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Note.—

* (An asterisk) preceding a name denotes a new variety or subspecies.

† (A dagger) indicates a new species.

‡ (A double dagger) indicates a new genus or subgenus.

** (A double asterisk) indicates a new family or subfamily.

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Edited by the Director, Zoological Survey of India

GARRA HUGHII, A NEW CYPRINOID FISH FROM THE WESTERN GHATS, PENINSULAR INDIA, WITH NOTES ON ITS BIONOMICS.

By E. G. SILAS, N. I. S. I. Research Scholar.

(From the Laboratories of the Zoological Survey of India, Calcutta.)

(Plate IV).

INTRODUCTION.

As has been demonstrated in many recent papers (Hora, 1941 ; Hora & Law 1941 ; Raj, 1941 ; Herre, 1945 ; Silas, 1951), the Western Ghats of Peninsular India, especially the hill ranges lying to the south of the Neilgherries have proved one of the most fertile fields for ichthyological discoveries. From the array of novelities that have been collected from this area in recent years, it would seem that in each of its river systems, especially towards the head-waters of the rivers, the naturalist is bound to come across new forms, or else, new facts pertaining to the status, relationships, bionomics, distribution, etc., of species already known. This is more so with reference to the smaller species. More than one factor is responsible for the paucity of our knowledge of the complete fish fauna of this area. As first may be mentioned the fact that earlier attempts at collecting have been made mainly from a few scattered centres along these hills, with very little importance attached to the nature of the different watersheds, etc. Another drawback has been that in many cases stray collections have been made by collectors, who had no particular knowledge of the habits and habitats of fishes to be found in such environs, and as a result, more often than not, many interesting forms have been overlooked. However, much credit goes to those pioneering efforts which have contributed greatly towards our present knowledge of the fauna.

During the past few years, I have visited these hill-ranges on different occasions, with a view to make a more systematic survey of the fish fauna and some of the results of these investigations have already been reported on. On my last visit to the south in October-November 1952, I spent a short period with my brother Mr. H. M. Silas in the High Range, Travancore-Cochin and made a collection from the streams in and around Periakanal Estate and Surianelle, about 10 miles south of Munnar. Since my return to Calcutta, I have been receiving regularly fish collections made by him from the different parts of the High Range. In the material obtained so far, there are 52 specimens of a species of mountain carp, of the genus *Garra* Hamilton, which has remained hitherto undescribed. In the present paper, a detailed morphometric study of this new species is undertaken, principally with a view to determine the more precise systematic characters in the genus, and to find the range of variation within individual species limits of certain charac-

ters, which have been earlier widely used for separating species and finally to provide a preliminary data on certain structural changes during growth, which may also help in defining the relationships of the species. Short notes on the ecology and bionomics of the new species are also given.

All the specimens of the new species were collected by Mr. H. M. Silas from a stream in the Lower Vauguvarrai Estate. This stream forms part of the little explored eastern watershed of the High Range. On enquiry, I have received the following information regarding the habitat of the new species of *Garra* described in this paper :—

“ *Lower Vauguvarrai*.—Most of the fish were collected from a large rock-pool called *Lakkum*. Elevation 4500 feet above mean sea level. The pool is very rocky with very little sandy bottom. All along the stream there are plenty of small waterfalls and rapids every 20 or 30 yards. Plenty of vegetation is afforded by the dense forests on either banks. The stream is rough, especially so during the monsoons. Since the fish were caught during day time (between 10 A.M. and 3 P.M.), they were found mostly under or very close to the rocks in the shade”

***Garra hughii** sp. nov.**

D. 2/7 ; P. 1/11-15 ; V. 1/7-8 ; A. 2/5 ; C. 18-19 ; L. l. 36-39 ; L. tr. 4-5/1/3

Diagnosis.—*Garra hughii* can be readily distinguished from the other known species of the genus by its elongate body form ; broad head ; broadly rounded snout with no tubercles on it ; the absence of a proboscis and lateral lobes on the snout ; the *total absence* of scales on the ventral surface as far back as, and between the pelvic fins and on the dorsal surface generally in a broad streak between the occiput and the origin of the dorsal fin ; the pharyngeals and its teeth and finally in its body colouration.

Description.—This species is remarkable for its slender body form and broad head. The dorsal profile rises gradually from the tip of the snout to midway between the origin of the dorsal fin and the occiput, from whence it slopes gently to the base of the caudal fin. The head and the anterior part of the body are greatly depressed and the ventral surface is flattened as far back as the commencement of the anal fin. The paired fins are broadly rounded and horizontally inserted.

The length of the head is contained 4.222 to 5.588 (typically 4.6 to 5.0) in the total length and 3.444 to 4.307 (typically 3.55 to 3.9) in the standard length. The height of head at occiput is contained 1.272 to 2.0 and the width of head 1.166 to 1.8 in its length. The snout is broadly rounded and smooth and is not produced into rostral lobes in front of, or outside the nostrils. But generally an almost indistinguishable depression or groove is present across the snout passing from one nostril to the other, a condition more or less similar to that found in *Garra lamta mullya* (Sykes). The length of the snout is contained 1.833 to 4.5 (typically 1.8 to 2.8) in the length of the head ; it being considerably shorter in smaller examples. On the sides of the snout there are three or four irregular rows of sensory pores which extend from its anterior border to below and behind the eye and in larger examples even to the opercular region. Tubercles are absent on the snout. The nostrils are situated externally and are placed much closer to the eye than to the tip of the snout. The

*I have great pleasure in naming this new species after my brother Hugh M. Silas.

anterior nostril is tubular while the posterior nostril is covered by a rectangular skin flap.

The eyes are small and are situated dorso-laterally, but are not visible from below. They are comparatively larger in smaller examples and this is best expressed by giving the ratios resulting from stepping the diameter of the eye into the length of the head. The total range for the sample examined is 3.25 to 7.5. In specimens 15 to 36 mm. in total length the range is from 3.25 to 4.25, while in larger examples measuring 37 mm. and upwards the range is from 4.25 to 7.5 (typically 5.0 to 6.6). The diameter of the eye is also contained 0.8 to 4.0 in the length of the snout (typically 0.8 to 2.75 in small examples ranging from 15 to 37 mm. in total length and 2.5 to 4.0 in specimens more than 37 mm. in total length). The inter-orbital distance is broad and slightly convex in small examples while in larger examples measuring over 40 mm. in total length it is almost straight, the upper margin of the orbit approaching the upper profile. The diameter of the eye is contained 1.166 to 3.25 in the interorbital distance (typically 1.2 to 1.6 in small examples measuring 15 to 36 mm. in total length and 2.0 to 3.25 in larger examples). Concomittant with changes in the relative length of the snout and the diameter of the eye during growth, variations are to be expected in the position of the eye in relation to the head length. This is so, for in examples measuring less than 40 mm. in total length, the eye is situated closer to the tip of the snout than to the posterior margin of the head and the pupil of the eye is also entirely in the anterior half of the head. In examples measuring between 40 and 49 mm. in total length, the eye is situated more or less in the middle of the head and so also, the pupil of the eye. In larger examples, with the elongation of the snout, the eye is in a position closer to the posterior margin of the head than to the tip of the snout. The pupil of the eye is also placed entirely in the posterior half of the head.

The mouth is broad and almost straight. The gape of the mouth is contained 1.6 to about 2.5 times in the length of the head (the mouth is comparatively less wider in smaller examples). The mouth is placed just behind the tip of the snout in small examples while in larger specimens it assumes a position slightly behind the tip of the snout, the rostral fold overhanging it. The upper jaw is almost completely covered by the rostral fold which has its ventral surface minutely striated in a longitudinal direction and the striae in the center bear minute papillae. The edge of the fold is uniformly fimbriated. The lower lip is broad and straight and does not bear any papillae. The adhesive disc in young examples measuring upto 25 mm. in total length is about as broad as long, and once it is well formed, (by about the 30 mm stage) there is very little variation in its structure. In larger examples the disc is broader than long, its length being contained 1.142 to 1.625 in its width. The shape and structure of the disc which varies in specimens less than 25 mm. in length, generally agrees with stage 7 as figured by Hora (1921, text figure 1, p. 640). In larger examples the disc consists of an anterior trans-verse band of soft tissue which is profusely papillated and is slightly directed backwards at the extremities. Anterio-

lateral to either extremity of it and posterior to the lower lip, at about the angle of the mouth there is on each side a small triangular papillated band. The central fleshy broad pad or disc-proper is very minutely and sparsely papillated, giving it the appearance of a more or less cartilagenous disc. This true disc is fringed by a narrow band of soft papillated integument, which is laterally and posteriorly free.

Two pairs of barbels are present. The rostral barbel is about 0.6 to 0.75 the length of the diameter of the eye. The maxillary pair which is borne on either corner of the mouth is short and stumpy, its length being only about 0.5 to 0.75 the length of the rostral barbel. A deep groove runs from slightly above the base of the rostral barbel to the angle of the mouth.

The gill-openings are fairly wide and extend to the ventral surface for a short distance. The isthmus on the ventral surface between the gill clefts is broad and is contained 1.5 to 1.9 in the length of the head. The opercular bones are followed by a narrow fleshy marginal flap posteriorly, the flap being wider near the upper angle of the gill-opening.

The greatest height of the body is about midway between the occiput and the origin of the dorsal fin. It is contained 5.9 to 8.0 (typically 6.2 to 7.8 in large examples) in the total length and 4.6 to 6.454 in the standard length (typically 5.0 to 6.3). The body is broadest behind the gill openings, between the bases of the pectoral fins. The width of the body is contained about 1.2 to 2.0 in the length of the head ; 6.545 to 9.5 in the total length and 5.272 to 7.5 in the standard length. It is almost equal to the height of the body at the origin of the dorsal fin. The caudal peduncle is elongated and narrow, its least height being contained 1.5 to 2.0 in its length.

The dorsal fin is as high as the height of the body below its origin. Its last undivided ray is soft, slender and is articulated in its distal two-thirds. The free margin of the dorsal fin is slightly concave and the length of the last branched ray is equal to about 0.75 the length of the last undivided ray. The height of the dorsal fin is contained 1.25 to 1.714 in the length of the head. The origin of the dorsal fin is slightly ahead of that of the pelvic fin, and in adult specimens it is opposite the 12th or 13th perforated scale of the lateral line, while the origin of the pelvic fin is generally opposite the 14th or 15th perforated scale of the lateral line.

The length of the pectoral fin is equal or slightly less than the length of the head ; it being contained 1.0 to 1.666 in the latter. When adpressed the pectoral falls short of the pelvic fin by about one-third its own length or about half the length of the pelvic fin. Above the base of the pectoral fin and behind the lower half of the gill-opening there is an almost triangular muscular pad which is devoid of scales. The number

of pectoral fin rays range from 1/11(12) to 1/15(16) (typically 1/14-1/15) and its frequency distribution is given in table I.

TABLE I.

Frequency distribution of the number of pectoral fin rays, lateral line scales and scales round caudal peduncle in Garra hughi, sp. nov.

Character.	Total Range.	Counts in Holo-type.	Total No. of speci-mens.	Mean $\pm \sigma \overline{M}$	Percentage.		
1. No. of pectoral fin rays.	12—16	14	43	14.488 $\pm$.107	12—13	14—15	16
					9.3	81.39	9.3
2. No. of lateral line scales.	36—39	38	34	37.735 $\pm$.012	36—37	38—39	
					29.41	70.58	
3. No. of scales round caudal peduncle.	13—15	14	19	14.105 $\pm$.010	13	14	15
					5.26	78.94	15.79

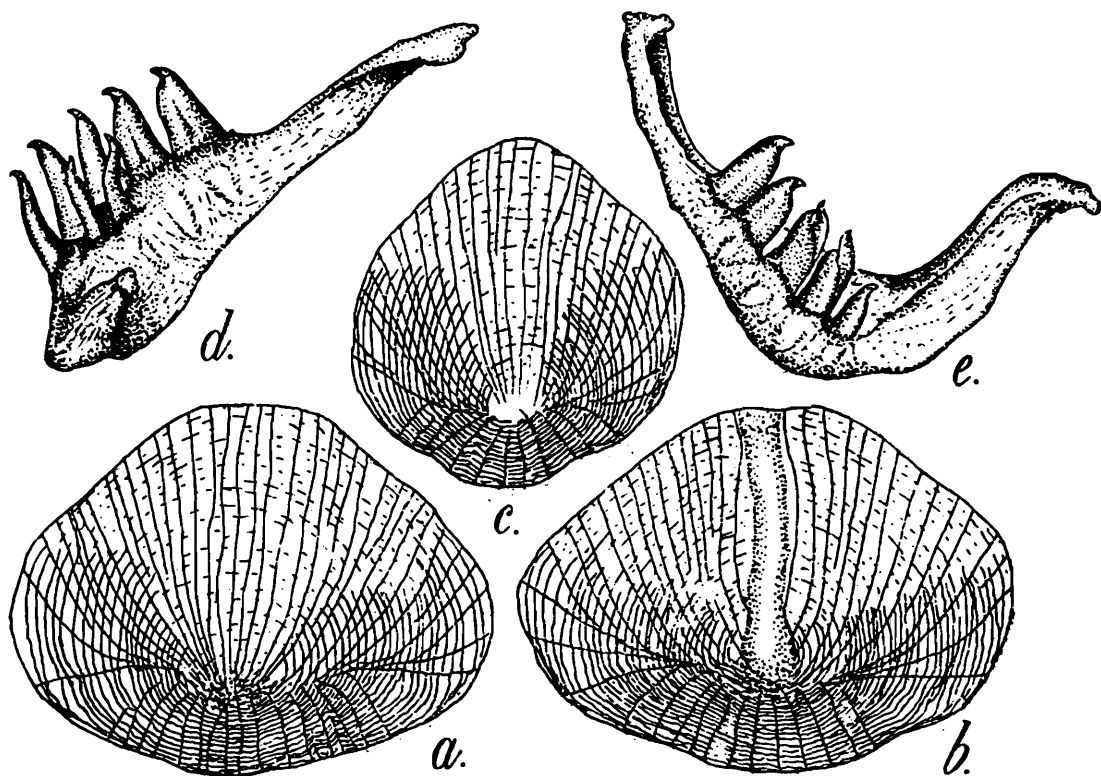
The outer four to five rays of the pectoral fin have thick fleshy muscular pads on their ventral surface to help in adhesion. The number of pelvic finrays range from 1/7.to 1/8, the holotype having the count 1/7 The pelvic fin reaches or slightly overlaps the anal opening, but falls considerably short of the origin of the anal fin. The length of the anal fin is contained 1.269 to 1.666 in the length of the head. The anal fin is shorter than the pelvic fin and its longest ray is 1.5 to 1.875 times in the length of the head. The last branched anal ray is about half the length of the last undivided ray. The anal fin has 5 branched rays and 2 undivided rays. The caudal fin is slightly longer than the head, its length being contained 4.181 to 5.75 in the total length and 3.181 to 4.75 in the standard length. The caudal fin is deeply emarginate, the lobes being equal and ending in pointed tips.

Certain additional body proportions are given here so as to help in distinguishing the new species from the known forms. In specimens less than 45 mm. in total length the origin of the dorsal fin is almost midway between the tip of the snout and the base of the caudal fin, while in larger examples it is closer to the tip of the snout. For all the specimens examined the ratio of the range of the distance between the tip of snout and origin of dorsal as stepped into the distance from the origin of the dorsal to the base of the caudal fin is 0.95 to 1.148. The former is also contained 1.875 to 2.111 and the latter 1.838 to 2.09 in the standard length. The commencement of the pelvic fin in specimens less than 45 mm. in total length is much closer to the base of the caudal fin, while in larger examples it is almost midway between the tip of the snout and the base of the caudal fin. When compared against the standard length the ratios obtained are 1.812 to 2.058 for the distance from the tip of the snout to the origin of the pelvic fin, and 1.944 to 2.44 for the distance from the origin of the pelvic fin to the base of the caudal fin.

¹ The count of 1/8 rays in the pelvic fin was observed in two specimens (one on the right side only and the other in both the pelvic fins.)

The vent (anal opening) is considerably removed from the anal fin and the distance between the vent and the origin of the anal fin is contained 3.5 to 4.2 times in the distance between the origins of the pelvic and anal fins. The anterior origin of the anal fin is much nearer to the base of the caudal fin than to the origin of the pelvic fin.

One of the most outstanding characters in the new species is the nature of the lepidosis and squamation. The scales are fairly large, non-deciduous and the lateral line is conspicuous. The scales along the lateral line range from 36 to 39 (typically 37 to 38 *vide* table I). The lateral line gently curves down just behind its origin in a line above the pectorals (in some it is almost straight) and runs straight to the middle of the base of the caudal fin. In a vertical below the origin of the dorsal fin, the lateral line is slightly nearer to the ventral than to the dorsal surface, while on the caudal peduncle it is equidistant from both. There are 3 rows of scales between the lateral line and the origin of the pelvic fin and 4 to 5 rows of scales between the origin of the dorsal fin and the lateral line. The scales round the caudal peduncle number 13 to 15 and their frequency distribution is given in table I.



TEXT-FIGURE 1.—Scales and pharyngeals and their teeth in *Garrus hughi* sp. nov.

- a. Scale from above lateral line midway between head and vertical from origin of dorsal. $\times 10$.
- b. Scale from lateral line from a vertical below origin of dorsal fin. $\times 10$
- c. Scale from caudal peduncle above lateral line. $\times 10$
- d. Inner view of pharyngeals and teeth taken from paratype. $\times 12\frac{1}{2}$
- e. Dorso-lateral view of the same. $\times 12\frac{1}{2}$

The scales are *totally absent* on the ventral surface as far back as, and between the base of the pelvic fins. In a few specimens the scaleless area extends still further backwards to the origin of the anal fin. But generally in this post-pelvic area a few ill-defined scale, almost completely embedded in the skin can be made out on careful examination. On

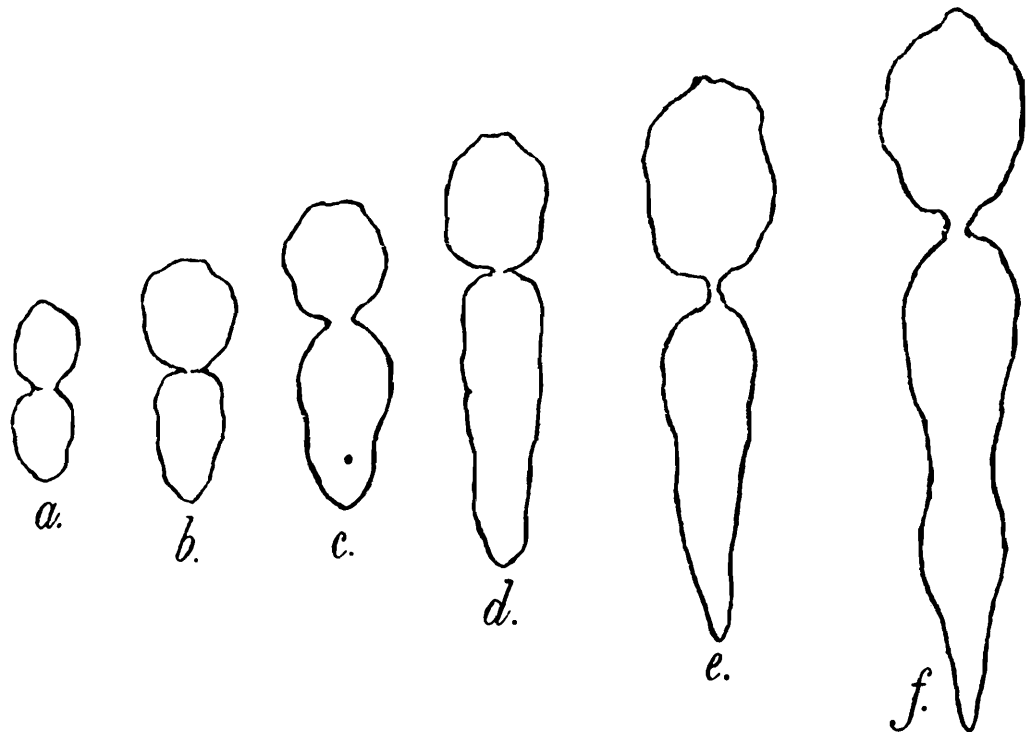
the dorsum, the scales are generally absent in a broad streak from the occiput to the origin of the dorsal fin. In a few examples the scaleless area is seen to extend along the entire dorsal surface as a broad streak from the occiput to the base of the caudal fin. This condition has been figured from one of the paratypes *vide* (Plate, I, figure 4). In such specimens careful examination has shown the presence of two or three scattered scales almost completely embedded in the integument in the post-dorsal region. In a few small examples rudimentary scales are also noticeable in part of the predorsal area, generally more towards the base of the dorsal fin.

The shape and structure of the scale differs considerably from that described and figured by Chu (1935) for *Garra imberba* (Garman) and *Garra schismatorhyncha* (Nichols & Pope) from China. As such, I have considered it best to present here the salient features of the scale of the new species which might prove taxonomically important in species distinction. The scales were examined in a number of specimens, but were found to adhere more or less to the general pattern as figured and described here for a paratype measuring 56 mm. in standard length. Generally the scales are roundish or vertically elliptical. The anterior margin is broadly rounded while the basilateral angles are round or slightly produced laterally. The focus is basal in position. The scales on the sides of the body are broader than long, while those on the caudal peduncle are slightly more elongate than broad. Both basal and apicolateral radii are present in all the scales. In the scale from the side of the body above the lateral line, in a vertical midway between the occiput and the dorsal origin (Text figure 1, *a*) the basal radii number 15 while the apicolateral radii, both complete and incomplete, number 36 (27 plus 9). In the second scale from the lateral line, taken from a vertical below the origin of the dorsal fin (Text figure 1, *b*), the basal radii number about 12, while the apicolateral radii number 31 (23 plus 8). In the third scale taken from the side of the caudal peduncle above the lateral line (Text figure 1, *c*), the basal radii number 12 while the apicolateral radii number about 31 (22 plus about 9). In these scales, 12 to about 16 circuli are present basally, while the number of lateral circuli range from about 20 to 32. In all the body scales, the apical circuli are indistinct and degenerate. No tubercles or granular prominences are evident on the apical portion of the exposed field.

The pharyngeals are rather long, its width being contained about four times in its length (Text figure 1, *d* and *e*). The anterior and posterior limbs are of about the same length. The pitted surface is broad in the middle, but does not continue forward to the tip of the anterior limb. The teeth are arranged in two rows, the formula being 5.2-2.5. They are placed fairly close together and are conical with the tips uncinatate or slightly recurved posteriorly. The outer row of teeth is enlarged and the grinding surface is more or less oblique.

The gas-bladder is comparatively reduced, but is of the normal cyprinid type. From the material examined it is evident that there is a considerable change in the structure, shape and size of this organ in the species, during different stages of growth. From the data given in

Table II, it will be noticed that in *Garra hughi* there is a general tendency for the decrease in the size of the gas-bladder as growth of the specimen increases resulting in a negetive correlation. Besides the size and the shape (Text figure 2a-f), the structure of the gas-bladder also undergoes certain changes. In small specimens both the anterior and posterior chambers are thin walled and large, while in larger examples the condition deviates considerably from this original type. The anterior chamber is reduced and is fixed to the body wall by a fibrous coat, while the posterior chamber becomes more narrower, cylindrical and thick-walled, the lumen inside being greatly reduced. Hora (1921, 1922) has pointed out the significance of the reduction of the gas-bladder in ' loach-like ' hill stream fishes and has correlated it with the ' ground habit of life ' of the fish.



TEXT-FIGURE 2.—Figure showing changes in the size and shape of the gas-bladder during growth in sepcimens of *Garra hughi* sp. nov. × 4.
a. Gas-bladder from a specimen 12 mm. in standard length.
b. Gas-bladder from a specimen 15 mm. in standard length.
c. Gas -bladder from a specimen 21 mm. in standard length.
d. Gas-bladder from a specimen 31 mm. in standard length.
e. Gas-bladder from a specimen 44 mm. in standard length.
f. Gas-bladder from a specimen 57 mm. in standard length.

TABLE II.

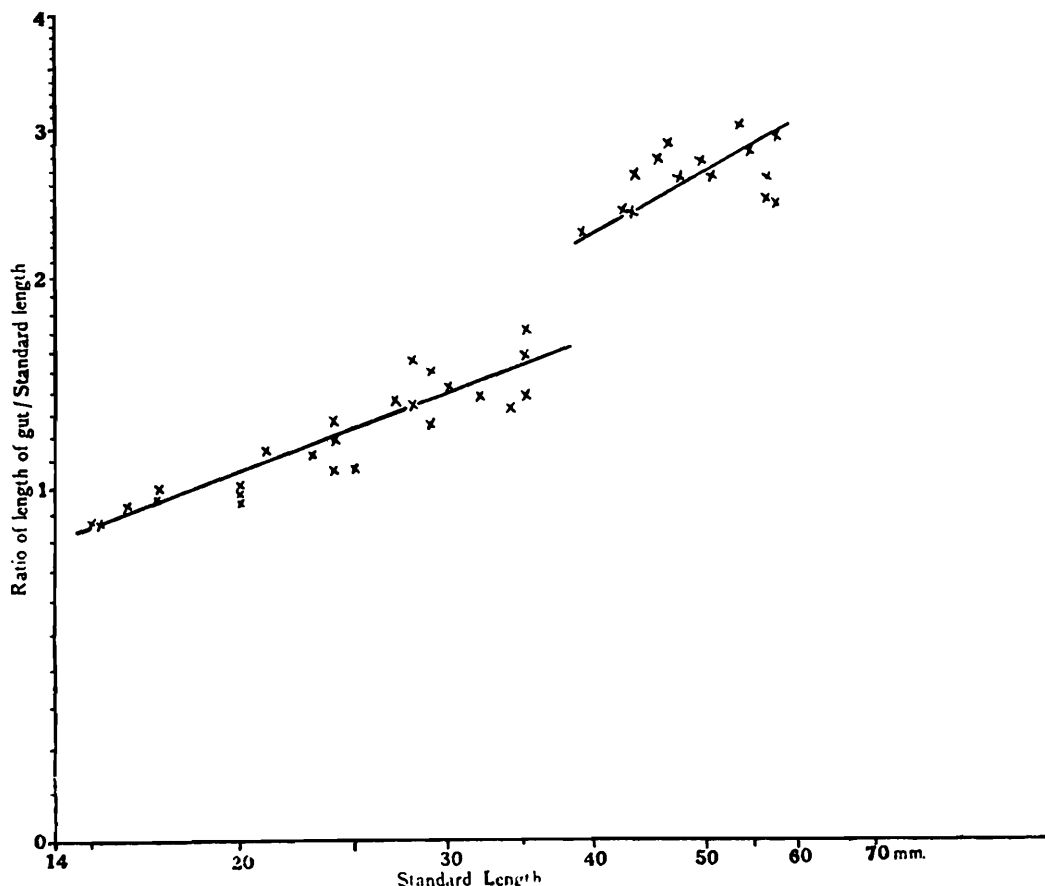
Table giving the relative lengths of the gas-bladder as compared against the standard length in six specimens of *Garra hughi* sp. nov.

Standard length in mm.	Length of gas-bladder.	Length of anterior chamber.	Width of anterior chamber.	Length of posterior chamber.	Width of posterior chamber.	St. length	St. length	St. length.
						Length of anterior chamber.	Length of posterior chamber.	Total length of gas-bladder
12	4.0	2.0	1.5	2.0	1.5	6.0	6.0	3.0
15	5.0	2.5	2.5	2.5	2.5	6.0	6.0	3.0
21	7.0	2.75	2.5	4.25	2.5	7.63	4.94	3.0
31	10.0	3.0	2.0	7.0	2.5	10.33	4.42	3.1
44	13.0	4.5	3.0	8.5	2.75	9.77	5.17	3.38
57	16.5	5.0	3.0	11.5	2.5	11.40	4.95	3.49

In measuring the anterior and posterior chambers of the gas-bladder, the measurement was carried out to the centre of the constricted portion separatiny the two chambers.

The comparatively larger size of the gas-bladder in smaller examples of *G. hughi* indicate that they probably are 'free-swimmers' and are found in more calmer waters closer to the banks and in pools and puddles along the course of the stream. The food of the young specimens also indicate that only after a certain stage they really take to the habit of living close to the substratum and graze on algae and slime found on the surface of submerged rocks and stones in the rapid streams, a condition for which the presence of a large gas-bladder will be a definite disadvantage.

The gut contents of 40 specimens (Text-figure 3) ranging from 15 to 57 mm. in standard length were examined to verify the nature of the food taken. It is interesting to find young specimens ranging from 15 to about 35 mm. in standard length, omnivorous in their habits, for the gut of some of the specimens were found stuffed with remains of earthworms, aquatic insects, mostly larvae of Chironomids and Ephimeropterans and bits of filamentous algae and detritus. A similar condition in another species of *Garra* viz., *G. ceylonensis ceylonensis* Bleeker has been recorded by Jones, (1941). He observes that juvenile specimens about two months old are "omnivorous in its diet greatly relishing chopped meat and flesh" In this case, however the specimens were reared in an aquarium. On account of the presence of only algae in the gut of the larger specimens examined, it is presumed that they feed mainly on vegetable matter. Comparisons



Text-figure 3. Double Logarithmic plot showing the ratios obtained of the length of the gut/standard length of 40 specimens of *Garra hughi* sp. nov. stepped against their respective standard length. The graph demonstrates the significant increase in the length of the gut after about the 35 mm. stage which synchronises with a change in the dietary habits of the species. (The connecting lines are given for visual aid).

of the length of the gut in these specimens in relation to the standard length shows that there is relatively a significant increase in the length of the former after a certain stage during growth. This sudden increase in the length of the gut after about the 35 mm. stage (standard length) thus indicates that the fish after an early life as an omnivorous feeder (predominantly carnivorous) later takes to feeding on vegetable matter (mainly algae) with a change in its mode of living, (*viz.*, from a more free swimming habit in calmer waters to life close to the substratum of the rapid waters of the streams, and this change in diet results in a greater increase in the length of the gut.

Colouration.—Colouration is characteristic, the sides and upper half of the body being greyish, while the ventral side and the abdomen are yellowish white. In young specimens the sides of the abdomen are whitish and the skin of the scaleless area on the abdomen is transparent, through which the coiled alimentary canal and the dark peritoneal lining are visible. In some adult specimens the greyish body colour extends to below the lateral line to the level of the origin of the paired fins dorsally. A dark conspicuous lateral band is present commencing from the upper angle of the gill-opening and extending to the base of the caudal fin along the lateral line. A dark blotch is usually present on the lateral line two scales from the base of the caudal peduncle. A second dark band is present along the scaleless area of the dorsum between the occiput and the origin of the dorsal fin. The scales on the upper half of the body, especially towards the dorsum have very dark bases and lighter margins. The fins are dirty white or dusky in colour and the upper surface of the outer rays of the paired fins are coloured dark greyish. In some of the immature specimens the sides of the body are coloured greyish brown and the mid-lateral dark band though present is not so conspicuous.

Types.—The Holotype F. 746/2 ; 88 mm. long (77 mm. in standard length). The 51 paratypes F. 747/2 were taken along with the holotype in March 1953. The Holotype and the paratypes are deposited in the collection of the Zoological Survey of India, Calcutta.

Type locality :—Stream in Lower Vauguvarrai Estate, High Range Travancore-Cochin.

In table III, I have given the ratios and the Average of the proportional measurements of 26 characters of the species. The detailed table was prepared so that it might help for future comparisons.

TABLE III.

Table giving the morphometric range (expressed as ratios) of 26 characters of Garra hughi sp. nov.

Characters.	Range for Holotype and paratypes.	Holotype.	No. of speci- mens.	Average.
1. Total length/Length of head.	4.222—5.588	5.333	40	4.914
2. Total length/Greatest height of body.	5.900—8.000	8.000	40	6.862
3. Total length/Greatest width of body.	6.545—9.500	8.800	40	8.194

TABLE III—*contd.*

Characters.	Range for Holotype and Paratypes.	Holotype.	No. of speci- mens.	Average.
4. Total length/Length of caudal fin.	4.181—5.750	5.176	38	4.789
5. Standard length/Length of head.	3.444—4.307	4.303	40	3.870
6. Standard length/Greatest height of body.	4.600—6.454	6.454	40	5.428
7. Standard length/Greatest width of body.	5.272—7.500	7.100	40	6.473
8. Standard length/Tip of snout to origin of dorsal fin.	1.875—2.111	2.088	40	2.000
9. Standard length/Origin of dorsal to base of caudal fin.	1.838—2.090	1.868	40	1.960
10. Standard length/Tip of snout to origin of pelvic fin.	1.812—2.058	1.972	40	1.946
11. Standard length/Origin of pelvic to base of caudal fin.	1.944—2.400	1.972	40	2.052
12. Standard length/Length of caudal fin.	3.181—4.750	4.176	38	3.789
13. Length of head/Width of head.	1.166—1.800	1.222	40	1.370
14. Length of head/Height at occiput.	1.272—2.000	1.833	40	1.705
15. Length of head/Length of snout.	1.833—4.500	2.062	40	2.346
16. Length of head/Diameter of eye.	3.250—7.500	6.600	40	5.358
17. Length of snout/Diameter of eye.	0.800—4.000	3.200	40	2.492
18. Interorbital distance/Diameter of eye.	1.166—3.250	3.000	40	2.339
19. Length of head/Height of dorsal fin.	1.250—1.714	1.500	38	1.471
20. Length of head/Length of pectoral fin.	1.000—1.666	1.031	38	1.150
21. Length of head/Length of pelvic fin.	1.269—1.666	1.269	38	1.431
22. Length of head/Longest anal ray.	1.500—1.875	1.650	38	1.710
23. Length of caudal peduncle/Least height of caudal peduncle.	1.500—2.000	1.785	40	1.729
24. Origin of dorsal to base of caudal fin/Tip of snout to origin of dorsal fin.	0.950—1.148	1.117	40	1.020
25. Height of body/Height of dorsal fin.	0.875—1.200	1.000	38	1.055
26. Width of mental disc/Length of mental disc.	1.142—1.625	1.583	32	1.407

Affinities of the new species.—In the number of lateral line scales, body proportions, etc., *Garra hughii* differs from all the known species of the genus from Peninsular India and by the combination of characters given in its diagnosis (*vide supra*, p. 2) it stands distinct from all the known species. However, in the absence of scales in the abdomen and the dorsum, a certain amount of convergent resemblance is exhibited by two other widely separated species *viz.* *Garra rossicus* (Nikolsky) from Baluchistan, Seistan and Oriental Persia and *Garra abhoyai* Hora from the Naga Hills, Assam to *G. hughii*. In *G. rossicus*, the chest and the back are scaleless, but in the possession of only a pair of barbels

(maxillary pair); triserial pharyngeal teeth (6·3·3-3·3·6); the position of the dorsal fin, the length of the head, height of body, etc. it differs considerably from the new species. In *G. abhoyai*, the scaleless condition has been described by Hora (1921, *op. cit.*, p. 664) as follows:—

“On the sides and on the dorsal surface behind the dorsal fin, the scales are well marked and their boundaries easily distinguishable, while in front of the dorsal fin they are much reduced and, indeed, to the naked eye the surface appears to be absolutely devoid of any scales. The under surface in front of the ventrals is naked, but ill-defined scales are present between the bases of the ventral and anal fins.”

I have examined the type of *G. abhoyai* in the fish collection of the Zoological Survey of India, and find that unlike the new species where the scales are totally absent on the abdomen between and in front of the base of the pelvic fins, ill-defined scales are in fact present and are almost completely embedded in the skin of the abdomen giving the false appearance of scalelessness. Moreover the Assamese species differs from *G. hughi* in the general body form, body proportions, number of lateral line scales, etc. Recently Hora (1953) has pointed out how ‘turbulent waters’ in a torrential stream (contrasted with rapid-flowing waters) resulting from the melting of the snows or due to orogenic movements or heavy rainfall, could bring about the reduction in the scales or even the total absence of scales in the body of fishes. As examples may be cited many of the Schizothoracine fishes and the Cobitid fishes of the Himalayas and the Central Asiatic Plateau. In *Garra* we find that such specialisation has taken place in three widely separated species. There is no doubt that this convergent similarity clearly reflects the effect of like responses to similar environment.

CONCLUSION.

During the past 33 years, since the publication of the last comprehensive work on the genus by Hora in 1921, a considerable amount of literature has accumulated on the taxonomy of these fishes, and many new species have been described by different authors from countries adjacent to India. A study of the literature shows that particular emphasis has been placed by taxonomists on certain characters not all of which; it is felt, are significant for separating species. However, it is evident that the materials on which they had to work on was mostly limited, so much so, primary importance seems to have been attributed to characters which are sometimes highly variable even within species limits. In many instances the variations which have formed the basis for species differentiation credit only racial or subspecific status. The present study and the assessment of the characters used in segregating species by earlier authors show that the length, width and height of head; the nature of the snout (not length); the presence or absence of proboscis and lateral lobes on the snout; the number of barbels; height of body; fin ray counts, lepidosis and squamation; position of the vent in relation to the origins of the pelvic and anal fins and the pharyngeals and their teeth are more dependable characters in the genus *Garra*. Much caution has to be exercised in using characters like the position of the eye in relation to head length; length of snout; origin of the dorsal and pelvic fins in relation to standard length;

nature of the adhesive disc, *etc.* as they are found to vary considerably both during growth as well as in specimens of about the same length in individuals of the same species itself. The maze of species that are known at present to constitute the genus *Garra*, seems definitely separable into different species groups including polytypic species with infra-specific levels of differentiations and only a taxonomic approach based on the present day species concept will help to clarifying the confusion that still exists in the taxonomy of this genus. Besides one other factor which needs elucidation is the redescription and the fixing of the precise range of distribution of the genotype, *Garra lamta* Hamilton, so that comparisons to it of spatially widely separated forms which have erroneously either been denoted as *G. lamta* or have been assigned other specific names, can be carried out. A study of the genus *Garra*, based on these lines is likely to make clear the phylogenetic affinities of the group ; the inter-relationships of the different species groups and finally give us a better idea of its distributional pattern.

ACKNOWLEDGEMENT.

I am greatly indebted to Dr. S. L. Hora, Director, Zoological Survey of India, for his helpful suggestions in the preparation of this paper. To my brother, Hugh M. Silas, Assistant Manager, Periakanal Estate, I am grateful for his constant help in the field during my visit to the High Range in 1952, and for the great pains he has taken for visiting and making fish collections for me from the different parts of the High Range over the past year.

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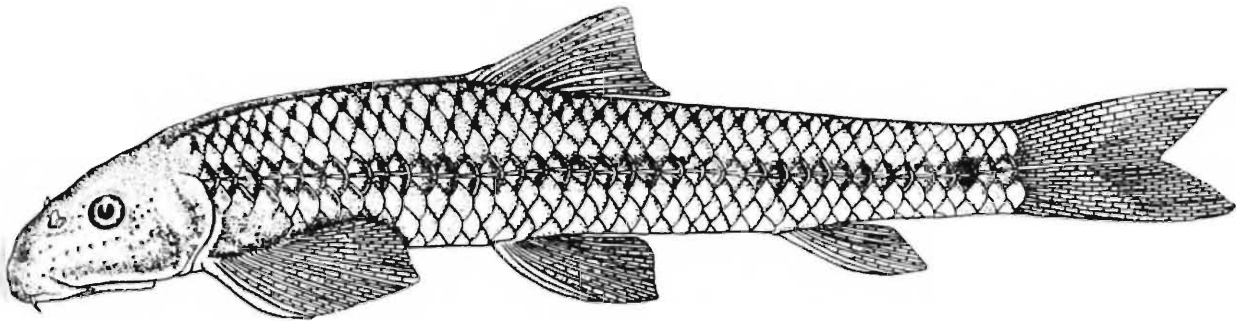
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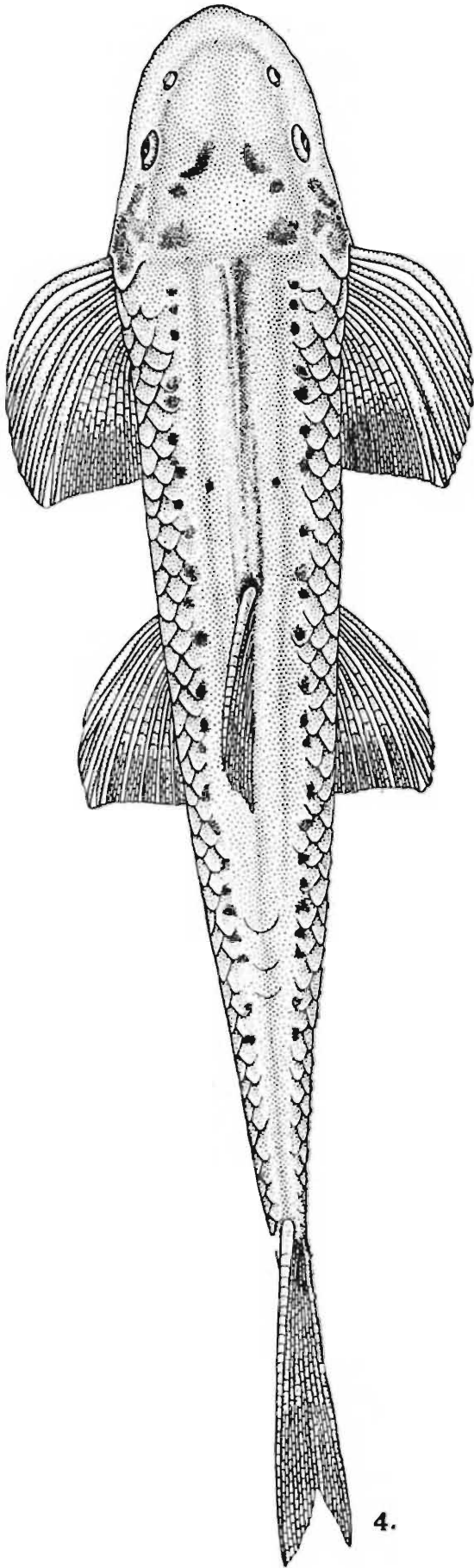
EXPLANATION OF PLATE. IV.

***Garra hughi* sp. nov.**

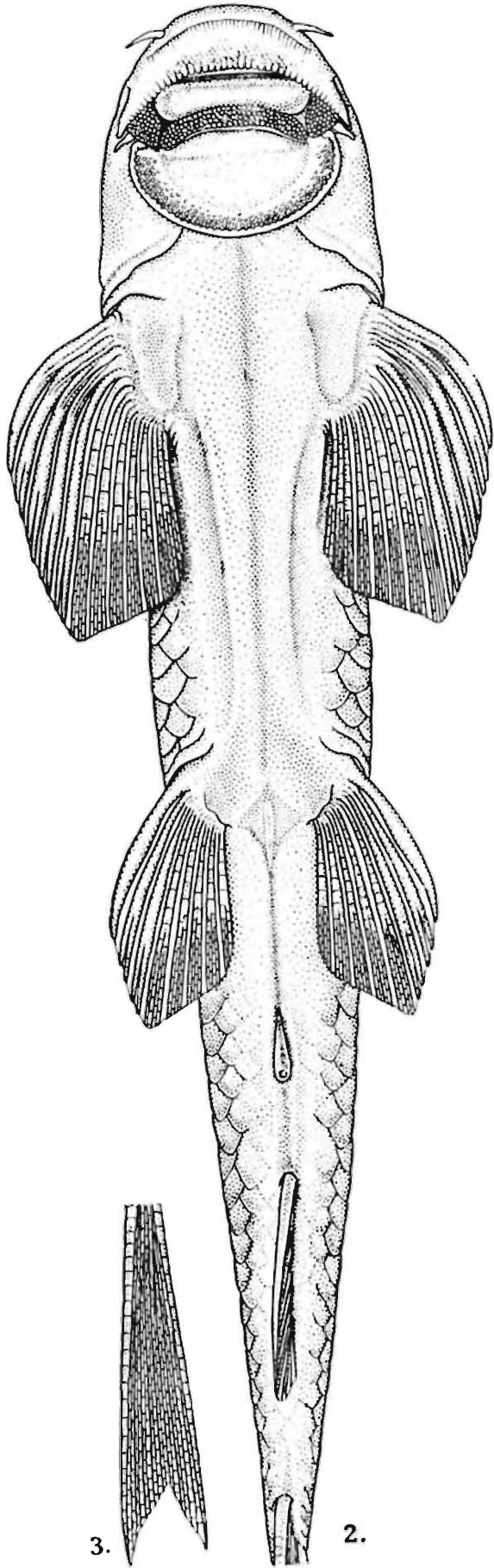
1. Lateral view of holotype measuring 88 mm. in total length. $\times 1\frac{1}{3}$.
2. Ventral view of same. $\times 2\frac{1}{2}$.
3. Portion of caudal fin of figure 2 drawn to same scale.
4. Dorsal view of paratype measuring 77 mm. in total length, showing the absence of scales in a broad streak across the dorsum, from the occiput to the base of the caudal fin. $\times 2\frac{2}{3}$.



1.



4.



2.



3.

1: R. Bagchi

Garra huschi sp. nov.

TWO NEW SPECIES OF ACANTHOCEPHALAN PARASITES OF BIRDS.

By M. N. DATTA, *M.Sc., Assistant Superintendent* and T. D. SOOTA, *M.Sc., Zoological Assistant, Zoological Survey of India, Calcutta.*

While dealing with the unnamed helminth material in the collection of the Zoological Survey of India, we found a pair (a male and a female) Acanthocephalan specimens collected from Scops Owl (*Otus* sp.) and another pair collected from Woodpecker (*Dinopium* sp.). Both the birds had died in the Zoological Gardens, Alipore, Calcutta, and sent to the School of Tropical Medicine. Col. R. Knowles had collected them from the intestines of those birds and presented them to the Zoological Survey of India. On study, they have been found to represent two new species of the genus *Centrorhynchus* Luhe, 1911. They are described below.

***Centrorhynchus knowlesi*, sp. nov.¹**

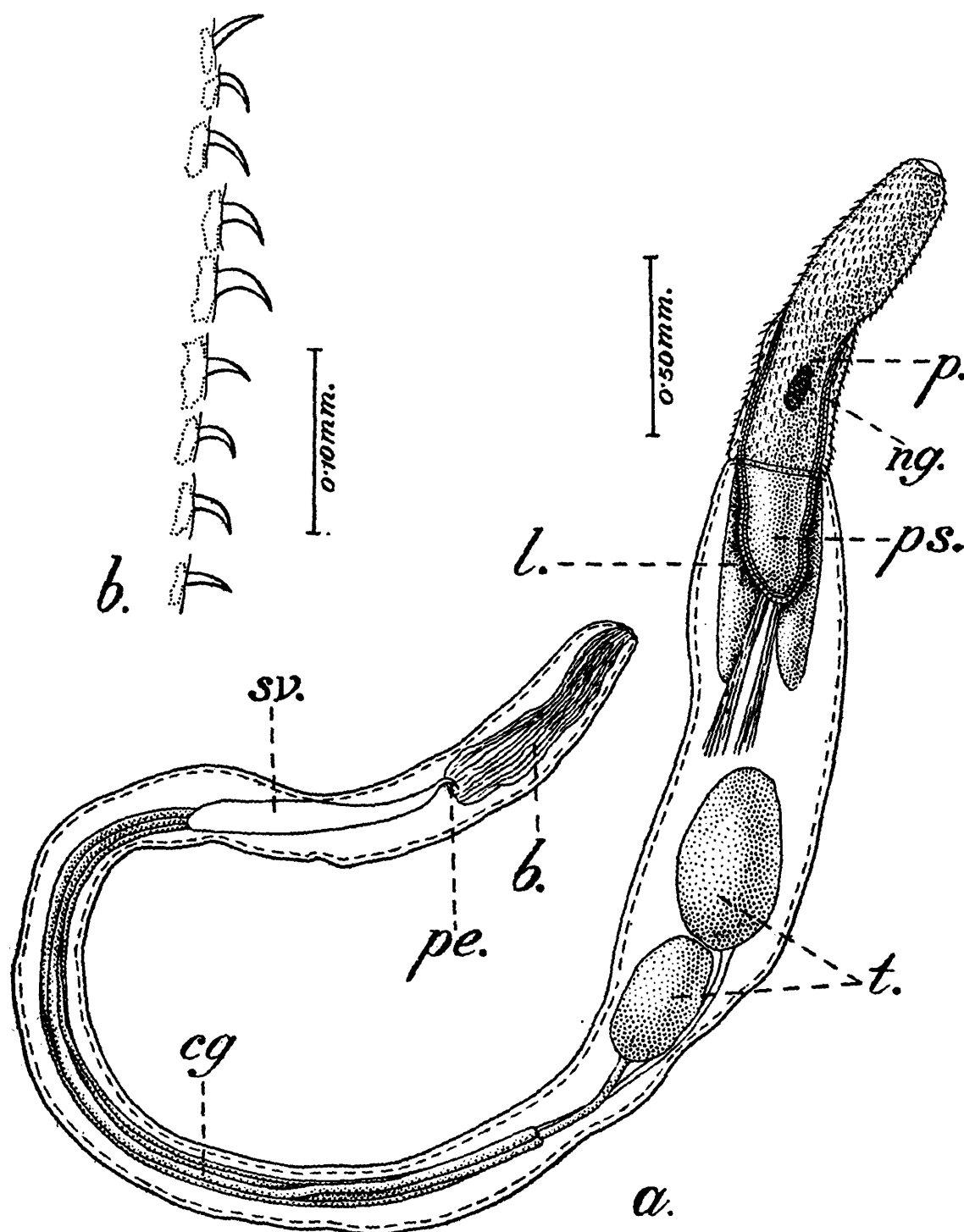
Male.—The body is divided into a broad oval anterior part and a narrow cylindrical posterior part. Total length of the worm is 7.37 mm. The anterior part including the proboscis measures 2.9 mm. in length and 0.48 mm. in width. The posterior part is 0.23 mm. wide. Proboscis is 0.53 mm. long and 0.23 mm. wide. Neck region measures 0.50 mm. in length and 0.29 mm. in width. The proboscis receptacle is 0.86 mm. long and 0.21 mm. wide. The portion anterior to the insertion of proboscis receptacle is slightly longer than the posterior part (neck region). The proboscis is armed with 42-46 longitudinal rows of hooks with 14-16 hooks in each circle. The hooks in the anterior region are bigger and measure 0.03-0.04 mm. while in the posterior region they diminish in size and measure 0.02-0.022 mm. The nerve ganglion is 0.62 mm. from the anterior end. The lemnisci measure 0.81 mm. in length.

The reproductive organs (Text-fig. 1 *a*) are fully developed. There is a pair of testes lying one behind the other. The anterior testis begins at 2.04 mm. from the anterior end and is 0.41 × 0.28 mm.; posterior testis is 0.38 × 0.23 mm. The portion of the worm from where cement glands arise is a bit damaged. The cement glands or prostate glands are long and cylindrical measuring 2.55 mm. in length. There is a prostatic reservoir. Seminal vesicle is 0.79 mm. long. Bursa is funnel like and measures 0.74 mm. in length. Small muscular and conical penis is situated at the top of the retracted Bursa.

Female.—The female specimen which is in three pieces is 9.16 mm. long. The anterior portion including the proboscis is 3.71 mm.

¹ The new species has been named after Col. R. Knowles, Late Director, Tropical School of Medicine, Calcutta, for having donated the specimens to the Zoological Survey of India.

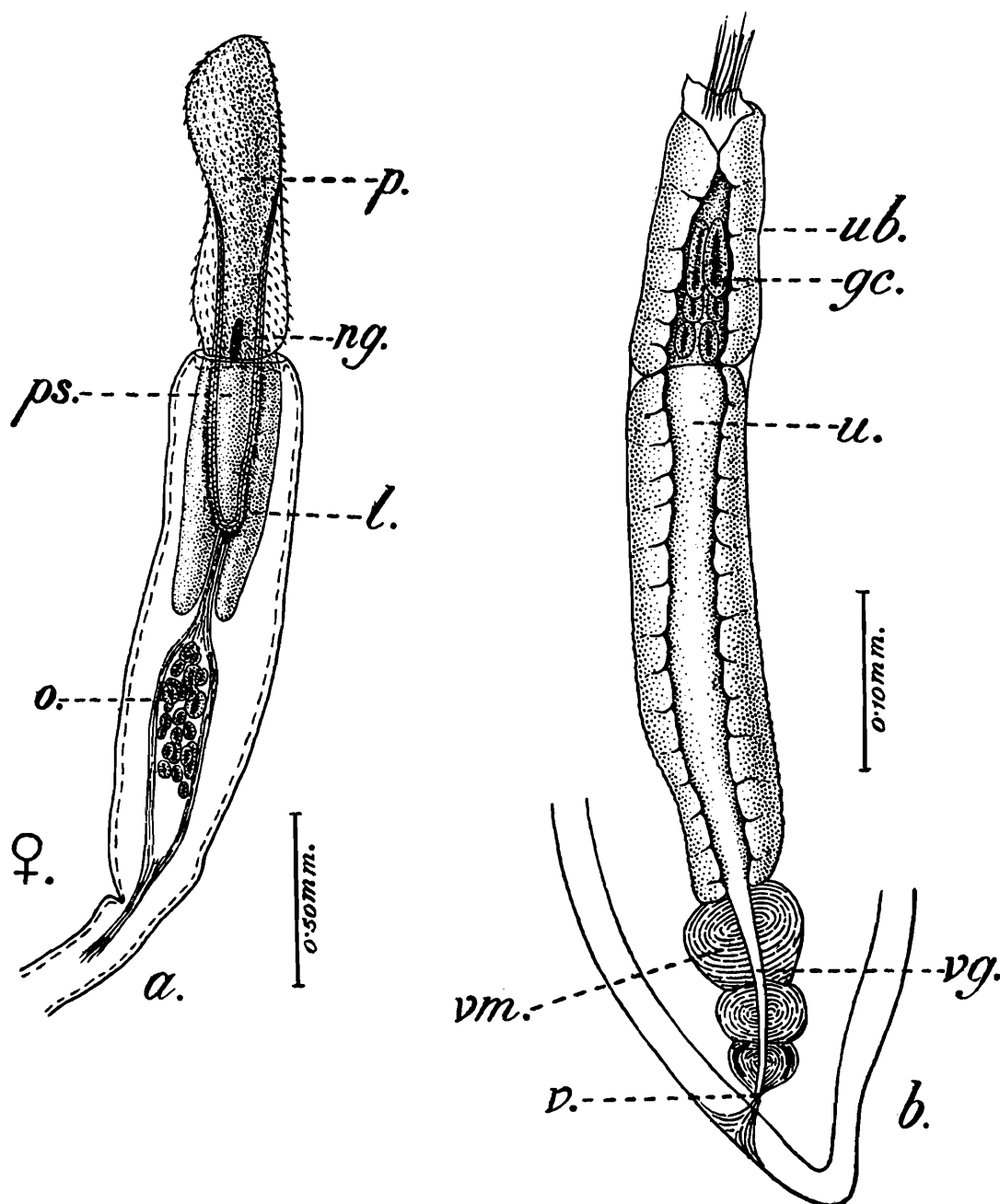
in length and 0.46 mm. in width. The posterior part is 0.21 mm. wide. Proboscis including the neck is 1.04 mm. in length. The hooks are of the same number and size as in the male. Proboscis sheath is 1.09 mm. long. Lemnisci measure 0.93 mm. in length. The nerve ganglion is 0.92 mm. from the anterior end.



Text-Fig. 1.—*Centrorhynchus knowlesi*, sp. nov. a. Entire male; b. Some of the hooks on proboscis and neck;

b., bursa; cg., cement glands; l., lemnisci; ng., nerve ganglion; p., proboscis; pe., penis; ps., proboscis sheath; sv., seminal vesicle; t., testes.

The reproductive organs (Text-fig. 2 a & b) are fully developed. The ovary is 0.46 mm. long and is having developing egg balls which after development will rupture the ovarian wall and the egg balls having the eggs in them will scatter all over the internal cavity. The eggs in turn after maturity will break away from the egg balls and will flow out



Text-Fig. 2.—*Centrorhynchus knowlesi*, sp. nov. a. Anterior region of female ; b. A part of posterior region of female.

gc., guard cells ; l., lemnisci ; ng., nerve ganglion ; o., developing ovary with ova ; p., proboscis ; ps., proboscis sheath ; u., uterus ; ub., uterine bell ; v., vulva ; vg., vagina ; vm., vaginal muscles.

through the uterine bell which measures 0.20 mm. in length. The uterus is 0.39 mm. and vagina 0.15 mm. in length.

	<i>C. californicus.</i>	<i>C. knowlesi.</i>
1. Length of the worms	3.15 mm.	♂—7.37 mm. ♀—9.16 mm.
2. Length of the broad anterior portion including the proboscis.		♂—2.9 mm. ♀—3.71 mm.
3. Width of the broad portion	0.38 mm.	♂—0.48 mm. ♀—0.46 mm.
4. Width of the narrow portion		♂—0.23 mm. ♀—0.21 mm.
5. Hooks	48 × 21-22	42—46 × 14-13
6. Length of the hooks in the anterior region of the proboscis.	0.042 mm.	0.03—0.04 mm.
7. Length of the hooks in the posterior region of the proboscis.	0.031 mm.	0.02—0.022 mm.

Specific diagnosis.—Length of the specimens 7·37-9·16 mm. Body divided into a broad oval anterior and a narrow cylindrical posterior portion. In the male the broad portion extending nearly upto the testes while in the female upto the ovary. Number of longitudinal rows of hooks 42-46 and number of hooks in each circle 14-16. Hooks in the anterior region bigger than in the posterior region.

Type specimens.—No. W 3830/1, Zoological Survey of India, Calcutta.

Host.—Scops Owl.

Locality.—Calcutta.

Remarks.—The new species approximates *C. californicus* Millzner in body form and number of longitudinal rows of hooks but differs from it in the body size and the number of hooks in each row.

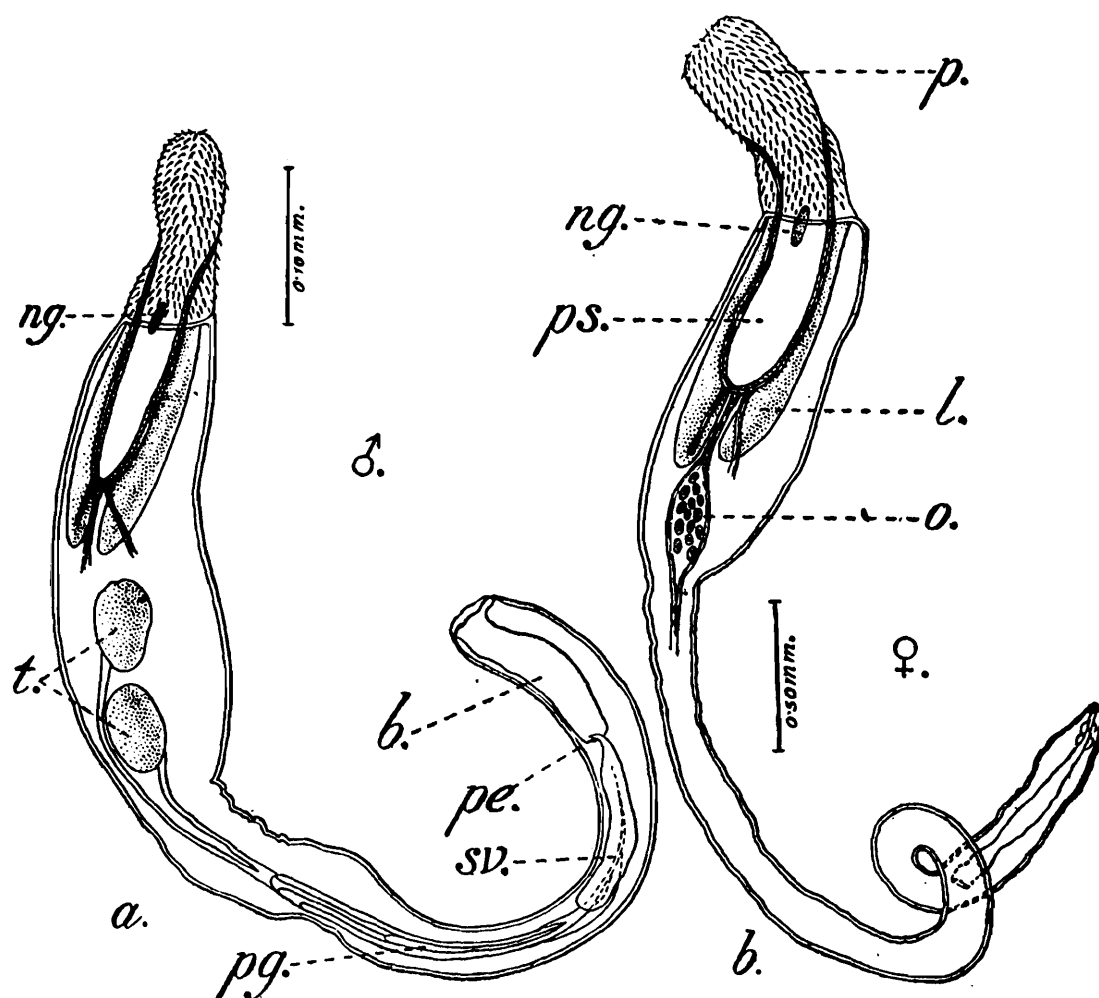
No comparison of the genital organs of the present species on the one hand and those of Millznern's specimens on the other, has been attempted because in the former the genital organs are fully developed, in the latter, only the male organs were developing and the female ones revealed nothing.

***Centrorhynchus bengalensis*, sp. nov.**

Male.—The length of the worm is 5·35 mm. Body is divided into a broad oval anterior part and a narrow tubular posterior part. The former including the proboscis measures 2·44 mm. in length and 0·59 mm. in width. The latter is 0·30 mm. wide. The proboscis is 0·47 mm. long and 0·28 mm. wide. The neck is 0·27 mm. in length and 0·32 mm. in width. The proboscis is armed with 35-40 longitudinal rows of hooks with 14-18 hooks in each circle. The hooks in the anterior region are bigger than in the posterior region. The former measure 0·02—0·04 mm. and the latter 0·022—0·025 mm. in length. The proboscis sheath is 0·73 mm. long. The nerve ganglion is 0·87 mm. from the anterior end. The lemnisci are 0·7 mm. long.

Reproductive organs (Text-fig. 3 a) are fully developed. The testes are equal in size being 0·31×0·23 mm. The anterior testis is situated at 1·68 mm. from the anterior end. Cement glands are 1·28 mm. long. There is a prostatic reservoir. In the mounted specimen the origin of each cement gland could not be traced and so the total length of the cylindrical cement mass was taken. Seminal vesicle is a pear shaped organ which is 0·49 mm. long. Bursa is 0·58 mm. in length.

Female.—The female specimen is 5·39 mm. long. The body is divided into two parts as in the male. The broad anterior part of the body including the proboscis is 2·26 mm. long and 0·40 mm. wide. The narrow posterior part of the body is 0·17 mm. wide. The proboscis is 0·52 mm. in length and 0·32 mm. in breadth. The neck is 0·29 mm. long and 0·30 mm. broad. The number and arrangement of the hooks is the same



Text-Fig. 3.—*Centrorhynchus bengulensis*, sp. nov. a. Entire male; b. Entire female; b., bursa; l., lemnisci; ng., nerve ganglion; o., ova; p., proboscis; pe., penis; pg., prostatic glands; ps., proboscis sheath; sv., seminal vesicle; t., testes.

as in the male. Proboscis receptacle is 0.93 mm. long. Nerve ganglion is 0.83 mm. from the anterior end of the body.

The ovary (Text-fig. 3 b) is attached to the base of the proboscis sheath by a ligament. Egg balls are clearly seen in it. Trace of uterine bell, uterus and vaginal duct was noticed in the specimen.

	<i>C. erraticus</i> .	<i>C. bengalensis</i> .
1. Length of the worms ..	7.5—8.5 mm.	♂—5.35 mm. ♀—5.39 mm.
2. Width of the anterior broad portion of the body.	1.2—1.4 mm.	♂—0.59 mm. ♀—0.40 mm.
3. Width of the posterior narrow portion of the body.	0.425—0.5 mm.	♂—0.30 mm. ♀—0.17 mm.
4. Hooks	36 × 21—22.	35—40 × 14—18
5. Length of the hooks in the anterior region of the proboscis.	0.055—0.065 mm.	0.02—0.04 mm.
6. Length of the hooks in the posterior region of the proboscis.	0.042 mm.	0.022—0.025 mm.

Specific diagnosis.—Length of the specimens 5.35 - 5.39 mm. Anterior portion of the body uniformly swollen nearly upto the region of the

testes in the male and the ovary in the female. Posterior portion of the body narrow and tubular. Number of longitudinal rows of hooks 35-40 with 14-18 hooks in each circle. The hooks in the anterior region of proboscis bigger than in the posterior region.

Type specimens.—No. W 3831/1, Zoological Survey of India, Calcutta.

Host.—Red-backed woodpecker.

Locality.—Calcutta.

Remarks.—The new species comes close to *C. erraticus* Chandler in the number of longitudinal rows of hooks but differs from it in the body shape and the number of hooks in each row.

In view of the fact that Chandlers' specimens were all immature, he did not give the description of the genital organs. Thus a comparison of the genital organs of the present species with those of Chandlers' does not arise.

