\frac{1}{2}$ or little less than $\frac{1}{2}$ the breadth of the ventrals. Keels present in the median dorsal rows, but very obtuse. *Ventrals*—Narrow, 189 to 210. *Anal*—Trifid, the median part largest. *Subcaudals*—25 to 36, mostly entire, but many often divided.

Dentition.—In my single skull which is from a Trichinopoly specimen the teeth are as follows :—*Maxillary*—11, gradually decreasing from before backwards. *Palatine*—4, decreasing from before backwards ; about as large as the maxillary. *Pterygoid*—3, subequal, well developed and about as large as the posterior maxillary. *Mandibular*—13, decreasing from before backwards.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plates and Diagrams.

BY

Major F. Wall, I.M.S., C.M.Z.S.

Part XVII with Plate XVII.

(*Continued from page 19 of this Volume.*)

As already stated in a previous paper (No. XVI of this Series), the boas and pythons are grouped together in a single family (*Boidæ*). They agree in possessing rudimentary hind limbs, but the pythons are grouped together in a distinct sub-family (*Pythonniæ*) characterised by the presence of a bone (the supra-orbital) which contributes largely to the roof of the orbit. In the boas on the other hand the roof of the orbit is formed as in colubrines, and most other snakes entirely by a lateral expansion of the frontal bone. The sub-family *Pythonniæ* comprises seven genera of which one only, *viz.*, *Python* is represented in our Indian Dominions.

The genus *Python* of which our Indian *molurus*, and the Papuasian *amethystinus* are the types, includes nine species distributed in Africa (*sebæ*, *anchietæ*, and *regius*), Malaya (*timorensis*, *reticulatus*, *curtus*), Australia (*spilotes*), Papuasia (*amethystinus*) and Asia (*molurus* and *reticulatus*). The two latter occur within Indian limits, and are dealt with in this paper.

Python molurus (Linné).

The Indian Python.

History.—Pythons were well known to the ancients, and probably it was the Indian *molurus* among others with which they were acquainted. In scientific literature the first certain allusion to our common Indian species, is by Linné who described it under the name *Coluber molurus* in 1766. In 1796 Russell figured it no less than four times in his first volume (Plates XXII, XXIII, XXIV, and XXXIX).

Nomenclature (*a*) *Scientific.*—The name *Python* came into generic use in 1803, when Danderi associated this snake with that known to the ancients by this name.

The word *Python* seems to be derived from the Pythian Vale, in the mud of which the fabled monster of the Greeks was supposed to have been generated after the Deluge. Milton* refers to the event in the following terms :—

> " but still greatest he the midst.
> Now dragon grown, larger than whom the Sun
> Engendered in the Pythian vale on slime
> Huge Python ; and his power no less he seemed
> Above the rest still to retain."

Dr. Brewer† says the word is derived from the Greek " puthesthai " to rot, because the monster after being killed by Apollo was left to rot in the sun. The scene of the tragedy—Mount Parnassus—was immortalised by the erection of Delphi. the famous shrine of Apollo.

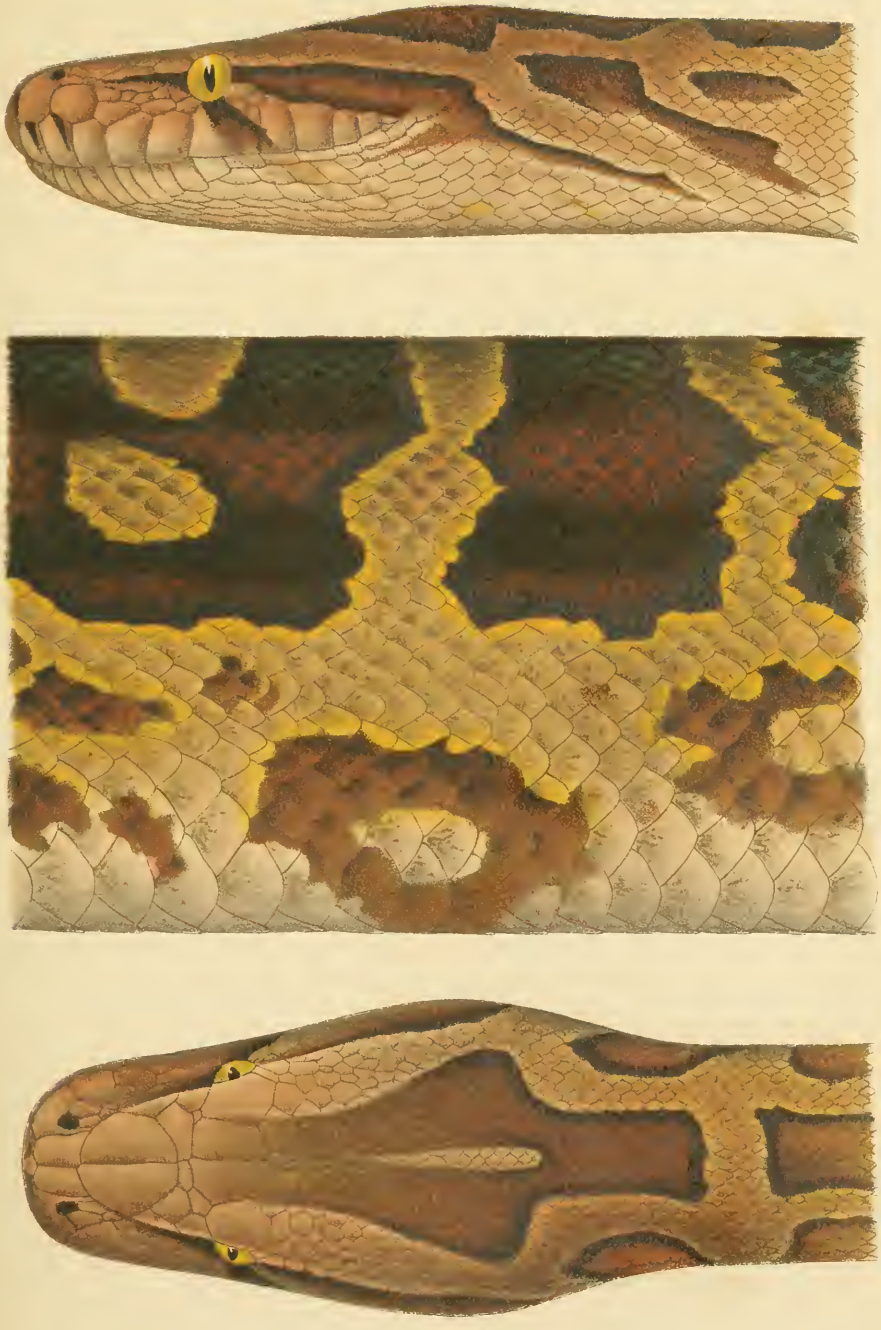
(*b*) *English.*—It is almost always known to the Anglo-Indian as the python, but sometimes is spoken of as the rock snake, by no means an appropriate name.

(*c*) *Vernacular.*—Throughout India it is pretty generally called " ajgar " the Hindustani for dragon, but has many other local names.

In Southern India it is frequently called by the Tamils " periya pamboo " which simply means " large snake." " Malai pamboo " or " hill snake " is also frequently in use by Tamils, and Father Bertrand, S.J., tells me in some parts the Tamils call it " Kaloodai viriyan " which means " ass viper." Russell mentions " pedda poda " as the name it is known by in the Ganjam District. This, am informed, is the Telugu for " large strikers," " poda " being he noun formed from the verb " potu " (pronounced more like " podu ") to strike. Father Higglin, S.J., though has it on good authority that the word is " peda " a head, and that " pedda peda " means " large head," or " large serpent." In Mysore the Canarese name is " heba havoo " (large snake), but spoken by a native

* Paradise lost, Book X, line 528, *et. seq.*

† The reader's handbook of allusions, etc.



J. G. del.

J. Green Chromo.

THE COMMON INDIAN SNAKES. (Wall.)

Python molurus *non poisonous, nat. size.*

the words sound more like "hebbow." The Telugu name about the same part of India is "dasira pam" a very appropriate one for it, as the python bears on its head three light, often pinkish stripes exactly like the three white stripes of the Hindu caste mark worn on the forehead and called by them "dasira." I am told that about Cuddapah it is known as "condasella." "Conda" is the Telugu for rock. Russell mentions "bora" as one of its names but I think this is generally applied in Bengal to the Russell's viper and not this snake. The two species being of somewhat similar build are often confused not only by natives, but by Europeans too.

In Ceylon all recent authorities concur in stating that the Singhalese name for it is "prinbera." The famous John Ray* however says that the name "anaconda" is Singhalese, and not South American as one might suppose. His friend Dr. Tancred Robinson gave him a catalogue of the Indian snakes he had noted in the Leyden Museum. No. 8 on this list read as follows:—"8 serpens indicus bubalinus anacandaia Zeylonensibus, id est bubalorum aliorumque jumentorum membra conterens." Colonel Yule† says he can find no mention of the name anaconda in old South American literature, and suggests that it is derived from the Singhalese "anai" elephant, and "kondra" which vanquished. I have failed to get any confirmatory evidence on this subject from Ceylon.

The Burmese throughout their Province call it "Sa-ba-ohn."

In South China I heard it called "hiang-zo" meaning "aromatic snake," a name probably suggested by its cooking flesh, since it is very savoury fare according to Chinese ideas. Swinhoe‡ mentions the name "vang" which is in common use among the Chinese in the Island of Hainan.

General characters.—The python is an extraordinarily massively built snake, and its development perhaps the most remarkable character it exhibits. Its girth relative to its length considerably exceeds that of all other snakes, except its own close allies. The body is thickest in the middle, reduces perceptibly towards the

* Syn. animal-quad. et Serp. 1693, p. 332.

† Hobson Jobson. ‡ Nat. Hist. of Hainan, 1870.

head, and the anus. It is rounded in outline, smooth, and if the snake is in good condition glossy. The neck is distinct. The head is very distinctly flattened, has a remarkably long snout fully four times the length of the diameter of the eye in adults, and a faint indication of a *Canthus rostralis*. The nostrils are large, open, directed upwards and placed high on the snout. The eye is very small, with an iris finely sprinkled with gold, and a vertical pupil. The rostral shield and the two first supralabials are deeply pitted or furrowed, a peculiarity only seen in this genus among Indian snakes. What these depressions really are, it is difficult to say, but I have noticed in dissecting out skulls that very highly developed nerves run through foramina in the maxilla corresponding with these pits and appear to me to ramify subcutaneously in them. It would appear from this that they may be sensory organs. Beneath the chin is a longitudinal furrow, the mental groove. The tail is short and prehensile, tapering rapidly and is about one-seventh to one-eighth the total length of the snake. Above the anus on each side is a carved claw-like process, the termination of the rudimentary limb, and which is more highly developed in the male.

Colour and markings.—On the head these vary a good deal with age, and in all individuals vary much according to whether desquamation has been recently completed, or is impending. The ground colour is greyish, whitish, or yellowish in adults, and often a very pretty shade of pink, in the young especially. There is a dark streak from the nostril to the eye in the young which often is completely obliterated in later life. Behind the eye at all ages is a conspicuous, dark, oblique band to the gape, and a more or less conspicuous patch below the eye tending to become obscure with age. On the front part of the lower lip there is often some fine mottling. On the back of the head and the nape is a large lance-shaped mark bisected in the median line, but this often fades so much anteriorly in adults that the similitude to a lance is more or less effaced. The light bisecting band, together with similar light bands, one of which passes over each eye-brow—especially distinct in the young—are very suggestive of the "dasira" mark already alluded to under vernacular nomenclature.

Dorsally the body is greyish or yellowish, and bears a series of large, somewhat roughly quadrate, patches extending from the neck on to the tail. These patches which are centrally much the same colour as the ground are well defined outwardly, and broadly outlined with black or blackish, and it is here that those lovely bluish and amethystine hues are seen in certain lights which show off the snake to such advantage, and which many an artist in the Royal Academy has tried, with varying degrees of success, to depict. Outside this median series of marks is another small series of a similar character, and outside this again a third sometimes, much less regular and smaller and mixed up with a coarse mottling extending into the flanks. The underparts are dirty-whitish, or faintly yellow. Seen in the sun's rays the iridescent effects on the dorsal patches defy alike the author's powers of description and the painter's art of reproduction. Virgil's * description however of the snake that encircled the tomb of Anchises, and which Kennedy has so graphically rendered in English verse as follows, leaves no doubt, but that it is a python that is indicated, and as likely as not our Indian species *molurus*.

"Scarce had he said when from the shrined base a slippery snake trailed huge seven coils, in each seven folds; and circling tranquilly the tomb slid o'er the altar; dark blue streaks its back lit up, its scales a sheen of spotted gold as (when the sun shines opposite) the bow darts from the clouds a thousand varied hues."

"Circling tranquilly" and the comparison of its colours to that of the rainbow are so graphic that one feels Virgil must have seen a python moving with the sun glancing upon its scales.

Identification.—The Python is a very easy snake to identify. The pits in the first two † upper labials will serve to distinguish it from every other Indian species. Only one other has those pits at all and this is its ally *P. reticulatus* which has the first *three* or *four* shields pitted. In case the head has been too mutilated to be certain of this point, attention should be directed to the costals. There are only three Indian snakes with the rows exceeding 50 in midbody, *viz.*, *Eryx johni*, *P. molurus*, and *P. reticulatus* which are

* Æneid Lib. V line 84, *et. seq.*

† Care must be taken not to count the pits on the foremost shield—the rostral.

easily separated by the number of ventral shields, *i.e.*, from throat to vent. In *Eryx* they are 192 to 210, in *molurus* 242 to 265, and in *reticulatus* 297 to 330.

Dimensions.—It is difficult to say with certainty to what length the python may attain. It seems probable that many of the great lengths given by travellers and sportsmen were guessed at, and the snake not actually measured. The creature is very thick relatively to its length, perhaps three or four times the girth of a Russell's viper of similar length, and five or six times that of a dhaman (*Zamenis mucosus*). If a python's length were judged from its girth, the estimate would grossly exceed the real measurement.

Specimens of 10 feet are not very uncommon, as will be seen from the following records, and there is little doubt that it exceeds 20 feet. In this Journal * Ferguson records an 18 foot one from the Ashambu Hills, and Major Begbie † one of a similar length killed near Baksa Duars. Other specimens of like proportions have been recorded by the late D. Ferguson in Ceylon‡, and in the *Pioneer* from Rajshai (Rajapur).¶ I saw the skin of a specimen of the same length in the possession of Mr. A. M. Harry in Assam. Mr. Prince of the King's Own Shropshire Light Infantry shot a female in the United Provinces in 1906 which measured 18 feet 3 inches. In *Land and Water* (August 10th, 1866 or 67 ?) one is mentioned from Mussoorie of 18 feet 9 inches. Tennent** refers to a specimen brought him in Ceylon that taped 19 feet. Another reported of a similar length was encountered by Captain George and Mr. Delsuage when shooting in Ceylon. This was captured and brought to Colombo, and exhibited in 1885 when I saw it. Jerdon †† saw a 19 foot specimen killed in Travancore, and Dr. Elmes told me of one he shot in Assam (N. Lakhimpur District) of the same size. A specimen measuring 19 feet 2 inches in our Society's collection, shot by the late Maharajah of Cooch Behar

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* Vol. X, page 69.

† Vol. XVII, page 1021.

‡ Rept. fauna, Ceylon, p. 22.

¶ 3rd July 1907

** Nat. His. of Ceylon, II, p. 153.

†† Journ. As. Soc., Bengal, XXII, p. 526.

in Assam was originally reported in this Journal * as a Malayan python (*P. reticulatus*). Captain Percival † says he saw one in Ceylon 22 feet long, and the specimen mentioned by John Ray, and stated by him to be in the Leyden Museum was, he states, 25 feet (I have not been able to get confirmation of this from Leyden, but notice that Dumeril and Bibron refer to one in that Institution 20 feet). Elliot ‡ claims that it grows to a length of 30 feet, and if this opinion were confirmed I think India could lay claim to the two largest species of the genus, for *reticulatus* is also reported to attain to a length of 30 feet. Within quite recent times (1905) a specimen of the latter in the possession of Mr. John Hagenbeck was, as far as could be ascertained, in life 28 feet. The African species *sebae* is also a very large reptile which is recorded up to 23 feet.

The weight of a python is remarkable, the specimen of *molurus* killed by the Maharajah of Cooch Behar, which measured over 19 feet, scaled 200 pounds (over 14 stone). Mr. John Hagenbeck's reticulated python just alluded to weighed 250 pounds.

Haunts.—For the most part the Indian python is a jungle inhabitant. It may be met with in the interior of the densest forest tracts, or in sparser forest growth such as that which clothes the rocky slopes of many low hills. Where jungle is not available it most usually attaches itself to rivers and jheels, especially the former. In jungle areas it is frequently observed in trees and at times at some considerable elevation aloft. It climbs stealthily but well, and having established itself in the branches secrets itself so well that it is no infrequent event for a monkey to come within striking distance, and forfeit its life. By means of its prehensile tail it is capable of suspending itself from branches, nearly all of its body remaining free, and there is no doubt that many an incautious animal comes within reach, and is victimised. Mr. Sharpe, D. S. P., in the Fyzabad District, told me in 1906 that he once climbed up into a banyan tree in dense jungle with his shikari, who told him that at that season when the fruit was

* Vol. XIII, p. 718.

† The Island of Ceylon, 1805, p. 311.

‡ Rept. Brit. Ass., 1870, Trans., p. 115.

ripening many animals especially deer visited these trees to eat the fallen fruit. After having been quiet for some time, he noticed close to him a movement in what he had up till then taken to be an aeriol root, but which on closer inspection proved to be a python suspended by its tail, and evidently established there for the same purpose that had actuated the sportsman. I have heard of pythons quartering themselves in hollow trees, and frequenting those on which egrets and night herons roost, to which at night the pythons stealthily crept and successfully took toll of.

In water this snake is quite at home, in fact it might be considered semi-aquatic in habit. It swims deftly and strongly, when its inclination prompts such activity, but is often to be observed partially or wholly submerged near the bank of a river, or jheel. As in captivity, it will lie for hours showing nothing but the tip of its snout, which is pushed out to raise the nostrils above the surface, and permit breathing. It can remain beneath the water entirely for many minutes. Colonel Fife Cookson * says that observations were made at Regent's Park which showed that it could keep entirely submerged for half an hour. I asked the attendant at Cross' Menagerie in Liverpool some years ago to make special observations in this direction, and he told me later that one kept its head below the water for 11 minutes, and remained above 9 minutes subsequently before again retiring below. Another kept below 12 minutes, and another 15 minutes.

If only partially submerged in water in its native haunts it keeps so still that any part of the body exposed is likely to be taken for a branch or root. My informant at Cross' Menagerie also told me that one kept in its bath from Wednesday till Sunday of one week, and often the sloughing period is passed in their tanks, from which the snake emerges resplendent in its new attire.

It is evidently a thirsty reptile, and in consequence probably is often impelled towards water for this reason. The dam in Paris in 1841 after accomplishing her maternal duties, and successfully launching forth her brood, drank eagerly swallowing

* Tiger shooting in the Doon and Ulwar, p. 31.

some two tumblerfuls of water, and the young too were observed to slake their thirsts. In drinking it does not fill the mouth, and throw back the head like birds, nor does it protrude the tongue and lap, but puts its mouth to the water, and imbibes like a mammal, the gulping movements of the throat being plainly visible.

Occasionally the python has been reported at sea, but it is probable that it has drifted thence on a log, or in the current of a flooded river. It shows no special affection for the sea.

Habits.—In spite of its cat-like pupil the python is very much on the alert during the day time, and very frequently when encountered in its native haunts is found in the act of swallowing some animal captured in broad daylight. On the other hand it is frequently on the move at night, for on many occasions where it has entered a poultry run, its depredations have been committed under cover of darkness.

Its size, beauty, and placid disposition make it a welcome addition to the snake charmer's stock-in-trade, so that scarcely a member of the fraternity is without one. It is therefore in India a very familiar creature to everyone. The juggler produces his specimen with some ostentation from a bag or basket, seeking to impress the on-lookers, and he trades upon the public's natural fears, for if one comes forward too close to inspect the creature, it is more than likely that the owner affects the greatest alarm for his safety, as though to foster the belief already prevalent in the assembled throng that it is to him, and him only that the snake is a peacefully inclined and harmless creature.

The python in all parts of India where there is an attempt at a cold season hibernates, retiring for some months to any convenient retreat, a hollow tree, or hole in a bank, or, in the hills, any natural crypt or cave of convenient size. In Dibrugarh once I found one in February beneath a log on the banks of the Brahmaputra. It was extremely somnolent. Sometimes one hears of several congregating in the same retreat. In the *Pioneer* (19th February 1906) is an account of six pythons being discovered in a cavity in the bank of a stream in Mysore. One after another was seized and dragged out and all ranged between 10

and 12 feet in length. I have also read of a similar occurrence in the Himalayas, though I cannot now lay my hands on the reference. A python was observed in a cave, and the raconteur with his Gurkha orderlies succeeded in extricating several, three or four, if I can rely on my memory.

It seems to me remarkable that in Southern India the python does not hibernate in the Plains, at least Colonel Dawson tells me it does not in Travancore, and Dr. J. R. Henderson says it does not in Madras in captivity, yet in Bombay which can lay no better claim to a cold season, a specimen caged in our Society's rooms hibernated for some months. Phipson* made some very interesting observations on this specimen at this period. Between the 21st December and the 13th of April, a period of 113 days, the snake refused food, and remained in a very sluggish, sleepy condition. It was noticed that its temperature fell from 82°F. (which had previously been the normal) to 73°. Two rats eaten on the 21st December were retained undigested until the 28th of February when they were thrown up. On ordinary occasions in the hot weather it had been recorded that a similar meal took about 8 days to digest. Desquamation during these months of lowered vitality did not occur, an interval of nearly seven months elapsing between the sloughing periods, though in the rest of the year this process was observed four times.

The movements of the python are very laboured and slow, in fact its mode of progression cannot be called anything but a crawl. This I believe to be due to the very narrow limits of the ventral shields, to the extremity of which the ribs on which the creature moves are fixed. The ribs are in consequence very much bowed, and only about half the body breadth—the middle two-fourths—are supported, leaving one-fourth overlapping each side. During progression waves of motion can be seen beneath the skin following one another in quick succession, corresponding to the movement of the ribs beneath, and reminding one of a similar series of wave-like successions seen in the legs of centipedes and millipedes whilst in motion.

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* Jourl., Bomb. N. H. Soc., Vol. II, p. 166.

Disposition.—Our Indian python is one of the most lethargic of snakes, and as such an uninteresting creature in the vivarium. In captivity it passes the day in lazy apathy, sometimes lying upon, or partially encircling the branch usually put into its cage, sometimes convoluted into a heap on the floor, or as frequently reclining partially or wholly immersed in its bath of water. In any of these attitudes it is familiar enough to every one who has visited the reptile house in our various zoological gardens. It is wont to lie for hours together without a movement in spite of the stream of spectators peering into its cage, and their repeated attempts usually in vain to rouse it to activity by drumming upon the glass, flourishing handkerchiefs, and other objects before it. This apathy many might suppose the outcome of a familiarity which breeds contempt even in animals that are naturally of a fierce disposition, but even in its natural haunts it seems to behave in very much the same way, exhibiting little if any timidity, rarely rousing itself seriously to escape, and even when attacked making no attempt to avenge offence or injury. It thus becomes an easy victim to those who seek to kill it, or an easy capture to those of a more courageous and venturesome spirit. Even the female that shows such unremitting devotion to her parental duty of incubation will suffer herself to be captured with her brood of eggs with little or no remonstrance. In Travancore in 1903 a 15 foot dam, with eggs as it proved on the verge of hatching, allowed herself to be boxed, and conveyed to Trivandrum without offering any resistance. Similarly in Balrampur Mr. Oakes told me that two large pythons, one a dam incubating eggs, were easily captured alive and brought in from the jungle, the female continuing her duties and successfully hatching out her eggs. Six to eight foot pythons have several times been brought in to me found basking on a log, or in a boat on the river. These seemingly allowed themselves to be captured by a couple of coolies with little or no attempt at escape, though nothing could have been easier than one wriggle and a plunge into the water. Father Dreckman met with one just under 20 pounds in weight when walking with a friend in jungle. It was seen leisurely crossing their path. His friend went for its tail, while Father Dreckman

negotiated the head, expecting a hard struggle, but except for an ineffectual snap at his face, the snake allowed its neck to be seized, and its head to be thrust into a bag, into which the rest of its body was unceremoniously huddled without remonstrance.

Strength.—It seems very strange that a creature possessing such a massive and muscular body and such gigantic strength that it can overpower a leopard with ease, does not show a more aggressive spirit. Few people who have not handled a python in life can have any conception of the strength at its command. A brother of mine in the Straits told me he had several times measured large pythons in life, and that it takes as many coolies as one can put in the length of the snake to hold it, and even then they were unable to straighten it properly. Buckland* relates an incident which happened off the Coast of Ceylon, where a python effected its "footing" on a ship lying at anchor. When captured it encircled a water butt on deck, and compressed this so violently that the staves were contracted so as to allow the middle hoops to fall on to the deck.

Food.—The python, as the following remarks will testify, is practically omnivorous. It feeds on mammals, birds and reptiles indiscriminately, but seems to prefer mammals of relatively large proportions.

Its courage and power may be estimated by the fact that it has been known to overcome and devour a full-grown leopard (*Felis pardus*), sustaining but trivial injuries in the encounter. Thus Major Begbie in this Journal† related the circumstances leading to the death of a python by coolies, which subsequent dissection showed had eaten a leopard measuring 4 feet 2 inches from nose to rump. The snake was 18 feet long, and except for seven claw cuts appeared to have escaped unhurt.

Encounters with tigers also occur, but in the only instances known to me, the snake had the worst of it. Whether it was the aggressor in these contests it is impossible to know. Mr. Inverarity‡ after killing a tiger found some 2 feet 3 inches of the tail

* Curiosities of Nat. Hist., p. 182.

† Vol. XVII, p. 1021.

‡ The Great Thirst Land, p. 147.

end of a python in the stomach. Another proof of a similar encounter is through Professor Von Linston * who found a tape-worm taken from the intestine of a tiger killed in the United Provinces, was of a species known to inhabit the python, which it must previously have eaten.

Many are the records of its having eaten deer. Jerdon† mentions one having eaten a cheetal (*Cervus axis*). Dr. Elmes told me that he saw a hog deer (*C. porcinus*), cut out of a python killed by a neighbour, and the horns he thought must have been fully a foot long. The 18 footer that Mr. Harry had killed on his estate in Assam had swallowed a barking deer whose horns were four inches or more long. Mr. Copeland had a 15 foot snake killed on his estate while I was in Assam, which was proved to have swallowed a hog deer.

The Rev. Cortets, S.J., wrote to me of a sambur fawn (*C. unicolor*) being devoured whilst the dam stood by helpless. Tennent mentions a chevrotain (*Tragulus meminna*) being eaten by one in Ceylon. Colonel Channer‡ recorded one in this Journal that had killed a langur monkey which lay in its coil at the time of encounter. The snake proved to be 12 feet 10 inches long. The attendant at Cross's Menagerie in Liverpool told me that one of their pythons got loose, and ate a monkey with the collar and chain that were attached to it, on which account probably it disgorged its meal some two days later. In the *Pioneer* of the 13th July 1907, an 18 foot python, killed at Raj Shahi, was found to have eaten a jackal (*Canis aureus*).

In the Philosophical Transactions¶, a gentleman is reported to have found a snake on an Island near Bombay lying dead with the quills of a porcupine (*Hystrix leucura*) sticking out through its ribs. We may assume that the snake was a python, as no other Indian species could swallow such an animal. I have also seen masses of porcupine quills that had passed in the dung of pythons. These softened by the digestive juices had been matted into

* Ind. Mus. Rec. II, pt. 1, p. 108.

† Jourl. As. Soc. Bengal, XXII, p. 526.

‡ Vol. IX, p. 491.

¶ Vol. XLIII, 1744, p. 271.

masses which were hard to unravel, the quills having regained their texture after drying.

In *The Field* of 21st December 1907, Mr. Thwaites relates having seen a python in Ceylon spring at a hare (*Lepus nigricollis*) that was racing by. Ferguson in this Journal* reports an 8 footer at Quilon that had killed a kid.

Birds are frequently preyed upon by this snake. Mr. Thwaites† mentions a peacock in the coils of a python in Ceylon, and Colonel Evans‡ knew one in Burma eat a pheasant (*Gennæus lineatus*). One when I was in Dibrugarh was killed in the act of swallowing a chicken. Mr. Staunton killed one in Assam that had swallowed three of his ducks, and another made an unwelcome visit to Dr. Elmes' fowl-house, accounting for five ducks, four fowls, and one pigeon of his stock, all of which had been swallowed, giving the snake a beaded appearance. Dr. Elmes shot another which he saw lying in a bhil (lake) and found the following in its stomach:—two large and two small water rats, and two or three toads. Reptiles sometimes furnish the repast. Mr. Millard in this Journal¶ records one in our Society's rooms swallowing a monitor lizard (*Varanus bengalensis*), a rat, and two frogs in quick succession. In its native jungles it sometimes comes into conflict with other large snakes, for Mr. Donaghey told me that coming back to camp one day in Burma his coolies produced two snakes which they said they had discovered fighting, and which they killed. These proved to be a *Python molurus*, and a hamadryad (*Naia bungarus*). They reported that the python had closed its jaws on the hamadryad and secured it fast. I saw and examined the two skins. The hamadryad measured 10 feet $3\frac{1}{2}$ inches, and the python 7 feet 11 inches. In the former skin at the junction of the middle and the posterior third was a rent $3\frac{1}{2}$ inches long corresponding to the python's grasp. It is impossible of course to surmise which was the aggressor in the fight, but the python though smaller was giving a good account of itself.

The most curious meal that I have had reported to me was a double handful of earthworms, and a handful of the berry called

* Vol. X, p. 69, † The *Field*, 21st December 1907.

‡ Bom. N. H. Jourl. Vol. XVI. p. 520. ¶ Vol. XVI, p. 757.

by natives "jaman". My informant was Mr. J. H. Mitchell, a planter in Assam.

In captivity the python usually eats heartily and frequently, accepting anything that is offered, as the following annual bills of fare will show:—Phipson* says one in Bombay ate 23 rats, 3 hens, 3 crows, and 1 kestrel. One in Madras† ate 82 jerboas, but would not touch house rats; another ate 59 jerboas, 8 squirrels and 2 quails; a third accounted for 37 rats, 21 squirrels and 3 quails.

In Travancore one ate a spotted deer and 11 fowls; another 1 nilghai fawn, 1 hare, 1 rabbit, 13 fowls, and 1 pond heron; a third ate 14 fowls and 1 crown pigeon; a fourth 2 dogs, 2 hare wallabies, 2 bandicoots, and 54 fowls, a fifth 4 bandicoots, 19 fowls, and 1 spotted dove, and a sixth 1 hare wallaby, 1 bandicoot and 15 fowls.‡

It not infrequently happens that where two are caged together both strike at the same animal, and begin to shallow from opposite ends till their noses meet, when if one does not relinquish its hold, one gets its jaws over the other and swallows its mate. This happened once in Regent's Park and once in our Society's Rooms¶ when both struck at the same partridge, and similar occurrences have been reported in other institutions where snakes are kept.

The young which hatched out in Travancore are reported to have eaten the rats offered to them.

One sometimes hears of human beings being swallowed by pythons, but though I have collected several instances of other large snakes overcoming men I have no authentic instance of this snake doing so, but it is amply capable of overpowering the strongest man. A young European told me once in Hong Kong that he had witnessed as a boy with his brothers, a large snake (almost certainly a *molurus*) swallow a Chinese baby on Stone Cutter's Island in the Harbour. The mother left the child while engaged in some work, and the boys were afraid to encounter so formidable

* Jourl. B. N. H. S. Vol. II, p. 166. † Kindly communicated to me by Dr. J. R. Henderson.

‡ For this information I am indebted to Colonel F. W. Dawson.

¶ Jourl. Bomb. N. H. S. Vol. XIV, p. 395.

a snake. Major Sealy of the 4th Gurkhas tells me that a reliable old Gurkha Officer told him that once when officiating at a funeral pyre, a python emerged from the water hard by, seized the corpse, and made off with it.

Usually in captivity live animals have until recently been given to the snakes in various Zoological gardens, but now that it is known that pythons among other snakes will accept dead food, the order has changed. The fact that they would eat dead animals was noted 15 years ago in this Journal by Ferguson* who says "they will eat a dead rat, or rabbit, just as readily as a live one." He further states that under these circumstances it makes no attempt to constrict, but proceeds to swallow at once. In Regent's Park for some years now, many of the snakes have been fed entirely on dead animals.† Dr. Chalmers Mitchell, who paid special attention to this, says it was not noticed that it made any difference whether the food was freshly killed, warm, or bleeding, or if dead for sometime. It was noticed that in many cases the prey was not taken until night, and this was particularly the case when pythons took large animals like goats. He further states that the pythons showed their readiness to feed by special restlessness and activity, often leaving the tanks in which they have been lying previously, and that they are specially alert when they hear movements in the passage behind their cages, or when the back door are moved, and in the words of the keeper "they are asking for food.†"

The habit of constricting is characteristic of the whole family—boas and pythons alike. The snake, roused to activity by the sight of food, advances towards its prey often with quivering tail and makes a sudden dash at it with open jaws, which are no sooner closed upon its victim than it throws a coil or two—according to the size of the quarry—round it, holding it as in a vice until its struggles have completely ceased when it relaxes its embrace and proceeds to swallow it almost always beginning at the head. Dr. Chalmers Mitchell says "there appears to be no special attempt to crush the prey, to suffocate it or to break its bones." I

* Vol. X. p. 69. † Dr. Chalmers Mitchell, P.Z.S., 1907. p. 785, *et seq.*

certainly agree that there is no attempt to crush with the intention of breaking bones, and so making the mass more easy to deal with, but if the victim is not suffocated how is it killed? My belief is that the vigour of the embrace is such that the victim's chest is incapable of expansion, and asphyxia results, or what amounts to the same thing the heart cannot beat against the pressure to which it is subjected.

In swallowing a small animal the mouth is widely opened, and the jaws fixed beyond the head of the victim which is easily engulfed. Prior to the actual seizure of the head, the python plays about over it with quivering tongue. It does not slaver over it as is commonly supposed, but the saliva flowing freely under the stimulus of food wets that part which has been received in the mouth, so that if the victim has been disadvantageously seized, and the snake rejects it to make a second attempt, the part of the quarry previously injested is coated with saliva.

When the animal is large, the snake seizing the head strives to fix its teeth as far back as possible over the victim, when, having got a firm purchase, the jaws—six in all and all moveable—work alternately over the head, one or more at a time relaxing their hold to be pushed further forward and obtain an extended purchase while the others retain the hold already gained. The process is sometimes a tardy one, and if so the snake is frequently observed to protrude its wind pipe, so that an inch or even two may be seen beyond the mouth, beneath the mass that is engaged within the jaws. This extension of the glottis is however not a peculiarity confined to the python, for it has been noticed in several other snakes, colubrines and vipers.

It is popularly supposed that after a large meal, the python lies torpid, in a condition of satiety, until digestion has far advanced. I very much doubt if this is the true explanation of the disinclination of the snake to move under such circumstances, a disinclination even greater than it displays at other times. I think it is much more likely that in many cases the snake is so distended that it is afraid to move on account of internal injuries it may receive in the attempt. Undoubtedly accidents do occur which must end fatally. In the case already referred to where a dead

snake was found, with the quills of a porcupine it had devoured, penetrating its flanks between the ribs, it is probable that the injuries were received whilst moving before the quills had softened under the influence of the digestive function. A python already referred to, which was killed by Mr. Copeland's coolies in Assam, refused to move from its refuse in the jungle though surrounded by a howling mob of coolies. After sometime, the sustained apathy it exhibited stimulated the courage of the men who advanced by degrees nearer and nearer till they actually probed it with sticks and bamboos, and made the situation so untenable that the snake was forced to bestir itself. In trying to get away the horns of a hog deer, which it had swallowed, penetrated its flanks. It was finally despatched, and measured 15 feet. The horns of the deer were about 7 or 8 inches long. Such accidents are not very uncommon in snakes of all kinds—from over-distension, or from mechanical causes, the beak of birds, claws of various animals, etc.,—and I have collected quite a number of incidents of the kind.

The old traveller's stories of pythons, boas, etc., swallowing stags is not borne out by modern observations. I doubt if a python ever kills any deer with horns it is not capable of swallowing. If it does then sooner or later it has to relinquish its victim. The old books that led one to believe that the stag was swallowed up to its antlers, which projected from the mouth, and remained *in situ* till the head rotted off certainly misled us. The only way in which the body could be retained, and the head rejected would be by a slow decomposition (not a digestive process) separating the head at the neck joint, a process that would probably take several weeks to accomplish, and would exhaust even a python's patience. The body of a stag in such a position would not reach the stomach, and would not be subjected to any digestive action, for the saliva is inert to animal tissues. Further I doubt whether the lung could fulfil its function satisfactorily even with the small oxygen requirements of a snake, when subjected to the great and continued pressure of a carcass like a stag's.

The digestive powers of a python depend naturally on its general health. Phipson found that in the hot weather in captivity

small creatures like rats and crows were completely digested in about 8 days. McLeod* mentions a goat with horns being swallowed that took 3 weeks to digest.

In a vigorous snake every part of the animal swallowed is completely digested except epithelial structures such as hair, feathers, quills, teeth, the beak and claws, the scales of reptiles, the cornea, or, in snakes, the disc before the eye which is the analogue of the eyelids in other animals. If the dung is inspected these structures will be found massed together, and often retaining in a wonderful degree the relationship occupied in the animal injested. In sickly snakes, or in those whose vitality is impaired, when hibernation is approaching, bones will be found passed in a more or less imperfectly digested state. In the excrement also may be seen circular spaces which are believed to be casts from the snake's intestine. Similar spaces were observed in the coprolites, or fossillised dung of the old reptilian monsters—*icthyosaurus* and *plesiosaurus*—by Buckland, who remarks upon them in his Bridgewater Treatise.

Mr. Kinnear tells me they are frequently asked by visitors to our Society's rooms, if pythons reject the horns of deer and stags eaten. I cannot speak positively upon this point, which however is one that could easily be demonstrated in our Society's rooms using goats as victims. I have never heard it suggested that they disgorge the horns, but this is one of the many points touched upon in this paper about which I feel many of our readers could give more satisfactory information than my limited experience permits me to dilate upon. I believe however that the horns like other epithelial appendages are passed intact in the dung.

Though we have shown that the python as a rule feeds well in captivity, sometimes it will refuse food for long periods, and without suffering perceptibly. Ferguson† records one that fasted for over a year in the Trivandrum Gardens, but changed its skin more than once, and always looked glossy and in perfect health. After this fast it ate a white rat, and later again two more.

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* The Voyage of H. M. S. "Alceste."

† Journ. Bomb. N. H. Soc., Vol. VI., p. 424.

Uses.—In the arts, the skin of the python, in common with the skins of other snakes and lizards, is made up in various ways, as reticules, purses, letter cases, etc., but for trade purposes it is but sparingly used owing to the difficulty in procuring skins in any quantity. Nearly all large specimens are skinned by those who kill them, the skins being retained as trophies which one frequently sees adorning the walls of bungalows in this country. Sometimes these are cut up, and I have more than once seen belts made of them.

All through the East certain natives regard the flesh of this snake very highly, and I can quite believe that it may be excellent. The traveller D'Albertis when in New Guinea shot a closely allied snake to the python (*Liosis albertisii*) 19 foot long, which he tasted when the natives with him had cooked it for their own purposes. He said that it was "not so bad" though tough and too sweet, but pronounces the soup made from it as excellent. Only recently it was reported in the papers that at a fashionable dinner in Paris, as a novelty, python steaks were served and reported "very good." In Southern China I know it is eaten as a great delicacy. In Burma the Karens and Burmese both regard it as excellent fare, and no python met by them is likely to be spared for this reason. In Travancore Colonel Dawson tells me the hillmen eat the snake and its eggs too. In *Land and Water* (August 10th, 1867) a correspondent says that a gipsy tribe in the Dun eat pythons, and Mr. Mackinnon tells me that there is a tribe called Myhras inhabiting the Dun that are ophiophagous. Many Indian people are snake-eaters, and as such are not likely to disdain the flesh of the python. Such are the Santhals, who occupy a strip of country between the Ganges and the River Baitarani, the Oraons or Dhangars, and Kols of Chota Nagpur, the Garos of the Garo Hills, Assam, the Nats, a nomadic gipsy caste, the Chentsus of the Nallamalley Hills, the Kanjars of the United Provinces, and according to a Mr. Edwin, who wrote to a London paper in 1768, the Ceylonese too, and doubtless there are many others.

These same races attribute all sorts of virtues to the internal organs and fat. The specimen shot on its eggs near Colombo

Mr. Jausz told me had all its fat carefully collected for use in cuts and abrasions, sprains, etc. Colonel Dawson tells me that in Travancore the fat is used locally for sprains, fractures, bruises and rheumatism, and internally for leprosy. In Burma the gall bladder is prized, and its contents used medicinally.

Breeding (a) season.—From what is known of the period of gestation, and the season when eggs are deposited, the mating season is in December, January and February, the coldest months of the year when we know that the python, at any rate in Northen India, is hibernating. We have already seen the effect on the vitality of the snake during this period, which is reduced to the extent that the body heat is sensibly diminished, and the capability for digestion lost. Under the circumstances it is most remarkable that the inclination for sexual indulgence is retained, and yet this conclusion is in perfect agreement with that observed by me in other snakes that hibernate. One must assume that pythons retire in pairs, and that the female is gravid when the term of hibernation is spent. In Paris in 1841 the pair that mated were observed "in copula" several times during the month of January and February and eggs were deposited in May, *i.e.*, the season when eggs are laid in India.

Period of gestation.—From the foregoing it will be seen that the period from mating to the deposition of eggs is about 3 or 4 months.

Our Indian python is oviparous* and lays from 8 to 100 eggs, 107 being the largest brood I have any knowledge of. These are discharged in the hot months, March, April, May and June. The eggs are usually described as being the size of goose eggs, but the only accurate measurement I have been able to procure is from the Director of the Berlin Aquarium who tells me they are 12 c. m. × 6 c. m. ($4\frac{3}{4}$ × $2\frac{7}{8}$ inches), no doubt they vary somewhat. They are white in colour, soft, and equally domed at the poles.

After deposition the female coils herself around them, and has been observed so in captivity, and in a state of nature. As far as

*The African species *regius* is viviparous.

I am aware she appears to be generally alone during this period, I have only once heard of her mate being seen anywhere near her, and I have several records of pythons found lying up with eggs in jungle and being killed, and with one exception no mention has been made of another snake being found close at hand. The eggs are laid sometimes more or less in the open, the dam proving rather a conspicuous object to the shikari. Sometimes the female retires into a hole in a tree, beneath a fallen tree or in a termite's nest, one in the latter situation having been found near Colombo some years ago. Several interesting observations have been made during the period of incubation. The dam's temperature during the event, which happened in Regent's Park in 1881, was recorded several times, and compared with that of a male in an adjoining cage. It was always rather higher being about 1°-4 to 3° Fahrenheit in excess of the male.* In this case the female having once settled herself around the egg remained there for six weeks without taking food, only leaving the eggs once for a few hours. In Paris too in 1841 it was reported that the dam refused food and drink during the whole period which lasted 58 days. When the young were hatching she drank about two tumblers of water. Her task accomplished it was noted that she took little or no notice of the young brood.

Period of incubation.—Though several pythons have laid eggs in captivity, in various Institutions, the eggs have frequently been sterile, or when fertile for some cause have failed to hatch. In Paris however in 1841 the incubation was brought to a successful conclusion, the period being 58 days. The 15 eggs were laid on the 6th of May, and on the 3rd of July eight hatchlings emerged out of the nine fertile eggs. (Günther, Rept. Brit. Ind., p. 330. I have seen it stated elsewhere on the authority of Dumeril that one hatched on the 3rd July, and eight more during the next four days.)

* P. Z. S. 1881, p. 960.

Young.—The hatchlings referred to already, acquired in Travancore, measured on an average 2 feet 5 inches.* In Regent's Park in 1881, the eggs which had been incubated for six weeks were found to be decomposing, and the contained embryos were then 11 inches long. The young hatched in Paris in 1841 are reported to have sloughed in from 10 to 14 days, prior to which they refused all food.

Growth.—The Travancore brood, it is reported, grew 11 inches in 4 months, and it would appear from this that growth in early life is more rapid than later, for Colonel Pollock† states that a specimen he had that was 12 feet long when he got it, grew about 3 feet in 2 years. The smallest incubating or gravid female with which I am acquainted was 11 feet long. This was shot on her eggs in April 1903 near Colombo, and I measured the skin which was in the possession of a Eurasian lad, an enthusiastic collector and lover of snakes. It is difficult to say precisely at what age this length would be attained, but I estimate that the snake would be beginning its sixth year. I find that most snakes double their length in the first year of life, so that a specimen $2\frac{1}{2}$ feet when hatched would be 5 feet at the end of the first year. If one allows a growth of 3 feet for 2 years, the rate given above by Colonel Pollock, 11 feet, would be attained at the end of the 5th year of life. A specimen in Regent's Park was 12 feet long when her eggs were laid. After maturity considerable growth continues for some years in most cases, but in captivity some examples grow little if at all after acquiring a length of 12 feet or less. Thus a specimen captive in Travancore for 12 years 9 months measured but $9\frac{1}{2}$ feet when it died.§

Age.—Very few records seem to have been made of this interesting matter. Gunther however mentions a python attaining the age of 19 years in Regent's Park. It was 4 years old when acquired, and lived a further period of 15 years in captivity. The various breeding events known to me are tabulated as fol-

* *The Field*, 3rd October 1903.

† Sporting days in Southern India, p. 223.

§ *The Field*, 16th March 1904.

lows, but I have been most unfortunate in failing to get details of many events I applied for to the various Institutions concerned.

Year and locality.	No. of Eggs.	Month observed.	Length of dam.	Remarks and Authority.
Paris 1841	15	May	?	Observed "in copula" several times in January and February. Eggs deposited 6th May, 9 hatched, 8 on 3rd July (Günther, p. 330).
Regent'sPark 1881	about 20	June	about 12′	Eggs deposited 5th and 6th June. On July 18th embryos 11 inches long (P. Z. S. 1881, p. 960).
Madras 1901	8	..	..	My informant Dr. J. R. Henderson.
Colombo 1903	60	April	11′	Found in termite's nest. I examined the skin.
Trivandrum 1903	40	..	15′	Found in jungle. Eggs hatched, the young averaging 2 ft. 5 inches. (*The Field*, 3rd October 1903).
Balrampur, U. Provinces.	107	Hot season	?	Two found at close quarters, ♂ and ♀ both caged. Eggs hatched. (My informant Mr. M. H. Oakes, D.S P.)
Manchester 1904	53 or 54	April	14′-2″	Dam obtained from Calcutta. Eggs laid 5th April, non-fertile. (*The Field* 30th April 1904, and 11th June 1904.)
U. Provinces 1906	50 to 100	March	18′-3″	Found in jungle on 7th March. (My informant Mr. Prince, K.S.L. Infantry. I saw and measured the skin).
Terai.	?	May	?	Found in open jungle. (My informant Mr. Campbell, Commissioner, U. P).

Sloughing—Many observations have been made in various quarters on this function, which appears to depend upon the general state of health and vital activities of the snake. I have already remarked upon the great reduction in temperature observed by Phipson in a python in our Society's rooms, during the period of hibernation, and with the vitality reduced to such

a low ebb that the snake was incapable of digesting its food, it is not surprising that there was a coincident abeyance in the disquamative process during this period. Specimens in Madras, and Travancore disquamated during the whole year, and appear not to have hibernated. In India the python sloughs five or six times annually as will be seen from the following table of records :—

Year of Observation.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	Authority.
1886-87.	..	..	27	..	17	..	27	..	..	..	..	..	..	10	..	..	..	Phipson, Journal Bom. N. H. S. II, p. 166.
1895-96.	..	26	..	..	..	18	..	..	..	19	..	..	..	..	..	..	..	Report, Madras Mus. 1896-97.
1896-97.	..	12	..	..	2	..	..	..	..	17	..	..	..	..	..	..	..	Do.
1897-98.	..	6	..	..	..	12	..	..	21	..	..	6	..	..	..	..	..	Do.
1900-01.	..	..	..	..	..	22	..	..	28	..	..	..	4	..	29	..	..	Trivandrum. Col. Dawson in epistola.
1900-01.	..	30	..	..	26	..	..	..	..	..	..	..	..	..	..	..	..	Do.
1901-02.	..	..	..	..	..	..	..	..	*	..	3	..	1	..	22	..	10	Do.
1901-02.	..	..	..	..	..	..	..	8	..	2	..	..	21	..	23	..	6	Do.
1902-03.	..	..	..	..	..	22	..	9	..	17	..	6	..	1	..	2	..	Do.
1902-03.	..	..	..	..	..	..	14	..	..	26	..	19	..	8	..	9	..	Do.
1902-03.	..	..	..	..	..	20	..	15	..	..	13	..	16	..	13	..	..	Do.
1909-10.	19	..	12	..	3	..	24	..	..	..	..	..	2	..	30	..	..	Millard, in epistola

* Date uncertain.

Parasites.—The python like most of its kind harbours many parasites, among which are :—

(1) A cestode or tapeworm (*Bothridium pythonis*) which may be found in great numbers in the intestine (duodenum), either free or attached to the mucous membrane. Professor Shipley found these in a specimen taken at Neligatta, Ceylon.*

* Spol : Zeylanica. Vol. I. page 49.

(2) A cestode (*Solenophorus megacephalus*). Von Linstow † found this parasite once in the intestine of a tiger killed in the United Provinces, which proved that the carnivore had recently devoured a python.

(3) A nematode or round worm (*Ascaris attenuata*) which inhabits the intestine. These were found by Von Linstow ‡ in a python from the United Provinces.

(4) A nematode referred dubiously by Professor Shipley ¶ to *Ascaris rubicunda*. This was found in the left lung of a Ceylon python.

(5) A linguatulid (*Pocephalus moniliformis*) also found by Shipley § in the lung of a Ceylon python.

(6) Captain Patton, I.M.S., tells me that in Southern India he has frequently found the python infested with ticks (*Aponomma geryasi*) which fix themselves to the skin between the scales.

In addition to the entozoa and ectozoa above referred to, this snake harbours—

(7) A blood parasite (*Haemogregarina pococki*) discovered by Sambon inhabiting the red blood cells.‖ The intestinal parasites may become a serious detriment to the health of their host, and even cost the snake its life as shown by Ferguson.** He says at one time all the pythons in one cage in the Trivandrum Gardens, Travancore, died, and showed on *post-mortem* examination that they were infested with round worms which in many instances had perforated the walls of the stomach and intestines.

Fables.—I have already under nomenclature referred to the Grecian fable of its antochthonous origin.

Dr. Percival in his book on Ceylon (p. 303) says that the python is reputed by the Singhalese to vanquish tigers, buffaloes and even elephants, and it may be this fable that originated the name "anaconda," which, as stated under nomenclature, appears to be a Ceylon word.

† Ind. Mus. Records, Vol. II. Pt. 1, page 108.
‡ Loc. cit. p. 109.
¶ Loc. cit.
§ Loc. cit.
‖ P. Z. S., 1907, p. 283.
** Bombay N. H. Journ. Vol. X. p. 69.

Tennent * tells me that the Singhalese say that when it has devoured a meal of uncomfortable proportions, it will drag itself through two closely adjacent trees with the object of crushing the contained mass. I put this down as a myth, because a great distension is in itself prone to tax the abdomen to its bursting power, and under such circumstances trifling mechanical agencies would still further jeopardise the integrity of the tissues.

Dr. Davy † says that the Singhalese believe that the "pimbera" when young was a tic polonga (Russell's viper) and had poisonous fangs, but at a certain age it loses these, acquires spurs (rudimentary limbs), and is then metamorphosed into a python. They suppose further that the "spurs" are poisonous, and it uses them in striking its prey. Another belief is that the dam twists her abdomen during parturition, and the males have then to seek and mate with female noyas, as though there were no other females of their own kind with which to mate! Noyas I take to be nagas or cobras. Such a belief seems curious in face of the fact which must be known to them, one would suppose, that the female incubates her eggs. Colonel Dawson tells me that in Travancore the natives believe so in the efficacy of the fat of the python as a healing agent, that they affirm that if a snake is cut in pieces, the application of the fat to the raw parts effects an immediate reunion of them.

Distribution.—Ceylon, Peninsula India from Cape Comorin to the Himalayas, Assam, Burma, but though apparently not inhabiting Indo-China re-appears in South China, the Malay Peninsula and Java.

