

RESULTS OF THE AUSTRIAN-CEYLONESE HYDROBIOLOGICAL MISSION 1970 OF THE 1ST ZOOLOGICAL UNIVERSITY INSTITUTE OF VIENNA (AUSTRIA) AND THE DEPARTMENT OF ZOOLOGY OF THE UNIVERSITY OF CEYLON, VIDYALANKARA CAMPUS, KELANIYA (SRI LANKA)

Part XVI: The Ceylonese Trichoptera

BY

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The Caddis flies of Ceylon have been well documented. In 1958, SCHMID published the results of his own collections, and, in addition, a summary of all the information available at that time.

The present material consists mainly of larvae which could not be identified to species in all cases. However, a number of pupae and adults could be exactly identified. Until further material is available for comparison, no detailed descriptions of the larvae will be presented. Only brief outlines are given.

Except for a few specimens which have been forwarded to Prof. Dr. H. H. COSTA, Department of Zoology of the University of Ceylon, Vidyalankara Campus for documentation, the material presented here is in the collection of the author. I would like to express my thanks to Professor STARMÜHLNER of the University of Vienna and to Professor COSTA of the University of Ceylon for providing me with the samples, and further for their confidence in my identifications. Some specimens from the collection of the Smithsonian Institution, Washington D.C., were kindly sent to me for comparison, by Mr. OLIVER S. FLINT, Jr. Dr. JOHN D. UNZICKER, Urbana (Illinois) kindly informed me about his work on Ceylonese Hydropsychids. Dr. A. KALTENBACH offered his help in connection with the BRAUER material in the Vienna Museum of Natural History. Miss SUSAN POWELL corrected the English manuscript. I express my sincere gratitude once again to them all.

LIST OF SPECIES IN COLLECTION

Rhyacophilidae

Apsilochorema diffinis BANKS 1920

Glossosomatidae

Synagapetus hanumata (SCHMID 1958)

S. rudis (HAGEN 1859)

Hydroptilidae

Plethus cursitans (HAGEN 1958)

Hydroptila kurukepitiya SCHMID 1958

Oxyethira sp.

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Philopotamidae

- Chimarra* sp.
Gunungiella madakumbura SCHMID 1958

Polycentropodidae

- Nyctoiphylax* sp.
Pseudoneureclipsis starmuehlneri n. sp.
P. maliboda n.sp. (described here, but not originating from this expedition)
P. thuparama SCHMID 1958

Ecnomidae

- Ecnomus* sp.

Psychomyidae

- Paduniella mahanawana* SCHMID 1958
P. subhakara SCHMID 1958

Hydropsychidae

Macronematinae

- Oestropsyche vitrina* (HAGEN 1859)
Macronema sp. larva A
M. sp. larva B
cf. *Pseudoleptonema* sp. larva A
cf. *P.* sp. larva B

Hydropsychinae

- Hydropsyche annulata* (ULMER 1905) (= *malassanka* SCHMID 1958)
H. katugahakanda SCHMID 1958
H. flinti UNZICKER in press
H. sp. larva A
H. sp. larva B
H. sp. larva C
H. sp. larva D
Synaptopsyche nikalandugola SHCMID 1958

Diplectroninae

- Diplectrona* sp. larva A
D. sp. larva B
Diplectronella taprobanes (HAGEN 1958)

Calamoceratidae

- Anisocentropus* sp.

Odontoceridae

- Marilia ceylanica* MARTYNOV 1936

Molannidae

Molanna taprobane FLINT in press

Leptoceridae

Trichosetodes argentolineata ULMER 1915

T. meghawanabaya SCHMID 1958

Adicella biramosa MARTYNOV 1936

Oecetis belihuloya n.sp.

O. hamata (ULMER 1915)

O. malighawa SCHMID 1958

O. sumanasara SCHMID 1958

Setodellina punctatissima SCHMID 1958

Goeridae

Goera katugalkanda SCHMID 1958

G. paragoda SCHMID 1958

Lepidostomatidae

Goerodes fuscata (NAVAS 1932)

G. punda MOSELY 1949

Sericostomatidae

Ceylanopsyche asaka (MOSELY 1939) (= *Noleca* a.)

C. spp. case type A

C. sp. case type B

Helicopsychidae

Helicopsyche amarawathi SCHMID 1958

H. ruprawathi SCHMID 1958

H. ceylanica BRAUER 1866 (not from this material, but reviewed here)

H. srilanka n.sp. (not from this material, but described here)

H. sp. case E

H. sp. case F

DESCRIPTIONS AND REMARKS ON SYSTEMATICS

Apsilochorema diffinis.—This name is used for all larvae and pupae which can be recognized as Hydrobiosini, because no other representatives of this group are known from Ceylon. The mature pupae, however, could be identified without doubt.

Synagapetus spp. The material contains a number of mature male pupae with clearly visible genital structures. The genitalia of these animals are very variable. No two specimens with identical ones, and no single specimen coincides exactly with the drawings and descriptions of SCHMID (1958). Identification was therefore difficult. It seems to me that in the systematics of Ceylonese *Synagapetus* there are still a number of unsolved problems. The larvae, less developed pupae, and female were not identifiable.

Hydroptila kurukepitiya.—Only one male pupa could be identified with certainty.

? *Oxyethira* sp.—Only one empty case and one immature pupa available, therefore not identifiable.

Chimarra spp. Unfortunately not one of the numerous larvae could be identified to species. The genus, however, is certain in all instances.

Nyctiophylax sp.—Only one female, which could not be identified to species.

Pseudoneureclipsis starmuehlneri n.sp.—Only one male pupa was available for identification. Thus, the form of the adult can not be described. It is a small species, comparable in size to *P. watagoda*.

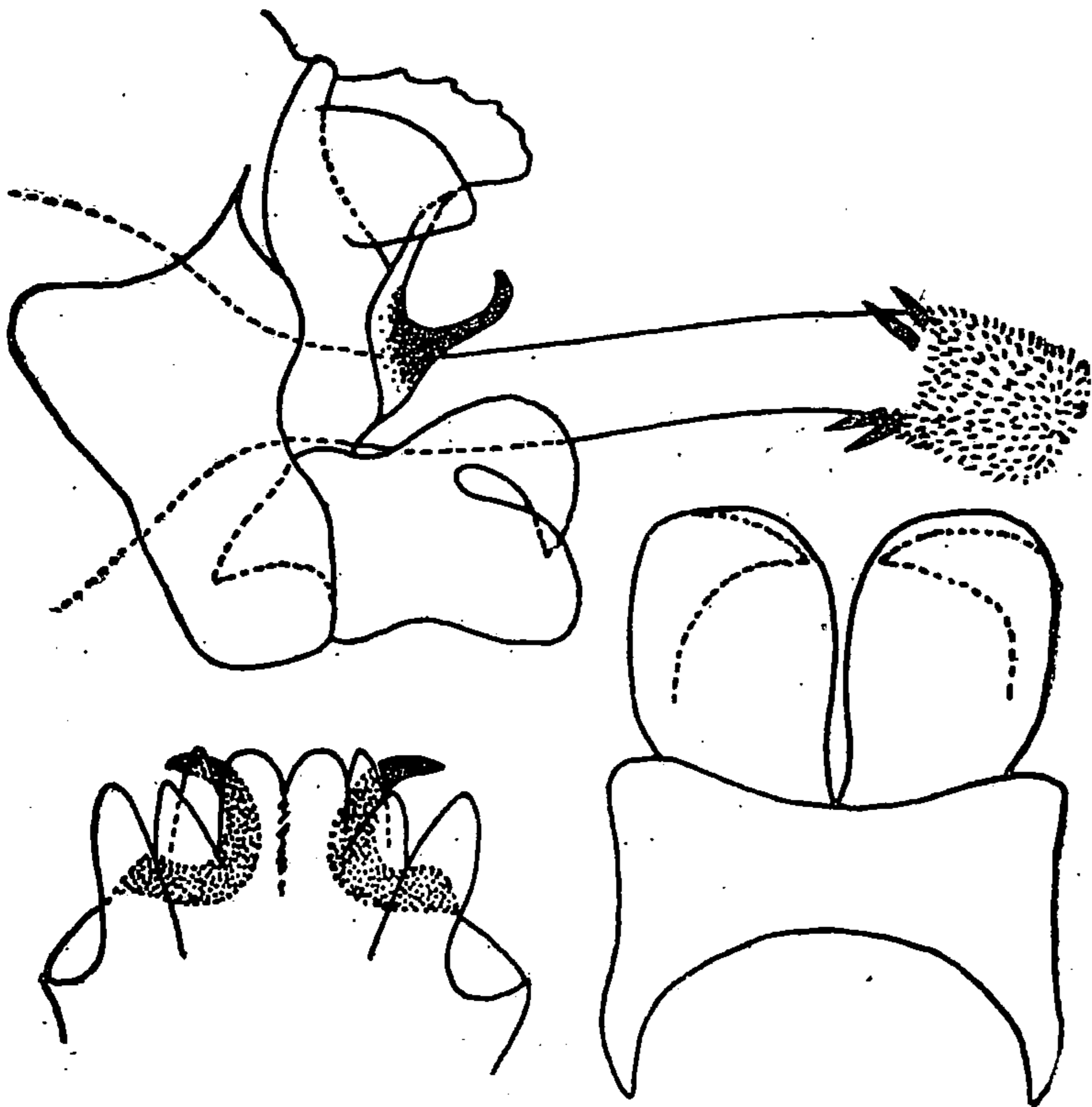


Fig. 1. *Pseudoneureclipsis starmuehlneri* ♂ genitalia : lateral (above), dorsal (left) and ventral (right) aspect.

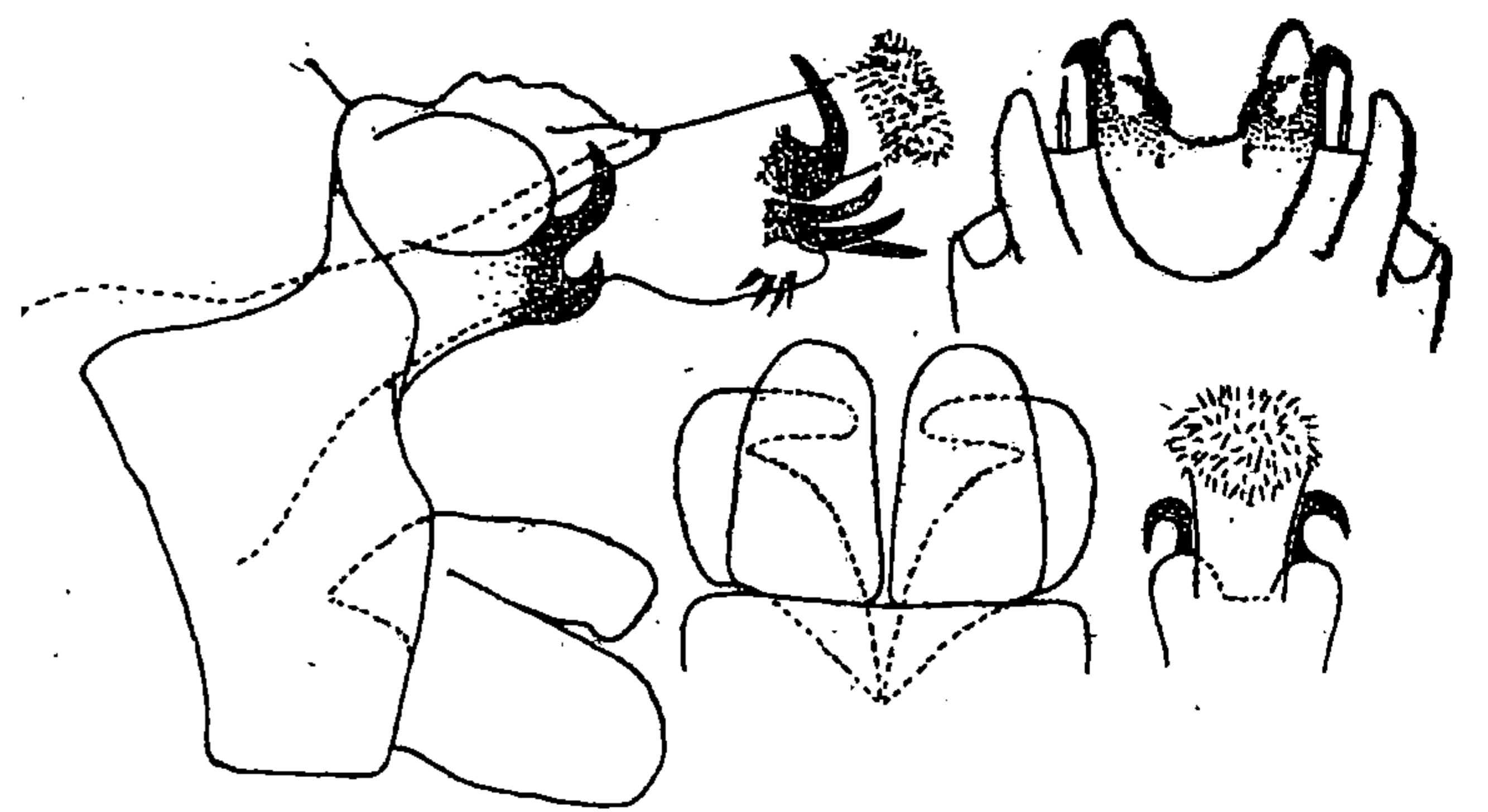


Fig. 2. *Pseudoneureclipsis maliboda* ♂ genitalia : lateral (left) dorsal (right above) and ventral (centre below) aspect. Dorsal aspect of aedeagus tip right below.

Male genitalia (Fig. 1)—The dorsal part of segment 10 consists of seven lobes of approximately equal length. Dorsally these are covered with about 70 setiferous tubercles. The median lobe is as long as it is broad, with an incision at the distal edge. The three other lobes on each side are arranged in the manner of tiles, i.e. the outermost one covers the lateral edge of the more centrally situated one. Penial spines of length nearly equal to that of the inferior appendages, curved upwards and outwards in a circular arc. The ventral part of the inferior appendage is rounded, the dorsal part broad and stout, the hook strongly curved downward. Aedeagus very long, distal part densely covered with fine spinules, proximally of this part four strong straight spines insert.

Holotype ♂ (pupa) : Kalu-Ganga near Carney-Estate, 800 m, 22.11.1970, in the author's collection.

This species seems to be most closely related to *P. funesta* (viz. fig. 9 on pl. 15 in SCHMID, 1958), but the very large curved penial spines, and the penial sclerites distinguish it clearly from *funesta*.

Pseudoneureclipsis maliboda n.sp.—The whole insect is brownish. The wing membrane is iridescent, and is irregularly covered with small glittering golden hairs. Wing venation similar to *P. watagoda* and *P. thuparama*. Length of anterior wing 4 mm.

Male genitalia (Fig. 2)—The dorsal part of segment 10 consists of one U-shaped plate which is bounded by an oval lobe on either side. The plate and the lobes are covered with approximately 30 hairs which insert in rough wart-like bases. The shoulder which connects the medium plate with the side lobes bears a large bipartite, bristle-like sensilla. The penial spines have two tips, the ventral one being shorter. Both are hook-like and curved upwards. The ventral part of the inferior appendages is roughly oval. The dorsal part forms a very stout hook, which is covered with long, well developed hairs, and which is horizontally bent inwards. The end of this hook is broadly rounded. The distal part of the aedeagus is covered with many spinules. Subdistal-ventral it has a membranous pocket, in which large spines originate: on each side, there is a powerfully developed hook whose tip is bent dorsally; ventrally, on each side, there are three less well developed spines which are of equal length, and are slightly curved dorsally. It should be noted that the specimen has 3 such spines on the left side, but only two on the right side. The outer surface of the pocket bears four shorter, lighter, straight spines ventrally. This species seems to be most closely related to *P. thuparama*.

Holotypes ♂—Ceylon, Maliboda, 29.1.1954, leg. F. SCHMID, in coll. Smithsonian Institution Washington D.C.—The specimen had been classified as a paratype of *P. watagoda* by SCHMID.

Polycentropodidae, Ecnomus, Psychomyidae.—The larvae of these groups could not be identified in all cases.

Hydropsychidae. Larval specimens of this family are abundant in the present material. Several genera and species can be easily distinguished, but only *H. katugahakanda* and *H. flinti* could be identified to species by comparing the larval exuviae remaining in the cocoons of identifiable male pupae. I am presenting only brief descriptions here to help further identifications.

