

A PRELIMINARY REPORT ON THE *HELICOPSYCHIDAE* (*TRICHOPTERA*)^{1, 2} OF NEW CALEDONIA

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Collections of Helicopsychidae from New Caledonia made by Dr. F. Starmühlner (Mission of the 1st Zoological Institut of the University of Vienna 1965), Dr. G. F. Edmunds, Jr., Dr. and Mrs. W. L. Peters, Dr. W. Beck, Dr. J. D. Holloway, and members of Bishop Museum field parties have together contained about a dozen species of *Helicopsyche*, distributed among several highly distinctive species groups. The family has not heretofore been recorded from the island, except generally by Starmühlner (1968). Thanks primarily to Dr. Starmühlner's extensive larval and pupal collections, we have associated adult and larval stages for several species scattered among these species groups.

It was my original intent to report only on Dr. Starmühlner's larval collections in order that he could use the information in his ecological analyses. As more and more species became identified on the basis of males, however, it became apparent that a perspective concerning the larvae could not be obtained without as good a picture of the total fauna as possible. I am therefore first describing the new species that have so far come to hand, then giving a report on Dr. Starmühlner's immature collections.

DESCRIPTIONS OF NEW SPECIES

In these New Caledonia species, two different types of vestiture are present on the tenth tergum. One type, which I am calling *setae*, arise from small sockets, are relatively small, and taper uniformly to a sharp point. The other type, which I am calling

macrochaetae, arise from much larger, raised, and somewhat keg-shaped sockets, and are usually much thicker than setae, either parallel-sided for most of their length (fig. 5), or are markedly thickened preapically and then taper to a sharp point (fig. 1).

To date I have found no reliable characters to identify the females to species. More than one species often occur in the same locality at the same time, and several species are known from a single male with no possibility of associating them now with females. I have therefore refrained from identifying any females at this time. For similar reasons, larvae are not included in the paratypes.

All specimens cited in this paper are from New Caledonia.

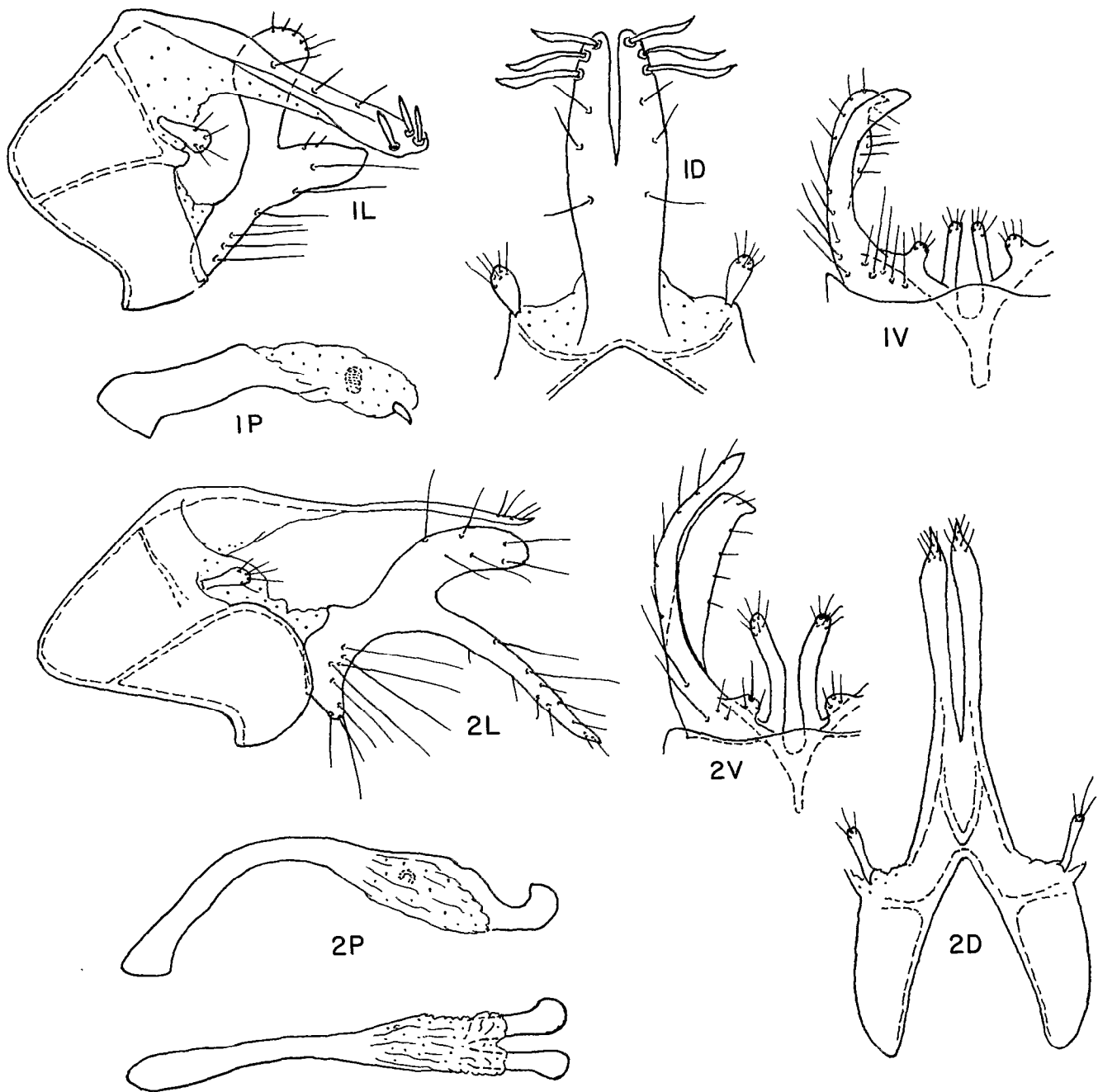
In the lateral views of the male genitalia of all species, the lateral view of the clasper is illustrated. In those drawings in which the clasper crosses the outline of the tenth tergum, the conflicting part of the clasper is shown in broken lines in order to give an unobstructed view of the tenth tergum.

KEY TO NEW CALEDONIA SPECIES-MALES

1. Tenth tergum having at least three pairs of long macrochaetae at apex, or near middle, or both, in addition to more slender setae that may be present (Figs. 1, 3, 10)..... 2
Tenth tergum having at most two short macrochaetae at base in addition to more slender setae (Figs. 2, 4)..... 9
2. Tenth tergum attenuated into a pair of slender, sharply pointed processes (Fig. 3)..... *edmundsi*

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(2) The collections of material made by Dr. Peters were supported by a travel and research grant from the National Geographic Society.



