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AUTHOR(S):

Kitakami, Siro

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## A New Genus and Species of Blepharoceridae from Japan

By

Sirô KITAKAMI

(Biological Laboratory, Medical Academy of Kyôto=Kyôto Huritu Ika Daigaku)

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*With Plates XXI-XXIII*

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In June 1937 Mr. Kindi IMANISI of the Ôtu Hydrobiological Station sent to me for identification a number of unusual Blepharocerid larvae and pupae which had been collected by Mr. Tôkiti KANI in August 1936 at Nagawa in the Province of Sinano. The specimens could not be referred to any of the Blepharocerids hitherto known from this country and seemed to belong to a different genus. Later I myself visited the locality and was fortunate enough to obtain all stages of larvae and pupae, from the latter of which male and female imagos were also induced. After careful examination, it has become clear that this specimen should be considered a new genus, though it is closely related to the genus *Hapalothrix* LOEW known from Central Europe. This deserves our special notice not only since this genus is quite new to science, but also on account of its peculiar geographical distribution, and moreover, because it is the second species of the subfamily *Paltostominae* EDWARDS ever recorded from Japan.

At this point I wish to acknowledge my great indebtedness to Professor Tamiji KAWAMURA of the Kyoto Imperial University for his kind advice and supervision throughout this work. Heartly thanks should also be expressed to Mr. T. KANI and Mr. K. IMANISI for favouring me with such invaluable materials. Acknowledgements are also due to Dr. B. J. MANNHEIMS for his kindness and generosity in sending me his European materials for comparison as well as his important publications; to Dr. F. W. EDWARDS and Prof. Dr. J. KOMÁREK for sharing many copies of their important articles; and also to Prof. Dr. C. P. ALEXANDER for his continuous encouragement and appreciation to my work.

### *Neohapalothrix* gen. nov.

*Imago.* Head (Figs. 1, 2) broad, transverse. Eyes large, bisected in both sexes; upper parts with larger brownish facets entirely contiguous on the vertex in male, in female slightly separated; lower parts with smaller

blackish facets much smaller than the upper parts in male, in female much larger. Pubescence on the eyes short, and no bristles. Occiput and gena with short setae. Antennae 15-jointed; second scapal joint much longer than the first, slender and apically swollen; flagellar joints very slender, longer than broad, tapering apically; clypeus and labrum elongated, much longer than the vertical height of the head. Mandibles absent in male, in female slender and delicate, but with no denticles. Blades of maxilla stout, half-tubular. Maxillary palpi very long, more than twice the length of the blades; being 3-jointed, first joint very short, second shorter than the blades, third very long, more than twice as long as the second, with several constrictions. Labium elongated and stout, its palpi divergent apically, with a small inner lobe on each. Thorax with the pro- and metanotum rudimentary; mesonotum conspicuous, but mostly glabrous. Wings (Fig. 3) subhyaline, anal lobe obtuse; macrotrichia short, confined on the costa and wing margins. Venation nearly identical with that of the genus *Hapalothrix*, except that the Cu and An attain the wing margin. Tibial spurs 1. 2. 2., but those of the fore- and mid-legs rudimentary. Last tarsal joint (Fig. 4) slightly curved, but simple. Claws simple, without denticles in both sexes. Empodia flat, not eminent. Abdominal tergites and sternites more or less sparsely set with very short setae. Male hypopygium (Figs. 5, 6): claspers rather simple, concave inwards, the apical part slightly bilobed dorso-ventrally; ninth sternite longer than broad, posterior margin undulated. Male aedeagus (Fig. 7) with long filamentous parameres and penis filaments; vesica rather large, nearly oval; apodeme rudimentary. Female hypopygium (Figs. 10, 11); ninth tergite with very long bristles; tenth tergite laterally bilobed by a longitudinal stripe, set with short stiff bristles arising from papillae; ninth sternite with a median lobe deeply cleft posteriorly; cerci slightly longer than the basal breadth of the segment, densely setaceous and pubescent.

*Pupa* (Figs. 12, 13, 14). Body oval, strongly convex, dorso-median ridge conspicuous, outer margin undulated. Respiratory horns conspicuous, nearly erect, somewhat separated from each other. Each horn with four nearly similar lamellae, which are flat and much elongated, dully pointed apically. Head mostly faced forwards. Thick granulation of minute, flat, circular, blackish granules on a part of mesothorax, most of the metathorax and the whole abdomen. A single thorn present on the middle of each of the first five or six abdominal segments. Three pairs of large adhesive pads at the ventral side of third to fifth abdominal segments. Residua of segmental gill-tufts of the larva preserved.