Macronema sp. larva A.—According to ULMER (1957 : 346–352) this type of larva belongs to the genus *Macronema*. The head is reddish yellow, its ledge is of equal size along its whole length. The thoracic nota are brownish yellow with narrow, black lateral edges. The body is whitish.

Macronema sp. larva B.—According to ULMER, this larval type belongs to *Macronema* too. Head and thoracic nota are yellowish brown, lighter laterally. The cranial ledge is elevated in a wing-like manner above the eyes. The body is densely covered with long, brown, adjacent hairs.

Pseudoleptonema sp. larva A.—The table of ULMER (1957 : 346–352) leads to the genus *Lep-tonema*, which is, however, not known from Ceylon. On the other hand, no *Pseudoleptonema* larvae have been described up to date. Therefore, it is by no means certain if this larva is really a representative of *Pseudoleptomena*. But, as the other genera known from Ceylon do not come in question. I shall use this name until evidence for the contrary exist. Unfortunately, the present material contains no pupae of this species which could be identified to species. Perhaps these larvae belong to *P. kalukandama* which, according to SCHMID (1958), is abundant in the lower and middle regions of the island. It would also be in accordance with its size. (length of the mature larvae about 15 mm).

The head of the larva, with the exception of the light eye region, is a glossy brownish black. The same is true for the pronotum. The mesonotum is brown, the metanotum brownish yellow, both have black lateral edges. The body is salmon pink. This larva constructs cases and nets of the *Hydropsyche*-type (SATTLER, 1958), and not of the *Macronema*-type (SATTLER, 1963), but, according to ULMER, it belongs to the *Macronematinae*.

Pseudoleptonema sp. larva B.—Remarks similar to the above may be made for this larva. Its head is reddish yellow with shadowy darker spots. The thoracic nota are reddish yellow with black lateral edges. The body is salmon pink. The body size of all specimens is smaller than that of the biggest specimens of the preceding species. However, it is not possible to distinguish if this species is of smaller absolute size, or if the present material contains only younger larval stages.

Hydropsyche sp.—This species will be described by UNZICKER in a forthcoming revision of the *H. bifida*-complex under the name *flinti*. It is closely related to *H. gautamitra* and *H. annulata*, but it is only half the size of the latter. The present material contains two male pupae which will be included in the paratype series, in addition to many larva from several localities. *H. flinti* seems to be frequent in Ceylon. It is amazing that SCHMID did not find it.

The larva may be easily recognized by the dark brown marks on the brownish yellow head (fig. 4). The trochantinus of the foreleg is bifurcate, both tips being spiny and sclerotinized. The thoracic nota are brownish yellow with black lateral edges as in *H. katugahakanda*. Body length about 10 mm.

Hydropsyche katugahakanda.—Head and thoracic nota of the larva brownish yellow. The head has a characteristic chestnut brown pattern (fig. 3) the extent of which may vary. The lasting yellow spots may even disappear in extremely dark specimens. But they may also be much larger in light ones, compared with the fig. 3. Meso- and metonotum are partially darker, with black lateral margins.

Hydropsyche sp. larva A.—Larvae of this type are represented in the majority of samples of the present material, but nevertheless it could not be identified to species. It is an euryoecous species of wide distribution in Ceylon however which seems now here to be abundant. Head and thoracic nota are pale yellow and are covered with many short, stout, black spinules, the nota being black at the lateral edge. The head has a dark brown marking which leaves a light 'star' on the frontoclypeus (fig. 7). The trochantinus of the foreleg is bifurcate with sclerotinized tips. It is not certain if this larva really belongs to either *Hydropsyche* or to any related genus. This applies similarly to the following three larval types.

Hydropsyche sp. larva B.—Head and thoracic nota of the larva (fig. 8) pale yellow, frontoclypeus light reddish brown. The nota are also darkened with a reddish brown color on their cephal edges, their lateral edges are black. Body yellowish white, in most instances densely covered with adherent detritus. Protrochantinus pale yellow, the ventral tip much stouter than the dorsal one. The biggest specimens are slightly bigger than fullgrown larvae of *H. flinti*.

Hydropsyche sp. larva C.—The head of the larva (fig. 9) is yellowish white, with chestnut brown marks. Pronotum light chestnut brown, mesonotum slightly lighter, metanotum much lighter. The ventral part of the protrochantinus is rounded, soft, and covered with bristles. The dorsal part is short, conical, and dark. All present specimens are small, as are the fullgrown larvae of *H. flinti*.

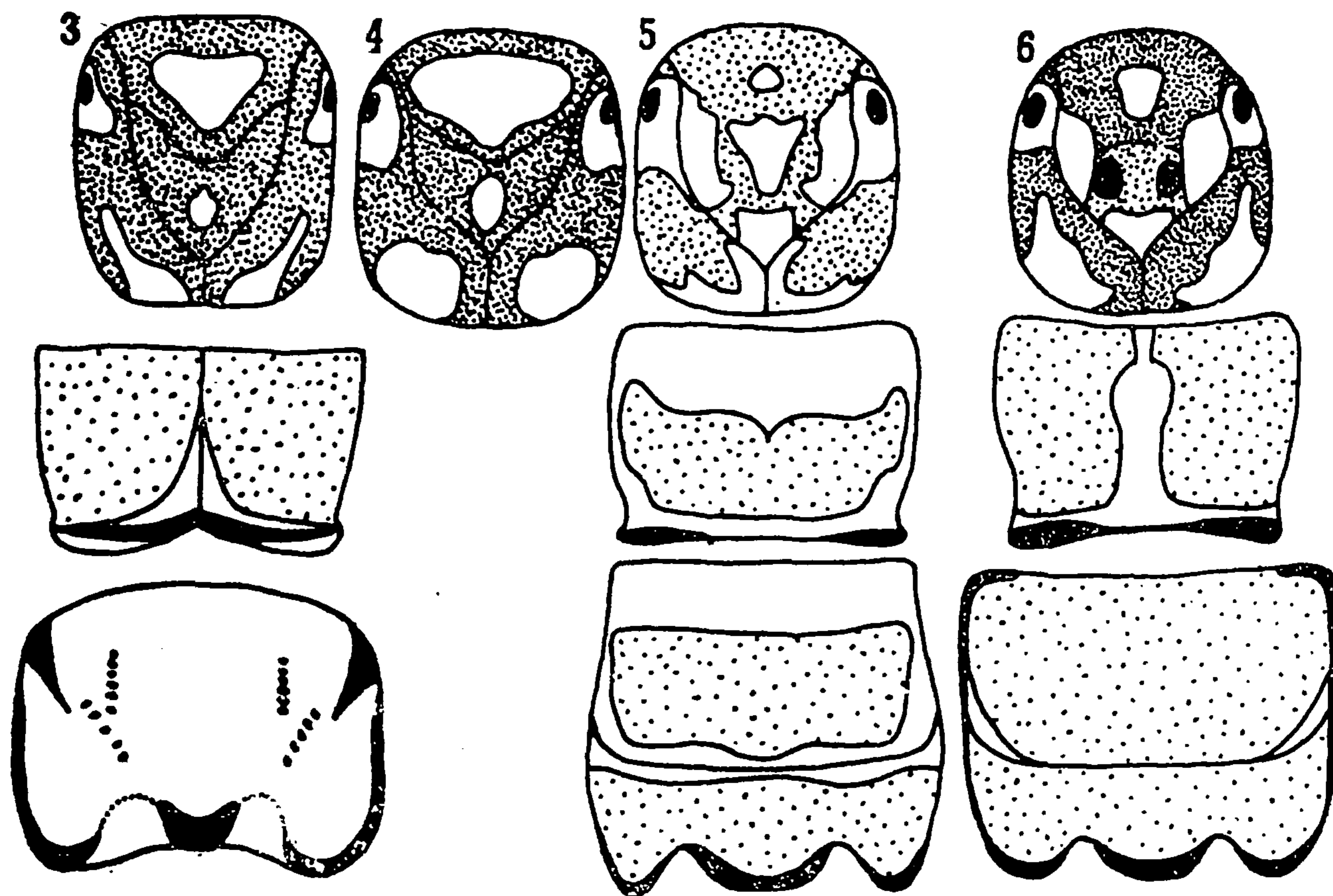
Hydropsyche sp. larva D.—Head and thoracic nota (fig. 10) of the larva light yellow with shadow-like dark spots. Protrochantinus soft, rounded, with bristles, dorsally with a small dark hump. Size similar to the preceding species.

Synaptopsyche nikalandugola.—Only one female of this genus in the present material. It seems to be this species, because it is the only one known for Ceylon.

Diptectrona sp. larva A.—According to ULMER (1957 : 417) this larva belongs to the genus *Diptectrona*. Head and thoracic nota are yellowish, with brown markings as shown in fig. 5.

Diptectrona sp. larva B.—This larva is similar to the preceding one, but the markings differ as can be seen in fig. 6.

Diptectronella taprobanes. This type of larva which seems to belong to *Diptectronella* according to ULMER (1957 : 417) is here classified as *D. taprobanes*, because this is the only known Ceylonese species. The head of the larva is monoton light reddish brown, except the eye region which is whitish.



Figs 3-6. Dorsal aspect of the head and thoracic segments of Hydropsychid larvae. 3. *Hydropsyche katugahakanda*. 4. *H. flinti*. 5. *Diptectropa* sp. larva A. 6. *D.* larva B. Various magnifications.

Hydropsychidae gg. spp.—Several young larvae and immature or female pupae could not be identified.

Anisocentropus sp.—The material contains only one larva and one immature pupa which could not be identified. According to the case construction, they may belong to this genus.

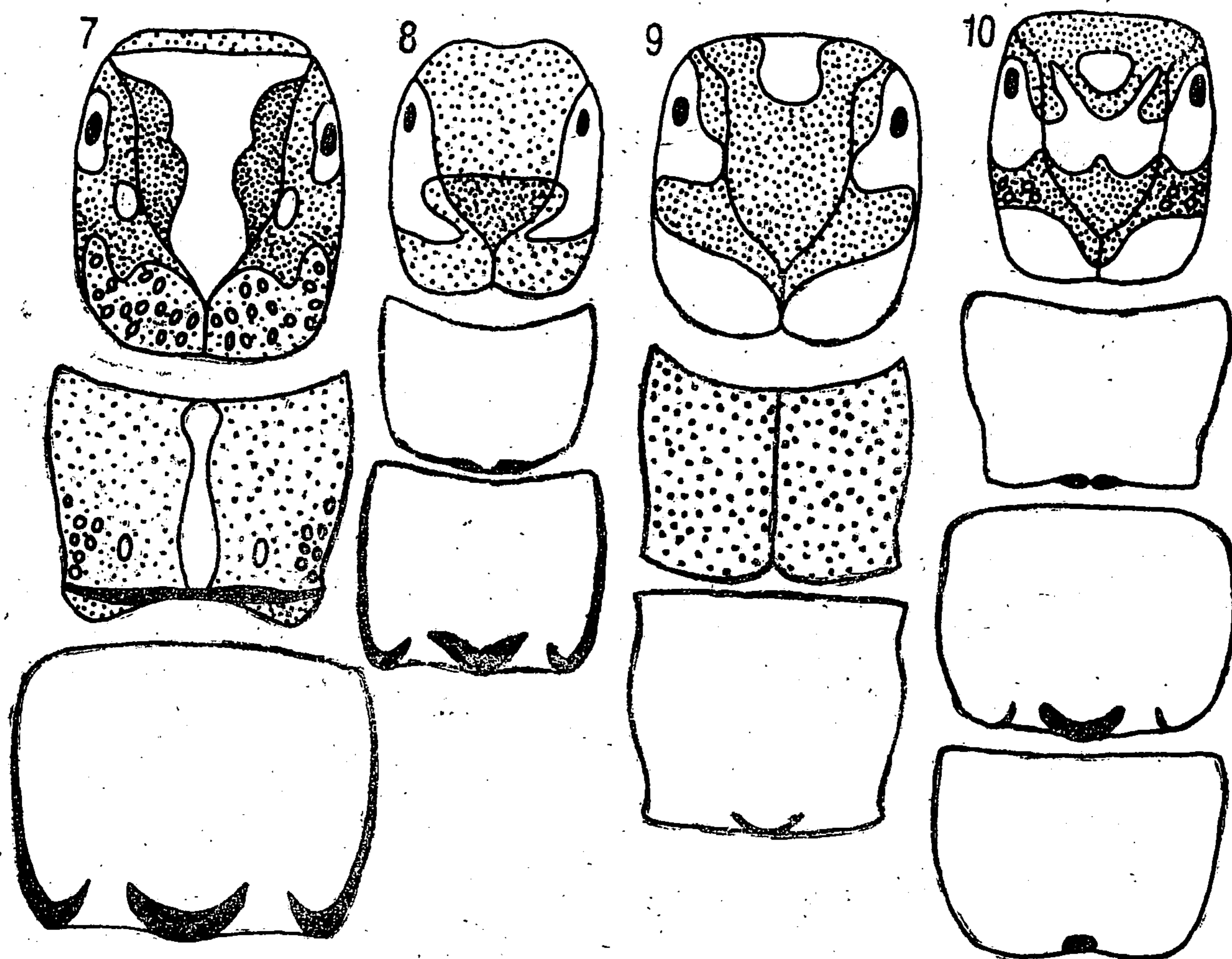
Marillia ceylanica—SCHMID (1958) uses the name *M. mixta* HAGEN for this species and writes : “ Je n’ai pas de preuve que *Molanna mixta* HAG. soit l’espèce de *Marilia* dont il s’agit ici. Mais je considère cela comme très probable, la description de Hagen correspondant très bien aux insectes et la famille des Molannides étant apparemment absente de Ceylan.”

Here is HAGEN’S (1858) complete description : “ Rufo fusca, antennis gracilibus rufis, basi pallidioribus ; capite thoraceque parce griseo-flavis pilosis ; pedibus rufis ; alis aticis angustis rufo-fuscis, parce pilis griseo-flavis interjectis ; posticis nigris. mas, femin. Long c. alis 9 mill ; Exp. alar. 17 mill. Hab. Rainbodde.”

I think that this description is not sufficient for a clear identification of the species. And, as the family Molannidae really occurs in Ceylon, it may be preferable to reject the name given by HAGEN (unless the types are revised), and to use the name *ceylanica*, supported by the good description of MARTYNOV.

Molanna n. sp.—This species will be described by FLINT under the name *taprobane* in a paper which is in preparation. The present material contains one female specimen which will be included among the paratypes.

Oecetis belihuloya n. sp.—Very similar to *O. malighawa*, including the bright yellow androconial bunch in the analis region of the male's hindwing. Wing venation as in *malighawa*. Abdominal segments 5–8 dorsally with comb-like structures: 5–7 with coarse, 8 with fine meshes (as in *malighawa* where this sign is not mentioned by SCHMID in the original description). Length of forewing 6–7 mm



Figs. 7–10. Dorsal aspect of the head and the thoracic segments of Hydropsyche larvae.
7. *Hydropsyche* larva A. 8. *H.* larva B. 9. *H.* larva C. 10. *H.* larva D.
Various magnifications.

Male genitalia (fig. 11)—Segment 9 as in *malighawa*. Appendices praeanales more slender, spoonlike. Segment 10: Dorsal part not in pairs, slender, bent somewhat distally downwards and rounded. Ventral part shorter, triangular, distally deeply incised. Aedeagus thick and broad, bent downwards. Its ventral gutter-like part is sclerotized, the dorsal part is soft and contains three large, heavily sclerotized spines which are straight, but basally strongly curved. Inferior appendages similar to *malighawa*, but longer and more slender.

Female genitalia (fig. 11)—As in *malighawa*, but the ninth segment has a pair of short, finger-like projections at the dorsal edge which are directed caudally.

Holotypus ♂ : Belihul-Oya, 650 m, 7.12.1970. Allotype ♀ and paratype ♀ with the same data. Paratype ♂ : Bibili-Oya near Kitulgala, 26.12.1970. All leg. STARMÜHLNER, in my collection. Additional paratypes : Nanu Oya, Peradeniya, 1500', 12.11.1970 : 1♂ ; Polpitiya, Kelani Ganga, 400', 24.11.1970 : 1♂ ; Udawalawe, Dam site, 250', 19.10.1970 ; 3♂ ; Uggalkaltota, 500', 10.-14.10.70 : 2♂ ; all leg. O. S. FLINT, Jr.—Lindula, 3.3.1954 ; 1♂ ; Carney 1.2.1954 : 1♂ ; Rukam Wewa, 14.3.1954 ; 1♂ ; Maturata, 1.3.1954 : 2♂ ; Kitulgala 2.3.54 : 1♂ ; Niriella, 4.2.1954 : 1♂ ; all leg. F. SCHMID (additional data about the localities may be found in SCHMID 1958 ; the specimens have been included by this author in the paratype series of *O. malighawa*). The latter 14 specimens in coll. Smithsonian Institution, Washington D.C.