Figs. 1, 2. — Male genitalia of *Helicopsyche*. 1, *vallonica*; 2, *kariona*. D, dorsal; L, lateral; P, phallus, lateral in 1, lateral and dorsal in 2; V, clasper, ventral.

- Tenth tergum with apical incision shallow (Fig. 7)
or lobes not sharply pointed (Figs. 1, 5)..... 3
3. Tenth tergum with a deep apical cleft (Figs. 1, 5).... 4
Tenth tergum with cleft no deeper than in Fig. 7..... 6
4. Basal half of tenth tergum with a pair of raised,
somewhat flaplike lobes each bearing 5 or 6 macro-
chaetae (Fig. 5)..... *petersorum*
Tenth tergum simple, without dorsal lobes (Figs. 1, 6).. 5
5. Macrochaetae only at apex (Fig. 1)..... *vallonia*
Macrochaetae both near apex and laterally near base
(Fig. 6)..... *starmuehlneri*
6. Each lateral half of tenth tergum with a single series
of macrochaetae (Fig.) situated laterally.. *caledonia*
Each lateral half of tenth tergum with two series of
macrochaetae arranged diagonally (Figs. 7, 9) or
the posterior series forming a patch (Fig. 10)..... 7
7. Base of tenth tergum with ventral margin produced
into a distinct lobe (Fig. 8)..... *lapidaria*
Base of tenth tergum without such a lobe..... 8
8. Anterior portion of tenth tergum with lateral lobes
curved and raised above level of central part of
segment; anterior series of macrochaetae much
longer, more slender and abundant than posterior
series (Fig. 10)..... *hollowayi*
Anterior portion of tenth tergum with lateral lobes
not so raised; anterior series of macrochaetae only
slightly more slender and numerous than posterior
series (Fig. 9)..... *boularia*
9. Tenth tergum elongate and narrow (Figs. 2, 4)..... 10
Tenth tergum short and wide (Figs. 11, 12)..... 11
10. Tenth tergum and phallus joined by wide lateral
flanges, the two sides asymmetrical; two short
macrochaetae at base of tenth tergum (Fig. 4)....
..... *asymmetrica*
Tenth tergum not joined to phallus, and without
macrochaetae (Fig. 2)..... *kariona*
11. Tenth tergum with a pair of long, sclerous, lateral
lobes each forked at apex (Fig. 11)..... *arenaria*
Tenth tergum with only short and pointed lateral
lobes (Fig. 12)..... *koumacea*

The 12 species of *Helicopsyche* known to date from New Caledonia are a remarkably diverse assemblage on the basis of both larval and adult male characteristics. These species can be assigned to species groups that are each cohesive within the group and that differ markedly one from another. All the New Caledonia species have the clasper divided into definite dorsal and posterior lobes as is true of certain Australian and New Zealand species.

Another feature of certain New Caledonia *Helicopsyche* is the presence of a pair of sclerous rods or plates attached to the base of the endotheca of the phallus. Because of their position (Figs. 11, 12) it seems logical to believe that these structures are the parameres.

Vallonia Group

This differs from all other New Caledonia groups in that no crease exists between the dorsal and posterior lobes of the clasper (Fig. 1). In ventral view there arise from the fused bases of the claspers a pair of fingerlike mesal processes and adjacent to each a small lobe arising from the baso-mesal portion of the clasper. The group contains two species, *vallonia* and *kariona*, and is more closely related than any other New Caledonia species to certain forms found in Australia, especially *heacota* Mosely and *murrumba* Mosely, both of which have well defined dorsal and posterior lobes of the clasper, but with no crease separating their bases (Mosely and Kimmins, 1953).

Helicopsyche vallonia new species

MALE. Length (of pupa) 4 mm. Color various shades of brown. General structure as for genus and group. Genitalia as in Fig. 1. Ninth segment fairly deep. Tenth tergum elongate, cleft to near middle, the apex with three pairs of laterally projecting macrochaetae, the central region with three pairs of long setae. Cercus small and clavate. Clasper with apical half divided into a clavate dorsal lobe and a wide posterior lobe of the same length; from the fused ventro-mesal area of the claspers arise a mesal pair of straight slender processes. Phallus with cylindrical base and a fairly long, membranous endotheca bearing a pair of small apical sclerous points and a small internal peritremal sclerite.

HOLOTYPE, ♂ pupa. — Waterfall on Hienghene Road, N. of Ouaieme Bay, Sept. 7, 1965, F. Starmuehlner (N97). In the Illinois Natural History Survey, Urbana, Ill.

REMARKS. In many respects this species resembles the Tasmanian species *bartona* Mosely from which it differs in having the macrochaetae of the tenth tergum apical rather than situated on preapical lobes, and in differences in the shape of many other parts.

Helicopsyche kariona new species

MALE. Length 4 mm. Color and general structure typical of genus and group. Genitalia as in Fig. 2. Ninth segment narrowed and produced anteriorly. Tenth tergum elongate and narrow, incised to middle, resulting in a pair of long, narrow, flat lobes clothed at apex with a group of short setae. Cercus short and narrow. Apical half of clasper divided into a rounded dorsal lobe and a longer, pointed posterior lobe. From the fused bases of the claspers arise a mesal pair of long curved processes surmounted by short setae; immediately laterad of these are a pair of short lobes each situated on the ventro-mesal portion of a clasper. Phallus long and slender, its lateral

aspect slightly sinuate; phallobase long and slender, merging into the membranous endotheca, the latter containing the small internal peritremal sclerite and surmounted by a pair of sclerous processes that are widened and upturned at the apex.

HOLOTYPE, ♂. — Trib. of Karionan Rv., 5 km. NNW of Païta, elev. 122 m.; Oct. 11-12, 1972, W. L. and J. G. Peters (N35). In the Illinois Natural History Survey.

REMARKS. The lack of macrochaetae on the tenth tergum, the large sclerous processes at the apex of the phallus and the long posterior process of the clasper differentiate *kariona* from *vallonia*. The latter structure is suggestive of the Australian species *heacola* Mosely, which differs from *kariona* in having a shorter, wider tenth tergum that is cleft on the meson for only a short distance.