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FURTHER OBSERVATIONS ON THE FISH FAUNA OF THE MANIPUR STATE

By A. G. K. MENON, *M.A., M.Sc., Asst. Zoologist, Zoological Survey of India, Calcutta.*

The earliest record of any comprehensive list of the fish fauna of Manipur is by Hora¹ who made an extensive survey of this State in February and March 1920. In his introduction on page 166, Hora makes a reference to another small collection made in 1910 by Rev. Mr. Pettigrew and observes that "the species in this collection, as Dr. Annandale informs me, were all obtained in the hill country, probably from the neighbourhood of Ukhrul which is situated at an altitude of 6,000 feet. Two new species found by Mr. Pettigrew, *Nemachilus manipurensis* and *Danio naganensis* were described by Dr. B. L. Chaudhuri, while notes on some of the other species are incorporated here" The only addition to our knowledge of the ichthyology of Manipur since Hora's account of it is a report by Menon² on the collection made by Dr. Roonwal from Central Manipur, about thirty miles radius of Imphal.

The present collection on which this paper is based was made by a Zoological Survey party consisting of the writer, Mr. A. K. Dutta, Zoological Assistant, one Collection Tender and one Peon, which surveyed the State for six weeks in January and February 1953, with a view to make a faunistic survey of the region and in particular to study the ecological changes and consequently the changes in its aquatic fauna since the last survey of the area in 1920. Dr. S. L. Hora, who had conducted the previous survey in 1920, also visited Manipur for a week in February to make a study on the spot of the present ecological conditions of the valley, so as to enable him to compare the present-day conditions with those of 1920.

The party made very extensive collections from the Loktak Lake, the Imphal river and the Barak river at different localities. In addition to these, collections were also made from all the major streams within the State, most of which, however, ultimately join either the Barak or the Imphal river. From a zoogeographical point of view, the great interest of this survey lies in the fact that the Imphal river is a tributary of the Chindwin River (Irrawadi Drainage System), while the

¹ Hora, S. L., *Rec. Ind. Mus.* XXII, pp. 165-224 (1921).

² Menon, M. A. S., *ibid.*, L, pp. 265-70 (1952).

Barak river forms part of the Brahmaputra River System. The following is the list ¹ of the species so far known from the Manipur State :

Family CYPRINIDAE.

Sub-family ABRAMIDINAE.

1. *Chela laubuca* (Ham.)

Sub-family RASBORINAE.

2. *Barilius barila* (Ham.)
 3. *Barilius bendelisis* chedra (Ham.)
 4. *Barilius bola* (Ham.)
 5. *Barilius dogarsinghi* Hora
 6. * *Barilius guttatus* Day
 7. *Brachydanio acuticephala* Hora
 8. *Danio aequipinnatus* (McClell.)
 9. * *Danio dangila* (Ham.)
 10. *Danio naganensis* Chaudhuri.

Sub-family CYPRININAE

11. * *Crossochilus latius burmanicus* Hora
 12. * *Garra abhoyai* Hora
 13. *Garra gotyla* (Gray)
 14. *Garra lissorhynchus* (McClell.)
 15. *Garra naganensis* Hora
 16. * *Garra nasutus* (McClell.)
 17. * *Garra rupiculus* (McClell.)
 18. * *Labeo angra* (Ham.)
 19. * *Labeo calbasu* (Ham.)
 20. * *Labeo pangusia* (Ham.)
 21. *Puntius clavatus* (McClell.)
 22. *Puntius conchoniis* (Ham.)
 23. *Puntius phutunio* (Ham.)
 24. *Puntius sarana* (Ham.)
 25. *Puntius ticto* (Ham.)
 26. *Rohtee belangeri* (C. V.)
 27. *Rohtee cotio cunma* Day.
 28. *Tor putitora* (Ham.)
 29. *Tor tor* (Ham.)

Family PSILORHYNCHIDAE.

30. *Psilorhynchus homaloptera* Hora and Mukerji

Family COBITIDAE.

31. *Acanthopthalmus pangia* (Ham.)
 32. *Botia berdmorei* (Blyth)
 33. * *Botia histrionica* (Blyth)
 34. *Lepidocephalichthys berdmorei* (Blyth)
 35. *Lepidocephalichthys guntea* (Ham.)
 36. *Lepidocephalichthys irrorata* Hora

37. *Nemachilus botia* (Ham.)
 38. *Nemachilus kanjupkhulensis* Hora
 39. *Nemachilus manipurensis* Chaudhuri
 40. * *Nemachilus prashadi* Hora
 41. * *Nemachilus sikmaiensis* Hora
 42. *Nemachilus zonalternus* Blyth

Family SILURIDAE.

43. *Callichrous bimaculatus* (Blyth)
 44. * *Wallago attu* (Bl.)

Family BAGRIDAE.

45. *Mystus affinis* Blyth
 46. *Mystus bleekeri* Day

Family SISORIDAE.

47. * *Gagata cenia* (Ham.)
 48. *Glyptothorax platypogonoides* (Blkr.)
 49. *Glyptothorax manipurensis*, sp. nov.
 50. *Glyptothorax trilineatus* Blyth

Family CLARIIDAE.

51. *Clarias batrachus* (Linn.)

Family AMBASSIDAE.

52. *Ambassis ranga* (Ham.)

Family NANDIDAE.

53. *Badis badis* (Ham.)

Family CHANNIDAE.

54. * *Channa gachua* (Ham.)
 55. *Channa harcourbutleri* (Ann.)
 56. *Channa punctatus* (Bloch)
 57. *Channa striatus* (Bloch)

Family ANABANTIDAE.

58. *Anabas testudineus* (Bloch)

Family OSPHRONEMIDAE.

59. *Colisa chuna* (Ham.)
 60. *Colisa fasciatus* (Bl.)

Family SYMBRANCHIDAE.

61. *Fluta alba* (Zuiew)

Family MASTACEMBELIDAE.

62. *Mastacembelus armatus* (Lacép.)
 63. * *Mastacembelus manipurensis* Hora

¹ Only species which have been actually recorded from the Manipur State are included. *Rasbora rabsora* (Ham.) and *Rhynchobdella dhanshorii* Hora recorded from Dimapur (Hora, Rec. Ind. Mus. XXII, pp. 187 and 205, 1921) and *Erethistes hara* (Ham.) = *Erethistes pusillus* Müller and Troschel) and *Erethistes elongata* Day (= *Couts conta* Ham.) (Hora, loc. cit., p. 173) have therefore been omitted.

The species, whose names are preceded by an asterix (*), are not represented in the recent collection, while *Chela laubuca*, *Psilorhynchus homaloptera*, *Glyptothorax trilineatus*, *Colisa chuna* and *Mastacembelus armatus* are recorded here for the first time from Manipur. A new species resembling the Chinese species *Glyptothorax sinense* has also been found in the present collection. Full description of this form is given in the paper in addition to a few remarks on species newly recorded here from the Manipur State.

***Glyptothorax manipurensis*, sp. nov.**

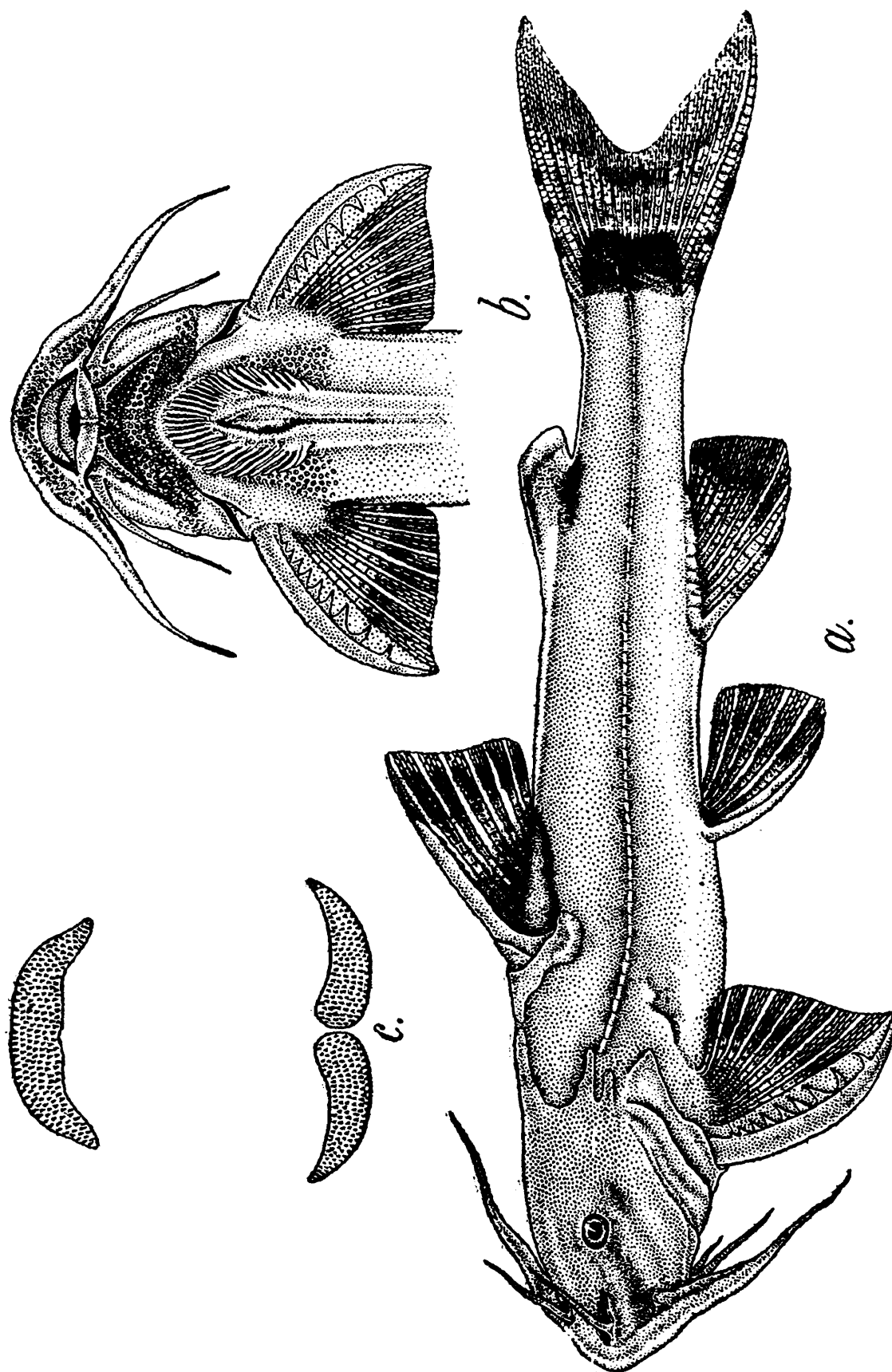
In the collection under report there are seven specimens belonging to the genus *Glyptothorax* which differ from all the other members of this genus so far known from India. However, they approximate to *Glyptothorax sinense* Regan, a species known from Burma and China, from which they differ in the body colouration and the much broader nature of their head. I propose to describe them here as belonging to a new species of *Glyptothorax*.

D.1/6., A.2/9., P.1/9., V.1/5., C.22-24.

Glyptothorax manipurensis is a very much laterally compressed, elongated form in which the dorsal profile rises from the tip of the snout to the origin of the dorsal fin whence it slopes down gradually to the base of the caudal fin. The head and part of body in front of the ventrals is greatly depressed. Beyond the anal fin the ventral profile rises to the base of the caudal fin. The head is broadly pointed, its length is contained from 4 to 4.6 times in the standard length; its height at the occiput is contained about 1.6 times and its width about 1.1 times in its length. The eyes are of the medium size and their diameter is contained from 6 to 7 times in the length of the head. The mouth is inferior and horizontal, the width of its gape is almost equal to the length of the snout. The lips are well-developed and are studded with papillae. The teeth in the jaws are villiform; those in the upper jaw form a narrow, continuous band while in the lower jaw the band is interrupted in the middle. The nostrils are situated much nearer to the tip of the snout than to the anterior margin of the orbit. The length of the snout is contained about 2 times in the length of the head. The inter-orbital width is contained from 2.7 to 3.1 times in the width of the head. The nasal barbels when pressed reach slightly beyond the anterior margin of the orbit, the maxillaries reach the middle of the base of the pectorals, the outer mandibulars reach the upper angle of the gill opening and the inner mandibulars reach as far as the anterior end of the adhesive apparatus.

The depth of the body is contained 5.1 to 5.5 times in the standard length. The caudal peduncle is more than twice as long as high. The dorsal fin commences almost in the beginning of the second third of the distance between the tip of the snout and the base of the caudal fin, it is slightly higher than the depth of the body below it. The basal bone of the dorsal is narrowly separated from the occipital spine which is two and a half times as long as wide. The dorsal spine is sheathed in skin; it is strong and is finely serrated along its posterior margin. The pectoral spine is broad and denticulated along its inner margin. The

pectoral fins are shorter than the head and are separated from the pelvics by a considerable distance. The pelvic fins are almost as long as the dorsal spine and extend well beyond the vent, but separated from the anal fin. The anal fin originates slightly in front of the commencement



Glyptothorax mampurensis, sp. nov.
a. Lateral view of the type specimen, $\times 4$; *b.* Ventral view of the head and body, $\times 23$; *c.* Teeth; bands of the upper and lower jaws, $\times 6$.

of the adipose dorsal and its longest ray is about the length of the dorsal spine. The caudal fin is deeply forked, the lobes being almost of the same length. The paired fins are not plaited.

The adhesive apparatus on the chest is longer than broad and is without any depression. The skin is smooth.

In spirit the colour is olivaceous with dark patches at the base of the dorsal, the caudal and the adipose fins.

Type-specimens.—F. 738/2, Holotype ; F. 739/2, Paratype, Zoological Survey of India, Calcutta.

Locality.—Barak river, Karong, Manipur State (Assam).

Remarks.—*Glyptothorax manipurensis* can be easily distinguished by the conspicuous dark patches at the base of the dorsal, the adipose and the caudal fins, whereas in *Glyptothorax sinense* there are two dark brownish transverse bands, one below the dorsal and the other below the adipose fin.

Measurements in millimetres.

Total length including caudal	94.5	84.5	78.5	76	75	66.5	60
Length of caudal	20	17	17.5	16	15.5	14.5	13
Length of head	18.5	18	17	15.5	15.5	14.5	12
Width of head	17	15	15	14	14	12	11
Height of head near occiput	11.5	11	11	9.5	9.5	9	7.5
Length of snout	9.5	8.5	8	8	8	7.5	6
Inter-orbital width	5.5	5	5	4.5	4.5	4	4
Depth of body	14.5	11.5	11.5	11	11	10	8.5
Height of dorsal fin	13	12.5	10.5	12	11.5	11	9
Length of pectoral fin	16.5	14.5	13	13.5	12	11	10
Length of ventral fin	11.5	10.5	9.5	9	9	9	7.5
Longest ray of anal fin	11.5	11	10.5	10	10	8	8
Length of caudal peduncle	15	12.5	12.5	12	12.5	11	10
Least height of caudal peduncle	7.5	6	5.5	5.5	5.5	5	4.5
Distance between tip of snout and commencement of dorsal fin	29	24.5	23.5	23	21.5	20.5	18
Distance between commencement of dorsal fin and that of adipose fin	26.5	26.5	22.5	21	21	18.5	17
Distance between commencement of dorsal fin and base of caudal fin	49	44.5	40	39.5	39	35	31
Distance between base of dorsal fin and commencement of adipose fin	16.5	15	14	13.5	13	11	11
Length of base of adipose fin	8	8.5	7	7	7.5	7.5	6

***Chela laubuca* (Ham.)**

1822. *Cyprinus laubuca*, Hamilton, *Fish Ganges*, pp. 260, 384.

1876. *Perilampus laubuca*, Day, *Fish India*, p. 598, pl. cl. 1, fig. 5.

1889. *Perilampus laubuca*, Day, *Faun. Brit. Ind.*, Fish .1, p. 360, fig. 112.

1916. *Laubuca* (*Laubuca*) *laubuca*, Weber and Beaufort, *Indo-Austral. Archipel.*, 111, p. 48.

1937. *Laubuca laubuca*, Shaw and Shebbeare, *Journ. Roy. As. Soc. Bengal*, 111, p. 20-21.

1945. *Chela laubuca*, Smith, *Bull. U. S. Nat. Mus.*, 188, p. 81-82.

There are only two specimens of *Chela laubuca* obtained from the Imphal river in the collection under report ; they vary from 50-57 mm. in length.

The species is widely distributed in India, Burma and Sumatra ; also found in Siam.

***Psilorhynchus homaloptera* Hora and Mukerji**

1935. *Psilorhynchus homaloptera*, Hora and Mukherji, *Rec. Ind. Mus.* XXXVII, pp. 391-397.

There are 13 specimens of *Psilorhynchus homaloptera* which agree well with the description and figure of the species by Hora and Mukerji. They were collected from the Barak river at Kairong. *Psilorhynchus homaloptera* has so far been known only from its type-locality, Keleki stream at Emilomi in the Naga Hills. Hora¹ collected a few young specimens of a species of *Psilorhynchus* from Piphima in the Naga Hills and it is very likely that those specimens also belong to this species since Karong and Piphima are both drained by one and the same river system.

***Glyptothorax trilineatus*, Blyth.**

1860. *Glyptothorax trilineatus*, Blyth, *Journ. As. Soc. Bengal*, XXIX, p. 154.

1953. *Glyptothorax trilineatus*, Menon, *Rec. Ind. Mus.* LI (In Press).

Glyptothorax trilineatus is represented by 3 specimens varying from 69 to 83 mm. in total length. They possess the characteristic three white stripes on the body and agree in every respect with Blyth's description of the species.

G. trilineatus is so far known only from Burma and Siam ; its record from Nepal being erroneous.² It is recorded here from the Imphal river in Manipur for the first time, though it is already known to occur in the Chindwin drainage.³

***Colisa chuna* (Ham.)**

1822. *Trichogaster chuna*, Hamilton, *Fish Ganges*, pp. 121, 372.

1876. *Trichogaster chuna*, Day, *Fish India*, pp. 373-44, pl. LXXIX, fig. 3.

1937. *Trichogaster chuna*, Shaw and Shebbeare, *Journ. As. Soc. Bengal*, III, p. 117.

There are a large number of specimens of *C. chuna* obtained from the Loktak Lake in the collection under report. This species is quite common in almost all the lakes and ditches in the valley. It is quite likely that this species had entered the Valley along with *Anabas testudineus* (Bloch) which was introduced there by the authorities of the State since 1920 and has now become a wild growth all over the Valley.

Colisa chuna is so far known only from Bengal and Assam and it is here recorded for the first time from Manipur.

***Mastacembelus armatus* (Lacep.)**

1800. *Mastacembelus armatus*, Lacepede, *Hist. Nat. Poisson*, 11, p. 286.

1876. *Mastacembelus armatus*, Day, *Fish India*, p. 340, pl. LXXIII, fig. 2.

1919. *Mastacembelus armatus*, Annandale, *Rec. Ind. Mus.*, XVI, p. 125.

1937. *Mastacembelus armatus*, Shaw and Shebbeare, *Journ. As. Soc. Bengal* III, p. 126.

One specimen, 480 mm. in length was collected from the Loktak Lake. This species is widely distributed in Ceylon, India, Burma and China. It is, however, recorded here for the first time from the Manipur Valley.

¹ Hora, S. L., *Rec. Ind. Mus.* XXII, p. 173.

² Hora, S. L., *Rec. Ind. Mus.* XXV, p. 29 (1923).

³ Hora, S. L., *ibid.*, XXXIX, p. 338 (1937).

NOTES ON FISHES OF THE GENUS *GLYPTOTHORAX* BLYTH.

By M. A. S. MENON, M.Sc., Offg. Scientific Assistant, Zoological Survey of India, Calcutta.

INTRODUCTION.

Hora¹ in 1921 created the genus *Laguvia* to accommodate two small species of Sisorid fishes, *L. shawi* and *L. riberoi* obtained from the rivers of the Darjeeling District, W Bengal. Discussing the affinities of the genus he remarked,

"It closely resembles *Erethistes* Mull. and Trosch., from which it can be distinguished by the nature of its gill-openings which are wide. From the genus *Glyptothorax* it differs in the possession of scapular processes, the presence of bony tubercles on the sides of the body and in the absence of a well-marked adhesive apparatus on the chest. In most respects the genus is intermediate between *Erethistes* and *Glyptothorax*."

Besides, he described the first pectoral ray of *Laguvia* as a strong spine which is denticulated internally.

In the generic key to Glyptosternoid fishes Hora² distinguished the genus *Glyptothorax* thus,

"Gill-openings wide, almost meeting each other on under surface; pectoral provided with a strong spine which is denticulated internally".

It is thus seen from a close comparison of the generic characters of *Laguvia* and *Glyptothorax*, that a strong, internally denticulated pectoral spine and wide gill-openings are salient features shared commonly by both the genera, *Laguvia*, according to Hora (*op. cit.*) differing from *Glyptothorax* only in the possession of humero-cubital and scapular processes, the presence of bony tubercles on the sides of the body and in the absence of a well-marked adhesive, thoracic apparatus. On an examination of the entire Glyptothoracid fishes in the collections of the Zoological Survey of India, it has been found that these minor characters as have been attributed only to the genus *Laguvia*, are so clearly discernible in some of the Glyptothoracid species like *G. tuberculatus* that it is proposed to merge *Laguvia* Hora into the synonymy of *Glyptothorax* Blyth. A revised key to the valid Indian and Burmese species, based mainly on the nature of the skin, relative length of the occipital spine, peculiarity of the thoracic adhesive apparatus etc., is provided along with a list of the Glyptothoracid fishes in the collections of the Zoological Survey of India. Besides, *G. madraspatanum*, *G. platypogonoides*, *G. trilineatus* and *G. horai* have been redescribed as the available descriptions of these species are rather meagre.

Hora's³ statement regarding the specific diagnosis of the members of the genus *Glyptothorax* are also worthy of consideration in this context. He remarks,

"The members of the genus *Glyptothorax* are still in a process of adaption to life in hill-streams and the specific characters in them are not yet properly fixed. The taxonomy of the genus is in a state of confusion and I agree with Day that some of the species may ultimately prove to be mere varieties."

¹ Hora, S. L., *Rec. Ind. Mus.* XXII, pp. 739-43 (1921).

² Hora, S. L., *Rec. Ind. Mus.* XXV, p. 8 (1923).

³ Hora, S. L., *Rec. Ind. Mus.* XXV, p. 27 (1923).

Thus while he expressed doubts with regard to the specific validity of Hamiltons' *Pimelodus botia*, *P. telchitta* and *P. cavia*, obliged as he was "to employ characters which in the case of most other Silurid genera would not be regarded as specific", adopted the plaited condition of the paired fins as the main character for grouping the different species of *Glyptothorax*.

In the group with plaited paired fins he included six species, viz., *G. annandalei**, *G. brevipinnis**, *G. stoliczkae*, *G. pectinopterus*, *G. saisii** and *G. striatus*; while eleven others, *G. kashmirensis**, *G. dekkanensis*, *G. gracilis*, *G. botia*, *G. telchitta*, *G. dorsalis*, *G. conirostre*, *G. minutus*, *G. lonah*, *G. trilineatus** and *G. madraspatanus** were referred to a group with non-plaited paired fins. *G. lineatus** was not, however, included in either category of his key.

Prashad and Mukerji¹ later described two more new species, *G. burmanicus** and *G. tuberculatus** and Mukerji² another new species *G. prashadi** from Burma.

Hora³ in his account of the Glyptothoracid fishes of the Deccan cleared up the systematic position of *G. lonah* and found *G. dekkanensis* conspecific with it. He also recorded a new variety, *G. conirostre poonaensis** from Poona and a new species *G. trewavasae** from Mysore, and invented a key for distinguishing them.

Since then Shaw and Shebbeare⁴ added a new species *G. horai** from N. Bengal and Herre⁵ another new species *G. housei* from Malabar, S. India.

Later Hora and Menon⁶ discussing the systematic position of Hamilton's *P. botia*, *P. telchitta* and *P. cavia* brought forward reasons for relegating *P. botia* to the synonymy of the valid species *G. telchitta*, and *G. burmanicus* and *G. lineatus* to *G. cavia*. The Indian and Burmese species have thus been reduced to 24 and these may be distinguished by means of the following key:—

KEY TO THE INDIAN AND BURMESE SPECIES OF

THE GENUS *Glyptothorax* BLYTH

- | | |
|---|-----|
| 1. Skin smooth, devoid of granulations or tuberculations | 3 |
| 2. Skin rough, with granulations or tuberculations | .19 |
| 3. Adhesive apparatus on chest distinctly longer than broad | 5 |

* Type of the species is in the Zoological Survey of India.

¹ Prashad, B. and Mukerji, D. D., *Rec. Ind. Mus.* XXXI, pp. 182 ; 184 (1929).

² Mukerji, D. D., *Rec. Ind. Mus.* XXXIV, p. 281 (1932).

³ Hora, S. L., *Rec. Ind. Mus.* XL, pp. 363-375 (1938).

⁴ Shaw, G. E. and Shebbeare, E. O., *Journ. Bombay Nat. Hist. Soc.* XXXIX, p. 188 (1937-38).

⁵ Herre, A. W. C. T., *Stanford Ichthyol. Bull.* II, p. 117 (1942).

⁶ Hora, S. L. and Menon, M. A. S., *Rec. Ind. Mus.* XLVI, pp. 55-62 (1948-49).

4. Adhesive apparatus on chest as long as or broader than long ..17
5. Occipital process touching basal bone of dorsal .. 7
6. Occipital process distinctly separated from basal bone of dorsal .. 9
7. Dorsal spine smooth; ventral surface of paired fins plaited *G. stoliczkae* (Steind.)
8. Dorsal spine serrated along both edges; ventral surface of paired fins non-plaited .. *G. madraspatanum* (Day)
9. Dorsal spine strong; adhesive apparatus on chest with a distinct central pit .. *G. cavia* (Ham.)
10. Dorsal spine weak; adhesive apparatus on chest without a central pit 11
11. Dorsal spine serrated along inner border .. *G. sinense* Regan
12. Dorsal spine non-serrated ..13
13. Origin of dorsal fin equidistant from base of adipose dorsal and tip of snout .. *G. conirostre* (Steind.)
14. Origin of dorsal fin distinctly nearer tip of snout than base of adipose dorsal 15
15. Maxillary and nasal barbels long; adhesive apparatus on chest well developed .. *G. housei*¹ Herre
16. Maxillary and nasal barbels short; adhesive apparatus on chest poorly developed .. *G. conirostre poonaensis* Hora
17. Occipital process touching basal bone of dorsal; ventral surface of paired fins plaited; adhesive apparatus on chest as broad as long .. *G. brevipinnis* Hora
18. Occipital process distinctly separated from basal bone of dorsal; ventral surface of paired fins non-plaited; adhesive apparatus on chest broader than long .. *G. horai* Shaw & Shebbera
19. Skin coarsely tuberculated or denticulated .. 21
20. Skin granulated .. 33
21. Adhesive apparatus on chest prominent 25
22. Adhesive apparatus on chest faintly marked or absent 23
23. Dorsal spine serrated along both the borders .. *G. ribeiroi* (Hora)
24. Dorsal spine smooth along both the borders .. *G. shawi* (Hora)
25. Pectoral fins distinctly shorter than head; nasal barbels nearly equal to eye diameter 27
26. Pectoral fins as long as head; nasal barbels much longer than eye diameter 31
27. Adhesive apparatus on chest with a distinct central pit .. *G. tuberculatus* Prashad & Mukerji
28. Adhesive apparatus on chest without a central pit ..29
29. Occipital process touching basal bone of dorsal .. *G. prashadi* Mukerji

¹ Not represented in the collections of the Zoological Survey of India and so not examined.

30. Occipital process distinctly separated from basal bone of dorsal .. *G. telchitta* (Ham.)
31. Dorsal fin distinctly higher than depth of body ; dorsal spine serrated *G. paltypogonoides* (Blkr.)
32. Dorsal fin as high as depth of body ; dorsal spine smooth .. *G. trewavasae* Hora
33. Occipital process touching basal bone of dorsal .. 35
34. Occipital process distinctly separated from basal bone of dorsal 43
35. Adhesive apparatus on chest longer than broad .. 37
36. Adhesive apparatus on chest small and as long as broad .. *G. pectinopterus* (McClell.)
37. Pectoral fins distinctly longer than head ; dorsal spine strong and serrated *G. gracilis* (Gthr.)
38. Pectoral fins as long as, or shorter than head ; dorsal spine weak and smooth .. 39
39. Head distinctly longer than broad .. .41
40. Head as long as broad *G. lonah* (Sykes)
41. Base of adipose dorsal distinctly longer than snout ; ventral surface of paired fins non-plaited *G. trilineatus* Blyth
42. Base of adipose dorsal as long as snout ; ventral surface of paired fins plaited .. *G. annandalei* Hora
43. Dorsal spine strong ; ventral surface of paired fins non-plaited *G. kashmirensis* Hora
44. Dorsal spine weak ; ventral surface of paired fins plaited .. 45
45. Base of adipose dorsal distinctly longer than snout .. *G. striatus* (McClell.)
46. Base of adipose dorsal equal to or shorter than snout .. *G. saisii* (Jenkins)

SYSTEMATIC ACCOUNT

Genus *Glyptothorax* Blyth

1860. *Glyptothorax*, Blyth, *Journ. As. Soc. Bengal* XXIX, p. 154.
1860. *Exostoma*, Blyth (in part : only the type-species of *C. berdmorei*), *Journ. As. Soc. Bengal* XXIX, p. 155.
1864. *Glyptosternum*, Gunther, *Cat. Brit. Mus.* V, p. 185.
1878. *Glyptosternum*, Day, *Fish. India*, p. 496.
1878. *Euglyptosternum*, Day (nec *Aclyptosternum* Blkr. and *Euclyptosternum* Gthr.), *Fish. India*, p. 499.
1889. *Glyptosternum*, Day, *Faun. Brit. Ind.*, Fish. I, p. 195.
1889. *Euglyptosternum*, Day, *Faun. Brit. Ind.*, Fish. I, p. 202.
1913. *Glyptosternum*, Weber and Beaufort, *Fish. Indo-Austral. Archipel.* II, p. 263.
1921. *Laguvia*, Hora, *Rec. Ind. Mus.* XXII, p. 739.
1923. *Glyptothorax*, Hora, *Rec. Ind. Mus.* VXX, p. 27.
1931. *Glyptothorax*, Myers, *Lingnan Sci. Journ.* X, p. 260.
1943. *Glyptosternon*, Nichols, *Natural History of Central Asia* IX, p. 52.
1945. *Glyptothorax*, Smith, *U. S. Nat. Mus. Bull.* No. 188, p. 396.

The reasons for synonymising *Laguvia* Hora with *Glyptothorax* Blyth have already been discussed (*vide supra*), and Hora¹ has so clearly defined the genus *Glyptothorax* that there is no need to add anything more by way of comment.

***Glyptothorax stoliczkae* (Steind.)**

1867. *Glyptosternum Stoliczkae*, Steindachner, *Sitzungsb. K. Acad. Wiss. Wien* LV, pt. 1, p. 533, pl. v. fig. 1 ; pl. vi, fig. 1.
 1878. *Glyptosternum pectinopterum*, Day, *Fish. India*, p. 499, pl. cxvi, fig. 6.
 1889. *Glyptosternum pectinopterum*, Day, *Faun. Brit. Ind.*, Fish. I, p. 201.
 1923. *Glyptothorax stoliczkae*, Hora, *Rec. Ind. Mus.* XXV, p. 17.

Hora (*loc. cit.* p. 17) has already shown that the two specimens described by Day as "*Glyptosternum pectinopterum*" are to be referred to this species.

G. stoliczkae can be easily recognised from its congener *G. pectinopterus* by its smooth skin, strong dorsal spine, well developed thoracic adhesive apparatus and the long maxillary barbels. Besides, in *G. stoliczkae* the pelvic origin is entirely behind the vertical from the post-end of the dorsal and the occipital spine is apposed to the basal bone of the dorsal.

Distribution.—Simla, W Himalayas.

G. stoliczkae is represented in the collection of the Zoological Survey of India from the following localities :—

<i>Regd. No.</i>	<i>Locality</i>	<i>Donor or Collector.</i>	<i>Remarks.</i>
1231	Simla.	Purchased from F. Day.	1 specimen : in bad state of preservation.
1311	Simla.	Ditto.	1 specimen : Original of Day's pl. cxvi, fig. 7 : in bad state of preservation.

***Glyptothorax madraspatanum* (Day)**

1867. *Glyptosternum lonah*, Day (*nec* Sykes), *Proc. Zool. Soc. London*, p. 285.
 1873. *Glyptosternum madraspatanum*, Day, *Journ. Linn. Soc. London*. XI.
 1878. *Glyptosternum madraspatanum*, Day, *Fish. India*, p. 49,
 1889. *Glyptosternum madraspatanum*, Day, *Faun. Brit. Ind.*, Fish. I, p. 200.
 1923. *Glyptothorax madraspatanus*, Hora, *Rec. Ind. Mus.* XXV, p. 29.
 1938. *Glyptothorax madraspatanus*, Hora, *Rec. Ind. Mus.* XL, p. 370,
 1941. *Glyptothorax madraspatanus*, Hora and Law, *Rec. Ind. Mus.* XLIII p. 255.
 ? 1951. *Glyptothorax prox. madraspatanus*, Silas, *Journ. Bombay. Nat. Hist., Soc.* XLIX, p. 676, figs. 1, 2, 3.

D. 1/6 ; A. 1/9-10 ; P. 1/9-10 ; V 1/5 ; C. 16-18+

G. madraspatanum is a well-built, medium sized fish in which the dorsal profile rises gently to the commencement of the dorsal fin beyond which it slopes down gradually to the base of the caudal fin. The ventral

¹ Hora, S. L., *Rec. Ind. Mus.* XXV, p. 8 (1923).

profile is almost horizontal as far as the base of the pelvic fins, thereafter ascending smoothly to the caudal region. The fish is laterally compressed in the posterior half while in the anterior half its body is somewhat sub-cylindrical.

The head is broadly pointed in front and flattened ventrally ; its length is contained from 4.1 to 4.3 times in the standard length ; its height at the occiput is contained from 1.3 to 1.5 and its width 1.1 to 1.2 times in its length. The eyes are moderately prominent and dorso-lateral in position ; their diameter is contained from 5.8 to 7.0 times in the length of the head. The length of the snout is contained from 2.0 to 2.2 times in the length of the head. The interorbital width is contained from 3.0 to 3.9 times in the width of the head. The mouth is inferior and horizontal ; the width of its gape is about two times the interorbital width ; the lips are papillated and reflected round the corner. The teeth in the jaws are villiform ; those in the upper jaw form a narrow, crescentic, continuous band while in the lower jaw the band is interrupted in the middle. The nasal openings are placed about half an eye diameter away from the tip of the snout. The nasal barbels are almost one-and-a-half eye diameter long ; the maxillaries are as long as the head behind the nasal openings, and extend upto the base of the pectoral fins ; the outer mandibulars are nearly equal in length to the snout while the inner pairs are of the same length as the gape of the mouth. The gill-openings form channelled, spout-like structures on the ventral surface in front of the bases of the pectoral fins. The gill-membrane is flap-like at the upper angle of the opening.

The depth of the body is contained from 4.8 to 5.8 times in the standard length. The caudal peduncle is 1.9 to 2.7 times as long as high. The origin of the dorsal fin is slightly nearer to the base of the adipose dorsal than to the tip of the snout. The dorsal is about 1.0 to 1.3 times higher than the depth of the body below it. The basal bone of the dorsal as seen or felt through the skin is gently apposed to the occipital process which is nearly 4.0 times as long as wide. The dorsal spine is naked, often serrated on both the edges ; its length is nearly equal to the greatest depth of the body. The pectoral spine is moderately broad ; it is denticulated internally. The pectoral fins reach beyond the middle of the dorsal fin and are separated from the pelvic fins by a distance equal to two eye diameters ; they are usually longer than the head and the caudal peduncle. The pelvic fins are almost as long as the dorsal spine ; they extend beyond the vent almost touching the anal fin. There is a small anal papilla. The anal fin is situated slightly behind the adipose dorsal ; its longest ray is longer than the dorsal spine. The caudal fin is deeply forked and the lobes are sub-equal.

The thoracic adhesive apparatus is longer than broad and vignitted posteriorly ; there is no central pit. The paired fins are devoid of any adhesive mechanism.

In the preserved specimens the colour is grayish-yellow becoming dirty-white below. The paired and unpaired fins bear well-marked, dark-gray bands at their bases. The skin is smooth.

In the Day's specimens, as well as in all the rest of the specimens examined by me, the skin is quite smooth as observed by Day (*op. cit.*). I refer here *Glyptothorax prox. madraspatanus* of Silas (*op. cit.*) as a doubtful synonym of *G. madraspatanum* Day; in these specimens which he obtained from the Anamalai Hills, W. Ghats, S. India, the skin is stated to be tuberculated. Besides, the paired fins while described as being plaited shows no sign of the adhesive plaits in the drawings. In body proportions also Silas's specimens differ from *G. madraspatanum*. Unfortunately, these specimens registered as (Nos. F 629/2 ; F630/2) "*Glyptothorax anamalaiensis* Silas" in the Accession Register, could not be traced in the reserve collections and so were not examined. From the description and figures provided by Silas, their resemblance to *Glyptothorax housei* Herre, a smooth skinned species described from the same locality—Anamalai Hills—can be easily noted.

Distribution.—Western Ghats, S. India.

G. madraspatanum is represented in the collection of the Zoological Survey of India from the following localities :—

<i>Regd. No.</i>	<i>Locality.</i>	<i>Donor or Collector.</i>	<i>Remarks.</i>
1235	Bhavani R., Nilgiris, Madras State.	Purchased from F. Day.	1 specimen : <i>Type</i> : Original of Day's pl. cxvi, fig. 4 : in fairly good state of preser- vation.
1313	Ditto.	Ditto.	1 specimen : in bad state of preservation.
F 10272/1	Nierololay stream, Bhavani R., Nilgris, Madras State.	N. Annandale.	2 specimens : in fairly good state of preser- vation.
F 10273/1	Mettupalayam, Coim- batore, Madras State.	N. Annandale.	2 specimens : in fairly good state of preser- vation.
F 12409/1	Cauvery R., Coorg State S. India.	C. R. Narayana Rao.	1 specimen : in bad state of preservation.
F 13590/1	Pampadampara, W. Ghats, Travancore.	S. Jones.	2 specimens : in good state of preservation.

TABLE I.—*Measurements in millimetres of Glyptothorax madraspatanum (Day)*

	Nilgiris.		Coimbatore.		Coorg.	W. Ghats.	
	1235	1313	F 10272/1	F 10273/1	F 10273/1	F 12409/1	F 13590/1
Standard length	97·0	70·5	84·0	73·5	86·5	121·2	88·3
Length of head	23·0	17·0	20·5	17·5	20·5	28·2	20·5
Height of head at occiput	14·5	10·5	13·0	12·5	D*	19·0	13·5

* Destroyed.

TABLE I.—*Measurements in millimetres of Glyptothorax madraspatanum (Day)*—contd.

	Nilgiris.			Coimbatore.			Coorg.	W. Ghats.	
	1235	1313 F	10272/1 F	10273/1 F	10273/1 F	12409/1 F	13590/1 F	13590/1	
Width of head	19.5	13.5	16.5	14.5	16.5	24.8	17.0	11.0	
Length of snout	11.0	7.5	10.0	8.0	10.2	14.0	9.2	6.0	
Diameter of eye	3.5	2.5	3.0	2.5	3.5	4.0	3.0	1.6	
Interorbital width	5.0	4.0	4.5	4.5	5.0	6.9	5.4	4.1	
Depth of body	17.0	12.0	15.0	12.5	15.4	22.5	15.5	10.0	
Length of caudal peduncle	17.5	13.0	17.5	15.0	18.0	22.9	17.2	10.4	
Least height of caudal peduncle	8.5	5.5	7.0	5.5	7.1	11.6	6.5	5.0	
Longest ray of dorsal	19.5	16.5	19.0	15.5	20.0	22.6	19.0	11.3	
Length of dorsal spine	D*	13.0	14.0	13.0	16.1	19.2	12.6	6.8	
Length of pectoral	24.5	20.0	20.5	18.5	D*	29.5	21.6	13.2	
Length of pectoral spine	D*	15.0	15.5	14.5	D*	24.1	15.6	7.0	
Length of pelvic	17.5	13.0	13.5	13.0	13.0	14.5	15.2	9.0	
Longest ray of anal	19.5	15.0	15.5	14.5	17.0	26.8	16.0	10.3	
Length of base of anal	13.5	9.5	10.0	9.0	10.4	16.5	11.1	7.5	
Length of base of adipose dorsal	14.5	10.5	13.0	11.5	13.6	21.0	12.0	7.8	

Glyptothorax cavia (Ham.)

1822. *Pimelodus cavia*, Hamilton, *Gangetic Fishes*, pp. 188, 378.
 1877. *Euglypiosternum lineatum*, Day, *Fish. India*, p. 500, pl. cxvi. fig. 7.
 1889. *Euglyptosternum lineatum*, Day, *Faun. Brit. Ind.*, Fish. I, p. 202, fig. 73.
 1923. *Glyptothorax lineatus*, Hora, *Rec. Ind. Mus.* XXV, pp. 9, 10, fig. 1a.
 1929. *Glyptothorax burmanicus*, Prashad and Mukerji, *Rec. Ind. Mus.* XXXI, p. 184, fig. 5, pl. vii, fig. 3.
 1937. *Glyptothorax lineatus*, Shaw and Shebbeare, *Journ. Roy. As. Soc. Bengaly Sci.* III, p. 102, text-fig. 104.
 1948. *Glyptothorax cavia*, Hora and Menon, *Rec. Ind. Mus.* XLVI, p. 60, 49, pl. ii, figs. 4, 6.
 1949-50. *Glyptothorax cavia*, Menon, *Rec. Ind. Mus.* XLVII, p. 235.

* Destroyed.

Hora and Menon (*loc. cit.*, pp. 56, 57) have cleared up the systematic position of this species and re-described it in detail.

G. cavia is easily separated from all the E. Himalayan and Burmese forms of *Glyptothorax* by its characteristic adhesive disc encircling a deep central pit as well as by its broad band of teeth in the upper jaw.

Distribution.—Northern Bengal, Assam, Eastern Himalayas and Burma.

G. cavia is represented in the collection of the Zoological Survey of India from the following localities :—

<i>Regd. No.</i>	<i>Locality.</i>	<i>Donor or Collector.</i>	<i>Remarks.</i>
1312	Jumna (? Bengal).	Purchased from F. Day.	1 specimen : <i>Type</i> of <i>G. linetius</i> : Original of Day's pl. cxvi, fig. 7 : in bad state of preservation.
F 10877/1	Sankha R., Myitkiyna Dt., U. Burma.		1 specimen : <i>Type</i> of <i>G. burmanicus</i> : in fairly good state of preservation.
F 11375/1	Rivers below Darjeeling, W. Bengal.	G. E. Shaw & E. O. Shebbeare.	1 specimen : in good state of preservation.
F 217/2	Kosi R., Nepal.	Kosi Survey.	3 specimens : in very good state of preservation.
F 218/2	Ditto.	Ditto.	Ditto.
F 219/2	Ditto.	Ditto.	4 specimens : in very good state of preservation.
F 220/2	Kosi R., Nepal.	Kosi Survey.	1 specimen : in very good state of preservation.

***Glyptothorax sinense* (Regan)**

1908. *Glyptosternum sinense*, Regan, *Ann. Mag. Nat. Hist.* (8), I, p. 110.

1931. *Glyptosternon sinense*, Chu, *Biol. Bull. St. John's Univ.* No. 1, p. 82.

1943. *Glyptosternon sinense*, Nichols, *Natural History of Central Asia* IX, p. 53.

G. sinense can be distinguished from *G. cavia* by its thoracic adhesive disc which is devoid of a central pit. While its resemblance to *G. conirostre* is noteworthy *G. sinense* may be separated from the latter by its serrated dorsal spine,

Distribution.—Burma and China.

G. sinense is represented in the collection of Zoological Survey of India from the following localities :—

<i>Regd. No.</i>	<i>Locality.</i>	<i>Donor or Collector.</i>	<i>Remarks.</i>
F 11444/1	Phungin Hka, tributary of Mali Hka R., Myitkiyna Dt., U. Burma.	R. W. Burton.	1 specimen : in fairly good state of preservation.
F 12209/1	No locality.	Fan Memorial Institute of Biology, Peiping, China.	1 specimen : in fairly good state of preservation.

Glyptothorax conirostre (Steind.)

1867. *Glyptosternum conirostre*, Steindachner, *Sitzungsb. K. Acad. Wiss. Wien.* LV, pt. 1, p. 532, pl. v, fig. 2; pl. vi, fig. 2.
 1871. *Glyptosternum modestum*, Day, *Proc. Zool. Soc. London*, p. 714.
 1878. *Glyptosternum lonah*, Day (in part), *Fish. India*, p. 496.
 1878. *Glyptosternum conirostre*, Day, *Fish. India*, p. 497, pl. cxvi, fig. 5.
 1889. *Glyptosternum lonah*, Day, *Faun. Brit. Ind.*, Fish I, p. 196.
 1889. *Glyptosternum conirostre*, Day, *Faun. Brit. Ind.*, Fish. I, p. 198.
 1923. *Glyptothorax conirostris*, Hora, *Rec. Ind. Mus.* XXV, p. 28.
 1931. *Glyptosternon conirostre*, Chu, *Biol. Bull. St. John's Univ.* No. 1, p. 81.
 1943. *Glyptosternon conirostre*, Nichols, *Natural History of Central Asia* IX, p. 5.

In *G. conirostre* the head is much longer than broad. The dorsal fin is higher than the body; the dorsal spine is weak and smooth. The pectorals are of the same length as the head. The pelvic origin is below the vertical from the last ray of the dorsal. The paired fins are non-plaited. The skin is smooth. The occipital spine is separated from the basal bone of the dorsal.

This species differs from its W Himalayan congener *G. pectinopterus* mainly in its longer head, larger thoracic adhesive disc, nonplaited paired fins and smooth skin.

Distribution.—Simla, W. Himalayas and Mahanadi river at Siliguri, E. Himalayas, China.

G. conirostre is represented in the collection of the Zoological Survey of India from the following localities :—

<i>Regd. No.</i>	<i>Locality.</i>	<i>Donor or Collector.</i>	<i>Remarks.</i>
1315 or F 10382/1	Simla.	Purchased from F. Day.	1 specimen : Original of Day's pl. cxvi, fig. 5 : in bad state of preservation.
F 11378/1	Mahanadi R., Siliguri, W. Bengal.	G. E. Shaw and E. O. Shebbeare.	1 specimen : in fairly good state of preservation.

Glyptothorax conirostre poonaensis Hora

1877. *Glyptosternum lonah*, Day (in part, *nec.* Sykes), *Fish. India*, p. 496, pl. cxiii, fig. 5.
 1938. *Glyptothorax conirostre* var. *poonaensis*, Hora, *Rec. Ind. Mus.* XL, p. 368, pl. vii, figs. 5, 6.

Hora (*loc. cit.*, p. 366) has already shown that in *G. conirostre poonaensis* the head is proportionately broader and the dorsal fin shorter than in *G. conirostre*. Besides, the pelvic origin is distinctly behind the vertical from the last ray of the dorsal.

This species can be separated from *G. lonah*, *G. annandalei* and *G. trewavasae* by its smooth skin and from *G. madraspatanum* by its smooth, dorsal spine and shorter pectorals.

Distribution.—Poona, Peninsular India.

G. conirostre poonaensis is represented in the collection of the Zoological Survey of India from the following localities :—

<i>Regd. No.</i>	<i>Locality.</i>	<i>Donor or Collector.</i>	<i>Remarks.</i>
F 12126/1	Moola-Mutha R., Poona, Bombay State.	Dept. of Fisheries, Bombay.	1 specimen : <i>Holotype</i> : in good state of pre- servation.

***Glyptothorax brevipinnis* Hora.**

1923. *Glyptothorax brevipinnis*, Hora, *Rec. Ind. Mus.* XXV, p. 16, pl. i, fig. 4.

In *G. brevipinnis* the thoracic adhesive disc is characteristically broader than long and not so well developed. The dorsal origin is nearer to the tip of the snout than to the base of the adipose dorsal. The pelvic is considerably behind the vertical from the last ray of the dorsal. The paired fins are plaited. The occipital process is apposed to the basal bone of the dorsal. The skin is smooth.

This species may be readily distinguished from *G. pectinopterus* by its smooth skin, its pectoral being shorter than head, the dorsal spine being shorter than depth of body and the dorsal origin being much nearer to the snout tip than to the base of the adipose dorsal.

The type-locality of the species is unknown.

Distribution.—Unknown.

G. brevipinnis is represented in the collection of the Zoological Survey of India from the following locality :—

<i>Regd. No.</i>	<i>Locality.</i>	<i>Donour or Collector.</i>	<i>Remarks.</i>
F 10134/1	Unknown.	No history.	4 specimens : <i>Type</i> : in fairly good state of preservation.

***Glyptothorax horai* Shaw & Shebbeare.**

1937. *Glyptothorax horai*, Shaw and Shebbeare, *Journ. Bombay Nat. Hist. Soc.* XXXIX, p. 188.

1937. *Glyptothorax horai*, Shaw and Shebbeare, *Journ. Roy. As. Soc. Bengal, Sci.* III, p. 101.

1949. *Glyptothorax horai*, Hora, *Journ. Zool. Soc. India* I, p. 2.

1949-50. *Glyptothorax horai*, Menon, *Rec. Ind. Mus.* XLVII, p. 235.

D. 1/5-6 ; A. 1/9-10 ; P. 1/7-9 ; V. 1/5 ; C. 16-18

In *G. horai* the dorsal profile rises gracefully from the tip of the snout to the origin of the dorsal fin and thereafter descends gradually to the tail. The ventral profile, somewhat straight and horizontal as far as the base of the pectoral fins, thereafter arches down gently to the commencement of the pelvic fin, whence ascending smoothly to the caudal region. The fish has a more or less cylindrical, steam-lined body.

The head is moderately depressed, flattened ventrally and broadly pointed in front ; its length is contained from 3.5 to 3.9 times in the standard length ; its height at the occiput is contained from 1.6 to 1.8 and its width 1.2 to 1.4 times in its length. The eyes are small and dorso laterally placed ; their diameter is contained from 9.7 to 11.5

times in the length of the head. The length of the snout is contained from 2.0 to 2.3 times in the length of head. The interorbital width is contained from 3.1 to 3.6 times in the width of the head. The mouth is inferior and horizontal; the width of its gape is nearly equal to the length of the snout and twice the interorbital width; the lips are papillated and continuous at the angles of the mouth. The teeth in the jaws are villiform; those in the upper jaw form a narrow, continuous, crescentic band while in the lower jaw the band is interrupted in the middle. The nasal openings are situated about an eye diameter away from the tip of the snout. The nasal barbels are twice as long as the distance between their bases and reach upto the eyes behind; the maxillaries are usually longer than the head extending considerably beyond the pectoral bases; the outer mandibulars, just reaching up the pectoral bases, are twice as long as, and the inner pairs, of the same length as the gape of the mouth. The gill-openings form well-developed, channelled, spout-like structures on the ventral surface in front of the bases of the pectoral fins, the gill-membrane being flap-like near the upper angle of the opening.

The depth of the body is contained from 4.8 to 5.7 times in the standard length. The caudal peduncle is 1.8 to 2.2 times as long as high. The origin of the dorsal fin is slightly nearer to the base of the adipose dorsal than to the tip of the snout. The dorsal fin is higher than the depth of the body in younger specimens and smaller in older individuals. The basal bone of dorsal as can be felt by a needle from outside, is widely separated from the occipital process which is nearly three times as long as wide. The dorsal spine is strong and enveloped by skin; on dissection it is found to be finely denticulated along its posterior margin. The pectoral spine is moderately broad and as long as the dorsal spine; it is denticulated internally. The pectoral fins are markedly shorter than the head and extend a little beyond the origin of the dorsal fin; they are, however, longer than the caudal peduncle and separated from the pelvic fins by a distance equal to the length of the pectoral spine. The pelvic fins are almost as long as the dorsal spine; they extend upto the vent. There is a small anal papilla. The anal fin is situated more or less opposite to the adipose dorsal; its longest ray is longer than the dorsal spine. The caudal fin is deeply forked, the upper lobe being slightly longer.

The adhesive apparatus is peculiar. It extends from the lip and traverses the gill-membrane to half way down the pectoral bases. In the thoracic region it is rhomboidal in shape anteriorly and vignitted posteriorly. There is no central pit. The paired fins are devoid of any adhesive mechanism.

A small mucus pit is discernible in the shoulder region below the cleithrum.

The preserved specimens are copper-gray with pale, brownish-yellow abdomen. The fins are lightly copper-tinged, the caudal being profusely spotted with gray. The skin is smooth.

G. horai is recognised from its E. Himalayan and Vindhyan congener *G. annandalei* by its smooth skin and its peculiar thoracic adhesive disc which extends from the lip and traverses the gill-membranes half way

down to the pectoral region in a rhomboidal form. In having the adhesive disc devoid of a central pit, this species is at once separated from *G. cavia* of the E. Himalayas and Burma.

Distribution.—Kosi river, Nepal, streams of Terai, E. Himalayas, Rihand river, Vindhya, Mirzapur District, U. P.

G. horai is represented in the collection of the Zoological Survey of India from the following localities :—

<i>Regd. No.</i>	<i>Locality.</i>	<i>Donor or Collector.</i>	<i>Remarks.</i>
F 11376/1	Streams of Terai, W. Bengal.	G. E. Shaw and E. O. Shebbeare.	1 specimen ; <i>Type</i> : in fairly good state of preservation.
F 234/2	Rihand R. near Dam site, Mirzapur Dt., U. P.	Rihand Survey.	22 specimens : in very good state of preservation.
F 235/2	Ditto.	Ditto.	4 specimens : in very good state of preservation.
F 236/2	Kosi R. at Chhatra, Nepal.	Kosi Survey.	2 specimens : in very good state of preservation.
F 237/2	Kosi R. at Barahakshetra, Nepal.	Ditto.	1 specimen : in very good state of preservation.

TABLE II.—*Measurements in millimetres of Glyptothorax horai Shaw & Shebbeare*

	Bengal. F 11376/1		Rihand R. F 234/2			Rihand R. F 235/2		Nepal. F 236/2	Nepal. F 237/2	
Standard length	90.1	77.0	35.0	65.3	71.5	75.1	68.0	98.5	67.2	70.1
Length of head	23.0	22.2	9.5	18.5	19.8	21.0	18.8	27.4	19.2	19.0
Height of head at occiput	14.1	13.0	5.2	11.0	12.0	12.0	10.2	14.5	10.2	11.0
Width of head	17.0	15.5	7.4	14.0	15.1	15.1	13.6	19.3	13.0	14.2
Length of snout	11.0	10.1	4.0	8.0	9.0	9.5	9.0	12.0	9.0	9.8
Diameter of eye	1.8	1.2	0.7	1.5	1.8	1.5	1.5	1.8	1.3	1.1
Interorbital width	6.0	4.5	2.0	4.4	4.5	5.0	4.0	5.2	4.0	4.1
Depth of body	19.5	16.5	8.0	14.0	14.0	14.4	12.3	19.0	13.0	13.7
Length of caudal peduncle	19.0	14.0	6.4	12.0	13.2	13.0	13.0	18.0	13.5	14.5
Least height of caudal peduncle.	8.0	7.0	3.1	6.0	6.8	6.5	7.0	8.5	6.0	7.2
Longest ray of dorsal	15.2	16.0	7.8	13.1	15.0	14.0	13.0	17.5	12.4	13.2
Length of dorsal spine	10.8	10.5	5.1	10.0	11.0	10.0	10.0	13.0	8.7	9.5
Length of pectoral	17.5	14.6	9.0	11.8	15.0	13.5	12.5	19.0	12.0	12.8
Length of pectoral spine	12.3	11.0	5.3	9.0	11.0	12.0	10.2	15.3	9.5	10.0
Length of pelvic	11.2	11.1	5.0	9.2	12.0	11.0	10.3	12.2	9.5	9.0
Longest ray of anal	16.0	15.8	7.4	13.2	15.1	13.0	13.0	9.0	11.2	12.4
Length of base of anal	13.0	10.2	5.0	9.4	10.1	11.0	9.5	16.5	9.1	10.0
Length of base of adipose dorsal	14.0	10.5	4.5	9.0	11.7	10.0	9.0	14.3	8.2	9.0

Glyptothorax ribeiroi (Hora)

1921. *Laguvia ribeiroi*, Hora, *Rec. Ind. Mus.* XXII, p. 741, XXIX, fig. 3.
 1937-38. *Laguvia ribeiroi*, Shaw and Shebbeare, *Journ. Roy. As. Soc. Bengal, Sci.* III, p. 104, text-fig. 106.
 1938. *Laguvia ribeiroi*, Hora, *Rec. Ind. Mus.* XL, p. 179, text-fig. 5.
 1941. *Laguvia ribeiroi*, Hora and Nair, *Rec. Ind. Mus.* XLIII, p. 372.
 1949. *Laguvia ribeiroi*, Hora, *Journ. Zool. Soc. India* I, p. 2.

G. ribeiroi has a somewhat stumpy form. The head is short and broad. The thoracic adhesive disc is faintly developed. The dorsal is as high as or less than the depth of body below it. The dorsal spine is strong and serrated. The pectoral spine is strong and denticulated internally. The pectorals do not reach to the pelvic bases. The pelvic origin is distinctly in advance of the vertical from the last ray of the dorsal. The pelvics are separated from the anal by a considerable distance. The gill-openings are wide. The skin is tuberculated.

This species is separated from *G. shawi* by its serrated dorsal spine, shorter head and paired fins and its pelvic origin which is clearly in front of the vertical from the posterior end of the dorsal base.

There are several nicely preserved specimens in the collection and they all agree with the type and description and figures given by Hora (*op. cit.*). There are, however, some examples from the Rihand river, U. P., in which a few uppermost rays of the caudal are noticeably elongated.

Distribution.—Tista drainage, Darjiling Himalayas, Kosi river, Nepal Himalayas, Morel river, Santal Parganas and Kamla river, Dharbhanga District, Bihar, and Rihand river, Vindhyan range.

G. ribeiroi is represented in the collection of the Zoological Survey of India from the following localities :—

<i>Regd. No.</i>	<i>Locality.</i>	<i>Donor or Collector.</i>	<i>Remarks.</i>
F 10086/1	Khoila R., tributary of the Tista, Jalpaiguri, W. Bengal.	S. L. Hora.	1 specimen : <i>Type</i> : in fairly good state of preservation.
F 12722/1	Mosel R. near Bario, Santal Parganas, Bihar.	H. A. Hafiz.	2 specimens : in fairly good state of preservation.
F 12722/1	Kamla R., Jainagar, Darbhanga Dt., Bihar.	P. N. Mitter.	13 specimens : in good state of preservation.
F 12722/1	Kosi R., Nepal.	Kosi Survey.	24 specimens : in good state of preservation.
F 12722/1	Duars and Terai, N. Himalayas.	S. L. Hora.	Several specimens : in good state of preservation.
F 12722/1	Rihand R., U. P.	K. S. Misra.	Several specimens : in good state of preservation.

Glyptothorax shawi (Hora)

1921. *Laguvia shawi*, Hora, *Rec. Ind. Mus.* XXII, p. 740, pl. xxix, fig. 2.

1937-38. *Laguvia shawi*, Shaw and Shebbeare, *Journ. Roy. As. Soc. Bengal, Sci.* III, p. 104, text-fig. 106.

1940-41. *Laguvia shawi*, Hora and Gupta, *Journ. Roy. As. Soc. Bengal, Sci.* VI, p. 5.

In *G. shawi* the body is more or less elongated. The head is long and broad. A faintly developed adhesive disc is present on the chest. The dorsal is as high as the depth of body below it. The dorsal spine is strong and smooth. The pectoral spine is strong and serrated internally. The pectorals nearly reach the pelvic bases. The pelvic origin is behind the vertical from the last ray of the dorsal. The pelvics extend almost to the anal base. The gill-openings are wide. The skin is tuberculated.

This species was first described by Hora (*loc. cit.*, p. 740) with three specimens, two from the Mahanadi river and one from the Sivoke river, Darjiling Himalayas. Since then "hundreds" of the species were collected by Hora (*loc. cit.* p. 179) and others from the same localities. Most of them seem to have been lost in the Varuna floods at Banaras where the Survey was housed during the last war, and the existing ones are in a bad state of preservation. Of the type-series, only the holotype from the Mahanadi river is now to be found in the collection of the Survey and it is in a poor state of preservation.

Distribution.—The Tista drainage of the Darjiling Himalayas.

G. shawi is represented in the collection of the Zoological Survey of India from the following localities :—

<i>Regd. No.</i>	<i>Locality.</i>	<i>Donor or Collector.</i>	<i>Remarks.</i>
F 10084/1	Mahanadi R., Darjiling Himalayas.	G. E. Shaw.	1 specimen : <i>Type</i> : in poor state of preservation.
F 11381/1	Siliguri, N. Bengal.	G. E. Shaw and E. O. Shebbeare.	1 specimen : in poor state of preservation.
F 13448/1	Kalimpong Duars and Siliguri Terai, Tista R. drainage.	S. L. Hora.	32 specimens : in bad state of preservation.

Glyptothorax tuberculatus Prashad & Mukerji

1929. *Glyptothorax tuberculatus*, Prashad and Mukerji, *Rec. Ind. Mus.* XXXI, p. 182, pl. vii, fig. 2 ; text-fig. 4.

In *G. tuberculatus* the head is slightly longer than broad. The height of the dorsal is equal to the depth of the body. The dorsal spine is weak and serrated along its inner border. The pectorals are shorter than the head. The pelvic origin is below the vertical from the last ray of the dorsal. The thoracic adhesive disc encircles a central pit. The paired fins are not plaited. The humerocubital and scapular processes are prominent. The skin is rough and tuberculated.

This species is readily recognised from *G. shawi* and *G. ribeiroi*, which also possess well developed humero-cubital and scapular processes, by its characteristic, prominent adhesive disc and rough skin.

Distribution.—Burma.

G. tuberculatus is represented in the collection of the Zoological Survey of India from the following locality :—

Regd. No.	Locality.	Donor or Collector.	Remarks.
F 10876/1	Sankha, a hill-stream midway between Kamaing and Mong-aung, Myitkyina Dt., U. Burma.	B. N. Chopra.	1 specimen : <i>Type</i> : in good state of preservation.

Glyptothorax prashadi Mukerji

1932. *Glyptothorax prashadi*, Mukerji, *Rec. Ind. Mus.* XXXIV, p. 281, text-fig. 1.

1945. *Glyptothorax prashadi*, Smith, *U. S. Nat. Mus. Bull.* No. 188, p. 402.

In *G. prashadi* the head is longer than broad and moderately depressed. The height of the dorsal is less than the depth of the body. The dorsal spine is strong and serrated. The pectorals are shorter than the head. The pelvic origin is just below the vertical from the last ray of the dorsal. The paired fins are nonplaited. The thoracic adhesive disc is fairly well developed and without a central pit. The cubito-humeral and scapular processes are not prominent. The occipital spine is apposed to the basal bone of the dorsal. The skin is rough and tuberculated.

Mukerji (*loc. cit.*, p. 281) has already remarked on the close resemblance of this species to *G. platypogonoides* (= *G. dorsalis*) from which it can be distinguished only by its deeper body, shorter pectorals and shorter caudal peduncle.

Distribution.—Burma, Peninsular Siam.

G. prashadi is represented in the collection of the Zoological Survey of India from the following localities :—

Regd. No.	Locality.	Donor or Collector.	Remarks.
F 11334/1	Kyenchauung R., Mergui Dt., L. Burma.	K. Biswas.	1 specimen : <i>Type</i> : in good state of preservation.
F 10845/1	Nakon, Sritamarat, Siam.	H. M. Smith.	1 specimen : in good state of preservation.
F 11341/1	Ditto.	Ditto.	1 specimen : in good state of preservation.

Glyptothorax telchitta (Ham.)

1822. *Pimelodus telchitta*, Hamilton, *Gangetic Fishes*, pp. 185, 378.

1822. *Pimelodus botius*, Hamilton, *Gangetic Fishes*, pp. 192, 378.

1871. *Glyptosternum telchitta*, Day, *Proc. Zool. Soc. London*, p. 228.

1877. *Glyptosternum telchitta*, Day, *Fish India*, p. 498, pl. cxvi, fig. 2.

1877. *Glyptosternum botia*, Day, *Fish. India*, p. 497, pl. cxii, fig. 4.

1889. *Glyptosternum telchitta*, Day, *Faun. Brit. Ind.*, Fish. I, p. 199.

1889. *Glyptosternum botium*, Day, *Faun. Brit. Ind.*, Fish. I, p. 198.

1923. *Glyptothorax* sp., Hora, *Rec. Ind. Mus.* XXV, p. 26, pl. iv. ag. 2.

1923. *Glyptothorax botia*, Hora, *Rec. Ind. Mus.* XXV, p. 27.

1923. *Glyptothorax telchitta*, Hora, *Rec. Ind. Mus.* XXV, p. 28.

1929. *Pimelodus telchitta*, Hora, *Mem. Ind. Mus.* IX, pl. xxi, fig. 3 (Hamilton's MS drawing published).

1937-38. *Glyptothorax telchitta*, Shaw and Shebbeare, *Jour. Roy. As. Soc. Bengal, Sci.* III, p. 103, text-fig. 105.

1939. *Glyptothorax botia*, Das, *Rec. Ind. Mus.* XLI, p. 448.

1948-49. *Glyptothorax telchitta*, Hora and Menon, *Rec. Ind. Mus.* XLVI, p. 57, pl. ii, figs. 1, 2, 3.

