TWO NEW NEMATODES FROM THE NICOBAR PIGEON AND THE COMMON SANDPIPER.

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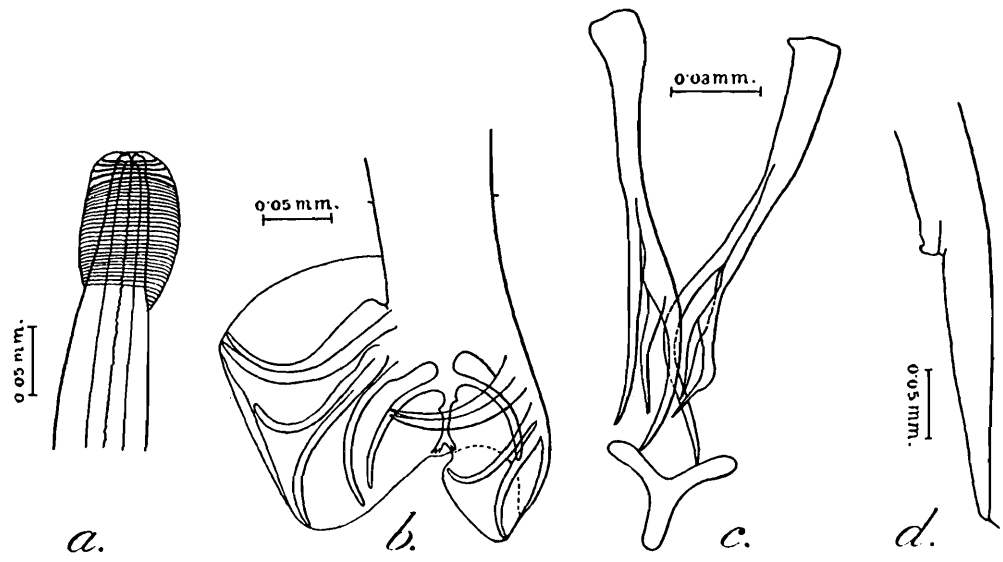
Ornithostrongylus nicobarica, sp. nov.

A number of examples of the species described below were found in the intestine of a Nicobar pigeon (*Caloenas nicobarica nicobarica* Linn.) which died in the Calcutta Zoological Gardens.

The small head is surrounded by a relatively prominent cephalic inflation which is slightly asymmetrical. It shows distinct transverse striations four of which behind the first at the anterior end are much coarser than the remainder (text-fig. 1*a*).

The male bursal rays are typical except for two small lateral branches arising asymmetrically from the lateral borders of the dorsal ray ; there



TEXT-FIG. 1.—*Ornithostrongylus nicobarica*, sp. nov.

a. Anterior region showing the cephalic inflation and the transverse striations. *b*. Posterior region showing bursa. *c*. Spicules showing tripplepointed ends and Y-shaped gubernaculum. *d*. Tail end of the female.

are pre-bursal papillae. It was not possible to get both sides of the bursa expanded at the same time, but it appears to be bilaterally symmetrical and the unequal appearance in text-figure 1*b* is caused by the foreshortening of the side which is rolled under. The spicules are equal and end in the usual three points, and there is a Y-shaped gubernaculum (text-fig. 1*c*).

In the female there is a typical ovejector with divergent equal limbs. The tail ends in a long tapering point surmounted by a cuticular spine, and the anterior lip of the anus is prominent (text-fig. 1*d*).

Table of measurements in (millimetres).

	Male	Female
Length	6·5—7·75	9·9—10·8
Maximum diameter	...	0·118
Excretory pore from anterior end ..	0·32	0·34
Head, diameter	0·028	0·028
Cephalic inflation, diameter	0·05—0·07	0·06—0·07
Nerve ring from anterior end ..	...	0·28
Oesophagus, length ..	0·33	0·39—0·45
Spicules, length ..	0·164—0·168	...
Gubernaculum, length	0·038	...
Distance from vulva to anus	...	2·0—2·36
Ovejectors, length ..	...	0·23
Anus to tip of tail ..	...	0·20—0·21

A comparison of this table with that given by Maplestone (1932) for *O. travassosi* shows that the present species is slightly larger. This alone is not sufficient for the creation of a new species, but it exhibits certain anatomical characters which justify this step.

In the new species the cephalic inflation is much larger and its posterior end is sharply defined, whereas in *O. travassosi* it gradually becomes narrower until it is continuous with the cuticle.

In the male the dorsal ray is relatively longer and bears two lateral asymmetrically placed branches in the new species, and the gubernaculum has three approximately equal limbs whereas in *O. travassosi* the posterior limb is about twice as long as the other two.

In the female of the new species the ovejector is much shorter although the worms are larger. The tail is relatively much longer in the new species and the anus has a prominent anterior lip, which is not present in *O. travassosi.*

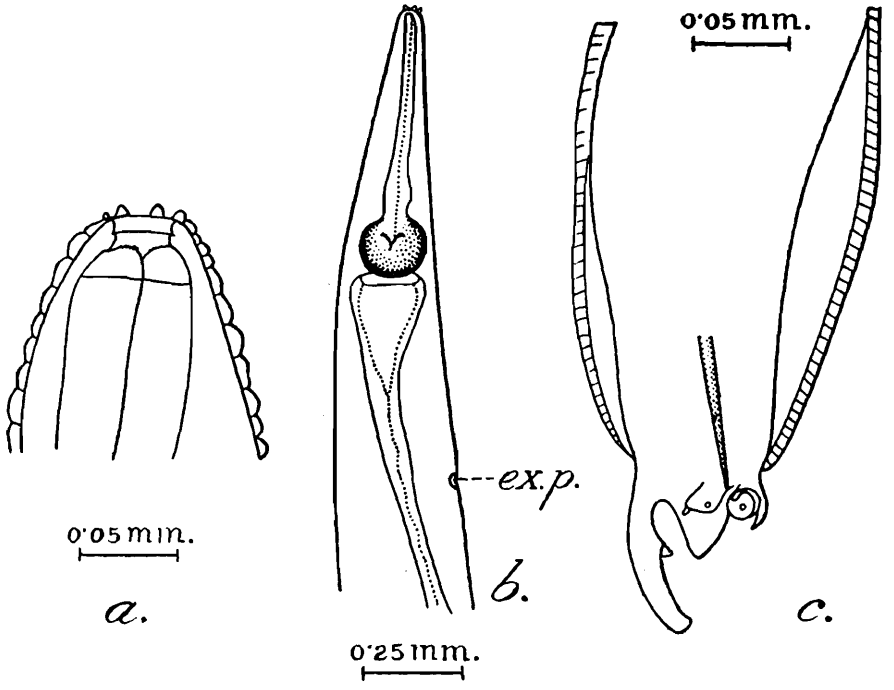
This worm also shows differences from all the other species of the genus listed by Travassos (1937), so it is proposed to name it *Ornithostrongylus nicobarica*, sp. nov.

Host.—The Nicobar Pigeon *Caloenas nicobarica nicobarica* Linn.

Thelandros avis, sp. nov.

This worm is said to have been found in the intestine of a sandpiper (*Tringa hypoleucos* Linn.) which died in the Calcutta Zoological Garden.

The skin shows coarse transverse striations and there are no lateral alae. The mouth opening is circular and is surrounded by six prominent papillae, only three of which are visible at one time under the microscope. The mouth leads into a lightly-chitinised short vestibule (text-fig. 2*a*). The oesophagus is typical and ends in a large spherical



TEXT-FIG. 2.—*Thelandros avis*, sp. nov.

a. Anterior region showing the mouth and vestibule. *b*. Anterior region showing the oesophagus and excretory pore. *c*. Posterior region of male.

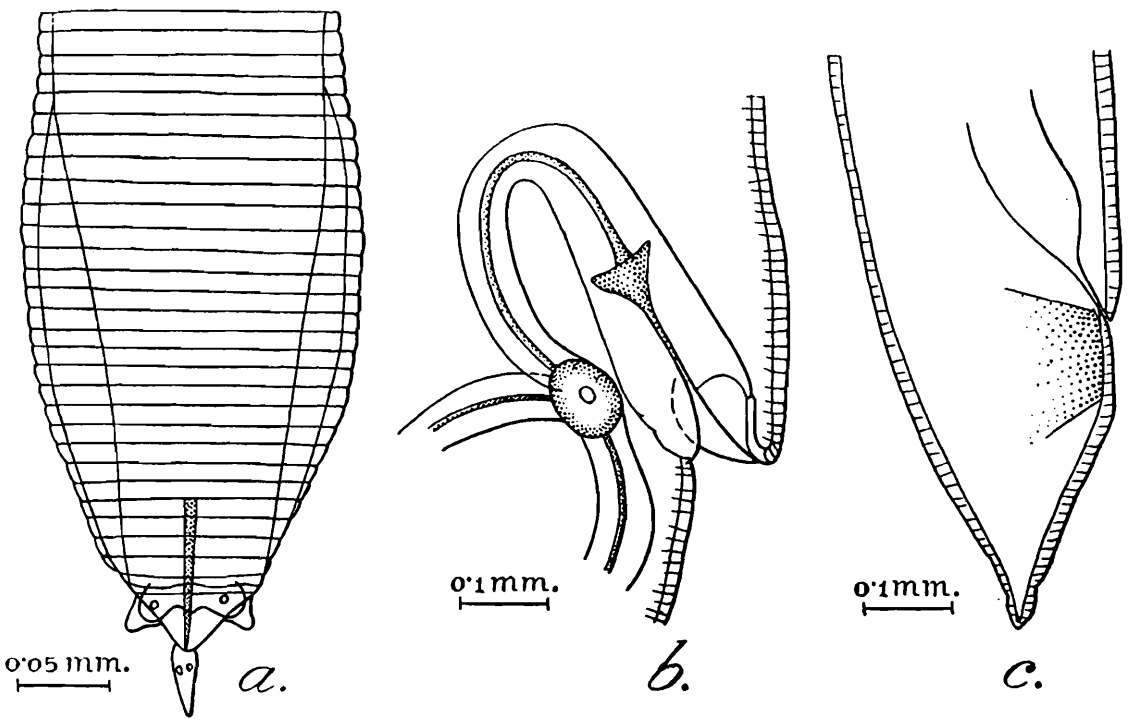
ex. p., excretory pore.

bulb which is preceded by an hour-glass constriction. The anterior end of the intestine is expanded at its junction with the oesophagus. The excretory pore is large and is situated some distance behind the oesophagus (text-fig. 2*b*).

The cuticle is swollen towards the posterior end of the male, and this, when viewed from the ventral aspect, gives a false impression of narrow caudal alae. There are two pairs of large papillae on each side of the cloaca, one just dorsal and the other just ventral to it, while there is a third pair of small papillae on the ventral surface of the caudal prolongation. The process ventral to the cloaca is in the form of a single point and is not fringed as in many members of the genus. There is a single, straight pointed spicule typical of the genus and there is no gubernaculum (text-figs. 2*c*, 3*a*).

In the female the vulva opens behind the middle of the body. It has a prominent anterior lip which gives the opening a somewhat funnel-shaped character, and it leads into a muscular ovejector. This organ runs slightly forwards at first and then curves posteriorly as the vagina, which soon divides into the two uterine stems (text-fig. 3*d*). The posterior end narrows abruptly a little behind the anus forming a short and

blunt tail (text-fig. 3*c*). The eggs are oval, asymmetrical and have an operculum at one end and are very similar to those figured by Sand-



TEXT-FIG. 3.—*Thelandros avis*, sp. nov.

a. Posterior region of male. *b*. Genital portion of female. *c*. Posterior end showing the anus and tail.

ground (1936) for *T seurati*; they are, however, much larger than in the latter species.

Table of measurements (in millimetres).

	Male	Female
Length	3·65—4·16	5·88—6·4
Diameter	0·35—0·38	0·59—0·63
Oesophagus, length	0·71—0·79	0·98—1·1
,, diameter of bulb ..	0·16—0·18	0·22—0·23
Excretory pore from anterior end	1·16—1·4	1·45—1·77
Spicule, length	0·084—0·096	...
Tail, length	0·072—0·08	0·35—0·36
Vulva from posterior end ..	...	2·39—2·48
Eggs	...	0·116—0·128 × 0·068—0·072

Although this worm is quite typical in its anatomical characters it shows sufficiently marked differences from other species of the genus *Thelandros* to warrant its being separated as a new species, for which

the name *Thelandros avis*, sp. nov. is proposed thus indicating the unusual host in which it was found ; all previous species having been recorded from reptiles.

Host.—The common sand piper *Tringa hypoleucos* Linn.

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VARIATIONS IN *TAENIA GAIGERI* (HALL, 1919.[1])

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(From the Helminthological Inquiry, under the Indian Research Fund Association, School of Tropical Medicine, Calcutta.)

This is an uncommon tapeworm, for with the exception of the material sent to Hall by Gaiger, on which the original description was based, the only records of the adult worms up to the present time (when we have found this species in 4 out of 200 dogs examined by us) are those in which worms have once or twice been recovered from dogs artificially infected by feeding them on the larval stage.

As there were a good many worms in the infected dogs it was possible to note that many variations from the standard description are liable to occur. The variations were so wide and frequent in our collection of specimens that individual worms might very well have been described as different species, but the almost imperceptible gradation between the extremes of variation showed that we were dealing, not with many, but with a single species. Consequently we give below a re-description of *T gaigeri* placing special emphasis on the variations.

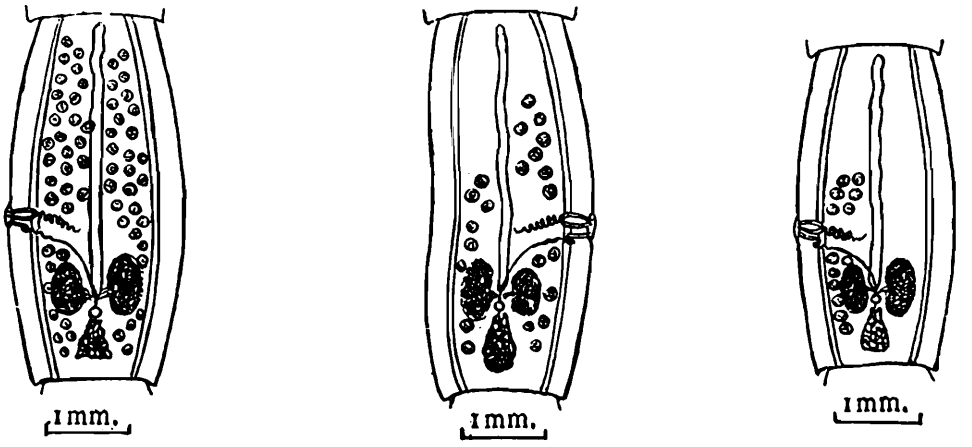
Head.—The head is square in end-on view and pyriform when viewed laterally, with its diameter varying between 0·69 and 1·27 mm. The poorly-developed rostellum bears a double crown of 26-34 hooks (Hall, 28-32). The hooks are 144 to 168μ in length (Hall, 160-180μ), and are so arranged that the tips of the handles of the larger hooks are nearer the centre. The blade is slightly curved, the handle shows undulations on both its sub-parallel borders, and its end is slightly upturned. The guard on lateral view, is bulb-shaped anteriorly with no visible notch in the middle. The short hooks measure 84 to 124μ (Hall, 115-150μ), the blade is slightly more curved and the handle relatively longer and more tapering than in the long hooks. The guard of the short hooks has a distinct notch in the middle, so that if a long and a short hook are examined with the blades looking directly upwards the guard of the short hook is much wider than that of the long hook.

Neck.—The neck is clearly defined, 0·45 to 0·75 mm. in diameter (Hall, 0·650 mm.), and 1·5 to 2·77 mm. in length.

Mature segments.—Mature segments are usually longer than broad but the ratio between length and breadth varies so much that we have decided to divide them into two main types, between which there are innumerable gradations of shape and size. In one type the segment is much longer than broad and is shaped like a " melon seed," with the

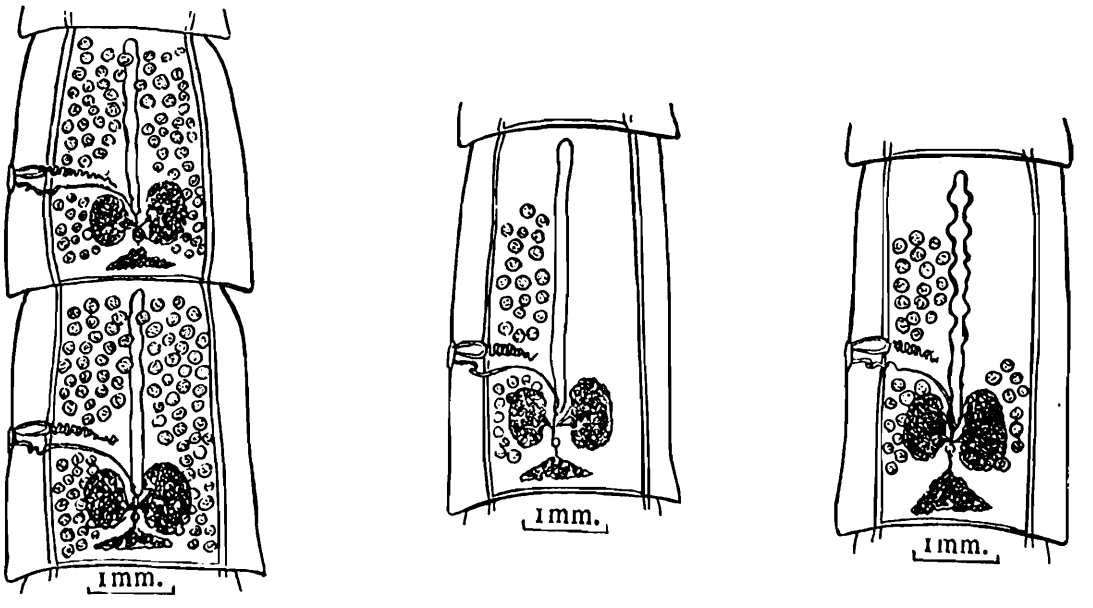
[1] We have followed Southwell (1930) in placing this worm in the genus *Taenia* instead of *Multiceps* in which Hall placed it. Our reason is that the generic character of *Multiceps* depends on the fact that the larval form is a *Coenurus*, but the adults have all the characters of a *Taenia*, and as the larval form can only be known in artificially induced infections this basis for a genus seems unsound.

widest part in the middle and the curved sides tapering towards both ends (text-fig. 1). In the other type the sides are straight, diverging



Text-Fig. 1.—"Melon seed" type of mature segment of *Taenia gaigeri* (Hall) showing variation in testicular development.

towards the posterior end and the segments are very little longer than broad, and the posterior angles project laterally so that the segments have the appearance of a "truncated cone" (text-fig.-2). This difference seems



Text-Fig. 2.—"Truncate cone" type of mature segments of *Taenia gaigeri* (Hall) showing similar testicular variation.

to lie in the fact that some segments retain the shape of the immature worm whereas others assume more rapidly the shape of the gravid segments which are always of the "melon seed" type.

The genital pores are slightly prominent, are situated about the middle or a little behind the middle of one side, and are irregularly alternating.

Male genitalia.—The testes are spherical and occupy the lateral fields, for the most part. They do not quite reach the anterior end of the uterus, and extend on either side to the excretory canals. On the pore side they do not encroach on the area occupied by the vas deferens and vagina, and in the centre, in front of the ovaries, there is an area without testes. The testes lie close to the ovaries on their outer borders and pass round behind them to the edge of the vitellarium. The develop-

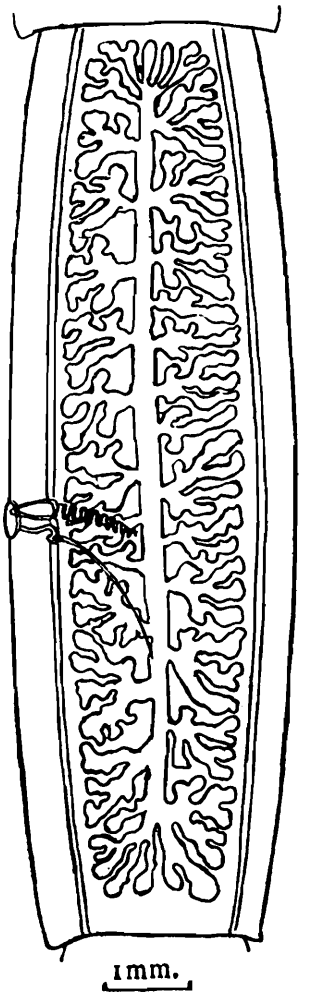
ment and distribution of the testes often present a considerable degree of variation. For example, there may be no more than one or two acini in some segments although the ovaries and other sexual organs appear quite normal, and from this very deficient form all grades occur up to those with normally abundant testes. When this deficiency occurs it is generally more marked on the a-poral than on the pore side, and frequently there are no testes on the side away from the pore. This testicular deficiency may occur in groups of segments either behind or in front of perfectly normal segments, therefore, it is clearly not a manifestation of the regular atrophy of the sex glands which takes place in all cestodes as maturity gives way to development of the uterus and the deposition of eggs. The vas deferens is a closely coiled tube running roughly parallel to the vagina some little distance anterior to it, and it opens into the cirrus pouch, which extends from opposite the excretory canals to the genital atrium on the lateral border of the segment (text-figs. 1 & 2).

Female genitalia.—The ovaries are reniform and are elongate in an antero-posterior direction. They are usually unequal, the one on the pore side being the smaller. The vitelline gland lies between and behind the ovaries. It is triangular in shape and in the short broad type of segment it has a broad base with the subtending angle opposite its centre only a short distance anterior to it; in the elongate " melon seed " type of segment it is still triangular but with the subtending angle much further away from the base so that the organ as a whole is longer than broad. Hall (1919) recorded an occasional abnormal type of gland in which he claimed that the vitellarium ran right forwards between the ovaries as a long narrow structure reaching nearly to the anterior border of the segment, overlying exactly the developing uterus. We searched our ample material for this abnormality and occasionally found a segment in which this condition appeared to be present, but closer examination always revealed that it was divided off from the vitelline gland in the inter-ovarian space by the shell-gland, ovarian ducts, etc., and that it was simply the uterus that had unaccountably taken the carmine stain so that its structure appeared granular like that of the vitelline gland. The shell-gland lies between the posterior poles of the ovaries, and the uterus begins just in front of it. The vagina runs from the ventral side of the commencement of the uterus and curving forward and outward it always runs round the anterior border of the ovary on that side and pursues a slightly undulating or a direct course as far as the excretory canals, where it is usually reflexed before proceeding to open into the genital atrium. The uterus runs straight forward from immediately in front of the shell-gland to near the anterior border of the segment (text-figs. 1 & 2).

Both male and female genital ducts pass between the lateral excretory canals, and when sections were examined it was found that the dorsal canal on one side was larger than the ventral one while on the other side of the segment the ventral canal was the larger. Further examination of this peculiar character demonstrated that the larger canal was always dorsal on the pore side, and as the pores are irregularly alternating, these canals, if traced through several consecutive segments,

would show alternate dilatations and constrictions, corresponding with the opening of the genital pore. The testes lie wholly within the inner circular muscle layer and in the middle of the segment in the dorso-ventral plane.

Gravid segments.—These are always elongate and have slightly convex lateral borders irrespective of whether the mature segments in the same strobila are of the " truncated cone " or " melon seed " type. They vary from 7·1 to 14·9 mm. in length and 2·5 to 4 mm. in breadth.



Text-Fig. 3.—A typical gravid segment of *Taenia gaigeri* (Hall).

The uterus has ten to fourteen primary branches on each side, which immediately break up into secondary branches, and thus form a confused pattern in a gravid segment in which it is difficult to enumerate the primary branches (text-fig. 3).

Discussion.

The size and shape of the hooks, the shape and character of the mature segments, the position and shape of the genital pores and the average distribution of the testes are the characters relied upon by Hall for the determination of this species, and although on the whole they are reliable we have shown that they are subject to a considerable degree of variation.

For example :—(*a*) The hooks in all our worms are smaller than what Hall describes, but they are typical in shape. This smallness is not to be explained by under-development in our specimens.

(*b*) The mature segments may have the shape of a " truncated cone " or of a " melon seed " with innumerable intermediate forms.

(*c*) The testes are subject to a great variation in number and distribution.

The variation in the shape of the segments is apparently a true morphological character and is not due to differences in contraction during the process of fixation, because all the worms were fully relaxed first and then fixed by the same technique in every instance. Testicular under-development is not to be explained by deficiency in nutrition, in the large number of worms present all the other organs appear perfectly developed, and the testicular under-development appears haphazard, irregularly alternating with fully developed segments in the same chain of proglottids.

The differences we have recorded in this paper are greater than have been used in many instances for differentiating species of cestodes, and it was only the large amount of material at our disposal that enabled us to assess them at their true worth. We are accordingly publishing these notes to prevent the creation of a number of species out of this single one, a possibility in the event of only one or two specimens being available for study by subsequent workers. This possibility is all the greater in the case of *T gaigeri*, which on account of its rarity, has not been extensively studied. It is probable that much of the confusion that exists at the present day among the Taeniae of dogs has been brought about in the manner shown above and we hope that this paper will prevent such an occurrence in the case of this species.

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Southwell, T., 1930.—Cestodes. *Fauna of British India.* II.

ON THE SUBSPECIES OF THE RING-DOVE, *STREPTOPELIA DECAOCTO* (FRIVALDSZKY)[1].

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CONTENTS.

I. INTRODUCTION.

The Ring-Dove, *Streptopelia decaocto* (Frivaldszky), has an extensive distribution from Hungary *via* south-eastern Europe, Iran, India and Turkestan to China and Japan in the east. Three valid subspecies, namely, *decaocto*, *stoliczkae* and *xanthocyclus*, are now recognised (Peters[2]). Of these, two, namely *decaocto* and *xanthocyclus*, occur within Indian limits. Unfortunately, although the Eastern Turkestan subspecies, *S. d. stoliczkae*, has long been recognised by many ornithologists as distinct from the Indian subspecies, *S. d. decaocto*, Stuart Baker[3] does not separate the two subspecies. The Eastern Turkestan subspecies, the type-specimen of which is in the Indian Museum, Calcutta, is both larger and paler than the Indian subspecies.

In the following account I have given the distinguishing characters of the three subspecies, with special emphasis on *stoliczkae* and *xanthocyclus* about which not much is hitherto known. The descriptions, measurements, etc., are based on a careful examination of the specimens present in the Indian Museum collection, and on the published data.

Our knowledge of the range of distribution of the Ring-Dove, specially of the Eastern Turkestan and the Burmese races, is in a very confused state. I have attempted to clear up the confusion as far as possible from available literature, but for a proper solution of the problem larger collections are necessary from Central Asia (for *stoliczkae*) on the one hand, and from Yunnan and southern China (for *xanthocyclus*) on the other.

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[1] C. B. Ticehurst (*Bull. Br. Ornith. Club* L, pp. 7-10, 1929) suggested that this dove might perhaps retain the older name *S. risoria* (Linnaeus). The suggestion has not found general acceptance.

[2] Peters, J. L., *Check-list Birds World* III, p. 92 (1937).

[3] Stuart Baker, E. C., *Fauna Br. India, Birds* (2nd ed.) V, p. 248 (1928); and *Nidification Birds Ind. Emp.* IV, p. 168 (1935).

The following abbreviations are used throughout :—

Reg. No.—Registered Number of the specimen in the collection of the Zoological Survey of India (Indian Museum), Calcutta.

Juv., Juvenile ; L., Total length of body ; W., Length of wing ; Tl., Length of tail ; Tr., Length of tarsus ; C., Length of culmen ; X., Length, along rhachis, of the white tip of the outermost tail feather.

Measurements given within round brackets in the Tables are approximate.

II. Key to the Subspecies of *Streptopelia decaocto*, and their Descriptions.

A. Bare orbital skin around eye white to pale slaty-gray (never yellow) in fresh specimens.

a. Darker and smaller. Under tail-coverts dark gray. ' White ' tip to outermost tail-feather usually with slight gray tinge (rarely pure white), and measures along rhachis 33-48 mm., once 53 mm. Wings 160-176 mm., average 168 mm. .. *S. d. decaocto*, p. 440.

b. Paler and larger. Under tail-coverts pale gray. ' White ' tip to outermost tail-feather usually pure white (rarely tinged with very pale gray), and measures along rhachis 50-65 mm., rarely as low as 43 and 45 mm. Wings 175-190 mm., average 182 mm., rarely 169 mm. *S. d. stoliczkae*, p. 444.

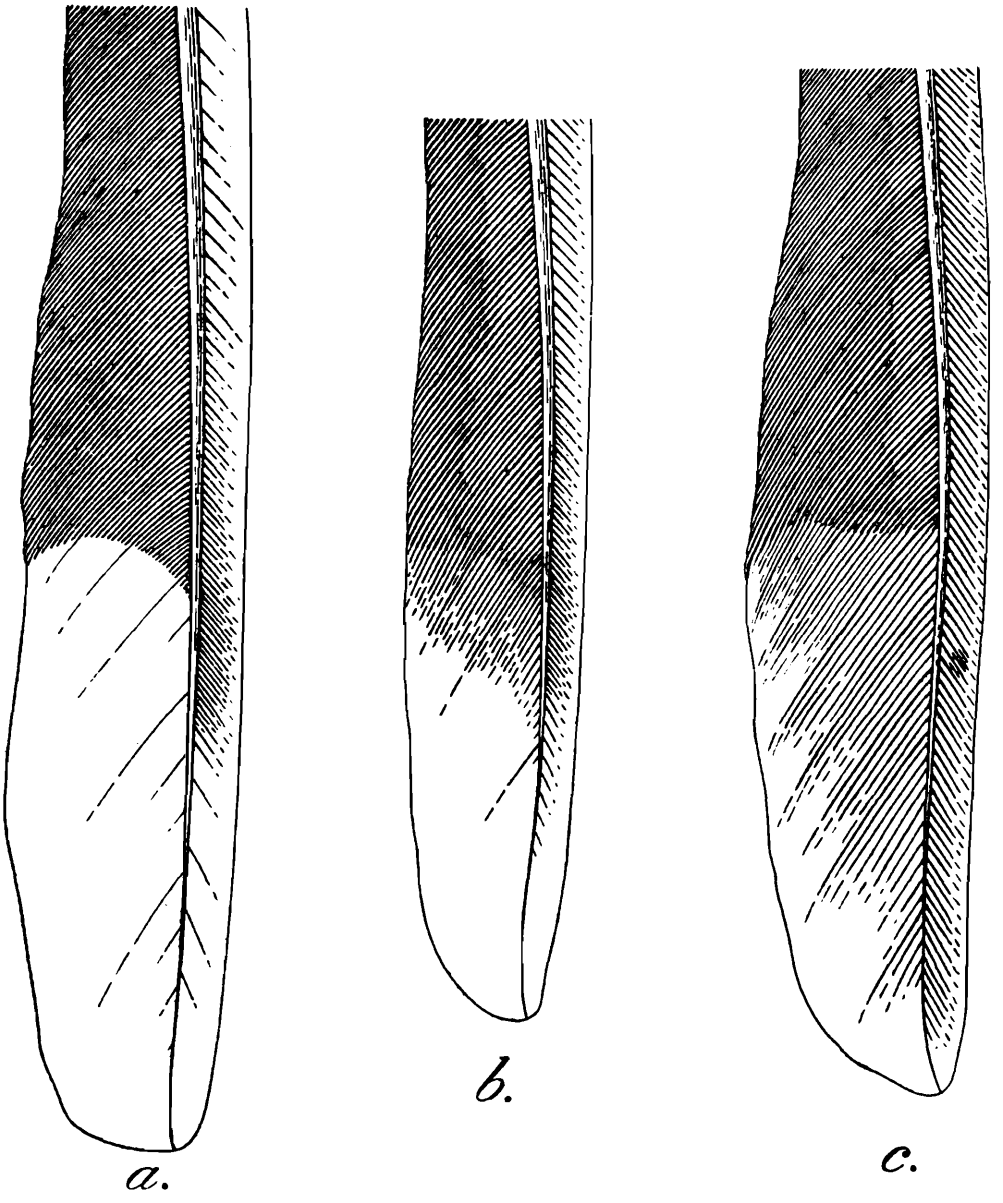
B. Bare orbital skin around eye bright yellow in fresh specimens. Under tail-coverts very dark gray. Size large. General plumage much darker and more vivid than in *S. d. decaocto*. ' White ' tip to outermost tail feather with distinct gray tinge, and measures along rhachis about 60 mm. Wings 181-182·5 mm., once 165 mm. *S. d. xanthocyclus*, p. 449.

As given in the key, the extent and colour of the ' white ' tip of the outermost tail feather is an important distinguishing character between the various races. The same structure provides yet another distinguishing character. If the dorsal aspect of the outermost tail feather is viewed from the *distal* end, the sharp line which divides the ' white ' tip of the inner web from the dark gray proximal portion of the feather, presents a characteristic curve in each race as follows, provided a series of skins is examined :—

S. d. stoliczkae.—The *median* (towards the rhachis) end of the line tends to extend further distally than does the outer or marginal end (text-figs. 1*a* and 2*a*).

S. d. decaocto.—The curve of the line tends, in a series, to be intermediate between *stoliczkae* and *xanthocyclus* (text-figs. 1*b* and 2*b*).

S. d. xanthocyclus.—The *outer* or marginal end of the line tends to extend further distally than does the median (towards the rhachis) end (text-figs. 1*c* and 2*c*). (Only one specimen examined.)

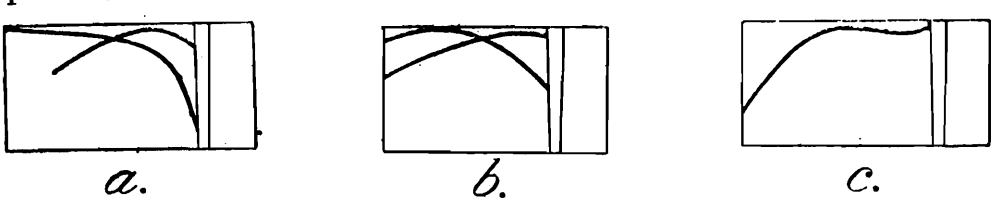


Text-fig. 1.—Dorsal views of the distal portion of the outermost right tail feathers showing the ' white ' tip: nat. size.

a. Streptopelia decaocto stoliczkae (Hume). I. M. skin No. 26534 (Holotype), adult ♂ from Kashgar (Eastern Turkestan), Feb. 5, 1874.

b. Streptopelia decaocto decaocto (Frivaldszky). I. M. skin No. 25733, adult ♀ from Rajadara (Ranchi District, Bihar, India), Oct. 18, 1927.

c. Streptopelia decaocto xanthocyclus (Newman). I. M. skin No. 9064, sex unknown, from the upper defile of the Irrawady, about 40 miles below Bhamo (Northern Burma), Sept. 1868.



Text-fig. 2.—Extremes of curves of the sharp line which divides the white ' tip of the inner web of the outermost tail feather from its dark-gray proximal portion. Drawn from the dorsal aspect as viewed from the distal end: *ca.* nat. size.

a. Streptopelia decaocto stoliczkae (Hume). (From five Eastern Turkestan specimens.)

b. Streptopelia decaocto decaocto (Frivaldszky). (From ten Indian specimens.)

c. Streptopelia decaocto xanthocyclus (Newman). (From one Burmese specimen only.)

1. **Streptopelia decaocto decaocto** (Frivaldszky).

THE TURKISH RING-DOVE[1].

1758. ? *Columba risoria*, Linnaeus, *Syst. Nat.* (10th ed.) I, p. 165. (India.) Considered by some as applying to domesticated forms only and, therefore, not applicable to the wild bird.

*1838. *Columba risoria* Linn., variety *decaocto*, Frivaldszky, *K. magyar tudos Társaság Evkönyvi* III, Pt. 3, p. 183. (Turkey.)

1844. *Turtur douraca*, Hodgson, in Gray's *Zool. Misc.*, p. 85. (Nepal.) *Nomen nudum.*

1849. *Turtur risorius* (part ?), Blyth, *Catal Birds Mus. Asiat. Soc. Bengal*, p. 235. (Part habitat North Africa is a mistake.)

*1855. ? *Peristera intercedens*, Brehm, *Vögelfang*, p. 258. (North Africa, by mistake. Hartert in *Vögel paläarkt. Fauna* II, p. 1496, 1920, points out that Brehm's type had gray-blue under tail-coverts and probably came from tropical India.)

1864. *Turtur risoria*, Jerdon, *Birds of India* III, p. 481.

1873-1888. *Turtur risoria*, several records in *Stray Feathers* I-XI.

1876. *Turtur risorius*, Blanford, *East Persia* II, p. 270.