*Larva. Fourth instar* (Figs. 15-18). Body plump, convex dorsally, neck-pieces entirely absent. General outline nearly elliptic, the third or fourth body-segment broadest of all. Color on the dorsal side mostly brownish black, with remarkable longitudinal whitish stripes and markings of spots. Antennae two-jointed, slender and very short. Thoracic spot obscured. Cephalothorax triangular, projected forwards. First abdominal segment with remarkable lateral lobes directed antero-laterally. A single small median

wart present on each abdominal segment from the second to the fifth. Dorsal integument is densely covered by very long, fine hairs. A pair of "fulcra" present on the distal end of each lateral lobe of the first six abdominal segments. The fulcra resemble the "feelers" of the genus *Parablepharocera*, rather than the "claws" of any genera, and are entirely separated from each other from the base. The last two body-segments scarcely separated. Seventh body-segment with an unique rudimentary fulcrum laterally. Caudal margin broadly curved, semicircular, and not chitinised. Ventral integument pale inwards, blackish outwards densely set with minute conical hairlets. Segmental gill-tufts each with seven long and slender filaments, of which the posteriorly directed four are dichotomized from two common stems; in the sixth segment filaments are characteristically five, and are all directed forwards. Anal gill large and thick. Suckers large.

*Third instar* (Fig. 19). Dorsal integument with longitudinal stripes and long hairs. Antennae two-jointed. Fulcra as in the fourth instar. Segmental gill-tufts each with four filaments, of which the posteriorly directed two are dichotomized from a common stem; in the sixth segment filaments are characteristically three, and are all directed anteriorly.

*Second instar* (Fig. 20). Dorsal integument obscure brownish black throughout, the long hairs rather sparse. Antennae unequally two-jointed, proximal joint very short. Lateral lobes of the first abdominal segment rudimentary. Fulcra distinctly dichotomized before and behind, resembling those of the third or fourth instar of the genus *Hapalothrix*; posterior branch longer than the anterior one. Segmental gill-tufts each with an unique slender filament usually curved circularly.

*First instar* (Fig. 21). Dorsal integument obscure brownish throughout, and set usually with a pair of transverse rows of thornlets on each segment, but no long hairs. Antennae jointless. A remarkable retractile hooked appendage present, instead of fulcra. Ventral integument pale, glabrous. No segmental gill-tuft. Anal gill large. Suckers rather small.

Genotype: *Neohapalothrix kanii* gen. et sp. nov.

In view of the venational characteristics, this new genus may be allied to some of the genera of the subfamily *Paltostominae* EDWARDS, such as the Neogaeen *Curupira*, *Paltostoma* and *Limonicola*, and the European *Hapalothrix*. The resemblances in the venation, general features of the pupa and its respiratory horns, of the larva and its fulcra, and in the Palæarctic distribution lead us to the assumption that this new genus is more closely related to the *Hapalothrix* than to any other genera. On the other hand, a number of differences between these two genera, as shown in the following table, lead us to the conclusion that they are evidently different genera. The new genus is more generalized than the *Hapalothrix*, and may be regarded as an original stock of the latter, as was expected by EDWARDS in 1929 (1929, p. 75).

*Tianschanella* BRODSKY (1930) from Central Asia is a genus closely re-

lated to and more specialized than the *Hapalothrix*. The series of these three genera, *Neohapalothrix* gen. nov., *Hapalothrix* LOEW and *Tianschanella* BRODSKY reveals a special branch of phylogeny of the family.

<i>Neohapalothrix</i> gen. nov.	<i>Hapalothrix</i> LOEW
Imago	Imago
Body, eyes, etc. without long bristles.	—with long bristles.
Upper parts of ♀-eyes enormous.	—rudimentary.
Antennae distinctly 15-jointed.	—13-jointed.
Labrum, libium, max.-palpi elongated.	—short.
Blades of maxilla stout.	—rudimentary.
Mandibles present in ♀.	—absent.
Anal angle of wing obtuse.	—acute.
Cu, An attaining wing margin.	—not attaining.
Tibial spurs 1. 2. 2.	—absent.
Claws simple in ♂ ♀.	—thickened in ♂.
Pupa	Pupa
Thorns present on the dorsal side.	—absent.
Granulation of mesothorax broad.	—much reduced.
Adhesive pads 3 pairs.	—4 pairs.
Respiratory lamellae subsimilar.	—rather dissimilar.
Larva	Larva
1. body-segment with eminent lateral lobe.	—without lateral lobe.
Fulcra separated from the base.	—dichotomized distally.
Fulcra of 2. instar subsimilar to	those of 3. or 4. instar.
Several gill filaments dichotomized.	—simple.
Long hairs, chitin warts present.	—absent.
Remarkable stripes and markings present.	—absent.

***Neohapalothrix kanii* gen. et sp. nov.**

**Male** (2 specimens, dissected from mature pupa).

Length ca. 6.5-7 mm.; wings ca. 6 mm. (breadth ca. 2.5 mm).