The homology of the apical processes of the phallus is uncertain. Their large size suggests that they might be the parameres but their dorsal position suggests that they may be homologous instead to the apical pair of processes found in *vallonia*.

Edmundsi group

The three species included here are quite diverse and may later prove to be much less closely related than indicated by this grouping. They differ from the *vallonia* group in having the clasper cleft very deeply and with a crease separating the dorsal and posterior portions. This characteristic is shared by the two following groups also, and seems to be typical of an assemblage of species endemic to New Caledonia. The *edmundsi* group differs from the *lapidaria* group in lacking an anterior apodeme on each side of the ninth segment, and from the *arenaria* group in having an elongate and narrow tenth tergum bearing macrochaetae.

Helicopsyche edmundsi new species

MALE. Length 5.5 mm. Color various shades of medium and light brown, wings without pattern. General structure typical for genus and group. Hind wing with a line of black hairs along Cu₂. Genitalia as in Fig. 3. Ninth segment fairly short, without anterior lateral apodemes. Tenth tergum long and tapering, with a pair of dorsal, anteriorly projecting, hornlike processes; apex deeply cleft, resulting in a pair of sharply pointed, almost appressed lobes, narrow from lateral view; vestiture consisting of 2 macrochaetae near the base of each «horn», a pair of them at the base of the apical cleft, and a few setae on each apical lobe. Cerci apparently absent. Clasper deeply cleft, in lateral view the dorsal lobe lozenge shaped, the posterior lobe fairly wide and fusiform. From the fused bases of the claspers arise a mesal

pair of somewhat trianguloid processes (Fig. 3 V) and lateral to them a slender process surmounted by a single long seta. Phallus simple and elongate, similar to Fig. 5 D, and without sclerous processes.

HOLOTYPE ♂ and 1 paratype ♂. — Ile des Pins, stream on the Pic Meunier, 80 m., Oct. 3, 1972, W. L. and J. G. Peters (N33). In the Illinois Natural History Survey.

REMARKS. The tenth tergum of this species is remarkably unique, as is also the pair of slender ventro-mesal processes of the claspers.

Helicopsyche asymetrica new species

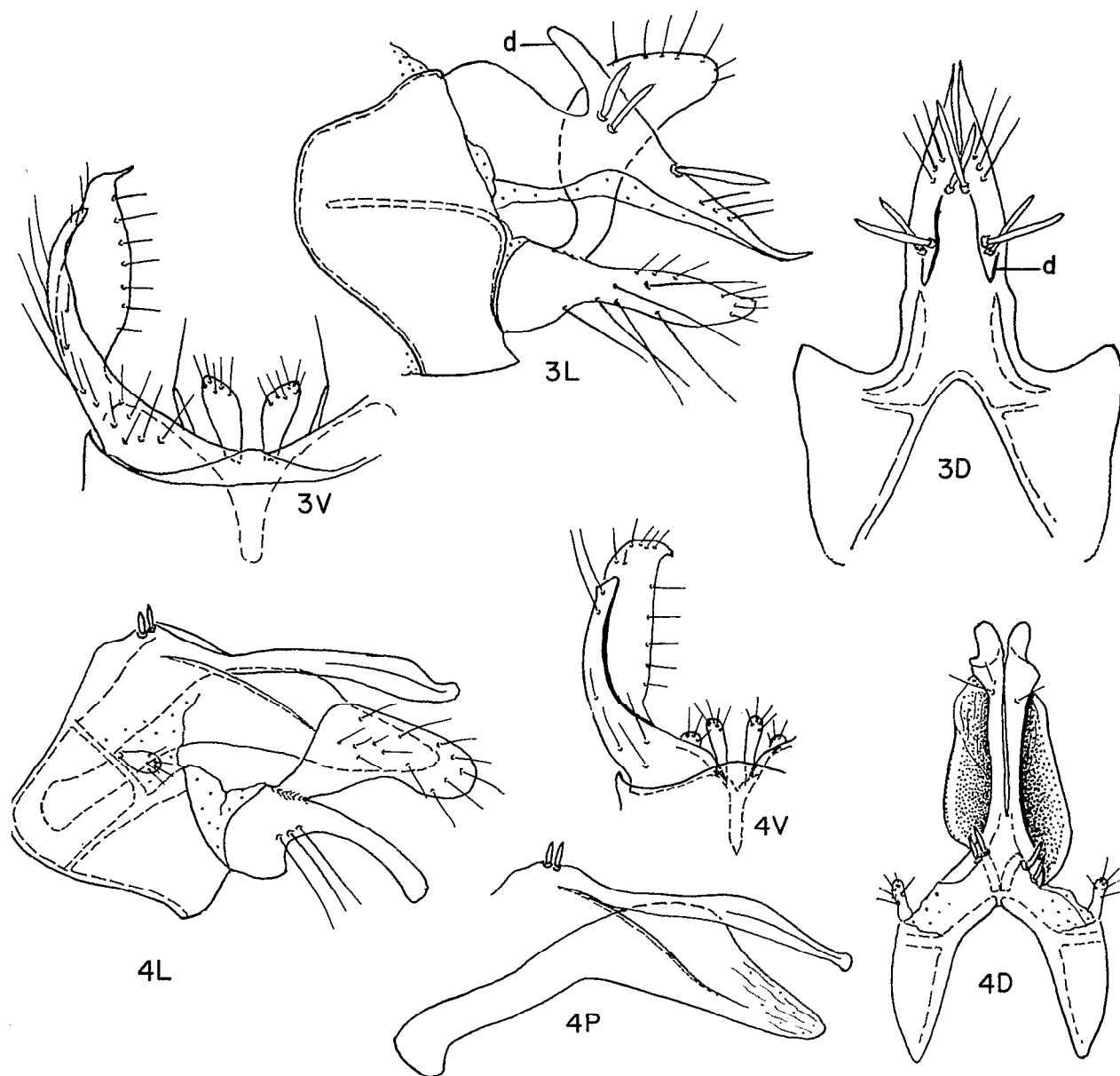
MALE. Length 4 mm. Color various shades of medium and light brown. General structure typical for genus and group. Wings without dark lines of hairs. Genitalia as in Fig. 4. Ninth segment fairly short. Tenth tergum elongate and narrow, incised to near base, widened near apex, the tips of the two lobes round; base having two short macrochaetae on each side and a few scattered setae at apex. The base of the tenth tergum fused to the phallus by two wide flanges, one on each side, the two asymmetrical. Cercus short and clavate. Clasper deeply divided, the dorsal lobe inverted boot-shaped, the posterior lobe narrow, rounded at apex. From the fused bases of the claspers arise a mesal pair of slightly clavate processes flanked by two small humplike processes, each arising from the ventro-mesal portion of a clasper. Phallus with narrow phallobase, gradually widening into a large endotheca that tapers to a narrower apex; no lateral sclerous processes present.