1949. *Glyptothorax telchitta*, Hora, *Journ. Zool. Soc. India* I, p. 2.

1949-50. *Glyptothorax telchitta*, Menon, *Rec. Ind. Mus.* XLVII, p. 235.

Hora and Menon (*loc. cit.*, pp. 55, 56) have discussed the taxonomic position of this species and redescribed it in detail.

G. telchitta can be easily separated from its Indian congeners by its more or less spindle-shaped body and the rough tuberculated skin. From *G. platypogonoides* this species may be distinguished by its shorter pectorals, shorter nasal barbels and spindle-shaped body, while from *G. prashadi* it is recognised by its smooth and feeble dorsal spine and the shorter occipital spine not reaching the basal bone of the dorsal.

Distribution.—Uttar Pradesh (Vindhyan Mountains), Bihar, N. Bengal and Nepal, E. Himalayas. Its record from the Punjab needs confirmation.

G. telchitta is represented in the collection of the Zoological Survey of India from the following localities :—

<i>Regd. No.</i>	<i>Locality.</i>	<i>Donor or Collector.</i>	<i>Remarks.</i>
1314	No. locality.	Purchased from F. Day.	1 specimen : Original of Day's pl. cxvi, fig. 2 (<i>G. telchitta</i>) : in very bad state of preservation.
1488	" Jumna ".	Ditto.	1 specimen : Original of Day's pl. cxiii, fig. 4 (<i>G. botium</i>) : in fairly good state of preservation.
Cat. 580 or F 9735/1	Birbhum, W. Bengal.	Museum Collector.	8 specimens : in very bad state of preservation.
F 5374/1	Jharahi R., Siripur, Saran Dt., Bihar.	M. Mackenzie.	1 specimen : in fairly good state of preservation.
F 6887/1	Mawai, Bara Banki, U. P.	M. M. Khan.	1 young specimen : in bad state of preservation.
F 6888/1	Ditto.	Ditto.	Ditto.
F 7033/1	Ditto.	Ditto.	Ditto.
F 10268/1	Jharahi R., Siripur, Saran Dt., Bihar.	M. Mackenzie.	2 specimens : in fairly good state of preservation.
F 1027/1	Ditto.	Ditto.	1 specimen : in fairly good state of preservation.
F 11377/1	Rivers of Terai and Duars, N. Bengal.	G. E. Shaw and E. O Shebbeare.	2 specimens : in fairly good state of preservation.
F 13326/1	Damodar R. near Ram- garh, Hazaribagh Dt., Bihar.	H. S. Rao.	4 young specimens : in fairly good state of preservation.
F 81/2	Rihand R. at Dam Site, Mirzapur Dt., U. P.	Rihand Survey.	5 specimens : in good state of preservation.
F 221/2	Mohalpahari, Santal Parganas, Bihar.	R. Bodding.	1 specimen : in fairly good state or preservation.
F 222/2	Kosi R., Nepal.	Kosi Survey.	Ditto.
F 233/2	Rihand R. at Dam Site, Mirzapur Dt., U. P.	Rihand Survey.	7 specimens : in very good state of preservation.

Glyptothorax platypogonoides (Blkr.)

1855. *Pimelodus platypogonoides*, Bleeker, *Nat. Tijds. Ned., Indie* IX, p. 272.
 1889. *Glyptothorax dorsalis*, Vinciguerra, *Ann. Mus. Stor. Nat. Genova* XXIX, p. 246, pl. vii, fig. 4.
 1921. *Glyptothorax dorsalis*, Hora, *Rec. Ind. Mus.* XXI, p. 180.
 1921. *Glyptothorax minutus*, Hora, *Rec. Ind. Mus.* XXII, p. 180, text-fig. 1.
 1923. *Glyptothorax minutus*, Hora, *Rec. Ind. Mus.* XXV, p. 27.
 1923. *Glyptothorax dorsalis*, Hora, *Rec. Ind. Mus.* XXV, p. 28.
 1923. *Glyptothorax siamensis*, Hora, *Journ. Siam Soc., Nat. Hist. Suppl.* VI, p. 168, pl. x, fig. 1.
 1945. *Glyptothorax platypogonoides*, Smith, *U. S. Nat. Mus. Bull.* No. 188, p. 397.

D. 1/6-7 ; A. 1/9-10 ; P. 1/9-10. V 1/5 ; C. 16-18

Glyptothorax platypogonoides is a medium-sized fish with the dorsal profile considerably arched and the ventral profile more or less horizontal. The dorsal profile rises gently from the tip of the snout to the base of the dorsal fin, hereafter descending gradually to the base of the caudal fin. The ventral profile is straight and horizontal as far as the origin of the pelvic fins and thereafter gradiently ascends to the caudal fin. The fish is compressed from side to side in the tail region, while anteriorly it is subcylindrical as far as the basal bone of the dorsal fin.

The head is flattened ventrally and pointed anteriorly ; its length is contained from 4.1 to 5.0 times in the standard length ; its height at the occiput is contained from 1.4 to 1.8, and its width 1.1 to 1.2 times in its length. The eyes are small and dorso-lateral in position ; their diameter is contained from 7.4 to 9.5 times in the length of the head. The length of the snout is contained from 2.2 to 2.3 times in the length of the head. The interorbital width is contained from 3.5 to 4.7 times in the width of the head. The mouth is inferior and horizontal ; the width of its gape is about three-fourth the length of the snout ; the lips are profusely papillated and reflected round the corner. The teeth in the upper jaw form a narrow continuous band while in the lower jaw the band is interrupted in the middle. The nasal openings are situated close to the tip of the snout and demarcated from it by a distance nearly equal to the diameter of the eye. The nasal barbels are almost as long as the distance between their bases ; the maxillaries are shorter than the head and extend to the bases of the pectoral fins ; the outer mandibulars are nearly of the same length as the gape of the mouth. The gill-openings form channelled, spout-like structures on the ventral surface in front of the bases of the pectoral fins. The gill-membrane is flap like near the upper angle of the opening.

The depth of the body is contained from 5.0 to 6.7 times in the standard length. The caudal peduncle is 3.0 to 3.6 times as long as high. The dorsal fin commences midway between the tip of the snout and the base of the adipose dorsal ; it is about 1.1 to 1.4 times higher than the depth of the body below it. The basal bone of the dorsal, as seen or felt through the skin, is closely apposed to the occipital process which is nearly four times as long as wide. The dorsal spine is sheathed in skin, strong and serrated internally ; it is almost as long as the greatest depth of the body.

The pectoral spine is strong and broad ; it is denticulated along its inner edge. The pectoral fins extend to the middle of the base of the dorsal fin ; they are nearly equal in length to the head and the caudal peduncle and separated from the pelvic fins by a considerable distance. The pelvic fins are shorter than the dorsal spine and they extend a little beyond the vent. A small anal papilla is present. The anal fin is situated opposite to the adipose dorsal ; its longest ray is usually longer than the dorsal spine. The caudal fin is deeply forked, the lower lobe being somewhat the longer.

The adhesive apparatus on chest is about 1.5 times as long as wide and devoid of any central pit. The outer rays of the paired fins are without any adhesive mechanism on their ventral surfaces.

The colour in the preserved specimens is brownish-olive on the dorsal and lateral regions of the body merging into pale yellow below. The head and sides are speckled with dark, oblong spots. All the fins are marked with spotted bands. The skin is rough with prominent tubercles arranged in regular longitudinal rows.

Smith (*loc. cit.*, p. 398) has already elucidated the reasons for regarding *G. dorsalis* Vinciguerra as a synonym of *G. platypogonoides* (Blkr.). Besides, expressing doubts as to the specific validity of *G. siamensis* Hora, he concluded that this species, formerly credited with being peculiar to Sumatra, may prove to be the same as *G. platypogonoides*. After an examination of the type of *G. siamensis* with the relevant materials, descriptions and figures, Smith's observations and surmises are found to be correct. Also, *G. minutus* Hora, reported from the Chindwin Drainage of Assam seem to be the same as the present species in spite of its small size and meagre description. No specimen of *G. minutus*, either type or collateral, exists for comparison. However, its relationships already indicated by Mukerji (*loc. cit.*, pp. 282, 283) with *G. platypogonoides* (= *G. dorsalis*) and *G. prashadi* are convincing enough to regard it as a synonym of the former.

Distribution.—Assam, Burma, Siam and Sumatra.

G. platypogonoides is represented in the collection of the Zoological Survey of India from the following localities :—

<i>Regd. No.</i>	<i>Locality.</i>	<i>Donor or Collector.</i>	<i>Remarks.</i>
F 9941/1	Imphal stream near Thanga, Manipur, Assam.	Manipur Survey.	3 specimens: one in fairly good state of preservation and the remaining two dissected and mutilated.
F 9942/1	Amamlu Turail, near Imphal, Manipur, Assam.	Ditto.	5 specimens: in very bad state of preservation.
F 9943/1	Ditto.	Ditto.	1 specimen: in very bad state of preservation.
F 10275/1	Pegu Yomas, Burma.	J. P. Cook.	1 specimen: in fairly good state of preservation.
F 10548/1	Nakon, Sritaramarat Hills, Siam.	H. M. Smith.	1 specimen: <i>Type</i> of <i>G. siamensis</i> : in good state of preservation.

TABLE III.—Measurements in millimetres of *Glyptothorax platypogonoides* (Blkr.)

		Manipur. F 9942/1		Imphal, Manipur. F 9941/1		Pegu Yomas. F 10275/1	Sittaung drainage.
		81.0	103.0	95.0	97.0	51.0	85.0
Standard length	..	19.0	23.7	23.0	23.0	12.1	20.0
Length of head	..	10.5	15.0	15.7	15.0	7.5	12.0
Height of head at occiput	..	15.5	20.0	18.0	18.0	9.9	16.0
Width of head	..	8.2	11.0	10.2	10.5	5.2	9.6
Length of snout.	..	2.0	3.0	3.0	3.1	1.3	2.3
Diameter of eye	..	4.0	4.2	4.5	4.1	2.5	4.0
Interorbital width	..	2.0	16.8	17.4	16.7	8.3	14.2
Depth of body	..	18.2	22.0	19.3	19.0	11.0	18.6
Length of caudal peduncle	..	5.0	6.5	6.0	6.0	3.0	6.0
Least height of caudal peduncle		16.0	22.0	21.4	20.0	11.0	18.0
Longest ray of dorsal	..	13.0	18.5	17.1	16.0	8.0	14.5
Length of dorsal spine	..	18.2	22.0	21.0	21.5	10.8	18.7
Length of pectoral	..	14.5	17.0	16.0	16.0	8.5	14.5
Length of pectoral spine	..	11.8	16.0	15.0	14.6	8.0	14.1
Length of pelvic	..	D*	20.2	19.0	18.3	11.0	17.2
Longest ray of anal	..	12.0	16.0	14.0	15.0	8.0	12.3
Length of base of anal	..	9.3	14.5	11.1	12.0	5.8	10.5
Length of base of adipose dorsal							

***Glyptothorax trewavasae* Hora**

1919. *Euglyptosternum saisii*, Annandale (nec Jenkins), *Rec. Ind. Mus.* XVI, p. 126.

1923. *Glyptothorax dekkanensis*, Hora (nec Gunther), *Rec. Ind. Mus.* XXV, p. 24, fig. 3.

1937. *Glyptothorax dekkanensis*, Hora (nec Gunther), *Rec. Ind. Mus.* XXXIX, p. 14.

1938. *Glyptothorax trewavasae*, Hora, *Rec. Ind. Mus.* XL, p. 373, pl. vii, figs. 3, 4.

In *G. trewavasae* the head is longer than broad and depressed. The dorsal is higher than the body. The dorsal spine is strong and smooth. The pectorals are shorter or equal to the head in length. The pelvic origin is a little behind the vertical from the last ray of the dorsal. The paired fins are not plaited. The occipital spine does not reach the basal bone of the dorsal. The skin is tuberculated.

This species is recognised from the rest of the Glyptothoracid fishes of the Peninsular India, by its shorter maxillary barbels barely reaching the bases of the pectorals, and its shorter pectorals less than the head in length in the adults.

Distribution.—Yenna and Koyna Valleys in the Satara District, Bombay and the Tunga river at Shimoga, Mysore. The waters of both these region drain into the Kistna river.

G. trewavasae is represented in the collection of the Zoological Survey of India from the following localities :—

<i>Regd. No.</i>	<i>Locality.</i>	<i>Donor or Collector.</i>	<i>Remarks.</i>
F 9723/1	Yenna Valley, Satara Dt., Bombay State.	N. Annandale.	1 specimen : <i>Holotype</i> : in fairly good state of preservation.
F 10269/1	Koyna Valley, Satara Dt., Bombay State.	F. H. Gravely.	1 specimen : in bad state of preservation.
F 12435/1	Thunga R. at Shimoga, Mysore State.	B. S. Bhimachar.	1 specimen : in bad state of preservation.

***Glyptothorax pectinopterus* (McClell.)**

1842. *Glyptosternon pectinopterus*, Mc Clelland, *Cal. Journ. Nat. Hist.* II, p. 587.

1923. *Glyptothorax pectinopterus*, Hora, *Rec. Ind. Mus.* XXV, p. 18, pl. fig. 1 ; pl. iv, fig. 3.

1936. *Glyptothorax pectinopterus*, Hora and Mukerji, *Rec. Ind. Mus.* XXXVIII, p. 137.

In *G. pectinopterus* the head and body in front of the pelvics are greatly depressed. The dorsal fin is higher than the body. The dorsal spine is weak and smooth. The pectorals are longer than the head. The pelvic origin is below the vertical from the last ray of the dorsal. The paired fins are strongly plaited and the thoracic adhesive disc characteristically small. The occipital process almost extends to the basal bone of the dorsal.

This species differ from *G. brevipinnis* in having a more depressed head, longer pectorals and pelvics, higher dorsal and granulated skin.

Distribution.—Punjab and U. P.

G. pectinopterus is represented in the collection of the Zoological Survey of India from the following localities :—

<i>Regd. No.</i>	<i>Locality.</i>	<i>Donor or Collector.</i>	<i>Remarks.</i>
1254 or F 10284/1	Jumna.	Purchased from F. Day.	1 juvenile specimen : in bad state of preservation.
F 10265/1	Sutle R., Badhmana Khad, Punjab.	Punjab Fisheries.	1 specimen : in good state of preservation.
F 10266/1	Kangra Valley, Punjab.	Ditto.	Several specimens : in good state of preservation.
F 12010/1	Irrigation Channel at Lachiwala, Dehra Dun, U. P.	S. L. Hora.	3 juvenile specimens : in fairly good state of preservation.
F 12011/1	Song R., Dehra Dun, U. P.	Ditto.	Ditto.

Regd. No.	Locality.	Donor or Collector.	Remarks.
F 12012/1	Junction of Song R. and Ray Naid, Lachiwala, Dehra Dun, U. P.	S. L. Hora.	7 juvenile specimens : in fairly good state of preservation.
F 12148/1	Nandhaur R., Nainital Dt., U. P.	Bhola.	2 specimens : in fairly good state of preservation.
F 215/2	Kangra Valley, Punjab	S. L. Hora.	Several specimens : in good state of preservation.
F 216/2	Ditto.	Ditto.	11 specimens : in very good state of preservation.

Glyptothorax gracile (Gthr.)

1864. *Glyptosternon gracile*, Gunther, *Cat. Brit. Mus. Fish.* V, p. 186.

1923. *Glyptothorax gracilis*, Hora, *Rec. Ind. Mus.* XXV, p. 25, text-fig. 4.

In *G. gracile* the skin is granulated. The thoracic adhesive disc is longer than broad. The occipital spine is apposed to the basal bone of dorsal. The dorsal origin is equidistant from the tip of the snout and the base of the adipose dorsal. The dorsal spine is strong and serrated. The pelvic origin is just below the vertical from the post-end of the dorsal.

Hora (*loc. cit.*, p. 25) has already shown the differences which separate this species from *G. trilineatus* such as longer pectorals and pelvics as well as longer maxillary barbels.

Distribution.—Nepal and Sikkim.

G. gracile is represented in the collection of the Zoological Survey of India from the following locality:—

Regd. No.	Locality.	Donor or Collector.	Remarks.
F 8293/1	Rangit R., Manjhitar, Sikkim.	B. L. Chaudhuri	1 specimen : in good state of preservation.

Glyptothorax lonah (Sykes)

1841. *Bagurs lonah*, Sykes, *Trans. Zool. Soc. London* II, p. 371.

1864. *Glyptosternum lonah*, Gunther, *Cat. Brit. Mus. Fish.* V, p. 187.

1864. *Glyptosternum dekkanensis*, Gunther, *Cat. Brit. Mus. Fish.* V, p. 187.

1878. *Glyptosternum lonah*, Day (in part), *Fish. India*, p. 496, pl. cxiii, fig. 5.

1889. *Glyptosternum lonah*, Day (in part), *Faun. Brit. Ind.*, Fish. I, p. 196, fig. 72.

1923. *Glyptothorax dekkanensis*, Hora, *Rec. Ind. Mus.* XXV, p. 24, fig. 3.

1923. *Glyptothorax lonah*, Hora, *Rec. Ind. Mus.* XXV, p. 30.

1937. *Glyptothorax lonah*, Hora and Misra, *Journ. Bombay Nat. Hist. Soc.* XXXIX, p. 513.

1938. *Glyptothorax annandalei*, Hora and Misra (*nec* Hora), *Journ. Bombay Nat. Hist. Soc.* XL, p. 36, pl. iii, figs. 3, 3a.

1938. *Glyptothorax dekkanensis*, Hora, *Rec. Ind. Mus.* XL, p. 241.

1938. *Glyptothorax lonah*, Hora, *Rec. Ind. Mus.* XL, p. 371 ; pl. vii, figs. 1, 2.

1947—49. *Glyptothorax lonah*, Chauhan, *Rec. Ind. Mus.* XLV, p. 274.

Hora (*loc. cit.*, pp. 363-367) has elucidated the systematic position of *G. lonah* in detail.

In this species the skin is granulated. The adhesive apparatus on chest and on the ventral surface of the outer rays of the paired fins, is well developed. The dorsal origin is nearer to the tip of the snout than to the base of the adipose dorsal. The dorsal spine is weak and smooth. The occipital process is long and narrow touching the basal bone of the dorsal. The pelvic origin is considerably behind the vertical from the post-end of the dorsal.

Hora (*loc. cit.*, p. 373) has already remarked on the resemblance of *G. lonah* to *G. annandalei* which can be differentiated from the former by the depressed form of its body and the longer pectorals and caudal peduncle.

Distribution.—Orissa, M. P. and Bombay States.

G. lonah is represented in the collection of the Zoological Survey of India from the following localities :—

<i>Regd. No.</i>	<i>Locality.</i>	<i>Donor or Collector.</i>	<i>Remarks.</i>
F 12676/1	Godaveri R. near Indore Road bridge, Nasik, Bombay State.	A. G. L. Fraser.	1 specimen : in good state of preservation.
F 12951/1	Gulli nullah at the foot of Baidila range, Bastar State, M. P.	H. Crookshank.	6 specimens : in fairly good state of preservation.
F 12953/1	Darna R. below Fitzgerald bridge, Poona, Bombay State.	A. G. L. Fraser.	1 specimen : in good state of preservation.
F 212/2	Mutha R. at Nanderi, Poona, Bombay State.	M. Suter.	14 specimens : in good state of preservation.
F 213/2	Ditto.	Ditto.	11 specimens : in good state of preservation.
F 214/2	Suktel R. up Harishanker Rest House, Patna State, Orissa.	Patna State Survey.	2 juvenile specimens : in fairly good state of preservation.

***Glyptothorax trilineatus* Blyth**

1860. *Glyptothorax trilineatus*, Blyth, *Journ. As. Soc. Bengal* XXIX, p. 154.
 1864. *Glyptosternum trilineatum*, Gunther, *Cat. Brit. Mus. Fish* V, p. 185.
 1878. *Glyptosternum trilineatum*, Day, *Fish. India*, p. 497, pl. cxvi, fig. 3.
 1889. *Glyptosternum trilineatum*, Day, *Faun. Brit. Ind.*, Fish. I, p. 197.
 1889. *Glyptothorax trilineatus*, Vinciguerra, *Ann. Mus. Stor. Nat. Genova* XXIX, p. 252.
 1923. *Glyptothorax trilineatus*, Hora, *Rec. Ind. Mus.* XXV, p. 29.
 1934. *Glyptothorax laosensis*, Fowler, *Proc. Acad. Nat. Sci. Philadelphia* LXXXVI, p. 88, figs. 28, 29, 30.
 1937. *Glyptothorax trilineatus*, Hora, *Rec. Ind. Mus.* XXXIX, p. 338.
 1945. *Glyptothorax trilineatus*, Smith, *U. S. Nat. Mus. Bull.* No. 188, p. 399.

D.1/6-7 ; A.1/9-10 ; P.1/10-11 ; V.1/5 ; 16-18

Glyptothorax trilineatus is a subcylindrical, elongated species in which the dorsal profile is considerably arched from the tip of the snout to the origin of the dorsal fin whence it slopes down gradually to the base of the caudal fin. The ventral profile is somewhat straight up to the origin of the pelvic fins, thence arching gently to the caudal peduncle where it is horizontal.

The head is broadly pointed, depressed and flattened ventrally ; its length is contained from 3.8 to 4.3 times in the standard length ; its height at the occiput is contained from 1.3 to 1.9 and its width 1.0 to 1.2 times in its length. The eyes are small and dorsolateral in position ; their diameter is contained from 7.5 to 9.7 times in the length of the head. The mouth is inferior and horizontal ; the width of its gape is almost equal to the length of the snout. The lips are profusely papillated and continuous at the angles of the mouth. The teeth in the jaws are villiform ; those in the upper jaw form a narrow, continuous band while in the lower jaw the band is interrupted in the middle. The nasal openings are situated an eye diameter away from the extremity of the snout. The nasal barbels, nearly as long as the distance between their bases, reach just midway up to the eyes posteriorly ; the maxillaries are as long as or longer than the head, and extend beyond the pectoral bases or even to the middle of the pectoral fins ; the outer mandibulars are half as long as the maxillaries and almost reach the pectoral bases while the inner mandibulars are equal in length to the distance between the eyes and the nasal openings. The gill-openings form channelled, spout-like structures on the ventral surface in front of the bases of the pectoral fins. The gill-membrane is flap-like near the upper angle of the opening.

The depth of the body is contained from 5.2 to 6.5 times in the standard length. The caudal peduncle is 2.1 to 2.9 times as long as high. The dorsal fin rises midway between the tip of the snout and the base of the adipose dorsal ; it is nearly 1.1 to 1.5 times higher than the depth of the body below it. The basal bone of the dorsal is gently apposed to the occipital spine which is 3.0 to 4.0 times as long as wide. The dorsal spine is sheathed in skin ; it is rather weak and smooth ; it is usually equal to or a little less than the greatest depth of the body. The pectoral spine is strong and broad ; it is denticulated along its inner margin. The pectoral fins are shorter or as long as the head ; they are longer than the caudal peduncle ; they are separated from the pelvics by a considerable distance. The pelvic fins are longer than the dorsal spine and they extend beyond the vent being separated from the anal fin by only a short distance equal to an eye-diameter. The anal papilla is prominent. The anal fin is situated opposite to the adipose dorsal ; its longest ray is longer than the pelvic rays. The caudal fin is deeply forked and the lobes are usually equal.

The adhesive apparatus on the chest is longer than broad and without any central depression. The paired fins are not plaited.

The preserved specimens are chest-nut brown in colour with pale yellow abdomen. There is a well-marked dirtywhite, longitudinal

streak along the back extending from the occiput to the base of the caudal fin. A similar one runs along the lateral line on each side. There is also a third faint line along the abdominal margin. The fins are tinged with dirty, brownish yellow. The skin is granulated.

This species can be separated from *G. gracile* by its smooth and rather weak dorsal spine, shorter pectorals and by its dorsal origin which is nearer to the snout end than to the adipose base. From *G. cavia* it may be recognised by its granulated skin and the thoracic adhesive disc which is without a central pit and from *G. sinense* by its granulated skin and smooth spine.

Distribution.—India, Nepal, Burma and Siam.

G. trilineatus is represented in the collection of the Zoological Survey of India from the following localities :—

<i>Regd. No.</i>	<i>Locality.</i>	<i>Donor or Collector.</i>	<i>Remarks.</i>
Cat. 581 or F 10380/1	Tenasserim, Burma.	Berdmore.	2 specimens : <i>Type</i> : in bad state of preservation.
Cat. 579 or F 10381/1	Rangoon, Burma.	A. Ball.	1 specimen : in bad state of preservation.
F 11117/1	Thagata juva, Burma.	Genova Museum.	1 specimen : in very bad state of preservation.
F 12460/1	Namya R. at Kongan Thana, Upper Chindwin Drainage, Assam-Burma border.	S. T. Duncan.	3 specimens : in good state of preservation.
F 13206/1	Doi Angka, N. Siam.	H. M. Smith.	1 specimen : in fairly good state of preservation.
F 238/2	Paunglaung Chaung, main tributary of the Sittaung R., Taloktwin, Burma.	V. P. Sondhi.	5 specimens : in very good state of preservation.

TABLE IV.—*Measurements in millimetres of Glyptothorax trilineatus Blyth*

	Tenasserim.		Rangoon.		Sittaung drainage.		U. Chindwin drainage.		
	Cat. 581		Cat. 579		F 238/2		F 12460/1		
Standard length . . .	59.2	79.5	109.5	120.0	63.0	90.2	61.8	66.8	73.0
Length of head	14.5	19.4	26.5	28.6	15.0	21.0	15.2	16.0	16.6
Height of head at occiput	8.5	10.0	14.6	20.2	11.0	13.0	10.0	10.7	11.0
Width of head	12.7	17.0	22.7	25.1	12.0	18.5	14.1	14.5	15.8
Length of snout . . .	7.0	8.7	12.0	13.8	6.4	9.0	6.8	7.3	8.0
Diameter of Eye	1.5	2.0	3.0	3.0	2.0	2.6	1.8	2.0	2.2
Interorbital width	4.0	5.0	7.1	7.8	3.2	5.7	4.0	4.3	5.0
Depth of body	9.0	12.3	17.1	22.0	12.0	15.3	11.1	11.5	12.0
Length of caudal peduncle	11.0	16.0	22.0	24.3	14.8	18.5	12.1	15.3	15.0
Least height of caudal peduncle	4.5	7.0	10.0	11.0	5.2	8.3	6.0	6.0	6.0
Longest ray of dorsal	12.3	18.6	22.1	24.0	13.0	18.0	13.5	15.2	15.6
Length of dorsal spine	8.1	13.3	17.0	17.0	11.0	14.0	9.0	10.5	10.2
Length of pectoral	14.0	18.8	23.8	26.0	15.0	19.0	14.2	16.8	15.1
Length of pectoral spine	9.2	12.5	16.0	17.5	11.5	14.2	10.0	12.5	11.2
Length of pelvic . . .	10.7	15.0	18.6	21.0	11.2	16.3	11.0	12.2	12.0
Longest ray of anal	12.8	16.0	20.3	20.0	13.8	19.3	13.2	15.0	14.5
Length of base of anal	9.2	11.3	15.8	19.0	9.9	14.0	10.0	10.0	10.8
Length of base of adipose dorsal	8.0	10.5	14.0	18.5	9.5	11.3	6.4	8.2	8.1

Glyptothorax annandalei Hora

1923. *Glyptothorax annandalei*, Hora, *Rec. Ind. Mus.* XXV, p.14; pl.i, fig. 3.

1938. *Glyptothorax annandalei*, Hora, *Rec. Ind. Mus.* XL, p. 372, text-fig. 3.

1949. *Glyptothorax annandalei*, Hora, *Journ. Zool. Soc. India* I, p. 2.

1949-50. *Glyptothorax annandalei*, Menon, *Rec. Ind. Mus.* XLVII, p. 237.

In *G. annandalei* the head and the part of the body in front of the pelvics are depressed. The dorsal origin is nearer to the tip of the snout than to the commencement of the adipose dorsal. The dorsal spine is weak and smooth. The pectorals are shorter than the head. The ventral origin is nearly below the vertical from the last ray of the dorsal. The occipital spine is apposed to the basal bone of the dorsal. The skin is granulated.

This species can be easily distinguished from *G. madraspatanum* by its plaited paired fins, smooth dorsal spine and granulated skin, while from *G. housei*, the third species found in the W. Ghats, it is readily separated by its granulated skin and greatly depressed head.

Distribution.—Western Ghats, Peninsular India, the Vindhya and Nepal Himalayas.

G. annandalei is represented in the collection of the Zoological Survey of India from the following localities :—

<i>Regd. No.</i>	<i>Locality.</i>	<i>Donor or Collector.</i>	<i>Remarks.</i>
F 10135/1	Nierolay stream, Bhavani R., Nilgiris, Madras State.	N. Annandale.	3 specimens : <i>Type</i> : in good state of preservation.
F 226/2	Kosi R. at its confluence with the Arun R., Tribeni, Nepal.	Kosi Survey.	6 specimens : in good state of preservation.
F 227/2	Kosi R. down Barahakshetra, Nepal.	Do.	3 specimens : in good state of preservation.
F 228/2	Kosi R. down Chhatra, Nepal.	Do.	1 specimen : in good state of preservation.
F 229/2	Kosi R., Nepal	Do.	30 juvenile specimens : in good state of preservation.
F 230/2	Rihand at Dam. Site, Mirzapur Dt., U. P.	Rihand Survey.	2 specimens : in good state of preservation.
F 231/2	Do.	Do.	16 specimens : in good state of preservation.
F 232/2	Do.]	Do.	3 specimens : in good state of preservation.

Glyptothorax kashmirensis Hora.

1923. *Glyptothorax kashmirensis*, Hora, *Rec. Ind. Mus.* XXV, p. 22, text-fig. 2.

1936. *Glyptothorax kashmirensis*, Mukerji, *Mem. Connect. Acad. Arts and Sci.* X, p. 326.

G. kashmirensis is at once recognised by its characteristic thoracic adhesive disc which is slightly longer than broad with its pinnules encircling

a central depression. The paired fins are not plaited. The dorsal spine is strong and smooth. The pelvic origin is behind the vertical from the last ray of the dorsal. The occipital process is distinctly separated from the basal bone of the dorsal. The skin is profusely granulated.

Hora (*loc. cit.*, p. 22) has already remarked about the sexual differences noted in this species with regard to the depth of the body and the length of the pectorals.

Distribution.—Kashmir and Punjab, W Himalayas.

G. kashmirensis is represented in the collection of the Zoological Survey of India from the following localities :—

<i>Regd. No.</i>	<i>Locality.</i>	<i>Donor or Collector.</i>	<i>Remarks.</i>
F 10270/1	Kashmir Valley	T. H. Pearse.	2 specimens : <i>Type</i> : in good state of preservation.
F 10271/1	Streams round Ichabal, Kashmir.	B. Prashad and B. N. Chopra.	4 specimens : in good state of preservation.
F 223/2	Hill streams of Chamba State, Punjab.	H. Crookshank.	1 specimen : in good state of preservation.
F 224/2	Jhelum R., Shadipur, Kashmir.	Yale North India Expedition.	1 specimen : in good state of preservation.

***Glyptothorax striatus* (Mc Clell.)**

1842. *Glyptosternon striatus*, Mc Clelland, *Cal. Journ. Nat. Hist.* II, p. 587, pl. vi, figs. 1, 2.
 1860. *Glyptothorax striatus*, Blyth, *Journ. As. Soc. Bengal* XXIX, p. 154.
 1864. *Glyptosternum striatum*, Gunther, *Cat. Brit. Mus. Fish.* V, p. 188.
 1878. *Glyptosternum striatum*, Day, *Fish. India*, p. 498.
 1889. *Glyptosternum striatum*, Day, *Faun. Brit. Ind.*, Fish. I, p. 200.
 1923. *Glyptothorax striatus*, Hora, *Rec. Ind. Mus.* XXV, p. 20.

In *G. striatus* the head and the anterior part of the body in front of the pelvis are greatly depressed. The dorsal fin is higher than the body and the dorsal spine weak and smooth. The pelvic origin is considerably behind the vertical from the last ray of the dorsal. The occipital spine does not extend to the basal bone of the dorsal. The thoracic adhesive disc is large and the paired fins strongly plaited. The skin is granulated.

The species is separated from *G. platypogonoides* by its weak and smooth dorsal spine, plaited paired fins and the occipital process not reaching the basal bone of the dorsal.

Distribution. Sikkim and Assam.

G. striatus is represented in the collection of the Zoological Survey of India from the following localities :—

Regd. No.	Locality.	Donor or Collector.	Remarks.
Cat. 578 or F 10379/1	Cherrapunji, Assam.	Bourne.	5 specimens : in bad state of preservation.
F 2689/1	Nong Priay R., Cherrapunji, Assam.	Museum Collector.	1 specimen : in fairly good state of preservation.
F 2690/1	Nong Priay R., Cherrapunji, Assam.	Do.	1 specimen : in fairly good state of preservation.
F 10238/1	Do.	S. L. Hora.	2 specimens : in good state of preservation.
F 10263/1	Below Gangtok, Sikkim.	F. M. Bailey.	1 specimen : in good state of preservation.
F 10264/1	Someswary R., Bagmara, Assam.	S. W. Kemp and B. N. Chopra.	1 specimen : in good state of preservation.

Glyptothorax saisii (Jenkins)

1910. *Glyptosternum saisii*, Jenkins, *Rec. Ind. Mus.* V, p. 128, pl. vi, fig. 6, text-fig. 1.

1923. *Glyptothorax saisii*, Hora, *Rec. Ind. Mus.* XXV, p. 20.

In *G. saisii* the head is longer than broad and depressed. The dorsal is higher than the body ; its origin is nearer to the snout end than to the base of the adipose dorsal. The dorsal spine is weak and smooth. The paired fins are plaited. The thoracic adhesive disc is longer than broad. The occipital spine extends to the basal bone of the dorsal. The skin is granulated.

This species differ from *G. pectinopterus* in the head being longer than broad and the thoracic adhesive disc being much longer than wide. It can be separated from *G. brevipinnis* by its higher dorsal, weaker dorsal spine and the well-developed thoracic adhesive disc which is longer than broad.

Distribution.—Paresnath hills, Bihar.

G. saisii is represented in the collection of the Zoological Survey of India from the following localities :—

Regd. No.	Locality.	Donor or Collector.	Remarks.
F 2583/1	Sita nullah, Paresnath hills, Bihar.	N. Annandale .	1 specimen : <i>Type</i> : in fairly good state of preservation.
F 3260/1 F 3261/1	Do.	Do.	Do.

THE EARTHWORMS OF BURMA-VI

By G. E. GATES.

INTRODUCTION.

In the period between completion of the manuscript of part V (Gates, 1936) of the present series and 1942 when the war finally ended this project, the collecting of earthworms was continued, with funds supplied by the University of Rangoon, throughout Burma. Earthworms were eventually secured from most sections of the country, between Victoria Point at the very southern end and Putao in the far north, between Kawkaik, the Salween district, Karenni, Kengtung and Yunnan in the east across to Akyab, the Arakan Hill Tracts and the Chin Hills in the west. Many more earthworms certainly were obtained than have ever been collected for scientific purposes in any other part of the globe regardless of its size or location.

A portion of the material that was secured during the above-mentioned period, belonging to the family Ocnerodrilidae, the genera *Woodwardiella*, *Ramiella*, *Dichogaster*, one species of *Desmogaster*, and three of *Pheretima*, has been considered in two articles in other journals (Gates, 1942 and 1943). The present contribution reports on as much of the remainder of the material as is now possible, with the exception of that belonging to one genus in each of two families, *Drawida* of the Moniligastridae and *Eutyphoeus* of the Megascolecidae.

Types of species known only from a single specimen or a very short series were re-examined, sometimes with further dissection, to obtain certain important information, prior to packing them, in 1942 for protection against damage during air raids. The cuticle had become loosened from the epidermis during the years since some of that material had been collected so that certain previously unknown external characteristics, *e. g.*, segment of the first nephropores, sites of subsequent pores, etc., could then be determined.

Some close relatives of certain species that are common to Burma and India were studied while the author was resident in India after the evacuation of Burma. One of the results was recognition of several supposed endemics as synonyms of peregrine forms. The names of three Burmese species, unfortunately, have had to be changed but that may be more than balanced by a clarification of certain zoogeographical problems.

The lists, in subsequent pages, of identified specimens have been shortened by omitting the name of the district when it was the same as the locality at which the worms were secured, by omission of the word district and putting the name of the district, other regional or political area in parentheses, and by indicating numbers of specimens of each of the usually recognized growth stages in a sequence of three figures. Thus, the expression "1-0-5 specimens", means, 1 juvenile, no

acitellate and five clitellate specimens. In a few cases in which large juveniles were not segregated from acitellate specimens, all juveniles as well as the acitellate individuals were lumped so that a sequence such as "--13-5" means, five clitellate specimens and 13 others some of which were juvenile and some clitellate.

Family MONILIGASTRIDAE.

Absence of typhlosole, presence of enterosegmental organs (of unknown function) and location of extra-oesophageal trunks of the circulatory system lateral to the hearts has now been found to characterize each Burmese species of this family except *H. browni* (Michaelson) 1907 which is unlikely to be unique in respect of any of those characteristics.

The gut in several postgizzard segments does not appear, in this family, to be intestinal in the usual sense and at the end becomes valvular as at the end of the oesophagus in other families. The term intestine accordingly is for the present restricted, in the Moniligastridae, to that portion of the gut behind the valve. This leaves an unusually long pre-intestinal section of the gut which may not be comparable to the oesophagus of other oligochaete families.

GENUS *Desmogaster* Rosa, 1890.

Desmogaster albalabia Gates, 1930.

External characteristics.—The nephropores of iii-ix are in *dd* but are still unrecognizable on xi-xii and posteriorly. The male pores are small, transverse slits, each in a transverse groove extending nearly across a white, nearly circular porophore.

Internal anatomy.—The postgizzard portion of the gut is slender, thick-walled, sigmoid. The intestinal origin is in xxvi or xxvii. Commissures from the extra-oesophageals are as in *C. doriae*. The proslatic capsule is approximately spheroidal, sessile on the parietes, with opaque, reddish wall and slit-like lumen, the inner lining of the capsule firm. The ceolomic cavity of xiii is closed off from the parietes.

Desmogaster doriae Rosa, 1890.

Karen hills (Toungoo), north of Thondaung, September, 1-5-2 specimens. G. E. Blackwell. From the Genoa Museum "*Desmogaster Doriae* Rosy Ann. Mus. Civ. Genova XXIX, 1890, p. 369. T. XII, f.2-11. Typus ! Meteleo (Carin Cheba) 1000-1400 m s/m. Giugno-Ottobre 1888. L. Fea Cat No. 52." 1-1-0 specimens.

External characteristics.—Length, 350 mm (+? the longest clitellate specimen a posterior amputee). Diameter, 14-16 mm. Nephropores are first recognizable on iii (2 specimens) or iv and are in *dd* to ix or x, usually at increasing distances from *d* lines posteriorly, lacking on xi-xii (adult specimens), from xiii posterior in the median half of *bc* very rarely in the lateral half of *bc*, or in *dd* and then in a position varying from just dorsal to *d* lines to just lateral to mid-dorsal line. On one clitellate specimen the pores are located in the median half of *bc* as follows: left side, 13, 16, 17, 23, 29, 37, 39, 40, 43, 47, 52, etc.; right side, 24, 25, 28, 33, 34, 37, 41, 43, 45, 47, 49, 51, 52, 53, 56, 59, 62, etc. (otherwise in *dd*). The clitellar coloration, a very dark red, extends from a postsetal portion of x to 18-19.

Internal anatomy.—Gizzards, 9-12, in xvi-xxix. The postgizzard portion of the gut is sigmoid, the inner wall with closely crowded annular ridges gorged with blood. The valve is short, narrow, in xxxv (3). Intestinal origin in xxxvi (3), possibly in xxxv (1) or xxxvii (1).

The dorsal vessel is double anterior to 5/6 (3). An extra-oesophageal is first visible on the parietes anterolaterally from whence it passes under the subpharyngeal ganglia and thence posteriorly close to or in contact with the nerve cord, with a connective to the corresponding vessel on the other side in iv, receiving several large vessels in front of 6/7 after passing up from the parietes. A large vessel (commissure) from the extra-oesophageal passes upwards on the posterior face of 10/11 (and also 11/12), and after passing through the septum joins the heart of x (or xi). The hearts do not open directly into the dorsal vessel but are continuous with each other, in a segment, over the gut, a small vessel passing from the heart-commissure junction to the ventrolateral face of the dorsal trunk. Segmental commissures of vi-ix pass directly into the dorsal trunk. The commissures of v, also lateral, are about as large as those of vi-ix dorsally but are slender and transparent ventrally. A large vessel passes into the testis sac along the male deferent duct and for some distance ventrally is adherent to that duct.

All nephridial ducts apparently pass in to *ab* muscle gap. Nephridial funnels are small but slightly iridescent and easily recognizable. Nephridia were not found in xi-xii of adults.

The vas deferens is 35-40 mm long, drops ventrally median to the heart, crosses laterally in front of the heart, with a long hairpin loop (open ventrally) extending up to the testis sac on the posterior face of the septum, passes under the extra-oesophageal trunk and into the parietes through the *ab* muscle gap, emerging again into the coelomic cavity from the *cd* gap in front of the prostate to pass into the ental end of that organ. The prostate is shortly elliptical to nearly circular in cross section. The glandular investment is thicker than the capsule to which it is rather firmly adherent. The capsule is opaque, red, elongately and slenderly digitiform, lumen small, transversely elliptical in section. The lining of the capsule is firm and has a white (almost muscular) sheen.

The spermathecal duct is 15-20 mm long, not at all thickened within the parietes. The ovisacs extend into xix or xx. The coelomic cavity of xiii apparently is not closed off from the parietes (or if so closed was opened in each dissection).

Remarks.—Clitellar coloration is restricted to the epidermis, the circular muscle layer of the clitellar region, as well as elsewhere, white. Sperm masses in clitellate specimens are usually ventral in the testis sacs and attached to the male funnels, an iridescent column occasionally penetrating dorsally into spongy tissue. Testis sacs of the juvenile (160 × 8 mm) are represented only by small white thickenings of septa though spermathecal ampullae and ducts are fairly well developed.

Desmogaster ferina Gates, 1943.

External characteristics.—The nephropores of iii-x are all in *dd*.

Internal anatomy.—The postgizzard portion of the gut is sigmoid. The intestinal origin apparently is in xxxv.

Desmogaster planata Gates, 1931.

External characteristics.—Nephropores of iii-x are in *dd*, but in *dd* or *bc* and with no regular alternation posteriorly.

Internal anatomy.—The postgizzard portion of the gut is sigmoid. The intestinal origin is in xxix. The commissures from extra-oesophageals on the posterior faces of 10/11-11/12 are as in *D. doriae*.

GENUS **Hastirogaster** Gates, 1930.**Hastirogaster livida** Gates, 1930.

External characteristics.—Nephropores of iii-x are in *dd*, in *bc* or *dd* but not regularly alternated posteriorly.

Internal anatomy.—The postgizzard portion of the gut is sigmoid. The intestinal origin is in xlii.

Family MEGASCOLECIDAE.

GENUS **Plutellus** Perrier, 1872.

Absence of pigment, location of the first dorsal pore on 7/8 or 8/9, saddle-shape of the clitellum (on xiv-xviii), pairing of female pores, location of gizzard (when present) in v, absence of calciferous glands both intra-and extra-mural, absence of a definite typhlosole, absence of testis sacs and presence of receptacula ovarum in xiv, have now been found to characterize all Burmese species of the genus.

In the circulatory system the dorsal trunk is single in each species and is continued onto the pharyngeal bulb. The trunk can be traced in favourable conditions, *i. e.*, when filled with blood (unrecognizable anterior to 4/5 in all material of *ambiguus*, *leucaspis*, *macer*, *pauxillulus* and *subtilis*) to the region of the cerebral ganglia where it bifurcates. The branches pass ventrally along with the nervous commissures to a median point over the subpharyngeal ganglia where they reunite to form the ventral trunk. A supra-oesophageal trunk, apparently always single, which may be as large as or even larger than the dorsal trunk, is present at least in x-xii or xiii. Anteriorly the trunk disappears into the gut wall in ix or close to the insertion of 8/9 or close to the insertion of septum 7/8 (*compositus*). Posteriorly the trunk often is not recognizable behind the last pair of hearts in which case the trunk appears to be formed by union in the median plane of the anterior branches of the hearts of the segment (xii or xiii). Occasionally a posterior continuation is recognizable but it disappears into the gut wall at or near the insertion of septum 12/13 or 13/14. The extra-oesophageal trunks pass into the ventral face of the gut in viii or ix and may come into contact mesially or nearly do so but apparently without uniting. The trunks

disappear into the gut wall in xiv in *ambiguus* and *pandus* or are unrecognizable, in the other species, behind xii or xiii. Transverse connectives between the extra-oesophageals have not been found except as specially noted in the accounts below. The lateroparietal trunks have been recognizable only in an anterior portion of the body, from xxiv, xix or xviii forwards, in *cd* or just lateral to the *d* lines. These trunks pass up from the parietes in xiii to become continuous with the extra-oesophageals, or to join the extra-oesophageals (if the latter are continued posteriorly) in xiii or in xii after first passing through 12/13. The portion of the lateroparietal trunk in xiii is long, in *comptus*, and extended dorsally in a hairpin loop, the closed end of which is nearly at the level of the dorsal face of the gut but with no recognizable branch to the gut. The lateroparietal trunk in *pandus* may pass directly into the extra-oesophageal, or it may bifurcate just in front of 13/14 into equisized branches, one passing into the extra-oesophageal and the other passing onto the dorsal surface of the gut and apparently into the supra-oesophageal. Or, the branch to the extra-oesophageal may be lacking (merely empty and unrecognizable?) the whole lateroparietal trunk passing into the supra-oesophageal. A subneural trunk apparently is lacking in each of the species. Two or three pairs of small vessels pass out from the ventral trunk anterior to 4/5 and these vessels either cross or join the extra-oesophageals on the subpharyngeal mesentery but were too small to trace further. These small vessels appear to be the segmental commissures (or rather the ventral portions of them) belonging to ii-iv, the connectives at anterior ends of the dorsal and ventral trunks presumably belonging to i. The segmental commissures of v-ix are lateral loops. Those of ix, in *compositus*, *pandus* and *pratensis*, are as large as the hearts. The commissures of x-xii or xiii are latero-oesophageal hearts.

The nephridia of v-xi or xii (when recognizable) have been on the anterior faces of the septa and appear to be astomate, as nephridial funnels were never found in those anterior segments though they could be recognized posteriorly. Filaments on the coelomic face of the body wall which had been regarded as a "micronephridial fur" in several Indian species have been interpreted as shreds of disintegrated parietal peritoneum though poor preservation may have been responsible for inability to recognize nephridial characteristics.

Three Burmese and one Indian species apparently would have to go into the subgenus *Diplotrema*, the remainder into the subgenus *Plutellus*, according to the classifications of Michaelsen who also included in the same genus *Pontodrilus* and *Fletcherodrilus*. All of the Burmese (and Indian) species can go into *Plutellus* as redefined by Stephenson (1930) so as to exclude *Diplotrema* as well as *Pontodrilus*. Even, however, as limited by Stephenson, *Plutellus* remained a heterogeneous complex of species, some with a single and others with a doubled dorsal blood vessel, some without and some with calciferous glands, and in the latter case with extramural glands in x-xii, xiv-xv, etc. Unfortunately, when *Plutellus* can be reduced to morphologically homogeneous genera, the generic name of the Burmese and Indian species will have to be changed

Plautellus ambiguus Gates, 1931.

External characteristics.—Nephropores, when visible, are on *d* lines. Spermathecal pores are on or just median to *b* lines, a pore on one specimen just lateral to the *a* line. Female pores are presetal, on the *a* lines, not quite halfway towards 13/14. The male field is protuberant but not distinctly demarcated, extending from the postsetal secondary furrow of xvii to the presetal secondary of xix, widest at 17/18 where it reaches into *bc*, 17/18-18/19 not continued across the field. A deep groove, on site of the setal secondary, crosses the field on xviii into mid *bc*. A small, transversely elliptical protuberance with a central greyish translucent spot is on the site of 17/18 and about in *ab*. The male pores are still quite unrecognizable. A circular aperture in *ab* and about on the setal equator is left when the prostatic duct is dissected out from the parietes.

Genital markings, protuberant, fairly distinctly demarcated, transversely elliptical, with speckled surface, are in *aa* on 11/12 and 12/13.

Internal anatomy.—The oesophagus has fairly high, slightly lamelli-form, longitudinal ridges on its inner wall in x-xiii. Although there is no definite typhlosolæ the roof of the gut at the median line is wrinkled and slightly raised.

Nephridia in xv and posteriorly are flattened against the parietes, in contact with both septa of a segment, reaching from mid *bc* to slightly lateral to *d* lines, but are slightly smaller in xiii-xiv, still smaller in xii, and in xi-v are vertically placed on the anterior faces of the septa. Very small, white, thread-like bodies that look, under highest power of the binocular, rather like micronephridia are present on the body wall in postprostatic segments. Microscopic examination failed to reveal any organization indicative of nephridial tubules and the threads are accordingly assumed for the present to be only shreds of peritoneum.

The prostates are sigmoid, elliptical in cross section. The vas deferens presumably is represented by a delicate filament which rises from the parietes anteriorly in xviii and passes to the ental end of the prostatic duct.

Spermathecae are small as in *P. compositus*.

The longitudinal musculature is uninterrupted over the genital markings. The epidermis of a presetal portion of xvi probably also is thickened in *aa*.

Remarks.—The slight softening that has now taken place permits recognition of ventral stumps of hearts of xii-xiii normally associated with the ventral trunk. The lack of a ventral bend (hooking) in an anterior portion of the body may be correlated with lack of a clitellum.

Intestinal origin in xv and presence of hearts in xiii indicate relationships to *P. pandus* from which *ambiguus* is distinguished by the octothecal battery and the more lateral location of the spermathecal pores,

Plutellus compositus Gates, 1933.

External characteristics.—Lateral setae of post-clitellar segments are longer and thicker than the ventral setae. Nephropores, when recognizable (on xii-v only), are on or just dorsal to *d* lines.

The male pores apparently are on or close to the *a* lines, in a field reaching laterally to *b* lines and similar to that of *P. pandus*. On each genital marking there is a rather indefinite, greyish translucent central area (5) or two such areas close to the midventral line.

Internal anatomy.—The gizzarū is in v (5 specimens). Between the small pharyngeal bulb and the gizzard is a mass of loosely aggregated, soft, whitish glands. The oesophagus in ix-xii is moniliform, heavily vascularized, with closely crowded, somewhat irregularly longitudinal, low, non-lamelliform ridges (with a greyish translucent appearance) on its inner wall. The oesophageal valve is in the anteriormost portion of xiv, the intestinal origin also in xiv (5). A very slight ridge at the median line on the roof of the intestine, is irregular interrupted, so slight as scarcely to be regarded as a typhlosole.

Nephridia from xii posteriorly are flattened against the body wall, small in xii-xiii, in postprostatic segments usually in contact with both septa, extending from slightly lateral to *b* to slightly lateral to *d* lines, with small amounts of a transparent, granular substance between the limbs of the loops. Funnels, which were recognized only from xv posteriorly are on the anterior faces of the septa just above the parietes and about over the *b* lines. The nephridia of xi-v are vertically placed on the anterior faces of the septa. A "fur" of very short white filaments is present on the body wall of postprostatic segments (peritoneal shreds or micronephridial fur?).

The vas deferens may be represented by a slender but tough filament, with a very slight iridescence, that rises from the parietes anteriorly in xviii and runs along the prostatic duct but is continued on through 18/19 and disappears into the gland only in xix.

Two penisetal follicles, in a common, diagonal muscle band, are associated with each prostatic duct. The follicles separate ectally, one passing into the parietes on the median face of the prostatic duct, the other passing into a cleft in the longitudinal musculature slightly but definitely median to the duct. The setal shaft tapers to a rather sharp point, a short ectal portion often curved gently towards one side, and then curved back in the opposite direction. The tip is slightly flattened but not widened. Ornamentation is of about five circles of rather elongately triangular, closely crowded spines. Measurements, in mm., by Miss Chapman, are shown in the table, the diameters through the thickest region nearer the ental end.

Variation in size of penial setae.

Seta.	Length.	Diameter.
F	0.53	0.008
R	0.38	0.010

Variation in size of penial setae.

Seta.	Length.	Diameter.
F	0.52	0.011
F	0.53	0.009
F	0.51	0.008
R	0.35	0.010
F	0.50	0.010
R	0.35	0.008
F	0.58	0.009
F	0.48	0.009
R	0.33	0.008
F	0.53	0.012
R	0.30	0.008
F	0.55	0.010
F	0.48	0.009
F	0.43†	0.008
R	0.40	0.009

F=Functional seta, protuberant from follicle or more ectally located in the follicle.

R=Reserve seta, not protuberant from end of follicle, more entally located, from same follicle as seta immediately above it in the table.

Spermathecae, as in *P. pandus* and *inflexus*, are small, and just reach above the nerve cord against which they are crowded. The diverticulum usually passes to the median face of the duct.

Life history.—No spermatozoal iridescence is recognizable on the male funnels or in the spermathecae. The seminal chambers of the spermathecae may be filled with a white translucent or transparent material presumably indicating a late postsexual stage.

Remarks.—This species is distinguished from *P. inflexus* by the more median location of the spermathecal pores and the absence of transverse connectives between the extra-oesophageal trunks.

Plutellus comptus, sp. nov.

Hlogu (Insein), September, 0.4-0 specimens. K. John. Pegu, August, 0.1-0 specimens. K. John. Paukkaung (Prome), August, 0.0-1 specimens. K. John. Twante (Hanthawaddy), September, 0.1-0 specimens. K. John.

External characteristics.—Length, 24-57 mm. Diameter, 1-2 mm. Unpigmented. Prostomium epilobous, $< \frac{1}{2}$ (7). Anterior end not hooked. Setae begin on ii on which all are present; on xx, $ab < \text{or } ca. = cd$, $dc < \text{or } ca. = aa$. Nephropores on *b* lines (?). First dorsal pore on 7/8 2), 8/9 (5, but with a quite pore-like marking on 7/8, 1).

Bithecal, spermathecal pores minute, superficial, on *b* lines, on 8/9 (7). Female pores on *a* lines midway between 13/14 and the setal equator.

Tip lacking.

Male pores minute, diagonally placed slits, on or just lateral to *b* lines. Male porophores may be quite unrecognizable, or each pore may be on a very slight elevation without definite demarcation, or each pore may be at the center of a grey, translucent, circular area within a transversely and shortly elliptical, distinctly demarcated porophore. Segment xviii is lengthened ventrally, on one specimen, and the epidermis between the *b* lines is slightly thickened but there is no definite demarcation of a male field.

Genital markings are small, raised, distinctly demarcated, transversely elliptical. A presetal marking in *ab* on xviii may come into contact with or even slightly indent margins of the male porophore (Hlegu specimens). Other markings are located as follows. Presetal on left side of ix, postsetal on right side of viii, with centers on or close to the *b* lines (Hlegu). Presetal on right side of viii, postsetal on right side of viii, centers on the *a* line (Hlegu). Presetal on right side of viii, center on *a* line (Hlegu). Presetal on ix, centers on or slightly median to *a* lines, postsetal on left side of ix in *aa*, on 17/18 on left side with center on *a* line, a pair of markings in *aa* on xviii slightly nearer to 17/18 (Pegu). Unpaired, median, postsetal markings in *aa* on viii, ix, xviii, a marking in *ab* on 17/18 on the right side (Paukkaung). A pair of markings on 17/18, centers about on the *b* lines (Twante).

Internal anatomy.—Septum 5/6 is membranous to slightly muscular, 6/7-8/9 muscular. The gizzard is in v (4). Glandular masses are present at sides of the gut in v-viii. The oesophagus in ix-xii has its inner wall marked off into small squarish patches by longitudinal and circular furrows. The intestinal origin is in xiv (4). No typhlosole (4). Last hearts in xii (4).

Nephridia from xvi posteriorly are flattened against the parietes, in contact with both septa of the segment, extending from mid *bc* or just median to *c* line well into *dd*, funnels about over *a* lines, ducts passing into parietes at *b* lines, in xiii-xv smaller but still on parietes, from xii anteriorly unrecognizable.

Holandric, seminal vesicles in xi and xii. Prostates sigmoid, in xix-xx, or looped rather loosely or tightly and regularly and reaching into xxii-xxv. The ducts are nearly straight, slightly thickened and with muscular sheen ectally. Vasa deferentia are unrecognizable anteriorly but in xvii a cord which appears to be the vas passes into the anterior face of the prostatic duct just ental to the parietes (3). No setae, penial or otherwise are recognizable ventrally in xviii (3).

Spermathecae are medium-sized and reach up at least to the oesophagus. The duct is shorter than the ampulla, slender in the parietes, but in the coelomic cavity nearly as thick as the ampulla from which it is distinctly delimited. The diverticulum which passes to the median face of the duct is almost spheroidal and nearly sessile, or with a shortly ellipsoidal seminal chamber distinguishable from a slightly narrower but very short stalk.

The longitudinal musculature is uninterrupted over genital markings.

Life history.—Spermatozoal iridescence is visible in one spermathecal

seminal chamber of one worm. Presumably in this case spermatozoa had not been absorbed before completion of clitellar regression.

Remarks.—The supposedly primitive vas-prostate junction segregates this from all but one of the Indian and Burmese species that have been known hitherto and the only further relationships to be considered are with two new species to be described below. From *P. exilis* Gates, 1945, *comptus* is distinguished by the bithecal battery.

***Plutellus inflexus* Stephenson, 1931.**

External characteristics.—Spermathecal pores minute, superficial, on *b* lines (4), on 5/6-8/9. Female pores slightly presetal, on *a* lines, within a transverse area of epidermal thickening (3). Male pores slightly lateral to *a* lines. A ventral portion of xviii is slightly modified, the male area much like that of *P. pandus*.

Genital markings, on 11/12-12/13 (3), are indistinctly demarcated, slightly raised, shortly elliptical, in *aa*, reaching to the pre- and post-setal secondary furrows of the segments, intersegmental furrows lacking on the markings.

Internal anatomy.—Masses of white glands are present between the posterior end of the short pharyngeal bulb and the gizzard. The oesophagus has longitudinal, slightly lamelliform, grey translucent ridges closely crowded on its inner walls in x-xii. The ridges are continued anteriorly and posteriorly but are more opaque and less crowded. The intestinal origin is in xiv. A rudimentary (?) typhlosole is represented by a low rather broad ridge, semicircular in cross section. This ridge may in part be due to pressing of the dorsal blood vessel into the gut but the intestinal wall underneath the vessel does appear to be slightly thickened. The extra-oesophageal trunks are connected with each other beneath the gut by a transverse vessel in each of vi, vii and viii. The last hearts are in xii (3).

Nephridia from xiii posteriorly are flattened against the parietes, in contact with both septa of the segment, extending from just median to the *c* line well into *dd*, the ducts passing into the parietes at the *d* line. The size decreases slightly from xvii to xiii and from xii to v the nephridia are vertically placed on the anterior faces of the septa. White threads (peritoneal shreds or micronephridia?) are present on the body wall posterior to xix.

The prostates are sigmoid, U-shaped, or practically straight, shortly elliptical in section. The lumen is central, recognizable nearly to ental end of gland, lined by a thin layer of opaque white tissue. The duct is nearly straight, thickened ectally, with marked muscular sheen. A filament, presumably the vas deferens, rises from the parietes anteriorly in xviii and passes into the prostate duct midway between the ectal and ental ends.

Spermathecae are small, only slightly larger than in *P. compositus*. The diverticulum passes into the median face of the duct.

The longitudinal musculature is uninterrupted over the genital markings.

Life history.—Brilliant iridescence on male funnels and in seminal chambers of the spermathecae of three specimens indicated, not only that the worms were sexually mature, but that they had copulated.

***Plutellus leucaspis*, sp. nov.**

Yandon (Maubin), October, 0-1-0 specimens. Maung Ohn Maung.

External characteristics.—Length, 25+ mm. (+ ? incomplete posteriorly). Diameter, ca. 2 mm. Unpigmented. Prostomium epilobous, tongue open. Nephropores on or near *d* lines (?). Setae begin on ii on which all are present, ventral setae enlarged anteriorly; on xxii, *aa* ca. = 2*bc*, *ab* slightly > *cd*. First dorsal pore on 8/9, a pore-like but apparently imperforate marking on 7/8.

Quadrithecal, pores on 7/8-8/9, on *b* lines. Female pores? Male pores minute, on xx, on *b* lines close to lateral margins of a transversely placed, markedly protuberant, clearly delimited male field reaching almost to 20/21 but not quite so close to 19/20. Within the field, with centers about on *a* lines, are two transversely and shortly elliptical, postsetal genital markings.

Genital markings of xv, also with centers on *a* lines, are within a presetal area of epidermal thickening of about the same size and shape as the male field, slightly dislocating 14/15 anteriorly and with the ventral setae on the posterior margin. Preclitellar genital markings are slightly smaller, not in special fields, and are located as follows: a postsetal pair on vii in *aa*, in contact mesially and not reaching to the *a* lines laterally, close to site of 7/8 which is unrecognizable ventrally; a single postsetal median on viii, nearer site of 7/8 than to the setal are.

Internal anatomy.—Septum 5/6 membranous, 6/7-8/9 muscular.

The gizzard is rudimentary, in v. The oesophagus has its inner wall in ix-xii marked off into small patches by longitudinal and circular furrows, the patches gorged with blood in ix-x, white in xi-xiii. The intestinal origin is in xiv. There is no typhlosole. The last hearts are in xii. (Lateroparietal trunks are unrecognizable.)

The nephridia from xv posteriorly are flattened against the parietes, in contact with both septa of a segment, extending from *b* lines about half way to mid-dorsal line, the funnels close to the parietes over *b* lines, the ducts passing into the parietes at the *a* lines.

Holandric, seminal vesicles in xi and xii, the posterior vesicles about twice the size of the others. The prostates are looped, in part irregularly, in xxi-xxiv, and are shortly elliptical in cross section. The duct is nearly straight, transversely placed in xx, thickened ectally and with slight muscular sheen. The vas deferens passes into the anterior face of the prostatic duct just ental to the parietes. The penisetal shaft is nearly straight except for an almost right angled bend of the tip portion (artefact?). The tip is flattened but not widened, truncate. Ornamentation, visible only with oil immersion, is of three to five rows of rather triangular teeth. Measurements (in mm. by Miss Chapman) are as follows: *a* seta 0.37 (length) × 0.009 (thickness, base), 0.010 (midshaft), 0.002 tip; *b* seta 0.36 × 0.010, 0.010, 0.002.

Spermathecae are medium-sized, reaching up to the oesophagus. The duct is slightly shorter than the ampulla, narrowed in the parietes, gradually thickened entally and at its thickest about half the width of the ampulla from which it is distinctly demarcated. The diverticulum is shorter than either duct or ampulla and comprises a shortly ellipsoidal seminal chamber and a shorter, slightly narrower stalk with a very narrow lumen, the stalk passing into median face of the duct just below the ampulla.

The longitudinal musculature is uninterrupted over the genital markings.

Life history.—Spermatozoal iridescence on male funnels and in the seminal chambers of the spermathecae is brilliant. The worm is thought to be postsexual, clitellar regression having been completed before resorption of sperms that were self produced or received in copulation.

Remarks.—An ectal junction of vas with prostatic duct indicates relationships with *comptus* and a new species described below, from both of which *leucaspis* is distinguished by location of the male pores on xx, the primitive quadrithecal battery, and location of those genital markings that are not included in an area of epidermal thickening. From *P. exilis* Gates the other oriental species with ectal vas-prostatic duct junction, *leucaspis* is distinguished by the location of the male pores on xx (+2) and little else. Such a posterior homoeosis is unlikely to have resulted from regeneration as all organs, except the terminalia, are in the usual segments which is not to be expected in hypermeric regeneration. Nothing is known of regenerative capacity in any species of *Plutellus* but replacement of all of a pre-intestinal region with included gonads is very rare, and at present is known in earthworms only in two genera, *Criodrilus* and *Perionyx*. The probability that the only specimen of the species that has been secured in twenty years of extensive collecting in Burma is a variant only with reference to the terminalia and as a result of some unusual individual anomaly in development seems low as such variation has not yet been recorded in any species of *Plutellus*.

***Plutellus longus*, sp. nov.**

1933. *Plutellus* sp., Gates, *Rec. Indian Mus.* XXXV, p. 484. (Type locality, Chaukan, near Pegu).

This worm is distinguished from all other Burmese and Indian species of the genus by a combination of three characteristics: length (250 mm), enlargement of setae on ii-vii, and intestinal origin in xvii. Either characteristic alone is sufficient to distinguish this from other Burmese species. Since each of the characteristics is so rarely found, the combination is not to be expected in another local species. As these characteristics not only enable future recognition but also keying, the species is now named without further waiting for clitellate material.

Definition.—Male pores on *a* lines. (Genital field ?) (Quadrithecal ?) Setae of ii-vii much enlarged and with blackened tips. (Segments ?) Length 250 ($\pm$?)mm. Diameter, 2 mm.

Gizzard ? Intestinal origin in xvii. Last hearts in xiii.

Plutellus macer, sp. nov.

Lashio (Northern Shan States), September, 0-0-1 specimens. H. Young.