*Head* (Figs. 1, 2) very large, transverse. *Eyes* very large, bisected; upper parts with rather large brownish facets entirely contiguous on the vertex, and mostly covering the head in dorsal aspect; lower parts with smaller, blackish facets much smaller than the upper parts, but occupying the larger part of the head in ventral aspect. Pubescence of eyes short, shorter than the width of one facet; no bristles on the eyes. Ocellar pro-

tubercle posteriorly placed, blackish, sparsely set with short setae; anterior ocellus much larger than the others. Occiput and gena with black short setae. *Antennae* slender and short, distinctly 15-segmented, sparsely set with short setae throughout; first scapal joint thick, slightly longer than broad; second joint slender and apically swollen, more than one and one-half times as long as the first; flagella very slender, their proximal joints cylindrical, much longer than broad (except the second which is short), distal ones ellipsoidal, very slightly longer than broad.

*Mouth-parts*: Clypeus elongated, sparsely setaceous. Labrum elongated, sharply pointed apically, and together with the clypeus much longer than the vertical height of the head. Mandibles absent. Blades of maxilla stout, half-tubular, the tip slightly undulated. Maxillary palpi very long, about two and one-half times as long as the blades, sparsely setaceous throughout; being 3-jointed, first joint very short, second cylindrical, shorter than blades, last joint (3. + 4. + 5.) very long, more than twice the second, with several constrictions. Labium elongated and stout, its palpi scarcely distinguished proximally, distally divergent and free, each with a small inner lobe.

*Thorax* with pro- and metanotum rudimentary. Mesonotum conspicuous, brownish black, with normal stripes and sutures; mostly glabrous, except the postscutellum which is very sparsely setaceous.

*Wings* (Fig. 3): membrane subhyaline, with slight brownish tint; microtrichia minute, but dense; macrotrichia short, confined on the costa and wing margins. Venation nearly identical with that of the *Hapalothrix*: Sc rudimentary;  $R_1$  ending before the apex of  $R_{2+3}$ , about a distance of the length of  $R_{2+3}$  from its apex;  $R_{4+5}$  about two and one-half times as long as  $R_{2+3}$ ;  $R_s$  nearly straight, its basal deflexion shorter than  $r-m$ ; M simple, distinct;  $Cu_1$ ,  $Cu_2$  and An faint, but attaining the wing margin. Anal lobe of the wing obtuse; anal angle with a chitin spot. Halteres well developed, stems and knobs nearly glabrous.

*Legs*: Trochanters of fore-legs long, cylindrical, thrice as long as broad. Femora club-shaped, in fore-legs shortest and much swollen apically. Tibiae slightly longer than femora in fore- and mid-legs, in hind-legs slightly shorter. Tibial spurs 1. 2. 2., each densely set with very short setae; in fore-legs nearly conical, shorter than the diameter of the segment; in mid-legs very slender, dissimilar, nearly as long as the diameter of the segment; in hind-legs very stout, subequal, nearly one and one-half times as long as the diameter of the segment.

*Tarsi* (Fig. 4) five jointed; last joint slightly curved and longer than the fourth, in mid-legs nearly two times as long as the fourth. Claws sharp, simple and with no denticles, but the proximal half very finely pubescent. Empodia distinct, flat and pubescent, but not eminent. In hind-legs measured: Femora 3 mm.; Tibiae 3.5 mm.; Tarsi 4 mm.

*Abdomen*: Tergites sparsely set with very short setae; median and posterior parts of each segment blackish, remaining parts pale. Sternites very sparsely setaceous.

*Hypopygium* (Figs. 5, 6). Eighth tergite rather eminent, blackish. Ninth tergite large, dully convex posteriorly, sparsely set with short setae. Tenth tergite (=anal segment) bilobed, its lobes slightly longer than its basal breadth, rather densely set with short setae. Claspers rather simple, concave inwards, their apical part slightly bilobed dorso-ventrally, densely setaceous. Dorsal dististyles slender, glabrous. Ninth sternite (=ventral plate) large, rather longer than broad, slightly narrowed in the middle, posterior margin undulated; mostly glabrous, but the dorsal parts very sparsely setaceous. Aedeagus (Fig. 7) with long filamentous parameres and penis filaments. Parameres are rolled up half-tubular in their whole length and not much thicker than the penis filaments. Penis filaments are of equal length and thickness, basal parts fairly thickened. Vesica rather large, nearly ovoidal, chitinised heavily; apodeme rudimentary, rather conical, directed postero-dorsally.