HOLOTYPE, ♂. — Stream on Mt. Pouedihi, 15 km. W of Ouénarou Forest Station, on Eaux et Forêts Road, 153 m., Sept. 5, 1972, Peters and Edmunds (N50). In the Illinois Natural History Survey.

REMARKS. The fused tenth tergum and phallus differentiate this species from any now known in the genus. From both *edmundsi* and *petersorum* (see below) it differs also in having only short and basal macrochaetae on the tenth tergum.

Helicopsyche petersorum new species

MALE. Length 8 mm. Color various shades of medium and light brown. General structure typical for genus and group. Hind wing with dark line of scales along vein Cu₂. Genitalia as in Fig. 5. Ninth segment with dorsal margin unusually long, the lateral aspect appearing cylindrical, the dorsal aspect flared and vasiform. Tenth tergum long, with a wide, deep apical incision, and with a pair of large, earlike, dorsally projecting lateral lobes near the base; anterior mesal incision extending posteriorly to the posterior margin of these lobes. Tip of each apical



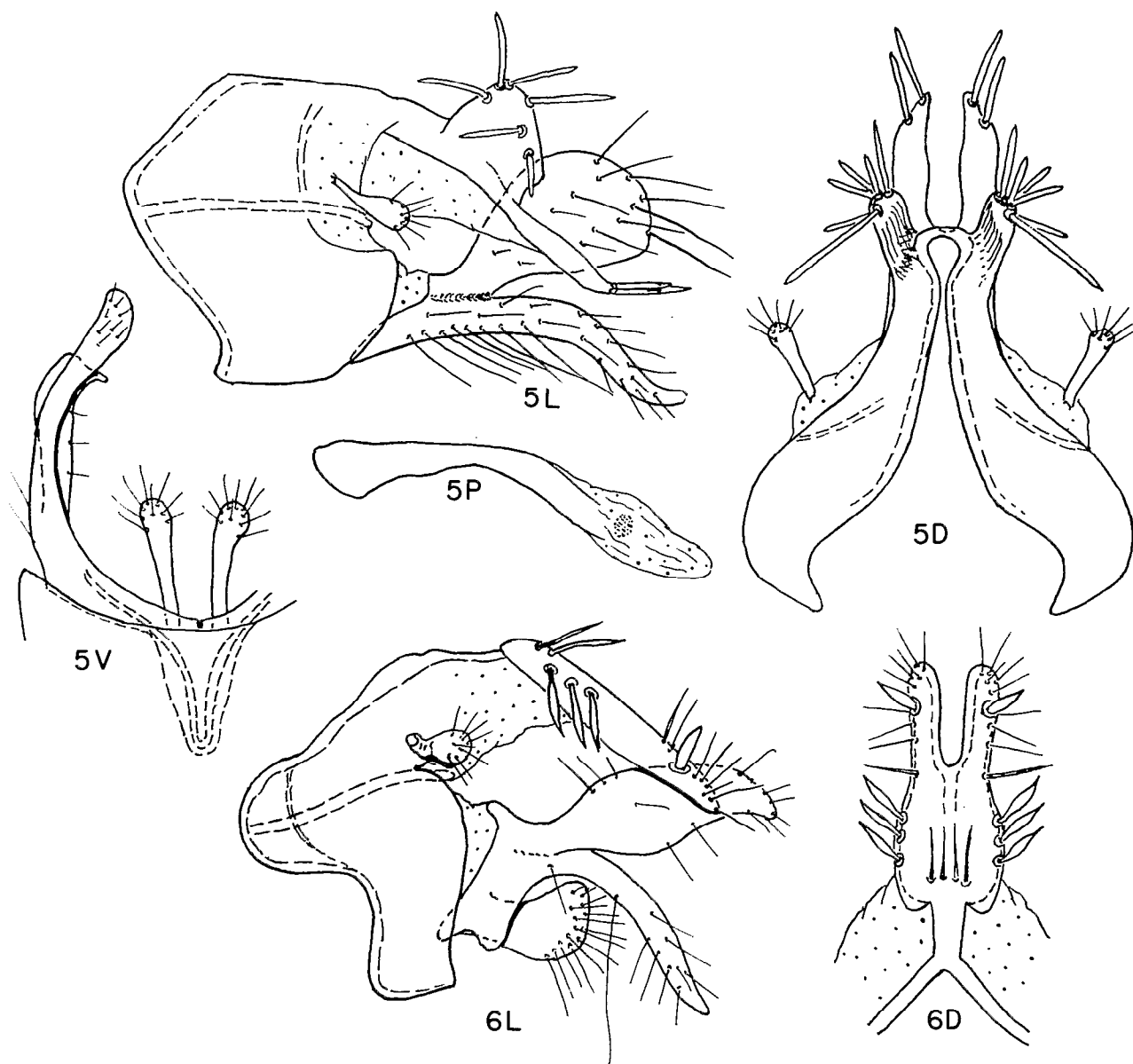
Figs. 3, 4. — Male genitalia of *Helicopsyche*. 3, *edmundsi*, 4, *asymmetrica*. D, dorsal; L, lateral; P, phallus, lateral; V, clasper, ventral; d, dorsal process.

lobe with two posteriorly projecting macrochaetae, each dorsal lobe with six, projecting dorsally and laterally. Cercus fairly long and clavate. Clasper deeply cleft, the dorsal lobe deep and rounded, the posterior lobe narrower, longer, and sinuate. From the fused bases of the claspers arise a pair of fairly long, slender clavate processes. Phallus simple, with no lateral sclerous processes.

HOLOTYPE, ♂. — Stream on Mt. Gaata, 4,3 km NW of Station Castex, 76 m., Oct. 22-29, 1974,

W. L. and J. G. Peters (N42). In the Illinois Natural History Survey.

REMARKS. The peculiar shape of the tenth tergum will serve to differentiate this species from all others known in the genus. In this respect it approaches *edmundsi* most closely, but differences in the basal clasper processes and cerci suggest that this similarity may not necessarily indicate a close relationship.



