ON A SPECIES OF *EUTYPHOEUS* FROM CALCUTTA.

By MAUNG HLA KYAW AND G. E. GATES.

Eutyphoeus masoni (Bourne) 1889.

Material examined.—From the Indian Museum: 3 aclitellate and 174 clitellate specimens labelled, "Collected from the lawn of the Museum House. October 1932." These worms are rather poorly preserved; the intersegmental furrows not clear especially ventrally in the post-clitellar region, the body wall adherent to the gut in the postprostatic region, the gut wall and certain other structures softened.

External characteristics.—Length to 200 mm. Diameter to 10 mm. No pigmentation now visible (alcoholic preservation).

The setae begin on segment ii. The setal distances are variable but the setal formula of xx can usually be represented as follows: $ab < cd < bc < aa$, $dd > \frac{1}{2}$ the circumference. The tips of the ventral setae of the clitellar segments are ornamented with short, transverse rows of fine teeth, with the rows more widely separated than on the penial setae.

The first dorsal pore is usually on 11/12 but functional pores may be lacking anterior to the clitellum, and possibly also, occasionally, for some distance behind the clitellum.

The clitellum is annular and extends from 13/14 or just behind the setae of xiii to or nearly to 17/18; dorsal pores and intersegmental furrows lacking, setae present. On a few specimens (7) the clitellum has a somewhat saddle-shaped appearance due to the slight development of the clitellar glandularity in the midventral region.

The spermathecal pores are small, slit-shaped to shortly elliptical, transversely placed apertures, the centres just lateral to *b*, in mid *bc*, or just median to *c*. The anterior and posterior margins of each aperture are usually slightly tumescent, protuberant and finely wrinkled. Just behind the posterior lip, there is, on many of the specimens, a transversely slit-like depression. This depression may be entirely lacking, slight, or of about the same size as the spermathecal pore. In the latter case the depression is continued as an invagination that is recognizable internally in the spermathecal duct when the latter is cut across horizontally fairly close to the parietes. On some of the specimens the opening of the posterior invagination might be mistaken for a spermathecal pore especially when the latter is tightly closed.

There is usually a single female pore, on the left side, presetal, in or about in *a*. Occasionally a second pore or rudiment of a pore is visible on the right side.

The vestibular apertures are shortly elliptical, transversely placed, in *ab*, often reaching slightly median to *a* and usually extending slightly lateral to *b*, on the average about $1\frac{1}{4}$ mm. wide and 1 mm. long (transverse and longitudinal diameters). On several specimens the vestibular roof has fallen so that the vestibular aperture is represented only by a crescentic, almost slit-shaped opening, the concave side of which faces anteromesially. The body wall is never depressed midventrally between

the two vestibular apertures. The vestibular lumen is wider than the aperture, deepest laterally, but does not extend internally, as a rule, above the general peritoneal level of the body wall. On the vestibular roof posterolaterally there is a rudimentary penis, nothing more than a low but fairly large annulus of soft, whitish tissue. A considerable number of specimens have been examined but in none of these do the penes attain a more definite development though the penial annulus is always present. The location of the penis seems to be variable, just lateral to *b*, in mid *bc*, or just median to *c*. This apparent variation may be the result of differences in contraction of the animal when killed. From the concavity within the annulus there may protrude two penial setae. These setae may be entirely lacking but there are never more than two.

The genital markings are paired, in *ab*, but often extending into *bc* or slightly median to *a*. The postclitellar genital markings appear to be intersegmental though on some specimens, (and those on which 18/19 is most clearly visible across the ventrum), 18/19 at least appears to pass behind a pair of genital markings. The intraclitellar markings on the aclitellate specimens are segmental and postsetal, extending posteriorly just to the intersegmental furrow. On the clitellate specimens the segmental location is not obvious but the markings usually are nearer to the anterior setae than to those next behind. The preclitellar markings (rarely present, 10 specimens) are, like the intraclitellar markings, segmental, first visible on the postsetal portion of the segment, but when fully developed dislocating the intersegmental furrow posteriorly though apparently not crossing that furrow. These markings are less sharply defined than the intra- and postclitellar markings. On each marking, when the specimen is well preserved, is visible a whitish, opaque, marginal rim or band surrounding a greyish, translucent, central area. The latter may have its long axis placed transversely (usually) or longitudinally. The markings are present on ix-x, xiii-xvi, and 18/19-26/27 as indicated below. The smallest number of markings noted is two pairs, on xv and 18/19 ; the largest number twelve pairs, on xiv-xvi and 18/19-26/27

