ON TWO UNDESCRIBED FORMS OF THE GENUS *OLIGOTOMA* WITH A DESCRIPTION OF THE EXTERNAL GENITALIA OF *OLIGOTOMA MICHAELI* AND DISTRIBUTIONAL RECORDS OF SOME INDIAN FORMS.

By S. MUKERJI, *D.Sc.*

In the collection of Embioptera of the Indian Museum, I came across two undescribed forms belonging to the genus *Oligotoma* Westw. One of these species is remarkable in that it appears to be the smallest amongst the Embiids so far recorded from India, while the second exhibits a considerable range of variation in the basal joint of the left cercus in specimens from different localities. In this paper, in addition to giving detailed descriptions of the two new forms, I have included a list of records of the localities from which the various species in the collection of the Indian Museum are represented. I also describe and figure the genitalia of *Oligotoma michaeli* MacLachlan as the earlier descriptions by MacLachlan, Hagen, Needham and Enderlein are incomplete.

The descriptions are drawn up from specimens preserved in alcohol, as a result of which the colouration of the specimens is a little paler. The specimen to be examined was laid on a slide with a second piece of thick glass over it to keep it flat: alcohol or dilute glycerine was run slowly between the two pieces of glass by means of a pipette and the specimen was then examined under a strong light. The appendages of the terminal segment were studied *in situ* by both transmitted and reflected light. The drawings of the wings, appendages, etc., were made with the help of a camera lucida.

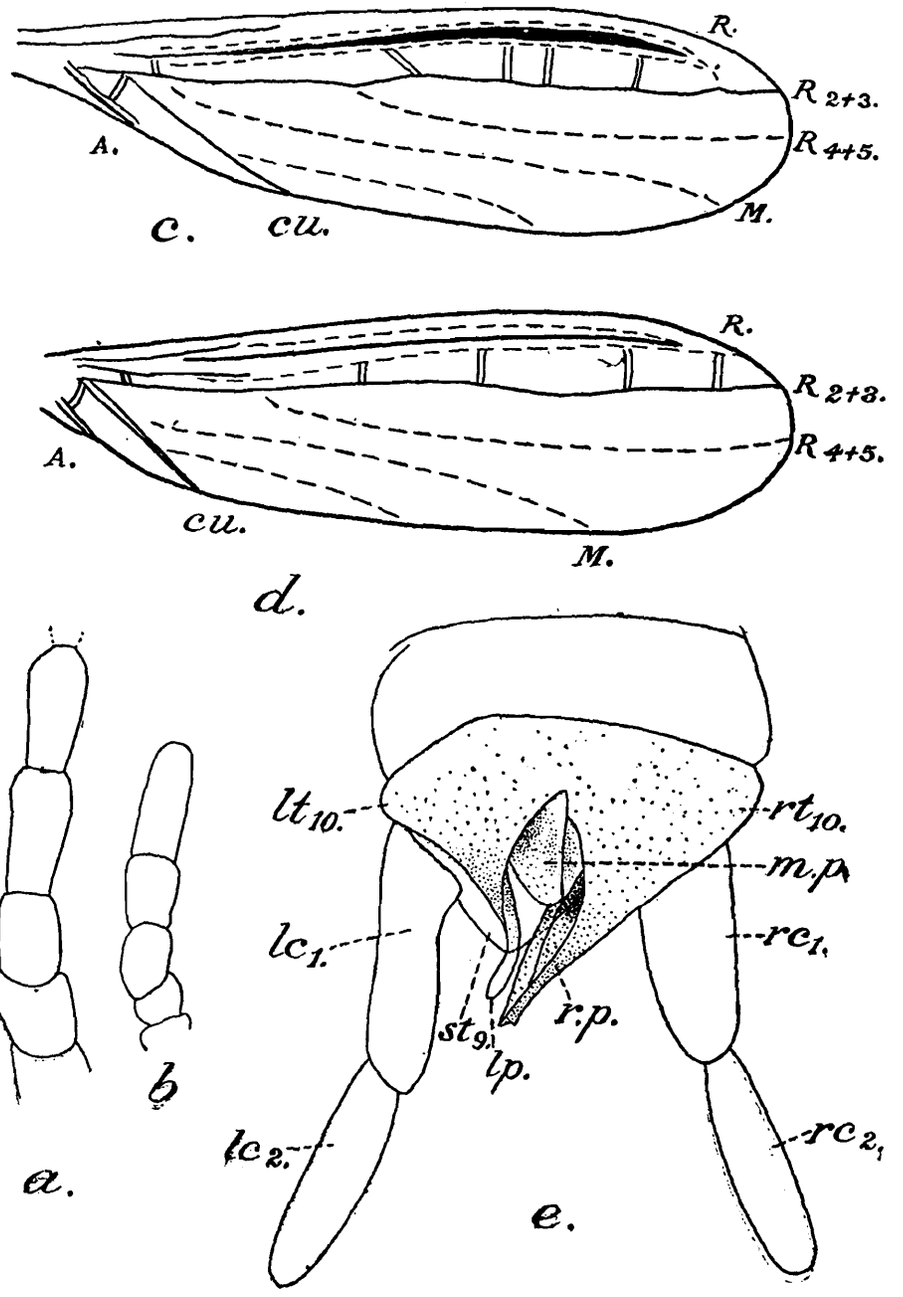
I am indebted to the authorities of the Zoological Survey of India for giving me facilities to work on the collection of the Embioptera in the Indian Museum.