**Female** (2 specimens, dissected from mature pupa).

*Head* (Figs. 8, 9) transverse, smaller than in male. *Eyes* large, bisected. Upper parts with large brownish facets rather eminent, occupying inner two thirds of the head in dorsal aspect; being separated from each other on the vertex, the area separating them is slightly broader than the diameter of anterior ocellus. Lower parts with smaller blackish facets much larger than the upper parts, and fully as high as the vertical diameter of the head. *Eyes* densely pubescent, but not setaceous. *Antennae* as in the male. *Mouth-parts* as in the male, except mandibles present, which are slender and delicate, devoid of denticles, and slightly longer than the blades of maxilla. *Wings* as in the male. *Legs*: Trochanters of mid-legs densely setaceous along the inner side. Femora of fore- and mid-legs shorter than the tibiae respectively. Tibial spurs as in the male. First tarsal joint in fore-legs subequal to the tibia in length. Last tarsal joint in fore-legs nearly twice, in mid-legs more than twice, in hind-legs one and one-half times as long as the fourth joint respectively. Claws and empodia as in the male. In hind-legs measured: Femora 2.5 mm.; Tibiae 2.5 mm.; Tarsi 4 mm.

*Hypopygium* (Figs. 10, 11). Ninth tergite with a transverse row of very long, stout bristles on the middle. Tenth tergite laterally bilobed by a longitudinal stripe, mainly set with short, stiff bristles arising from cylindrical papillae, median narrow area glabrous and pale. Eighth sternite rather strongly cleft on the median posterior margin. Ninth sternite with a median lobe pubescent, which has a deep cleft posteriorly (or with a pair of knob-like processes); lateral lobes of the segment chitinised, blackish. Tenth sternite with a few long bristles near the posterior end. Cerci slightly longer than the basal breadth of the segment, densely setaceous and pubescent, its apical parts slightly bilobed laterally, outer lobe rounded, free, with a few short stiff bristles.

**Pupa** (36 specimens) (Figs. 12-14).

Length 5.2-6.2 mm.; breadth 2.9-3.7 mm.; height 1.9-2.2 mm. (including horns 2.6-2.9 mm.).

Body oval, strongly convex, dorso-median ridge conspicuous, outer margin undulated. Dorsal integument blackish brown or brownish black, except lighter dorso-median ridge. Respiratory horns conspicuous, ca. 1.3-1.4 mm. in length, nearly erect and separated from each other. Each horn with four nearly similar lamellae, the outer ones chitinised, intermediate ones more delicate. Each lamella flat and simple, sharp-triangular, the height about two and one-half times the base, but the apex rather dully pointed. Head mostly faced forwards. Prothorax rather eminent. Thick granulation of minute, flat and circular, blackish chitin granules on the median parts of mesothorax, most of the metathorax and the whole abdomen; anterior part of mesothorax (before the pupal horns), dorso-median ridge, postero-lateral parts of the seventh abdominal segment and the caudal parts of the last segment very sparsely granulated. A single blackish thorn present, on the middle of the dorso-median ridge of each of the first five or six abdominal segments, but on the first and sixth segments it is rudimentary. The thorn is nearly one and one-half times as long as the basal diameter. Dorsal integument of mesothorax slightly crumpled transversely. Ventral surface of the last segment with sparse granulation at the margins. Three pairs of large, elliptic adhesive pads at the ventral side of third to fifth abdominal segments. Residua of segmental gill-tufts of the larva faintly preserved.

The male pupa can be distinguished from the female by the ratio of the length of body to the breadth, the male being 2:1, the female nearly 3:2.

**Larva.** *Fourth instar* (24 specimens) (Figs. 15-18).

Length 4.1-7.3 mm.; breadth 1.6-3.7 mm., including fulcra 2.1-4.4 mm.

Body plump, convex dorsally, neck-pieces entirely absent. General outline nearly elliptic, the third or fourth body-segment being broadest of all. Color on the dorsal side mostly brownish black, except remarkable whitish stripes and markings of spots. Median portions of the first six body-segments with a pair of longitudinal yellowish white stripes, among which is interposed a blackish median longitudinal stripe. Whitish spots are also present on the area between the interno- and externo-lateralia, on basal and apical parts of the lateral lobe of each body-segment; last body-segment usually with three spots. These spots tend to be less conspicuous in immature specimens.

*Antennae* two-jointed, very slender and short, about  $1/5$  as long as the longitudinal diameter of the first body-segment; each joint mostly black, articular portions pale; proximal joint slightly thickened apically, less than thrice as long as broad; distal joint cylindrical, more than four times as long as broad, and one and one-half times longer than the proximal one. Head chitin plates black. Eyes blackish. Thoracic spot absent. Cephalothorax triangular, projected forwards. Lateral lobes of the first abdominal segment remarkable, directed antero-laterally, fully as long as the longitudinal diameter of the base. Lateral lobes in succeeding segments transverse,



conical, nearly twice as long as the diameter of the base. A single, small, black median wart present on the dorsal side of each of the first six abdominal segments, of which the first and sixth are much smaller than the rest. A pair of minute black granules present on both sides of the wart; a group of granules also found at the base of each lateral lobe. Dorsal integument is densely covered by very long, fine, whitish hairs, which are as long as the height of the body, but gradually shorter outwards. Anterior and posterior margins of each lateral lobe densely set with short, curved bristles.