External characteristics.—Length, 32 mm. Diameter, through clitellum, ca. 1 mm., less elsewhere. Unpigmented. Prostomium epilobous $< \frac{1}{2}$, tongue open. Setae begin on ii; on xxi, $ab < cd < bc < aa$. Dorsal pores unrecognizable. Clitellum light brownish, saddle-shaped, reaching ventrally into *ab* except on xvii, onto xiii and xviii but markedly protuberant only on xvi-xvii; dorsal pores and intersegmental furrows lacking, setae present. The anterior end is not hooked and is nearly straight.

Quadrithecal, pores represented by transversely slit-like depressions the anterior and posterior margins of which are slightly swollen, with centers on *c* lines, postsetal on vii-viii, about halfway between setal equators and intersegmental furrows. Female pores on *a* lines, nearly midway between setal equators of xiii and xiv. Male pores on *b* lines, each pore on the tip of a very slight, conical elevation from a nearly circular porophore that extends to *a* line and into median portion of *bc* without reaching 17/18 and 18/19.

No genital markings.

Internal anatomy.—Gizzard lacking, the gut wall in v almost transparent. Oesophagus widened and moniliform in ix-xii, heavily vascularized, with low ridges on its inner wall, valvular in the posterior-most portion of xiii. Intestinal origin in xiv just behind 13/14. No typhlosole. (Lateroparietal trunks unrecognizable.) Last hearts in xii.

Nephridia from xiv posteriorly flattened against the parietes, in contact with anterior septa only; in xiii-xii smaller and slightly more median, from xi forwards on anterior faces of the septa.

Holandric, seminal vesicles in ix and xii. Prostates loosely looped in xviii-xxi, elliptical in cross section. Prostatic duct with no muscular sheen, bent into a J-shaped loop, the short and ental limb posteriorly, scarcely thickened ectally. A delicate filament with slight iridescence (presumably the vas) rises from the parietes in xviii and passes into the ental portion of the duct just below the prostate gland. Penial setae 0.32 and 0.37 mm. long, 0.018 and 0.019 mm thick. Shaft with short ectal portion gently curved. Tip tapers to a sharp point. No definite ornamentation recognizable under oil immersion, slight transverse irregularities somewhat ental to the tip presumably artefacts.

Spermathecae are fairly large, reaching up above level of dorsal face of gut. The duct is nearly as thick as and longer than a shortly ellipsoidal ampulla from which it is distinctly delimited, the lumen narrow but just below the diverticulum slightly widened. The diverticulum is spheroidal and apparently sessile on the median face of the duct just below the ampulla.

Life history.—Brilliant spermatozoal iridescence on male funnels and in seminal chambers of spermathecae indicates, with the clitellar development, full sexual maturity.

Remarks.—*P. macer* is distinguished from all other quadrithecal Burmese species by a postsetal location of spermathecal pores on vii and viii. Relationships, as indicated by location of the anterior seminal vesicles in ix presumably are with a new species described below.

Plutellus has not hitherto been found anywhere on the Shan Plateau.

***Plutellus pandus* Gates, 1933.**

Rangoon (Hanthawaddy), October, 0-8-0 specimens. K. John. Twante (Hanthawaddy), September, 12-12-18 specimens. K. John. Hmawbi (Insein), September, 0-10-2 specimens. K. John. Wanetchaung (Insein), September, 0-1-0 specimens. K. John. Yandoon (Maubin), October, 0-5-3 specimens. Maung Ohn Maung. Henzada, October, 0-1-3 specimens. Maung Ohn Maung. Pegu, "jungles to the east", 0-9-28 specimens. K. John.

External characteristics.—Length, to 115 mm. Unpigmented clitellum reddish to brownish. All clitellate worms are hooked anteriorly. Setae *c* and *d* are longer and thicker than *a* and *b*.

Spermathecal pores are always on or median to the *a* lines, often at *a* lines on 5/6, gradually more closely paired till 8/9. Male pores are on or very slightly median to *a* lines. A ventral portion of xviii is always slightly modified but variably and often so slightly as not to permit concise characterization. The area may be bounded at 17/18 and 18/19 by a transverse strip of greyish translucence, laterally and close to *b* lines by a diagonal opaque strip with the posterior end very slightly nearer to the midventral line. A very small region bearing the minute male pore may be very slightly tumescent, slightly more opaque and whiter than the rest of the area except the lateral strips.

On each genital marking and on or near the *a* line there is usually a rather indefinite, greyish translucent area.

Internal anatomy.—Gizzard in v (15 specimens). Oesophagus with closely crowded, low, longitudinal, nonlamelliform ridges on its inner wall in x-xiii. These ridges usually have a dark grey translucent appearance due to the accumulation of blood beneath translucent tissue. Intestinal origin in xv (15), oesophageal valve in a posterior part of xiv and anteriormost portion of xv. Typhlosome apparently lacking, occasionally a very low and interrupted ridge recognizable. Last hearts in xiii (15).

Nephridia from xiii posteriorly are flattened against the parietes, in contact with both septa of a segment, extending from *b* to slightly beyond *d* lines; from xii anteriorly smaller, on the anterior faces of the septa but close to the parietes and about in *ab*.

The prostates are sigmoid, elliptical in cross section. The duct is about $\frac{3}{4}$ mm long. A filament often with slight iridescence, presumably the vas, rises from the parietes in xviii and passes along the prostate, on the surface or in a slight groove, to the duct at a point about half way from the ental end from whence it is no longer recognizable. The penisetal shaft has a slight curvature at either end, or none entally, or strongly curved like the handle of a cane entally. A short ectal portion about 0.02 mm. long may be flattened or occasionally hollowed on one side. The tip is bluntly rounded to pointed. Ornamentation is of

15-20 somewhat irregular circles (?) of a few rather triangular teeth. Measurements (in mm. by Miss Chapman) are given below.

Variation in size of penial setae in *Pluteilus pandus*.

Length.	THICKNESS.			
	Base.	Midshaft.	Across flat surface of tip.	Through side of tip.
0.58	0.005	0.006	0.005	0.002
0.54	0.006	0.007	0.005	0.002
0.52	0.006	0.007	0.006	0.003
0.44R	0.009	0.007	0.004	0.002
0.60	0.009	0.007	0.005	0.003
0.38	0.011	0.006	0.004	.. Tip truncate.
0.45R	0.006	0.007	0.005	0.002
0.43R	0.010	0.005	0.004	0.002 Tip truncate.
0.50	0.006	0.007	0.005	..
0.48	0.006	0.007	0.004	0.002
0.44R	0.005	0.006	0.005	0.002
0.42*	0.007	0.007	..	..
0.50	0.010	0.007	0.005	..
0.30R	0.010	0.006	0.004	0.003
0.26R	0.010	0.005	0.004	0.002
0.13R	0.023	..	..	..*
0.10R	0.022	..	..	..*

Spermathecae, six (21 specimens) or seven pairs (2, Rangoon), are small, as in *P. compositus* and *inflexus*, in xi as well as in xii usually with diverticula which may have a brilliant spermatozoal iridescence (acelitellate Pegu specimens).

Genital markings are areas of epidermal thickening only. When genital markings are present on 9/10 and 10/11 spermathecal pores are included.

Life history.—Brilliant iridescence characterized male funnels and seminal chambers of spermathecae of all clitellate specimens that were dissected. Aclitellate worms with similar iridescence are assumed to be postsexual.

Remarks.—In measurements of penisetal length in the original description (Gates, 1933, p. 483) the decimal point is obviously one place to the left of its proper position.

R=Reserve seta.

* Tip not flattened, tapering to a sharp point like a pencil.

Presence of hearts in xiii and the intestinal origin in xv indicate relationship to *ambiguus* from which *pandus* is distinguished by addition of two pairs of spermathecae with pores in the very unusual location (for the Megascolecidae) of 10/11-11/12, as well as by the more median location of the spermathecae.

***Plutellus pauxillulus*, sp. nov.**

Aungsaing (Thaton), September, 0-0-1 specimens. K. John.

External characteristics.—Length, 28 mm. Diameter, *ca.* 1 mm. Unpigmented. Anterior end hooked ventrally in clitellar region. Prostomium prolobous. Setae; on xxi, $ab < cd < bc < aa$, dd slightly $< \frac{1}{2}C$, posteriorly d setae progressively nearer the mid-dorsal line until $dd =$ or $< \frac{1}{4}C$. First dorsal pore on 8/9. Clitellum light brownish, saddle-shaped, reaching ventrally about to b lines, extending across xvi-xviii just onto xix and xiii though thinner there; intersegmental furrows and dorsal pores (except those of 13/14 and 18/19 lacking, setae present.

Sexthecal, spermathecal pores minute, superficial, on 6/7-8/9, on or just lateral to b lines. Female pores on a lines midway between setal equator of xiv and 13/14. Male pores on xix, on b lines, each pore on a tiny central, rather conical protuberance from a circular porophore that extends less than half way into ab and to an equal distance lateral to b lines.

A transverse area of grey translucence, on xx, on the setal equator, may be a genital marking.

Internal anatomy.—The oesophagus is heavily vascularized in ix-xii and with low ridges on its inner wall, valvular anteriorly in xiv. Intestinal origin in xiv. No typhlosole. Last hearts in xii.

Nephridia from xv posteriorly are flattened against the parietes, in contact with both septa of a segment, extending from c to lateral to d lines; apparently lacking in xiv; in xiii-x still flattened against the body wall but progressively smaller. A small portion of each nephridium, in postclitellar segments, has a light yellowish and granular appearance.

Holandric, seminal vesicles in xi (?) and xii. Prostates elliptical in cross section, in xxi-xxv, the loops compacted into a flattened mass that has a superficial resemblance to a racemose gland. The duct is about 1 mm. long, in xix-xx, a major portion slightly bowed and with a marked muscular sheen, a very short ental portion slenderer and in a u-shaped loop. No penial setae.

Spermathecal ampulla elongately ellipsoidal, in contact with the dorsal parietes, much longer than and sharply delimited from the slender duct which has a thick wall and narrow lumen. The diverticulum, which is nearly as long as the main axis and passes into the median face of the short coelomic portion of the duct close to the parietes, is rather club-shaped and without external definition of a stalk and seminal chamber. The lumen gradually narrows ectally, the wider ental portion filled by a shortly ellipsoidal mass without iridescence.

Life history.—A brilliant spermatozoal iridescence characterizes the male funnels but is lacking in the spermathecae.

Remarks.—The type is not normal. Assuming (as in the account above) that the female pores are, as usual, on xiv, there are only 11 normal segments anterior xiv. Between ii and iii however there is a short, asetal "segment" marked off by a very slight furrow into two portions. A somewhat similar "segment" has occasionally been observed in head regenerates of *Perionyx sansibaricus* Michaelsen, 1891. Possibly the anterior end of the type was lost in the region of 4/5 or 5/6 and in regeneration of a new head only segments i-ii or i-ii and v developed normally, the anlage of iii-iv failing to be completely differentiated into normal segments. If the regenerate was developed at or just behind 6/7, by analogy with *P. excavatus* E. Perrier, 1873 the anterior spermathecae could be an extra pair and the species normally quadrithecal.

Behind segment vii there is no indication of abnormality and from there posteriorly at least the type is assumed to be normal. The gut in the region anterior to vii is soft (as might be expected in a recent regenerate) and broke into pieces on manipulation so that gizzard characteristics could not be determined.

With all organs of x-xv normal it would appear unlikely that location of male pores on xix is due to hypermeric regeneration (*vide* remarks, *P. leucaspis* above).

Relationships, as indicated by the ectal junction of the vas with the prostatic duct, are with *comptus* and *leucaspis*, from both of which *pau-illulus* is distinguished by the sexthecal battery and location of the male pores on xix.

***Plutellus pratensis* Gates, 1932.**

Toungoo district, in the hills seven miles southwest of Toungoo, September, 0-0-1 specimens. G. E. Blackwell. Toungoo district, "Pegu Yomas, No. 1," September, 0-0-2 specimens. G. E. Blackwell.

External characteristics.—Length, 55-85 mm. Diameter, $3\frac{1}{2}$ -4 mm. Setae: behind the clitellum *aa* much larger than *bc* throughout. First dorsal pore on 7/8 (3). Nephropores, on the clitellar segments on *c* lines, anteriorly occasionally displaced nearer to the *b* lines, posteriorly not definitely identifiable but probably on the *c* lines.

Male pores minute, on or lateral to *b* lines, each on a very small, circular tubercle on the lateral wall of a depression extending from *a* line into *bc* and deepest laterally. Spermathecal pores minute, superficial, on viii and ix, on or very close to *b* lines, very slightly but definitely behind the intersegmental furrows.

Preclitellar genital markings presetal, in *ab*, on viii, ix and x (3). Posterior markings small, transversely elliptical tubercles, each with an opaque white rim indistinctly delimited peripherally, and a grey translucent central portion centered in *ab*, intersegmental or apparently such as furrows may be unrecognizable; on 16/17, 17/18, 18/19, and 19/20: Markings of 18/19 are rudimentary and on the posterior wall of male pore depressions, markings of 17/18 on the anterior wall.

Internal anatomy.—Septum 5/6 membranous, 6/7 muscular, 7/8-9/10 thickly muscular, 10/11 and possibly the next two slightly muscular.

Gizzard in v (3). Oesophagus with low, longitudinal but not lamelliform ridges, which may be crossed by very slight circular furrows, on its inner wall in vii-xiii. Intestinal origin in xv (3). Typhlosole (?) begins in or near xxiv(3) and is a very low, slightly irregular, non-lamelliform ridge, interrupted or low midsegmentally, highest at region of septal insertion, terminating gradually (1) about five mm. from hind end (length 75 mm). Last hearts in xii (3). A transverse connective between the extra-oesophageals is present just in front of 4/5, also in vi and likewise in vii.

Nephridia in postclitellar segments are long slender loops, extending from *a* to slightly beyond *d* lines; in xvii-xiii or xii the loops gradually shortened; from xii or xi to v much smaller, on the anterior faces of the septa near the ventral parietes, and about in *ab*.

Prostates looped in xviii-xxi, shortly elliptical in cross section, a central lumen recognizable with binocular only in the ectal portion. The duct is about 2 mm. long, slightly thickened and with muscular sheen ectally. A filament, presumably the vas, passes to an ental portion of the prostatic duct slightly below the gland. Penial setae are 0.44, 0.46, 0.58, 0.62, and 0.65 mm. long, 0.010-0.011 mm. thick. The shaft is slightly curved at each end, both curves on the same side or with two gentle curves, that in the ectal half in an opposite direction to that of the ental half. The tip is simple (5) or terminating in a very delicate almost filamentous spine (1). The ornamentation is of 6-11 circles of fine spines, recognizable only under oil immersion, near the tip. In addition there are on two setae, slight marginal serrations between circles of spines and about 0.008 mm. apart.

The spermathecal duct is much shorter than the ampulla from which it is distinctly delimited, abruptly narrowed in the parietes, with slight muscular sheen and rather thick wall; lumen in the coelomic portion slit-like, shortly elliptical or almost circular in section. The diverticulum is pear-shaped to club-shaped, occasionally nearly as long as the main axis. Seminal chamber, with thin wall, or with slight ridge-like thickenings (contraction?) contains an ellipsoidal to sausage-shaped mass of sperm. The stalk is shorter than the chamber, not clearly delimited externally but is recognizable on clearing by its thicker wall and narrow lumen, usually bent into a shortly u-shaped loop, passing into median face of the duct close to the parietes.

Genital markings are areas of slight epidermal thickening only.

Life history.—The brilliant spermatozoal iridescence on the male funnels and in the seminal chambers of the spermathecae, together with the development of the clitellum, demonstrate full sexual maturity.

Remarks.—This species has no apparent relationships with other Burmese forms. It has retained the supposedly primitive quadrithecal battery, but with some slight posterior dislocation of the spermathecal pores, lacks hearts in xiii but does have the oesophagus extended back into xv.

***Plutellus subtilis*, sp. nov.**

Kyaikto (Thaton), August, 0-0-1 specimens. K. John.

External characteristics.—Length, 40 mm. Diameter, ca. 1 mm. Anterior end hooked ventrally. Unpigmented. Setae begin on ii; on postclitellar segments $ab < cd$, and $aa < bc$, but ratio of aa to bc varies at different levels. (First dorsal pore ?) Nephropores possibly are on or near the c lines. Clitellar boundaries rather indistinct but probably at 13/14 and 17/18, a brownish clitellar coloration lacking and intersegmental furrows visible in bb ; intersegmental furrows and dorsal pores lacking, setae present.

Quadrithecal, spermathecal pores on 7/8-8/9, on or immediately lateral to b lines. Female pores on a lines and ca. half way between 13/14 and the setal equator of xiv, in a transverse area of epidermal thickening. Male porophores very small, transversely oval, with pointed ends reaching mesially nearly to a lines. Male pores about on b lines and on lateral portions of porophores. The tip of a penial seta protrudes to the exterior slightly median to each male pore.

Genital markings are a pair of shortly elliptical, transversely placed, rather indistinctly demarcated areas, a trifle larger than the male porophores with which they are almost in contact, presetal on xviii, with centers about on the b lines, not reaching mesially to a lines. Just antero and postero-median to each male porophore there is a slight depression.

Internal anatomy.—Septum 4/5 membranous, 5/6-7/8 with a few muscular fibres. Gizzard rudimentary, in v. Masses of iridescent (glandular ?) material are present at the sides of the gut in iv-vii, larger in v-v. The oesophagus has longitudinal rows of rather shortly pyramidal protuberances on its inner wall in x-xii. The intestinal origin is just behind 13/14. No typhlosole. The last hearts are in xii.

The nephridia are flattened against the parietes, in contact with both septa of a segment, extending from b line into cd or to d line; funnels unrecognized, ducts apparently passing into parietes at or close to c lines. Nephridia in xii-x are on the anterior faces of the septa but from ix anteriorly were not recognized.

Holandric, seminal vesicles in ix and xii (one vesicle containing several spheroidal brown bodies). Prostates in xix-xxi, regularly looped with limbs of the loops in contact, the gland shortly elliptical in cross section. The duct is ca. $\frac{1}{2}$ mm long, nearly straight, transversely placed in xviii just in front of 18/19. The vas though small is clearly visible, looped on the parietes in xiv-xviii, slightly iridescent, passing into the prostatic duct slightly ectal to the middle of the coelomic portion. Penial setae are 0.37 and 0.38 mm long, 0.005 mm thick. The shaft is slightly curved towards the ectal end. The tip is bluntly rounded. Ornamentation apparently is lacking but at the margins of the shaft dark areas are visible under oil immersion as if a fairly broad band passed spirally around the shaft, the region between the bands as wide as the band.

Spermathecae are large, reaching into contact with the dorsal parietes. The duct is longer than the ellipsoidal ampulla from which it is clearly

delimited, slightly bulbous, or spindle-shaped; lumen narrow ectally and entally, widened in a middle portion into which, on the lateral face, the diverticulum opens. The diverticulum is much shorter than the duct, with a shortly ellipsoidal to spheroidal seminal chamber and a stalk slightly longer and nearly as thick as the chamber.

Life history.—Brilliant iridescence on the male funnels and in the seminal chambers of the spermathecae, together with the clitellar development demonstrates that the animal was fully sexual.

Remarks.—Penisetal follicles, in this species, apparently open to the exterior independently of the male pores. Determination of exact relationships between penisetal follicles and prostatic ducts in this and other species of the genus may provide information of taxonomic value.

Relationships, as indicated by location of the anterior seminal vesicles in ix rather than in xi, are with *P. macer* from which *subtilis* is distinguished by a more ectal junction of the vas with the prostatic duct, more median location of the spermathecal pores, and the presumably primitive intersegmental location of those pores.

***Plutellus thanbulanus*, sp. nov.**

Thanbula (Thayetmyo), August, 2-2-0 specimens. K. John

External characteristics.—Oothecal, spermathecal pores minute, superficial, on 5/6-8/9, exactly on *b* lines. Male pores minute, superficial, about on *b* lines, on an indistinctly delimited, very slightly tumescent area of greyish translucence reaching from *a* line to slightly lateral to *b* line but not reaching to 17/18 or 18/19. No genital markings.

Internal anatomy.—Oesophagus with inner wall marked off by longitudinal and circular furrows into small, rather squarish areas in ix-xiii. Intestinal origin in xiv (2). No typhlosole (2). Last hearts in xiii (2).

Nephridia posteriorly are flattened against the parietes, in contact with both septa of a segment, extending laterally to or just beyond *d* lines.

Holandric, seminal vesicles in xi (?) and xii. Prostates sigmoid-elliptical in cross section, in xix.

Spermathecal duct almost confined to the parietes. The diverticulum which passes to the median face of the duct has a seminal chamber containing a spheroidal, to ellipsoidal mass of sperm which may be continued for a short distance into the narrow lumen of the stalk.

Life history.—Brilliant spermatozoal iridescence in seminal chambers of the spermathecae (aclitellate specimens) demonstrates that copulation had taken place. Unless copulation can take place before development of the clitellum, absence of a clitellum indicates that the worms were in a postsexual stage after completion of clitellar regression.

Remarks.—No information is available as to penial setae. The "andry" and location of the anterior seminal vesicles require confirmation, presence of a very sticky coagulum in x-xi having rendered determination of certain characteristics difficult.

P. thanbulanus is distinguished from the other octothecal species as follows : from *inflexus* and *compositus* by presence of the hearts of xiii, from *ambiguus* by the primitive intestinal origin in xiv and the absence of genital markings.

This is the first record of an octothecal species south of Mandalay, though *pandus*, present in a still more southern part of the country, presumably had an octothecal ancestry.

Genus **Ramiella** Stephenson, 1921.

Ramiella bishambari (Stephenson), 1914.

- 1914. *Octochaetus bishambari* Stephenson, *Rec. Indian Mus.* XVI, p. 347. (Type locality, Saharanpur, United Provinces, India. No. types.).
- 1920. *Octochaetus pachpaharensis* Stephenson, *Mems. Indian Mus.* VII, p. 239 (Type locality, Pachpahar, near Kotah, South Rajputana, India. Types in the Indian Museum.).
- 1923. *Ramiella bishambari* + *R. pachpaharensis*, Stephenson, *Oligochaeta*, in : *The Fauna of British India*, pp. 398 and 400.
- 1931. *Ramiella cultrifera* Stephenson, *Rec. Indian Mus.* XXXIII, p. 187. (Type locality, Rangoon, Burma. Types in the British Museum.).
- 1935. *Ramiella cultrifera* Michaelsen, *Anns. Mag. Nat. Hist.* (10), XV p. 10 (Christmas Island near Java.).
- 1942. *Ramiella cultrifera* Gates, *Bull. Mus. Comp. Zool. Harvard*, LXXXIX, p. 122. (Four districts of Burma.).

R. cultrifera has been distinguishable hitherto from two less adequately characterized species of the genus only as follows. From *R. pachpaharensis* by the rolled tube structure of the penial setae. From *R. bishambari* by the presence of more than one pair of nephridia per segment posteriorly and by the absence of seminal vesicles in x. Examination of the types of *pachpaharensis* has now shown that the penial setae are of the rolled tube type. Indeed, one seta from a type actually unrolled in a drop of water while it was being observed under the microscope. The presence of only a single pair of nephridia per segment in *bishambari* apparently was inferred from appearances of internal organs as seen through the transparent body wall. Supposed seminal vesicles in x (possibly also in xi) may well have been only hardened masses of testicular coagulum such as the supposed vesicles in one segment of *O. pittnyi* were found to be. Types of *bishambari* were lost long ago. Material collected for the author at the type locality, Saharanpur, has characteristic rolled tube penial setae and is indistinguishable from *cultrifera*.

Genus **Lennogaster** Gates, 1939.

Lennogaster chittagongensis (Stephenson) 1917.

Ramree (Kyaukpyu), "Hill," September 0-0-5 specimens. I. M. Ismailjee. Sandoway, "Doedaung Hill", September, 0-0-1 specimens. I. M. Ismailjee.

Lennogaster yeicus (Stephenson), 1931.

Sandoway, "Doedaung Hill", September, 0-0-1 specimens. I. M. Ismailjee.

This worm is 52 mm. long and 1 mm. thick. It is proandric, the testis sacs vertically ovoidal. Penial setae have truncate or simply pointed tips.

Genus *Octochaetoides* Michaelsen, 1921.*Octochaetoides beatrix* (Beddard), 1902.

1902. *Octochaetus Beatrix* Beddard, *Ann. Mag. Nat. Hist.*(7), IX, p. 456. (Type locality, Calcutta. Holotype, if still in existence, probably in the British Museum.)
1907. *Octochaetus Fermori* + *O. Hodgarti* Michaelsen, *Mitt. Mus. Hamburg*. XXIV, pp. 171 and 172. (Type locality of *fermori*, Raniganj, Burdwan district, Bengal. Type locality of *hodgarti*, Gowchar, Nepal. Types of both species in the Indian and Hamburg Museums.)
1909. *Octochaetus beatrix* + *O. fermori* + *O. hodgarti*, Michaelsen, *Mems. Indian Mus.* 1, pp. 204, 212, 213.
1910. *Octochaetus Beatrix* + *O. Fermori* + *O. Hodgarti* + *O. Pittnyi* Michaelsen, *Abh. Nat. Hist. Ver. Hamburg*, XIX, (5) pp. 12 and 86. (Type locality of *pittnyi*, Trivandrum, Travancore. Types in the Indian and Hamburg Museums.)
1914. *Octochaetus fermori* + *O. dasi* Stephenson, *Rec. Indian Mns.* X, pp. 344 and 346. (Type locality of *dasi*, Baroda. Types in the Indian Museum.)
1923. *Octochaetus (Octochaetoides) beatrix* + *O. fermori* + *O. hodgarti* + *O. pittnyi*, Stephenson, *Oligochaeta*, in: *The Fauna of British India*, pp. 376, 378, 381, 391.
1929. *Octochaetus lunatus* Gates, *Proc. U. S. Nat. Mus.* LXXV (10), p. 24. (Type locality, Mandalay, Burma. Types in the Indian, British and U. S. Nat. Museums.)

Kyaikmaraw (Amherst), August, 0-0-1 specimens. K. John. Duiyzeik (Thaton), September, 0-0-3 specimens. K. John. Thaton, September, 0-0-6 specimens. K. John. Kyaikto (Thaton), August, 0-0-1 specimens; September, 0-0-7 specimens; October, 0-0-32 specimens. K. John. Bilin (Thaton), September, 0-0-2 specimens; October, 0-0-11 specimens. K. John. Taungzun (Thaton), August, 0-0-1 specimens. K. John. Thinbawgyin (Bassein), October, 0-0-15 specimens. K. John. Henzada, October, 0-0-1 specimens. Maung Ohn Maung. Shwegyin (Toungoo) October, 0-0-21 specimens. Marshall Shwin. Buthidaung-Maungdaw (Akyab), September, 0-0-1 specimens. I. M. Ismailjee. Magwe, August, 0-0-21 specimens. K. John. Minbu, August, 0-0-1 specimens. K. John. Mt. Popa (Myingyan), September, 0-0-1 specimens. K. John. Meiktila, September, 0-0-3 specimens. K. John. Kyaukse, "two miles to the west", September, 0-0-4 specimens. K. John. Tada-U (Sagaing), September, 0-0-2 specimens. K. John. Myotha (Sagaing), September, 0-0-2 specimens. K. John. Ye-U (Shwebo), September, 0-0-1 specimens. Saw San Thwe. Kin-U (Shwebo), September, 0-3-4 specimens. Saw San Thwe. Kyaukmyaung (Shwebo) "nearby hills", September, 0-2-21 specimens. "Town", 0-0-1 specimens. Saw San Thwe. Naba (Katha), "nearby hills", September, 0-0-2 specimens. Saw San Thwe. Indaw Lake (Katha), September, 0-0-9 specimens. Saw San Thwe. Wuntho (Katha), "hills to the west", September, 0-0-3 specimens. Saw San Thwe. Mohnyin (Myitkyina), "jungle", October, 0-0-8 specimens. R. C. Sharma. Myitkyina and vicinity, September, 0-0-10 specimens. K. John. Weshi (Myitkyina), November, 0-0-1 specimens. F. D. Forbes. Bhamo and vicinity, September, 0-0-56 specimens. K. John. Lashio (Northern Shan States), September, "bare and rather dry soil in bamboo grove", 0-0-1 specimens. "Banyan grove. Ground with thin covering of leaves and grass", 0-0-6 specimens. "Woods, ground covered with leaves, 8 miles on the Hsenwi road from Lashio", 0-0-1 specimens. H. Young. Namkham (Northern Shan States), December 1926, 0-0-1 specimens. H. S. Rao. (Indian Museum).

Lucknow (United Provinces, India), a number of clitellate specimens. K. N. Bahl. Bombay, August, 0-0-8 specimens. K. N. Bahl. Udaipur (Rajputana), August, 1-0-14 specimens. Miss Ella Macleavy.

The following material from the Indian Museum has also been examined.

"*Octochaetus (Octochaetoides) fermori* Michaelsen. Saharanpur, U. P. Lt.-Col. Stephenson, W. 36/1.", 2 a clitellate and 9 clitellate (1 dissected) specimens. "*Octochaetus hodgarti* Michaelsen. Gowchar, Nepal. Hodgzt. ZEV 2852/7. Types.", 1 juvenile and 1 clitellate (dissected) specimens. "*Octochaetus pittnyi* Michaelsen. Trivandrum, Travancore. R. S. N. Pillay/ZEV 3174/7. Types.", 1 a clitellate and 2 clitellate (1 dissected) specimens. (The tube also contained a juvenile specimen with perichaetine setae.). "*Octochaetus pittnyi* Michaelsen, Mangalore, Malabar. G. Matthai. ZEV 3491/7.", 1 clitellate (dissected) specimen. "*Octochaetus dasi* Stephenson. Baroda. Lt.-Col. J. Stephenson W 34/1. Types.", 3 clitellate specimens (2 dissected). "*Octochaetus beatrix* Beddard Bombay. Prof. J. P. Mullan. W 704/1.", 1 clitellate (dissected) specimen.

The following material from the Hamburg Museum has also been examined.

"*Octochaetus fermori* Michlsn. L. L. Fermor. Bengalen. V 7136", 4 clitellate (2 dissected) specimens.

External characteristics.—Pigment is lacking in the body wall which is transparent in live worms except for the clitellum. The latter is usually bright orange to red in life.

Penial setae of *a* and *b* follicles emerge from the epidermis separately. prostatic pores, if distinct from apertures of *b* follicles, have been unrecognizable. A narrow region immediately lateral to each seminal furrow is slightly tumescent and if extended laterally on xviii and/or xix may be marked off into a circular central area (slightly depressed in a regularly concave fashion and greyish translucent) and a peripheral rim so as to have an appearance of a small genital marking.

Internal anatomy.—Calciferous gland stalks are slender, about three-fourths mm. long, passing to gut wall dorsolaterally at site of insertion of 15/16. Apertures of the ducts into the oesophageal lumen are small and each is covered over by a lamella or ridge, with free dorsal margin, that is attached just below the aperture. The intestinal origin is in xvii. The typhlosole begins in xxii-xxv, is one to two mm high. The ventral bifurcations decrease in height posteriorly and usually have become unrecognizable at xc but the lamella still remains high for several segments and usually ends abruptly in cviii-cxii. No lateral or ventral typhlosoles or ridges were found.

Septa 10/11 and 11/12 are bound together peripherally. A portion of the reduced coelomic cavity of xi is closed off by a delicate, transparent membrane to form a testis sac which is small, u-shaped with limbs reaching up to the gut. The male funnels of xi frequently have a spermatozoal iridescence that has always been lacking on the funnels of x in every specimen dissected.

The spermathecal diverticulum, which passes into the anterior face of the duct, often rests on the parietes against which it may be flattened in a shelf-like fashion. It is frequently covered by septal and nephridial tissues and invisible until they have been removed.

Abnormality.—No. 1. The right anterior spermatheca lacking. No. 2. Three spermathecae, each with own pore, in viii on left side. The ducts of the spermathecae of ix unite in the circular muscle layer to open to the exterior through a single, median, transversely slit-like pore.

Parasites.—Two insect larvae, each about six mm long and two mm thick (preserved, contracted) crawled out of the mouth of a worm that had just been killed in spirits.

Remarks.—No adiverticulate spermathecae have been found though a considerable number of specimens were examined for information on this particular point. Coverage by nephridia explains the failure to recognize the diverticula in Stephenson's specimens of *beatrice* and *dosi* and presumably also in the type of *beatrice*. The supposed seminal vesicles in xi of *pittnyi* are hard masses of testicular coagulum.

Octochaetoides aitkeni (Fedarb) 1898 from Travancore, which was unfortunately designated as the genotype, still is inadequately characterized. Except for the apparent absence of a typhlosole and several minor characteristics the species could be united with *beatrice*.

***Octochaetoides surensis* (Michaelson), 1910.**

1910. *Octochaetus surensis* Michaelson, *Abh. Nat. Hist. Ver. Hamburg*, XIX. (5), p. 88. (Type locality, Sur Lake, Orissa. Type in the Indian Museum.)
 1916. *Octochaetus surensi* (sic), Stephenson, *Rec. Indian Mus.* XII, p. 338. (Barkul, Sur Lake, Orissa.).
 1923. *Octochaetus* (*Octochaetoides*) *surensis*, Stephenson, *Oligochaeta*, in: *The Fauna of British India*, p. 394.
 1925. *Octochaetus* (*Octochaetoides*) *birmanicus* Gates, *Anns. Mag. Nat. Hist.* (9), XVI, p. 55. (Type locality, Rangoon. Types in the Indian, British and U. S. Nat. Museums.).

Kyaikmaraw (Amherst), August, 0-2-0 specimens. K. John. Moulmein (Amherst), August, 0-0-3 specimens. October, 14-0-11 specimens. K. John. Mupun (Amherst), October, 6-6-29 specimens. K. John. Kyaikto (Thaton), August, 8-12-23 specimens. September, 0-0-10 specimens; October, 0-0-68 specimens. K. John. Sittang (Thaton), October, 0-17-165 specimens. K. John. Mokpalin (Thaton), October, 0-0-16 specimens. K. John. Thongwa (Hanthawaddy), September, 0-0-11 specimens. K. John. Kyauktan (Hanthawaddy), September, 4-2-3 specimens; August, 72-11-7 specimens. Saw San Thwe and K. John. Kungyangon (Hanthawaddy), August, 0-18-22 specimens. K. John. Twante (Hanthawaddy), August, 25-10-4 specimens. K. John. Pegu, "jungle 2 miles to the east," August, 2-13-10 specimens. "Jungle to the west," 4-3-4 specimens. "Town", 0-9-3 specimens. K. John. Thanatpin (Pegu), August, 16-10-9 specimens. K. John. Thameintaw (Pyapon), September, 4-12-21 specimens. Maung Ohn Maung. Pyapon, September, 18-3-2 specimens. Maung Ohn Maung. Kyaiklat (Pyapon), September, 0-0-1 specimens. Maung Ohn Maung. Dedaye (Pyapon), September, 1-0-1 specimens. Maung Ohn Maung. Bogale (Pyapon), September, 2-0-0 specimens. Maung Ohn Maung. Wakema (Myaungmya), October, 1-0-0 specimens. Maung Ohn Maung. Yandoon (Maubin, October, 0-0-1 specimens. Maung Ohn Maung. Danubyu (Maubin), October, 0-0-1, specimens. Maung Ohn Maung. Pantanaw (Maubin), October, 0-0-1 specimens. Maung Ohn Maung. Henzada, October, 0-0-2 specimens. Maung Ohn Maung. Bassein, October, 65-11-191 specimens. K. John. Thinbawgyin (Bassein), October, 0-1-73 specimens. K. John. Padaukchaung (Bassein), October, 0-0-17 specimens. K. John. Hmawbi (Insein), September, 5-7-9 specimens. K. John. Taikkyi (Insein), September, 8-3-36 specimens. K. John. Hlawga (Insein), September, 5-9-21 specimens. J. John. Wanetchaung (Insein), September, 2-4-19 specimens. K. John. Pyinmana (Yamethin), October, 5-2-14 specimens. K. John. Toungoo, October, 0-1-23 specimens. K. John. Kyaukse, September, 0-0-9 specimens. K. John. Naba (Katha), "nearby hills", September, 5-0-1 specimens. Saw San Thwe. Bhamo, "waste land beyond town" October, 0-0-47 specimens. S. C. Paul.

Cuttack, Orissa, India, February, 0-0-2 specimens. H. F. Chaudhry.

The following material from the Indian Museum has also been examined :

"*Octochaetus surensi* Mchlsn. Barkul, 0-1,000 feet, Orissa. Dr. F. H. Gravely ZEV/6526/7." 2 clitellate dissected specimens.

Remarks.—Septa 5/6-7/8 are lacking in the Cuttack and Barkul specimens, as in the Burmese and Assam specimens and as also in *beatrice*. This was clearly demonstrated in the Cuttack and Barkul specimens by the presence between septum 8/9 and 4/5 of four pairs of vessels from the dorsal trunk, one pair immediately in front of 8/9, another slightly further forward, a third passing to the postgizzard enlargement of the oesophagus or to the gizzard, and a fourth in front of the gizzard. These obviously represent the segmental commissures of v-viii. With the recognition of the first muscular septum in *surensis* as 4/5, of the next septum as 8/9, and of the presence of hearts in xiii there is no longer any justification for maintenance of *birmanicus*.

Genus **Tonoscolex** Gates, 1933.**Tonoscolex depressus** (Gates), 1929.

Hopin (Myitkyina), October, 0-0-3 anterior fragments. R. C. Sharma.

Calcareous granules were still present in the calciferous glands when these specimens were examined, preservation having been in spirit instead of formalin as usual. The typhlosole begins abruptly in the first intestinal segment and is a simple lamelliform ridge, about one mm. high at first, gradually decreasing in height posteriorly.

Genus **Perionyx** E. Perrier, 1872.**Perionyx excavatus** E. Perrier, 1872.

Moulmein (Amherst), October, 4-0-0 specimens. K. John. Mupun (Amherst), October, 13-1-1 specimens. K. John. Thaton, September, 0-0-4 specimens. K. John. Bilin (Thaton), September, 1-0-0 specimens. K. John. Kyaikto (Thaton), October, 0-9-3 specimens. K. John. Sittang (Thaton), October, 7-0-4 specimens. K. John. Twante (Hanthawaddy), August, 32-0-1 specimens. K. John. Kyauktan (Hanthawaddy), September, 1-0-0 specimens. K. John. Syriam (Hanthawaddy), August, 0-0-1 specimens. Saw San Thwe. Kungyangon (Hanthawaddy), August, 0-0-4 specimens. K. John. Wanetchaung (Insein), September, 3-0-2 specimens. K. John. Hlegu (Insein), September, 3-0-0 specimens. K. John. Hmawbi (Insein), September, 1-0-0 specimens. K. John. Pyapon, September, 4-0-0 specimens. Maung Ohn Maung. Thameintaw (Pyapon), September, 3-0-0 specimens. Maung Ohn Maung. Bogale (Pyapon), September, 1-0-0 specimens. Maung Ohn Maung. Dedaye (Pyapon), September, 2-0-0 specimens. Maung Ohn Maung. Kyaiklat (Pyapon), September, 2-0-0 specimens. Maung Ohn Maung. Pegu, August, 0-0-12 specimens. "Jungle to the west", 0-0-2 specimens. K. John. Bassein, October, 4-0-0 specimens. K. John. Thinbawgyin (Bassein), October, 0-0-6 specimens. K. John. Mayungmya, October, 2-0-0 specimens. Maung Ohn Maung. Wakema (Myaungmya), October, 7-0-0 specimens. Maung Ohn Maung. Pantanaw (Mabun), October, 2-0-0 specimens. Maung Ohn Maung. Danubyu (Mabun), October, 3-0-0 specimens. Maung Ohn Maung. Ingabu (Henzada), October, 4-0-0 specimens. Maung Ohn Maung. Zalun (Henzada), October, 1-0-0 specimens. Maung Ohn Maung. Henzada, October, 9-0-0 specimens. Maung Ohn Maung. Sandoway, "hills", September, 0-2-2 specimens. I. M. Ismailjee. Kyaukpyu, September, 0-0-1 specimens. I. M. Ismailjee. Akyab, September, 0-0-1 specimens. I. M. Ismailjee. Myohaung (Akyab), September, 0-2-0 specimens. I. M. Ismailjee. Buthidaung-Mungdaw (Akyab), September, 0-3-2 specimens. I. M. Ismailjee. Paukkaung (Prome), September, 0-2-0 specimens. K. John. Prome, September, 3-0-0 specimens. K. John. Laboo (Prome), "under leaves", August, 0-12-0 specimens. K. John. Thayetmyo, September, 0-1-0 specimens. K. John. Taungdwingyi (Magwe), September "in cow manure in jungles to the east", 0-0-6 specimens. "In the town", 0-2-2 specimens. K. John. Pauk-taw-gwin (Salween), October, 0-1-0 specimens. Marshall Shwin. Daylo (Toungoo Karen Hills), September, 0-1-0 specimens. H. I. Marshall. Toungoo, October, 3-0-0 specimens. K. John. Pyinmana (Yamethin), October, 4-0-4 specimens. K. John. Mt. Popa (Myingyan), September, 0-9-3 specimens. K. John. Mogaung (Myitkyina), October, 0-20-8 specimens. R. C. Sharma. Bhamo, "banks of lake", October, 0-0-1 specimens. S. C. Paul.

Perionyx sp.

Kyaiktiyo (Thaton), October, 10-0-0 specimens. K. John. Kumingyaung (Thaton), October, 12-0-0 specimens. K. John. Bilin (Thaton), October, 5-0-0 specimens. K. John. Thaton, September, 5-0-0 specimens. K. John. Naung-gala (Thaton), September, 7-0-0 specimens. K. John. Pegu, "jungles to the west", August, 7-0-0 specimens. K. John. Thanatpin (Pegu), August, 2-0-0 specimens. K. John. Kyaukpyu, September, 0-0-8 specimens. I. M. Ismailjee. Akyab, September, 2-0-0 specimens. I. M. Ismailjee. Myohaung (Akyab), September, 89-0-0 specimens. I. M. Ismailjee. Pathichaung (Toungoo Karen Hills), September, 0-0-4 specimens. H. I. Marshall. Daw Pakko, near Thandaung (Toungoo Karen Hills), September, 0-23-0 specimens. H. I. Marshall. Shwenyaungbin bungalow on road to Thandaung (Toungoo Karen Hills), "in tree 20-30 cubits from the ground", September, 0-24-0 specimens. H. I. Marshall. Daylo (Toungoo Karen Hills), September, 0-17-0 specimens. H. I. Marshall. Lalawata Ferry (Toungoo Karen Hills), September, 0-19-0 specimens. H. I. Marshall. Pelachi

village, (Toungoo Karen Hills), September, 0-37-0 specimens. H. I. Marshall. Sah Der village (Toungoo Karen Hills), "on epiphytic ferns 15 feet from ground," October, 6-0-0 specimens. "On fern roots on branches of tree", 57-0-0 specimens. H. I. Marshall. Shwe-ta-dah (Toungoo Karen Hills), October, "in hollow of tree, five feet from ground" 61-0-0 specimens. "In hollow of tree, eight feet from ground", 53-0-0 specimens. H. I. Marshall. Myasawni Bridge (Toungoo Karen Hills), October, "on tree, ten feet from ground", 37-0-0 specimens. H. I. Marshall.

Genus **Lampito** Kinberg 1867.

Lampito mauritii Kinberg 1867

Moulmein (Amherst), October, 19-2-5 specimens. K. John. Mupun (Amherst), October, 2-3-4 specimens. K. John. Syriam (Hanthawaddy), August, 0-1-0 specimens. Saw San Thwe. September, 0-3-0 specimens. K. John. Pyapon, September, 0-6-1 specimens. Maung Ohn Maung. Kyaiklat (Pyapon), September, 14-39-21 specimens. Maung Ohn Maung. Bassein, October, 6-2-4 specimens. K. John. Sandoway, "river side", September, 0-1-0 specimens. I. M. Ismailjee. Kyaukpyu, September, 3-6-5 specimens. I. M. Ismailjee. Akyab, September, 2-4-7 specimens. I. M. Ismailjee. Buthidaung-Maungdaw (Akyab), September, 0-4-4 specimens. I. M. Ismailjee. Prome, August, 0-10-3 specimens. K. John. Thayetmyo, August, 3-2-4 specimens. K. John. Thanbula (Thayetmyo), 0-1-1 specimens. K. John. Allanmyo (Thayetmyo), September, 1-3-0 specimens. K. John. Toungoo, October, 4-4-6 specimens. K. John. Pyinmana (Yamethin), October, 24-14-17 specimens. K. John. Magwe, September, 1-20-6 specimens. K. John. Taungdwingyi (Magwe), 1-0-14 specimens. K. John. Natmauk (Magwe), August, 0-3-3 specimens. K. John. Minbu, August, 0-6-17 specimens. K. John. Myingyan, September, 0-67-16 specimens. K. John. Taungtha (Myingyan), September, 0-15-20 specimens. K. John. Meiktila, September, 0-10-4 clitellate specimens. K. John. Kyaukse, "to the west", September, 12-12-16 specimens. K. John. Myotha (Sagaing), September, 1-0-17 specimens. K. John. Tada-U (Sagaing), September, 1-0-0 specimens. K. John. Sagaing, September, 16 juvenile and a clitellate specimens. Saw San Thwe. Monywa (Lower Chindwin),—116-35 specimens. West of Monywa, September, 1-0-0 specimens. Saw San Thwe. Kyaukmyaung (Shwebo). September,—54-3 specimens. Saw San Thwe. Kin-U (Shwebo),—14-3 specimens. Saw San Thwe. Shwebo, September,—34-15 specimens. Saw San Thwe. Ye-U (Shwebo), September, 1-11-11 specimens. Saw San Thwe. Katha, September,—46-5 specimens. Saw San Thwe. Indaw Lake (Katha), September,—34-4 specimens. Saw San Thwe. Bhamo, "banks of lake", October, 0-28-5 specimens. Bhamo, October, "banks of lake", 0-28-5 specimens. "Banks of river", 0-18-5 specimens. "Town", 0-19-2 specimens. "Waste land beyond town", 0-5-13 specimens. S. C. Paul.

Genus **Pheretima** Kinberg, 1867.

Pheretima alexandri (Reddard), 1900.

Mayan Chaung (Tavoy), "near Tavoy River", September, 0-0-1 specimens. W. D. Sutton. Posoe Chaung (Tavoy), "near Tavoy River", September, 0-0-2 specimens. W. D. Sutton. Nyaungdonle Chaung (Tavoy), "plains", September, 0-0-3 specimens. W. D. Sutton. Pyinthadaw (Tavoy), "plains", September, 0-0-1 specimens. W. D. Sutton. Kamaungthwe River east (Tavoy), September, 0-0-10 specimens. W. D. Sutton. Moulmein (Amherst), August, 0-0-4 specimens. K. John. Kyaikmaraw. (Amherst), August, 0-0-2 specimens. K. John. Kinmunsakhan (Thaton), October, 0-0-9 specimens. K. John. Kyaiktiyo (Thaton), October, 0-0-3 specimens. K. John. Kyaikto (Thaton), October, 0-0-7 specimens. K. John. Taungzun (Thaton), October, 0-0-36 specimens. K. John. Bilin (Thaton), September, 0-0-3 specimens; October, 0-0-31 specimens. K. John. (Thaton), September, 0-0-26 specimens. K. John. Duiyzeik (Thaton), September, 0-0-14 specimens. K. John. Aungsaing (Thaton), 0-0-9 specimens. K. John. Twante (Hanthawaddy), August, 0-0-2 specimens. K. John. Wakema (Myaungmya), October, 0-0-3 specimens. Maung Ohn Maung. Danubyu (Mauhin), October, 0-0-2 specimens. Maung Ohn Maung. Prome, August, 0-0-1 specimens. K. John. Laboo (Prome), 1-0-6 specimens, August. K. John. Toungoo, October, 0-0-1 specimens. K. John. Daylo (Toungoo Karen Hills), September, 0-0-1 specimens. H. I. Marshall. Daylo Stream (Toungoo Karen Hills), October, 0-0-1 specimens. H. I. Marshall. Ler-mu-htee (Salween) October, 0-0-19 specimens. Marshall Shwin. Pautaw-gwin (Salween), October, 0-0-10 specimens. Marshall Shwin. Mewaing (Salween), October, 0-0-19 specimens. Marshall Shwin. Thayetmyo, August, 0-0-10 specimens. K. John. Thanbula (Thayetmyo), August, 0-0-8 specimens. K. John. Magwe,

August, 0-0-6 specimens. K. John. Pyinmana (Yamethin), October, 0-0-6 specimens. K. John. Mt. Popa (Myingyan), September, 0-0-9 specimens. K. John. Kin-U (Shwebo), September, 8-0-27 specimens. Saw San Thwe. Kyaukmyaung (Shwebo), September, 0-1-4 specimens. Saw San Thwe. Naba (Katha), "hills", September, 0-0-12 specimens. Saw San Thwe. Indaw Lake (Katha), September, 0-0-4 specimens. Saw San Thwe. Wuntho (Katha), "hills", September, 0-0-24 specimens. Saw San Thwe. Katha, "hills", September, 0-1-1 specimens. Saw San Thwe. Lashio, September. "Open grassy ground", 0-0-7 specimens. "Grassy ridges of paddy fields", 0-0-9 specimens. "Soil under banyan tree", 0-0-10 specimens. "Dense jungle near water", 0-0-5 specimens. "Open grassy ground, soil red and rather dry", 0-1-12 specimens. "Lantana thicket, soil covered with leaves", 0-0-5 specimens. "Hard, red earth in open ground of old highland field", 0-0-10 specimens. "Leaf covered soil on well wooded, rocky crag 5 miles southwest of town", 0-0-4 specimens. "Gravelly soil in densely wooded ravine on Hsenwi road 10 miles from town", 0-2-18 specimens. "Rich soil covered with leaf mould at base of cliff 10 miles from town", 0-0-16 specimens. Richly manured soil in Shan garden at E Nai village", 0-0-2 specimens. "Muddy ground covered with water cress at Wan Hu Mone village", 0-3-0 specimens. H. Young. Man Meh Hang village (Hsipaw State), "bullock caravan camp", September, 0-3-0 specimens. H. Young. Na Hko Sheh village (Pang Long State), "thatch grass, soil dry and red", October, 0-0-6 specimens. H. Young. Pang Noi village (Pang Long State), "rich dark soil under clump of trees", October, 0-0-2 specimens. H. Young. Hpa Cha village (Pang Long State), "rocky soil in woods", October, 0-0-2 specimens. H. Young. Meung Nawng village, Salween Ferry (Pang Long State), "manured ground in low and damp Shan garden", October, 0-0-1 specimen. H. Young. Meung Nawng (Pang Long State) "sandy soil in woods along bank of Salween", October, 0-0-1 specimens. H. Young. Tan Yang (Mong Yai State), September, 0-0-7 specimens. H. Young. Nawnglon Mang Lun State), September. "Bamboo thicket", 0-0-7 specimens. "Grassy ground near bank of stream", 0-0-16 specimens. H. Young. Man Peng (Mang Lun State), September, "Sandy soil covered with leaves on wooded hillside", 0-0-5 specimens. H. Young. Tan Yang (Mong Yai State), September. "Bamboo grove", 0-0-3 specimens. "Open ground at Pa Mung village", 0-0-5 specimens. H. Young. Taungyi (Shan States), "tall grass", August, 0-0-24 specimens. H. Young. Mogok (Katha), September, 0-0-22 specimens. Mrs. A. C. Hanna. Myitkyina and vicinity, September, 0-1-38 specimens. K. John. N Sop Zup (Myitkyina), November, 0-0-1 specimens. F. D. Forbes. Hopin (Myitkyina), October, 0-0-16 specimens. R. C. Sharma. Bhamo and vicinity, September, 0-3-14 specimens. K. John. "Banks of lake", October, 0-0-9 specimens. S. C. Paul. "Town", October, 0-0-101 specimens. S. C. Paul. "Waste land beyond town", October, 0-0-1 specimens. S. C. Paul. Lawng Neu (Mong Lem State, Yunnan), "red soil in bamboo grove", October, 0-0-2 specimens. Ca La per H. Young. Selan (Northern Shan States), "ca. 2500-2700 feet", December 1926, 0-0-3 specimens. H. S. Rao. (Indian Museum) Namkham (Northern Shan States), "streams and pools on the north bank of the Shweli River ca. 2500 feet", December 1926, 0-0-6 specimens. H. S. Rao (Indian Museum).

Also examined.

"*Amyntas alexandri*. Type. 1904. 10-5-757. India. coll. Beddard.", 0-0-1 specimens. (British Museum).

Pheretima analecta Gates, 1932

Kyauk-kyi (Toungoo), October, 0-0-2 specimens. Marshall Shwin. Sah Der (Toungoo Karen Hills), September, 0-0-1 specimens. H. I. Marshall. Daylo Stream, (Toungoo Karen Hills), September, 0-0-9 specimens. H. I. Marshall. Paut-taw-gwin (Salween), October, 0-0-1 specimens. Marshall Shwin.

External characteristics.—Setae : vi/20, vii/25, viii/26, xvii/22, 77/viii 77/xii, 80/xx (Sah Der) ; vi/33, vii 35, viii/36, 83/viii and vi/32, vii/37, viii/38, 89/viii (Daylo) ; xviii/16-35 xviii/16-35, viii/48-52 (Kyauk-kyi) ; vi/44, vii/50, viii/47, xvii/36, xviii/12, xix/20, 132/viii, 123/xii, 118/xx (Paut-taw-gwin).

In genital markings (Kyauk-kyi and Paut-taw-gwin) the ratio of width to length is 2 : 1. Markings of two Daylo specimens are located as follows ; right 19/20 and left 20/21, left 19/20 and right 18/19.

Internal anatomy.—Vertical ridges on the inner wall of the oesophagus in xi-xiii are interrupted at mid-dorsal and mid-ventral levels. The

valve is anteriorly in xv. The typhlosole begins abruptly in the caecal segment (represented anteriorly only by a very slight, whitish line) and gradually decreases in height posteriorly, the hinder half translucent, unrecognizable behind xcii.

The nerve cord is included within the testis sac of xi but is excluded from the sac of x (Pau-taw-gwin).

Remarks.—Daylo and Kyaukkyi, specimens appear to be in an unhealthy condition, with gaps in the setal circles where setae had been dehisced.

***Pheretima andersoni* Michaelsen, 1907.**

Nyinmaw (Tavoy), September, 0-0-1 specimens. W. D. Sutton. Migyaunglaung (Tavoy), "plains", September, 0-0-1 specimens. W. D. Sutton. Pyinthadaw (Tavoy), "hills", September, 0-0-1 specimens. W. D. Sutton. Siyigyan (Tavoy), "plains", September, 0-0-1 specimens. W. D. Sutton. Zinba (Tavoy), September, 0-0-1 specimens. W. D. Sutton. Thaton, September, 0-0-7 specimens. October, 0-13-0 specimens. K. John. Naung-gala (Thaton), October, 0-7-0 specimens. K. John. Bilin, (Thaton), October, 0-0-14 specimens. K. John. Kyaiktiyo (Thaton), October, 0-0-4 specimens. K. John.

***Pheretima anomala* Michaelsen, 1907**

Sitpye (Tavoy), September, 0-0-1 specimens. W. D. Sutton. Nyaungdon (Tavoy), September, 0-0-5 specimens. W. D. Sutton. Posoe Chaung (Tavoy) "near Tavoy. River", September, 0-0-1 specimens. W. D. Sutton. Kawlet Chaung (Tavoy), "hills" September, 0-0-1 specimens. W. D. Sutton. Siyigyan (Tavoy), "plains", September, 0-0-1 specimens. W. D. Sutton. Kamaungthwe River east (Tavoy), October, 0-0-2'7 specimens. W. D. Sutton. Moulmein (Amherst), October, 0-0-3 specimens. K. John. Mupun (Amherst), October, 0-0-2 specimens. K. John. Bilin (Thaton), September, 0-0-1 specimens. October, 0-0-1 specimens. K. John. Kyaikto (Thaton), August, 0-0-1 specimens. September, 0-0-1 specimens. October, 0-0-4 specimens. K. John. Kumingyaung (Thaton), October, 0-0-33 specimens. K. John. Thaton, September, 0-1-21 specimens. K. John. Duiyzeik (Thaton), September, 0-4-8 specimens. K. John. Twante (Hanthawaddy), August, 0-0-4 specimens. K. John. Kyaiklat (Pyapon) September, 0-0-5 specimens. Maung Ohn Maung. Myaungmya, October, 0-0-3 specimens. Maung Ohn Maung. Myohaung (Myaungmya), October, 0-0-1 specimens. William Law. Bassein (October), 0-0-2 specimens. K. John. Danubyu (Maubin, October, 0-0-1 specimens. Maung Ohn Maung. Maubin, October, 0-0-1 specimen. Maung Ohn Maung. Yandoon (Maubin), October, 0-0-1 specimens. Maung Ohn Maung Damsite (Insein), September, 0-0-2 specimens. K. John. Hmawbi (Insein), September, 0-0-1 specimens. K. John. Wanetchaung (Insein), September, 0-0-5 specimens. K. John. Pegu, August, 0-1-8 specimens. "Jungles to the west" 0-0-2 specimens. K. John. Ingabu (Henzada), October, 0-0-13 specimens. Maung Ohn Maung. Zalun (Henzada), October, 0-0-2 specimens. Maung Ohn Maung. Henzada, October, 0-0-5 specimens. Maung Ohn Maung. Prome, August, 1-1-0 specimens. K. John. Kyaukkyi (Toungoo), October, 0-0-1 specimens. Marshall Shwin. Maw Pah Der, (Toungoo Karen Hills), October, 0-0-5 specimens. H. I. Marshall. Daylo Stream (Toungoo Karen Hills), September, 0-0-1 specimens. H. I. Marshall. Pauk-taw-gwin (Salween), October, 0-0-2 specimens. Marshall Shwin. Pyinmana (Yamethin), October, 0-0-16 specimens. K. John. Akyab, September, 0-0-2 specimens. I. M. Ismailjee. Buthidaung-Maungdaw (Akyab), September, 0-0-1 specimens. I. M. Ismailjee. Thanbula (Thayetmyo), August, 0-0-1 specimens. K. John. Maymyo, (Northern Shan States), September, 0-1-9 specimens. Miss Laura Johnson. Lashio (Northern Shan States), September. "Open grassy ground, red and rather dry soil", 0-22-9 specimens. "Lantana thicket soil covered with leaves", 0-1-0 specimens. "Leaf covered soil on well wooded, rocky crag, 5 miles southwest of town", 0-0-2 specimens. "Richly manured soil in Shan garden at E Nai village", 0-34-7 specimens. "Richly manured Shan garden", 0-16-13 specimens. "Manure pile in Nam Hkai Shan village," 0-0-1 specimens. "In black leaf mould at entrance to Nun's cave west of town", 0-10-14 specimens. "Banana garden, nunnery", 0-0-1 specimens. "Bare and rather dry soil in bamboo grove", 0-9-6 specimens. "Shaded, muddy ground at edge of paddy field in Ta Pung village", 0-6-0 specimens. "Tall thatch grass at 6'th mile on the road to Hsenwi", 0-1-0 specimens. "Damp soil in wooded ravine at 6'th mile on Namtu road", 0-1-8 specimens. "Dense thicket in woods at 15th mile on the Namtu road", 0-1-11 specimens. "Bamboo jungle on high

hill north of town" 0-0-1 specimens. "Mud along banks of Nam Yao river 6 miles northeast of town" 0-30-29 specimens. H. Young. Man Meh Hang village (Hsipaw State), "bullock caravan camp", September, 0-0-1 specimens. H. Young. Man Hung (Pang Long State), "rocky soil covered with leaves in woods", October, 0-0-1 specimens. H. Young. Nam Hpen village (Pang Long State), October, 0-1-13 specimens. H. Young. Na Kho Sheh village (Pang Long State), "thick woods near water 1 mile to the north", October, 0-0-1 specimens. H. Young. Ha Hta village (?), "damp soil in wooded ravine near village", October, 0-0-2 specimens. H. Young. Meung Nawng (Pang Long State) October. "Manured ground in low and damp Shan garden", 0-0-1 specimens. "Sandy soil in woods along bank of Salween", 0-0-6 specimens. Naba (Katha), September "hills", 0-0-4 specimens. Saw San Thwe. Mogaung (Myitkyina), October, 0-0-3 specimens. R. C. Sharma. Mohnyin (Myitkyina), October, 0-0-3 specimens, R. C. Sharma Sumprabum (Myitkyina), November, 0-0-2 specimens. F. D. Forbes. Bhamo, October, 0-0-1 specimens. S. C. Paul.

***Pheretima austrina* Gates, 1932.**

Migyaunglaung (Tavoy), "plains nearby", September, 0-0-3 specimens. W. D. Sutton. Siyigyan (Tavoy), "plains", September, 0-0-3 specimens. W. D. Sutton. Kamaungthwe River east (Tavoy), September, 0-0-4 specimens. W. D. Sutton. Kyaiktiyo (Thaton), September, 0-0-1 specimens. K. John. Kumingyaung (Thaton), September, 0-0-2 specimens. K. John. Ler-mu-htee (Salween), October, 0-0-1 specimens. Marshall Shwin. Paut-taw-gwin (Salween), October, 0-0-1 specimens. Marshall Shwin.

Remarks.—A pair of presetal genital markings is present on ix of one of the Siyigyan specimens. The typhlosole begins in the caecal segment and is a fairly high, simple lamella.

***Pheretima birmanica* (Rosa), 1888.**

Maw Pah Der (Toungoo Karen Hills), October, 0-0-2 specimens. H. I. Marshall. Naba (Katha), "hills", September, 0-0-2 specimens. Saw San Thwe. Katha, "hills" September, 0-0-7 specimens. Saw San Thwe. Mogok (Katha), September, 0-0-4 specimens. Mrs. A. C. Hanna. Bhamo and vicinity, September, 0-0-22 specimens. K. John. Myitkyina and vicinity, September, 0-0-79 specimens. K. John. Kutka. (Northern Shan States), September, 0-0-55 specimens. G. J. Geis. Lashio, September "Dry, red earth", 0-0-3 specimens. "Open grassy ground, red and rather dry soil", 0-0-2 specimens. "Lantana thicket, soil covered with leaves", 0-0-1 specimens. "Banana garden, Nun monastery", 0-0-3 specimens. "Grassy ridges of paddy field", 0-0-9 specimens. "Manure pile, Nam Khai Shan village", 0-0-17 specimens. "Corn field in Gurkha village", $2\frac{1}{2}$ miles to the south", 0-0-1 specimens. "Shaded, muddy ground at edge of paddy field, Ta Pung village", 0-0-1 specimens. "Richly manured soil in Shan garden, E Nai village", 0-0-2 specimens. "Bamboo jungle toward top of high hill, north of town", 0-0-3 specimens. "Muddy ground covered with water cress, Wan Hu Mone village", 0-0-1 specimens. "Gravelly soil in densely wooded ravine on Hsenwi road 10 miles from town", 0-0-1 specimens. "Rich soil covered with leaf mould at base of cliff 10 miles from town", 0-0-2 specimens. "Gravel pit on the Namtu road 5 miles from town", 0-0-1 specimens. "Open ground, bullock caravan camp on the Namtu road 11 miles from town", 0-0-7 specimens. "Mud along banks of Nam Yao River, 6 miles northeast of town", 0-0-1 specimens. H. Young. Tan Yang (Mong Yai State), September, 0-0-1 specimens. "Open ground, Pa Maung village", 0-0-1 specimens. H. Young. A Kin De village (Pang Long State), "loose, dark soil in richly manured garden", October, 0-0-2 specimens. H. Young. Na Kho Sheh village (Pang Long State), "thatch grass, soil dry and red", October, 0-0-1 specimens. H. Young. Pang Noi village (Pang Long State), "rich dark soil under clump of trees", October 0-0-1 specimens. H. Young. Hpa Cha village (Pang Long State), "rocky soil in woods", October, 0-0-1 specimens. H. Young. Meung Nawng village, Salween Ferry (Pang Long State), "manured ground in low and damp Shan garden", October, 0-0-1 specimens. H. Young. Nawng Kham (Mang Lun State), "bare ground under banyan tree", September, 0-0-1 specimens. H. Young.

***Pheretima oslifarnica* Kinsbery, 1867**

Meung Nawng village, Salween Ferry (Pang Long State), October, 0-0-1 specimens. Khamko (Myitkyina), October, 0-0-3 specimens. F. D. Forbes. Lawanga (Myitkyina), October, 0-0-3 specimens. F. D. Forbes. Nawangkai (Myitkyina), October, 1-0-2 specimens. F. D. Forbes. Putao (Myitkyina), November, 0-0-13 specimens. F. D. Forbes. Kankiu (Myitkyina), November, 0-0-12 specimens. F. D. Forbes.

Remarks.—The extra-oesophageal trunks are on the ventral face of the gut from just behind the gizzard, turning laterally in xiv. Hearts of x-xiii open into the supra-oesophageal trunk and in xii-xiii at least also into the dorsal trunk.