Its exact limits in North-West India are uncertain, but Murray records it from Sind (Joongshai, Jerruck) and the Punjab. Many of our members should be able to give us information as to whether it occurs in Kashmir. It seems probable that the Indus demarcates its limits in this part of India.

Whilst occurring plentifully in Burma, it is not known from the Andaman-Nicobar Insular group. As regards the Malayan Penin-

* Nat. Hist. of Ceylon, p. 304.

† An Account of the Interior of Ceylon, p. 82.

sula and Java further evidence of a confirmatory nature seems desirable, since Flower (Jourl. As. Soc. Bengal 1899, p. 655) reminds us of what is very true, *viz.*, that *molurus* is found in localities outside its natural range, often being carried thence by itinerant Indian jugglers. He records seeing one in Bankok which enquiry elicited had come with a conjurer from India. Pythons too are accidentally transported in ships occasionally to regions far removed from their natural haunts. It is far commoner I think in the plains than in the hills, but ascends to altitudes up to about 6,000 feet in the Himalayas, and other Indian ranges.

Lepidosis.—*Rostral* much broader than high; in contact with 6 shields, the sutures made with the internasal decidedly shortest; impressed with two elongate furrows or pits parallel to and just below the superior borders.

Internasals.—A pair, the suture between them two-thirds to three-fourths that between the præfrontal fellows. *Præfrontals* a pair, separated from the frontal by a transverse series of small scales.* *Frontal*—Divided longitudinally, as large or rather smaller than the præfrontals. *Supraoculars.*—Rather shorter than the frontal, rather broader than each frontal half. *Parietals.*—None, the frontal being succeeded by small scales. *Nasals.*—In contact with 1st and 2nd labials. *Loreal region* occupied by many scales. Eye surrounded by many scales hardly deserving the name of præoculars, postoculars, etc.

Supralabials 10 to 13, the anterior 2 deeply pitted as shown in our Plate. Sometimes one (usually the 6th) touches the eye. *Infralabials* 18 to 22. Usually some of the anterior and posterior are indented with small roundish depressions, but those may be entirely absent. *Sublinguals* absent, the mental groove being bordered by 5 or 6 small scales. *Costals* two heads-lengths behind heads 54 to 56; in midbody 61 to 75; two heads-lengths before vent 43 to 45. On the back the scales are longer than broad, but in the flanks they enlarge till in the last 2 rows the breadth exceeds the length. The last row is just one-half the breadth of

* This is a curious departure from the usual colubrine arrangement of head shielding but is also seen in the snake *Zamenis diadema*.

the ventrals. *Ventrals*—242 to 269, narrow, occupying about the middle third of the belly. *Anal*—Entire, as broad as the ventrals; *Subcaudals* 60 to 72 in pairs. Russell had a specimen which he figures (Pl. XXXIX, Vol. I.) in which 36 pairs were succeeded by 28 entire shields, and these by 3 more pairs.

Dentition.—Præmaxillary 4 small teeth, a pair on each side widely separated in the median line. *Maxillary* 18 to 19. The 2nd to 6th or 8th longest, subequal, the rest gradually decreasing in length. All more or less obliquely set with points directed inwards, the posterior almost transverse. *Palatine* 6, first 4 subequal, and as long as maxillary, last 2 progressively decreasing. All strongly inclined inwards. *Pterygoid* 8 to 10, about as large as the posterior maxillary, strongly inclined inwards. *Mandibular* 16 to 19, the 2nd to 6th or 8th longest and subequal, the subsequent teeth progressively diminishing. Strongly inclined inwards, the posterior being almost transverse.

Our Plate is in every way excellent, Mr. Green having in this surpassed all his previous good work.

(To be continued.)

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plates and Diagrams.

BY

Major F. Wall, I.M.S., C.M.Z.S.

Part XVIII with Plate XVIII, Diagram and Map.

(Continued from page 475 of this Volume.)

The genus *Helicops* is one of many into which aglyphous colubrines, *i.e.*, colubrines without grooved or tubular teeth either in the front or back of the maxilla, are divided. It contains eleven species, which inhabit South Asia, Tropical Africa, and North and South America, but only one of these, *viz.*, *schistosus* occurs within Indian limits. The type is the Brazilian *H. carinicauda*.

HELICOPS SCHISTOSUS (Daudin).

The Olivaceous Keelback.

Our first introduction to this snake is through Russell who figured, and remarked upon it in 1801.*

Nomenclature (*a*) *Scientific.*—The generic name for which Wagler is responsible, dates back to 1830, and is from the Greek "elis," rolling, and "ops," eye, and seems to me specially suitable to our Indian representative, for I do not think I have ever observed another snake move its eyeballs so actively. The specific title given by Daudin in 1803 from the Latin meaning "slaty", was probably suggested by the dorsal colour of Russell's plate, or a spirit specimen. It is to my mind not appropriate, for in life the snake is olivaceous.

English.—The olivaceous Keelback seems to me a suitable name.

Vernacular.—Russell says it is known to the natives (on the Coromandel coast?) as "Chittee" which I am told is Telugu for

* Ind. Serp., Vol. II, Plate IV.

little, and "Nalla wahlagillee pam." In Mysore it is known by the Canarese name "Barmnya."

General characters.—The head is chiefly remarkable for its short, and rather pointed muzzle. The shields are glossy. The nostril is slit-like and placed rather high, distinctly approaching the type seen in the true water snakes of the Family *Homalopsinæ*. It occupies about half the depth of the nasal shield, which is divided below it by a suture running to the 1st supralabial. The eye is lateral in its setting, rather small, the pupil round, and the iris speckled throughout with gold. The commissure of the mouth viewed in profile is seen to take a sudden bend upwards behind the eye. The tongue is plum-coloured. The neck is not very evident. The body is rather stout for the length of the snake, and the scales on the back are sharply ridged as in other Keelbacks. The tail is long, its relative length being nearly one-third the total length in males, but nearer one-fourth in females.

Dimensions.—My largest specimen is a ♀ measuring 2 feet 10¼ inches. Females attain a greater length than males, and I have had 7 measuring over 2 feet, but never a ♂ reaching this length. The average length of my 7 largest females is 2 feet 4¾ inches and that for my 7 largest males only 1 foot 10 inches.

Identification.—In colouring and general appearance it may be very easily confused with the water snake *Hypsirhina enhydris*, but bears a still more striking resemblance to *Rhabdops bicolor*. It is rather remarkable too that all these three snakes possess but a single internasal shield, a rare feature in lepidosis. If the lepidosis is studied its identification from all Indian snakes is easy. Three characters must coexist, and these are (1) a single internasal, (2) 19 costal rows in midbody, and 17 at a point two headslengths before the vent, and (3) 8 or 9 supralabials. The combination of the 1st and 2nd of these is only seen in two other Indian snakes, *viz.*, *Cantoria violacea* and *Hypsirhina plumbea* which have respectively but 4 and 5 supralabials.

Colour.—Though Boulenger says it is dorsally olive-brown, all the many specimens I have seen in life have been olive-green. This hue is uniform on the upper parts of the head, body and tail in adults, and abruptly ceases in the middle of the penultimate

row. Boulenger * says there is usually a more or less distinct dark lateral streak, and some specimens have two series of small black spots along the back, but I have never noted these. Günther† says that the young have a blackish streak from the orbit, continued along the fore part of the body. The lower half of the penultimate row of scales, the ultimate and the under parts of the snake are uniform yellow, sometimes of a very bright hue. Sometimes there is a pinkish or lilac suffusion on the penultimate and ultimate rows. The head is uniform olivaceous above, merging to yellow on the lips, and usually has no streaks from the orbit, nor on the labials.

A very distinct variety occurs in South India which bears a narrow reddish line down the back on the confines of the 5th and 6th rows above the ventrals where the scales are 19, and the 4th and 5th where 17. This line disappears at the vent and I have noted is more vivid in males than females. I have never seen this in specimens from the Ganges Basin (Fyzabad).

Disposition.—Though Cantor‡ remarks that the species is very fierce, and Ferguson§ quotes Ingleby's words to the same effect, I have invariably found it very much the reverse, in fact I know of no Indian snake with a more inoffensive nature and nicer manners. I am not courageous where snakes are concerned, and object strongly to being bitten even by species that I know to be harmless, so I am always chary of handling them, but this species like the buff-striped Keelback (*Tropidonotus stolatus*) is so remarkably gentle that I pick it up fearlessly and have never been struck at, or bitten. When alarmed the snake will erect itself and flatten the neck like all other Keelbacks, and it may have been this behaviour that led the writers named above to suppose it fierce. Even the two I had conjoined in Bangalore permitted my handling them and making close investigations, without resenting my interference further than to try and elude my grasp. This placid nature is by no means associated with a lack of spirit, for the little reptile is as vivacious, active in movement and alert as any snake I know.

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* Cat. 1893 Vol. 1, p. 274.

† Rept. Brit. Ind. 1864, p. 273.

‡ P. Z. S. 1839, p. 54.

§ Bomb. N. H. Journ., Vol. X, p. 73.

Haunts.—The olivaceous Keelback exhibits a strong taste for an aquatic environment, and the position and character of its nostrils conforming to the type seen in the true fresh water snakes (*Homalopsinæ*) in itself proclaims the snake a water snake by habit. In Fyzabad I got no specimen during 19 months' residence, but when the river overflowed its banks and flooded the country for miles in August 1906, I had 8 specimens brought to me in 14 days, all from the inundated area. It by no means haunts rivers to the exclusion of jheels and similar collections of water, nor does it show a greater liking for flowing water, for in Bangalore where it was very common it was found haunting the small collections of water in the Lal Bagh, and other similar pools, elsewhere. The snakemen there denied that it was a watersnake, and said they never found it actually in the water, but at the edge of the pools where the dank soil favoured a luxuriant growth. They also frequently encountered it in the foliage, and lying along the stems of the bamboo brush near the water. In the rains I think it leaves the vicinity of pools, and wanders further afield, there being abundant moisture in the grass and weeds that spring up everywhere. I have met with it in the grass at some distance from water during the monsoon, and remember capturing one which crossed the pitch at Berhampur while a cricket match was in progress on the parade ground. Ferguson remarks that one he had in captivity in Trivandrum was never seen to enter the chatty of water provided for it and Mr. Ingleby mentions that a caged specimen he had invariably buried itself in the sand at the bottom of its cage with nothing but the extremity of its head and its eyes sticking out.

Habits.—*Schistosus* evinces a markedly diurnal habit being frequently encountered in daylight in the haunts it favours. It is probable that with such pronounced aquatic tastes, it is forced to retire for many months in the year. All the specimens I can recall were about during the rainy season of the year.

I have already alluded to the attitude it adopts when alarmed, a posture very typical of the Keelbacks of many genera including *Tropidonotus*, *Pseudoxenodon* and *Macropisthodon*. The neck in this species is very markedly flattened cobra-wise, and in addition

the snake flattens the part of the body not erected against the ground. I think this is noticeable to a more marked degree in the ♀. By no means every specimen one meets displays this attitude of alarm, for while some erect themselves as soon as disturbed, others require a good deal of provocation before they are worked up to the necessary degree of excitement. Usually when disturbed it slips away to the nearest cover, moving actively and speedily, and when captured is a very restless little creature striving time after time to reach the nearest available cover.

It is evidently an adept climber, to successfully negotiate the smooth stems of bamboo that arise at first perpendicularly from the ground. The Bangalore snakemen told me that they frequently found it as high as 8 and 10 feet from the ground, and it was in such a situation that the conjoined pair brought to me were reported to have been found.

Food.—Specimens I had in captivity fed on frogs, and Mr. Ingleby found the frogs that he offered were taken. Günther* includes fishes in its dietary. I cannot recall ever having got a specimen that had recently fed in a state of liberty.

The sexes.—As far as I can judge from my notes the sexes in Fyzabad and Bangalore are evenly balanced. Females as already stated attain considerably greater length than males, but males have relatively much longer tails, and therefore more numerous subcaudal shields. The males of the S. Indian variety appear to have a brighter red dorsal line and females appear to be able to flatten themselves more noticeably. The ♂ clasper is beset with numerous small falciform processes from the base to the tip.

Breeding.—Our knowledge of this is somewhat fragmentary, and leaves a good deal yet to be elucidated. The mating season appears to be during the rains from the single dated observation available, which came under my own notice. None of the 4 adult females I had in Fyzabad were gravid which points to the deposition of eggs being already accomplished before August, unless mating had up till then not been in progress. The latter possi

* Loc. cit.

bility is suggested by the pair found "in copula" in Bangalore, and brought to me on the 27th of August. These were observed united reclining on a bamboo stem 8 or 10 feet above the ground. On the evening of the 26th an attempt was made to capture them, but not pressed as the snakemen feared they would not earn their reward of Rs. 5 if they separated. They were successfully captured next morning and brought to me still united, and I had them under observation for some time. As far as I know they did not disengage for at least 25½ hours. During this time I repeatedly examined them, and found the left clasper of the male engaged with the right orifice of the female. The ventral apposition of the two was so limited that nobody seeing them together would have suspected that they were coupled. They each lay in sinuous courses without their bodies or their tails being enwreathed and there was nothing demonstrative in their attachment as far as I could see at any time. Unfortunately the union was unfruitful, due, I believe, to my moving north to the United Provinces immediately after. The cold weather so far depressed the natural vigour of a *Macropisthodon plumbicolor* I also took from Bangalore with me, that a frog it swallowed remained undigested for some weeks and was subsequently disgorged and when the snake died 5 months and 6 days subsequently to its capture it was found to be gravid with the impregnated follicles but little enlarged, and much in the same state as the impregnated follicles of the *schistosus* at death. The period of gestation is not known.

Eggs.—The species is known to be oviparous from a cluster of eggs which Tennent* refers to which was found near a river in Ceylon, and from which 20 young snakes subsequently emerged. Unfortunately he does not give the date of their birthday. I had a gravid specimen sent me from Ceylon containing 10 eggs nearly one inch long but the date of capture was not recorded. My impregnated ♀ referred to above had 18 follicles enlarged. From these events it appears that *schistosus* is moderately productive.

Young.—The smallest specimens I have had both from Ceylon, measured 6⅝ and 6¾ inches, and from their appearance I believe

* Nat. Hist. of Ceylon, p. 308.

were hatchlings. Here again no dates were given as to date of capture.

Distribution.—It is probably a commoner snake than available records which are rather meagre would make it appear. Before I went to the United Provinces it was not known to occur any where near there, but was evidently not uncommon. I got several specimens when stationed in Orissa (Berhampore). It is one of the commonest snakes about Bangalore, and is evidently common in Ceylon as I had 3 specimens in a small collection sent me from Henaratgoda.

It appears to be chiefly, if not entirely, a snake of the plains but is plentiful at 3,000 feet in Mysore, and has been recorded from the Anamallays and the Wynaad without any definite altitude being specified.

I have examined the three specimens collected by Anderson* in Yunnan which he referred to as a variety, *viz.*, *Yunnanensis*, but as all these specimens have the internasal shield divided, and a single internasal shield is one of the generic characters, and constant in all the other species it seems to me that these should be referred to a species apart from *schistosus* and unless the generic characters are modified should not even rank as a *Helicops*. Besides this feature in lepidosis, there is another, *viz.*, that the nasal shields in Anderson's specimens touch the 1st and 2nd supralabials, whereas in Indian specimens it almost always touches the 1st only.

The Malay Peninsula which has been included within its area of distribution on Cantor's authority I discredit, having already shown good cause to doubt many of Cantor's records.† No less than six Indian species have been recorded by this authority alone, from the Malay Peninsula, and as he received snakes from India the inference is that Indian specimens got mixed with his own Malay collection.

The accompanying map shows the area of distribution based on present records, but it seems likely to be extended as our knowledge progresses.

* Ann. Zool. Res. Yunnan 1879, p. 822.

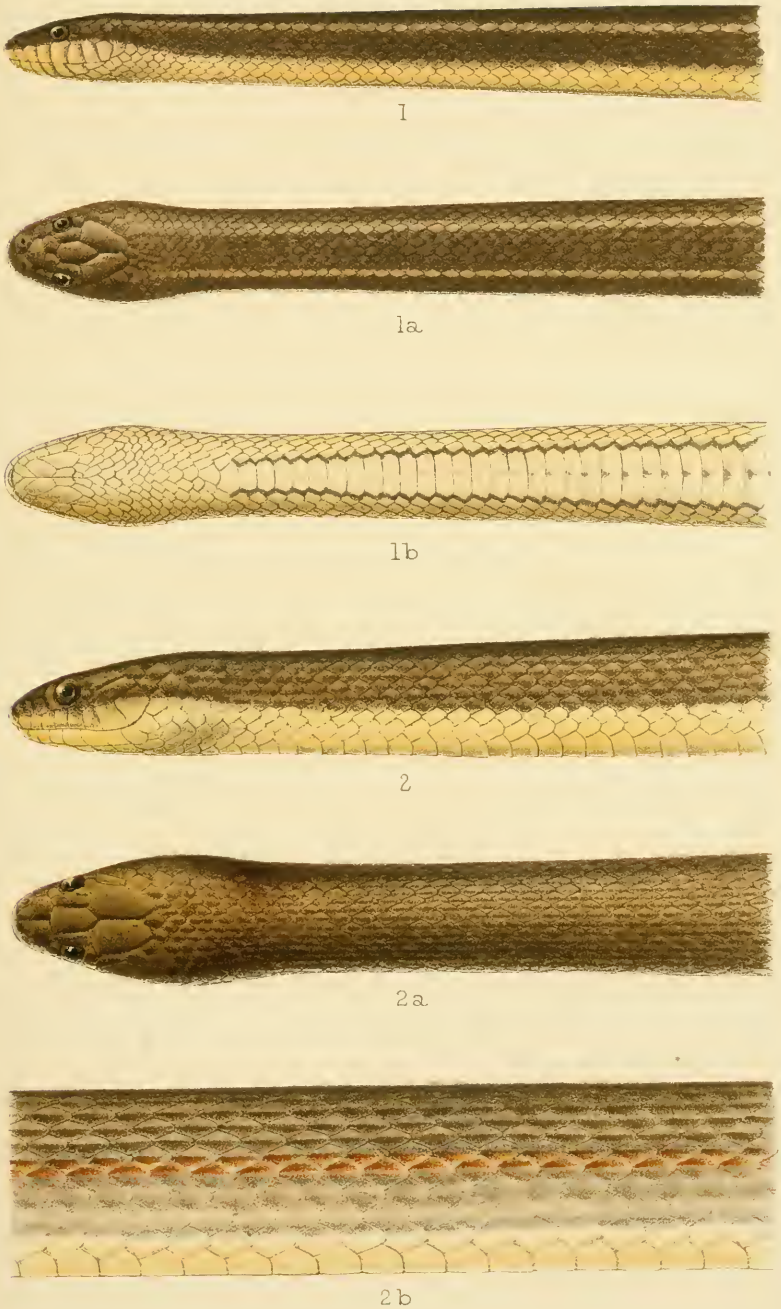
† Bomb. N. H. Jourl., Vol. XVIII, p. 720.

Lepidosis—Rostral.—Touches 5 shields, the nasal sutures largest. *Internasal*—Single. *Prefrontals*—Two, the suture between them subequal to the prefronto-frontal; in contact with internasal, nasal, loreal, præocular and supraoculars. *Frontal*—Touches 6 shields, the supraocular sutures longest. *Supraoculars*—Length and breadth rather less than frontal. *Nasal*—Semi-divided, touching the 1st only of the supralabial series usually, the 2nd also sometimes. *Loreal*—Single, about as long as high. *Præoculars*—One. *Postoculars*—Three. *Temporals*—Two, elongate, the lower touching the 6th, 7th and 8th supralabials. *Supralabials*—8, with the 3rd and 4th touching the eye, or 9 with 4th and 5th touching the eye. *Infralabials*—7, the 5th, 6th and 7th normally touching the posterior sublinguals, 7th largest and touching 3 scales behind. *Sublinguals*—Two pairs, the posterior rather the larger. *Costals*—Two headslengths behind head 19, midbody 19, two headslengths before vent 17. Where the rows reduce from 19 to 17 the 4th row above the ventrals is absorbed into the one above or below. (This step usually well behind midbody sometimes occurs at midbody or even slightly before this); keels distinct except in the last two rows in midbody where they are absent; apical pits wanting. *Ventrals*—139 to 149 in Bangalore specimens, 145 to 157 in Fyzabad (Boulenger 129 to 151). *Anal*—Divided. *Subcaudals*—Divided, 63 to 82 (Boulenger 55 to 85).

Anomalies.—I have twice seen the internasal partially divided posteriorly in Indian specimens. I have twice seen 3 prefrontals in a transverse series, the median rather the smallest. Once there were but 2 postoculars on one side. Once the last ventral was divided and once the 35th, 36th and 37th ventrals were divided. In one example there were only 7 supralabials, the 3rd and 4th touching the eye.

Dentition—Maxillary*—19 to 21, gradually but progressively increasing in size posteriorly with no gap. *Palatine*—11, subequal, and about the same size as the median maxillary. *Pterygoid*—17 to 18, subequal, and about the same size as palatine. *Mandi-*

* From 2 Fyzabad skulls.



1

1a

1b

2

2a

2b

P. Gerhardt del.

J. Green, Chromo.

THE COMMON INDIAN SNAKES. (Wall).

1. Hypsirhina enhydris, *poisonous, nat. size*
2. Helicops schistosus, *harmless. nat. size.*

bular—20 to 22, subequal, the first and last perhaps rather shortest.

Our plate leaves nothing to be desired, unless it is the dorsal colour which is usually of a greener tinge.

HYPSIRHINA ENHYDRIS (Schneider).

Schneider's Water Snake.

This snake being furnished with grooved teeth in the back of the maxilla comes into the opisthoglyphous "series" of colubrines. The series includes three subfamilies, *viz.*, *Homalopsinæ*, *Dipsadomorphiinæ* and *Elachistodontinæ*.

The homalopsids are true fresh water snakes and classified in ten genera, seven of which are represented in India. One of these, *viz.*, *Hypsirhina*, includes fifteen species, one of which *enhydris* forms the subject of this paper. The type of the genus is *H. plumbea* which inhabits the Malayo-Chinese area and has been found in Burma.

History.—Our first introduction to *H. enhydris* is through Russell*, who under the name "Mutta pam" figured and remarked upon a specimen in 1796 which had been captured in an Eel trap in the Lake of Ankapilly (North of the Godavery, near Vizagapatam). Three years later Schneider alluded to it in his History of Amphibians, under the name *Hydrus enhydris*.

Nomenclature—Scientific.—The generic name from the Greek "hypsi," high, and "rhis," the nose, was introduced by Wagler in 1830 on account of the high position of the nostrils on the snout. The specific name also from the Greek "En," in, and "hydor," water, was given in 1799 by Schneider in allusion to its aquatic mode of life.

English.—Schneider's Water Snake suggests itself, reserving Russell's name to designate the other common water snake first alluded to by him and to which Schneider also stands as godfather. I refer to *Cerberus rhynchops*.

Vernacular.—The names mentioned by Russell are the only ones known to me in India. These "Mutta pam," mud snake, and

* Ind. Serp., Vol. I, pl. XXX.

"Ally pam" are presumably in use in the Vizagapatam District. In most places in India I expect it would come under that very comprehensive title "pani ka samp." Günther mentions "oular ayer" as the name by which it is known to the natives in Java. and Flower says—"In Siam it is called "Ngu-pla," or fish snake. in common with other homalopsids.

General characters.—The head is moderately depressed and the snout evenly rounded so as to present no canthus. The muzzle is rather long, and presents a moderately rounded anterior outline. The nostrils which are transverse slits, are placed on the top of the snout, and perforate the middle of the nasal shields, a suture running from them to the first supralabials. The eye is rather small, placed high on the face and set laterally with an inclination forwards and upwards. The iris is studded with golden specks. especially at the pupillary margin so that the vertically elliptic shape of the pupil is distinctly revealed. The commissure of the mouth turns up abruptly behind.

The body is smooth glossy and cylindrical, of moderate calibre for the length of the snake and dwindles to a neck anteriorly. Posteriorly the attenuation is more gradual. The tail is about one-fifth the total length.

Dimensions.—I have seen no specimens exceeding the measurement given by Boulenger which is 2 feet $2\frac{3}{4}$ inches (680 mm). My largest specimen was 2 inches less.

Colouration.—Dorsally the snake is a dark olivaceous green, or olivaceous brown, this colour ending abruptly on the 3rd costal row above the ventrals, and just above the supralabial on the side of the face. Usually there is a pale stripe down the body on the 8th row above the ventrals, but this may be obscure or even absent. The belly and the lowermost two and a half costal rows are pale lemon-yellow. The ventrals are demarcated laterally by a dark line and there is often too a median continuous, or interrupted dark line in the middle of the belly, but this may be entirely absent.

(*H. bilineata* and *H. furcata* (Gray). A specimen sent to me by Captain Frere from Mimbu, Burma, has a beautiful coral-pink stripe in the flanks, anteriorly on two rows (the penultimate and

ante-penultimate), later on the penultimate only. This stripe begins behind the neck and ends before the vent. The specimen otherwise is like Indian examples. Flower records a specimen from Kedah in the Malay Peninsula which appears to have had five ventral lines instead of the normal three.)

Identification.—This is very easy. First note that the nasal shields are in contact behind the rostral, then count the scale rows in midbody which will be found to be 21 to 23.

Disposition.—I cannot recall ever having seen a live specimen, but Dr. Cantor who appears to have been very familiar with it says it is a timid inoffensive snake.

Haunts.—Schneider's water snake is thoroughly aquatic in habit, as might be inferred from the character, and position of its nostrils. It frequents rivers, estuaries, lakes and marshy ground, even being found according to Cantor in irrigated fields.

Food.—Dr. Cantor states that it feeds on fishes under natural conditions, though these were not acceptable in captivity.

Breeding.—Captain (now Colonel) G. H. Evans came across a pair "in copula" at Hmawbi (Lower Burma) on the 16th October * 1899, which were unfortunately despatched instead of being kept for the fruits of their intercourse. The two snakes measured 1 foot $8\frac{1}{2}$ inches and 1 foot $8\frac{3}{4}$ inches, and though the sexes were not at the time ascertained we may presume the former to have been the ♀ by the numbers of the ventral and subcaudal shields, which were 169 + 67. In the longer specimen these shields counted 161 + 72. Another ♀ was taken by Theobald † near Rangoon in a gravid condition in March. She measured 18 inches and contained 6 eggs. Although it is definitely known that the species is viviparous from Cantor's observations, the period of gestation is not known as it appears from his account that a ♂ shared the incarceration. Apparently congress was not witnessed but after six months' captivity the ♀ gave birth to 11 young. During parturition it was observed that the anterior part of the

* Not as originally reported November.

† Cat. Rept. Brit. Burma, p. 57.

abdomen was retracted towards the spine. The mother died immediately after the event, and two of her brood within two hours. These were noted to have measured 6 and 6¼ inches. The young sloughed immediately after birth, even the two that succumbed so soon having accomplished this function. The remainder of the family wreathed themselves round the ♂, lifting their heads at intervals to the surface to breathe. All died within two months. The season when the event took place is not noted.

Parasites.—A specimen sent to me from Champaran (Behar) had numerous nematodes in the stomach, probably the same worm that is so frequently seen in the stomach of the chequered keelback (*Tropidonotus piscator*) and other snakes. I took it to be this worm, *viz.*, *Kallicephalus willeyi*. As a result of this parasitic invasion the organ was much thickened, and its walls rigid and distorted.

Distribution.—North-East India, Assam, Burma, and the South of the Asian Continent through Indo-China to China. Tenasserim, Malay Peninsula to the Archipelago as far East as Celebes.

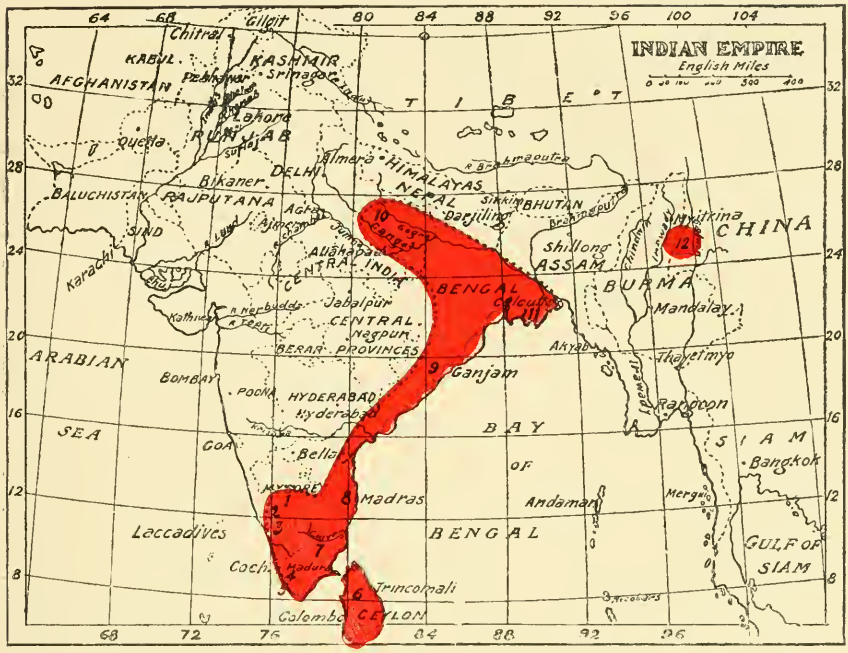
Though Ceylon is mentioned by Flower and Boulenger (Cat. 1896) I can find no authority for this. It was not mentioned in Haly's list of Ceylon snakes in 1891, nor in Willey's list published as recently as 1906 (Spol. Zeylan. April 1906. p. 233). Further though Jerdon says it occurs in Southern India I can find no record of it south of the Godavery River. There is a specimen in the British Museum presented by Jerdon, and reported as from Darjeeling. This in all probability means Darjeeling District, and probably came from the base of the Himalayas. I have had a specimen from Jalpaiguri in the same neighbourhood. Though known from Burma and Tenasserim it has not as yet been reported from the Andamans or Nicobars.

The precise localities known to me are shown in the accompanying map.

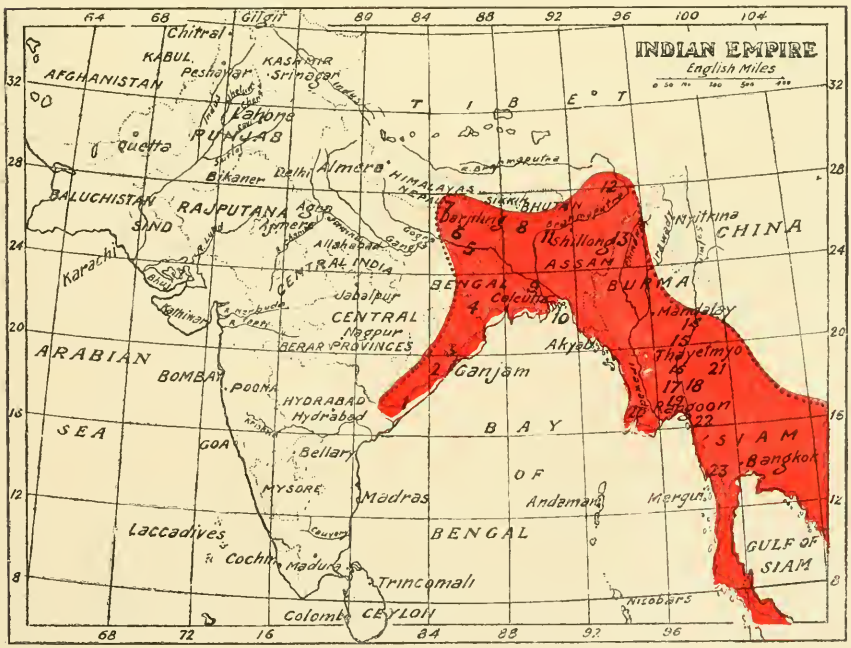
It may be a commoner snake in India than available records make it appear. In Assam too the same remark may apply. In Burma Theobald says it is common in the Pegu District, and Evans and I collected 9 specimens in 15 months, in the Lower part of that Province.

Distribution of *Helicops schistosus*.

.....Implies limits uncertain.



Distribution of *Hypsirhina enhydris*.



Lepidosis—Rostral.—Touches 4 shields. *Nasals*—In contact behind the rostral; semi-divided; in contact with only the 1st of the supralabial series. *Internasal.*—Single, broader than long. *Praefrontals*—A pair: in contact with internasal, loreal, præocular and supraocular. *Frontal*—Touches 6 shields, the fronto-supraocular sutures longest. *Supraocular.*—Breadth and length rather less than frontal. *Loreal*—One. *Praeocular*—One. *Postoculars*—Two. *Temporal*—One. *Supralabials*—8 normally, the 4th only touching the eye. *Infralabials*—6; the 6th longest, the 3rd, 4th, 5th and 6th, or the three latter only touching the posterior sublinguals. *Sublinguals*—Two pairs; the anterior larger. The posterior quite separated by scales. *Costals*—Two headslengths behind head usually 23 (rarely 25), midbody usually 21 (rarely 23), two headslengths before vent 21; smooth. *Ventrals*—150 to 177, rather narrow so that 3 or 4 rows of costals can be seen on each side when the snake is laid on its back. *Anal*—Divided. *Subcaudals*—47 to 78, divided.

Anomalies—I have seen two præoculars once, and two temporals once. The last two ventrals were divided in one specimen, and the last only in another. In another example the 38th to 54th subcaudals were entire.

Dentition.—Maxillary teeth 17, subequal; followed after a short gap that would take one tooth, by a pair of enlarged, obliquely set teeth deeply grooved on their anterior faces. *Palatine*—10 to 11 subequal, as well developed as the maxillary. *Pterygoid*—18 to 24, as well developed anteriorly as the maxillary; decreasing in size posteriorly. *Mandibular.*—23 to 24, subequal as long as the maxillary.

Our plate is excellent in every particular.

(*To be continued.*)

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plates and Diagrams.

BY

Major F. Wall, I.M.S., C.M.Z.S.

Part XIX with Plate XIX, Diagram and Map.

(*Continued from page 1021 of this Volume.*)

COLUBER HELENA (Daudin).

The genus *Coluber* is one of the many into which the family *Colubridæ* is divided, and belongs to the "aglyphous" (or fangless) series.

It contained, when Boulenger's Catalogue appeared in 1894, 45 species inhabiting Europe, Asia and America. Nine of these are known to occur within Indian limits. The type of the genus is the North American *C. guttatus*.

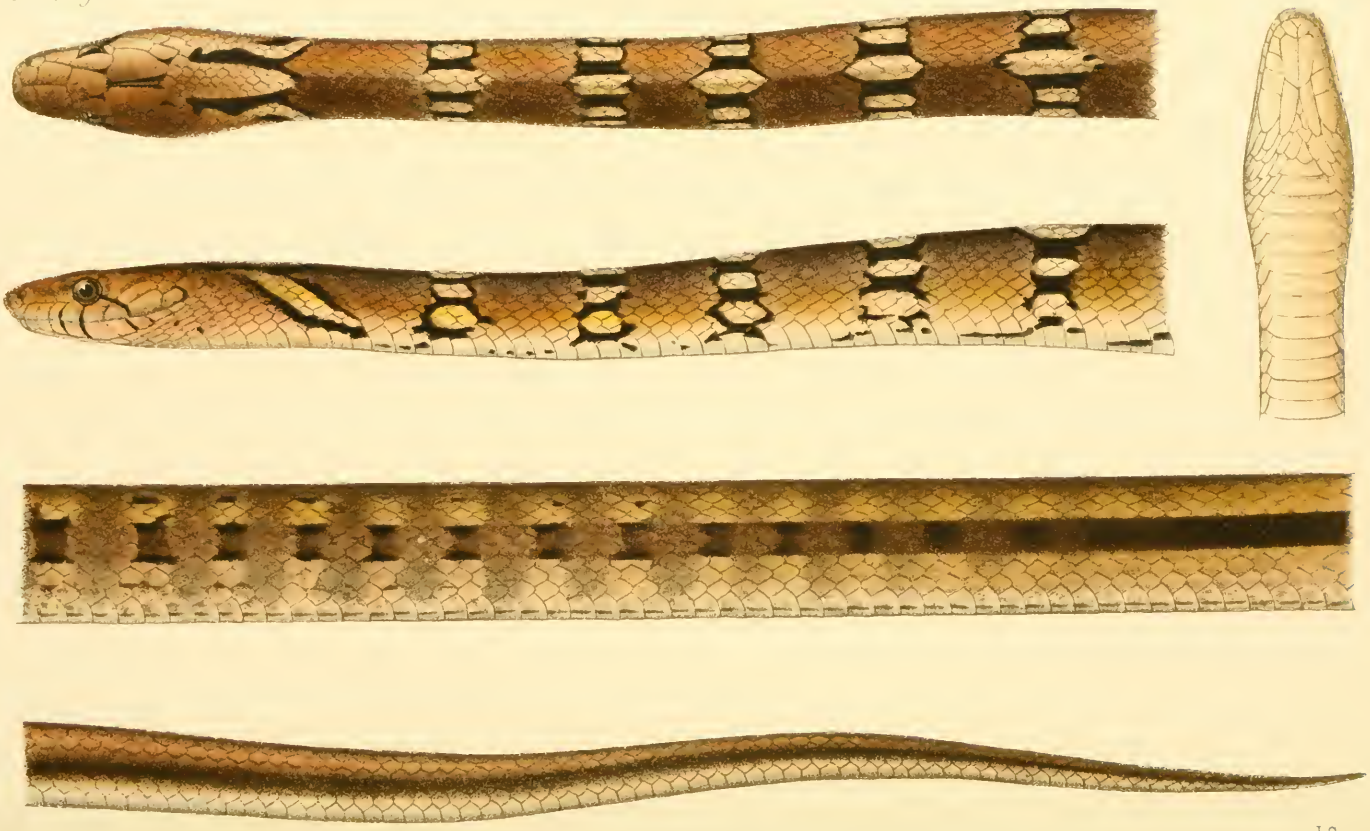
History.—Our earliest reference to *Coluber helena* is contained in Russell's work published in 1796, where it is figured (Vol. 1, plate XXXII), and some interesting notes are incorporated with a description of the snake.

Nomenclature—Scientific.—The generic name is from the Latin coluber, a term applied to any species in the same way as our English word "snake" is. Under this term Linné in 1766 included many species which subsequent authors on very good grounds have dissociated, and made the types of genera distinct. *Helena* the specific name was given to it by Daudin in 1803, in recognition of its beauty.

English.—"The trinket snake" suggests itself as appropriate, the beautiful ornamentation anteriorly reminding one of jewels set in a ring or trinket.

Vernacular.—Russell mentions the name "mega-rekula-poda" as in use about Vizagapatam, and Willey says in Ceylon it is called "mudu karawala."

General characters.—The head is rather narrow, with a somewhat elongate, and bluntly rounded snout. There is little or no indication of a *canthus rostralis*. The nostril is fairly large, and occupies about three-fourths of the upper part of the suture between the nasal shields. The eye is moderately large, rather less than half the length of the snout, and placed laterally. The pupil is round, or horizontally eliptical, and the iris is adorned with gold. The tongue pinkish at the base, becomes bluish black except at the very tips which are white. I noted in a specimen from the Nilgiris that the mucous membrane of the mouth was blackish.



J. G. del

THE COMMON INDIAN SNAKES. (Wall).

Coluber helena. *harmless, nat size.*

J. Green. Chromo

The neck is fairly evident, and the body which is robust, is compressed somewhat, and smooth. The belly is angulated obtusely on either side. The tail is short, and about one-fifth the total length of the snake.

Colour and markings.—The ground colour dorsally is brownish, but subject to much variation, some specimens being very light, others very dark. One I had from the Anamallays was almost blackish. On the face the brown fades to dirty yellow, or whitish on the lip. There is almost always a more or less obvious oblique black stripe from the eye to the lip before the gape, and often some, or all the sutures on both lips have dark streaks. The forebody for a variable length is very beautifully ornamented with ocellated cross-bars of a pattern peculiar to this among Indian snakes. In a well marked, and freshly sloughed specimen, such as we have figured in our Plate, these bars are outlined, and intersected with rich black, the intersecting lines being specially heavy. In Günther's * excellent figure those are shown in almost the entire length of the snake, but this is unusual. Frequently they are only seen in the anterior half of the body, and sometimes in a much more restricted length. In all specimens they become modified sooner or later, and gradually disappear. This is well shown in figure 3 of our Plate. On the nape there is usually, but not always, a conspicuous black mark, which may be V. shaped, or merely consist of two parallel lines. Sometimes these project backwards to connect two or three cross-bars, and in some specimens they resemble a hairpin rather than a capital V. In all the specimens I have seen from Western India as far North as about Bombay, the anterior cross-bars are connected by narrow festoons on the sides of the ventral shields. These are seen though somewhat more disconnected than usual in figure 2 of our Plate. There is no vestige of these in Himalayan specimens, nor do I find a trace of them in an example from Udaipur, in another from Broach, and in a third from Berhampore (Orissa).

On the sides of the body as the cross-bars fade, a dark and broad stripe gradually appears. This involves the upper half of the 3rd and the 4th, 5th, and 6th rows of scales above the ventrals and passes backwards along the tail to its tip.

The skin between the dorsal scales is pinkish. The belly is uniform pearly white, or faintly yellow in the middle, and more or less mottled with greyish beyond the angulation of the ventral shields. Russell figures a somewhat differently marked specimen from Vizagapatam in which the anterior two-thirds of the body is yellowish on the back, and pink on the sides. There are no cross-bars such as I have described above, but a dark

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* Rept. of Brit. India, Pl. XXI A.

zigzag line runs down the back with a white dot, at each angle of the zigzag.

Identification.—This is not difficult if attention is given to scale characters. The following combination of characters will distinguish it from other Indian snakes: (1) Scales 25 to 29 in mid-body, (2) an entire anal, (3) two or three labials touching the eye.

Dimensions.—Specimens over 4 feet are unusual, and over 5 feet rare. The largest I have seen measured 4 feet 11 inches from Matheran, 5 feet 2 inches, and 5 feet 3 inches from Paralai in the Anamallay Hills.

Disposition.—All who have remarked upon the species are in agreement as to its vicious temper. Russell * speaking of a specimen he had in Vizagapatam says: "It appeared singularly alert in its movements, and snapped at everything presented to it. In preparing to attack, it wreathed its neck, and part of the trunk, into close turns, and at the same time, retracting its head, presented, at a distance, something of the appearance of a hooded snake. When it snapped, the body being more raised by the assistance of the tail, the wreaths were rapidly unwreathed, and the head darted obliquely forward, with a motion so rapid, that the animal, without rising from the ground, seemed to fly on his prey. In this manner it could unexpectedly seize an object which in appearance lay far beyond its reach. A chicken, intended for experiment, having made its escape, was accidentally pursued into the chamber where the snake had been left at liberty, and was no sooner perceived than the snake flew furiously at him, snapped several times as he passed, and soon seized and secured him, by wreathing round the body. In two minutes the bird was found dead, having been strangled by the snake's tail.

A second chicken was attacked in like manner, and had he not been relieved in time, would have suffered the same fate. He was bitten in several places."

Colonel Light in a letter written to our Secretary remarks of one he got in Poona that "It showed great fierceness, and struck repeatedly at the stick when being killed." A young specimen I had in Bangalore I noted was wonderfully active. When teased it showed fight by erecting, and throwing the forepart of the body into broad sigmoid curves, which it straightened in the act of striking. It struck out repeatedly and in an upward direction much like the Dhaman (*Zamenis mucosus*). I noticed that prior to striking the neck was markedly compressed, the spine in this region arched, and the throat distinctly pouched, just, in fact, exactly similar to what I have seen in the Dhaman under similar circumstances. When erect the body scales anteriorly were

* *Loc. cit.*

separated, revealing the pinkish colour of the intervening skin, and enhancing the beauty of the little reptile.

Haunts.—As far as I am aware, it is usually to be found in or near jungle though this may not be very dense. It certainly frequently quarters itself in, and about well-populated areas, being frequently found in Cantonment limits, and it is no unusual circumstance for it to stray into habitations. One was killed in the Municipal Library in Almora two years ago, and another in my sweeper's house. This one would expect from the nature of its food.

Habits.—It is frequently encountered during the day, more often, I think, under these circumstances being disturbed from its lair in brushwood, than actively pursuing its quest for food. More usually in man's immediate environment, it seems to emerge as daylight fails, and is abroad at night.

One specially interesting trait in its character is its habit of constricting its prey prior to deglutition. Green* speaking of specimens in his vivarium says: "I have several times observed its capture of a small skink (*Lygosoma*, sp.). On one occasion the Coluber had captured a lizard, and was tightly constricting it, the whole body of the snake being twisted into a complicated knot. It commenced work upon the tail, which became detached from the body of the lizard and was promptly swallowed. The snake then apparently forgot that the largest part of its captive was still enclosed in the folds of its body, and began looking about for another victim. Eventually it re-discovered its original capture, and commenced to engulf it, drawing it gradually through the encompassing coils."

Food.—Under natural conditions a decided partiality is shown for mammalian fare, but it would seem that lizards, and even snakes are acceptable under press of hunger. Green† has frequently seen his captive specimens eat lizards, as already mentioned, but he remarks that in hunting lizards it is very inexpert, and repeatedly fails to effect a capture. As soon as the lizard stopped, the snake lost interest in it and appeared attracted by moving objects only. Mr. Millard writing to me some time ago said that a specimen in Bombay refused lizards and frogs, but took a mouse that was offered at once. One voracious individual tried on two occasions to eat snakes with which it was incarcerated. Once the species was *Chrysopelea ornata*, and once *Dendrophis pictus*.

Breeding.—It is remarkable that of the many specimens that have come into my hands none should have proved gravid. I know nothing of its breeding habits, nor can I find anything in the literature of the species to which I have access. The smallest

* Spol., Zeylan, Vol. III, Part X, p. 157, and Vol. III, Part XI, p. 197.
† *Loc. cit.*

specimens I have had were 1 foot $3\frac{3}{8}$ inches from Almora in March, 1 foot $3\frac{1}{4}$ and 1 foot $3\frac{1}{2}$ inches from Paralai, dates of capture unrecorded.

Parasites.—I have found the stomach invaded by the nematode worm *Kallicephalus willeyi.*

Distribution—(a) *Local.*—I have always regarded *Coluber helena* as a hill snake that rarely straggles into the plains in the proximate vicinity of hills, but it will be seen from our map that it occurs sparingly in certain localities at low elevations removed from hilly country. There is no doubt that it favours altitudes between about 1,500 and 6,000 feet, and below this it is in my experience a distinctly rare snake. Haly, in his List of Ceylon Snakes in 1886, wrote: "a very common up-country snake. The collection (Colombo Museum) possesses no specimen from the low country." Later, however, in 1891 he records one in the collection from Colombo. Ferguson, writing of the snakes * of Travancore in this Journal, says it is a common snake above an altitude of 1,000 feet. I have had many specimens from the Anamallays at an elevation of 3,500 to 4,000 feet, and I am told by Father Gombert that at Shembaganur in the Palneys it is common at 6,000 feet. I have had it from Kil Kotagiri in the Nilgiris above 5,000 feet. On the Mysore Plateau at about 2,000 to 3,000 feet, and at the same altitude on the Western Ghats it is not uncommon. In the Western Himalayas about Kumaon it is quite common, and I have had it from as far West at Bakloh. One cannot escape the conviction that it must occur in the Eastern Himalayas since a specimen in the Indian Museum is from Samaguting in the Naga Hills, Assam. If it occurs in the Eastern Hamalaya it must be rare as there is no record, as far as I am aware, from this region.

It is common in parts of Rajputana notably where the altitude exceeds about 1,500 feet, such places as Mount Abu, Udaipore, Ajmer, and Jeypore, all in or beside the Aravalli Hills. It is noteworthy also that Vizagapatam where Russell got his specimen is close to hills, and Berhampore (Orissa) from where I have had a specimen, is only ten miles or so from hills. On the other hand Karachi, Broach, Purneah District, 24 Parganas, and Colombo from whence there are records, cannot be said to be near hills.

A detailed enumeration of its known localities is given in our map.

Geographical distribution.—Ceylon, Hills of Peninsula India, Sind, Rajpootana, Western Hamalayas, Bengal, East of Purneah, Naga Hills, Assam.

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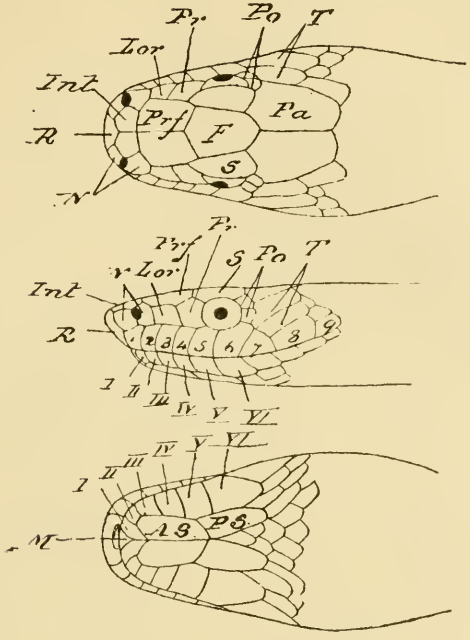
* Vol. x., p. 72.



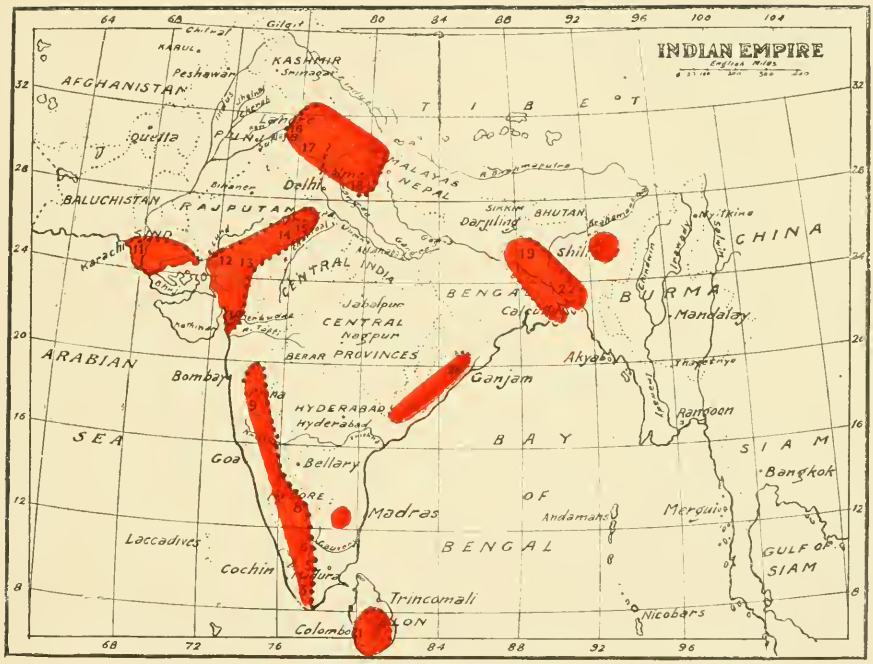
Coluber helena (1/1)

Lepidosis Rostral.—Touches 6 shields; the rostro-nasal sutures largest about twice the rostro-internasal. *Internasals.*—A pair; the suture between them half or less than half that between the præfrontal fellows, about two-thirds the internaso-præfrontal sutures. *Præfrontals.*—A pair; the suture between them rather greater than the præfronto-frontal; in contact with internasal, postnasal, loreal, præocular, and sometimes with the supraocular. *Frontal.*—Touches 6 shields usually, 8 when the præocular meets it; the fronto-supraocular sutures largest. *Supraoculars.*—As long as frontal, but not so broad in a line connecting the centres of the eyes. *Nasals.*—Two, almost entirely separated by the nostril, a suture running to the 1st supralabial. *Loreals.*—One rather longer than deep. *Præoculars.*—One. *Postoculars.*—Two. *Temporals.*—Two, the upper touching a supralabial usually, the 6th or 7th. *Supralabials.*—Very variable, 9, 10 or 11; usually two touch the eye, the 5th and 6th most constantly, sometimes the 6th and 7th, or in some examples three touch the eye. *Infralabials.*—6. The 5th and 6th touch the posterior sublinguals; the 6th is the longest and in contact with three scales behind. *Sublinguals.*—Two pairs, subequal or the anterior rather longer. *Costals.*—Subject to much variation. In midbody they may be 25 to 29. Anteriorly

the rows are two less than in midbody, and posteriorly six less when the rows are 25 in midbody, 8 less when 27 or 29 in midbody. The increase and decrease of the rows is interesting. Where they increase anteriorly (some 1 to 5 heads lengths behind the head), it is the 7th row from the vertebral that divides. Where the rows decrease at the first step (at or just behind the middle of the body) it is the 6th or 7th below the vertebral that is absorbed. In all the subsequent reductions the 9th or 10th rows below the vertebrals disappear. Keels are present in some of the median costals posteriorly, and some of the basal supracaudals, but are but feeble. Apical facets are present in pairs. *Ventrals.*—220 to 265 ; angulate laterally. *Anal.*—Entire. *Subcaudals.*—74 to 96, divided. *Anomalies.*—Blanford mentions a speciemen with two loreals.