A pair of *fulcra* (Figs. 17, 18) present on the distal end of each lateral lobe of first six abdominal segments. The fulcra are entirely separated from each other from the base, so that they resemble the "feelers" of *Parablepharocera* rather than the "claws" of any genera. They are fairly well chitinised, set with many long bristles as well as short spiny bristles on the dorsal and distal surface. The anterior fulcrum is rather club-shaped, posterior end dully turned ventrally and chitinised, slightly less than thrice as long as broad, ventral surface nearly glabrous. The posterior fulcrum is elongate conical, and slightly longer than the anterior one, ventral surface mostly covered by minute, black, conical hairlets. Last two body-segments scarcely separated, their lateral constriction is about half the length of the posterior fulcrum. Seventh body-segment with many granules on the dorsal side, and at the lateral margin with an unique rudimentary fulcrum, which is chitinised black and nearly as long as broad. Caudal margin broadly and gradually curved, semicircular, set with many long bristles, but never chitinised.

Ventral integument pale on the inner portion, blackish outwards; outer two thirds of each lateral lobe is densely covered by black, conical hairlets. First body-segment darker, with three pairs of long bristles and a pair of granules on both sides of the sucker. Last body-segment densely set with hairlets on the marginal half, and on the inner half with many circular granules.

Segmental *gill-tufts* (Fig. 16) each with seven filaments in second to fifth segments, and five filaments in sixth segment characteristically. Filaments are white, slender and long, curved irregularly; when there are seven, three are directed forwards and four backwards; posteriorly directed four arise from two common stems which dichotomise fairly distant from the base; two from the last stem are especially long, and often entangled with the anterior filaments of the succeeding segment; those in the sixth segment are all simple, directed forwards. The base of each tuft is slightly prominent, forming a white area. Anal gill large and thick; anterior pair of filaments directed forwards, longer than the diameter of the sucker, and more than thrice as long as the posterior ones. Suckers large, the diameter being more than 1/5 of the breadth of the segment.

*Third instar* (20 specimens) (Fig. 19).

Length 2.3-4.5 mm.; breadth 0.8-1.9 mm., including fulcra 1.1-2.4 mm.

Body plump, neck-pieces absent; the breadth of the body-segments nearly equal throughout. General coloration and the stripes on the dorsal side as in the fourth instar, but the whitish markings tend to be obscure, especially in immature specimens. Antennae two-jointed, distal joint slightly longer, about thrice as long as broad, pointed apically. Dorsal warts indistinct. Long hairs on the dorsal side and the stout curved setae tend to decrease. Fulcra as in the fourth instar, chitinised blackish; fulcrum of seventh body-segment much reduced. Segmental gill-tufts each with four filaments in second to fifth segments, and three in sixth segment; when four, two directed anteriorly and two posteriorly; posteriorly directed two arise from a stem, which dichotomises near its base; when three, they are all simple, directed anteriorly. Anal gill as in the fourth instar.

*Second instar* (21 specimens) (Fig. 20).

Length 1.4-2.4 mm. Body plump, neck pieces absent. Dorsal side usually obscure brownish or brownish black throughout, but mature specimens with somewhat lighter markings. Antennae unequally two-jointed; proximal joint as long as broad, distal one slightly thicker and twice as long as broad, with a remarkable apical prominence. Lateral lobes of the first segment rudimentary. Long hairs on the dorsal side each arising from a minute black punctation, and very sparse. Fulcra black, distinctly dichotomised, resembling those of the third or fourth instar of *Hapalothrix*; proximal common stem is slightly longer than broad; anterior branch is one and one-half times as long as broad; posterior branch nearly twice as long as broad, and longer than the anterior one; both with a few stout bristles apically. The fulcrum of the seventh segment much reduced to a minute prominence, with a few apical bristles. Just before moulting specimens have irregular dark markings on each lateral lobe. Segmental gill-tufts each with a unique filament, which is very long and slender and usually circular, the apex directed backwards. Anal gill large. Suckers rather small.

*First instar* (5 specimens) (Fig. 21).

Length 0.8-1.4 mm. Body rather slender, neck-pieces absent, lateral lobe reduced. Color on the dorsal side obscure brownish yellow throughout. Antennae jointless, cylindrical, about twice as long as broad, with a conical prominence at the tip. First body-segment longer than broad, dully pointed anteriorly. No long hairs on the dorsal side. A pair of transverse rows of thornlets present on each body-segment, of which anterior row is confined on the median portion, posterior one extending to the lateral margins; first and last body-segments each with four rows characteristically. Thornlets are rather stout and short on the median portion, but elongated on the lateral margins and resembling spiny bristles. A remarkable retractile hooked appendage present; instead of the fulcra. This appendage is cylindrical and long, fully  $1/4$  of the width of body-segment in full expansion, and twice as long as broad in retraction; its apex set with more than ten hooklets curved outwards. Last two body-segments scarcely divided, nearly circular. Caudal margin with a few short setae. Ventral in-

tegument pale, glabrous. No segmental gill-tuft. Anal gill large. Suckers rather small.