1880. *Turtur riosrius* (part), Legge, *Hist. Birds Ceylon* II, p. 702.

1893. *Turtur* (*Streptopelia*) *douraca* (part), Salvadori, *Catal. Birds Br. Mus.* XXI, p. 430.

1898. *Turtur risorius* (part), Blanford, *Fauna Br. India. Birds* (1st ed.) IV, p. 46.

1913. *Streptopelia risoria risoria* (part), Stuart Baker, *Indian Pigeons & Doves*, p. 219.

1920. *Streptopelia decaocto decaocto* (part), Hartert, *Vögel paläarkt. Fauna* II, p. 1495.

*1928(1927). *Streptopelia decaocto zarudnyi*, Serebrowskij, *Compt. Rend. Acad. Sci. URSS.*, Leningard, p. 326. (Husseinabad, Seistan, East Iran.) See Hartert & Steinbacher, *Vögel paläarkt. Fauna*, Ergänzungsbd., p. 460, 1936.

1928. *Streptopelia decaocto decaocto* (part), Stuart Baker, *Fauna Br. India, Birds* (2nd ed.) V, p. 248. *Vide* also Vol. VII, pp. 440, 441 (1930), Synonymies.

*1928. *Streptopelia decaocto decaocto*, Boetticher, *Anz. ornith. Gesell. Bayern* XII, p. 132. Discussion on races.

1931. *Streptopelia decaocto decaocto*, Wait, *Man. Birds Ceylon* (2nd ed.), p. 297.

*1934. *Streptopelia decaocto koreensis*, Buturlin, *Polnyi opredelitel pitts S S S R.* I, p. 226. New name for *S. d. torquata* Bogdanov (part).

*1935. *Streptopelia risoria alba*, H. H. Bailey, *Bailey Mus. & Libr. Nat. Hist. Bull.* No. 9, p. 2. (Vicinity of Miami, Florida, N. America.) Aviary variety, *vide* Peters *infra.*

1935. *Streptopelia decaocto decaocto* (part), Stuart Baker, *Nidification Birds Ind. Emp.* IV, p. 168.

1936. ? *Streptopelia decaocto decaocto*, Shaw, *Biol. Sinica* (B) XV, Fasc. 1, vol. 2, p. 487. (Hopei Province, north-eastern China.)

1937. *Streptopelia decaocto decaocto*, Peters, *Check-list Birds World* III, p. 92.

1938. ? *Streptopelia decaocto decaocto*, Wilder & Hubbard, *Birds N. E. China*, p. 508. Gives *S. d. stoliczkae* as its synonymy !

1938. ? *Streptopelia decaocto* (subspecies ?), Meinertzhagen, *Ibis* II (14th Ser.), p. 709. (Kabul; Upper Kabul River near Undi Pass, about 7,000 feet; and Jelalabad—all in Afghanistan.) Not mentioned whether the birds were typical *decaocto* or of race *stoliczkae.*

While the typical race, *S. d. decaocto*, with its type locality in Turkey, extends from central Europe to the whole of India (as far east as Assam) and Ceylon, in the following account the Indian birds alone have largely been taken into consideration. I have not been able to examine many extra-Indian specimens. Other authors do not mention any difference between Indian and extra-Indian specimens of this subspecies.

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[1] This name is preferable to " The Indian Ring-Dove " used by Stuart Baker (*Fauna Br. India, Birds*, 2nd ed. V, p. 248, 1928), because the type-locality is Turkey, and not a place in India.

* Not seen in original.

Table 1.

Specimens of S. d. decaocto *in the Indian Museum, Calcutta.*

Reg. No.	Sex.	Locality.	Date.	Collector or Donor.	Measurements (mm.).				
					W.	Tl.	Tr.	C.	X.
24858	♂	Khwaja Ahmad (Seistan, E. Iran) ..	May 7, 1905	J. W. N. Cumming	(164?)	140	23	16	...
9980	♀ (Juv. ?)	Pishin (Baluchistan)	Feb. 10, 1872	W. T. Blanford	[161	128	23	15	36]
17822	♂	Mt. Abu (Rajputana)	May 22, 1868	S. King	167	(135)	23	..	48
25733	♀	Rajadara (Ranchi Dist., Bihar)	Oct. 18, 1927	Dr. S. C. Law	173	143	23	16	43
25739	♀	Chandwa (Ranchi-Palamau border, Bihar) ..	Oct. 22, 1927	Dr. S. C. Law	168	139	23	16	42
4058	(?)	Manbhum (E. Bihar)	(?)	"Mus. Coll."	167	133	24	15	40
4060	(?)	Manbhum (E. Bihar)	(?)	"Mus. Coll."	176	148	25	17	45
4061	(?)	Singhbhum (E. Bihar)	(?)	V. Ball	175	140	27	15	40
4333	(?)	Nepal	(?)	(?)	172	140	..	16	45
4059	♂	Nagpur (Central Prov.)	(?)	W. T. Balnford	171	150	24	17	53
4062	(?)	S. E. Berar	(?)	W. T Balnford	161	131	22	15	33
11902	♂	Phonda (Devgarh Tāluk, Ratnagiri Dist., Bombay Pres.).	Mar. 23, 1878	J. Armstrong	161	136	25	(13)	44
18442	♀	Near Bangalore (Mysore State)	(?)	"Mus. Coll. Jaffa"	160	132	22	15·5	38
26533[1]	(Juv.?) (Albino)	Calcutta	(1842-45)	Asiat. Soc. Bengal	[155	(?)	23	18	...]

[1] This is No. 1430 H of Blyth's *Catal. Birds Mus. Asiat. Soc. Bengal*, pp. 235, 236, 1849, where it is described as: "Young (White race)" under *Turtur risorius*. The plumage is entirely white, and the small size suggests that the specimen is probably a juvenile. I have accepted this identification on Blyth's authority.

Vernacular Names.—See Stuart Baker[1]. Not *Pākhtak* (Turki) which applies to *S. d. stoliczkae.*

Description.—Based on Indian material. Sexes alike; according to some authors, female perhaps slightly smaller than male.

The entire head and neck lilac-gray, sometimes with a faint tinge of brown, the forehead and the sides of the neck paler than the rest; the throat pale vinaceous and the chin albescent; on the neck a narrow white collar formed by white tips of lilac-gray feathers, followed by a black crescentic collar, 5-9 mm. wide, composed of black feathers tipped white, the white tips forming a narrow posterior collar; middle and inner wing-coverts, back, rump and upper tail-coverts pale-earthy to fawn-brown, sometimes (in specimens from Manbhum, eastern Bihar, in the Indian Museum collection) suffused with gray; secondaries brownish-gray, the gray specially marked around the rhachis; primaries dark brown, sometimes tending to black, edged narrowly with pale white especially on the outer edge; the inner primaries with a small faintly pale gray area (sometimes hardly distinguishable) towards the tip; outer wing-coverts pale gray, gradually changing into the colour of back; central tail feathers brown, more or less suffused with ashy gray; succeeding tail feathers more gray and with diffuse, narrow, grayish-white margin; outermost tail-feather black at base, and with extensive grayish-white tips, 33-48 mm. (in one case 53 mm.) long along rhachis (text-figs. 1*b* and 2*b*); lower aspect of tail feathers very much paler than upper; breast vinaceous-gray (less gray than brown), changing to pale dove-gray on the abdomen and lower flanks; under tail-coverts dark gray; upper flanks, axillaries and under wing-coverts silvery-gray; under aspect of primaries and secondaries light silvery-brown; bastard wing silvery-gray.

Some birds, *e.g.*, Reg. No. 17322 from Mt. Abu and Reg. No. 4333 from Nepal, are almost as pale as the race *stoliczkae.*

According to Hartert [2], Ceylon and South Indian birds are probably smaller and have darker backs.

Colour of Soft Parts.—Iris. Red. *Naked orbital skin.* In fresh specimens, white or pale-gray (not yellow); narrower than in *S. d. xanthocyclus.* (Dull ochreous brown to ochreous yellow in dried skins.) *Bill.* Black. *Legs and toes.* Purple-red. *Claws.* Black.

Measurements and Weight (based on Indian material).—*Total length.* 311-313 mm. (Cripps[3]; and Scully[4]). *Wing.* 160-176 mm., average 168 mm. *Tail.* 128-158 mm. (Stuart Baker [5] gives the minimum as 117 mm.). *Tarsus.* 22-27 mm. *Culmen.* 15(13?)-17 mm. *Whitish tip to outermost tail-feather (along rhachis).* 33-48 mm., once 53 mm. *Weight.* ♂ 6·12 oz., ♀ 6·25 oz. (Cripps, *loc. cit.*).

Distribution.—" Resident from Hungary over south-eastern Europe, Asia Minor, Turkestan, northern China and Japan, south to Palestine, Iraq, Persia, India, Ceylon and Western China. A pale variety found

[1] Stuart Baker, E. C., *Fauna Br. India, Birds* (2nd ed.) V, p. 248 (1928).
[2] Hartert, E., *Vögel paläarkt. Fauna* II, p. 1497 (1920).
[3] Cripps, J. R., *Stray Feathers* VII, p. 297 (1878).
[4] Scully, J., *Stray Feathers* VIII, p. 342 (1879).
[5] Stuart Baker, E. C., *Fauna Br. India, Birds* (2nd ed.) V, p. 248 (1928).

under domesication" (Peters [1]). The Turkestan, northern Chinese and Japanese birds would seem, by their size, to be nearer to the Eastern Turkestan race than to *S. d. decaocto*. (Also see under *stoliczkae*, p. 448.)

The Indian distribution is given by Stuart Baker [2] and others as follows:—Throughout India (excluding Burma), except in the wettest, most heavily forested regions of the eastern Himalayas. Probably entirely absent from the Malabar Coast, only once met with in the extreme east of Kanara. Davison[3] found it not uncommon in southern Mysore. (Not uncommon in the Nilgiris; occurs in the Palnis and in the Pittur Valley in South India, *vide* Whistler & Kinnear [4]). Found near Cape Comorin. (Ali & Whistler [5] also recently obtained it at Cape Comorin and Aramboli, but state that it is decidedly rare.) Common in eastern Bengal and western Assam, but rare in the extreme east and in Cachar and Sylhet. Ali & Whistler[6] record it as common in Central India.

Birds from the Manipur Valley have recently been shown by Higgins [7] to belong to the Burmese *xanthocyclus*; it appears that this subspecies is probably replaced by *xanthocyclus* in the Chittagong area. The exact dividing line between *decaocto* and *xanthocyclus* has yet to be worked out. The bird ascends the Himalayas up to about 9,000 feet.

Birds from Kashmir (Osmaston [8]; and Hellmayr [9]) and the North-West Frontier Province (Peshawar District) (Briggs & Osmaston[10]) are typical *decaocto* (not *stoliczkae*). Osmaston (*loc. cit.*) found a flock at 10,000 feet at Dras in Kashmir, but says that they were apparently on their way elsewhere, and that the usual maximum height is 6,000 feet.

The bird is locally migratory in many areas in India, and Stuart Baker [11] is wrong in asserting to the contrary. Thus, it is a summer visitor in British Baluchistan, but is resident in central and coastal Mekran and in Las Bela State (Ticehurst[12]). In Bombay and Salsette Islands it is a winter visitor (Ali & Abdulali[13]). In the southern portion of the Bombay Presidency, *viz.*, Ratnagiri District, it is a winter visitor "disappearing entirely at the approach of the hot weather and in all probability returning to the Deccan plains to breed" (Vidal[14]). There are several other records of its migratory habit.

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[1] Peters, J. L., *Check-list Birds World* III, p. 92 (1937).
[2] Stuart Baker, E. C., *Indian Pigeons & Doves*, p. 221 (1913).
[3] Davison, W., *Stray Feathers*, X (5), p. 408 (1883).
[4] Whistler, H. & Kinnear, N. B., *Journ. Bombay Nat. Hist. Soc.* XXXVIII, p. 680 (1936).
[5] Ali, S. & Whistler, H., *Journ. Bombay Nat. Hist. Soc.* XXXIX, p. 342 (1937).
[6] Ali, S. & Whistler, H., *Journ. Bombay Nat. Hist. Soc.* XLI, p. 478 (1940).
[7] Higgins, J. C., *Journ. Bombay Nat. Hist. Soc.* XXXVII, p. 303 (1934).
[8] Osmaston, B. B., *Journ. Bombay Nat. Hist. Soc.* XXXVII, p. 144 (1934).
[9] Hellmayr, C. E., *Chicago Field Mus. Nat. Hist.* (*Zool.*) XVII, No. 3, pp. 132, 133 (1929).
[10] Briggs, F. S. & Osmaston, B. B., *Journ. Bombay Nat. Hist. Soc.* XXXII, p. 758 (1928).
[11] Stuart Baker, E. C., *Fauna Br. India, Birds* (2nd ed.) V, p. 249 (1928).
[12] Ticehurst, C. B., *Journ. Bombay Nat. Hist. Soc.* XXXII, p. 73 (1927).
[13] Ali, S. & Abdulali, H., *Journ. Bombay Nat. Hist. Soc.* XL, p. 378 (1938).
[14] Vidal, C. S., *Gazetteer Bombay Pres.* X. *Ratnagiri and Savantvadi*. Birds, pp. 86, 87 (1880).

In Ceylon *S. d. decaocto* is confined to the north-western region of the island.

Breeding.—In India it breeds throughout the year in the plains and lower hills, but in eastern Bengal few birds lay during the heaviest rains in July, August and September. In the hills they lay from April to September. All pairs have at least two broods a year, and many have four to five. Incubation period is about thirteen days in India. Breeds up to 8,000 feet, but usually not above 4,000 to 5,000 feet. (Stuart Baker [1].) Whistler & Kinnear [2] remark that there is no information about its breeding season in the Madras Presidency, although the bird appears to be resident there.

Nest.—As in other doves, the nest is made of twigs but is more cup-shaped and perhaps a little better made. It may be placed low down in any kind of bush or tree, thorny ones being frequently preferred, either in the open country, scrub-jungle, round villages or in gardens, but never in buildings (cf. *S. d. stoliczkae*). The nest is usually from 5 to 15 feet above ground, but rarely it may be on the ground, or 30 to 40 feet above it (Stuart Baker, *loc. cit.*).

Eggs.—Two in a clutch, rarely one or three. Smooth and white. *Size.* Average: 30·1×23·2 mm. Maxima: 32·2×23·9 mm. Minima: 27·8×21·8 mm. These figures, taken from Stuart Baker (*loc. cit.*), presumably also include the eggs of the Eastern Turkestan race, *S. d. stoliczkae*, which Stuart Baker does not separate from *S. d. decaocto*.

Habits.—In India it frequents open country, and is tolerant of great heat and sandy deserts, but less tolerant of heavy forest and excessive rainfall. Common in cultivated country and near human habitations. Goes about in pairs or in small flocks and is very sociable. Feeds almost entirely on the ground on seeds, grains, berries, but also on trees when the fruit is ripe. Is locally migratory.

Call.—In Indian birds it is a tri-syllabic " coo ", sounding like *koo-koo-koo*, *koo-koo-koo*, continually repeated. In birds from north-eastern China which are said to belong to *S. d. decaocto*, though this is doubtful, the call, according to Wilder & Hubbard [3], is *coo-coo*, *coo-roo*, repeated about seven times.

2. **Streptopelia decaocto stoliczkae** (Hume).

THE KASHGAR RING-DOVE.

[*Holotype in the Indian Museum, Calcutta.*]

1831. ? *Columba* (misprinted *Colubam*) *risoriam*. Pallas (*nec* Linnaeus), *Zoogr. Rosso-Asiatica* I, p. 565. (Ghilan, Asiatic Russia.)

*1873. *Columba chinensis*, Severtz (*nec* Scopoli), *Turk. Jevont.*, p. 68. Name preoccupied.

1874. *Turtur Stoliczkae*, Hume, *Stray Feathers* II, p. 519. (Kashgar, Eastern Turkestan.) Holotype in Indian Museum, Calcutta.

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[1] Stuart Baker, E. C., *Fauna Br. India, Birds* (2nd ed.) V, p. 248 (1928); and *Nidification Birds Ind. Emp.* IV, p. 168 (1935).

[2] Whistler, H. & Kinnear, N. B., *Journ. Bombay Nat. Hist. Soc.* XXXVIII, p. 680 (1936).

[3] Wilder, G. D. & Hubbard, H. W., *Birds N. E. China*, p. 509 (1938).

* Not seen in original

1875. *Turtur risoria*, Stoliczka, *Stray Feathers* III, p. 217. (Kashgar.) In a foot-note on the same page Hume points out that this bird=*T. stoliczkae* Hume.
1875. *Turtur Stoliczkae*, Hume, *Stray Feathers* III, p. 415. (Kashgar.)
1876. *Turtur Stoliczkae* (*? intercedens*), Scully, *Stray Feathers* IV, p. 178. (Yarkand and Kashgar, Eastern Turkestan.)
1881. *Turtur stoliczkae*, Sharpe, *Sci. Res. Second Yarkand Miss., Aves*, p. 117, and pl. xiv (inaccurate in some details). (Sanju and Kashgar, Eastern Turkestan.)
*1881. ? *Streptopelia torquata*, Bogdanov (*ex* Brisson, *nec* Brisson), *Tr. Siber. Obtsch. Jestestv.* XII, p. 98. (Turkestan.)
*1884. ? *Streptopelia torquata*, Bogdanov (*nec* Brisson), *Consp. Av. Imp. Ross.* I, p. 9.
1885. *Streptopelia torquata*, Menzbier, *Ibis* III (5th Ser.), p. 357. (Aksu and Kashgar, Eastern Turkestan.)
1888. ? *Streptopelia torquata*, Pleske, *Mem. Acad. St. Petersbourg* XXXVI (7th Ser.), No. 3, p. 46. (Turkestan.)
*1891. *Turtur douraca*, Biandri & Berezowski, *Aves Gansu* (Kansu ?), p. 27. (? Kansu, China.)
1893. *Turtur* (*Streptopelia*) *douraca* (part), Salvadori, *Catal. Birds Br. Mus.* XXI, p. 430.
1896. *Turtur douraca stoliczkae*, Richmond, *Proc. U. S. Nation. Mus.* XVIII, p. 588. (Uchturfan, 5,000 ft., Eastern Turkestan.)
1898. *Turtur risorius* (part), Blanford, *Fauna Br. India, Birds* (1st ed.) IV, p. 46.
1899. *Streptopelia stoliczkae*, Sharpe, *Hand-List Gen. & Sp. Birds* I, p. 79. (Central Asia.)
1901. *Turtur risorius*, Schalow, *Journ. f. Ornith.* XLIX, p. 410. (Kashgar, Eastern Turkestan.)
1913. *Streptopelia risoria risoria* (part), Stuart Baker, *Indian Pigeons & Doves*, p. 219.
1920. *Streptopelia decaocto decaocto* (part), Hartert, *Vögel paläarkt. Fauna* II, p. 1495.
1928. *Streptopelia decaocto decaocto* (part), Stuart Baker, *Fauna Br. India, Birds* (2nd ed.) V, p. 248. *Vide* also vol. VII (1930), pp. 440, 441, Synonymies.
1929. *Streptopelia decaocto stoliczkae*, Hellmayr, *Chicago Field Mus. Nat. Hist.* (*Zool.*) XVII, p. 132. (Echitgo, Carshamba Bazar, Yarkand River; and Kashgar. Both places in Eastern Turkestan.)
1934. *Streptopelia decaocto stoliczkae*, Ludlow & Kinnear, *Ibis* IV (13th Ser.), p. 99. (Chinese Turkestan.)
1935. *Streptopelia decaocto decaocto* (part), Stuart Baker, *Nidification Birds Ind. Emp.* IV, p. 168.
1936. *Streptopelia decaocto stoliczkae* (part ?) Hartert & Steinbacher, *Vögel paläarkt. Fauna*, Ergänzungsbd., p. 459.
1936. ? *Streptopelia decaocto decaocto*, Shaw, *Biol. Sinica* (B) XV, Fasc. 1, vol. 2, p. 487. (Hopei Province, north-eastern China.)
1937. *Streptopelia decaocto stoliczkae*, Peters, *Check-list Birds World* III, p. 92.
1937. *Streptopelia decaocto stoliczkae*, Stresemann, Meise & Schönwetter, *Journ. f. Ornith.* LXXXV, p. 441. (North-western Kansu, China.)
1938. ? *Streptopelia decaocto decaocto*, Wilder & Hubbard, *Birds N. E. China*, p. 508. Gives *S. d. stoliczkae* as its synonymy.

This bird was first described as a separate species *Turtur stoliczkae* by Hume[1] in 1874, from a ♂ obtained at Kashgar (Eastern Turkestan) on February 5, 1874, by Dr. F. Stoliczka during Forsyth's Second Yarkand Mission. Sharpe[2] admitted the species and published a re-description of the Holotype, and also a coloured figure (his Plate XIV). The Plate, however, is inaccurate in the following details:—(i) The naked orbital skin is not shown. (ii) The collar is shown purplish-violet instead of black. (iii) The bill is shown light pink instead of quite black. Subsequently a number of authors, *e.g.*, Richmond (1896),

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* Not seen in original.
[1] Hume, A., *Stray Feathers* II, p. 519 (1874).
[2] Sharpe, B., *Sci. Res. Second Yarkand Miss., Aves*, p. 117 (1881).

Hellmayr (1929), Stresemann, Meise & Schönwetter (1937, 1938) and Peters (1937) have recognised the distinctness of the Eastern Turkestan bird (*stoliczkae*) which is both paler and larger than the Indo-European form. Hartert [1] at first did not recognise the race *stoliczkae*, although he admitted that the Eastern Turkestan and Chinese birds were much larger than the Indo-European ones; later, however, Hartert & Steinbacher [2] recognised it and gave its range as from Eastern Turkestan to Jehol (China), Korea and Hondo Is. (Japan). Stuart Baker [3], unfortunately, did not separate *S. d. stoliczkae* from *S. d. decaocto*.

The Holotype of *S. d. stoliczkae* is in the Indian Museum, Calcutta (I. M. Reg. No. 26534), and an examination of it, as also of a number of other specimens from the type-locality (Kashgar) and other localities in Eastern Turkestan, has convinced me of the validity of the race *stoliczkae*. Characters which best distinguish it from *S. d. decaocto* are the paler colour, the larger size and the greater length of and the absence of gray in the white apical tip of the outermost tail feather. According to Hellmayr [4], the blackish colour at the base of the lateral tail feathers used by Buturlin [5] as a criterion for the Turkestan race is exceedingly variable in extent, and does not seem to afford a reliable character for subspecific differentiation. The following description is based on specimens in the Indian Museum collection, and also on the published accounts of the bird.

TABLE 2.

Specimens of S. d. stoliczkae *in the Indian Museum, Calcutta.*

Reg. No.	Sex.	Locality.	Date.	Collector or Donor.	Measurements (mm.).					
					L.	W.	Tl.	Tr.	C.	X.
26534 (Holotype)	♂	Kashgar	Feb. 5, 1874.	F. Stoliczka	318 (Sharpe.)	187	167	23·5	14	58
17325	♀	Kashgar	Oct. 23, 1874.	J. Scully	375 (Scully.)	169	144	23	16	43
17323	♂	Yarkand	Feb., 1875	J. Scully	343 (Scully.)	176	145	...	16·5	45
17326	♀	Yarkand	Feb., 1875	J. Scully	332 (Scully.)	175	140	26	16	50
17324	♂	Yarkand	Mar. 22, 1875.	J. Scully	348 (Scully.)	184	165	26	15·5	57

Remarks.—Specimen No. 17324 (♂, Yarkand) has its plumage dark, oily and with traces of soot. This condition is explained by the following remarks of Scully [6]: "A favourite trick of the Yarkand boys is to capture one of these Doves, and smear its feathers all over with

[1] Hartert, E., *Vögel paläarkt. Fauna* II, p. 1495 (1920).
[2] Hartert, E. & Steinbacher, *Vögel paläarkt. Fauna*, Ergänzungsbd., p. 459 (1936).
[3] Stuart Baker, E. C., *Fauna Br. India, Birds* (2nd ed.) V, p. 248 (1928); and *Nidification Birds Ind. Emp.* IV, p. 168 (1935).
[4] Hellmayr, C. E., *Chicago Field Mus. Nat. Hist.* (*Zool.*) XVII, p. 132 (1929).
[5] See Boetticher, H. v., *Anz. Ornith. Gesell. Bayern* XII, p. 132 (1928).
[6] Scully, J., *Stray Feathers* IV, p. 178 (1876).

soot mixed up with oil. The bird is then allowed to fly away, and after a few days, when the feathers have been shaken into their ordinary positions the Ring-dove presents quite a natural appearance. Only as it moves about with its fellows, it looks truly a dove in mourning."

Vernacular Name.—Turki : *Pāḳhtak ; cf. Fākhtah,* a Dove, in Persian. (Scully [1].)

Description.—Sexes alike ; according to some authors, female perhaps slightly smaller than male.

Paler than *S. d. decaocto.* Under tail-coverts pale gray ; " white " tip to outermost tail feather pure white. Hume's [2] excellent and accurate description of the type-specimen (♂) applies to all specimens that I have examined, and is quoted below in full : " The entire head, neck all round, and breast, pale pure vinaceous, albescent on the chin and upper throat ; abdomen paler and tinged with pearl grey ; vent and lower tail-coverts very pale French grey ; on the crown there is the faintest possible brown tinge ; there is a black nuchal collar, fully double the width [3] of that in *risorius* [4], margined distinctly both above and below with white ; the vinaceous of the sides of the neck extends in a broad band on either side *behind* the nuchal collar, and is only faintly tinged with brown towards the middle ; mantle and tertiaries dull, rather pale, earthy brown ; rump and upper tail-coverts and central tail feathers very pale pearl grey, more or less tinged and suffused with pale earthy brown. These parts are decidedly paler, while the mantle is slightly darker than in *risorius ;* shoulder of the wing, winglet, secondary coverts, and secondaries pale pure pearl grey ; primary greater coverts grey, tinged more or less with dusky ; primaries dark brown, margined albescent and the later ones especially much suffused towards their bases with grey ; the lateral tail feathers next the central pair a delicate French grey on the upper surfaces, paling to white towards the tips, and faintly tinged brown on part of the outer webs ; on the lower surface the terminal 3 inches greyish white, below this blackish dusky, paling again towards their bases ; the external tail feathers of all with the terminal 2·4 inches, and the whole outer web, except a slatey grey (on the upper surface) or dusky patch towards the middle of this latter, white [*vide* text-figs. 1*a* and 2*a* of present paper] ; basal portion of the inner webs brownish, slatey on upper, and black on lower surface, paling slightly only, towards the extreme bases. The intermediate feathers are intermediate in character between these two."

Colour of Soft Parts.—Iris. Lake-red, dark-red or crimson (Scully, *loc. cit.*, ♂ and ♀) ; or reddish-brown (Schalow [5], ♀). *Naked orbital skin.* Colour not recorded. Probably whitish or pale gray (not yellow), paler than in *S. d. decaocto.* Pale ochreous-brown in dried skins. Lower eye-lid slate-coloured—Scully's labels on specimens in the Indian

[1] Scully, J., *Stray Feathers* IV, p. 178 (1876).
[2] Hume, A., *Stray Feathers* II, p. 519 (1874).
[3] This does not seem to be an important differentiating character, as in other specimens of the race the collar is quite narrow. Even in the type-specimen, the collar appears very wide because the head is bent forwards too much, thus spreading the collar unnaturally.
[4] *Turtur risorius* (Linn.)=*Streptopelia decaocto decaocto* (Frivaldszky).
[5] Schalow, H., *Journ. f. Ornith.* XLIX, p. 410 (1901).

Museum, ♂. *Bill.* Black. *Legs and toes.* Purple-red (Scully [1]). *Claws.* Dusky or black, with brown tips (Scully, *loc. cit.*).

Measurements and Weight.—Total length. 318-348 mm. *Wing* 175-190 mm., once 169 mm. *Tail.* 140-167 mm. *Tarsus.* 23-26 mm. *Culmen.* 14-16 mm. *Whitish tips to outermost tail feather (along rhachis).* 50-65 mm., in two cases 43 and 45 mm. *Weight.* 6·00-7·25 oz. (Scully, *loc. cit.*).

Distribution.—S. d. stoliczkae has been recorded from several places in Eastern Turkestan, *viz.*, Kashgar, Yarkand, Sanju, Cherchen Darya, Uchturfan, Aksu and Echitgo (Carshamba Bazar); and from some places in western China, *e.g.*, Sinnig-fu and the foot-hills of Rhichthofen Mountain in north-western Kansu Province. It is very common in Yarkand (Scully *loc. cit.*). Probably it extends further east into the eastern portions of Kansu Province. Hartert & Steinbacher[2], however, extend its range as far north as Jehol and east to Korea and Hondo Is. (Japan). It is possible that the north Chinese, Korean and Japanese birds are larger than those from Eastern Turkestan, in which case they may have to be subspecifically separated. I have, however, not examined birds from north-eastern China and the adjoining regions. The western range is equally uncertain, and it is not known whether birds from Russian Turkestan are referable to *stoliczkae.*

The southern range is, however, more certain and, as pointed out by Hellmayr [3], the bird does not cross the mountains south of the Tarim Basin (Eastern Turkestan), and birds from Kashmir and Nepal are unquestionably referable to *S. d. decaocto.* This is supported by the finding of typical *decaocto* in Kashmir, even up to 10,000 feet at Dras by Osmaston[4]; and in the Peshawar District of the North-West Frontier Province by Briggs & Osmaston[5]. Afghanistan birds might *presumably* be intermediate between *S. d. stoliczkae* and *S. d. decaocto,* but definite proof is wanting, and in a recent account Meinertzhagen[6] lists Afghanistan birds simply as *S. decaocto,* without giving the subspecies.

Breeding.—Breeds from beginning of April to about middle or end of June (Scully, *loc. cit.*; and Stresemann, Meise & Schönwetter[7]).

Nest.—In Yarkand, according to Scully (*loc. cit.*) it builds nests on the top of walls (*S. d. decaocto* never does so) and on low trees, about 7 to 8 feet from the ground. The nest, according to Stoliczka's observations (quoted by Sharpe [8]), is made of a few twigs and a thick lining of cotton-wool inside.

Eggs.—Two in a clutch. Smooth and glistening white. *Size.* 28·7 × 23·9 mm. to 31·5 × 24·3 mm. (Stresemann, Meise & Schönwetter, *loc. cit.*).

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[1] Scully, J., *Stray Feathers* IV, p. 178 (1876).
[2] Hartert, E. & Steinbacher, *Vögel paläarkt. Fauna,* Ergänzungsbd., p. 459 (1936).
[3] Hellmayr, C. E., *Chicago Field Mus. Nat. Hist.* (*Zool.*) XVII, p. 132 (1929).
[4] Osmaston, B. B., *Journ. Bombay Nat. Hist. Soc.* XXXII, p. 144 (1927).
[5] Briggs, F. S. & Osmaston, B. B., *Journ. Bombay Nat. Hist. Soc.* XXXII, p. 758 (1928).
[6] Meinertzhagen, R., *Ibis* II (14th Ser.), p. 709 (1938).
[7] Stresemann, E., Meise, W. & Schönwetter, M., *Journ. f. Ornith.* LXXXVI, p. 194 (1938).
[8] Sharpe, B., *Sci. Res. Second Yarkand Miss., Aves,* p. 118 (1881).

Habits.—Very common in the plains of Eastern Turkestan where it is a permanent resident. Always found near villages and houses, perching on trees or running about on the ground and picking up grains and seeds. Are very tame. (Scully[1].)

Call.—Not recorded. Wilder & Hubbard[2] record the call of the bird of the Hopei Province in north-eastern China as *coo-coo, coo-roo,* repeated seven times. It will be noticed that the last coo is *roo,* not *coo.* It is not, however, clear whether the birds from north-eastern China are nearer to *S. d. decaocto* or *S. d. stoliczkae.*

3. **Streptopelia decaocto xanthocyclus** (Newman).

THE BURMESE RING-DOVE.

1875. *Turtur risorius,* Blyth, *Journ. Asiat. Soc. Bengal* XLIV, Pt. 2 (Extra No., *Catal. Mammals & Birds Burma,* p. 146). (Thayetmyo, Burma.)
1875. *Turtur risorius,* Hume & Oates, *Stray Feathers* III, p. 165. (Upper Pegu, Burma. *Rare.*)
1879 (1878). *Turtur risorius,* Anderson, *Anat. & Zool. Res. Yunnan Exped.* I, p. 666. (Upper Burma, about 40 miles below Bhamo.)
1883. *Turtur risorius* (part), Oates, *Handb. Birds Br. Burma* II, p. 293. (Upper Burma. *Rare.*)
1887. *Turtur risorius,* Oates, *Stray Feathers* X, p. 235. (Thayetmyo, Burma. *Rare.*)
1888. *Turtur risorius* (part), Hume, *Stray Feathers* XI, p. 299. (Manipur basin, *common;* and northern Arakan and northern Pegu, Burma, *rare.*)
1893. *Turtur* (*Streptopelia*) *douraca* (part), Salvadori, *Catal. Birds Br. Mus.* XXI, p. 430.
1898. *Turtur risorius* (part), Blanford, *Fauna Br. India, Birds* (1st ed.) IV, p. 46.
1899. *Streptopelia douraca* (part), Sharpe, *Hand-List Gen. & Sp. Birds* I, p. 79.
*1906. *Turtur decaocto xanthocycla,* Newman, *Avicult. Mag.* (N. S.) IV, p. 321. (Burma.)
1907. *Turtur xanthocyclus,* Mears & Oates, *Journ. Bombay Nat. Hist. Soc.* XVIII, p. 86. (Chindwin, Upper Burma.)
1908. *Turtur exanthocyclus* (obviously misprint for *xanthocyclus*), Harington, *Journ. Bombay Nat. Hist. Soc.* XVIII, p. 687. (Burma. *Common in dry zone.*)
[2]1909. *Turtur xanthocycla,* Harington, *Birds Burma,* p. 68.
1913. *Streptopelia risoria xanthocycla,* Stuart Baker, *Indian Pigeons & Doves,* p. 225.
1920. *Streptopelia decaocto xanthocyclus,* Hartert, *Vögel paläarkt. Fauna* II, p. 1497.
1922. *Streptopelia decaocto xanthocycla,* Stuart Baker, *Journ. Bombay Nat. Hist. Soc.* XXVIII, p. 837.
1928. *Streptopelia decaocto xanthocycla,* Stuart Baker, *Fauna Br. India, Birds* (2nd ed.) V, p. 249.
1934. *Streptopelia decaocto xanthocycla,* Higgins, *Journ. Bombay Nat. Hist. Soc.* XXXVII, p. 303. (Manipur Valley, E. Assam. *Common.*)
1935. *Streptopelia decaocto xanthocycla,* Stuart Baker, *Nidification Birds Ind. Emp.* IV, p. 169.
1937. *Streptopelia decaocto xanthocyclus,* Peters, *Check-List Birds World* III, p. 92.
1938. *Streptopelia decaocto,* Stanford, *Journ. Bombay Nat. Hist. Soc.* XL, p. 572. (Shwebo, Northern Burma.)

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[1] Scully, J., *Stray Feathers* IV, p. 178 (1876).
[2] Wilder, G. D. & Hubbard, H. W., *Birds N. E. China,* p. 509 (1938).
[3] Not seen in original. So quoted by Stuart Baker (*Indian Pigeons & Doves,* p. 225, 1913). It may be added in this connection that many references given by that author on the same page are incorrect. Thus, " Mears " should be " Mears & Oates ", " Macdonald, p. 496 " should be " Harington, p. 687 ", and " Oates, Cat. Eggs B. M." does not list any Burmese representative of the dove at all.
* Not seen in original.

Remarks.—Very little is on record about *S. d. xanthocyclus* and the greater part of all that we know is contained in four accounts by Anderson (1879), Oates (1883), Newman (1906) and Hartert (1920). Anderson had noted its larger size and darker and more vivid colour as compared to the Indian specimens. Oates first noted the yellow colour of the orbital skin, but apparently did not consider it as an important character. Newman re-noted the broad yellow bare skin around the eye (as contrasted with the whitish or grayish orbital skin in the Indian and the Turkestan birds) and distinguished the Burmese birds under a separate subspecies *xanthocycla*. I have re-examined Anderson's specimen which is in the Indian Museum collection, and am able to confirm his description. Its measurements and other particulars are given in Table 3 below; the measurements of the race published by Oates and by Hartert are also included. These are the only measurements so far available for this race. Stuart Baker's[1] statement that the measurements are the same as in *S. d. decaocto* is not correct; the Burmese birds are much larger.

Table 3.