Dentition.—*Maxillary* teeth 19 to 25, in an uninterrupted series, the median rather the longest. *Palatine* 10 to 14, subequal or median rather longest, as large as the maxillary. *Pterygoid* 15 to 30 (15 and 16 in a specimen from Bakloh, W. Himalayas ; 27 to 30 in an example from Paralai, Anamallay Hills). Smaller than the maxillary reducing in length posteriorly ; closely set with a strong inclination inwards, so that they lie nearly transversely to the jaw. *Mandibular* 22 to 30, subequal, or median slightly longest ; as large as maxillary.

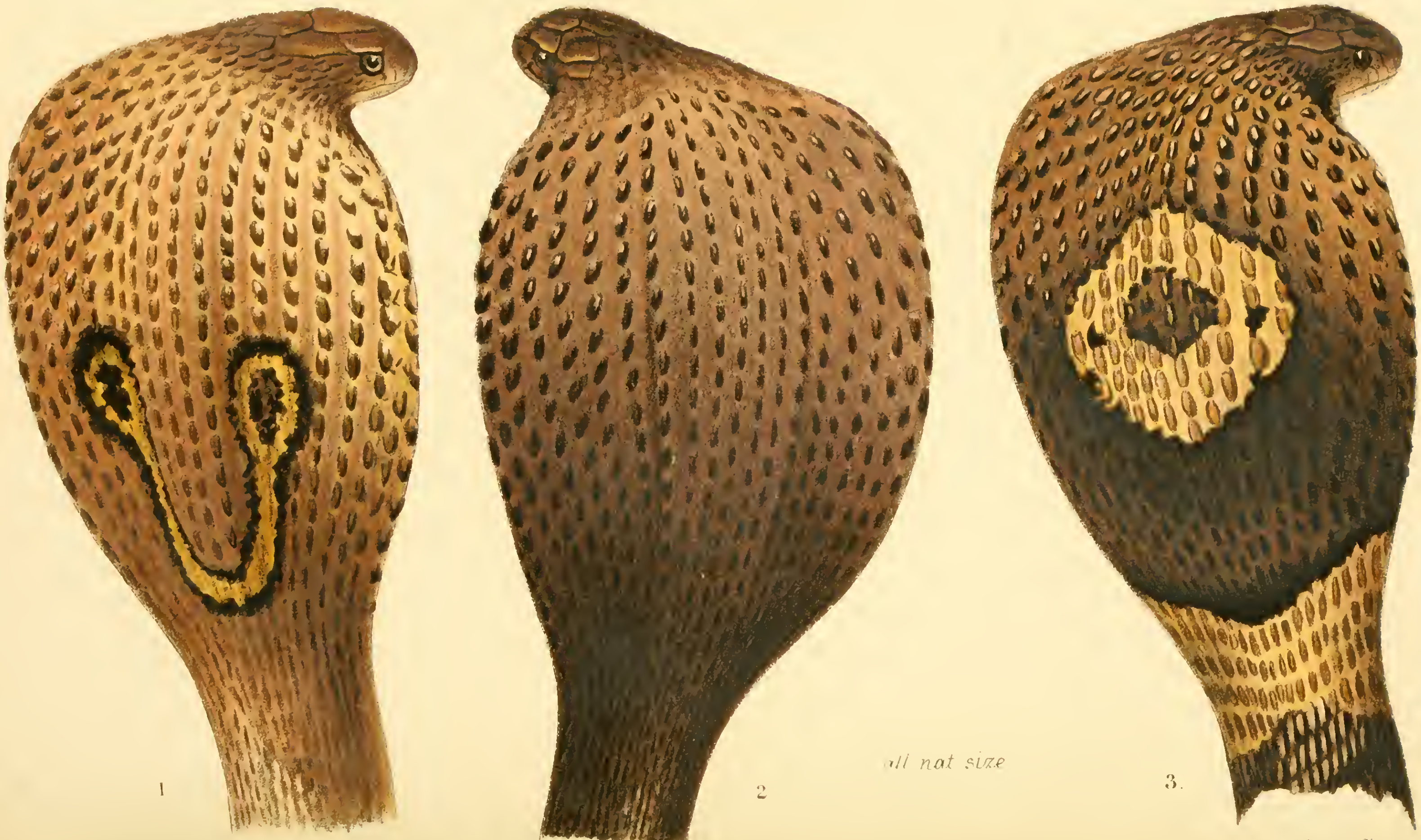
(*To be continued.*)



1 Colombo (Haly) near Galle (I. M.). 2 Ceylon Hills (Haly). 3 Travancore Hills (Ferguson). 4 Anamallays (B. M. and F. W.). 5 Palneys (Father Gombert in letter to me). 6 Nilgiris (F.W.). 7 Shevaroys (I.M.). 8 Bangalore (F.W.). 9 Poona. Khandalla. Matheran (B. M. and Bo. M.). 10 Broach (F.W.). 11 Karachi (I.M.). 12 Mount Aboo (I.M.). 13 Udaipore (F.W.). 14 Ajmere (I.M.). 15 Jeypore (I.M.). 16 Bakloh (F.W.) 17 Dehra Dun and Mussoorie (F.W.). 18 Almora (F.W.). 19 Caragola. Purneah District (I.M.). 20 Berhampore, Orissa (F.W.) 21 Vizagapatam (Russell). 22-24 Parganas (I.M.). 23 Samaguting Naga Hills (I.M.).

B.M. implies British Museum. I.M. Indian Museum. Bo. M. Our Society's collection. F.W., the author.

Dotted lines show uncertain limits



P. Gerhardt del

J. Green, Chromo

THE COMMON INDIAN SNAKES. (Wall.)

[illegible]

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plates and Diagrams.

BY

Major F. Wall, I.M.S., C.M.Z.S.

Part XX with Plate XX.

(*Continued from page* 28 *of this Volume.*)

Proteroglyphous colubrines or snakes with canaliculate fangs in the front of the maxillæ, are divided into two sub-families, *viz.*, *Hydrophiinæ* the sea snakes, and *Elapinæ*, the poisonous land colubrines. The latter included 29 genera when Mr. Boulenger's catalogue appeared in 1896, one of which—*Naia*—contains the subject of this paper. As classified by Mr. Boulenger the genus *Naia* comprises ten species, seven African, one peculiar to the Philippines, and two *viz.*, *tripudians* and *bungarus* denizens of Malayasia.

NAIA TRIPUDIANS (MERREM).

THE COBRA.

(Part I.)

History.—As one would expect the cobra is one of the very earliest snakes to receive mention in scientific literature. Long before the inauguration of scientific nomenclature it was referred to. Seba in 1734 appears to have been the first to describe, and figure it. Later in 1754 Linné figured it, and from him it received its scientific baptism under the name *Colober naja*. Laurenti was the next to refer to it under the name *Naja lutescens* in 1768, and then Russell described and figured it in both his volumes which appeared in 1796 and 1801. In addition this authority wrote much on the effects of its poison, and reported many cases of cobra bitten subjects. In the 19th century it is referred to under a host of names by every herpetologist who has written on the Indian snakes.

Nomenclature—(*a*) *Scientific.*—The generic name introduced by Laurenti, was borrowed from the specific title bestowed upon it by his predecessor Linné.

"Nag," the Sanscrit word for snake, is most probably the origin of Linné's "Naja," but why the "j" has been substituted for the "g" it is difficult to understand. It is still more difficult to understand why the word once latinised as "Naja," and accepted by every herpetologist as such for over a century, should appear as a

"Naia" in Mr. Boulenger's works.* I notice Professor Stejneger in his more recent work† adheres to the original rendering of the word, and I also prefer to accept this.

The specific title "tripudians" bestowed by Merrem is from the Latin meaning literally "dancing on the toe." This is obviously in allusion to the cobra's characteristic attitude when excited.

(*b*) *English.*—To Europeans generally the snake is known as "the cobra" a word however applied in Portuguese to any snake. The Portuguese always referred to it as the "cobra de capello" or "hooded snake," and for many years subsequent to their occupation of India the qualifying adjective, now obsolete, was retained to distinguish it from the "cobra monil" or "necklace snake" (Russell's viper), the "cobra de aqua, or "water snake," etc., etc.

(*c*) *Vernacular.*—In most parts of India the cobra is known to the natives as "nag," "nag samp," or some variation of "nag." The varieties that natives pretend to recognise, and to which they apply special names are endless. Every juggler has a dozen qualifying terms, at his command, and no two jugglers will agree in the name they apply to a given individual. One hears of "arege nagoo," "coodum (wheat) nagoo, "jonna nagoo," based on colours resembling that of various cereals, "chinta" or "scinta (tamarind) nagoo," "malle (jasmine) nagoo" and "mogla nagoo" based on the names of plants. "cowri nagoo" and "sankoo nagoo" based on the names of shells. "kala nag," "sata nag," and a host of other "nags." Such names mostly emanate from professional snake men, and are of little or no interest, but there are many other local names that deserve mention. "Naya" is the name applied to the cobra by the Singhalese in Ceylon, but in this Island where so much Tamil labour is employed, South Indian names are frequently heard, such as "nalla pambu" (good snake), and "naga pambu." On the West Coast I heard "murukan" literally "cruel," and "sair-poom," both Malayalam words applied to it. In Mysore the Canarese call it "nagara hava." In Bengal where the two forms, *viz.*, the binocellate and the monocellate are associated, the former is known as "naga gokurra." and the latter as "keauthia", according to Fayrer, Ewart, Nicholson and others with "kala" or other qualifying prefixes "Gorhmon" is another name used in Bengal for pale varieties according to Simson.‡ Mr. D'Abreu tells me that in Behar "goh-manna" and "nag" are in use. In the North-West about Rawal Pindi "chajli" or "chajliwalla" is the common name for the cobra. "Chaj." I understand, is the Pushtu for a winnowing fan, which its dilated hood is somewhat fancifully held to resemble. Another Pushtu name in allusion to the hood is, I am told, common

* Faun. Brit. Ind. Reptilia and Batrachia and Cat. Snakes, British Museum.
† Herp. of Japan.
‡ Letters on Sport in Eastern Bengal, p. 239.

about Peshawar, *viz.*, "chamcha-mar" (spoonsnake). The comparison to a flattened spoon is quite a good one, and has been noticed by natives in other parts. "mywe howk," the usual name for the cobra in Burma implies "hissing snake." In the Chin Hills, Venning* tells us, the vernacular name is "thua-kan." Flower† writing of Siamese snakes says, the cobra in Siam is called "ngu how." The same authority mentions "toodong sta" as the name for it among the Malays at Kedah. Cantor, however, gives the Malay name for it as "ular mata -ari" (sun snake), and Annandale and Robinson‡ "ular tedong sendok kunyit" meaning "turmeric ladle hood snake."

Varieties.—I think it wisest in this paper to adhere to the arrangement of the varieties contained in Mr. Boulenger's catalogue (Vol. III, p. 380). Though my notes are voluminous and I have examined many hundreds of cobras I do not consider the material I have worked upon adequate to justify the introduction of another system yet. I have appealed through this journal to our readers to assist our Society in procuring specimens from every part of India, and this may be possible hereafter¶.

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* Bomb. N. H. Jourl., Vol., XX, p. 335.

† P. Z. S. 1899, p. 690.

‡ Fasci., Malay, 1903, p. 168.

¶ From the available literature at my disposal, and the much larger materia contained in my note-books I realise that the classification of the cobra (*N. tripudians*) is a very complicated matter. Stejneger (Herp., Japan, p. 394) suggests that a method based on lepidosis, *i.e.*, scale rows, ventrals and subcaudals is more scientific, and might be productive of a better grouping of the varieties than the scheme laid down by Boulenger which gives primary attention to colour, and hood markings. My own views accord completely with those of Stejneger, and I think that most herpetologists would unhesitatingly allow that lepidosis is of far greater importance than coloration. A scheme based primarily on lepidosis however does not pan out as satisfactorily as Stejneger anticipated, still complicated though it remains it is less so than Boulenger's scheme, and it groups the specimens much more satisfactorily in accordance with geographical areas.

I find that in many localities the variations in colour and hood marks are very numerous, whereas there is a very close agreement in scale characters. According to Boulenger's method a specimen from South India (where the scale rows in midbody are invariably 23 to 25) which has no mark on the hood, is grouped with a specimen from the Punjab without a hood mark, though in the Punjab all the cobras have but 21 scales in midbody !. Into the same group falls the *oxiana* of Eichwald, a variety with a range of ventrals and subcaudals distinct from the cobras of the East of Asia, and with a distinct geographical distribution restricted to the North-Western part of our Indian Empire, and beyond. An anocellate cobra from Burma, Java, or even the Philippines falls into the same group, *viz.*, variety *B. cæca.*

It seems to me this method is as unscientific as it is unsatisfactory. The fact is the colour and hood marks of individuals in many localities are too varied to permit of their being grouped satisfactorily on these characters. As an example, take the cobra referred to usually as the black *cæca.* A typical specimen is black, and bears a hood mark. In Fyzabad, U. P., a uniform black or blackish cobra was the commonest form. Many of these had a perfect "spectacle" mark on the hood, many had a modified or disintegrated "spectacle," some had one or more spots which however were placed in the situation usually occupied by the "spectacle" and some rare individuals had no indication of even a spot. The marks in many of these black specimens are obscure, often so much so

that they escape notice unless specially looked for, and even then are often but obscurely visible or suggested. In Almora again the prevalent cobra is a black one. Just as in the Fyzabad specimens I find some with perfect spectacles, some with disintegrated spectacles, and some with no trace of a mark. Mr. Mackinnon some years ago told me all the cobras in the Dun were black, and without spectacles, but while I was in Mussoorie he sent me one from the Dun on which I found a very perfect and distinct spectacle. Colonel Bannerman sent me specimen of a black cobra with no hood marks from the Central Provinces All his first specimens, I discovered, showed obscure but unmistakable indications of a disintegrated spectacle, and he had some trouble to eventually find a specimen without any mark at all on the hood. Major O. A. Smith told me the common cobra in Multan is a black one with no hood marks. One that he sent me however had a very perfect "spectacle." From this it appears to me conclusive that the form "*cæca*" does not deserve recognition as a variety apart from "*typica*," and only a few deserve the name "*cæca*" as hitherto understood, many being typically spectacled, and a host of intermediate forms cannot be placed in either category, (*i.e.*, *cæca* or *typica* as previously defined).

The only form I saw in Chitral where it was common was the *oxiana* of Eichwald. One specimen however was uniformly blackish instead of being an olivaceous-brown with darker cross bars anteriorly, breaking up later into an irregular variegation. This specimen however accorded well with the ranges of ventrals and subcaudals found peculiar to variety *oxiana*, and not with those characteristic of the black Indian form called *cæca*, which it so closely resembled. Similarly a specimen from Duki, N. Baluchistan without any trace of dark cross bars anteriorly showed a range of ventrals and subcaudals typical of *oxiana*, and not of the Indian forms, and this should thus, I hold, be classed as an aberrant colour variety of *oxiana*.

Mr. Boulenger arranges the varieties as follows :—

"A.—Forma Typica (*C. naja*, *L.* ; *N. lutescens*, *fasciata*, *brasiliensis*, *siamensis*, Laur.; *C. rufus*, Gmel.).—Yellowish to dark brown above, with black-and-white spectacle-mark on the hood and a black-and-white spot on each side of the lower surface of the hood. 25 to 35 scales across the neck, 23 to 25 across the middle of the body.

(*a*) One or two dark brown cross-bands on the belly behind the hood.

(*b*) Body variegated with darker, and lighter; belly with several dark cross-bands which may extend across the back.

B.—Var. Cæca (*N. non-naja*, Laur.; *C. cæcus*, Gmel.; *T. oxiana*, Eichw.).—Uniform pale brown or grey to blackish; no marking on the hood; one or more dark cross-bands on the anterior part of the belly; young sometimes with dark rings. 25-31 scales across the back, 21-25 across the middle of the body.

C.—Var. Fasciata, Gray (*N. kaouthia*, Less.; *N. larvata*, Cant.; var. *scopinucha*, Cope).—Brown, olive, or blackish above, often with more or less distinct light, black-edged cross-bars; hood with a whitish, black edged ring or U, or with a mask-shaped figure; a black spot on each side under the hood. 25-31 scales across the neck, 19 to 21 across the middle of the body.

(*a*) Body dark brown behind, with light variegations; two to four blackish cross-bars under the anterior part of the body.

(*b*) Olive to blackish above, the skin between the scales black;

lower surface of neck white, with a black cross-bar, rest of lower part dark brown or blackish.

D.—Var. SPUTATRIX (*N. sputatrix*, Boie; var. *nigra*, Gray; *N. atra*, Cantor).—Black or dark brown above and beneath, with some yellow or orange on the sides of the head, and neck; young with a pale U or O-shaped marking on the hood, and the chin and throat whitish. 25 scales across the neck, 19-21 across the middle of the body.

E.—Var. LEUCODIRA.—Brown or blackish; no marking on the hood; lower surface of neck yellowish white, followed by a black cross-band, and usually with an azygos black spot anteriorly and one or two on each side. 21-25 scales across the neck, 17 to 19 across the middle of the body.

F.—Var. MIOLEPIS.—Dark brown or black; sides of head and throat yellowish, whitish in the young; no marking on the hood; young with whitish rings completely encircling the body and tail, and with the white of the sides of the neck extending backwards towards its fellow to form an angular band behind the hood. 21-23 scales across the neck, 17 to 19 across the middle of the body."

To these varieties I can add the following which I cannot place in the above scheme.

In Shillong (Khasi Hills, Assam) I was told by three people independently of a bright green cobra that was in the possession of a juggler shortly before my visit. Unfortunately the man had evidently left the station as I could not trace him. Curiously enough talking to Mr. W. Tottenham. Commissioner of Forests in Dibrugarh, a few days before this he mentioned a bright green cobra that he had encountered in North Siam, at a place called Nan on the Mekong River, but which for want of spirit he could not preserve. On my publishing this information in this Journal * I heard from Mr. H. Hampton from the Ruby Mines, Burma, that the natives there report the existence of a green cobra, but though he has tried for years he has failed to procure a specimen. The Burmans call this snake "indaing-mwe-howk." Further two Europeans told him they had seen this snake, but described it as a bright blue. Shan visitors to the menagerie confirm these statements, and report the snake as rare. Variety *viridis* would be a suitable name for it.

I have examined a curious variety of the cobra from the Andamans submitted to me by Dr. Annandale from the Indian Museum. It differs in colouration from anything I had previously seen, and does not conform to anything I have read of. It is fawn coloured and has well defined, broad, black, chevrons running

* Vol. XVIII, p. 331.

down the back, the apices directed forwards, and the arms ending low in the flanks. The intervals are about one-third to one-fourth the width of the chevrons. Also in the flanks between each chevron is a small black triangular spot. The hood bears a light monocellus. The ventrals and subcaudals are 175 and 65, the scales in midbody 21, and the lepidosis as in a normal cobra except that the præocular shield fails to touch the internasal. If not already christened I suggest for this the name *sagittifera*.

Dimensions.—The cobra when adult measures usually from four and a half to five and a half feet. Larger specimens are rare, and six-footers extremely rare. Dr. Nicholson*, who for some time distributed the rewards for poisonous snakes on behalf of the Mysore Government, says that out of 1,200 specimens that passed through his hands at Bangalore only 4 exceeded 5 feet 6 inches, and the largest of these measured 5 feet 8 inches. I have probably examined 500 cobras from various parts of Asia between Baluchistan and Chitral to South China. I have only once seen a six footer and this was sent to me by Mr. P. W. Mackinnon and was killed in the Dun. It taped 6 feet 4 inches. Mr. H. Hampton writing to me from Mogok, Ruby Mines, Burma, early last year, told me he had obtained a specimen of a precisely similar length, which he had sent to the British Museum. He further stated that Mr. Boulenger in acknowledging the specimen told him it was the largest received in that Institution where there are upwards of 70 examples. Mr. Millard has told me of two specimens he has seen, one 6 foot from Khandalla, and another 6 feet 5½ inches, locality not specified. Mr. C. Bateman wrote to me in 1909 that he had killed one of the monocellate variety in the Jalpaiguri District that measured 6 feet 5½ inches unstretched. Writing to Mr. Millard in 1906, Mr. S. H. Pearless said that the four largest examples he had killed at Badulla, Ceylon, measured respectively 5′-11″, 6′-0½″, 6′-6″, and 6′-10½″, and he believed specimens running to 7 feet were on record. *The Pioneer* of the 12th February 1908 contained an account of a 7 foot cobra, quoted from the *Times of Ceylon*. It appears that on the 31st January 1908, Mr. Webster whilst motoring Sir Thomas Lipton in Colombo saw a crowd of natives collected on the road. These proved to be watching a hole in which a snake was partly visible. Mr. Webster by means of a noose of rope managed to extract the snake, and kill it, and it was found to be a cobra of unusual length which when taped measured 7 feet. The account further stated that a local taxidermist set up the specimen. On writing to Sir Thomas Lipton he repeated this story to me, and gave me permission to see the specimen in his

* Indian Snakes, pp. 106 and 173.

residence at Osidge. It is set up in the erect posture with open mouth, showing the fangs. I measured it, and found it taped 6 feet 7½ inches. * Our Society has recently acquired a specimen, from Shamshirnagar, 6 feet 7 inches unskinned. Lyddeker † says one has been recorded 7 feet 3 inches in length, but gives no details of the locality where it was found nor the authority who measured it.

General characters.—The head is depressed, the snout rather short, with no canthus, and broadly rounded as seen from above. The nostril is rather large, and occupies the full depth of the suture between the nasal shields. The eye is moderate in size, and the round shape of the pupil can usually be well seen in life. In some specimens however the usually distinct arc of gold at the pupillary edge may be so faint that the pupil does not show up against the iris. There is a more or less obvious swelling in the temporal region over the underlying poison glands. The tongue is blackish at the tips.

The shields on the head are highly polished. A neck is scarcely if at all evident. Just behind the neck the hood commences, and is discussed later. The body is depressed, and there is a more or less distinct narrow groove down the spine. The scales over the back like those on the head are highly polished. The body maintains a fairly uniform girth throughout. The tail is short, and accounts for from one-fifth to one-ninth the total length.

It is very interesting how much the relative length of the cobra's tail differs in various localities, and I wish in my earlier days I had been more careful to record this, for it may, I think, assist in the difficult question of the classification of the varieties. I find that in Cannanore the tail in ♂ ♂ was one-eighth the total length, and in ♀ ♀ about one-ninth. In Fyzabad and Almora the tail is about one-sixth in both sexes. In Chitral it was also about one-sixth, and often in males only two-elevenths. In the Punjab it was as much as one-fifth in some males, and from one-fifth to one-sixth in females. In Burmah it was usually one-sixth in males, and varied from one-fifth to one-seventh in females.

Identification.—This is easy if attention is paid to the lepidosis. The presence of the little "cuneate" scale between the 4th and 5th infralabials (see ‡ Diagram Cun.) will declare the snake a cobra among all *land* snakes. It is found in many of the sea snakes however. Rarely two such scales exist in the cobra, but it is very rarely absent on both sides. Another important relationship is that of the præocular with the internasal shield. (*Vide* figure Pra. and Int.) This is only seen in the snail snake, *Amblv-*

* Jour. Bom. Nat. Hist. Soc., Vol. XXI, p. 718.
† Royal Nat. Hist. Reptilia and Fishes, p. 223.
‡ Will be published in the second part.

cephalus monticola peculiar to the Eastern Himalayas, the Assam Hills, and Nicobar Islands, and as an abnormality in the little *Xylophis perroteti* known from the hills of Southern India. In neither of these does the 3rd supralabial shield touch the eye as it does always in the cobra.

If a typical hood mark is present either of the monocellate, or binocellate type the diagnosis is also easy, but in many specimens there is no hood mark at all, and in death rigor mortis stiffens the joints so that the hood is not easily demonstrable. It is for this reason that attention to shield characters is recommended. If the hood is seen dilated in life there should not be any doubt about the snake, but it must be remembered, that the hamadryad (*N. bungarus*) has a well developed hood and that other snakes flatten the neck to a more limited degree. The cobra has been confused by Europeans and natives with the *Pseudoxenodon macrops* in the Eastern Himalayas, and Assam, and Burmese Hills, and with the *Zamenis fasciolatus* a snake common in the Western Ghats, but also known from the Eastern Ghats, and the Ganges Valley.

Disposition.—The cobra is usually not an aggressive snake. When flushed in its native haunts it nearly always tries to escape, and usually succeeds in doing so, but is often shot before it gets to a place of safety. I have encountered many, and find that at close quarters if suddenly disturbed, or it may be if stepped upon, it quickly erects itself, hisses loudly, sways backwards and forwards and awaits its opportunity to strike. If one keeps still, the menace is quickly over, and the snake drops its head, and slinks off. An incautious movement however causes it to turn, erect itself once more, and challenge the intruder again. Many good observers have remarked on its timid nature. Mr. Phipson even went so far as to describe it as an exceedingly timid snake. Elliot* says : " Of one thing I feel certain, the cobra is a timid snake, that it is not at all inclined to bite, and unless assailed, and so infuriated will not bite, even if trodden on by accident so long as the snake is not hurt." He cites two cases known to him where a cobra was actually stepped on, but in neither case did it inflict a bite. Wall (A. J.) remarks that a full grown cobra can be handled with perfect safety, and Flower mentions one that was picked up in his garden by a servant, and brought to him alive not having attempted to bite him.

In Chitral one day an adult passed right through my pony's legs, whilst I was walking along the road with another mounted officer. The snake did not even erect itself though in danger of being trodden upon, but glided through the pony's feet, and then when three or four yards distant turned, half erected itself for a second, and then

* Gold, Sport, and Coffee Planting in Mysore, p. 164.

glided off down a bank. I could quote many more incidents and opinions illustrating the unaggressive temper of this snake, but on the other hand I have certainly witnessed many incidents of a completely contrary character. The cobra is sometimes very fierce, and when disturbed may be a very dangerous snake to encounter. Whatever spirit and aggressiveness may be natural to it in the early days of captivity, I think all will agree that it is very easily tamed. This is evident to anyone who has seen jugglers, and professional snake-men with their captive specimens. If a specimen has been on show for long, it will often require a good slap on its back to provoke it to erect itself and hiss. The cobra that will do so without such treatment one may depend upon it has been but recently deprived of its liberty.

Young cobras are much more dangerous than adults as a rule. They seem more on the alert, more easily excited, and strike repeatedly and with much malice. Wall (A. J.) speaks in similar terms when he says: "When the young cobra is hatched, it is very small, very irritable and exceedingly dangerous. A full grown cobra can be handled with perfect safety, but a young one, ten or eleven inches long, is so active, and its body is so small, that it can be scarcely touched with impunity." It is certainly significant that one never sees a young cobra in the hands of jugglers.

The cobra's effective striking range is a very limited one. I believe the erection of its forebody and the expansion of its hood are invariable preliminaries, and the height to which it can erect itself forms the radius of its stroke. This radius when the snake is erect is very deceptive, appearing much greater than it proves to be when measured along the ground on the completion of its stroke. Jugglers from long practice estimate this range wonderfully, and contrive to evade their captive's menace, with remarkable precision, withdrawing their hands often only a few inches from the spot where the stroke is delivered.

The bite is often a mere snap of the jaws, and the bitten part immediately released, but sometimes the snake will fasten itself tenaciously, necessitating a forcible opening of the jaws to effect release. Mr. Donaghy told me of an incident witnessed by him where a young sampwalla was bitten, and the snake hung on to him so that it had to be removed by forcibly prizing open the jaws. Sometimes after a bite a drop or more of venom may be seen on the skin of the bitten subject which may be wiped off without gaining access to the punctures inflicted. More rarely poison is shaken off in the form of a spray or jet by the forcible thrust forward of the snake, which may fail to reach the object of its attack.

I have on more than one occasion witnessed this with jugglers who unconcernedly wiped away the poison emitted. In our

Journal* Mr. Goring Jones reported a cobra at Mandalay striking at Lieut. Gibson who was bending down near the snake. He was not actually struck, but had poison ejected into his eye, much swelling and pain following. A Hospital Assistant of mine, whilst trying to dislodge a cobra that had taken refuge in the wall of his garden, had a jet of poison ejected into his face. Mr. Kinnear tells me that in our Society's rooms it is a matter of common observation that cobras "spit" at spectators and leave a spray on the glass. One may presume that some such incident caused Boie to christen one variety of our Indian cobra *sputatrix* (spitter). The habit is well known among certain African cobras, notably *N. flava*, *N. nigricollis*, and perhaps *N. melanoleuca* † I believe the venom ejected is shaken off the fangs, and carried forward by the vehemence of the thrust. In some instances, however, where a shower of spray is reported it is more probably caused by the explosive expiratory blasts from the glottis which occur while the snake is hissing, and to which I refer again later.

Haunts.—The Cobra may be found almost anywhere. I have encountered it in heavy jungle, and in open country far removed from forest growth. The ryot disturbs it in his crops, the mali in Cantonment gardens, and the sportsman when quail, partridge or hare shooting. It is a common snake in almost every populated area, and I have had it sent to me frequently from within Cantonment limits, from the regimental and other bazaars, from Artillery and other lines, the suburbs and actually in the gardens of our largest towns, from inside jails, the godowns of the Supply and Transport Corps, and the Telegraph and such like departments, from the warehouses of various mills, and such like situations. No amount of bustle or disturbance seems to deter it from taking up its abode in man's immediate vicinity. It was sent in to me several times in Rangoon from timber yards, where hundreds of men were working daily, elephants pounding up and down moving timber, engines vibrating and throbbing and circular saws screeching through boles of teak. Even in such scenes of turmoil it will establish itself beneath a stack of wood, or convenient drain, and escape dislodgment for long periods.

Old masonry invariably harbours cobras among other snakes. In Delhi the old walls of the Fort were always a safe draw for the snakeman whom I saw every week bring in his bag—some half dozen or more—to be robbed of their poison, which was being collected for the Government of India. Similarly old cemeteries, and ruined habitations, mosques, etc., furnish ideal quarters for

* Vol. xiii., p. 376.

† The spitting snake of S. Africa is usually admitted to be *Scpedon hæmachates* the "ringhals" of the Dutch.

this snake. Another favourite haunt is the loose brick work of old wells. The basements of many houses in Cantonments and bazaars can boast a cobra tenant, and it is not surprising therefore that this snake is so frequently encountered inside bath-rooms, and dwelling rooms, besides stables and servant's habitations. Further afield an ant's nest is often a specially favoured resort, or it may be any hole in the ground, or at the basement of a tree among its roots. It is frequently found near water, and often actually in that element, in which it swims with facility and strength.

A few cases of cobras climbing trees are reported, the object usually being the plunder of some bird's nest.

It has been occasionally reported in the sea, perhaps carried thence by rivers in flood time, but sometimes no river being in the vicinity it must have taken to the sea of its own free will. In one instance a four footer is said to have managed to board a man-of-war, *viz.*, the Wellington, lying off the Coast of Ceylon at Aripo.* Another account of the incident † however, says that the sailors saw the snake in the sea swimming vigorously towards the ship, and assailed it so successfully with billets of wood and other missiles that it returned to land. Bassett Smith in this Journal‡ mentions one fourteen inches long trying to board the flagship at Trincomalee when lying out about half a mile from land.

Food.—The cobra feeds principally on rats, frogs, toads, and less frequently on birds and it seems to show no special preference for any of these creatures. Its choice in batrachians is largely determined by their size, the most bulky individuals being apparently those most sought after. Thus among frogs it is the bull frog, *Rana tigrina*, which is most usually victimised, and among toads *Bufo melanostictus*, and *B. andersoni* receive special attention, and internal accommodation. Rats and mice are very frequently taken, and I think there can be no doubt the numbers of these vermine are materially checked by this snake. I was astonished in Bangalore some years back to see with what avidity the captive cobra belonging to a juggler, accepted dead mice which he withdrew from his pocket. The man offered them as one would a morsel to a dog and one of his cobras nosed its snout into his hand, and took three mice, swallowing them one after another in a couple of minutes or so. Other creatures are taken as circumstances dictate. The Rev. C. Leigh, S.J., writing from Trichinopoly of his captive specimens told me that after eating two small frogs, and then three middle sized ones, one cobra finally disposed of two squirrels (*Sciurus palmarum*). Sometimes birds are attacked, and

* "Ceylon" by an Officer late of the Ceylon Rifles, Vol. II, p. 89.
† Tennants' "Ceylon," Vol. I, page 193-4.
‡ Vol. XI, p. 547.

killed, especially poultry. In Fyzabad one got under a hen coop one night in a native hut, and killed the hen and six chicks. The snake met its death the next night, swallowing a frog bated on a hook. On another occasion one got into a quailery in Fyzabad, and accounted for 13 birds in the night. One only of these had been swallowed, and it seems to me likely that some or all the rest may have died from fright. Only recently in Almora an officer whilst quail shooting flushed a cobra which he shot in attempting to escape down a hole. The snake was cut in half by the shot and a freshly swallowed quail fell out of the stomach. Ferguson* mentions one in this Journal, that was brought in to him at Trivandrum enormously distended. It measured four feet, and contained a monitor lizard (*Varanus bengalensis*) two feet long. Phipson mentions lizards being taken by the young in our Society's rooms. Occasionally the cobra exhibits ophiophagous tastes. Mr. Millard tells me that one in our Society's rooms ate another with which it was caged, both snakes having seized the same frog, and commenced eating from opposite ends. On another occasion one was observed to eat a wolf-snake (*Lycodon aulicus*). Mr. Frere recently sent me a young example measuring 14½ inches, that was eating a *Lycodon aulicus* measuring 13½ inches. I saw one once in a well in Trichinopoly in the act of devouring a gamma snake (*Dipsadomorphus trigonatus*). Colonel G. H. Evans found one in Burma eating a young snake of the genus *Simotes*. Mr. Kinlock wrote to me of one he encountered at Kil Kotageri. It measured 5 feet 7 inches, and was engulfing a dhaman (*Zamenis mucosus*) 6 feet long. Flower† again mentions one in Siam swallowing a snake (*Macropisthodon rhodomelas*.) Here I may mention that the cobra itself sometimes falls a victim to its larger and more confirmed ophiophagous relative the King cobra (*Naja bungarus*).

Some interesting accounts have appeared in this Journal of cobras eating the eggs of poultry. Mr. C. P. George recovered the egg of a guinea fowl from a cobra's interior, which he set, and in due course hatched out. Miss Hopley in her book on snakes (p. 60) records an exactly parallel incident.

In this case however the egg was a hen's. It was marked after extraction and placed under a guinea fowl, and successfully incubated. Mr. Brook Fox records a cobra that had got into a guinea fowl's nest, and had eaten 6 of the 15 eggs. It was photographed in this state. The eggs were subsequently removed, and set and 3 eventually hatched out. After the publishing of these events Colonel Bannerman experimented on cobras in the Parel Laboratory, to ascertain how long it took for the egg shell

* Vol. X, p. 75.

† P. Z. S., 1896, p. 894, Vol. XVI, pp. 174, 363, 369 and 395.

to dissolve under the influence of the gastric pieces, and he found that it required about 48 hours. Inspection of the subsequent excrements showed in one case that a few pieces of egg shell were discharged 16 days after the experiment.

In captivity many specimens feed eagerly, and thrive well. Mr. Phipson wrote that those in the Society's rooms "fed freely on rats, birds, and toads." Similarly Ferguson said those at Trivandrum took large frogs "with avidity." The Rev. C. Leigh wrote to me that one of his captive specimens ate "rats with relish," and two others "took frogs with avidity." On the other hand Dr. Nicholson speaking of cobras in captivity says "I have never seen a cobra feed and I think that unless fed by force he will starve himself to death." This statement coming from such an authority is remarkable, but it would appear from the methods of some professional snake-men that they too find some of their specimens difficult to tempt with food, for many carry with them a small natural funnel which appears to be part of the shaft of the tibia of a goat, which they insert into some cobras' throats, and into which they break a fowl's egg, or pour milk.

Habits.—The most notable habit in the cobra is the very remarkable pose it adopts when alarmed and which has gained for it world-wide renown. Not only does it erect the forebody to a remarkable degree, but it flattens its neck in a very remarkable, and characteristic way to form the so called "hood." The height to which a cobra can erect itself is usually very much overestimated by the casual observer. I have taken careful measurements on several occasions, marking off the height on a stick when the snake's attention was engaged by a juggler. The measurement of the whole snake in life is not easy, and the lengths given must not be taken as very exact. I found the degree of erection commensurate with the degree of excitement or provocation. One snake measuring 5 feet $2\frac{1}{2}$ inches poised vertically to a height of 13 inches, another 5 feet 4 inches long sat up $15\frac{1}{2}$ inches, a third 6 feet and $\frac{1}{2}$ an inch raised itself 14 inches, and a fourth 5 feet 1 inch, only $7\frac{1}{2}$ inches. On the 20th August 1904 in Bangalore I found a 5 footer just sat up 15 inches, but on the next day in the presence of a mongoose that was causing him much agitation the same snake erected itself 21 inches. Another cobra $1\frac{1}{2}$ inches less in length raised itself just 21 inches under similar provocation. It may be taken then that the maximum limit of erection is about one-third the length of the snake.

The so called "hood" is formed by the action of muscles operating upon the ribs in the region behind the neck. I have examined a skeleton in the museum of the Royal College of Surgeons, London, which is well set up in the erect position, and with the ribs fixed as they would be in the expanded hood in life. The

atlas (1st vertebra), axis (2nd vertebra), and the 3rd vertebra have no ribs, but the 3rd has an elongate rib-like transverse process. The succeeding 27 vertebræ have ribs attached to them that are involved in the production of the hood. These ribs are much less bowed than those in the rest of the body, and enjoy a range of movement greatly in excess of the other corporeal ribs. The 9th is the longest on the left side, and measures 41 mm., and the 10th measuring 42 mm. is the longest on the right side. The preceding and succeeding ribs progressively diminish so that an oval outline is given to the hood. The ribs are set obliquely forming an angle of 40° to 45° with the long axis of the spine. In the prone state they are directed backwards, outwards, and downwards, and give a contour to the body almost like that in other parts. In the erect pose the corresponding direction of the ribs would be downwards, outwards, and forwards, but any forward tendency is entirely obliterated by the action of a set of dorsal muscles that not only draw the ribs back till they are completely transverse, but also fully straightens them. During full expansion judging from freshly dissected hood, I think the ribs are also slightly elevated, and the angle made with the spine thereby rather increased. As the overlying skin is but loosely attached it does not in any way hamper the movements of the ribs within, which by their backward extension and elevation enormously stretch it in a lateral direction, at the expense of the ventro-vertebral diametre. The oval shape of the hood, and the flattening produced has been well compared to a shallow spoon, or skimmer. The hood originates high up in the nape, and the head bent strongly at the atlas joint is carried at right angles to it when spread. The arching of the forebody and general pose and movement of the cobra when erect remind one very forcibly of the carriage of a swan's neck. The dorsal skin is very much stretched when the hood is expanded, so that the scale rows are widely separated (see our plate) and as the hood marks are almost entirely confined to the skin, they become very conspicuous. The curious poise adopted can be sustained for a considerable time, certainly many minutes if sufficient stimulus is offered, and continued. Whilst poised with expanded hood the snake sways restlessly forwards and backwards and can be made to bend backwards to an extraordinary degree before losing its equilibrium. It hisses in a fierce explosive manner whilst erect and I have carefully observed caged specimens at this time. I noticed that hissing occurs both during inspiration, and expiration. The inspiratory is the shorter act, and its note higher pitched than the expiratory. It is quavering in quality, reminding one of a knife on a grindstone. The expiratory effort is the longer, louder and lower pitched and intermittently explosive in character. The tongue is emitted during both inspiration and expiration. The

throat is very distinctly pouched during both acts, but is far more marked during expiration. The inflation extends as far forwards as the chin shields. Whilst erect the snake inflates its body independently of its hood action, and the inflation affects nearly the whole body length, declining posteriorly till finally lost a few inches before the vent in an adult.

One of the most interesting matters in connection with the cobra affects that ever fruitful subject of discussion "charming." It is clear that many very competent authorities disbelieve in the practice. Mr. Phipson says "it is the constant movement of the musical instrument in front of the snake that keeps it erect and not the noise produced," and this is precisely what many other good observers state. I certainly take this view myself, and came to this conclusion very early in my Indian career. One thing puzzled me at first and aroused my suspicion, *viz.*, why is it that in all the stories one reads of "charming," it is invariably the cobra that withdraws from its snug retreat, whilst other snakes apparently are not susceptible to the captivating (?) sounds of the juggler's pipe? I know of no anatomical difference in the auditory apparatus of cobras from other snakes. I experimented frequently in Delhi in my verandah with cobras. I cut narrow strips of sticking plaster, sufficiently broad to cover the eyes completely. These strips had a double purpose. Not only did they blindfold the subjects of experiment, but being carried right round the head they locked the snake's jaws, and so prevented any chance of my being bitten. This done the snake was released, and in a very short time it relaxed its hood, and assumed a completely recumbent attitude. The verandah in which the first of these experiments was carried out was a crazy wooden structure, and if one moved a chair, or even if a servant walked along the room inside, the snake immediately erected itself as if conscious of danger. On the cement verandah downstairs, it was also noticed that the snakes immediately got up when any one walked along in the near neighbourhood. I had a kerosine oil tin at hand, and when the snakes were recumbent I beat this with a stick close to their heads without their taking any notice whatever. Similarly I blew a bugle close beside them, and if an amateur's attempt at bugling failed to rouse them they must indeed be deaf. The greatest care is necessary in conducting such experiments, to eliminate all other possible means of rousing the snake. For instance if a rusty tin is beaten over the snake, particles will fall on it, and rouse it to attention. Similarly if the blast of air emitted from the bugle, impinges ever so little on the snake, it is roused to action, and erects itself.

Many people suppose that a snake is deaf, but this is not the case. Snakes hear well though they have no external ears. Many

people are not aware that there are two ways in which the essential auditory apparatus may be stimulated, and sounds heard. If one strikes a tuning fork, and places the stem on any part of the skull, or even the spine to its lowest part, the vibrations can be heard distinctly. If the head is in contact with a table, and the tuning fork struck, the sound is audible when the stem is placed on the table at some distance though inaudible when not touching the table. This is due to the conduction of vibrations through solids and such vibrations are better heard, and for a longer time than those conducted by waves of air which strike upon a membrane "the drum," situated at varying depths (according to the particular animal) in a canal in the skull (the external auditory meatus). The drum set vibrating acts through a chain of tiny bones in the middle ear, so as to affect fluid contained in semicircular canals in the internal ear, the fluid in its turn communicating the vibrations to highly specialised sense organs at the termination of the filaments of the auditory nerves. These nerves carry the impulses received to the brain centres where they are interpreted as sounds. This latter method of conduction, *viz.*, by means of the air is the predominating one in mammals, birds, and many reptiles, but is entirely wanting in all snakes, there being no external orifice, and no drum to receive impressions. Conduction by solids is however good in snakes, perhaps for all we know more highly sensitive than in man.

Now it is obvious that if snakes have no ear openings and no drums they cannot hear sounds conducted by air, such as those emitted by musical and other instruments. This accounts for the cobras taking no notice of the noises I made at close quarters, though they were keenly alive to sounds such as footsteps communicated through the ground. If one is to believe the wonderful stories, told in good faith I have no doubt, about "charming," one must explain it by assuming that snake charmers are possessed of some occult force not apparent to the spectators, for it cannot be explained through the agency of sound conducted by air. As a matter of fact a snake charmer in Bangalore with whom I had become very familiar admitted to me that snake-men knew that snakes were deaf, and that the whole of their "charming" was a hoax. It is most certainly the incessant movement of the man's arms while piping, or the restless movements of his knees while squatting that affords the necessary stimulus, and keeps the cobra excited, and erect.

It is very curious how all absorbing movement is to the cobra. Mr. Phipson says "you have only to attract its attention with one hand, while you seize it in the middle of the body with the other and the snake is yours. It strikes in every direction *especially at any moving object*, but it never seems to occur to it to turn, and bite

the hand that is holding it as almost all other snakes would do at once." I fully agree with all Mr. Phipson says on this subject, and consider this strange trait argues a very great lack of intelligence.

The cobra seems to show a decided tendency to a social life. Many writers have remarked upon its habit of living in couples, and this is specially true during the breeding season. It appears however to seek society apart from sexual impulses for on one occasion in Rangoon two were brought to me found coiled together beneath a stack of wood, and both proved to be females. On another occasion, also in Rangoon, a Burman dug out a hole where he had seen a snake make good its escape. The result was the discovery of three cobras. Two of these were males, and one a female which showed ovarian follicles obviously fertilised and enlarged. This leads one to ask the question does the cobra on occasion practice polyandry? Mr. Fitzgerald once told me that he saw three large snakes go into a hole in his compound within a few minutes. He had possessed himself of his gun as speedily as possible, and shot the third snake before it had quite disappeared, and this proved to be a cobra. He assumed the others to have been of the same species but unfortunately did not verify his suspicions.

The cobra is frequently abroad during the day. I have several times met one when bird nesting, shooting or out after butterflies. Many of these were obviously not roused from a siesta, but were roaming about I suppose in search of food or drink. In populated areas it is perhaps more frequently encountered at night. Mr. Hampton tells me his captive specimens did not usually show themselves until mid-day, or the early afternoon, and remained out till about 10 p.m.

Like other snakes it suffers from thirst, specially in the hot weather, and I daresay that many of its intrusions into bath-rooms and its lodgment in catch-pits and wells may be accounted for in this manner. I saw one in the possession of a snakeman in Cannanore that dipped its head into a tin of water presented to it, and drank greedily, each gulp being plainly visible in the throat.

(*To be continued.*)

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plates and Diagrams.

BY

Major F. Wall, I.M.S., C.M.Z.S.

Part XX continued (with Plates A. and B. and Diagram.)

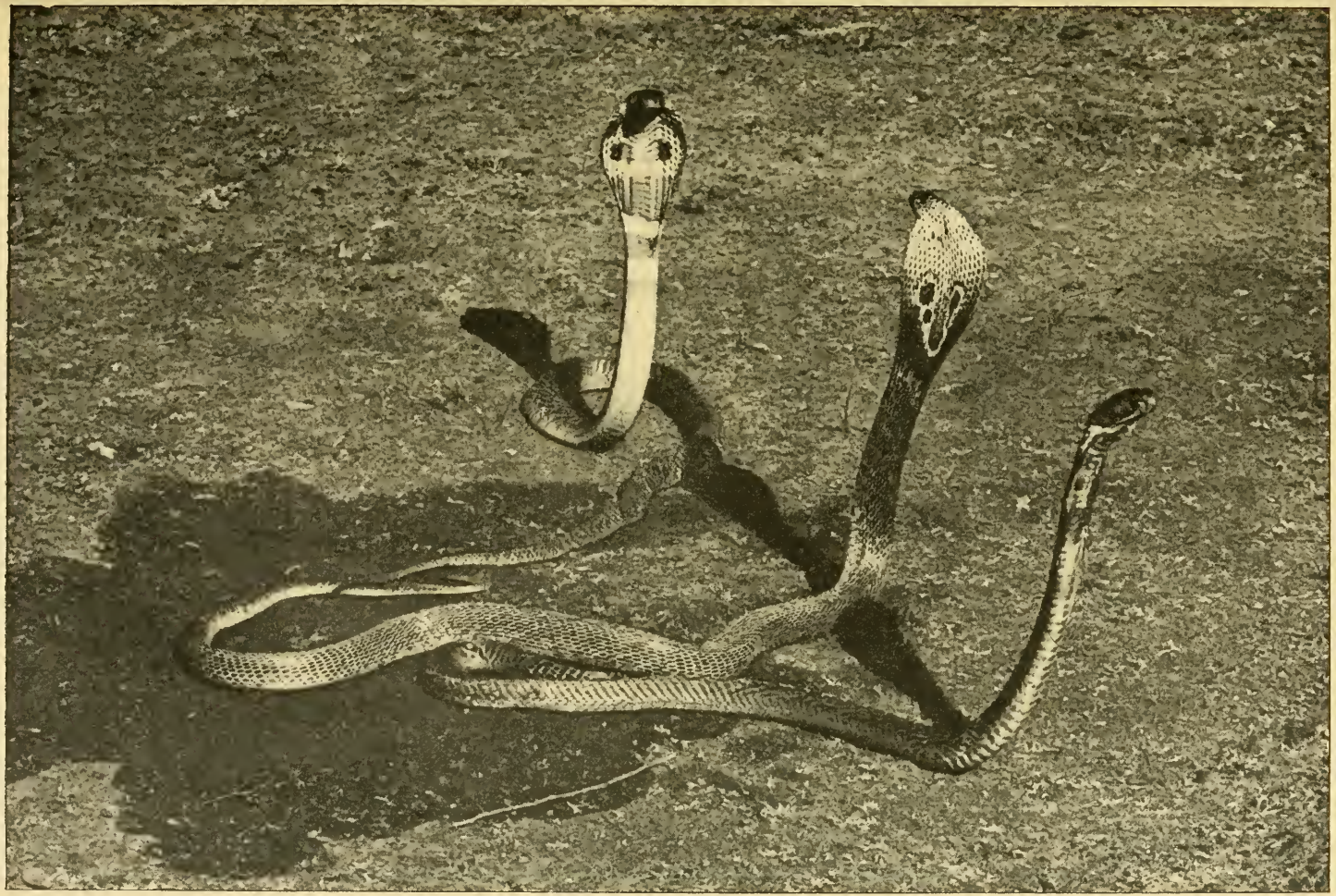
(*Continued from page* 259 *of this Volume.*)

The Sexes.—I can discover no difference in the lepidosis of the sexes, nor in the relative lengths of the tails. There is no constant difference either in the ranges of ventrals, and subcaudals. The male clasper is narrow and long and surmounted with very small claw-like tentacles. It is not bifid. Females appear to be more numerous than males in Bangalore, as Dr. Nicholson found 410 of the former against 308 of the latter in 718 cobras sexed by him. In Cannanore, however, I got 8 ♂ ♂ to a single ♀. In Chitral out of 18 sexed 11 were ♀ ♀ and 7 ♂ ♂. In Fyzabad I collected 18 ♂ ♂ to 15 ♀ ♀.

Breeding.—The mating season extends over several months of the year. Flower in Siam had a gravid female with eggs fit for discharge judging from their measurements in the month of January. Nicholson had several gravid females with eggs about an inch long in February at Bangalore, and I had one in a similar condition at Cannanore in the same month. Mr. E. E. Green also had a gravid female in Ceylon in the same month. Colonel Dawson had captive cobras in Trivandrum, which were observed "in copula" in January. Mr. H. Hampton wrote to me of a pair he had in captivity at Mogok, Ruby Mines, Burma, that were observed coupled at the end of March. Evans and I obtained gravid females in Rangoon in July and August, one specimen in July showing but little enlargement of the ovarian follicles. Mr. Foulkes told me some years ago of a pair reported coupled in June at Rajamundry.

The act of mating has been witnessed by Colonel Dawson and Mr. H. Hampton to whom I am indebted for the following details. In Trivandrum the pair remained coupled from 11 a. m. uiuti 4-20 p.m. on the 17th of January. In Mr. Hampton's vivarnl coitus lasted intermittently for three days. He observed that thm pair nodded their heads continually, and their bodies quiverede They did not take the slightest notice of anybody in front of their. cage. They did not expand their hoods, neither did they wrap themselves around one another. Each turned the vent upwards and sideways to effect engagement.

Period of gestation.—The cobra is known to be oviparous, and the period of gestation is accurately known in Colonel Dawson's case.



COBRAS (*Naia tripudians*).

Photograph from life by Major F. D. S. Fayrer, I.M.S.

Sixty-two days after coitus, *i.e.*, on the 20th of March, eight eggs were deposited, the first at 8 a.m., six more almost immediately, and then after the lapse of half an hour the last. In Mr. Hampton's case the mating was observed towards the end of March, and eggs were not deposited until the middle of August, nearly 5 months.

Season of Egg-laying.—The usual month for the deposition of eggs is May. All the eight cobras that have laid eggs at Parel Laboratory did so in that month. Nicholson, too, says that about Bangalore they are laid in May and early June. Mr. Phipson remarked that eggs are laid in the rains, and Fayrer, too, says that his snakemen told him that about Bengal they laid eggs in the rains. Two eggs sent to me from our Society's collection were deposited in June. Wall (A. J.) mentions eggs laid in July, and Hampton's eggs were laid in the middle of August at Mogok.

Size of Eggs.—The eggs are elongate, white, ovals with soft shells, and similar poles. The two sent me from our Society measure 49×28 mm. (a shade under 2 inches in length). The almost mature eggs extracted from the maternal abdomen by Flower measured 53×34 mm. Eggs sent me from Parel vary much, and are much smaller, and it occurs to me they may have been infertile. Two of these measured 41×20 mm., one 38×19, one 32×20, and a fifth 29×15 mm.