*Locality* and data of collection as in the following table:—

Date	Locality	Data	W. t.	Collector
17/VIII/1936	Nagawa (Prov. of Sinano)	Larva (iv), Pupa	18°C	KANI
20/VI /1937	"	Larva (iv, iii, ii, i)	15°-16°C	KITAKAMI
I/VIII/ "	"	Larva (iv, iii, ii), Pupa	17°C	"
31/VIII/ "	"	Pupa	17°C	"

The locality of this species, so far as now known, is restricted to a small rapid mountain stream in the Nagawa-Village above mentioned. This stream is called Kurokawa, and is about 5 meters in width, and about 1,100 meters above the sea-level, running near the foot of Mt. Norikura.

In its life cycle, this species is very different from other members of our Blepharocerids. As the data of collection indicate, this species may be regarded, almost with certainty, as one of the members of the "mono-generative summer-type," to which no other species of our Blepharocerids hitherto known belongs. Thus this species forms by itself the fourth category of the type of life cycle. The materials collected by Mr. T. KANI included 3 larvae of fourth stage and 2 pupae still immature. On August 31, I obtained but a few mature and immature pupae, and neither imagoes nor larvae were captured, although the collection was very carefully carried out; while on August 1, mature larvae and pupae were found in abundance. These facts convinced me that the season's swarm was drawing to a close.

As to the mode of living, this species belongs to the typical "submersed-type." The larvae and pupae are prevalent in the central portions of the stream where the water is always rushing and boiling. They are attached fast to the rock or stone about 20 cm. below the surface, so that the collector must drag the rapids and remove the stone to the bank.

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### Explanation of Plates.

#### Plate XXI

- Fig. 1. Head of male, dissected from pupa; dorsal view,  $\times 28$ .
2. " " ; ventral view,  $\times 28$ .
3. Wing of male, dissected from pupa,  $\times 11$ .
4. Hind tarsus of male, dissected from pupa,  $\times 55$ .
5. Male hypopygium, dissected from pupa; dorsal view,  $\times 28$ .
6. " " ; ventral view,  $\times 28$ .
7. Parts of male aedeagus, dissected from pupa; dorsal view,  $\times 75$ .
8. Head of female, dissected from pupa; dorsal view,  $\times 28$ .
9. " " ; ventral view,  $\times 28$ .
10. Female hypopygium, dissected from pupa; dorsal view,  $\times 35$ .
11. " " ; ventral view,  $\times 35$ .