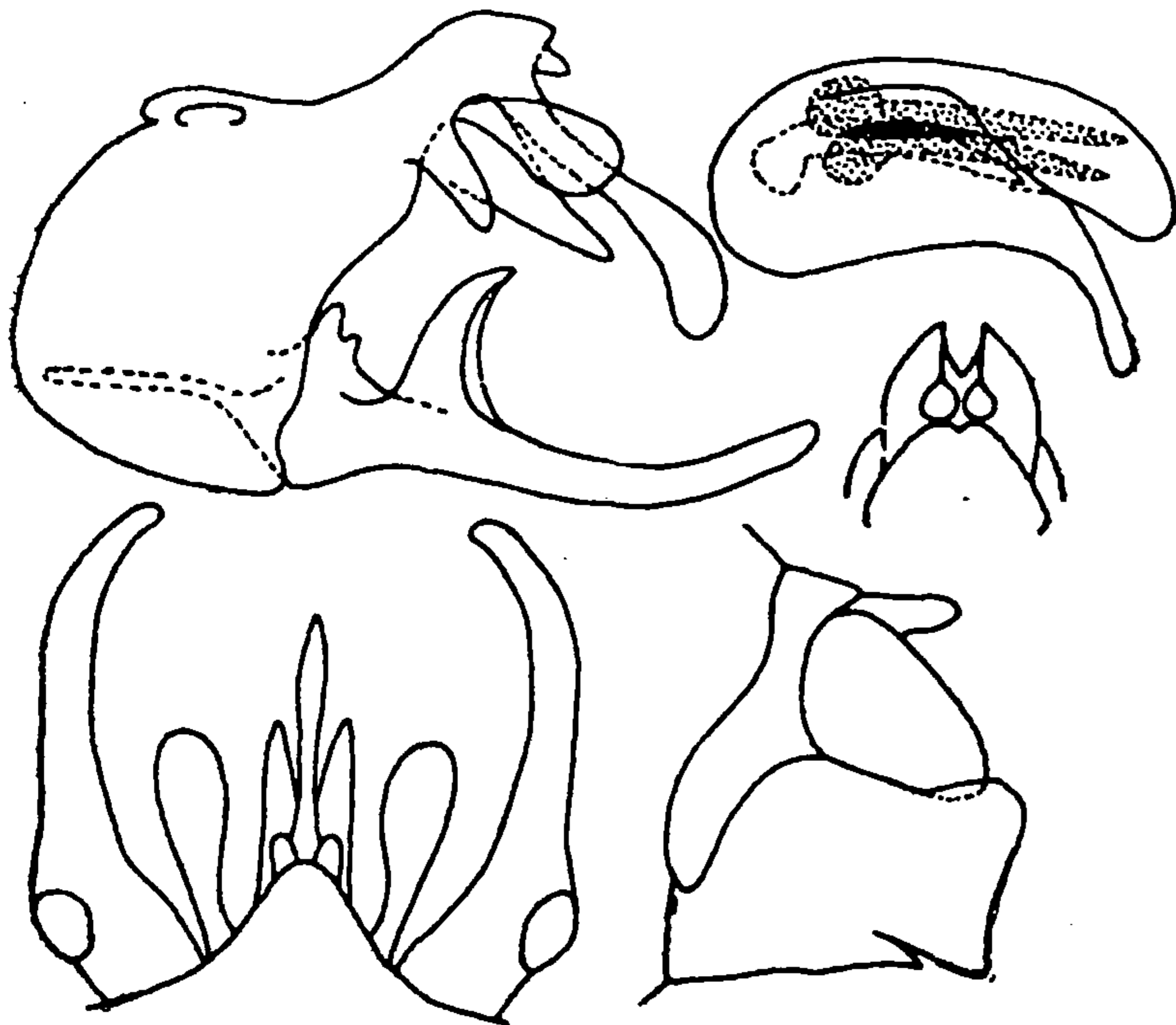


Fig. 11. *Oecetis belihuloya* genitalia. Left above : male lateral. Left below : male dorsal. Right above : aedeagus lateral. Right centre : female ventral. Right below : female ventral aspects.

Leptoceridae gg. spp.—The numerous cases and larvae of various species could not be identified.

Goera paragoda.—One male pupa of the present material does not correspond exactly with the drawings of SCHMID (1958), but nevertheless there is no doubt that it is this species.

Goerodes spp.—Many larvae and empty cases could not be identified to species.

Ceylanopsyche asaka. The early stages of the genus *Ceylanopsyche* FISCHER 1970 (= *Noleca* MOSELY, 1939) seem to be unknown up to date.

The cases are long, slender, conical, and slightly flattened dorsoventrally. They are covered with fine sand grains. The membrane which covers the caudal opening has a subdorsal, somewhat bean-like hole (fig. 12b). Before pupation, the caudal third of the case is bitten off by the larva, so that the case looks very much like the case of *Marilia ceylanica*. However it is smaller (4–5 mm long, 1 mm broad ; in *Marilia ceylanica*. 7–10 mm long, 1.5 mm broad) and covered with finer sand grains. At each end, on the ventral edge, one to three short stalks with distal broad discs are located. They fasten the case to the supporting rocks, etc. The anterior opening of the pupal case bears a circular silken cover which has a horizontal, slightly ventrally-convex slit in the ventral half (fig. 12d). This cover is surrounded by a short, funnel-like collar made of sand grains and of silk. The posterior opening of the case has a similar cover, which, however, is situated at the very distal edge (without collar) and which has a median vertical slit of two-thirds of its diameter (fig. 12e).

The larva is clumsy, cylindrical, and it fills the complete width of the case. A prosternal horn is lacking. In fig. 13, ventral and dorsal views of the head with head sutures are presented. Prothorax and mesothorax are each covered with a large, undivided sclerite which has a fine light dorsal

line. The metathorax has a narrow transverse sclerite caudally and, on each side, another plate which extends to a point anteriorly and which includes two small sclerites (fig 14). Legs are rather short and stout, all three pairs directed forwards. Protochantinus large, flat, curved cephalad (fig. 14). Abdominal segment 1 on each side provided ventrolaterally with a small hump. Abdomen

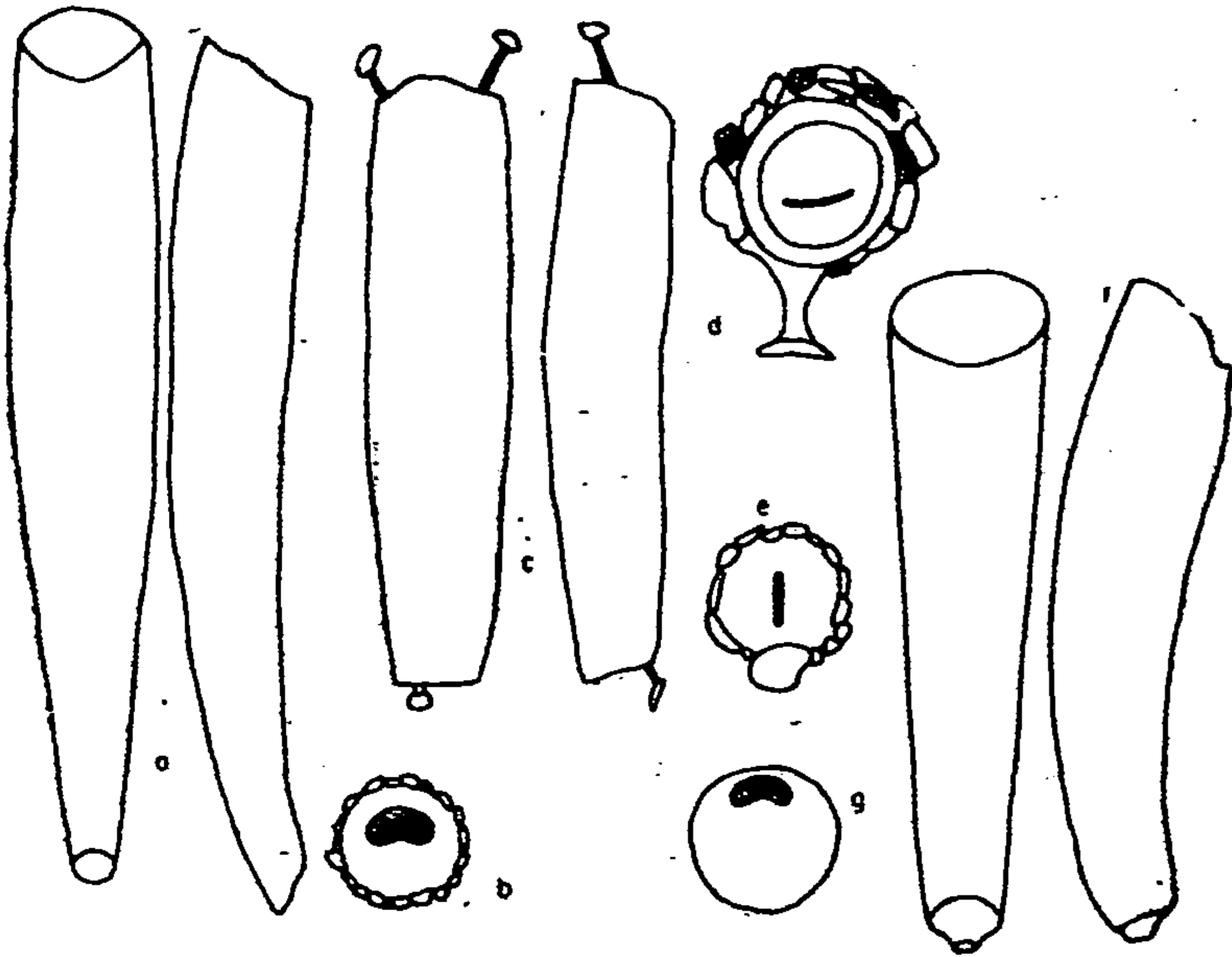


Fig. 12. *Ceylanopsyche* cases in outlines. a-e.: *C asaka* a. ventral and lateral aspects of larval case, b. Caudal membrane of same, c. dorsal and lateral aspects of pupal case, d. anterior membrane of same. e. caudal membrane of same. f. C case type Biventral and lateral aspects of larval case g. caudal membrane of same.

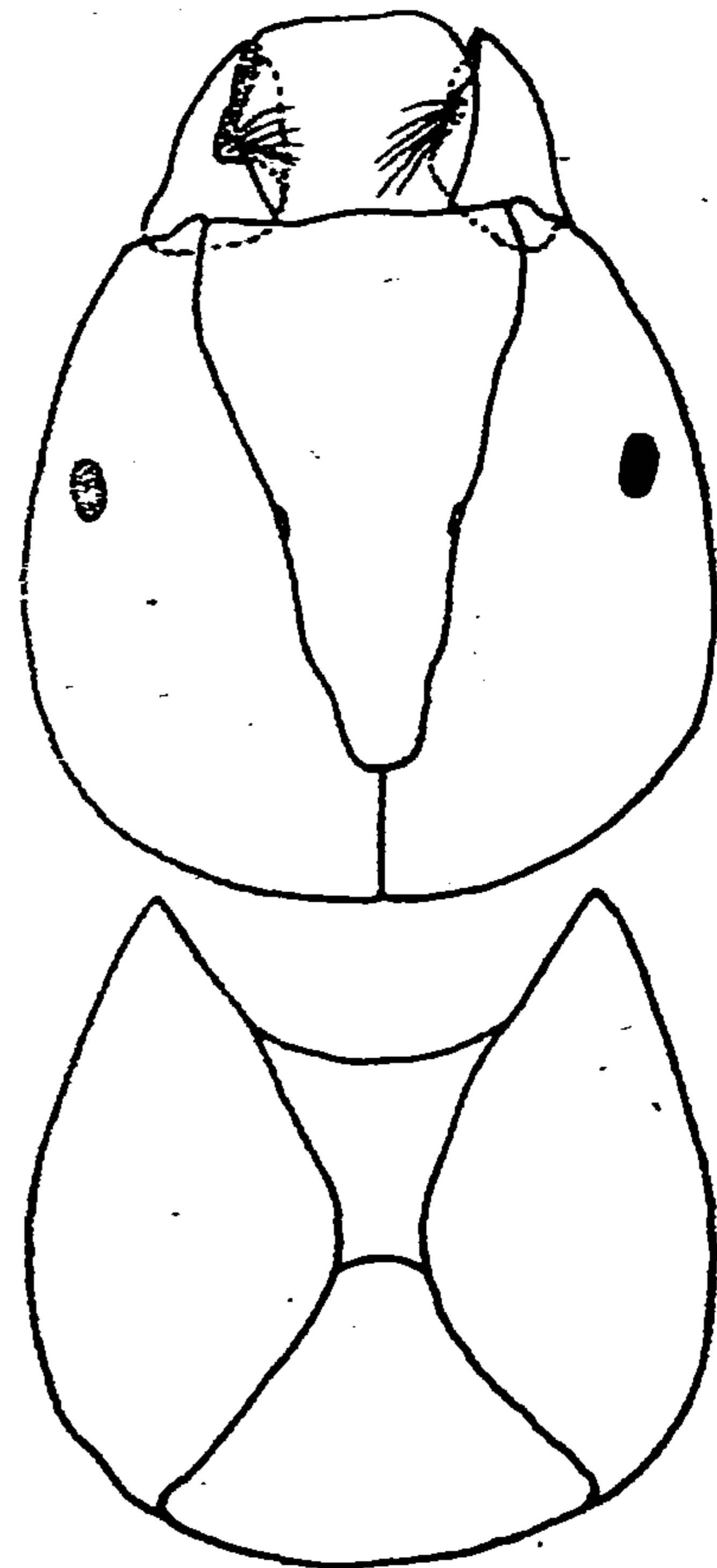


Fig. 13. Head of the larva of *Ceylanopsyche asaka* in outline (dorsal and ventral aspects).

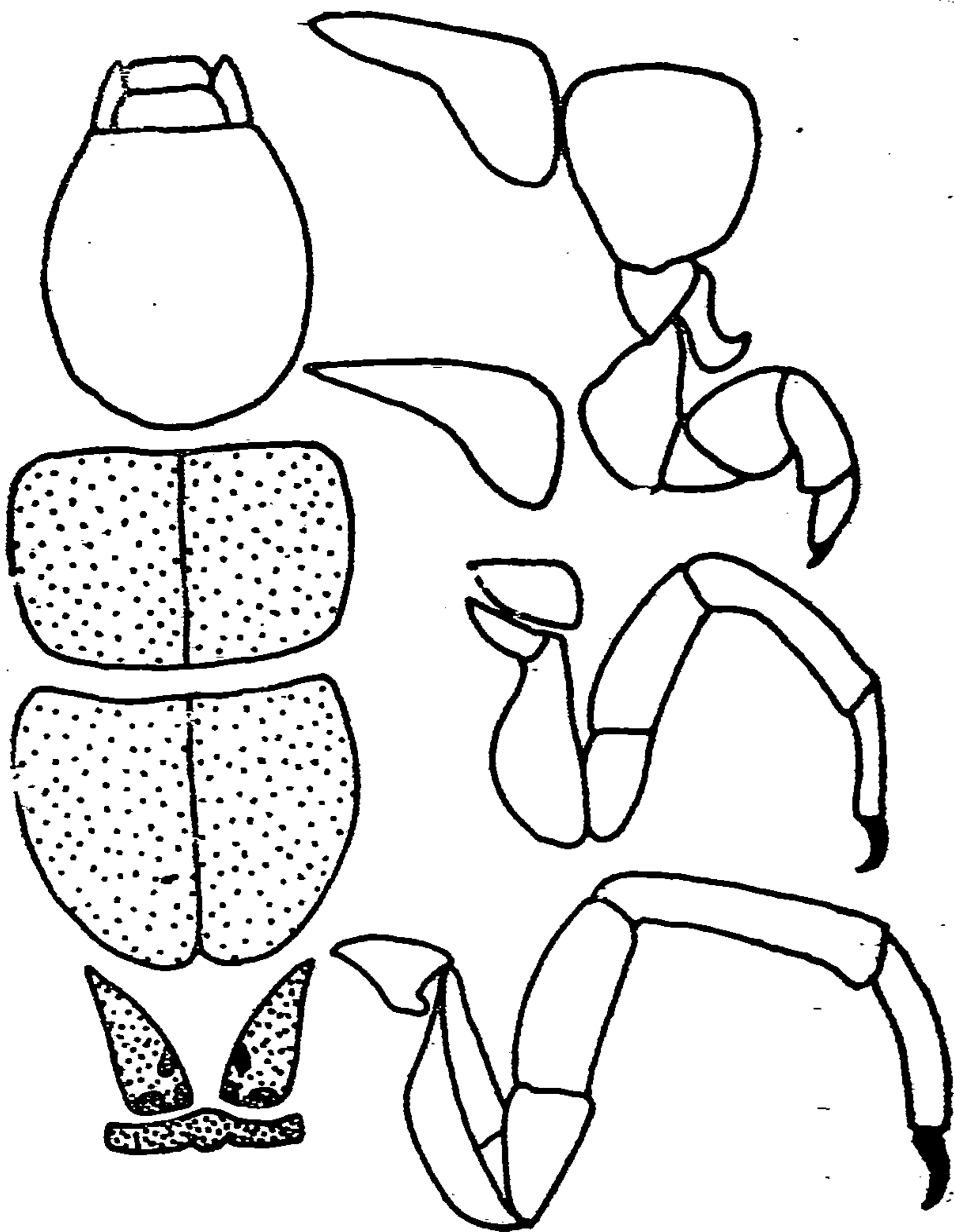


Fig. 14. Head and thoracic sclerites of larva of *Ceylanopsyche asaka*, left: dorsal aspect, right: middle and hind legs.