***Pheretima campanulata* (Rosa), 1890.**

Kamaungthwe River east (Tavoy), October, 0-0-80 specimens. W. D. Sutton. Nyinmaw (Tavoy), September, 0-0-21 specimens. W. D. Sutton. Nyaungdonle Chaung (Tavoy), "plains", September 0-0-12 specimens. W. D. Sutton. Migyaunglaung (Tavoy), "nearby plains", September, 0-0-3 specimens. W. D. Sutton. Pyinthadaw (Tavoy), "nearby hills", September, 0-0-32 specimens. "Plains", 0-0-16 specimens. W. D. Sutton. Posoe Chaung (Tavoy), "near Tavoy River", 0-0-13 specimens. W. D. Sutton. Mayan Chaung (Tavoy), "near Tavoy River", 0-0-21 specimens. W. D. Sutton. Kawlet Chaung (Tavoy), "nearby hills", September, 0-0-2 specimens. W. D. Sutton. Zinba (Tavoy), September, 0-0-7 specimens. W. D. Sutton. Siyigyan (Tavoy), "plains", September, 0-0-2 specimens. W. D. Sutton. Mupun (Amherst), October, 0-0-2 specimens. K. John. Moulmein (Amherst), October, 0-0-2 specimens. K. John. Sittang (Thaton), October, 0-0-2 specimens. K. John. Boyagyi (Thaton), October, 0-0-1 specimens. K. John. Kyaikto (Thaton), "hills nearby", October, 0-0-25 specimens. K. John. Kyaikto (Thaton), August, 0-0-3 specimens. October, 0-0-7 specimens. K. John. Kyaktiyo (Thaton), October, 0-0-3 specimens. K. John. Taungzun (Thaton), October, 0-0-3 specimens. K. John. Kumingyaung (Thaton), October, 0-0-22 specimens. K. John. Thaton, September, 0-3-11 specimens. K. John. Duyinzeik (Thaton), October, 0-0-2 specimens. K. John. Naung-gala (Thaton), October, 0-0-3 specimens. K. John. Kungyangon (Hanthawaddy), September, 0-0-4 specimens. K. John. Kyauktan (Hanthawaddy), September, 0-0-1 specimens. K. John. Twante (Hanthawaddy), September, 0-1-1 specimens. K. John. Hlegu (Insein), September, 0-0-1 specimens. K. John. Hlawga (Insein), September, 0-0-1 specimens. K. John. Damsite (Insein), September, 0-6-5 specimens. K. John. Padaukchaung (Bassein), October, 0-0-2 specimens. K. John. Bassein October, 0-0-19 specimens. K. John. Myohaung (Myaungmya), October, 0-0-3 specimens. William Law. Pantanaw (Maubin), October, 0-0-5 specimens. Maung Ohn Maung. Danubyu (Maubin), October, 0-0-4 specimens. Maung Ohn Maung. Maubin, October, 0-0-2 specimens. Maung Ohn Maung. Thameintaw (Pyapon), September, 0-8-13 specimens. Maung Ohn Maung. Kyaiklat (Pyapon), September, 0-0-2 specimens. Maung Ohn Maung. Prome, September, 0-0-1 specimens. K. John. Sandoway, "hills", September, 0-0-3 specimens. I. M. Ismailjee. Ramree Island (Kyaukpyu), September, 0-0-1 specimens. I. M. Ismailjee. Kyauktaw (Akyab), September, 0-1-1 specimens. I. M. Ismailjee. Akyab, September, 0-0-1 specimens. I. M. Ismailjee. Myohaung (Akyab), September, 0-0-1 specimens. I. M. Ismailjee. Buthidaung-Maungdaw (Akyab), September, 0-0-3 specimens. I. M. Ismailjee. Paletwa (Arakan Hill Tracts), September, 0-0-11 specimens. I. M. Ismailjee. Pegu, "jungles to the east", August, 0-0-2 specimens. K. John. Toungoo, October, 0-0-2 specimens. K. John. Pathichaung (Toungoo Karen Hills), "nine miles out on Mawchi Road", September, 0-0-1 specimen. H. I. Marshall. Daw Pakko (Toungoo Karen Hills), September, 0-9-0 specimens. H. I. Marshall. Daylo Stream (Toungoo Karen Hills), October, 0-0-1 specimens. H. I. Marshall. Sah Der, (Toungoo Karen Hills), September, 0-0-5 specimens. H. I. Marshall. Myasawni bridge (Toungoo Karen Hills), "on tree 10 feet from ground", October, 0-0-1 specimens. H. I. Marshall. Pa Taw Lo (Toungoo Karen Hills), October, 0-0-2 specimens. H. I. Marshall. Kyaukkyi (Toungoo), October, 0-0-17 specimens. Marshall Shwin. Shwegyin (Toungoo), October, 0-0-16 specimens. Marshall Shwin. Ler-mu-htee (Salween), October, 0-0-1 specimens. Marshall Shwin. Pauk-taw-gwin (Salween), October, 0-0-16 specimens. Marshall Shwin. Mewaing (Salween), October, 0-0-76 specimens. Marshall Shwin. Lashio (Northern Shan States), September. "Richly manured Shan garden", 0-4-1 specimens. "Open, grassy ground, red and rather dry soil" 0-7-0 specimens. "Lantana thicket, soil covered with leaves", 0-0-1 specimens. "Banana garden", 0-24-0 specimens. "Corn field", Nam Khai Shan village, 0-17-1 specimens. "Shaded, muddy ground at edge of paddy field, Ta Pung village", 0-7-0 specimens. "Richly manured soil in Shan garden, E Nai village", 0-12-1 specimens. "Gravelly soil in densely wooded ravine on Hsenwi road 10 miles from town", 0-16-8 specimens. "Rich soil covered with leaf mould at base of cliff ten miles from town", 0-2-1 specimens. "In tall thatch grass at 6th mile on road to Hsenwi", 0-4-0 specimens. "Gravel pit at 5th mile on the Namtu road", 0-17-8 specimens. H. Young. Na Shai village (Pang Long State), October, "short grass, soil dry and hard", 0-0-1 specimens. H. Young. Indaw Lake (Katha), September, 1-0-0 specimens. Saw San Thwe. Hpunchan Hka (Myitkyina), November, 3-0-1 specimens. F. D. Forbes. Sumprabum (Myitkyina), November, 0-0-6 specimens.

F. D. Forbes. Hkamho (Myitkyina), November, 0-0-9 specimens. F. D. Forbes. Lawange (Myitkyina), November, 0-0-2 specimens. F. D. Forbes. Masum Zup (Myitkyina), November, 0-0-5 specimens. F. D. Forbes. Putao (Myitkyina), November, 0-0-3 specimens. F. D. Forbes. Kankiu (Myitkyina), November, 0-0-19 specimens. F. D. Forbes. Kadranyang (Myitkyina), November, 1-10-0 specimens. F. D. Forbes. Kawapang (Myitkyina), November, 0-0-10 specimens. F. D. Forbes. Tiang Zup (Myitkyina), November, 0-0-3 specimens. F. D. Forbes. Weshi (Myitkyina), November, 0-0-3 specimens. F. D. Forbes. N Sop Zup (Myitkyina), November, 0-0-10 specimens. F. D. Forbes. Chinkram Hka (Myitkyina), November, 0-0-3 specimens. F. D. Forbes. Supkaga (Myitkyina), November, 0-0-6 specimens. F. D. Forbes.

Remarks.—Male porophores are markedly protuberant and abnormal on the Kadranyang and Kawapang worms. Large numbers of coelomic gregarines are present in the coelomic cavities of the postprostatic segments.

In addition to the worms listed above a number of specimens are athecal, or if thecal not normally so—the organs rudimentary, abnormally developed, in part lacking (f. *rugosa*, Gates, 1936, p. 409). These worms are listed below. The first or only set of figures is of completely athecal specimens, the second set which is in parentheses is of the other specimens.

Sittang (Thaton), October, 0-0-2 specimens. K. John. Kyaikto (Thaton), “nearby hills”, October, 0-0-4 and (0-0-1) specimens. K. John. Kumingyaung (Thaton), October, 0-0-4 specimens. K. John. Taungzun (Thaton), October, 0-0-3 specimens. K. John. Kyaikto (Thaton). August, 0-0-11 specimens. October 0-0-18 and (0-0-1) specimens. K. John. Bilin (Thaton), October, 0-0-1 specimens. K. John. Thaton, September, 0-0-1 specimens. K. John. Duiyzeik (Thaton), October, 0-0-3 and (0-0-3) specimens. K. John. Aungsaing (Thaton), October, 0-0-1 and (0-1-0) specimens. K. John. Pegu, August, 0-0-5 specimens. K. John. Kungyangon (Hanthawaddy), September, 0-0-1 specimens. K. John. Twante (Hanthawaddy), September, 0-0-1 specimens. K. John. Myaungmya, October, 0-0-2 specimens. Maung Ohn Maung. Bassein, October, 0-0-5 and (0-0-1) specimens. K. John. Taukkyan (Insein), September, 0-0-1 specimens. K. John. Dam-site (Insein), September, 0-0-1 specimens. K. John. Pantanaw (Mauhin), October, 0-0-8 specimens. Maung Ohn Maung. Danubyu (Mauhin), October, 0-0-1 specimens. Maung Ohn Maung. Ingabu (Henzada), October, 0-0-7 specimens. Maung Ohn Maung. Prome, August, 0-6-7 and (0-2-1) specimens. K. John. Laboo (Prome), August, 0-0-2 and (0-1-9) specimens. K. John. Pauk-taw-gwin (Salween), October, 0-0-3 and (0-0-1) specimens. Marshall Shwin. Mewaing (Salween), October, (0-0-1) specimens. Marshall Shwin. Shwegyin (Toungoo), October, 0-0-4 and (0-0-2) specimens. Marshall Shwin. Kyaukkyi (Toungoo), October, 0-0-13 and (0-0-1) specimens. Marshall Shwin. Toungoo, October, 0-0-2 specimens. K. John. Maw Pah Der (Toungoo Karen Hills), October, 0-0-1 specimens. H. I. Marshall. Daylo Stream (Toungoo Karen Hills), September, 0-0-6 and (0-0-1) specimens. H. I. Marshall. Pa Taw Lo (Toungoo Karen Hills), October, 0-0-16 and (0-0-3) specimens. H. I. Marshall. Pyinmana (Yamethin), October, 0-0-1 and (0-0-1) specimens. K. John. Lashio (Northern Shan States), September, “bullock caravan camp at Man Meh Hang village, 0-0-1 specimens. H. Young. Katha, September, 0-5-0 specimens. Saw San Thwe. Wuntho (Katha), September, (0-0-3) specimens. San San Thwe. Bhamo, October, 0-0-19 specimens. S. C. Paul.

Athecal specimens usually have large masses of gregarine cysts in the coelomic cavities of iii or iv to vii. Often there are further cysts scattered through the coelomic cavities of the postclitellar segments. Cysts were not found in a few of the “thecal” specimens.

Male pores, prostates and prostatic ducts are lacking, as well as the spermathecae in a few specimens : Duiyzeik (2), Myohaung (1), Laboo (2), and Thaton (2, not listed above). *Testes, male funnels, testes sacs and seminal vesicles are also lacking in the Duiyzeik worms !* Testes, funnels, sacs and seminal vesicles are present in the Thaton worms as well as the other athecal and “thecal” specimens specially listed above.

Pheretima diffringens (Baird) 1869.

Lawanga (Myitkyina), November, 0-0-2 specimens. F. D. Forbes. Tutuga (Myitkyina), November, 0-0-4 specimens. F. D. Forbes. Hpunchan Hka (Myitkyina), November, 0-0-4 specimens. F. D. Forbes. Hpungin Hka (Myitkyina), November, 0-0-13 specimens. F. D. Forbes. Sumprabum (Myitkyina), November, 0-0-17 specimens. F. D. Forbes. Kankiu (Myitkyina), November, 0-0-1 specimens. F. D. Forbes. Putao (Myitkyina), November, 0-0-1 specimens. F. D. Forbes.

External characteristics.—Genital markings in the preclitellar regions are in two longitudinal series on each side, those of one series just behind spermathecal pores, those of the other series more median. These markings are present on one, two or all of segments vii-ix of 20 specimens. Additional markings are present on one or two of those segments (14 specimens) and are so placed that with the other markings a slightly diagonal row of 3 to 5 is formed extending from the spermathecal pore posteromesially to the setal equator. Postclitellar markings, present on only one specimen, are on xviii, one just in front of and one just behind each male porophore.

Internal anatomy.—Prostates are lacking, though ducts are present and in a u-shaped loop, except as follows: large prostate on left side in xvi-xx (1, Sumprabum), small prostate on right side in xviii-xix (1, Sumprabum).

Seminal chambers of spermathecae are distended by a white material in which no spermatozoal iridescence is visible except in three specimens (Hpungin Hka) in which seminal chambers are lacking (only the stalk portion of the diverticulum developed).

Hearts of x are usually lacking (or unrecognizable ?) but one is present, on the left side of one worm.

Pheretima elongata E. Perrier, 1872.

Kungyangon (Hanthawaddy), September, 2-9-120 specimens. K. John. Thongwa (Hanthawaddy), September, 0-0-29 specimens. K. John. Kayan (Hanthawaddy), September, 1-0-28 specimens. K. John. Thameintaw (Pyapon), September, 0-0-4 specimens. Maung Ohn Maung. Pyapon, September, 0-2-0 specimens. Maung Ohn Maung. Bogale (Pyapon), September, 5-12-29 specimens. Maung Ohn Maung. Dedaye (Pyapon), September, 0-1-4 specimens. Maung Ohn Maung. Danubyu (Maubin) October, 0-0-2 specimens. Maung Ohn Maung. Maubin, October, 0-0-20 specimens. Maung Ohn Maung. Wakema, (Myaungmya), October, 0-0-17 specimens. Maung Ohn Maung. Henzada, October, 0-0-1 specimens. Maung Ohn Maung. Thinbawgyin (Bassein), October, 0-0-2 specimens. K. John. Pyinmana (Yamethin), October, 0-0-1 specimens. K. John. Ramree Island (Kyaukpyu), September, 0-0-2 specimens. I. M. Ismailjee. Sandoway, "riverside", September, 4-3-3 specimens. I. M. Ismailjee. Mt. Popa (Myingyan), September, 0-33-32 specimens. K. John. Taungtha (Myingyan), September, 0-1-7 specimens. K. John. Lashio, (Northern Shan States), "woods, ground covered with leaves, 8th mile on road to Hsenwi", September, 1-2-1 specimens. H. Young. Indaw Lake (Katha), September, 1-1-0 specimens. Saw San Thwe.

Pheretima exigua Gates, 1930.

Lashio (Northern Shan States), "Shan garden", August, 0-0-4 specimens. September. "Open grassy ground, red and rather dry soil", 0-0-3 specimens. "Town", 0-0-1 specimen. "In black leaf mould at entrance to Nun's cave west of the town", 0-0-1 specimen. "Shan pepper garden at Myo Wan village, 0-0-45 specimens. "Banana garden at monastery", 0-1-5 specimens. "Woods, ground covered with leaves at 8th mile on the road to Hsenwi", 0-3-34 specimens. "Gravelly soil in densely wooded ravine at 10th mile on road to Hsenwi", 0-0-3 specimens. "Dense woods at 7th mile on road to Namtu", 0-0-21 specimens. "Banyan grove, ground with thin covering of leaves and grass, at 14th mile on road to Namtu", 0-0-6 specimens. "Bullock caravan camp, Man Meh Hang village, 3-0-2 specimens. H. Young. E Nai village (North Hsenwi State), "at base of bamboo clump", September 0-0-1 specimen. "Richly manured soil in Shan garden, 0-3-7 specimens. H. Young.

***Pheretima gemella* Gates, 1931.**

Nyinmaw (Tavoy), September, 0-0-4 specimens. W. D. Sutton. Nyaungdonle Chaung (Tavoy), "plains", September, 0-0-1 specimens. W. D. Sutton. Nyaungdon (Tavoy), September, 0-0-4 specimens. W. D. Sutton. Pyinthadaw (Tavoy), "plains", September, 0-0-1 specimens. W. D. Sutton. Mayan Chaung (Tavoy), "Lear Tavoy River", October, 0-0-2 specimens. W. D. Sutton. Kamaungthwe River east (Tavoy), October, 0-3-36 specimens. W. D. Sutton.

***Pheretima houlleti* (E. Perrier), 1872.**

Kamaungthwe River east (Tavoy), October, 0-0-4 specimens. W. D. Sutton. Nyinmaw (Tavoy), September, 0-0-1 specimens. W. D. Sutton. Nyaungdonle Chaung (Tavoy), "plains", September, 0-0-4 specimens. W. D. Sutton. Tanbin Hills (Tavoy), September, 0-0-8 specimens. W. D. Sutton. Kawletchaung (Tavoy), "nearby hills", September, 0-0-3 specimens. W. D. Sutton. Zinba (Tavoy), September, 0-0-7 specimens. W. D. Sutton. Moulmein (Amherst), October, 0-0-4 specimens. K. John. Mupun (Amherst), October, 0-0-14 specimens. K. John. Sittang (Thaton), October, 0-1-618 specimens. K. John. Boyagyi (Thaton), October, 0-0-20 specimens. K. John. Bilin (Thaton), September, 0-0-4 specimens. October, 0-0-7 specimens. K. John. Mokpalin (Thaton), October, 0-0-16 specimens. K. John. Kyaikto (Thaton), August, 0-0-3 specimens. October, 0-0-75 specimens. K. John. Duiyzeik (Thaton), September, 0-1-0 specimens. October, 0-0-11 specimens. K. John. Kumingyaung (Thaton), October, 0-0-24 specimens. K. John. Taungzun (Thaton), October, 0-0-3 specimens. K. John. Thaton, September, 0-2-22 specimens. K. John. Naung-gala (Thaton), September, 0-0-3 specimens. K. John. Aungsaing (Thaton), September, 0-1-14 specimens. K. John. Thongwa (Hanthawaddy), September, 0-0-17 specimens. K. John. Kungyangon (Hanthawaddy), September, 0-0-1 specimens. K. John. Twante (Hanthawaddy), September, 0-4-21 specimens. K. John. Kyauktan (Hanthawaddy), August, 0-0-2 specimens. Saw San Thwe, September, 0-2-2 specimens. K. John. Thameintaw (Pyapon), September, 0-2-3 specimens. Maung Ohn Maung. Pyapon, September, 0-0-4 specimens. Maung Ohn Maung. Bogale (Pyapon), September, 0-0-6 specimens. Maung Ohn Maung. Kyaiklat (Pyapon), September, 0-1-30 specimens. Maung Ohn Maung. Wakema (Myaungmya), October, 0-0-5 specimens. Maung Ohn Maung. Myohaung (Myaungmya), October, 0-0-3 specimens. William Law. Pantanaw (Maubin), October, 0-0-10 specimens. Maung Ohn Maung. Maubin, October, 0-0-1 specimens. Maung Ohn Maung. Danubyu (Maubin), October, 0-1-4 specimens. Maung Ohn Maung. Yandoon (Maubin), October, 0-0-11 specimens. Maung Ohn Maung. Bassein, October, 0-0-3 specimens. K. John. Thinbawgyin (Bassein), October, 0-0-7 specimens. K. John. Hmawbi (Insein), September, 0-1-5 specimens. K. John. Taikkyi (Insein), September, 1-0-5 specimens. K. John. Wanetchaung (Insein), September, 0-0-9 specimens. K. John. Hlawga (Insein), September, 0-0-3 specimens. K. John. Tauk-kyan (Insein), September, 0-0-1 specimens. K. John. Ingabu (Henzada), October, 0-0-1 specimens. Maung Ohn Maung. Henzada, October, 0-0-7 specimens. Maung Ohn Maung. Pegu, August, 0-0-1 specimens. K. John. Thanatpin (Pegu), August, 0-0-1 specimens. K. John. Pegu, August, "jungles to the west", 0-0-3 specimens. "Jungles to the east", 0-0-7 specimens. K. John. Prome, August, 1-1-10 specimens. K. John. Paukkaung (Prome), September, 0-0-10 specimens. K. John. Laboo (Prome), September, 0-0-5 specimens. K. John. Toungoo, October, 0-0-1 specimens. K. John. Maw Pah Der (Toungoo Karen Hills), October, 0-0-2 specimens. H. I. Marshall. Toungoo Karen Hills, "on epiphytic ferns, 15 feet from ground, on the road to Thandaung", October, 0-0-1 specimens. H. I. Marshall. Shwenyaungbin (Toungoo Karen Hills), September, 0-0-2 specimens. H. I. Marshall. Pathichaung (Toungoo Karen Hills), "at ninth mile on the road to Mawchi", September, 0-0-1 specimens. H. I. Marshall. Shwegyin (Toungoo), October, 0-0-13 specimens. Marshall Shwin. Kyaukkyi (Toungoo), October, 0-0-9 specimens. Marshall Shwin. Paut-taw-gwin (Salween), October, 0-0-164 specimens. Marshall Shwin. Thayetmyo, September, 0-5-2 specimens. K. John. Thanbula (Thayetmyo), August, 0-1-8 specimens. K. John. Sandoway, "Doedaung hill", September, 0-0-4 specimens. "Hills", September, 0-0-4 specimens. I. M. Ismailjee. Kyaukpyu, September, 0-0-54 specimens. I. M. Ismailjee. Magwe, August, 0-0-1 specimens. K. John. Minbu, August, 0-0-1 specimens. K. John. Pyinama (Yamethin), 0-0-10 specimens. K. John. Akyab, September, 0-1-7 specimens. I. M. Ismailjee. Myohaung (Akyab), September, 0-2-2 specimens. Ismailjee. Buthidaung-Maungdaw (Akyab), September, 0-3-17 specimens. I. M. Ismailjee. Paletwa (Arakan Hill Tracts), September, 0-0-3 specimens. I. M. Ismailjee. Mt. Popa (Myingyan), September, 0-15-20 specimens. K. John. Kin-U (Shwabo), September, 0-3-5 specimens. Saw San Thwe. Indaw Lake (Katha), September, 0-0-4

specimens. Saw San Thwe. Naba (Katha), "nearby hills", September, 0-0-6 specimens. Saw San Thwe. Wuntho (Katha), "nearby hills", September, 0-2-9 specimens. Saw San Thwe. Katha, September, 0-12-5 specimens. Saw San Thwe. Lashio (Northern Shan States), September. "Open grassy ground, red and rather dry soil", 0-0-3 specimens. "Woods, ground covered with leaves, at 8th mile on road to Hsenwi", 0-1-2 specimens. "Gravelly soil in densely wooded ravine, at 10th mile on road to Hsenwi", 0-0-2 specimens. "Open ground, bullock caravan camp, at 11th mile on the Namtu road", 0-0-1 specimens. H. Young. Man Meh Hang village (Hsipaw State), "bullock caravan camp, September, 0-0-17 specimens. H. Young. Nam Hung (Pang Long State), "rocky soil covered with leaves in woods", October, 0-0-2 specimens. H. Young. Ta Pung village (Hsenwi State), "shaded muddy ground at edge of paddy field", September, 0-6-22 specimens. H. Young. Meung Nawng, Salween Ferry (Pang Long State), October, "manured ground in low and damp Shan garden", 0-1-2 specimens. "In sand along bank of Salween River", 0-0-4 specimens. H. Young. Bhamo, "banks of lake", October, 0-0-2 specimens. "Around wells", 0-0-1 specimens. S. C. Paul. Mogaung (Myitkyina), October, 0-0-7 specimens. R. C. Sharma. Hopin (Myitkyina), October, 0-0-2 specimens. R. C. Sharma. Putao (Myitkyina), November, 0-0-3 specimens. F. D. Forbes. N Sop Zup (Myitkyina), November, 0-0-2 specimens. F. D. Forbes. Chinkram Hka (Myitkyina), November, 0-0-8 specimens. F. D. Forbes.

Remarks.—Some of the spermathecae are lacking in several specimens: on the right side of vii only (1, Mogaung), on both sides of vii (2, Prome and Mogaung), all except that on the right side of viii (1, Prome).

***Pheretima mamillana* Gates, 1931.**

Nyinmaw (Tavoy), September, 0-0-5 specimens. W. D. Sutton. Nyaungdonle Chaung (Tavoy), "plains", September, 0-0-3 specimens. W. D. Sutton. Tanbin Hills (Tavoy), September, 0-1-13 specimens. W. D. Sutton. Myigyaunglaung (Tavoy), "nearby plains", September, 0-0-4 specimens. W. D. Sutton. Nyaungdon (Tavoy), September, 0-0-2 specimens. W. D. Sutton. Pyinthadaw (Tavoy), "hills", September, 0-15-21 specimens. "Plains", 0-0-21 specimens. W. D. Sutton. Posoe Chaung (Tavoy), "near Tavoy River", September, 0-0-46 specimens. W. D. Sutton. Mayan Chaung (Tavoy), "near Tavoy River", September, 0-0-23 specimens. W. D. Sutton. Zinba (Tavoy), September, 0-0-17 specimens. W. D. Sutton. Kamaungthwe River east (Tavoy), October, 0-0-31 specimens. W. D. Sutton. Siyigyan (Tavoy), "plains", September, 0-0-2 specimens. W. D. Sutton. Kinmunsakhan (Thaton), October, 0-0-2 specimens. K. John.

Remarks.—Spermathecae are lacking in two specimens (Nyaungdonle chaung) in which masses of protozoan parasites surround the gut in segments vii-viii.

***Pheretima meridiana* Gates, 1932.**

Kamaungthwe River east (Tavoy), October, 0-0-15 specimens. W. D. Sutton. Zinba (Tavoy), September, 0-0-2 specimens. W. D. Sutton. Siyigyan (Tavoy), "plains", September, 0-0-1 specimens. W. D. Sutton. Tanbin Hills (Tavoy), September, 0-0-1 specimens. W. D. Sutton. Pyinthadaw (Tavoy), "hills", September, 0-0-2 specimens. "Plains", 0-0-1 specimens. W. D. Sutton. Posoe Chaung (Tavoy), "near Tavoy River", September, 0-0-2 specimens. W. D. Sutton. Mayan Chaung (Tavoy), "near Tavoy River", September, 0-0-1 specimens. W. D. Sutton. Kawlet Chaung (Tavoy), "nearby hills", September, 0-0-2 specimens. W. D. Sutton. Duiyzeik (Thaton), October, 0-0-1 specimens. K. John. Naung-gala (Thaton), October, 0-0-1 specimens. K. John. Shwegyin (Toungoo), October, 0-0-1 specimens. Marshall Shwin. Sah Der (Toungoo Karen Hills), September, 0-0-3 specimens. H. I. Marshall. Maw Pah Der (Toungoo Karen Hills), October, 0-0-1 specimens. H. I. Marshall. Kyaukkyi (Toungoo), October, 0-0-7 specimens. Marshall Shwin. Ler-mu-htee (Salween) October, 0-0-4 specimens. Marshall Shwin. Pauk-taw-gwin (Salween), October, 0-0-3 specimens. Marshall Shwin. Mewaing (Salween), October, 0-0-4 specimens. Marshall Shwin. Myohaung (Akyab), September, 0-0-1 specimens. I. M. Ismailjee. Paeetwa, (Arakan Hill Tracts), September, 0-0-1 specimens. I. M. Ismailjee. Lashio, (Northern Shan States), September. "Bamboo jungle toward top of high hill north of town", 0-0-6 specimens. "Rocky soil covered with leaves in woods, Man Hung", October, 0-0-1 specimens. "Thatch grass, soil dry and red, Na Kho Sheh village", October, 0-0-1 specimens. H. Young. Maymyo (Shan Plateau), September, 0-0-4 specimens. Miss. Laura Johnson. Kadranyang (Myitkyina) November, 0-0-1 specimens. F. D. Forbes. Supkaga (Myitkyina), November, 0-0-2 specimens. F. D. Forbes.

Remarks.—The Man Hung specimen is unusually small, only 85×3 mm. and looks superficially much like *houletti*.

Genital markings, usually lacking in this species, are present on three Maymyo worms: one on the left side of $7/8$; one on the right side of $8/9$ and one on the left side, each just median to a spermathecal aperture; one on the posterior margin of viii, each side, just median to the spermathecal apertures; one on the anterior margin of viii just median to the left spermathecal aperture.

The right spermathecal invagination of ix is everted in one specimen a condition that has never been noted before.

Spermathecae are totally lacking in one specimen from Na Kho She.

***Pheretima morrisi* (Beddard), 1892.**

Lashio, September. "Leaf-covered soil in dense woods, Nawng Pa Shi Tin", 0-0-11 specimens. "Very damp soil in deep woods 3 miles west of town", 0-0-1 specimens. H. Young. Meung Nawng village, Salween Ferry (Pang Long State) October, "manured ground in low and damp Shan garden", 0-0-1 specimens. H. Young.

Remarks.—Two genital markings are just median to each male porophore on each of these worms.

***Pheretima peguana* (Rosa), 1890.**

Kamaungthwe River east (Tavoy), September, 0-0-5 specimens. W. D. Sutton. Tanbin Hills (Tavoy), September, 0-0-1 specimens. W. D. Sutton. Migyaunglaung (Tavoy), "nearby plains", September 0-0-1 specimens. W. D. Sutton. Nyaungdon (Tavoy), September, 0-0-4 specimens. W. D. Sutton. Pyinthadaw (Tavoy), "nearby hills", September, 0-0-8 specimens. Kawlet Chaung (Tavoy), "nearby hills", September, 0-0-10 specimens. W. D. Sutton. Siyigyan (Tavoy), "plains", September, 0-0-19 specimens. W. D. Sutton. Zinba (Tavoy), September, 0-0-9 specimens. W. D. Sutton. Moulmein (Amherst), October, 0-0-7 specimens. K. John. Mupun (Amherst), October, 0-0-36 specimens. K. John. Boyagyi (Thaton), October, 0-0-1 specimen. K. John. Bilin (Thaton), September, 0-0-23 specimens. October, 0-0-2 specimens. K. John. Sittang (Thaton), October, 0-0-28 specimens. K. John. Kyaikto (Thaton), August, 0-0-1 specimens. October, 0-0-33 specimens. "Nearby hills", October, 0-0-10 specimens. K. John. Taungzun (Thaton), August, 0-0-1 specimens. October, 0-0-6 specimens. K. John. Naung-gala (Thaton), September, 0-0-4 specimens. K. John. Duyinzeik (Thaton), September, 0-0-6 specimens. K. John. Aungsaing (Thaton), September, 0-0-11 specimens. K. John. Thaton, September, 0-3-24 specimens. K. John. Kyauktan (Hanthawaddy), August, 0-0-1 specimens. Saw San Thwe. September, 0-1-7 specimens. K. John. Syriam (Hanthawaddy), August, 0-0-10 specimens. Saw San Thwe. Twante (Hanthawaddy), September, 0-0-10 specimens. K. John. Kungyangon (Hanthawaddy), September, 0-0-4 specimens. K. John. Thongwa (Hanthawaddy), September, 0-0-3 specimens. K. John. Kayan (Hanthawaddy), September, 0-0-3 specimens. K. John. Thameintaw (Pyapon), September, 1-0-10 specimens. Maung Ohn Maung. Pyapon, September, 0-1-0 specimens. Maung Ohn Maung. Bogale (Pyapon), September, 0-0-1 specimens. Maung Ohn Maung. Dedaye (Pyapon), September, 0-0-10 specimens. Maung Ohn Maung. Myaungmya, October, 0-0-2 specimens. Maung Ohn Maung. Bassein, October, 0-0-15 specimens. K. John. Thinbawgyin (Bassein), October, 0-0-18 specimens. K. John. Padaukchaung (Bassein), October, 0-0-1 specimens. K. John. Pantanaw (Mauhin), October, 0-0-15 specimens. Maung Ohn Maung. Danubyu (Mauhin), October, 0-0-1 specimens. Maung Ohn Maung. Mauhin. October, 0-0-10 specimens. Maung Ohn Maung. Yandoon (Mauhin), October, 0-0-21 specimens. Maung Ohn Maung. Hmawbi (Insein), September, 0-0-4 specimens. K. John. Taikkyi, (Insein), September, 0-0-13 specimens. K. John. Wanetchaung (Insein), September, 0-0-7 specimens. K. John. Taukkyan (Insein), September, 0-0-2 specimens. K. John. Hlegu (Insein), September, 0-0-2 specimens. K. John. Hlawga (Insein), September, 0-0-1 specimens. K. John. Pegu, August, 0-0-9 specimens. "Jungles to the east", 0-0-1 specimens. "Jungles to the west", 0-0-5 specimens. K. John. Ler-mu-lteo (Salween), October, 0-0-1 specimen. Marshall Shwin. Ingabu (Herzada), October, 0-0-7 specimens. Maung Ohn Maung. Zalun (Henzada), October, 0-0-2 specimens.

Maung Ohn Maung. Henzada, October, 0-0-13 specimens. Maung Ohn Maung. Sandoway, September, "Doedaung hill", 0-37-12 specimens. "Hills", 0-2-5 specimens. I. M. Ismailjee. Toungoo, October, 0-0-7 specimens. K. John. Kyaukkyi (Toungoo), October, 0-0-5 specimens. Marshall Shwin. Shwegyin (Toungoo), October, 0-0-64 specimens. Marshall Shwin. Maw Pah Der (Toungoo Karen Hills), October, 0-0-7 specimens. H. I. Marshall. Paukkaung (Prome), September, 0-0-10 specimens. K. John. Prome, September, 0-0-11 specimens. K. John. Laboo (Prome), September, 0-0-4 specimens. K. John. Thayetmyo, September, 1-0-5 specimens. K. John. Thanbula (Thayetmyo), August, 0-0-7 specimens. K. John. Allanmyo (Thayetmyo), August, 0-0-3 specimens. K. John. Kyaukpyu, September, 0-4-6 specimens. I. M. Ismailjee. Ramree Island (Kyaukpyu), September, 0-0-17 specimens. "Hill", 0-0-46 specimens. I. M. Ismailjee. Myebon (Kyaukpyu), September, 0-0-4 specimens. I. M. Ismailjee. Akyab, September, 0-0-33 specimens. I. M. Ismailjee. Myohaung (Akyab), September, 0-0-26 specimens. I. M. Ismailjee. Pyinmana (Yamethin), October, 0-0-17 specimens. K. John. Taungdwingyi (Magwe), "jungle to the east", 0-0-5 specimens. K. John. Mt. Popa (Myingyan), September, 0-0-9 specimens. K. John. Tada-U (Sagaing), September, 1-0-6 specimens. K. John. Myohaung (Mandalay), October, 0-0-107 specimens. K. John. Kin-U (Shwebo), September, 0-25-10 specimens. Saw San Thwe. Kyaukmyaung (Shwebo), September, 0-3-7 specimens. Saw San Thwe. Naba (Katha), "nearby hills", September, 0-4-61 specimens. Saw San Thwe. Bhamo, October, 0-0-1 specimens. "Banks of lake", 0-0-6 specimens. "Around wells", 0-0-1 specimens. S. C. Paul. Alam (Myitkyina), November, 0-0-4 specimens. F. D. Forbes.

Variation and abnormality.—No. 1. Only one genital marking present, on the right side, reaching posteriorly only to 17/18 which is visible clear across the ventrum (Naba). No. 2. Genital markings lacking on 17/18. Left spermatheca of vii lacking (Prome). No. 3. Median (unpaired) female pores on xiii and xiv, clitellum on xiv-xv on right side, on xiv-xvi on left side. Genital markings of right side on 16/17 and 17/18. Right seminal vesicle of xii rudimentary, right ovary and oviducal funnel in xii, left in xiii, right spermatheca of ix lacking (Kayan). No. 4. Median (unpaired) female pores on xiii and xiv. Genital markings of left side on 16/17 and 17/18, left male pore on xvii, left heart of xiii lacking and left seminal vesicle of xii absent. Left anterior seminal vesicle reaches into contact with septum 7/8. Paired oviducal funnels present in xiii but only the right ovary. An oviducal funnel in xiii on the left side but no ovary. The left spermatheca of ix lacking (Akyab).

***Pheretima planata* Gates, 1926.**

Moulmein (Amherst), October, 12-0-42 specimens. K. John. Mupun (Amherst), October, 3-0-2 specimens. K. John. Sittang (Thaton), October, 8-0-33 specimens. K. John. Kyaikto (Thaton), September, 0-0-1 specimens. October, 3-1-7 specimens. K. John. Sittang (Thaton), October, 0-0-3 specimens. K. John. Bilin (Thaton), October, 0-0-2 specimens. K. John. Thaton (September), 0-2-3 specimens. K. John. Kayan (Hanthawaddy), September, 0-1-0 specimens. K. John. Thongwa (Hanthawaddy), September, 0-1-2 specimens. K. John. Kungyangon (Hanthawaddy), September, 0-5-1 specimens. K. John. Twante (Hanthawaddy), September, 0-4-1 specimens. K. John. Kyauktan (Hanthawaddy), August, 0-3-0 specimens. Saw San Thwe. Syriam (Hanthawaddy), August, 10-1-0 specimens. Saw San Thwe. Bogale (Pyapon), September, 0-7-0 specimens. Maung Ohn Maung. Dedaye (Pyapon), September, 1-3-0 specimens. Maung Ohn Maung. Kyaiklat (Pyapon), September, 0-3-0 specimens. Maung Ohn Maung. Thameintaw (Pyapon), September, 0-56-2 specimens. Maung Ohn Maung. Pyapon, September, 0-5-1 specimens. Maung Ohn Maung. Wakema (Myaungmya), October, 2-0-0 specimens. Maung Ohn Maung. Myohaung (Myaungmya), October, 0-3-0 specimens. William Law. Bassein, October, 0-2-0 specimens. K. John. Thinbawgyin (Bassein), October, 0-8-5 specimens. K. John. Padaukchaung (Bassein), October, 0-1-3 specimens. K. John. Danubyu (Maubin), October, 0-1-0 specimens. Maung Ohn Maung. Maubin, October, 0-3-2 specimens. Maung Ohn Maung. Yandoon (Maubin), October, 0-1-0 specimens. Maung Ohn Maung. Hmawbi (Insein), September, 1-0-0 specimens. K. John. Taikkyi (Insein), September, 1-0-0 specimens.

K. John. Wanetchaung (Insein), September, 4-4-0 specimens. K. John. Hlegu (Insein), September, 0-1-0 specimens. K. John. Hlawga (Insein), September, 0-0-1 specimens. K. John. Pegu, August, 0-0-1 specimens. K. John. Thanatpin (Pegu), August, 2-1-0 specimens. K. John. Zalun (Henzada), October, 0-5-4 specimens. Maung Ohn Maung. Henzada, October, 10-0-0 specimens. Maung Ohn Maung. Ingabu (Henzada), October, 1-0-0 specimens. Maung Ohn Maung. Paukkaung (Prome), September, 0-1-2 specimens. K. John. Sandoway, September, "hills", 0-3-1 specimens. I. M. Ismailjee. Toungoo (October), 4-0-5 specimens. K. John. Shwegyin (Toungoo), October, 0-0-15 specimens. Marshall Shwin. Kyaukkyi (Toungoo), October, 0-0-1 specimens. Marshall Shwin. Pathichaung (Toungoo Karen Hills), September, 0-1-0 specimens. H. I. Marshall. Pa Taw Lo, (Toungoo Karen Hills), October, 0-0-1 specimens. H. I. Marshall. Thanbula, (Thayetmyo), September, 0-3-0 specimens. K. John. Akyab, September, 4-1-0 specimens. I. M. Ismailjee. Buthidaung-Maungdaw (Akyab), September, 26-3-1 specimens. I. M. Ismailjee. Paletwa (Arakan Hill Tracts), September, 0-1-1 specimens. I. M. Ismailjee. Indaw Lake (Katha), September, 41-0-6 specimens. Saw San Thwe. Wuntho (Katha), "hills to the west", September, 17-0-3 specimens. Saw San Thwe. Bhamo, October, 0-0-1 specimens. "Banks of lake", 0-25-0 specimens. "River bank", 0-4-0 specimens. "Waste land beyond town", 0-23-0 specimens. "Around wells", 0-1-0 specimens. S. C. Paul. Alam Myitkyina, November, 1-0-0 specimens. F. D. Forbes. Weshi (Myitkyina), November, 0-0-2 specimens. F. D. Forbes. N Sop Zup (Myitkyina), November, 0-1-8 specimens. F. D. Forbes. Mogaung (Myitkyina), October, 0-0-3 specimens. R. C. Sharma. Mohnyin (Myitkyina), October, 0-0-4 specimens. R. C. Sharma.

Remarks.—Copulatory chambers (one or both) are everted in a number of these specimens and on the protuberance thus formed there are visible ten to thirteen genital markings.

***Pheretima posthuma* (L. Vaillant), 1868.**

Moulmein (Amherst), October, 0-0-8 specimens. K. John. Mupun (Amherst), October, 0-3-26 specimens. K. John. Sittang (Thaton), October, 0-0-4 specimens. K. John. Thongwa (Hanthawaddy), September, 0-0-2 specimens. K. John. Kyauktan (Hanthawaddy), September, 0-1-0 specimens. K. John. Twante (Hanthawaddy), September, 0-0-2 specimens. K. John. Thameintaw (Pyapon), September, 5-12-21 specimens. Maung Ohn Maung. Pyapon, September, 0-2-3 specimens. Maung Ohn Maung. Bogale (Pyapon), September, 0-1-1 specimens. Maung Ohn Maung. Dedaye (Pyapon), September, 0-2-2 specimens. Maung Ohn Maung. Myaungmya, October, 0-0-1 specimens. Maung Ohn Maung. Danubyu (Maubin), October, 0-0-1 specimens. Maung Ohn Maung. Maubin, October, 0-0-2 specimens. Maung Ohn Maung. Yandoon (Maubin), October, 0-6-6 specimens. Maung Ohn Maung. Bassein, October, 0-1-14 specimens. K. John. Hlegu (Insein), September, 0-0-2 specimens. K. John. Taikkyi (Insein), September, 0-2-1 specimens. K. John. Wanetchaung (Insein), September, 0-2-1 specimens. K. John. Pegu, August, 0-5-0 specimens. K. John. Henzada, October, 0-0-2 specimens. Maung Ohn Maung. Paukkaung (Prome), August, 0-0-4 specimens. K. John. Prome, August, 0-0-9 specimens. K. John. Laboo (Prome), August, 1-0-2 specimens. K. John. Sandosay, "hills", September, 0-3-0 specimens. I. M. Ismailjee. Kyaungnagwa (Toungoo), October, 12-9-27 specimens. H. I. Marshall. Toungoo (October), 0-0-5 specimens. K. John. Allanmyo (Thayetmyo), August, 0-3-3 specimens. K. John. Thanbula (Thayetmyo), August, 0-1-1 specimens. K. John. Thayetmyo, August, 0-0-5 specimens. K. John. Kyaukpyu, September, 0-0-3 specimens. I. M. Ismailjee. Magwe, August, 0-2-13 specimens. K. John. Taungdwingyi (Magwe), August, 0-0-8 specimens. K. John. Pyinmana (Yamethin), October, 1-6-14 specimens. K. John. Minbu, August, 0-1-4 specimens. K. John. Myingyan, September, 0-0-4 specimens. K. John. Akyab, September, 0-0-5 specimens. I. M. Ismailjee. Kyaukse, "two miles to the west", September 0-0-10 specimens. K. John. Monywa (Lower Chindwin), September, 0-2-15. Saw San Thwe. Ye-U (Shwebo), September, 0-0-4 specimens. Saw San Thwe. Kin-U (Shwebo), September, 0-5-11 specimens. Saw San Thwe. Kyaukmyaung (Shwebo), September, 0-0-1 specimens. Saw San Thwe. "Nearby bank of the Irrawaddy River", 0-16-38 specimens. Saw San Thwe. Katha, September, 0-0-6 specimens. Saw San Thwe. Nava (Katha), October, 0-0-4 specimens. Saw San Thwe. Indaw Lake (Katha), September, 3-6-28 specimens. Saw San Thwe. Bhamo, October. "Banks of lake", 0-0-2 specimens. "Banks of Irrawaddy River", 0-0-58 specimens. S. C. Paul.

Remarks.—Worms of this species are "innumerable" on the banks of the Irrawaddy River, the surface covered for miles with their castings,

according to Saw San Thwe. Similar reports, for other sections of the Irrawaddy, as well as for the Sittang and Salween Rivers have been made by other collectors.

***Pheretima robusta* (E. Perrier), 1872.**

Lashio (Northern Shan States), September, "Damp ground in woods at 11th mile on the road to Hsipaw", 0-0-24 specimens. "Bullock caravan camp, Man Meh Hang village, on the road to Hsipaw", 0-0-1 specimens. H. Young. Pang Noi village (Pang Long State), October, "rich dark soil under clump of trees", 0-0-3 specimens. H. Young. Hpa Cha village (Pang Long State), October, "rocky soil in woods", October, 0-0-1 specimens. H. Young. Meung Nawng village, Salween Ferry (Pang Long State), "manured ground in low and damp Shan garden", October, 0-0-3 specimens. H. Young.

Remarks.—Two genital markings are median to the male porophores on 23 specimens, one postsetal, the other presetal, the latter slightly more lateral than the postsetal. The right postsetal is lacking (1 specimen), or the left postsetal (2), both postsetals (1), all except the right presetal (1), all lacking (2). The right presetal is doubled on two specimens.

One genital marking is present on each spermathecal porophore, immediately behind the spermathecal pore. Further preclitellar markings, occasionally present, are 2-4 inter-setal intervals median to the spermathecal pore lines, on viii.

The nerve cord is attached to the ventral faces of the testis sacs of both x and xi (6 specimens).

The ampulla is bound down around an ental portion of the spermathecal duct so as to camouflage a slightly bulbous thickening within which the duct lumen is widened into a small chamber into which the diverticulum opens. The wall of this chamber has annular ridges and the floor is convex. On the center of the convexity is a minute opening into the narrow lumen of the ectal portion of the duct.

No spermatozoal iridescence was noted in any of the seminal chambers of any of these specimens.

Family GLOSSOSCOLECIDAE.

Genus ***Pontoscolex*** Schmarda, 1861.

***Pontoscolex corethrurus* (Fr. Müller), 1857.**

Sitpye (Tavoy), September, 2-0-9 specimens. W. D. Sutton. Nyinmaw (Tavoy), September, 2-0-6 specimens. W. D. Sutton. Nyaungdonle Chaung (Tavoy), "plains" September, 14-0-48 specimens. W. D. Sutton. Mayan Chaung (Tavoy), "near Tavoy River", September, 0-0-6 specimens. W. D. Sutton. Posoe Chaung (Tavoy), "near Tavoy River", September, 0-0-4 specimens. W. D. Sutton. Kamaungthwe River eas (Tavoy), October, 1-0-26 specimens. W. D. Sutton. Kyaikmaraw (Amherst), August, 0-3-3 specimens. K. John. Moulmein (Amherst), August, 0-0-2 specimens. October, 0-0-3 specimens. K. John. Mupun (Amherst), October, 0-0-4 specimens. K. John. Sittang (Thaton), October, 0-0-19 specimens. K. John. Thaton, September, 9-0-3 specimens. K. John. Boyagyi (Thaton), October, 0-0-46 specimens. K. John. Duiyzeik (Thaton), September, 0-0-26 specimens. K. John. Bilin (Thaton), September, 2-0-2 specimens. October, 2-0-30 specimens. K. John. Kyaikto (Thaton), September, 0-0-2 specimens. October, 11-0-7 specimens. K. John. Kyaiktiyo (Thaton), October, 0-0-1 specimens. K. John. Kumingyaung (Thaton), October, 0-0-22 specimens. K. John. Taungzun (Thaton), October, 0-0-4 specimens. K. John. Thaton, "Hills to the west", September, 0-0-3 specimens. K. John.

Aungsaing (Thaton), September, 5-0-2 specimens. K. John. Kyauktan (Hanthawaddy), September, 0-1-2 specimens. K. John. Thongwa (Hanthawaddy), September, 0-0-2 specimens. K. John. Kungyangon (Hanthawaddy), August, 0-0-3 specimens. K. John. Pyapon, September, 0-0-6 specimens. Maung Ohn Maung. Thameintaw (Pyapon), September, 8-0-7 specimens. Maung Ohn Maung. Dedaye (Pyapon), September, 0-0-9 specimens. Maung Ohn Maung. Kyaiklat (Pyapon), September, 0-0-5 specimens. Maung Ohn Maung. Taikkyi (Insein), September, 0-0-1 specimens. K. John. Myaungmya, October, 9-0-109 specimens. Maung Ohn Maung. Myohaung (Myaungmya), October, 0-0-3 specimens. William Law. Henzada, October, 3-0-0 specimens. Maung Ohn Maung. Bassein, October, 0-0-7 specimens. K. John. Thinbawgyin (Bassein), October, 0-3-0 specimens. K. John. Sandoway, September, "Hills", 0-1-0 specimens. "Riverside", 0-1-1 specimens. I. M. Ismailjee. Kyaukpyu, September, 0-1-4 specimens. I. M. Ismailjee. Akyab, September, 0-0-2 specimens. I. M. Ismailjee. Buthidaung-Maungdaw (Akyab), 0-5-2 specimens. I. M. Ismailjee. Kyauktaw (Akyab), September, 7-0-1 specimens. I. M. Ismailjee. Pyinmana (Yame-thin), October, 0-0-3 specimens. K. John. Toungoo, October, 0-0-3 specimens. K. John. Indaw Lake (Katha), September, 0-0-1 specimens. Saw San Thwe. Mogok (Katha), September, 0-33-113 specimens. Mrs. A. C. Hanna. Thandaung, "under rocks to the north", September, 0-13-0 specimens. G. E. Blackwell. Bhamo, "banks of lake", October, 0-0-1 specimens. S. C. Paul. Mt. Harriet (S. Andaman), "in clay of termites waste heap", ca. 500 feet, 30. XI. 23, 0-2-0 specimens. Port Blair (Andaman Islands), "Sta. B. 15", 0-19-0 specimens. Andaman Island, 2-0-0 specimens. Mt. Harriet (S. Andaman), 0-2-0 specimens. (All Andaman Islands specimens from the Indian Museum.)

Genus *Glyphidrilus* Horst, 1889.

Glyphidrilus sp.

Sittang (Thaton), October, 5-0-0 specimens. K. John. Kayan (Hanthawaddy), September, 18-0-0 specimens. K. John. Kyauktan (Hanthawaddy), September, 1-0-0 specimens. K. John. August, 0-34-0 specimens. Saw San Thwe. Thanatpin (Pegu), August, 12-0-0 specimens. K. John. Pyapon, September, 0-1-0 specimens. Maung Ohn Maung. Kyaiklat (Pyapon), September, 1-0-0 specimens. Maung Ohn Maung. Thinbawgyin (Bassein), October, 2-0-0 specimens. K. John. Ingabu (Henzada), October, 1-0-0 specimens. Maung Ohn Maung. Zalun (Henzada), October, 25-0-0 specimens. Maung Ohn Maung. Henzada, October, 5-0-0 specimens. Maung Ohn Maung. Prome, August, 0-3-0 specimens. K. John. Taungdwingyi (Magwe), "jungle to the east", several specimens. K. John. Minbu, "edge of water in small pit", August, 0-4-0 specimens. K. John. Lashio (Northern Shan States), "in mud of paddy flats to the northeast", September, 28-0-0 specimens. H. Young. A Kin De village (Northern Shan States), "wet boggy ground covered by thick growth of water plants", October, 2-0-0 specimens. H. Young. Tiangzup (Myitkyina), November, 1-0-0 specimens. F. D. Forbes.

Remarks.—Records of clitellate specimens, of three species, were lost in the war.

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NOTES ON THE SYSTEMATICS OF THREE LEAF MONKEYS IN THE COLLECTION OF THE INDIAN MUSEUM (ZOOLOG. SURV.)

By H. KHAJURIA, M.Sc. Hons., Zoological Survey of India, Indian Museum, Calcutta.

(PLATE I.)

While going through the collection of mammals in the Indian Museum in connection with the preparation of a Catalogue, I had an opportunity of studying the types of three leaf monkeys (Colobidae), namely, *Presbytis barbei* Blyth, *Semnopithecus rutledgei* Anderson and *Semnopithecus holotephreus* Anderson. The systematic position of these three forms is far from clear because, while the types (syntypes) of *P. barbei* have been incorrectly reported upon by a number of authors giving rise to a great confusion with regard to the identity of the species, the types of the other two have been considered to be lost so that their systematic positions have also been rendered liable to confusion.

Since the type specimens, as found out now, are all well-labelled and fairly well-preserved, except that most of the hairs on the lips of the syntypes of *P. barbei* have fallen off, it has been considered worth while to examine them anew in an attempt to clarify the positions regarding their respective identities.

I am indebted to Drs. S. L. Hora and B. Biswas for their valuable suggestions and criticism.

***Presbytis barbei* Blyth.**

- 1847. *Presbytis barbei*, Blyth, *J. Asiat. Soc. Bangal*, XVI, p. 734 (Ye, Tenasserim).
- 1863. *Presbytis barbei*, Blyth, *Cat. Mam. Mus. Asiat. Soc. Bangal*, p. 14 (Tippera Hills, East Pakistan).
- 1875. *Presbytis barbei*, Blyth, *J. Asiat. Soc. Bangal*, XLIV, Ex. No., p. 11.
- 1878. *Semnopithecus barbei*, Anderson, *Anat. zool. Resch.*, I, p. 12.
- 1881. *Semnopithecus barbei*, Anderson, *Cat. Mam. Indian Mus.*, I, p. 48.
- 1888. *Semnopithecus barbei*, Blanford, *Faun. Brit. India, Mammalia*, p. 39.
- 1894. *Semnopithecus barbei*, Forbes, *Handbk. Primat.*, II, p. 102.
- 1913. *Pygathrix barbei*, Elliot, *Rev. Primat.*, III, p. 48.
- 1928. *Pithecus pyrrhus barbei*, *Pithecus pyrrhus atrior*, Pocock, *J. Bombay nat. Hist. Soc.*, XXXII, pp. 668 and 673.
- 1934. *Trachypithecus obscurus barbei*, *Trachypithecus phayrei atrior*, Pocock, *Proc. zool. Soc. London*, pp. 949 and 952.
- 1936. *Trachypithecus barbei*, Hill, *Ibid.*, p. 105.
- 1939. *Trachypithecus phayrei phayrei*, *Trachypithecus pyrrhus atrior*, Pocock, *Faun. Brit. India, Mammalia*, I, pp. 130 and 143.
- 1951. *Presbytis cristatus atrior*, Ellerman and Morrison-Scott, *Checklist Pal. Indian Mam.*, p. 208.

Labels on the syntypes read as follows :—Types of *Presbytis barbei* Blyth, presented by Rev. J. Barbe (1845) Tippera, East Bangal. Indian

Museum Catalogue Nos. 19a and 19b (=36A and 36B respectively of A. S. B. Catalogue).

This leaf monkey has been the subject of great controversy. Blyth (1847, p. 734) in his original description based on an adult male and an adult female specimens collected from Ye, Tenasserim, stated that the pale markings of the face (pale eyelids and lips) resembled those of *Presbytis obscurus* Reid. However, some years later, he (Blyth, 1863, p. 14) not only changed the type locality from Ye, Tenasserim, to the interior of Tippera Hills, East Pakistan, but also surprisingly made the statement that *P. barbei* differed from *P. obscurus* and *Presbytis phayrei* Blyth in having the face black. Apparently in conformity with these views, he (Blyth, 1863, 1875) also suggested that *P. barbei* may be identical with *Presbytis femoralis* (Horsfield). The change of the type locality is perhaps acceptable, because it was based on the information supplied by the collector of the specimens, Rev. J. Barbe who, as stated by Pocock (1928, p. 668) did collect specimens in Tippera. But the question of the colour of the face remained unexplained even by Anderson (1878, 1881), Blanford (1888) and Elliot (1913) who examined or had the facility of examining the syntypes of *P. barbei*.

Although the specimens which Anderson (1881) included under *P. barbei* greatly differ from those which he considered as *P. phayrei*, yet he much confused the issue by stating that *P. barbei* 'appears to be very closely allied to the next¹ and a larger series of specimens than is at my disposal will probably prove their identity'. Perhaps in this he followed, but apparently without argument, Blyth (1847, p. 734) who favoured the consideration of *P. barbei* as a subspecies *P. phayrei*. Anderson (1878) further complicated the matter when he stated that there was no sexual difference as regards colouration in the syntypes of *P. barbei*, although, as given in the original description, the female specimen markedly differs from the male in having paler areas on the inner side of the bases of the thighs.² Hill (1936) borrowed these specimens from the Indian Museum and published a detailed description and a photograph of the male skin. He pointed out that, though the skin of the lips was black yet there were white hairs on the lip margins.³

The confusion caused by the foregoing statements can better be judged from the writings of an authority of Pocock's standing who was obliged to change his opinions thrice regarding the identity of this form (*vide* Pocock, 1928, p. 668; 1934, p. 949; 1939, pp. 130 and 143). While discussing the question at some length, he (Pocock, 1939, pp. 130-131) concluded that Blyth's (1847) original description was not based on the specimens which Blyth later (1863) described as having black faces.

On examination of these much discussed specimens, I find that the last opinion given about them by Pocock (1939) was rather unjustified,

¹ *P. phayrei*.

² This character is reported to be present in almost all adult females of the genus *Trachypithecus* as recognised by Pocock (1934). But it is not clear why Pocock (1939) did not consider this character as occurring in the Indian species of this genus, except *T. pyrrhus* (Horsfield); and even used this as a key character to distinguish Indian form of *pyrrhus* from the species *obscurus* and *phayrei*.

³ A similar statement was also made by Anderson (1878) and Forbes (1894).

as they appear to me to be the same specimens on which Blyth originally based his description. In the first place the specimens under report were presented to the Asiatic Society of Bangal in 1845 by Rev. J. Barbe and so, even assuming that they are not the syntypes of *P. barbei*, Blyth, then Curator of the Museum of Asiatic Society of Bangal, who identified them as true *barbei* must have taken cognisance of their characters when he described this leaf monkey in 1847. Secondly, excepting the doubtful point about the pale face markings, these two specimens resemble so closely Blyth's original description based on two specimens of the same sex and age that one who has an opportunity of examining them cannot but believe that they represent the syntypes of the species.¹ Regarding the pale face markings the position appears to me as follows:—The pallor of the eyelids is quite pronounced in the female specimen but not so in the male, apparently due to the long exposure and deposition of dirt during exhibition in the galleries of the Museum of Asiatic Society of Bangal. Moreover, this character is of little interest as it is not a distinguishing character, and it may be present even in *Presbytis pyrrhus atrior* Pocock of which Pocock considered *barbei* as a synonym. The only confusing point is the paleness of the skin of the lips which in these skins is black and not pale as may appear from the original description. This colour cannot be attributed to exposure or the deposition of dirt.

There appears to be only one explanation of this puzzle. As stated by Anderson (1878), Forbes (1894) and Hill (1936), the lips are covered with white hairs. Most of these white hairs have now fallen off from the upper lip in the male specimen and from both lips in the female specimen. I suspect that Blyth wrongly compared the presence of white hairs on the lips to the pale lips of *P. obscurus*. In 1863 his statement that the skin of the face was black appears to be based on the fact that most of the hairs on the upper lip had fallen off by that time. This supposition is further strengthened by the presence of a skin, identified as *P. barbei* by Anderson (1881, 19d), in this collection in which the whiteness of the hairs on the lips is so pronounced as to appear by a superficial observation as resembling the condition found in *P. obscurus*. Perhaps still more convincing may be found the writings of Blyth (1875, p. 11) himself when he apparently concurred with Cantor (quoted by Blyth, *loc. cit.*) according to whom the face of this species 'during life is intense black, except the white-haired lips and chin which are of milk white colour.'

The skull without lower jaw (Plate I, figs. 1 and 2) of the male specimen and the lower jaw (Plate I, fig. 3) of the female specimen are present in this collection.² They were described but not figured by Anderson (1878).

¹ It may also be pointed out that Blyth (1863) listed only these two specimens as sole representatives of *P. barbei* in the collection of the Asiatic Society of Bangal.

² The presence of the well-labelled skulls of these specimens in this collection is a further proof that Blyth was rather inaccurate in his statements about this monkey as according to him (Blyth, 1875) these skins were not provided with skulls.

It thus appears certain that the specimens at present in the collection of the Zoological Survey of India are the syntypes of *P. barbei* (Blyth, 1847). The description of *P. pyrrhus atrior* (Pocock, 1928) is precisely applicable to them and thus *atrior* must be considered as a synonym of *P. barbei*. The form is evidently a well-defined race of *P. cristatus* (Raffles).

Diagnostic characters.—*P. cristatus barbei* may be distinguished from all other races of *P. cristatus* by the general absence of silvering of the pelage which at the most is very faintly visible towards the foreparts of the dorsal surface in some skins, by the tail (especially towards the tip) being appreciably paler than the dorsal surface, and also by the general colour being somewhat paler.

Distribution.—As far as at present ascertainable, the form is found from Tippera, East Pakistan, to Tennasserim and adjoining parts of Siam.

***Semnopithecus rutledgei* Anderson.**

- 1878. *Semnopithecus rutledgei*, Anderson, *Anat. zool. Resch.*, I, p. 12 (No locality).
- 1881. *Semnopithecus cristatus*, Anderson, *Cat. Mam. Indian Mus.*, I, p. 51.
- 1894. *Semnopithecus rutledgei*, Forbes, *Handbk. Primat.*, II, p. 133.
- 1910. (?) *Presbytis ultimus* Elliot, *Proc. U. S. natl. Mus.*, XXXIII, p. 351.
- 1913. *Pygathrix cristatus*, (?) *Pygathrix ultimus*, Elliot, *Rev. Primat.*, III, pp. 79 and 81.
- 1940. (?) *Pithecus pyrrhus ultimus*, Chasen, *Bull. Rafl. Mus. Singapore*, XV, p. 82.

The label on the type specimen reads as follows :—Type of *Semnopithecus rutledgei* Anderson, presented by W. Rutledge, Esq., 18-9-1871. Indian Museum Catalogue No. 22b.

Elliot (1913, pp. 79-80) considered this leaf monkey as a synonym of *Pygathrix* (= *Presbytis*) *cristatus* (Raffles) and stated that the type could not be traced. The skin of the type has now been found; and on comparing this skin with those of *Presbytis cristatus* in this collection from one of which Elliot (*loc. cit.*) also drew up the description of *P. cristatus* in his monograph, I find that there is a marked difference in colouration. The general colour in the original description (Anderson, 1878, p. 12) was described as black, but it is much paler than the skins of *P. cristatus*. Also the hairs are much more extensively silvered at the tips all over the body, and the black hands and feet are well contrasted with the frosted forearms and legs. Chason (1940, p. 82) assigned exactly the same characters to *P. ultimus* (Elliot, 1910), and, thus, *rutledgei* should replace *ultimus*. However, it still appears somewhat doubtful whether *ultimus* is distinguishable from *cristatus* particularly on account of the curious distribution assigned to it, *i.e.*, Malaya States, Borneo, and Sumatra (part.); and unfortunately, or fortunately, *rutledgei* is without a locality.

The skull of *P. rutledgei* was described by Anderson (*loc. cit.*) as like that of *P. maura* (= *cristatus*) but with gradually expanding extremities. *P. rutledgei*, if revived, should evidently be considered as a race of *P. cristatus*.

Diagnostic characters.—*P. cristatus rutledgei* is distinguished from all other races of *P. cristatus* by much more extensive silvering of hairs all over the body, and by its quite paler ground colour.

***Semnopithecus holotephreus* Anderson.**

1878. *Semnopithecus holotephreus* Anderson, *Anat. zool. Resch.*, I, p. 27 (No locality).
1881. *Semnopithecus holotephreus*, Anderson, *Cat. Mam. Indian Mus.*, I, p. 50.
1894. *Semnopithecus holotephreus*, Forbes, *Handbk. Primat.*, II, p. 124.
1913. *Pygathrix holotephreus*, Elliot, *Rev. Primat.* III p. 42.

The label on the type specimen reads as below :—Type of *Semnopithecus holotephreus* Anderson, presented by W. Rutledge, Esq., 29-10-1872. Indian Museum Catalogue No. 21a.

Elliot (1913) who thought this species as a synonym of *P. barbei* could not trace out the type specimen. The skull of the type specimen is now available in this collection. Although nothing final can be said about the identity of this species on the basis of the skull alone, yet a reference may be made to some remarks made about it by Anderson. He (Anderson, 1878, p. 27) in his original description described this leaf monkey as having the areas around eyes and lips white, and some years later he (Anderson, 1881) again repeated the same description for this species. Although, while describing *P. barbei* in 1878 and 1881, he did not mention the areas around eyes and lips as white, yet in 1881 he suggested that *P. holotephreus* may be a synonym of *P. barbei*. Elliot supported his views, but apparently without argument. As *P. holotephreus* differs from *P. barbei* in very important characters of the colour of the lips and the eyelids, there appears to be no justification in considering the former as a synonym of the latter. As far as it can be judged from the original description of the skin, the species should be relegated to the synonymy of *P. phayrei* Blyth.

As the skull of this species has not been figured so far, photographs are now being published (Plate I, figs. 4-6).

EXPLANATION OF PLATE I.

All figures $\times ca \frac{3}{4}$

Presbytis barbei Blyth.

FIG. 1. Skull of the male syntype. Dorsal view (Z. S. I. Reg. No. 11837).

FIG. 2. Skull of the male syntype. Lateral view.