Oligotoma minuta, sp. nov.

General colour brownish yellow; anterior pair of legs brownish testaceous; second and third pair of legs somewhat concolourous with the body; cerci also of the same colour as the body; 10th abdominal segment brownish testaceous.

Head more or less oval, with the anterior margin somewhat broader, castaneous; black eyes situated at its broadest part, slightly projecting anterolaterally, reniform in shape, their concavities approaching the base of the antennae. Antennae (text-fig. 1*a*) brownish yellow, joints whitish; 1·75 mm. long, with 14 joints; 1st somewhat thick and short; 2nd thick, slightly longer and closely united with 1st; 3rd the smallest of all and nearly uniform in thickness throughout; rest of the segments more or less similar in shape and size; first four segments have proportional lengths of 7 : 12 : 9 : 16. Maxillary palpi (text-fig. 1*b*) pale brown in colour, lengths of the joints in proportions 4 : 10 : 18 : 19 : 32.

First thoracic tergite somewhat rectangular, narrowed anteriorly, its anterior and posterior angles produced but rounded; mesially it has a short suture. Second thoracic tergite subquadrate in shape, with its anterior end rounded, two lateral edges parallel and straight; posterior margin bears two rather large concavities leaving distinct spaces between the second and third thoracic tergite; dorso-anteriorly the tergite bears a heart-shaped raised area carrying a few brownish hairs on its anterior



Text-fig 1.—*Oligotoma minuta*, sp. nov. Male.

a. First five antennal joints ·×48; *b*. Maxillary palp. ·×48; *c*. Right anterior wing. ×8·4; *d*. Right posterior wing. ×8·4; *e*. External genitalia with 10th abdominal segment as seen from above.

A.=Anal vein; C.=Costal vein; Cu=Cubital vein; l. c. b. p.=Left cercus basipodite, lc_1, lc_2=First and second joint of the left cercus; l.p.=Process of the left tenth tergal plate; lt_{10}=Left tenth tergal plate; M.=Median vein; m.p.=Median plate; plc_1=Process of the first joint of the left cercus; R_1, R_{2+3}, R_{4+} R_{5}.=Radial veins; rc_1, rc_2=First and second joints of the right cercus; rp.=Process of the right tenth tergal plate; rt_{10}=Right tenth tergal plate; st_9=Ninth sternal plate.

margin. Third or last thoracic tergite similar in structure to the second, its anterior margin less rounded, raised portion somewhat triangular dorsally with its posterior edge reaching about half the length of the tergite ; the posterior fourth of the tergite overlapped by the first abdominal segment ; dorsally the tergite bears a longitudinal median suture. The thoracic segments are sparingly covered with brownish hairs.