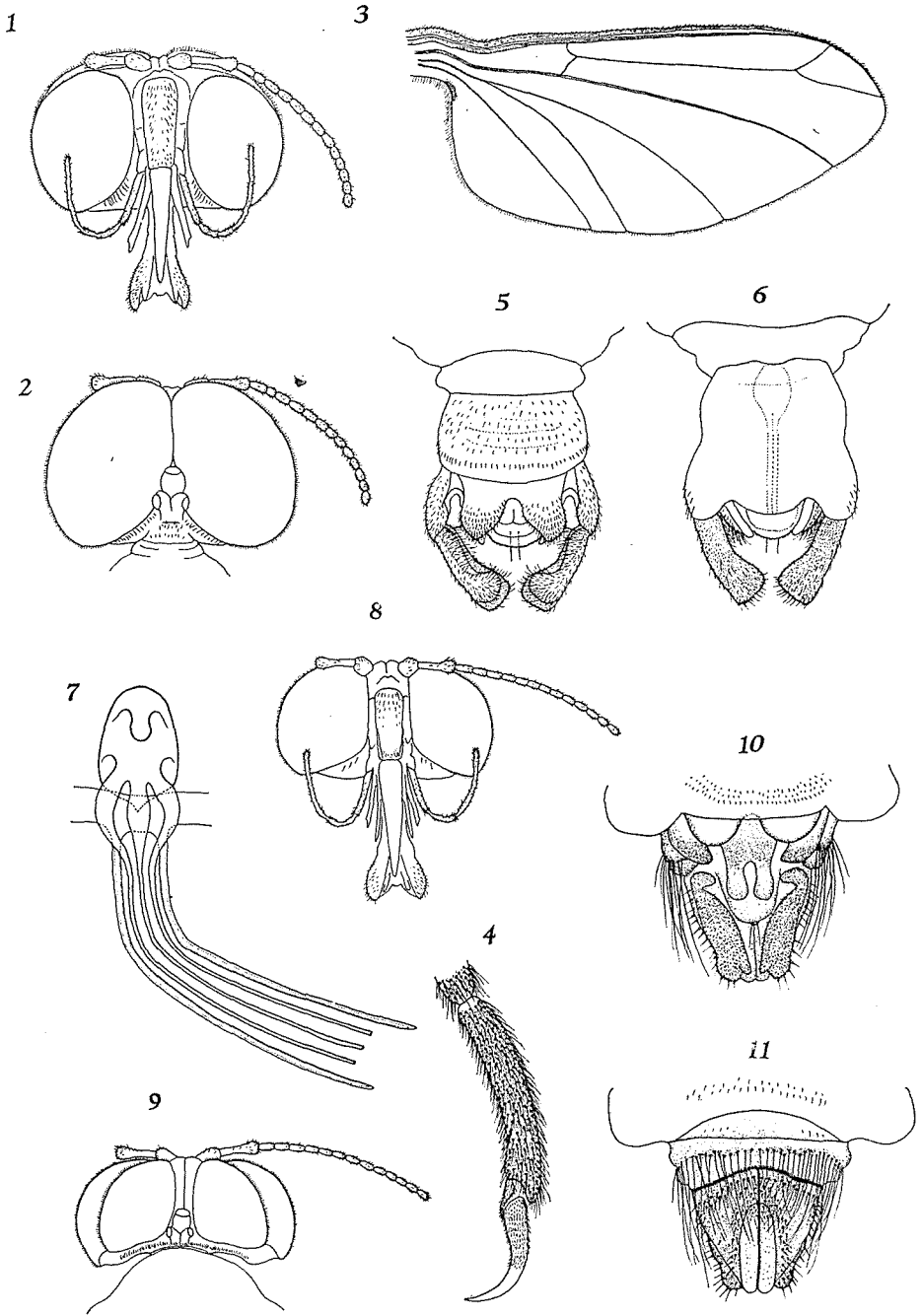
#### Plate XXII

- Fig. 12. Pupa (male); dorsal view,  $\times 11$ ,
13. " " ; lateral view,  $\times 11$ .
14. " " ; ventral view,  $\times 11$ .
15. Full-grown larva; dorsal view,  $\times 11$ .
16. " " ; ventral view,  $\times 11$ .

#### Plate XXIII

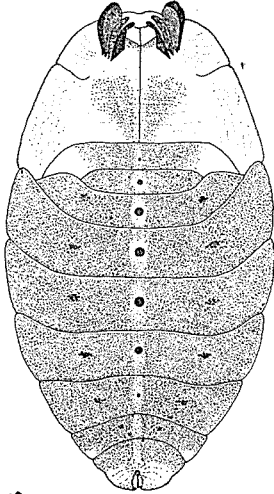
- Fig. 17. Full-grown larva; fulcra; dorsal view,  $\times 54$ .
18. " " ; " ; ventral view,  $\times 54$ .
19. Third instar (intermediate two body-segments omitted); ventral view,  $\times 34$ .
20. Second instar; ventral view,  $\times 34$ .
21. First instar; dorsal view,  $\times 54$ .



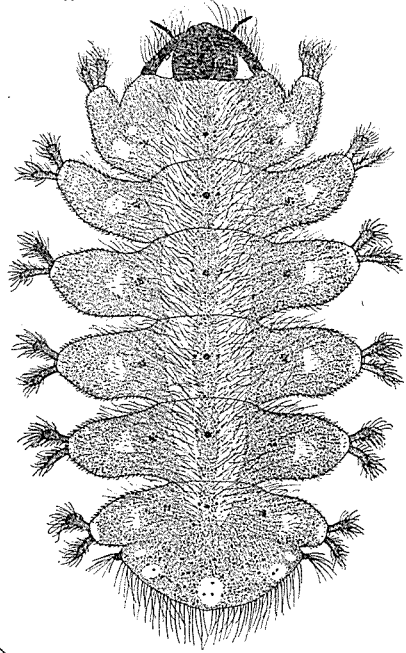


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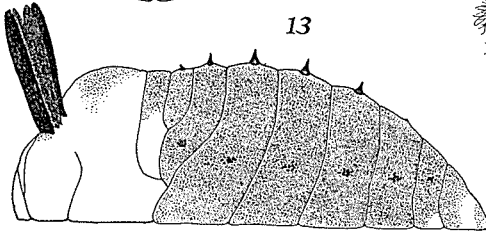
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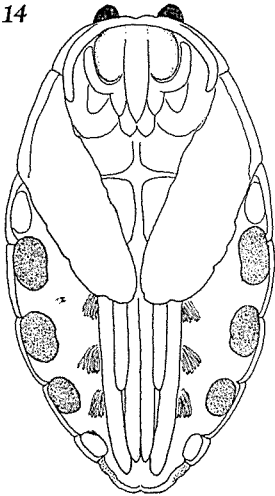
15