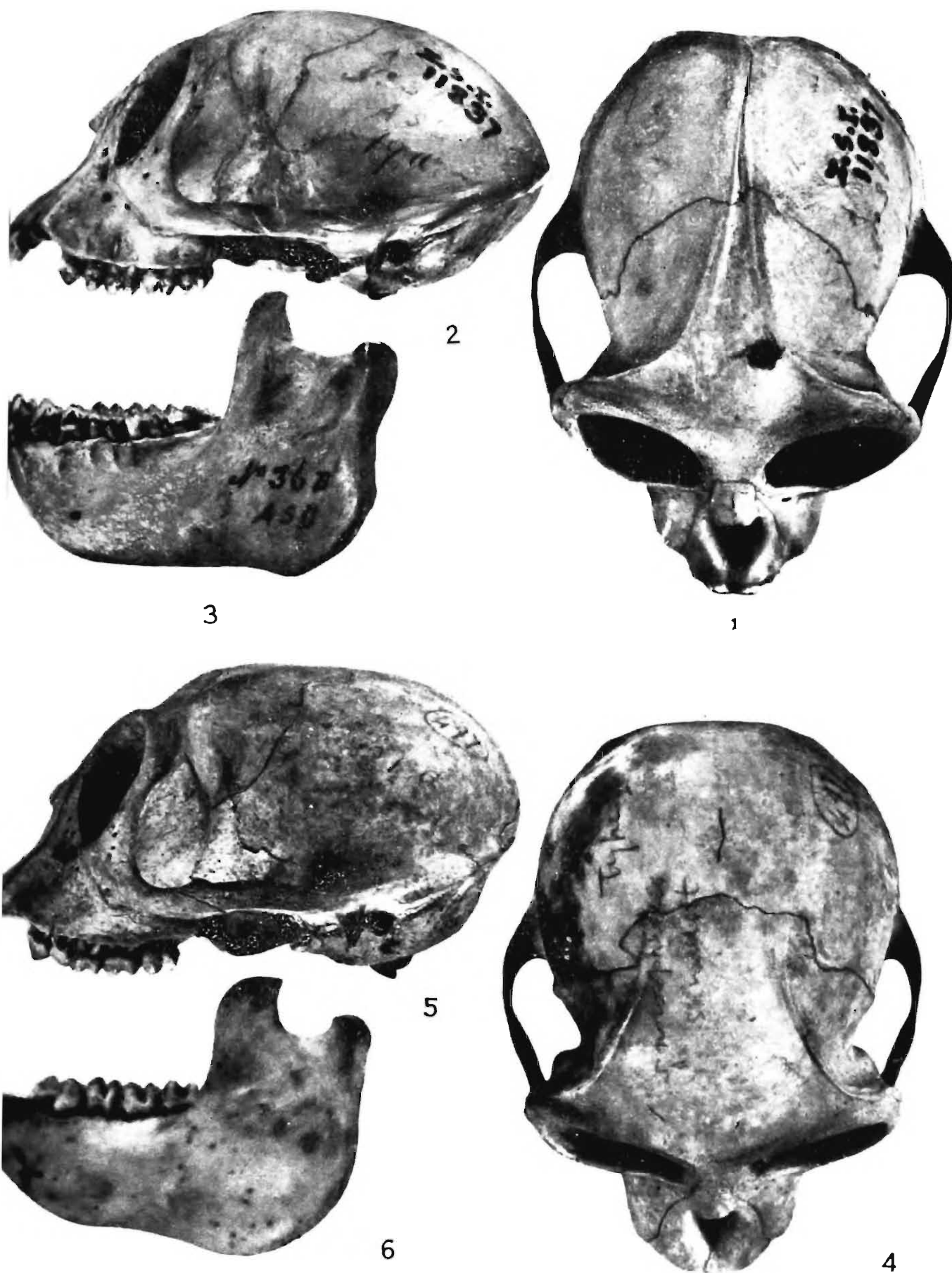
FIG. 3. Lower jaw of the female syntype (Z. S. I. Reg. No. 11876).

Semnopithecus holotephreus Anderson.

FIG. 4. Skull of the type. Dorsal view (Z. S. I. Reg. No. 12228).

FIG. 5. Skull of the type. Lateral view.

FIG. 6. Lower jaw of the type.



Skulls of the types of *Presbytis barbei* Blyth and
Semnopithecus holotephreus Anderson

CATALOGUE OF MAMMALS IN THE INDIAN MUSEUM (ZOOLOGICAL SURVEY.¹) II. PRIMATES : CERCOPITHECIDAE.

By H. KHAJURIA, M.Sc. Hons., Zoological Survey of India, Indian Museum, Calcutta.

(PLATES II-III.)

The general plan of the work has already been explained in Part I (Khajuria, 1953a) which also contains the explanation of the abbreviations used in the measurements of the skulls², and some other general remarks on the collection. The family Cercopithecidae is represented in this collection by forty eight forms some of which are difficult for subspecific determination for want of proper data. Out of the seventeen subspecies described from the area covered by the Fauna of India, thirteen are represented in this collection. The study has brought to light interesting individual and geographical variations and some cranial abnormalities. A false hybrid between *Papio comatus* E. Geoffroy and *Macaca nemestrina* Linnaeus has been reported upon.

I am much indebted to Drs. S. L. Hora and B. Biswas of this Department for their valuable suggestions.

2. REMARKS ON THE CLASSIFICATION OF CERCOPITHECIDAE.

Although the guenons, the macaques, the Celebes apes³, the mangabeys, the baboons, and the gelada have long since been recognized as forming a very natural group of the Primates, yet there has been no agreement whether the group should be given a family or a subfamily status, both views being backed by equally competent students. The matter is also of no great moment but it may be remarked that, though the basic differences of this group from the closely allied group of the leaf monkeys may only justify a separation into a subfamily, yet viewed as a whole, the group has deviated so much from the Colobine type⁴ that I am inclined to uphold its family rank. Elliot (1913) included the following eleven genera in the group: *Papio*, *Theropithecus*, *Cynopithecus*, *Magus*, *Simia*, *Pithecus*, *Cercocebus*, *Rhinostigma*, *Lasiopyga*, *Miopithecus*, and *Erythrocebus*. Allen (1925) split up Elliot's *Papio* into three genera, namely, *Papio*, *Comopithecus*, and *Mandrillus*; but it has now been shown that the proper name for *Papio* in Allen's sense is *Chaeropithecus* Gervais and that *Papio* Erxleben should be used for *Mandrillus* (vide Hopwood, 1947, and Ellerman and Morrison-Scott, 1951). I, however, agree with Ellerman and Morrison-Scott (*op. cit.*) that the three

¹Report No. I (Khajuria, 1953a) was published with the titles 'Catalogue of mammals, in the Zoological Survey of India'; but it has now been decided to use the words 'Indian Museum (Zool. Surv.)' instead of Zoological Survey of India.

² Only the adult skulls are measured. In several cases, the skulls were found to be so well inserted inside the skins that, in view of the fragile nature of the skins, it was not possible to take them out without badly damaging the skins. Such skulls are not measured.

³ *Cynomacaca* and *Cynopithecus*.

⁴ See for instance the astonishing modifications of such important structures as the skull, the generative organs, the tail, etc.

groups may better be considered as subgenera of *Papio*. As is now well known *Magus*, *Simia*, and *Pithecus* are all synonyms of *Macaca*, and *Rhinostigma* and *Miopithecus* are of *Cercopithecus*. Lang created *Allenopithecus* for a species described by Pocock (1907, p. 739, pl. 42) as *Cercopithecus nigroviridis*. The genus has been considered valid by subsequent workers, but it has been overlooked by Pocock (1925). *Cynomacaca* has recently been created for the Celebes ashly black monkey (Khajuria, 1953b).

For the diagnostic characters of the various forms included under *Cercopithecus*, *Erythrocebus*, and *Allenopithecus*, Pocock's (1907) still seems to me to be the best single work. For *Macaca* again, the species of the Indian region were quite adequately dealt with by him (Pocock, 1939). Schawrz's work on the classification of *Cercocebus* is also an outstanding contribution. For other genera and species Elliot (1913) remains to be the best basic work. Allen (1939), Chasen (1948), and Ellerman and Morrison-Scott (1951) have been of great help in following up of the changes in the nomenclature.

In the past it has been a general procedure to treat *Macaca* as more primitive than *Cercopithecus*, though the reverse appears to me to be the case. Geologically both the genera appear to be equally long in time, having originated in India in the Middle Pliocene. *Cercopithecus* lacks all the specializations exhibited by *Macaca* in the skull, the generative organs, the tail, etc. It should, thus, ordinarily be considered as an ancestral stock of *Macaca*. *Cynomacaca* and *Cynopithecus* on one hand and baboons on the other appear to me to be two independent off-shoots of *Macaca* stem which have undergone a parallel evolution with regard to their skull characters.

3. THE CATALOGUE.

SUPERFAMILY CERCOPTHECOIDEA.

FAMILY CERCOPTHECIDAE.

Cercopithecus diana roloway (Schreber).

1774. *Simia roloway* Schreber, *Säugethiere*, I, p. 109, pl. 24 (Guinea).

Material—

10536	♂	Skin and skull	Zool. Gardens, Calcutta (30-12-1919).
12062	S. ad. ♂	Skin . . .	W. Rutledge (7-10-1884).
12063 (I. M. 35a)	Young ♀	Skin and skull	Do. (9-7-1878).

Remarks.—There is a marked variations in the colourations of the crown. In the adult male, it is perfectly black without any speckling. In the young female, it is darker than the parts behind, but there is a marked speckling. In the subadult male, there is no such demarcation. In the last specimen, the belly is also not so dark as in other specimens.

Distribution.—Guinae and Gold Coast.

***Cercopithecus diana* (subsp.?).**

1758. *Simia diana* Linnaeus, *Syst. Nat.*, ed. 10, I, p. 26 (Guinae, i.e., Liberia).

Material—

11889 (I. M. 35 b)	Young♂	Skull	Purchased (18-5-1879).
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Remarks.—The skull differs from that of *C. d. roloway* in having the forehead much elevated and in the muzzle being comparatively shorter. Since the skin is not available, I am not sure about its identity ; and place it as above on the authority of Anderson (1881).

Distribution—?

***Cercopithecus mitis mitis* Wolf.**

1822. *Cercopithecus mitis* Wolf, *Abbid. Besch. merk. naturg. Genest.*, II, p. 145, pl. 34(Angola).

Material—

12072	Skin	No history.
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Remarks.—The specimen is a flat skin from which a good deal of hairs have fallen off. It agrees closely with the description given by Pocock (1907, p. 689). There is no white spot near the eye as mentioned by Elliot (1913, p. 308).

Distribution.—West Africa.

***Cercopithecus mitis kolbi* Neumann.**

1902. *Cercopithecus kolbi* Neumann, *Proc. zool. Soc. London.*, p. 144 (Kedong Escarpment, about 70 miles south West of Mt. Kenya, Kenya Colony).¹

Material—

11869 (I. M. 30c)	♂	Skin and skull	Purchased (26-11-1875).
12064 (I. M. 30e)	♂	Skin	Do. (17-6-1878).

Measurements of the skull. (No. 11869).—*l*, 101 ; *cb*, 80·7 ; *zw*, 70·0 ; *ow*, 49·7 ; *mw*, 32·9.

Remarks.—Certain differences from Elliot's (1913, p. 361) description have been noted. The hairs of the outer sides of the arms are not speckled with white and black but are perfectly black with lighter bases. The general speckling of the body is continued on the inner anterior parts of the upper arm. There are short tufts of white hairs on the ear.

Distribution.—Undefined.

***Cercopithecus mitis albogularis* (Sykes).**

1831. *Semn (Opithecus)? albogularis* Sykes, *Proc. zool. Soc. London*, pt. I, p. 106 (Zanzibar).

Material—

7579	Young♀	Skin and skull	W. Rutledge (26-6-1897).
12078 (I. M. 30a)	Adol.♀	Do. (exhibited)	Rajendra Mullick (1953).
12079 (I. M. 30b)	Adol♂	Skin and skull	Purchased (16-3-1866).

¹ See Moreau, Hopkins, and Hayman (1946) who corrected the Type locality given by Allen (1939).

Remarks.—The specimen No. 7579 agrees with the description given by Pocock (1907, p. 700) except that the crown is speckled black and yellowish (a few annulations showing even a reddish tinge) instead of black and grey, and in the faint speckling of the outer sides of the thighs. Also in the lumbo-sacral region, the orange hue is more pronounced. These appear to me to be only individual variations. In the other specimens the colours have much faded away due to exposure.

Distribution.—East Africa.

Cercopithecus mitis (sub sp.?).

Material—

11842	.	.	.	Skull	.	.	.	Exchange with H. Lydekker
(I. M. 32a)								(15-12-1877).
12326	♀	.	.	Skeleton	.	.	.	Angola. By Exchange
(I. M. 32b.)								(21-1-1879).

Measurements of the skull—

Z.S.I.	.	.	.	<i>l cb</i>	<i>zw</i>	<i>ow</i>	<i>mw</i>	<i>c¹-m³</i>	<i>ml</i>
Reg. Nos.									
11892	.	.	.	112.3	92.7	51	31.2	37	83.8.
12326	.	.	.	97.4	77.2	64.5	42.5	22.5	30.0 76.0

Remarks.—As the distinguishing skull characters of the species are unknown, I am unable to say much about the identity of the specimens. They are being included under this species on the authority of Anderson (1881). On the basis of the locality, No. 12326 appears to belong to the nominate race.

Distribution.—?

Cercopithecus nictitans signatus Jentink.

1886. *Cercopithecus signatus* Jentink, *Notes Leyden Mus.*, VIII, p. 55 (West Africa, perhaps from Banana Congo).

Material—

12327	.	.	.	Skin	.	.	.	No history.
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Remarks.—The specimen shows typical characters.

Distribution.—West Africa (undefined).

Cercopithecus nictitans petaurista (Schreber).

1779. *Simia petaurista* Schreber, *Säugethiere*, I, p. 103, pl. 19B (Guinea).

Material—

12069	Juv. ♂	.	Skin	.	.	.	W. Rutledge (29-10-1878).
(I.M. 34a)							

Remarks.—The specimens do not agree with Pocock's (1907) description inasmuch as there is no whitish stripe behind the corner of the eye; and the temple band, though well developed does not extend as a parieto-occipital stripe. But as Elliot (1913, p. 299) does not mention these characters as occurring in this species, I have no hesitation to include the specimen under this form.

Distribution.—Guinea, Gold Coast, Bandama, Ivory Coast (West Africa).

***Cercopithecus nictitans ascanius* (Audebert).**

1799. *Simia ascanius* Audebert, *Hist. Nat. Singes Makis*, fam. 4, Sect. 2, fig. 13 (Type locality unknown).

Material—

12070 Juv.♂ Skin and skull W. Rutledge (1-12-1884).

Remarks.—The black brow and temple band is present. The hairs on the crown are speckled black and pale yellow. The pale yellow hue is gradually replaced towards the dorsal hinder quarters by orange red and then by red towards the tip of the tail. The hairs on the ears have fallen off but a few with the characteristic colour can still be made out. The nose-spot is tinted yellow.

Distribution.—Congo to Angola; Oubangui, Alima [Pousargues; Quimpampla (Santos)].

***Cercopithecus nictitans nictitans* (Linnaeus).**

1766. *Simia nictitans* Linnaeus, *Syst. Nat.*, ed. 12, I, p. 40 (Guinae).

Material—

12071 Juv.♂ Skin . . . W. Rutledge (26-10-1884).

Remarks.—There is no black band across the collar bone as mentioned by Pocock (1907, p. 696), but its absence may perhaps be a juvenile character.

Distribution.—West Africa, Camroons to Sette Cama in French Congo, Gaboon.

***Cercopithecus mona mona* (Schreber).**

1775. *Simia mona* Schreber, *Säugethiere*, I, p. 97, pl. 15 (Barbery).

Material—

11888	Juv.♂	Skin and skull without lower jaw.	W. Rutledge (21-12-1882).
12067 (I.M. 31a)	Juv.♂	Skin	Purchased (8-6-1878).

Remarks.—The brow band is not very clearly marked off from the crown. In 12067, the various hues on the outside of the arms, the legs and on the dorsal surface have not attained their full intensity.

Distribution.—Nigeria and Camroons.

***Cercopithecus mona cambelli* Waterhouse.**

1838. *Cercopithecus cambelli* Waterhouse, *Proc. zool. Soc. London*, p. 61 (Sierra Leone).

Material—

12068 Juv.♂ Skin Purchased (27-11-1879).
(I.M. 31c.)

Remarks.—The specimen has acquired all the characters of the adult except that the hairs on the outside of the legs and on the lumbo-sacral region still show very faint annulations and that the tail is not black at the tip but is more or less speckled like the foreback.

Distribution.—Sierra Leone (West Africa).

Cercopithecus mona (subsp. ?).*Material—*

12224	Young ♀	In spirit	M. N. Roy. (3-3-1881).
12225	Young ♀	Do.	Do. (15-2-1881).

Remarks.—The specimens are provisionally determined as the true nature of their colour cannot be ascertained on account of their being preserved in spirit for a long time.

Distribution.—?

Cercopithecus cephus cephus (Linnaeus).

1758. *Simia cephus* Linnaeus, *Syst. Nat.*, ed. 10, I, P. 27 (America=West Africa).

Material—

7647	Juv. ♂	Skin and skull	W. Rutledge (18-11-1897).
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Remarks.—The nose is without any definite patch of white hair but is covered with a greyish pubescence which forms a diamond-shaped area around the nose. The hairs on the crown are speckled black and yellow but the black predominates. On the rest of the dorsal surface the yellow is replaced by reddish orange.

Distribution.—West Africa¹.

Cercopithecus aethiops johnstoni Pocock.

1907. *Cercopithecus pygerythrus johnstoni* Pocock, *Proc. zool. Soc. London*, p. 738 (Moshi, Kilima Njaro District, Tanganyika).

Material—

12058	♀	Skin	Zool. Gardens, Calcutta (17-11-1889).
12059 (I. M. 28c)	♂	Skin and skull	W. Rutledge (18-11-1876).
12060 (I. M. 28d)	♂	Skin	Zool. Gardens, Calcutta (29-5-1880).

Remarks.—Though there is the characteristic predominance of pale annulations on the hairs the specimens appear well speckled on the dorsal surface and on the outer side of the arms and the legs. In No. 12060, the tail is also well washed with yellowish rufous.

Distribution.—Undefined.

Cercopithecus aethiops pygerythrus (F. Cuvier).

1821. *Simia ? pygerythra* F. Cuvier, *Hist. nat. Mam.*, XXIV, p. 2, pl. 139 ("Africa").

Material—

7786		Skin and skull	W. Rutledge (19-3-1902).
7868	♂	Do.	Zool. Gardens, Calcutta (23-12-1903).
8029		Skin	J. G. Scott (22-12-1905).
12077 I. M. 28e)	Adol. ♂	Skin (exhibited)	Purchased (28-7-1869).

¹ According to Shortridge (1942) this monkey is restricted to the banks of the Orange River in Namaqualand.

Remarks.—The white on the cheeks and ventral surface is well marked in 7786 and 7868. Elliot's (1913, p. 340) remarks regarding the colouration of the rump, the limbs, the hands, and the feet do not seem to hold good in all cases. No. 12077 shows general fading of the various hues particularly of the red at the base of the tail on account of long exposure.

Distribution.—West Africa.

***Cercopithecus aethiops cynosuroides* (Scopli).**

1786. *Simia cynosuroides* Scopli, *Deliciae Faun. et Flor. Insubrica*, I, p. 44 pl. 19 (Banana, lower Belgium Congo).

Material—

7435 Young ♂ Skin and skull W. Rutledge (4-3-1896).
(exhibited).

11890 ♀ . Skull Zool. Gardens, Calcutta.

Measurements of the skull (No. 11890).—*l*, 100.3 ; *cb*, 77.4 ; *zw*, 63.3 ; *ow*, 47.5 ; *mw*, 25.9 ; *c¹-m³*, 29.1 ; *ml*, 71.2.

Remarks.—A character which is not recorded in the descriptions available to me is that the hands, the feet, and the tail tip are quite darker. The ears appear to be rather large but this may probably be due to the faulty preparation of the skin. The skull No. 11890 is provisionally assigned to this form as the skull characters are not well known.

Distribution.—West Africa.

***Cercopithecus aethiops aethiops* (Linnaeus).**

1758. *Simia aethiops* Linnaeus, *Syst. Nat.*, ed. 10, I, p. 28 (Ethiopia, Upper Egypt, i.e. Senaar).

Material—

7646 ♂ . . Skin and skull W. Rutledge (19-5-1898).

11822 . Skull By Exch. with H. Lydekkerr
(I. M. 29f) (5-12-1877).

11892 ♂ . Skull C. C. Egerton (1836)
(I. M. 29a)

12073 . Skin (damaged) and No history.
skull without lower jaw.

12074 ♂ Skin Abyssina. E. Rüppell (April
(I. M. 29c) 1856).

12075 ♂ Do. Adigrat, Tiger, Abyssinia
(I. M. 29d) (8,000'). W. T. Blanford
(Abyssinian Exped. 1868).

12346 ♂ Skeleton Anseba Valley Abyssinia,
(I. M. 29e) 4000', 1868. W.T Blanford
(Abyssinian Exped.), 1868.

Measurements of the skulls—

Z. S. I.	.	.	.	1	<i>cb</i>	<i>zw</i>	<i>ow</i>	<i>mw</i>	<i>c¹m³</i>	<i>ml</i>
Reg. Nos.										
11822	.	.	.	98.8	82.3	63.2	44.8	25.2	35.6	72.7
11892	.	.	.	103.4	83.6	67.8	48.5	28.2	32.5	71.3
12073	.	.	.	96.9	76.8	65.2	47.5	27.5	28.6	..
12346	.	.	.	96.7	72.4	66.3	45.0	25.5	30.5	67.0

Remarks.—In Nos. 12074 and 12075 the throat, the ventral side and the inner side of the limbs have yellowish tinge instead of being white; and the outer side of the limbs has almost the same colour as the dorsal surface. In No. 12074 the hairs on the crown and the foreparts of the dorsal side are annulated orange and black.

The skull No. 11892 is being assigned to this form only under the authority of Anderson (1881), since I have not seen its skin. The specimen was identified by him as *C. sabaesus* Linn., but his *sabaesus* all belong to this form. This skull differs from other skulls of this form I have examined in the presence of a slight constriction on the bridge of the nose at the point where it meets the supraorbital ridge, in its larger size, and in having the nasals flat. These characters, though important in other groups, can be considered in the Primates generally as individual variations only.

Distributions.—Upper Nile : Abyssinia, Senaar, Kordofan.

Erythrocebus patas patas (Schreber).

1774. *Simia patas* Schreber, *Säugethiere*, I., p. 98, pl. 16 (Senegal).

Material—

7492	Young ♀	Skin	W. Rutledge (21-12-1896).
7528	Young ♀	Skin and skull	Do. (13-3-1897).
11856 (I.M. 33b)	S. ad. ♂	Skin and skull	• Do. (18-1-1879).
11873 (I.M. 33a)	S. ad.	Lower jaw	...
12065	S. ad.	Skin	Zool. Gardens, Calcutta (5-9-1882).
12066 (I. M. 33c)	Young ♀	Do.	O. L. Fraser (27-10-1880).
12223	♀	In spirit	W. Rutledge (26-2-1881).

Remarks.—Pocock (1907, p. 743) states that the hairs on the lumbo-sacral region, above the root of the tail, and on the upper parts of the thighs are uniformly red; but a close examination shows that the hairs with black tips are also present in these regions. Moreover, I do not find the tail tip appreciably paler than the rest. Pocock's (*op. cit.*, p. 744) view that the hairs on the lips turn black to white and those on the appendages from yellowish to white is borne out by my observations.

Distribution.—Senegal to Lake Chad (Africa).

Macaca¹ irus² aurea Geoffroy.

1831. *Macaca aureus* Geoffroy, *Zool. Voy. de Belanger*, pp. 56 and 76 (Pegu Burma).

Material.—

4389 (I. M. 39d) ♂, 4390 } (I. M. 39f), young ♂ 4392 } (I. M. 39g) ♀ . }	Skins and skulls	Houngdarau, Moulmein Dist., Tenasserim, 10-12-1880. Limborg and J. Anderson.
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¹ The division of *Macaca* into several subgenera appears to be desirable but is here abandoned for the sake of convenience.

² I consider the species to be the most primitive of all the species of *Macaca* as it appears to lack all the specializations shown by others.

5236	♂	Skin	Mergui, Burma, 25-12-1881. J. Anderson.
11824 (I. M. 39b)	♂	Skin and skull	Desertion Creek, Elephant Point, Banks of Irrawady near Rangoon. J. Arm- strong (27-11-1827).
11904 (I. M. 39m)	♀	Skulls	Arakan. A. P. Phayre (1843).
11912 (I. M. 39i)	♀		
11989 ♂ (I. M. 39e)	♀	Skin and skull	Houngdarau, Moulmein Dist. Tenasserim, 10-12-1880. Limborg and J. Anderson.
11990 (I. M. 39c)	♂	Do.	Arakan, 1871, Museum Collector.

Measurements of skulls.—

1 ♂ (No. 11824) from Rangoon: *l*, 127·6; *cb*, 88·2; *zw*, 88·1; *ow*, 51·8; *mw*, 34·0; *c¹-m³*, 40·6; *ml*, 96·8.

2 ♀ (Nos. 11904 and 11912) from Arakan: *l*, 104·3-114·0; *cb*, 78·0-91·0; *zw*, 69·7-76·5; *ow*, 46·1-47·9; *mw*, 26·7-30·0; *c¹-m³*, 33·5-38·5; *ml*, 74·5-84·8.

Remarks.—The general colour of all the skins is noticeably uniform, though they have been collected from three different localities at different dates (*cf.* Pocock, 1939, p. 79). On the dorsal side the hairs have blackish and yellowish annulations. In the skull No. 11824 the brow ridges are very thick. The female skull No. 11912 is appreciably smaller than the previous records.

Distribution.—Lower Burma, Mergui Archipelago, South West Siam.

Macaca irus (subsp. ?).

1818. *Macaca irus* Cuvier, *Mem. Mus. Hist. Paris*, IV, p. 120 (Sumatra).

Material.—

3509 (I. M. 89jj)	Young ♂	In spirit	W. Rutledge (19-7-1879).
11812 (I. M. 39k)	♂	Skull	
11819 (I. M. 39a)	♂	Do.	Purchased (1844).
11821 (I. M. 39o)	♂	Skin and skull	Do.
11825 (I. M. 39p)	Adol. ♂	Skull	Do. (Dec., 1865).
11848 (I. M. 39h)	♂	Do.	
11849 (I. M. 39r)	Adol. ♂	Do.	Purchased (16-10-1868).
11850 (I. M. 39mm)	Young ♀	Do.	Do. (20-12-1867).
11859 (I. M. 39nn)	♂	Skeleton	Do. (4-1-1868).
11866 (I. M. 39oo)	Adol. ♀	Do.	Do. (8-1-1868).
11870 (I. M. 39ee)	Adol. ♂	Skin and skull	W. Rutledge (5-10-1880).
11880 (I. M. 39z)	♀	Incomplete skeleton and skin.	G. Nevill (1-7-1873).

11881 (I. M. 39aa)	♀	Incomplete skeleton and skin.	W. Rutledge (9-7-1873).
11885 (I. M. 39dd)	♂	Do.	Zool. Gardens, Calcutta. (5-8-1878).
11911 (I. M. 39j)	♂	} Skulls	
11913 (I. M. 39qq)	♀		
11914 (I. M. 39l)	♀		
11915			
11932 (I. M. 39s)	♀	Skin and skull	W. Rutledge (10-3-1868).
11991 (I. M. 39q)	♂	Do. .	Do. (12-6-1870).
11992 (I. M. 39cc)	Young ♀	In spirit	O. L. Fraser (12-6-1870).
11993 (I. M. 39gg)	Young ♂	Do.	Purchased (28-5-1870).
11994 (I. M. 39ff)	Juv. ♂	Do.	Do. (10-10-1867).
11995 (I. M. 39hh)	Young ♀ .	Do. . .	W. Rutledge (29-9-1871).
12034 (I. M. 39t)	Adol. ♂ . .	Skin (exhibited)	J. Anderson (17-4-1868).

Measurements of skulls.—

Z. S. I. Reg. Nos.	<i>cw</i>	<i>cb</i>	<i>zw</i>	<i>cw</i>	<i>mw</i>	<i>c¹-m³</i>	<i>ml</i>
11812	121.2	95.4	80.0	50.1	32.0	32.0	84.4
11819	123.0	99.0	80.0	53.2	34.4	43.5	91.3
11821	121.0	93.8	78.6	51.7	35.0	40.9	85.5
11848	121.7	97.4	83.0	53.3	32.0	40.4	90.8
11859	113.6	85.7	73.8	50.8	28.0	39.0	79.8
11870	111.4	88.3	69.0	46.9	31.3	36.8	79.4
11911	127.3	102.0	86.5	53.5	31.0	42.5	97.4
11913	89.9	72.0	60.2	42.1	22.8	31.0	66.3
11914	103.3	81.3	64.2	45.3	27.0	33.2	73.0
11932	99.4	76.0	66.0	44.1	25.8	29.6	69.0

Remarks.—The specimens are too inadequately labelled to allow subspecific determination. They probably represent a mixture of more than one form. No. 11870 is much darker on the dorsal surface and its hairs have blackish and reddish orange annulations. In the young specimens (No. 11992, 11994, and 11995) there is a prominent parting on the crown. In the skulls great variations exist in the development of brow ridges. In some they are highly developed with a deep cranial constriction behind them. In others they are nearly absent. As shown by the measurements, the length of the muzzle is also very variable.

Distribution.—?

Macaca sinica sinica (Linnæus).

1771. *Simia sinica* Linnæus, *Mant. Plant.*, p. 521 [‘ India orientali ’ but locality changed to Ceylon by Hinton and Wroughton (1921)].

Material.—

12042 (I. M. 38a)	♂	Skin (exhibited)	Ceylon, R. Templeton (1848).
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Remarks.—There is a marked reddish wash over the hind quarters. The hairs on the cheeks and on the forehead are very scanty probably due to pathological condition.

Distribution.—The low country dry zone from the extreme north to the extreme south of Ceylon.

Macaca sinica aurifrons Pocock.

1931. *Macaca sinica aurifrons* Pocock, *J. Bombay nat. Hist. Soc.*, XXXV, p. 286 (Rayigam Korale, Western Province, Ceylon).

Material.—

6773		Skin	Ceylon, Colombo Museum.
12097	Juv. ♀	Skull	Mankeni, East Province, Ceylon? 1913. E. W. Mayer.

Remarks.—The colour of the anterior fringe of the bonnet has much faded away perhaps due to the age of the specimen. The back is speckled and its general colour is dark grey. The outer sides of the limbs are reddish. In the skull the external narial aperture is laterally bordered by high bony ridges which appears to be an abnormality.

Distribution.—The low country wet zone and central hill-zone of Ceylon.

Macaca sinica (subsp. ?).*Material.*—

11871 (I. M. 38d)	S. ad.	Skull without lower jaw.	Ceylon, E. L. Layard.
11874 (I. M. 38c)		Lower jaw	Ceylon.

Remarks.—Due to the lack of sufficient material and particulars, the material cannot be subspecifically determined.

Distribution.—Ceylon.

Macaca radiata diluta Pocock.

1931. *Macaca radiata diluta* Pocock, *J. Bombay nat. Hist. Soc.*, XXXV, p. 279 (Boothapundy, North of Aramboly in Travancore, South India).

Material.—

8495 ♂		Skin	Travancore, 28-11-1908. N. Annandale.
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Measurements of the skin.—*h.b.*, 545; *t*, 545; *h.f.*, 143; *e*, 40.

Remarks.—The forepart of the bonnet is greyish white. The arrangement of the hairs on the head is similar to that of the type specimen as described by Pocock (1939, p. 42). The colour on the dorsal surface is dark grey with yellowish speckling. The measurements of the skin fall within the range of the measurements of the nominate race.

Distribution.—Travancore.

Macaca radiata radiata (Geoffroy).

1812. *Cercocebus radiatus* Geoffroy, *Ann. Mus. nat. Hist. Paris*, XIX, p. 98 ('India' = South India).

<i>Material.</i> —			
7089	S. ad. ♂	Skull	Tenmalai S. Arcot, Madras. Mus. Collector (W. P. Howell).
10748		Skin	Shevaroy Hills (5,400'), Salem Dist., Madras, 25-5-1929. N. A. N. Baptista.
11826 (I. M. 37f)	Young ♀	Skin and skull	R. Swinhoe (1859).
12007	Ad.	Skin	S. Arcot, Madras. Mus. Collector.
12010 (I. M. 37n)	Juv. ♂	In spirit	Madras. Zool. Gardens, Calcutta (22-6-1880).
12041 (I. M. 37a)	♂	Skin (exhibited)	Purchased (12-6-1870).
12086	S. ad. ♂	Skin and skull	Machur, Palni Hills (4,000') Madura, Madras. G. C. McCann.
12087	♀	Skin	Dharwar (2,300'), Bombay, 14-11-1911. G. C. Shortridge.

Measurements of the skin. No. 12087.—*h.b.*, 515; *t*, 566; *h.f.*, 129; *e*, 38.

Remarks.—In No. 12041 the parting on the forehead is much more prominent than in other specimens.

Distribution.—Southern India upto Satara in the west and the Godavary River in the east but absent in Travancore.

Macaca radiata (sub. sp. ?).

<i>Material.</i> —			
4795	Juv.	In spirit	Zool. Gardens, Calcutta.
11847 (I. M. 37l)	♂	Skull	J. Anderson.
11878 (I. M. 37g)	♀	In spirit	Purchased (September, 1886)
12008 (I. M. 37h)	Juv. ♂	Skin	W. Rutledge (5-1-1875).
12009	Juv. ♂	In spirit	

Measurements of the skull. No. 11847.—*l*, 109.9; *cb*, 90.4; *zw*, 76.8; *ow*, 49.2; *mw*, 34.0; *c¹-m³*, 38.8; *ml*, 80.0.

Remarks.—In the juveniles the cheeks and the area in front of the bonnet are hairless. No further remarks on the identity of the specimens can be given.

Distribution.—?

Macaca mullata villosa True.

1894. *Macacus rhesus villosus* True, *Proc. U. S. natl. Mus.*, XVII, p. 2 (Lolab, northern end of Wular Lake, about 40 miles north-west of Srinagar, Kashmir).

Material.—

12091	♂	Skin and skull	Jirna, Ramnagar, Kumaon, Uttar Pradesh, 17-1-1914. C. M. Crump.
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Measurements.—Skin : *hb.*, 510 ; *t*, 265 ; *hf.*, 161 ; *e*, 45 ; *wt*, 16½ lbs.

Skull : *l*, 124.1 ; *cb*, 97.4 ; *zw*, 85.5 ; *iw*, 53.3 ; *mw*, 32.0 ; *c¹-m³*, 40.0.

Remarks.—There are no brow and temporal ridges in the skull (*cf.* Pocock, 1939, p. 49).

Distribution.—From southern Kashmir and upper Panjab (Murree, Dharamsala, Kangra, etc.) to Kumaon.

Macaca mullata mullata (Zimmermann).

1780. *Cercopithecus mulatta* Zimmermann, *Geogr. Gesch. Mensch.*, XX, p. 195 [“India”, but type locality fixed by Pocock (1932) as Nepal Terai].

Material.—

619 (I. M. 41m)	♀	Skin	Kakhyen Hills, Yunnan, 1868. J. Anderson.
7294	♂	Skin and skull	Sukna, Darjeeling, Bangal, 25-4-1892. Mus., Collector, W. Partridge.
7295	♂	Lower jaw	Sepoy Dora ? (3,000'), (6-6-1892). Mus., Collector, W. Partridge.
11906 (I. M. 41j)	♂	} Skins and skulls	Sundabans, Bangal, 26-4-1870. Mus., Collector.
11905 (I. M. 41i)	♂		
11907	Young ♂	Skull without lower jaw.	
11925 (I. M. 41h)	♂	Skin and skull without lower jaw.	Sundarbans, Bangal, 26-4-1870. Mus. Collector.
11928	♂	Skin and skull	Assam, Zool. Gardens, Calcutta.
11931 (I. M. 41l)	♀	Do.	Sundarbans, Bangal, 26-4-1870. Mus., Collector.
11984 (I. M. 41g)	♂	Skin	Do.
11985 (I. M. 41k)	Young ♂	Skin and skull	Do.
11986 (I. M. 41n)	Adol. ♀	Skin and skeleton	Hotha Valley, Western Yunnan, 1868. J. Anderson.
11987 (I. M. 41o)	Young ♂	Skin and skull	Samaguting, Assam, 4-10-1872. C. Butler.
12088	♀	Do.	Hkampti, Upper Chindwin, Burma (5,000'), 4-7-1914. G. C. Shortridge.
12089	S. ad. ♂	Skin	20 miles of Toungoo, Burma, 26-11-1928. J. M. Mackenzie.
12090	♂	Skin and skull	Margherita, Lakhimpur, Assam (2,000'), 14-11-1914. H. W. Wells.

Measurements.—

Skulls.—							
Sex and locality.	<i>l</i>	<i>cb</i>	<i>zw</i>	<i>iw</i>	<i>mw</i>	<i>c¹-m³</i>	<i>ml</i>
2♂ from Sundarbans	110.4	86.8	77.0	49.3	26.8	31.9	79.0
	to	to	to	to	to	to	to
	115.7	89.5	78.0	50.6	29.5	37.4	80.5
1♂ from Darjeeling	116.0	88.3	79.3	55.0	29.4	38.3	81.9
1♂ from Assam	127.5	102.5	92.0	61.2	37.0	45.5	95.0
1♀ from Upper Chindwin	99.6	74.7	?	48.3	24.5	33.7	?

Skin.—1♀ from upper Chindwin (No. 12088); *hb*, 515; *t*, 198; *hf.*, 140; *e*, 37 *wt*, 9½ lbs

Remarks.—In all the specimens from the Sundarbans the orange hue is markedly restricted to the more hinder quarters seldom extending beyond one fifth of the body length. More material from Sundarbans is, however, needed to ascertain whether the specimens from this area represent an undescribed race. In one of these specimens (No. 11984), although the fore-parts are duller than the hinder quarters, the orange red hue is curiously restricted to a few hairs on the back of the right thigh. The coat in this specimens is also much coarser and somewhat longer than in other specimens. I suspect that the presence of this specimen in the collection made from Sundarbans may be one of the reasons why Anderson (1881, No. 41e) referred a specimen, formerly considered by him (Anderson, 1872) as ‘a supposed new monkey’, to the form under notice. This latter specimen (No. 11999) is now considered, with consensus, as belonging to *Macaca assamensis* McClelland principally because it totally lacks the orange red hue on the hinder parts; but, since it remarkably intergrades with specimens of *M. mullata* (especially through No. 11984) from Sundarbans with regards to the important character of colouration, Anderson’s later opinion should not be considered as wholly unfounded (*cf.* Hinton and Wroughton, 1921a). For the purpose of collecting more specimens of this monkey, the author personally visited the Sundarbans in the winter of 1954, but the enquiries on the spot showed that the monkey occurs only in that part of Sundarbans which at present is included in East Pakistan. The skull of the specimen No. 11928 from Assam is the largest in this collection and falls within the range of *M. m. villosa* as given by Pocock (1939). The female skull No. 12088 from Upper Chindwin is smaller than the measurements given by Pocock (*op. cit.*).

Distribution.—Northern India (in the south extending at least upto the Tapti River in the west and south of the Godavari River in the east), Burma, Siam and Indo-China.

***Macaca mullatta* (sub sp. ?).**

<i>Material.</i> —			
11816	♂	Skull	Purchased (23-9-1869).
(I. M. 41w)			
11853	♂	Lower jaw	J. Anderson (July, 1876).
(I. M. 41k)			
11864	♀	Skeleton without lower jaw.	Do.
(I. M. 41u)			
11929	♂	Skin and skull	O. L. Fraser (17-8-1876).
11986	S. ad. ♂	In spirit	W. Rutledge.
12028	♂	Skin (exhibited)	..
(I. M. 41a)			
12029	Adult	. Skull. (Do.)	. ..

Measurements of the skulls.—

Z. S. I. Reg. Nos.	<i>l</i>	<i>cb</i>	<i>zw</i>	<i>ow</i>	<i>mw</i>	<i>c</i> ¹ - <i>m</i> ³	<i>ml</i>
11816	115.5	90.0	84.6	56.0	34.0	39.3	83.0
11864	100.7	82.0	72.0	49.9	26.0	36.0	..
11929	123.6	94.9	85.5	53.2	33.3	40.0	90.5
12029	130.0	99.0	83.3	56.1	36.6	48.1	88.8

Remarks.—The measurements of the skulls Nos. 11929 and 12029 fall within the range of *M. m. villosa*. In No. 12029 the incisors are in pathological condition, being very weak and underdeveloped. From the development of the molars this skull appears to be fully adult but some of the sutures are still very distinct, again indicating pathological condition. In No. 11864, there is a deep depression on the frontals.

Distribution.—?

***Macaca assamensis pelops* Hodgson.**

1840. *Macacus (Pithecus) pelops* Hodgson, *J. Asiat. Soc. Bangal*, XI, p. 1213 (Kachar, Nepal).

Material.—

12095	Adol ♂	Skin and skull	Pashok, Darjeeling (3,000') 3-2-1915. C. A. Crump.
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Remarks.—The skull is weak in its general build and the cranial ridges are not developed.

Distribution.—From Mussoorie to Sikkim in the Himalayas (2,000' to 6,000').

***Macaca assamensis assamensis* McClelland.**

1839. *Macaca assamensis* McClelland in Horsfield, *Proc. zool. Soc. London*, p. 148 (Assam).

Material.—

7821	S. ad. ♀	Skin	W. Rutledge (16-12-1902).
11187	S. ad. ♂	Skin and skull	Imphal valley about four miles north of Imphal Dinapur Road, Manipur, Assam, 6-11-1945 M. L. Roonwal.
11909 (I. M. 43c)	♀	Skin and skeleton	Second Defile of Irrawady, Upper Burma. J. Anderson.
11923	S. ad. ♂	Skin and skull	W. Rutledge (19-1-1881).
11924 (I. M. 42a)	S. ad. ♂	Do.	Bhamo, Upper Burma, 1875. J. Anderson.
11999 (I. M. 41c)	♂	Skin	Sundarbans, Bangal, 26-4-1870. Mus., Collector.
12002 (I. M. 42b)	Juv. ♂	Skin and skull	Mishmi hills, Assam, 6-6-1876. J. Anderson.
12093		Skin	Mokokchung, Naga Hills, Assam, 5,000', 11-10-1919. J. M. Mills.
12094	Juv. ♂	Skin and skull	Yin, Lower Chindwin (East, Bank), Burma, 15-6-1914. G. C. Shortridge and S.A. Macmillan.

Measurements of the skull No. 11909.—*l*, 113.8; *cb*, 90.4; *zw*, 73.3; *ow*, 49.4; *mw*, 28.0; *c*¹-*m*³, 40.0.

Remarks.—There are great variations in the colour of the dorsal side. In the two specimens (Nos. 11187 and 12093) from Assam the general colour is dark brown with orange tinge. The individual hairs are dark grey at the base with reddish orange annulations towards the tip. The young one (No. 12002) from the same area is, however, much paler, appearing almost yellow. Specimens Nos. 11909, and 12094 from Burma and No. 11923 are also much paler owing to the predominance of the yellowish hue. In No. 11924 the red predominates. No. 11909 which has the hairs of the back speckled was identified by Anderson (1881, p. 72, 43c) as *Macacus leoninus* Blyth (= *Macaca nemestrina leonina* Blyth), although he had on an earlier occasion (1875, p. 66) referred it to the form under report. The reason for the change of his opinion is difficult to ascertain at present, except that the measurements of skull of the specimen are smaller than those given by Pocock (1939) for *M. assamensis assamensis* and fall within the range of *M. n. leonina*. No taxonomic importance can be attached to this character, as it shows great variations in this group. Anderson's inclusion of this specimen in *M. n. leonina* caused considerable confusions to the later workers like Pocock (1931, p. 300) who found it difficult to accommodate it in this form.

Pocock (1939, p. 541) described an immature specimen from Upper Chindwin as unusually brightly tinted, almost reddish ochreous on the head, the nape and the shoulders with yellowish wash over the hind quarters and the legs with the remarks that the specimen may belong to a new race. As the specimens in our collection from Burma also differ from those from Assam in being more brightly tinted like the one described by Pocock, the possibility of their being racially distinct from the Assam specimens gains weight. A study of a number of specimens described from Upper Burma on a later occasion by Pocock (1941, Append., p. 470) leaves no doubt, however, that the brightly tinted skins only represent an individual variation.

The skull No. 11187 is remarkably smooth for the age of the specimens there being no indication of the development of the occipital and the sagittal crests. The upper canines are also very small (*cf.*, Pocock, 1939). No. 7821 is provisionally assigned to this form as I have not seen its skull; and No. 11999 may belong to an undescribed race (see Pocock, 1939, p. 54)¹.

Distribution.—From Assam to Upper Burma, Tongking and Annam.
***Macaca nemestrina leonina*² (Blyth).**

1863. *Inuus leoninus*³ Blyth, *Cat. Mam. Mus. Asiat. Soc.*, p. 7 (Northern Arakan, Burma).

Material.—

11823 (I. M. 43a)	♂	Skin	Arakan, 1844. A. P. Phayre (Type of the form).
11863 (I. M. 43b)	Adol. ♂	Skin and skeleton	Purchased (1867).

¹ In an attempt to clarify the position regarding the identity of this specimen, the author recently visited that part of Sundarbans which is now included in the Indian Union. Personal investigation and the enquiries on the spot, however, revealed that the monkey is apparently absent from this part of Sundarbans.

² Chasen (1940) has used *andamanensis* Bartlett as a subspecific name for this macaque, apparently in ignorance of the views of Pocock (1939, p. 60).

³ Pocock's (1939) statement that the form was originally described by Blyth as *Macacus leoninus* is an error.

11908 (I. M. 43d)	♂	Skull	Purchased (1867).
11926 (I. M. 43e)	Young♂	Skin and skull	Perak, 6-1-1878. O. L. Fraser.
12030 (I. M. 44f)	S. ad.♂	Skin (exhibited)	Purchased (9-11-1866).
12031 (I. M. 44i)		Do.	Do. (27-8-1867).
12096	Young♀	Skin	Bankachon, V. P. Tenasserim 29-12-1919. G. C. Shortridge.

Measurements of the skull No. 11908.—*l*, 128.0; *cb*, 101.0; *zw*, 94.4; *ow*, 57.4; *mw*, 35.5; *c*¹-*m*³, 45.0; *ml*, 94.8.

Remarks.—In a very young male (No. 11926) the tail is very thinly haired and does not show the characteristic black upper surface. In No. 11863, the skull (Pl. II) has its muzzle greatly distorted towards the left side. The dorsal and the ventral views (Pl. II, figs. 1—3) show that the distortion begins at about the level of the posterior roots of the zygomatic arches and effects the size and position of all bones lying anterior to this plane. A line joining the middle of the anterior end of the basioccipital with the anteriormost point on the premaxillary symphysis makes an angle of about 21° with the line running through the middle of the foramen magnum and the basioccipital which are intact. Such a distortion of the cranial bones appears to be very rare in mammals. At present no explanation can be offered as to the cause of this abnormality. According to Anderson the skull No. 11908 probably belongs to the skin No. 11863.

Distribution.—Upper Burma to Tenasserim, the Mergui Archipelago and Siam.

Macaca nemestrina nemestrina (Linnæus).

1766. *Simia nemestrina* Linnæus, *Syst. Nat.*, ed. 12, I, p. 35 (Sumatra).

<i>Material.</i> —			
11817 (I. M. 44e)	♂	Skeleton	Purchased (1843-52).
11818 (I. M. 44k ?)	♂	Skull	Do.
11855 (I. M. 44o)	♂	Skin and skull	Zool. Gardens, Calcutta (17-3-1877).
11858 (I. M. 44p)	♂	Skull and incomplete skeleton.	Purchased (1865).
11861 (I. M. 44z)	♂	Skeleton	Do.
11893 (I. M. 44u)	♂	Skull	Do.
11894	♂	Do.	Zool. Gardens, Calcutta 23-2-(1909 ?).
11895 (I. M. 44b)	♂	Do.	W. Rutledge (10-5-1870).
11896 (I. M. 44n)	♂	Do. .	Do. (3-11-1878).
11897	♂	Skin and skull	Zool. Gardens, Calcutta (1882).
11898 (I. M. 44t)	Adol.♂	Skull	Purchased (1882).
11910 (I. M. 44c)	♂	Skin	Zool. Gardens, Calcutta
11982 (I. M. 44j)	♂	Skull	Purchased (1843).
12000 (I. M. 44j)	♂	Skin (damaged) and skull.	Do. (28-10-1869).
12001	Ad. .	Skull (damaged)	.....
12003	Young♂	Skin and skull	Purchased (25-6-1869).

Measurements of the skulls.—

Z. S. I. Reg. Nos.	<i>l</i>	<i>cb</i>	<i>zw</i>	<i>ow</i>	<i>mw</i>	<i>c¹-m³</i>	<i>mi</i>
11817	145.5	115.0	90.0	61.2	43.0	48.0	104.0
11818	152.0	120.6	94.0	57.5	41.8	48.2	112.0
11855	148.7	120.0	101.2	59.2	46.1	47.5	110.0
11858	143.8	?	96.0	64.5	42.0	49.6	107.3
11861	158.2	125.4	101.0	?	48.0	49.5	118.4
11893	161.8	128.0	105.0	62.0	45.4	51.0	117.4
11894	145.0	116.0	98.6	61.7	38.0	44.7	107.5
11895	153.2	121.8	102.0	62.0	47.3	47.5	117.0
11896	158.5	127.8	102.0	66.7	50.9	54.6	117.5
11897	142.0	119.0	95.3	60.7	44.8	51.8	111.4
11910	154.4	126.4	105.8	60.2	45.5	47.5	116.0
11982	155.0	121.2	95.0	66.2	50.8	50.0	113.0

Remarks.—These specimens have been referred to this form mainly on the grounds of the skull characters. The skin characters (colour and annulations of hairs) which are supposed to distinguish this form from *blythi* Pocock do not seem to be much reliable. Only in one skin (No. 12003) the annulations of the hairs are conspicuously absent. There are, however, no prominent annulations in the hairs of the chest in these skins which are supposed to be present in *blythi*. The measurements as recorded here show great variations in size and proportions.

Distribution.—Malay Peninsula (north to about Trang), Borneo, Banga Island, and Sumatra.

Macaca nemestrina (sub. sp. ?).*Material.*—

7644	♂	.	Imperfect skin	.	W. Rutledge.
11827	Adol.♀	.	Skull	.	....
(I. M. 44b)					
11854	Young ♀	.	Skin (damaged)	and	O. L. Fraser (29-4-1876).
(I. M. 44m)			skull.		
11889	.	.	Viscera in spirit	.	W. Rutledge.
(I. M. 44w ?)					
11900	.	.	Do.	.	Purchased (1867).
(I. M. 44v)					
12032	♂	.	Imperfect skin	and	Do. (13-7-1867)
(I. M. 44a)			skull.		

Remarks.—The material is too inadequate to enable me to place it under subspecies correctly.

Distribution.—?

***Macaca silenus* (Linnæus).**

1858. *Simia silenus* Linnæus, *Syst. Nat.*, ed. 10, p. 23 (South India).

Material.—

7749	♀	}	Skins and skulls.	. W. Rutledge.
7750	♀			
7751	♀			
7752	♀			
7753	♀			
8045	Ad.		Skin	. J. G. Scott.
10880	Ad.	.	Skin (exhibited)	. Zool. Gardens, Calcutta.
11851 (I. M. 40e)	Adol.♂)		Skin and skull	Rajendra Mullick (19-12-1871).
11852 (I. M. 40f)	Adol.♀	.	Skull	Purchased (12-2-1866).
11901			Viscera in spirit	. ....
11916 (I. M. 40j)	Adol.♀	.	Skull	. ....
12004	.		Skin	. ....
12005 (I. M. 40c)	Young♂	.	Do.	. Malabar Coast. Purchased (1848).
12006 (I. M. 40b)	Adol.♂	.	Do.	. J. McClelland.
12025 (I. M. 40a)	S. ad.♂	.	Skeleton (exhibited)	. Barrackpore Menagerie (1843).

Remarks.—In Nos. 8045 and 12025 the caps on the crown are ill-defined.

Distribution.—South India, 14°N lat. to Cape Comorin.

***Macaca speciosa speciosa* F. Cuvier.**

1825. (*Macacus*) *speciosus* F. Cuvier, *Hist. nat. Mam.*, 46 (East Indies).

Material.—

11902	.	.	Viscera in spirit	. Kakhyen Hills, Bhamo Upper Burma. J. Anderson.
11996 (I. M. 45e)	Young♀		Skin	. Tipperah, East Pakistan. Zool. Gardens, Calcutta (17-10-1878).
11997 (I. M. 45a)	♂		Do.	. Kakhyen Hills, Bhamo, Upper Burma. J. Anderson.
12033 (I. M. 45b)	Young♂	.	Do. (exhibited)	Do.
12214 (I. M. 45c)	.	.	Do. In spirit	. ?Sadiya, Assam J. Anderson (30-6-1876).

Remarks.—The colour on the dorsal surface shows intermingling of yellowish, reddish, and blackish hues, the individual hair being yellowish at the base and blackish towards the tip with a reddish tinge throughout. No. 11997 has been described in life by Anderson (1881, p. 75). In this specimen, however, the red has become a markedly prominent colour. In No. 12033 which is the type of *M. brunneus* Anderson, there is a parting on the forehead.

Distribution.—Assam, Upper Burma, South China, Tongking and Annam.

***Macaca speciosa* (sub. sp. ?).**

Material.—

7653	Young	Skin and skull	W. Rutledge.
11933	Young♀ .	Skin and skull without lower jaw.	Zool. Gardens, Calcutta.
11998 (I. M. 45f)	Young♀ . . .	In spirit . . .	Purchased (20-3-1879).

Remarks.—In No. 7653 the coat is thin, the upper parts are darker with a reddish shade, and the ventral surface and the bases of the dorsal hairs are yellowish.

Distribution.—?

***Macaca maura* F. Cuvier.**

1823. *Macacus maurus* F. Cuvier, *Hist. nat. Mam.*, pl. xl (Celebes).

Material.—

7582	♀ .	} Skins and skulls .	W. Rutledge.
7583	♀ .		
7584	♂ .		
11820 (I. M. 46g)	♀ . .	Do. . .	Do. (1880).
11865	♀ . .	Skull without lower jaw.	Purchased.
11875 (I. M. 46a)	Adol.♂ . .	Lower jaw only	W. Rutledge (5-6-1871).
11887 (I. M. 46b)	♂ . .	Bones of trunk . .	O. L. Fraser (28-10-1881).
11921 (I. M. 46c)	♂ . .	Skin and skull . .	W. Rutledge (8-6-1881).
11922	♀ . .	Do. . .	Purchased.
11942 (I. M. 46e)	♀ . .	Do. . .	W. Rutledge.
12011 (I. M. 46h)	Juv.♂ . .	Skin . . .	Do. (4-7-1880).
12012 (I. M. 46f)	S. ad.♀ . .	Do. . .	O. L. Fraser (21-11-1880)
12035	♀ . .	Skeleton without skull	W. Rutledge (21-11-1880).
12219	Young♂ . .	In spirit . . .	...

Measurements of the skulls.—

Z. S. I. Reg. Nos.	<i>l</i>	<i>cb</i>	<i>zw</i>	<i>ow</i>	<i>mw</i>	<i>c¹-m³</i>	<i>ml</i>
11820	115.0	89.0	76.0	49.1	30.0	38.6	80.8
11865	118.0	90.6	76.5	50.2	29.0	37.0	?
11921	147.6	115.0	95.7	57.7	37.5	43.4	104.4
11942	121.0	93.7	76.5	51.0	31.0	41.9	85.5

Remarks.—See under *Cynomacaca ochreata*.

Distribution.—South-western peninsula of the Celebes and Aru Island (Elliot, 1913).

*Cynomacaca*¹ *ochreata* (Ogilby).

1840. *Papio ochreatus* Ogilby, *Proc. zool. Soc. London*, p. 56 (Celebes).

Material.—

7559	Young♂, 7581♂	} Skins and skulls.	. W. Rutledge.				
7590	Young♂ .		Do. (exhibited). . Zool. Gardens, Calcutta (18-1-1898).				
7910	. .	Skin and skull .	. W. Rutledge.				
8420,	10534♂ .	} Do. . . .	. Zool. Gardens, Calcutta.				
11918 (I. M. 47c)	Adol.♂		Skull . . . Do. (25-8-1878).				
11919 (I. M. 47a)	Adol.♂ .	Do. . .	. Maharaja of Burdwan (1858).				
11920 (I. M. 47b)	Adol.♂	Skull without lower jaw.		W. Rutledge (22-2-1880).			
12013 (I. M. 47b)	Young♂ .	Skin and lower jaw .		Do.			
12014	Young	Skin . .		....			
12015	♂ .	Skin and skull		Zool. Gardens, Calcutta (17-2-1929).			
12016	. .	Skull . . .		....			
12036	Young .	Skin and skull (exhibited).		....			

Measurements of the skull (No. 12015).—*l*, 144.8 ; *cb*, 116.0 ; *zw*, 92.7 ; *ow*, 57.4 ; *mw*, 41.3 ; *c¹-m³*, 49.1 ; *ml*, 102.6.

Remarks.—*Cynomacaca ochreata* and *Macaca maura* have long since been considered as very closely related forms. It was, however, recently discovered (Khajuria, 1953b) that the two forms belong to separate genera. A few more observations regarding the colouration which is very similar in the two species may be of interest. The young ones at birth are said to be brownish in both the species. As they grow up,

¹ See Khajuria (1953b).

they develop, in *C. ochreata*, an intense ashy black colour on the back, the nape, the crown, and on the outer surface of the limbs. In *M. maura*, the colour on these parts remains much paler, but in certain cases (No. 11921, p. 120) the colouration may be just intermediate between the two extremes. Again the legs and forearm may become paler in old individuals of *C. ochreata*. In the young ♂ No. 12013, the arms and the legs, including the hands and the feet, are much paler. I find it difficult to agree with Elliot (1913, p. 168) that the colour of the hands and the feet is a distinguishing character between the two species.

Distribution.—South eastern parts of Celebes and the islands of Muna and Buton.

Cynopithecus¹ niger Desmarest.

1820. *Cynopithecus niger* Desmarest, Mammal., 3. 534 (Celebes).

Material.—

11881	♀	Skeleton	W. Rutledge (29-10-1871).
(I. M. 48m)			
11882	♀	Skin and bones of trunk.	Do. (16-1-1872).
(I. M. 48b)			
11883	Adol.♂	Skeleton	W. Rutledge (9-7-1873).
(I. M. 48k)			
12017	Young♀	Skin and skull	Do. (5-6-1871).
(I. M. 48f)			
12018	♂	Skin	Zool. Gardens, Calcutta (9-8-1880).
(I. M. 48g)			
12020	Young♂	Skeleton without skull	W. Rutledge (3-6-1872).
(I. M. 48o)			
12037	Young♀	Skin (exhibited)	Do. (28-2-1871).
(I. M. 48d)			
12056	Young♀	Skeleton	Do. (13-1-1872).
(I. M. 48n)			
12057	Young♀	Skin (exhibited)	Do. (11-4-1871).
(I. M. 48e)			

Measurements of the skull (No. 11881).—*l*, 115.3; *cb*, 87.0; *zw*, 71.0; *ow*, 47.1; *mw*, 31.0; *c¹-m³*, 39.0; *ml.*, 80.0.

Remarks.—The colour of both the young and the adult is black. In some (Nos. 11882 and 12037) the hands and the feet are darker.

Distribution.—Northern peninsula of Celebes and down the western coast to Balanipa, Batchian, and Menadoptoua islands.

Cercocebus torquatus atys (Audebert).

1797. *Simia atys* Audebert, *Hist. nat. Singes Makis*, fam. 4, Sect. 2, p. 13 pl. 8 ("Afrique occidentale").

Material.—

11860	Adol.♂	Skin and skeleton	Purchased (May, 1879).
(I. M. 36a)			
11963	♂	Skin and skull without lower jaw.	Zool. Gardens, Calcutta.
12019	Adol.♂	Skin	O. L. Fraser (14-10-1880).
(I. M. 36b)			

¹ Only one species of this genus has with consensus been recognized; but Sody (1949) has created another, *C. togeanus* from Malengie, Togeian group, east of Celebes. Sody's conception of genus *Cynopithecus* appears, however, to be very different as he has included *Macaca maura* in this genus.

The photographs of the skull of this monkey published by Elliot (1913, II, pl. XVIII), cannot by any chance belong to this species.

Remarks.—There is no sagittal line along the back. In only one of the skins (No. 11860) the face is flesh coloured. None of the skins has any parting on the crown. The hairs on the back are speckled but not conspicuously. The tail tip is not paler. In No. 11860 there is an accessory cusplet on the second lower molar. The hairs are quite long.

Distribution.—French Guinae to Liberia.

Papio doguera (Pucheron). Subgenus *Chaeropithecus*.

1856. *Cynocephalus doguera* Pucheron, *Rev. Mag. Zool.*, (2) VIII, p. 96 (Abyssinia).

Material.—

7915	.. ♀	.. Skin	..	Zool. Gardens, Calcutta (June, 1902)
10991	.. ♂	.. Do. (exhibited)	..	Do. (1-5-1937).
11815	.. ♂	Skull	..	W. Rutledge.
11828 (T.M. 51c)	Adol. ♀	.. Skin and skull	..	Zool. Gardens, (29-10-1880) Calcutta.
11927 (I.M. 50c)	.. ♀	.. Incomplete skeleton	..	W. Rutledge (30-6-1876)
11955	♂	.. Skin and skull without lower jaw.	..	Do. (12-5-1885).
11956	.. ♂?	.. Skin (damaged) and skull.	..	Do. (18-1-1886).
11957	♂	.. Skin and skull	..	Do. (24-7-1881).
12023 (I.M. 50b)	♂	.. Skin (damaged)	..	Do. (14-6-1876).
12039 (I.M. 50d)	Ad. ♂?	.. Incomplete skeleton	..	Do. (15-8-1876).

Measurements of the skulls.—

Z. S. I. Reg. Nos.		<i>l</i>	<i>cb</i>	<i>zw</i>	<i>ow</i>	<i>mw</i>	<i>c¹-m³</i>	<i>ml</i>
11815	.. ..	230 (approx.)	185.0	136.0	77.6	60.8	73.0	160.0
11927	.. ..	183.8 (approx.)	148.9	114.3	64.6	42.6	61.9	135.0
11955	.. ..	217.0	174.3	128.0	74.9	57.5	70.4	..
11956	.. ..	225.5	177.0	113.0	71.1	55.6	70.5	164.3
11957	.. ..	217.0	179.8	120.8	78.1	59.6	75.3	162.8
12039	.. ..	185.6	146.0	113.8	62.0	43.7	59.2	137.9

Remarks.—The males fairly agree with the description of *P.d. tessellatus* Elliot as given by Elliot (1913) and Allen (1925) but the skulls of these specimens are smaller. In the females the annulations of the hairs are not well marked, and so the general appearance is less checkered. In both the female skins the coat is everywhere very long and coarse and the hairs of the napes have very long terminal black bands. A patch

of hairs with the long terminal black band arises in front of the ear and sweeps backward below the ear to join the hairs of the nape. No. 11828 was identified by Anderson (1881, No. 81c) as *Cynocephalus porcarius* Bodd. Although the character of the nose cannot be studied in made-up skins, the length of the tail clearly shows that it was a mistake. Regarding this specimen Anderson (*loc. cit.*) remarked as follows: "Although this animal was far from being adult, it had huge swellings around the vaginal orifice while alive. The bones of the skull are enormously thickened and heavy but those of face are softened. The animals lived in the Zoological Gardens, Calcutta for some years and during that period appeared quite healthy". For lack of material for comparison, I am unable to refer the material to any subspecific category.

Distribution—Abyssinia.

***Papio comatus* E. Geoffroy.**

1812 *Papio comatus* E. Geoffroy, *Ann. Mus. Hist. nat. Paris*, XIX, p. 103 (Cape of Good Hope).

Material—

11814 (I.M. 51b).	Young ♂	Skull without lower jaw.	Purchased (1846).
12024 (I.M. 51d).	juv. ♂	In spirit	Rajendar Mullick (1862).
12040 (I.M. 50a)	♂ ..	Skin (exhibited)	Purchased (8-2-1870).

Remarks.—Anderson (1881, No. 50a) determined No. 12040 as *Cynocephalus doguera*. However, since the nose is projected beyond the upper lip, I place it under the present species. No. 12024 (Plate III) was stated by him (*op. cit.*, No. 51d) to be a hybrid between this species and *Macaca nemestrina*, but it is not on record which species represents which parent. As far as it can be judged from the spirit-preserved specimen, it resembles the present species in all its external characters excepting perhaps the hands and the feet about which nothing can be said with certainty. If Anderson's statement is taken as correct, I suspect that it may be a case of a 'false hybrid'. False hybrids have been reported in several plants, invertebrates, and some lower vertebrates, but not, as far as I am aware, in mammals.¹

Distribution.—South Africa.

***Papio hamadryas hamadryas* (Linnaeus). Subgenus *Comopithecus*.**

1758. *Simia hamadryas* Linnaeus, *Syst. Nat.*, ed. 10, I, p. 27 (Egypt. where now extinct).

Material—

12022	♂	Skin and skull	Hadoda, near Annesley Bay, Abyssinia (1868). W. T. Blanford (Abyssinian Exped.).
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¹See Wilson (1928, p. 467). Also see Zuckerman (1931, p. 338) where a hybrid between *Mandrillus spinx* and *Macaca irus* has been recorded.

12026 (I.M.49d)	♂	}	Skulls (exhibited)	Lebka Valley, Abyssinia, 1868. W. T. Blanford (Abyssinian Exped.).
12027 (I. M. 49e)	♂			
12038 (I. M. 49a)	♂	..	Skin (exhibited)	Purchased (6-10-1866).