Specimen of S. d. xanthocyclus *in the Indian Museum, Calcutta.*

Reg. No.	Sex.	Locality.	Date.	Collector or Donor.	Measurements (mm.).					
					L.	W.	Tl.	Tr.	C.	X.
9064	(?)	"Upper defile, Irrawady", about 40 miles below Bhamo (N. Burma).	Sep. 1868	J. Anderson	..	182	151	27	(17)	60
Oates' measurements for the subspecies					344	165	140	25	..	..
Hartert's three specimens :—Wing 181-182·5 mm.										

Vernacular Names.—Manipuri (spoken in eastern Assam) : *Khunu halamān* (Hindu) or *Khunu gurumān* (Mohammedan). Burmese : *Gyo-lin-pya.*

Description.—Sexes alike; according to some authors, female perhaps slightly smaller than male.

Compared to *S. d. decaocto*, the Burmese birds have the following characters :—Colour of both upper and lower sides much darker and more vivid. Under tail-coverts very dark gray. 'White' tip of outermost tail feather more gray and longer, being about 60 mm. long (*vide* text-figs. 1*c* and 2*c*). Black collar on neck slightly larger and perhaps more crescentic.

Colours of Soft Parts.—As in *S. d. decaocto*, except that the naked orbital skin is, in fresh specimens, *yellow* (instead of whitish or grayish) and is larger. In dried specimens the naked orbital skin is ochreous brown.

Measurements (from a few examples) and Weight.—Total length. 344 mm. *Wing.* 181-182·5 mm., once 165 mm. *Tail.* 140-151 mm. *Tarsus*

[1] Stuart Baker, E. C., *Fauna Br. India, Birds* (2nd ed.) V, p. 249 (1928).

25-27 mm. *Culmen.* 17 mm. *Whitish tip to outermost tail-feather (along rhachis).* 60 mm. *Weight.* Not recorded.

Distribution.—Hartert [1] gives its distribution as: Burma, Shan States, Yunnan and Cochin-China. Stuart Baker[2] adds to this: "South and Central China and the Indo-Chinese countries", while Peters[3] adds: "eastern China (lower Yangtse valley and Fohkien)" I do not know on what authority Yunnan, Indo-China and eastern China have been included in the range of *xanthocyclus*. Neither Rothschild[4] gives it in his list of Yunnan birds, nor do Delacour & Jabouille[5] record it in their account of the birds of French Indo-China. The only record from China appears to be that of a bird with pale yellow eyelids recorded long ago by Swinhoe [6] from "Seuenhwafoo" in eastern China and which Newman [7] considered as belonging to the Burmese race because of its pale-yellow eyelids.

In Burma itself, it has been so far recorded from the upper and central regions north up to about 40 miles south of Bhamo (Anderson [8]), west in Thayetmyo and Arakan, and south to Pegu (Oates [9]). Stanford [10], however, points out that Oates never got further south than Thayetmyo. Most observers consider it a rare bird in Burma, but according to Harington [11] it is common in dry zones.

Higgins [12] records it from the Manipur Valley (eastern Assam) where it is common. Hume[13] had previously noted that it is common in the Manipur basin, but is seen nowhere in the surrounding hills.

Breeding.—Breeds throughout the year (Stuart Baker [14]).

Nest.—As in *S. d. decaocto* (Stuart Baker [15,16]).

Eggs.—Average size: 29·6×24·1 mm. Maxima: 31·1×25·6 mm. Minima: 27·0×23·0 mm. (Stuart Baker [17].)

Habits.—Frequents open spaces and cultivated areas, showing partiality towards proximity to human habitations. Harington [18], however, says that it is essentially a jungle bird. Goes about singly, or in pairs or in small flocks (Oates, *loc. cit.*). Probably undertakes local migrations, but nothing is actually known about the subject.

Call.—Deeper than in the Indian bird; also, as it flies, it is said to have an almost hawk-like call quite different from its ordinary notes (Harington, *loc. cit.*).

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[1] Hartert, E., *Vögel paläarkt. Fauna* II, p. 1497 (1920).
[2] Stuart Baker, E. C., *Fauna Br. India, Birds* (2nd ed.) V, p. 249 (1928).
[3] Peters, J. L., *Check-List Birds World* III, p. 92 (1937).
[4] Rothschild, Lord, *Novitat. Zool.* XXXIII, pp. 222-224 (1926).
[5] Delacour, J. & Jabouille, P., *Oiseaux l'Indochine Française* II, pp. 8-44 (1931).
[6] Swinhoe, R., *Proc. Zool. Soc. Lond.*, p. 446 (1870).
[7] Newman, T. H., *Avicult. Mag.* (N. S.) IV, p. 321 (1906).
[8] Anderson, J., *Anat. & Zool. Res. Yunnan Exped.* I, p. 666 (1879).
[9] Oates, E., *Stray Feathers* X, p. 235 (1887).
[10] Stanford, J. K., *Journ. Bombay Nat. Hist. Soc.* XL, p. 572 (1938).
[11] Harington, H. H., *Journ. Bombay Nat. Hist. Soc.* XVIII, p. 687 (1908).
[12] Higgins, J. C., *Journ. Bombay Nat. Hist. Soc.* XXXVII, p. 303 (1934).
[13] Hume, A. O., *Stray Feathers* XI, p. 299 (1888).
[14,15] Stuart Baker, E. C., *Nidification Birds Ind. Emp.* IV, p. 170 (1935).
[16] Stuart Baker, E. C., *Fauna Br. India, Birds* (2nd ed.) V, p. 249 (1928).
[17] Same as 14.
[18] Harington, H. H., *Journ. Bombay Nat. Hist. Soc.* XVIII, p. 687 (1908).

III. SUMMARY.

1. The distinguishing characters of the three subspecies of the Ring-Dove *Streptopelia decaocto* (Frivaldszky) are discussed in detail, and their distribution critically examined on the basis of available data. A list of the specimens present in the collection of the Indian Museum, Calcutta, is given.

2. *S. d. decaocto* (Frivaldszky).—Its Indian range includes practically the whole of the country, except extreme eastern Assam where (Manipur Valley) it is replaced by *S. d. xanthocyclus*. The exact dividing line between the races *decaocto* and *xanthocyclus*, however, remains to be worked out.

3. *S. d. stoliczkae* (Hume).—Stuart Baker's (*Fauna Br. India, Birds*, 2nd ed., V, p. 248, 1928) inclusion of this subspecies under *decaocto* is not justified. The Holotype of *stoliczkae* is in the Indian Museum, Calcutta. This subspecies is found in Eastern Turkestan and N. W Kansu (China) and probably a little further north-east.

4. *S. d. xanthocyclus* (Newman).—This subspecies is found in the Manipur Valley (eastern Assam), Central Burma and parts of Upper Burma. (Not found in Yunnan and Indo-China.) Its exact northern and eastern limits have yet to be worked out.

NOTES ON ALEURODIDAE (RHYNCHOTA) FROM INDIA. II.

By KARAM SINGH, *Department of Zoology, College of Science, Nagpur.*

(Plate VII.)

Genus **Taiwanaleyrodes** Takahashi (1932).

Taiwanaleyrodes hexcantha, sp. nov.

(Plate VII, figs. 1-4.)

Locality.—Nagpur, Chanda.

Host.—Bauhinia sp.

Pupa case.—(Pl. VII, fig. 1). Colourless, thin, with two brownish patches, an anterior one, in the region of the mouth parts and the other about the middle of the anteriormost abdominal segment; convexo-flat, cake-like, with a narrow fringe of white powdery wax. Shape sub-elliptical, narrowing posteriorly, not constricted, a little indented at the posterior end. Mid-thoracic suture reaching the margin of the dorsal disc, thoracic segments faintly defined from one another, thoracic-abdominal suture almost reaching the margin of dorsal disc; abdominal segments distinct. Submarginal area narrow defined from the dorsum by irregular and unequal elevations (Pl. VII, fig. 2), without distinct markings. Dorsum with sparse granules sublaterally; cephalothorax with a pair of rounded tubercle-like markings on the bases of the first pair of legs, an indistinct pair externally to the third pair of legs and a pair of fairly long spines with rounded bases situated a little in front of the distal extremity of the first pair of legs. Abdomen with a pair of similar spines sublaterally on the first segment and with longitudinal wavy markings on the median areas of the first two segments, rarely faintly seen also on the third segment; a pair of fine setae present near the vasiform orifice, a pair of longer spines at the hind end. Thoracic tracheal folds not discernible, their terminations on the margin clearly indicated by the absence of crenulations (Pl. VII, fig. 4). Caudal fold 0·063 mm. long, having a chitinised margin, narrowing towards the hind end, fairly wide, with sparse irregular markings, the " cleft " widely concave, indicated by the absence of marginal crenulations. Margin with two pairs of usual setae, a pair anteriorly, and a pair postero-laterally, marginal teeth minute, rounded at the apex, wider than long, ventral submarginal area well defined.

Vasiform orifice 0·042 mm. by 0·033 mm., subsemicircular, with a thickened rim (Pl. VII, fig. 3), without a notch at the posterior end, without teeth. Operculum almost filling the orifice, obscuring the lingula. Length of case 0·7 mm.; breadth 0·46 mm. Adults unknown.

This species bears some resemblance to *Taiwanaleyrodes carpini*, Takahashi (1939), but differs from it in colour, details of markings, tracheal folds and details of vasiform orifice.

Collected by the author in Dec. 1937. Several specimens on slides and leaves in my collection. Holotype in the Indian Museum (No. 5837/H7), Calcutta.

Genus **Aleuromarginatus** Corbett (1935).

Aleuromarginatus indica, sp. nov.

(Plate VII, figs. 5-12.)

Locality.—Nagpur.

Host.—Tephrosia purpurea.

Pupa case.—(Pl. VII, fig. 5). Occurring on both upper and lower surfaces of leaves, surrounded by a white marginal fringe of fine wax filaments ; light brown, with three deep brown areas, one anteriorly about the mouth parts, middle one about the anterior abdominal segments, and posteriorly round the vasiform orifice ; elliptical, slightly constricted across thorax. Exhibiting considerable variation regarding colour, some specimens lacking deep brown areas. Margin with two rows of teeth (Pl. VII, fig. 6), outer long and acute, inner short and rounded, about nine in each series up to 0·1 mm. Tracheal folds and clefts absent. Caudal groove indicate anteriorly, enclosing the vasiform orifice. Both thoracic and transverse sutures reaching the margin. Submargin with radial linear sculpturing merging into honey-comb-like markings on the subdorsal area. Dorsal disc without median rachis, thoracic and abdominal sutures clearly defined and extending into the subdorsal area. Paired chitinised thickenings on thoracic and abdominal segments. Minute spines and pores scattered on dorsum as shown in the figure. Legs thick and conical, antennae tapering and long.

Vasiform orifice (Pl. VII, fig. 7) subcordate, about 0·071 by 0·075 mm. with the anterior margin somewhat concave, inner and posterior margins armed with fine setae. Operculum filling about two-third of the orifice, rounded laterally and truncate posteriorly. Lingula cylinderical, knobbed, setose with a pair of bristles at the posterior end, which is exposed and included within the orifice. Length of female case 1·2 mm., breadth 0·74 mm. Male cases much smaller.

Adult female.—Body yellow, with paired grey patches on the dorsal side of the abdomen, wings white, covered with the usual waxy powder, eyes crimson constricted in the middle, tip of the rostrum black. Length from vertex to tip of abdomen about 1·62 mm.

Antenna (Pl. VII, fig. 11) of seven segments, annulated ; segment II subelliptical 0·063 mm. long with two or three spines ; segment III imbricate 0·105 mm. long with a sensorium at the distal end ; segment IV subpyriform 0·021 mm. long ; segment V cylindrical 0·042 mm. long with a fringed sensorium at the distal end ; segment VI 0·1 mm. with a sensorium near the distal end ; segment VII 0·138 mm., pointed and setose at the distal end, which also bears two indistinct sensoria.

Forewing about 1·38 mm. long and 0·46 mm. broad, translucent white, without any patches. Radial sector with a single flexure, extending to the outer margin of the wing, cubitus distinct reaching the hind margin. Hindwing about 1·07 mm. by 0·40 mm., with the basal part of

the anterior margin thickly chitinised and armed with a few large spines, with the usual vein extending all along its length.

Abdomen with the usual two pairs of wax glands. Hind tibia 0·462 mm. long, proximal tarsus 0·130 mm., distal tarsus 0·092 mm. Claws short and curved, paronychium shorter and thinner, hairy at the base. Vasiform orifice (Pl. VII, fig. 9) circular, operculum defined into two lobes, posterio-lateral margin heavily chitinised, smaller than the orifice and lying within it. Lingula cylindrical, setose, with a few longer bristles at the tip, which slightly extends beyond the orifice ; a grey patch surrounding the orifice. Ovipositor with the ordinary parts, a submoniliform filamentous structure (Pl. VII, fig. 10) segmented at the distal end, arising from the right anterior end of the genital plates, the corresponding structure on the left appears to have fallen off ; these appear to be unusual anal cerci.

Adult male.—Length about 1·33 mm., coloured like the female.

Antenna (Pl. VII, fig. 12) of seven segments, provided with sensoria like those of the female, the VI and VII segments having peculiar bright V shaped markings, the lengths of the segments being as follows. II 0·054 mm. ; III 0·084 mm. ; IV 0·0084 mm. ; V 0·012 mm. ; VI 0·189 mm. ; VII 0·231 mm.

Abdomen with the four pairs of wax glands. Vasiform orifice like that of the female, proportionately smaller. Claspers 0·134 mm. long (Pl. VII, fig. 8), with a single serration and two spines on the inner margin near the distal end. Penis about two-thirds the length of the claspers, with a conical process dorsally at the tip.

This species closely resembles *Aleuromarginatus tephrosiae* Corbett (1935), from which it is differentiated by the following characters :—The longitudinal suture never reaches the fourth abdominal suture, the absence of circular markings on the submargin, the vasiform orifice is enclosed by a broad shallow, and incomplete caudal groove, operculum larger and the lingula with a pair of terminal bristles.

Breeding was noticed in September. Adults rather inactive. Fairly common. Types in the Indian Museum (Nos. 5838-5840/H7), Calcutta.

Genus **Aleurolobus** Quaintance and Baker (1914).

Aleurolobus bidentatus, sp. nov.

(Plate VII, figs. 13-17.)

Locality.—Simla.

Host.—Jasminum sp.

Pupa case.—On both sides of leaves, black, surrounded by a broad filamentous colourless fringe, next to which is a marginal fringe of white waxy powder ; demarcation between submargin and dorsal disc indicated by a waxy powder laterally, within which the outlines of the head, thorax and abdomen are again defined in wax, the body outline connected with the submarginal line by six radial lines, in the abdominal region (Pl. VII, fig. 17).

After boiling in KOH cases brownish yellow, elliptical, flattened. Margin (Pl. VII, fig. 15) with two rows of teeth, the lower row of broad wedge shaped teeth with semicircular curvatures at their bases, the

upper row smaller and narrower, with the distal ends transversely fluted here and there, and a row of dark dots basally. Submargin with suture-like lines running inwards. A dark and a light band separates the dorsal disc from the submargin all round, except at the posterior end, where the two merge into one another. Dorsal disc distinctly segmented, with a few minute pores disposed as shown in the diagram (Pl. VII, fig. 13). Longitudinal suture reaching the margin; transverse suture extending only up to the submargin; submedially paired oval markings on cephalothorax and abdomen, the number varying in different specimens; crescentic eye spots distinct. Thoracic tracheal folds not indicated, terminating on the margin in three rounded teeth, bounded submarginally by an irregular dark area, occupying about one third of the submargin (Pl. VII, fig. 16).

Vasiform orifice 0·117 mm. by 0·084 mm., subtriangular, enclosed by the trilobed area characteristic of the genus, with a few projections and reticulations posteriorly (Pl. VII, fig. 14). Operculum similarly shaped, almost covering the orifice, with the outline of the lingula indicated below it. Caudal tracheal fold a little longer than the orifice, narrow, without any markings, but with three or four tooth-like projections directed inwards, near about its distal end, which terminates into three rounded teeth, like the thoracic folds, the outer two of these bearing minute setae marginally. Length of female case, 1·29 mm., breadth, 1·01 mm. Adults unknown.

This species bears close resemblance to *Aleurolobus rhododendri* Takahashi (1934), differing from it in the characters of the margin, as also the absence of submarginal setae. It is also somewhat like *Aleurolobus niloticus* Priesner and Hosny (1934), but differs in details of the vasiform orifice, and the caudal tracheal " cleft "

Abundant material on leaves and slides. Collected by the author in June 1935. Type in the Indian Museum (No. 5841/H7), Calcutta.

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EXPLANATION OF PLATE VII.

Taiwanaleyrodes hexcantha, sp. nov.

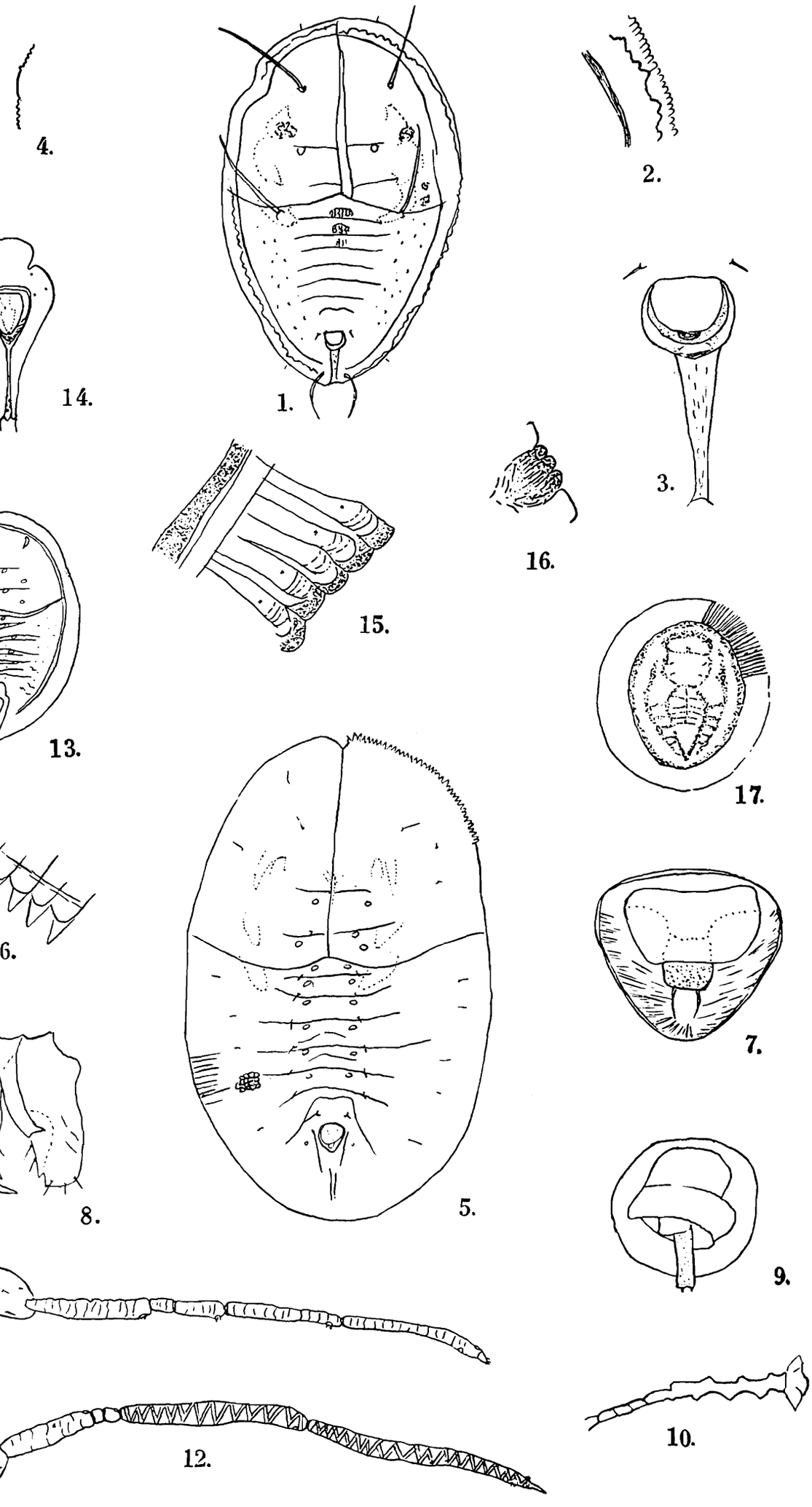
FIG. 1.—Pupa case : ×66⅔.
FIG. 2.—Margin and submargin of pupa case : ×300.
FIG. 3.—Vasiform orifice and caudal tracheal fold of case : ×300.
FIG. 4.—Thoracic tracheal " cleft " of case : ×300.

Aleuromarginatus indica, sp. nov.

FIG. 5.—Pupa case : ×53⅓.
FIG. 6.—Margin of pupa case : ×300.
FIG. 7.—Vasiform orifice of case : ×300.
FIG. 8.—External genitalia of male : ×150.
FIG. 9.—Vasiform orifice of female : ×240.
FIG. 10.—One of the anal cerci of female : ×240.
FIG. 11.—Antenna of female : ×150.
FIG. 12.—Antenna of male : ×150.

Aleurolobus bidentatus, sp. nov.

FIG. 13.—Pupa case : ×21⅓.
FIG. 14.—Vasiform orifice, with trilobed area and caudal fold of case : ×66⅔.
FIG. 15.—Margin and submargin of case : ×240.
FIG. 16.—Thoracic tracheal " cleft " of case : ×240.
FIG. 17.—Pupa case on leaf showing waxy secretion.



Indian Aleurodidae.

ON A NEW SPECIES OF *ECHENEIBOTHRIUM* FROM *RHINOBATUS GRANULATUS* CUV.

By M. K. SUBRAMANIAM, *M.A., D. Sc., Department of Zoology, University of Madras.*

CONTENTS.

INTRODUCTION.

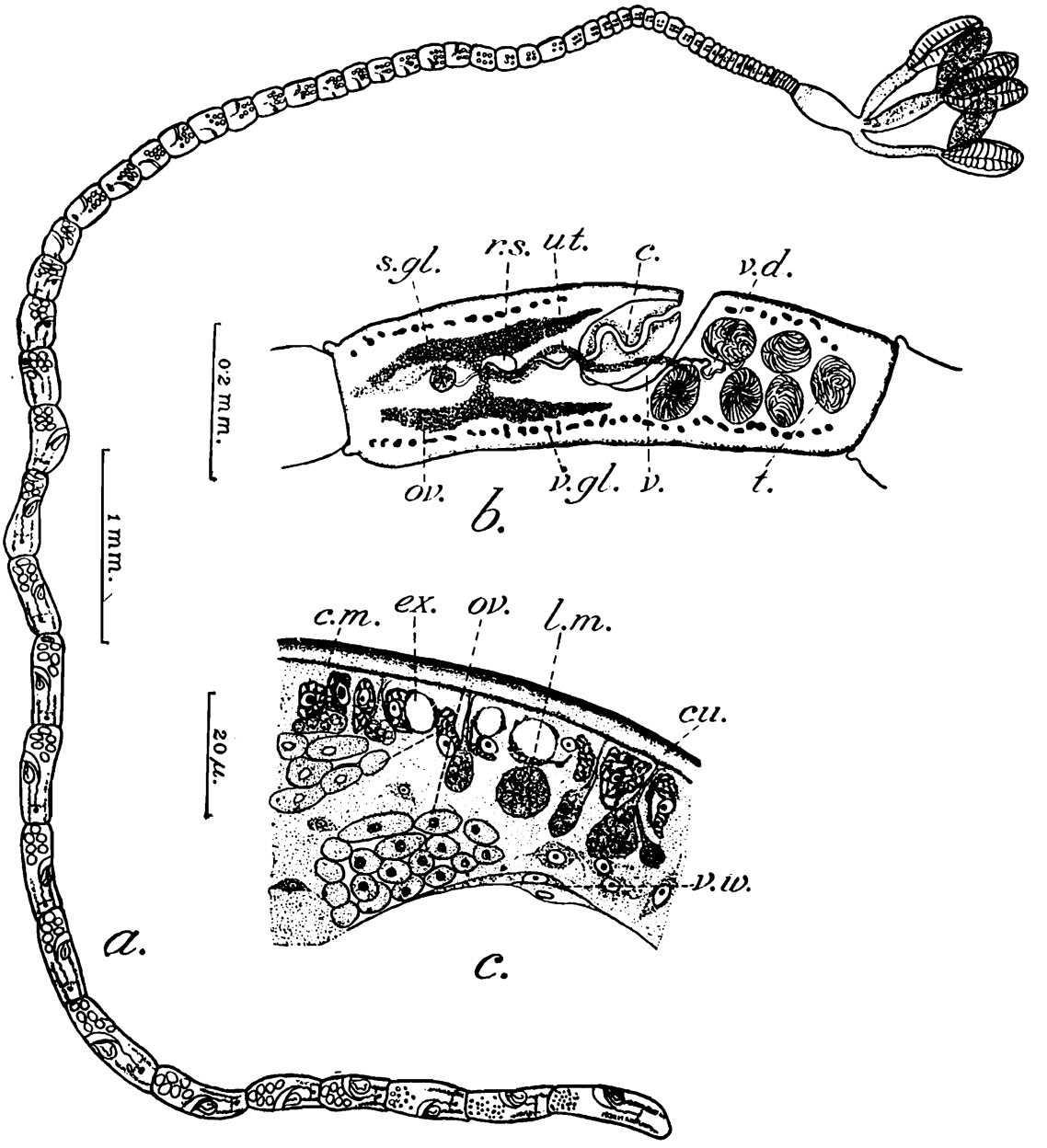
The Phyllobothrid which forms the subject matter of this paper was collected from the spiral valve of *Rhinobatus granulatus* Cuv. in November 1938. Only 13 specimens were available for study and of these the majority were immature. The mature ones were sectioned in frontal, sagittal and transverse planes, and the details of their internal structure, so far as it could be made out, indicate that the worms belong to a new species distinct from *Echeneibothrium flexile* (Linton). I name this new species *Echeneibothrium oligotesticularis* based on the pecularity that it has only a limited number of testicular vesicles.

My thanks are due to Prof. R. Gopala Iyer for his kind interest in the work.

THE HEAD.

The head is constituted by four bothridia on pedicels, the length of which depends on the degree of contraction (text-fig. 1*a*.) The bothridia are hinged and each bothridium along with its stalk is Y-shaped. The two halves of each bothridium have entire margins and the face of each is divided by transverse flaps into 9 to 13 loculi. A longitudinal septum dividing the loculi into two rows is present in most. The

bothridia are very active and in living specimens the halves of the bothridia exhibit independent movement.



Text-fig. 1.—*Echeneibothrium oligotesticularis*, sp. nov.

a. Holotype—entire worm. *b*. A proglottid. *c*. Transverse section showing structure of body wall.

c., cirrus inside pouch; *c.m*., circular muscles; *cu*., cuticle; *ex*., excretory vessels in the sub-cuticular layer; *l.m*., longitudinal muscle bundles; ov., ovary; *r.s*., receptaculum seminis; *s.gl*., shell gland; *t*., testis; *ut*., uterus; *v*., vagina; *v.d*., vas deferens; *v.gl*., vitelline glands; *v.w*., wall of cirrus pouch.

The measurements of the head of the Holotype together with that of another, the body of which was sectioned, are given in the Table below.

——	Holotype.	Specimen 2.
Length of stalks	1. 450 μ 2. 474 μ 3. 427 μ 4. Not clear.	521 μ 261 μ 379 μ Not clear.

—	Holotype.	Specimen 2.
Width of stalks	1. 119 μ	119 μ
	2. 142 μ	95 μ
	3. 119 μ	95 μ
	4. Not clear.	Not clear.
Length of each half of the bothridia measured from the hinge.	1. 521 μ	261 μ
	2. 190 μ	403 μ
	3. 190 μ	356 μ
	4. 498 μ	261 μ
	5. 498 μ	474 μ
	6. Not clear.	450 μ
	7. Not clear.	Not clear.
	8. Not clear.	Not clear.

The cuticular covering of the pedicels, in sections, becomes extremely thin in the bothridia and is absent on the faces of the loculi. Below the cuticle of the neck is a layer of cells with irregularly scattered nuclei and with indistinct cell boundaries. In the periphery of the central core of parenchyma lie the well developed bundles of longitudinal muscles which separate into four groups at the base of the pedicels. There appears to be no layer of circular muscles either in the stalk or in the bothridia and in sagittal sections of the latter could be observed the fan-like distribution of the longitudinal muscles to the loculi. One bundle appears to proceed to the middle of the loculus and from a locus near the longitudinal partition the fibres spread out uniformly. The mode of distribution of the longitudinal muscles suggests that the various shapes assumed by the bothridia in living and preserved material are due to differential contraction of the various longitudinal muscles supplying them.

The loculi of the bothridia are composed of more than one layer of cells. In structure and staining reactions, the cells of the partitions differ entirely from the others, which are vacuolated and appear to be secretory in nature. In sagittal sections structures resembling transversely cut ducts are visible. Owing to paucity of material it was impossible to determine whether these are intended for the transport of the secreted product to the outside.

NECK AND SEGMENTS.

The total length of the Holotype is 14·5 mm. and it has 66 segments. The neck is swollen and is divisible into two regions based on the presence of annulations in the posterior half (text-fig. 1*a*.). It measures 432μ out of which a length of 240μ exhibits indentations. It is quite possible that these annulations may represent regions where septa appear later. Near its joint with the stalks the neck has a width

of 96μ and it has a maximum width of 206μ in the dilated region. The measurements of the various segments are given in the Table below.

Segment.	Length in μ	Width in μ
1	19	129
2	24	129
3	28	125
4	24	120
5	33	144
20	86	144
30	139	154
40	206	168
50	261	190
54	495	213
66	687	213

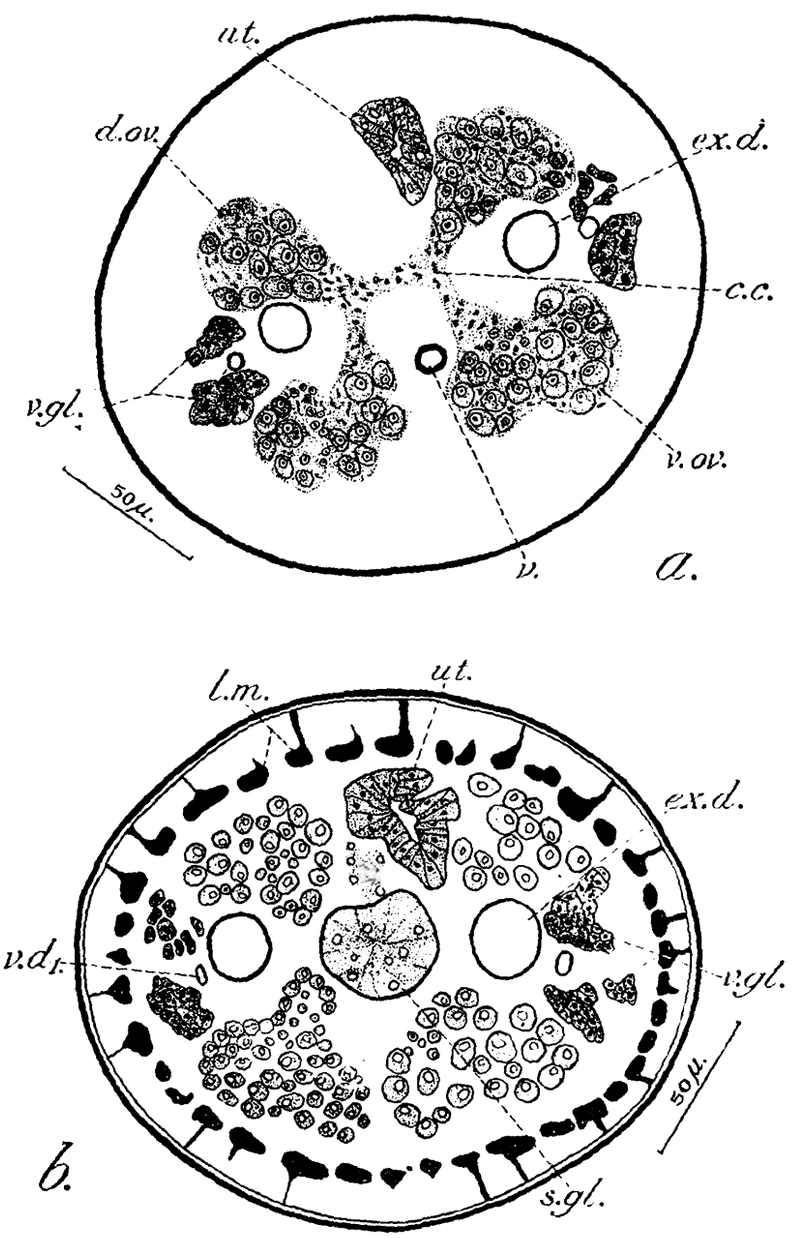
Testicular vesicles ranging in number from 4 to 6 become evident from the 25th segment onwards. In the 30th segment the cirrus sac and vagina are represented by masses of deeply staining cells. Their directions suggest that the future openings will be indistinctly alternate. The length of the 40th segment is greater than its breadth and spaces inside the vagina and the cirrus sac could be first made out in the 47th segment. The ovary at this stage is roughly H-shaped, but very small. Various structures associated with the reproductive system become distinct in the 54th and later segments.

THE BODY WALL AND MUSCULATURE.

The outer cuticle has a thickness of 6-10μ (text-fig. 1*c*). Just below it could be made out under the oil immersion lens certain strands clearly seen only in transverse section having a maximum thickness of 0·5μ which I take to represent the circular muscle layer. The well developed longitudinal muscle bundles have a peculiar disposition. Though thin extensions of all these bundles could be seen extending to the circular muscle layer, the main mass of each of the bundles lies at the periphery of the medullary parenchyma (*l.m.* text-fig. 1*c*). The subcuticular layer has a thickness of 20-40μ, the cells of which are elongated. The cytoplasm of some stains blue and the nuclei lie at different levels. Judging from the shape and stainability of the nucleus and the structure of the cytoplasm, it appears that there are three different types of cells, one of which at least seems to belong to the excretory system.

EXCRETORY SYSTEM.

In the subcuticular layer occur 12-16 vessels, clearly seen in sections passing through the region of the ovary, which seem to open at different levels into the 2 main excretory vessels. These smaller vessels are of a varying diameter, the largest measuring 5μ. In structure these are unicellular, the cells themselves being represented by nuclei lying in bits of cytoplasm excentrically disposed on the walls of these ducts (text-fig. 1*c*). The two main vessels have the largest diameter of 16-20μ in the region of the ovarian commissure (text-fig. 2*a*) and their shape varies



TEXT-FIG. 2.—*Echeneibothrium oligotesticularis*, sp. nov.

a. Transverse section passing through the central commissure of the ovary. *b*. Transverse section passing through shell gland.

c.c., central commissure of ovary ; *d.ov.*, dorsal lobe of ovary ; *ex.d.*, main excretory duct ; *l.m.*, longitudinal muscle bundles ; *s.gl.*, shell gland ; *ut.*, uterus ; *v.*, vagina ; $v.d_1$., vitelline duct ; *v.gl.*, vitelline glands ; *v.ov.*, ventral lobe of ovary.

slightly in transverse sections passing through different regions of the proglottid. There appears to be a ring vessel at the junction of the pedicels with the neck and starting from this are two vessels in each pedicel proceeding to the bothridia.

The Male Reproductive System.

The testes vesicles vary in number from 4 to 7 (text-figs. 1*a*, *b*). They are roughly oval and in the 50th segment measure 62 by 48μ. There is a slight increase in size in the segments following, the maximum observed being about 80μ.

The vas deferens, a very thin coiled tube, passes ventral to the transverse portion of the vagina and has an average diameter of 5-8μ. The cirrus sac is oval and lies posterior to the transverse portion of the vagina and measures 77 by 105μ in the 54th segment and 114 by 90μ in the 60th segment. The cirrus, in all the specimens, was contracted and has an average thickness of 50μ. It is spiny and each spine has a tripod-like base. Each spine measures 6μ in height and its base 3μ in diameter.

The genital atrium is situated about the middle of the segment but lies more towards the anterior end in mature segments. The maximum diameter of the opening of the genital atrium is about 50μ.

The Female Reproductive System.

The ovary in full mounts is H-shaped (text-figs. 1*a*. *b*). This appearrance, however, is slightly misleading, for, transverse sections (text-figs. 2*a*, *b*) reveal an entirely different picture. In such sections it is observed to be constituted by two dorsal and two ventral wings (text-fig. 2*a*) connected by small commissures to a median transverse commissure. In transverse sections passing through the median commissure, therefore, it has the shape of an X. In the type specimen the wings of the ovary in the 54th segment measure 216μ in length and 48μ in width. The distance separating the wings and bridged by the commissures is 53μ.