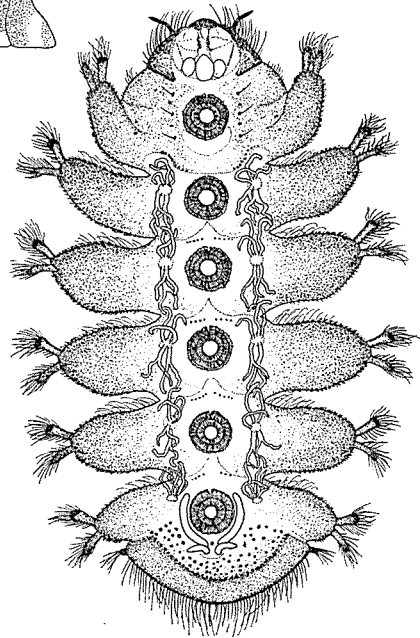
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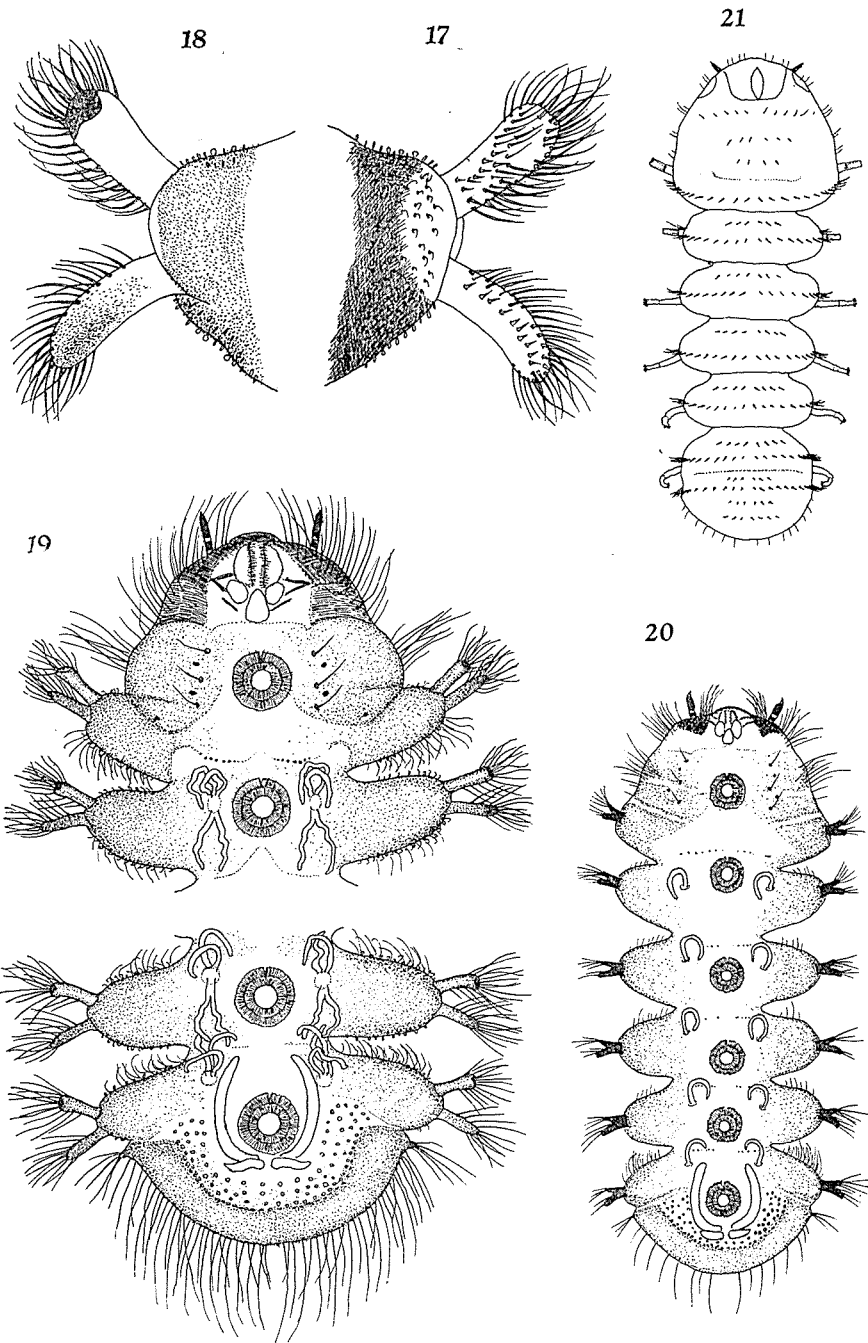


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