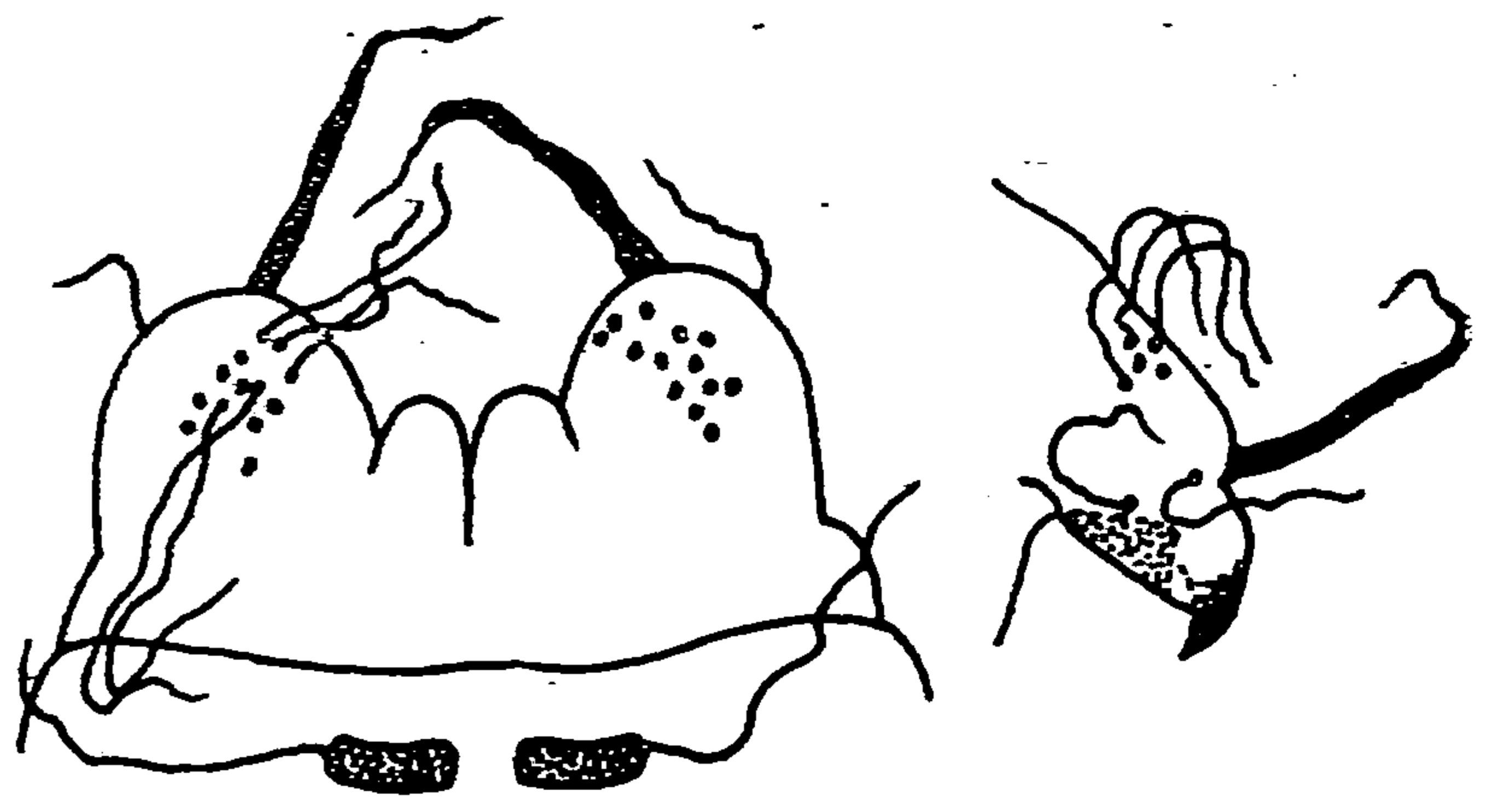


Fig. 15. Pygopodes of *Ceylanopsyche asaka* larva, left dorsal, and right lateral aspects.

without tracheal gills. Segment 9 bears two small sclerites dorsally, each has two bristles. Pygopodes (fig. 15) : The basal limb carries caudally one very strong and about 20 much finer bristles ; they are curved in an extremely irregular manner. Basal limb stout, provided ventrolaterally with a heavy sclerotized edge. The claw is cone-like, blunt, and directed ventrally.

The pupa has two long, thin, simple sticks on its caudal tip.

From the material collected by Mr. FLINT, it was noticed that the same type of case is also constructed by *C. watukaragoda* and *C. nittimaluna*. Cases of this type without mature pupae are listed in this paper under the name *Ceylanopsyche* sp. case A.

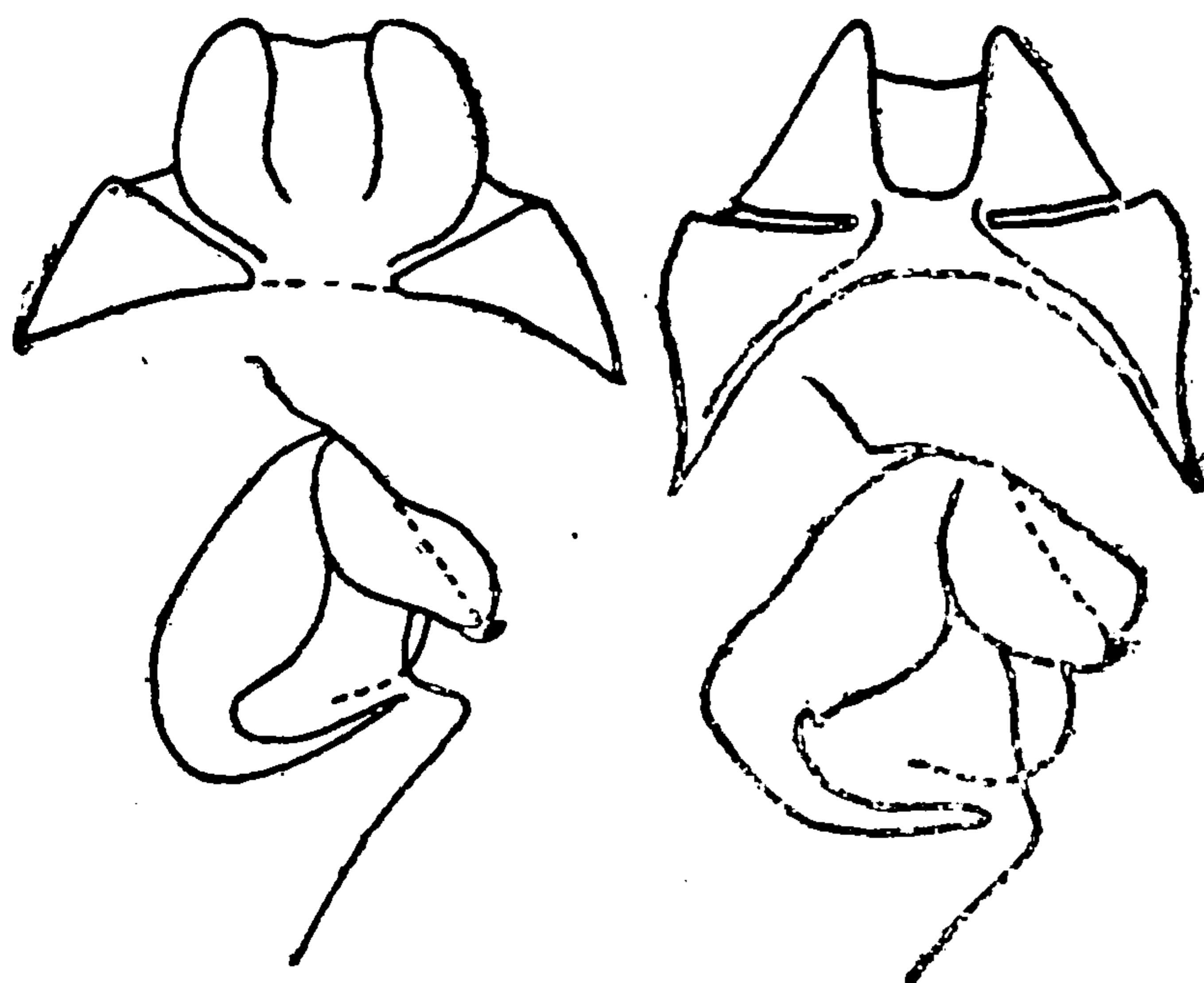


Fig. 16. Female genitalia of *Helicopsyche ruprawathi* (left) and *H. srilanka* (right). Dorsal aspect (above) and lateral aspect (below).

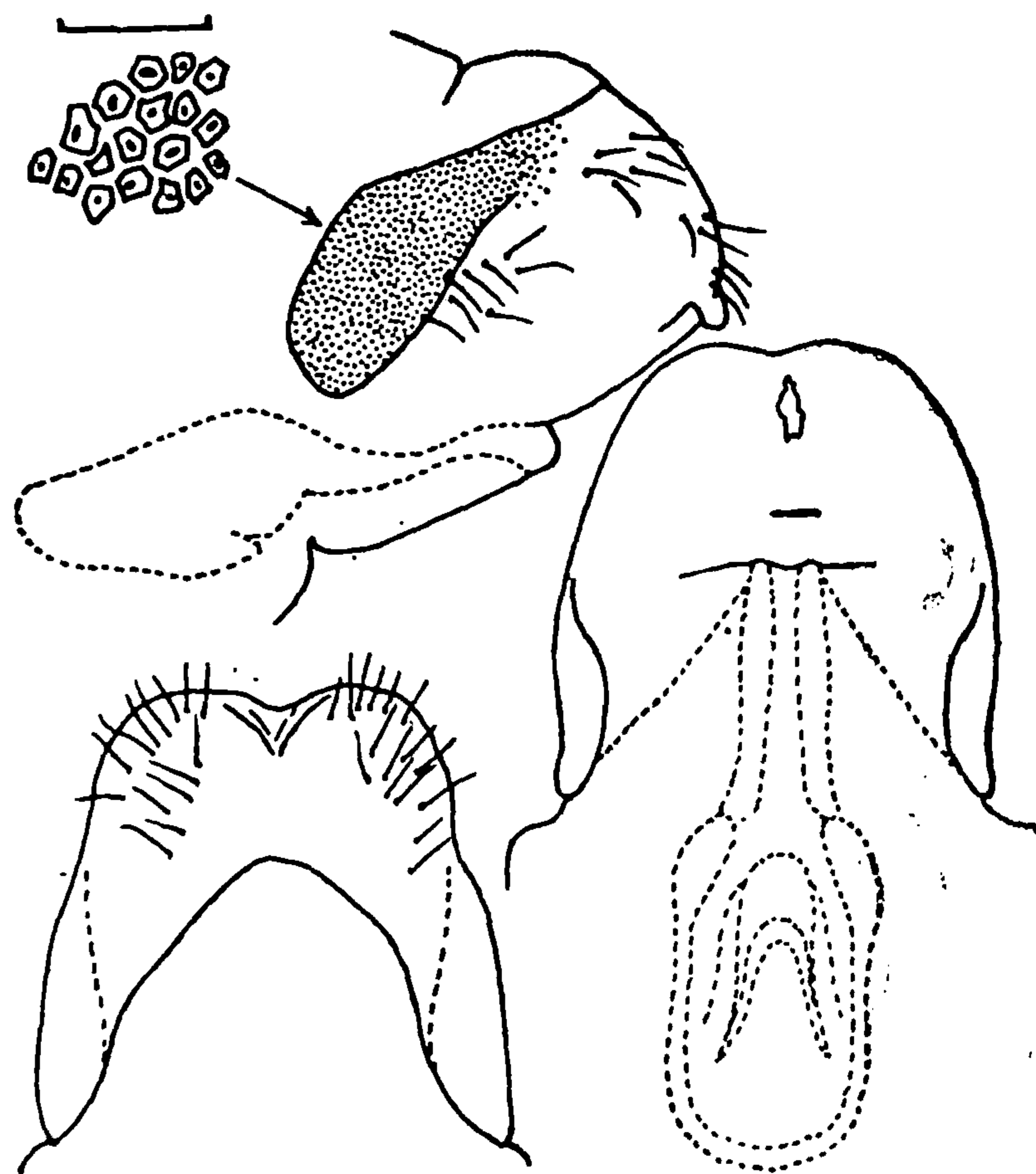


Fig. 17. Female genitalia of *Helicopsyche ceylanica*. Lateral (above), dorsal (left), and ventral (right) aspects. Above left : structure of the comb-like area at higher magnification (scale 25 μ m).

Ceylanopsyche sp. case B. Another species with the same type of larvae constructs a different kind of case (fig. 12f and g). It is more stout, consists of silken material only, and, in exceptional instances, may be covered with single sand grains. The larva is also stouter, and narrowed conically towards their caudal end according to the shape of the case. Unfortunately neither the material of the Austrian expedition nor the material collected by Mr. FLINT, contained mature pupae, so that it remains questionable to which species this kind belongs.

The study of the adults of *Ceylanopsyche* did not provide sufficient information for a decision as to which family this genus might belong. They have several characteristics which indicate that they belong to the *Sericostomatidae*, as this family was understood formerly. However, they also have several reductions and apomorphic characteristics. (SCHMID 1958) classified the genus in the family *Helicopsychidae*. However with respect to the above described characters of the larvae and the cases they should be included in the *Sericostomatidae* s.str. as a very apomorphic group. This would also change the general aspect of the distribution of this family.