In the 60th segment the wings measure 308μ by 38μ and the distance separating the two wings is 53μ. In both these segments the length of the wings of the ovary is almost half the length of the segment itself. Oocytes in various stages of growth are seen in sections of the ovary.

The shell gland (text-figs. 1*b*, 2*b*) lies between the two wings but behind and on a level with the ovarian commissure. It is circular and measures 34μ in the 54th and 60th segments. The duct of this gland seems to originate on its dorsal side and is slightly coiled.

A very simple funnel takes its origin in the middle of the median transverse commissure on its ventral aspect and proceeding some distance behind as the oviduct receives the opening of the shell gland and the receptaculum seminis. A dilated ootype was not observed either in full mounts or in sections.

The vagina (text-fig. 1*b*) starts as a very thin coiled tube measuring only about 5-10μ in diameter and dilates suddenly near the cirrus sac. The transverse portion of the vagina has slightly varying disposition and seems to be lined with cuticle. It measures 114μ in the 60th segment and the canal inside measures 15μ in width. Its wall in this region is particularly thick measuring 8-10μ. The genital pores are irregularly alternate.

The oval receptaculum seminis is very clear in the 60th segment measuring 82 by 24μ (text-fig. 1*b*). In *E. flexile* Southwell (1930) des-

cribes the receptaculum seminis as a dilatation of the vagina. Sections and full mounts of *E. oligotesticularis*, however, give me the impression that it is an anteriorly directed blind sac opening into the ootype near the openings of the shell and vitelline ducts.

From transverse sections it appears that the vitelline glands occur as two streaks, dorsal and ventral on either side each being composed of a number of vesicles. In the 60th segment the streaks have a width of about 15μ, each vesicle having an irregularly oval shape measuring along its longest axis 15-40μ. The two vitelline ducts lie just in front of the shell gland on a level with the ovarian commissure but ventral to it. The figures of transverse sections given by Southwell (1930) indicate that the vitelline glands have a similar distribution in *Echeneibothrium flexile* also, though in his description it is stated that these glands occur as two strips, one lying parallel to each margin.

The uterus occurs in varying stages of development in different segments. It could be made out as a streak of irregularly shaped chromophile cells arranged in two layers in an irregular fashion. The canal of the uterus, which is formed by a splitting of the layers, is irregular in outline in transverse sections and the cells composing its walls are arranged in a single layer. No muscle fibres have been noticed on the walls of the uterus and neither have I been able to observe any opening of this structure either into the ootype or to the outside. It seems likely that both arise later. The uterus in the 60th segment has a wavy course and extends from the hind end to the middle of the hindermost of the testicular vesicles, having a length of 408μ and a width of 25-30μ.

DISCUSSION.

Southwell (1925) united *Rhinebothrium flexile* Linton 1890, *Echeneibothrium walga* Shipley and Hornell 1906 and *Rhinebothrium insignia* Southwell 1911, into a single species *Echeneibothrium flexile* (Linton) which is defined as having 26-38 loculi in the Y-shaped bothridia divided into two rows by a distinct or indistinct longitudinal septum, with 18-26 tests, with a bilobed ovary occupying the posterior quarter of the segment and with vitelline glands occurring as two strips, one lying parallel to each lateral margin. The specimens examined by me showed very little variation in the number of loculi, and no specimen had more than 26 or less than 18. The longitudinal septum of course, was indistinct in some and distinct in others : even the halves of a single bothridium showing some variation. The number of testes was limited, ranging from 4 to 7, and in no specimen was there a greater number than seven. In the last three segments of the Holotype, however, it appears as if there are more than 7 testicular vesicles. Sections definitely show that sperm formation is completed long before the maturation of the oocytes and in segments containing mature oocytes in the ovary, no spermatocytes or spermatids are visible in the testes. The scattered vesicles in the last three segments appear to be merely clumps of fully formed sperms not deserving the name of testicular vesicles. This point raises the question whether the number of testes is worthy of consideration as a specific character. In *E. oligotesticularis* their number is constant and as segments containing unripe ova are easier to obtain it

seems to me that this character can be relied upon if a rigid distinction is made between a testicular vesicle and a bundle of sperms. Southwell (1930) states that he has examined specimens of *E. flexile* ranging in length up to 3 cms. and possessing 80 segments, with 18—26 testicular vesicles in each segment. As the number of these vesicles is much fewer (4 to 7) in the specimen described in the present paper it is reasonable to conclude that the worm is distinct from *E. flexile.*

Very recently (1934) Yamaguti has recorded *E. flexile* from *Dasybatus akajei.* In several points his description is at variance with that of Southwell. He figures and describes the last segment of *E. flexile* as having 10 testicular vesicles. It may be pointed out that though Southwell gives the number of testicular vesicles as varying from 18-26 in his monograph, as well as in the Fauna of British India, his figures are at variance with his description. He figures, for instance, 24 testicular vesicles in his fig. 138 but only 8 in his fig. 139 in the monograph, and his fig. 99A in the Fauna volume shows 14 testicular vesicles.

It is difficult to agree with Beauchamp's contention (1905) that as the characters are variable one should be wary in creating new species, for he never took into account the number of testicular vesicles as a basis for differentiation between species. Since this character has been used as a criterion to distinguish between species of *Tylocephalum*, I do not see why it should not be employed to differentiate the species having Y-shaped bothridia. It appears to me that the animals at present described as *E. flexile* (Linton) if re-examined will be found to be composed of more than one species.

Echeneibothrium oligotesticularis, sp. nov.

Length of body varying up to a maximum of 20 mm. with 4 bothridia carried on stalks, each being hinged and Y-shaped and divided into 18 to 26 loculi, with 4 to 7 testicular vesicles, with a spiny cirrus, with the genital apertures irregularly alternate, with an H-shaped ovary composed of right and left dorsal and ventral lobes connected separately to a central commissure and extending to the middle of the segment, and with the vitelline vesicles arranged in two rows, dorsal and ventral, on either side of the body.

Host.—Rhinobatus granulatus Cuv.

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THE AMPHIBIANS AND REPTILES OBTAINED BY MR. RONALD KAULBACK IN UPPER BURMA.

By MALCOLM A. SMITH.

[From the Department of Zoology, British Museum (Nat. Hist.), London.]

(Plate VIII.)

The British Museum is indebted to Mr. Ronald Kaulback for a valuable collection of amphibians and reptiles obtained by him in the extreme north of Burma during the years 1937, 1938 and 1939. It makes a valuable addition to our knowledge of the herpetology of that region, which is of particular interest as being the meeting place of the fauna of Indo-China with that of the Eastern Himalayas and China. The country explored by him, mainly for geographical reasons, lies on the borders of Tibet and China, to the north of the tribal area generally known as The Triangle. It is typical of much of the country of the Trans-Himalayan region and consists mainly of densely wooded precipitous hills intersected by deep well-watered ravines. The rainfall during the wet monsoon is heavy, varying from 200 to 220 inches annually. In the valleys the conditions during the hot weather may be almost tropical, but the precipitous hills make it possible to rise to cooler temperatures almost in a few hours.

The collection consists of 630 specimens, of which there are 25 species of amphibians, 15 of lizards and 42 of snakes. Of these, 5 frogs, 2 lizards and 1 snake appear to be new to science.

Of the 82 species enumerated, 14 are widely distributed throughout the Oriental Region, and 29 widely distributed over the Indo-Chinese subregion; 20 belong to the Eastern Himalayas, 8 are Chinese and 11 are so far peculiar to Upper Burma.

Of the 32 genera included we find that 21 are widely distributed over the Oriental Region, some of them worldwide, 6 belong to Indo-China extending into the Malayan subregion, 3 are Trans-Himalayan and 2 Chinese. One genus, namely *Ophisaurus*, is Irano-Turanian.

Mr. Kaulback's notes upon habits, habitats and the colouration of the living specimens are incorporated in the text.

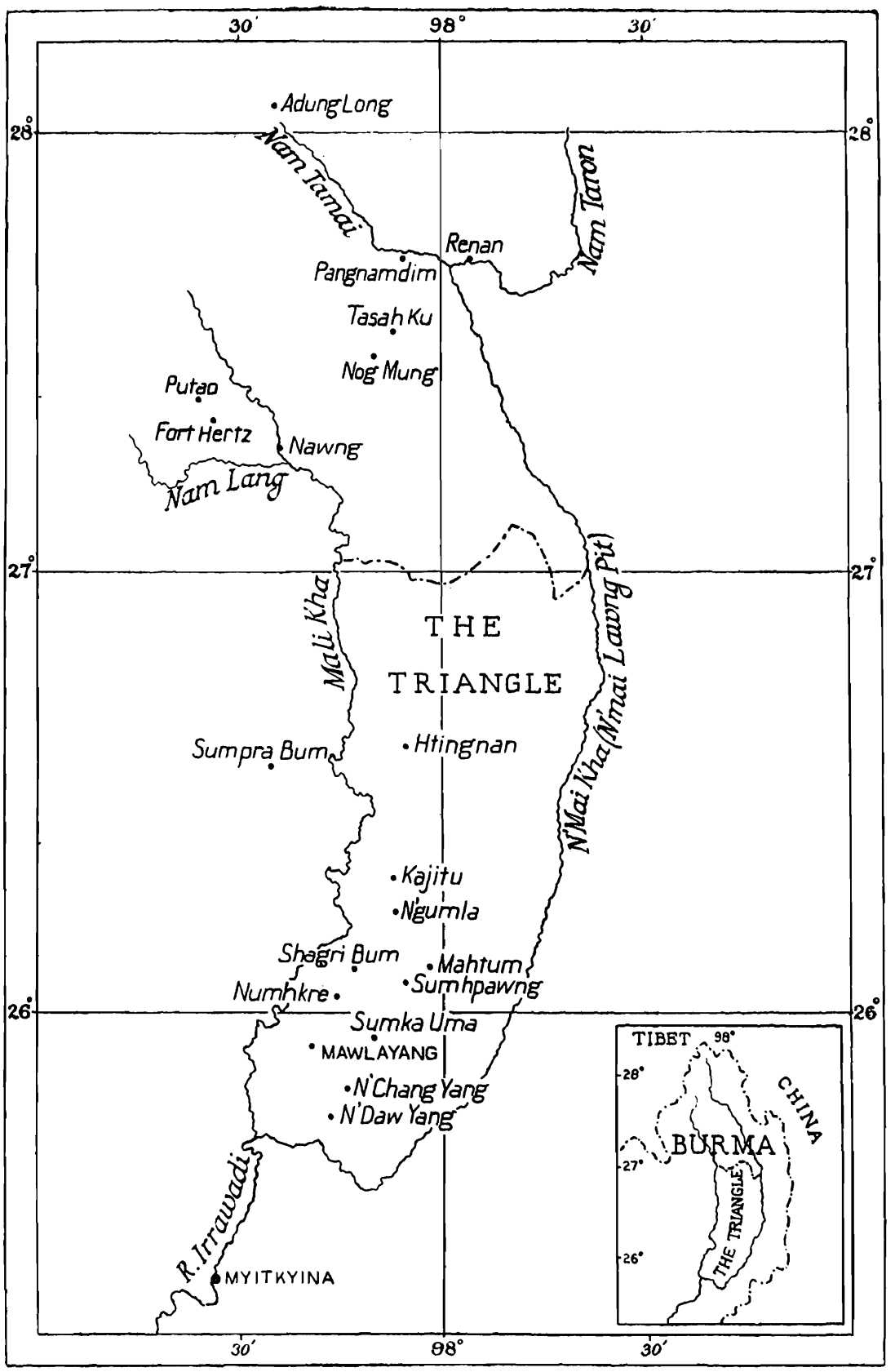
In the arrangement of the Snakes I have followed my Volume in the *Fauna of British India Series*, now in the press.

The types of all the new species are in the British Museum.

I am indebted to Dr. Baini Prashad, Director, Zoological Survey of India, for the loan of some rare material for comparison.

The latitudes and longitudes of various localities mentioned in the paper are given in the following table; those marked with an asterisk

are shown in the map. The entire area explored by Mr. Kaulback lies roughly between latitudes 25° 43′-28° 04′N. and longitudes 97° 22′-98° 18′E.



Map of the area in which collections were made.

The Triangle is a tribal area bounded on the West by the Mali Kha (-Mali Hka), and on the East by the N'Mai Kha (-N'Mai Hka), Rivers. Northwards it extends to Lat. 27° N. as indicated by the dotted line.

Names of localities.	Latitude.	Longitude.
	° N. ′	° E.
*Adung Long	28 04	97 43
Ahke	26 56	98 12
Aliwang, Taron Valley	27 42	98 08
Dadung, Taron Valley	27 40	98 18
Dinghputyang	25 58	97 53
Goletu	27 37	97 54
Goletutap	27 37	97 54
Hkandau	26 01	97 52
Hkawng Ga	25 58	98 00
Hkrang Hka	26 34	97 58
Hkunlum	26 53	98 11
*Htingnan	26 36	97 52
Htingraw Ga	26 04	97 59
Htisyengyang	26 51	98 04
*Kajitu	26 18	97 50
Labu Ga	25 46	97 40
Lunghkang Ga	26 36	97 48
*Mahtum	26 06	97 58
Mashaw Tingsa	26 46	97 58
Matsatap	27 30	97 50
*Mawlayang	25 54	97 40
Mawndam, Taron Valley	27 45	98 18
Mungdung, Nam Tamai Valley	27 42	98 00
Naurayang Ga	26 48	98 03
*Nawng	27 15	97 45
*N'Chang Yang	25 50	97 48
*N'Daw Yang	25 46	97 32
*N'Gumla	26 12	97 49
Ningma, Mali Hka Valley	26 33	97 42
*Nog Mung	27 30	97 50
*Numhkre	26 01	97 42

Names of localities.	Latitude.	Longitude.
	° N. ′	° E. ′
Paira Ga	26 43	98 04
Pali Bum	25 43	97 38
*Pangnamdim, Nam Tamai Valley	27 42	97 54
Patsarlamdam, Taron Valley	27 38	98 10
*Putao	27 20	97 22
Ratnamhti	27 25	97 47
*Renan, Taron Valley	27 41	98 03
Samatu	26 00	97 40
*Shagri Bum	26 06	97 45
Shenjung, Taron Valley	27 58	98 18
Sherawthu, Taron Valley	27 50	98 18
Sinan Hka	26 26	97 35
*Sumhpawng	26 04	97 52
*Sumka Uma	25 57	97 49
*Sumpra Bum	26 35	97 42
Tara Hka	26 09	97 52
*Tasah Ku	27 35	97 52
Uyawm Uka	26 00	97 59
Wadan	26 47	98 04

AMPHIBIANS.

APODA.

Ichthyophis glutinosus (Linn.).

1 ♀. Sumpra Bum.
Caught on August 10th ; contained 12 eggs.

PELOBATIDAE.

Megophrys hasselti (Tschudi).

1908. *Megalophrys hasseltii*, Boulenger, *Proc. Zool. Soc. London*, p. 425, pl. xxv, fig. 3.

1 ♀. Pangnamdim.
Tips of fingers and toes white in life ; it contained ripe ova.

Megophrys major Boulenger.

1908. *Megalophrys major*, Boulenger, *Proc. Zool. Soc. London*, p. 416, pl. xxiii.

2 ♂♂, 6 ♀♀. Sumka Uma, Pangnamdim.

The males have a large subgular vocal sac extending on to the front of the chest. The openings in the mouth are on either side, just in front of the angle of the jaw. The inner two fingers have a pad of dark brown, rugose skin. The males, as shown by Boulenger, are smaller than the females.

Megophrys feae Boulenger.

1908. *Megalophrys feae*, Boulenger, *Proc. Zool. Soc. London*, p. 428.

4 ♂♂, 1 ♀, 1 juv. Ahke, Mahtum, Pangnamdim.

Males with internal vocal sacs opening on each side of the mouth near the angle of the jaw. I cannot discover any other external secondary character by which to distinguish them from the females.

The largest male measures 120, from snout to vent, the largest female 115 mm.

"This frog had a piercing cry, not unlike a small Klaxon (horn). For each performance it filled its lungs in three distinct breaths, opened its mouth, paused a little, and then gave vent to a continuous harsh screeching until its wind had gone."

Bufonidae.

Bufo melanostictus Schneid.

13 specimens. Various localities in The Triangle, as far north as Htingnan (26° 36¹ N.).

Bufo stuarti Smith.

1929. *Bufo stuarti*, Smith, *Rec. Ind. Mus.* XXXI, p. 78, text-fig. 1.
1935. *Bufo stuarti*, Smith, *ibid.* XXXVII, p. 238.

1 ♂, 2 ♀♀. Pangnamdim, Mashaw Tingsa.

The male was bright yellow in life; it is now uniform pale greyish in colour. The 1st finger has an inconspicuous pad composed of minute rounded granules. One female is light brown with conspicuous, regular markings of dark brown upon the back, the limbs with dark bars; the other, with ripe ova, measures 100 mm. from snout to vent, and is uniform dark brown in colour.

Ranidae.

Rana tigrina tigrina Daudin.

1920. *Rana tigrina* forma *typica*, Boulenger, *Rec. Ind. Mus.* XX, p. 17.

2 ♂♂, 4 ♀♀. Samatu, N'Chang Yang.

The specimens belong very clearly to the typical form with pointed snout, prominent longitudinal glandular folds and tibio-tarsal articulation reaching to beyond the eye. They are identical with specimens from Nepal in the British Museum.

Rana limnocharis Wiegm.

1920. *Rana limnocharis* forma *typica*, Boulenger, *Rec. Ind. Mus.* XX, p. 28.

47 specimens. Various localities in The Triangle as far north as Mashaw Tingsa (26° 46¹ N.).

Rana hascheana (Stoliczka).

1929. *Rana hascheana*, Smith, *Rec. Ind. Mus.* XXXI, p. 77.

1 ♂. Lunghkang Ga.

Rana kuhli Dum. & Bibr.

1920. *Rana kuhli*, Boulenger, *Rec. Ind. Mus.* XX, p. 62.

3 ♂♂, 9 ♀♀, 4 juvs. N'Gumla, Htisyengyang, Mashaw Tingsa.

All the males are larger than the females. The largest male measures 72 mm. from snout to vent, the largest female 63 mm. In the male the head is broader than long, and as broad as, or broader than, the body ; in the female it is longer than broad. The tympanum is hidden in the males, visible but indistinct in the females. The toes are webbed to the discs, the webs being strongly emarginate.

The present localities mark a considerable extension northwards for this species ; it has not been recorded before in Burma.

Rana feae Boulenger.

1887. *Rana feae*, Boulenger, *Ann. Mus. Civ. Genova* (2) V, p. 418, pl. iii.
1920. *Rana feae*, Boulenger, *Rec. Ind. Mus.* XX, p. 68.

3 adult ♀♀, 1 juv. Pangnamdim.

I identify them as *Rana feae* although they do not agree entirely with the description. The vomerine teeth in two specimens are in small, rounded, scarcely oblique groups ; in the third they are distinctly oblique ; the tympanum is distinct in one specimen and in the juvenile, and $\frac{1}{3}$ the diameter of the eye ; in the other two it is hidden ; the first finger is not quite as long as the second. There is no ocellus in the groin. The largest specimen measures 90 mm. from snout to vent.

I have examined the specimen from Yunnan, in the Indian Museum ; it is a male, with nuptial spines upon the 1st finger, but none upon the chest. The type is in Genoa.

Rana taipehensis van Denburgh.

1931. *Rana taipehensis*, Pope, *Bull. Amer. Mus. Nat. Hist.* LXI, p. 539.
1923. *Rana taipehensis*, Smith, *Journ. Nat. Hist. Soc. Siam* VI, 1923, p. 205, text-fig. 4 (figure of the foot).

1 ♂. N'Chang Yang.

To this species I provisionally refer one specimen, 32 mm. from snout to vent. It has an unusually large tympanum, distinctly larger than the eye, and there is no external metatarsal tubercle. In all the material of *taipehensis* in the British Museum from Formosa, Canton, Hainan, Tongking and Annam there is a very distinct tubercle.

Rana jerboa Günther.

1920. *Rana jerboa*, Boulenger, *Rec. Ind. Mus.* XX, p. 196.

2 ♀♀. Htingnan, Tara Hka.

Rana jerboa is known from Malaysia, the Kareni Hills in Burma, and the extreme north of Siam. In the character of the skin, which is granulate, of the dorso-lateral fold, which is broad and indistinct, and in colouration, these two specimens agree better with individuals from Borneo than they do with those from Siam.

Rana gerbillus Annandale.

1912. *Rana gerbillus*, Annandale, *Rec. Ind. Mus.* VIII, p. 10, pl. ii, fig. 1.
1920. *Rana gerbillus*, Boulenger, *Rec. Ind. Mus.* XX, p. 207.

4 ♂♂, 4 ♀♀. Pangnamdim.

These specimens agree well on the whole with Boulenger's description which was drawn up from the type and two other specimens. I have examined them all; there are some differences but they appear to be individual rather than specific. The toes are fully webbed, the discs of the 3rd and 5th being involved in the web. Boulenger's statement that the toes are " nearly completely webbed " does not appear to be correct.

The back is smooth or obscurely granulate, the males having in addition numerous minute white tubercles; the glandular dorso-lateral fold is moderately broad, and not very distinct. In the type it consists of a series of disconnected warts rather than in a continuous fold. The males have external vocal sacs on either side of the jaw, and grey velvety pads upon the first finger.

Colour.—Greyish or greyish brown above; lips white, with small black spots; a dark brown stripe along the side of the head, including the tympanum; lower parts whitish, the throat, and sometimes the belly, speckled with black; thighs marbled behind with dark brown and yellow.

The largest male measures 50 mm. snout to vent, the largest female 68 mm.

Two specimens (No. 79 and 80) were caught in *copula*.

A common frog at Pangnamdim.

Rana andersoni Boulenger.

1920. *Rana andersonii*, Boulenger, *Rec. Ind. Mus.* XX, p. 174.
1931. *Rana andersonii*, Pope, *Amer. Mus. Nat. Hist.* LXI, p. 550.

2 ♂♂, 2 ♀♀, 1 juv. Pangnamdim.

Pope has discussed the sexual differences in this species, and Mr. Kaulback's specimens confirm his remarks. The males are 60 and 61 mm. from snout to vent, the females 90 and 94 mm. The tympanum of the male, in proportion to his size, is considerably larger than that of the female. The only important point of difference is with regard to the vocal sacs. Boulenger's statement that the male has an internal vocal sac is correct for the specimens examined by him. Pope states that he finds " a poorly developed one " In Mr. Kaulback's two males there are well-developed sacs appearing as modified patches of

skin at the angles of the jaws. The differences, however, may be due to the different times of the year in which the males were caught.

Rana afghana (Günther).

1920. *Rana latopalmata*, Boulenger, *Rec. Ind. Mus.* XX, p. 217.

1 ♀. N'Chang Yang.

Rana kaulbacki, sp. nov.

(Plate VIII, fig. 1.)

2 ♂♂. Pangnamdim.

Type, and paratype Brit. Mus., 1940. 6. 1. 1-2.

Vomerine teeth in oblique groups, commencing on a level with the choanae, and extending posteriorly behind them, equidistant from the choanae and from each other; head a little broader than long, much depressed. Snout rounded, projecting slightly beyond the mouth, a little longer than the eye; canthus rostralis obtuse; loreal region oblique, feebly concave; nostrils equidistant from the eye and the end of the snout; distance between the nostrils greater than the inter-orbital width, which is a little greater than that of the upper eye-lid; tympanum feebly distinct, $\frac{1}{3}$ the diameter of the eye, $1\frac{1}{2}$ times its distance from the latter. Fingers very long, with very large discs, which are broader than long; first finger shorter than second, the tip merely swollen; third finger twice as long as the snout; subarticular tubercles well-developed.

Hind-limbs long, the tibio-tarsal articulation reaching beyond the tip of the snout; heels strongly overlapping when the legs are folded at right angles to the body; tibia a little longer than the foot, $1\frac{3}{5}$ times in the distance between the snout and the vent; discs of the toes smaller than those of the fingers, completely webbed, the web feebly emarginate and involving the bases of all the discs; outer metatarsals separated to the base; subarticular tubercles moderate; inner metatarsal tubercle oval, flat, $\frac{2}{5}$ the length of the inner toe; no outer tubercle.

Skin smooth; a narrow glandular fold above the tympanum; belly smooth; hinder part of thighs coarsely granulate.

No vocal sacs; a thick, grey, velvety pad on the inner side of the first finger.

Bluish above, green in life, with black spots and marblings; limbs with numerous black cross-bars; belly greyish; hinder parts of thighs yellowish.

From snout to vent 70 mm.

The paratype, also a male, does not differ from the description; it measures 72 mm. in length.

Rana kaulbacki is closely related to *Rana formosa* from the Eastern Himalayas and Khasi Hills. It differs in the absence of vocal sacs and in the character of the glandular fold above the tympanum. In *Rana kaulbacki* this is a thin, narrow strip; in *formosa* it is a thick, prominent, parotoid-like swelling, extending to beyond the angle of the mouth, and succeeded by two or three prominent glandules (Pl. VIII, fig. 1).

Rhacophorus mutus, sp. nov.

12 ♂♂, 18 ♀♀. Htingnan, Sumpra Bum, Kajitu, N'Gumla, N'Chang Yang.

Types ♂ and ♀, Brit. Mus. 1940. 6. 1. 3-4, type loc. N'Chang Yang.

I can discover no morphological character by which to distinguish this tree-frog from the common and widely distributed *Rhacophorus leucomystax*, except that the male is without vocal sacs. Specimens of *Rh. leucomystax* from the surrounding regions, namely Darjeeling, Siam, Tongking, Hainan and Canton, have distinct internal vocal sacs, showing as two slit-like or rounded openings on each side of the floor of the mouth, just in front of the angle of the jaw.

The types are uniform greyish in colour above, whitish below, the throat of the male heavily speckled with dark grey; hinder parts of thighs marbled with black and yellow.

Paratypes, from the above mentioned localities. They are light or dark grey in colour above, many of them with 4 longitudinal dark lines (as in *Rh. leucomystax*, colour var. *quadrilineata*); some have small black spots scattered upon the back.

Rhacophorus verrucosus Boulenger.

1893. *Rhacophorus verrucosus,* Boulenger, *Ann. Mus. Civ. Genova* (2) XII, p. 337, pl. x, fig. 2.

3 ♀♀. Htingnan, Mashaw Tingsa.

All the specimens have ripe, unpigmented ova. This frog, originally described from the Karin Hills in Burma, has since been found in S. Annam and Tongking.

Rhacophorus turpes, sp. nov.

(Plate VIII, fig. 2.)

9 ♂♂, 4 ♀♀. Htingnan.

Types, ♂ and ♀, Brit. Mus. 1940. 6. 1. 29-30.

Vomerine teeth in oblique series between the choanae, which are very large, nearer to the choanae than to each other. Head as broad as long, much depressed. Snout more or less truncate anteriorly, a little longer than the eye; canthus rostralis distinct; loreal region oblique, feebly concave; nostril much nearer the end of the snout than the eye; distance between the nostrils less than the interorbital width, which is twice that of the upper eye-lid; tympanum distinct, 1/3 the diameter of the eye, half its distance from it. Fingers half webbed, their discs smaller than the tympanum; toes fully webbed, their discs smaller than those of the fingers; an inner metatarsal tubercle, no outer; the tibio-tarsal articulation reaches to the eye; subarticular tubercles of fingers and toes well developed.

Skin smooth above, strongly granulate upon the belly and the anal region; above the vent they form a more or less distinct horizontal fold; a few enlarged tubercles upon the hinder part of the belly, and a series of them (4 to 7 in number) along the underside of each thigh; a well-developed pointed, dermal projection on the heel; a glandular fold above the tympanum. Male without vocal sacs.

Pale pinkish-brown above, the male with small black spots, the female with an indistinct dark patch filling up most of the central part of the back; limbs with dark bars; underparts yellowish-white, that of the male powdered with grey.

Female with very large, unpigmented ova, the vitelline sphere measuring 3½ mm. in diameter.

From snout to vent, ♂ 32, ♀ 38 mm.

The paratypes, 8 ♂♂ and 3 ♀♀, do not differ markedly in morphological characters from the types. The tubercles upon the thighs are present in all of them, but their serial character may be obscured by additional tubercles.

Their colouration is variable, but consists mainly in variations of the colour pattern already given. The dark mark upon the back may be broken up into spots.

In form and general colouration *Rhacophorus turpes* is like the Sumatran *Rh. phyllopygus*, from which, however, it differs in a number of characters.

Rhacophorus bimaculatus Boulenger.

1912. *Rhacophorus bimaculatus*, Boulenger, *Fauna Malay Pen.*, p. 250.

1 juv. Pangnamdim.

The specimen agrees well with material from the Khasi Hills, in the British Museum, except that the large spots upon the flanks are absent.

Rhacophorus taronensis, sp. nov.

(Plate VIII, fig. 3.)

1 ♀. Patsarlamdam.

Type, Brit. Mus. 1940. 6. 1. 39.

Vomerine teeth in strong, almost transverse, groups, commencing at the inner margin of the choanae. Head broader than long, much depressed; snout rounded, scarcely projecting beyond the mouth, shorter than the eye; canthus rostralis distinct; loreal region oblique, feebly concave; nostril a little nearer the tip of the snout than the eye, nearly as broad as the interorbital space, broader. than the upper eyelid; tympanum very distinct, 4/5 the diameter of the eye, close to it.

Outer three fingers with very large discs, which are as broad as long and as large as the tympanum; more than half webbed, the membrane reaching the disc of the 4th finger and that of the 2nd on the outer side (Pl. VIII, fig. 3); toes fully webbed, their discs smaller than those of the fingers; the tibio-tarsal articulation reaches to between the eye and the tip of the snout; subarticular tubercles of both fingers and toes strongly developed; a short oval inner metatarsal tubercle; no outer.

Skin smooth above, that of the belly and hinder part of the thighs coarsely granulate. A dermal fringe, feebly distinct, on the outer side of the fore-arm, tarsus and foot.

Bluish above, green in life, with small black spots; lower parts whitish, thickly speckled with dark grey; hinder part of thighs black with white spots.

From snout to vent 78 mm.

Rh. taronensis is related to *Rh. bimaculatus*; it differs in the less extensive web to the fingers, the absence of a dermal projection on the heel and very distinctly in colouration.

Rhacophorus maximus Günther.

1890. *Rhacophorus maximus*, Boulenger, *Fauna Brit. Ind.*, p. 472.

1 ♂, 2 ♀♀. Htingnan, Kajitu.

Philautus tytthus, sp. nov.

2 ♀♀. Htingnan.

Type, Brit. Mus. 1940. 6. 1. 40.

Head as long as broad, depressed; snout rounded, a little longer than the eye; nostril nearer the tip of the snout than the eye; distance between the nostrils less than the interorbital width which is greater than that of the upper eye-lid; tympanum feebly distinct, 1/3 the diameter of the eye. Fingers not webbed, their discs about as large as the tympanum; toes 3/4 webbed, their discs a little smaller than those of the fingers; inner metatarsal tubercle distinct, no outer; the tibio-tarsal articulation reaches to between the eye and the tip of the snout.

Skin smooth above, with scattered tubercles; flanks more thickly studded with tubercles; belly and anal region strongly granulate.

Dark greyish on the back; with a large indistinct blackish)(-shaped mark; flanks outside the mark whitish, speckled with grey; lower parts black, thickly spotted with white; thighs black, with large white spots; tibia and forelimb with black bars; a dark stripe from the eye to the angle of the mouth; a large white spot in the groin.

From snout to vent 21 mm.

Paratype, Brit. Mus. 1940. 6. 1. 41, has the back outside the)(mark entirely grey.

Near *Ph. carinensis* from which it differs in the shape of the head, the less extensive web to the toes and markedly in colouration.

To this species I provisionally refer a specimen obtained in the Hkamti Plain, Burma-Tibet frontier, by Capt. Kingdon-Ward (Brit. Mus. 1932. 6. 8. 4-5).

Microhylidae.

Microhyla ornata (Dum. & Bibr.).

1934. *Microhyla ornata*, Parker, *Monogr. Microhylidae*, p. 139.

10 ♂♂. Samatu, N'Chang Yang.

All the specimens are males with black-pigmented throats.

LIZARDS.

Geckonidae.

Gymnodactylus khasiensis tamaiensis, subsp. nov.

1935. *Gymnodactylus khasiensis*, Smith, *Fauna Brit. Ind.* II, p. 53.

1 ♂. Pangnamdim, Nam Tamai Valley.

Type, Brit. Mus. 1940. 6. 1. 42.

Like *Gymnodactylus khasiensis* from the Eastern Himalayas and Upper Burma in all respects, differing only in the arrangement and number of the preanal and femoral pores. These extend in a continuous series, in front of the vent and along the thigh, 20 or 21 in number on each side.

Head and body 90, tail 105 mm.

The specimen was caught on a tree some 6 feet from the ground.

Hemidactylus garnoti Dum. & Bibr.

1935. *Hemidactylus garnoti*, Smith, *Fauna Brit. Ind.* II, p. 100.

6 ♀♀. Mahtum, N'Chang Yang, Ningma.

I have nothing to add to the description given in the Fauna. It is remarkable that no males of this species have yet been obtained.

AGAMIDAE.

Draco maculatus (Gray).

1935. *Draco maculatus*, Smith, *Fauna Brit. Ind.* II, p. 138, text-fig. 42.

Draco norvilli Alcock.

1935. *Draco norvilli*, Smith, *Fauna Brit. Ind.* II, p. 142.

2 ♂♂. Sumka Uma.

Inside of wattles and transverse bands on the patagia deep tomato red; gular appendage whitish or yellowish, belly and under-surface of patagia pale greenish; tail with dark brown bands. In colouration it agrees excellently with Alcock's sketch in the original description.

Ptyctolaemus gularis (Peters).

1935. *Ptyctolaemus gularis*, Smith, *Fauna Brit. Ind.* II, p. 149.

16 ♂♂, 15 ♀♀. Common everywhere throughout The Triangle as far north as Pangnamdim.

Pale greenish-brown or olivaceous above, pale fawn below; gular pouch green or yellow, the folds (in the male) very dark blue. Most of the specimens were caught on trees and bushes. Except for the character of the throat, I can find nothing by which to distinguish the sexes. Many of the specimens show enlarged conical tubercles upon the sides of the neck; others have a more or less complete series of enlarged scales on either side of the body parallel with the vertebral scales. One female caught on July 16th contained 5 eggs. The largest specimen, a male, measures 85 mm. from snout to vent, tail 200 mm.

Goniocephalus armatus crucigerus (Boulenger).

1935. *Goniocephalus armatus crucigerus*, Smith, *Fauna Brit. Ind.* II, p. 160.

4 ♂♂, 4 ♀♀, 2 juvs. Various localities in The Triangle as far north as Htingnan.

The Triangle extends the range of this form considerably to the north. I do not know of any previous records north of Lat. 18° in Siam. Most of the specimens were caught in trees or bushes. The colours in life

are very variable, the pale markings on the body and limbs ranging through yellow and white to blue or green ; the enlarged scales and the spines upon the head and dorsal crest are always blue or green.

Two females caught in August and September contained 16 and 20 eggs respectively, the eggs being equally developed in both oviducts.

Japalura kaulbacki Smith.

(Plate VIII, fig. 4.)

1937. *Japalura kaulbacki*, Smith, *Journ. Bombay Nat. Hist. Soc.* XXXIX, p. 755.

1 ♂, 7 ♀♀. Pangnamdim, Ahke.

The original description, based on a single specimen, can now be amplified. The large scales on the lower jaw and cheek extend to the level of the tympanum and are sharply defined from those on the temporal region (Pl. VIII, fig. 4). The tail of the male is distinctly swollen, and is covered with enlarged thickened scales.

The male has a small gular pouch covered with small scales ; in the female this is represented by a longitudinal fold of skin.

Both the male and the females are presumably fully grown. They measure, head and body 100, tail 195 mm. for both sexes.

Colour in life. Male.—Upper surface of head, body and limbs brown, with indistinct green transverse bars ; chin bright yellow ; gular pouch pale blue in front, scarlet behind ; belly and under-surfaces of limbs bluish-green.

Females.—Greenish above with darker markings and cross-bars ; lips and throat yellowish.

Japalura sagittifera, sp. nov.

6 ♂♂, 6 ♀♀. Pangnamdim, Dadung.

Types, ♂ and ♀, Brit. Mus. 1940. 6. 1. 43-44.