Measurements of the skulls—

2♂ from Abyssinia : *l*, 183. 2-195. 4 ; *cb*, 139. 2-153. 0 ; *zw*, 111. 0-115. 6 ; *ow*, 56. 9-62.5 ; *mu*, 46.6-49.6 ; *c¹-m³*, 60. 6-61. 0 ; *ml*, 134. 6-145. 6.

Remarks.—A study of the skulls of this species renders the validity of *P. brockmani* Elliot doubtful as they combine the characters of both the species.

Distribution.—Eastern Ethiopia and eastern Sudan.

Papio hamadryas* (sub sp.?).Material.*—

7448	Young ♂	Skin and skull (damaged).	W. Rutledge.
11001	S. ad. ♂	Skeleton (exhibited)	Zool. Gardens, Calcutta.
11903	♂	Penis in spirit	O. L. Fraser (13-4-1866).
12038 (I. M. 49a)	.. ♂	Skin (exhibited)	.. Purchased (6-10-1866).
12053 (I.M. 49b)	Adol. ♂	Incomplete skin and skull.	Do. (29-1-1867).
12054 (I. M. 49h).	Adol. ♂	Skin	Do. (5-1-1878).
12055 (I. M. 49g).	Young ♀	Skin and skull	W. Rutledge (11-3-1877).

Remarks.—The young ♀, No. 7448, is provisionally assigned to this species as the characters of the adult have not so far appeared. The general colour of this specimen is brownish yellow and the hairs are faintly annulated. The mane is just beginning to appear. In the young ♂ No. 12055 also the speckling is very faint. In the case of No. 12054, Anderson (1881) states that the skull and scapulae are quite light and friable and the scapulae are thrown into folds as it were a piece of paper mache. This condition of bones is attributed by him to its being reared from an early age in captivity.

Distribution.—?

***Papio sphinx* (Linnaeus). Subgenus *Papio*.**

1758. *Simia sphinx* Linnaeus, *Syst. Nat.*, ed. 10, I, p. 25 (Borneo-West Africa).

Material.—

10447	♂	.. Skeleton (exhibited)	Zool. Gardens, Calcutta.
12021	♂	.. Skin (damaged)	.. W. Rutledge (15-6-1886).

Measurements of the skull.—*l*, 230.0 ; *cb*, 173.0 ; *zw*, 136.0 ; *ow*, 77.0 ; *mu*, 66.0 ; *c¹-m³*, 78.0 ; *ml*, 158.0.

Remarks.—The skull furnishes some good diagnostic characters, the most conspicuous of which is the peculiar development of the maxillary ridges and highly developed occipital crest. The maxillary ridges as they arise from below the orbit are very thick and marked with longitudinal ridges and furrows. They then become thinner and sweep inward and forward leaving a wide depression on the side of the muzzle. Their height is the greatest in the middle of the muzzle. The occipital crest slopes downward and forward. The forehead is very broad and the orbits are semicircular. The various colours on the face, the callosities, and the anal and genital region have faded away.

Distribution.—Senegamula to Congo, West Africa (Elliot).

Papio leucophaeus (F. Cuvier).

1817. *Simia leucophaeus* F. Cuvier, *Ann. Mus. Hist. nat., Paris*, XIX, p. 47 (Probablement des cotes d' Afrique).

Material.—

7824	.. ♂	.. Skin (damaged) and skull	Zool. Gardens, Calcutta (4.1.1903).
8494	.. ♂	.. Skin and skull (exhibited)	Zool. Gardens, Calcutta.
11953	Young ♀	Skull without lower jaw	W. Rutledge (11.5 1875).

Remarks.—The red colour of the lower lip and the greenish brown of the sides of the crown as given by Elliot (1913, p. 153) are not discernable, apparently due to the age of the specimen. The general colour of the upper parts and the outside of the limbs is dark brown. The ventral aspects and the inner surfaces of the limbs are paler.

Distribution.—North Camroon, Konje Farm near Mundame, and Victoria (Elliot).

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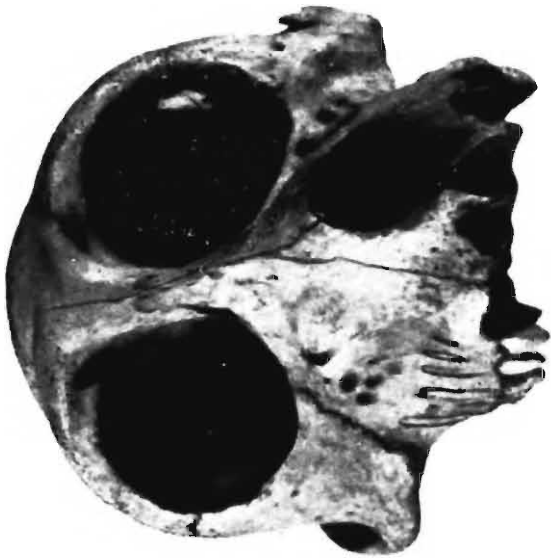
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EXPLANATION OF PLATE II.

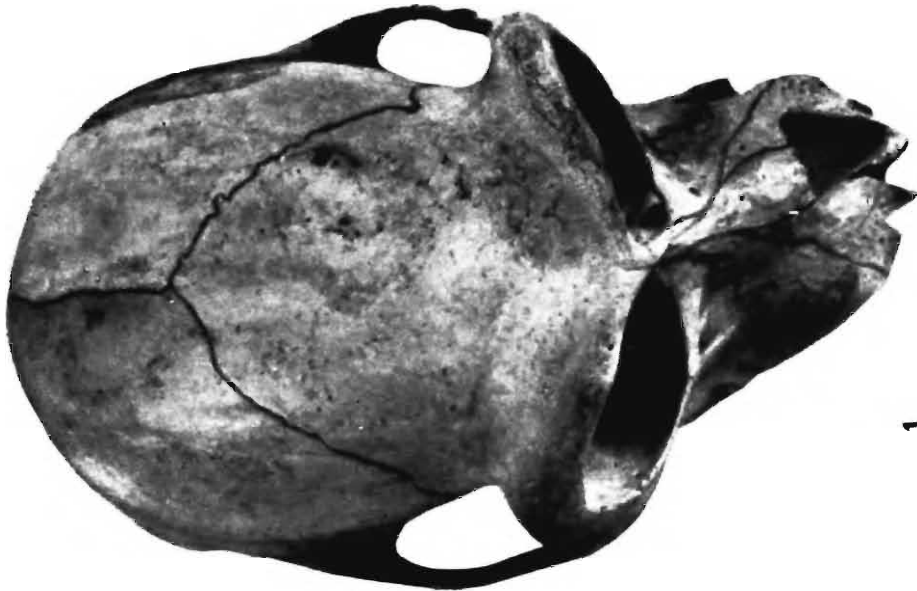
PLATE II.—Dorsal, anterior, and ventral views of an abnormal skull of
Macaca nemestrina leonina (Blyth). ca $\times \frac{2}{3}$.



3



2



1

Abnormal skull of *Macaca nemestrina leonina* (Blyth)

EXPLANATION OF PLATE III.

PLATE III.—A hybrid between *Papio comatus* E. Geoffroy and *Macaca nemestrina*. $ca \times \frac{2}{3}$.



A hybrid between *Papio comatus* E. Geoffroy and *Macaca nemestrina* (Linn.)

MORPHOLOGY OF THE GENITAL STRUCTURES OF SOME INDIAN ANOBIIDAE AND PTINIDAE. (COLEOPTERA, BOSTRYCHOIDEA).

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Although Pic¹ as early as 1912, recognized Anobiids and Ptinids as two distinct families, Imms in his Text Book of Entomology included Ptinids under Anobiids. Joy² separated the two families mostly by their antennal characters. Crowson³, however, placed both the families under the Super-family Bostrychoidea and gave the adult and larval characters which separate the two families. Unfortunately, the proper homology of the genital structures, both males and females, of the two families remained either undescribed or insufficiently treated.⁴ An attempt has, therefore, been made in the following pages to describe in detail the structure of genitalia of some well represented Indian genera and species of the two families. The results obtained indicate that the genitalic characters are not only useful for separating the two families but appear on the whole to be equally dependable or more so in distinguishing the various genera and species. Well determined Indian forms of the two families in sufficient numbers were, however, not available for such studies so that they were confined to three genera of Anobiidae represented by three distinct and well distributed species and only one genus of Ptinidae, represented by single species.

Anobiids are of economic importance in that they are known to injure a wide range of stored materials attacking beans (dried), tobacco products (cigarettes, cigars), spices, ginger, biscuits, flour, bread, many drugs including opium and aconite together with a variety of other food products. The genus *Gastrallus*, on the other hand, represents the book-worm. Although accurate data as regards the damage caused by this insect pest to library books and stored documents are not available, it can, however, be assumed that the damage caused by this insect borer is appreciable.

Ptinids of the genus *Gibbium*, on the other hand, are known to affect the wheat grains, Belladonna and, like genus *Gastrallus*, it is also known to attack book covers. Some are also known to infest birds' nests.

The specimens of three species of Anobiidae, namely, *Lasioderma serricorne* F., *Gastrallus indicus* Reitt., and *Stegobium*(=*Sitodrepa*) *panicea* L., and one species of Ptinidae, namely, *Gibbium psyllioides* Czemp, were examined.

¹ Pic, M. (1912).—"Coleopterorum Catalogus". Anobiidae and Ptinidae, W. Junk, Berlin.

² Joy, N. H. (1932).—"A Practical Hand Book of British Beetles". H. F. & G. Witherby, London.

³ Crowson, R. A. (1951).—*Ent. Month. Mag.* No. 137, pp. 152-156.

⁴ Buck, F. D. (1950).—*Ent. Month. Mag.* No. 124, pp. 127-128.

Buck figured the male genitalic structures of an Anobiid, *Grynobius excavatus* Kug., unfortunately, he has neither homologized, nor the parts were properly delimited. However, from Buck's figure it appears that the genus *Grynobius* is allied to the Indian genus *Gastrallus*. Sarp and Muir (1912) in *Trans. Ent. Soc. Lond.*, Part III have given some figures of genitalia of Anobiidae but they seem to have considered Ptinids under Anobiidae.

The named specimens were obtained from the National Pusa Collection of the Indian Agricultural Research Institute, New Delhi. The details of the host records quoted herein have been noted down from the labels affixed to the specimens. The specimens of *Lasioderma serricorne* F., were available in the collection from Ajwan, Aniseed, Cinnamon, Cardamom (in storage), *Coriandrum sativum* (in storage), cotton seed (in storage-larvae), coconut cake (in storage), Date (in storage), kusum flower cake (in storage), nutmeg (boring in storage), *Peucedenum graveolens* (seeds in storage), plantain leaf, *Poinciana regia* (pod poppy petals) (pressed), poppy leaf (wrappings), ("Shaftal" leaves, larvae), tobacco packets, cigarettes (in tin), cigar-"cheroot", turmeric dry (in storage); of *Gastrallus indicus* Reitt., from paste-board, book, cover of books; of *Stegobium* (= *Sitodrepa*) *panicea* L. from Aniseed (in storage) and Cummin seed (in storage); and of *Gibbium psyllioides* Czemp., from *Belladonna*, wheat grain (in storage) and Bird's nest.

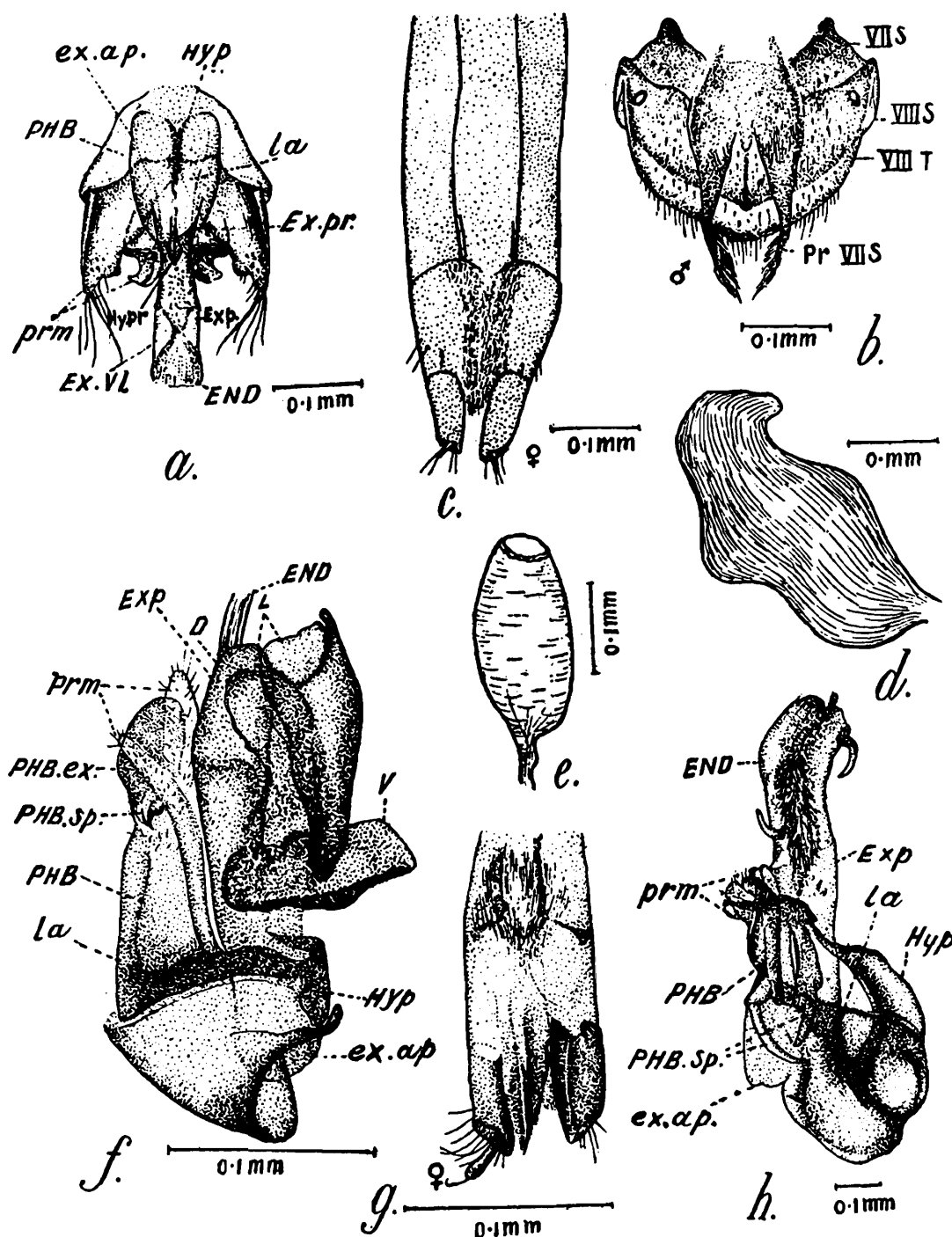
ANOBIIDAE

Gastrallus indicus Reitt.

MALE. (Text-fig. 1, *a. b.*)

The lateral arches (Text-fig. 1 *a*) of each side not distinct as in the case of Bruchidae; the basal portion of the paramere (*prm*) of each side descends rather indistinctly as lateral arches ventrad and joins with its pair of the opposite side thus forming a rather thin ridge from which a small feeble-shaped hypomere (*Hyp*) originates; the parameres of each side, basally broad and sub-triangular, its distal one-third forked or paired on each side, the latero-ectad part thickly built, excavated entad at distal one-third and bears a shallow notch at the middle dividing the paramere into an inner tubercular part and a finger-shaped process ectad fringed with longish hairs; inwardly near about the middle, it bears a few short hairs, the portion laterad to the exophallus arises from the excavity at the base of the paramere of each side, subtriangular and hollow structurally, its distal tip ending in a pair of closely apposed hooks, the entire structure joins angularly on each side with the main body of the paramere by a narrow perpendicular ridge formed by a pair of laminated plates. The dorsal part of the paramere at the base represents the phallobase (PHB) and between somewhat indistinguishable dorsal (phallobase) and latero-ventral arches (lateral arches) runs the prominent exophallus (*Exp*) somewhat narrower at the base but broader distally; the exophallus at its distal half deeply chitinized and bears near about the middle a pair of laminated processes with their pointed tips directed cephalad (*Ex.pr.*), distally the exophallus bears in the middle sparsely distributed hairs, the exophallic valve (*Exvl*) at the tip of the exophallus triangular in shape with its margin rounded off, the exophallic valve gives support to the fairly large cylindrical endophallus (END) well spread out when evaginated; the distal half of the endophallus is deeply chitinized internally and bears a cone-shaped appearance at the spread-out tip of which the gonopore opens. In continuation of the exophallus, the sub-ellipsoidal exophallic apodeme (*ex.ap*) extends

beyond the tenth segment, cephalad it bears notch just mesodorsad to the indistinct hypomere, the narrower distal end of the hypomere bears a distally clubbed but pointed peculiar structure the hypomeral prong (Hy pr.) which apparently supports the base of the well developed exophallus and enclosed endophallus, the tip of this prong extends beyond the anterior margin of the exophallic apodeme. This slender rod-like



Text-fig. 1. *Gastrallus indicus* Reitt. a. ♂ genitalia, END—endophallus; Ex. ap.—exophallic apodeme; Exp—exophallus; Ex. pr.—prongs of exophallus; Ex. vl.—exophallic valve; Hypr.—hypomere; Hyp.—hypomeral prong; la—lateral arch; prm.—parameres. b. VII S, VIII S—7th and 8th Sternites; pr. VII S—prongs of 7th sternite; VIII T—8th tergite. c. ♀ genitalia. d. ♀ bursa copulatrix. e. ♀ spermatheca. f. *Stegobium* (= *Sitodrepa*) *panicea* L. ♂ genitalia, END—endophallus; ex. ap.—exophallic apodeme; Exp. exophallus (with D. L. V.—dorsal, ventral and lateral valves); Hyp—hypomere; PHB—phallobase; PHB. ex.: Phallobase (expanded part); PHB. sp.—spines on phallobase; la—lateral arch; prm.—paramere. g. ♀ genitalia. h. *Lassioderna serricorne* F. ♀ genitalia; END—endophallus; ex. ap.—exophallic apodeme; Hyp—hypomere; PHB—phallobase; PHB. sp.—Spines on phallobase; la—lateral arch; prm. paramere.

structure according to Sharp and Muir (1912)¹ present also in *Ptilinus pectinicornis*. The hypomeral prong appears to vary in size in *Gastrallus indicus* Reitt.

The entire ninth and tenth segments remain covered up by the arch-shaped eighth segment as also by a pair of sub-triangular median processes (Text-fig. 1, *b*) which taper off distally (Pr VIIs), these processes appear feathery being furnished with longish hairs entad.

FEMALE. (Text-fig. 1, *c, d, e.*)

Tenth segment appears as separate plates dorsally with sparsely distributed longish setae on distal two-thirds, the inner and outer margins of the pair of plates almost parallel, meso-ventrad to the plates fine and compact backwardly directed setae in large numbers visible.² The plates of the tenth segment converge to a point at the tip and appear closely apposed, their distal extremities reaching half the length of the first segment of the cercus; first segment of cercus sub-cylindrical, slightly curved and nearly equal in thickness, its distal tip angularly excavated ectad, the excavated area bears medium-sized long hairs; the second segment comparatively smaller, sub-cylindrical and appears slightly dilated at the distal end which bears longish hairs. Bursa copulatrix (*d*) saccular, slightly curved at the distal end. Spermatheca sub-ellipsoidal (*e*), its distal margin furnished with a circular rim.

Stegobium (Sitodrepa) panicea (L).

MALE. (Text-fig. 1, *f.*)

The lateral arch (*la*) of each side more or less distinct and descends ventrad almost perpendicularly from the phallobase (PHB), on each side they appear as arcs, ventrad they meet to form a short, stumpy convex hypomere (Hyp) which projects anteriorly and fits in with the ventral condylar portion of the ninth segment. The phallobase (PHB) fairly conspicuous. From the latero-ventral border of the lateral arches somewhat laterad to the exophallus originates, finger-shaped and rather long, left paramere (*prm.*); it is more or less uniform in thickness and somewhat curved near about the middle, distally slightly narrower and rounded off, with sensory hairs distributed over distal two-thirds; the right paramere thicker, considerably shorter than the left and spatulate, it arises ventrad to the leaf-like distal projection of the phallobase (PHB. *ex*) from its anterior margin and furnished almost throughout its length with short sensory hairs; at the base of the leaf-like extension of the phallobase, a pair of thick set spines visible (PHB *sp.*), proximally their pointed ends closely apposed. In contrast to the genus *Gastrallus* the exophallus (Exp) appears considerably modified so much so that three separate sclerites distinguishable, which appear to work in unison, the convex dorsal part (D) covers the endophallus (END) which when everted appears as a short, thin-walled projected process longitudinally striated in appearance, the lateral part of the exophallus (L) form the

¹Sharp, D., and Muir F., *Trans. ent. Soc.*, London. part III, p. 534 (1912).

² This setal arrangement of the tenth segment appears to be characteristic of the two families.

latero-ventral support of the composite exophallus, while the narrow winnow shaped portion (V) supports the latero-ventral (L) and dorsal (D) parts of the composite exophallus, the ventral part apparently acting as a fulcrum. The exophallic apodeme (ex. ap.) when present not distinct and apparently remains covered up by the ninth tergite. The ninth tergite bears a finger-shaped slightly curved process, its curved portion fits in with the projection of the hypomere (Hyp).

FEMALE. (Text-fig. 1, *g.*)

Tenth segment subquadrate, the division between the two plates on the dorsum appears incomplete as compared with the other genera, the fine suture running upto the distal two-thirds, the two portions run closely apposed and end almost to a point. The first segment of right cercus sub-cylindrical slightly dilated at the tip with an angular excavity ectad, the excavity furnished with fine setae ectad and entad ; the second segment originates from the distal excavity of the first and about half the length and one-third the thickness of the first with a fine long curled hair at the tip ; left cercus single jointed, sub-cylindrical and appears excavated entad throughout, with the distal end rounded off, its proximal edge bears inwardly a transverse notch the entire left cercus appears more deeply pigmented as compared to the right.

***Lasioderma serricorne* F.**

MALE. (Text-fig. 1, *h* ; Text-fig. 2, *a*, *b.*)

The lateral arches (*h*) appear to emerge from the phallobase (PHB) as a thin subtriangular lamina on each side progressively narrowed anteriorly, distally they surround the circular foramen ; exophallus (Ext) more or less tubular proximally somewhat oblique and uniform in thickness, no valve traceable on the exophallus ; exophallic apodeme (*ex.ap*) when present not broad and laminated ; the hypomere (Hyp) does not appear to be fused with the lateral arches, in fact, a thin suture present between them, distally the hypomere abruptly narrows to a point and its tip remains fused with the ventral region of the phallobase ; the phallobase peculiar in that it bears a two jointed process (PHB.sp.) the basal joint of which distinctly thicker than the terminal finger-shaped segment ; the parameres (*prm*) of each side peculiar in being trilobed (Text-fig. 2 *a.*) the three lobes differing from one another, the first (I) spatulate, narrow at base, concave and bears on its surface a large number of setae apparently sensory in function, the second (II) broad somewhat hollow at the base, finger-shaped, slightly curved and more or less uniform in thickness, the (I) and (II) appear to originate together from a common stem but the distal half of (II) remains very closely associated and enclosed within the groove of the third ; the third lobe (III) of the paramere peculiar in that its wall of one side near about the middle perpendicular to its long axis, this portion of (III) encloses the distal half of (II), the raised portion distally well rounded off and bears a distinct notch near about the tip, the raised portion of (III) enclosing (II) apparently prevents displacement and keeps the parameres in position, a

few hairs traceable near about the base and distal portions of (III), near about the tip of (III) a small but distinct tubercle traceable; the endophallus appears slightly curved near about the tip and when everted appears polymorphic at the terminal end, the endophallus bears inwardly characteristic groups of setae (Text-fig. 1, *h.*) and spines (Text-fig. 2, *b.*) of various shape and size, these act as claspers.

FEMALE. (Text-fig. 2, *c, d, e.*)

Tenth segment dorsally represented by a pair of broad plates which appear subquadrate and somewhat convex, narrower and rounded off at the distal margin; just meso-ventrad of the plates of tenth segment, fine backwardly directed setae in longitudinally placed compact group traceable, distad the plates furnished with a few short as also longish hairs; first segment of the cerci large, well rounded off distally and the tip excavated slantingly ectad, the excavated area bearing a few longish hairs, hairs present anteriorly on the body of the first segment, the second segment of the cerci subcylindrical, minute and vestigial bearing a few fine hairs at the tip; Bursa copulatrix, saccular, large with a pair of distinct circular cup-like structures (*d, bu. cu.*); spermatheca sub-ellipsoidal with a thick circular cap-like structure on top (*e*).

PTINIDAE

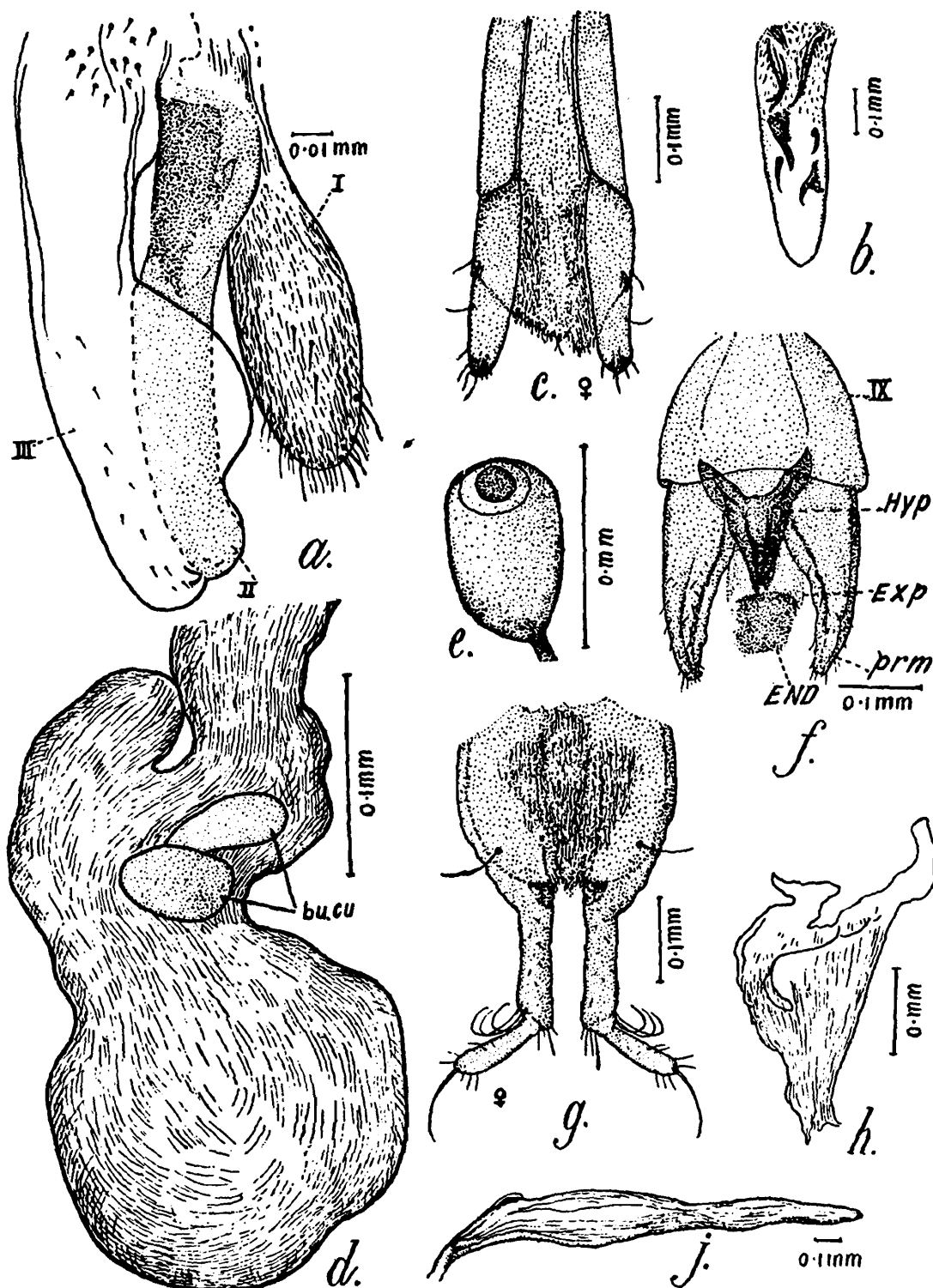
Gibbium psyllioides Czemp. 1778-(*scotias* F. 1781).

MALE. (Text-fig. 2, *f.*)

The male genitalia as compared to the Anobiids extremely simple. The parameres (*prm*) thick at base and tapering distally, sub-triangular, slightly curved distad with a broad groove running entad; thickly built hypomere (*Hyp*) tridradiate, the two proximal prongs directed angularly anterolaterad beyond the distal border of the ninth sternite; the distal median one thicker at the base, sub-triangular, with its narrow pointed end directed mesially distad, its distal margin reaching nearly the entire length of the thick set broad cylindrical exophallus; proximal half of the paramere appears to be intimately fused with the tenth segment ventrally with no trace of any lateral arches, between the prongs of the proximal arms of hypomere, a small roundish process present mesially, a small ellipsoidal perforation present in the hypomere dorsally which appears to communicate ventrally with a median longitudinal slit dividing the hypomere into two separate parts; apparently the well developed hypomere supports the fairly large exophallus; the cylindrical exophallus (*Exp*) with a wide circular opening at the tip and a fine longitudinal slit ventrad just above the distal prong of the hypomere; the endophallus (*END*)-the everted part broad, sub-cylindrical with its distal rim slightly narrower, no endophallic armature traceable.

FEMALE. (Text-fig. 2, *g. h. j.*)

Tenth segment subquadrate dorsally, with its inner margin more or less straight, mesoventrad the plates bear compact



Text-fig. 2—*Lasioderma serricorne* F., a., parameres; b., exophallic armatures; c., ♀ genitalia; d., bursacopulatrix; e., Spermatheca; f., *Gibbium psyllioides* Czemp. ♂ genitalia, END—endophallus; Exp—exophallus; HYP—hypomere; prm—paramere; g. ♀ genitalia; h. spermatheca; j. bursa copulatrix.

longitudinal group of backwardly directed setae; the first segment of the cerci large, sub-cylindrical and nearly equal in thickness, with its basal part excavated entad while the distal margin excavated angularly ectad, the excavity bearing longish hairs some of which extend beyond the second segment of the cerci, the second segment

sub-cylindrical well developed somewhat narrow anteriorly, and distally well rounded off bearing a group of short and longish hairs, the hairs on the distal extremity being definitely longer, the second segment appears to be set nearly at right angles to the first. Bursa copulatrix (*j*) elongated and saccular in a collapsed condition. Spermatheca appears irregularly shaped in a collapsed condition, a pair of polymorphic processes present at the two distal corners (*h*), the spermatheca opens at a distance of one-third proximal from the base.

ON THE BIONOMICS AND POST-EMBRYONIC DEVELOPMENT OF *EURYTOMA SALICIPERDAE* MAYR, A SUPPOSED CHALCIDOID PARASITE OF THE CECIDOMYIID OR GALL MIDGE *RHABDOPHAGA SALICIPERDA* (DUF.).*

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I.—INTRODUCTION.

Eurytoma saliciperdae† along with four other species (*E. aciculata*, *E. salicis*, *E. nobbei* and *E. dentata*) was first described from the Cecidomyiid galls by Mayr (1878). Of these *E. salicis* only appears in Morley's (1910) list of 23 *Eurytoma* as indigenous to British Isles. *E. saliciperdae* and *E. aciculata* have since been recorded from England as emerging from

*The work reported here was completed a few years back at the laboratories of the Imperial College of Science, London, but its publication had to be withheld owing to the outbreak of war and certain other unforeseen difficulties.

† The species was very kindly identified by late Dr. Waterston.

galls on willow plants (*Salix fragilis*, *Salix alba*) formed by the midges *Rhabdophaga saliciperda* and *R. triandraperda* respectively (Barnes, 1935 ; Sen, 1938 ; Callan, 1940).

The mere fact that *E. saliciperdae* lives in the same gall inhabited by the midge *R. saliciperda* led Sen (*loc. cit.*) to suggest that the species might be a parasite of the midge as did a few others in reporting on the *Eurytoma* species they studied (Lichtenstein, 1919 ; Urbahns, 1920 ; Barnes, *loc. cit.*). Recently, however, in pursuing the life-history of this insect more critically, its parasitic role could not be established and it transpired from all evidences that the species was primarily phytophagous.

II.—METHODS.

The galled stems of the willow *Salix fragilis* were opened up at frequent intervals and the developmental phases in the life-history of the insect noted.

Experiments were also conducted for studying the general behaviour and habits of the *Eurytoma* in captivity within glass cells similar to those designed by Balfour-Browne (1922) in his studies on the life-history of *Melittobia acasta*. The glass cells, about 8 mm in diameter and 3 to 4 inches in length, were closed at both ends with pieces of muslin. These cells contained different stages of the gall midge and into each was liberated a fertilised female *Eurytoma* to note its parasitic propensity, if any.

Microscopic preparations also were studied. For whole mounts the specimens were deeply stained in Carbol Fuchsin and treated in warm caustic potash solution (8 %) until sufficiently clear, dehydrated and then mounted in the usual way. Borax carmine was found unsuitable for mass staining. The earlier stages were mounted unstained in Berlese medium.

III.—BIONOMICS.

Eurytoma saliciperdae emerges as adults from the galled parts of the willow twigs sometime in May and June depending on temperature. In an incubator set at 26°C, the insects would emerge from the galled twigs even during the winter as discussed elsewhere. They are positively phototrophic on emergence and are poor fliers, often making peculiar leaping movements. The males appear to emerge earlier in the month and they constituted 43 per cent. of the emergences in a total of 223, in other words the sexes are represented in the proportion of two males to every three females. In captivity they do not live for more than 9 or 10 days.

The females lay eggs up to 12 in number in a chain soon after emergence with or without mating, but the eggs from the virgin females never hatch. The eggs with long distorted pedicels are laid on the cambium and can be seen on stripping the bark of the twig floating freely within the cell sap. The eggs hatch out into the minute larvae which persist till the last week of August. These undergo three moults growing in size after each moult and the maximum size is attained in March or April at the close of winter.

The larvae cause some amount of damage to the willow plants by tunnelling the woody tissue and usually lie separately, one in each burrow, almost next to the galleries inhabited by the gall midge larvae; very rarely two or three such burrows may become continuous. The number of *Eurytoma* larvae present in a gall and their proportion to the midge larvae are highly variable and largely depend on the size of the gall and the intensity of infestation as will be seen from the accompanying table (Table I).

TABLE I.

(*Relative abundance of Eurytoma and Rhabdophaga larvae in willow galls.*)

Sample No.	Total Rhabdophaga larvae.	Total Eurytoma larvae.	Ratio (1) : (2.) Per cent.
	(1)	(2)	
A	104	35	33.6
B	40	4	10.0
C	39	7	18.0
D	37	7	19.0
E	21	3	14.3
F	20	1	5.0
G	13	8	61.5

The larvae pupate towards the end of April or in May and the pupal period is short occupying 10 to 15 days only. The pupae are highly sensitive to the atmospheric changes and will not grow as a rule if they are exposed. The mature larvae however, are not so affected by this change since the full-grown larvae on being exposed may transform into the pupae.

The insects thus appear to possess one generation a year.

IV.—DESCRIPTION OF THE DIFFERENT STAGES.

(a) The Egg.

The eggs when newly laid are cylindrical in shape with the distal end tapering but with age they increase in size and assume a globular shape (Fig. 1,a) like that of the Braconid *Dacnusa areolaris* (Haviland, 1922). The egg is about 0.4 mm long and 0.3 mm broad. It has a long distorted pedicel with the tip slightly swollen at one pole. The pedicel which is used for attachment of the egg to the plant tissue shortens as the egg advances in age. At the other pole—the anterior end, the egg has a short slender stalk narrowed almost to a point apically. This structure sticking out of the cell-sap obviously assists respiration.

The chorion is smooth and blackish in an advanced egg. The embryos hatch out at a comparatively early stage owing to poor yolk contents of the eggs in this group of insects as already suggested by Imms (1919) for *Blastothrix britannica*.

(b) The Larva.

There are four larval instars in this species.

(i) *The First Instar.*

The newly hatched larva is transparent and cylindrical, the thoracic region being the widest part of the body (Fig. 1, *b*). The larva measures about 0.9 mm to 1.1 mm in length with a maximum width of 0.5 mm. The head is glabrous and the abdominal segments are undifferentiated without any appendages. Such incomplete segmentation of the abdominal region has also been noted in various other groups of Chalcid, Cynipid and Proctotrypidæ (Clausen, 1923; Parker, 1924; Marchal, 1906; Keilin and Pluvinel, 1913; Eastham, 1929).

A pair of papillae, the antennae, and four to six stiff bristles dorsally can be made out on the head. The bidentate mandibles are prominent but the maxillary and the labial areas are not well-differentiated. The labrum is hood-like covering the mandibles partially.

The respiratory system consists of a pair of spiracles situated nearer the posterior margin of the mesothorax; the tracheal trunks are ill-defined.

This stage is prevalent from the middle of July to late August.

(ii) *The Second Instar.*

In this stage the larva measures about 1.5 mm in length and 0.6 mm in width. The body-segments of the larva become distinct and it has a well-defined head slightly bent downwards.

The larva now possesses eight pairs of spiracles, one mesothoracic and seven abdominal, one in each of the first seven abdominal segments.

This stage is of short duration and prevails towards the end of August and the first week of September.

(iii) *The Third Instar.*

The third stage larva measures about 2.0 mm to 2.3 mm in length and 0.9 mm in width. These larvae differ from those of the preceding stage mainly in the respiratory system which now becomes typically holopneustic bearing nine pairs of spiracles, one pair each in the mesothorax and metathorax and the first seven abdominal segments. The head is more sharply differentiated and the larva appears somewhat brownish and opaque owing to greater development of the fat-body. The abdominal segments are distinct and the larva is arched ventrally. The mouth-parts are more strongly chitinised, and as the general pattern is the same, these have been described in the final stage.

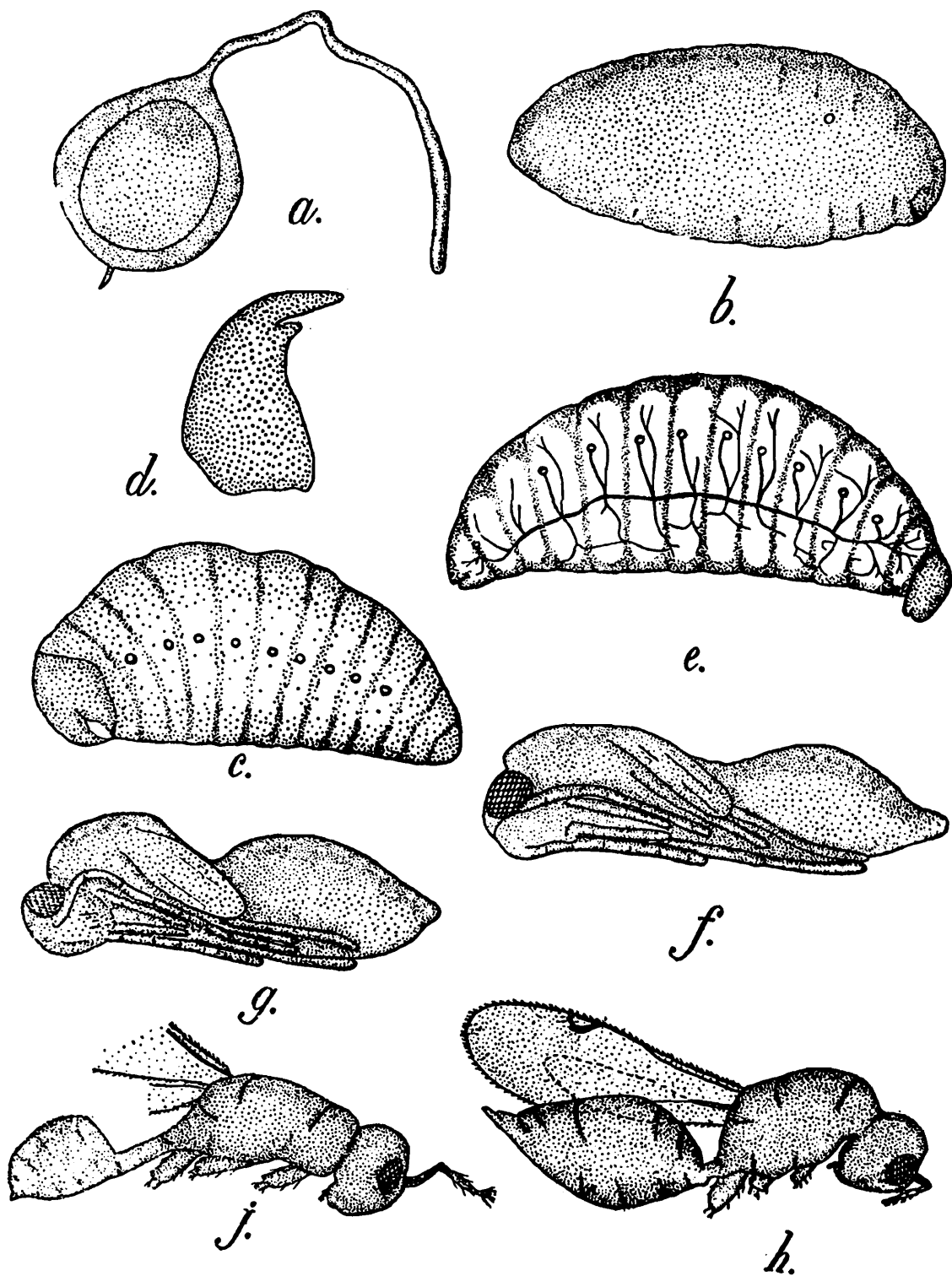
The third instar larvae are met with till late September.

(iv) *The Fourth Instar.*

The full grown larva (Fig. 1, *c*) varies considerably in size, the smallest measuring about 2.8 mm and the largest 3.7 mm in length with a width of 1.3 mm and 1.5 mm respectively. It is dark brown and highly opaque at this stage.

The bidentate mandibles have their dentition sharply edged (Fig. 1,*d*). Bordering the mandibles lie a pair of maxillary prominences, but the labium is imperfectly developed. The labrum becomes strongly chitinated.

The tracheal branches are highly developed with extensive ramifications which are best seen in a freshly killed specimen, otherwise the respiratory system resembles to that of the third instar larva (Fig. 1,*e*). The main longitudinal tracheae running laterally one on each side of the larva give off two cross branches on either side one going inwardly



TEXT. FIG. I. (a). Egg of *Eurytoma saliciperdae*. (b) First instar larva. (c) Final stage larva. (d) Mandible of larva. (e) Final stage larva showing tracheae of one seg. (f) Female pupa. (g) Male pupa. (h) Female *Eurytoma saliciperdae*. (j) Male *Eurytoma saliciperdae*.

and the other outwardly; these ultimately break up into the minute tracheoles in the different parts of the viscera. There is also another short tracheal transverse branch in each of the spiracle-bearing segments connecting the main trachea with the spiracle of its side.

The species normally winters in this stage.

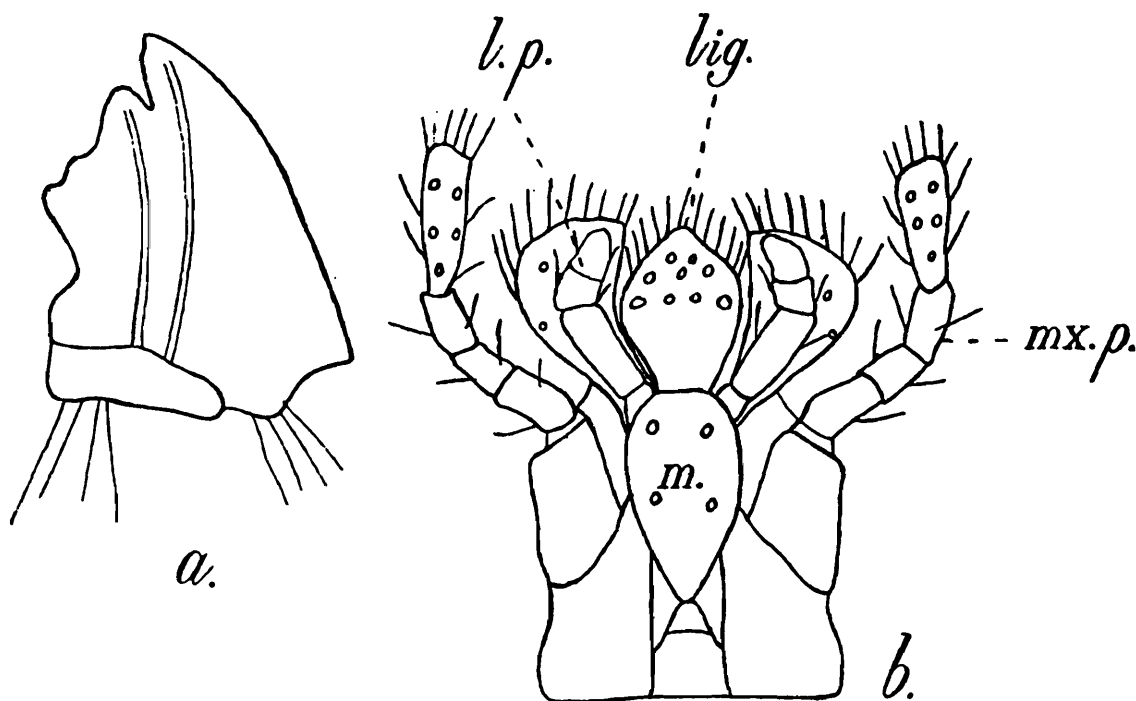
(c) The Pupa.

The pupae (Fig. 1, *f* and *g*) when newly formed are whitish but soon turn blackish and measure 2.2 mm to 3.0 mm in length. The pupae of both the sexes may be of equal size, but usually the male is smaller than the female. There are other characters also to differentiate the sexes. The antennal sheath in the male extends beyond the posterior extremity of the wing sheath; in the female it stops short of the wing sheath. The eyes of the male are usually pinkish and the male claspers are visible through the pupal sheath.

(d) The Imago.

The imagines (Fig. 1, *h* and *j*) are dark non-metallic in colour. The head is compressed antero-posteriorly and bears a pair of typical chalcidoid antennae provided with grooved sensillae and a few stiff hairs.

In the mouth-parts the mandible (Fig. 2, *a*) is roughly quadridentate of which the anterior pair is sharp and prominent. The maxilla bears

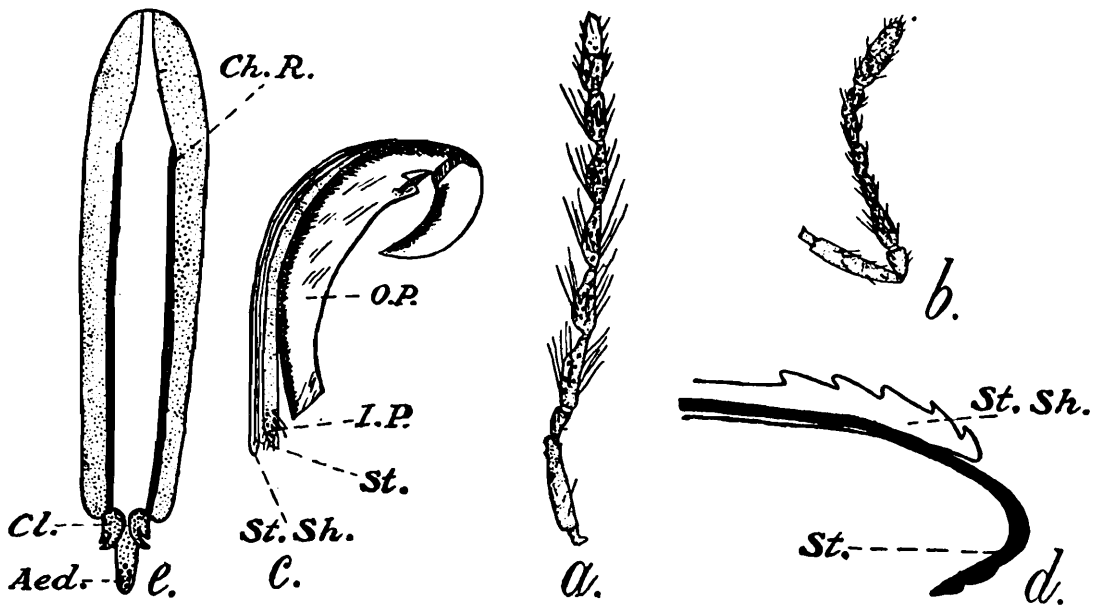


TEXT FIG. 2. (a). Quadridentate mandible of *Eurytoma saliciperdae*. (b) Maxillae and Labium of *E. saliciperdae*. (Abbreviations explained under Fig 3.)

a four-segmented palp of which the distal segment is usually the longest (Fig. 2, *b*). The labium is composed of a strongly chitinous basal piece, the mentum, and a distal portion the ligula provided with rows of strong setae. The submentum is rudimentary. The labium bears on either side a three-segmented palp of which the basal segment is the longest. The small labrum has a few minute setae.

(i) *The Female Characters.*

The female (Fig. 1, *h*) is distinctly larger than the male and measures about 3.2 mm in length. The head is nearly as broad as the thorax. The conspicuously肘ed antenna has the club composed of three segments (Fig. 3, *b*). The petiole is short and the abdomen is the widest part in the body which terminates in a pointed ovipositor.



TEXT-FIG. 3. (a). Antenna of male *E. saliciperdae*. (b) Antenna of female *E. saliciperdae*. (c) Female genitalia from side. (d). Tip of ovipositor showing the serrated nature of the stylet and the sheath. (e). Male genitalia.

Abbreviations used :

Aed, Aedeagus ; *Ch. R.*, Chitinous rod ; *Cl*, Clasper ; *I. P.*, Inner plate ; *l. p.*, Labial palpi ; *lig.*, Ligula ; *m*, *Mentum* ; *mx. p.*, Maxillary palpi ; *O. P.*, Outer plate ; *St.*, Stylet ; *St. Sh.*, Stylet sheath.

The ovipositor consists of a pair of slender tubular stylets which when expanded surpass in length the sheath enclosing the stylets (Fig. 3, *c*). The tips of the sheath and the stylets are serrated, the sheath having five teeth and the stylets two each (Fig. 3, *d*). Basally, the sheath and along with it the stylets diverge into a pair of arms, one on each side. The two pairs of chitinous plates, the inner and outer plates of Hymenoptera, are well developed. The inner plates are much narrower and lie closely apposed to the stylet sheath ; the apical ends of these plates are provided with certain sensory hairs. The outer plates are much wider and shorter and they terminate bluntly at the apex.

(ii) *The Male Characters.*

The male (Fig. 1, *j*) measures about 2.8 mm in length. The head is broader than the thorax and this constitutes the widest region of the insect. The antenna is larger than that of the female and is darker. The antennal hairs are larger and denser. The flagellar segments are separated by deep constrictions and the club is composed of two segments, (Fig. 3, *a*).

The petiole is long and slender and the abdomen short and thin. In the external genitalia the cylindrical aedeagus is enclosed in a saccular

sheath and supported by a pair of chitinous rods one on each side at its base. Its tip is provided with a few genital papillae, and a pair of claspers lie ventral to the structure (Fig. 3,e).

V.—THE HABITS OF THE IMAGINES.

(a) *Emergence.*

The imago cuts a hole by means of its sharp mandibles on the bark of the tree in the act of emergence with characteristic side to side revolving movements of the head. In this process the antennae come out first through the hole, then the head is pushed out and thus the insect gradually frees itself from the burrow. The whole process takes about 35 to 40 minutes.

The newly emerged insect is very weak and does not move from the site of emergence for sometime. The wings remain closely apposed to the body of the insect at this time. They are soon released by working the hind legs in between the wings and the body. The wings are then brushed clean by the sweeping movement of the spurs in the hind legs. All the rubbish is then passed on to the mid-legs and from there to the front legs which also help to clean the antennae by alternately grasping them within the front tarsi and releasing with slow pulls. The waste matter thus accumulated on the front legs is eventually passed to the mouth to be devoured by the insect. This cleaning process takes about 15 to 20 minutes.

(b) *Courting.*

The male soon after emergence finds out his mate and brings his antennae close to the female. The female usually responds by moving towards the male and her antennae then become interlocked with those of the male. The male mounts on the back of the female while mating and remains in this position for nearly an hour.

(c) *Oviposition.*

The female *Eurytoma* when ready to lay her eggs first moves about the host plant for a short while in search of a suitable spot which is almost always in the vicinity of the previous years' attack. When the spot is found her ovipositor is brought in contact with the bark. The ovipositor can now be seen to be slowly expanding and contracting in the act of penetrating the bark; when sufficiently penetrated she starts to deposit the eggs usually laying one at a time. The number of eggs laid by a female under natural conditions is difficult to determine as the eggs are not laid at one place.

VI.—EXPERIMENTAL.

Since evidence of parasitisation by *E. saliciperdae* was not noticed under natural conditions a number of experiments was set up to induce these insects to parasitise the gall midges in artificial cells. The fertilised females of the chalcid were introduced to the special glass cells one in each containing either (i) the living larvae of *R. saliciperda* or (ii) their

pupae or (iii) the eggs. The result of five sets of experiments under each head is given below (Table II) :—

TABLE II.
(Experiments to study parasitisation of *E. saliciperdae*.)

Series.	Date Eurytoma introduced.	No. of Eggs laid.	Date Eurytoma died.	Remarks.
(With larvae of <i>R. saliciperda</i>).				
(1)	11-5-29	1	16-5-29	Larvae of <i>saliciperda</i> unattacked. Eurytoma eggs laid on glass surface.
(2)	11-5-29	12	16-5-29	
(3)	14-5-29	2	19-5-29	
(4)	14-5-29	4	19-5-29	
(5)	1-6-29	7	4-6-29	
(With pupae of <i>R. saliciperda</i>).				
(1)	21-5-29	6	23-5-29	Pupae of <i>saliciperda</i> unattacked. Eurytoma eggs laid on glass surface.
(2)	21-5-29	1	23-5-29	
(3)	1-6-29	3	3-6-29	
(4)	3-6-29	2	7-6-29	
(5)	3-6-29	4	8-6-29	
(With eggs of <i>R. saliciperda</i>).				
(1)	26-6-29	3	2-7-29	Midge eggs unattacked. Eurytoma eggs laid on glass surface.
(2)	26-6-29	2	2-7-29	
(3)	26-6-29	6	4-7-29	
(4)	28-6-29	4	3-7-29	
(5)	28-6-29	1	4-7-29	

The result obtained from the above table may be summarised as follows : (a) *Eurytoma saliciperdae* females did not attack the eggs, larvae or pupae of the gall midge *Rhabdophaga saliciperda*, (b) *Eurytoma* laid 1 to 12 eggs in captivity and (c) *Eurytoma saliciperdae* females lived for 3 to 9 days.

VII.—INCUBATION.

Series A.

With larvae inside galled twigs.

21-3-29.—A galled twig of *Salix fragilis* infested with the larvæ of both *R. saliciperda* and *E. saliciperdae* was placed in an incubator at about 26°C.

12-4-29.—Pupation of *Eurytoma* was noticed a week after that of the *Rhabdophaga*.

19-4-29.—Four *Eurytoma* males were obtained twelve days after *Rhabdophaga* started emerging.

20-4-29.—Another lot of *Eurytoma* of which only one was female was obtained.

25-4-29.—Last emergence of *Eurytoma* recorded ; females prepondered.

Conclusion.—The *Eurytoma* larvae were ready to pupate after three weeks' stay at summer temperature within the incubator. The pupal duration lasted about a week. The males emerged first and then the females ; the emergence continued for a week.

Series B.

With larvae removed from the galls.

12-11-30.—Mature larvae of *E. saliciperdae* were placed in a petri-dish with moistened sterilised sand and kept in an incubator at about 22°C. The sand was kept moist throughout the experiment.

24-11-30.—The larvae started pupating, the early pupae being whitish.

4-12-30.—The imagines began to emerge.

Conclusion.—The larvae started pupating after twelve days' stay inside the incubator at 22°C and the pupation lasted for ten days. This difference in the number of days from that observed under *Series A* where the larvae were incubated at 26°C while still inside the galls depended on two factors—the absence of food, the larvae being removed from the galls, and the altered temperature condition. While the absence of food in the present series and a comparatively lower temperature hastened the pupation of the insect, the pupal life on the other hand lengthened at this lower temperature.

VIII.—DISCUSSION.

The *Eurytomidae* are of variable habits, some among them may be parasitic but there are others which are not only phytophagous living either as guests in galls of other insects or as pests but may even be gall-producers themselves like *Eurytoma fellis* (Noble 1933). From the present study *E. saliciperdae* appears to be strictly phytophagous living in the same gall with *R. saliciperda* as an inquiline. The species has not been observed to parasitise the gall midge *R. saliciperda* at any stage of its development.

Many *Eurytoma* which were considered as parasitic on Cecidomyiidae at one time proved false on closer observation ; *E. tylodermatis* is a recent example (Berry, 1947). On the contrary, they constituted in most such instances, pests to the plants themselves as in the present instance (Westwood, 1882 ; Urbahns, *loc. cit.*). And many among those which are parasitic in habit have been known to attack not only certain pests injurious to a plant but other insects as well equally important as parasites of the pests concerned. The *Eurytoma* sp. attacking both the clover stem-borer *Languria mozardi* and its parasite *Habrocytus languriae* affords an instance for illustration (Wildermuth and Gates, 1920). The importance of *Eurytoma* at least in instances where it is a parasite of the nature cited above is therefore of a low order.

Besides, the parasitic role played by many Eurytomid is greatly overshadowed by the subsequent damage they cause to the plant owing to many of them taking up a simultaneous liking for the phytophagous mode of feeding. *Eurytoma parva* for example, a parasite of *Harmolita* (*Isosoma*) *tritici* infesting wheat plants has been reported to cause more damage than the recognised pest by continued feeding inside the plant tissue when the primary pest *Harmolita* was inactivated (Phillips, 1927). Similar digression into the phytophagous mode of feeding among Chalcidoidea is taken as a secondarily acquired character evolved as a result of severe struggle for existence. (Brues, 1921).

Many earlier workers consider the pedicel in the eggs of Eurytomidae as respiratory in function (Adler, 1881 ; Cameron, 1890 ; Imms, *loc. cit.*); accordingly the length of the structure is greater in eggs laid deeper in the plant tissue than those laid superficially (Cameron, *loc. cit.*). Riley (quoted by Sharp, 1910), on the other hand, took this as an organ of attachment as confirmed by the present study in *E. saliciperdae*. The respiration in the egg is carried out by the stalk-like prominence at the anterior end. The pedicel in *E. saliciperdae* eggs has been noticed to reduce in size with the egg advancing in age, and the view that its length is proportional to the depth of the site of deposition of the eggs cannot therefore be supported. With regard to this organ Haviland (1921), however, pursues a middle course ; she observes pedicel to function for both the respiration and attachment in certain eggs.

Parker (*loc. cit.*) mentions of three instars only in the several *Eurytoma* he studied as opposed to four instars noted in *E. saliciperdae* in the present study, a condition corroborated in *Eurytoma fellis* by Noble (1936). Parker must have missed one of the stages and possibly the first, since the stage described as first by him showing four pairs of spiracles or even five pairs according to Phillips (*loc. cit.*), in fact corresponds more closely to the multi-spiracular second instar larva in *E. saliciperdae* where the first instar larva as mentioned above shows one pair of spiracles only, a condition not detected before in the *Eurytoma*.

The reason for missing one of the stages in the larval development of *Eurytoma* is not difficult to understand. It is extremely difficult to follow the moultings in the same individual larva inside the gall, and once exposed it will not grow well. This difficulty was mitigated in the present study by observing many individuals of the same age

often as possible through several years, a method indicated by Eastham (*loc. cit.*). The changes in the respiratory system of the *Eurytoma* larvae following each instar also afforded a reliable guide to differentiate the various instars.

SUMMARY.

1. *Eurytoma saliciperdae* is not a parasite of the gall midge *Rhabdophaga saliciperda* as has been hitherto believed but a phytophagous inquiline chalcidoid insect damaging the willows (*Salix fragilis*) to a certain extent along with the midge whose galls it inhabits.

2. The life-history of the insect has been fully dealt with ; it has one generation a year, and the imagines emerge during May and June in nature. The males comprised 43 per cent. of the total emergence. The female in captivity lays not more than 12 eggs and she may live upto 9 days. The insect normally winters in the last larval stage.

3. The eggs are laid inside the bark, each being attached to the tree by a long pedicel which shortens with age. The different interpretations on the function of the pedicel have been discussed.

4. Four larval instars have been detected in the *Eurytoma* described here. The first instar larva possesses a pair of spiracles on the mesothorax. In the second instar, the number increases to eight pairs, one mesothoracic and seven abdominal ; the last two instars are typically holopneustic possessing nine pairs of spiracles including the two pairs in meso-and metathorax.

5. The pupal and imaginal features with special reference to the male and female characters are given.

6. Experimental evidence to show the non-parasitic habit of the species towards the different stages of the gall midge has been detailed.

7. Results of incubating the larvae of *Eurytoma saliciperdae* while both inside and outside the galls and at altered temperature conditions show that the time required to be ready to pupate and the period of pupation which is normally 10 to 15 days may somewhat vary with the temperature.

ACKNOWLEDGMENTS.

I am deeply indebted to Professor J. W. Munro of the Imperial College of Science, London for his guidance and help during the progress of the work. My thanks are due to Dr. Ferriere of the British (Natural History) Museum for his readiness to discuss connected matters with me.

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A NEW SEMI-PARASITIC COPEPOD FROM AN ESTUARINE ACTINIARIAN OF MARDAS.

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Reporting on the structure, bionomics and systematic position of two halocamptid actiniarians found in the brackish waters of Adayar, Madras, Panikkar (1936) had noted the presence of a large number of copepods living in the gastral cavity of *Phytocoetopsis ramunni*. The present author is indebted to Mr. S. Krishnaswamy, M.Sc., of this department for finding a large number of these in the specimens stored in the laboratory. Later more were obtained by the author and the present paper is based on a study of nearly 32 males, 20 females and 10 immature forms of this lichomolgid cyclopoid. Since this was found to differ from the species described before, it is treated as a new species *Lichomolgus panikkari*, sp. nov. and a full description is given here.

***Lichomolgus panikkari*, sp. nov.**

THE FEMALE.

Size.—Mature adults including egg-bearing forms varied from 2.7 mm. to 3.1 mm. with an average length of 2.9 mm., exclusive of caudal rami. Of the 12 species of this genus, this is probably the largest.

Body.—The form is typically cyclopoid with the first thoracic segment faintly demarcated from the cephalon. The cephalothorax is as broad, *if not slightly broader*, as long. The dorsal surface is convex with the edges curving ventrally and free of surface markings. The four free segments are of decreasing length and breadth. The genital segment which follows is far longer but resembles a truncated funnel in shape and is posteriorly half as wide as it is in front. The egg sacs were unequal in size in the five females which bore them. The eggs were few compared to the size of the sac and were found lumped together inside. The walls of the sacs were very thin and in some females the sac had evidently been torn away leaving the egg-mass clinging to the spines of the vestigial V or VI pairs of legs. The abdomen is of three segments of decreasing width and length. The caudal rami were longer than the last two abdominal segments put together but narrow, their width being less than a fifth of the length. Each ramus bears a long spine on the external margin, half way down the length and four spines on the apex.

The appendages.—The first antenna is of seven segments. If its total length is of 241 units, the different joints are of 40, 51, 26, 32, 42, 26, 24 units, the second joint being the longest. The spines borne were long and alike. The *second antenna* is four-articled. If the entire appendage is 155 units long, the joints are 60, 35, 20 and 40 units in length, the first being the longest. The first two joints bear a spine

each, the third bears two spines and the last bears six spines of which "one is stout and straight and another is stout and curved like a claw". The *labrum* is deeply cleft and covers the mandibles and the maxillae. The *mandible* is two-articled, the foliaceous distal joint having a long acuminate tip and margins fringed with spinules. It appears capable of being folded with the margins lying one over the other. The *first maxilla* also is two jointed. The distal ventrally directed joint bears two long spines while the proximal carries a long stout tapering lappet fringed with spines. The *second maxilla* is three jointed. The proximal segment is broad, while the terminal of the two tapering joints, ends in a long stout spine and a long lash on which the spines diminish in size towards the free tip. The *maxillipede* is of three stout tapering joints. The middle joint bears two branched spines, while the distal sharp-tipped joint carries two short tooth-like spines.

The first three pairs of swimming legs are similar and biramus, the rami being three-articled. The fourth swimming leg has a three jointed exopod and a two segmented endopod. On these four legs, typical plumose natatory setae are borne as follows :—

I Exopod-0, 1, 4 ; Endopod-1, 1, 4 ; II-0, 1, 5 ; 1, 2, 3. III-0, 1, 5 ; 1, 2, 2. IV-0, 0.5 ; 1, 3. The legs bear spines on the joints of their rami as follows :—I Exopod-1, 1, 4, Endopod 1, 1, 5. II-1, 0, 3 ; 1, 1, 5. III-1, 0, 2 ; 1, 1, 5. IV-1, 0, 2 ; 0, 4. These spines are either chitinous emergences or are stout long articulated spines which show traces of their setal character. The latter kind are of three different types, (a) sharp pointed spines with reduced hairs, (b) blunt, smooth spurs, (c) serrately-toothed spines. Three of the last type are found on the exopod of the first leg. The fifth leg is reduced to a single joint and is more lateral in its articulation to the fifth thoracic segment. At its base a small swelling bears a long spine while at the slightly tapered apex, there are two long spines. The proportion of the width to the length of the single joint forming the fifth leg measured in about eight specimens selected at random ranged from : 2.75 to 1 : 4, with an average of 1 : 3. There appears to be a certain amount of individual variation. The sixth leg is more vestigial than the fifth and is more easily seen on the sides of the genital segment of females which do not bear egg-sacs. It consists of two spines one far longer than the other springing from separate swollen bases.