Helicopsyche spp.—In addition to the *Helicopsyche* material collected by Prof. STARMUHLNER, Mr. FLINT sent me his material for comparison. Finally, it was possible to re-examine the *Helicopsychids* from Ceylon, collected by the Austrian Novara expedition 1857-59, which have already been

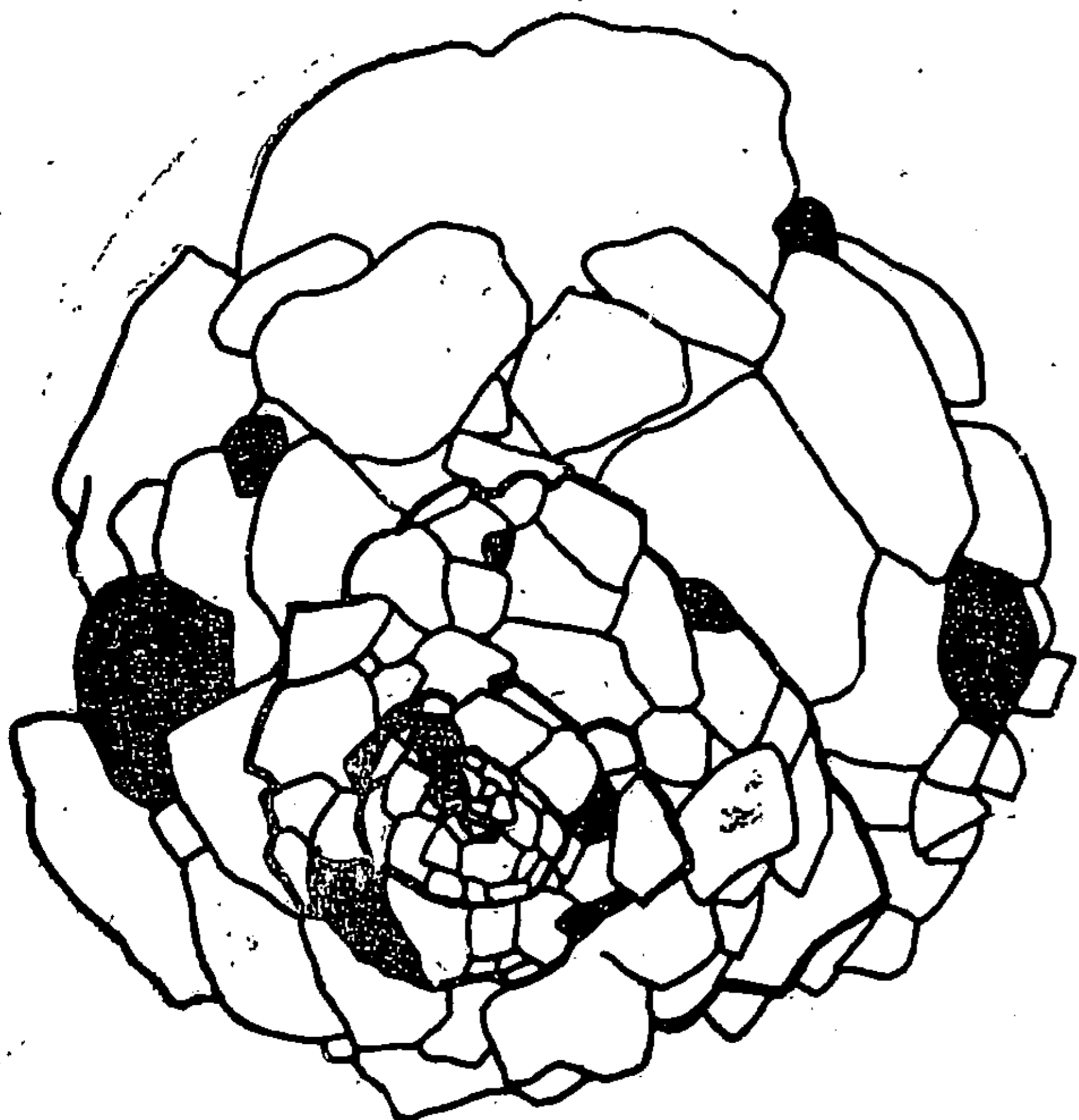


Fig. 18. Case of *Helicopsyche amarawathi*, dorsal (above) and lateral (below) aspects.

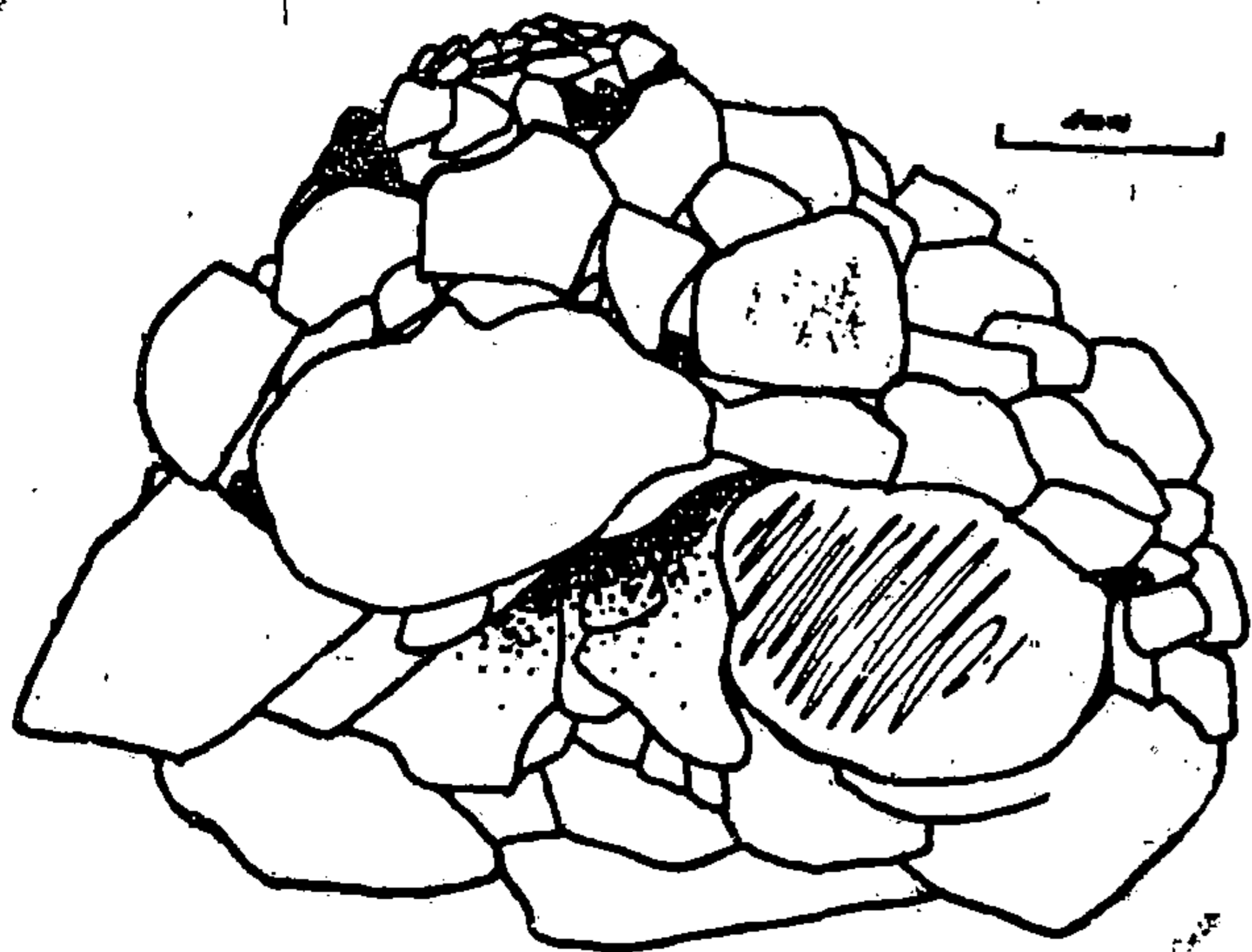
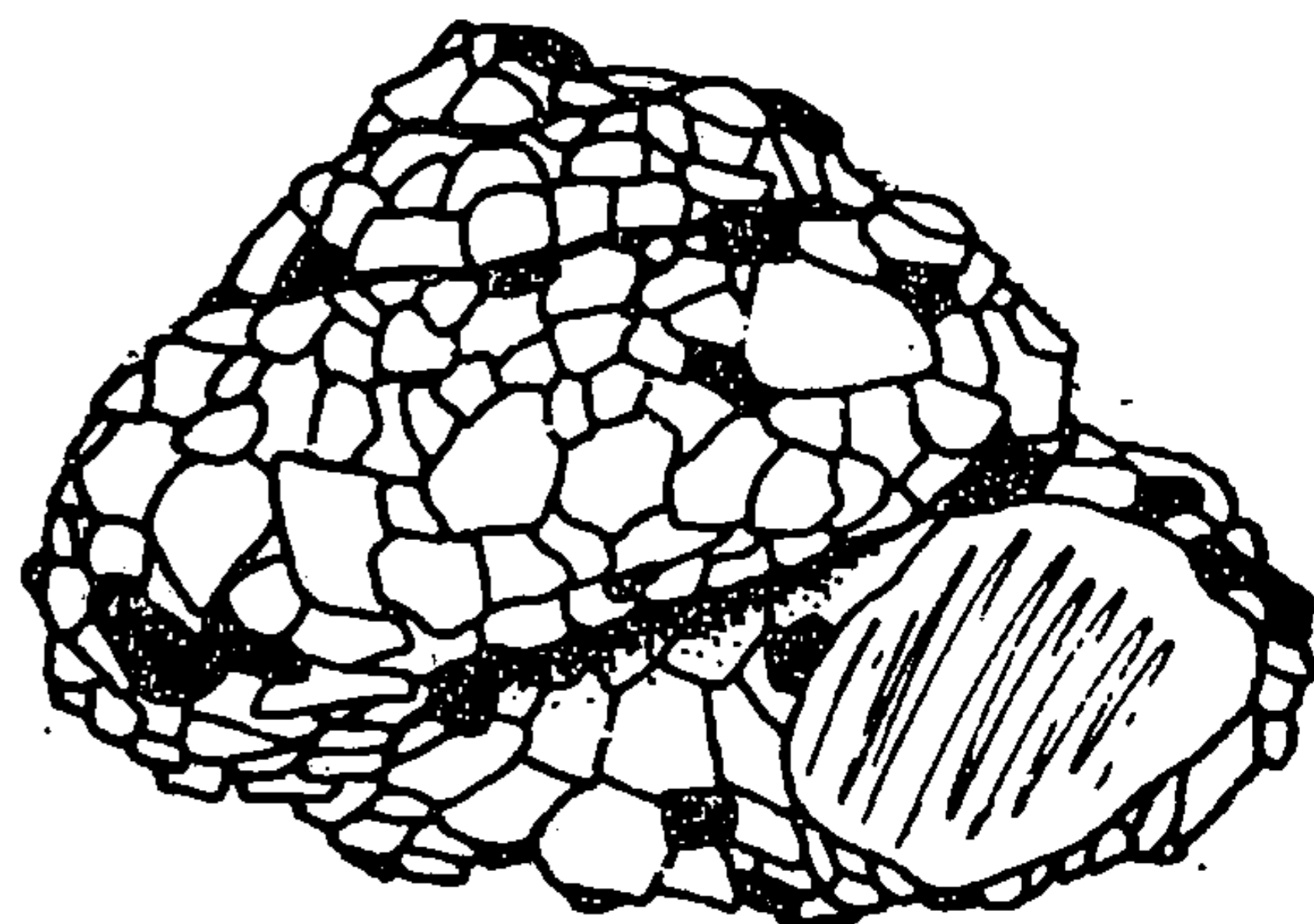
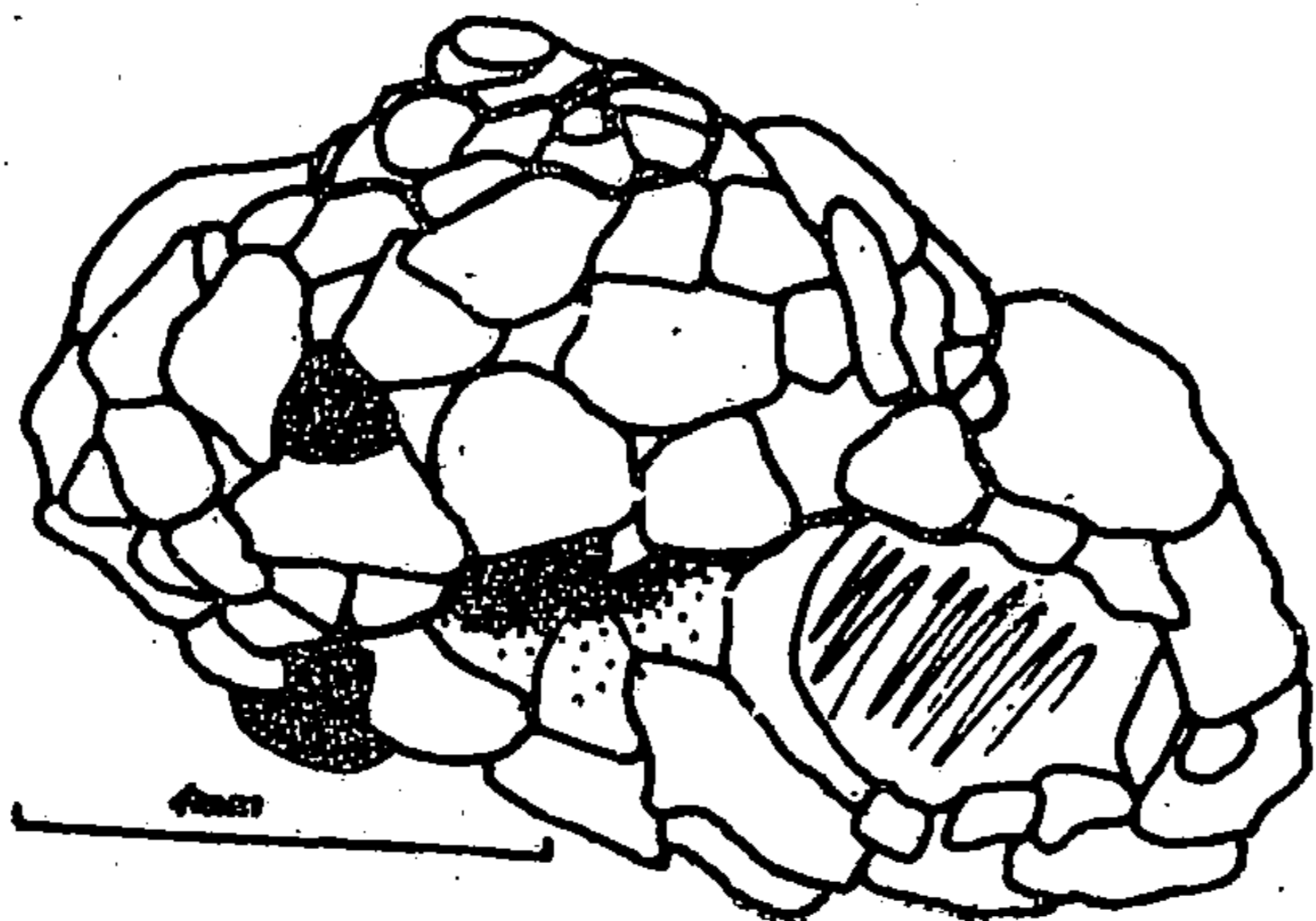
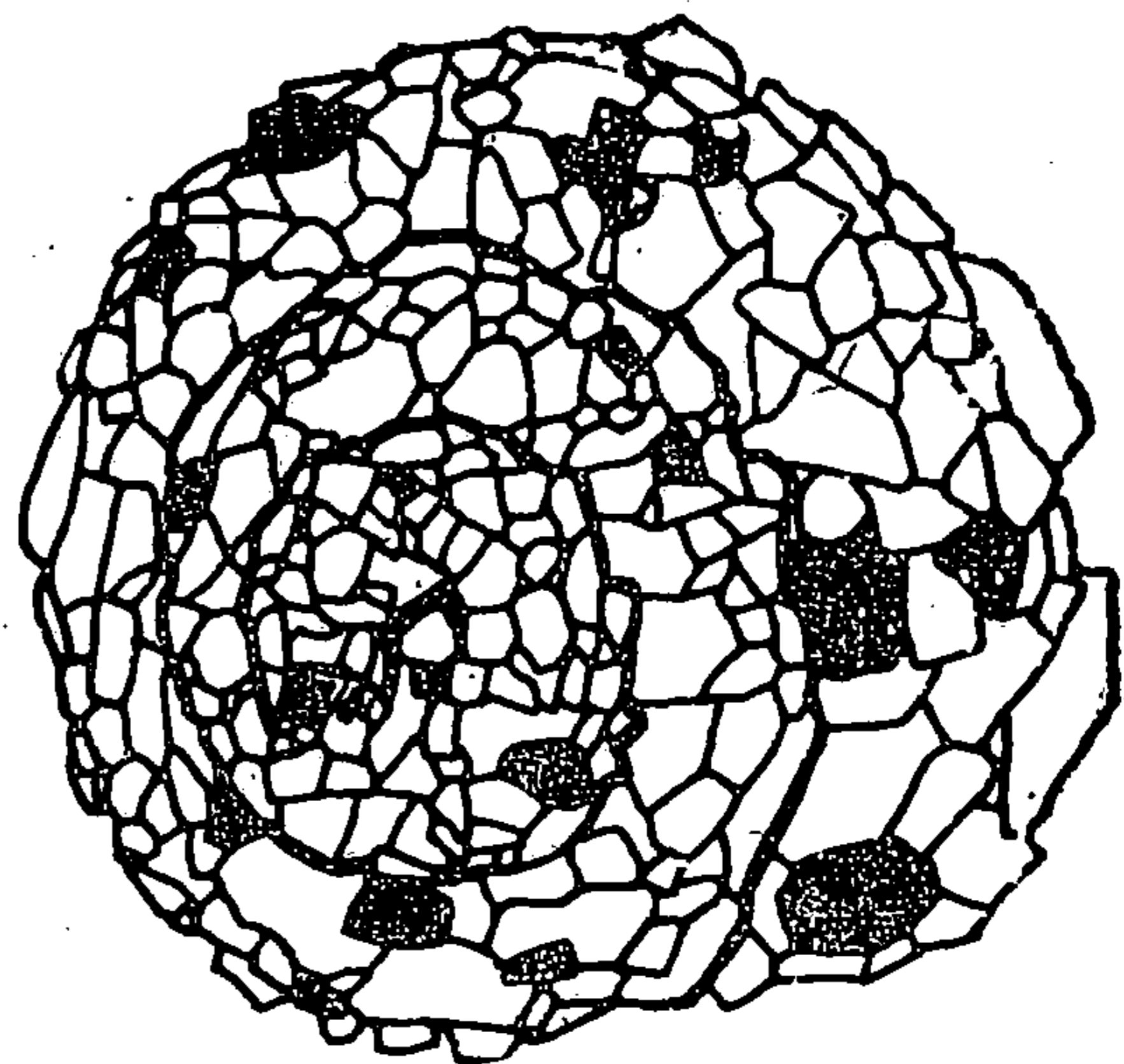
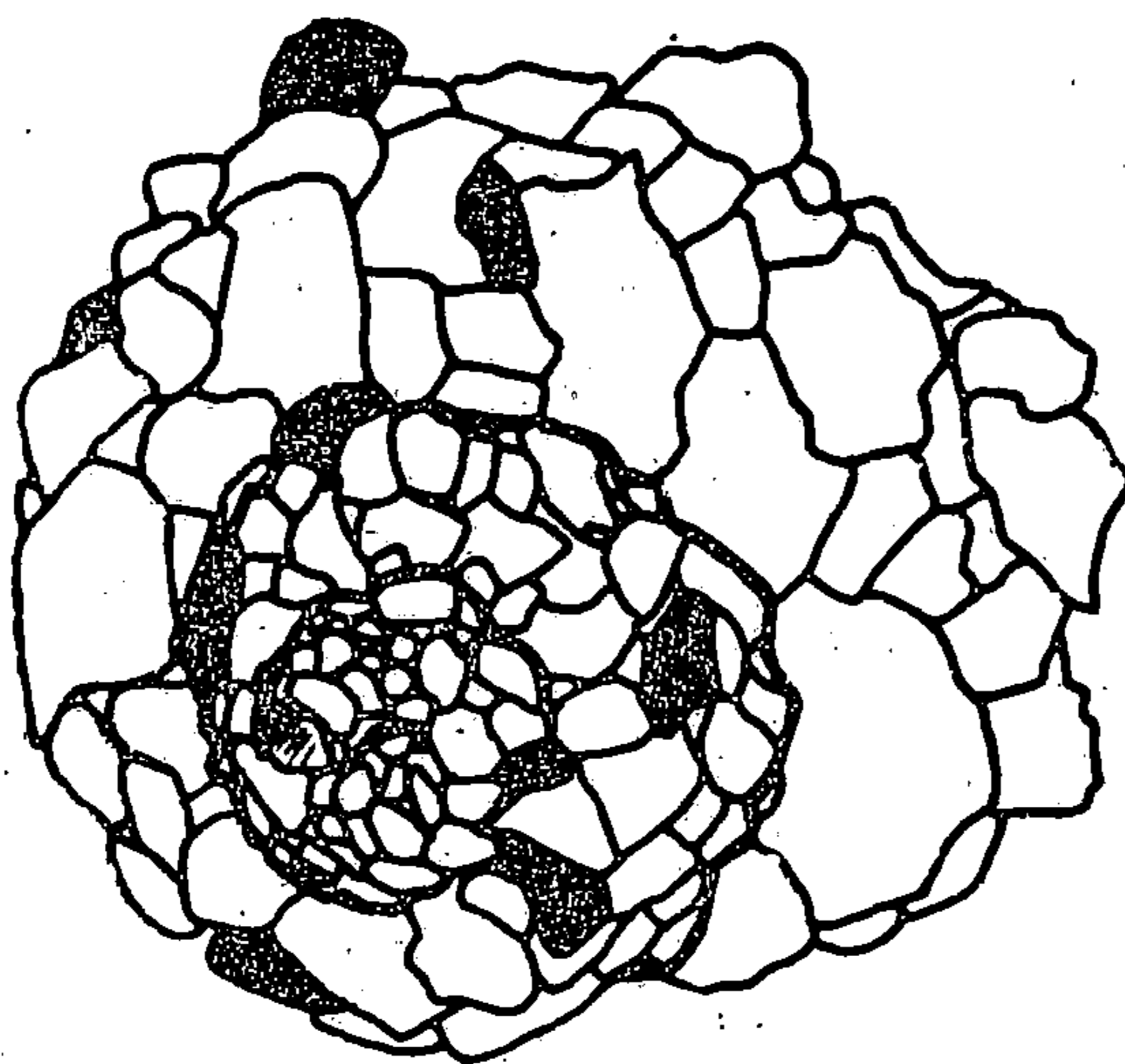