Body not depressed, tympanum concealed ; head one and a half times longer than broad ; top of head with large, unequal, keeled scales ; occiput with spinose tubercles ; a series of 3 or 4 enlarged scales behind the eye ; dorsal scales unequal, imbricate, the upper rows pointing backwards and upwards, the lower straight backwards, or backwards and downwards, with much larger, strongly keeled ones arranged in 5 chevron-shaped series upon the back and base of the tail ; ventral scales as large as, or larger than, the largest dorsals, smooth or obtusely keeled ; gular scales smaller than the ventrals ; a small gular sac, distinct in life, the scales covering it not markedly smaller than the surrounding ones ; no transverse gular fold ; a slight fold in front of the shoulder in the male, absent in the female ; no nuchal crest ; dorsal crest a serrated ridge. Limbs slender, 4th toe longer than 3rd ; the hindlimb reaches to beyond the snout in the male, to the nostril in the female. Tail compressed at the base, covered with keeled scales, those below of uniform size, about as large as the ventrals.

The degree of development of the chevron-shaped series of scales is variable. In one female they are poorly developed ; in another female and in a male they are entirely absent.

Colour.—Male blue above, whitish below, speckled with black; a dark brown longitudinal stripe on the neck; another from the eye to the angle of the mouth, bordered in front with white; tail greyish. Female dark brown above, the enlarged scales blue; lower parts as in the male.

Mr. Kaulback's sketches show the blue of the male as bright green in life, with a scarlet spot on the throat in the position of the gular pouch; in the female the blue scales are green. In one female (chevrons absent) the whole of the back is light brown; the flanks are green, the two colours being sharply defined.

♂, head and body, 50, tail 115; ♀, head and body, 60, tail 120 mm.

The paratypes do not differ from the types, except as already mentioned.

Japalura sagittifera is related to *J. andersoniana* from Assam. It differs in a broader and shorter head, in the larger gular scales and in the absence of any nuchal crest. It bears also a close resemblance to *J tricarinata* in which species the tympanum is always naked.

Calotes versicolor (Daudin).

1935. *Calotes versicolor*, Smith, *Fauna Brit. Ind.* II, p. 189.

3 ♂♂, 4 ♀♀. Sumpra Bum, N'Chang Yang.

Calotes jerdoni Günther.

1935. *Calotes jerdoni*, Smith, *Fauna Brit. Ind.* II, p. 194.

13 ♀♀. Many localities in The Triangle.

Two specimens caught on February 16th were uniform dark crimson in colour, except for the scales on the chin and throat which were half green and half crimson. After death the colour changed rapidly to green on the upper parts, yellowish green below; lips brown, the fold in front of the shoulder brown, the spots on the elbows, knees and ankles yellow. Two others were light olive green when caught, and changed rapidly to dark red and then back again to green; the spots on the elbows, knees and ankles were white. Most of the specimens were caught upon low bushes.

A female caught on June 28th contained 7 eggs.

An examination of Mr. Kaulback's material shows that the differential characters by which *jerdoni* is separated from *maria*, namely the spinous ridges above the tympanum, the character of the gular scales and the number of scales round the body, cannot be relied upon. There is, in fact, little by which to distinguish the two, except the fold in front of the shoulder. This is always quite distinct in *jerdoni*, but in some specimens of *maria* I find it indicated. The characteristic spots on the elbows, knees and ankles are present in both. *C. maria* has so far been found only in the Khasi Hills, where *jerdoni* is also said to have been obtained. I am not quite satisfied, however, that the material of *jerdoni* in the British Museum really came from the Khasi Hills. Further investigation may show that the two should be united specifically, *maria*, the western form, being confined to Assam, and *jerdoni*, the eastern form, to Burma.

SCINCIDAE.

Lygosoma indicum Gray.

1935. *Lygosoma indicum*, Smith, *Fauna Brit. Ind.* II, p. 281.

10 specimens. Pangnamdim, Htingnan, Ningma, Htisyengyang, Ahke.

Lygosoma maculatum (Blyth).

1935. *Lygosoma maculatum*, Smith, *Fauna Brit. Ind.* II, p. 285.

2 specimens. Htisyengyang, Htingnan.

Tropidophorus berdmorei (Blyth).

1935. *Tropidophorus berdmorei*, Smith, *Fauna Brit. Ind.* II, p. 325.

1 specimen. Mahtum.

34 smooth scales round the body. The light transverse markings on the back are pale orange in life ; the belly and undersurface of the tail bright orange.

Not previously found in Burma north of Bhamo.

ANGUIDAE.

Ophisaurus gracilis (Gray).

1935. *Ophisaurus gracilis*, Smith, *Fauna Brit. Ind.* II, p. 393.

7 specimens. Matsatap, Goletutap, Hkunlum, Kajitu, N'Gumla. Underparts bright yellow in life.

VARANIDAE.

Varanus salvator (Laurenti).

1935. *Varanus salvator*, Smith, *Fauna Brit. Ind.* II, p. 406.

3 juvenile specimens. N'Chang Yang, Sumpra Bum.

The smallest of the three specimens, 130 mm. from snout to vent, has a series of bright yellow, narrow transverse stripes upon the back and base of the tail, alternating with other, less distinct ones, which are pale grey in colour.

SNAKES.

TYPHLOPIDAE.

Typhlops diardi diardi Schlegel.

6 ex., Sumpra Bum, Htingnan, N'Gumla, Pali Bum, N'Chang Yang. Scales in 26 or 28 rows at mid-body.

Four of the six specimens were caught on jungle paths after heavy rain.

DIPSADIDAE.

Pareas macularius Theobald.

1 ♂, 5 ♀♀. Htingnan, Numhkre.
♂. V 153, C. 48 ; ♀♀ V 159-165, C. 42-45.
The stomachs of two individuals contained slugs.

Pareas hamptoni (Boulenger).

3 ♀♀. Pangnamdim, Paira Ga.
V 181-194 ; C. 73-87.
In disposition they were quiet and inoffensive. Ventrals yellowish in life.

COLUBRIDAE.

Elaphe prasina (Blyth).

1 ♂, 4 ♀♀. Sumpra Bum, Htingnan, Mahtum.
♂, Scale-rows 19/19/17 ; V 199 ; C. 102 ; ♀♀, Scale-rows 19/19/15, except one which has 17/17/13 ; V 199-209 ; C. 98-107 One example has the prefrontals united.
Three of the specimens were caught among bamboos, two coiled up inside the nodes. In disposition they varied ; one was fierce and bit repeatedly when caught, another was gentle.

Elaphe taeniura Cope.

5 ♂♂, 6 ♀♀. 4 males and 5 females from Pangnamdim and Htingnan have a scale formula of 23/23/17 ; V 255-263 ; C. 96-102 (three with tails incomplete not included). One male from Sumpawng Mada has a formula of 19/19/17 ; V 231 ; C. 94. One female from N'Chang Yang has 19/19/17 ; V 249 ; C. 88.
One specimen was caught in the roof of a hut, another in a bamboo clump, the remainder in rice fields. One caught on July 23rd, contained 11 eggs. In disposition they varied. Some were fierce and bit repeatedly when handled, others were docile.

Elaphe cantoris (Boulenger).

2 ♂♂, 2 ♀♀. Pangnamdim. V. 226-235 ; C. 79-83+.
The largest specimen, a male, is considerably bigger than any previously recorded ; it measures 1960 mm. in total length, tail 335, not quite complete.
All were caught in thick jungle ; in disposition they were docile. One caught on July 28th contained 10 eggs.

Elaphe porphyracea porphyracea (Cantor).

2 ♂♂, 4 ♀♀. Pangnamdim, Tasah Ku, Htingnan, Mahtum.
V 207-214 ; C. 61-68.
Quiet and inoffensive in disposition, making no attempt to bite when handled.

Elaphe leonardi leonardi Wall.

1 ♂. Patsarlamdam. V. 221 ; C. 58+.

Grey above with black markings, some of the scales tinged with red ; ocellar centres grey ; ventrals yellow with black markings. In disposition quiet and easy to handle.

Elaphe mandarina (Cantor).

2 ♂♂, 3 ♀♀. Pangnamdim, Ahke.

V. 225-236 ; C. 70-79. Scale-rows 23 or 21 at mid-body ; loreal absent in all ; dorsal spots 28 to 30 in number on the body.

Caught in rice fields ; quiet and docile in disposition.

Ptyas korros (Schlegel).

2 ♂♂, 2 ♀♀. Mahtum, Ningma, Htingnan.

V. 180-184 ; C. 132-138.

One example was shot with an arrow while swimming across a stream.

Zaocys nigromarginatus (Blyth).

2 ♂♂, 3 ♀♀. Pangnamdim.

Scale-rows 14 or 16 at mid-body. V 201-206 ; C. 126-133.

A common snake at Pangnamdim. An excellent climber, often seen in trees and bushes. Four females caught in July contained 8, 8, 8, and 9 eggs respectively. Development had commenced, the embryos measuring between 12 and 24 mm. in length. A hatchling in life was coloured as follows :—top of head dark green, the scales edged with black ; supralabials yellow ; throat bluish-white ; lower parts greenish-white.

Liopeltis frenatus (Günther).

10 ♂♂, 12 ♀♀. Htingnan. V. 157-169 ; C. 87-100.

A common snake in the neighbourhood. Many of the specimens were caught inside bamboos ; in disposition they were very gentle. Three juveniles, with the egg shells from which they had emerged, were brought in on Jan. 28th, 1939. They measured 183-195 mm. in length, tail 50-54 mm.

Oligodon cinereus Günther.

(*Oligodon violaceus*, auct.)

1 ♂. Sinan Hka. V. 174 ; C. 36 ; 7 supralabials ; a subocular ; T. 1+2. The colouration is that of var. III of my Volume.

Oligodon catenata Blyth.

(*Oligodon herberti*,, auct.)

7 ♂♂, 3 ♀♀. Pangnamdim, Matsatap.

Males, V. 190-196 ; C. 38-43 ; females, V. 205-209 ; C. 37-39. One example has a loreal on the right side, another a loreal on both sides.

The largest specimen, a female, measures 580 mm. in total length, tail incomplete. One caught in July contained 3 eggs. Belly bright red in life.

All the specimens were caught in thick undergrowth. In disposition they were quiet and inoffensive.

Oligodon dorsalis (Gray).

1 ♂. N'Chang Yang. V 175; C. 40.

Ahaetulla cyanochloris (Wall).

2 ♂♂, 3 ♀♀. N'Chang Yang, Htingnan.

Males, V 180-189; C. 149; females, V 196-211; C. 135-141. There is considerable variation in the breadth of the vertebral scales, but they are always broader than those of scale-row I. One example has a well defined black flank stripe; in the others it is absent. In two examples the pale green of the belly is clearly marked off from the bronze colour of the back; in two others the belly is dark green and there is no line of demarcation. All were caught in low bushes or in bamboo clumps.

Chrysopelea ornata Shaw.

1 ♀; Mahtum. V 217; C. 107+.

The black dorsal cross-bars are very distinctly marked, as in specimens from Tongking.

Dinodon flavozonatum Pope.

3 ♂♂, 2 ♀♀. Pangnamdim, Mungdung, Renan. V 225-233; C. 87-89.

A fierce snake, biting viciously and holding on when handled. Cross-bars and underparts yellow in life. Not previously recorded west of Tongking.

Sibynophis collaris (Gray).

1 ♂, 7 ♀♀. Hkrang Hka, N'Gumla, Mawlayang, N'Chang Yang, Aliwang, Htingnan, Wadan.

V 173-181; C. ♂ 121, ♀♀ 98-112.

All the specimens were found in heavy jungle undergrowth. In disposition they were timid and inoffensive. One individual caught in June contained 6 eggs.

Natrix nuchalis (Boulenger).

1 ♂, 3 ♀♀, 10 juv. Pangnamdim, Ahke. V 156-160; C. 48-65.

Lips and underparts of some individuals pinkish in life. A shy, inoffensive snake.

Natrix venningi taronensis, subsp. nov.

5 ♂♂, 5 ♀♀. Pangnamdim and Aliwang in the valley of the Taron.

Type.—♂, Brit. Mus. 1940, 6. 1. 93, from Pangnamdim, V. 175; C. 94.

Differs from the typical form in having fewer caudal shields, 92-106 ; Ventrals 166-176. Dark greyish brown above, with an indistinct chequering of small squarish black spots ; lower parts mottled with black and yellow anteriorly, entirely black posteriorly.

The typical form occurs further south in Upper Burma and has a caudal count of 117-140.

Most of the specimens were caught in small mountain streams. One was eating a frog, another had eaten tadpoles. In disposition they were quiet and inoffensive.

Natrix parallela (Boulenger).

1 ♀. Pangnamdim. V. 170 ; C. 85.

Lower parts yellowish anteriorly, pinkish posteriorly.

Natrix khasiensis (Boulenger).

2 ♂♂, 1 ♀. Nawng Khai, Sumka Uma, Mahtum. V. 144-148 ; C. 95-97+.

Lower parts pale coral red in life.

The stomach of one individual contained insect remains.

Natrix piscator piscator (Schneider).

3 ♂♂, 3 ♀♀, 6 juv. N'Chang Yang.

V. 135-150 ; C. 83-92.

All the specimens in which the chequered pattern is discernible belong to the Indian form, and not to the Indo-Chinese.

Natrix percarinata (Boulenger).

1 ♀. Sumpra Bum. V 152 ; C. 70.

Caught on the banks of a stream.

Natrix himalayana (Günther).

4 ♂♂, 4 ♀♀, 2 juv. Pangnamdim, Htingnan, N'Chang Yang, Dinghputyang, Mahtum.

V. 169-178 ; C. 85-92.

Two specimens were caught *in copula* on July 24th. Another caught on July 7th contained 7 eggs.

Natrix subminiata helleri Schmidt.

1 ♂, 8 ♀♀. Putao, Htingnan, N'Chang Yang, Sumka Uma, Mahtum, Kajitu.

V 164-172 ; C. 81-91.

Three juveniles have the colouration of the typical form which inhabits the southern half of Indo-China. One female, caught on Jan. 10th, contained 11 eggs. A vicious snake, biting fiercely when provoked. When pursued they would sometimes turn at bay and attack with open mouth.

Pseudoxenodon macrops (Blyth).

6 ♂♂, 4 ♀♀. Pangnamdim, Mawndam, Sherawthu, Shenjung, Ratnamhti, Numhkre, Tara Hka.

V. 164-178 ; C. 62-74.

All the specimens were caught between Aug. 25th and Oct. 8th. Of the six males, four have strongly developed " knobbed " keels on the scales of the ischiadic region ; one is only half-grown. The other two, one adult, the other a juvenile, show no trace of " knobs "

Plagiopholis nuchalis (Boulenger).

1 ♂, 2 ♀♀. Dinghputyang, Mahtum. V 132-142 ; C. 23-27.

Lower parts pinkish in life. Quiet and inoffensive in disposition.

Blythia reticulata (Blyth).

2 ♂♂, 2 ♀♀. Htingnan, Sumpra Bum. V 131-135 ; C. 17-22+.

Found under logs and decaying vegetation. Quiet and gentle in disposition.

Boiga quincunciata Wall.

1 ♂, 1 ♀. Htingnan. V 247-253 ; C. 124-125.

Two specimens of this very beautiful snake, hitherto known only from three specimens. Both were found inside bamboos. They were sluggish in disposition, and did not resent being handled, perhaps owing to the cold as they were caught early in February.

Psammodynastes pulverulentus (Boie).

10 ♂♂, 3 ♀♀. Htingnan, Tasah Ku, Shagri Bum, Sumka Uma, Dinghputyang, Hkandau, Sumhpawng Mada, Mahtum.

V 165-176 ; C. 56-69.

Most of the specimens were caught in heavy jungle undergrowth.

Dryophis prasinus Boie.

6 ♂♂, 3 ♀♀. Sumpra Bum, Htingnan, N'Daw Yang, Sumka Uma, Uyawm Uka, Hkawng Ga.

V 196-206 ; C. 159-187.

" One caught on June 10th contained 7 eggs with transparent shells through which the embryos could clearly be seen moving. Average size of eggs 35×15 mm. ; length of embryo about 25 mm."

Elapidae.

Bungarus bungaroides (Cantor).

1 ♂, 1 ♀. Matsatap, Ahke. V. 229-230 ; C. 43-46.

The larger of the two specimens, a male, measures 1400 mm. in total length, tail 160 mm.

Naja naja kaouthia Lesson.

2 ♂♂, 2 ♀♀. Sumhpawng Mada, Mahtum, Kajitu, Sumpra Bum.

Scale formulae : ♂ 31/21/15 ; V 188 ; C. 55 ; ♂ 25/21/15 ; V 187 ; C. 53 ; ♀ 27/21/15 ; V 189 ; C. 54 ; ♀ 25/21/15 ; V. 191 ; C. 55+.

One example had eaten a bird, another a skink. The " monocle " on the hood is well marked in three individuals. The other, fully grown, is uniform brown in colour above without any markings.

Naja hannah Cantor.

1 ♂. Sumpra Bum. V. 243 ; C. 88.

VIPERIDAE.

Trimeresurus mucrosquamatus (Cantor).

1 ♂, 5 ♀♀. Pangnamdim. V. 203-214 ; C. 79-88.

All the specimens were caught in heavy jungle undergrowth. In disposition they were sluggish, and made but little attempt to escape when caught.

Trimeresurus monticola Günther.

4 ♂♂, 4 ♀♀. Pangnamdim, Adung Long, Naurayang Ga.

Males, V. 137-161 ; C. 54-59. Females, V 137-170 ; C. 47-48.

Subcaudals paired or single. One example from Adung Long is uniform yellowish below.

Five examples had eaten small mammals (rats or mice, not yet identified).

Trimeresurus jerdoni Günther.

3 ♂♂, 3 ♀♀. Pangnamdim, Mungdung, Renan, Patsarlamdam, Ahke.

V. 182-188 ; C. ♂ 67-78, ♀ 64-65.

Trimeresurus kaulbacki, sp. nov.

(Plate VIII, fig. 5.)

Types ♂ and ♀, Brit. Mus. 1940. 6.1.51-52.

Snout three times as long as the diameter of the eye ; upper head scales rather small, unequal, smooth, scarcely imbricate, those on the snout larger than those on the crown of the head ; supraoculars large, entire, 8-10 scales in a line between them ; internasals large, broader than long, in contact with one another, or separated by 1 or 2 scales ; 2 enlarged scales in a line between the internasals and supraoculars ; 8 supralabials, first entirely separated from the nasal, second forming the anterior border of the loreal pit, third largest ; anterior genials very large, followed by 5 or 6 pairs of smaller scales, the two series separated from one another by a deep mental groove ; no series of scales between the labials and the subocular ; temporal scales smooth, the series just above the labials being much larger than the others.

Scales in 25/25/19 or 17 rows, strongly keeled, except the outer one or two rows. V. ♂ 205, ♀ 204, C. ♂ 75+, ♀ 70, some of the anterior ones being single.

Hemipenis extending to the 14th caudal plate, forked opposite the 10th ; the distal half is calyculate, the proximal spinous, the spines in the area remote from the sulcus being much larger than those adjacent to it. Olive green above, with a series of dark, diamond-shaped or angular vertebral spots, which may be united to one another and form a zig-zag band ; sides with much smaller and less distinct spots, corresponding in position with the vertebral ones each vertebral spot covers from 12 to 20 scales, which are green at the centres and black at the edges ; lower parts grey, with large, squarish or semi-lunar yellow spots ; throat and anterior part of the body mostly whitish ; top of the head black with yellow longitudinal lines, one extending from the tip of the snout to between the eyes where it divides, the arms diverging and extending backwards to connect above the angle of the mouth with a line which passes backwards from the eye ; nape with 2 parallel longitudinal lines ; upper lip uniform yellow.

Total length ♂ 1340, tail 225 mm. ; ♀ 1390, tail 230 mm.

Paratypes :—10 more adults, all females, all from the type locality, agree closely with the above description. Some individuals have a complete series of small scales between the subocular and labials. V 204-212; C. 66-76.

36 juveniles, hatched out from three batches of eggs, differ slightly in colouration but not in morphological characters from the adults. They are pale greyish (light brown in life) above, and have the dark (reddish brown in life) dorsal markings edged with white ; lower parts black and white, the two colours in almost equal proportions ; lips and the whole of the lower jaw white (pink in life) with large black spots symmetrically arranged.

Trimeresurus kaulbacki is most nearly related to *T jerdoni* to which it bears a stong resemblance. It differs in the longer and narrower head, in the greater number of scales round the body, the greater number of ventrals and in colouration. The head markings, although of the same pattern, are more clearly defined, as also are the dorsal spots.

T jerdoni further is known to be viviparous whereas *T. kaulbacki* is oviparous.

Mr. Kaulback obtained three females on guard over their eggs. They were found in holes in the ground. With one mother were 6 eggs, with another 16, in two batches of 8 each, and with the third 32, in three batches of 12, 12 and 8. The embryos of the third " nest " were all fully developed and began to emerge from their envelopes on the same day. There is no reason to think, therefore, that they were the product of three different mothers. When born they averaged 260-270 mm. in length.

Trimeresurus albolabris Gray.

8 ♂♂, 8 ♀♀. Nog Mung, Htingnan, Mashaw Tingsa, Labu Ga, N'Chang Yang, Sumka Uma, Mahtum, Sumpra Bum.

Males V 159-166 ; C. 66-73. Females V 163-169 ; C. 53-60.

Trimeresurus stejnegeri Schmidt.

2 ♀♀. Ratnamhti. Scale formula 17/17/13 ; V 146-149 ; C. 59-60.

These specimens are provisionally referred to *T stejnegeri*, although normally that species has 19 scales at mid-body.

EXPLANATION OF PLATE VIII.

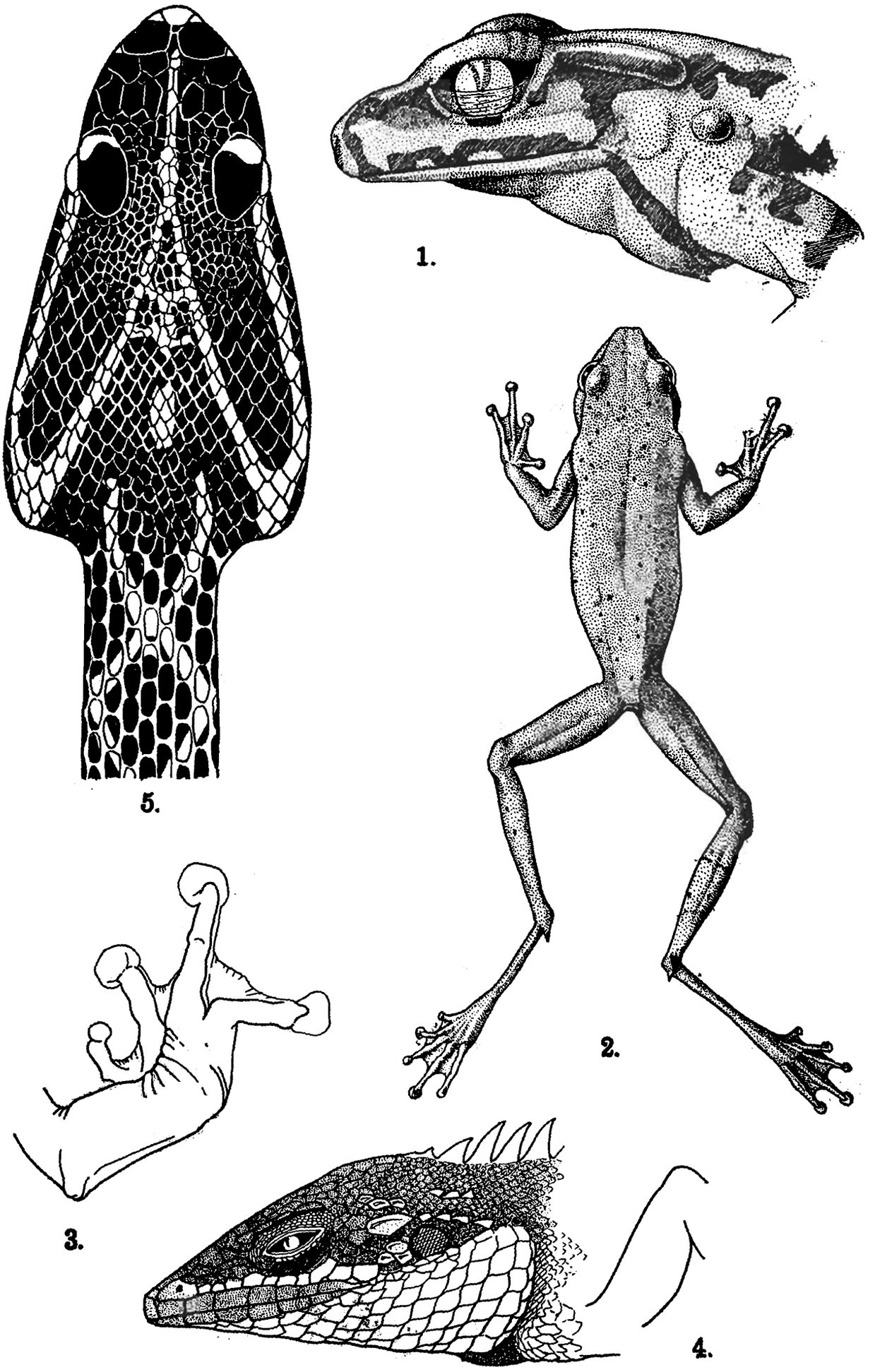
FIG. 1.—*Rana kaulbacki*, sp. nov., lateral view of head.

FIG. 2.—*Rhacophorus turpes*, sp. nov. ♂ type.

FIG. 3.—*Rhacophorus taronensis*, sp. nov., right hand.

FIG. 4.—*Japalura kaulbacki* Smith, ♂ lateral view of head.

FIG. 5.—*Trimeresurus kaulbacki*, sp. nov. ♀ type, dorsal view of head.



Upper Burma Amphibians and Reptiles.

INDIAN EARTHWORMS.

XIII. The genus *Moniligaster*.

By G. E. Gates, *Judson College, Rangoon, Burma.*

Contens.

Introduction.

Some years ago Dr. Wilhelm Michaelsen proposed to issue a taxonomic monograph on the earthworms somewhat along the lines of his volume on the Oligochaeta in *Das Tierreich* (volume X), but subsequently decided on a joint production by several authors. Among the groups assigned to the writer of the present article was the family Moniligastridae. Although the original project was abandoned because of the financial depression, work on the Moniligastridae has been carried on as opportunity arose and circumstances permitted. The preliminary work on this revision was to have been completed by examination of such types as are in European Museums while on leave of absence in 1940. This plan had to be abandoned as a result of the war. Only one portion of the work, namely, that on the genus *Moniligaster*, has been advanced to a stage to warrant publication. As there is little possibility of the completion of the work on the remainder of the family for some years to come, the section on *Moniligaster* is being included in the series on Indian genera.

All the specimens assigned to the genus, as well as those hitherto unidentified, have been studied except the one from Tiger Shola (possibly in the Hamburg Museum), the one formerly in the Cambridge University Museum (present whereabouts unknown), the several specimens from Ponmudi and Bonaccord in Travancore (if still in existence probably in the Hamburg Museum), and the type specimen of *M. deshayesi* (in the Paris Museum). As a rule inspection of types is necessary for a revision of the older species of earthworms, but as a result of Michaelsen's examination of the type and of Aiyer's work on the Travancore material further study of the type of *M.deshayesi* is probably unnecessary.

As previous work on Indian genera was based on limited material, several questions as to the taxonomic value of characteristics of certain structures remain unanswered. Although three species, including two new, are known only from aclitelate material, it is probable that the structures of taxonomic importance are sufficiently developed in them to enable recognition of specific characteristics.

During the course of earlier work on species of the closely related genus, *Drawida*, with a more extensive series of material it was found that the prostatic capsule has a characteristic shape which is not subject, as a rule, to appreciable intra-specific variation. Furthermore it was found that the relationship of the male deferent duct to the longitudinal musculature was also not subject to intra-specific variation. Assuming the characteristics of these two organs to be similarly valid as criteria of specific distinction in the genus *Moniligaster*, it has been possible to separate forms hitherto referred to two species into five species, and three new species have also been discovered. All the species, with one possible exception, are known only from very limited areas; the combined areas of all the species are also restricted.

The author's thanks are extended to Dr. B. Prashad for the opportunity of examining material in the Indian Museum, to Dr. F. H. Gravely for the opportunity of examining material in the Madras Museum, for information as to localities, and especially for arranging collections of earthworms to be made in several localities in South India, to Dr. Michaelsen for the loan of several specimens, to the Rev. Father Münch S. J. for collection of specimens in Shembaganur near Kodaikanal, and to Prof. K. S. P. Aiyer for information and for specimens which he himself had already recognized as belonging to an undescribed species.

Systematics.

Genus **Moniligaster** Perrier.

1872. *Moniligaster*, Perrier, *N. Arch. Mus. Paris*, VIII, p. 130. (Genotype *M. deshayesi* Perrier 1872.)
1889. *Moniligaster* (part), Vaillant, *Hist. Nat. Annel.* III, (1) p. 179. (Including only the genotype.)
1894. *Moniligaster* (part), Bourne, *Quart. J. Mic. Sci.* XXXVI, p. 359. (Including only the genotype.)
1895. *Moniligaster* (part), Beddard, *Monog.* p. 196. (Including only the genotype.)
1900. *Moniligaster*, Michaelsen, *Das Tier.* X, p. 112.
1909. *Moniligaster*, Michaelsen, *Mem. Ind. Mus.* I, p. 150.
1922. *Moniligaster*, Stephenson, *Proc. Zool. Soc. London*, 1922, p. 141.
1923. *Moniligaster*, Stephenson, *Oligochaeta*, in *Faun. Brit. Ind.*, p. 121.
1930. *Moniligaster*, Stephenson, *The Oligochaeta*, p. 814.

Diagnosis.—Bithecal, spermathecal pores transversely placed slits on 7/8 in region of *cd*. Male pores transversely placed slits on 10/11 in *bc*. Female pores minute, on 11/12 in or close to *ab*. Clitellum extends over x-xiii at least. Nephropores begin on iii, usually dislocated dorsally on vii, viii and xii[1], from xiii posteriorly in part and irregularly dislocated

[1] Further information is needed with regard to dorsal dislocation of pores on vii, viii and xii in *gravelyi*. For the present, types of *gravelyi* are regarded as slightly aberrant individuals with respect to a tendency which seems to be fairly uniform throughout the genus, the aberration being a retention of or reversion to an ancestral condition.

dorsally or ventrally to *ab*, functional pores present on x. Body-wall thickened laterally. Pigmentation blue. Gizzards four to six, in successive segments in region of xiii-xxiii. Intestine begins in region of xxv-xxxii. Last hearts in ix. Testis sacs in 9/10. Vas deferens long and looped, an ental portion slender. Prostatic duct 2-4 mm. long and more or less bulbous ectally. Segment xi reduced to a horseshoe-shaped ovarian chamber. One (?) or two atrial glands associated with each spermatheca, each gland branched in a more or less regularly dichotomous fashion, the branches and terminal tubules closely compacted into an ellipsoidal to disc-shaped body with mamillated surface.

Distribution.—Western portion of southernmost part of Indian Peninsula; Travancore and Cochin, British Indian area of Courtallam in Tinnevelly District, Palni and Nilgiri Hills, and Tirumalai Hills (Chittoor district, Madras Presidency). The significance of the single record from the Tirumalai Hills is unknown. Even if the Tirumalais represent its northern limit the *Moniligaster* area is small, the north-south extent being less than that of the *Hoplochaetella* area.

Remarks.—Several characteristics that could have been included in the generic definition as applicable to all known species of the genus have been omitted as there is evidence to indicate that these apply equally to all other Moniligastrid genera[1]. Among these are the following: prostomium prolobus and attached to the roof of the buccal cavity at or behind the region of 1/2; setae lumbricine and paired; dorsal pores lacking; clitellum annular, male and female pores included; reproductive apertures on or close to inter-segmental furrows, spermathecal and male pores anterior to female pores in the order named; gizzards oesophageal but posterior to the ovarian segment, closely crowded, low but lamelliform ridges in a post-gizzard portion of the oesophagus, possibly containing tissues with the function of a calciferous gland, paired entero-segmental organs on an anterior portion of the post-gizzard section of the gut, absence of a typhlosole; location of the last pair of hearts in the segment next but one in front of the ovarian chamber (or ovarian segment if not reduced to a chamber), the single dorsal blood vessel, lateral hearts, paired extra-oesophageal vessels lateral to the hearts and opening posteriorly into a sub-neural trunk; mega-nephric excretory organs with very small pre-septal funnels; testes in paired, dorsal sacs suspended in an inter-segmental septum (or in two successive septa as in *Desmogaster*), much elongated male deferent ducts opening through capsular prostates to exterior on or close to inter-segmental furrow behind that corresponding to septum bearing testis sacs, presence of paired longitudinally placed ovisacs which are outgrowths dorsal to the posterior wall of the ovarian segment or chamber, spermathecal ducts slender and coiled, spermathecal ampullae attached dorsally to the posterior face of a septum (or septa).

Pigment when present in species of *Moniligaster* is always blue, located in the circular muscle layer. This pigment can be completely

[1] As has already been pointed out elsewhere the Syngenodrilinae must be excluded from the family Moniligastridae. A discussion of the problem of Syngenodrilin relationships so far as the Moniligastridae are concerned has been prepared and will be published later.

bleached out by preservation in alcohol. It is therefore quite possible that in those forms in which the colour is unknown, blue pigment may also have been present. Clitellar colouration seems to be characteristically red or light yellowish in each species but further information is needed as to the appearance in life and post-mortem changes that may occur in alcohol or formalin.

Relative widths of the major inter-setal intervals have been regarded in the past as of systematic importance. So far as can be determined from the rather limited material available, variation in widths of these intervals relative to each other is so great as to prevent its use in taxonomic work on species of *Moniligaster* at least.

A glance at the specific diagnoses will be sufficient to indicate the necessity, at least for the present, of dissection of worms in determination of specific identity.

In 37 specimens in which the location of gizzards was recorded, there are four to six gizzards as follows: four gizzards 21 specimens, five gizzards 12 specimens, six gizzards 4 specimens. Segmental locations of gizzards will probably prove to be of little, if any, taxonomic value in this genus at least, as a result of intra-specific variation.

In the Moniligastridae, gizzards have hitherto been regarded as intestinal, but this is incorrect. The cuticular lining of the oesophagus is continued through the gizzards into a post-gizzard portion of the gut which has closely crowded, low, lamelliform ridges as in the calciferous portion of the oesophagus in species of *Pheretima*, and which opens into the intestine proper through a valve as in the Megascolecidae and other earthworms. Unfortunately in many of the specimens examined the valve is distended by the soil on which the worm feeds while the intestine itself may be deeply contracted or constricted so as to have somewhat the appearance of a valve or even of a pre-valvular portion of the oesophagus. In these circumstances recognition of boundaries, especially in those individuals in which the gut is macerated, is difficult if not impossible. The segment of intestinal origin appears at present to be characteristic but much more information with regard to this matter is needed.

All species of *Moniligaster*, and probably other Moniligastrid genera as well, are characterised by the presence of a pair of longitudinal blood vessels which run on or close to the ventral parietes from the anterior most portion of the body to a region behind the ovarian chamber where they gradually decrease in size and disappear from sight, with asymmetrical connectives in the region of the ovarian segment to the sub-neural trunk. Judging from the appearance in some specimens, it might be more accurate to describe this system as composed of a longitudinal vessel on each side which opens into the sub-neural trunk, a short posterior parietal vessel opening into the anterior trunk as it turns mesially to join the sub-neural. Although opening into the sub-neural trunk much as in *Pheretima* and certain other genera, the trunks in Moniligastrids are not, except perhaps in the pharyngeal region, in contact with or even close to the oesophagus, and furthermore are lateral to the hearts. These trunks have been referred to as extra-oesophageals which may perhaps be unfortunate in view of the lack

of information regarding the origin or function of these trunks as in the extra-oesophageals of Megascolecid or Lumbricid worms. In view of this past usage, and to avoid invention of an inapt term for the Moniligastrid trunks the use of " extra-oesophageal " will be retained until such time as studies of the method of development or of the function in circulation of the blood have indicated the nature of these vessels.