Legs normal except as regards the arolia or ventral pads of the tarsi ; hind pair of legs with very small pad on the first tarsal joint (metatarsus), arolia of the second tarsal joint comparatively large. Tarsal claws of each pair of legs curved at apex and not differing from one another.

Wings more or less hyaline with pale brownish pigmented bands. In the anterior wing (text-fig. 1*c*), R_1 brownish yellow, R_{2+3} complete but R_{4+5} only represented by a complete pigmented band ; M and anterior branch of Cu only represented by pigmented areas, straight stem of Cu as a true vein. Basal radio-median cross-vein absent, no true cross-vein between C and R_1 ; 4-5 cross-veins between R and R_{2+3} ; one oblique cross-vein at the base between R_1 and R_s, none between the two branches of R_s and none between R_{4+5} and M ; a slight notch, apparently the remnant of a cross-vein, between the anal A and the basal stem of Cu and R_s.

In the posterior wing (text-fig. 1*d*) C, S_c, R, R_s, R_{2+3}, and the straight branch of Cu well developed, R_{4+5}, M and the upper branch of Cu represented by pigment bands only ; no cross-vein between C and R_1 or between R_1 and R_{2+3} 3-4 cross-veins between R_1 and R_s, a small oblique cross-vein present at the base ; no radio-median cross-vein, no cross-vein between the two branches of R, between R_{4+5} and M or between M and upper branch of Cu ; a rather thick notch present between the basal stem of Cu and R_s (just where the fork begins) and A, this probably represents a cross-vein. In both the wings the " pseudo-radial lines "[1] are well represented.

The first abdominal segment rather small, overlapping the metathorax ; the anterior margin irregularly convex ; second to eight segments similar to one another ; ninth small and compressed ; the tenth asymmetrical ; appendages as shown in (text-fig. 1*e*). Right half of the Xth tergite (rt_{10}) larger than the left (lt_{10}), its distal half abruptly narrowing into a spinous process, concave inwardly (r. p.) ; left half of tenth tergite with a projecting piece (1p). IXth sternite (st_9) with a triangular process, concave dorsally and distally reaching half way along the length of the process of the left tergal plate. There is also a cone-shaped narrow median plate (m. p.) with its distal end rounded. Cerci more or less similar in shape ; first joint of the left cercus (l. c_1.) slightly longer and less stout than that of the right (r. c_1.), second joint of the left (l. c_2.) slightly longer than that of the right (r. c_2.), more or less similar in shape. Segments of left cercus sub-equal ; terminal segments of right cercus (r. c_2.) longer and narrower than basal joint (r. c_1.).

The form of the chitinous process of Xth tergite together with the size of the insect at once distinguish this species.

Female unknown.

Male : Total length 4·25 mm. ; Forewing 3 mm. ; Hindwing 2·5 mm.