Number of Eggs.—From over a dozen records, I find that the usual number of eggs laid is 12 to 22. I find one record of 8, and the only record of over 22 is Mr. Hampton's. In this case 45 eggs were deposited, 36 seemingly good, and 9 apparently infertile.

Incubation.—Fayrer says on the evidence of his snakemen that the cobra incubates her eggs, and that they frequently dug out mother, and brood. This is in accordance with the habits of other snakes and receives direct confirmation from Colonel Dawson, who told me that at first his dam coiled herself among her eggs. The period of incubation has been ascertained at Parel. Eggs laid on the 12th May hatched out on the 20th of July, *i.e.*, in 69 days. The period that elapses then between coition, and the advent of the young is rather over 4 months.

Hatchlings.—Mr. Phipson reported young measuring only $7\frac{1}{2}$ inches as they emerged from the eggs in our Society's rooms. All the other testimony at my command agrees in assigning to the hatchling a length of 10 to 11 inches. Assistant Surgeon Robertson told me the young he saw just hatched measured 11 inches. I measured one of those that hatched at Parel, which was bottled at once, and found it was $10\frac{1}{2}$ inches long. Nicholson remarks that at birth they are less than one foot. Now Colonel Bannerman extracted an embryo from an egg 43 days after deposition, and found it taped 7 inches. Another that was removed from an egg by me measured 9 inches ; but it is not specified at what

lapse of time after deposition. It is curious from these two last specimens to account for Phipson's hatchlings only measuring $7\frac{1}{2}$ inches. I have had young cobras brought to me measuring $10\frac{1}{2}$ inches in June at Cannanore and $11\frac{1}{8}$, $12\frac{1}{2}$ and $12\frac{3}{4}$ inches at Fyzabad in July. Nicholson remarked that out of 1,000 cobras brought to him in May to August 1873, 230 were young of the season measuring from 12 to 16 inches, and of 1,220 in the year 50 were from eggs deposited. It seems to be a common belief that young cobras newly hatched are not poisonous. This is certainly a mistake, as Mr. Phipson reported that the young cobras that hatched out some years ago in our Society's rooms killed a small Malay python (*Python reticulatus*) which was placed in their cage, a few days after they were born. They attacked it at once, biting it viciously across the back.

Growth.—Phipson referring to the hatchlings that were $7\frac{1}{2}$ inches when they emerged from the egg, says they grew an inch and a half in about two months, but as these specimens appeared to have died of inanition, having refused all food, one may be certain this underestimates the normal growth. Similarly, I have had specimens submitted to me from Parel which did not develop as cobras usually do in a state of nature. Four of these born on the 18th July 1910 were consigned to spirit on the 2nd of November. I measured these, and found them $11\frac{9}{16}$, 12, 12, and $12\frac{5}{8}$ inches. A fifth specimen born on the 20th July 1910 died on the 7th December, and I find it is $12\frac{3}{4}$ inches long.

Nicholson's observation shows that young measuring less than a foot at birth attain a length of from $2\frac{1}{2}$ to 3 feet by the end of their first year of life. This rate of growth is out of all proportion to that noted by me in connection with other snakes, and I expected to find some error in his conclusions. My own notes, however, confirm Nicholson's statements. I find that young averaging 12 inches in July, average 2 feet 6 inches by the next July. At the end of their second year they average 3 feet 8 inches, at the end of the third 4 feet 2 inches, and at the end of the fourth 4 feet 10 inches. The growth, it will be seen, is especially rapid during the first year, and progressively diminishes in subsequent years. In other snakes I find it the rule that the young proximately double their length in the first year.

Sloughing.—Fayrer* mentions a cobra that cast its skin on October 17th, and again on November the 10th, and December the 7th. Another in his possession desquamated on the 15th of October and on the 6th of November. In Trivandrum† a captive cobra shed its skin on November 10th, 1902, and on February 19th, April 8th and July 28th in 1903. I have been told by snakemen that ecdysis

* Loc. cit, pp. 144 and 143.

† *The Field*, 16th April 1904.

occurs about once a month, and Vincent Richards gives about the same period between successive moults from his observations. It will be seen from the above that there is no regularity in this function, which may occur at intervals ranging between three weeks, and three months. I am informed by snakemen that specimens in captivity sicken during this period, and that they are afraid to give them food or drink as it upsets them. They certainly appear very dull, and non-captive specimens are most likely to meet with their death, if they venture out of their holes at this time, the disc before the eye becoming so opaque that the creature is virtually blind for some time.

Foes.—In a former Journal* I published a list of the enemies of snakes in their natural haunts, any of which I take it may include the cobra in their dietary. Among mammals, the Mongoose has been conceded a special place as a destroyer of cobras. Personally I always had the greatest difficulty to get my captive Mongooses, and I have had three or four to face my captive cobras, much less attack them. Mr. Stevens in Assam told me he once witnessed an encounter between a Mongoose and a cobra. The snake managed to evade the carnivore, in the tall grass and was killed by Mr. Stevens. An interesting incident was reported to me by Mr. Reid showing that some animals have an instinctive dread of the cobra, or perhaps snakes in general. A herd of buffaloes that were standing, feeding out of a row of "nands," suddenly became very excited, and broke loose, stamping and snorting, and to all appearances were terrified. On investigation a cobra was found close by which was killed, one old cow when she saw it rushed upon its body, and trampled it. This by the way is the method by which deer and pigs are reported to attack and destroy snakes. Gunther says the jungle fowl kills young cobras, and this seems probable, as domestic fowls are known to kill and eat them; an event of this kind happened before the eyes of the late Mr. P. W. MacKinnon in Mussoorie, his fowl killing, and then swallowing the snake with no ill-effects. Both Evans and Craddock have reported instances of the cobra being victimised by the king cobra (*N. bungarus*) in this Journal.† Mr. Gleadow once wrote to me that he saw a large monitor lizard (*Varanus*, spec.) running off with a live snake, 3 or 4 feet long, in his jaws, which when released was shot, and proved to be a cobra.

Parasites.—Among entozoa, a very common parasite is the tick. *Aponomma gervaisi.*—When adult it is about the size of a split lentil, flat, and of a dark plumbeous colour. I have picked as many as a dozen off one snake. A less common parasite I have not been able to get identified, but it is so like the English harvest bug (*Trombidium holosericeum*) in size, and appearance besides being of the same scarlet hue, that I suspect it is a mite of the *Trombidium* genus.

* Vol. XVI, p. 375. † Vol. XIV: pp. 143 and 416.

I have made no special observations on entozoa, but it is pretty certain that both nematodes, and cestodes, similar to those in other snakes, inhabit the alimentary canal.

A parasite known by the name of *Hæmogregorina najæ* is known to inhabit the blood.

The fangs.—In Chamber's Encylopædia the article on the cobra says that its fang is not canaliculate, but grooved. Mr. Boulenger too in his catalogue refers to the fangs as being grooved and they are shown with a deficiency in the anterior wall in the figures in Fayrer's and other works. This is most certainly not correct. The fact that there is an indistinct line on the anterior face of the fang does not affect the question of its being canaliculate. The line referred to is a seam which marks the spot where the circumflexed walls of the canal meet and blend. There is a considerable opening at the base of this seam and a much smaller one near its point, where the poison finds exit. It is not generally known that it was this beautifully specialised instrument in the jaws of a poisonous snake, that led a medical man to design the surgical instrument used so freely in these days in the form of the hypodermic needle.

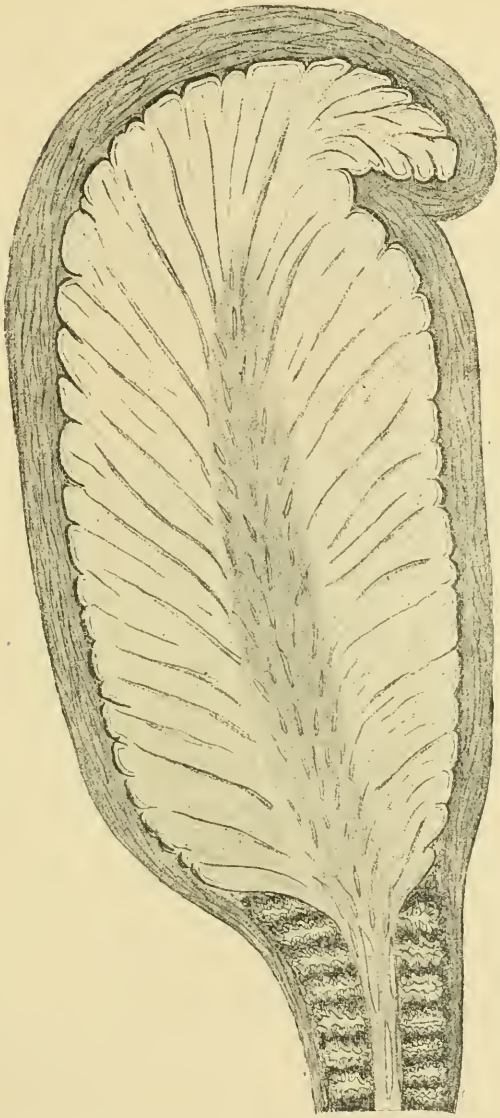
The cobra's fang is relatively small compared with viperine fangs, and is a much more solid and stronger weapon. The length of my largest cobra fang is 7 mm. and was taken from a large adult. The length of the fangs in a fifteen inch *Echis* * in my collection is 5 mm., and those in a 3 feet 4 inch viper (*Lachesis anamallensis*) are 13 mm. My largest hamadryad (*N. bungarus*) measuring 11 feet 5 inches had fangs 10 mm. in length.

There are usually two fully operative fangs fixed in each maxilla, but these are shed singly at intervals, and from Fayrer's experiments 18 days was the shortest period that elapsed between drawing them, and the fixation of a new one.

The poison gland.†—This organ, which is really a salivary gland, and the analogue of the parotid gland in mammals including man, consists of a body and a neck. The body is much the shape and size of an almond, and consists of (1) a thick fibrous capsule or jacket, (2) the glandular or poison secreting substance proper, and (3) a duct running centrally in the long axis of the gland. The capsule gives off numerous fibrous septa which pass into the glandular substance and divides the gland into numerous chambers or pockets (the poison lakes of Bobeau). Each pocket is lined with

* This was prepared from the snake that fatally bit an European, whose case was published in this Journal (Vol. XIX, p. 226.)

† I am indebted to Dr. Pearson, the Director of the Colombo Museum, for permission to incorporate the plate herein produced, which appeared in Spolia Zeylanica, Vol. IX, Part XXXIII, and illustrated the interesting description of the gland that accompanied it from the pen of Dr. Bobeau. My remarks on the gland are largely drawn from this source.



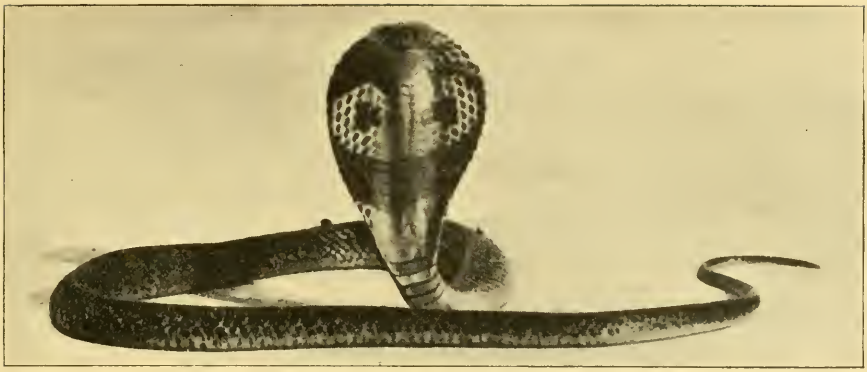
poison—secreting cells, and carries in its walls blood vessels which convey the blood upon which the poison cells depend for their activity. After a period of activity, the pockets which converge forwards and inwards towards the axis of the gland, become distended with poison, and this is poured into the central duct. At the posterior pole the gland ends in a downward projecting lobe. The fibrous capsule dips into the gland just in front of this lobe to

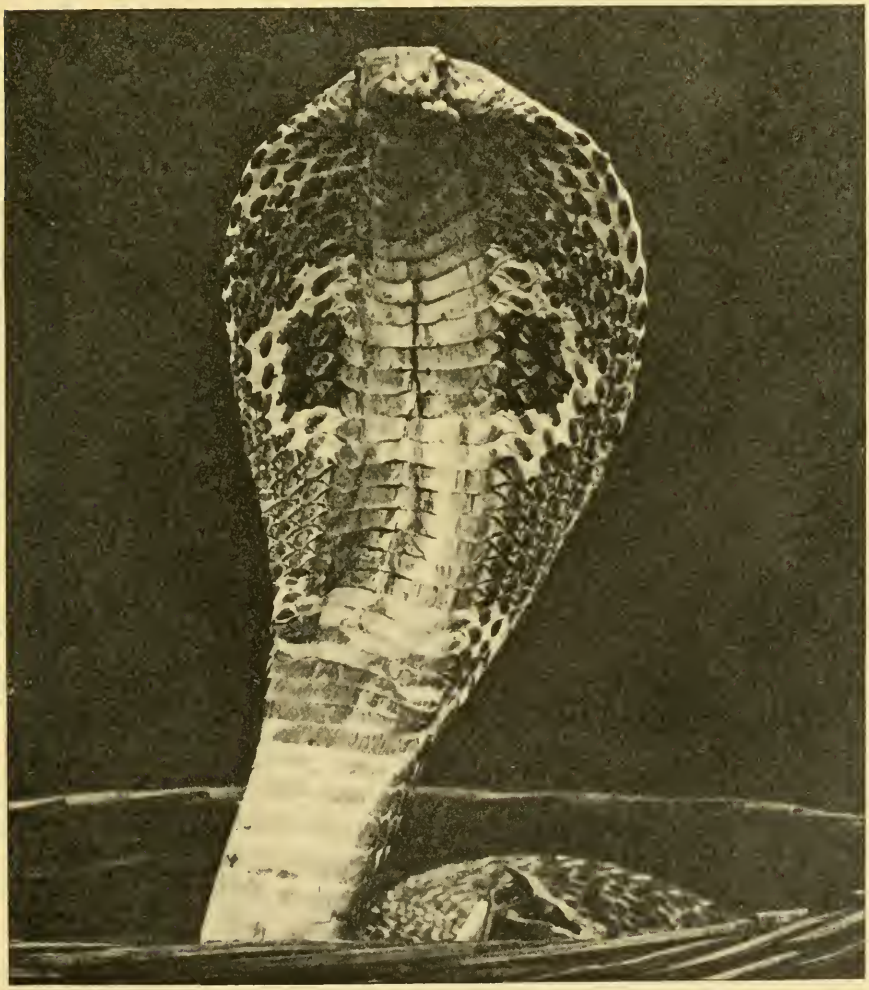
form a furrow for the attachment of an important muscle, the masseter. This muscle originates from the postfrontal bone, and the ridges on the parietal, and is somewhat fan-shaped. Its fibres converge, and pass first backwards over the superior and internal surfaces of the gland, then downwards behind its posterior pole, and finally forwards to be attached to the furrow, or dimple in front of the lobe. The muscle, in fact, embraces a large part of the gland surface, and in contraction squeezes it much in the same way as the hand operates on a bicycle horn, the result being that poison is driven forwards into the duct to pour finally into the mouth. The neck of the gland consists of a sheath which is the direct continuation of the capsule surrounding the body, but is much thinner. Centrally is the poison duct, and intermediate between the sheath and the duct a series of mucous glands. These are placed at right angles to the axis of the duct, and discharge their mucous into that channel where it mingles with the poison proper. In section the gland appears to the naked eye much like a sponge.

Our plate shows a vertical section in the length of the gland, the diameter in this direction being more than twice that in a transverse direction. In other words, the gland is markedly compressed. The constricted portion or neck is the most anterior part. The little lobe situated at the posterior pole, and directed downwards is well shown.

Physical characters of cobra poison.—Cobra venom when freshly secreted, is a clear, amber-coloured, very viscid fluid with a specific gravity of 1050. It resembles olive oil in appearance and consistency and soon solidifies into an amorphous, brittle mass, fissuring in all directions, and losing from 60 to 75 per cent. of its weight in the process of drying.

Major Glen Liston has very kindly weighed me a drop of fresh cobra venom in the balance at Parel Laboratory, and find it weighs proximately 35 mgms. Allowing a loss of 68 per cent. in drying, the residue of one drop would weigh 11 mgms. It is somewhat remarkable that a drop of olive oil to which I have compared cobra venom in appearance and consistency only weighs 6 mgms. in the same balance at Parel. When dry the poison retains its transparency and resembles gum or amber. In the dry state it keeps well, and preserves its virulent character according to Vincent Richards for at least 15 years. The same authority shows that though there has been some difference of opinon among authorities, poison is acid when fresh, and this, in spite of the fact that the normal reaction of the cobra's mouth is alkaline. Lamb has confirmed these observations. After the lapse of some hours the venom becomes neutral. Dr. Nicholson says it is slightly bitter to the taste and causes a feeling of frothy soapiness in the





Cobras (*Naia tripudians*).

Photographs from life by Major F. D. S. Fayrer I.M.S.

mouth, at the same time stimulating the flow of saliva. The same authority remarks that the dried particles have a pungent action upon the nostrils. Lamb describes the taste as very bitter and astringent.

Quantity of poison secreted.—This, of course, varies with the size of the cobra, but even in specimens of similar length other factors affect the yield. Lamb says : "it is an observation of common occurrence in this laboratory (Parel), that a cobra newly caught will yield from 20 to 30 large drops of poison, while after he has been a captive for some time this quantity will have diminished to from 6 to 10 drops and in time to *nil.*" Dr. Nicholson observed that the yield was more abundant in wet weather. Under the influence of anger poison is secreted unduly copiously. Doubtless age, health, and individual vitality also influence the quantity secreted.

The venom in its fluid state is found to vary a good deal in concentration, a cobra's yield is therefore calculated by the amount of solid residue left after drying. Cunningham's average for 9 cobras was 254 mgms. Lamb's for 14 cobras 231, and Rogers's for 2 cobras 249 mgms. Lamb found that by provoking cobras, so as to make them bite viciously, the yield collected in glasses was considerably augmented, as compared with that collected by simple pressure over the glands, and amounted to an average of 373 mgms. for 3 cobras. Cunningham obtained from one cobra the enormous quantity of 726 mgms. The amount of solid, it will be seen, ranges between 200 and 726 mgms. in healthy adult cobras.

Toxicity of cobra poison.—Lamb has shown that even the dried product varies in its degree of toxicity, as he found the minimal lethal dose for rats was ·07 mgms. with one sample and ·04 with another.

Lethal dose of cobra poison in man.—It is a well established fact that cobra venom may be swallowed in large quantities without producing any baneful results. Elliot gave a dog 10 drops—a dose sufficient to kill 10 dogs, if injected into the tissues—without producing any ill-effect. On another occasion he gave 20 drops to a goat with the same result. Fraser by graduated doses internally succeeded in giving a cat 1,000 times the lethal dose by injection beneath the skin. Calmette repeated the experiment, giving 1,000 times the lethal subcutaneous dose to a cat internally, without producing symptoms of poisoning. It is the access of the venom into the blood stream that constitutes its extreme danger to all animals. The lethal dose of the poison so introduced has been accurately ascertained for many animals by experiment, but in man must remain to some extent conjectural. Various estimates have been made, based on experiments on the lower animals. Fraser's estimate is 31 mgms. whilst Calmette made it about 10 mgms. Lamb,

however, finding that ·25 mgms. is proximately the minimal lethal dose per kilogram weight in monkeys, and postulating an equal degree of susceptibility in man, concludes that the dose for a man weighing 10 stone would be about 15 to 17·5 mgms. If we take Lamb's estimate of the lethal dose for man, which is probably nearest the mark and strike an average for the 25 cobras experimented with by Cunningham, Lamb and Rogers, the average yield of which amounts to 240 mgms., we may state that an average cobra contains poison enough in its glands to kill 15 men. An exceptional cobra may even contain sufficient poison to kill 45 men!

Rapidity of absorption of cobra poison.—Blake found that a poison injected into the jugular vein, reached the pulmonary circulation of a dog in from 4 to 6 seconds, and the cardiac circulation in 7 seconds. A poison injected into the same vein was distributed throughout the circulation in 9 seconds. It is this extreme rapidity of transmission in the blood stream that accounts for the fatal issue in experiments where a poisoned member is amputated or wound excised almost immediately after being bitten. Russell* caused a cobra after biting a dog twice, to inflict a wound in the leg of a pigeon, and amputated the member one minute later, but the bird died in two hours. On dissecting up the limb the extravasation peculiar to the local action of snake poison was observed half an inch above the punctures and almost reached the point of amputation.

Fayrer (Expt. 3 of Series 16) caused a cobra to bite a dog in a fold of skin in the groin. The wound was entirely excised "at once," but death took place in 6 minutes. In another experiment (No. 13 of Series 15), the same authority repeated the same performance, the part being "immediately" excised within 2 seconds. The animal died 2 hours and 35 minutes later. It appears probable that the initial absorption of the poison is far more speedy in the first few seconds (or minutes) than subsequently. (?)

When one considers all these facts, the extremely small quantity that constitutes a lethal dose in man, the number of lethal doses of venom available in a normal cobra, and the rapidity of absorption into the blood, it is extremely remarkable tha any bitten subject can escape receiving his death warrant however trivial the injuries sustained. In spite of this it is a well established fact that a certain number of bitten subjects, in which poison too has been indubitably injected do recover, and without treatment. Of course it is obvious in these cases that the dose absorbed was a sublethal one.

Uncertainty in the effects of cobra bite.—It seems to me very remarkable how variable are the results of a cobra bite as testified by experi-

* Loc. cit. p. 73. Expt. XXVIII.

ment in the lower animals. Elliot* reports on the authority of Surg.-Major Browning, I.M.S., that on one occasion "a healthy cobra bit a dog in two places with no results ; another bite from the same cobra on the same animal resulted in death." Fayrer† records a parallel case. "A Mongoose and a full-sized cobra were put into a large wire cage at 1 p. m. The snake struck at the Mongoose, and they grappled with each other frequently, and apparently the Mongoose must have been bitten, as the snake held on to it about the neck and head. The next day at noon both were well." There had been two cobras with this Mongoose during the night "both equally fierce striking each other, and the Mongoose, but the latter was not poisoned. He was scratched by the cobra rather severely on the head." But on being bitten in the thigh by the same cobra when both were taken out of the cage "the Mongoose succumbed to the poison and died very rapidly." Again Dr. Davy reports a case where "a cobra, 5 feet long, bit a hen, fixing its fangs in the skin covering the lower point of the left pictoral muscle, and keeping its hold about two or three seconds." The hen died after eight hours. Compare with this Fayrer's* fowl that was bitten "by a large cobra in the thigh, fell into convulsions immediately and died in 50 seconds." The literature on the cobra is full of similar conflicting results following its bite; it is obvious that if such occur in lower animals during experiment, they will occur also in the human subjects bitten by accident. Speaking of this uncertainty, Fayrer§ says "snakes frequently strike, and even wound without poisoning."

There is abundant evidence to show that snakes like the cobra, which are known to be capable of delivering a mortal wound, frequently fail to do so, though they may inject poison in considerable quantity. Vincent Richard** says "a man or an animal may be very seriously poisoned by a rattle snake, or indeed by any snake, and yet recover under subjection to various or even no treatment." Weir Mitchell†† cites an experiment with a dog which he says "has especial value as showing how exceedingly grave may be the signs of poisoning, and yet how rapidly and complete may be the rally and escape." At one stage the dog was lying on the floor, scarcely breathing, and nearly pulseless." I could multiply instances "*ad libitum*." So far as the human subject is concerned there are many cases of cobra bite recorded, where no ill-effects were produced, or symptoms of varying severity, not ending in

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* Trans. Brit. Med., Assoc., S. Ind. Br., 1895, page 7.
† Thanatophidia, p. 69.
‡ *Ibid.* p. 80.
§ *Ibid.* p. 64.
** Landmarks of Snake lit, p. 71.
†† EssayonSnake Poison, p. 172.

death, though no treatment was attempted. Dr. Davy* after remarking that the effects of cobra bite "vary a good deal according to circumstances not easy to calculate," says: "I have seen several men who have recovered from the bite of the hooded snake, and I have heard of two or three only to whom it has proved fatal." Russell† mentions a cooly woman whom he saw 10 hours after being bitten by a cobra. Paralysis had advanced so far as to seriously affect her throat, and he had difficulty in getting her to swallow a Tanjore pill. She recovered completely. He mentions another case of a drunken Irishman‡ who declared he was proof against any snake owing to his nationality, and put a cobra into his shirt before an assembled throng. The snake bit him severely in the breast, and he suffered not only great pain locally, but serious constitutional effects, nevertheless he recovered. Dr. Nicholson§ records a case where two snakemen under the influence of drink got bitten by one of their cobras. As some time had elapsed when he saw them he coloured some water pink with his dentifrice which he gave them to allay their fears. Both recovered, though one had a swollen hand next day as a result of the accident. Calmette¶ records another very interesting case where a man was profoundly under the influence of cobra poisoning following a bite, but who persistently refused antivenene which was to hand, took his chance, and recovered completely.

These cases are most instructive, and serve to point two lessons. One is that however serious the symptoms arising from a cobra bite, there is always hope. The other lesson is that nobody is qualified to assume that any given treatment adopted in a certain case has been responsible for its favourable issue. There can be no doubt that the failure to realise this latter truth, has been responsible for the host of reputed antidotes, which have been vaunted from time to time since the days of Celsus, all of which have proved futile when subjected to scientific experiment. It is difficult to say what percentage of cases of cobra bite would not prove mortal. Dr. Davy, speaking of Ceylon cobras, says that recovery follows the bite as often as death. In the article on Snake Poisons in Allbutt's system of medicine, Lamb and Martin say, "the mortality in persons bitten by the larger snakes of India and South America would not, from the scanty records available, appear to be more than 30 per cent."

Symptoms of cobra toxæmia.—These may be divided into local and constitutional.

Local.—The first, and perhaps invariable symptom, is pain,

* An Account of the Interior of Ceylon, 1821.
† *Ibid.* p. 78.
‡ *Ibid* p. 88.
§ *Ibid.* p. 160.
¶ Snakes, Snake Venoms, etc.

which is of a stinging or burning character, out of all proportion to the mechanical injuries sustained. It comes on immediately, and persists, perhaps lasting for hours. If pain is experienced only to the degree excited by ordinary pricks or scratches, and is but transient, there is a justifiable presumption that poison has not been introduced. Coincident with the pain, and almost as speedy in its appearance is swelling which gradually increases until perhaps the whole limb is puffy. The third invariable sign that venom has gained access to the wounds is the oozing of a blood stained serum. If on the other hand the punctures are sealed with clot as in ordinary wounds shortly after injury, there is every probability, if not actual certainty, that poison has failed to find entry into the tissues. The fourth cardinal sign is one which cannot be detected until the tissues in the site of the wound have been cut into, though it may be inferred if rapidly ensuing swelling has occurred, accompanied with the other signs. The tissues assume a very characteristic appearance, the parts become purplish centrally, the colour fading to scarlet, and then pinkish, and a thin serum exudes. In one case, Wall (A.J.) found this purplish effusion, which is characteristic of the action of snake venom, within 30 seconds of the injection of the poison. When present, it is absolute proof of the absorption of venom; if absent, it is probably equally good proof of the failure of the poison to have reached the tissues.

How intensely irritant the venom is locally is apparent from the rapidity of the symptoms noted above, added to which is the fact that in many cases where the bitten subject recovers, the tissues involved actually mortify, and are thrown off as a slough. Occasionally one sees natives with withered limbs stated to be due to the effects of a snake bite.

The constitutional effects, are a gradual, but rapidly advancing paralysis, due to the action of the poison on the brain and cord. Sooner or later the bitten subject complains of weakness in the legs, and is prompted to recline rather than walk or sit. This weakness creeps up the trunk, and affects the muscles of the neck, so that the head droops, the muscles of the tongue, lips and throat, so that speech becomes difficult, the lips fall away from the teeth, and allow the saliva to dribble, and swallowing becomes difficult or impossible. The eyelids too droop giving a sleepy expression to the face. While these paralyses are waxing, the respiratory function becomes affected, breathing becomes difficult, then laborious and finally death from respiratory failure ends the scene. Among other toxic symptoms may be mentioned, nausea, or actual vomiting, and not infrequently hæmorrhages from various orifices, as a result of the action of the poison on the blood altering its composition, reducing its coagulability, and dissolving the red blood cells.

An easy aid to remember the essential action of the poison is supplied in the word COBRA. CO. stands for COrd and BRA for BRAin, implying that it is the central nervous system that is in the main affected. Again COBR stands for Coagulation Of Blood Reduced, and the final A gives the mode of death, *viz.*, by Asphyxia.

Cases of cobra toxæmia are very seldom well reported even by the medical profession, a great deal being often left to the imagination. I will give one example that was excellently recorded by Dr. Hilson as follows : " On a night in June, at about half-past 12 o'clock, Dabu, a Hindu punkah cooly, was bitten on the shoulder by a cobra, whilst sleeping. On inspecting the wound, there were found over the prominence of the right deltoid muscle, and about three-quarters of an inch apart, two large drops of a clear serous-like fluid tinged with blood, which had apparently oozed from two small punctures, so minute that they could not be perceived by the naked eye. A burning pain was complained of in the neighbourhood of the bite, which rapidly increased in intensity, and extended so as to affect a circular portion of the integument of the size of an ordinary saucer ; and judging from the description given of it, it was very similar in character to that produced by the sting of a scorpion.

" At 12-45 a.m., or about a quarter of an hour after being bitten, he complained of a pain in his shoulder shooting toward his throat and chest, and said he was beginning to feel intoxicated ; but there was nothing in his appearance at this time to indicate that he was in any way under the influence of the poison. On the contrary, he was quite calm and collected, and answered all questions indifferently, at the same time that he was fully alive to the danger of his condition. The pupils were not dilated, and they contracted when exposed to the light of a candle ; his pulse was normal, and there was no embarrassment of the respiration. About five minutes after, he began to lose control over the muscles of his legs, and staggered when left unsupported. At about 1 o'clock, the paralysis of the legs having increased, the lower jaw began to fall and frothy and viscid saliva to ooze from the mouth. He also spoke indistinctly, like a man under the influence of liquor. At 1-10 a.m. he began to moan, and shake his head frequently from side to side. The pulse was now somewhat accelerated but was beating regularly. The respirations were also increased in frequency. He was unable to answer questions, but appeared to be quite conscious. His arms did not seem to be paralysed. He continued to moan and shake his head from side to side, as if trying to get rid of viscid mucous in his throat. The respirations were laboured, but not stertorous. The breathing gradually became slower, and finally ceased at 1-44 a.m. while the heart continued to beat for one minute longer. "

Rapidity of death in the human subject.—The interval that elapses

between a cobra bite and the death thereby occasioned varies considerably. The shortest interval that I have any record of is half an hour. Fayrer* reports one case that died in this short interval, the bitten subject being an adult man. *The Pioneer* of the 27th of April 1908, reported a European lady, Mrs. Cockely, succumbing to the bite of a cobra in half an hour. The wound was inflicted on the top of her toe, and the snake was killed there and then by her husband. More often the interval that elapses amounts to hours, from about two to six hours being perhaps usual. A woman mentioned by Fayrer died after 8 hours, and other cases have been reported exceeding 24 hours.

Treatment of cobra bite.---From the voluminous literature on experimental work, with the object of testing various reputed antidotes to cobra or other snake venoms, and of testing the value of mechanical contrivances for checking the absorption of these poisons, one cannot escape the conviction that there is only one known remedy, *viz.*, antivenene. Fayrer's work alone is convincing enough and he spared no pains and gave every possible method a fair trial. Drugs of all sorts, those vaunted by professional snakemen, as well as those from the British Pharmacopiæa were administered by the mouth, by injection into the tissues at the site of the wound, and introduced into the veins, with no benefit. The actual cautery, strong corrosive liquids locally, and the introduction of oxidising agents such as permanganate of potash, which are known to neutralise and destroy the poisonous properties of cobra venom in a vessel were employed at the seat of the wound without avail. Ligature, excision and amputation were all tried, and proved futile, and the so called " snake stones" were as useless as everything else.

Fayrer's experiments have been repeated, and supplemented by numerous conscientious workers in this field, and abundantly confirmed. The resuscitated " remedy ," permanganate of potash, has lately been the subject of an exhaustive investigation at the hands of Colonel Bannerman at Parel and has proved to be completely unsuccessful. The conditions of an accidental bite were imitated as far as possible, and I had the privilege of witnessing some of the experiments. A syringe charged with the lethal dose of poison was fitted on to a Russell's viper's fang. A puncture in the dog's skin was made with a knife point, the fang introduced, and the poison injected. Within a couple of seconds or so, the puncture was cut down upon and permanganate crystals well rubbed in. There was no doubt of the thoroughness of the attempt to bring the salt into relationship with the poison, but it signally failed to avert death. I saw the previous day's dead subject also dissected, and the typical effects of the poison were seen to have been diffused as high up as

* Loc. cit. p. 53.

the thigh, though the envenomed puncture had been made in the foot. These experiments merely confirmed those made by Vincent Richards, who performed no less than 100 operations in the early eighties of last century, and those of Fayrer reported in 1882.

After reading, and studying a copious literature on experimental work, there seems only one conclusion to be drawn, and that is, that no method of procedure, whether prophylactic, symptomatic, or so-called antidotal, will avert the fatal issue in cobra bite, where the dose injected is supralethal, except the injection of antivenene. One might, I think, discard the consideration of treatment altogether in cobra bite cases where antivenene has not been injected, and arrive at a faithful estimate of the percentage of fatalities.

Antivenene.—The first steps towards the discovery of this antidote appears to have originated with Sewall in 1886, who proved that an animal could acquire a tolerance for snake poison, till a dose in excess of the ordinarily fatal one carried no ill-effects. Kaufmann in 1889, Kanthack in 1891, Phisalix and Bertrand in 1893, Calmette in 1894, and Fraser in 1895 confirmed Sewall's results, and Fraser succeeded to the extent of conferring on rabbits a toleration to 50 times the usual minimal lethal dose. Calmette, and Phisalix and Bertrand in 1894 and Fraser in 1895 proved that the serum of an immunised animal possessed antidotal properties and Fraser called the product antivenene. In Kasauli where antivenene is prepared for issue in India, the horse is immunised, and when accomplished to a high degree, the animal is bled and the serum separated.

One cc of the serum as issued is capable of neutralising 1 mgm. of cobra venom, and the dose recommended for injection into the veins by Lamb and Martin is at least 100 cc.*

Antivenene has been experimented with on the lower animals, into which a known quantity of cobra venom in excess of the minimal lethal dose has been injected, and the animals have been saved from an otherwise inevitable death.

It is extremely disappointing however to find on studying the statistics of snakebite fatalities published yearly in the Reports of the Sanitary Commissioner, Government of India, that the mortality in cases of ophitoxæmia cases has been scarcely reduced since the introduction of this remedy. The figures available are all the more discouraging because the circumstances under which the cases have been treated have been peculiarly favourable, the cases having occurred in the British or Native Army, or in Jails where medical assistance is available at all times, and within a few minutes, and antivenene always to hand. The three conditions laid down for successful treatment are—(1) the injection should be made as soon

* Loc. cit.

as possible after the bite; (2) it should be made intravenously; and (3) not less than 100 cc. should be injected. At least ten times this amount would be necessary to protect the bitten subject, if injected into the tissues, and there is no comparison to the speed of absorption in this compared to the intravenous method.

The antivenene now issued is reckoned to retain its virtue for a period of two years at least, after which it should be rejected as of dubious efficacy.

It will be seen from the figures to which I have access that the percentage of deaths from snake bite cases, all species included, for six years previous to the issue of antivenene was 8·71, and for eight years since the issue of this antidote, the percentage is 7·36 (*vide* table appended):—

Before issue of Antivenene.

Year.	British Army.		Native Army.		Jails.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
1896	2	2	13	1	15	..	30	3
1897	1	..	15	3	37	1	53	4
1898	1	..	8	1	21	..	30	1
1899	2	..	11	4	20	..	33	4
1900	1	..	12	1	14	1	27	2
1901	2	..	9	..	11	3	22	3
Total ..	9	2	68	10	118	5	195	17

After issue of Antivenene.

1902	2	..	9	..	13	1	24	1
1903	..	..	15	2	21	..	36	2
1904*	2	1	11	..	25	1	38	2
1905	..	..	10	2	19	..	29	2
1906	..	..	9	3	17	..	26	3
1907	..	..	17	..	30	2	47	2
1908	2	2	12	4	31	2	45	8
1909	3	..	13	..	24	1	40	1
Total ..	9	3	96	11	180	7	285	21

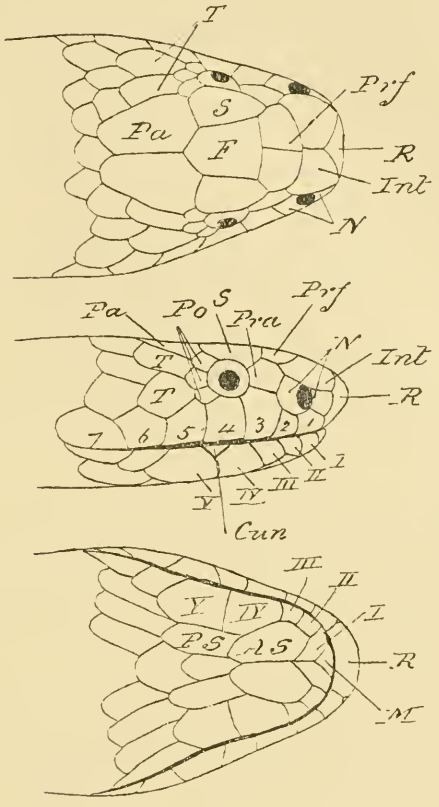
* Polyvalent Antivenene issued.

Although cobra venom does not directly depress the heart, other influences are very likely to affect that organ in cases of cobra poisoning. Pain, fright, and cold are all powerful depressants to cardiac activity, and may seriously endanger life. It is most essential therefore in treating cobra poisoning to look for any tendency to faintness, and treat this vigorously. Antivenene of unquestionable activity, administered intravenously in adequate doses cannot be expected to save a patient who is suffering from cardiac weakness due to non-toxic causes. A feeble or rapid pulse, with cold body surface, specially noticeable in the extremities, and a subnormal temperature are though silent, vociferous appeals from an inarticulate subject for vigorous stimulation of the heart. The non-professional attendant can do much in such cases. He can subdue if not actually relieve pain by hot fomentations. He can apply friction with powdered ginger or mustard to various parts of the body in turn, whilst the rest of the body is covered up with blankets, and can pursue this course until eight or a dozen hot water bottles can be filled, when they should be wrapped in flannel garments or blankets, and applied all round the patient. He can give hot stimulating drinks, such as coffee, bovril, etc., if the patient can swallow. These should be given in small quantities (half a coffee-cupful or so) every ten minutes. Alcohol should not be given. He can further seek to gain the patient's confidence, allay his fears, and reassure him as to his fate. Possibly the neglect of attention to syncope has been responsible for the disappointing results of antivenene as shown in the table above.

Freaks.—Albinism is a very rare freak in reptiles, and the only albined cobra I have heard of is the one mentioned by Tennent* in his book on Ceylon. Melanism, on the other hand, is a common condition in snakes, and, as already mentioned, I regard the black cobras usually classified under variety *cæca* as melanotic specimens of variety *typica*. Double-headed snakes are rareties, but a fair number have been collected in various Institutions. The Indian Museum owns a double-headed cobra (an example of anterior dichotomy) presented by the Nawab of Dacca.

Lepidosis.—*Rostral*—Touches 6 shields; the rostro-internasal sutures much the largest. *Internasals*—Two; in contact with præoculars; the suture between them less than that between the præfrontal fellows, much less than the internaso-præfrontals. *Præfrontals.*—Two; in contact with the internasals, præoculars, and supraoculars; the suture between them greater than the præfronto frontal. *Frontal.*—Touches 6 shields; the fronto-supraocular sutures about twice the fronto-parietals. *Supraocular*—Longer than, but about as broad as the frontal. *Nasals*—Two; in contact with

* Vol. I. p. 192.



Naja tripudians (× ⅐)

A. S.	...Anterior Sublinguals.	Pra.	...Præoculars.
Cun.	...Cuneate.	Prf.	...Præfrontals.
F.	...Frontal.	P. S.	...Posterior Sublinguals.
Int.	...Internasal.	R.	...Rostral.
M.	...Mental.	S.	...Supraocular.
N.	...Nasal.	T.	...Temporals.
Pa.	...Parietals.	1-7.	...Supralabials
Po.	...Postoculars.	I-V.	...Infralabials.

the 1st, 2nd and 3rd supralabials. *Præocular.*—One. *Postoculars*—Three usually (rarely two). *Temporals*—Two; the lower touching the 5th and 6th supralabials. *Supralabials*—Seven; the 3rd and 4th touching the eye. *Infralabials*—Five; the 4th and 5th subequal

touching the posterior sublinguals. A small cuneate scale (rarely two, rarely none) between the 4th and 5th. *Sublinguals.*—Two pairs; the anterior rather larger, the posterior quite separated by a single scale. *Costals*—Very variable in number according to the variety and the locality. In *Typica* usually 23 (less commonly 25) in midbody in South India; 21 or 23 in the Central Provinces; 23 (less commonly 21) in the United Provinces; 21 in the Punjab and Western Himalayas.

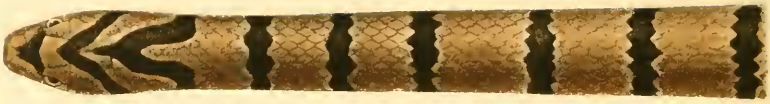
In *fasciatia* usually 23 (rarely 21) west of Calcutta; 21 (rarely 19) east of Calcutta. In variety *spatatrix* 19 or 21. In variety *oxiana* 21. Usually 6 (sometimes 8) rows are absorbed before the vent. The vertebral row subequal to adjacent scales, or rather narrower, no keels. No apical pits. *Ventrals* variable in number according to variety and locality. In *typica* from Ceylon and South India 170 to 193, from other parts of India 176 to 200. In *fasciata* from Assam and Burma 179 to 194. In *oxiana* 195 to 213.

Anomalies.—The head shields are wonderfully constant, and except for the rare absence of the little cuneate shield, and the presence of two instead of three posticulars I do not think I have ever seen an abnormality. Two specimens killed by Mr. Bernard Cooke had, he told me, the 3rd supralabial divided into an upper and a lower part.

Dentition.—Maxilla furnished with two operative canaliculate fangs. One of these is often loose, not yet having become anchylosed into the bone, or having functioned is about to be shed. A single grooved tooth in the posterior end of the jaw is usually present, but when shed may not be replaced for some days. *Palatine.*—6 to 8 subequal teeth grooved on their inner faces. *Pterygoid.* —In varieties *Typica* and *Fasciata* 11 to 15 grooved on their inner faces, and diminishing in size posteriorly. In *oxiana* 20 to 22. *Mandibular*, 13 to 15, grooved on their outer faces, reducing in size behind.

Our coloured plate (page 243) shows three varieties of the cobra, (1) *typica*, the binocellate or spectacled cobra of Europeans, and the "gokurrah" of natives: (2) *caeca*, the blind cobra with no hood marks; and (3) *fasciata*, the monocellate cobra of Europeans, and the "keautiah" of natives in Bengal. Mr. Gerhardt is to be congratulated on the excellence of these pictures which are most life-like.

Plates A and B are reproduced from Major Fayrer's most successful photographs. The upper figure in Plate B shows the hood expanded, and a very moderate degree of erection of the body. Contrast with this the three specimens in figure A, all of which are seen erected to their full extent.



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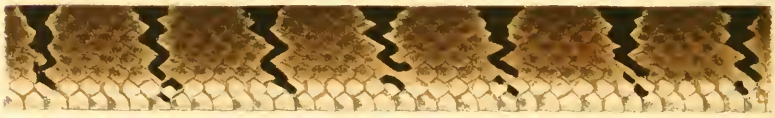
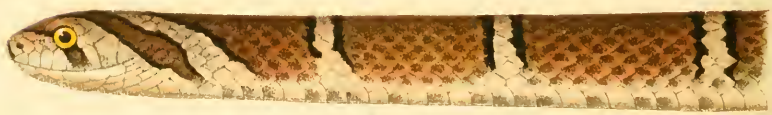


1a

1b

2

2a



2b

J. G. del

J. Green, Chromo

THE COMMON INDIAN SNAKES. (Wall).

1 Simotes arnensis, *harmless, nat size*

2. Simotes albocinctus, *harmless, nat size.*

Errata.

For Part XX. with Plate XX, *read* Part XXI. with Plate XXI.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plates and Diagrams

BY

Major F. Wall, I.M.S., C.M.Z.S.

Part XXI (with Plate XXI Text figure and Map.)

(Continued from page 568 of this Volume.)

Both the subjects of this paper belong to the genus *Simotes*, one of the many into which aglyphous or fangless colubrines are divided. The genus contained 22 species when Mr. Boulenger's Catalogue appeared in 1894. Its representatives are denizens of the Southern part of the Asiatic Continent from the Punjab to Southern China, and range through the Malayan Archipelago from Sumatra as far East as Timor, and as far North as the Philippines and Formosa. Of the 22 species no less than 11 occur within our Indian Dominions.*

The types are the Indian *arnensis*, the Malayan *octolineatus*, and the Malayasian *purpurascens*.

SIMOTES ARNENSIS (Shaw).

The Common Kukri Snake.

History.—Seba appears to have been the first to depict this snake, his illustration dating back to the year 1735. Later in the same Century—in the year 1796—Russell figured and remarked upon it twice in his first volume (Plates XXXV and XXXVIII).

Nomenclature.—(*a*) *Scientific.*—Dumeril and Bibron are responsible for the generic name which is from the Greek "simos" a snub-nose and refers to the rostral shield which is reflected back on to the snout to a remarkable degree in all the kukri snakes. (*See* figure A of Diagram.) Arni from which the snake derives its specific name is a town close to Arcot in the Madras Presidency, where the subject of Russell's Plate XXXV was captured.

(*b*) *English.*—The common kukri snake seems to me an appropriate name for it. As already mentioned in a previous article of this series (Vol. XIX, p. 556) the name is suggested by the blade

*It is extremely dubious whether the two genera *Oligodon* and *Simotes* established by Boie and Dumeril and Bibron respectively, and upheld by Dr. Günther and Mr. Boulenger deserve separate recognition. The characters made use of to distinguish them based mainly on the presence or absence of palatine orpterygoid teeth are not tenable. I have skulls of 11 species (6 *Simotes* and 5 *Oligodon*) and can find no important constant differences between them. A study of the lepidosis too fails to reveal any single character, or combination of characters that can justify the division. I feel certain therefore that the two will have to be amalgamated under Boie's title *Oligodon* which is the older.

like character, and peculiar shape of the posterior maxillary teeth in all the species of *Simotes* and *Oligodon*.

(c) *Vernacular.*—Russell says it is called "katla tutta" in the Vizagapatam District, and Mr. Muir tells me that in Bengal around Kalna it is called "sanka." I have heard no special native names for it myself.

Identification.—It is not an easy matter to distinguish this from some other kukri snakes to which it bears considerable resemblance in colour and markings. It is safer to identify the snake by attention to scale characters only. The brevity of the sutures between the internasal and præfrontal fellows, are, I think, if taken together, sufficient to establish the genus as either *Simotes* or *Oligodon*. The internasal suture is half or less than half the internaso-præfrontal suture, and the præfrontal distinctly less and often but half the præfronto-frontal suture. In order to distinguish *arnensis* from the other kukri snakes the following points must co-exist :— (1) a divided anal shield, (2) presence of loreal, (3) 7 supralabials, and (4) more than 40 subcaudals, of course taking care to see that the tail is not imperfect.

Perhaps an easier way of putting the matter is this. Any snake found in the plains of Peninsula India (*see* map of distribution) which has 17 scale rows anteriorly and in midbody, and only 15 at a point two headslengths before the vent, together with only 4 or 5 infralabials will almost for certain prove to be *arnensis*. This remark, though will not apply to the hills for the following species combining the same characters, may be associated with *arnensis* in certain upland localities. In the Eastern Himalayas, including of course Nepal, *Oligodon erythrogaster* occurs, and in the South Indian Hills *Simotes beddomei*, *Oligodon venustus O. travancoricus*, and *O. affinis*. In these Hills, and their immediately adjacent low country recourse must be had to the method of identification first indicated.

General characters.—The body is cylindrical, rather short, smooth, and of even calibre throughout. A neck is slightly indicated behind the slightly expanded jaws. The head is moderately depressed, the snout short, rather blunt, and devoid of any canthus. The nostril is open, and evident, and the eye is of moderate size with round pupil, and an iris of ruddy or brownish gold. The tail is short, somewhat compressed basally, and accounts for about one-sixth to one-seventh the total length of the snake.

Colouration.—The ground colour is brown of various hues, inclined sometimes to a ruddy, or a purplish tint. It fades to a more or less degree in the flanks. The back is crossed with black bars which are narrowly, but usually distinctly, outlined with whitish or pale yellow. They do not reach the ventrals, but break up in the flanks into streaks. They vary somewhat in width, but are, I think,

always distinctly narrower than the intervals left between them. Their number seems to vary with the locality. In the United Provinces, Punjab, N. W. Frontier and the Western Himalayas my examples have shown from 41 to 54 on the body, and 9 to 12 on the tail. From Orissa I have had one with 37 bars on the body, and only 6 on the tail. Russell's Arni specimen had only 22 on the whole length and Günther mentions one from Ceylon with only 17 on the body. I have seen as many as 62 bars in a specimen from Behar. In the vast majority of specimens these bars are of even width in mid-dorsum and taper costally, but I have seen a specimen in Fyzabad, and another from Bannu in which they were indented in the median line anteriorly and posteriorly and converted into twin beads, or figures of eight. This form of mark is common in many of the species of *Simotes* and *Oligodon*. In the intervals between the bars the flanks are variegated with short streaks. The belly is usually of a uniform pearly white, but is often black spotted, or Mr. Boulenger says the ventrals may be bordered at their free edges with brown. The spotted specimens are, I find, not peculiar to any locality, for I have seen a specimen in Almora in which most ventrals had a spot at one or other side, and Mr. Boulenger records such from Nepal, and S. India, where the majority of specimens are unspotted. The head is adorned with three conspicuous black marks which are often, if not usually, bordered narrowly with white or pale yellow. The anterior mark is crescentic, and passes across in front of the eyes to re-appear below them. The median and posterior are sagittate, the apex of the former reaching to the frontal and the arms to behind the gape, whilst the apex of the latter passes to the parietals, and the arms to the sides of the neck. The posterior sagitta is much the broader one. These three marks are nearly always discrete, unlike the same marks in some other species which are connected by a median shaft. In very old specimens these head marks tend to disintegrate, and become obscured. There are usually some dark streaks to be seen in some of the supralabial sutures.

Dimensions.—Adults usually range between 18 and 21 inches, but I have had at least eight specimens exceeding these measurements, the two largest, both females, being exactly two feet long. Günther mentions one 25 inches long.

Haunts.—Nearly all the specimens I have had came from within Cantonment limits. I have come across many alive on the roads, or the wayside, and have even met with it on the open parade ground more than once. More usually it does not stray from within easy touch of efficient cover. It appears to make its home for the most part in masonry, frequently domiciling itself in bungalows and outhouses. I have received many with the report that they were found in the house. Mr. Reid tells me that in Behar, where it is common, it frequents buildings and old walls. I once had one sent to me

that had fallen into a well in the compound, having probably fallen from the masonry. One received this year was found at night in the bedding of one of the Gurkhas encamped on granite hill, Almora. This like other kukri snakes is of course harmless, but a specimen in Bannu was responsible for the death of a sepoy. I am indebted to Captain Sumner, I.M.S., for the details of the incident. It appears that the sepoy with others was on duty at Kurram Garti (8 miles from Bannu) and under canvas. He came off sentry at about 11 p.m., removed his uniform, and laid down on his bed on the ground. He jumped up immediately rubbing his buttock, and declared that something had bitten him there. His companions searched his bedding, and there found a snake which they killed. They examined him, but could see no signs of a bite and tried to persuade him, though without success, that he had not been bitten. The next morning he did not get up, and his companions could not rouse him. The Hospital Assistant was sent for and found him comatose. He did what he could for him, and sent him in a dhooly to Bannu, but he expired on the way. Captain Sumner here examined the body, and could find no local signs of the bite, and was much perplexed as to the cause of death. The snake was put into a bottle, and kept in the hospital, and when I heard of the case I wrote to Lt.-Col. Magrath in Bannu, who sent me the specimen. To my surprise I found the author of the mischief was a common kukri snake, 1 foot $7\frac{1}{2}$ inches long. It seems to me that the man must have died of fright, believing himself bitten.