For specific identification in this genus not only is a dissection necessary but the external glandular layer must be carefully removed from the prostatic capsule as the conformation of the capsule appears at present to be the only important criterion of specific identity, and characteristic shapes may be concealed from view by the outer glandular layer. Condition of the capsule appears to be variable. In some worms the capsule is definitely muscular while in other individuals of the same species the capsule is composed of brittle, almost transparent material. Possibly we have here to do with a cyclic sexual change in structure. Of less importance but still essential, especially in the case of new species, is a determination of the relationship of the male deferent duct to the longitudinal muscular layer (*i.e.*, whether or not the vas passes underneath the longitudinal muscle in x prior to its junction with the prostate)

In a thin-walled chamber within an ectal portion of the prostatic duct there may be a copulatory structure in then ature of a penis. In one species this appears to be a definite organ (not temporary as when formed by eversion of an ectal portion of the duct or of an invagination), protrusible to the exterior and with a thick muscular wall. In another species only a low annulus was found. In other species an ectal chamber is apparently not marked off, and there is no definite penis though an ectal portion of the duct may be everted to function as a temporary penis. In view of the possibility of these structures being of some taxonomic importance, studies of the male genital terminalia are desirable.

As a result of immaturity of types and lack of sufficient material it has not been possible to determine whether a species has only one atrial gland, or if the two distinct glands of the juvenile stage are merely enclosed in a common sheath. Even if this distinction does not appear to be of very great importance further information should be accumulated, especially in view of the limited number of criteria now available for specific identification.

The only difference between *Moniligaster* and *Drawida* is the presence in the former of branched glands on the spermathecal atria. In view of the close relationship indicated by this similarity Michaelsen (1908, p. 137) suggested that " It might even be justifiable to unite these two genera, to include the genus *Drawida* without restriction in a genus *Moniligaster sensu lato*, or to regard *Moniligaster sensu stricto* and *Drawida* as sub-genera of a genus *Moniligaster sensu lato* " In the absence of evidence to indicate a diphyletic or polyphyletic origin of the *Moniligaster* group, generic status may as well be retained for the present, if only for reasons of convenience. (*Vide* Stephenson 1930 pp. 908, 909).

Attention has already been directed in previous articles to the necessity for caution in the identification of immature individuals of *Drawida*,

and such caution is even more necessary in the identification of Moniligastrids from the *Moniligaster* area where worms still generically unrecognizable (unless sectioned, and possibly, even then indeterminable) may reach a fairly large size. In this connection the question may be raised if some of Bourne's species of doubtful status have not been mistakenly transferred to *Drawida*.

According to Michaelsen (1908, p. 137), *Moniligaster* has been derived from *Drawida* by the development on each lobe of a bifid spermathecal atrium similar to that found in certain South Indian species such as *D. ghatensis* Michaelsen, 1910 or *D. robusta* (Bourne, 1886), of a characteristic branched gland. At present this does not seem to be impossible, and it may be noted that at least the two species just mentioned have functional nephridia in x as determined by the presence of open nephropores[1]. Stephenson (1922, p. 141) disagreed with Michaelsen's derivation and preferred " to read the series if indeed it is a series in the reverse direction ", deriving *Drawida* from *Moniligaster* by reduction in size and eventual disappearance of the glands and atrium. In this connection it may be noted that those species of *Drawida* with a bilobed spermathecal atrium in shape much like that of the common atrial duct and individual gland ducts of *Moniligaster* were not regarded by Stephenson as primitive. On the contrary those species of *Drawida* which he considered to be the most primitive have a simple (*i.e.*, not bifid) spermathecal atrium. The zoogeographical distribution of the Moniligastrids as known to-day certainly seems to be more in accord with Michaelsen's than with Stephenson's derivation.

Key to species of Moniligaster.

1. *a.*	Vas deferens penetrates into longitudinal muscle layer prior to junction with prostate ..	2.
b.	Vas deferens passes directly into prostate without penetrating into longitudinal muscle layer ..	4.
2. *a.*	Outer (coelomic) glandular layer covers prostatic capsule ; capsule not flattened latero-mesially	3.
b.	Outer glandular layer not covering prostatic capsule, and lacking mesially and laterally ; capsule flattened latero-mesially	*M. stephensoni.*
3. *a.*	Prostatic capsule spheroidal ..	*M. aiyeri.*
b.	Prostatic capsule ovoidal to anvil-shaped	*M. horsti.*
4. *a.*	Spermathecal atria confined to vii	5.
b.	Spermathecal atria in vii and viii	6.
5. *a.*	Leaflets present on vas deferens, thickened portion of vas short ..	*M. deshayesi.*
b.	Leaflets lacking, thickened portion of vas long	*M. gravelyi.*
6. *a.*	Prostate and duct bound to parietes in a C-shaped figure, capsule ovoidal	*M. michaelseni.*
b.	Prostate and duct not so bound to parietes, capsule not ovoidal	7.
7. *a.*	Prostatic capsule reniform, not nodulated ..	*M. perrieri.*
b.	Prostatic capsule shortly tubular and U-shaped, with irregularly placed nodulations	*M. beddardi.*

[1] In numerous species of *Drawida* nephropores are closed with sexual maturity, if not before, and the nephridia become reduced in size, or disappear.

Moniligaster aiyeri, sp. nov.

Material examined.—From Prof. K. S. P. Aiyer: 1 clitellate specimen labelled, "*Moniligaster* species, to be described. Muthukkuzhi, Travancore, 4,000 ft.", and 3 dissected anterior fragments of aclitellate specimens presumably from the same locality.

External characteristics.—Length 456 mm. Diameter 13 mm. Number of segments, *ca.* 310. Pigmentation unrecognizable (alcoholic preservation). The body wall is slightly thickened laterally. In sections the thickening is recognizable only in the circular muscle layer, the thickened region extending from slightly below *c* well into *dd*, the distance from *d* definitely greater than *bc*. The body is shortly elliptical in cross section behind the clitellar region. The prostomium is prolobous.

Setae are small but black and readily recognizable, closely paired, the lateral couples slightly more so than the ventral; on xix-xx, *aa* and *bc* about equal (2) or *aa* slightly smaller than *bc* (2). On the type only *a* and *b* of the right side are visible on ii, while the lateral couple is unrecognizable or lacking on the left side of iii.

Nephropores begin on iii and from xiii posteriorly may be dislocated dorsally or ventrally to *ab* but quite irregularly as follows: dorsally, vii, viii, xii, xiii-xiv-right, xv, xvii-left, xix-left, xxi-right, xxiii-xxiv-left, xxvii, xxix-right, xxxii-right, xxxiv-right, xxxv-left, xxxvi-left, ventrally, xiii-left, xiv-left, xvi-right, xviii-left, xxii-left, xxiv-right, xxv, xxvi-right, xxx-right, xxxi-right, xxxii-left (type); dorsally, vii, viii, xii, xviii-left, xix-right, xxiii-right, xxvi-left, xxix, xxx-right, xxxii-left, xxxiii-left, xlii, xliii-right, xliv-right, xlvi-left, ventrally, xiii-right, xxi, xxiv-left, xxvii-left, xxx-left, xxxi-right, xxxiv-right, xxxvii-left, xl-right, xlvi-right; dorsally, vii, viii, xii, xiii-right, xv-xvi-left, xvii, xix-right, xx-left, xxiii-right, xxvi-right, ventrally, xiv-left, xvi-right, xxii-xxiv-left; dorsally, vii, viii, xii, xiv-left, xix-right, xxii-left, xxiii, right, xxxiii-left, xxxv-xxxvi-right, xxxvii-xxxix-left, xli-right, xliv ventrally, xiv-right, xviii, xix-left, xxiv-left, xxv-right, xxxii-left, xxxiii-right, xxxiv-left, xxxix-right, xlv-right. Nephropores of x are functional.

The clitellum is annular, extending across x-xiii and slightly on to xiv, clitellar colouration light yellow. The epidermis of x-xiii is markedly thickened, of xiv and probably also of ix slightly thickened.

Spermathecal pores are transversely placed slits on 7/8 in the region of *cd*, the margins of the apertures tumescent and slightly wrinkled. Removal of the atrial duct from the parietes leaves an aperture in the epidermis about as large as that left by removal of the prostatic duct in the same way.

Male pores are transversely placed elliptical apertures on 10/11 with median margins slightly nearer to *b* than the lateral margins are to *c*. Through each aperture of the type there is protuberant to the exterior an antero-posteriorly flattened, soft, penis-like structure with a transversely slit-like aperture on the ventral face. Removal of the prostatic duct from the parietes leaves an elliptical opening in the epidermis about two mm. wide. In the paratypes the protuberance may be lacking and when present is variable as to shape and location of the pore.

Female pores are minute, on 11/12, on *b*.

No genital markings.

Internal anatomy.—None of the septa is thickly muscular, 6/7-8/9 strengthened but transparent or translucent.

Gizzards are in xvi-xxi (type), xvii-xx (1), xvii-xxi with some special muscularity in xvi and xxii (1), xviii-xxiii (1). The post-gizzard portion of the oesophagus extends through nine or ten segments, the (calciferous ?) ridges longitudinal, regularly zig-zagged. A definite valve is present. Intestine begins in xxxi (1) or xxxii (1). Entero-segmental organs are quite large in xxiv-xxx (type) but gradually decrease in size from xxx posteriorly. No typhlosole.

The vascular system is much like that of *M. deshayesi* except that the anterior commissures arise from the extra-oesophageals just behind 8/9 and passing through 8/9 open into the hearts of ix just lateral to the median plane. The hearts of viii unite just above the dorsal level of the gut and from the median region a single, short vessel passes up to open through the ventral face into the dorsal trunk (relationships of hearts of viii and anterior commissures in this species the same as of the hearts of ix and the posterior commissures of *M. deshayesi*). The subneural passes forwards to a point just in front of the subpharyngeal ganglia. Nephridia are present in x.

One or both testis sacs dislocated posteriorly under the ovarian chamber. Septum 9/10 is attached to the equator of the testis sac but no constriction is recognizable. The entalmost portion of the vas, about 5 mm. long is rather thick, the next 100 mm. relatively slender and just underneath the testis sac in a cluster of hair-pin loops part of which may be in x. The next portion of the vas is much thicker, 1210 mm. long, looped, the cluster of loops entirely in ix and larger than the testis sac. Emerging from this cluster the vas passes (twice ?) around the heart of ix, through 9/10 and into the longitudinal musculature, passing laterally under a wide but thin band of muscle (4 specimens), emerging again into the coelomic cavity and passing straight upwards into the prostate through a vertical cleft in the glandular layer on the anterior face. The prostates are mushroom-shaped, the diameter of the spheroidal head slightly less than, or about as great as, the length of the duct. The approximately spheroidal capsule is muscular, thick, opaque and lined internally with a white material which is raised into irregular ridges which considerably reduce the size of the lumen. The duct is 3-4 mm. long, with thick neck and slightly bulbous ectal portion concealed from view by strong muscle bands, the wall thickly muscular, the lumen slit-like in cross section and usually nearer the median side. On the wall of the passage are several vertical ridges of which two are especially large and close together. The wall of the ectal chamber is thin, in the paratypes the lumen is practically filled by a short, thick penis which is circular in cross section and with a wall mainly of circular muscle.

The spermathecal duct is 20 mm. long and apparently passes into the base of the posterior atrial gland, but after removal of connective tissue the duct can be traced on to the median face of the common duct.

Two atrial glands with the usual mammillate surface, one on each side in vii, and the other in viii, the posterior about 9 mm. long, and the anterior about 7 mm. long. Ectally the two glands appear to be united but can be separated after removal of the investing tissues. The common duct of the atrial glands is thick (2-2½ mm. antero-posteriorly, flattened latero-mesially), short (height from parietes 1-1½ mm.), the ental bifurcations (individual ducts of the glands) very short and only recognizable after removal of basal portions of the glands (*vide* fig. 1, which shows a similar type of duct). Within the atrial duct and attached broadly by a dorsal base is a rather conical, soft and wrinkled structure the ventral tip of which is barely visible through the spermathecal pore after separation of the margins. On the conical protuberance there are several vertical fissures one of which is deeper than the others and contains at its upper end, near the bifurcation of the duct, a minute pore which may be the opening of the spermathecal duct. The lumen of the atrial duct is large, its wall with several, low, vertical ridges.

Segment xi is closed off to form a horse-shoe-shaped ovarian chamber. Ovisacs extends into xvi or xvii, and have a thick wall. The lumen is filled with a yellowish coagulum in which no ova are recognizable. A few free ova are present in the ovarian chamber. The type has certainly not reached the climax of sexual development, and is probably post-sexual.

Remarks.—It was impossible to determine the segmental location of the atrial glands in the dissected paratypes, but Prof. Aiyer was kind enough to write that he had noted from one of his dissections that both glands were in vii on the right side while on the left side the glands were separated from each other by 7/8. The little evidence available indicates that the glands are usually separated by 7/8.

Brown discs are present in coelomic cavities of anterior segments in two specimens.

M. aiyeri belongs to a hitherto unrecognized group of species in which the vas deferens, prior to junction with the prostate, penetrates into the longitudinal muscle layer, and is distinguished from other species in that group by the characteristic prostates.

Diagnosis.—Male pores with centres nearer *b*. Pigmentation ? Clitellum light yellowish. Length 456 mm. Diameter 13 mm.

Gizzards in xvi-xxiii. Intestine begins in xxxi (±1 ?). One or both testis sacs dislocated posteriorly under ovarian chamber. Vas deferens very long (1,300 mm.), loops of slender portion in ix and x, thickened portion in a cluster of loops in ix which is larger than the testis sac, passing laterally in x underneath a band of longitudinal musculature and then emerging to pass into the anterior face of prostate. Prostates mushroom-shaped, thickness of head and length of duct about equal length of gland and duct 6-8 mm., capsule spheroidal. Atrial glands usually in vii and viii, common atrial duct thick and short.

Distribution.—Known only from the type locality, Muthukkuzhi, Travancore, at 4,000 feet.

Moniligaster beddardi, sp. nov.

1924. *Moniligaster perrieri* (part), Stephenson, *Rec. Ind. Mus.* XXVI, p. 322. (Excluding all except specimens from Kodaikanal referred to below.)

Material examined.—From the Indian Museum : 4 small juveniles, 1 aclitellate and 4 clitellate (1 dissected) specimens labelled, " *Moniligaster perrieri* Michaelsen. Kodaikanal, 6,900-7,200 ft. Palni Hills, S. India. Aug. 1922. Dr. S. W. Kemp. W 707/1." From the Rev. Father Münch S. J. : 1 aclitellate anterior fragment labelled, " Shembaganur, Madura district. 25th September 1936."

External characteristics.—Length 320-347 mm. Diameter 14-16 mm. The aclitellate Kodaikanal specimen is 270 mm. long and 9 mm. thick, the diameter of the Shembaganur fragment 11 mm. Pigmentation blue, dense, restricted to the dorsum except anterior to the clitellum and on one specimen at the hind end, the pigmented portion rather sharply demarcated with boundary close to region of *cd*. The pigment of the circular muscle layer is unrecognizable in sections through the ventrum. The body wall is thickened laterally beginning some distance behind the clitellum though this thickening is not always recognizable. In one specimen the body wall in *dd* is thicker than in *cc*. In an anterior region extending to some distance behind the clitellum the body is almost circular to shortly elliptical in cross section. Posteriorly the body is markedly flattened dorso-ventrally and elongately elliptical in cross section. The prostomium is of the usual Moniligastrid prolobous type.

Setae are small, closely paired, deeply retracted in the anterior portion of the body when they are invisible or only occasionally recognizable. Behind the clitellum the relative widths of the major inter-setal intervals are variable ; on the Kodaikanal aclitellate specimen *bc* is one half mm. wider than *aa* while on the Shembaganur fragment *aa* is one half to one mm. wider than *bc*.

Nephropores begin on iii and are functional on x, on vii, viii and xii usually dislocated dorsally, behind xii irregularly dislocated dorsally or ventrally to *ab*. On one clitellate specimen the pores of vii are dislocated only slightly or not at all, the left pore of vii of another specimen in *cd*. On the Shembaganur fragment dislocations are as follows : dorsal, vii, viii, xii, xx, xxii, lxix on the right side, vii, viii, xii, xviii, xxvi, xxvii, xxix, xxxv, xli on the left side ; to *ab*, xxxv, xl, xlv, lxii, lxx, lxxix, lxxxvi, xciii, xciv, cviii on the right side, xxii, xxx, xxxiv, xxxvi, xxxix, xliv, xlv, lx-lxv, lxxiii, lxxv, lxxxiv-lxxxvi, lxxxix, xc, xcvii, ci, cv, cxi, on the left side.

The clitellum is on x-xiii, annular, and of a creamy yellow colour. Blue pigment is present in the circular muscle layer of the clitellar segments, at least dorsally, but is unrecognizable externally because of the thickness of the clitellar epidermis.

Spermathecal pores are transversely placed slits on 7/8, in the region of *cd*, about as large as the male pores.

Male pores are transversely placed slits on 10/11, in the median half of *bc*, or perhaps reaching slightly lateral to mid *bc* on some of the Kodaikanal specimens.

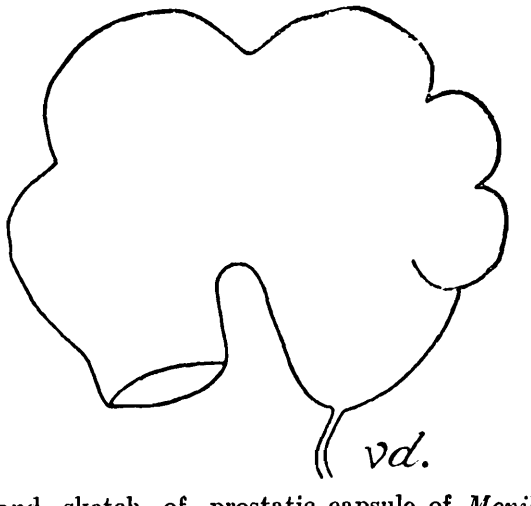
Female pores were not actually seen but are probably on 11/12, in or close to *ab*.

Internal anatomy.—Septa 5/6-8/9 are strengthened with muscular fibres but are translucent; a variable number of post-gizzard septa muscular.

The inner wall of the oesophagus in the region of vi-xii is provided with irregular, low and rounded, longitudinal ridges. The gizzards are in xv-xix, xvi-xx, xvii-xxi, xviii-xxi, xviii-xxii, or in xix-xxii. The inner wall of the oesophagus in most of the post-gizzard portion, except at the mid-ventral and mid-dorsal lines is provided with rather irregular, low, lamelliform, vertical, white ridges. The intestine begins in xxxi (specimen with gizzards in xvii-xxi). No typhlosole (2 specimens). Contents of the gut are black. Entero-segmental organs are present as usual.

Hearts are present in vi-ix and are median to the extra-oesophageal trunks. Paired commissures from the extra-oesophageals are present on the posterior faces of 8/9 and 9/10. The sub-neural is recognizable anteriorly to a point slightly in front of the sub-pharyngeal ganglia. Nephridia are present in x.

The testis sacs at first appear to be entirely in x but an anterior portion of each sac is contained within a posteriorly directed pocket of 9/10, the sacs unconstricted by the septum. The vas deferens is looped in a hair-pin fashion, some of the loops 3 mm. long, the loops in the pocket of 9/10 and on the anterior face of the septum forming a cluster that may be as large as or even larger than the testis sac, the heart of ix passing through the ventral portion of the cluster. An ental portion 46 mm. long is slender, followed by a slightly thicker region 16 mm. long, the widened portion 490 mm. long (measurements without stretching or straightening out some of the kinks at apices of the loops). Emerging into x the vas is close to but not in contact with the ventral parietes to which it is connected by transparent tissue, sinuous but not looped, then passing straight upwards to the ventrally directed anterior end of the prostate. In two specimens a fairly wide strand with strong muscular appearance passes across the ventral por-



TEXT-FIG. 1. Free hand sketch of prostatic capsule of *Moniligaster beddardi* after removal of external glandular layer. Nodulations on external surface not shown. *vd.*, vas deferens.

tion of the vas in x so that the vas appears at first glance to be within the parietes, but the strand appears to be diagonal and the vas is not

actually in contact with the ventral parietes. The prostate at first appears to be latero-mesially flattened and of a reniform type like that of *M. perrieri*, but removal of the external glandular layer discloses a quite different and characteristic shape. The capsule (text-fig. 1) is short U-shaped, the ventrally directed limbs almost in contact, the duct passing into the ventral end of the posterior limb, the vas into the anterior limb. The U-shape is not regular as the result of development of slight bulges or lobes (nodulations) which are most obvious on the capsules of the previously dissected specimen. If straightened out the capsule would be a somewhat irregular tube probably 5 mm. or slightly less in length. The capsule is muscular and lined internally with a layer of soft white material raised into several fairly high ridges. The coelomic portion of the duct is probably about 2 mm. long but is bound to the parietes by diagonal muscle strands, and is far from being as conspicuously protuberant into the cavity as in *M. perrieri*. The duct is bulbous ectally but the neck region is thicker than in *M. perrieri* and about as thick as the posterior limb of the prostatic capsule excluding the external glandular layer. In the neck the lumen is small, widened ectally and irregular as a result of the presence of longitudinal ridges. Within the parietes the lumen is of about the same width as the male aperture but is abruptly widened just above the level of the ventral parietes. This chamber is shut off from the wide lumen of the ental part of the bulb by a horizontal partition. At the centre of the ventral face of the partition is a small aperture into the more ental chamber of the bulb and around this aperture is a ring of tissue which in the previously dissected specimen is so high as to form a definite, rather short, conical, thick penis.

The spermathecal duct is 22 mm. long. The atrial glands are in vii and viii (each specimen), each gland a rather flattened disc of elliptical outline, about 6 mm. long, bound down around and concealing from view its own duct. The coelomic portion of the common atrial duct is fairly stout, thickened entally, the inner lining ridged, a circular ridge around a tiny tubercle which bears the aperture of the spermathecal duct.

Segment xi is reduced to a horse-shoe-shaped ovarian chamber. Ovisacs may extend as far back as xvii but are usually turned upwards in xii or xiii.

Remarks.—None of the clitellate worms is sexual, free ova lacking in the ovarian chamber and ovisacs, though ovaries may be large. Ovisacs may be yellowish or reddish but appear to be contracted, the lumen of the sac filled with a felted mass of white fibres in the interstices of which there may be particles of yellowish debris but no free ova (a few free ova in sacs of previously dissected specimen ?). The female funnel is represented by a marked thickening of the posterior wall of the ovarian chamber in the form of a vertically placed disc about 5 mm. high with irregular, low but thick, rounded ridges. Ventrally the median margin of the disc is folded over laterally so that only a small ventral portion of the disc is really funnel-like.

In one of the smaller juveniles the spermathecal atria and prostates are just barely protuberant into the coelomic cavities above the parietal

level. The vas deferens does not pass into the parietes. Gizzards are in xiii-xvii. Identification of immature juveniles is at present impossible.

One of the clitellate worms is an anterior fragment. A small terminal portion of each of the other clitellate specimens is unpigmented, almost triangular in outline dorsally and ventrally, with anus at the pointed tip, and is of about ten segments. These short portions appear to be regenerates.

The dissection was completed in the specimen opened by Stephenson. The aclitellate and clitellate specimens were opened, and one prostatic capsule of each examined.

M. beddardi is distinguished from *M. perrieri* by the characteristic U-shaped and lobed prostatic capsule, the larger size, and possibly also by the restriction of pigmentation to the dorsum, and from *M. michaelseni* sp. nov. by the shape and lobing of the prostatic capsule, vertical erection of prostate into the coelomic cavity (not bound to parietes) and possibly also by the absence of red colour in the clitellum. (As all types of *M. beddardi*, *M. michaelseni*, and of *M. aiyeri* have been preserved for some time in alcohol the differences in clitellar colouration appear to be characteristic.)

Diagnosis.—Male pores in median half (?) of *bc*. Pigmentation restricted to dorsum. Clitellum light yellowish. Length 320-347 mm. Diameter 14-16 mm.

Gizzards in xv-xxii. Intestine begins in xxxi (± ?). Vas deferens long (550 mm.), loops of slender portion in a posteriorly directed pocket of 9/10, loops of thickened portion in a vertical cluster in the pocket and on anterior face of 9/10, passing directly into the anterior end of the prostate. Prostatic capsule tubular, *ca.* 5 mm. long, about as thick as neck of duct, bent into a short U-shaped, vertically placed figure with ends of limbs ventrally; surface with several low, rounded nodulations; duct bound to parietes. Atrial glands in vii and viii, common atrial duct rather stout and thickened entally.

Distribution.—Kodaikanal and Shembaganur, Palni Hills at elevations of 6,500 to 7,200 feet. (Shembaganur is said to be 500 feet below Kodaikanal.)

Moniligaster deshayesi Perrier.

1872. *Moniligaster deshayesi* Perrier, *N. Arch. Mus. Paris* VIII, p. 130. (Type locality unknown. Originally supposed to have been in Ceylon. Type in the Paris Museum.)
1889. *Moniligaster Deshayesi*, Vaillant, *Hist. Nat. Annel.* III, (1), p. 180.
1894. *Moniligaster deshayesi*, Bourne, *Quart. Jour. Mic. Sci.* XXXVI, p. 373. (Diagnosis.)
1895. *Moniligaster deshayesi*, Beddard, *Monog.* p. 199.
1897. *Moniligaster deshayesi*, Michaelsen, *Mitt. Mus. Hamburg* XIV, pp. 6 and 11.
1900. *Moniligaster deshayesi*, Michaelsen, *Das Tier.* X, p. 112.
1903. *Moniligaster Deshayesi*, Michaelsen, *Die Geogr. Verbr. Olig.* p. 65.
1909. *Moniligaster deshayesi*, Michaelsen, *Mem. Ind. Mus.* I, pp. 107, 136 and 149. (After examination of type.)
1910. *Moniligaster Deshayesi*, Michaelsen, *Abh. Nat. Ver. Hamburg* XIX, (5), pp. 9 and 54.
1911. *Moniligaster deshayesi*, Cognetti, *Ann. Mag. Nat. Hist.* (8) VII, p. 494.
1913. *Moniligaster deshayesi var. minor*, Michaelsen, *Mitt. Mus. Hamburg* XXX, p. 78. (Type locality Chimungi, Travancore. Types in the Hamburg Museum.)

1923. *Moniligaster deshayesi* (part), Stephenson, *Oligochaeta* in *Faun. Brit. Ind.*, p. 121. (Excluding *M. deshayesi* Stephenson 1915.)
1926. *Moniligaster deshayesi*, Stephenson, *Rec. Ind. Mus.* XXVIII, p. 250.
1929. *Moniligaster deshayesi* + *D. travancorensis* (*part*, 2 specimens from Tenmalai), Aiyer, *Rec. Ind. Mus.* XXXI, pp. 44 and 49.

Material examined.—From Prof. K. S. P. Aiyer ; 4 aclitellate specimens labelled, "*Moniligaster deshayesi*. Tenmalai. Aug. 1936.", and two juveniles (undissected) labelled, "*D. travancorensis* Mich. Tenmalai. 11th September 1926 ". From the Madras Museum : 1 aclitellate, dissected specimen labelled, "*Moniligaster deshayesi* E. Perrier. Nedumangad, Travancore ". From the Hamburg Museum : 1 clitellate specimen labelled, "*Moniligaster deshayesi* Perr. Travancore. Pittny." (this specimen is probably from Anachardie, *vide* Michaelsen 1910, p. 54), and 1 clitellate specimen labelled, "*Moniligaster deshayesi* Perr. *var. minor* Mich. Travancore, Chimungi. Shunkara Narayana *leg* ". From the Indian Museum : 1 aclitellate and 1 clitellate, dissected specimens labelled, "*Moniligaster deshayesi*, E. Perr. Anachardie, Travancore. R. S. N. Pillay. ZEV 4147/7 ", 1 juvenile anterior fragment labelled, "*Moniligaster deshayesi* E. Perr. On the way to Shenbagadevi Falls, Courtallam. H. S. R. 24th October 1924, W 3199/1 ".

External characteristics.—Blue pigmentation is recognizable in small regions in spite of the alcoholic preservation. The prostomium is prolobous (4). Lateral thickenings of the body wall are practically unrecognizable externally and in sections, but the musculature of the ventral portion of the body appears to be thicker than the dorsal portion (clearly visible on Tenmalai juveniles). Behind the clitellar region the cross section of the body is short elliptical. Nephropores begin on iii and are functional on x, from xiii posteriorly dislocated dorsally or ventrally to *ab* but quite irregularly as follows : dorsally, vii, viii, xii, xv-right, xix-left, xx-right, ventrally, xvi-right, xviii-right, xix-right, xxi-right, xxii-xxv-left, xxx-right, xxv-right, xxxix-left ; dorsally, vii, viii, xii, xiii-left, xiv-right, xv, xviii, xix-right, xxv-left, xliii-left, xlv-left, ventrally, xiii-right, xiv-left, xvii-left, xix-left, xx-left, xxii-left, xxvi-right, xxx-left, xxxi-right, xxxiv, xxxv-left ; dorsally, vii, viii, xii-left, xxi-right, xxv-right, xxvii-right, xxviii-right, ventrally, xiii, xiv-left, xxxi-left, xxxii-left, xxxvi-right, xxxvii-left ; dorsally, vii, viii, xii ; dorsally, vii, viii, xii, ventrally, xvii, xviii-left, xix-right, xxii, xxiii-right, xxiv-left, xxv-right, xxvii, xxxiii-right (Anachardie specimen) ; dorsally, vii, viii, xii (Courtallam specimen) ; dorsally, vii, viii, xii, xviii, ventrally, xiii-left, xvii-right, xx-xxi-right, xxii-left, xxiv-left, xxvi-right, xxvii-left, xxviii-right, xxx, xxxi-right, xxxiv, xxxv-xxxvi-left, xxxvii, xxxix-right, xl-right, xli-right, posteriorly many are displaced to *ab* (Pittny specimen) ; dorsally, vii, xii, ventrally, xiii-right, xiv-left, xv-right, xvii-left, xviii-right, xix, xxi-left, xxiii-left, xxvii-left, xxviii-left, xxix-right, xxx-right, xxxii (Chimungi specimen). In the last worm the left nephropore of ix is dislocated ventrally to *ab*. On Tenmalai juveniles the nephropores of vii-viii and xii are dorsal except on right side or left side of xii ; all pores[1] of vii-viii and xii dorsal on the two Anachardie specimens from the Indian Museum.

Clitellar colouration is unrecognizable, possibly as a result of the method of preservation. The epidermis of one specimen is markedly

[1] Opacity or adherence of cuticle, folding or twisting of body, etc., may render determination of nephropore locations difficult or impossible in certain regions. Locations are usually determined on each specimen posteriorly as far as the last segment mentioned.

thickened on x-xiii. The clitellar colouration, when visible (1 Anachardie specimen, 1 Pittny specimen, 1 Chimungi specimen), is dark red and extends across x-xiii or the pre-setal portion of xiv in addition (Pittny specimen).

Spermathecal pores are transversely placed slits of 7/8 in or just median to *cd*.

Male pores are transversely placed slits on 10/11, with centres on or close to mid *bc*. On one specimen an ectal portion of the prostatic duct is everted as a short, columnar, translucent, soft protuberance bearing a tiny, transverse slit-like aperture on its ventral face.

Female pores are minute, on 11/12, on or close to *b*.

Genital markings are lacking but a semi-circular area just in front of and just behind each male pore of the clitellate specimens lacks the red clitellar colouration and is white. Similar areas are recognizable on the Tenmalai worms even in the absence of clitellar colouration.

Internal anatomy.—Septa 5/6-8/9 are muscular, 7/8-8/9 slightly thicker than the others. Several post-gizzard septa are muscular.

Gizzards are located as follows: xiii-xvi (1, Tenmalai juvenile), xiv-xvii (2, Nedumangad and a Tenmalai juvenile), xiv-xviii (1, Tenmalai), xv-xviii (2, Anachardie), xv-xviii and rudimentary in xix (1, Tenmalai), xvi-xix (2, Tenmalai and the Pittny specimen), xvi-xx (1, Tenmalai). The inner wall of the oesophagus in xx-xxv is provided with closely crowded, vertically placed, white, lamelliform ridges slightly zig-zagged and of variable height, lacking at the region of the mid-dorsal and mid-ventral lines (2, Anachardie specimens). In both of the Anachardie worms the oesophagus is straight. The intestine begins in xxvi (somewhat doubtfully in one Nedumangad specimen), xxvii (1, Anachardie specimen with gizzards in xv-xviii) or xxviii (1, Anachardie specimen with gizzards in xv-xviii). Entero-segmental organs are present, in a specimen with the last gizzard in xviii beginning in xix but small in xix-xx, large from xxi posteriorly for several segments and then decreasing in size posteriorly. No typhlosole (6 specimens).

The single dorsal blood vessel is continued anteriorly on to the pharyngeal bulb. The ventral vessel is continued forwards to the sub-pharyngeal ganglia where it bifurcates, the branches passing dorsally along the circumpharyngeal nerve commissures. The sub-neural trunk is slender and scarcely recognizable from ix anteriorly, but after receiving a commissure from the extra-oesophageal of the left side in vi is larger than elsewhere from this segment to just in front of the sub-pharyngeal ganglia. Extra-oesophageal trunks are lateral to the hearts, gradually decreasing in size posterior to x and unrecognizable behind xv-xvii, with a commissure to the sub-neural in x or xi (two sides asymmetrical) with a commissure to the dorsal vessel in v (two sides asymmetrical as regards size and antero-posterior location in segment), passing latero-dorsally anterior to v. Paired hearts are present in vi-ix (4 specimens), all opening into the ventral trunk. Hearts of vi-vii and possibly also of viii open directly into the dorsal trunk. Just above the level of the dorsal face of the gut each heart of ix is slightly constricted and beyond the constriction has a thin, translucent or transparent wall. The transparent portions of these hearts unite mesially

below the level of the dorsal trunk. Into the thin, transverse commissure between the hearts and slightly lateral to the median plane there opens on each side the posterior commissure from the extra-oesophageal trunk. A short vessel passes straight up to the dorsal trunk in the median plane from the transverse commissure between the hearts of ix. The anterior commissures from the extra-oesophageal trunks arise just behind 8/9 and are firmly bound by strong but transparent tissue to the posterior face of 8/9, apparently opening directly into the dorsal trunk just behind 8/9. In vii a large vessel from the extra-oesophageal passes on to the spermathecal atrium. One or two large blood vessels pass along the prostate with the vas deferens, one of these apparently from the extra-oesophageal or from the posterior commissure close to its junction with the extra-oesophageal.

One or both testis sacs are usually dislocated posteriorly underneath the ovarian chamber. If a sac is not displaced posteriorly the equatorial attachment of 9/10 is usually indicated by a very slight constriction, and the sac is about equal in ix and x. The vas is slender as it emerges from the testis sac and is twisted into a number of hair-pin loops immediately underneath the sac and then passes into and downwards through a vertical column of "leaflets" Emerging from the column median to the heart of ix and close to the ventral parietes the vas passes around the heart of ix, through 9/10 and straight on to the prostate without penetrating into the musculature, the portion ectal to the leaflets being 15-20 mm. long. Short loops of the nephridium of x on the posterior face of 9/10 close to the ventral parietes may easily be mistaken for a portion of the vas unless the latter is carefully traced from its emergence at the bottom of the column of leaflets. In several specimens some of the hair-pin loops of the slender ental portion of the vas deferens as well as several of the leaflets appear to be in x. In some cases however a thin membrane, presumably a portion of 9/10, can be discovered behind the protuberances. The posterior dislocation of the testis sac produces a considerable posterior pocketing of 9/10 with a portion of the leaflet column contained within the pocket as well as the anterior portion of the testis sac. Prostates are 12-15 mm. long, *ca.* 1 mm. thick, rather rod-like, dark red, slightly and very gradually narrowed ectally, short elliptical to almost circular in cross section. The vas disappears from sight into the prostate slightly below the ental end. The capsule is thin and transparent or nearly so. The inner lining of the capsule is a soft, dark red tissue raised into irregularly criss-crossed ridges which may meet at the central axis. These ridges mark chamber-like cells, of which five to seven or even more may be seen in a single transverse section. Passing ectally, ridges and chambers are smaller, eventually disappearing. The prostatic duct is about 2 mm. long with strong muscular appearance, slightly narrower than the prostate entally, and somewhat widened passing ectally. The main lumen of the duct in a considerable ental portion is definitely crescentic. In the longitudinal ridge producing this crescentic appearance is a narrow canal. Ectally the ridge disappears and the lumen widens, an ectal chamber though apparently lacking one or two circular ridges may be fairly conspicuous.

The spermathecal duct is 10-16 mm. long. Spermathecal atria are in vii (6 specimens). The duct passes into, or at least on to the posterior limb of the atrial duct slightly ental to the crotch, the portion of the spermathecal duct in vii 3-4 mm. long and with several short loops. Delicate tissue binds the two atrial glands together, usually in such a way that one gland is dorsal to the other.