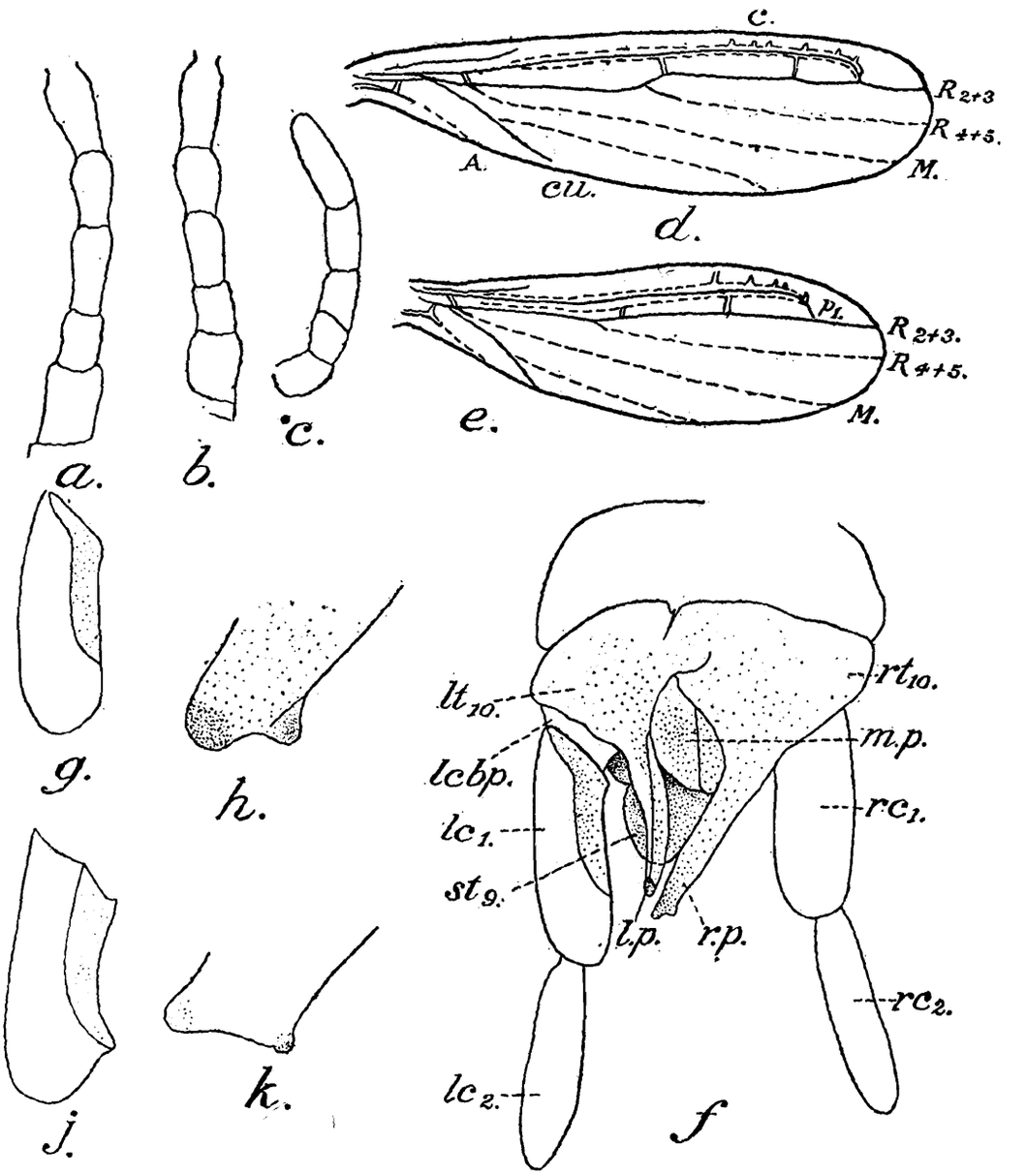
[1] Mukerji, S., *Rec. Ind. Mus.* XXIX, 4, p. 260 (1927).

There are four specimens, all males, in the Indian Museum Collection; presumably all collected from Calcutta and its suburbs, as follows:—

C. Paiva Coll.; 15.iv.14. in house; F. H. Gravely Coll.: 21.v.11, Zoological Garden, Alipore; F. H. Gravely Coll.: 19.v.15. in house at light; F. H. Gravely Coll. 25.xi.16.

Oligotoma ceylonica, Ender. var. **variegata,** nov.