Fig. 19 & 20. Case of *Helicopsyche ruprawathi*, (left) & *H. Sri Lanka* (right). dorsal aspects (above) and laterae aspects (below).



described by BRAUER (1866). Altogether this material contains six distinguishable types of cases. Unfortunately most of the cases only contained larvae which I was not able to categorise to species. Very few mature or partly developed female pupae were present. These could be identified to species. Surprisingly, the cases also exhibitedarked differences.

Helicopsyche amarawathi.—The adults have been both clearly described and diagrammed by SCHMID. The females may be recognized by the pair of dorsal lobes on the abdomen tip. These are even present in specimens in the partly developed pupal stage.

The case is by far the biggest of the six species (fig. 18). Its diameter (abbreviated : D) may be 6 mm or more. It is rather high : diameter to height ratio (abbreviated : D/H) is about 1, 5. The first whorls are rather narrow ; the last one very wide. The navel is very narrow and deep. The surface is covered with extraordinarily rough sand grains of variable size and of irregular arrangement. The case of the mature larva has a little more than 3 whorls. The anterior opening of the pupal case is covered by an oval silken membrane which has, in its left half, many minute openings which are arranged in a circular area (fig. 24).

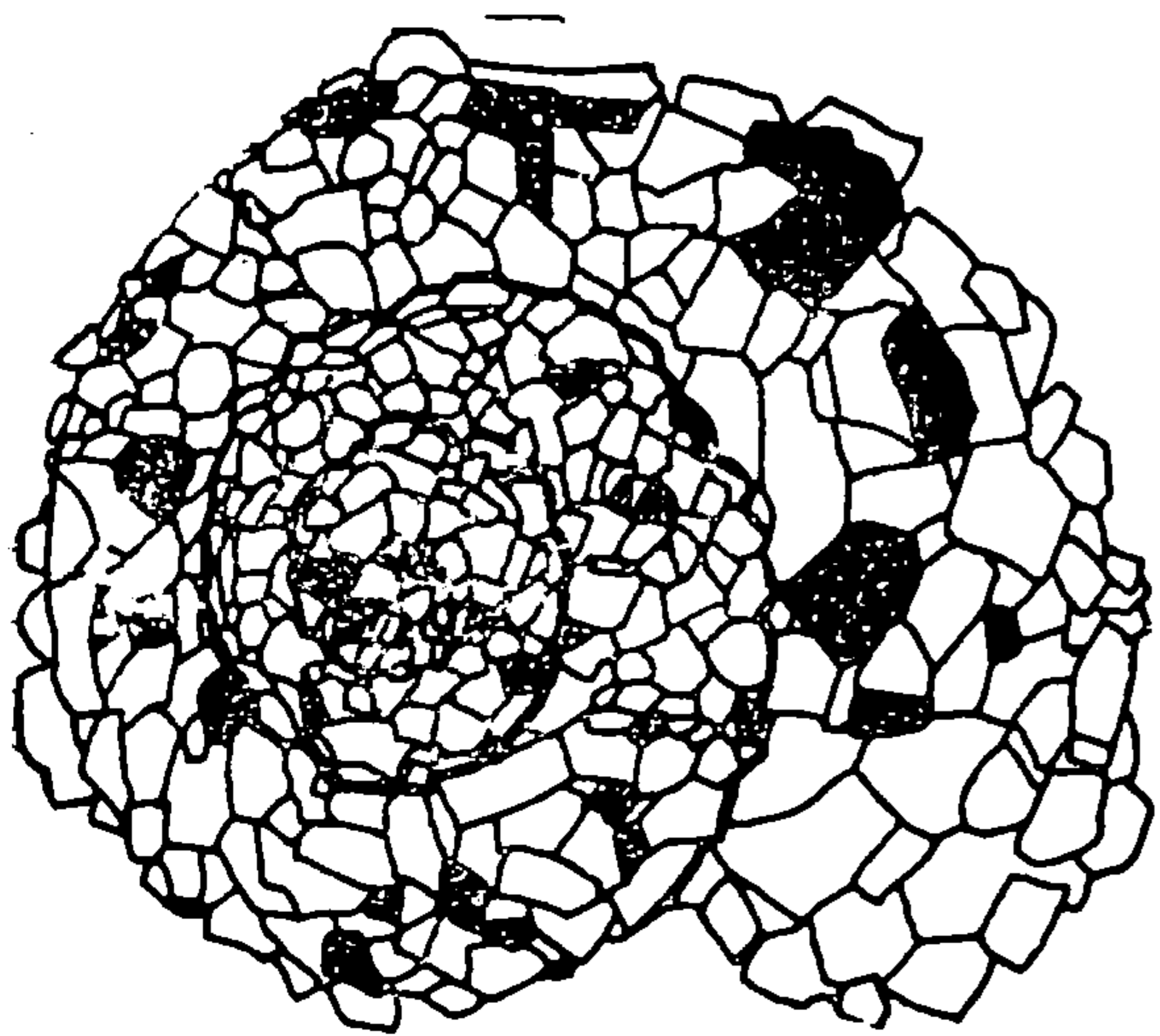


Fig. 21. Case of *Helicopsyche ceylanica*.

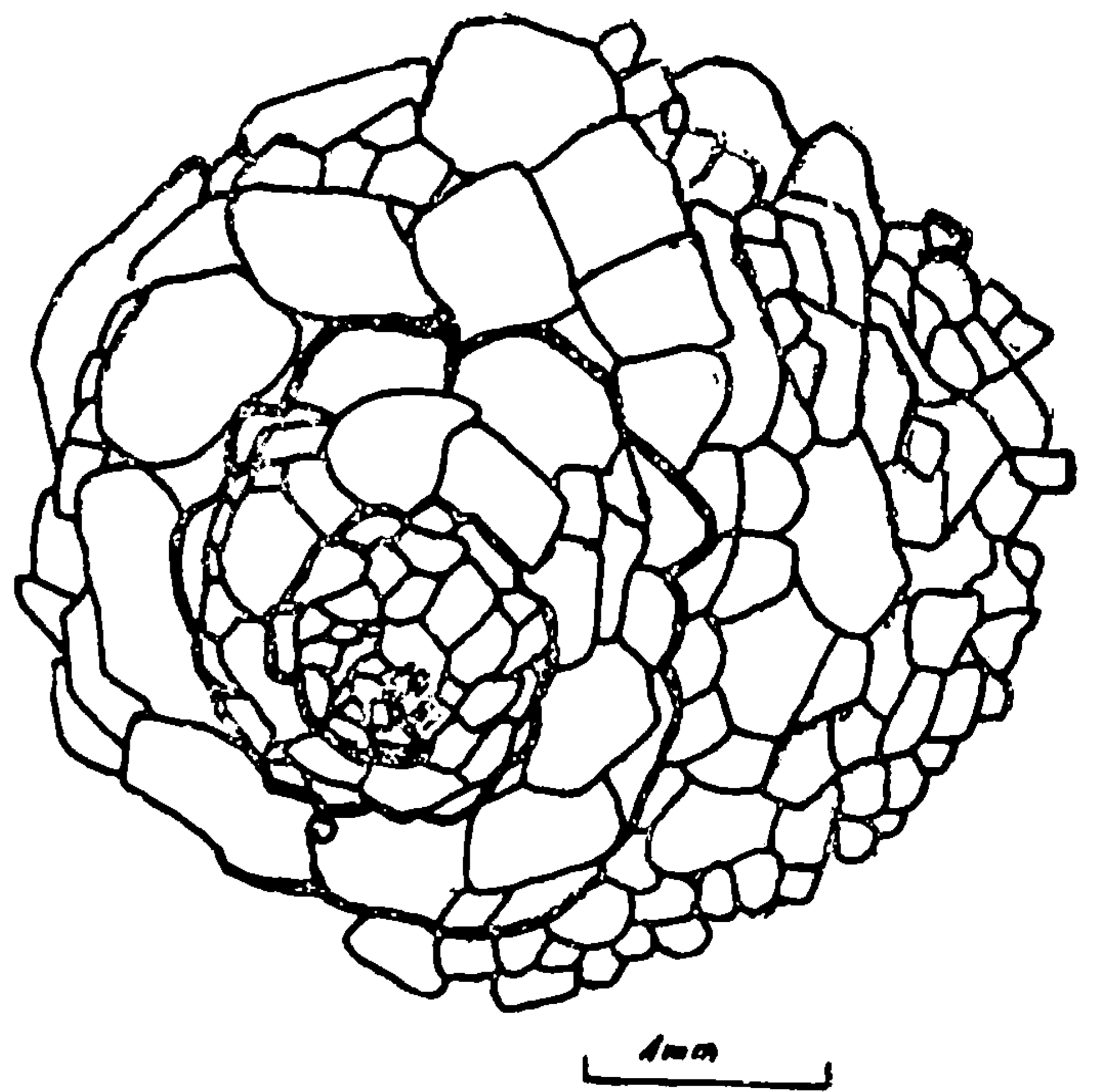
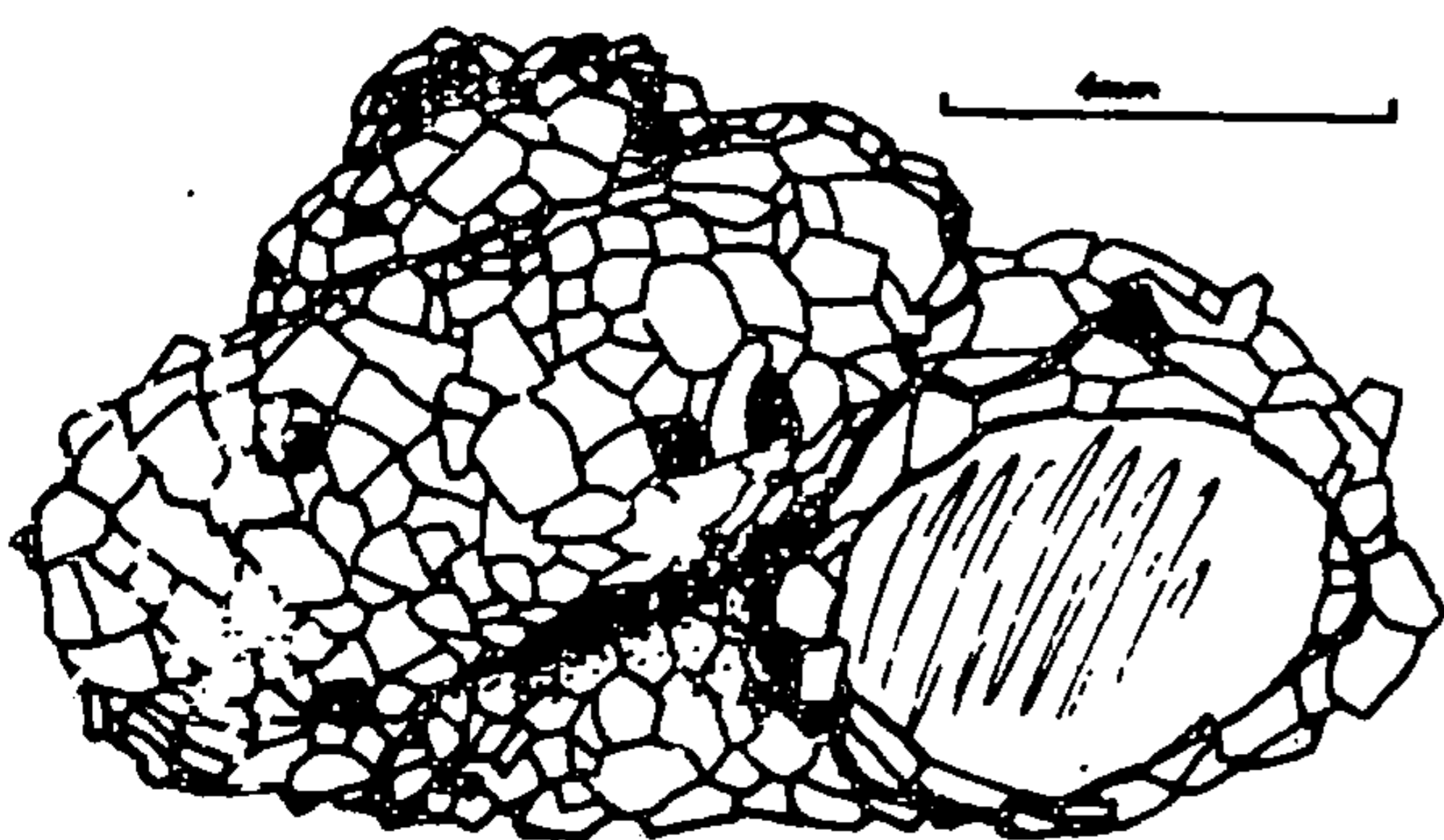


Fig. 22. Case of *H* sp. case E.