Parasites.—Several nematodes were found in the coelomic cavities of the anterior-most segments. In post-genital segments thicker and more transparent nematodes are present in the coelomic cavities. In a posterior portion of the body the larger nematodes are each contained within a spheroidal cyst on the parietes.

Remarks.—The description given above is of the aclitellate Tenmalai specimens except where otherwise indicated. The horseshoe-shaped ovarian chambers are filled with a yellowish debris which is also present in the somewhat contracted ovisacs. The worms are doubtless slightly post-sexual.

After removal of the external glandular layer of the prostates in one of the Anachardie specimens, small, rather circular, translucent and very slightly raised spots are visible on an ental portion of the capsule. The translucent appearance of these spots is due to local thinning of the layer lining the capsule. The prostate of the Chimungi specimen is twisted in a rather zig-zagged or slightly spiral fashion and is about 5 mm. long. This worm is distinguished from others referred to *M. deshayesi* only by its dwarf size (114×4 mm.) and the correspondingly shortened prostates.

Prostates may be bent into a J or U-shape or twisted in a rather spiral fashion or may be almost straight. Except in one specimen the glands are dark red. In alcoholic specimens the red colouration may leach out from the glands and stain the parieties in contact with the glands.

Lateral thickenings of the body wall may be much more obvious on some of the specimens than on the Tenmalai forms.

The individual stalks of the atrial glands may be longer than the united common stalk.

In the Tenmalai juveniles (labelled *D. travancorensis*) the ovisacs are mere threads, testis sacs small and only slightly behind 9/10, prostates (together with ducts) only about 3 mm. long. Leaflets are unrecognizable in one specimen (preservation poor internally), but so are the loops of the vas of the ordinary type. In the second specimen leaflets as well as mammillae are just recognizable on the surface of the atrial lobes. In the first specimen the spermathecal atria are rudimentary and only slightly T-shaped. In both worms the atria are confined to vii.

Diagnosis.—Male pores with centres on or near mid *bc*. Clitellum red. Length 114-160 mm. Diameter 4-8 mm.

Gizzards in xiv-xx. Intestine begins in xxvii (±1 ?). One or both testis sacs dislocated posteriorly under ovarian chamber. Vas deferens with loops of slender portion in posterior pocket of 9/10 (and in x ?), thickened portion about 20 mm long, passing through centre of a cluster of leaflet-like glands—each gland a fine, convoluted tubule opening into the vas—and directly into prostate slightly below ental end, leaflets in pocket of 9/10 and ix (in x ?). Prostates rod-like, 12-15 mm. long, red

lining of capsule raised into criss-crossed ridges. Spermathecal atria in vii, common atrial duct slender.

Distribution.—Travancore (Anachardie, Nedumangad, Chimungi, Tenmalai) and Courtallam, *ca.* 15 miles from Tenmalai (Tinnevelly district) up to elevations of 4,000 feet. No information has been available during the last 30 years to indicate that Michaelsen's conclusion regarding the supposed Ceylon provenance of the type of the species is incorrect.

Moniligaster gravelyi Stephenson.

1915. *Moniligaster deshayesi* (part), Stephenson, *Mem. Ind. Mus.* VI, p. 57. (Including only var. *gravelyi*. Type locality of *gravelyi* Trichur, Cochin. Type in the Indian Museum.)

1923. *Moniligaster deshayesi* (part), Stephenson, *Oligochaeta* in *Faun. Brit. Ind.*, p. 121. (Including only *M. deshayesi* var. *gravelyi* Stephenson 1915.)

1925. *Moniligaster deshayesi*, Stephenson, *Rec. Ind. Mus.* XXVII, p. 48.

Material examined.—From the Indian Museum : 1 juvenile, dissected specimen labelled, "*Moniligaster deshayesi* var. *gravelyi* Stephenson. Type. Trichur, 3,000 ft., Cochin State, 1-4.x.1914. F. H. Gravely. ZEV 6913/7." From the Madras Museum : 1 aclitellate, dissected specimen labelled, "*Moniligaster deshayesi* E. Perrier. Kavalai, Cochin Forest. Sept. 1914."

External characteristics.—Pigmentation unrecognizable, the "reddish brown" appearance noted by Stepehnson (1925) probably an alcoholic artefact. The body wall is thickened laterally. The prostomium is of the usual moniligastrid prolobous type (2 specimens).

Setae, when visible, are closely paired, fine, unrecognizable on some of the anterior segments and elsewhere though this may be due in part to the condition of the specimen.

Nephropores begin on iii and are functional on x. Pores are not dislocated dorsally on vii and viii or the left side of xii of the Kavalai specimen or vii-right side and viii of the Trichur specimen ; dislocated dorsally on the right side of xii (Kavalai specimen) or both sides of xii (Trichur specimen), and ventrally to *ab* as follows : xiii-right, xvii-right, xix-xxi-right, xxv, xxvi-xxvii-right, xxix-left, xxx-right (Kavalai specimen). Behind the clitellar region an occasional pore is dislocated dorsally (Trichur specimen).

A clitellum is unrecognizable externally but the epidermis of ix-xiv at the dorsal incision appears to be slightly thickened (Kavalai specimen).

The spermathecal pores are transversely placed slits on 7/8 just median to *c*.

Male pores are transversely placed slits on 10/11, in *bc*, quite definitely nearer to *b* than to *c*, each aperture surrounded by a rather wide, finely wrinkled, annular band that may have been formed by a slight evagination of the ectal end of the prostatic duct.

Female pores are possible on 11/12 on or near *b*.

Internal anatomy.—Septum 6/7 is thickly muscular, 7/8-8/9 very thickly muscular, much more so than in *M. deshayesi*.

The gizzards are in xiii-xvii (Kavalai specimen) or xv-xviii (Trichur specimen). On the inner wall of the post-gizzard portion of the oesophagus, except at the mid-dorsal and mid-ventral lines there are closely crowded, vertically placed, slightly lamelliform, white ridges. The

intestine begins in xxv (2 specimens). No typhosole (2 specimens). Entero-segmental organs are present.

The last hearts are in ix. Anterior commissures from the extra-oesophageals are visible from behind 8/9 but are covered over with a fairly thick layer of tissue and probably are within the septum. Extra-oesophageal trunks are lateral to the hearts. Nephridia are present in x.

The vas deferens is long, an ental portion slender and in two clusters of hair-pin loops, one in ix and one in x. Emerging from the more ectal of these clusters the vas is thickened and looped in an elongately hair-pin fashion, part of the loops in x and part in ix, the cluster of loops larger than the testis sac. The heart of ix passes into the ventral portion of the cluster of loops. Passing through 9/10 the vas disappears from sight on the prostate *ca.* 2 mm. below the ental end without first passing into the parietes. The prostate is flattened and rather strap-like, with slight incisions of the lateral margins, *ca.* 10 mm. long, $2\frac{1}{2}$ mm. wide and 1 mm. thick or slightly less. Ectally the gland is slightly and gradually narrowed. The capsule, after scraping off the external glandular layer, also appears at first to be strap-shaped but with nodulated surface and incised margins, some of which are quite deep. The lumen is relatively quite small and in at least a considerable portion of the capsule with an appearance of being twisted backwards and forwards in a fairly regular zig-zagged fashion, the limbs of the loops transverse to the long axis of the capsule. The prostatic duct is *ca.* $1\frac{1}{2}$ mm. long, with muscular appearance, a short and slender neck, and an ectal bulbous portion which is partly imbedded within the parietes. A horizontal partition appears to divide the cavity of the bulb into two chambers. The aperture in the partition is small, slit-like, and surrounded by an annular ridge.

The spermathecal duct has a muscular (?) appearance. Spermathecal atria are confined to vii. The atrial stalk (coelomic portion) is slender, passing into a single (?) gland with characteristic mamillated surface.

Segment xi is reduced to a horseshoe-shaped ovarian chamber. Ovisacs extend into xiv (Kavalai specimen).

Parasites.—Several nematodes were found in the coelomic cavities of the Kavalai specimen.

Remarks.—Except when otherwise indicated the account given above is based on the Kavalai specimen. As a result of the rather poor external condition of this worm setae are almost unrecognizable. Failure to recognize dorsal dislocations of the nephropores on this specimen may also be due to the condition of the sdecimen rather than to the absence of such dislocations.

The ovarian chamber and ovisacs (Kavalai worm) are not sexual but a strong (spermatozoal ?) iridescence characterizes the testis sacs. The ovisacs of the Trichur specimen are tiny rudiments in xii.

The internal organs of the Kavalai worm were brittle, and what remained of the spermathecal atrium crumbled into fragments while attempting to discover if the usual two glands were bound together in a common investment of connective tissue. Discrete glands are unrecognizable in both specimens.

Accurate characterization of the prostate must await further study of more material, but from the dissection of a single gland of the Kavalai worm it is clear that the muscular capsule is a slender tube looped in a regularly zig-zag fashion with the limbs of the loops in contact and bound together in such a way as to produce an appearance of a flattened and strap-shaped organ. In the Trichur specimen margins of the prostates are deeply incised but the looping here appears to be more irregular (external glandular layer firmly adherent to capsule and removed in part only with difficulty).

M. gravelyi is clearly distinguished from *M. deshayesi* by the absence of " leaflets " on the male deferent ducts as well as by the characters of the prostates. If there is only one atrial gland on each side this will further serve to distinguish *M. gravelyi* from *Moniligaster* sp. from Parambikulam (*vide* below). Further possible distinctions are slenderness and looping of the capsule.

Diagnosis.—Male pores in median half of *bc* (?). (Nephropores of vii, viii and xii not usually dislocated dorsally ?) Pigmentation? Clitellum ? Length 118 mm. Diameter 6 mm.

Gizzards in xiii-xviii. Intestine begins in xxv (±?). Vas deferens long, loops of both slender and thickened portions in ix and x, passing directly into prostate towards ental end. Prostates *ca.* 10 mm. long, 2½ mm. wide and 1 mm. thick, with a flattened, ectally narrowed, rather strap-shaped appearance, capsule slenderly tubular and looped in a more or less regularly zig-zag fashion with limbs of loops short and closely bound together (?). Atria confined to vii (only one atrial gland on each side ?) ; common atrial duct slender.

Distribution.—Trichur and Kavalai, Cochin State, South India, at elevations of *ca.* 3,000 feet (elevation of Kavalai, according to Dr. Gravely, 1,300-3,000 feet).

Moniligaster horsti, sp. nov.

Material examined.—From the Madras Museum : 1 juvenile specimen and 2 aclitellate anterior ends labelled, " Bungitappal. The Kundahs, Nilgiri District, May 1928. E. Barnes."

External characteristics.—Diameter 9 mm. Pigmentation unrecognizable (alcoholic preservation). The body wall is thickened laterally. The prostomium is prolobous.

The setae which begin on ii are small but with black and readily recognizable tips, closely paired, *c* and *d* a trifle more closely than *a* and *b* and probably slightly smaller than the ventral setae ; on xvii-xx *aa* slightly smaller than *bc*.

Nephropores begin on iii and from xiii posteriorly may be dislocated dorsally or ventrally to *ab* but quite irregularly as follows : dorsally, vii, viii, xi-left, xii, xiii-right, xx-xxi-right, xxii-xxiii-left, xxv-right ; ventrally, xiv-right, xvii-right, xxvii-left, xxxi-left, xxxix-left, xl-left, xliii-xliv-left ; dorsally, vii, viii and xii (other dislocations not noted). Nephropores of x are functional.

The spermathecal pores are transversely placed slits on 7/8 just median to *c*.

Male pores are transversely placed slits on 10/11, with centres about mid *bc*.

Female pores are minute, on 11/12, on *b*.

Internal anatomy.—Septa 5/6-8/9 are slightly muscular. Some of the post-gizzard septa are slightly strengthened with muscular fibres.

Gizzards are in xiv-xvii (juvenile) or xv-xviii, with some special muscularity of the gut in xiv of one specimen. A post-gizzard portion of the oesophagus has a thickened wall and on the inner face numerous, closely crowded, low, longitudinally placed and zig-zag, white ridges which are lacking on the intestinal wall. Valves were not definitely identified but the intestine appears to begin in xxviii (1 specimen) or xxx (1 specimen). No typhlosole (2 specimens). Entero-segmental organs are present.

The last pair of hearts is in ix. Paired commissures from the extra-oesophageal trunks are present on the posterior faces of 8/9 and 9/10. Extra-oesophageal trunks are lateral to the hearts.

Testis sacs at first appear to be confined to x but an anterior end of each sac is in a posteriorly directed pocket of 9/10, the sacs unconstricted by the septum. The vas deferens is long, an ental portion slender, looped in hair-pin fashion, the cluster of loops nearly twice the size of the testis sac. The loops at first appear to be in ix but are covered over by a transparent sheet of tissue which is continuous mesially and laterally with septum 9/10. No leaflets. After passing around the heart of ix and through 9/10 the vas penetrates into the longitudinal muscle layer just lateral to the nerve cord and then passes laterally, emerging into the coelomic cavity just in front of the prostate into the anterior margin of which and near the parietes it passes. The prostate gland is *ca.* 3½ mm. long, ovoid in shape, and with the long axis longitudinal. The capsule is anvil-shaped, the bluntly rounded end posterior, the more pointed anterior end directed slightly ventrally. The capsule is opaque and muscular, the lumen very irregular due to the projection into it (especially dorsally) of high, short ridges of the lining, some of the ridges so high and short as to be almost finger-like. The duct which passes into the ventral face of the posterior end of the capsule is bulbous, narrowed entally and just at the parietes, the coelomic portion slightly more than 2 mm. long, nearly circular in transverse section, the lumen transversely slit-like in section, narrowed abruptly half-way towards the capsule and then widened again entally. Muscle strands from the body wall are attached to the duct. Nephridia are present in x.

Spermathecal ampullae are slightly distended and translucent. The duct has a white (muscular ?) sheen and is about 15 mm. long. One atrial gland is in vii and one in viii on each side (2 specimens), the glands erect and reaching to, or nearly to, the dorsal parietes, slightly flattened, 5-6 mm. long, 2-2¼ mm. wide and 1-1½ mm. thick. A slight annular basal constriction marks off each gland into two portions, the ental about twice the length of the ectal part. The common duct is a longitudinally placed body partially buried in the parietes with longitudinal ridges on the inner wall. The spermathecal duct at first appears to pass into the anterior face of the stalk of the posterior gland but can be dissected off to the junction of the two stalks.

The ovarian chamber is horseshoe-shaped. The ovisacs extend into xiii or xv.

Parasites.—A number of nematodes was found in the coelomic cavities of vii, viii and ix of one of the specimens. These parasites have been forwarded to the British Museum for study.

Remarks.—The juvenile worm is macerated in a short region behind the gizzards. Male and spermathecal apertures of the juvenile specimen are minute, the genital organs rudimentary, the ental ends of the prostates and atrial glands just protuberant into the coelomic cavities from the parietes. Ovarian chambers of other specimens are not sexual, and the ovisacs are juvenile.

In the Bungitappal worms one of the taxonomically most important characters is the penetration of the vas into the longitudinal musculature. It is extremely unlikely that this feature will be changed on attaining full maturity. Prostatic capsules seem to have attained definitive shape and appear to provide adequate means of distinction from other species having the male deferent ducts similarly buried within the longitudinal musculature. The diagnosis is of course incomplete and provisional.

Diagnosis.—Male pores with centres at or close to mid *bc*. Pigmentation ? Clitellum ? Length ? Diameter 9 mm.

Gizzards in xiv-xviii. Intestine begins in xxix ($\pm$1 ?) ? Vas deferens very long, the cluster of loops nearly twice the size of the testis sac, loops mostly in ix but covered over by a thin sheet that is attached mesially and laterally to 9/10, passing laterally in x within the longitudinal musculature, emerging to pass into the prostate anteriorly. Prostatic capsule ovoidal to anvil-shaped, *ca.* 3½ mm. long, the more pointed end directed antero-ventrally, and the duct into the ventral face of capsule posteriorly. Atrial glands in vii and viii, coelomic portion of common atrial duct a longitudinally placed body.

Distribution.—Known only from the type locality, Bungitappal, in the Nilgiri Hills, at an elevation of 8,000 feet. (The type locality could not be found on any maps available locally, but Dr. Gravely writes that "Bungitappal is a point about 8,000 feet high, on the Kundah range of the Nilgiris in South India.")

Moniligaster michaelseni, sp. nov.

Material examined.—From the Madras Museum : 1 undissected, clitellate specimen labelled, "Kodaikanal, *ca.* 6,000-6,800 ft., Palni Hills, 17-27.ix.1930. Gravely.", and 1 clitellate (?) specimen labelled, "Kodaikanal, *ca.* 6,000-6,800 ft., Palni Hills. April-May 1929. Gravely."

External characteristics.—Length 175 mm. (clitellate specimen) and 274 mm. Diameter 16 mm. (clitellate specimen) and 9 mm. Pigmentation dark bluish in the dorsum. The body wall is thickened laterally. The buccal region is everted and softened but the prostomium appears to be prolobous (2 specimens).

Setae are small and closely paired, invisible on ii and on some of the clitellar segments (1) and also elsewhere on the other worm ; on xvii-xx (1) *aa* slightly greater than *bc*.

Nephropores begin on iii and from xiii posteriorly may be dislocated dorsally or ventrally to *ab* but quite irregularly as follows : dorsally,

vii, viii, xii, xix-left, xx-left, xxi-left (?), xxiii-left, ventrally, xiii-left, xvi-left, xviii-right, xxiv-left, xxv-left, xxix-left (1); dorsally, vii, viii, xii, xiv-right, xx-left, xxii-right, xxvi-left, xxvii-right, xxx-left, xxxii-right, xxxiii-right, ventrally, xvii-left, xxi-right, xxv-right, xxvii-left, xxviii-left, xxxi-right, xxxiii-left, xxxiv-left, xl. Nephropores on x are functional.

The clitellar colouration is reddish and extends from a posterior portion of ix on to xiv (1). On the second specimen only the faintest trace of a reddish clitellar colouration is visible.

Spermathecal pores are wide transversely placed slits on 7/8, extending from *d* mesially. On the anterior and posterior margins of the apertures there are fine, longitudinally placed furrows.

Male pores are transversely placed slits on 10/11 in the median part of *bc*, reaching mesially to *b*. On the first specimen the ectalmost portion of each prostatic duct is slightly everted to form a low annular lip around the male pore, the lip wrinkled and soft. Just anterior and just posterior to the lips of each male pore, on the anterior and posterior portions of x and xi, there is a smooth, whitened, transversely placed area of crescent shape (1 only).

Female pores are minute, on 11/12, on *b*.

Internal anatomy.—Septum 9/10 is tough but membranous and transparent; 5/6-8/9 muscular but slightly translucent, some of the post-gizzard septa strengthened with muscular fibres.

The gizzards are in xviii-xxi (1) or xvi-xx. A valve is unrecognizable but a post-gizzard portion of the gut to xxviii or xxx has a thickened wall and, on its inner face, numerous closely crowded, rather irregular, longitudinally placed whitish ridges. This portion of the gut, with a structure like that of the post-gizzard section of the oesophagus in other Moniligastrid species is accordingly considered to be oesophageal even though a valve is unrecognizable (probably because of distention by the dark, almost black soil). No typhlosole (2 specimens). Entero-segmental organs are present from xxii or xxiii posteriorly.

The last pair of hearts is in ix. There is a pair of commissures from the extra-oesophageal trunks on the posterior faces of 8/9 and 9/10. Extra-oesophageal trunks are lateral to the hearts. Nephridia are present in x.

A testis sac may at first appear to be wholly in x though an anterior portion is in a posteriorly directed pocket of 9/10, the testis sacs unconstricted by the septum. The vas deferens is long, with the elongately hair-pin-shape loops in a vertically placed cluster underneath the testis sac, and the ental portion of the vas slender. The cluster of loops is about as large as the testis sac or larger and appears to be in ix, but is actually covered over by a transparent sheet of connective tissue which is continuous (or appears to be so) mesially and laterally with septum 9/10. No leaflets. After passing around the heart of ix and through 9/10, the vas drops on to the floor of the coelomic cavity to which it may be bound but without passing into the longitudinal muscle layer, and with a few very short loops in x. The vas passes into the prostate slightly below the ental end and is slightly thickened just prior to its entrance. The prostate (including the duct) is 5-6 mm. long and

slightly more than 2 mm. thick in the widest portion, bent into a C-shape, with the concave side facing antero-laterally. The duct emerges from the parietes and passes posteriorly on the floor of the coelomic cavity and then is bent around mesially and anteriorly. The duct and gland are of about equal length, the duct bulbous and thickest ectally, almost conical, with strong diagonal muscle bands to the basal portion, and with a rather slender short neck. The gland and capsule are almost ovoidal, slightly flattened, and narrow ectally. The capsule is thick and muscular, lined with soft pinkish material in several high, longitudinal ridges, and with a large lumen. In the basal portion of the duct the lumen is large and transversely slit-like, with its inner wall provided with vertical ridges, or the lumen may be H-shaped in cross section with one side definitely thicker.

The spermathecal duct is 18 mm. long, and has a white muscular appearance; it is coiled underneath the ampulla and passes into the dorsal face of the common atrial duct between the two glands. One atrial gland is in vii and one in viii on each side (2 specimens). The gland is ovoidal and about $3\frac{1}{2}$ mm. long, and its stalks at first appear to be very short, but the basal portion of the gland is bound down around the ental part of the stalk. The common duct of the glands is short but the coelomic portion resting on the parietes is a longitudinally placed body noticeably longer than thick or high. The wall is muscular, with the annular ridges on the inner face and a wide lumen.

Segment xi is closed off to form a horseshoe-shaped ovarian chamber which is sexual. From the posterior margin of the chamber a sheet of tissue (septum ?) passes to the dorsal parietes. In the first specimen the right ovisac is rudimentary, whitish and without ova, the left ovisac reaching into xviii. In the other worm the ovisacs extend only into xv.

Remarks.—The shorter specimen may have lost a considerable length of its posterior portion at some time but the narrowed, almost pointed, and rather soft tail does not show any definite evidence of autotomy or of regeneration aside from shape, size and a possible lack of pigment. The tail end of the other specimen is bluntly rounded. The second specimen appears to be sexual in spite of the faint colouration of the clitellar segments. The gut had been ruptured in both specimens as a result of crowding into small tubes.

M. michaelseni is distinguished from *M. perrieri* by the shape of the prostatic capsule, the relation of the gland to the prostatic duct, and by the prone position of prostate and duct on the parietes.

Diagnosis.—Male pores in median half of *bc.* Clitellum red. Pigmentation restricted to dorsum ? Length 175-274 mm. Diameter 9-16 mm.

Gizzards in xvi-xxi. Intestine begins in xxix ($\pm$ 1 ?). Vas deferens long, the cluster of loops as large as, or larger than, the testis sac, and in ix covered over by a thin sheet that is attached mesially and laterally to 9/10, and passing directly into prostate slightly below ental end. Prostates 5-6 mm. long, gland and duct of about equal length, bent into a C-shape with concavity antero-laterally, and bound to the parietes; capsule rather flattened and ovoid. Atrial glands in vii and viii, the coe-

lomic portion of the common atrial duct being a longitudinally placed body.

Distribution.—Known only from the type locality, Kodaikanal, Palni Hills, at an elevation of 6,000 feet or more.

Moniligaster perrieri Michaelsen.

1907. *Moniligaster perrieri* Michaelsen, *Mitt. Mus. Hamburg* XXIV, p. 146. (Type locality-Kodaikanal, Palni Hills, South India. Types in the Indian Museum.)
1909. *Moliligaster perrieri*, Michaelsen, *Mem. Ind. Mus.* I, pp. 107 and 150.
1910. *Moniligaster perrieri*, Michaelsen, *Abh. Nat. Ver. Hamburg* XIX (5), p. 9.
1923. *Moniligaster perrieri* (part), Stephenson, *Oligochaeta* in *Faun. Brit. Ind.*, p. 123. (Excluding Travancore worms, from Bonaccord and Ponmudi.)
1924. *Moniligaster perrieri* (part), Stephenson, *Rec. Ind. Mus.* XXVI, p. 322. (Including only one specimen from Neutral Saddle.)
1925. *Moniligaster perrieri*, Stephenson, *Rec. Ind. Mus.* XXVII, p. 48.

Material examined.—From the Indian Museum : 1 dissected specimen labelled, "*Moniligaster perrieri* Michlsn. Type. Kodaikanal, Palni, Hills, 7,000 ft. June 1907. J. R. Henderson. ZEV 2902/7.", 1 undissected specimen labelled, "*Moniligaster perrieri* Michlsn. Type. Kodaikanal, Palni Hills, 7,000 ft. June 1907. J. R. Henderson. ZEV 2903/7.", and 1 macerated anterior fragment labelled, "Under stones in dense jungle near Neutral Saddle, 4,200 ft. Palni Hills, S. India. 14 Sept. 1922. S. Kemp. W 1109/1." From the late Dr. Michaelsen : 1 dissected specimen labelled, "*Moniligaster perrieri* Michlsn. Palni Hills. J. R. Henderson." From the Madras Museum : 1 aclitellate and 3 clitellate, dissected specimens labelled, "*Moniligaster perrieri* Michlsn. Sirumalais. June 1914. Under stone near a stream. Colour dark blue."

External characteristics.—Length 105-160 mm. (types), 100-140 mm. (Tirumalai specimens). Diameter 4 mm. Pigmentation now unrecognizable in all specimens. The prostomium is always of the characteristic Moniligastrid prolobous type. The body wall is thickened laterally.

Nephropores begin on iii, and from xiii posteriorly they may be dislocated dorsally or ventrally to *ab* but quite irregularly as follows : dorsally, vii, viii, xiv on the right side, vii (viii ?), xii, xiii, xv, xvi, xx, xxi, xxiii on the left side, ventrally xv, xx, xxiii, xxv, xxx, xxxi, xxxix, xxxv, xlii on the right side, ix, xxx, xxxii on the left side (Michaelsen's paratype, right pore of xii in *cd*) ; dorsally, vii, viii, xi, xii, xiv, xx on the right side, vii, viii, xii, xiii, xv, xxii on the left side, ventrally xv, xix on the right side, xiv on the left side (type) ; dorsally, vii, viii, xii (Indian Museum paratype). Nephropores of x are functional.

Clitellar colouration is unrecognizable, but the epidermis is markedly thickened on x-xiii or xiv and posteriorly on ix at the mid-dorsal incision (types and Tirumalai specimens).

Spermathecal pores are transversely placed slits on 7/8 just median to *c* or reaching laterally to or nearly to *d* (Tirumalai specimens).

Male pores are transversely placed slits on 10/11, slightly lateral to *b* but in median half of *bc* (types) or nearer mid *bc* (Tirumalai specimens). A small region immediately in front of and behind each male pore may be finely furrowed, the grooves longitudinal, the anterior areas obviously though only slightly depressed (types).

Female pores are on 11/12 in *ab* (types and one Tirumalai specimen) on or just lateral to *b* (Tirumalai specimens).

Internal anatomy.—Gizzards are in xiv-xvii (Indian Museum paratype) ; xv-xviii (Neutral Saddle) ; xiii-xvi, xiv-xviii, or xv-xix

(Tiru-malai specimens). On the inner wall of the oesophagus in xxi-xxvi there are numerous, closely crowded, rather irregular but longitudinally placed, white ridges (types). Between these ridges in one of the specimens there are clusters of fine white granules, probably calcareous. The intestine begins in xxviii (two types, one Tirumalai specimen and the Neutral Saddle specimen). No typhlosole. Entero-segmental organs are present.

Hearts are present in vi-ix. Paired commissures from the extra-oesophageals are on the posterior faces of 8/9 and 9/10. Extra-oesophageals are lateral to the hearts. Nephridia are present in x.

Testis sacs are apparently not dislocated posteriorly behind the ovarian chamber. A short ental portion of the vas deferens is slender, coiled in short hair-pin loops just under the testis sac, the remainder of the duct thickened and in longer hair-pin loops on the anterior face of 9/10. Passing through 9/10 the vas is fairly close to, but not in contact with, the parietes though connected therewith by transparent tissue, slightly sinuous but not markedly looped, passing directly into the anterior end of the prostate. The thickened portion of a male deferent duct of one Tirumalai specimen is 405 mm. long. The prostate is reniform, concave side ventrally, antero-posteriorly directed (occasionally twisted around on the neck so as to be transversely placed), slightly-flattened latero-mesially, 3-4 mm. long, 1-1½ mm. thick latero-mesially or dorso-ventrally. The capsule is muscular (type, transparent in Tirumalai specimens) with its surface fairly smooth, *i.e.*, without nodulations. The duct passes into the hilus (concavity of the ventral side) and approximately midway between the anterior and posterior ends. The capsular lining is raised into several conspicuous ridges, the aperture of the vas on the end of a slightly conical protuberance, and the opening into the duct at the centre of a tiny tubercle. The prostatic duct is 2-3 mm. long (coelomic portion), a short ental portion slender, the remainder of the coelomic portion of the duct markedly bulbous and conspicuously protuberant into the coelomic cavity. To the lateral face of the bulb near the parietes there are attached several rather weak diagonal muscle strands. In the neck the lumen is small and transversely slit-like in cross section, rapidly widened passing ectally and irregular as a result of the presence of longitudinal ridges. Within the parietes the lumen is slit-like and of about the same width as the male aperture, but abruptly widened just internal to the parietes. A horizontal partition shuts off this cavity from the one in a more ental part of the bulb, but the method of communication between the two chambers was not determined. The ectal chamber is presumably lined with cuticle as the walls have a smooth glistening appearance.

The spermathecal duct is 12-15 mm. long (Tirumalai specimens). Atrial glands are in vii and viii (types, Neutral Saddle and Tirumalai specimens). The rather stout common atrial duct appears to be thickened entally but this appearance is due in part to the fact that the glands cover over and conceal from view the origin of the individual ducts. The lining of the common duct is ridged.

Parasites.—In the ovisacs of one of the Tirumalai specimens there are cysts, probably protozoan. A fairly large, encysted nematode was seen in the coelomic cavity of one of the types.

Remarks.—There is nothing in the literature to indicate that the pigmentation is restricted to the dorsum, in fact quite the contrary as Michaelsen notes with reference to the colour, "dorsally darker than ventrally" (1908, p. 150).

Setae are closely paired, the lateral setae of the Tirumalai specimens more closely than the ventral. Setae of Tirumalai specimens are ornamented near the tips with several closely crowded, transversely placed rows of fine teeth.

Female pores are invisible on one of the types but the sites of the pores are indicated by tiny but relatively rather conspicuous tubercles.

Internal organs had been partly removed in earlier dissections so that redetermination of gizzard locations in two types is impossible.

In the Indian Museum paratype the outer (coelomic) glandular layer of the prostate has a slight reddish tinge which is either lacking or was not observed in certain worms.

The three types are probably post-sexual, the ovarian chambers and ovisacs being distended by a yellowish debris in which ova are unrecognizable. The ovarian chamber of the Neutral Saddle specimen (which is probably a fairly late juvenile) is not sexual, the ovisacs also being juvenile. As a result of maceration the connective tissue binding the branches of the atrial glands into ellipsoidal bodies in the Neutral Saddle specimen is perfectly transparent though still remarkably tough, the terminations of the branches clearly visible, and the connective tissue extending into the interior of the gland along the branches.

In view of the restricted distribution, apparently characteristic of most species of *Moniligaster*, the occurrence of *M. perrieri* in the Tirumalai Hills of Chittoor district, some distance from the type locality, seems unusual. Unfortunately the Tirumalai specimens or the specimen from Neutral Saddle, could not be studied simultaneously with the types of *M. perrieri* but the laboratory notes on the prostates of worms from the two localities are almost identical.

Diagnosis.—Male pores in median half of *bc*. Clitellum ? Pigmentation on ventrum as well as dorsum ? Length 100-160 (—210 ?) mm. Diameter 4 (—5 ?) mm.

Gizzards in xiii-xix. Intestine begins in xxviii. Vas deferens long (405+mm.) loops in a vertical cluster on the anterior face of 9/10, passing directly ventral to the anterior end of prostate. Prostatic capsule reniform, concave side ventrally and longitudinally directed, slightly flattened latero-mesially, 3-4×1-1½ mm.; duct passing into ventral face of capsule about midway between anterior and posterior ends. Atrial glands in vii and viii, common atrial duct rather stout and thickened entally.

Distribution.—Kodaikanal, Neutral Saddle (Palni Hills, at elevations of 4,200-7,000 ft.) and the Tirumalai Hills (exact locality and elevation unknown).

Moniligaster stephensoni, sp. nov.

1924. *Moniligaster perrieri* (part), Stephenson, *Rec. Ind. Mus.* XXVI, p. 322. (Including only Vanderavu specimens and one specimen from Kodaikanal.)

Material examined.—From the Indian Museum : 1 dissected and 4 undissected, aclitellate specimens labelled, " *Moniligaster perrieri* Mich. Vanderavu, *ca.* 7,400 ft. Under stones in stream in jungle. Palni Hills. S. India. Aug. 1922. S. Kemp W 1106/1", and 1 aclitellate, macerated specimen labelled, " *Moniligaster perrieri* Michaelsen. Kodaikanal, 6,900-7,200 ft. Palni Hills, S. India. Aug. 1922. Dr. S. W. Kemp, W 707/1."

External characteristics.—The dissected specimen is incomplete posteriorly but is 90 mm. long and 8 mm. thick. Undissected specimens from Vanderavu are 60-92 mm. long and 4-5 mm. in diameter. The Kodaikanal specimen is about 165 mm. long and 7 mm. thick. Pigmentation now unrecognizable. The body is slightly flattened dorso-ventrally behind the clitellar region, and the body wall is thickered laterally. The buccal cavity of each of the Vanderavu specimens is everted, but the prostomium appears to be prolobous, and characteristically so on the Kodaikanal specimen.

Setae are fine, closely paired, unrecognizable, or recognizable only with difficulty, anteriorly. On the 8 mm. specimen $aa<bc$ on the post-genital segments but on the smaller worms *aa* and *bc* may be about equal.

Nephropores begin on iii and are functional on x, dislocated dorsally on vii, viii and xii (except that one pore of xii of a Vanderavu specimen is in *cd*, the right pore of vii and both pores of viii in or close to *cd* on the Kodaikanal specimen). On the largest Vanderavu specimen pores are dislocated as follows : dorsally xiv-left, xvii-right, xx-xxi-left ; ventrally to *ab*, xv-right, xvi-left, xviii-right, xxi-left, xxiii, xxv-left, xxix-left, xxxviii-right. On the Kodaikanal specimen left pores of ix and x are in *ab*.

Spermathecal pores are transversely placed slits on 7/8 in the region of *cd*.

Male pores are large transverse slits on 10/11, in *bc* with centres nearer to *b* than *c*.

Female pores are probably on 11/12, on or close to *b*.

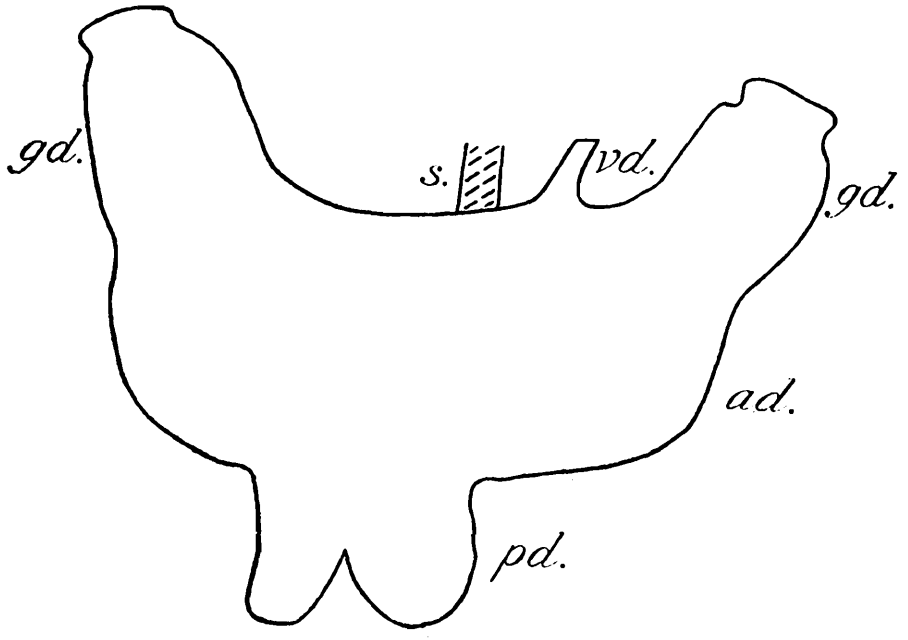
Internal anatomy.—Septa 5/6-8/9 are muscular ; several post-gizzard septa, as many as nine in the largest Vanderavu worm, are muscular.