Male.—General colour yellowish brown; anterior $\frac{2}{3}$rd of the head reddish brown, posterior $\frac{1}{3}$rd brownish yellow; pseudo-radial lines of



TEXT-FIG. 2.—*Oligotoma ceylonica* var. *variegata*, nov. Male.

a. First six antennal joints; (Ceylon specimen) ×12; *b*. First six antennal joints (Barkuda specimen) ×12; *c*. Maxillary palp. ×30; *d*. Right anterior wing × 2·6; *e*. Right posterior wing ×2·6; *f*. External genitalia with 10th abdominal segment as seen from above; *g*. Basal joint of the left cercus (Barkuda specimen) ×30; *h*. Process of right tenth tergal plate (Barkuda specimen) ×96; *j*. Basal joint of left cercus (Ceylon specimen) ×30; *k*. Process of right tenth tergal plate (Ceylon specimen) ×96.

Lettering same as in text-fig. 1.

wings reddish-brown; antennae with the joints of lighter colour; legs yellowish brown with the joints paler, segment bearing the claw somewhat paler; hairs of the body long, brownish-yellow; the sides of the abdomen of a darker colour than the general colouration of the body; intersegmental spaces of the abdomen lighter; abdominal segments mottled brown dorsally; appendages of right and left plate of the Xth tergite of a slightly darker tint than the general body.

Head somewhat small; surface markings not very prominent though in some cases about 4 indistinct longitudinal lines present in the posterior $\frac{1}{3}$rd of head, two dorsolateral ones more or less straight, pair of sub-dorsal ones somewhat thicker and their distal ends at the margin of the head thickened in the shape of triangles; pigment bands of a brownish colour arise from a pigmented mass of the same colour occupying the anterior $\frac{2}{3}$rd of the head; head somewh at bulging laterally in front of the eyes; head about 0·45 mm. long and 0·62 mm. broad behind the eyes; region posterior to the eyes also slightly bulging and distal margin well rounded; eyes only slightly projecting laterally, large about $\frac{2}{3}$rd visible from above; antennae moderately developed, about 14-19 segments visible[1]; 1st joint thick and short; 2nd considerably larger, about 1·4 times as long as broad; proximal antennal joints (text-figs. 2*a*, *b*) have their lengths in the proportions of 8 : 16 : 12 : 20 : 15 : 22; antennal hairs of medium size; maxillary palpi (text-fig. 2*c*) 5 jointed, lengths of segments in the proportions of 9 : 8 : 9 : 11 : 19.

Pronotum subquadrate, its angles more or less rounded laterally, sides somewhat excavated, transverse sulcus present as a fine streak; about two thirds from anterior edge; median longitudinal suture present in the posterior two thirds of the pronotum as a fine sulcus, posteriorly the pronotum bears a triangular raised portion; the transverse sulcus mentioned above forms the base of the triangle while the longitudinal suture runs perpendicular to the base. Mesonotum quadrangular, its anterior margin bears a small concavity which slightly projects into the pronotal area divided into three somewhat raised triangular areas and a posteromedian area irregular in shape. Metanotum similar in structure to mesonotum, slightly narrowed posteriorly, longitudinal suture occupies about half the distance between apex and base; the posteromedian concavity absent, its area occupied by convexly arched overlapping anterior portion of first abdominal segment.

Metatarsus of the fore-leg nearly as long as tibia. Wings more or less normal (text-fig. 2*c* and *d*), greatest breadth of anterior and posterior wings nearly equals 1 mm.; sub-hyaline with pale yellowish pigment bands; R_1 brown; pseudo-radial lines sharp and well developed; R_{2+3} complete R_1 · posteriorly curved falling into R_{2+3}, R_{4+5} only represented by a short basal piece and complete pigment band; M and anterior branch of Cu only represented by pigment band; straight stem of Cu present as a true vein. A very small oblique indistinct cross-vein, perhaps the representative of the basal radiomedian cross-vein, present. No true cross-veins between C and R_1 but about 6 indistinct small incom-

[1] Owing to the brittle nature of the antennal joints, specially in specimens preserved in spirit, it is difficult to determine their exact number.