Helicopsyche ruprawathi.—The adult stage of this species has also been described and diagrammed by SCHMID. The case (fig. 19) is much smaller than that of amarawathi, and much flatter (D—2,5 mm ,D/H—2,0). The case, which has 2 1/2 whorls, is covered with relatively rough sand grains, but they are much smaller than those of amarawathi. They are arranged rather irregularly. Their

respective size increases proportionally with the width of the whorl. The navel is deep and moderately wide. The membrane of the pupal case has a considerable number of small openings, but they are arranged in diverging lines (fig. 24).

Helicopsyche srilanka n.sp.—The material contains one female pupa which had been on the point of emerging. It is very similar to *H. ruprawathi*. It is completely black, but on the forewing has the white transverse line as does *ruprawathi*. In addition it has a white spot at the base of the wing which may be present in *ruprawathi* too and another white spot in the centre of the black area which is separated in the apical region of the wing by the white line mentioned. In all *ruprawathi* specimens I have seen the white discoidal spot is lacking. The female genitalia (fig. 16) are also very similar to those of *ruprawathi*, but the lateral parts of segment 9 protrude more than in *ruprawathi*, and viewed from above, the pair of dorsal lobes of segment 10 are not at a rounded bean-like shape as the latter, but are triangular.

Holotypus ♀ (pupa)—Ceylon, Belihul-Oya, 12.10.1970, 2000', leg. O. S. Flint, Jr., in coll. Smithsonian Institution, Washington D.C.—A half dozen cases with larvae in the same collection.

The case (fig. 20) is about the same size as *ruprawathi*'s, but it is moderately higher ($D=2.2$ mm, $D/H = 1.8$). The $2\frac{1}{2}$ whorls dilate very gradually, and are evenly covered with very small sand grains, which gives the surface a smooth appearance. The size of sand grain increases with the width of the whorl, also very gradually. The navel is wide and of moderate depth. The pupal membrane is similar to *ruprawathi*'s in the arrangement of the openings, which, however, are long and narrow (fig. 24).

Helicopsyche ceylanica. BRAUER described only the case, larva, and pupa of the species. His material, preserved in alcohol, is in good condition. It contains, amongst others, two rather well developed female pupae which, however, are far from ready to emerge. The mature black pupa, mentioned by BRAUER in his description (1866 : 26, 28) has been dissected into small pieces, probably by BRAUER himself, and the genitalia are no longer recognizable.

The caudal part of the female abdomen (fig. 17) is without characteristic prolongations or appendages. It is rounded and only ventrally has a clearly recognizable horizontal ledge. The lateral oval parts of segment 9 have a very conspicuous network of fine, polygonal meshes. A similar structure is also known for the female of *Helicopsyche martynovi* from India (Mosely 1939 : 43, pl. 7). The terminal segment bears a number of fine, long hairs.

Lectotypus ♀(pupa) (fixed here)—In alcohol in a glass tube with printed label ; " Erste oesterreichische Weltumseglung der Fregatte Novara in den Jahren 1857. 1858. 1859.", with additional handwritten note : " Helicopsyche ceylanica Brauer—larva nympha—Ceylon ". On a second label is written : " LVIII.1. "—In his description (l.c. : 30) BRAUER mentions ; " Vaterland : Ceylon, Adamspik ". Further material : one female (pupa) paralectotype and several cases with larvae and premature pupae with the same data. All in coll. Museum of Natural History, Vienna, Austria.

The case of *H. ceylanica* (fig. 21) has been very well diagrammed by BRAUER (l.c., pl. 1). Its smooth surface is similar to *H. srilanka*, but it is bigger and flatter ($D=3$ mm, $D/H = 2.0$). It has a little more than $2\frac{1}{2}$ whorls which dilate very gradually. The same is true for the increase in size of sand grains respective to the width of the whorl. The navel is wide and deep. The anterior opening is surrounded by a distinct ledge, consisting of small sand grains. In the three species described above such a ledge is absent, the edge is smoothed by a silk cover. The membrane covering the pupal case has only one large transverse slit a little below the centre (fig. 24).

Helicopsyche sp. case E. Only cases and larvae present. The case (fig. 22) is rather large and high ($D=4$ mm, $D/H=1,6$). It has $2\frac{3}{4}$ whorls, the navel is narrow and deep. The first whorl is covered with very fine sand grains. In the course of the second whorl the grain size increases abruptly, and these large grains which undergo little further increase in size, form the covering of the next approximative $1\frac{1}{2}$ whorls. Then, the larva uses fine grains similar to those of the first whorl again to cover the broad structure which overhangs the opening. This opening is surrounded by a distinct stout ledge made of sand grains, with silk cover. The form of the pupal membrane can not be described, because the material only contains one case, in which the inhabiting larva had begun to spin a membrane, which is thus incomplete. In present stage only irregular rough meshes are formed. Material: about 40 cases with larvae, collected near Maskeliya, sample FC 17 b.

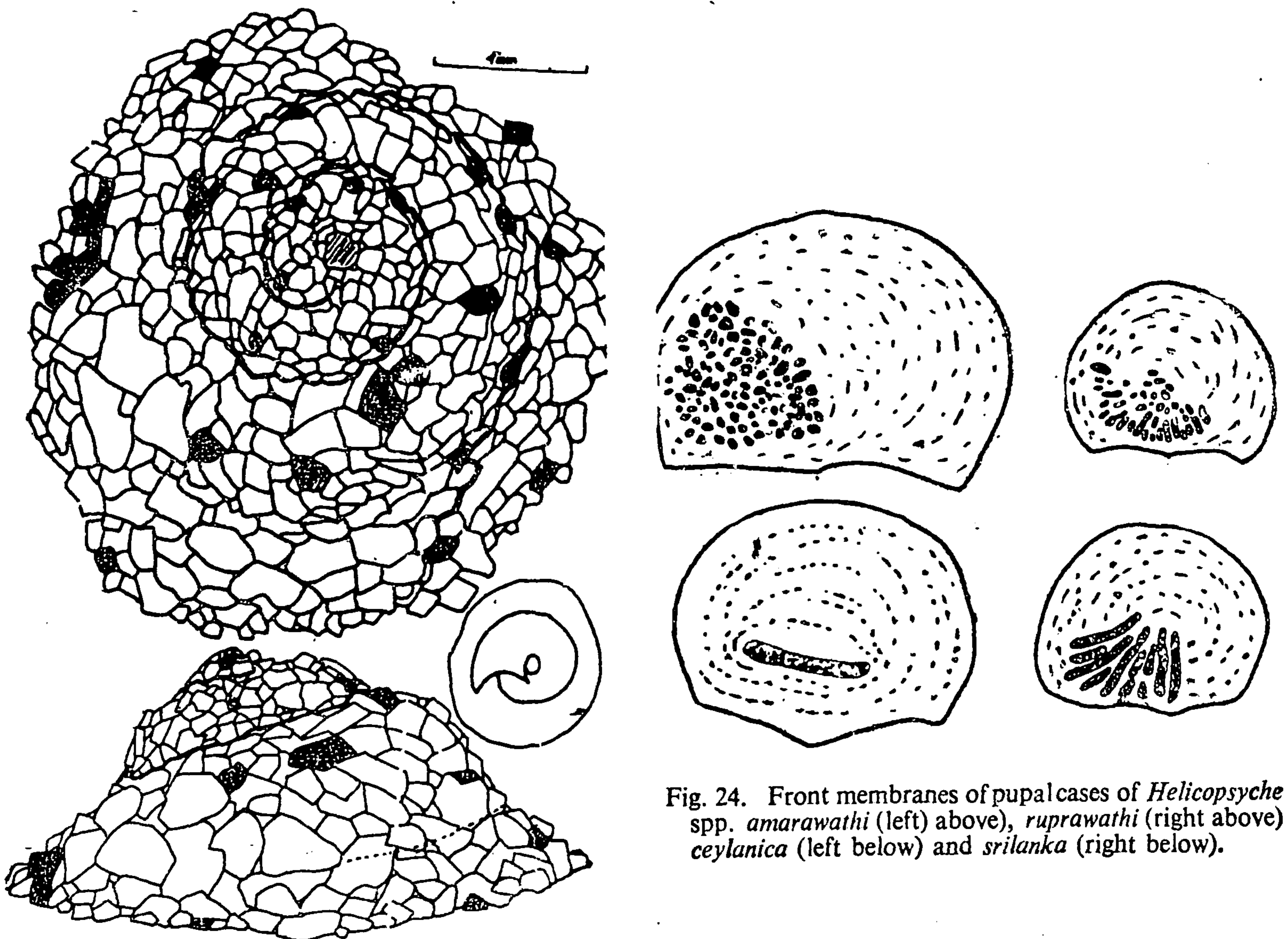


Fig. 23. Case of *Helicopsyche* sp. case F.

dorsal aspect (above), lateral aspect (below) and ventral aspect in outline (centre).

Fig. 24. Front membranes of pupal cases of *Helicopsyche* spp. *amarawathi* (left above), *ruprawathi* (right above), *ceylanica* (left below) and *srilanka* (right below).

Helicopsyche sp. case F. This case (fig. 23) is very characteristic and differs from the other five in having a broad conical margin encircling its ventral area. Some species of *Synagapetus* have a similar margin on their cases, but it is soft and movable. In this *Helicopsyche* it is stiff. The case is rather large and very flat ($D=4$ mm, $D/H=2,7$) and has $1\frac{3}{4}$ whorls. The edge of anterior opening is not particularly thickened. The sand grains used are of approximately the same medium size along the whole case, and only a few larger ones are located on the outer whorl. They are arranged regularly, and the surface is smooth. The navel is wide and very deep. On the dorsal part of the case there is an additional navel which is surrounded by the first whorl. These two navels touch

one another ; the remaining hole is closed by a soft silken membrane and may be stuffed with detritus. No pupal membrane is present in the material, which only contains larvae and cases, originating from several localities (see list below.).

TABLE

Summary of characteristics of the cases of Ceylonese Helicopsyche

Species	diameter in mm	ratio diameter/height	number of whorls	surface	grain size	anterior opening with/without ledge
<i>Amarawathi</i>	6	1,5	3+	rough	big	without
<i>Ruprawathi</i>	2,5	2,0	2 1/2	rough	medium	without
<i>Srilanka</i>	2,2	1,8	2 1/2	smooth	small	without
<i>Ceylanica</i>	3	2,0	2 1/2	smooth	small	with
E	4	1,6	2 3/4	rough	small/big/small	with
F	4	2,7	1 3/4	smooth	small	without

LIST OF THE MATERIAL, ACCORDING TO SAMPLING LOCALITIES

The numeration of the localities is the original one used by the expedition. The numbers are always used in combination with the letters FC. In most instances, the samples were divided into several sub-samples according to the micro-habitats (shore region, region of intensive current, region of cascades) concerned. This sub-division is not maintained in this list. Nevertheless the ecological conclusions which derive from that sub-division are pointed out in the next chapter.

In the list some data are given in brackets. This refers to specimens which could not be identified themselves, but which are probably the named species, because other individuals in the same sample were identified with certainty. All sampling localities are streams and rivers. More detailed descriptions are given by Starmühlner (1972).

La = larvae(e), p = pupa(e), ca = empty case(s)

FC 1 Meda-Dola (tributary of Gin-Ganga, region Deniyaya), 1,000m, 20,2°C, pH 5,8, 9.11.1970. Virgin forest, heavy shadow.

Chimarra sp. 3 la

Hydropsyche larva A 3 la, 1 p.

Diplectrona larva B 2 la

Diplectronella taprobanes 2 la

Oecetis sumanasara 1♂ p (5 ca)

Goera katugalkanda 1♂ p. (2 la, 12 ca)

Goerodes sp. 1 la

FC 3 Hola-Dola (tributary of Gin-Ganga, region Deniyaya), 700 m, 21,1–22,2°C, pH 5,8, 10.11.1970. Cascade stream coming from the virgin forest.

Synagapetus sp. 3 la

Macronema larva A 1 la

Diplectronella taprobanes 4 la

Leptoceridae g. sp. 3 ca

Goerodes sp. 1♀ p.

FC 4 Pasumale-Dola (tributary of Gin-Ganga, region Deniyaya), 800 m, 27,7—28.2° C, pH 5,8. 10.11.1970. Cascade stream without shadow.

Psychomyidae g. sp. 12 la, several ca
Hydropsyche katugahakanda 5 la. (1♀ p.)

FC 5 Campden-Hill-Dola (tributary of Gin-Ganga, region Deniyaya) 700 m, 24,1—24,7° C pH 5,8, 11.11.1970. Cascade stream without shadow.

Synagapetus hanumata 3♂ p (3 la, 5 p)
Hydroptila kurukepitiya 1♂ p. (1 la, 7 p, 36 ca)
 ? *Oxyethira* sp. 1 la
Chimarra sp. 1 la
Polycentropodidae g. sp. 1 la
Hydropsyche katugahakanda 3 la
Hydropsyche flinti 30 la, 1♂ p.
Hydropsyche larva A 17 la
Diplectrona larva B 1 la, 1 p
Hydropsychidae g.sp. 2 la, 5 p
Oecetis sumanasara 1♂ p
Leptoceridae g, sp. 3 la, 4 ca
Goerodes sp. 2 ca

FC 6 Kiriwel-Dola (tributary of Gin-Ganga, region Deniyaya), 700 m, 23,8° C, pH 5,8, 11.11.1970. River in the valley ground, without shadow.

Synagapetus hanumata 1♂ p (2♀, p, 22 la)
Psychomyidae g. sp. 1 la
Hydropsyche katugahakanda 1 la
Hydropsyche flinti 1 la
Hydropsyche larva A 17 la
Hydropsyche larva D 1 la
Diplectronella taprobanes 1 la
Hydropsychidae g. sp. 2 p
Leptoceridae g. sp. 2 ca
Goerodes sp. 2 ca

FC 7 Thanipita-Dola (tributary of Nilwala-Ganga, region Deniyaya), 600 m, 25,1—27,3° C, pH 6,0, 12.11.1970. Cascade stream in woodland, partially shadowed.

Macronema larva B 1 la
Hydropsyche flinti 1♂ p, 17 la
Hydropsyche larva A 25 la
Hydropsyche larva B 3 la
Trichosetodes argentolineata 1♀ p.
Leptoceridae g.sp. 2 la

FC 8 Nagahaketa-Dola (tributary of Nilwala-Ganga, region Deniyaya), 500 m, 24,2–25,4° C, pH 5,8, 13.11.1970. Stream in woodland, partially without shadow.

Synagapetus sp. 10 la, 1 p.
Chimarra sp. 2 la
Hydropsyche larva A 3 la
Hydropsyche larva B 15 la
Hydropsychidae g. sp. 1 la
Setodellina punctatissima 1 ♂
Leptoceridae g. sp. 1 la
Goerodes sp. 1 ca
Helicopsyche ruprawathi 4 la

FC 9 Bodathpitiya-Ela (tributary of Kalu-Ganga, region Ratnapura), 500 m, 26,0–27,2° C, pH 6,0, 17.11.1970. Waterfall, without shadow.

Chimarra sp. 2 la
Polycentropodidae g.sp. 2 la
cf. *Pseudoleptonema* larva B 5 la
Hydropsyche katugahakanda 3 la, 1 p
Hydropsyche larva A 5 la
Marilia cf. *ceylanica* 2 la, 1 ca
Leptoceridae g.sp. 1 la, 1 ca
Helicopsyche ruprawathi 1 ♀ p.