Gizzards are in xiv-xix (one Vanderavu specimen) or xvii-xxii (Kodaikanal specimen). In the other two dissected Vanderavu specimens some unusual contraction appears to have driven the gizzards forward so that the first gizzard appears to be in front of the ovarian chamber. The post-gizzard portion of the oesophagus is markedly sigmoid, the inner wall provided with closely crowded, longitudinal, white ridges. The intestine appears to begin in xxx (specimen with gizzards in xiv-xix) or in xxxiii (Kodaikanal specimen). No typhlosole. Entero-segmental organs are present.

Hearts are present in vi-ix and are median to the extra-oesophageal trunks. Commissures from the extra-oesophageals are on the posterior faces of 8/9 and 9/10. Nephridia are present in x.

Testis sacs at first appear to be wholly in x but the anterior ends are in posterior pockets of 9/10, the sacs unconstricted by the septum.

The vas deferens is long, a short and slender ental portion in a small cluster of loops just under the testis sac and in the pocket of 9/10, the widened portion in a cluster of hair-pin loops on the anterior face of 9/10 that is nearly as large as the testis sac. Emerging into x the vas passes into the parietes and laterally underneath a fairly wide strand of longitudinal muscle, emerging just anterior to the prostate and passing up and into the anterior face of the prostate just above the ectal margin of the external glandular layer. The prostates are latero-mesially flattened and rather disc-like, with convex dorsal surface, the ventral side slightly concave and symmetrical with regard to the attachment of the duct. The external glandular layer extends further ventrally on the anterior and posterior surfaces than on the median and lateral faces,



TEXT-FIG. 2. Camera lucida sketch of a spermathecal atrium of a specimen of *Moniligaster* sp. from the Palni Hills after removal of atrial glands.

ad., common atrial duct; *gd.*, duct or stalk of a single gland; *pd.*, parietal portion of common duct; *s.*, septum; *vd.*, vas deferens: × *ca.* 39.

so that portions of the lateral and median faces of the capsule are exposed. The capsule is muscular and lined with a layer of soft material that is raised into a few ridges. A very short ental portion of the duct is slender and with the sheen of a muscle, the lumen in this neck narrow and slit-like in section. Ectally the duct is widened and bulbous, with numbers of strong muscle bands attached to the lateral face of the bulb, and the lumen in this portion irregular as a result of the presence of vertical ridges.

One atrial gland is in vii and one in viii on each side. The common atrial duct is slender, erect in vii just anterior to 7/8.

The horseshoe-shaped ovarian chamber contains a few loose and apparently ripe ova. Ovisacs are sexual and extend into xvi.

Remarks.—The account given above is mainly based on the previously dissected worm which appears to be mature in spite of apparent lack of a clitellum, epidermis of x-xiii thickened though recognizable only at the dorsal incision. In one other Vanderavu specimen and the Kodaikanal specimen the prostates appear to be of a characteristic form

though small. In another opened specimen the prostates just protrude through the parietes into the coelomic cavity. In all opened specimens the vas passes into the longitudinal musculature and is not again visible in the coelomic cavity in juvenile prostates.

A horizontal partition and penis in an ectal portion of the bulb of the duct (as in *M. beddardi*) are lacking, but the passage into the neck is constricted by an annular ridge.

M. stephensoni belongs to a group of three species in which the vas deferens passes into the parietes and under the longitudinal muscle prior to its junction with the prostate, and is distinguished from the other two species of the group by the latero-mesially flattened disc-shaped capsule.

Diagnosis.—Male pores with centres nearer *b*. Pigmentation ? Clitellum ? Length 92-165 mm. Diameter 7-8 mm.

Gizzards in xiv-xxii. (Intestine begins in region of xxx-xxxiii ?) Vas deferens long, loops of slender portion in a posterior pocket of 9/10, loops of thickened portion in a cluster in ix that may be as large as the testis sac, passing laterally in x underneath a strand of longitudinal muscle, emerging to pass into the anterior face of the prostate just above the ectal margin of the glandular layer. Prostatic capsule disc-shaped, latero-mesially flattened, with convex dorsal surface and slight concavity at centre of ventral face, external glandular layer lacking on portions of lateral and median faces of capsule ; duct to ventral face of capsule midway between anterior and posterior ends. Atrial gland in vii and viii, common atrial duct slender and erect in vii.

Distribution.—Vanderavu and Kodaikanal, in the Palni Hills, at elevations of 6,900-7,400 feet.

Moniligaster sp.

1915. *Moniligaster deshayesi* (part), Stephenson, *Mem. Ind. Mus.* VI, p. 57. (Excluding var. *gravelyi*.)

1923. *Moniligaster deshayesi* (part), Stephenson, *Oligochaeta* in *Faun. Brit. Ind.* p. 121. (Including only *M. deshayesi* Stephenson 1915, specimens, from Parambikulam only.)

Material examined.—From the Indian Museum : 1 aclitellate and 1 clitellate, dissected specimens labelled, " *Moniligaster deshayesi* E. Perrier. Parambikulam, 1,700-3,200 ft., Cochin State. 16-24.9.14. F. H. Gravely. ZEV 6595/7."

External characteristics.—The prostomium is retracted but is of the characteristic Moniligastrid prolobous type (2 specimens).

Nephropores begin on iii and are functional on x, dislocated dorsally on vii, viii, xii, except on the left side of vii and viii of the clitellate specimen, dislocated dorsally on the right side of xiii and xiv of one specimen.

The clitellum has a light yellowish colouration.

Interna anatomy.—Gizzards are in xv-xviii (2 specimens). The inner wall of the post-gizzard portion of the oesophagus except at the mid-dorsal and mid-ventral lines is provided with closely crowded, low and lamelliform, white ridges. The intestine begins in xxv (2 specimens). No typhlosole. Intestinal contents are black. Entero-segmental organs are present.

Hearts are present in vi-ix and are median to the extra-oesophageal trunks. Anterior commissures from the extra-oesophageals appear to be on the posterior face of 8/9 but are bound to the septum by strong tissue.

The vas deferens is long, in a cluster of elongately hairpin-shaped loops and does not pass into the parietes in x though transparent tissue from the vas passes ventrally to the body wall. The vas disappears from sight on the prostate slightly below the ental end. No leaflets. The prostates are about 10 mm. long (mature specimen), slightly and gradually widened passing entally, circular in cross section ectally, elliptical in section entally. The margins are not incised but there are slight nodulations of the surface. The lining of the capsule is raised into an irregularly criss-crossed network of ridges which may meet and unite centrally. The duct is slightly less than 2 mm. long, the ental half with sheen as of muscle and small, slit-like lumen, the ectal portion bulbous but not thicker than the gland, lumen wide and irregular as a result of the presence of vertical ridges. A horizontal partition in the bulb was not found.

Spermathecal atria are in vii, two distinct lobes clearly recognizable, each with its own individual duct (clitellate specimen). The common atrial duct is slender, 2-3 mm. long.

Segment xi is reduced to a horseshoe-shaped ovarian chamber.

Remarks.—The citellate specimen appears to be slightly post-sexual, with no free ova in the ovarian chamber but with ovisacs distended by a yellowish debris. The second specimen is juvenile, the ovisacs being small rudiments in xii.

Prostates of the clitellate specimen differ from those of *M. gravelyi* in the absence of deep marginal incisions of the capsule, the smooth surface (slight irregularities appear to be due to twisting or crowding by other organs), and the regularly elliptical to circular cross section. Prostates of the second specimen have a few slight marginal incisions, and may be more like those of *M. gravelyi* but the external glandular layer is strongly adherent to the capsule.

Both specimens are clearly distinguished from *M. deshayesi* by the absence of leaflets on the vas deferens. The clitellate worm appears to differ from *M. gravelyi* in characteristics of the prostatic capsule which are of sufficient importance to indicate that the worm belongs to a distinct species. The juvenile worm should perhaps be referred to *M. gravelyi* but is really too immature for specific identification.

The specimens referred to below could not be secured for examination. In view of the possibility that these specimens do not belong to the species to which they were referred they have been excluded from the preceding portion of the paper.

Moniligaster sp.

2.

1909. *Moniligaster perrieri* (part), Michaelsen, *Mem. Ind. Mus.* I, p. 150. (Specimen from Tiger Shola.)

Quite possibly correctly identified.

3.

1913. *Moniligaster perrieri*, Michaelsen, *Mitt. Mus. Hamburg* XXX, p. 78. (Specimens from Ponmudi and Bonaccord, Travancore, at elevations of 500-750 M.)

1929. *Moniligaster perrieri*, Aiyer, *Rec. Ind. Mus.* XXXI, p. 15.

Possibly *M. aiyeri* ?

4.

1924. *Moniligaster perrieri* (part), Stephenson, *Rec. Ind. Mus.* XXVI, p. 322. (Including only Cambridge Museum specimen.)

Present location of this specimen, if still in existence, is unknown. It is not in the Cambridge Museum or in the British Museum. The diameter is only slightly greater than that of *M. beddardi.* The description of the prostate as sausage-shaped and bent on itself, together with the information that the prostates are longer than in those specimens now referred to *M. beddardi,* may or may not be evidence for a similar identification[1].

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Michaelsen, W., 1908.—The Oligochaeta of India, Nepal, Ceylon, Burma and the Andaman Islands. *Mem. Ind. Mus.* I.

Stephenson, J., 1922.—Contributions to the morphology, classification, and zoogeography of Indian Oligochaeta. *Proc. Zool. Soc. London,* 1922.

Stephenson, J., 1930.—*The Oligochaeta.* (Oxford).

[1] Dr. L. Cernosvitov has been kind enough to check over the material in the British Museum, and writes that the only specimen of *perrieri* is labelled as follows : " *Moniligaster perrieri* 1925.5.12.95. Kodaikanal, S. India. Indian Museum. Ex. W 707/1." This obviously is not the Cambridge specimen but is from the batch that contained the types of *beddardi* as well as a specimen of *stephensoni.*

CYCLOPOÏDES (CRUSTACÉS COPÉPODES) DE L'INDE.

par K. LINDBERG.

Dioithona indo-gallica, sp. nov.

DESCRIPTION.—*Femelle.* Longueur environ 600 μ. Division antérieure du corps (tête+5 segments thoraciques) de forme ovoïde, plus longue que la queue (4 segments abdominaux+furca). Extrémité céphalique obtuse, sans rostre proprement dit, mais à masse ganglionnaire bilobée bien visible sur la face ventrale. Abdomen allongé et étroit. Le segment génital est le plus long, ensuite vient le troisième segment ; le deuxième et le quatrième segment sont de même longueur ou le deuxième surpasse légèrement en longueur celle du quatrième. La longueur combinée du deuxième et troisième segments dépasse un peu celle du segment génital. Furca à branches fortement divergentes, de 5 à 6 fois aussi longues que larges ; rebord interne glabre. Soie latérale externe de longueur assez considérable, insérée bien en avant du milieu de la branche de la furca. Soie dorsale extrêmement développée, de longueur à peu près égale à celle de la soie apicale médiane externe. Soie apicale externe et soie apicale interne toutes les deux très courtes et minces, différant peu en longueur entre elles. Première antenne apparemment composée de 16 articles ; rabattue elle atteint le bord postérieur du quatrième segment thoracique. Deuxième antenne à

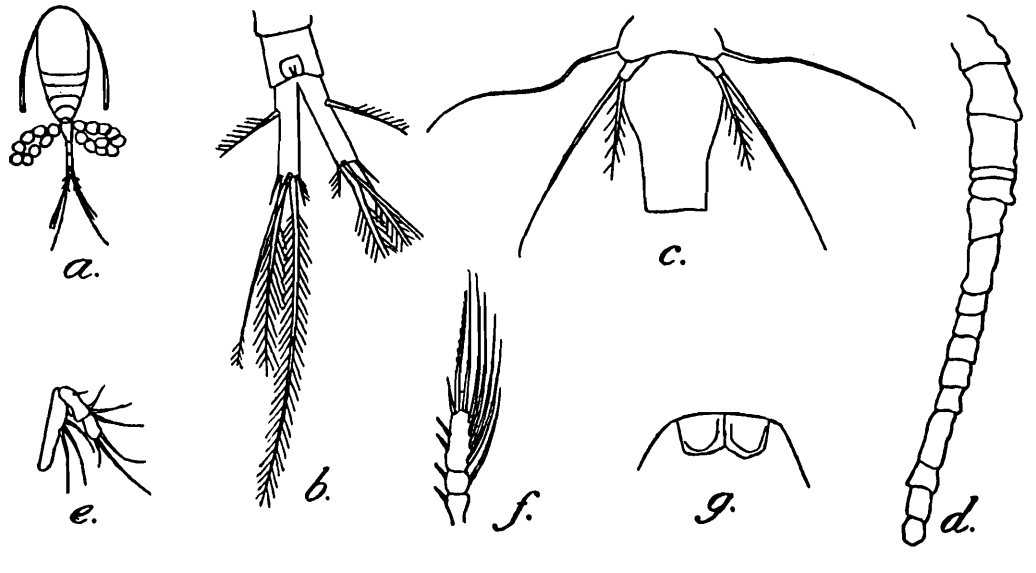

FIG. 1.—*Dioithona indo-gallica,* sp. nov.

a. Configuration générale ; *b.* Furca ; *c.* Cinquième patte ; *d.* Première antenne ; *e.* Deuxième antenne ; *f.* Endopodite de la quatrième paire de pattes ; *g.* Extrémité céphalique, face ventrale.

3 articles. Deuxième basopodite de la mandibule terminé par 2 fortes soies à extrémité recourbée. Toutes les branches des pattes natatoires

triarticulées. Formule des épines 3-4-4-4 ; formule des soies 5-5-5-5. Epines apicales du dernier article amincies, ressemblant à de fortes soies barbelées. Cinquième patte composée d'un article bien développé assez allongé, portant deux appendices terminaux, une longue soie externe ciliée et une forte soie interne à cils plus nombreux qui possède presque les caractères d'une épine. De plus, le cinquième segment thoracique est pourvu d'une longue soie latérale, tout comme les autres représentants connus du genre *Oithona*. Le réceptacle séminal n'a pas été observé. Ovisacs bien écartés du corps, contenant de 12 à 15 oeufs arrondis. Mâle encore inconnu.

Habitat. Une mare dépourvue de végétation, à eau probablement saumâtre, très boueuse, située près d'une lagune à Oupalom, faubourg de Pondichéry, côte de Coromandel (Inde française) ; récoltée au mois de janvier en très petit nombre.

Oithona dissimilis, sp. nov.

Description.—*Femelle.* Espèce ressemblant beaucoup dans sa configuration générale à la forme précédante. Longueur de 579 à 650 μ. Division antérieure de forme ovoïde, toujours plus longue que l'abdomen +la furca ; rapport entre le céphalothorax et la queue de 1·17 : 1 à 1·66 : 1. Extrémité céphalique aplatie, sans rostre, à masse ganglionnaire bilobée très distincte sur la face ventrale. Abdomen

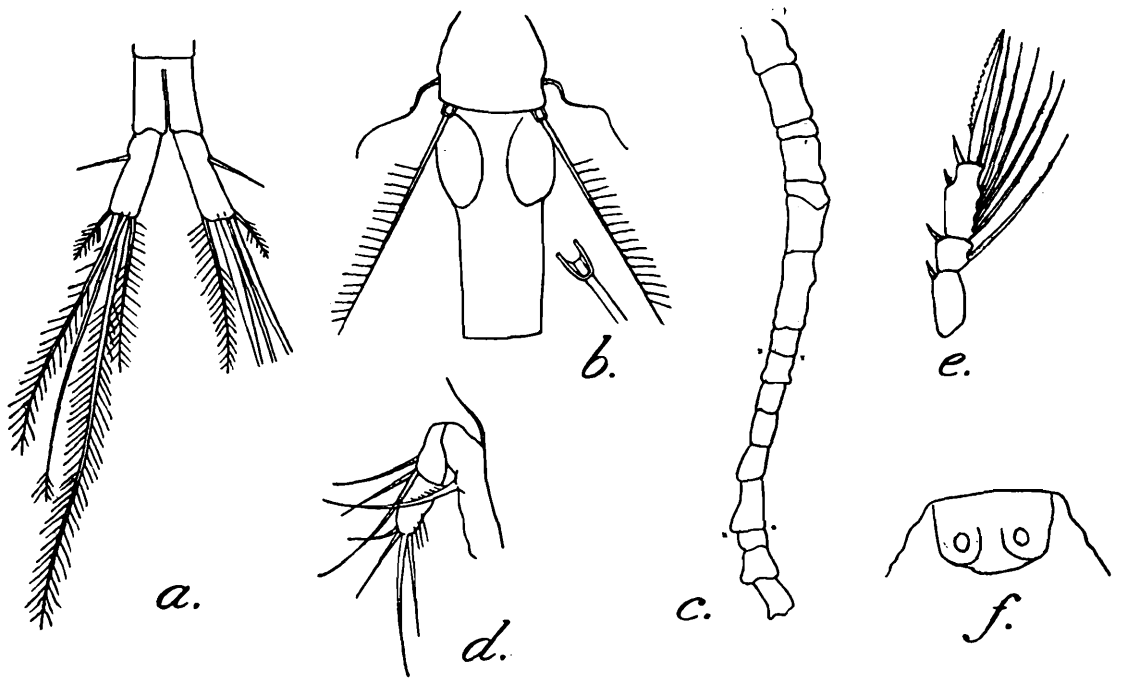

Fig. 2.—*Oithona dissimilis,* sp. nov.

a. Furca ; *b.* Cinquième patte ; *c.* Première antenne (les petites croix montrent la position des divisions incertatines) ; *d.* Deuxième antenne ; *e.* Endopodite de la quatrième paire de pattes ; *f.* Extrémité céphalique, face ventrale.

allongé et étroit ; le segment génital est le plus long et dépasse légèrement la longueur combinée des deux segments suivants ; les deuxième,

troisième et quatrième segments sont de longueur à peu près égale entre eux. Furca à branches fortement divergentes, de 3 à 4 fois aussi longues que larges ; rebord interne dépourvu de poils. Insertion de la soie latérale externe bien en avant du milieu de la branche de la furca ; la soie latérale externe est assez courte. Soie dorsale très longue dépassant parfois en longueur celle de la soie apicale médiane externe. Soie apicale interne longue. La première antenne semble composée de 16 articles, mais les divisions entre les huitième et neuvième et treizième et quatorzième articles sont peu distinctes ; rabattue elle atteint le milieu ou le bord postérieur du quatrième segment thoracique. Deuxième antenne à 3 articles. Les deux branches des 4 paires de pattes natatoires à 3 articles. Formule des épines 3-4-4-3. Epines apicales du deuxième, troisième et quatrième paire à rebord interne obtus et rebord extèrne aminci en lancette. Article terminal de l'exopodite de la quatrième paire de pattes près de 2 fois aussi long que l'article correspondant de l'endopodite de la même paire de pattes. Cinquième patte formée d'un article allongé portant une très longue soie à cils épars. Soie thoracique basale longue et grêle, en général tortillée. Le cinquième segment thoracique est en outre muni d'un petit groupe de soies, à insertion dorso-latérale en avant du milieu du segment. Ovisacs souvent très grands, dirigés au dehors, contenant chacun de 10 à 22 oeufs arrondis.

Mâle. Légèrement inférieure en longueur à celle de la femelle (longueur 570μ). Céphalothorax plus long que la queue. Branches de la furca de 2 à 3 fois aussi longues que larges. La soie dorsale, les deux soies médianes et la soie apicale interne sont de longueur à peu près égale. Formule des épines 3-4-4-3. Les bords latéraux des deux premiers articles des exopodites sont munis chacun d'une épine ; le troisième article de 2-3-3-2 épines. Epines apicales en lancette comme celles de la femelle. Sixième patte rudimentaire formée d'une longue soie ciliée qui atteint presque le milieu du troisième segment abdominal.

Habitat. La mare déjà mentionnée près de Pondichéry en compagnie de l'espèce précédante. Dans cette mare se trouvaient aussi quelques *Mesocyclops leuckarti* Claus, des *Mesocyclops hyalinus* (Rehberg), d'assez nombreux *Microcyclops tricolor* Lindberg et un *Microcyclops* encore indéterminé.

Remarques. Les deux espèces qui viennent d'être décrites offrent des caractéristiques si frappantes qu'on ne peut, autant que je vois, les rapprocher d'aucune des formes connues et elles sont présentées ici comme nouvelles pour la science. Il semble que toutes les espèces connues jusqu'ici du genre *Oithona* sont des animaux marins avec une seule exception. La découverte de 2 formes assez aberrantes dans un biotope à eau probablement légèrement saumâtre où vivaient aussi de nombreux cyclopides d'eau douce est intéressante et sera peut-être susceptible de fournir une explication à certaines particularités de structure.

A la suite de la création par Kiefer du genre *Dioithona* pour les formes des *Oithoninae* possédant une cinquième patte à 2 appendices, je l'ai adopté pour désigner la première espèce, ce genre comptant maintenant 5 représentants différents.

MENSURATIONS.

Dioithona indo-gallica, sp. nov.

Femelles adultes I, II.

—	I	II
Longueur	598μ	598μ
Largeur .	171μ	171μ
Longueur du céphalothorax	323μ	342μ
Longueur de la queue	275μ	256μ
Furca		
Longueur	18+40μ	19+36μ
Largeur ..	10μ	11μ
Soie latérale externe	43μ	46μ
Soie dorsale	121μ	123μ
Soie apicale externe	20μ	18μ
Soie apicale médiane externe	121μ	121μ
Soie apicale médiane interne	208μ	202μ
Soie apicale interne	18μ	18μ
Cinquième patte		
Soie thoracique	...	75μ
Soie apicale externe	...	56μ
Soie apicale interne ..	...	40μ

Oithona dissimilis, sp. nov.

Femelles adultes I, II, III et mâle.

—	I	II	III	Mâle
Longueur	598μ	617μ	627μ	570μ
Largeur ..	190μ	178μ	190μ	171μ
Longueur du céphalothorax ..	323μ	361μ	342μ	370μ
Longueur de la queue	275μ	256μ	285μ	200μ
Furca				
Longueur ..	18+28μ	18+30μ	12+31μ	10+20μ
Largeur	12μ	12μ	11μ	13μ
Soie latérale externe	26μ	33μ	...	...
Soie dorsale	113μ	133μ	116μ	75μ
Soie apicale externe	36μ	33μ	35μ	50μ
Soie apicale médiane externe	123μ	130μ	120μ	108μ
Soie apicale médiane interne	225μ	217μ	240μ	110μ
Soie apicale interne ..	80μ	75μ	91μ	91μ

Eucyclops semidenticulatus, sp. nov.

DESCRIPTION.—*Femelle.* Longueur environ 900 à 1,000μ. Bord latéral du cinquième segment thoracique muni de poils de longueur modérée. Segment génital à partie proximale élargie et arrondie se rétrécissant brusquement du côté distal ; rebord postérieur de ce segment de même que celui du deuxième et du troisième segment découpé en fine dentelure sur l'aspect ventral. Le rebord postérieur du quatrième segment abdominal porte la rangée usuelle de petites épines sur la face ventrale. Sur les bords de l'échancrure anale ne se voient pas de poils au moyen des grossissements ordinaires. Branches de la furca bien divergentes assez éloignées l'une de l'autre à la base, de 4 à 6·2 fois aussi longues que larges, souvent légèrement tordues et un peu moins larges vers leur milieu. Rebord interne glabre ; rebord externe à serra bien développée, commençant sur la face ventrale près de la base et s'étendant sur le rebord externe pour s'arrêter au niveau de l'insertion de la soie latérale externe. La serra compte de 26 à 32 denticules, dont plus de la moitié sont visibles sur le rebord externe quand l'aspect dorsal de

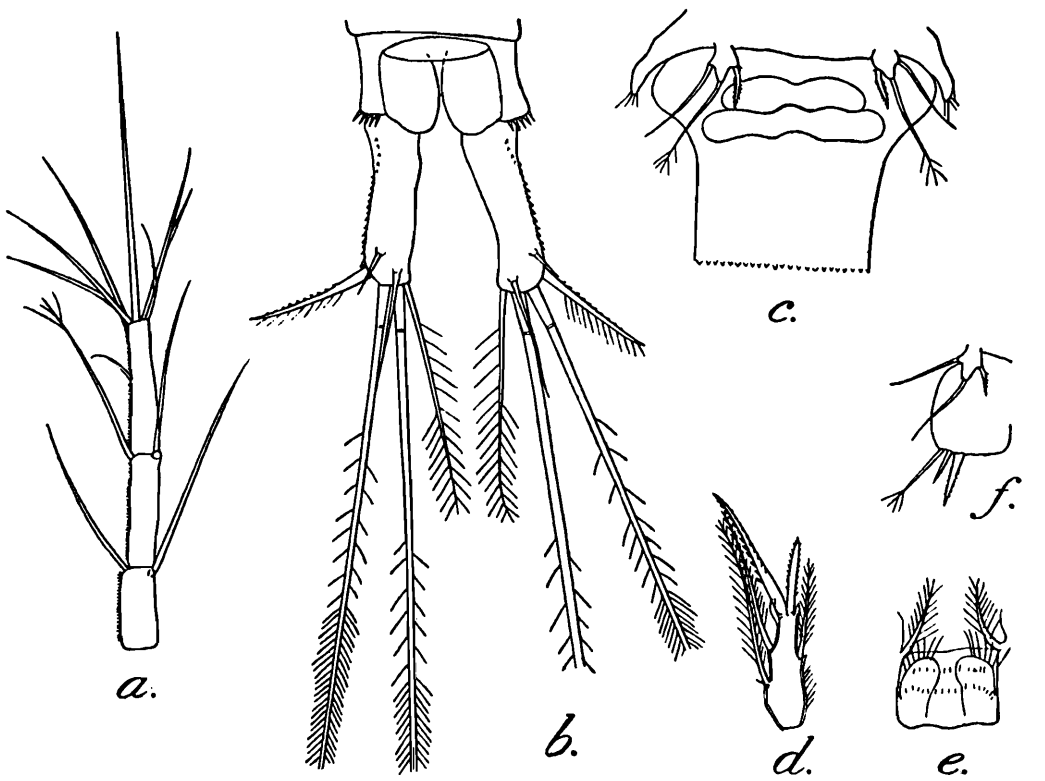

FIG. 3.—*Eucyclops semidenticulatus,* sp. nov.

a. ♀ Première antenne, 3 derniers articles (Kotagiri) ; *b.* ♀ Furca et segment anal (Kotagiri) ; *c.* ♀ Segment génital et cinquième patte (Kotagiri) ; *d.* ♀ Article terminal de l'enp. 4 (Kotagiri) ; *e.* ♀ Lamelle basale de la quatrième paire de pattes (Kotagiri) ; *f.* ♂ Cinquième et sixième pattes (Kotagiri).

l'animal est regardé d'en face. Les denticules proximales sont très petites et les plus distales les plus longues, mais, par suite de la position différente de leurs insertions, le degré de différence de longueur est plus apparent que réel. Soie apicale externe forte, très écartée, pouvant se trouver même presqu'à l'angle droit de la branche de la furca. La longueur de la soie apicale interne dépasse considérablement celle de la

soie apicale externe ; elle en peut atteindre deux fois la longueur ; elle est pourvue de cils assez espacés, moins nombreux du côté externe que du côté interne. L'aspect des deux soies apicales médianes se voit sur la figure. Première antenne à 12 articles ; rabattue elle atteint le bord postérieur du deuxième segment thoracique. Les 3 derniers articles sont munis d'une membrane hyaline très étroite à indentation aisément visible, celle-ci se voyant le mieux sur la moitié proximale du douxième article. Formule des épines 3-4-4-3 ; la plupart, et notamment les épines apicales des exopodites, présentent une ébauche d'apparence en lancette. Article terminal de l'enp. 4 assez allongé, à 2 épines apicales dont l'interne égale à peu près en longueur celle de l'article. Lamelle basale de la quatrième paire de pattes portant des poils tant longs que courts. Cinquième patte formée d'une épine interne assez mince souvent légèrement arquée, dont la largeur égale ou ne dépasse que de peu celle de la soie médiane ; elle est ciliée d'une façon hétéronyme, les petits cils ou épines minuscules du côté interne étant plus nombreux et plus fins que ceux du côté externe. Réceptacle séminal représenté d'une façon approximative sur la figure ; la partie proximale se voit en général distinctement même chez les animaux conservés, la partie distale par contre offre souvent des contours plus ou moins estompés. Ovisacs elliptiques dirigés au dehors, atteignant le plus souvent le niveau du tiers distal de la furca ; ils contiennent chacun de 8 à 12 oeufs assez gros.

Mâle. Longueur environ 650 à 780μ. Branches de la furca parallèles de 3·78 à 4·5 fois aussi longues que larges. Cinquième patte semblable à celle de la femelle. Sixième patte rudimentaire formée d'une épine interne assez forte qui n'atteint pas le rebord postérieure du deuxième segment abdominal, d'une soie médiane plus courte et d'une soie externe ciliée assez longue.

Habitats. Des mares à végétation abondante près du lac Povaï et des étangs près du lac Véhar dans l'île de Salsette (Bombay), au mois de décembre ; un petit ruisseau à Gharipouri (près Barsi, Deccan) au mois de mai ; une mare près d'une chute d'eau à Kotagiri (Montagnes Nilghiris) au mois d'avril ; une petite rivière à Pandharpour (Deccan) au mois de février.

Remarques. Cette espèce, de même que la suivante ressemble beaucoup à *E. serrulatus* (Fischer). Les points distinctifs principaux sont la présence d'une membrane hyaline étroite à fine indentation avec une épine de la cinquième patte assez courte et mince et une soie apicale interne de la furca relativement longue.

Eucyclops microdenticulatus, sp. nov.

Description.—*Femelle.* Longueur environ 830 à 1,080μ. Ressemble beaucoup à l'espèce précédante dans son habitus général, dans la structure du cinquième segment thoracique et celle du segment génital. Sur la face ventrale de tous les segments abdominaux se voient des épines minuscules en rangées plus ou moins régulières ; cette ornementation est assez indistincte et ne semble pas constante. Échancrure anale pourvue de nombreux poils très fins. Branches de la furca bien divergentes, plus rapprochées à la base que chez *E. semidenticulatus.* Serra

semblable à celle de cette espèce ; j'ai compté jusqu' à 36 denticules. Soie apicale interne de la furca bien plus courte que chez *E. semidenticulatus* par rapport à la soie apicale externe mais la dépassant toujours nettement en longueur ; cils de la soie apicale interne plus nombreux des deux côtés et plus serrés que chez l'espèce précédante. Première antenne à 12 articles, rabattue elle atteint le bord postérieur du deuxième

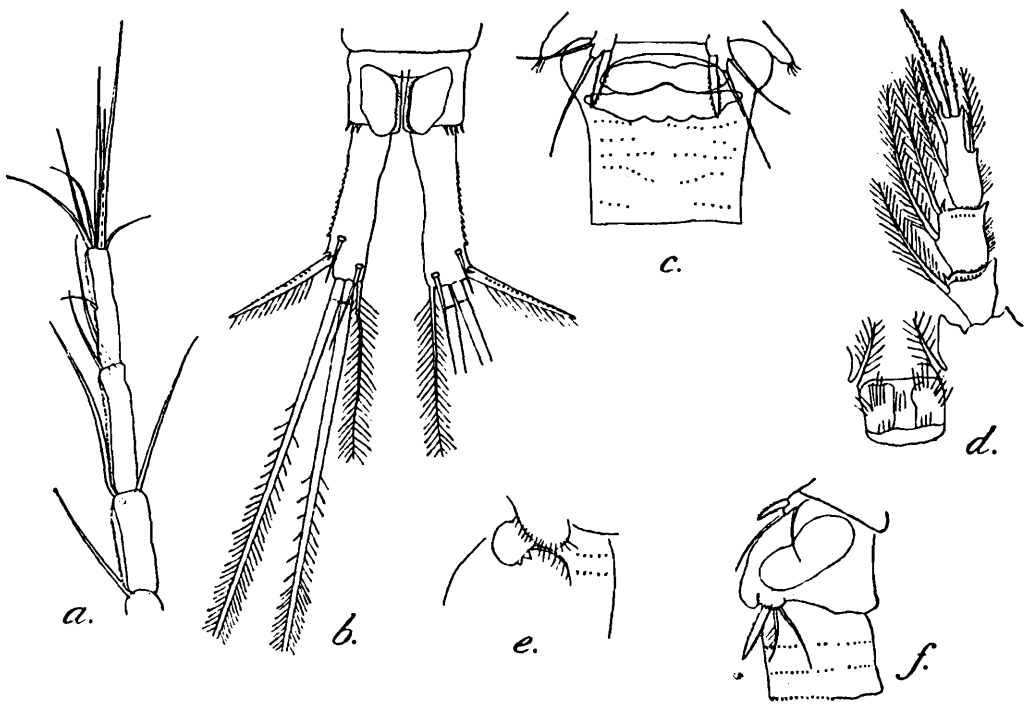

FIG. 4.—*Eucyclops microdenticulatus*, sp. nov.

a. ♀ Première antenne, 3 derniers articles (Kodaikanal) ; *b.* ♀ Furca et segment anal (Kodaikanal) ; *c.* ♀ Segment génital et cinquième patte (Kodaikanal) ; *d.* ♀ Enp. 4 et lamelle basale (Ootacamund) ; *e.* ♀ Appendices génitaux et aile latérale du cinquième segment thoracique (Kodaikanal) ; *f.* ♂ Cinquième et sixième pattes (Kodaikanal).

segment thoracique. Les trois derniers articles munis d'une membrane hyaline assez large, qui à premier abord semble souvent unie, mais qui au fort grossissement se montre très finement indentée. Epines des pattes natatoires montrent en général une ébauche de structure en lancette. Article terminal de l'enp. 4 moins allongé que chez *E. semidenticulatus*, à épine apicale interne surpassant considérablement en longueur celle de l'article qui la porte. Lamelle basale de la quatrième paire de pattes munie de poils ; elle est à peu près semblable à celle de l'espèce précitée. Cinquième patte formée d'une épine interne très élargie, de 3 à 4 fois aussi large que l'une des soies. Réceptacle séminal représenté sur la figure d'une façon approximative. Ovisacs ressemblant à ceux de *E. semidenticulatus* ; contenant chacun de 6 à 12 gros oeufs.

Mâle. Longueur environ 740 à 790μ. Segments abdominaux (sauf le premier) ornementés comme chez la femelle. Branches de la furca parallèles, de 3·3 à 3·8 fois aussi longues que larges. Tendance d'apparence en lancette des épines des 4 paires de pattes en général plus marquée que chez la femelle. Cinquième patte semblable à celle de la femelle, mais à épine moins élargie. Sixième patte rudimentaire composée d'une forte épine interne qui peut atteindre le rebord postérieur du deuxième segment abdominal, mais qui le plus souvent ne fait que

dépasser le milieu de ce segment. Chez les animaux examinés les 3 appendices étaient de longueur à peu près égale.

Habitats. Une petite mare près d'un torrent à Kodaikanal (Montagnes Palni) en janvier ; le lac, près des bords à Ootacamund (Montagnes Nilghiris) en avril ; mare de rivière près de Nadiad en mars ; des mares à Adjanta et un petit ruisseau à Aurangabad (Etat de Haidérabad).

Remarques.—L'espèce qui vient d'être décrite se distingue nettement du *E. semidenticulatus* notamment par la structure différente de l'épine de la cinquième patte, celle de la soie apicale interne de la furca et celle de la membrane hyaline de la première antenne. De *E. serrulatus* (Fischer) elle se différencie par l'aspect différent de la membrane hylaine et par l'épine courte de la sixième patte chez le mâle. De *E. agiloides* Sars elle se sépare de même par l'indentation de la membrane hylaine, par la soie apicale interne de la furca étant plus courte par rapport à la longueur de la soie apicale externe et par la largeur plus grande de l'épine de la cinquième patte.

Le *E. semidenticulatus* et le *E. microdenticulatus* ont une distribution très étendue dans la péninsule indienne et se rencontrent tous les deux tant au niveau de la mer que dans les hautes montagnes.

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ADDENDUM.

With reference to the paper " On a new Trematode genus *Proacetabulorchis* and a new species of the genus *Procrassiphiala* Verma 1936 from Rangoon " by B. S. Gogate, published in the *Records of the Indian Museum* Vol. XLII, Part I, pp. 19-23 (March, 1940), the name of the host of the first species *Proacetabulorchis prashadi*, gen. *et* sp. nov. was unfortunately omitted on p. 19. This new genus of Trematoda was found in the liver of the kingfisher *Halcyon smyrnensis* (Linn., 1758).

Editor.

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