Disposition.—I do not consider it a malicious snake, though it will sometimes menace, or even inflict a bite when molested, or its liberty is jeopardised. I have had many alive, picked up several in their natural haunts, and had more than one in captivity. Some showed great timidity, others faced round pluckily and menaced or struck without inflicting an injury, or more rarely actually bit me. Russell had one that he brought face to face with pigeons and chickens, but which he could not induce it to bite.

Habits.—It is an active and voracious little reptile, easily taking alarm, and hastily attempting concealment. It is often wonderfully adroit in evading swift movements directed towards seizing it by the neck, and has made me realise how cautious one should be in attempting the capture of poisonous snakes in this manner.

I have seen it inflate its body to a remarkable degree under the influence of excitement. It was noticed that the expansion affected a length of the body considerably in excess of the limits of the lug, for it was observed to reach to the 13th cross-bar. Subsequent dissection showed the lug ended at the 11th cross-bar. In addition to this inflating effort, some specimens may be observed

to flatten the posterior part of the head on to the ground by the action of the quadrates, and in so doing they make the neck much more apparent than normal. I have nearly always encountered it in motion in broad daylight, but some specimens I have had sent to me were killed in bungalows after nightfall. It climbs with facility as do most snakes that have their ventrals angulate, this condition approximating to that of the true keeled condition seen in the tree snakes *Dendrophis* and *Chrysopelea*. Two were discovered in Fyzabad, evidently a pair, in the act of scaling a mud wall, another fell off the top of a doorway in Berhampur on to a lady when opening a godown. The situation, some six feet from the floor, was a remarkable one for any snake, and an inspection of the place gave no clue to its probable path of ascent. It is more frequently met with in the rains than at other times during the year.

Food.—I have but rarely found anything in the stomach. A specimen killed in Almora contained two sausaze-shaped gristly masses of a yellow colour, the nature of which I could not ascertain as the material appeared to have no structure. With these was the flaccid envelope of a snake's or lizard's egg, which had been extensively perforated at both poles. On another occasion I found a plug of hair in the cloaca of considerable proportions. This taken with the choice of an abode about habitations leads me to think that it preys chiefly upon mice.

The Sexes.—In Fyzabad out of 15 sexed, 8 proved to be ♂ and 7 ♀. In Almora of 12 sexed, 9 were ♂ and only 3 ♀. The female has a relatively longer body, and shorter tail as might be inferred from the difference in the ventrals and subcaudals in the sexes. There appears to be little, if any, difference in the growth of the sexes, for although my two largest records of two feet were both females, I have had males 1 foot $10\frac{3}{4}$ inches and 1 foot $11\frac{3}{4}$ inches.

Breeding.—The mating season in the plains is during the rains. I have on two occasions—both in Fyzabad—acquired gravid females, but both unfortunately were killed. One contained 5 eggs of very considerable dimensions, the largest measuring $1\frac{8}{20} \times \frac{7}{20}$ inches. There was no trace of an embryo within. My second gravid specimen obtained like the first in August had 4 impregnated ovarian follicles enlarged to $\frac{12}{20}$ of an inch. In the latter case a ♂ was killed at the same time, both snakes being discovered within a couple of yards of one another scaling the same wall. This adds another instance to many already mentioned in these papers, to show that the matrimonial bond does not abruptly cease after sexual gratification. The smaller gravid ♀ measured 1 foot $9\frac{3}{4}$ inches, a length which I estimate would be attained by the end of the fourth year of life. It is not known for certain whether this species is

oviparous though this is probably the case. My youngest specimens which I took to be hatchlings measured $6\frac{1}{2}$ and $6\frac{5}{8}$ inches in April, $7\frac{1}{2}$ and $7\frac{3}{4}$ inches in May and $7\frac{1}{4}$ and $7\frac{3}{4}$ inches in July. It is probable, therefore, that the breeding season embraces three or four months of the year.

Growth.—From my records of length it appears that the young grow some 4 to 5 inches in their first year, and 3 to 4 inches in the second, third and fourth years of life.

Distribution.—Peninsular India and Ceylon. In India it extends north to the Himalayas and East and West to the outside limits of the territory drained by the Ganges and Indus Rivers. To the North-East it appears to be limited by the Teesta River, at any rate I can find no record East of this river excepting the Sikkim one to which I will refer again.* To the North-West it ranges to the Frontier, but there is no record of its occurrence in the Indus system further South, *viz.*, in Rajputana and Sind, and it is quite likely that it does not extend into these Provinces.

It is for the most part a snake of the plains, but is common in Almora at 5,400 feet, so that one may suppose it occurs in other hills up to about 6,000 feet. I have had it from the Himalayas as far West as Bakloh (4,500 feet). There are specimens from Nepal in the British Museum, with no altitude specified, but I discredit the locality of the specimen in the same institution said to be from Sikkim.† Nicholson mentions it from Bangalore (circa 3,000 feet) in Southern India, and there are examples in the British Museum from the Anamallays, altitude not specified.

I found it a common snake in the United Provinces. Mr. Reid tells me it is common in Behar, and Mr. Muir says it is fairly common in Bengal (Kalna). Jerdon reports it rather common in Southern India, and Haly in the low country in Ceylon. In the last locality it does not appear to have been collected at a greater altitude than Kandy (circa 1,600 feet).

The precise localities known to me are set forth in the accompanying map.

Lepidosis.—*Rostral*—Touches 6 shields, the rostro-internasal sutures being equal to, or rather longer than, the rostro-nasal; the portion visible above equal to or little less than its distance to the

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* Mr. W. A. Jacob, I.F.S., has collected assiduously in the Jalpaiguri District, East of Teesta, for some years and has given me a list of 29 species he has found there. This does not include *arnensis*. The fauna of this District agrees with that of Assam as remarked upon by me in a previous paper in this Journal (Vol. XIX, p. 897).

† As already stated I can find no record other than this one from East of Teesta; and here, I may remark, that I have examined at least 1,200 snakes from various altitudes in Sikkim, but never seen *arnensis*. It is a very significant fact too that Messrs. Von Schlagintweit from whom this record emanates are also responsible for the records of *Eryx conicus*, and *E. johni* from Sikkim, both of which are discredited by Mr. Boulenger (*vide* Catalogue, Vol. I, pp. 124 and 128).

frontal. *Internasals.*—A pair, the suture between them equal to, or rather less than that between the præfrontal fellows, less than half the internaso-præfrontal sutures. *Præfrontals*—A pair, the suture between them less than (about half) the præfronto-frontal sutures, touching the internasal, postnasal, loreal, præocular and supraocular.

Frontal.—Touches 6 shields, the sutures subequal, or supraoculars rather longest. *Supraoculars.*—Length less than the frontal, breadth about half the frontal opposite the middle of the eyes. *Loreal*—Single, very small, about half the length of the nasals, rarely absent. *Præocular.*—One, not reaching the top of the head. *Postoculars.*—Two *Temporal*—One. *Supralabials.*—7, the 3rd and 4th touching the eye. *Infralabials*—5, the 5th largest, and in contact with two scales behind; 4th and 5th touching the posterior sublinguals. *Sublinguals.*—Two pairs; the anterior rather larger. *Costals.*—Two headslengths behind the head 17, midbody 17, two headslengths before the vent 15. The reduction of rows is caused by a disappearance of the 4th above the ventrals, which is usually absorbed into the 3rd (more rarely the 5th). Apical pits and keels absent.

Ventrals.—These vary with the sex. In the ♂ 170 to 186, in the ♀ 180 to 199; somewhat angulate laterally. *Anal*—Divided. *Subcaudals*—Divided, varying in number with sex. In the ♂ 48 to 59, in the ♀ 41 to 50.

Anomalies.—Sometimes a fragment is detached from the parietal to form a pseudo-temporal. The loreal is rarely absent. In one instance where I found it so the præfrontal touched the 2nd and 3rd supralabials. It is not very unusual to find the 6th supralabial failing to come to the labial margin, but wedged between the 5th and 7th shields (*see* figure B (*a*) of our Diagram). I have once seen the 6th and 7th supralabials completely confluent. Only 4 infralabials occur somewhat commonly. I have seen one specimen with the anal entire, and another in which the 4th, 6th and 7th subcaudals were entire.

*Dentition.**—The *maxilla* supports from 8 to 11 teeth markedly syncranterian in type, the posterior especially being highly compressed and bladelike. There is an edentulous space in front that would accommodate 3 or 4 teeth. The *palatine* has an edentulous space anteriorly, that might take two teeth, and a much longer space posteriorly. In the middle there are from 3 to 6 teeth. The *pterygoid* has an edentulous space in front behind which are from 6 to 18 teeth (6 to 11 in Almora specimens, and 15 to 18 in a Fyzabad example). The *mandibular* array number 13 to 14, which are small and subequal.

Our plate is good. Many specimens, however, show the bars even more clearly outlined with yellow, and it is not usual for the bars to pass as low in the flanks before disintegrating. The first head

* Taken from 3 skulls in my collection.

mark is not usually so sagittate as represented. Figure 1 (*b*) shows the somewhat unusual ventral maculation.

SIMOTES ALBOCINCTUS (Cantor.)

The Ladder Back or Light-barred Kukri Snake.

History.—Dr. Cantor is responsible for our first introduction to this snake, which he described in the year 1839. It has been confused with several others of the same genus by past authors, partly on account of the great similarity in lepidosis shown by many of the allied forms, and partly owing to the great variability in the colour and markings of many individuals of what are still held to be but one species. Blyth in 1854 remarked on the variability of this species, but as he refers to specimens from Southern India and Ceylon, we may presume that *arnensis* was at least one of the forms to which he alluded. Even, as late as 1894, Mr. Boulenger recognised these varieties in his Catalogue. One of these, *viz.*, Var C., I think, I have shown in (Vol. XX of this Journal, p. 162), is entitled to rank as a distinct species which I have named *juglandifer*. Besides the very distinctive dorsal marks shaped like walnut kernels, or the quadruple spots placed crosswise and the complete absence of light bars, such as are seen in *albocinctus* it shows a short edentulous space in front of the palatine, that does not occur in *albocinctus*.

Nomenclature—(*a*) *Scientific.*—The specific name is derived from the Latin "albus," white, and "cinctus." a belt, but is not altogether satisfactory, as the marks referred to are dorsal bars and not belts.

English.—The regularity of the bars on the back, and their wonderful uniformity in spacing remind one of a ladder and suggested the name "ladder back," but perhaps the "light-barred kukri snake" may appeal more to some.

Vernacular.—The only name I am acquainted with is "sar-vul-saw" which Captain Venning (Vol. XX, p. 335 of this Journal) tells us is applied by the natives in the Chin Hills, Upper Burma, to this as well as to the snakes *Coluber porphyraceus*, and *Callophis macclellandi*, all by the way reddish snakes.

Identification.—Attention must be directed to the sutures between the internasal and præfrontal fellows, to which I have already referred in discussing the identification of *arnensis*. The following combination of characters will separate the "ladder back" from other kukri snakes except *juglandifer* :—(1) Costals 19 in midbody, (2) anal entire, (3) a single temporal. The bars across the back of *albocinctus* are very distinctive, and no trace of them is to be seen in *juglandifer*.

General characters.—The body is cylindrical, smooth, stout, and

rather short, and the skin as in other kukri snakes is not nearly so loose as in most colubrines and vipers. The belly is angulated at the sides. The head is short and broad, and the snout subtruncate. There is no indication of a canthus, and the head even at the back is barely broader than the neck. The nostril is open, and placed between two shields. The eye is of moderate size with round pupil and a yellow iris. The tongue is reddish at the base and black at the tips. The tail is compressed at the base and short, accounting for about one-fifth to one-sixth the total length.

Colouration.—Though Blyth has remarked on the variability of the snake, and other writers have recognised three, and even four varieties, my experience—I have examined over fifty specimens—shows that it is variable in its general colouration, but wonderfully constant, and distinctive in its markings. The ground colour is brown of various tones, but often more or less strongly tinged with purplish or red. In some the hue is much the same as in a cigar, in others it is like raw beef, and in others again berry-red, and even lobster-red. In the ruddy specimens the underlying hue is usually a lobster-red, which on close inspection will be seen at the bases and edges of the scales. A suffusion of brown on the rest of the scale tones down the general colour, which is always however most vivid in the flanks. Rarely there is no suffusion of darker tones, and the specimen is uniform lobster or salmon-red.

The back is crossed by bars which differ from those seen in *arnensis*, in being light centrally, and heavily bordered with black. These bars which number from 17 to 25 on the body and 4 to 8 on the tail are seen at wonderfully regular intervals in the whole length of the snake, and they involve two or three scales in the body length, the intervals involving from five to eight. Each bar is of uniform width, and extends well into the flanks, its central zone blending with the light underparts. The light central zone may be whitish, greyish-white, grey, or pale yellow, the last hue being often seen in the berry-red examples. In some specimens some rather obscure longitudinal striping may be observed just as one sees in *S. cyclurus*, and some of the other species. When present this consists of a dark band about five scales broad which passes down the middle of the back, and a narrower similar band on the 3rd and 4th scale rows above the ventrals.

The head is pale greyish or yellowish and bears the usual three marks which are so characteristic of the kukri snakes. In the lobster-coloured specimens the marks are white. There is a great tendency for some or all of these marks to be disintegrated and more or less confluent, as will be seen in figure 2 (*a*) of our Plate, where the median sagitta is much broken up, and its isolated central macula is confluent with the apex of the nuchal sagitta. In many

specimens one sees a light black-edged stripe on the nape, the edges of which may be parallel as in our Plate, or more or less U shaped. The belly is pearly-white, or in the ruddy specimens more or less mottled with pinkish, and is always spotted or mottled with dark tones. Usually there are squarish spots just within the angulation of the ventrals, and arranged with a tendency to miss each alternate or third shield. These spots may be discrete, and distant, or united by a band passing across each ventral, as seen in figure 2 of our Plate.

A solitary specimen collected by Theobald in the Arakan Hills was made the type of a distinct species (*amabilis*) by Günther. It is, however, considered by Mr. Boulenger only a variety of *albocinctus*, differing only in having more numerous bars, *viz.*, 55, with correspondingly shorter intervals, involving from 3 to 4 scales.

Dimensions.—The average length of an adult is about two to two-and a-half feet. My largest example taped exactly three feet.

Haunts, Habits, etc.—I have seen very few specimens in life, nearly all having been spirit specimens. As nearly all of these came from Tea Estates in Assam, or in the vicinity of Darjeeling, I may safely infer that this kukri snake is commonly to be met with in the day-time among the tea bushes during plucking operations. Two specimens at least were killed actually inside a bungalow in Dibrugarh. I know nothing of its disposition.

Food.—I found a mass of soil in the stomach of one, mixed with grits, shreds of vegetable fibre and two longish hairs, which I can only suppose were swallowed during its death throes, the scene being perhaps a stable floor. On the other few occasions, where I have found the stomach full, a mouse had furnished the repast. In one case the tail only was discovered, and the quarry must have made its escape.

The Sexes.—In the neighbourhood of Darjeeling the ♂ appears to be much more abundant than the ♀, I having had no less than 23 of the former to 14 of the latter sex. The tail is longer in the ♂, as may be inferred from the numbers of subcaudals, *viz.*, 61 to 68, compared with from 42 to 57 in the ♀. There is also some slight difference in the relative lengths of the body in the sexes, but this is not so obvious from the ranges of the ventrals, which number from 181 to 199 (177, Boulenger) in the ♂, and from 182 to 206 in the ♀.

Breeding.—My only note bearing on this subject is to the effect that a ♀ killed on the 10th of July in Dibrugarh was found with three impregnated ovarian follicles measuring from $\frac{3}{8}$ to $\frac{5}{8}$ of an inch. The specimen measured 2 feet $5\frac{1}{4}$ inches, but the tail was imperfect, and accounted for only 4 inches of that length.

Distribution.—The light-barred kukri snake has a more restricted range of distribution than most of the snakes dealt with in

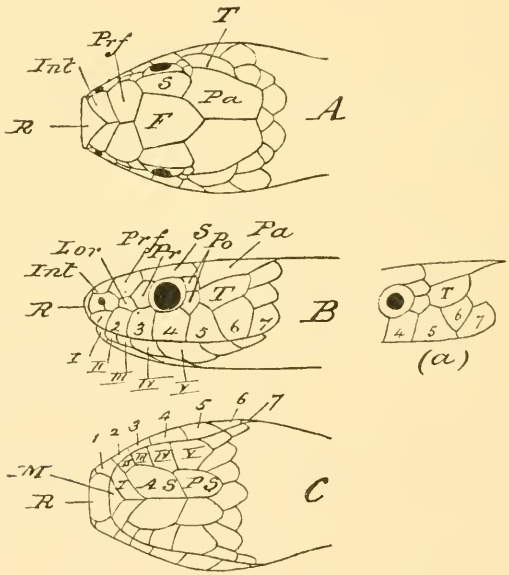
these papers, but is so common within that area that it deserves mention in the series. It inhabits the Assam Hills and plains ranging North into the Eastern Himalayas, and East to the conterminous ranges bounding the North and West of Burma, *i.e.*, the Kachin Hills, Manipur Hills, Chin Hills and Arakan Yomas. Its probable Western limits are the Teesta and Brahmaputra Rivers. The exact localities known to me are given in the accompanying map, but I have not been able to include the many places referred to in Sclater's list of the snakes in the Indian Museum, as it is impossible to tell from this list what are specimens of true *albocinctus* and what may be *juglandifer*.

It appears to be a Hill snake, at any rate it is much commoner in most of the Hills within its habitat than it is in any part of the plains. In the Eastern Himalayas it is a very common snake between the plains and 5,000 feet elevation, but, although Mr. D'Abreu got one in Kurseong at 6,000 feet, it rarely ascends to to this altitude. At Buxa Dooars (1,200 to 1,500 feet) I found four specimens in a collection of twenty-two. Mr. Jacob has collected several in the plains at about the 350 feet elevation in the Jalpaiguri District. It was not a common snake about Dibrugarh but I got a few there. It is known from the Khasi Hills, but out of 335 snakes collected in Shillong at 4,900 feet I failed to get one specimen. In the Chin Hills Mr. Venning has met with it up to 6,500 feet.

Lepidosis.—*Rostral.*—Touches 6 shields, the internasal sutures are equal to or rather longer than the anterior nasals; visible portion above equals, or nearly equals its distance to the frontal. *Internasals.*—A pair, the suture between them equals or nearly equals that between the prœfrontal fellows less than half the internaso-prœfrontal suture. *Prœfrontals.*—A pair, the suture between them half or less than half the prœfronto-frontal suture; in contact with internasal, postnasal, loreal, prœocular and supraocular. *Frontal.*—Touches 6 shields, the sutures are subequal, or those made with the supraoculars, rather largest. *Supraoculars.*—Length rather less than frontal, breadth half or less than half the frontal opposite the centres of the eyes. *Nasals.*—Quite divided, in contact with the 1st and 2nd supralabials. *Loreal.*—One. *Prœocular.*—One. *Postoculars.*—Two. *Temporal.*—One. *Supralabials.*—7, the 3rd and 4th touching the eye. *Infralabials*—5, the 4th and 5th touching the posterior sublinguals, 5th largest, and in contact with two scales behind. *Sublingual.*—Two pairs, the anterior rather the larger. *Costals.*—Two headslengths behind the head 19, midbody 19, two headslengths before the vent 15 (rarely 17); no apical pits; no keels. *Ventrals.*—Angulate laterally; 177 to 199 in the ♂, 182 to 206 in the ♀. *Anal.*—Entire. *Subcaudals.*—Divided, 61 to 68 in the ♂, 42 to 57 in the ♀. *Anomalies.*—The

commonest abnormality is to find 8 supralabials, the 4th and 5th touching the eye. I have seen the præocular divided once, also the 2nd supralabial divided once. In Evans's specimen the loreal and præfrontals were confluent. The costal rows reduce sometimes only to 17 posteriorly. I have seen the 3rd and 4th subcaudals entire in two examples.

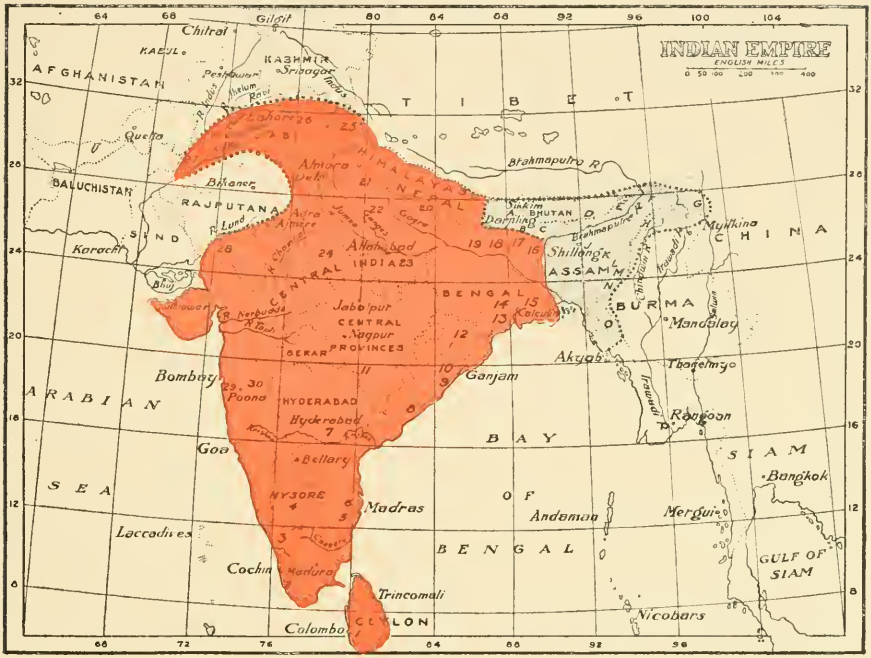
Dentition.—The *maxilla* has 10 or 11 teeth rapidly increasing in length from before backwards. The *palatine* supports 8 to 10 subequal teeth (7 on one side in one specimen), and there is no edentulous space anteriorly.* The *pteryoid* teeth number from 16 to 19, and are subequal, and much smaller than the palatine. The *mandible* bears from 13 to 16 subequal teeth. Our Plate is good in every way, but perhaps it was a pity that a specimen for painting was selected that exhibited abnormal supralabials.



Simotes arnensis.
(× 1½)

* In this respect it differs from *juglandifer* where a space is seen anteriorly that would take one tooth. The teeth in 3 skulls of *juglandifer* number 7 (6 on one side in one specimen).

Map to show distribution of *Simotes arnensis* in red. *Simotes albocinctus* in grey.



..... lines shown thus, imply boundary doubtful

Localities in Map showing by figures Distribution of

SIMOTES ARNENSIS.

(1) Ceylon (Haly and B. M.), (2) Travancore (Bo. M. and Ferguson), (3) Anamallays (B. M.), (4) Bangalore (Nicholson), (5) Arni (Russell), (6) Madras (B. M.), (7) Hyderabad (Bo. M.). (8) Vizagapatam (Bo. M.), (9) Aska (I. M.), (10) Berhampur (F. W.), (11) Chanda (Bo. M.), (12) Singbhum, (I. M.), (13) Kalna (F. W.), (14) Serampur and Bankura (I. M.), (15) Calcutta (I. M.), (16) Kaliganj (I. M.), (17) Purneah (I. M.), (18) Champaran (F. W.), (19) Muzzaffarpur (I. M.), (20) Nepal (B. M.), (21) Almora (F. W.), (22) Fyzabad (F. W.), (23) Allahabad (I. M.), (24) Nowgong (I. M.), (25) Bakloh (F. W.), (26) Lahore (F. W.), (27) Bannu (F. W.), (28) Deesa (B. M.), (29) Bombay, Bassein, Kalyan, Karwar (Bo. M.) and (30) Poona (B. M.)

B. M., implies British Museum, I. M., the Indian Museum, Bo. M., our Society's collection, F. W., the author.

Localities in Map showing by letters Distribution of

SIMOTES ALBOCINCTUS.

(A) Darjeeling and vicinity (F. W.), (B) Buxa Dooars (F. W.), (C) Jalpaiguri (F. W.), (D) N. Lakhimpur (F. W.), (E) Dibrugarh (F. W.), (F) Sadiya (F. W.), (G) Sadon, Kachin Hills (Evans), (H) Jaipur (F. W.), (J) Khasi Hills (B. M.), (K) Cherrapunji (Gunther), (L) Haflong, N. Cachar Hills (F. W.), (M) Manipur (F. W.), (N) Chin Hills (Venning), (O) Arakan Hills (B. M.).

B. M. implies British Museum, F. W. the author.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plates and Diagrams.

BY

Major F. Wall, I.M.S., C.M.Z.S.

Part XXII (with Plate XXII, Diagrams and Maps.)

(*Continued from page 760 of Volume XXII.*)

The next three species dealt with in this series of papers belong to the genus *Zamenis*, and are *Z. fasciolatus*, *Z. ventrimaculatus*, and *Z. diadema*. *Z. mucosus*, the commonest, and most widely distributed has been already discussed in a former paper (Vol. XVII, p. 259). When Mr. Boulenger's catalogue appeared in 1896, the genus included 34 species chiefly Asian and American. Of this total 10 occur within Indian limits.

ZAMENIS FASCIOLATUS.

The Fasciolated Rat-snake.

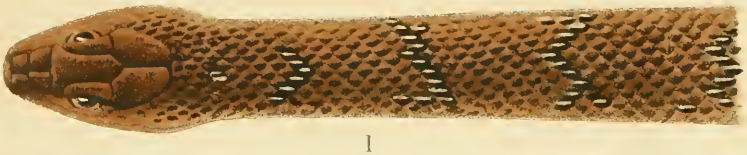
History.—Russell in his great work on the Indian snakes, published in 1796, was the first to mention this snake, and this Volume contains an excellent coloured plate (No. XXI) of a handsomely marked juvenile specimen. Shaw in 1802, and Daudin in 1803, next referred to it, and then Cantor in 1839. Since then many writers have contributed scraps of information concerning it.

Nomenclature.—(*a*) *Scientific.*—It received its specific baptism in 1802. Shaw's name (a diminutive form of the Latin *fasciatus* "banded") having reference to the narrow crossbars usually so distinct in early life. It was assigned to its present place among the *Zamenis* by Günther in 1864. The generic name is from the Greek "Zamenes" meaning "very strong."

(*b*) *English.*—I can suggest no better name than the fasciolated rat-snake which is the equivalent of its scientific designation.

(*c*) *Vernacular.*—"Nooni paragoodoo" is the name Russell gives on the authority probably of natives in Vizagapatam, since "gedi paragoodoo" or "grass runner" is the name given to the Krait in the Vizagapatam District, according to the same author. I am told that "nooni" is Telugu for oil, and "paragudu" means "runner." The former word which I believe is also used for glistening is probably suggested by the smooth and polished character of the scales.

Colour.—The prevailing hue dorsally is some shade of brown, or olive-brown, some specimens being very light and almost yellowish, others very dark. Young specimens are beautifully ornamented



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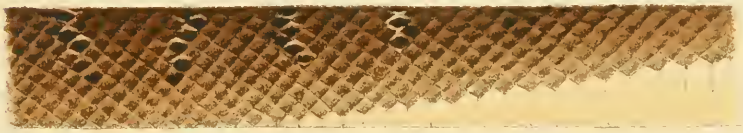

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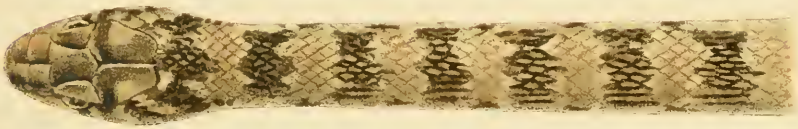

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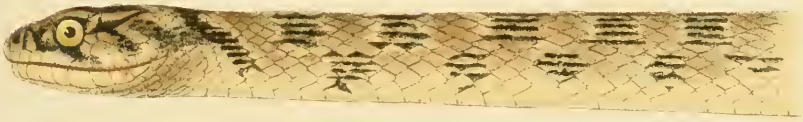

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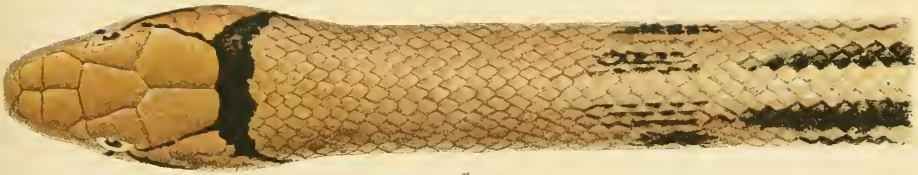

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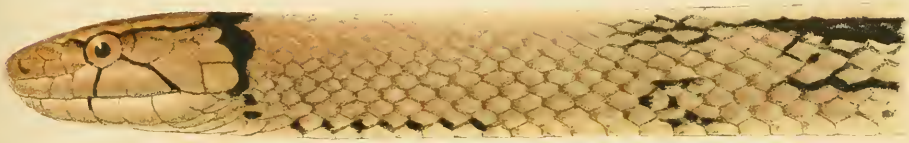

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P. Gerhardt del J. Green, Chromo.

THE COMMON INDIAN SNAKES. (Wall.)

1-2. Zamenis fasciolatus, *harmless*. 3-4. Zamenis ventrimaculatus, *harmless*

5-7. Coluber radiatus, *harmless*.

all nat size.

with crossbars, spotted or variegated with black and brown on a whitish ground. These bars are most conspicuous anteriorly and gradually disappear before, at, or at some distance behind the middle of the body. They become increasingly obscure as age advances. and some old specimens are nearly uniform in colour. The head is usually uniform olivaceous, and without any markings, but a young specimen of mine in Fyzabad was marbled with lighter hues. The belly is uniformly whitish, or yellowish. In my young specimen it was greenish-yellow.

General characters.—The head is of moderate length and width. The upper jaw projects rather prominently, and is sometimes rather parrot-like. A "canthus rostralis" is moderately evident. The nostril is of fair size, and occupies the upper two-thirds of the suture between the nasal shields. The eye is about half the length of the snout, and its round pupil easily discerned in life. A neck is fairly evident. The body is round, moderately long and smooth, and the tail is slender in form, and accounts for one-fourth to one-fifth the length of the snake.

Identification.—In many respects it is very like Hodgson's rat-snake (*Coluber hodgsoni*), a Himalayan species. It bears a superficial resemblance to Cantor's rat-snake (*Coluber cantoris*), another Himalayan form, and some other species of *Zamenis* and *Coluber* as well as the cobra. It is best recognised by attention to its scale rows first. These are usually 21 at a point two headslengths behind the head, 23 in midbody, and 17 two headslengths before the vent. Added to this the anal shield is divided; the supralabials are 8, the divided 3rd with the 4th and 5th, or the divided 4th with the 5th and 6th touching the eye; and the præocular touches the frontal shield.

Length.—It grows to upwards of three feet. The largest I have examined measured 4 feet 2½ inches.

Disposition.—It appears to be a plucky and vicious snake when molested. The few comments in this direction to be found in the literature on the species are in agreement. Stoliczka says it is rather a fierce snake when molested, and Blanford speaking of a specimen he encountered says, though young, it was one of the fiercest snakes he ever captured. The only specimen I have ever seen alive, probably a hatchling, was remarkably active and plucky. I understand from Mr. Millard, who is very familiar with it, that it is on account of its habit of flattening its body and a general resemblance in colour and appearance to a small cobra when moving that the Konkani natives so frequently declare it is a female cobra. My young specimen gave me a lively exhibition of its cobra-like behaviour. It erected itself probably as high relatively as a cobra would do, and flattened itself very remarkably.

Habits.—I believe it frequents jungly tracts chiefly, but will stray

into populated areas, and according to Stoliczka has been known to enter houses in Calcutta.

Food.—A specimen sent me from Patna had swallowed a rat. Stoliczka, however, remarks that it feeds on frogs and worms.

Breeding.—Very little is known in this connection. A specimen which I took to be a hatchling, measuring 11¼ inches, was captured by me in Fyzabad in the month of July. Mr. D'Abren told me of a hatchling he obtained in Patna in May.

Distribution.—Though Jerdon remarks that it is not uncommon in the Carnatic, this has not been my experience. I never obtained one when in residence in Southern India (Trichinopoly, Madras, Berhampore, Cannanore, and Bangalore), and I noticed that in the list of Travancore snakes given by Ferguson in this Journal (Vol. X, p. 68, and Vol. XIV, p. 386), this is not mentioned as one of the 58 land snakes enumerated. In my whole Indian career (19 years), I have had one specimen brought to me, *viz.*, in Fyzabad, and only one sent to me for identification, except the examples that have reached me from our Secretary from around Bombay. It is poorly represented in numbers in both the British and Indian Museums. The fact, however, that Nicholson supports Jerdon in saying that it is fairly common in Mysore; and Mr. Millard tells me it is quite a common snake in the Konkan, added to the fact that it is often mistaken for the cobra in the Konkan, and has a fairly wide distribution in Peninsula India justifies its inclusion in these papers.

It occurs in Northern Ceylon. In India it is found from Cape Comorin to the base of the Himalayas, excepting, perhaps, Travancore. It does not extend as far as Rajputana and the Punjab on the north-west, nor further east than Calcutta. I have elsewhere* given good reasons for doubting the accuracy of the locality of Cantor's specimen in the British Museum said to be from the Province Wellesley in the Malay Peninsula. The exact localities known to me are shown in the accompanying map.

Lepidosis.—*Rostral*—Touches 6 shields; the rostro-internasal sutures usually greater than the rostro-nasal. *Internasals*—Two; the suture between them two-thirds to three-fourths that between the præfrontal fellows, about two-thirds the internaso-præfrontal suture. *Prefrontals.*—Two; the suture between them subequal to the præfronto-frontal sutures; in contact with internasal, postnasal, loreal, præocular. *Frontal*—Touches 8 shields; the fronto-supraocular sutures about twice as long as fronto-parietals. *Supraoculars*—Length subequal to frontal breadth about two-thirds the frontal along a line connecting the centres of the eyes. *Nasals*—Two; in contact with the first and second supralabials. *Loreal*—One. *Præoculars*—One touching, or almost touching the frontal. *Postoculars*—Two.

* Pois. Terr. Snakes, Brit. Ind. Dom. 1908, Footnote, p. 21.

(1) Jaffna (Willey. Spol. Zeylan. April 1906, p. 33), (2) Anamallay Hill (I.M.), (3) Collagelly Hills (I.M.), (4) Mysore (Nicholson, Ind. Snakes, p. 87), (5) Madras (B. M.), (6) Ellore (Blanford, I. A. S. B. XLVIII, p. 115), (7) Vizagapatam Dist. (B. M.), (8) Calcutta (I. M.), (9) Monghyr (I. M.), (10) Patna (F. W.), (11) Benares (B. M.), (12) Allahabad (I. M.), (13) Fyzabad (F. W.), (14) Gwalior (B. M.), (15) Saugor (Bo. M.), (16) Nagpur (D'Abreu *in epistola*), (17) Salsette, Bombay, Thana, (Bo. M.), (18) Poona, Khandalla (Bo. M.)

B. M., implies British Museum; I. M., Indian Museum; Bo. M., Bom. Nat. Hist. Society's collection; F. W., the author.

Temporals—Two; the lower touching three supralabials (usually the 5th, 6th and 7th). *Supralabials*—8; the 3rd, 4th and 5th or 4th, 5th and 6th touching the eye. Either the 3rd or 4th usually divided and touching the eye. *Infralabials*—6; the 4th, 5th and 6th, or 5th and 6th only, touching the posterior sub-linguals; the 6th largest and in contact with 3 scales behind. *Sublinguals*—Two pairs; the anterior rather the longer, the posterior completely separated. *Costals.*—Two headslengths behind head 21, midbody 23, two headslengths before vent 17. In the step from 21 to 23, a row appears on each side of the vertebral; in the reduction from 23 to 21 the two rows next to the vertebral unite; in the reduction from 21 to 19 (which occurs close to the preceding step, in fact, the absorption of rows in these two steps may be reversed), the 3rd above the ventrals is absorbed; in the reduction from 19 to 17, the 7th or 8th row above the ventrals is absorbed. Vertebrals not enlarged. No keels. Apical facets present in pairs.

Ventrals.—197 to 225. *Anal*—Divided. *Subcaudals*—73 to 92 in pairs.

Dentition.—(From a single skull in my collection). *Maxillary*, 13 subequal teeth, succeeded (after a gap that would accommodate one tooth), by two teeth little if any larger than the preceding ones. *Palatine* 11, decreasing in length from before backwards, the anterior subequal to the maxillary. *Pterygoid* 15 to 16, decreasing in length from before backwards. *Mandibular* 18, decreasing in length anteriorly, and posteriorly from about the 5th. I think the dentition is sufficiently distinctive to dissociate this species from the genus *Zamenis* in which several species with various dental characters are now grouped.

I take the view in this paper and for the reasons specified in a footnote that the forms of *Zamenis* described under the names of (1) *ventrimaculatus* (Gray), (2) *rhodorhachis* (Jan.), (3) *ladacensis* (Anderson), (4) *dorsale* (Anderson), and (5) *chesnei* (Martin), are all varieties of a single species for which the foremost name must stand having priority. Boulenger in his Catalogue (1893, Vol. 1, pp. 398 and 399) has already united Nos. 1 and 5, under the name *ventrimaculatus*, and Nos. 2, 3 and 4 under *rhodorhachis*, but distinguishes between these two*.

* The descriptions of these two forms given by Boulenger in his Catalogue (1893) are identical with the exception of the ranges of the ventral, and subcaudal shields. I have now examined a large series of both forms from localities as widely separated as Almora in the East to Aden in the West. The dentition of all these agrees with that of the type of *ventrimaculatus* in the British Museum and the type of Anderson's *ladacensis* in the Indian Museum which I have also examined. I can discover no differences in lepidosis (examining specimens of each most critically side by side) except in the ranges of the ventrals and subcaudals. In one form both are more numerous than in the other. This becomes more noticeable in a comparison of the aggregates of these shields. Specimens of each agree in colouration, and they appear to grow to a similar length. I have examined the

ZAMENIS VENTRIMACULATUS (Gray).

Gray's Rat-snake.

History.—First referred to by Gray in 1834, who figured it in his Illustrations of Indian Zoology (Plate LXXX, Vol. II). The type specimen collected by General Hardwicke is in the British Museum, but the locality where found has been lost sight of. It is one of the few shielded forms. (Ventrals 206, subcaudals 98, Boulenger.) Under the name *Z. chesnei* Martin redescribed it in 1838. It has been redescribed under various other names, or confused with other species by many other authors.

Nomenclature—(a) Scientific.—"Ventrimaculatus" is from the Latin and implies spotted belly, in allusion to the irregular series of roundish spots seen at the edge of the ventrals in the forepart of the belly.

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geographical distribution of each and append maps which show that their distribution is almost the same. One (the few shielded) extends South of the Indus whilst the other has not yet been recorded so far South in India. A list is also appended showing the number of specimens of each that I have examined and added to the specimens in Boulenger's Catalogue and the ventral and subcaudal ranges. I think from these considerations most herpetologists will hesitate to accept these forms as distinct species. In this paper, therefore, I treat them all as one species under the name *ventrimaculatus*.

SYNOPSIS OF SPECIMENS.

—	No. of examples.	Range of ventrals.	Range of subcaudals.	Aggregate of foregoing.	Locality.
		Variety Typica.			
Few shielded	6	199-210	82-112	281-321	Persia.
Many do.	13	214-241	126-137	341-376	
Few shielded	2	207-209	109-112	316-331	Aden and around.
Many do.	10	222-236	124-138	346-372	
Few shielded	17	194-211	95-121	295-326	Sind, Baluchistan. Thar and Parkar. Rajputana, Punjab.
Many do.	..	....	....	....	
Few shielded	18	190-221	101-125	293-335	W. Himalayas, from Almora to Gilgit, and Chitral.
Many do.	10	216-246	126-145	347-391	
		Variety rhodorhachis (Jan.)			
Few shielded	..	....	....	....	Persia.
Many do.	6	217-236	125-137	347-363	
Few shielded	2	211-222	111-122	322-344	Chitral.
Many do.	..	....	....	....	

(*b*) *English.*—For want of a better title, and owing to the difficulty of finding anything distinctive in this member of a large genus, I propose to associate Gray's name with it.

(*c*) *Vernacular.*—According to Captain Shakespeare who sent 7 young specimens to our Society's collection from Koweit on the Persian Gulf it is called "dawaib-al-khail" in Arabia.

Identification.—The scale rows two headslengths behind the head are 19, in midbody 19, and two headslengths before the vent 15, or more commonly 13. The anal shield is divided. The supralabials are 9; the 4th divided and the 4th, 5th and 6th touching the eye (less commonly they are 8; the 3rd divided and the 3rd, 4th and 5th touching the eye).

There are only about 12 others of our Indian snakes with the scale rows as given above. 6 of these have an entire anal shield, and none have the condition of the supralabials peculiar to this species. The divided 3rd or 4th supralabial must be carefully looked for (*see* figure).

General characters.—This is a remarkably graceful species, the body is smooth on the surface, round, slender and elongate, and the tail is unusually long, and tapering accounting for more than one-fourth the total length. The head is moderately narrow, and the snout moderate in length, and obtuseness. The nostril occupies about the upper two-thirds of the suture between the nasal shields. The eye of medium size has the pupillary border of the iris fine specked with gold, so that the round shape of the pupil is clear evident in life. A neck is moderately evident. The attenuation of the body is very gradual, and continues so insidiously that the origin of the tail is barely if at all indicated. The belly is slightly angulated on each side.

Colour and varieties.—The variety *typica* of Gray, and far the commonest variety is very variable in its prevailing tones and markings. It may be dirty yellowish, olive-greenish, olive-brownish, stone coloured, or greyish. The posterior part of the body for a variable length, and the tail are uniformly coloured. Anteriorly the body is variously marked with spots, or crossbars, or both. A common form is shown in our plate where crossbars are evident, alternating with a single series of largish costal spots. These bars may be as long as the intervals, as in our plate, or only half the length. In another very common form there are no crossbars, but 5 or 6 rows of small spots arranged quincuncially. In some 3 series of small spots alternate with one another each side, and the uppermost with a series of narrow crossbars. The head partakes of the prevalent dorsal hue, and exhibits a blackish spot on the lore, a blackish oblique stripe below the eye, another on the temporal region to the gape, a band between the eyes, and various marks on the occiput. A crossbar, or a single longitudinal stripe, or twin stripes may

be present on the nape. These very variable marks are obscure, or more or less obsolescent in some specimens especially old ones but are quite conspicuous in the young. In a large number of examples there is a conspicuous, white, or buff zone around the eye. The belly in life is saffron yellow, or a paler shade, sometimes merging to pinkish posteriorly, or exhibiting a pinkish suffusion laterally. A more or less irregular series of black spots occurs at the edges of the ventrals beyond their angulation.

In the specimens I saw in life in Chitral the skin was dun coloured, and the scales in the anterior part of the body were black on their basal margins and pale yellowish or whitish on their apical margins where overlapped. This produced a beautiful variegation chiefly visible when the snake inflated itself under excitement. This variety is the prevailing one in India, in Chitral, Sind, Baluchistan, Persia, Arabia, and N. W. Africa.

Variety *rhodorhachis* (Jan) (From the Greek "rhodos," a rose and "rachis," the spine.) This variety which is far less abundant than *typica* is characterised by a reddish stripe down the spine which in some specimens is a brilliant vermillion, in others a vivid rose, and in others a brownish, or rusty red. It may involve from 3 to 5 scales in the breadth of the snake, and commencing at the nape may extend to the tail tip, or end at the vent, or sometimes before midbody. In other respects this form is marked as in *typica*, but I think all the specimens I have seen showed the quincunciate arrangement of small spots, and none any crossbars. I have seen the red spinal stripe very limited in extent, and but faintly indicated, and such specimens are completely intermediate between the forms *typica* and *rhodorhachis*.

There are specimens in the British Museum from Persia, and I have seen specimens from Chitral and from Aden Hinterland (Dthalla).

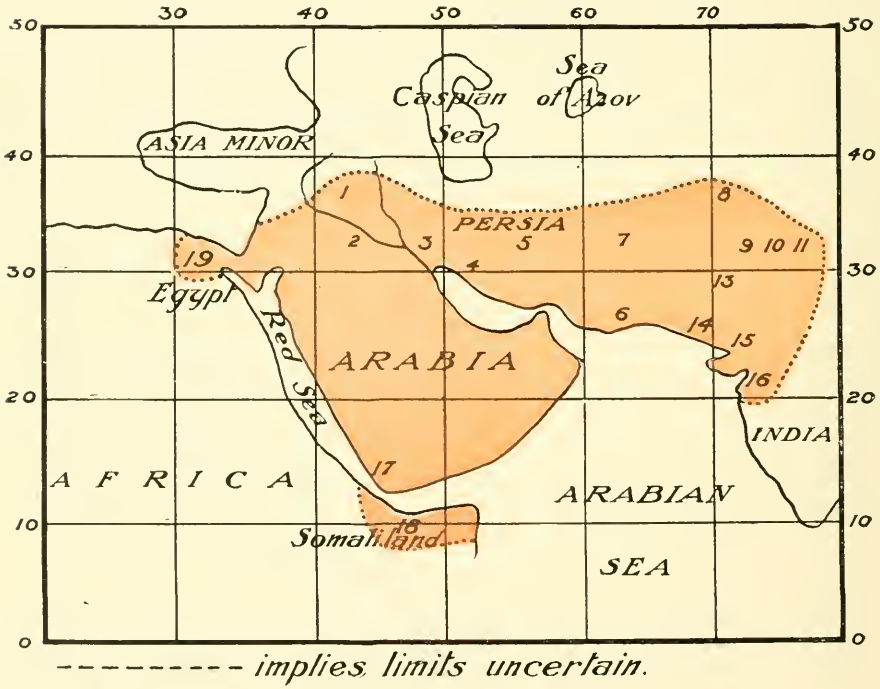
Variety *subnigra* (Boettger) uniform slatish in the anterior part of body, merging to purplish brown posteriorly. A narrow blackish mesial line on the neck expanding gradually and merging to purplish-brown so as to suffuse the entire dorsum. A few black spots costally. Head olive-greyish. Belly yellow beneath the neck, merging to purplish-brown behind, and with the usual black spots at the sides of the ventrals. Described by Boettger from an example from Somaliland, also recorded by Boulenger from the Abian Country, Arabia.

I have seen a uniformally blackish specimen from the Aden Hinterland (Dthalla) which I considered a melanotic example. (Ventrals 231, subcaudals 138).

Dimensions.—Adults usually measure from three to four feet. The largest specimen I have seen which had its tail slightly imperfect was a ♂ which taped four feet, and half an inch in the fresh state.

Map 1.

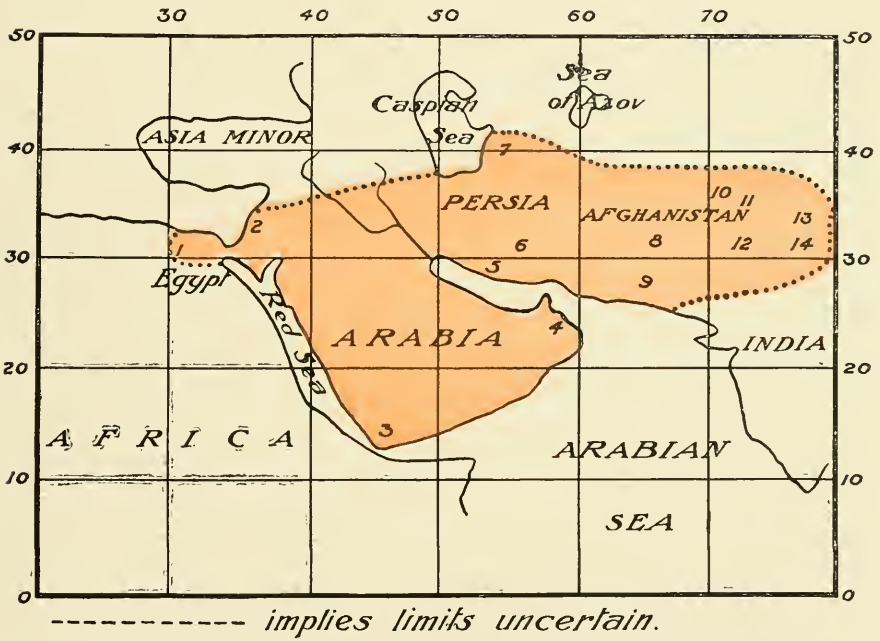
Distribution of the few-shielded variety (Ventrals 199—222. Subcaudals 82—122. Aggregate 281—344).



(1) Mesopotamia (B. M.), (2) Euphrates (B. M.), (3) Fao (B. M.), (4) Bushire (B. M.), (5) Persia (B. M.), (6) Gwadar (B. M.), (7) Afghanistan (B. M.), (8) Chitral (F. W.), (9) Lahore (Bo. M.), (10) Mussoorie (Bo. M.), (11) Almora (F. W.), (12) Delhi (F. W.), (13) Hyderabad (Bo. M.), (14) Karachi (B. M.), (15) Deesa (Bo. M.), (16) Deolali (Bo. M.), (17) Aden Hinterland (Bo. M.), (18) Somaliland (Boettger), (19) Egypt (Murray, Vert. Zool. Sind, p. 378).

Map 2.

Distribution of many-shielded variety (Ventrals 214—246. Subcaudals 124—145. Aggregate 341—391).



(1) Egypt (B. M.), (2) Dead Sea (B. M.), (3) Aden Hinterland (B. M.), (4) Muscat (B. M.), (5) Bushire (B. M.), (6) Shiraz (B. M.), (7) Transcaspia, (B. M.), (8) Baluchistan (B. M.), (9) Regan (B. M.), (10) Chitral (F. W.), (11) Gilgit (B. M.), (12) Punjab (Bo. M.), (13) Ladakh (Anderson), (14) Kasauli (Bo. M.)

B. M., implies specimen is in the British Museum; Bo. M. in our Society's collection at Bombay; F. W., the author's authority.

Haunts.—The many specimens brought to me in Chitral, Malakand and Delhi were encountered on the hill sides or in open spaces, or cultivated ground. There is no jungle worth the name in those localities, and I think the same may be said of most of the countries it inhabits. Several were killed inside our very congested little fort at Drosh, and another inside the mess at Chitral where it was seen in the roof. Another was killed in a house at Malakand where I think it was seeking retirement for the winter. Major Magrath tells me too that it is common about bungalows in Cantonment in Peshawar.

Habits and disposition.—I have met a good many during the day time, either basking in the open close to cover into which they quickly withdrew on my approach, or I disturbed them in the act of swallowing a victim. On one occasion the victim which had been swallowed proved so bulky that it seriously handicapped the snake's movements, and it could not in consequence evade capture. It is probably about at night too sometimes since it preys on Stoliczka's gecko, a lizard I never saw except after dark. It is a very active snake, but so far as a very limited experience of living specimens is concerned I do not think it is fierce or aggressive. Alcock and Finn who collected many specimens on the Perso-Baluch border also remark that it is not fierce. Many specimens I was unable to catch owing to the precipitate manner in which they disappeared on my approach, and one that I liberated went off so hurriedly that I had great difficulty in recovering it.

Food.—On three occasions I found a lizard of the genus *Calotes* had been taken. Twice this was the species *versicolor*, and on the third occasion probably the same species. Twice I found Stoliczka's gecko *Gymnodactylus stoliczkæ* had furnished the meal.

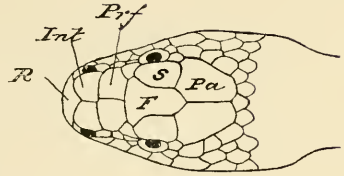
Breeding.—My three gravid specimens were captured in May and June, so that it is probable that mating occurs in the early spring, soon after they emerge from hibernation. The smallest dam was 2 feet 11 inches, a length which would be attained by about the end of the third year of life. There were 3 eggs in one, 8 in another and 9 in the third, so that the species cannot be considered prolific. The largest eggs which measured from one, to one and a half inches in length, contained no trace of an embryo, so that it seems probable that the snake is oviporous, and that the embryo does not begin to develope until after oviposition. The hatchlings probably emerge from the egg in August and September. I have had young specimens measuring $12\frac{3}{8}$ and $13\frac{1}{4}$ inches in September. The ♂ claspers in adults are studded with hook-like horny appendages. The secretion of the anal glands is white, and looks like white paint.

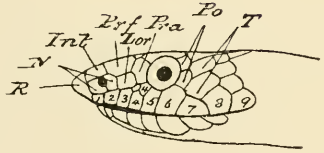
Growth.—The smallest specimen I have any record of is the one mentioned by Stoliczka captured at Sobattoo which measured $11\frac{1}{2}$ inches, and I think this will prove to be about the length of a

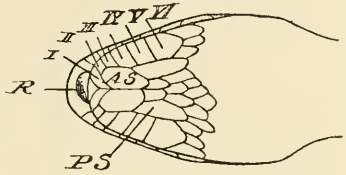
newly hatched specimen. As far as I can judge the species appears to grow about 10 or 12 inches each year until mature, *i.e.*, about the end of the third year, but like other snakes they will grow considerably after attaining sexual maturity.