Segment or Furrow.	Number of specimens.
xiii	1
xiv	54
xv	174
xvi	159
18/19 (or xviii)	174
19/20	158
20/21	84
21/22	38
22/23	6
23/24	4
24/25	3
25/26	2
26/27	1

Note.—On some of the specimens, one marking of a pair is lacking but this is not shown above, the asymmetrical marking being counted as if a pair were present.

Internal anatomy.—The intestine begins in xv (25). Lateral intestinal caeca have not been found in any of the specimens that were dissected (25). Unpaired, median and ventral caeca have been observed but the number and segmental locations are difficult to determine because of the poor preservation. In one specimen these caeca are present in segments xxxiv-lxvi. The supra intestinal glands are in four (1 specimen), five (5), or six (1) successive segments as follows : lxxxvi-xc, lxxxvii-xci (2), lxxxviii-xcii, lxxxviii-xciii, lxxxix- xcii, lxxxix-xciii. There may be only one pair of glands per segment or some or all of the glands may be crossed dorsally by a deep transverse groove which thus marks off two pairs of glands per segment. The dorsal wall of the gut in the segment next in front of the first gland segment may be thickened and whitened and may even be raised into a pair of rounded protuberances that look like rudimentary glands. The typhlosole is a low ridge, V-shaped in section. It begins in xxviii and extends into the last supra intestinal gland segment, apparently enlarged in the gland segments, smallest through a region in front of the gland segments.

The dorsal blood vessel terminates anteriorly with the hearts of vii (25). The last pair of hearts is in xiii (25). The hearts of xi are bound down to the gut and are not usually visible or their positions recognizable until the connective tissue has been dissected off.

There is an unpaired and suboesophageal testis sac into which the hearts of xi pass beneath the gut. The seminal vesicles are fairly large and extend from 10/11 to 12/13, pushing 12/13-13/14 back into contact with 14/15. The prostates are in xvii-xix or xx. The prostatic duct is 9-14 mm. long. There is a fairly well-developed and coelomic bulbus ejaculatorius, spindle-shaped, about 1 mm. long.

The spermathecal duct is rather short, only about 0·8 to 1·5 mm. long, muscular but without sheen, thick, longitudinally oval in horizontal section, the lumen fairly large, transversely slit-like to crescentic in section, eccentric and much nearer to the anterior than the posterior wall. On the posterior wall of the lumen is a rather conspicuous, smooth, vertical ridge. On this ridge is a fairly deep vertical groove. The spermathecal diverticula open into the lumen of the duct at the sides of the ridge. The duct is rather abruptly narrowed entally, the narrowed portion very short, not readily recognizable as the ampulla is bound down firmly around the entalmost portion of the duct. The diverticula are paired, median and lateral, the shape varying according to the number, size and arrangement of the small, ovoidal, seminal chambers. Each diverticulum is attached to the entalmost portion of the duct and may be posteriorly directed on both sides so that the two diverticula are separated from each other only by a slight gap, in contact with each other, or even grown together. In every worm dissected the diverticula, even when united posteriorly, open separately into the duct. After carefully dissecting off the ampulla, the narrowed portion of the duct may appear to be almost completely surrounded, except anteriorly, by the diverticula. The seminal chambers have a spermatozoal iridescence. The spermathecal ampulla is small, usually rather anteroposteriorly elongated, an anterior portion marked off from the larger posterior part by a deep dorsal groove. The anterior portion is lobed,

the lobes small, quite similar in appearance and often in size to the seminal chambers of the diverticula. Each of these lobes opens through a small aperture into the large, undivided lumen of the posterior portion of the ampulla. The small, anterior, ampullary lobes might very readily be mistaken for diverticula but (all specimens examined) no spermatozoal iridescence has been observed within any of these lobes which are almost always empty. Masses with spermatozoal iridescence, possibly spermatophores, have occasionally been noted in the spermathecal ampullae. Each of these masses is rather top-shaped, the bulbous, almost spheroidal portion resting on the opening from the ampulla into the duct, the narrowed, pointed portion within the duct lumen. Only one spermatophore is to be found within an ampulla and when present is always in the position indicated.