plete veinlets dorsal to the pseudo-radial lines of the wing. Between R_1 and R_{2+3} in the anterior wing 3 cross-veins present, 2 posterior to the fork and one very small anterior to the fork near to the base. In the hind-wing 2-3 cross-veins between R_1 and R_{2+3} none between the two branches of R_s and none between R_{4+5} and M. In all the four wings a somewhat indistinct cross-piece between Cu and A present. Abdomen as in the genus; first abdominal segment small, semilunar in shape, overlapping metasternum, its anterior arched edge somewhat serrated, second smaller than following segments; rest of the segment more or less similar in shape; their breadth gradually reaches their maximum near about the middle of the abdomen after which it gradually decreases to the 9th segment. 9th segment more or less compressed, narrow. In the apical segment of male (text-fig. 2*f*) left part of 10th tergite (lt_{10}) with a long finger shaped process curved towards left (l. p.), the terminal portion somewhat narrower, round, tip of this process bearing a very minute groove visible only under a high power of microscope. Right part of 10th tergite (rt_{10}) with a long process (r. p.) slightly broad basally, only terminal $\frac{1}{4}$th narrower, terminal end bearing a small concavity with two round protuberances, a large one along inner angle and a small one along the outer angles (text-figs. 2*h* and *k*); IXth sternite (st_9) with flat irregularly shaped and terminally rounded appendages; left cercus basipodite (l. c. b. p.), ring shaped, moderately developed, occupying the area between the basal joint of the left cercus and the left portion of the Xth tergite (lt_{10}): Basally the process of the 9th sternite adjacent to the cercus basipodite (l. c. b. p.). The median process or sclerite (m. p.), situated between the bases of the process of left and right portions of Xth tergite, rather small, terminally rounded and with a pigmented straight median suture. First joint of right cercus proportionately developed; the terminal joint slightly longer than the basal. Basal joint of left cercus slightly longer than that of the right; about $\frac{2}{3}$rd of the inner margin of the basal joint excavated (text-figs. 2*g* and *j*) the cavity extending nearly to the outer angle of the proximal end of the joint. Terminal joints of both the cerci of nearly the same length as the first or proximal, but distinctly thinner. Lengths of the first and second joints of left cercus are in the proportions of 15 : 13. Abdomen about 2·5 mm. long with cerci, and 0·5 mm. broad.

Female unknown.

Male total length 5·5 mm.; fore-wing 3·75 mm.; hind-wing 3·0 mm. There are four specimens, all males, in the Indian Museum collection.

Localities.—N. Annandale Coll. Barkuda Island, Chilka Lake, Ganjam District, Madras, 1.x.22 at light; Barkuda Island, Chilka Lake, Ganjam District, Madras, 2.viii.23. (Badly preserved); F. H. Gravely Coll. Peradeniya, Ceylon, 25. v.10; Peradeniya, Ceylon, vii.1910.

In its external genitalia the new variety resembles *Oligotoma ceylonica* Enderl., and *O. japonica* Oka. The process of the left tenth tergal plate is finger-shaped and long in both; in *O. ceylonica* the tip of the process of the left tenth tergal plate is more or less rounded, its apex somewhat straight reaching nearly to the terminal end of the appendage of the Xth sternite. In the case of *ceylonica* var. *variegata*, nov., on the other hand, the tip of the process (text-fig. 8, l. p.) though round, is somewhat narrow