Figs. 5, 6. — Male genitalia of *Helicopsyche*. 5, *petersorum*; 6, *starmuehlneri*. D, dorsal; L, lateral; P, phallus, lateral; V, clasper, ventral.

Lapidaria group

Five species, *boularia*, *caledonia*, *hollowayi*, *lapidaria*, and *starmuehlneri*, share a feature that seems to be unique in the genus. The antero-lateral margins of the ninth segment are produced anteriorly into an apodeme-like structure (Fig. 7L, D), presumably used for the attachment of muscles that result in more efficient movement of the genital structure. All but *starmuehlneri* also share a wide tenth tergum having a wide but shallow apical incision and a

single pair of large, laterally curved, ventro-mesal processes arising from the fused bases of the claspers (Figs. 7 L-10 L). All have a simple phallus without lateral sclerous processes (Fig. 9 P).

Helicopsyche starmuehlneri new species

MALE. Length of pupa, 5 mm. General structure typical for genus and group. Wing characters not discernible. Genitalia as in Fig. 6. Ninth segment with lateral anterior portions each produced anteriorly into a rounded projection whose posterior

limits are demarked by a thin sclerous thickening. Tenth tergum with a narrow sclerous base, beyond this widening into a flat, somewhat vasiform structure whose apex is deeply incised, forming a pair of wide, rounded well-separated lobes. At the apex of each lobe is a thick macrochaeta, and some long setae; more anteriorly there are 3 pairs of lateral macrochaetae and dorsally several stout setae. Cercus fairly large and clavate. Clasper deeply cleft, the dorsal lobe slightly sinuate, the posterior lobe more slender and also slightly sinuate; the ventromesal lobes are unusually large, especially from lateral view and have a large apical area bearing long setae. Phallus as for group.

HOLOTYPE, ♂ pupa. — 3 km. from mouth of Mou R. Reg. Ponerihouen, Aug. 28, 1965, F. Starmühlner (N 84/2).

Paratype. — Middle Hienghene R., Gue, NW coast, Sept. 3, 1965, F. Starmühlner (N 88), 1 ♂ pupa. In the Illinois Natural History Survey.

REMARKS. Because of its deeply cleft tenth tergum this species is undoubtedly the most primitive member so far discovered in the *lapidaria* group. The arrangement of macrochaetae on the tenth tergum readily differentiates this species from others in the genus.

Helicopsyche caledonia new species

MALE. Length 6 mm. Color shades of medium-brown. General structure typical of genus and for the group. Hind wings with no rows of dark hairs. Genitalia as in Fig. 7. Anterior apodeme of ninth segment short but quite deep dorso-ventrally. Tenth tergum fairly long and broad, the apex round except for a shallow mesal incision; each baso-lateral area forming a dorso-laterally expanded area that rises above the mesal level of the tergum and bears several macrochaetae; and with several setae on the anterior portion. Cercus fairly short and clavate. Lateral aspect of clasper with dorsal lobe long, slender and curved, posterior lobe slender and straight. Ventromesal processes of clasper and the phallus as described for the group.

HOLOTYPE, ♂. — La Crouen, Jan. 31, 1963, light trap, C. Yoshimoto and N. Krauss. **Paratypes**. — Same data as holotype, 3♂, same but Jan. 30, 2 ♂. Mt. Koghi, 600 m., Jan. 26-30, 1963, light trap, Yoshimoto and Krauss, 2 ♂. Stream on Mt. Gaata, 4,3 km. NW of station Castex, 76 m., Oct. 22-29, 1972, W. L. and J. G. Peters (N 42), 40 ♂. Middle Tchamba R. below Tchamba, Aug. 26, 1965, F. Starmühlner (80/1), 2 ♂ pupae. Holotype and 4 paratypes in the Bishop Museum, Honolulu, H. I., other paratypes in the Illinois Natural History Survey, the U. S. National Museum, the British Museum

(N. H.), and Centre O.R.S.T.O.M. and the Centre Technique Forestier Tropical, New Caledonia.

REMARKS. The long tenth tergum and few macrochaetae readily separate this species from the following members of the *lapidaria* group.