Distribution.—It has been found in the Indian Tropical Region in the Konkan, (Bombay, Poona, and Deolali), on the confines of the Tropical Region, [Deesa, (B. N. H. S. Collection), Jeypore (Sclater), and Delhi (F. W.)], but otherwise only in the Mediterranean subregion of the Holarctic (Sind, Rajputana, Punjab, Western Himalayas, (West of Almora,) Kashmir, Chitral, Afghanistan, Baluchistan, Persia, Transcaspia, Mesopotamia, Arabia, Egypt and Somaliland). It is common everywhere on our N. W. Frontier. Major Bukhle tells me it is abundant at Sukkur, Sind. Alcock and Finn found it frequently on the Perso-Baluch boundary, and I have examined many specimens from Baluchistan. In the Aden Hinterland it was one of the commonest snakes met with. It is evidently plentiful in Persia judging from the many specimens in various Museums from that country.

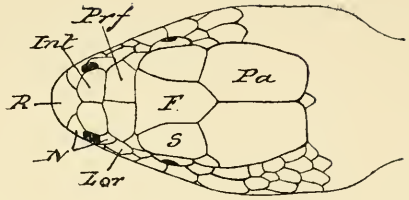
Lepidosis.—Rostral.—Touches 6 shields, the rostro-nasal sutures larger than the rostro-internasal. *Internasals.*—Two; the suture between them rather less than that between the præfrontal fellows, subequal or rather less than the internaso-præfrontals. *Præfrontals*—the suture between them, rather greater than the præfronto-frontal; in contact with internasal, postnasal, loreal and præocular. *Frontal*—Two; touches 8 shields; the fronto-supraocular sutures twice or more than twice the fronto-parietals. *Supraoculars*—About as long, and as broad as the frontal. *Nasals;*—Two, in contact with the 1st and 2nd supralabials. *Loreal*—One; longer than high. *Præocular*—One; touching frontal. *Postoculars.*—Two. *Temporals*—Two; the lower in contact with 3 supralabials (usually the 6th, 7th and 8th). *Supralabials.* Usually 9; the 4th divided and the 4th, 5th and 6th touching the eye (sometimes 8; the 3rd divided and the 3rd, 4th and 5th touching the eye). *Infralabials*—Six; the 6th largest and in contact with 3 scales behind normally. *Sublinguals*—Two pairs; the posterior longer, and in contact with the 5th and 6th infralabials, quite separated by small scales. *Costals*—Two headslengths behind the head 19, in midbody 19, two headslengths before the vent 13. In the reduction from 19 to 17, the 3rd or 4th row above the ventrals is absorbed, in the second step from 17 to 15 the two rows next to the vertebral coalesce; and from 15 to 13 the two rows next to the vertebral again fuse. As the first two steps occur close together, they are sometimes reversed, or intermixed. Keels absent. Apical facets in pairs. *Ventrals*—Angulate laterally. In the few shielded "form" 190 to 222; in the many shielded 214 to 246. *Anal*—Divided *Subcaudals*—In the few shielded "form" 82 to 125, in the many shielded 124 to 145.

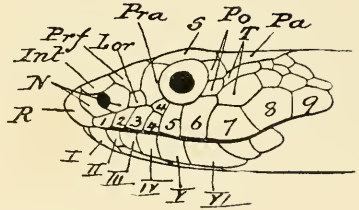


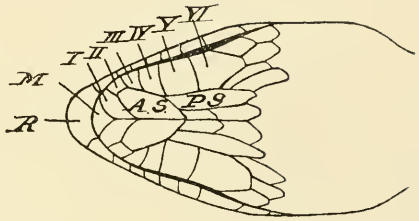




A. S.	Anterior Sublinguals.
F.	Frontal.
Int.	Internasals.
Lor.	Loreal.
M.	Mental.
N.	Nasals.
Pa.	Parietals.
Po.	Postoculars.
Pra.	Præoculars.
Prf.	Præfrontals.
P. S.	Posterior Sublinguals.
R.	Rostral.
S.	Supraocular.
T.	Temporals.
I—IX.	Supralabials.
I—VI.	Infralabials.







Zamenis fasciolatus (1/1)

Zamenis ventrimaculatus (×2)

Dentition.—From 7 skulls in my collection, including Variety *typica*, Karachi (Ventrals 201 + 114), Variety *typica*, Chitral (Ventrals 239 + 136), Variety *rhodorhachis*, Chitral (Ventrals 215 + 113), Variety *typica*, Sukkur (Ventrals 204 + 121). *Maxillary* 10 to 14, slightly increasing backwards, then a gap that would accommodate two teeth followed by a pair of obliquely set, enlarged teeth. *Palatine*, 9 to 11, the median about as long as the median maxillary, slightly decreasing forwards and backwards. *Pterygoid*, 15 to 24, gradually decreasing backwards. *Mandibular* 15 (14 ?) to 20 (21 ?), the first 3 or 4 progressively increasing, the posterior gradually decreasing.

Plate.—Our illustrations are good, and show one of the commonest colour forms. This Plate also contains three figures of another member of the genus *Zamenis*, which will be discussed in the next paper.

(*To be continued.*)

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plates and Diagrams

BY

Major F. Wall, I.M.S., F.L.S., C.M.Z.S.

Part XXIII (with Plate XXIII, Diagram and Map.)

(Continued from page 43 of Volume XXIII.)

Family—Colubridæ.

COLUBER RADIATUS.

The Copper-headed Rat-snake.

History.—The first mention of this snake in literature is by Russell who figured it in his Second Volume published in 1801. The plate (XLII) is an excellent one taken from a specimen received by him from Java. In 1837 Schlegel figured it, and christened it. Since then almost every herpetologist writing on Asiatic snakes has referred to it.

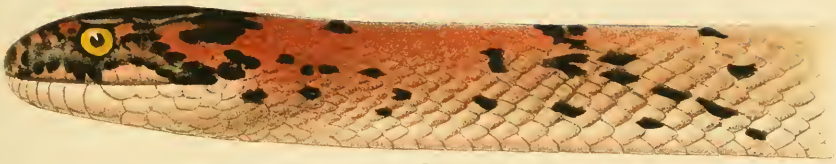
Nomenclature—(*a*) *Scientific.*—The generic name introduced by Linné in 1766 is from the Latin "coluber," a word applied indiscriminately to any snake. "Radiatus," from the Latin implying "radiating," emanated from Schlegel, and refers to the three black lines that radiate from the eye like the spokes of a wheel.

(*b*) *English.*—The copper-headed rat-snake suggests itself to me as distinctive, and appropriate.

(*c*) *Vernacular.*—In Upper Assam (Dibrugarh) I heard it called "goom phitti."

General characters.—This is a handsome species of moderately large proportions, ornamental in colouring, and distinctive in its markings. The head is moderately elongate, smooth, and evenly rounded from side to side, showing little evidence of a canthus rostralis. The snout is obtuse. The eye is moderate in size and the iris golden or golden brown especially towards its pupillary margin. The nostril is deep vertically and occupies the whole suture between the anterior and posterior nasal shields. The tongue is pale at the base, and has black tips. The body is elegant in form and distinctly compressed, its surface ribbed longitudinally with keels. The tail is round in section, and moderately long, being about one-sixth the total length.

Colour.—The head in life is a copper colour, or dull orange, and this tone merges to a duller one at the neck. A transverse black stripe passes across the head at the posterior limit of the parietal shields. This sends black limbs forwards to the eyes, and frequent-



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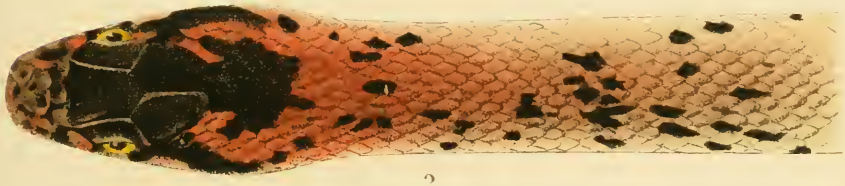

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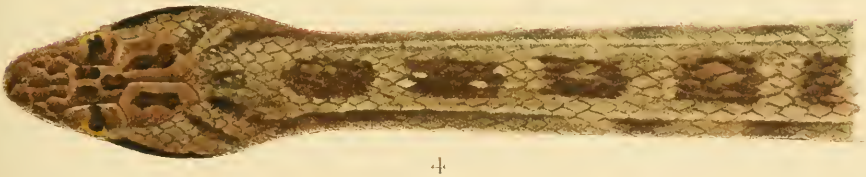

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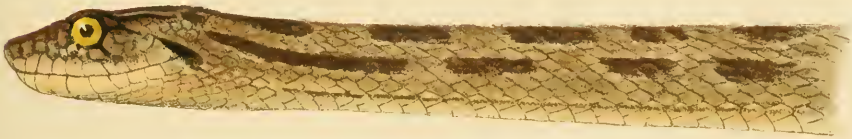

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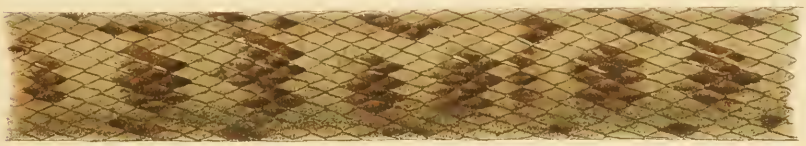


6.

P Gerhardt del. J. Green, Chromo.

THE COMMON INDIAN SNAKES. (Wall)

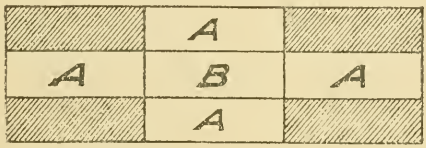
1-3. Zamenis diadema, *var.* atriceps, *harmless.*

4-6. „ „ „ typica, *harmless.*

all nat. size.

ly two black limbs backwards which pass for some distance down the back. The ends of the transverse stripe turn backwards, and are continued as stripes down the back parallel to the median, and thicker stripes just referred to. Two short black streaks pass from the eyes, one downwards, and one obliquely backwards.

Anteriorly the body is adorned with black longitudinal stripes, usually three in number on each side, and progressively narrowing from above downwards; the lowest usually more or less interrupted being placed near the edge of the ventrals. The median are usually connected with the black collar but may commence further back as in our plate. These black marks are very faintly visible in the cast skin. The ground colour is yellowish, brownish, ruddy brown, or leaden grey vertebrally, merging to lighter tones in the flanks. The skin anteriorly is chequered as shown diagrammatically in the attached figure. The shaded oblongs are black, oblongs A are a pale blue-grey, and oblong B bright yellow. The effect is very striking when the snake under excitements inflates itself, and reveals these hues.



Posteriorly the body loses its black stripes, and is uniformly light-yellowish, brownish or leaden grey dorsally, merging to lighter tones in the flanks. The belly is whitish, or pale yellowish often more or less obscurely mottled with greyish especially posteriorly, and beneath the tail. The young are coloured and marked exactly like adults.

Dimensions.—Adults usually vary from five to six feet. My largest of 32 measured specimens was a ♀ 6 feet and $\frac{5}{8}$ of an inch. Stoliczka had one $6\frac{1}{2}$ feet long in the Sikkim Terai, Mr. Frere wrote to me of one he got in Tharrawaddy 6 feet 10 inches long, and the Revd. C. Leigh wrote to me of one he captured at Kurseong exactly 7 feet.

Identification.—Attention must be paid to the following points which must coexist. (1) Scales in 19 rows anteriorly (two heads-lengths behind head), 19 rows in midbody, and 17 posteriorly (two headslengths before vent). Median rows with keels. (2) An entire anal shield. (3) Ventrals 224 to 250. (4) Subcaudals 83 to 106. (5) A black transverse mark on the back of the head. I know of no simpler method of identification.

Haunts.—Its favorite haunts appear to be in open fields near jungle, but it will wander anywhere in search of food. It will take to the water readily, and swims actively, and strongly even in a swiftly flowing river in flood. In Rangoon one was brought to me that had taken up its quarters in a bullock cart, in which it was

found coiled up asleep. It is not unusual for it to come into habitations, and as its sole purpose is probably to hunt rats, it should be encouraged as a benefactor.

Disposition and Habits.—Without being an aggressive snake, it is certainly a plucky one that will strike, and strike viciously when suddenly encountered, or driven into an uncomfortable situation. At such times it will erect the forebody, and strongly compress the neck, forming a sort of pouch in the throat, just as the common rat-snake (*Zamenis mucosus*) does. I have little doubt that it emits the same warning snoring sound, though I have not actually heard this. It is very active, and difficult to capture alive usually menacing with such determination that its would-be captor hesitates to seize it, and finds by his hesitation his chance has gone. It is a remarkable fact that of all the fifty odd specimens I have had, one only was less than $3\frac{1}{2}$ feet. It would seem that the young are specially active, and able to evade danger.

Food.—It seems to feed exclusively on mammals, and especially rats. I have on two occasions found a large rat in the stomach, and once four blind and callous offspring almost certainly belonging to a rat. At other times I have found mammalian hair in the stomach or intestine, that suggested a murine victim.

The sexes.—My notes leave much to be desired in this direction. Of 25 sexed in Assam 18 proved to be females. As regards size my notes make it appear that the sexes grow to the same length. There seems no special difference in the length of the tail in the sexes, unlike what is usual in other species. The anal glands secrete an ochraceous coloured matter.

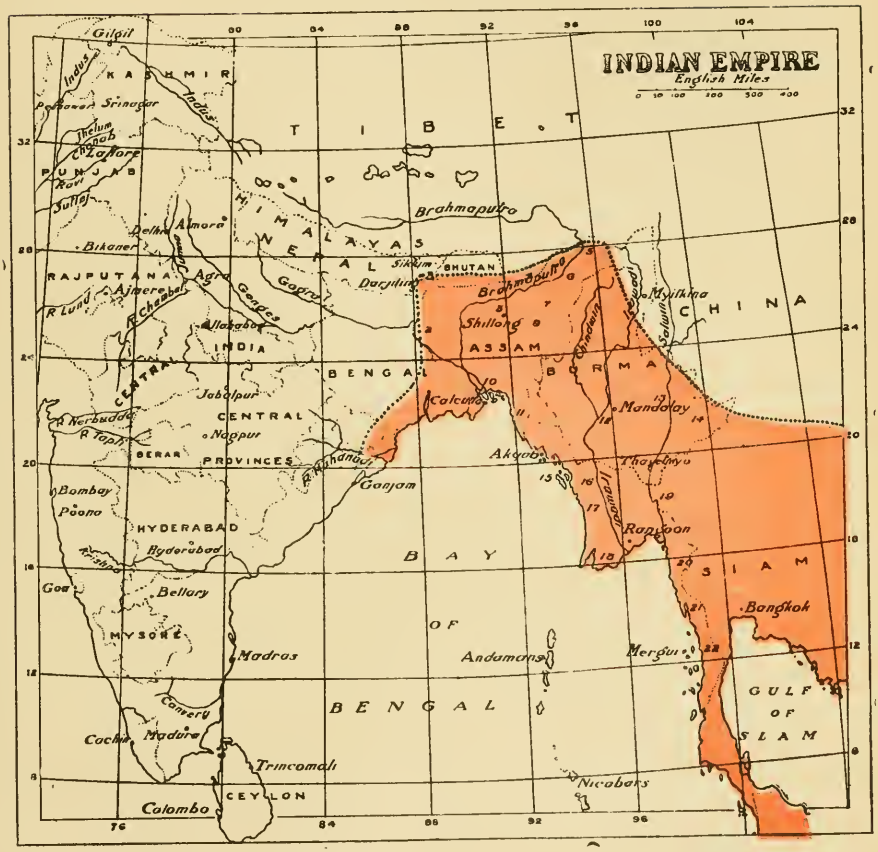
Breeding.—I have had seven gravid females in the months of April, May, June and July. On the 27th April one year in Assam, two were seen playing with one another (flirting), and killed. The female was found to be in an advanced stage of gestation, showing as I have frequently remarked before with other snakes, that conjugal attachment continues for some time after the initial act of mating. The species is not nearly so prolific as many snakes. I never found more than twelve eggs developing in the abdomen, and on one occasion there were only five. Cantor however records one with twenty-three eggs. The largest eggs I measured were $2\frac{1}{16}$ inches long.

Growth.—Having had so few small specimens I am unable to estimate the annual growth.

Parasites.—In one specimen killed in water I found two leeches in the mouth. I have frequently found in the abdomen small white parasites, which were pronounced larval forms of a tapeworm of the genus Pterocercus by Professor Von Linstow.

Distribution.—Bengal, Eastern Himalayas, Assam, Burma, Siam, Cochin-China, South China, Malay Peninsula, Sumatra and Java.

Distribution of Coluber radiatus.



..... limits of distribution uncertain.

1 Cuttack (Annandale), 2 Buxa Dooars (F. W.), 3 Darjeeling District (B. M. & F. W.), 4 Dibrugarh District (F. W.), 5 Sadiya (F. W.), 6 Sibsagar (I. M.), 7 Samaguting (I. M.), 8 Shillong (F. W.), 9 Cachar (I. M.), 10 Bakerganj (Sclater), 11 Chittagong (I. M. & F. W.), 12 Myingyan (Wall and Evans), 13 Mandalay (I. M.), 14 Taomggya (Wall and Evans), Fort Stedman (B. M.), 15 Ramri Island (I. M.), 16 Prome (Wall and Evans), 17 Pegu (I. M.), 18 Rangoon District (Wall and Evans), 19 Toungoo (B. M.), 20 Moulmein (I. M.), 21 Tavoy (I. M.), 22 Mergui (B. M. and I. M.)*

B M. implies British Museum ; I. M. Indian Museum : F. W. the author.

* I am almost certain I have seen a young specimen in the Western Himalayas (Ranibagh, Almora District, Circa 2,000 feet). It had its head protruding from a hole in a stone facing, and I stood within two yards of it for a minute or two but failed to catch it. I could see distinctly the bright reddish head, a black transverse occipital stripe, and two black stripes from the eye, the two lower ones typically seen in *radiatus*. As far as I am aware there is no other snake in the Western Himalayas with these distinctive marks.

The accompanying map shows the exact localities known to me from which it has been reported within Indian limits. Essentially a resident in the low country, it finds its way occasionally to considerable altitude. The Rev. C. Leigh obtained it at Kurseong which is about 5,000 feet, and I had one specimen in Shillong (Khasia Hills) at about 4,800 feet.

Its numerical strength may be judged from the following figures. In Burma chiefly around Rangoon Evans and I got 11 specimens out of 615 snakes of all kinds. In Upper Assam out of 615 snakes collected 41 were of this species, and in the Eastern Himalayas below Darjeeling (between 1,200 and 5,200 feet) out of 408 specimens there were 6 copper-headed rat-snakes. In Lower Bengal it is uncommon, if not actually rare.

Lepidosis—Rostral.—Touches 6 shields; the rostro-nasal sutures longest. *Internasals.*—Two; the suture between them half to two-thirds that between the præfrontal fellows, less than the internaso-præfrontals. *Præfrontals.*—Two; the suture between them greater than the præfronto-frontal; in contact with internasal, postnasal, loreal, præocular and supraocular. *Frontal.*—Touches 6 shields; the fronto-supraoculars about twice the fronto-parietals. *Supraoculars.*—Length subequal to frontal, breadth rather less than frontal along a line connecting the centre of the eyes. *Nasals.*—Two; touching 1st and 2nd supralabials. *Loreal.*—One. *Præocular.*—One. *Postoculars.*—Two. *Temporals.*—Two; the lower in contact with 3 supralabials, usually the 6th, 7th and 8th. *Supralabials.*—9 usually the 4th, 5th and 6th, or 5th and 6th only touching the eye (sometimes 8, with the 3rd, 4th and 5th, or 4th and 5th only touching the eye). *Infralabials.*—6 usually (sometimes 7) the 5th and 6th touching the posterior sublinguals; the 6th largest. *Sublinguals.*—Two pairs: subequal in size. *Costals.*—Two heads-lengths behind head 19, midbody 19, two heads-lengths before vent 17. The reduction to 17 occurs shortly behind midbody, and is due to the absorption of the 4th or 5th row above the ventrals. The vertebral row is not enlarged. Keels present. Apical facets present in pairs. *Ventrals.*—Angulate laterally; 224 to 250. *Anal* entire. *Subcaudals.*—Divided; 83 to 106.

Anomalies.—I have seen a small cuneate shield occasionally below the præocular, wedged between the 4th and 5th supralabials. There is a single temporal in rare examples.

Dentition—Maxilla.—21 teeth in an uninterrupted series, subequal in length, the last 3 stouter, and more compressed. *Palatine*—11 to 12, subequal to maxillary. *Pterygoid.*—20 to 21, the anterior subequal to maxillary, reducing in size posteriorly. *Mandibular.*—25 to 27 subequal to maxillary, decreasing in size posteriorly.

Plate.—Our coloured figure leaves nothing to be desired.

Mr. Green's work is excellent. Many specimens, perhaps most, are a brighter shade of ruddy or copper than shown by him.

ZAMENIS DIADEMA (Schlegel).

The Royal Snake.

History.—Like most of our common Indian snakes this species is first referred to by Russell. He gave an excellent figure of it in his Second Volume published in 1801 taken from the larger of two specimens collected at Buchier (Bushire?). Geoffrey in his book on Egyptian snakes appears to be the next to describe and figure it in 1809. Since this most herpetologists treating of Asian snakes have referred to it under various titles. In 1858 Günther placed it in the genus *Zamenis*, and it has remained there since, but I think it is more than likely that it will sooner or later be removed, as it differs in many ways from the type of that genus.

Nomenclature—(*a*) *Scientific.*—The specific name given by Schlegel in 1837 refers to the quoit-like mark on the head of some specimens.

(*b*) *English.*—The Royal Snake seems to me fitting equivalent to the scientific title.

(*c*) *Vernacular.*—Russell gives "chunalee" as the native name in Persia (if I am correct in assuming that Buchier=Bushire). In Rajputana (Jodhpore) Mr. Colan tells me it is called "rājit-bānsār" or "rajitbānsi."

General characters.—The head is a longish oval, well demarcated from the neck. The snout is rather long and moderately obtuse. A largish nostril occupies the upper two-thirds of the suture between the nasal shields. The eye is rather small, its pupil round, and the iris golden, especially towards the pupil. The gold is often tinged brownish, or reddish. The body is compressed, rather stout, and clumsy, and attenuates very noticeably into the neck, and more gradually towards the tail. The belly is slightly angulated each side. The tail is longish, and accounts for rather more than one-fifth, but less than one-fourth the total length.

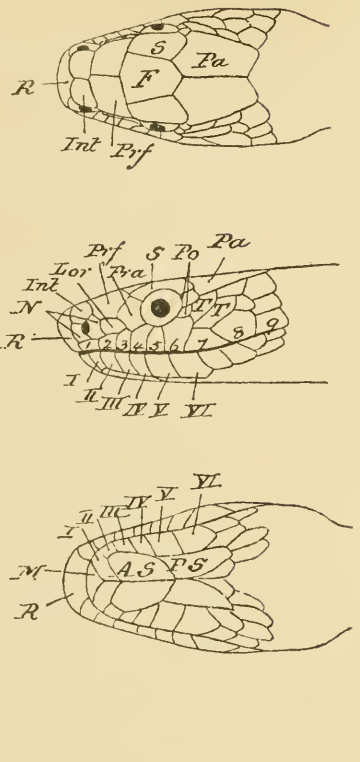
Colouration.—All the young I have seen and from various localities including the Punjab, the N. W. Frontier, Chitral, and Baluchistan conform to one type. They are of a light brown or fawn colour, with three sets of largish, dark dorsal spots. The median may be rounded or rhomboidal in outline, or form short transverse bars and pass down the back from the nape well on to the tail. These marks alternate with the smaller spots of the lateral series. The head is light brown variously spotted, or mottled with darker marks. There is often a band between the eyes, and a quoit-like mark on the parietals (hence the name *diadema*). The latter may be connected with the former by a median stripe, or remain quite detached, or throw back from one to three short

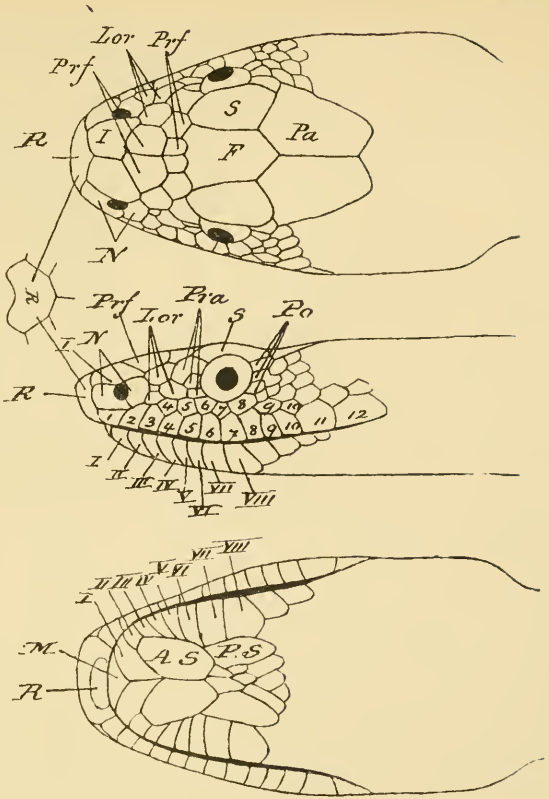
A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Explanation of Diagram.

COLUBER RADIATUS AND *ZAMENIS DIADEMA.*

A. S.	Anterior Sublinguals.
F.	Frontal.
Int.	Internasals.
Lor.	Loreals.
M.	Mental.
M. S.	Median Sublinguals.
N.	Nasals.
Pa.	Parietals.
Po.	Postoculars.
Pra.	Præoculars.
Prf.	Præfrontals.
P. S.	Posterior Sublinguals.
R.	Rostral.
S.	Supraocular.
Sl.	Supraloreal.
Su.	Sublingual.
T.	Temporals.
1 to 12	Supralabials.
I to VIII.	Infralabials.





Coluber radiatus $\left(\frac{1}{1}\right)$

Zamenis diadema (circa × 2)

THE COMMON SNAKES OF INDIA.

stripes posteriorly. Many departures from this arrangement may be seen, either towards a confluence, or a disintegration of these marks, and in many specimens the interorbital and diadem marks are not or barely suggested. The belly has been white in all the specimens I have seen. Adults vary very much, but may be grouped thus.

A. Variety *typica*.—This may exactly agree with that seen in the young just referred to. The dorsal marks, and those on the head are often much obscured as age advances, and of course are rendered inconspicuous by impending desquamation. I have sometimes however seen the head marks including the quoit very distinct. Many of these specimens have heads tending towards or quite typical of the next variety. The belly is usually white, but often it is more or less suffused with pink especially in the middle line, and there are frequently greyish spots or mottlings at the sides of the ventrals.

It is a common form—perhaps the commonest—on the N. W. Frontier and in Chitral, and I have seen examples from Sind (Sukkur), Rajputana, the Punjab, and many from Baluchistan, and Aden Hinterland. It is very nicely figured in our Plate (figs. 4, 5 and 6).

B. Variety *atriceps* (Fischer).—This variety is usually much lighter than the last, the prevailing hue being buff, pinkish-buff or pale brownish, getting paler in the flanks which may be citron-yellow. A very few isolated scales in some specimens, many in others, are of a deep claret colour, and there is great irregularity in the disposition of these. Both head and neck are a brilliant strawberry-scarlet, or more often the scarlet on the neck merges into claret colour on the head, or the two hues may be sharply , and more or less irregularly defined. It is to these black headed specimens that Fischer gave the name *atriceps*. The belly is usually a uniform clear rose-pink relieved laterally by darkish mottling or spots. Colonel Light says it is the common variety in Bhuj (Cutch) and Blanford mentions it from Rajputana. I found it common in Delhi and the N. W. Frontier, and have seen specimens from Fatehgarh, Palanpur, Multan, Sind and Baluchistan. It is excellently shown in figures 1, 2 and 3 of our Plate.

In some specimens the dorsal spots as seen in variety *atriceps*, are grouped in such a way as to suggest more or less forcibly the shape and arrangement of the spots seen in variety *typica*, and such specimens are completely intermediate between the two forms. These specimens are unusual, and in all those I have seen the colouration of the head and the belly conforms much more closely to that of *atriceps* than *typica*. I have seen specimens from Baluchistan.

C. Variety *melanoides* (Wall).—In this form the prevailing colour

is black or blackish. In many if one looks closely, one can see darker marks of the same shape and pattern as those characteristic of *typica*. In this peculiarity one is forcibly reminded of the spots one can discern in the coat of a black leopard. In one or two rare cases I have not been able to discern these spots in the snake. I regard these examples as melanotic. The variety is unusual. I have seen specimens from Rajputana (Jodhpore) and Baluchistan.

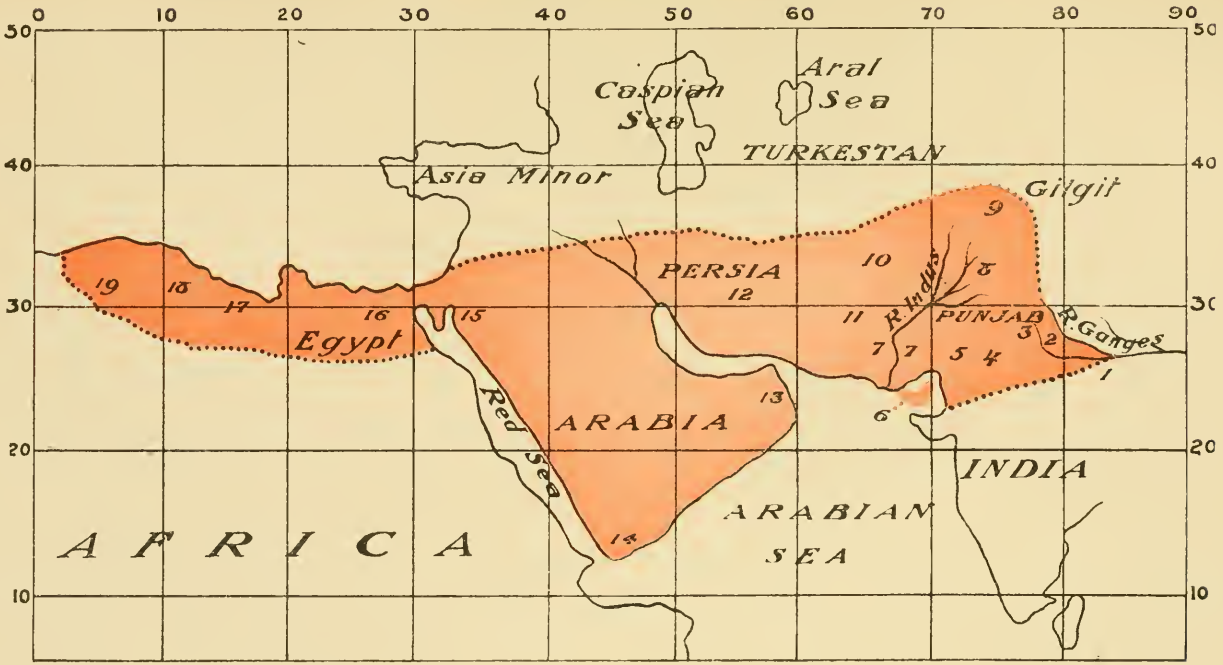
Identification.—Nearly all our Indian snakes that have large head shields, possess a single pair of præfrontal shields (*Vide* the figure of *Coluber radiatus* in this paper).

The Royal Snake is one of the few exceptions to the rule, and in this species a double row of small scales replaces the pair of præfrontals seen in normal head shielding. If the scale rows in midbody number from 25 to 33 (27 to 31 usually) there can be no doubt as to the identity. A very nearly allied species is *Zamenis arenarius*, apparently a very rare snake only known from Rajputana and Sind. In this there is a single row of præfrontals numbering 3 or 4, and the rostral shield is very much larger than in *diadema*. Colonel Light remarks that *diadema* is frequently confused with Russell's viper (*Vipera russelli*) in Cutch. I too have more than once had specimens of variety *typica* sent to me as Russell's viper, the spots and their arrangement being somewhat similar in the two snakes, hence the importance of inspecting the lepidosis.

Dimensions.—The vast majority of adults range between 5 and 6 feet, but Colonel Light has met with several at Bhuj (Cutch) over 6 feet, and one measured 6 feet 7 inches. Mr. Millard received a specimen 6 feet 3 inches from Deesa, and the skin of one sent to our Society from Palanpur with the head deficient measured 7 feet 4½ inches.

Disposition.—I have very little knowledge of the Royal Snake in life. The few specimens I have encountered were in a great hurry to get away and my endeavours were mainly directed to securing the specimen at any cost, which meant that the specimen was killed forthwith. In Delhi a well-known snakeman always had one or more of these snakes in his possession, and they always allowed themselves to be handled without being disagreeable. Mr. Kinnear speaking of one in confinement in our Society's rooms, and recently received through Mr. Colan from Rajputana told me that it was very quiet to handle usually, but on one occasion when he opened the cage "it set up a tremendous hissing, expanding and contracting its body like a cobra." Mr. M. H. Oakes sent me a fine specimen of variety *atriceps* from Fatehgarh, U. P., which his wife found on a shelf among the stores in her godown. It sat up and hissed at her most menacingly and she killed it.

Distribution of Zamenis diadema.



..... limits of distribution uncertain.

LOCALITIES REFERRED TO IN MAP.

(1) Allahabad (I. M.), (2) Fatehgarh (F. W.), (3) Agra (B. M. and I. M.), (4) Rajputana Bhartpore (I. M.), Jaipur (I. M.), Jodhpore (Bo. M.), Ajmer (B. M.), (5) Palanpur (Bo. M.), Deesa (Bo. M.), (6) Cutch (Bo. M.), (7) Sind, Snkkur (F. W.), Kotri (B. M.), Karachi (B. M.), (8) Punjab, Delhi (I. M. and F. W.), Rajanpur (I. M.), Harrand (B. M.), Multan (Bo. M.), Campbellpore (Bo. M.), Lahore (I. M.), (9) N. W. Frontier, Gilgit (I. M. and B. M.), Chitral(I. M. and F. W.), Malakand (F. W.), Bannu (F. W.), (10) Afghanistan (B. M.), (11) Baluchistan (I. M. and B. M.), (12) Persia (I. M. and B. M.), (13) Muscat (B. M.), (14) Aden Hinterland (Bo. M.), (15) Midiax (B. M.), (16) Egypt (B. M.), (17) Tripoli (B. M.), (18) Tunisia (B. M.), (19) Algeria (B. M.)

B. M. implies British Museum ; Bo. M. the Society's Museum ; I. M. Indian Museum ; F. W. the author.

Habits.—I became familiar with the Royal Snake in Chitral. Here the country is very stony, and in clearing the ground for cultivation it is difficult to dispose of the stones. Many are utilised to build walls, which loosely put together encompass every khet. The surplus are thrown into heaps. These walls and heaps furnish attractive quarters for many snakes. but to this species, and the cobra specially. Being loose in their construction there are spacious crevices, and galleries running through them in every direction. The Royal Snake frequently hibernates among these stones, which even in the winter absorb sufficient heat from the sun to offer cosy accommodation. As the year advances, and the sun gets hotter, it is tempted to emerge for a sun bath, and on the least approach of danger precipitately disappears into its stony fastness. It is obviously on this account much more frequently seen than captured. In April 1899 when the Fort at Chakdara was being reconstructed, no fewer than four adult specimens of this snake and two cobras were dislodged while dismantling a few yards of an old masonry wall. One of these had recently fed on a rat, and it seems probable that even in winter retirement a chance meal can sometimes be secured. More than one specimen was killed in the crowded fort at Malakand, and I have known others invade habitations presumably in search of food.

Food.—I have on two occasions known rats eaten, and on one a mouse. Mr. Colan writing from Jodhpore (Rajputana) found one up in a tree shikaring a squirrel.

Breeding.—Though I have seen a large series of freshly killed as well as Museum specimens it is singular that I have never had one gravid female. I can find no mention of one in the literature of this snake. I feel pretty confident that the eggs (presuming that the species is oviparous) are deposited in the hot months, May, June and July. a season when I was at 10,000 ft. in the Hills. The few specimens sent to me during this period were either ♂ ♂, immature ♀ ♀ or specimens too putrified to examine. The length of the hatchling is not known. The smallest specimens I have had were 1 foot $6\frac{1}{2}$ inches and 1 foot $7\frac{1}{4}$ inches in October or November, 1 foot $8\frac{1}{2}$ inches in February, and 1 foot $4\frac{5}{8}$ inches in March. It appears to grow about a foot between the 2nd and 3rd, and 3rd and 4th years of life, and a similar rate of growth in the first year seems to indicate that the hatchling is about fourteen to sixteen inches long. The sexes are very evenly balanced judging from my Chitral records Of 24 sexed, 12 proved to be ♂ ♂, and 12 ♀ ♀. The ♂ claspers are beset with pedunculated cartilaginous processes. The anal glands secrete a material like custard in consistency and colour.

Parasites.—I found many specimens infested with small, oval-shaped, white, parasites which were very numerous in the peritoneum around the coils of the intestine. These were submit-

ted to Professor A. E. Shipley who pronounced them protozoa, probably *Sarcosporidia*, but possibly *myxosporidia*. Among Ectozoa I have seen a tick presumably of the genus *Aponomma*.

Legends.—Mr. Colan tells me that in Rajputana this snake is believed by the natives to be the female cobra.

Distribution.—It occurs in one or other of its varied forms from the United Provinces of India, through Rajputana, Cutch and Sind, the Punjab, the N. W. Frontier of India as far North as Chitral, Baluchistan, Afghanistan, Persia, Arabia, to Northern Africa as far West as Algeria. Its Eastern limit in India is roughly the Ganges. (Allahabad, Fatehgarh.) Its Southern limit in India is roughly a line drawn* from Allahabad to the South of Cutch. The exact localities known to me are shown in the accompanying map.

Lepidosis.—Rostral.—Touches 6 shields, the rostro-nasal sutures subequal to, or greater than the rostro-internasal. *Internasals.*—A pair, the suture between them half or less than half its distance to the frontal; in contact with the uppermost loreal. *Praefrontals.*—Usually in two rows (rarely one or three): from two to three usually in the anterior row, and from three to five in the posterior. *Frontal.*—Touches from 8 to 12 shields; the fronto-supraocular sutures about twice as long as the fronto-parietals. *Supraoculars.*—Length subequal to the frontal; breadth about three-quarters the frontal along a line connecting the centres of the eyes. *Nasals.*—Two, in contact with the 1st and 2nd labials. *Loreal.*—3 to 6. *Praeoculars.*—Two or three. *Postoculars.*—Two to three. *Supralabials.*—10 to 13: the 3rd to the 9th or 10th may be divided into an upper and a lower part: usually the upper parts of three, the 5th, 6th and 7th, or the 6th, 7th and 8th, touch the eye†; the last longest. *Infralabials.*—7 or 8, three, usually the 5th, 6th and 7th touch the posterior sublinguals. *Sublinguals.*—Two pairs, the anterior longer, the posterior quite separated by small scales. *Costals.*—Two headslengths behind the head, usually 4 more than in midbody; in midbody usually 29 to 31 (rarely 25 to 33); two heads-lengths before the vent 19 to 21 (rarely 17). The rows increase anteriorly by the division of one of the two uppermost rows (not including the vertebral). They decrease posteriorly by a succession of steps, 5 usually (sometimes 4 or 6). In one of the first three steps, all of which occur close together, the 3rd or the 4th row above the ventrals is absorbed, but in all the other steps (whether 4 or 6) it is one of the two uppermost rows (not including the vertebral) that is absorbed. The vertebrals are not enlarged. Keels are

* Murray records one from Mahim (Bombay). It is quite possible for such a snake to be transported in cargo from another Port, say Karachi, where it is known to be common.

† Those who regard the upper parts of these shields as suboculars say no supra-labials touch the eye.

present, and apical facets in pairs. *Ventrals.*—210 to 278, angulate. *Anal.*—Entire. *Subcaudals*—65 to 110 divided.

Dentition.—(From four specimens in my collection from Malakand, Chitral, Multan, and Delhi?). *Maxillary.*—16 to 19 uninterrupted, subequal, or the posterior perhaps progressively decreasing in length. *Palatine.*—9 to 10, subequal, and about as long as the maxillary. *Pterygoid.*—15 to 19, slightly decreasing in length anteriorly and posteriorly. *Mandibular.*—20 to 22, the 3rd to about the 7th or 9th subequal, the rest progressively reducing in length posteriorly and anteriorly. The intracranial lining membrane is black, and this colour is more or less visible through the calvarium.

Our Plate is excellent.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plates and Diagrams

by

F. Wall, C.M.G., C.M.Z.S., F.L.S., Lieut.-Colonel, I.M.S.

Part XXIV (with Plate XXIV and Diagram.)

(*Continued from page 215 of Volume XXIII.*)

Family—Typhlopidæ.

(Greek "tuphlos," blind, "ops"=Eye.)

In the scheme of ophidian classification laid down by Boulenger in his catalogue of the Snakes in the British Museum published in 1896, the blind snakes are included in the two first of the nine families, *viz.*, Typhlopidæ and Glauconiidæ. The species of these two families are easily recognised from all other snakes by having ventral shields that are not enlarged. The species of the former family are peculiar in having four supralabials, whereas in the latter there are only two, the 1st situated in front of, and the 2nd behind the ocular shield (see figure A 4).

The family Typhlopidæ comprises the most degenerate of all ophidian forms, their degeneracy being inferred from their eyes which are purblind, their locomotion which above the surface of the ground is very laboured, and their extremely defenceless condition, for they have no weapon of offence or defence. The mouth being small, placed beneath the snout and having few and no opposable teeth, is incapable of grasping anything but minute objects. Their existence depends upon the subterranean life to which they have adapted themselves, and by which they escape annihilation from a host of rapacious foes. The family embraces three genera (1) *Helminthophis* including 5 species all inhabiting tropical America, (2) *Typhlops* including over 100 species inhabiting parts of all five Continents, (3) *Typhlophis* represented by a single species inhabiting Brazil and Guiana.

Genus—Typhlops.

The type of this genus is the S. American *T. reticularis*, described by Schneider in 1801. The genus contains many of the most diminutive of snakes, some only attaining to a length of but four or five inches in their adult state. They live for the most part beneath the soil, and subsist upon worms, grubs and insects. The eye is situated beneath one or more shields, and is thus protected

from injury when the snake is burrowing. Vision is more or less obtuse at the best, but becomes more and more obscured as a period of desquamation approaches, from scratches sustained during burrowing operations. Some of the species are endowed with a minute spine at the tip of the tail which is directed downwards, with which they anchor the posterior part of the body, and against which they can push, or retract the rest of the body. Many are not so endowed, and some of these, but by no means all, have the snout provided with a beak directed downwards. Those with the snout rounded appear to burrow as expeditiously beneath the soil as the beaked species, so that the beak cannot be claimed as a specialised burrowing organ.

Very little is known of the habits of these snakes, many of the species of which indeed are only known from solitary specimens. They are believed to be oviparous in habit, but I am not aware of any authenticated instance of the eggs of any of them having been deposited. Some of the species have been observed to exhibit a gregarious disposition, but whether the attraction is supplied by the rich store of food a rotten trunk or log has to offer, or is related to the sexual functions is not certain. It may be that like other snakes they pass through a period of inactivity, and during the hibernating season, seek for warmth in their retirement, such as rotting wood generates. In such an environment they are amply supplied with sustenance in the form of maggots and chrysalides of beetles, ants, and other insects. Further as many snakes (perhaps all) during their retirement live in company with a mate, it is often at this time that conjugal duties are initiated. If this is so a third object is gained by the formation of colonies. Once I saw a colony dislodged from beneath the soil, but I am not prepared to say that in the jungle where this occurred, there may not have been rotting roots in which the members were embedded.

The head is covered with shields having a form and relationship that is peculiar to this family, and the Glauconiidæ. The scales on the body of these creatures are very highly polished and this appears to be a special adaptation with the object of preventing earth adhering to them. Owing to this polish it is difficult to see their outlines. As in many cases too a subterminal dark line is seen near the scale margins, which seems to indicate the edge of each scale, one is very easily misled as to the real limits of the scale. In some species especially, even when the head or body is dipped into red or black ink to throw up the scale borders, it is extremely difficult to ascertain with certainty the details one is specially looking for. The difficulty in many cases is materially increased by the diminutive proportions of the specimen under examination.

To count the costal rows round the body is almost impossible

unless both hands are free, and one has to accustom oneself to the use of a powerful watchmaker's lens. With this in the eye (and it must be remembered that the eye not in use must be kept open in order to retain the lens) the snake is grasped in both hands, and gradually rolled round as one rolls a cigarette, the eye never straying or blinking while the count is being made, and it is necessary to make a pinprick or some such mark on one of the scales from which the count is commenced, or transfix the specimen with a fine needle. With the head shields too it is necessary usually to have the freedom of both hands, but some points may have to be elucidated with the aid of a glass much stronger than that of the usual watchmaker's lens. I have a special lens made by Messrs. Baker and Co., Opticians, Holborn, for this work, and the examination of teeth, etc., in minute skulls. I have also used a special make of watchmaker's lens with double glasses, employed in the trade to examine the holes in watches in which gems are set, and this has proved suitable for the fine work the examination of these snakes necessitates. With the best lens available, however, it is impossible to see the true outline of the scales unless the light is allowed to strike obliquely across them, a trick which takes a little time to acquire dexterously.

Within our Indian limits 20 species have up to the present been differentiated, the three commonest of which form the subject of this paper.

All the species are probably a great deal commoner than Museum collections make it appear. Natives usually take them for worms, and in consequence rarely bring them in for rewards. Most Europeans too do not recognise the smaller varieties as snakes.

TYPHLOPS ACUTUS.

(Latin "acutus" sharp pointed, in reference to the beak.)

The Beaked Blind Snake.

Described by Dumeril and Bibron in 1844. It is not uncommon. In Malabar it is called "kooroodam pamboo" meaning "blind snake," a term applied equally in the same locality to the cæcilian *Uræotyphlus oxyurus*.

Identification.—It is the only Indian species with a beaked snout.

Length.—Grows to about two feet.

Colour.—Brownish or blackish above, paler beneath. Each scale with a transverse lighter mark.

Habits.—It lives beneath the ground, or takes refuge beneath stones, and other objects, and sometimes strays into houses. It uses the beak on the head much in the same way that other species which are furnished with a spine on the tail use that little organ,

and when handled presses the beak into one's skin. It burrows dexterously in loose soil. Above the soil it is restless and endeavours to bury itself as speedily as possible. It is believed to feed on worms. Nothing is known of its breeding habits.

General characters.—Snout pointed and furnished with a sharp hook directed downwards, from which a horizontal edge passes backwards. Eye visible, beneath the nasal, and ocular shields. Nostrils beneath the snout, and close to the rostral. Neck not distinguishable. Body stout, and of even calibre throughout. Tail short and terminating in a small spine directed downwards, and slightly backwards. Diameter of body about $\frac{1}{40}$ to $\frac{1}{60}$ the entire length.

Lepidosis. Rostral—Very large; extending behind the level of the eyes; about $\frac{1}{2}$ the breadth of the head. *Nasals*—Not meeting behind the rostral; completely divided. The suture above the nostril shorter than that below, the latter passing to the 2nd labial. *Præfrontal, frontal,* and *interparietal*—Small, progressively decreasing in size. *Supraocular*—Broader than parietals, touching two shields behind. *Præocular*—Small, touching 2nd and 3rd labials. *Ocular*—Not in contact with any labial. *Subocular*—Present, in contact with the 3rd and 4th labials. *Temporals* three. *Supralabials*—Four. *Costals*—Boulenger says in 28 to 34 rows at midbody. In the few specimens examined by me I find them 28 anteriorly, 24 to 26 in midbody, and 24 behind.

Habitat.—The Plains and low Hills of Peninsular India, South of the Ganges Basin.

TYPHLOPS BRAMINUS.

The Brahminy Snake or Common Blind Snake.

History.—First described and figured in 1796 by Russell in his first Volume (Pl. XLIII). Christened by Daudin in 1803 under the name *Eryx braminus.*

Nomenclature (*a*) *Scientific.*—The specific name is a latinised version of the word brahmin, and was given in reference to its brownish colouration. (*b*) *English.*—The Brahminy Snake seems to me suitable. (*c*) *Vernacular.*—The vernacular names "rendoo thalalay-pamboo" or "reti thalalay pamboo" two-headed snake, "sevi pamboo" ear snake, "poorän" centipede, "manallay "pamboo" earth snake, used by the Tamils, "depat-naya" two-headed snake, used by the Singhalese in Ceylon and "do mukh ka samp," two headed snake, generally used in India are loosely applied to any snakes of a burrowing habit. In the Cocos Islands it is called "ular minyah" according to Boulenger.

General characters.—This snake is cylindrical, and of even calibre in its whole length showing no indication where the head or tail begin. The head is bluntly rounded anteriorly and somewhat

P. Gerhardt del J. Green, Chromo

THE COMMON INDIAN SNAKES. (Wall.)

1-2. Typhlops acutus, *harmless*. 3-5. Typhlops brahminus, *harmless*.
6-7. Typhlops diardi, *harmless*.

depressed. The eyes are indistinct, and the nostril directed somewhat downwards. The tail is very short and ends in a small spine directed downwards and backwards. The scales are perfectly smooth and polished. The diameter of the snake is about one-thirty-fifth to one-fifty-fifth the total length.

Identification.—It shows with *limbricki* (Annandale) the peculiarity that the suture below the nostril passes to the præocular shield and not to the 2nd labial, as in all the other species. It differs from *limbricki* in being smaller, and by its relatively stouter habit.

Dimensions.—Grows to about 6 or 7 inches.

Colour.—Three colour varieties have been described.

Variety (*a*) *typicus* is brown or blackish-brown above, rather lighter beneath. The snout, anal region, and end of tail whitish. This is much the commonest variety.

Variety (*b*) *arenicola* (Annandale).—In this each scale on the back is faintly tinged with buff, those on the head being faintly vermiculated with the same hue. In life it appeared of a pale flesh colour. The belly is white. Dr. Annandale met with this in S. India.

I have also met with specimens of a pale grey colour like a new slate pencil. The eyes were invisible. This colour may be a passing phase due to approaching desquamation. The specimens were from Assam.

Habits.—The Common Blind Snake is not often seen by Europeans or if seen is not recognised as a snake, its size and general appearance allowing it to pass for an earthworm. It spends most of its life beneath the surface soil, through which it burrows nimbly, and is often brought to light by the mali's hoe, or the ryot's plough. It is likely to be met with by the amateur gardener in and about his pots, in the heap of leaf mould, or in the soil freshly turned over by the trowel. It not infrequently secretes itself beneath stones or debris. After heavy rains it is not infrequently seen on the ground by those who can recognise it, after being swamped out of its subterranean burrows. On such occasions it is met with singly, but it has been occasionally discovered in large colonies inhabiting rotten wood.

It is an active little creature, making vigorous attempts to escape if dislodged from its hiding place. When handled it shows its resentment by vehement struggles, and is most difficult to hold owing to the high polish of its scales. When its struggles have quieted down it presses the little spine with which its tail is endowed, into the hand, anchoring itself as it were and from the purchase so derived wriggles about restlessly in all directions, pushing its nose about, and insinuating itself forcibly between the clefts of one's fingers. It is able to move backwards and forwards, but though it wriggles about with much muscular effort I have

always noticed that its progress above ground is very slow. Under excitement it protrudes the tongue like other snakes. This organ is bifid as in other snakes, and white at the tip.

This is almost certainly the species which some years ago invaded the water supply in Calcutta, many specimens finding their way into the pipes of distribution. Much surprise and consternation were evinced by timid residents when a living specimen appeared through the tap supply. It sometimes invades houses in considerable numbers, from the garden, or pot plants. Captain Stevenson, I.M.S., told me that in Manipur it is extremely common in houses. He has found 3 in a single evening wriggling about the floor when he was dressing for dinner, and one subaltern in his regiment collected about one hundred in his house in about a month.

This species affords considerable sustenance to the young of the common krait (*Bungarus cæruleus*). In Fyzabad I cut open no less than eight young kraits, and found one or more of these blind snakes in their stomachs.

Parasites.—This is one of the many snakes known to harbour the nematode, intestinal worm called *Kallicephalus willeyi* by Von Linstow.

Food.—Most of those that I have dissected have had full stomachs and the contents when investigated proved to be the larvæ, pupæ, and imagines of ants, and probably beetles, and other insects. Dr. Annandale discovered one in the burrow eaten by a caterpillar in a stalk of sugarcane. The caterpillar had vacated or perhaps had been eaten by the snake, and subsequently in captivity the snake was observed to eat the caterpillar droppings.