The genital marking glands are sessile on the parietes, each gland rather flat and usually slightly larger than its marking.

Though only two penial setae protrude simultaneously to the exterior through the penial annulus each penisetal follicle contains 5-9 setae (including the two functional setae). (Setae protruding to the exterior are considered functional setae while those within the follicle but not protuberant to the exterior are termed reserve setae.) The following numbers were noted : 5 setae (7 follicles), 6 setae (2), 7 setae (5), 8 setae (3), 9 setae (4). Length of the reserve setae varies from 2·4 to 4·5 mm. as follows : 2·4 mm. (1 seta), 3 mm. (4), 3·3 mm. (1), 3·5 mm. (3), 3·6 mm. (1), 3·9 mm. (1), 4 mm. (2), 4·1 mm. (1), 4·2 mm. (3), 4·5 mm. (1) —measurements made to nearest tenth mm. The functional setae are usually 4-5 mm. long. The thickness varies : at the ental end 0·055-0·060 mm. ; near the middle of the shaft, 0·032-0·035 mm. ; tip, when thickened (rarely) about 0·040 mm. The shape and appearance of the tip varies. Often the tips are obviously softened, wrinkled irregularly, folded back on or bent around the shaft, rarely split or cracked, more rarely with a short cavity at or near the centre of the shaft. The tips of the functional setae are often lacking, the seta having been broken squarely across. On those setae of which the tips appear to be least softened or modified the shape is again variable. The seta may narrow gradually to a bluntly rounded point, or the shaft may be slightly widened just behind the point in such a way as to produce a spear-head-like appearance, or the tip may be spoon-shaped. The hollowed-out portion is small and shallow but quite definite. The spoon-shaped tip may perhaps represent the state of least post-mortem modification, but is rare, usually found only once or twice in a follicle and occasionally not at all. The spoon-shaped tip has been noted more frequently on reserve than on functional setae but this frequency has little if any significance since so many tips of the functional setae are lacking. The ornamentation extends ectally nearly to the terminal point, ending in case of spoon-shaped tips just behind the hollowed or bowl portion and consists of closely crowded, transverse rows of fine spines. The rows may be short, rather irregularly placed and with but few teeth (fish-scale appearance) or the rows may be longer, less irregular, at times almost straight and approximating to circumferential rings. Although the short rows present a somewhat ' fish-scale ' appearance, the rows

are not as evenly spaced or regularly placed with reference to each other as figured by Michaelsen for *bastianus* (1909, pl. xiv, fig. 59). In one particular follicle one seta has a tip much like that figured by Stephenson for *orientalis* (1922, p. 438, fig. 3, right seta), another seta has a tip very like that figured for *bastianus* by Michaelsen (1909, pl. xiv, fig. 61) while two other setae, one reserve and one functional, have spoon-shaped tips. The second functional seta lacks the tip while the tips of other reserve setae are softened.

Remarks.—According to Stephenson's key (1923, p. 423) the worms from Calcutta described above must be referred to *E. masoni.* However it is necessary to point out that certain characteristics of taxonomic importance have never been studied in any of the specimens hitherto referred to that species.

REFERENCES.

Michaelsen, W., 1909. The Oligochaeta of India, Nepal, Ceylon, Burma, and the Andaman Islands. *Mem. Ind. Mus.* I.

Stephenson, J., 1922. Some earthworms from Kashmir, Bombay, and other parts of India. *Rec. Ind. Mus.* XXIV

Stephenson, J., 1923. Oligochaeta. *Fauna of British India Series.*