Helicopsyche lapidaria new species

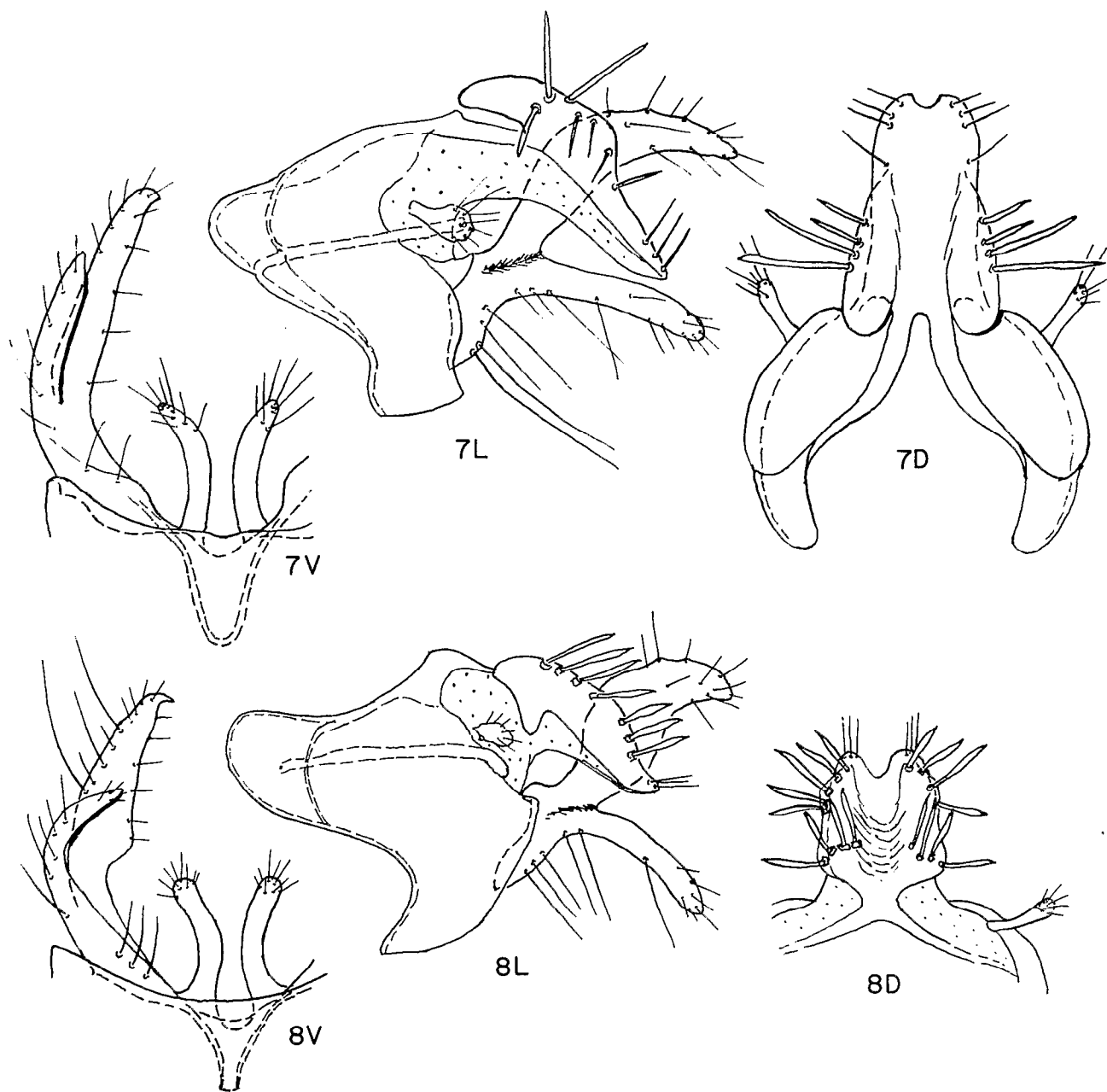
MALE. Length 7 mm. Color various shades of medium brown, wings without a conspicuous pattern. General structure as for genus and group. Hind wing with a line of dark hairs on Cu₂. Genitalia as in Fig. 8. Apodeme of ninth segment almost as long as deep. Tenth tergum wide and short, the apex broadly but shallowly incised, the baso-lateral corners not rising above the mesal level of the tergum, but with a baso-lateral thumblike extension of the ventral margin; tip with lateral clusters of a few setae each, the preapical lateral areas with two somewhat diagonal rows of macrochaetae, those of the apical row slightly thicker than those of the basal row. Cercus slender and slightly clavate. Clasper with dorsal lobe of medium width and sinuate, posterior lobe narrower and curved both ventrally and mesally. Phallus as for group.

HOLOTYPE, ♂. — Stream on Pic Mouirange, Camp des Travaux Publics on Terr. Route 2, 153 m., Sept. 24-29, 1972, Edmunds and Peters (N 27). **PARATYPES**. — Same data as holotype, 12 ♂. Riv. des Pirogues, 2,5 km. SW of Col de Ouénarou, on Terr. Route 2, 137 m., Sept. 23, 1972, W. L. and J. G. Peters (N 26), 7 ♂. Riv. Bleue at bridge on Eaux et Forêts road, 21 km. NW of Ouénarou Forest Station, 183 m., Nov. 6-7, 1972, W. L. and J. G. Peters (N 51), 18 ♂. Tara Creek, between Yate and Touaourou Mission Station, Aug. 18, 1965, T. Starmühlner (N 75), 1 ♂ pupa. Stream on Mt. Pouedihé, Bon Secours, 7 km. NW of Ouénarou Forest Station, on Eaux et Forêts road, 153 m., Sept. 22, 1972, W. L. and J. G. Peters (N 25), 1 ♂. Overlooking Koué R., 40 m., Aug. 14, 1971, J. D. Holloway (N 75), 1 ♂. Holotype in the Illinois Natural History Survey, paratypes deposited in the same institution and in the Bishop Museum, U. S. National Museum, British Museum (N. H.), and Centre O.R.S.T.O.M. and Centre Technique Forestier Tropical, New Caledonia.

REMARKS. This and the following two species form a closely related complex separated by the characters used in the key. In all three species, the lateral aspect of the claspers varies sufficiently that it is impossible to use this structure for accurate diagnosis; in each instance an average condition has been illustrated.

Helicopsyche boullaria new species

MALE. Length 9 mm. Color various shades of medium brown. General structure typical of genus



Figs. 7, 8. — Male genitalia of *Helicopsyche*. 7, *caledonia*; 8, *lapidaria*. D. dorsal; L. lateral; P, phallus, lateral; V, clasper ventral.

and group. Hind wing with a line of black hairs along vein Cu_2 . Genitalia as in Fig. 9, almost exactly the same as the preceding species except for the following. Tenth tergum wide, fairly short, incised on meson, bearing a small cluster of setae at the tip of each apical lobe, and two fairly well-ordered ranks of macrochaetae. Of these, a few of the more apical, lateral ones are longer and thicker than the others.