Breeding.—The brahminy snake is believed to be oviparous, but I am not aware of any certain evidence in this direction. All the gravid females I have known were in Assam, and these eight in number were collected in the hot weather from April to July. In length they ranged between 6" and $6\frac{3}{8}$." Six of these were brought to me on the same day by the same boy, who had evidently unearthed a colony, and only one male was brought with them. The eggs which whilst in the abdomen resemble grains of cooked rice varied from 2 to 7 in number, the largest measuring $\frac{1}{3}\frac{8}{2}'' \times \frac{5}{32}''$.

Legends.—The Tamil names "Sevi pambu" or "ear snake" and "poor an" or "centipede," I am told by Dr. J. R. Henderson are applied because both this snake and the centipede, are popularly supposed to enter the human ear.

Lepidosis.—Snout rounded. *Rostral*—About one-third the width of the head, hardly extending to the level of the eyes. *Præfrontal, frontal* and *interparietal*—Subequal. *Supraocular, præparietal* and *postparietal*—Subequal. *Nasals*—Quite divided; the suture above the nostril much longer than that below; the latter extending to the præocular; not in contact behind the rostral. *Præocular*—Large,

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Explanation of Diagram.

A 1, 2 and 3. *Typhlops braminus* (much enlarged)

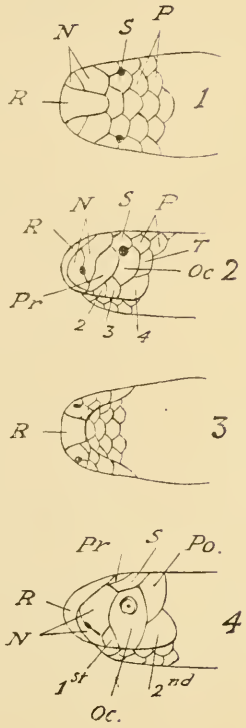
A 4. *Glauconia blanfordi* (much enlarged).

B 1, 2 and 3. *Typhlops acutus* (× 4).

C 1, 2 and 3. *Typhlops diardi* (× 2).

F.	Frontal.
I.	Interparietal.
N.	Nasals.
Oc.	Ocular.
P.	Parietals.
Po.	Postocular.
Pr.	Præfrontal.
R.	Rostral.
S.	Supraocular.
Su.	Subocular.
T.	Temporals.
1 to 4.	Supralabials.

A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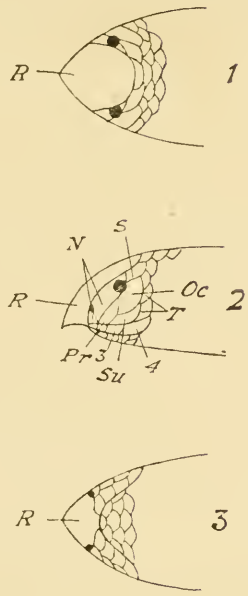
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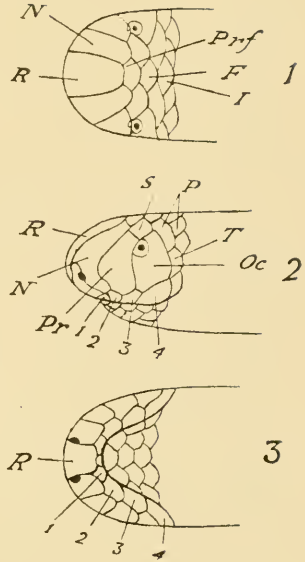
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in contact with the 2nd and 3rd labials. *Ocular*—Touching the 3rd and 4th labials. *Subocular*—Absent. *Temporal*—One. *Supralabials*—Four. *Costals*—In 20 rows in whole body.

Distribution.—South Asia from Arabia in the West, throughout India, Assam, Burma, and the Malayan Continent to South China. The Malayan Archipelago to the Philippines. Islands of the Indian Ocean, Ceylon, Cocos, Andamans (not hitherto recorded from the Nicobars), Mauritius, Madagascar, Comoros. Africa at Cape Colony and North America. It is quite a common snake in every part of the plains I have visited.

TYPHLOPS DIARDI.

Diard's Blind Snake.

Described by Dr. Schlegel in 1844. After *braminus* this is much the commonest of our blind snakes. In Burma it is called "mywe-hsin-pyit" meaning literally "elephant darting snake." There is a legend that it can spring off the ground and strike its foe, and it is believed to be so venomous that if it strikes even an elephant the creature will soon sicken and die.

Identification.—The scale rows are 24 or 26. It will be recognised if it has 24 rows, by the partial suture above the nostril, and the absence of pits beneath the snout. If the rows are 26 a rounded snout will differentiate it from *acutus*, the only other species with a similar number of rows.

General characters.—Snout rounded, nostrils lateral. Eye fairly distinct; beneath the ocular shield. Neck not apparent. Body stout, cylindrical, of uniform calibre throughout. Diameter $\frac{1}{29}$ to $\frac{1}{35}$ the total length. Tail short, with a small spine terminally directed downwards, and slightly backwards.

Length.—Up to 17 inches.

Colour.—There are two varieties (*a*) *typica*. This is black or blackish above, lighter below. The eyes very distinct. (*b*) *cinereus* (Wall). Pale grey like a new slate pencil, the eyes very indistinct. The latter I have only seen in Assam, where it is much the scarcer of the two.

Habits.—This the largest of our blind snakes with the single exception of *acutus* lives like the other species for the most part beneath the soil. It is rarely seen on the surface unless thrown up with recently disturbed soil, dislodged from beneath stones and debris, or swamped out of its natural haunts by heavy rains. When unearthed it struggles most strenuously to regain safe quarters beneath the soil, which if loose it burrows into with great ease, and is soon lost to view. Its movements above ground though energetic are not conducive to progress. In water it swims expeditiously and strongly. The high polish on its scales

makes it a most difficult creature to maintain in one's grasp, and it wriggles unceasingly. It is quite unable to bite one, the mouth being too small to gain a grip on the skin. Under excitement it protrudes the tongue which is a bifid organ as in other snakes.

Dentition. The upper jaw bones are placed transversely in the mouth, and each bears 4 or 5 teeth. There are no other teeth at all.

Food.—Its food consists in the main of the larval, pupal, and adult forms of ants, but other insects in their various metamorphic stages are also devoured.

Breeding.—In Assam and Burma it breeds in the hot weather. I obtained gravid females in April, and Captain F. E. W. Venning a gravid specimen in the Chin Hills in June. The embryos attain a considerable degree of development inside the egg before the latter is discharged. We do not know yet whether the egg is voided as such or whether the embryo develops to such a degree that it is able to rupture its envelope inside the mother, and be born alive as in the case of most vipers, sea snakes, and some other ophidians. It is probable however that the embryo attains but a limited degree of development in the egg before it is discharged, as we know to be the case with some snakes notably certain species of *Dendrophis*, and *Dendrelaphis*, *Lachesis monticola*, etc. From 5 to 8 eggs have been observed in one female.

Lepidosis.—*Rostral*—About one-third the width of the head. *Præfrontal, frontal*, and *interparietal*—Subequal. *Supraocular* and *præparietal*—Broader than the postparietal. *Nasals*—Semi-divided; the suture above the nostril nearly reaches the rostral, and is about one-third to one-fourth the suture below it; the latter suture passes to the 2nd labial. *Præocular*—Large, in contact with the 2nd and 3rd labials. *Ocular* large, in contact with the 3rd and 4th labials. *Subocular*—Absent. *Temporals*—Two. *Supralabials*—Four. *Costals*—In 26 rows anteriorly (rarely 24), 24 or 26 rows in midbody, 22 (sometimes 24) behind.

Habitat.—The Teesta and Hooghly Rivers form its Western boundary and it extends from there through the Brahmaputra, Irrawaddy-Salween, Menam, and Mekong Basins and as far South as the Malayan Peninsula. It has been recorded from the Eastern Himalayas (Paniaghatta and Buxa Dooars) by me, from the Khasi Hills by me, from the Abor Hills by Dr. Annandale and from the N. Chin Hills by Captain F. E. W. Venning.

Our plate is in every way excellent.

(*To be continued.*)

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plates and Diagrams

BY

F. Wall, C.M.G., C.M.Z.S., F.L.S., Lieut.-Colonel, I.M.S.

Part XXV (with Plate XXV and Diagram).

(Continued from page 382 of Volume XXV.)

CALLOPHIS MACCLELLANDI (Reinhardt).

Macclelland's Coral Snake.

Of proteroglyphous colubrines, or colubrines that carry canaliculate poison fangs in the front of their maxillæ there are two sub-families, the *Hydrophiinæ* or sea snakes, and the *Elapinæ* including the cobras, kraits, coral snakes, &c. The *Elapinæ* includes 29 genera, only 5 of which are represented in India. *Callophis* one of the 5, contains 5 species according to Mr. Boulenger's classification, and 4 of these including the subject of this paper occur within Indian limits.

History.—Macclelland's Coral Snake was introduced to scientific notice by Reinhardt in 1844.

Nomenclature. (*a*) *Scientific.*—The generic name initiated by Gray is from the Greek "kalos" beautiful, and "ophis" snake. The specific title conferred by Reinhardt is in honour of Mr. J. Macclelland, a member of the Indian Forest Department, during the middle of the last century.

(*b*) *English.*—Macclelland's Coral Snake. Named in honour of the late Mr. J. Macclelland of the Burma Forest Department.

(*c*) *Vernacular.*—In the Chin Hills Captain Venning says it is one of the snakes called by the natives "sar-vut-saw."

General characters.—It is a little snake chiefly remarkable for its beautiful and very distinctive colouration. The head is flattened and broad, the snout broadly rounded as seen from above, and the neck hardly evident. The nostril is chiefly contained in the anterior nasal shield occupying about two-fourths of its depth. The suture below it passes to the 2nd labial shield, a distinctly rare condition. The eye is rather small, its diameter being rather less than half the length of the snout. The pupil is often not discernable, but in some specimens there is an arc or a ring of ruddy gold that enables one to see that it is round. The body is cylindrical, moderately robust and of even calibre throughout. The tail is

short, usually being only about one-ninth to one-eleventh the total length of the snake.

Identification.—The broad enamel-white band across the head is very distinctive, and quite peculiar to this snake. The most important shield characters to pay attention to are as follows:—(1) The costals which are in 13 rows in the entire body. (2) The suture below the nostril which passes to the 2nd labial. (3) There are 7 supralabials. (4) The temporal shield touches the 5th and 6th supralabials. These points taken together will distinguish it from all other snakes within Indian limits.

Colouration.—(*A*) Variety *typica* is red dorsally, the colour varying in richness from a bright strawberry-red to cherry-red, and more rarely purplish-red. In the flanks these hues are lightest and brightest. From 16 to 35 black rings encircle the body, and 2 to 5 the tail. These rings are frequently interrupted in the flanks. The black may or may not be narrowly outlined with yellow or buff. Each ring involves about two scales in the body length. In a specimen sent me by Captain Venning from the Chin Hills, and in another obtained by Evans and me from the Pegu Yomas a series of small dorso-lateral spots were present in each interspace, and I have rarely seen a similar single series down the spine. The head is shining black with a sharply defined broad ivory-white or more rarely cream-coloured cross-band behind the eyes. The belly is saffron, and the intervals between the rings exhibit large irregularly-shaped black blotches.

(*B*) Variety *univirgatus.*—Differs from *typica* in that a black stripe runs down the spine, and the rings are frequently incomplete near the spine, especially in mid-body. The rings vary from 23 to 32 on the body and 3 to 4 on the tail.

(*C*) Variety *gori.*—Differs from the two preceding in the absence of the black rings and the spinal stripe. There is a series of 27 to 38 small black spots down the spine, usually round, sometimes rather broader than long.

The belly has irregularly-shaped median black spots smaller than in the other two forms.

(*D*) Variety *nigriventer.*—Differs from the above in having a black stripe down the spine as in *univirgatus*, but no rings. A continuous irregular black stripe passes along the middle of the belly.

Habits.—Speaking of the genus, Fayrer says: "Its representatives are sluggish, and allow themselves to be approached with little sign of fear. They are not aggressive, and bite reluctantly." These remarks certainly apply well to the subject under discussion. Venning remarks: "I could never provoke any of them to bite or show temper." The very few living specimens that have come into my hands were most inoffensive, and exhibited no temper in spite of much provocation. The "type" of *gori* resented being handled,

but would not bite any object with which I attempted to irritate it. It merely flattened its body posteriorly, and when I picked it up by the neck secreted poison copiously which collected as a drop in the rostral arch. Through the drop its tongue flickered in and out tremulously.

The fact that there are no records of a bite from this snake though common enough in certain localities, seems to confirm the opinions expressed above as to its placid nature.

It is eminently a jungle as well as a hill species. In all the localities where it is met with, the country is heavily forested. The little specimen Evans and I got in the Pegu Yomas was trodden on by a wounded elephant, and pressed firmly into the soft soil. The trackers discovered it wriggling vainly to extricate itself, and it was practically undamaged. One of Venning's largest specimens was discovered on the parade ground while a game of football was in progress. It is always found in hills or in their near vicinity. For choice it inhabits a zone at an altitude of about 4,000 to 6,000 feet, but may occur lower. The specimens sent to me by Mr. Gore were from probably about 1,000 feet elevation, but quite close to outliers of the Naga Hills in Assam. Those from the Abor Hills were from a similar elevation.

Food.—Fayrer says that it feeds chiefly on snakes. I have no single record of its diet though more than 50 have passed through my hands.

Breeding, &c.—Very little is known of its breeding habits. A gravid female measuring 1 foot 11 inches that I obtained from Shillong in August 1911, contained 6 eggs, 2 in one ovary, 4 in the other. The longest of these eggs measured $1\frac{5}{16}$ inches by $\frac{7}{16}$ of an inch. When cut into they were found to contain young embryos about 1 to $1\frac{1}{2}$ inches long. It is not certain however that the young are born alive, it may be that the eggs are discharged as such still harbouring young that are destined to hatch some time later, as in the case of some of the tree snakes of the genus *Dendrophis*, and the pit-viper *Lachesis monticola*. The length of the hatchling or young, as the case may be, is not known. The smallest specimen I have seen was $9\frac{1}{4}$ inches.

The anal glands secrete a custard-like material.

Poison.—Little or nothing is known about the virulence of this venom.

No case has been recorded of a bite in the human subject. Fayrer remarks that fowls succumbed to its bite.

Length.—It grows to about 2 feet, but specimens exceeding this are uncommon. I have however had a specimen 2 feet $7\frac{1}{2}$ inches from Burma, and three specimens sent to me from Haka in the Chin Hills by Captain Venning measured 2 feet $5\frac{3}{4}$ inches; 2 feet 6 inches; and 2 feet 8 inches respectively.

Distribution.—From the Western Himalayas through other mountain ranges to Southern China, and Formosa.

Variety *nigriventer* (Wall).—From the Western Himalayas as far West as Kasauli. Very rare. Only one specimen is known which is in our Society's collection.

Variety *univirgatus* (Gunther).—From Nepal, through the Eastern Himalayas as far East as Sikkim. Fairly abundant in Sikkim.

Variety *typica* (Reinhardt).—Hills of Assam and Burma to South China and Formosa. Annandale has recorded it from the Abor country, Assam, North of the Brahmaputra at about 1,000 feet elevation. It is quite common in the Khasi Hills. Venning found it fairly common in the Chin Hills. There is a specimen in the British Museum from Pegu (presumably Hills), and Evans and I got a specimen from the Pegu Yomas.

I have had it from the Hills in the Southern Shan States (Mogok), and there are specimens in the British Museum from Hills in South China, and Formosa.

Variety *gori* (Wall).—Naga Hills in Assam, and Manipur. Apparently uncommon. Only four specimens are known, three were sent me from Jaipur near the Naga Hills, and one from Manipur.

Lepidosis, *Rostral.*—Touches 6 shields, the rostro-nasal sutures are about four-thirds the rostro-internasals, and twice or three times the rostro-labials. *Internasals.*—Two, the suture between the fellows about two-thirds that between the præfrontal fellows, and about two-thirds the internaso-præfrontal sutures. *Prafrontals.*—Two, the suture between them equal to, or rather greater than, the præfronto-frontal. *Frontal.*—Touches 6 shields, the fronto-supra-ocular sutures equal to, or rather less than the fronto-parietals. *Supraoculars.*—About two-thirds the length and breadth of the frontal. *Nasals.*—Two, in contact with the first three labials (rarely first two only). *Loreal.*—Absent. *Preocular.*—One. *Postoculars.*—Two. *Temporal.*—One anterior, touching the 5th and 6th labials only. *Supralabials.*—Seven, the 3rd and 4th touching the eye. *Infralabials.*—Four, the 4th largest, about as long, and twice as broad as the posterior *sublinguals*: touching two scales only behind. *Sublinguals.*—Two subequal pairs, the posterior touching the 4th, or 3rd and 4th *infralabials*. *Costals.*—In 13 rows in the whole body length; smooth; vertebrals not enlarged. *Ventrals.*—182 to 240, more numerous in the ♀. *Anal.*—Divided. *Subcaudals.*—20 to 36 pairs.

Anomalies.—It is not unusual to find a few of the earlier subcaudals entire. I have seen the last ventral divided in one specimen. The 2nd infralabial rarely fails to touch the anterior sublinguals. I have also seen a confluence of the temporal and 6th labial more

than once, and a confluence of the lower postocular and 5th labial at least once.

Dentition.—(From 6 skulls in my collection). *Maxilla.*—Two strong canaliculate fangs anteriorly, no teeth behind. *Palatine.*—6 to 8, decreasing in both directions from the 3rd or 4th; grooved on their inner faces. *Pterygoid.*—2 to 6, small. *Mandible.*—9 to 11, decreasing in size in both directions from about the 4th or 5th; grooved on their outer faces.

Plate.—Our figures are good as regards colouring but incorrect in the following matters. The scale rows are shown as 15 instead of 13. The eye is too small and the iris far more conspicuously golden than is the case in life.

The second subject of this paper belongs to a family as yet not touched upon in these popular series, *viz.*, *Uropeltidæ*.

Family *UROPELTIDÆ*.

(From Greek "oura" tail, and Latin "peltis" shield, referring to the curious terminal shield peculiar to the tails of these snakes). According to Boulenger's scheme of classification this is the fifth of the nine families into which the snakes of the world are divided (Cat. Snakes in Brit. Mus. 1896). All the representatives are to be found exclusively in the Hills of Southern India and Ceylon.

The members of the family are most easily recognised by the breadth of the ventral shields which though distinctly enlarged are not twice the breadth of the last costal row. In this respect they agree with those of one other family, *viz.*, *Ilysiidæ*. The snakes of the latter family however have 6 supralabials, and those of the *Uropeltidæ* only 4.

The family is sub-divided into 7 distinct genera (comprising 42 species), one of which, *viz.*, *Silybura* includes the species dealt with hereafter.

Genus *SILYBURA*.

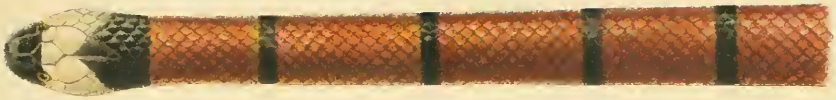
(From Greek "silubou" a thistle, and "oura" tail, in allusion to the two terminal points on the last caudal shield). At least 22 different species are known.

SILYBURA OCELLATA.

The Ocellate Thistle Tail.

History.—Discovered by the late Colonel Beddome who described it in 1863 from specimens collected by him at Walaghat in the Nilgiri Hills.

Nomenclature (*a*) *Scientific.*—The specific title conferred by Beddome is from the Latin and is a diminutive form of "oculus"



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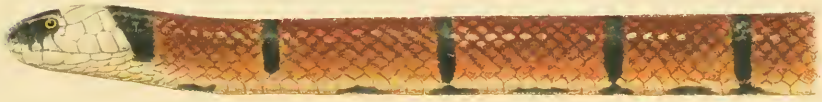

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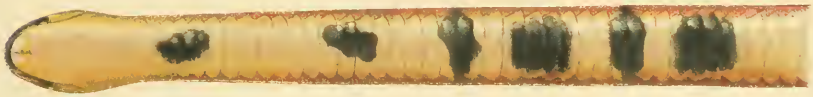

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4

P. Gerhardt del. J. Green, Chrom.

THE COMMON INDIAN SNAKES. (Wall.)

1–3. Callophis macclellandi, var. typica, *poisonous*.

4. Silybura occellata. *harmless*.

all nat size

an eye. This refers to the many little, round, yellow spots grouped so as to form irregular cross bands on the body.

(*b*) *English.*—The Ocellate Thistle Tail is the equivalent of its scientific designation.

(*c*) *Vernacular.*—Nothing distinctive is known to me.

General characters.—A small snake rarely exceeding 18 inches. The head smaller in girth than the body, tapers to an obtuse point. The nostril is open, and pierced in the front of the nasal shield. The eye is contained in the ocular shield and is small, being about one-third the length of that shield. No neck is indicated, on the contrary this region is swollen, and the body then maintains a similar calibre in its whole length. The tail is short and subtruncate and ends in two small spines placed side by side.

Colour.—The scales are olivaceous-brown, or olivaceous-green at their edges, lighter centrally. The whole body is beset with small round bright yellow spots, grouped so as to form irregular chains across the back, incorporated in rather ill-defined dark crossbars. These bars end subcostally where many spots become confluent to form a yellow patch with an outline like a bunch of grapes. The yellow which is often a bright canary is a very unstable colour dissolving in spirit in a few hours. In some specimens I have found it so intense as to stain the inside of the skin, the muscles, and even the viscera a turmeric yellow. I have seen some specimens with the yellow adornment almost wanting.

Dimensions.—My largest specimen which came from Paralai in the Anamallay Hills measured 17$\frac{1}{8}$ inches, much the largest measurement I know. ♂ specimens frequently reach 12 to 13 inches, and ♀ 14 to 16 inches.

Identification.—The breadth of the ventrals, *viz.*, about $\frac{3}{5}$ that of the last costal row, taken with the two spines placed side by side on the terminal tail shield will establish the genus, but attention to many more points is necessary to identify the species. These are:—

(1) Costals in midbody 17.
(2) Nasals in contact behind the rostral.
(3) Diameter of eye $\frac{1}{3}$ or less than $\frac{1}{2}$ that of the ocular shield horizontally.
(4) Portion of rostral seen from above longer than its distance from the frontal.
(5) Rostral not more than $\frac{1}{3}$ the shielded part of the head.
(6) Ventrals 185 to 234.

Disposition.—I have found it a very inoffensive quiet little creature, allowing itself to be picked up and handled without trying to bite, and with very little show of displeasure. It is a restless little reptile, continually pushing its snout between the clefts of one's fingers as though seeking to hide itself. When

encountered it betrays little or no alarm, and even when given a chance to burrow in loose earth only does so in a quiet leisurely fashion if it does so at all.

Habits.—It lives for choice beneath the soil but is sometimes seen on the surface or only partially submerged. It burrows in loose earth with facility using its snout only for this purpose. I frequently observed specimens in captivity, and never saw the tail used in any way as to suggest its aid in burrowing, and I failed to discover any use for this curiously fashioned appendage.

Food.—The many specimens I have dissected contained in the stomach nothing but earthworms. These are rarely found whole, but in many fragments, suggesting that the worm when seized breaks itself off by its contortions only to be seized again, and lose another instalment. The intestines and cloaca of the snake are invariably loaded with liquid mud derived from the alimentary systems of the worms ingested, and I have no doubt that every snake accounts for a large number of worms weekly.

The sexes.—Of 21 specimens from the Wynaad sexed by me 13 were ♀ and 8 ♂. The female attains to a greater length than the male. The average of my six largest females from the Wynaad was 14½ inches, against 11¾ inches for my six largest males from the same locality. The body is relatively longer, and the ventral shields more numerous in the female, and the tail is relatively shorter with fewer subcaudals in this sex. The terminal caudal shield also shows slight sexual differences. It is rather broader in the ♀, and the terminal spines less well developed than in the ♂.

Breeding.—I have lately ascertained that it is viviparous in habit. The season of birth apparently ends in July in the Nilgiris, and the brood is a small one for an ophidian, *viz.*, 3 to 5. I had two gravid mothers in July measuring respectively 14½ and 11 inches. The former contained 5 fœtuses seemingly fit for birth, the largest of which measured 4½ inches. The latter had 3 embryos, the largest measuring 4⅜ inches. In both cases these were contained in transparent membranous sacs, as one sees in vipers. No other females subsequently received (some dozens) were in a gravid state. I reckon that the smaller mother would be just about 3 years old.

Growth.—The smallest specimens I have had were about 5 inches and my notes make it appear that the young grew from 2 to 3 inches in the first year of life.

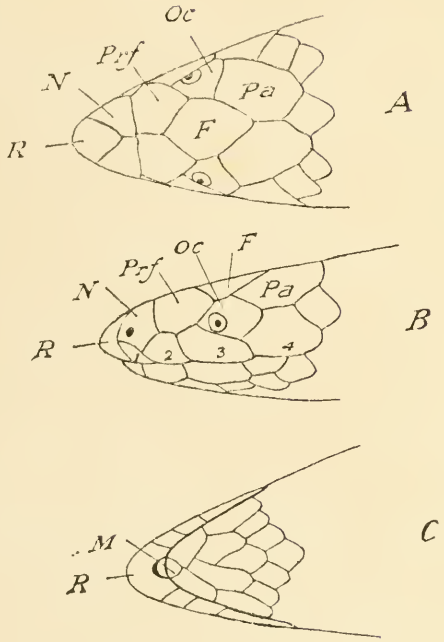
Distribution.—The Nilgiri Hills, Anamallays and conterminous Hills to the South of India between about 2,000 and 4,500 feet elevation. In the Nilgiri Hills this year I obtained 101 specimens all of which came from the Wynaad. The slopes in this locality face West, and it is perhaps remarkable that the slopes facing South and East furnished no single specimen.

Explanation of Diagram.

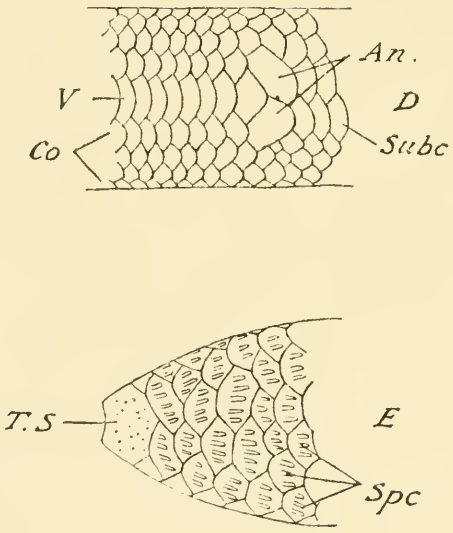
An.	Anal.
A. S.	Anterior Sublinguals.
C.	Costals.
F.	Frontal.
I.	Internasals.
M.	Mental.
N.	Nasals.
Oc.	Ocular.
Pa.	Parietals.
Po.	Postoculars.
Pr.	Præocular.
Prf.	Præfrontals.
P. S.	Posterior Sublinguals.
R.	Rostral.
S.	Supraocular.
Spc.	Supracaudals.
Subc.	Subcaudals.
T.	Temporals.
T. Sc.	Terminal Scute.
V.	Ventrals.
1—7.	Supralabials.
I—IV.	Infralabials.

Callophis macclellandi.—A, B, C are three views of the head.

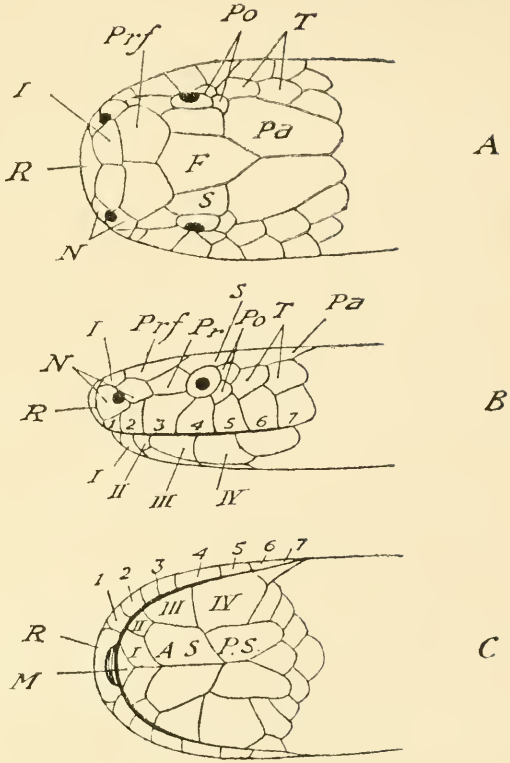
Silybura ocellata.—A, B and C are views of the head shielding. D shows the anal region with ventrals, subcaudals, and $3\frac{1}{2}$ rows of costals visible on each side of the ventrals. E. View of top of tail to show the terminal scute and pluricarinate supracaudals.



Silybura occallata.
(× 3)



THE COMMON SNAKES OF INDIA.



Callophis macclellandi.
(× 2½)

Lepidosis. Rostral.—Touches 4 shields, the rostro-nasal being about twice the length of the rostro-labial; the portion visible from above is greater than its distance to the frontal, and nearly one-fourth the shielded part of the head. *Nasals.*—In contact behind the rostral; touching the 1st and 2nd labials. *Præfrontals.*—In contact with the 2nd and 3rd labials. *Frontal.*—In contact with 6 shields; about as long as the parietals. *Ocular.*—In contact with the 3rd and 4th labials. *Supralabials* 4; the 4th longest. *Sublinguals* absent. *Mental groove* absent. *Costals.*—Broader than long, smooth, with rounded outlines posteriorly; 19 (rarely 21) two heads-lengths behind the head, 17 (rarely 19) in midbody, and 17 (rarely 19) two heads-lengths before the vent. About three heads-lengths behind the head, the rows reduce to 17 by a fusion of the 4th and 5th rows above the ventrals. About three heads-lengths further back the 4th row again divides to establish, 19 for a few rows, and again about two heads-lengths further back the 4th row is again absorbed, and the scale rows then remain 17. *Ventrals.*—About $\frac{3}{2}$ the breadth of the last costal row. In Wynaad specimens they number 185 to 197 in the ♂, and 194 to 208 in the ♀. In Anamallay specimens they range from 214 to 231 in the ♂, and from 218 to 230 in the ♀. *Anal.*—Divided; about twice the breadth of the ventrals. *Subcaudals.*—Divided; 9 to 12 in the ♂, and 6 to 8 in the ♀. *Supracaudals.*—The scales on the subtruncate part of the tail have many keels. *Terminal shield.*—Large and furnished with two points placed side by side.

Anomalies.—One specimen obtained at Paralai had 21 scale rows anteriorly and 17 at midbody and behind. I considered this merely an aberrant specimen of *ocellata* and sent it to the British Museum where my view was confirmed.

I have seen the last ventral sometimes divided.

Dentition.—The maxilla supports 4 to 5 teeth. There are no palatine, or pterygoid teeth. The mandibular series numbers 6 or 7.

(*To be continued.*)

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plates and Diagrams

by

F. Wall, C.M.G., C.M.Z.S., F.L.S., Lieut.-Colonel, I.M.S.

Part XXVI (with Plate XXVI and Diagram).

(*Continued from page 635 of Volume XXV.*)

As now classified the large family *Colubridæ* is divided into three "series" depending upon peculiarities in the dentition of the Maxillæ.

Series A. Aglypha (Greek "a" without, and "glupho" I carve) comprises those snakes that have no grooved (carved) nor canaliculate fangs.

Series B. Opisthoglypha (Greek "opisthe" behind, and "glupho") the representatives of which have grooved fang-like teeth at the back of the maxilla.

Series C. Proteroglypha (Greek "proteros" in front, and "glupho") including those snakes with a pair of canaliculate or true fangs in the front of the maxilla. The first subject of this paper comes into "Series" B, and the second into "Series" C.

"Series" B. *OPISTHOGLYPHA.*

This "Series" comprises three sub-families (1) Homalopsinæ. (2) Dipsadomorphiinæ, and (3) Elachistodontinæ. The first of these contains our first subject.

Sub-family *HOMALOPSINÆ.*

This is again divided so as to represent ten genera, seven of which occur within Indian limits.

Genus *CERBERUS.*

Three species are known, one Australian, one peculiar to the Philippines, and a third *rhynchops* which has a wide range of distribution in India and beyond.

CERBERUS RHYNCHOPS (Schneider).

The Dog-faced Water snake.

History.—This was first brought to the notice of the scientific world by Russell who figured it twice, once in his First Volume

(Plate XVII) which appeared in 1796, and again in the Second Volume (Plate XL) issued in 1801. It was first christened by Schneider in 1799. Its synonymy differed with almost every writer until 1864 when Gunther fixed the proper designation under which it now rests.

Nomenclature. (*a*) *Scientific.*—The generic title is from Greek "kerberos," the famous three-headed dog that guarded the entrance to Hades in Grecian mythology. The name appears to have been suggested by the forbidding aspect of the snake. The specific name is also from Greek ("rhunchos" snout, and "ops" face) probably in allusion to the peculiar under-hung condition of the lower jaw.

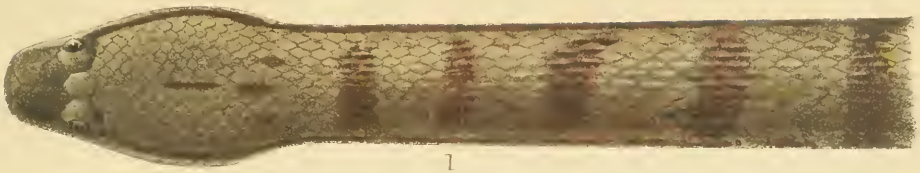
(*b*) *English.*—The dog-faced water snake seems to me appropriate, and is not only distinctive but accords with the scientific generic name.

(*c*) *Vernacular.*—None known to me.

General Characters.—The head is pear-shaped as seen from above expanding considerably towards the occiput. The snout is narrow, and in profile shows an unusually prominent lower jaw little if at all shorter than the upper. This feature to a large extent gives the snake its forbidding expression. The nostrils are directed almost as much upwards as laterally and are narrow slits convex forwards. They approach the condition seen in the sea-snakes. The eye is rather small, directed as much upwards as laterally, and the eyebrow is remarkably prominent. The iris is minutely speckled with gold and reveals a vertically elliptical pupil. The neck is fairly evident. The body is stout, and rough from the strong keels on the costal scales. It is dull dorsally, glossy on the belly, including the last three costal rows. The tail is short, rather compressed at the base, and rapidly tapers to an obtuse point. It is about one-fifth the total length of the snake.

Dimensions.—Most specimens range between two and three feet, and anything over this is unusual. The longest of which I am aware is that reported by Stoliczka from Burma which was four feet, two inches.

Colouration.—The back is bluish grey when the snake is submerged, lightish grey when dry. It is crossed by numerous ill-defined but conspicuous darker bars involving one to two scales in the length of the snake, the intervals involving five to seven scales. These bars grow less distinct posteriorly, and the foremost are broken up into spots in some specimens. The dorsal colouration ceases abruptly about midcosta, and is replaced by buff subcostally, and venerally. The belly is buff coarsely spotted or dappled with deep greenish black. The head is coloured above like the back, and the grey is sharply defined just above the supralabials. The upper lip and chin are buff. A conspicuous



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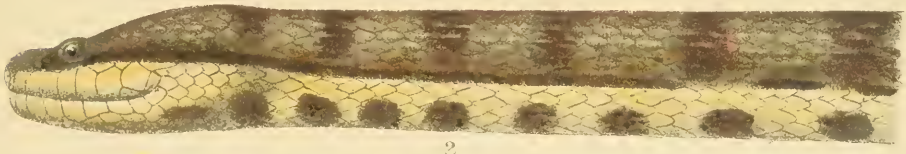

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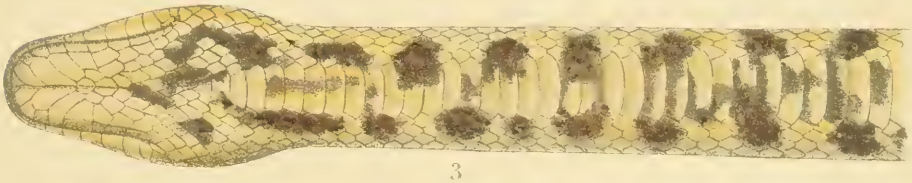

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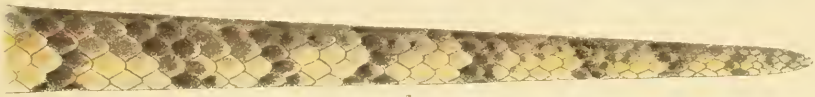

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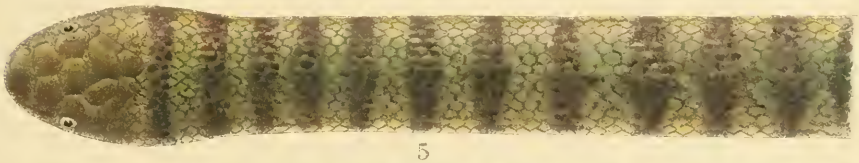

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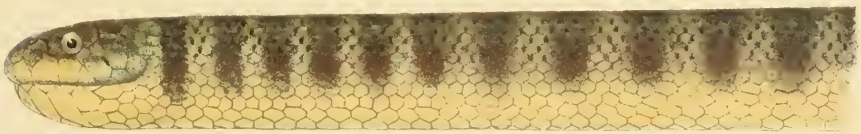

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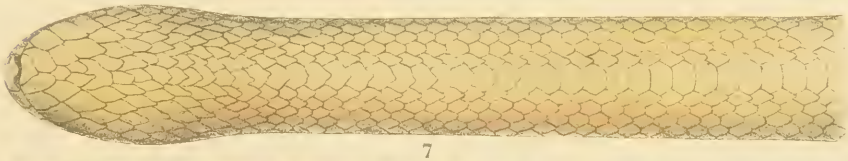

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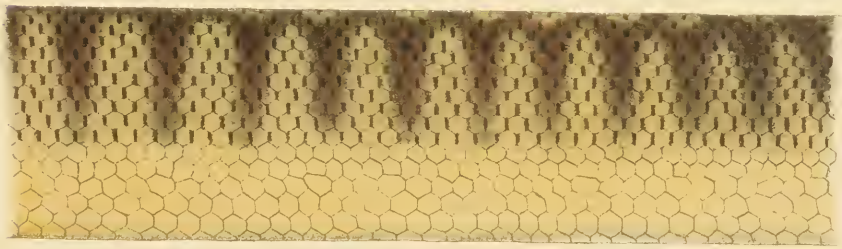


8.

P Gerhardt del. J. Green, Chromo.

THE COMMON INDIAN SNAKES, (Wall.)

1-4. Cerberus rhynchops, *harmless.* 5-8. Enhydrina curtus, *poisonous.*

all nat. size.

dark postocular streak is prolonged backwards to the side of the forebody.

Identification.—The frontal which is partially, and the parietals which are wholly broken up, furnish an easy means of knowing the snake, but perhaps a more certain method is as follows:—A snake which when laid on its back, reveals well developed ventrals at least three times the breadth of the last costal row, and at the same time shows three or more rows of costals on each side of the ventrals will prove to be a Homalopsid. *Cerberus* will be easily distinguished from its near Indian relations by possessing (1) two internasals, (2) 9 to 10 supralabials, and (3) 23 to 27 costal rows in midbody.

Haunts and habits.—It is eminently an aquatic species usually inhabiting the brackish waters of tidal-rivers, creeks, and estuaries. Ferguson and Cantor say that it frequents fresh water also, and Cantor, Haly and Flower, all report it from the sea in close proximity to our coasts. I became acquainted with it in Burma, and frequently observed it in the waters of the narrowest channels connected with the tidal-river system, as well as in the river itself. I frequently saw it swimming in the ebb and flood tides. It swims powerfully usually allowing itself to be carried with the stream, but it sometimes anchors itself to a convenient bamboo stake, anchor rope, or submerged branch by its tail, and from this purchase swings about in the current on the look-out for fish passing by. As the tide ran out many were observed lying along the branches of the trees, and bushes just above the water, and when hustled dropped off into the stream below. Numbers were left stranded on the mud flats left by the receding tide and in the teak yards nearly every bole harboured beneath it, some of these snakes. I have seen it exhibit some intelligence in the following manner. Lying extended in the length of a nearly empty ditch, after a period of quietude, it flicks its tail round first on one side and then the other in such a way as to make an unwary fish recede from the movement towards its head, when coming within sight the fish falls an easy victim to the manœuvre. Taken at a disadvantage on land it will occasionally exhibit great activity, and try to escape. When prevented from so doing it protrudes the tongue, and hisses, and flattens itself on the ground. When held down by a stick it will sometimes strike, and bite viciously, and under such excitement emits a disagreeable odour not necessarily accompanied by a discharge of the cloacal contents. When picked up it wreaths itself with some force around the hand.

Its mode of progression is curious. The body is thrown forward in a curve in advance of the head, and the head subsequently advanced, the body being again thrown forward before the snake quite extends itself. It gives the impression of moving sideways.

Disposition.—In spite of its forbidding appearance this is a peculiarly inoffensive reptile. Blanford and other have remarked upon its quiet nature and I can support their observations. It does not usually take alarm when encountered, but will permit one to approach close enough to place a stick over it, and allow itself to be captured. In captivity it is a singularly uninteresting, lethargic creature allowing itself to be handled, and rarely betraying a malicious spirit. Drumming on the glass of the vivarium even when its nose is against the glass, usually evokes little if any response. In a tank it is hardly more interesting.

Food.—It feeds exclusively and voraciously on fishes. About Rangoon on the mud-flats it frequently pursued a little fish commonly called the walking perch from its mode of active progression on the mud by means of fins that are used as legs. I once found a large fish eight inches in length inside a specimen measuring three feet, three inches. I have also known an eel taken. I frequently saw *Cerberus* wriggling at the end of a fisherman's hook bated with a fish, to the disgust of the angler.

Breeding.—This like all the other Homalopsids I know is viviparous in habit. The young are born in May, June and July, but it is quite likely further observations may extend the season already known. The period of gestation is now known, but from analogy is likely to exceed six months. I found eggs with no trace of an embryo in a gravid female from Rangoon on the 21st February 1900.

It is fairly prolific, its brood amounting to at least 26. Gunther records a brood of 8. My specimen above alluded to contained 7 eggs, and three gravid females received from Moulmein captured between the 26th March and 4th April 1900, contained 14, 23 and 26 eggs. These were all in about the same stage of development, the embryos within measuring about $2\frac{1}{2}$ inches.

Growth.—In spite of the meagre figures at my disposal these furnish a good deal of information. Gunther's brood already referred to measured from 7 to $7\frac{1}{2}$ inches. I have had small specimens in Burma brought to me measuring $7\frac{3}{8}$ and $7\frac{7}{8}$ inches in May and July respectively. I find the young double their length in the first year of life, and have about trebled it by the end of the second year. It would probably take another two years before specimens attained to three feet, and I have examples of such 3 feet 1 inch, and 3 feet 3 inches in June from Burma. Unfortunately, I have lost my detailed notes regarding the length of my gravid females, so am unable to say when the species is sexually mature.

Distribution.—It occurs all along out Indian Coasts from Sind and Mekran in the North-west to Tenasserim, and through the Malayan Region to the Philippines and Pelew Islands.

It is quite common around India, but not nearly so common as in Burma where there must be literally thousands in every tidal-river. Haly reports it common in Ceylon, and Blyth says the same with reference to the Andamans. It occurs in the Nicobars.

Lepidosis, Rostral.—In contact with 4 shields, the rostro-nasal, and rostro-labial sutures subequal ; sometimes a partial median suture is seen in the upper part of the shield. *Internasals.*—Two, sub-triangular ; their bases apposed in the median line ; the suture between them equal to rather greater than that between the præfrontal fellows, subequal to the internaso-præfrontal suture. *Præfrontals.*—Two, the suture between them subequal to the præfronto-frontal ; in contact with nasal, loreal and præocular. *Frontal.*—In contact with 7 shields, frequently more or less disintegrated posteriorly. *Parietals* —Disintegrated into many parts. *Nasals.*—In contact behind the rostral ; touching the first labial only. *Loreal.*—Present. *Præocular.*—One. *Postoculars.*—One or two. *Temporals.*—Replaced by small scales.

Suboculars.—One to three. *Supralabials.*—9 or 10, none touching the eye ; the last three or four divided into an upper and lower part. *Infralabials.*—Many small.

Sublinguals.—One pair only present ; in contact with 3 or 4 infralabials. *Costals.*—Two headslengths behind the head 25 (rarely 23) ; midbody 23 to 25 (rarely 27) ; two headslengths before the anus 19 or 17. Where the rows are 25 they reduce to 23 and again to 21 by a fusion of the 4th and 5th, or 5th and 6th rows ; from 21 to 19 the 3rd and 4th rows fuse. Strongly keeled in all rows except the last for a variable extent posteriorly.

Ventrals.—Well-developed, 132 to 160. *Anal.*—Divided. *Subcaudals.*—Divided. 49 to 72.

Dentition.—Maxillary. 15 to 16 teeth are followed by a short edentulous space, after which there is a pair of grooved pseudo fangs little if at all larger than the preceding teeth. *Palatine.*—9. *Pterygoid.*—22 to 25. *Mandibular.*—20 to 23 ; the 3rd to about the 7th longest and subequal.

Our plate.—Mr. Green and Mr. Gerhardt have very faithfully portrayed a typical specimen.

"Series" C. *PROTEROGLYPHA.*

The "Series" is again divided into sub-families (1) *Hydrophiinæ* including the marine forms with valvular nostrils, strongly compressed bodies (except *Platurus*) and compressed fin-like tails, and (2) *Elapinæ* which includes the terrestrial poisonous snakes with open nostrils, round or feebly compressed bodies, and a cylindrical and tapering tail.

Sub-family *HYDROPHIINÆ.*

This contains at least eleven genera, one of which *Enhydris* includes the first sea-snake to be discussed in these papers.

Genus *ENHYDRIS.*

(Greek "En" in, and "hudor" water).

Stejneger has thrown doubts on the validity of this name for the genus for which he substitutes *Lapemis* (Herpetology of Japan, 1907, p. 435). I adhere to the generic title used by Boulonger as late as 1912 (Fauna of Malay Peninsula, Rept and Batrach., p. 192) which is the one with which all of us have grown familiar It contains only two species, viz., *curtus*, a very common snake, around our coasts, and *hardwicki* rare in Indian seas, but common further east in the Malayan Archipelago.

ENHYDRIS CURTUS (Shaw).

Shaw's Sea-snake.

History.—Described by Shaw in 1802 from a young specimen labelled "India" (the type) now in the British Museum.

Nomenclature. (*a*) *Scientific.*—The generic name simply implies "water snake," and the specific is from the Latin "curtus" meaning short.

(*b*) *English.*—I think it a fitting tribute to the work of Shaw, once the herpetologist, and custodian of the reptile collections in the British Museum, to associate his name with the species.

(*c*) *Vernacular.*—None known to me.

General Characters.—The species is remarkably stout, and short for a sea-snake. The head is massive, and the jaws strong, the body heavy, short, and strongly compressed, and the tail markedly compressed, and fin-like.

Colour.—The dorsum is olivaceous-green merging about midcosta to pale yellow. The back is beset with a series of dark greenish-brown or greenish-black rather ill-defined crossbars, about 45 to 55 in number, and rather broader than the interspaces. The first of these passes across the back of the head. In the young these bars extend further ventrally, and often form complete bands.

Identification.—Very easily recognised among all Indian sea-snakes on account of the disintegrate condition of the parietal shields. An alternative method concerns the breadth and number of the ventrals. These shields are so little enlarged in midbody and posteriorly that they hardly deserve the name of shields, but would be better considered as scales. Their number 130 to 219, with their feeble development will establish the genus. *Curtus* is easily distinguished from *hardwicki* by the parietal shields being

broken up into three parts (rarely more). Again in *curtus* with very few exceptions the suture from the nostril passes to the second supralabial, whereas in *hardwicki* it passes to the first.

Habits.—It frequents our Indian Coasts in large numbers. In rough weather in common with other sea-snakes it appears to keep well out to sea, judging from the dearth of numbers brought in from the fishing nets at this time. I have known a specimen taken on land close to a backwater one and-a-half miles from the sea. Out of 84 specimens collected in June and July this year which I sexed 21 were ♂ and 28 ♀. The tubercles on the scales in females are feeble, but in males are stronger, and on the lowest costal rows in old adults actually spinose. The male when adult has also a distinct swelling at the base of the tail not seen in the female.

Breeding.—The season for the birth of the young is probably from May to August. I had 12 gravid females from Madras between the 20th June and the 12th of July this year. The fœtuses 22 in number ranged between $8\frac{1}{2}$ and 14 inches. Other specimens already born this year numbering 9, measured from $13\frac{3}{4}$ to $17\frac{1}{2}$ inches. From this one may infer that the $17\frac{1}{2}$ inch specimen had been born probably in May if not before, and that the $8\frac{5}{8}$, and $8\frac{1}{2}$ inch specimens would not have been born till August, or possibly later. Seven of the nine young of the year measured from 13 to 15 inches, and this taken with the fact that one fœtus measured 14 inches, makes it appear that the young are about 13 to 14 inches long at birth. They are contained in the usual transparent sacs seen in viviparous snakes, but these are relatively much larger than I have observed in other species. Most of the sacs were 3 inches, some 4 and one even $4\frac{1}{4}$ inches in length.

It is the least prolific of all the snakes I know except *Hydrophis gracilis.*—Four mothers contained but a single fœtus, seven contained 2 only (one of these an infertile egg also), and one held 4 embryos. These mothers varied in length from 27 to $32\frac{1}{2}$ inches and it appears to me that the smallest length would have been attained at the end of the second year of life. If my inference is justified from the figures at my command, this species attains to sexual maturity a year earlier than other snakes whose habits I have studied. I find that at the end of the first year seven specimens had attained to a length of from 19 to $21\frac{3}{4}$ inches, and if a similar rate of growth is allowed for the second year, *i.e.*, 6 to 8 inches, the length of the smallest mother would easily be acquired by that time.

Food.—Remains of fish in the stomachs of many show it depends upon this form of diet in common with other hydrophids. I was not able to procure any fish in a suitable state to make the identification probable.

Poison.—I know of no records in the human subject of a bite, but the venom has been experimented with in the laboratory by Fraser and Elliot.

Quality.—The poison from Madras specimens submitted to these experts was described as consisting of thin scales of a very pale yellow colour.

Quantity.—Dr. Pinto who collected the poison found the average yield from eight fresh specimens represented ·00275 grammes when dried.

Toxins.—Fraser and Elliot found the effects of the poison on lower animals almost exactly that produced by cobra venom, except that the respiratory embarrassment in *curtus* poisoning was much more pronounced. The action is practically identical with that of *Enhydrina* venom. As this is dealt with fully in the 28th and last paper of this series the reader is referred to that article for particulars of the composition and action, of this poison, symptoms and treatment. Death is caused by a paralysis of the respiratory centre in the brain as in the toxæmiæ of other colubrine snakes.

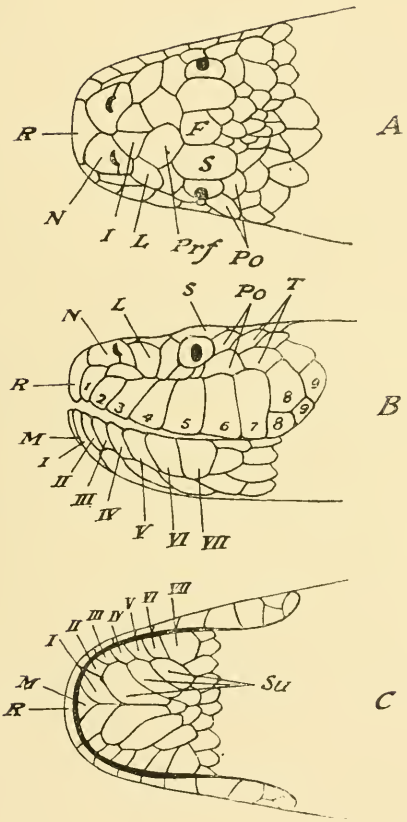
Lethal dose.—The minimal lethal dose for rats is ·0006 grammes per kilogramme weight of the rodent. As the lethal dose of *Enhydrina* venom for rats was found to be ·00009 grammes, the toxicity of this is about seven times greater than that of *curtus*.

Distribution.—From the Persian Gulf to the Malayan Archipelago. I found it very common on the Malabar Coast about Cannanore, where it is only second to *Enhydrina valakadyn* in its numerical strength. On the Coromandel Coast at Madras a collection of 192 sea-snakes furnished me with 84 specimens as compared with 60 *Enhydrinas*.