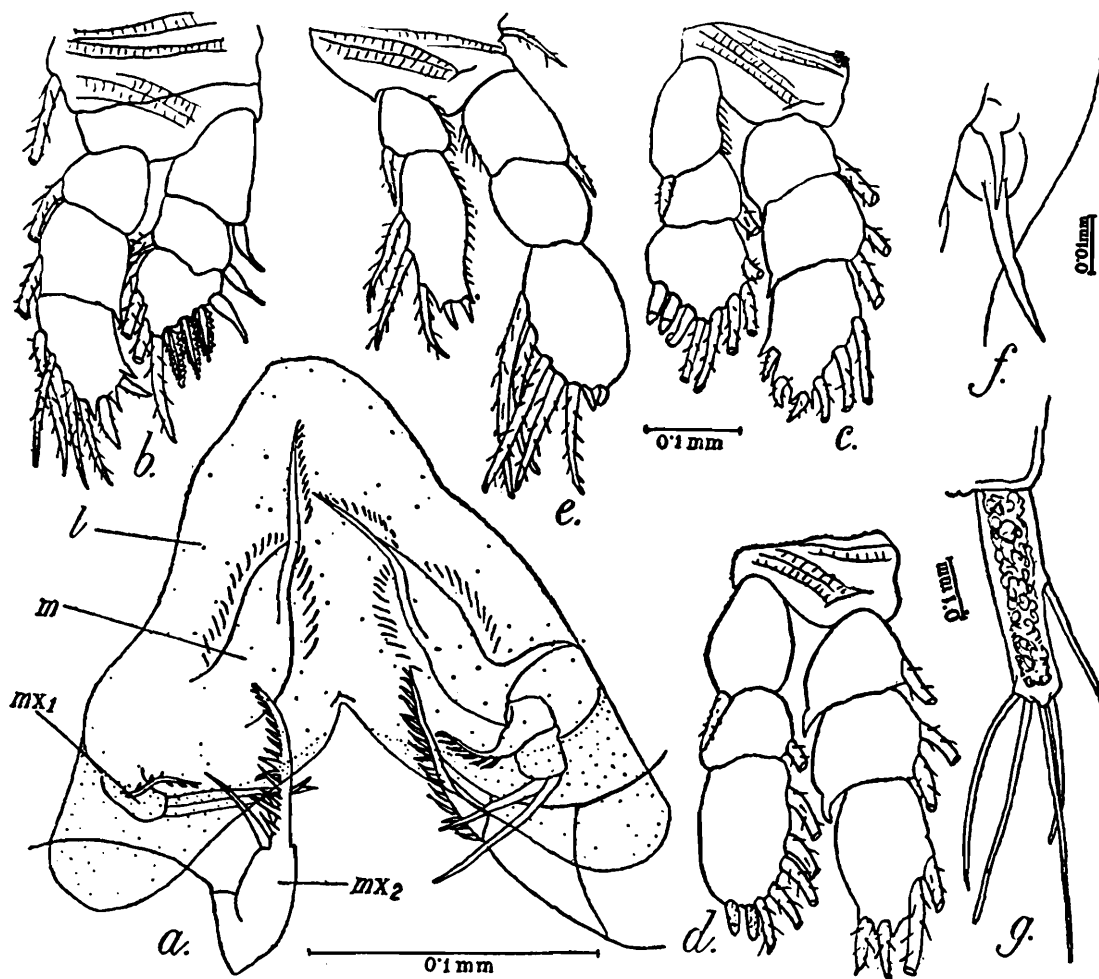
THE MALE.

Size.—Mature adults vary from 2.4 mm. to 2.8 mm. with an average length of 2.7 mm. exclusive of caudal rami.

Body.—The body appears more slender because of the cephalothorax, though slightly longer than in the female, is proportionately far narrower. In a male measuring 190 units long, the cephalothorax is 68 units long and 60 units broad while in a female 200 units long, it is 72 units long and 80 units broad ; the free segments are therefore narrower than in the female. The genital segment however is broader than in the female and its lateral margins being markedly convex distinguishes the male.

The abdomen is of four segments, more or less equal in size. The caudal rami are as in the female.

Appendages.—The first and second pairs of antennae, the mandibles and the two pairs of maxillae are as in the female. The *maxillipede* however is characteristic. The distal of the three joints is long and narrow capable of folding against the second like a chela. This hand is grooved and the two edges though devoid of teeth are rough and suited for prehension. The first two joints bear two spines each, the claw bears three spines.



TEXT-FIG. 1. *Lichomolgus panikkuri*, sp. nov.; a, adult female $\times 80$; b, First antenna $\times 200$; c, Second antenna $\times 200$; d, mandible $\times 600$; e, First maxilla $\times 600$; f, maxillipede $\times 200$; g, fifth leg $\times 400$; h, serrate spines of exopod of first leg $\times 800$

The six pairs of thoracic legs are as in the female, the sixth being more conspicuous since the sides of the genital segment are convex in the male.

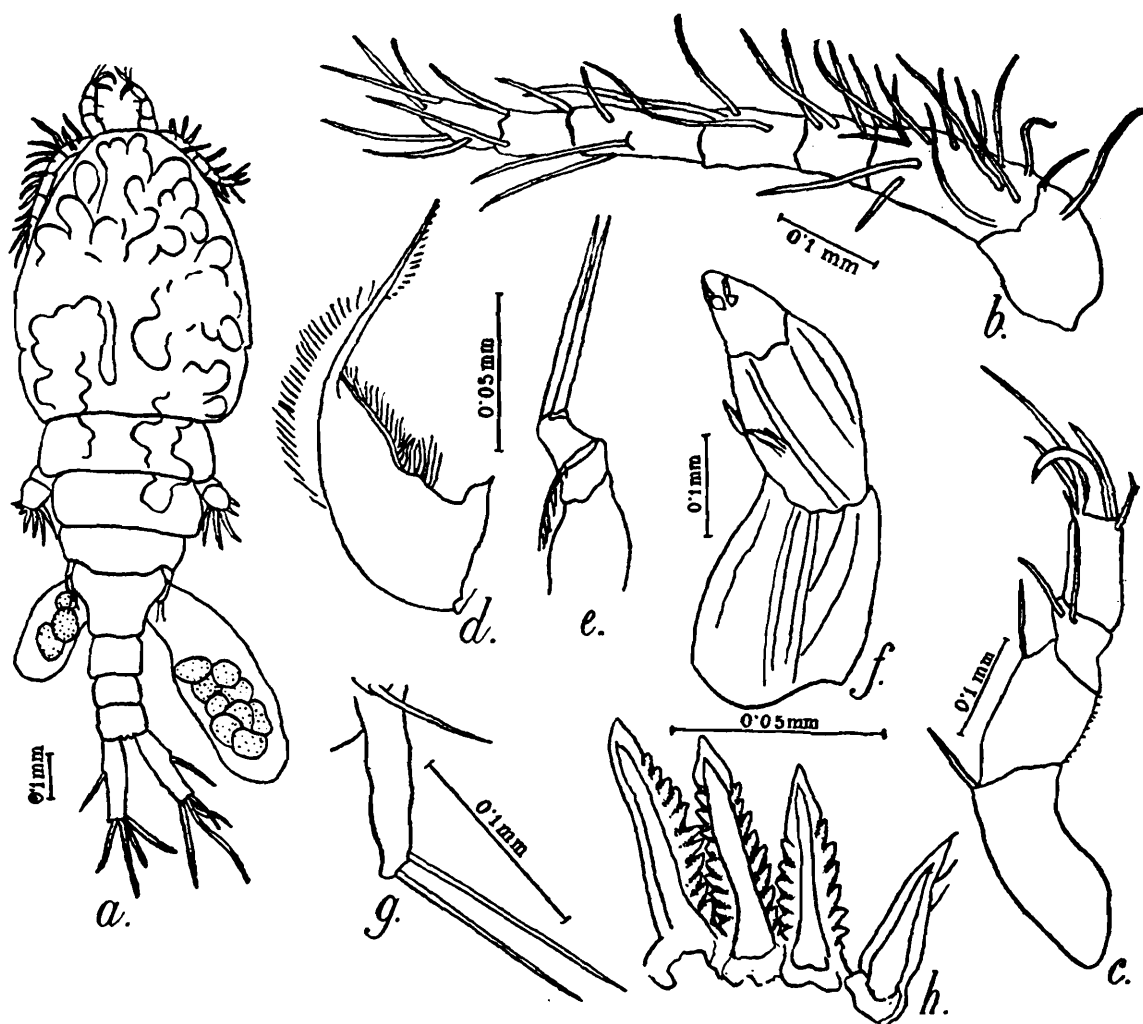
The Immature forms.—Of the ten collected, nine belonged to the fifth copepodid stage, four being males and five females, and the tenth belonged to the fourth copepodid stage.

The fifth copepodid ranged from 1.7 mm. to 2.5 mm. in length. The males had only three abdominal segments like all females, mature and immature, but the features of the adult male are already foreshadowed. In a male measuring 1.50 mm. long the cephalothorax is 50 units long but only 47 units broad, while in a female 1.75 mm. long, it is 55 units long and as broad, the female appearing broader than the

malc. The genital segment however appears broader in the male than in the female, as in the adult state. The maxillipede of the male shows a rudimentary claw like spine at its tip, though the form of the appendage and other spines are as in the female.

The fourth copepodid measured 1.5 mm. in length and did not show any indication of sex. There were only two abdominal segments so that there were eight segments in the whole body, including the cephalothorax. These eight segments had the following proportions of length and breadth. Cephalothorax 50, 53; free thoracic segments 10, 42; 12, 30; 8, 21; 6, 15; genital segments 8, 12; abdominal segments 6, 10, 7, 8 units. The caudal rami were proportionately shorter being about only thrice the width. If the lengths of the first antennae of the adult and of the fourth copepodid are adjusted to 100 units, the measurements of the seven joints would compare as follows:—

IV $\frac{\text{Copepodid}}{\text{Adult.}}$ $\frac{14}{16.5}, \frac{20}{21}, \frac{7}{11}, \frac{12}{13}, \frac{20}{17.5}, \frac{14.5}{11}, \frac{12.5}{10}$, Fewer setae were borne by the different segments in the larva, than in the adult. With regard to other appendages, which were similar to those of the adult, the absence of serration on all the spines of the exopod of the first leg may be noted.

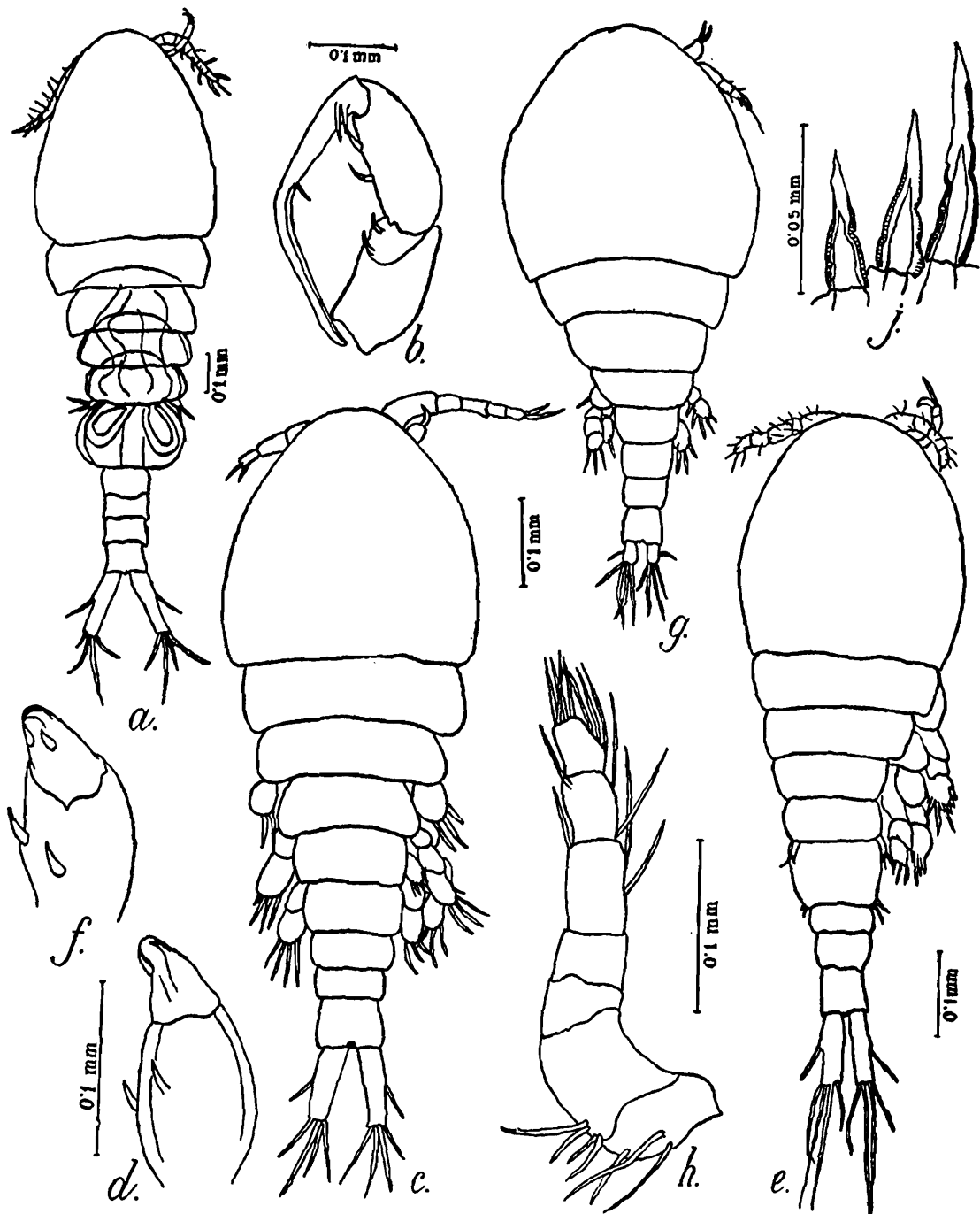


TEXT-FIG. 2. *Lichomolgus panikkari*, sp. nov : a, Labrum and mouth appendages $\times 600$; b, First leg $\times 200$; c, Second leg $\times 200$; d, Third leg $\times 200$; e, Fourth leg $\times 200$; f, Sixth leg $\times 200$; g, Caudal ramus $\times 120$; l, labrum; m, Mandible; $m \times 1$, First maxilla; $m \times 2$, Second maxilla.

Taxonomic remarks.—That this lichomolgid cyclopoid belongs to the genus *Lichomolgus* is clear from the fact that only two genera

Macrochiron and *Lichomolgus* are distinguished by a seven-articled first antenna as well as two-jointed endopodites of the IV leg. *Lichomolgus* is distinguished from *Macrochiron* by its relatively shorter and wider Vth leg and by the second maxilla having the lappet long and not dilated at base.

Sewell (1940) in his report on the littoral and semi-parasitic cyclopoidea reviews the position of several species of the genus and accepts seven as valid. These (1) *L. gracilis*, (2) *L. jeversi*, (3) *L. Lankhensis*,



TEXT-FIG. 3. *Lichomolgus panikkari*, sp. nov.; a, adult male $\times 80$; b, maxillipede $\times 200$; c, Fifth copepodid female $\times 200$; d, maxillipede of female $\times 400$; e, Fifth copepodid male $\times 200$; f, maxillipede of male $\times 400$; g, Fourth copepodid $\times 200$; h, First antenna $\times 400$; j, spines of exopod of first leg $\times 800$.

(4) *L. elegans*, (5) *L. gigas*, (6) *L. dentipes* and (7) *L. robustus* had been established by Thomson and Scott (1911) and recorded from the Indian Ocean. Gurney (1927) added (8) *L. aegypticus*, (9) *L. vagans* and (10) *L. faxi*. Two more species (11) *L. spondyli* (1936) and *L. rotundus* (1949)

were added by Yamaguti and Sewell respectively. Detailed comparisons of the present species with these are made difficult because of insufficient data. However, from the available description and figures, it can be seen that they differ from the present form in several respects. The form and size of the present species, especially in relation to the abdominal segments, differ from *L. gracilis*, *L. lankhensis*, *L. elegans*, *L. gigas*, *L. aegypticus*, *L. vagans*, and *L. rotundus*. In the abdominal segments being nearly equal, it is distinct from *L. dentipes* and *L. robustus*. The terminal segment of II antenna has a larger number of apical claws in *L. jeversi*, *L. foxi*, *L. aegypticus* and *L. rotundus*. The proportion of the length to the width of the single joint of the fifth leg has been found to be either twice or six times in most of the species. In the present form it varies from three to four times. The unique feature of the present form in possessing four plumose setae on the endopod of the fourth leg taken together with the facts that it is larger than all other known species in size and that it lives in the gastral cavity of actinarians, mark the present form as belonging to a species not described before. This new species *Lichomolgus panikkari* can be defined as follows :—The first thoracic segment faintly demarcated ; posterior to this segment, the body is slightly longer than the anterior half ; the second antenna bears one hook, a stout spine, and four other spines terminally ; the genital segment is broad in front and narrows behind ; it is as long as the last two abdominal segments, the furca is three-fourths the length of the abdomen and bears a lateral spine and four long terminal spines ; the exopod of first leg has three serrate spines absent in the fourth copepodid stage of development ; the endopod of fourth leg bears four plumose setae ; the fifth leg is thrice as long as wide and has two apical spines ; and the sixth leg is reduced to two short spines.

The types.—Both the holotype (♀) and the allotype (♂) are deposited in the Indian Museum collections of the Zoological Survey of India, Calcutta.

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CATALOGUE OF BIRDS IN THE INDIAN MUSEUM.

III. CAPITONIDAE (BARBETS).

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INTRODUCTION.

Parts I and II of the *Catalogue* by Roonwal (1941, 1947) dealt with the collections of Columbæ and Pterocletes of the Indian Museum. The work had to be discontinued by him, due to his appointment in 1945, as Mammalogist to the G. H. Q. (I), Indian Field Typhus Research Team. In 1949 he was appointed as the Forest Entomologist, Indian Forest Research Institute, Dehra Dun. The author who is working in the Bird Section of the Indian Museum has undertaken to continue the cataloguing work. The present contribution dealing with the barbets forms the third part of the series.

During World War II, the Zoological Survey of India, which is the custodian of the zoological collections of the Indian Museum including those of the Asiatic Society, was shifted, with all its collections, in 1942 from Calcutta to Banaras, and was housed there in a building on the bank of the Varuna river. In September 1943 an unforeseen and unprecedented flood of the Varuna river played havoc with the collections : a part of the material was submerged under water for three days before it could be salvaged. Many skins were washed away, a number of them had to be discarded being so thoroughly drenched, and many have lost all their history, their labels being washed away, so that they do not serve any practical purpose. Furthermore, many old skins could not withstand the rigors of packing and repacking during transfer from and to Calcutta. It is pitiable indeed that among the lost material a good number of specimens were from now inaccessible places, like Yunnan, Shan States (Burma), and Yarkand. The loss to the collections as calculated in the family *Capitonidae* alone was 69 per cent. However, since the catastrophe the staff of the Zoological Survey of India has been making every possible effort to restore the damaged collections by repairing whatever was possible, but mostly by adding new material. The collections went on accumulating for more than a hundred years when the disaster came ; this fact alone may give the reader an idea of the magnitude of the project of replacement before the Survey.

At the present moment there are 174 specimens of barbets in the Indian Museum collections, on which this catalogue is prepared. This number includes recently collected specimens, old undamaged skins and those salvaged from flood damaged lot.

As far as possible information on the following points for each specimen has been given :

(i) Zoological Survey of India Registered number ; (ii) number given in Blyth's (1852) catalogue, (iii) Sex ; (iv) Locality ; (v) Date of collection ; (vi) Collector or Donor, and (vii) Measurements. Miscellaneous information has been given under 'Remarks'. Unless otherwise stated all specimens are adults.

As for the synonymy, I have given under each form the original reference and any subsequent modifications made after the publication of Peters' (1948) check list. I have given my remarks on the taxonomy when called for.

In the *Fauna of British India*, Baker (1927) accepted six genera of barbets within the Indian limits (India, Nepal, Pakistan, Burma and Ceylon). Ripley (1945), followed by Peters (1948) and Biswas (1953), recognised only two genera within the above defined area. The generic names as used by Baker (1927), Ripley (1945), Peters (1948) and Biswas (1953) are as follows :—

Baker (1927).		Ripley (1945), Peters (1948) and Biswas (1953).	
1. <i>Megalaima</i> G. R. Gray		}	<i>Megalaima</i> G. R. Gray
2. <i>Thereiceryx</i> Blanford	.		
3. <i>Chotorhea</i> Bonaparte	.		
4. <i>Cyanops</i> Bonaparte	.		
5. <i>Xantholaema</i> Bonaparte	.		
6. <i>Calorhamphus</i> Lesson	.	.	<i>Calorhamphus</i> Lesson

For the Indian species and subspecies I have followed Peters (1948) as far as possible. In some cases, however, I have differed from him, and such instances have been discussed in appropriate places.

The following species and subspecies are listed in the present catalogue :—

1. *Megalaima virens marshallorum* Swinhoe
2. *Megalaima virens magnifica* Baker
3. *Megalaima virens clamator* Mayr
4. *Megalaima virens virene* (Boddaert)
5. *Megalaima lineata hodgsoni* Bonaparte
6. *Megalaima lineata kutru* Mukherjee
7. *Megalaima zeylanica zeylanica* (Gmelin)
8. *Megalaima zeylanica inornata* Walden
9. *Megalaima zeylanica caniceps* (Franklin)
10. *Megalaima viridis* (Boddaert)
11. *Megalaima mystacophanos mystacophanos* (Temminck)
12. *Megalaima flavifrons* (Cuvier)
13. *Megalaima franklini franklini* (Blyth)
14. *Megalaima asiatica asiatica* (Latham)
15. *Megalaima asiatica davisoni* Hume
16. *Megalaima henrici* (Temminck)
17. *Megalaima pulcherrima* Sharpe
18. *Megalaima australis cyanotis* (Blyth)
19. *Megalaima australis duvauceli* (Lesson)
20. *Megalaima haemacephala indica* (Latham)
21. *Calorhamphus fuliginosus hayi* (J. E. Gray)
22. *Calorhamphus fuliginosus fuliginosus* (Temminck)
23. *Gymnobucco peli* Hartlaub
24. *Pogoniulus pusillus uropygialis* (Heuglin)
25. *Tricholaema melanocephalum melanocephalum* (Cretzschmar)
26. *Lybius undatus thiogaster* Neumann

The following species and subspecies although occur within the Indian limits are not represented in our collections :—

1. *Megalaima incognita* Hume
2. *Megalaima australis stuarti* (Robinson & Kloss)
3. *Megalaima franklini ramsayi* (Walden)
4. *Megalaima rubricapilla* (Gmelin)

I am indebted to the authorities of the Bombay Natural History Society and the Bengal Natural History Society, for the loan of some specimens for my study. I am grateful to Dr. S. L. Hora, Director, and Dr. B. Biswas, Assistant Superintendent, Zoological Survey of India, for critically reading through the manuscript and suggesting improvements.

Order PICIFORMES

Suborder GALBULAE

Superfamily CAPITONOIDEA

Family CAPITONIDAE

Genus *Megalaima* G. R. Gray

Megalaima virens (Boddaert)

The species ranges throughout the Himalayas from West to East and through Upper Burma extends to Eastern and Southern China, South to Tenasserim, Northern Siam and Northern Annam.

In the Indian Museum collections all the four subspecies admitted by Peters (1948) are represented.

Megalaima virens marshallorum Swinhoe

(The great Western Himalayan barbet)

1870. *Megalaima marshallorum* Swinhoe *Ann. Mag. nat. Hist.*, (4), 6 : 348 - Simla, Western Himalayas.

Megalaima virens marshallorum is represented by the following skins :—

Reg. No.	Sex.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
					W.	Tl.	B.	
7944	♂	Kashmir (ca. 4500')	5 May 1876	J. Biddulph	153	105	47	..
14453	♂	Muree, Rawalpindi Dist., West Punjab.	3 Feb. 1876	J. Biddulph	143+	100+	45	Wing and tail slightly worn.
14454	♀	Muree, Rawalpindi Dist., West Punjab.	3 Feb. 1876	J. Biddulph	155	104	47	..
20230	..	Muree, Rawalpindi Dist., West Punjab.	24 June 1873	F. Stoliczka	145+	102	43	Wing slightly worn.
876	..	Simla, *PEPSU	1873	F. Stoliczka	148	100	41	..
14451	..	Simla, PEPSU	1876	J. Biddulph	143	105	43.5	Wing slightly worn.
14452	..	Simla, PEPSU	1876	J. Biddulph	149	101	44	..
25965	♂	Nainital (ca. 5000'), Uttar Pradesh.	6 Nov. 1928	S. C. Law	152	105	45	..

*Patiala and East Punjab States Union.

Systematic notes.—The single specimen from Kashmir has interesting abnormalities in its plumage. It has some sulphur yellow spots on lores and a band of sulphur and dirty cream yellow feathers on the upper and central back.

The birds of Garhwal and Kumaon cannot be separated from *marshallorum* and are therefore, included here.

Range.—North-Western Himalayas from Kashmir to Kumaon between 3,000 and 8,000 feet.

Megalaima virens magnifica Stuart Baker

(The great Eastern Himalayan barbet)

1926. *Megalaima virens magnifica* Stuart Baker, *Bull. Brit. orn. Cl.*, **47**: 43. Machi, Manipur.

1945. *Megalaima virens mayri* Ripley, *Proc. Biol. Soc. Wash.*, **61**: 100.—Mishmi Hills, N. E. Assam.

Megalaima virens magnifica is represented by the following skins:—

Reg. No.	Sex.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
					W.	Tl.	B.	
15236	♂	Nepal valley	8 Dec. 1877	J. Scully	..	..	..	Juvenal.
27406	♂	Godavari, Nepal valley	11 May 1947	B. Biswas	140	95	43.5	♂ ..
27407	♂	Godavari, Nepal valley	13 May 1947	B. Biswas	142	99	42	..
27408	♂	Godavari, Nepal valley	13 May 1947	B. Biswas	141+94.5	44		Wing slightly worn.
27409	♂	Godavari, Nepal valley	13 May 1947	B. Biswas	141+	105	46	Wing slightly worn.
15237	♀	Nepal valley	9 Nov. 1877	J. Scully	137	90	44	..
27410	♀	Godavari, Nepal valley	15 May 1947	B. Biswas	138	97	46	Wing slightly worn.
4891	..	Kathmandu, Nepal	..	Mus. Collector	130+	..	41	Wing slightly worn and tail worn.
871	♂	Darjeeling, North Bengal	..	J. Anderson	142	90	46	..
18278	♂	Darjeeling, North Bengal	..	G. Mason	142	92	48	..
872	♀	Darjeeling, North Bengal	..	J. Anderson	137+	98	42	Wing slightly worn.
18279	♀	Darjeeling, North Bengal	..	G. Mason	140	91	44	..
869	..	Darjeeling, North Bengal	..	J. Anderson	140	92	40	..
870	..	Darjeeling, North Bengal	..	J. Anderson	..	..	..	Subadult.
874	..	Darjeeling, North Bengal	..	J. Anderson	142	90	43	Body feathers in moult.
14455	..	Darjeeling, North Bengal	3 Feb. 1876	Col. Mainwairing.	139	91	44	..
27465	♂	Kyozing-Temi Road (ca. 5800') West Sikkim.	7 Jan. 1953	B. Biswas	140	98.5	45	..
27466	♂	Temi (ca. 5000'), West Sikkim.	9 Jan. 1953	B. Biswas	144	100	44	..
27464	♀	Dentam, West Sikkim	1 Jan. 1953	B. Biswas	140	87	43.5	Tail moulting.
27467	..	Dikchu-Gangtok Road, (ca. 5000'), Sikkim.	..	B. Biswas	148.5	102	46	..
14807	..	Garó Hills, Assam	..	O. L. Fraser	147	97.5	49	..
27411	♀	Barapani (ca. 3300'), Khasi Hills, Assam.	22 May 1949	H. L. Hiteshi	146	99	45	..
22939	♀	North Cachar Hills, Assam.	28 May 1898	E. C. S. Baker	138+	92+	48.5	Wing and tail some worn.
27413	♂	Chongli-emseu, Hills, Assam.	4 Mar. 1935	Z. S. I. Party	142	102	47	..
27412	♀	Chongli-emseu, Hills, Assam.	4 Mar. 1935	Z. S. I. Party	146	97	48	..
12969	..	Manipur State	Jan. 1882	R. D. Oldham	140	94	44	..
25276	♀	Rotung (ca. 1400'), Abor Hill North-East, Assam.	2 Jan. 1912	S. W. Kemp	144	94	44	..

Systematic notes.—Baker (1927) placed the birds of Nepal and Sikkim with *marshallorum* and stated that they are intermediate between *marshallorum* and *magnifica*, but are nearer the former. The birds of central Nepal, Darjeeling and Sikkim, when compared with topotypical *marshallorum*, are found to be smaller and deeply coloured, quite distinct from the Simla population and approximate closer to the Eastern Himalayan race *magnifica*. I have, therefore, listed them with *magnifica*. The race *M. virens mayri* Ripley from Mishmi Hills, N. E. Assam, is differentiated from *M. v. magnifica* in being darker and larger. The specimens of *magnifica* from Sikkim and Abor Hills are darker compared with the topotypical specimen of *magnifica*, all the specimens present in our collection being in fresh plumage and were collected in January. Some of the specimens from Khasi, Garo, and Naga Hills, are more or less of the same size or slightly smaller than *mayri*, (*vide* above Table), and a specimen from Sikkim (No. 27467), is even larger. I am unable to differentiate *mayri* from *magnifica*.

Range.—The Himalayas from Central Nepal to Eastern Assam and the hills of North Burma.

Megalaima virens clamator Mayr

(The great Burmese barbet)

1941. *Megalaima virens clamator* Mayr, *Ibis*, (14) 5: 489. – Shweli-Salween divide, Upper Burma.

Megalaima virens clamator is represented by the following skins :—

Reg. Sex. No.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
				W.	Tl.	B.	
23290 ♂	Loisampa (ca. 5500'), = Loi-SanPa, Möng Köng, Southern Shan States, Burma.	30 Dec. 1899	C o l. C. T. Bingham	133	94	48	..

Remarks.—In this specimen the scapulars are deep maroon. In size it is smaller than the type of *clamator*.

Range.—Upper Burma in the Hpimaw Hills and the Shweli-Salween divide (Peters).

Megalaima virens virens (Boddaert)

(The great Chinese barbet)

1873. *Bucco virens* Boddaert, *Tabl. Pl. enlum.* 53, Based on *Pl. enlum.*, 871. – China.

Megalaima virens virens is represented by the following skins :—

Reg. Sex. No.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
				W.	Tl.	B.	
21218 ..	Foochow, Fukien Dist., South-East, China.	Dec. 1889	C. B. Rickett	147	..	43	Tail damaged.
21219 ..	Foochow, Fukien Dist., South-East, China.	May 1891	C. B. Rickett	138	100	41	..

Remarks.—The white streaks on the back are absent in the specimen number 21218.

Range.—Southern and South-Eastern China, South to Tenasserim, Northern Siam, Laos and Northern Annam.

Megalaima lineata Blyth

The species is distributed in the lower Himalayas as far West as Sutlej and Eastward through the Northern and Southern Assam and Burma to Yunnan, Siam, Cambodia and Cochin-China, South to Malay Peninsula, Java, Bali; Westward to Orissa in the Indian Peninsula.

Out of the three recognizable subspecies, two occur within the Indian limits. The Indian Museum collections are represented by the following two subspecies.

Megalaima lineata hodgsoni Bonaparte

(The Assam lineated barbet)

1850. *Megalaima hodgsoni* (sic) Bonaparte, *Consp. Gen. Av.*, 1: 144.—Nepal.

1950. *Megalaima zeylanica rana* Ripley, *Proc. Biol. Soc. Wash.*, 63: 101.—Bajora, W. Nepal.

Megalaima lineata hodgsoni is represented in the collections by the following skins :—

Reg. No.	Sex.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
					W.	Tl.	B.	
27414	♂	Hardwar, Dehra Dun Dist., W. Himalayas.	22 May 1947	H. L. Hiteshi	135	77	35	..
26437	♀	Gish, Jalpaiguri Dist., N. Bengal.	21 Nov. 1938	Z. S. I. party	131	85.5	35	Bengal Duar Coll. 1938.
7716	♀	Dafra, Assam	24 Oct. 1876	Godwin Austin	126	77	35	..
26905	♂	Tangla, Darrang Dist., Assam.	14 Nov. 1939	M. L. Roonwal	128	79	34	..
26906	♀	Lokra, Balipara Frontier Tract, Assam.	14 Nov. 1939	M. L. Roonwal	127	75	34	..
27433	♂	Palasbari, Kamrup Dist., Assam.	16 May 1950	B. Biswas	136	83	34	..
27434	♂	Barnihat, Khasi Hills, Assam.	23 May 1949	R. V. Sherard	134	81	34	..
27435	♀	Nangpoh, Khasi Hills, Assam.	11 Feb. 1940	Mrs. A. E. Ford	136	87	36	..
24601	♀	South Sylhet, Luskerpore valley, Assam.	1903	C. B. Antram	128.5	77	33.5	Purchased.
24602	♀	South Sylhet, Luskerpore valley, Assam.	1903	C. B. Antram	129	74	34	Purchased.
24603	♀	South Sylhet, Luskerpore valley, Assam.	1903	C. B. Antram	135	85	35	Purchased.
20552	♀	Kutta, N. Cachar, Assam.	6 June 1892	E. C. S. Baker	134	81	35	..
24124	..	Helblintaung, between Chin and Victoria Hills, Upper Burma.	5 Dec. 1901	Lieut. Wood	135	86	35	..
24125	..	Helblintaung, between Chin and Victoria Hills, Upper Burma.	4 Dec. 1901	Lieut. Wood	135	84	85	

Reg. No.	Sex.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
					W.	Tl.	B.	
5899	..	Arakan, W. Burma	..	Museum Collector.	130	77	32.5	..
892	..	South of Irrawaddy, Burma.	Mar. 1873	Museum Collector.	129	87	34	..
893	..	South of Irrawaddy, Burma.	Mar. 1873	Museum Collector.	133	83	35	..
895	..	South of Irrawaddy, Burma.	Mar. 1873	Museum Collector.	129	87	34	..
896	..	South of Irrawaddy, Burma.	Mar. 1873	Museum Collector.	131	80	31	..
900	..	South of Irrawaddy, Burma.	Mar. 1873	Museum Collector.	134	85	34	..
901	..	South of Irrawaddy, Burma.	Mar. 1873	Museum Collector.	126	80	31	Complete moult.
902	..	South of Irrawaddy, Burma.	Mar. 1873	Museum Collector.	128	80	31	..
903	..	South of Irrawaddy, Burma.	Mar. 1873	Museum Collector.	127	81	32	..
23293	♀	Möng löng, (ca. 2900') Möng Kōng, S. Shan States, U. Burma.	2 Jan. 1900	C. T. Bingham	128	80	31	Flood damaged.
23294	♀	Möng löng (ca. 1900') Möng Kōng, S. Shan States, U. Burma.	2 Jan. 1900	C. T. Bingham	132	77	32	Flood damaged.

Range.—The Himalayas from Mussorie and Simla to Eastern Assam the Shan States and Annam, South to the Malay Peninsula, Siam, Cambodia and Cochin-China (Peters).

Megalaima lineata kutru Mukherjee

(The Simlipal lineated barbet)

1952. *Megalaima lineata kutru* Mukherjee, *Bull. Brit. orn. Cl.*, 72 : 36.—Chahālā Simlipal Hills, Mayurbhanj, Orissa.

Megalaima lineata kutru is represented in the collections by the following skins :—

Reg. No.	Sex.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
					W.	Tl.	B.	
27297	♂	Chāhāla, Simlipal Hills, Mayurbhanj Dist., Orissa.	13 Feb. 1951	B. Biswas	125	77	32	Holotype.
27298	♂	Chāhāla, Simlipal Hills, Mayurbhanj Dist., Orissa.	13 Feb. 1951	B. Biswas	122.5	78	33	Paratype.
27294	♀	Chāhāla, Simlipal Hills, Mayurbhanj Dist., Orissa.	8 Feb. 1951	B. Biswas	132	77	31.5	Paratype.
27295	♀	Chāhāla, Simlipal Hills, Mayurbhanj Dist., Orissa.	13 Feb. 1951	B. Biswas	128	79	32	Paratype.
27296	♀	Chāhāla, Simlipal Hills, Mayurbhanj Dist., Orissa.	13 Feb. 1951	B. Biswas	126	78	33.5	Paratype.

Range.—So far known only from the Simlipal Hills, Orissa.

Megalaima zeylanica (Gmelin)

The species is distributed in India and Ceylon. In India it ranges as far as Kangra (E. Punjab) in the North-West and Mt. Abu (Rajasthan in the West, and West Bengal in the East, and occupies the greater part of the Peninsular India.

There are three recognizable subspecies. All of them are represented in the collections of the Indian Museum.

Megalaima zeylanica zeylanica (Gmelin)

(The Ceylon green barbet)

1788. *Bucco Zeylanicus* Gmelin, *Syst. Nat.*, ed., 13, 1(1) : 408.—Ceylon.

Megalaima zeylanica zeylanica is represented by the following skin :—

Reg. No.	Sex.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
					W.	Tl.	B.	
19132	..	Ceylon	1891	R. Templeton	115	65	33	Flood damaged skin.

Range.—Travancore and Ceylon (Peters).

Megalaima zeylanica inornata Walden

(The Bombay green barbet)

1870. *Megalaima inornata* Walden, *Ann. Mag. nat. Hist.*, (4) 5 : 219. —“Malabar, Coorg, and Candeish”, restricted to Malabar by Mukherjee (1952).

Megalaima zeylanica inornata is represented by the following skins:—

Reg. No.	Sex.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
					W.	Tl.	B.	
11921	♂	Munche=Murshi, Ratnagiri Dist., Bombay Presidency.	3 Mar. 1878	J. Armstrong	119+	73	37	Wing slightly worn.
11266	♂	Munche=Murshi, Ratnagiri Dist., Bombay Presidency.	3 Mar. 1878	J. Armstrong	119	75	35	..
11300	♂	Munche=Murshi, Ratnagiri Dist., Bombay Presidency.	2 Mar. 1878	J. Armstrong	120	75	36	Flood damaged.
11352	♂	Munche=Murshi, Ratnagiri Dist., Bombay Presidency.	3 Mar. 1878	J. Armstrong	123	78	36	Flood damaged.
11616	♂	Munche=Murshi, Ratnagiri Dist., Bombay Presidency.	3 Mar. 1878	J. Armstrong	116.5	72	36.5	Flood damaged.
11350	♂	Ratnagiri, Ratnagiri Dist., Bombay Presidency.	1878	J. Armstong	121	75	40	Flood damaged.
11348	♂	Bhoura=Bavda, Kolhapur Dist., Bombay Presidency.	14 Apr. 1878	J. Armstrong	119	75	37	Flood damaged.
11859	♂	Bhoura=Bavda, Kolhapur Dist., Bombay Presidency.	13 Apr. 1878	J. Armstrong	123	76	37	Flood damaged.
11861	♂	Bhoura=Bavda, Kolhapur Dist., Bombay Presidency.	5 Apr. 1878	J. Armstrong	111	69	36	Flood damaged.
11351	♀	Bhoura=Bavda, Kolhapur Dist., Bombay Presidency.	3 Apr. 1878	J. Armstrong	118	70	38	Flood damaged.
11860	♀	Bhoura=Bavda, Kolhapur Dist., Bombay Presidency.	6 Apr. 1878	J. Armstrong	113	69	37	Flood damaged.

Range.—The distribution of his race in South and East has not been clearly defined so far. Baker (1927) stated that it extends as far as Travancore in the South and the Nilgiris in the East. Peters (1948) gave its range in the South at least to Cannanore, and the Godavari river to the East. I am unable to agree with Peters regarding the distribution of this race in the East. The specimen of Eastern Hyderabad has been noted by Whistler (1935) as intermediate, agreeing close in colour with *T. z. caniceps* but is too small for the race. The distribution may be redefined as follows :—

Throughout the Bombay Presidency along the Sahyadri ranges, and as far as Mt. Abu (Rajasthan) in the North and Malabar in the South. It extends Eastward to the Nilgiris.

***Megalaima zeylanica caniceps* (Franklin)**

(The Northern green barbet).

1831. *Bucco caniceps* Franklin, *Proc. Zool. Soc. Lond.*, (1) : 121.—“ On the Ganges between Calcutta and Banares, and in the Vindhyan Hills between the later place and Gurrah Mundela on the Nerbudda ”.

1934. *Thereiceryx zeylanicus kangrae* Whistler, *J. Bombay Nat. Hist. Soc.*, 37: 516.—Ranital, 2,000 feet, Kangra.

Magalaima zeylanica caniceps is represented by the following skins :—

Reg. No.	Sex.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
					W.	Tl.	B.	
25964	♀	Faridpur, Bareilly Dist., Uttar Pradesh.	24 Oct. 1928	S. C. Law	125	71	36	..
4893	..	Nepal	..	Museum Collector.	115	75	33	Complete moult.
27415	♂	Banaras Cant., Uttar Pradesh.	9 Sept. 1945	Kartar Singh	123	76	35	..
27416	♂	Banaras Cant., Uttar Pradesh.	8 July 1946	A. N. Fernandez.	118	77	34	..
27417	♂	Banaras Cant., Uttar Pradesh.	16 Feb. 1943	M. N. Dutta	126	80	35.5	..
27418	♂	Dharhara, Monghyr Dist., Bihar.	26 Nov. 1947	A. N. Fernandez.	124	78	32	..
885	..	Manbhum Dist., Bihar	..	Lieut. R. C. Beavan.	125	76	35.5	..
19012	..	Darbhanga, Bihar	..	E. Stewart	122	79	34	..
26228	♀	Ranchi, Bihar	3 Nov. 1931	S. C. Law	120	75	34	..
26248	♀	Ranchi, Bihar	8 Nov. 1931	S. C. Law	116	70	31	Complete moult.
27299	♂	Chahala, Simlipal Hills, Mayurbhanj District, Orissa.	13 Feb. 1951	B. Biswas	121	77	33	..
27452	♀	Sikargung, Rewa Dist., Vindhya Pradesh.	10 Apr. 1947	M. L. Roonwal	121	74	36	..
27419	♂	Pachmarhi, Hoshangabad Dist., Madhya Pradesh.	15 Feb. 1941	M. L. Roonwal	119	72	32	Flood damaged.

Range.—Foothills of the Himalayas from Kangra in the West to Nepal in the East and the Northern Indian plains (except Punjab, Sind and Eastern Bengal). Southward its range extends as far as the Godavari Delta and Eastern and Northern portion of the Hyderabad State.

Megalaima viridis (Boddaert)

(The small green barbet)

1783. *Bucco viridis* Boddaert, *Tabl. Pl. enlum.*, **53**.—Mahé, India, ex. Daubenton, pl. 870.

Megalaima viridis is represented by the following skins :—

Reg. No.	Sex.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
					W.	Tl.	B.	
11452	..	Bhoura=Bavda, Kolhapur Dist., Bombay Presidency.	26 Mar. 1878	J. Armstrong	114	62	26.5	Flood damaged.
11862	♂	Bhoura=Bavda, Kolhapur Dist., Bombay Presidency.	7 Apr. 1878	J. Armstrong	115	63	27	Flood damaged.
27453	..	Yercaud (ca. 4500'), Shevaroy Hills, S. India.	2 Feb. 1952	R. V. Sherard	109	65	27	..
27454	♀	Yercaud (ca. 4500'), Shevaroy Hills, S. India.	2 Feb. 1952	R. V. Sherard	110	65.5	28	..
26724	♂	Trivandrum, Travancore State, S. India.	26 June 1942	N. G. Pillai	95	56	25.5	Purchased.
23892	♀	Moonai, Trivandrum Travancore State, S. India.	..	Trivandrum Museum.	103	64+	25.5	Received in exchange, tail some what worn.

Range.—Hill ranges of South-Western India, from Tapti river in the North to Cape Comorin in the South and the Shevaroy Hills and Chitteri ranges in the Eastern Ghats.

Megalaima mystacophanos (Temminck)

The species extends from South Tenasserim South Ward to Malay Peninsula, Sumatra, Borneo and Batu Islands. There are three subspecies as recognised by Peters (1948), of which only the nominate subspecies occurs within the Indian limits.

Megalaima mystacophanos mystacophanos (Temminck)

(The gaudy barbet)

1924. *Bucco mystacophanos* Temminck, *Pl. col., livr.*, **53**, pl. 315.—Sumatra.

Megalaima mystacophanos mystacophanos is represented by the following skin :—

Reg. No.	Sex.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
					W.	Tl.	B.	
27437 (323)	..	Malay Peninsula	1848	Mr. E. Lindstedt and Mr. Firth.	99	52	32	One of the three adults of Blyth (1852).

Range.—South Tenasserim, Southward over the Malay Peninsula and Sumatra (Peters).

Megalaima flavifrons (Cuvier)
(The yellow-fronted barbet)

1817. *Bucco flavifrons* Cuvier, *Régne Anim.*, 1 : 428, note 2.—Ceylon.

Megalaima flavifrons is represented by the following skin :—

Reg. Sex. No.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
				W.	Tl.	B.	
19126 .. (320)	Ceylon	1848	E. L. Layard	90	62	22.5	One of the three skins of Blyth (1852).

Range.—Ceylon.

Megalaima franklini (Blyth)

The species is distributed in the hill ranges of the Himalayas from Nepal to Assam, Upper Burma and Yunnan, South to Malay Peninsula, Siam and Annam. Five subspecies of *M. franklini* have been admitted by Peters (1948) of which only two occur within the Indian region. In the Indian Museum collections, it is represented by the nominate subspecies only.

Megalaima franklini franklini (Blyth)

(The golden-throated barbet)

1842. *Bucco franklinii* Blyth, *J. Asiat. Soc. Beng.*, 11 (1) : 167.—Darjeeling.

Megalaima franklini franklini is represented by the following skins :—

Reg. Sex. No.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
				W.	Tl.	B.	
27460 ..	Godvari, Nepal Valley	13 May 1947	B. Biswas	106	66	27	..
27461 ♀	Thankot, Nepal Valley	31 Mar. 1947	P. N. Mittra	104	63	26	..
26046 ♀	Darjeeling, N. Bengal	31 Mar. 1930	S. C. Law	101	61	26	..
27405 .. (326)	Darjeeling, N. Bengal	1845	Mr. Webb	87.5	43	20	Juvenal, one of the three cotypes listed by E. Blyth (1852).

Range.—Lower hills of the Himalayas as far West as Nepal, Eastwards through Northern and Southern Assam, extends to Northern Burma, Southern Yunnan, Tonkin, Northern Laos and Northern Annam.

Megalaima asiatica (Latham)

The species ranges throughout the lower altitudes of the Himalayas, and the hills and plains of Assam, Bengal, Burma, Shan States and Yunnan ; South to Tenasserim, Siam, Annam and North Borneo. According to Peters (1948), three of the five races recognised by him, occur within the Indian limits. I have, however, grouped these three subspecies into two.

Megalaima asiatica asiatica (Latham)

(The blue-throated barbet)

1790. *Trogon asiaticus* Latham, *Index orn.*, 1 : 201.—India=Calcutta, *vide* Stuart Baker.1896. *Cyanops rubescens* Stuart Baker, *Novit. zool.*, 3 : 257.—N. Cachar.*Megalaima asiatica asiatica* is represented by the following skins :—

Reg. No.	Sex.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
					W.	Tl.	B.	
15249	..	Dehra Dun, Uttar Pradesh.	1870	J. Scully	103+	70	29	G. King coll. Wing slightly worn.
15240	..	Dehra Dun, Uttar Pradesh.	Jan. 1871	J. Scully	110	70	28.5	G. King coll.
15243	♀	Nowakot, Nepal	29 Nov. 1877	J. Scully	100	69	28	G. King coll.
15245	..	Nepal	19 June 1877	J. Scully	107	66	28	Wing and tail moulting.
15247	..	Nepal valley	21 May 1877	J. Scully	100	70	27	..
27438	♀	Kathmandu, Nepal	4 Apr. 1947	P. N. Mitter	101	65.5	27	Tail moulting.
27439	♀	Pasupatinath, Kathmandu, Nepal.	5 Apr. 1947	P. N. Mitter	102	68.5	28	..
27440	♀	Pasupatinath, Kathmandu, Nepal.	11 Apr. 1947	B. Biswas	108	69	27	..
27441	♀	Pasupatinath, Kathmandu, Nepal.	11 Apr. 1947	P. N. Mitter	103	63	29	Tail moulting
27442	♀	Pasupatinath, Kathmandu, Nepal.	28 Apr. 1947	P. N. Mitter	102	65	27	..
27443	♂	Godavari, Nepal Valley, Nepal.	13 May 1947	B. Biswas	105	66	27	..
27444	♂	Hitaura, Doons, Nepal	2 June 1947	B. Biswas	103+	65	29.5	Wing some what worn.
5530	..	Darjeeling Terai, N. Bengal.	..	J. Anderson	102	65	26	..
27445	..	Teesta, Darjeeling Dist., North Bengal.	..	S. C. Law	107	65	25+	Tip of the bill slightly damaged.
15250	..	Sikkim	Jan. 1876	J. Scully	102+	66	28	D. D. Cunningham coll. Wing somewhat worn.
27468	♀	Rangpo, Rangpo valley, Sikkim.	18 Dec. 1952	B. Biswas	108	66.5	28	..
5523	..	Bengal	..	..	105	70	29	..
5529	..	Calcutta	1866	Purchased	102	64	29	..
5535	..	Calcutta	..	J. Anderson	101	..	28	Tail missing.
25617	♂	Chakdah, Nadia Dist., Bengal.	18 Oct. 1926	A. Rahim	108	70	27	..
25674	♂	Chakdah, Nadia Dist., Bengal.	7 Apr. 1927	A. Rahim	107	67	29	..
26907	♂	Lokra, Balipara Frontier Tract, Assam.	11 Nov. 1939	M. L. Roonwal	104	62	28	Tail moulting.
25275	♂	Kobo (ca. 400'), Abor Hills, N. E. Assam.	9 Dec. 1911	S. W. Kemp	107	65	27	British Abor Hill expedition (1911).
25292	♂	Rotung, Abor Hills, N. E. Assam.	13 Mar. 1912	S. W. Kemp	105	66	27	British Abor Hill expedition (1911).
446	♂	Gauhati, Kamrup Dist., Assam.	30 May 1949	H. L. Hiteshi	100	65	27	..

Reg. Sex. No.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
				W.	Tl.	B.	
27447 ♂	Nongpoh, Khasi Hills, Assam.	10 May 1949	R. V. Sherard	102	65	27.5	..
27448 ♂	Kekrima, Naga Hills, Assam.	17 Feb. 1935	Z. S. I. party	103	64	26.5	..
27449 ♀	Kohima, Naga Hills, Assam.	2 Feb. 1935	Z. S. I. party	100	66	26	..
27450 ♀	Khezhbma, Naga Hills, Assam.	26 Jan. 1936	Z. S. I. party	103	64	26.5	..
26977 ♂	Manipur State, Assam	2 Feb. 1936	Naga Hills Survey, Z. S. I. party.	103	67	27	..
23300 ♂	Kalaw, S. Shan States, Upper Burma.	Jan. 1900	C. T. Bingham	104	62	26	..
23301 ♀	Kalaw, S. Shan States, Upper Burma.	22 Jan. 1900	C. T. Bingham	100	60	26	..
23298 ♂	Wetpyne (ca. 3000'), S. Shan States, Upper Burma.	25 Jan. 1900	C. T. Bingham	102	61.5	26	..
8733 ♂	Tsitkan, Kakhien Hills, W. Yunnan, China.	12 Feb. 1875	J. Anderson	102	64	28	..

Systematic notes.—The Western Himalayan populations are larger as compared with those of the Eastern Himalayas. The crimson specks at the base of the lower mandible is universally present.

The ruddy barbet (*Cyanops a. rubescens*) of Baker (1927) from North Cachar, seems to be merely an erythristic form.

Range.—Throughout the lower hills of the Himalayas, Assam, Bengal, Upper Burma and the Northern Shan States.

***Megalaima asiatica davisoni* Hume**

(Davison's blue-throated barbet)

1877. *Megalaima Davisoni* Anonymous=Hume, *Stray Feath.*, 5 : 108.—Meetan, Tenasserim.

Megalaima asiatica davisoni is represented by the following skins :—

Reg. Sex. No.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
				W.	Tl.	B.	
8129 ♂	Meetan=M i t a n, Amherst Dist., S. Burma.	Jan. 1877	J. Anderson	102	58	28	Tenasserim Expedition.
27436 ♀	Tenasserim, Burma	1877	J. Anderson	101	59	27	Tenasserim Expedition.

Range.—Southern Shan States, Karenni, Tenasserim, Siam, South-Eastern Yunnan, Kwangsi, Tonkin, Northern Laos and Northern Annam (Peters).

***Megalaima henricii* (Temminck)**

The species occurs in Peninsular Siam, Malay States, Sumatra and Borneo. Only two subspecies have been recognized by Peters (1948) of which *M. henricii henricii* is represented in the Indian Museum collections.

Megalaima henricii henricii (Temminck)

(Henrici's barbet)

1831. *Bucco henricii* Temminck, *Pl. Col. livr.*, **88**, pl. 524.—Sumatra.*Megalaima henricii henricii* is represented by the following skin :—

Reg. Sex. No.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
				W.	Tl.	B.	
19127 ♂ (324)	Malacca, Malay Penin- sula.	1844-1846	Messrs. M. de Storr and Rev. J. W. Lindstedt.	94	48	27	One of the three specimens of Blyth (1852).

Range.—Peninsular Siam and the Malay States ; Sumatra (Peters).**Megalaima pulcherrima** Sharpe

(The Bornean blue-throated barbet)

1888. *Megalaima pulcherrima* Sharpe, *Ibis*, (5) **6** : 393, pl. 11, fig. 2.—Mt. Kina Balu, Borneo.*Megalaima pulcherrima* is represented by the following skin :—

Reg. Sex. No.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
				W.	Tl.	B.	
20618 ♂	Mt. Kina Balu (ca. 6000') Borneo.	21 Mar. 1892	H. A. Haviland	92	65	25	..

Range.—Mountains of Northwestern Borneo. (Peters).**Megalaima australis** (Horsfield)

The species ranges from North-Eastern India to Burma, Siam and Cochin-China, South to Malay Peninsula, Sumatra, Java and Borneo. Peters (1948) admitted seven subspecies, of which only two occur within the Indian limits.

Megalaima australis cyanotis (Blyth)

(The Indian blue-eared barbet)

1847. *Bucco cyanotis* Blyth, *J. Asiat. Soc. Beng.*, **16** (1) : 465.—Arakan.1896 *Cyanops robustirostris* Stuart Baker, *J. Bombay nat. Hist. Soc.*, **10** : 356, pl. F1.—North Cachar Hills.*Megalaima australis cyanotis* is represented by the following skins :—

Reg. Sex. No.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
				W.	Tl.	B.	
27462 ♂	Gauhati, Kamrup Dist., Assam.	1 June 1949	R. V. Sherard	83	49	19	..
24557 ♀	South Sylhet, Assam	..	C. B. Antram	83	49	20	Purchased.
24558 ♀	South Sylhet, Assam	..	C. B. Antram	84	44	20	Purchased.
24559 ..	South Sylhet, Assam	..	C. B. Antram	..	..	..	Not fully adult.
27463 ♀	South Sylhet, Assam	..	A. M. Pomiror	84	49	21	..
5787 ♀	Samaguting, Naga Hills, Assam.	..	Capt. Butler	84	48	19	..

Systematic notes.—Baker's *Cyanops robustirostris* from North Cachar Hills is a juvenile form of *M. australis*. (See also Biswas 1953, p. 34, and Ripley 1953, pp. 547-548.)

Range.—Sikkim, Assam, Burma, South to Tenasserim, Siam, Laos, Annam, Cambodia and Cochin-China. (Peters.)

***Megalaima australis duvauceli* (Lesson)**

(The scarlet-eared barbet)

1830. *Bucco Duvaucelii* Lesson, *Traité' Orn., livr., 3*: 164.—Sumatra.

Megalaima australis duvauceli is represented by the following skin :—

Reg. No.	Sex.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
					W.	Tl.	B.	
924	..	Welesley Province, Malay Peninsula.	15 Aug. 1870	..	..	..	..	Purchased. Juvenal

Range.—Malay Peninsula, Sumatra, Banka, Borneo. (Peters.)

***Megalaima hæmacephala* (P. L. S. Müller)**

The species is distributed practically throughout India, Burma, Malay Peninsula, through Siam to Cochin-China and the Polynesian Islands. Peters (1948) admitted five subspecies, of which only *M. hæmacephala indica* occurs in the Indian region.

***Megalaima hæmacephala indica* (Latham)**

(The crimson-breasted barbet)

1790. *Bucco indicus* Latham, *Index orn., 1*: 205.—Calcutta.

Megalaima hæmacephala indica is represented by the following skins :—

Reg. No.	Sex.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
					W.	Tl.	B.	
25811	♂	Bareilly, Uttar Pradesh	25 Oct. 1928	S. C. Law	82	37	18.5	..
27455	♀	Banaras, Uttar Pradesh	4 Oct. 1945	Kartar Singh	81	35	19	..
27456	♂	Banaras, Uttar Pradesh	21 May 1946	M. N. Dutta	..	..	..	Juvinial.
25729	♂	Angara, Ranchi Dist., Bihar.	2 Oct. 1925	S. C. Law	70	35	18.5	
26244	♀	Hundroo Forest, Ranchi Dist., Bihar.	8 Nov. 1931	S. C. Law	78	83	19	Flood damaged.
27457	♂	Raghunathpur, Manbhum Dist., Bihar.	6 Dec. 1948	Chotanagur Survey Z. S. I. party	83	85	20	..
27458	♂	Chahala, Mayurbhanj Dist., Orissa.	14 Feb. 1951	B. Biswas.	80	84	18	..
5538	..	Calcutta	..	J. Anderson	80 + 33	18		Flood damaged and wing somewhat worn.

Reg. No.	Sex.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
					W.	Tl.	B.	
27458	♂	Calcutta	24 Sep. 1951	R. V. Sherard	8.5	34.5	19	..
27459	♂	Palasbari, Kamrup Dist., Assam.	17 May 1951	B. Biswas	83.5	37	20	..
11541	♂	Ratnagiri, Dist., Bombay Presidency.	22 Dec. 1878	J. Armstrong	79	34	19	..
11302	..	Bombay Presidency	1878	J. Armstrong	80	33.5	19	..
26725	♀	Trivandrum, Travancore State, S. India.	20 June 1942	N. G. Pillai	76	30+	18	Purchased, tail slightly worn.
23292	♂	Sinh (Ca. 2900'), S. Shan States, (Upper Burma).	16 Dec. 1899	Col. C. T. Bingham.	86	34	20	..
23566	..	Myinmu, Shwebo, Upper Burma.	1899	Col. C. T. Bingham.	86	35	18	..

Systematic notes.—There is a tendency of the green streaks on the under parts to becoming oblescent from East to Northwestward.

Range.—Throughout India, Ceylon and ,Burma, Northern Malay State, Siam, Cambodia and Cochin-China.

Genus **Calorhamphus** Lesson

Calorhamphus fuliginosus (Temminck)

The species is distributed in South Tenasserim, Malaya, Sumatra and Borneo. Peters (1948) recognised three subspecies, of which only *C. fuliginosus hayi* occurs within the Indian limits. In the Indian Museum collections only two subspecies are represented.

Calorhamphus fuliginosus hayi (J. E. Gray)

(The brown barbet)

1831. *Bucco hayii* J. E. Gray, *Zool. Misc.*, 33.—Malacca.

Calorhamphus fuliginosus hayi is represented by the following skins :—

Reg. No.	Sex.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
					W.	Tl.	B.	
944	..	Malacca, Malay Peninsula.	16 Aug. 1870	..	81	37	26	Purchased.
13567	..	Malacca, Malay Peninsula.	..	Bengal Economic Museum.	85	50	24.5	..
3568	..	Malacca, Malay Peninsula.	..	Bengal Economic Museum.	83	47	24	..

Range.—Southern Tenasserim and Peninsular Siam, Southward over Malay Peninsula ; Sumatra (Peters).

Calorhamphus fuliginosus fuliginosus (Temminck)

(The red-breasted brown barbet)

1830. *Mycropogon fuliginosus* Temminck, *Pl. col. lior.* 83.—West coast of Borneo, i.e. Pontianak.

Calorhamphus fuliginosus fuliginosus is represented by the following skin :—

Reg. Sex. No.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
				W.	Tl.	B.	
22583 ..	Kuching, Sarawak, Borneo.	16 Aug. 1898	Sarawak Mu- seum.	81	51	24	Received in exchange.

Range.—Borneo (except Northern) (Peters).

Genus **Gymnobucco** Bonaparte

The genus is limited to Africa with four subspecies, as admitted by Peters (1948). The Indian Museum collections are represented by a single species *G. peli*.

Gymnobucco peli Hartlaub

(The bald-headed barbet)

1857. *Gymnobucco peli* Hartlaub, *Syst. orn. Westafr.*, 175.—Dabocrom, Gold Coast.

Gymnobucco peli is represented by the following skin :—

Reg. Sex. No.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
				W.	Tl.	B.	
8457 ..	Fantee, W. Africa	..	British Museum	85	45	20	Received in exchange.

Range.—Gold Coast colony, Southern Nigeria, Cameroons, and Gaboon (Peters).

Genus **Pogoniulus** Lafresnaye

Pogoniulus pusillus (Dumont)

The species ranges in Somaliland, Eritrea, Ethiopia, Lake Victoria in the West and Dar-es-Salaam in the South.

There are four subspecies as admitted by Peters (1948), of which only *P. pusillus uropygialis* is present in our collections.

Pogoniulus pusillus uropygialis (Heuglin)

(The fiery-rumped barbet)

1862. *Barbatula uropygialis* Heuglin, *J. f. orn.*, 10 : 37.—Ain Saba, Eritrea.

Pogoniulus pusillus uropygialis is represented by the following skins :—

Reg. Sex. No.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
				W.	Tl.	B.	
9324 ..	Anseba valley (ca. 4000') Eritrea, N. E. Africa.	29 July 1868	W. T. Blandford	56	32	12.5	The British Abyssinian expedition of 1867-1868.
9325	N. E. Africa	July 1868	W. T. Blandford	55	30	13	The British Abyssinian expedition of 1867-1868.

Range.—Eritrea, Bogosland, the greater part of Ethiopia and Northern Somaliland (Peters).

Genus **Tricholaema** Verreaux and Verreaux

Tricholaema melanocephalum (Cretzschmar)

The species is distributed in Bogosland, Ethiopia, Somaliland, Kenya and Northern Tanganyika territory.

There are three subspecies as admitted by Peters (1948) of which only the nominate subspecies is represented in the Indian Museum collections.

Tricholaema melanocephalum melanocephalum (Cretzschmar)

(The Ethiopian black-foreheaded barbet)

1826. *Pogonias melanocephala* Cretzschmar, in *Ruppell's Atlas*, 1826, *Vog*: 41 *pl.* 28, *f.a.*—Kordofan and Sennar=Ethiopia? *cf.* Sclater and Mackworth-Praed, *Ibis*, (11) 1, 1919: 637.

T. melanocephalum melanocephalum is represented by the following skin :—

Reg. No.	Sex.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
					W.	TL.	B.	
9428	♀	Massawa, Eritrea, N. E. Africa.	1868	W. T. Blanford	66	36	19	The British Abyssinian expedition of 1867-1868.

Range.—Bogosland and Northern Ethiopia, South to Addis-Ababa and Eastward to near Harar (Peters).

Genus **Lybius** Hermann

Lybius undatus (Ruppell)

The species is distributed throughout Eritrea and Ethiopia.

There are four subspecies as admitted by Peters (1948), of which *L. undatus thiogaster* is represented in the Indian Museum collections.

Lybius undatus thiogaster Neumann

(The undulated barbet)

1903. *Lybius thiogaster* Neumann, *Orn. Monatsb.*, 11: 59.—Keren, Bogosland.

Lybius undatus thiogaster is represented by the following skins :—

Reg. Sex. No.	Locality.	Date of collection.	Collector or Donor.	Measurements.			Remarks.
				W.	Tl.	B.	
9331 ♂	Addigerat (ca. 8000'), Eritrea, Africa.	3 Apr. 1868	W. T. Blanford	80	50	22	The British Abyssinian expedition of 1867-1868.
9333 ♀	Badraket, Tigre, Abyssinia.	N. 24 May 1868	W. T. Blanford	80	45	20	The British Abyssinian expedition of 1867-1868.

Range.—Eritrea and Northern Ethiopia (Peters).

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