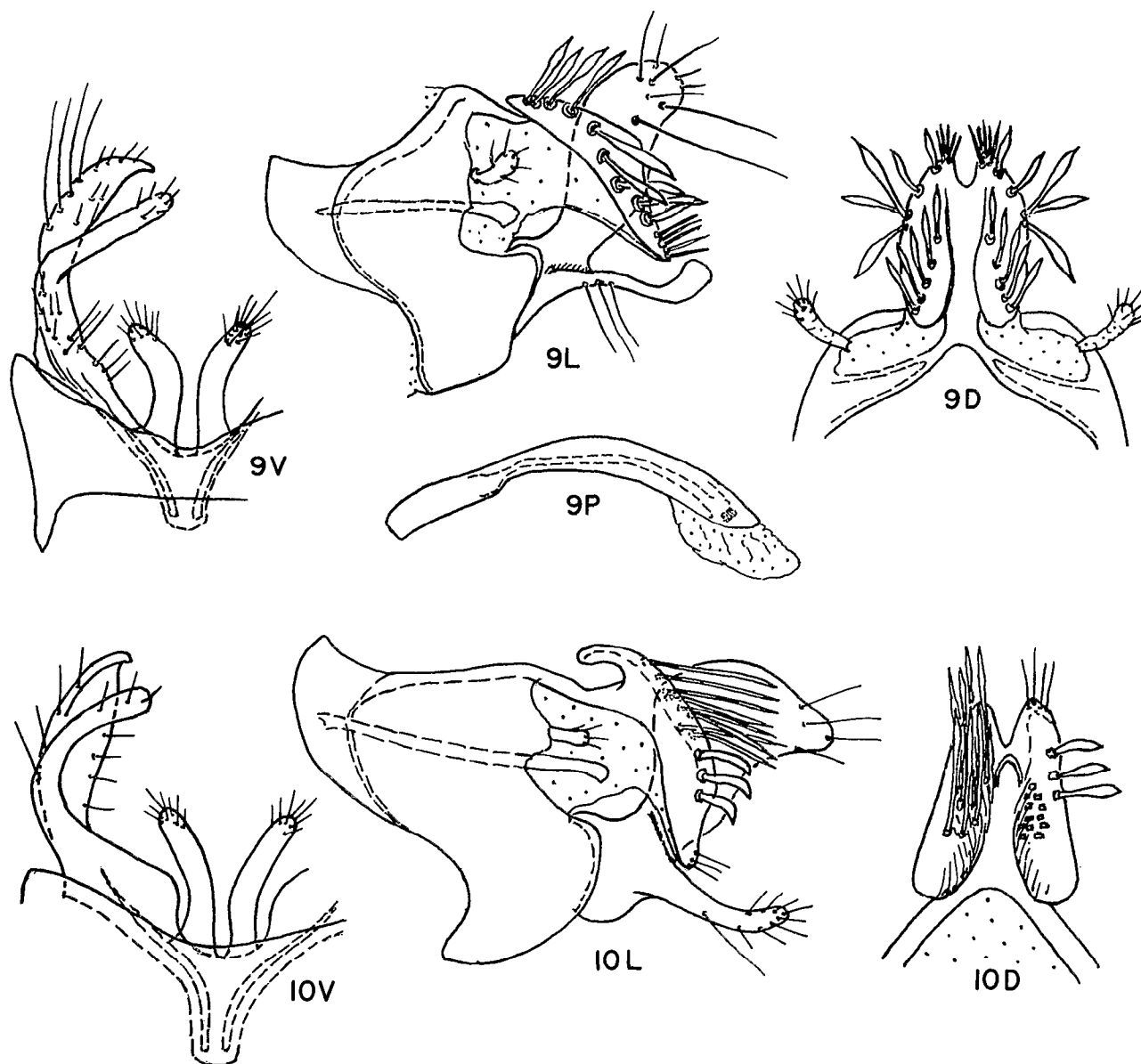
HOLOTYPE, ♂, and 63 ♂ paratypes. - - Mt. Stream

up Boulari R., Nov. 3, 1958, light trap, C. R. Joyce. Holotype and 57 paratypes in the Bishop Museum, 6 paratypes in the Illinois Natural History Survey.

REMARKS. Same as for *lapidaria*, above.

Helicopsyche hollowayi new species

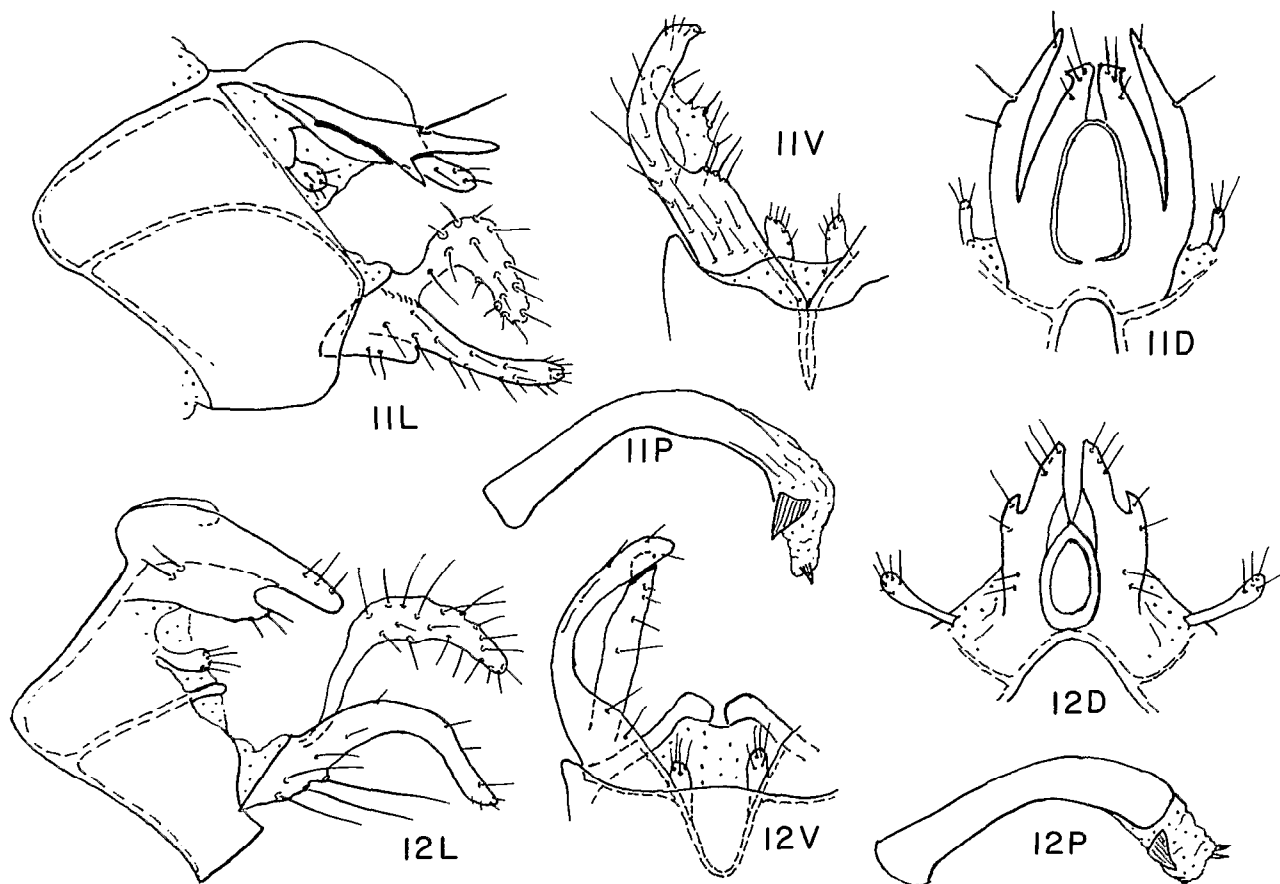
MALE. Length 10 mm. Color various shades of medium brown. General structure as for genus and group. Hind wing without a line of dark scales on Cu_2 ,



Figs. 9, 10. — Male genitalia of *Helicopsyche*. 9, *boularia*; 10, *hollowayi*. D, dorsal; L, lateral; P, phallus, lateral; V, clasper, ventral.

but with an unusually thick row of darkened hair along basal half of posterior margin. Male genitalia (Fig. 10) similar to those of *lapidaria* except as noted below. Lateral aspect of clasper with dorsal lobe fairly wide. Tenth tergum slightly narrower, the anterior end of the lateral edges of the lateral lobes conspicuously higher than the meson of the tergum, and with a V-shaped apical incision; each lateral lobe with macrochaetae of two distinct types, 3 or 4 apical shorter and thicker ones, situated laterally, and a more basal cluster of longer, slender ones situated on the mesal side of the tergum lobes.