terminally and its distal half is curved and extends beyond the appendage of the 9th sternite (st_9) as in *O. japonica*. In the var. *variegata*, there is a small cavity at the tip of the process (l. p.). The process of the right tenth tergal plate in the var. *variegata* is not abruptly narrowed as in *ceylonica* but is of more or less equal thickness throughout; terminally this process bears a distinct depression which is furnished with two round protuberances at the inner and outer angles (text-figs. 2*h* and *k*). In the var. *variegata* the left cercus basipodite is not spread out and does not bear the two uvula-shaped appendages as in the case of *ceylonica*. As is shown in the figure, this structure appears to be more or less annular in shape. The median plate (m. p.) is distinct and broadly rounded off; this structure has not been shown by Enderlein in the figure of genitalia of *O. ceylonica*. The basal joint of left cercus of *O. ceylonica* is only slightly scooped out at the base but in var. *variegata* the anterior $\frac{2}{3}$rd of the basal joint of left cercus bears a distinct cavity (text-figs. 2*g* and *j*)[1]. It will thus be seen that *Oligotoma ceylonica*, *O. japonica* and the present form resemble each other closely and I regard the new form as a variety of Enderlein's *O. ceylonica*. It is therefore suggested that a separate *ceylonica* group should be erected to which these three forms may be assigned.

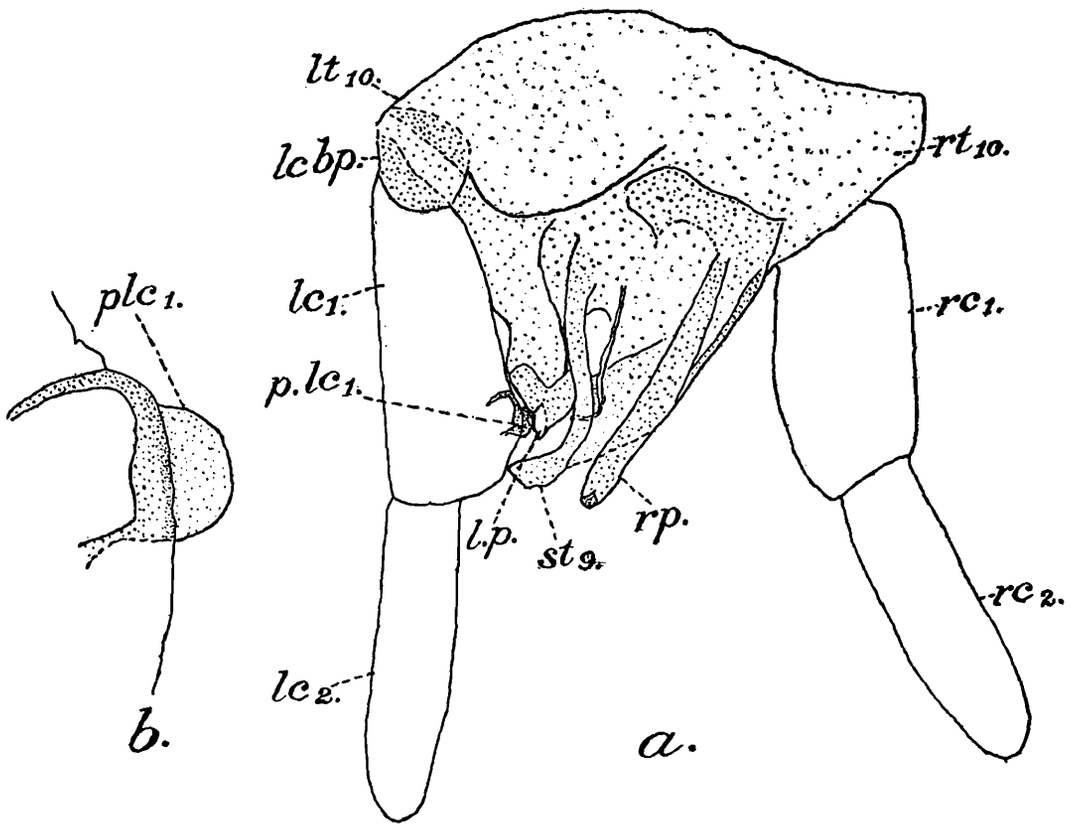
DESCRIPTION OF THE EXTERNAL GENITALIA OF *OLIGOTOMA MICHAELI* MACL.