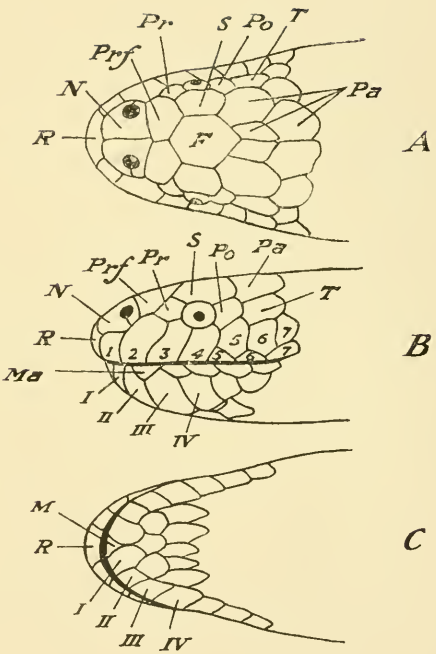
Lepidosis. $\frac{3}{4}$ *Rostral.*—Touches 4 shields, the portion visible above one-third or less than one-third the length of the suture between the nasals. *Nasals.*—Touch the 1st and 2nd supralabials; the suture from the nostril passes to the 2nd (rarely 1st) supralabial.

Præfontals.—Touch the 2nd supralabial. *Frontal.*—Entire.

Parietals.—Disintegrate, usually into three parts. *Præocular.*—One. *Postocular.*—One or two. *Temporals.*—Scale-like, two or three superposed scales anteriorly. *Supralabials.*—7 usually (sometimes 8); the 3rd and 4th normally touch the eye (rarely the 4th only or the 3rd, 4th and 5th). *Infralabials.*—4; the 4th largest, and in contact with three or four scales behind. *Marginals.*—A complete row after the 2nd infralabial. *Sublinguals.*—Poorly developed. Often so small as hardly to deserve the name; both fellows separated by scales. *Costals.*—Two headslengths behind the head 29 to 36; midbody 30 to 45; two headslengths before the anus 31 to 32; tuberculate, juxtaposed everywhere; the lowest 3 or 4 rows enlarged and in old males often with spinose tubercles. *Ventrals.*—151 to 219; entire anteriorly, divided posteriorly. Each part in old males with



CERBERUS RHYNCHOPS
(× 1½)



ENHYDRIS CURTUS
(nat. size.)

COMMON INDIAN SNAKES.

spinose tubercles. *Dentition. Maxilla.*—Behind the paired fangs there are usually 4 (rarely 3) grooved teeth. Palatine 5 to 6; an edentulous space behind that would accommodate about two more teeth. *Pterygoid.*—18 to 22. *Mandibular*—12 to 16.

Our plate is in every way excellent.

(*Explanation of figures for all.*)

F.	Frontal.
I.	Internasals.
L.	Loreal.
M.	Mental.
Ma.	Marginal.
N.	Nasals.
Pa.	Parietals.
Po.	Postoculars.
Pr.	Præocular.
Prf.	Præfrontals.
R.	Rostral.
S.	Supraocular.
Su.	Sublingual.
T.	Temporals.
Arabic numerals	Supralabials.
Roman ,,	Infralabials.

(*To be continued.*)

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plate and Diagrams

BY

F. Wall, C.M.G., C.M.Z.S., F.L.S., Lieut.-Colonel, I.M.S.

Part XXVII (with Plate XXVII and Diagram.)

(Continued from page 97 of Volume XXVI.)

HYDROPHIS SPIRALIS (Shaw).

The Narrow-ringed Sea-snake.

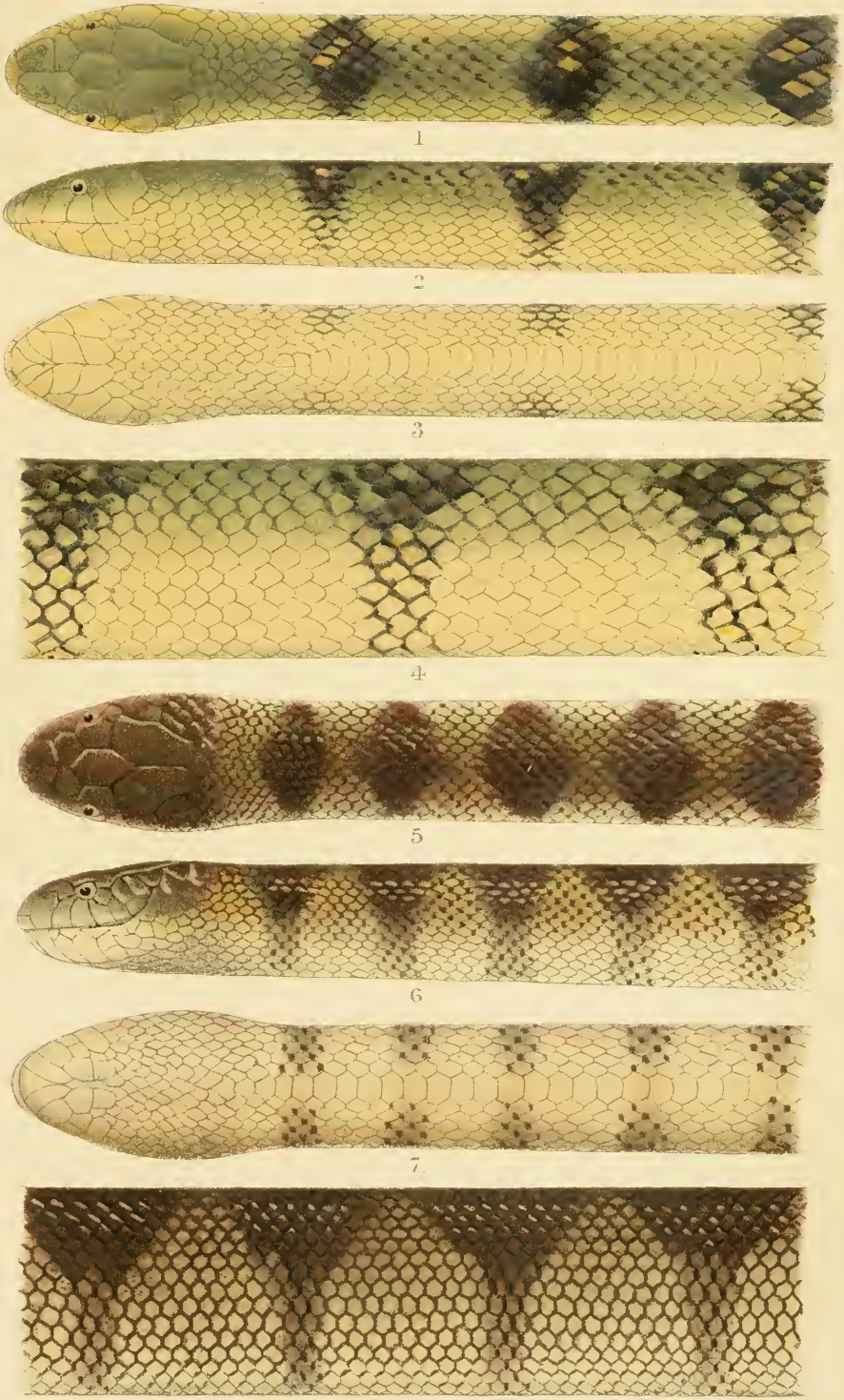
History.—The type is the young example collected by Russell, now in the British Museum, labelled from the "Indian Ocean". It was described by Shaw in 1802. In my monograph of the sea-snakes published by the Asiatic Society of Bengal in 1909 I expressed the opinion that *spiralis* (Shaw) and *brugmansi* (Boie) were identical species; and subsequently in this Journal (Vol. XX, p. 558) in 1911 substantiated this opinion by remarks upon the variations in the lepidosis, and colouration of a brood of 14 young. The snake described by Gray under the name *subcincta*, and that by Gunther as *longiceps*, both known from single specimens in the British Museum, I cannot dissociate from this species. Again the snake described by me and christened *alcocki* in 1906 (memoirs of the Asiatic Society of Bengal) I now think cannot be regarded as a species distinct from *spiralis*.

Nomenclature. (a) *Scientific.*—The generic name is from the Greek "hudor" "water", and "ophis" "snake," and the specific title from Latin refers to the decoration of the body. This, however, is in the form of rings rather than spirals.

(b) *English.*—The narrow-ringed sea-snake fits this subject, in which the rings so commonly seen in sea-snakes are narrower than in the other species, at any rate those within Indian seas.

(c) *Vernacular.*—Tamil fishermen do not discriminate between the various kinds, and call most sea-snakes "kadel nagam" or "sea-snake."

Identification.—The most reliable and at the same time simple way that I can suggest to identify this species is by counting the costal rows two heads-lengths behind the head, and the same distance before the anus. In no other sea-snake (excepting the species of *Platurus* and *H. jerdoni*) are the rows posteriorly so few in excess of those anteriorly. In the latter spot they range between 25 and 31, and posteriorly only number 2 to 6 more, whereas in other species the posterior count is from 10 to 20 in excess of the



P. Gerhardt del. J. Green, Chromo.

THE COMMON INDIAN SNAKES. (Wall)

1-4. Distira spiralis, var. brugmansii, *poisonous*. . 5-8. Distira cyanocincta, *poisonous*.

all nat. size.

anterior. A common though not invariable shield character is the large temporal which usually descends to the border of the lip (see figure A. in diagram).

General characters.—For a sea-snake, it is of conspicuously robust habit and unusually elongate. The calibre of the body anteriorly is but little less than that posteriorly. Anteriorly it is cylindrical, posteriorly but little compressed. The head is large with strong jaws, and the tail as in other hydrophids is a strongly compressed fin.

Colour and markings.—The back is usually a dull greenish or bluish hue fading about midcosta, where the lower half of the snake becomes uniform yellow or buff. The body is usually encircled, with from 34 to 59 black or blackish bands, often expanded vertebrally and ventrally, but these may be replaced by dorsal bars, the arrangement being very variable. The specimens may be grouped as follows :—

(*A*) Body banded.

(*a*) Variety *bruymansi* (Boie). With bands much narrower at midcosta than the intervals. No vertebral nor ventral spots. With this I place *robusta* (Gunther), *bishopi* (Murray), and *melanocephalus* (Gray). The commonest variety, from the Persian Coast (Gangestun and Muscat) to the Malay Archipelago (Penang).

(*b*) Variety *typica*, vel *spiralis* (Shaw). Differs from the last only in exhibiting vertebral spots in one, many, or in all the interspaces. When few, these are usually seen in the foremost, and posterior spaces. Common from the coast of Sind to Madras.

(*c*) As the last with a similar series of ventral as well as vertebral intermediate spots. I know only one specimen which is in the Colombo Museum, presumably from the Ceylon Coast.

(*d*) Variety *melanosoma* (Gunther). Bands at midcosta as broad or broader than the spaces, dilated both vertebrally and ventrally so as to be more or less confluent in these regions. I place also *floweri* (Boulenger), and *alcocki* (Wall) with this which is an unusual form.

(*B*) Body barred.

(*e*) Variety *subcincta* (Gray). The dorsum is barred and these bars are interrupted near midcosta so as to leave a series of spots on the side of the body. An unusual form, the type of which comes from the Indian Ocean.

(*f*) Variety *longiceps* (Gunther). With dorsal bars, broader than the interspaces, and no costal spots. *Temporalis* (Blanford) I also place with this. It is uncommon. I have seen specimens from Bombay and Karachi.

(*C*) Body banded anteriorly, barred posteriorly.
This form is intermediate between A and B. Such a specimen was sent by Dr. Henderson to the British Museum from Madras.

Habits.— As one would expect from its conformation, it is strong and active. It swims with vigour, and from its large size might prove a very disagreeable foe to encounter in the water. An amusing account of the capture of a giant specimen appeared in this Journal in 1913 (Vol. XXII, p. 403) over the signature of Mr. Stone, the Chief Officer of the P. and O. Steamer Arcadia.

Food.—I have lately had several specimens and submitted the curious elongate fish which they had fed upon to Dr. Henderson for identification. These fish were eel-like in conformation, and were pronounced the young of a murænid, either *Ophichthys boro* (Ham. : buch :) or *O. orientalis* (McClelland).

Breeding.—For the only domestic occurrence known to me I am indebted to Dr. Henderson. On the 1st June 1910 a large gravid ♀ was caught in Madras, and submitted to me with its unborn brood of 14 for my examination. The brood in an advanced stage of development included 10 males and 4 females. The males (with genitals extruded) measured $10\frac{1}{2}$ to $11\frac{1}{2}$ inches, and the females $10\frac{3}{4}$ to $11\frac{1}{4}$ inches.

Length.—The young are probably about 15 inches long at birth, judging from specimens of this length in which the umbilicus is open. Adults usually range between $4\frac{1}{2}$ and $5\frac{1}{2}$ feet, and specimens over 6 feet occur, but are unusual. Dr. Henderson's gravid ♀ alluded to above measured 8 feet 3 inches. Mr. Stone's specimen from Penang to which a reference has been made, was 9 feet in life and the skin when I measured it had shrunk to 8 feet 9 inches. This is much the largest sea-snake I have ever heard of, and such a monster might very easily have been the foundation for the story of "*the* sea-snake," now I suppose universally discredited. A snake always appears to be a great deal longer than actual measurement reveals. Only lately Dr. Henderson showed me a python's skin in the Madras Museum. A friend knowledgable in snake matters was asked to compute its length as the snake lay alive in the vivarium, and estimated it at about 26 feet. When dead it proved to be 16 feet.

Poison.—Nothing is known of the toxicity of this venom. No casualties in the human subject have been reported, and the poison has not been experimented with in the laboratory.

Distribution.—From the Persian Gulf to the Malayan Archipelago.

Lepidosis.—*Rostral*—Broader than high. *Nasals.*—In contact behind the rostral; the suture from the nostril, when present passes to the 2nd labial. *Præfrontals.*—With rare exceptions touch the 2nd labial. *Præocular.*—One. *Postoculars.*—One (rarely two). *Temporals.*—One large anterior, succeeded by a posterior of equal size; the anterior frequently descending to the margin of the lip. Rarely there are two superposed anterior temporals, and the posterior shield is not infrequently replaced by small scales. *Supralabials.*—6 to 8: the anterior 4, 5 or 6 usually large and undivided, the rest divided. The 3rd and 4th usually (rarely the 5th also) touch the eye. *Infralabials.*—4; the last in contact with 3 or 4 scales behind. *Marginals.*—Usually one wedged between the 3rd and 4th infralabials (rarely two after the 3rd). *Sublinguals.*—Two well developed pairs, the fellows of each in contact (or the posterior separated.) *Costals.*—Two headslengths behind the head, usually 25 to 29 (rarely 23 to 31); in midbody usually 31 to 35 (rarely 29 to 36); two headslengths before the anus 28 to 36: more or less imbricate, smooth or nearly smooth in the young, feebly or strongly tuberculate in adults. *Ventrals.*—282 to 373. Entire throughout except for a few posteriorly; less than twice or hardly twice the breadth of the last costal row.

Dentition.—I have examined the *maxillary* teeth of well over a dozen examples, and find there are usually 7 (rarely 6) behind the paired fangs. *Palatine.*—7. *Pterygoid.*—12 to 13. *Mandibular*—13 to 15.

Plate.—Our figures are excellent, and show the commonest form, (Variety *brugmansi*) to be met with around our coasts. The ventrals are shown too broad relatively.

*HYDROPHIS CYANOCINCTUS** (Daudin).

The Chittul.

History.—The type of this species I take to be the specimen in the British Museum from the Sunderbunds, which was one of the

* I have no hesitation in declaring the *tuberculata* and *crassicollis* of Anderson, the *dayanus* of Stoliczka, and the *trachyceps* of Theobalds (all of which are known from single specimens in the Indian Museum which I have examined) identical with *cyanocinctus*. Further I think the *sublævis* and *lapemidoides* of Gray, all of which I have examined in the British Museum, will prove to belong to this species. It is more than likely too that the *melanocephalus* of Gray, and the *melanosoma* of Gunther may have to be referred to this species. I have seen the types of each in the British Museum. The *bituberculata* of Peters I have not examined, but I see no reason from the description and figure given to dissociate it from *cyanocinctus*.

collection originally presented by Russell to the Royal College of Surgeons. This specimen is probably the subject from which figure IX Russell's second volume published in 1801 is taken. The name *cyanocinctus* was conferred by Daudin in 1803.

Nomenclature. (*a*) *Scientific.*—The generic name is from the Greek signifying "water snake," and the specific is a hybrid word of Greek and Latin origin meaning "blue banded."

(*b*) *English.*—One cannot do better than appropriate the vernacular name for English use.

(*c*) *Vernacular.*—According to Russell "chittul" is the name by which the snake is known to the natives about the Sunderbunds, but I very much doubt if they can really discriminate between this and many other sea-snakes. The word is probably a derivative of "chitti" implying spotted or mottled.

General Characters.—The adult is a strongly built and heavy snake. The forebody is cylindrical, and varies from about two-fifths to two-thirds the depth of the body at its greatest girth, except in heavily gravid females where it may be only one-third. Posteriorly the body is compressed, and the tail is flatly compressed as in other sea-snakes. The head, of the same calibre as the forebody, is relatively large and the jaws strong.

Colouration.—The many varieties have been summed up by Mr. Boulenger, and I have little to add to his arrangement.

Variety (A),—*typica* (Daudin). With well-defined black bands, more or less connected ventrally.

(*a*) All the bands complete. A common form ranging from the Persian Gulf to Tenasserim.

(*b*) With some of the posterior bands interrupted costally or subcostally. Not uncommon. From the Persian Gulf to Tenasserim.

(*c*) With some of the posterior bands deficient ventrally, and thus converted into bars. Not uncommon. From the Persian Gulf to Tenasserim.

Variety (B).—With well-defined black bands not united ventrally. A common form occurring between the Persian Gulf and Tenasserim.

Variety (C).—With obscure bands or bars. A common form usually met with in adult specimens, and occurring between the Persian Gulf and Tenasserim.

Variety (D).—With well-defined dorsal bars. A common form seen in examples from the Persian Gulf to Tenasserim.

Variety (E).—The *phipsoni* of Murray. With a continuous, black dorsal band. A rare form known from a single specimen from Bombay, in the Bombay Natural History Society collection.

Identification.—Given a normal specimen identification is easy. A large majority of specimens will be found to have the 3rd, 4th and 5th labials entire, and all touching the eye. In addition there is nearly always a complete row of marginals after the 2nd infralabial, which cuts off the subsequent infralabials from the margin of the lip. Unfortunately in many specimens certain of the head shields are subject to great variation. Thus only two labials may touch the eye, and either the 3rd, 4th, or 5th or all, may be divided. Rarely specimens have a single cuneate marginal between the 3rd and 4th infralabials, or a complete row after the 3rd infralabial. The ranges of costal rows and ventrals are considerable. These facts make identification in some cases difficult, in fact many new species have been created by various authors, on individuals that present a number of costals or ventrals in excess of the previously recorded ranges or that present unusual characters in their head shields. Where only two labials touch the eye, the costals and ventrals must be counted, and these may come within the ranges of the following species, *nigrocinctus*, *diadema*, *mamillaris*, and *cærulescens*. An examination of the maxillary teeth is then called for, and this is best left to an expert. *In nigrocinctus* there are 2 teeth behind the fangs, in *cyanocinctus* 6 to 8 (usually 7), in *diadema* 8 to 10, in *mamillaris* 9 to 10, and in *cærulescens* 13 to 17.

The species is, however, more frequently confused with *spiralis* (Shaw) (vel *brugmansi* (Boie)), than with any other species. The most important points of difference between these two are, that in *spiralis* the scale rows at the greatest girth range from 29 to 36, whereas in *cyanocinctus* they range from 38 to 49. Further the scale rows in *spiralis* are usually only 2 to 6 more numerous at the greatest girth than in the forebody, whereas in *cyanocinctus*, they are usually from 8 to 16 more numerous.

Habits.—Nothing special has been recorded about the habits of this snake in spite of its being such a common species.

Breeding.—A small specimen only 2 feet 11 inches long, in the Indian Museum, I found gravid. The date of its capture is not recorded. It contained 3 fœtuses, varying in length from 1 foot 2 inches to 1 foot 3 inches.

Another gravid specimen captured in the Bombay harbour, I found contained 9 young. The parent measured 4 feet 4 inches, and the young of which, 4 were ♂, and 5 ♀, varied from 12 to 13 inches in length. The date of capture is not known.

Fayrer, in his Thanatophidia, mentions a gravid specimen from Puri (date not recorded) in which Mr. Stewart found sacs of the size of hen's eggs, containing 16 very young embryos. A gravid female 33 inches long, captured in the Chantabum River, Siam, in

March 1916, contained eight embryos varying in length from 10 to 10½ inches.

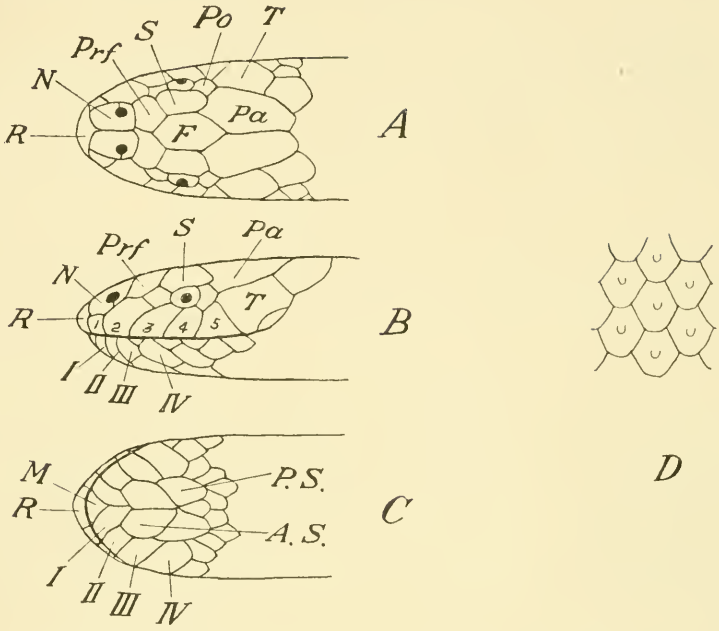
Poison.—Nothing is known. There is no record of a bite in the human subject, but the poison may be judged to be virulent, from the fact that a fowl that Russell caused to be bitten by a five-footer succumbed in 8 minutes.

Lepidosis.—*Rostral.*—Broader than high. *Nasals.*—In contact behind the rostral. When there is a suture from the nostril this passes to the 2nd labial. *Præfrontals.*—Touch the 2nd labial. *Frontal.*—The sutures with the parietals are rather longer than with the supraoculars. *Supraoculars.*—In length and breadth about two-thirds to three-fourths that of the frontal. *Præocular.*—One. *Postoculars.*—Usually two, sometimes one. *Temporals.*—Usually two between the parietal and the 6th labial. *Labials.*—7 to 8. The first 5 usually entire and the 3rd, 4th, and 5th usually touching the eye. *Infralabials.*—5; the 3rd and 4th broadest, the 5th touching 3 or 4 scales behind. *Marginals.*—Usually a complete row after the 2nd infralabial, rarely, a single cuneate, or a complete row after the 3rd infralabial. *Sublinguals.*—Two pairs, the fellows of each in contact or the posterior rarely separated. *Costals.*—Two headslengths behind the head 27 to 36; at the greatest girth 38 to 49. Anteriorly imbricate, posteriorly imbricate, sub-imbricate, or juxtaposed. Each scale has a keel occupying its median three-fifths or so. Almost always this keel is divided by one or two indentations into two or three parts. The very distinctive keels and their serrations are much more conspicuous in males where they are sometimes most pronounced and even spinous on the belly. In females and young though somewhat obscure they are usually discernible if looked for. *Ventrals.*—296 to 398, usually entire, rather less than twice the breadth of the last costal row, keeled on either side like the lowest costals.

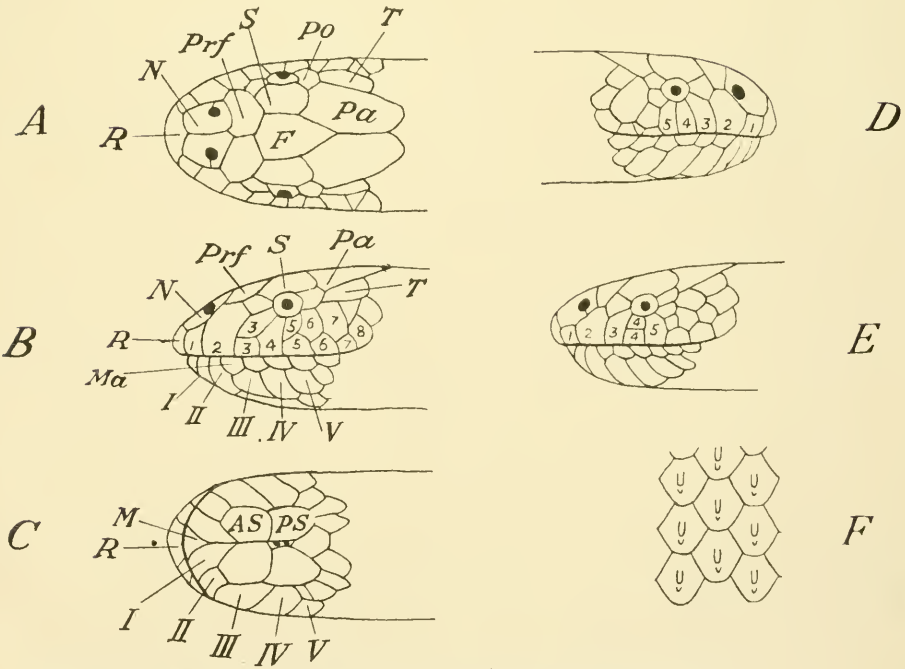
Dentition.—*Maxilla.*—In well over 20 specimens examined I find there are nearly always 7 teeth behind the fangs, but they vary from 6 to 10. The numbers of mandibular, and other teeth given are from the single skull in my collection and are: *Palatine.*—9. *Pterygoid.*—18. *Mandibular.*—14 to 17.

Length.—Adults are usually 4 or 5 feet long, the largest in the British Museum being 4 feet 10 inches. I doubt if I have ever seen one 6 feet, but Murray says it grows to 7 feet. Judging from the length of the young compared with those of *spiralis*, one would expect to hear of as large or even larger specimens than in that species.

Distribution.—In Indian limits it occurs from the Persian Gulf to Tenasserim. It is probably the common set sea-snake on our



Hydrophis spiralis A, B, C. (nat: size) D (x 2)



Hydrophis cyanocinctus A to E (nat: size) F (x 2)

shores with the single exception of the Jew's nose (*E. valakadyn*). In the Persian Gulf it is probably the commonest of all sea-snakes. About Ceylon it appears to be much less abundant than on the shores of India. I can find no record from the Andamans, though one can hardly doubt that it occurs there.

Plate.

On the coloured plate the names of the snakes are given as * *Distira spiralis* var *brugmansii* and *Distira cyanocincta*; these should now be changed to *Hydrophis spiralis* var *brugmansii* and *Hydrophis cyanocincta* respectively.

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* In my "Monograph of the Sea-snakes" published in the Memoirs of the Asiatic Society of Bengal in 1909, I pointed out that the genus *Distira* (Boulenger) rested on a mistaken basis. I contended that the posterior maxillary teeth in *all* Hydrophis were grooved, and Boulenger was in error in supposing these teeth in *Hydrophis* were not grooved. This being the only difference on which the two were separated I claimed that they should rest under a single generic title. Since this Boulenger has published a work on the Malayan Reptilia, and in this he has accepted my observations and *Distira* now is suppressed in favour of *Hydrophis*, for all those species previously included by him under *Distira* and *Hydrophis*.

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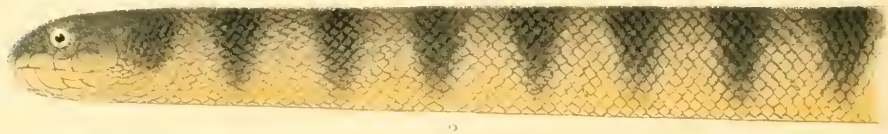

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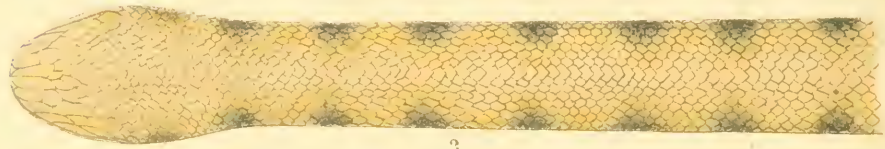

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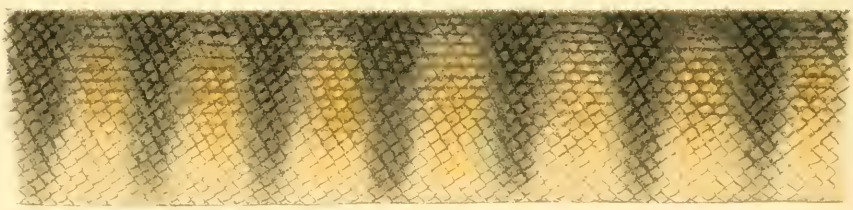

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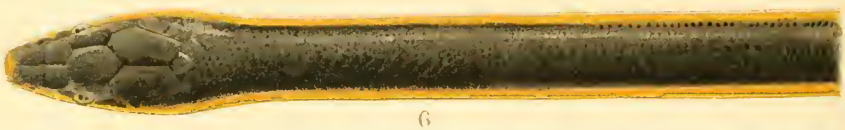

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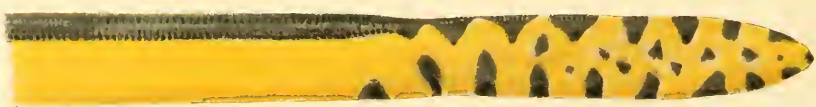


8

T. Anthony del. d. Green, Chromo.

THE COMMON INDIAN SNAKES. (Wall.)

1-5 Lapydrina Valakadien. *poisonous* 6-8 Hydrus platurus, var. bicolor. *poisonous*

di nat. size

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plate and Diagrams

BY

F. Wall, C.M.G., C.M.Z.S., F.L.S., Lieut.-Colonel, I.M.S.

Part XXVIII (with Plate XXVIII and Diagram.)

(Continued from page 437 of Volume XXVI.)

ENHYDRINA VALAKADYN (Boie).

(*vel SCHISTOSA* (Daudin)).

The Jew's-nosed Seasnake.

History.—The type-specimen, which had previously been lost sight of, I discovered in the Royal College of Surgeons' Museum, London. It is No. 523 of their catalogue (1859, p. 78), and is the original specimen from Tranquebar figured by Russell in his second volume (plate xi). It was one of Russell's collection which was presented to the above Institution by the East India Company, most of which has since been transferred to the British Museum.

I do not concur with Boulenger in thinking plate x. of Russell's same volume a distinct species. I agree with those herpetologists, and they are many, who think that the figure on plate x represents the same species as plate xi. If this opinion is correct this snake should be known by the name *schistosa* given it by Daudin in 1803, while Boie's name *valakadyn* dating from 1827 should be suppressed. I prefer in this paper however to retain the title with which all have been familiar for so many years.

Nomenclature. (*a*) *Scientific.*—The generic name is from the Greek "en" in, and "hudor" water. The specific name is borrowed from the vernacular.

(*b*) *English.*—I would suggest "Jew's nosed Seasnake" or simply "Jew's nose." These names draw attention to a very obvious feature which is peculiar to this species.

(*c*) *Vernacular.*—According to Russell "valakadyn" is the name given to it on the Coromandel Coast, and "hoogly pattee" about Calcutta. The former is Tamil from "valla" strong and "Kadyen" biter. "Pattee," a "bandage," obviously refers to its flattened body.

General characters.—The snake is robust in habit, the forebody cylindrical, and much less constricted relatively than in many seasnakes. Posteriorly the body is very compressed and heavy, especially in gravid females. The head is large, and has a peculiar

downward prolongation of the snout, and equally peculiar pronounced furrow in the chin. The tail is a flattened vertical paddle similar to that in other hydrophids.

Colour.—Very variable. The young are bluish or bluish-grey with many well defined, black annuli, often dilated vertebrally. As age advances these bands become more and more obscured, first disappearing ventrally, to become dorsal bars, which in old specimens may disappear altogether. In old adults the dorsum is frequently a uniform bluish or bluish-grey, merging at midcosta to yellow or yellowish ventrally. Both dorsal and ventral hues again are subject to much modification according to whether the specimen has recently desquamated or is about to do so. In the latter case the yellow on the belly becomes often tinged with brown.

Identification.—The downward projection of the rostral shield to below the level of the lip and the groove in the chin are both features peculiar to this species, and make identification as easy as it is certain.

The suture from the nostril passes to the 1st labial, a very unusual feature seen in only one other species, *viz.*, *Enhydris hardwicki*.

Habits.—This is far the commonest seasnake around our shores, and extraordinarily plentiful. On the Malabar Coast the fishermen brought them in bucketfuls until deterred from doing so. I have certainly had over fifty brought to me in one morning taken from their nets. On the Coromandel Coast at Madras and at Gopalpore I have seen the nets brought in with a dozen or more of these snakes among the haul. At Cannanore the men in the 75th Carnatic Infantry fishing in the sea with lines, more often it seemed to me hooked a "jew's nose" than a fish!

It frequently comes up tidal rivers, and several were captured for me at Watiya in Burma at a distance of 40 miles from the sea. It has been taken in Tolly's Nullah, Calcutta, 80 miles from the sea.

In Cannanore I kept several of these snakes in a dry masonry trough among my flower pots, where they lived many days without any water. Here they crawled about in a clumsy awkward fashion, but progression was far less hampered than is the case in the very thin necked seasnakes. All these specimens were conspicuously gentle creatures, that I failed to provoke to bite an offending object. This placid disposition is well exemplified by the fact that the sepoys and others who habitually bathed at Cannanore were never bitten, plentiful as I have shown that the "Jew's nose" is there.

The Sexes.—Females appear to be more numerous than males from the few notes at my disposal. In Cannanore of 13 specimens sexed 8 were ♀. Again of 19 fœtuses obtained in the same station 12 proved to be ♀. Except for the basal swelling in the tail

in males there is nothing to distinguish the sexes. The tubercles on the scales are rather more pronounced in males than in females. Each male clasper is bifid with its extremities beset with villose papillæ. A raphé passes from the cloaca up the inner face, and then to the back of the "stalk" where it divides to pass up up each limb.

Food.—They live entirely on fishes. Speaking of Malayan specimens Dr. Annandale says: "A very large proportion of the fish on which they feed are silurids and others provided with long, sharp spines, and the manner in which these spines are eliminated from the snake's bodies is curious, for they appear to pass out through the walls of the alimentary canal and through the body wall to the exterior. I have frequently found specimens of the Hydrophinæ with fish spines actually protruding from within through the integument, without, apparently, causing any inflammation or inconvenience. Seasnakes cannot hiss, but produce a low gurgling sound when annoyed."

Breeding.—The season is only proximately known. On the 12th November 1903, in Cannanore, I had a gravid ♀ in which small eggs were discovered containing no trace of embryo. In December the same year I had a gravid mother with fœtuses, ranging from $6\frac{5}{8}$ to 7 inches long. In January and February 1904, I had four other gravid females in which the embryos were well developed, the most advanced measuring from $10\frac{3}{8}$ to 11 inches on January 29th. As Gunther has recorded a newly born individual $10\frac{1}{2}$ inches long, the brood above referred to would probably have been born early in February.

In 1917 I had 11 specimens from Madras in June (evidently this year's offspring) which varied in length from $12\frac{1}{2}$ to 17 inches. My youngest mother measured 3 feet 2 inches in January, a length I reckon (from rather meagre figures) she would have attained at the end of her 3rd year of life. My six gravid specimens contained respectively 4 fœtuses, and 5 fœtuses and 1 infertile egg, 6 eggs, 6 fœtuses, 9 fœtuses and 8 fœtuses. The young latterly are contained in transparent membranous sacs filled with a viscid fluid of the consistency of castor oil. Males before birth as usual had their genitals extruded.

Growth.—The young appear to double their length in the first year, when they are about 20 to 24 inches long. At the end of the 2nd year they are about 30 inches long, and at the end of the 3rd about 38 to 40 inches, and growth continues for some years later. Average adult specimens range between 3 and 4 feet, but I have had larger examples, *viz.*, a ♀ 4 feet $3\frac{1}{2}$ with a girth of $6\frac{1}{2}$ inches at its greatest thickness, and a ♂ 4 feet 7 inches long.

Food.—I have only found fish ingested.

Venom of Enhydrina.

Quality.—In its dried state Fraser and Elliot report that it consists of "thin scales of a very pale yellow colour."

Quantity.—Rogers estimated that the average amount injected during a bite represented one centigramme in the dried state. (Average from 13 specimens.) Fraser and Elliot's estimate for six specimens is much lower, but could not be stated exactly owing to an accident.

Toxins.

(1) Neurotoxins operating on nerve cells.
  (*a*) A depressor paralysing the respiratory centre (Rogers, Fraser and Elliot).
  (*b*) A depressor paralysing centres in the bulb (Inferred from the remarks of Rogers, Fraser and Elliot).
  (*c*) A depressor paralysing nerve endings, the phrenics especially (Fraser and Elliot).

(2) A direct stimulant to cardiæ muscle (or nerve endings). Very feeble (Fraser and Elliot).

(3) Toxins affecting the constitution of the blood.
  (*a*) Hæmolysin. Very feeble (Fraser and Elliot).

Analysis of the action of Enhydrina toxin.

(1) (*a*) The "neurotoxin" paralysing the respiratory centre is the chief agent in producing death. It is powerfully assisted by (1) (*c*).
  (*b*) This neurotoxin evokes symptoms of paralysis of the lips, tongue, throat and voice.
  (*c*) This assists (1) (*a*) in arresting breathing.

(2) This is so feeble in action as to be altogether a negligible factor in the toxæmia.

(3) (*a*) This affects the blood so little that hæmorrhages are not likely to be seen.

Symptoms of Enhydrina poisoning.

These have only been studied on lower animals in the laboratory. Rogers says there is no difference between the toxic manifestations of this species and the cobra.

Fraser and Elliot, however, have pointed out that there is much greater respiratory embarrassment with Enhydrina venom than cobra venom, and this is accounted for by the fact that in Enhydrina poisoning the heart and blood vessels are practically unaffected by any direct action of the venom, whereas in cobra toxæmia both are markedly affected. Again the paralysis of the end plates of the phrenic nerves is more pronounced than in cobra poisoning.

In the human subject then one would expect a clinical picture such as I have portrayed in my article on the cobra (Part XX of

these papers, Vol. 22, p. 243). Over and above this, one would expect a greater degree of respiratory embarrassment. Hæmorrhages are not so likely to occur and the local effects according to Lamb are slight. Death, as in other Colubrine toxæmiæ, is due to a paralysis of the respiratory centre.

Treatment.—Fraser and Elliot have shown that Calmette's antivenene has a very feeble action in neutralising the effects of the poison, so that this agent or the Kasauli preparation may be tried. Otherwise treatment should be symptomatic, and on the lines laid down in my book (Pois. Terr. : Snakes. 1913, p. 145).

Lethal dose.—The minimal lethal dose for rats was found to be ·00009 grammes of dried venom per kilogramme weight of the rodent. In rabbits the dose was ·00006 grammes and in cats, the least susceptible of the three animals experimented with, ·0002 grammes.

Distribution.—Around all our coasts from the Persian Gulf to Tenasserim, the Malayan Region and as far East as New Guinea. At Cannanore though I have no figures to support me I judge that I got at least ten specimens for every one of all other species put together. In Madras in 1917, out of a collection of 199 seasnakes, 60 proved to be of this species. Though I have frequently witnessed the drawing in of the huge nets (perhaps a mile long) the fishermen use in Ceylon, I very rarely saw any seasnake captured, and never this species. I can find no record of it from the Andaman Islands though very common on the Coast of Burma.

Lepidosis.—*Rostral.*—Rather deeper than broad, projecting below the level of the lip. *Nasals.*—In contact behind the rostral ; the suture from the nostril passes to the 1st labial. *Præfrontals.*—Usually touch the 2nd labial (in rare instances the præoculars meet the nasals). *Frontal.*—The parietal sutures are equal to the supraoculars or sometimes slightly longer. *Supraoculars.*—Usually as long and as broad as the frontal. *Præocular.*—One. *Postoculars.*—One or two. *Temporals.*—One, large, nearly descending to the lip, often divided into two. *Labials.*—7 to 8 ; the first 4 usually entire, the 3rd and 4th touching the eye. *Infralabials.*—5, the 5th in contact with 3 or 4 scales behind. *Marginals.*—None. *Sublinguals.*—Absent. Two small pairs both widely separated by small scales are regarded by some as such. *Costals.*—Two headslengths behind the head 47 to 61, at greatest girth 50 to 70 : imbricate or subimbricate everywhere ; furnished with keels occupying the median $\frac{1}{3}$ to $\frac{3}{5}$ of each scale, and frequently twice or thrice denticulated. The keels and their denticulations are most pronounced on the belly, especially in males which may be very rough in consequence. In females and young the keels are less obvious, or even obsolescent. This condition resembles very closely that seen in *H. cyanocinctus*, and *coronatus*. *Ventrals.*—230 to 361 ; little broader than the last costal rows ; often divided ; laterally keeled as in the last costal rows.

Dentition,—*Maxilla*.—Two fangs and 3 to 5 small teeth behind *Palatine*—5 to 6. *Pterygoid*—15 to 16. *Mandible*—16.

HYDRUS PLATURUS (Linne).

Linné's Seasnake.

History—Described by Linné in 1766. Figured by Russell in 1796 on the XLI plate of his 1st volume.

Nomenclature.—(*a*) *Scientific*—The generic name is from the Greek "udor" water, the specific from the Greek "platys," flat, and "oura," tail.

(*b*) *English*.—Linné's seasnake.

(*c*) *Vernacular*.—According to Fayrer this snake is called "kullundur" by natives about Puri.

General characters.—It is the most eel-like of all the marine forms. The head is relatively large, and depressed, and the snout unusually long. The body anteriorly is not nearly so constricted as in many seasnakes, and is compressed. The back is sharply ridged. The tail is a vertical paddle as in other seasnakes.

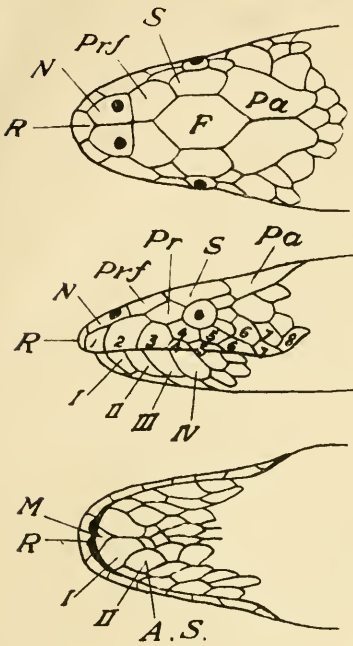
Identification.—The scale rows anteriorly (40 to 54) are unusually numerous for a marine species, and there are no marginals. Only one other species, *viz*., *E. valakadyn*, agrees in these respects, and this is known by the downward projecting rostral, the groove in the chin, and the suture running from the nostril to the 1st labial, all features not seen in *H. platurus*. Osteologically it differs from the other marine species in that the præfrontal bones do not meet the parietal or postfrontals, and in the possession of a subparietal crest or keel. The snake, however, is very distinctively marked and once seen could hardly be mistaken for any other.

Colouration.—There are several colour varieties which may be grouped as follows.

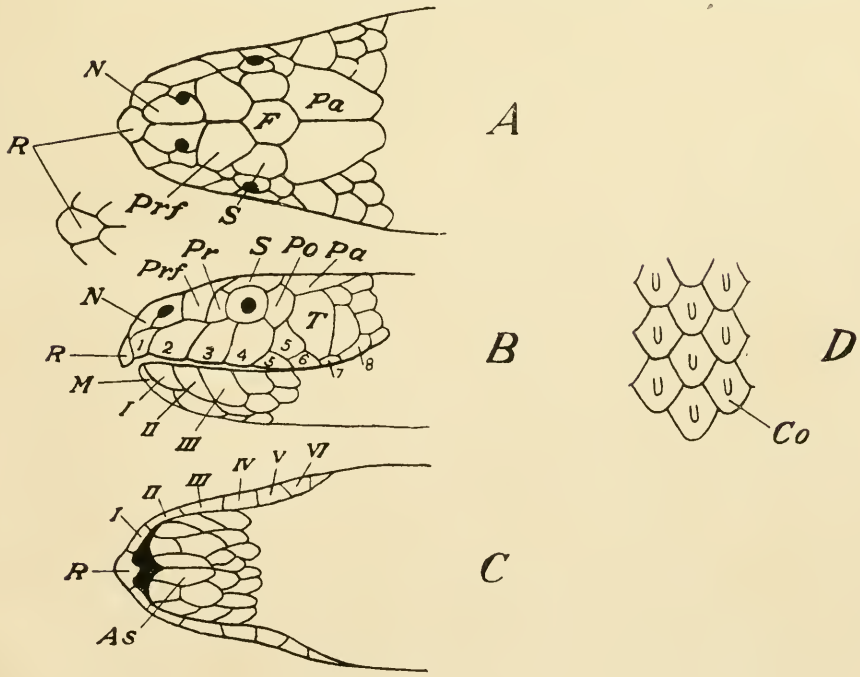
Variety (*A*) (= the *bicolor* of Schneider, and variety E of Boulenger's Catalogue, Vol. III, p. 268). Head chocolate or black above, yellow beneath. Body with a broad stripe dorsally of the same colour as the head. The lower edge of the stripe is straight, and sharply demarcated from the pale yellow of the sides and belly. Tail with black dorsal bars, and lateral spot.

This is by far the commonest variety on our coasts. Some specimens have a series of black costal spots in the yellow, or these may be confluent and form a more or less irregularly-outlined stripe. (Variety C of Boulenger's Catalogue.) Such specimens are not infrequent.

I have seen specimens in the Indian Museum from Ceylon and Puri. A specimen in the Bombay Natural History Society's collection from Madras, and another in the Indian Museum from the Nicobars, have the posterior part of the dorsal stripe festooned



Hydrus platurus (Nat. size)



Enhydrina valakadyn
A.B.C. nat. size D $\times \frac{2}{1}$

COMMON INDIAN SNAKES.

instead of straight, and thus constitute a form transitional between Varieties A and B.

Variety (*B*) (= the *ornata* of Gray, the *maculata* of Jan, and Varieties A and B of Boulenger's Catalogue). In this the dorsal stripe is broken up into cross-bars in the whole body length, or for a variable extent posteriorly and a series of spots costally alternates with the bars. It is a rare form known from Borneo, but dubiously from our coasts.

Variety (*D*) (= Variety D of Boulenger's Catalogue). Like Variety A, but the yellow is replaced by a khaki hue. In some the hues are separated by a yellow line. I saw three such with a yellow line from Ceylon in the Colombo Museum, and there is one from Bombay in the British Museum. One without the yellow line in the Indian Museum is from Travancore, and there is another in the Colombo Museum from Ceylon.

Variety (*E*) (= Variety G of Boulenger's Catalogue). The name *pallidus* would suit this form. It differs only from Variety A in that the sides and belly are whitish or greyish, and the dorsal stripe and caudal marks are much paler than normal, indeed these may be almost obsolescent. Such a specimen from Travancore is in the British Museum. Probably a specimen I saw in the Colombo Museum from Ceylon, another in the Indian Museum from the Persian Gulf, and a third in the Bombay Natural History Society's collection from Bombay, all of which I took at first to be very faded specimens, belong to this variety. The last is so pale, and the vertebral stripe so extremely indistinct; I regarded it dubiously as an albino. Father Dreckman in 1913 wrote to me of a somewhat similar specimen he had recently acquired near Bandora on the Bombay coast. This was a light grey colour with a somewhat darker vertebral stripe. The tail had the usual characteristic black marks.

Breeding.—As far as I am aware no breeding events have been published, and I have never seen a gravid specimen myself. It is probably viviparous in habit like other sea snakes.

Poison.—In "Land and Water" (Nov. 15th, 1879) is an account of one that climbed up the anchor chain of a man-of-war in the Ganges. An unfortunate midshipman who tried to capture it was bitten and died shortly afterwards.

Ectozoa.—Both Dr. Annandale and Dr. Willey, among others, have remarked upon barnacles that attach themselves to this snake. Dr. Annandale mentions *Conchoderma hunteri* as one species, and Dr. Willey published an excellent plate of this snake with a cluster of Barnacles of two species, *viz.*, *C. hunteri* and *Lepas anserifera* clinging to the tail (Spolia Zeylanica, 1906, p. 207,

and 1910, p. 180). These creatures are not parasites, frequently clinging to inanimate objects. When attached to snakes they furnish an example of commensalism.

Length.—This is a small snake, specimens exceeding two feet being unusual. The largest measurement I know is 2 feet, 3½ inches.

Lepidosis.—*Rostral.*—Broader than high. *Nasals.*—In contact behind the rostral. There is usually no suture from the nostrils, but when present it passes to the 2nd labial. *Præfrontals.*—Usually touch the 2nd labial, but sometimes they are cut off by the apposition of the præocular and nasal. *Frontal.*—The parietal sutures are equal to, or little longer than the supraocular. *Supraoculars.*—In length and breadth about three-quarters that of the frontal. *Præocular.*—One, rarely two. *Postoculars.*—Two, or sometimes three. *Temporals.*—Two or three small scales hardly deserving the name of temporals lie between the parietals and the 6th labial. *Labials.*—7 to 9 ; the first 3 usually entire, many of the succeeding frequently divided; the 4th, 5th, and 6th usually touching the eye. *Infralabials.*—5, the 5th largest, and touching 3 or 4 scales behind. *Marginals.* Absent. *Sublinguals.*—Small, but usually descernible as such; the fellows of both pairs separated by several scales. *Costals.*—Two headslengths behind the head 40 to 54, at greatest girth 41 to 55; juxtaposed everywhere. Each scale has a pair of small round tubercles in the middle, one behind the other, which are very characteristic. (A similar feature is only seen in two other seasnakes, *viz.*, *H. gracilis* and *H. cantoris.*) These tubercles are very pronounced in males, especially on the lowest costal rows, and give the snake a rough rasp-like feel. At or about midcosta the tubercles become single, and dorsally may be obsolescent, especially in females and young. *Ventrals.*—284 to 339 ; small, not or hardly broader than the last costal row, but usually recognisable as such, and countable; bituberculate laterally as in the lowest costal rows.

Distribution.—Persian Gulf to Tenasserim and the Andamans. Beyond Indian limits it has a very wide range extending to Japan, Australia, New Zealand, South Africa, and the Western Coast of North America.

Not uncommon on our shores. Ferguson speaking of Ceylon remarks that it is common about Colombo, and at the pearl fisheries.

Dentition.—*Maxilla.*—The upper jaw bears from 8 to 10 teeth behind the fangs. *Palatine* 6 to 7. *Pterygoid.* 23 to 27. *Mandibular* 16 to 18.

Plate.—Our figure shows a good illustration of Variety *bicolor* of Schneider.

(*This series of Popular Articles is now concluded.*)

INDEX TO THE SCIENTIFIC NAMES IN "A POPULAR TREATISE ON THE COMMON INDIAN SNAKES"

by

FRANK WALL

1905-1919

Indexed by Simon M. Campden-Main

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From 1905 to 1919, F. Wall published a series of papers on Indian snakes, in 29 different issues of the Journal of the Bombay Natural History Society. It is uncertain how many complete sets of these papers have been brought together and bound, but the following index can be used either with bound sets or to find references throughout the original issues of the Journal. Each reference in the index gives the volume first, followed by the pages on which the scientific name is used. The plates were numbered consecutively throughout the series, so they are referred to only by number. The list below is a summary of the entire set of papers, with the dates given taken directly from the title page of the Journal. The dates should not be taken as definitive for nomenclatorial purposes.

Vol.	No.	Pages	Plates	Date	Vol.	No.	Pages	Plates	Date
16	4	533-551	1	2/11/05	21	1	1-19	16	31/10/11
17	1	1-9	2	23/4/06		2	447-475	17	31/3/12
	2	259-273	3	20/9/06		3	1009-1021	18	30/7/12
	4	857-870	4	29/6/07	22	1	22-28	19	21/4/13
18	1	1-17	5	12/11/07		2	243-259	21	30/9/13
	2	227-243	6	13/4/08		3	550-568		20/12/13
	3	525-554	7	15/7/08		4	749-760	20	31/3/14
	4	711-735	8	15/11/08	23	1	34-43	22	30/6/14
19	1	87-106	9	15/4/09		2	206-215	23	20/11/14
	2	287-298	10	15/8/09	25	3	375-382	24	15/1/18
	3	555-563	11	15/11/09		4	628-635	25	10/6/18
	4	775-792	12	28/2/10	26	1	89-97	26	20/12/18
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	3	603-633	13,14	31/1/11		3	803-810	28	20/10/19
	4	933-953	15	20/5/11