FC 10 Katugas-Ela (tributary of Kalu-Ganga, region Ratnapura), 500 m, 25,1–25,3° C, pH 5,8, 18.11.1970. Cascade stream in the shadow of a gorge.

Chimarra sp. 1 la
Psychomyidae g.sp. 1 ca
cf. *Pseudoleptonema* larva A 18 la, 4 p
Hydropsyche larva A 1 la
Hydropsyche larva B 2 la
Leptoceridae g.sp. 1 ca

FC 11 Rajanawa-Dola (tributary of Kalu-Ganga, region Ratnapura), 24,6–26,1° C, pH 5,8, 19.11.1970. Cascade stream below waterfall in virgin forest, heavy shadow.

Synagapetus cf. *hanumata* 1 ♂ p (1 la)
Plethus cursitans 1 ♂
Chimarra sp. 25 la
Polycentropodidae g. sp. 2 la
Ecnomus sp. 6 la
Psychomyidae g. sp. 2 la
Macronema larva A 3 la
cf. *Pseudoleptonema* larva A 10 la
Hydropsyche larva A 3 la
Hydropsyche larva B 24 la
Diplectronea larva A 1 la
Hydropsychidae g. sp. 1 la
cf. *Trichosetodes meghawanabaya* 1 ♀ 1p
cf. *Adicella biramosa* 1 ♀ p

Leptoceridae g. sp. 3 la, 1p, 9 ca
Goerodes sp. 1 ♀ 1p, 2 ca
Helicopsyche amarawathi 1 ♀ 1p, 3 la

FC 12 Kalu -Ganga near the town of Ratnapura, 50m. 26,1-26,6°C, pH 6,5, 20.11.70. River in a deep valley, 20-30m broad.

Pseudoneureclipsis thuparama 1♂p
Ecnomus sp. 2 la
Hydropsyche larva A 5 la
Hydropsyche larva C 2 la
Ceylanopsyche case A 1 la

FC 13 Upper region of Kalu-Ganga near Malwala, 100m, 26,3-26,7°C, pH 7,2, 21.11.70. Without shadow.

Synagapetus sp. 1 ca
Psychomyidae g. sp. 5 la
Hydropsyche larva B 4 la
Hydropsyche larva C 1 la
Hydropsychidae g.sp. 2 la
 cf. *Marilia ceylanica* 1 la
Leptoceridae g. sp. 1 p, 3 ca
Goerodes sp. 2 ca

FC 14 Upper region (Headwater) of Kalu -Ganga near Carney-Estate, 800m, 22,8-23,8°C, pH 6,5, 22.11.70. Gorge in virgin forest in heavy shadow.

Synagapetus sp. 2 la
Hydroptila sp. 1 ca
Pseudoneureclipsis starmuehlneri 1♂p
Polycentropodidae g. sp. 2 la
Psychomyidae g. sp. 2 la
Hydropsyche larva A 1 la
Diplectronella taprobanes 3 la
Leptoceridae g. sp. 1 p. 3 ca
Goerodes sp. 1 ca
Ceylanopsyche asaka 1 ♂ p, 2 la (3 la, 1 p, 3 ca)
Helicopsyche amarawathi 4 la

FC 15 Ira-Handha-Pana-Ela, 100m, 25,6-26, 6° C, pH 6,7, 23.11.70. Tributary from the right shore of Kalu-Ganga.

cf. *Oxyethira* sp. 1 p
Chimarra sp. 4 la
Polycentropodidae g. sp. 4 la
Ecnomus sp. 1 la
Psychomyidae g. sp. 1 la, 1 ca
 cf. *Pseudoleptonema* larva A 3 la

Hydropsyche katugahakanda 3 1a
H. flinti 6 1a
H. larva A 11 1a
H. larva B 13 1a
Hydropsychidae g. sp. 2 1a, 3 p
Leptoceridae g. sp. 5 1a, 1 p
Goerodes sp. 1 ca

FC 16 Mocha-Dola (tributary of Maskeliya reservoir), 1,800m, 18,7-20,7°C, pH 6,1, 28.11.70.
 Stream without shadow.

Apsilochorema diffinis 1 1a
Synagapetus cf. hanumata 3 ♂ p (3 1a)
Synagapetus cf. rudis 1 ♂
Hydropsyche katugahakanda 1 ♂ p, 61 1a (1 p)
Hydropsyche larva A 5 1a
H. larva B 16 1a
Diplectrona larva B 2 1a

FC 17 Gartmore-Dola (region Maskeliya), 2,000 m, 16,1-17,2° C, pH 5,6, 29.11.70. Spring
 stream from native forest, not shadowed.

Psychomyidae g. sp. 1 1a
 cf. *Pseudoleptonema larva A* 9 1a, 1 p
Hydropsyche katugahakanda 5 1a
H. annulata 2 ♂ p (1 ♂ p, 3 ♀ p)
H. larva B 1 1a
Diplectronella taprobanes 3 1a
Hydropsychidae g. sp. 1 ♀
Marilia cf. ceylanica 1 ca
Molanna taprobane 1 ♀
Goerodes sp. 5 1a, 1 ca
Ceylanopsyche case A 3 1a
Helicopsyche case E 41 1a
Helicopsyche case F 1 1a

FC 18 Gartmore-Dola, below the waterfall, same stream as in FC 17. 1800m, 16, 9°C, pH 5,9,
 30.11.70. Without shadow.

Hydroptilidae g. sp. 1 p
Ecnomus sp. 1 1a
Psychomyidae g. sp. 2 1a
Goerodes sp. 4 1a
Ceylanopsyche case A 18 1a
Ceylanopsyche case B 27 1a
Helicopsyche amarawathi 1 ♀ p
H. ruprawathi 3 1a
H. larva F 4 1a

FC 19 Tributary of FC 18, near the manager-bungalow of Gartmore-Estate, 1800m, 15,3-19, 4°C, pH 6,3, 30.11.70. Partially shadowed.

Apsilochorema diffinis 2 la
Synagapetus sp. 1 ♀, p, 3 ca
Chimarra sp. 2 la
Polycentropodidae g. sp. 8 la, 1 p
Diplectrona larva B 1 la
Diplectronella taprobanes 1 ♂
Hydropsychidae g. sp. 1 ♀ p
Oecetis sumanasara 1 ♂ p, 2 ♀ p (15 la, 3 p, 7 ca)
Goerodes sp. 1 ca

FC 20 Maskeliya-Dola near Adams Peak, 1 km upstreams from the Maskeliya reservoir 1800m, 18, 3-19,9°C, pH 6,4, 1.12.70.

Chimarra sp. 1 ♀
Psychomyidae g. sp. 1 la
Hydropsyche katugahakanda 2 la
Hydropsyche larva A 1 la
Diplectrona larva B 1 la
Hydropsychidae g. sp. 1 la, p
Leptoceridae g. sp. 1 p
Goera paragoda 1 ♂ p
Goerodes fuscata 1 ♂ (3 la)
Helicopsyche amarawathi 4 la

FC 21 Hakgala-Dola, 2000m, 14,9-15,2° C, pH 6,9, 2.12.1970. Cascade stream near Nuwara Eliva, shadow.

Apsilochorema diffinis 1 la
Polycentropodidae g.sp. 2 la
Ecnomus sp. 1 la
Diplectrona larva B 1 la
Hydropsychidae g.sp. 1 p.
Goerodes sp. 7 la

FC 23 Dick-Dola between Maskeliya and Hatton, 1800 m, 18,6-20,8° C, pH 6,4, 3.12.1970. Without shadow, polluted by sewage from the town.

Oestropsyche vitrina 1 ♂ p
Hydropsyche katugahakanda 1 ♂ p, 119 la (1 p.)
Hydropsyche larva A 2 la
Leptoceridae g.sp. 1 la

FC 24 Belihul-Oya (tributary of Walawe-Ganga, upstream of the resthouse, 650 m, 18,3-21,4° C, pH 6,6, 7.12.1970. Not shadowed.

Paduniella mahanawana 2♂
Paduniella subhakara 1♂
Polycentropodidae g.sp. 1 la
Psychomyidae g.sp. 1 la
Hydropsyche katugahakanda 1 la
Hydropsyche larva A 2 la
Synaptopsyche nikalandugola 1♀
Diplectronella taprobanes 2♀
Hydropsychidae g.sp. 1 p.
Marilia ceylanica 1♂ p(1 la)
Trichosetodes meghawanabaya 2♂
Adicella sp. 1♀
Oecetis belihuloya 1♂, 2♀
Oecetis hamata 2♀
Oecetis malighawa 1♂
 cf. *Oecetis* sp. 1 la
Leptoceridae g.sp. 1♀p
Goerodes sp. 2 la

FC 25 Kirikatu-Oya (tributary of Walawe-Ganga), 700m, 18,8-19,6°C, pH 7,1, 8.12.1970.

Polycentropodidae g.sp. 1 la
Hydropsyche katugahakanda 1 la
Hydropsyche larva A 1 la
Hydropsychidae g.sp. 6 p.
Leptoceridae g.sp. 1 la
Goerodes sp. 2 la, 2 p

FC 26 Veli-Oya (tributary of Walawe-Ganga), 700 m, 20,8-21,0° C, pH 7,0, 8.12.1970.
 Cascade stream without shadow.

Synagapetus sp. 21 la
Hydroptilidae g. sp. 1 ca
Hydropsyche katugahakanda 12 la, 1 p.
Hydropsyche larvae A 4 la
Goerodes punda 1♂ p (4 la)

FC 27 Kuda-Oya (tributary of Menik-Ganga near Buttala in the south-eastern lowland, region Belihuloya) 25,2° C, pH 7,7, 9.12.1970. Stream in the shadow of the virgin forest.

Psychomyidae g.sp. 2 la
Hydropsyche flinti 6 la
Hydropsyche larva A 4 la
Hydropsyche larva B p la
Hydropsyche larva C 19 la
Hydropsychidae g.sp. 3p
Anisocentropus sp. 1 la, 1 p
Leptoceridae g.sp. 2 la
Goerodes sp. 2 la

FC 28 Wetakei-Ela (tributary of Kirindi-Ganga near Wellawaya in south-eastern Ceylon, region Belihuloya) 100m, 23,9°C, pH 8,3, 9.12.1970. Stream in virgin forest with travertine concretions.

Chimarra sp. 14 la
Hydropsyche larva B 2 la
Helicopsyche amarawathi 1 p, 9 la

FC 29 Diyaluma-waterfall, region Belihuloya, 500m, 20°C, pH 6,7, 9.12.1970.

Hydropsyche katugahakanda 1 la
Hydropsyche larva B 1 la

FC 30 Wegan-Oya (headwaters of Wegan-Oya, tributary of Kalu-Ganga, region Belihul-oya near Balangoda), 550m, 24,7-25,6° C, pH 7,2 10.12.1970.

Plethus sp. 1 la, 3p, 2 ca
Hydropsyche flinti 29 la
Hydropsychidae g.sp. 4 p.
Leptoceridae g.sp. 1 la

FC 34 Bibili-Oya (tributary of Kelani-Ganga, below Kitulgala), 25.4-25,8° C; pH 6, 28.12.1970. Partially in shadow.

Plethus sp. 1 la
Chimarra sp. 2 la
Nyctiophylax sp. 1 ♀
Polycentropodidae g.sp. 5 la
Oestropsyche vitrina 1♂
Hydropsyche flinti 1 la
Hydropsyche larva A 1 la
Hydropsyche sp. 2♀
Trichosetodes meghawanabaya 1♂p (6 la, 8 ca)
Oecetis belihuloya 1♂

FC 35 Hal-Oya (tributary of Kelani-Ganga near Ginigathhena), 700 m, 22,5-23,1° C, pH 6,8, 27.12.1970.

Chimarra sp. 6 la
Gunungiella madakumbura 1♂
Hydropsyche katugahakanda 1♂p, 21 la
Hydropsyche larva A 1 la
Hydropsyche larva B 4 la
Leptoceridae g.sp. 1 la, 1 ca.

FC 36 Rambukpoth-Oya (tributary of Kelani-Ganga near Pitawela), 650m, 25°, C, pH 6,7, 27.12.1970

Synagapetus cf. *hanumata* 3♂p. (11p. 24 la)
Hydropsyche katugahakanda 3 la
Hydropsyche larva A 1 la
Hydropsychidae g.sp. 1p
Leptoceridae g.sp. 1 p.
Helicopsyche amarawathi 1♀p, 20 la

FC 37 Kelani-Ganga (near the resthouse of Kitulgala), 24,3-26,4°C, pH 6,7, 28.12.1970.

Psychomyidae g.sp. 2 la
 cf. *Pseudoleptonema* larva B 1 la
Hydropsyche larva A 2 a
Marilia ceylanica 1♂p (7 la, 23 p, 22 ca)
Trichosetodes argentolineata 1♂p, (2 la, 9 ca)
Leptoceridae g.sp 1 la, 3 ca
Goerodes sp. 2 ca

Ratnapura, light trapping at the resthouse, 18.-24.11.70.

Diplectronella taprobanes 1♀

REMARKS ON THE ECOLOGY

The present material is relatively uniform, as it stems exclusively from streams and rivers. Thus it lacks the numerous caddisflies which live in stagnant water bodies. At the sampling localities the material was collected from various micro-habitats which differed mainly in their current velocity. From this it is indicated that the larvae of all *Hydropsychids* and *Chimarra* collected, and those of *Ceylanopsyche* prefer high current velocities, the *Helicopsyche* species, on the other hand, favour calm spots within the streams. The other species do not appear to exhibit such preferences for stream velocity. The same is true in respect to acid, neutral, and alkaline water. However distinct preferences are shown in respect to water temperature and, accordingly, to altitude above sea level.

The following species prefer relatively cool water (registered temperature at time of sampling between 15 and 25°C); *Apsilochorema diffinis*, *Hydropsyche katugahakanda*, *Diplectronella taprobanes*, *Diplectrona* larva B, *Oecetis sumanasara*, *Helicopsyche* case E. In contrast, relatively warm water (actual temperature between 20 and 30°C) is preferred by *Pseudoleptonema* larva A and B, *Hydropsyche flinti*, *Hydropsyche* larva B and C, *Marilia ceylanica*, and the majority of *Leptocerids*. In *Hydropsyche* larva A, which is the most frequent species in the present material, such a preference is not indicated. It seems to be very euryoëcous.

The mass occurrence of *Hydropsyche katugahakanda* in the sample FC 23 is striking. This sample contains very few species at all; the stream is polluted by urban sewage. This is a further example of the high resistance of some *Hydropsychid* larvae to polluted conditions.

The immediate comparison of the present species list with the results published by SCHMID (1958) shows considerable differences which may be due to different methods of collecting. The Austrian expedition concentrated on collecting aquatic stages and on obtaining physical and chemical data. SCHMID used the light trapping and sweepnet methods. The number of species found by SCHMID is much higher, but corresponding ecological data and young stages are lacking. However, Prof. STARMÜHLNER succeeded in finding species not recognized by SCHMID.

SCHMID (1958:32) points out that in general the body size of Ceylonese caddisflies increases with altitude. In some groups of closely related species, the smaller ones live in the lowlands, the larger ones in the mountains. Another example of this phenomenon is presented by *Hydropsyche annulata* and *H. flinti*. The former which is twice the size of the latter, prefers mountains regions. *H. flinti* is widespread in the lowlands and in warm water.

It is worth mentioning, that some Ceylonese caddisworms, particularly the species of *Synagapetus* and *Helicopsyche*, as well as *Hydroptila kurukepitiya*, select minute rubies for the case construction, in addition to various variegate sand grains. This gives the cases an excellent aspect. Such cases occur e.g. in the samples FC 5, 6, 18, 20, and 26, as well as in BRAUER's type series of *Helicopsyche ceylanica*.

SUMMARY

The Trichoptera collected in Ceylon by the Austrian Indo-Pacific Expedition in autumn and winter 1970 (larvae and adults) are evaluated in systematic and ecological respects. The following new species are described; *Pseudoneureclipsis starmuehlneri*, *P. maliboda*, *Oecetis belihuloya*, and *Helicopsyche sri lanka*. *Helicopsyche ceylanica* BRAUER 1866 is re-described. Several types of larvae and cases of *Hydropsychidae*, *Ceylanopsyche*, and *Helicopsyche* are described or at least roughly characterized. According to the larval characters the genus *Ceylanopsyche* seems to belong to Seriocostomatidae s.str.

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