Male.—Among the Embiids, *Oligotoma michaeli* MacL. is one of the oldest known species, having been described as early as 1877. Hagen (1885) gives a detailed description of the external genitalia, but as no figure was published with his description, it is difficult to follow him. Later Needham (1909) figured the external genitalia, but this and the account of the genitalia of the species in the otherwise excellent monograph of Enderlein (1912) are far from complete. I, therefore, give a detailed description of the external genitalia of a specimen which I believe to belong to this species.

The 10th tergite assymmetrical, appendages as shown in the figure (text-fig. 3), right half of the Xth tergite ($rt._{10}$) larger than the left (lt_{10}), its distal half produced into a finger-shaped process which apparently bears a concavity at the apex (r. p.); the left half of Xth tergite with a projecting process (l. p.) bearing a slight constriction; it then broadens distally but narrows abruptly near the end. 9th sternite subtriangular, produced into a somewhat laminated process directed towards left cercus, it projects beyond the process of the left plate. In the specimen before me, I failed to trace a distinct median plate. Cerci distinctly asymmetrical, first joint of left cercus (l. c_1.) somewhat narrow basally, and distinctly broadened distally, next the distal end of the joint it bears on its inner margin a small cup-shaped process (text-fig. 10. *b*. $plc._1$) first joint of left cercus slightly longer but less stouter than that of the right ($rc._1$); distal joint of both cerci similar

[1] The area of excavated portion is variable in specimens collected from different localities and the extent of variation is indicated by the figures.

in shape and size. Lengths of basal joints of left and right cerci are in the proportion of 45 : 38.



TEXT-FIG. 3.—*Oligotoma michaeli*, MacL.

a. External genitalia of the male with 10th abdominal segment as seen from above ×21 ; *b*. A portion of the basal joint of left cercus ×91·6.
Lettering same as in text-fig. 1.

The specimen was very kindly sent to me by Mr. T. B. Fletcher, Imperial Entomologist, Pusa, Bihar, and is labelled :—Assam, Shillong 4,900 ft. 30.v.18. A. G. R. Coll. : (Pusa).

DISTRIBUTIONAL RECORDS OF SOME INDIAN FORMS.

Oligotoma saundersi Westw., 1837.

Males.—Ross I., Andamans ; at light, 29.iii.11 (C. Paiva) ; Saugor, Central Provinces ; at light, 19.iii.19 (F. H. Gravely) ; Burhanpur, Central Provinces ; 4-6 iii. 19 (F. H. (Gravely ; Medha, Yenna Valley, Satara District, *ca.* 2,200 ft., Bombay Pres. ; 23.iv.12 (F. H. Gravely) ; Barkuda I., Chilka Lake, Ganjam District, Madras Pres. ; at light, 17.iii.24 (N. Annandale) ; Calcutta Museum Compound, Bengal ; 12.vii.10 (S. W. Kemp) ; Calcutta, Bengal ; 7.viii.14 (F. H. Gravely) ; Calcutta, Bengal ; in house, at light, 9.vii.26 (S. Rebeiro) ; Calcutta, Bengal ; in house, Museum Compound, at light, 3.ii.11 (F. H. Gravely) ; Calcutta, Bengal ; in house, Museum Compound, at light, 26.x.10 (F. H. Gravely) ; Ratnagiri District, *ca.* 400 ft. ; 1-2.v.12 (F. H. Gravely).

Oligotoma latreillei Ramb., 1843.

Males.—Medha, Yenna valley, Satara district, *ca.* 2,200 ft., Bombay Pres.; 17-23.iv-12 (F. H. Gravely) ; Burhanpur, Central Provinces ; 4-6.iii.19 (F. H. Gravely) ; Peradeniya, Ceylon ; 1.vi.10 (F. H. Gravely).

Oligotoma greeniana Enderl., 1912.

Males.—Peradeniya, Ceylon ; at light, 9.VI.10 ; Peradeniya, Ceylon ; viii.10 ; Peradeniya, Ceylon ; VI.10 (F. H. Gravely).

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