HOLOTYPE, ♂. — N. of Mt. Aoupinie, Haut Mou, Napone Areu valley, 520 m., July 30-31, 1971, J. D. Holloway (N 62). PARATYPES. — Same data as holotype, 1 ♂. Brehoa R., Col de Amieu Road, 320 m., June 14-15, 1971, J. D. Holloway (N 24), 1 ♂. Trib. of Karionan R. n 5 km., NNW of Païta, 122 m., Oct. 11-12, 1972, W. L. and J. G. Peters (N 35), 30 ♂. Stream on Eaux et Forêts road, NW of Col d'Amieu, 412 m., Sept. 16, 1972, W. L. and J. Peters (N 21), 1 ♂. Ouatou R., col d'Amieu road, 320 m., June 13, 1971, J. D. Holloway (N 23), 1 ♂. Pouebo, 20 m., Jan. 15, 1964, R. Straatman, 4 ♂. Holotype in the Illinois



Figs. 11, 12. — Male genitalia of *Helicopsyche*. 11, *arenaria*; 12, *koumaca*. D, dorsal; L, lateral; P, phallus; V, clasper, ventral.

Natural History Survey, paratypes in the same institution and in the Bishop Museum, British Museum (N. H.), U. S. National museum, Centre O.R.S.T.O.M. and Centre Technique Forestier Tropical.

REMARKS. As for *lapidaria*, above.

Arenaria group

In this group (Figs. 11, 12) the posterior lobe has become the principal sclerous portion of the clasper, the dorsal lobe being reduced in size and either membranous or semi-membranous in texture. The tenth tergum has an unusual central raised oval area. The phallus has a pair of triangular parameres and a pair of small apical sclerous processes. The mesal processes arising from the bases of the claspers are small. The case (Fig. 13, h-k) is unusual in being constructed of fine sand grains and in having a flange extending beyond the coils proper. The larval pronotum is pale creamy yellow, its anterior margin having alternating slender long and short hairs.

Helicopsyche koumaca new species

MALE. Length 5.5 mm. Color various shades of medium brown. General structure typical of genus and group. Genitalia as in Fig. 12. Ninth segment narrowed dorsally, the lateral aspect narrow. Tenth tergum fairly short but wide, the lateral margin produced into a short pointed lobe, the central portion with an oval elevated area, the apex divided deeply into two pointed lobes; a few setae are scattered over the surface. Cercus fairly long, slender and slightly clavate. Clasper with dorsal lobe semi-membranous, narrow, and with a long narrow base; posterior lobe sclerous, curved ventrally and mesally; internal apodemes of fused clasper bases forming a thin arcuate band; the pair of mesal processes arising from this area are small and rounded. Phallus as described for group.

HOLOTYPE, ♂. — Pouebo, 20-100 m., February 3, 1964, R. Straatman. *Paratype*. — Dried river bed Le Cresson, on the Koumacé-Bonde-Ouigoua Road, September 18, 1965, F. Starmühlner (N 110), 1 ♂

pupa. Holotype in the Bishop Museum, paratype in the Illinois Natural History Survey.

Helicopsyche arenaria new species

MALE. Length 5,5 mm. Color various shades of brown. General structure typical for genus and group. Hind wing with two lines of dark hairs, each line about half length of wing, the two situated one on each side of Cu₂. Genitalia as Fig. 11. Lateral aspect of ninth segment massive, greatly narrowed dorsally. Tenth tergum relatively short and broad and the central area forming a high dome, the apex incised, each side with a long, lateral sclerous process that is forked at apex, the apical lobes of the tergum truncate from dorsal view and bearing a few short setae. Cercus short and clavate. Clasper with dorsal lobe membranous, posterior lobe sclerous and curved mesally, ventral aspect with a broad base. Fused bases of claspers forming a narrow rod, the pair of mesal processes arising from them short and slightly curved. Phallus as in *koumaka*.

HOLOTYPE, ♂. — Stream, Val de l'Hermitage, 1 km. NE of Terr. Route 1., 76 m., Oct. 10, 1972, W. L. and J. G. Peters (N 34). PARATYPES. — Ba Ouinore R., 3 km. NE of Col d'Amieu Forêt Station on Terr. Route 5, 259 m., Sept. 15, 1972, G. F. Edmunds (N 19e), 1 ♂ pupa. Stream on Mt. Gaata, 4,3 km. NW of Station Castex, 76 m., Oct. 22-29, 1972, W. L. and J. G. Peters (N 42), 5 ♂. Stream on Pic Mouirangé, Camps des Travaux Publics on Terr. Route 2, 153 m., Nov. 15, 1972, W. L. and J. G. Peters (N 55), 1 ♂. Trib. of Karionan R., 5 km. NNW of Païta, 122 m., Oct. 11-12, 1972, W. L. and J. G. Peters (N 35), 1 ♂. Trib. Hienghene R., 5 km. below Kavatch Castex Station, Sept. 6, 1965, F. Starmühlner (N 95), 1 ♂ pupa. Holotype in the Illinois Natural History Survey, paratypes in the same institution and in the Centre O.R.S.T.O.M. and Centre Technique Forestier Tropical.

LARVAL CONSIDERATIONS

To date, some members of the four species groups are known from both larvae and adults, and each group possesses distinctive morphological traits and case constructions.

KEY TO NEW CALEDONIA GROUPS-LARVAE

1. Anterior margin of pronotum with a regular row of thornlike spines; disk of pronotum with many long, fine setae and a few scattered spines (Fig. 13d).....
..... *lapidaria* group
- Anterior margin of pronotum with thorn-like spines few and these restricted to the antero-lateral corners.. 2
2. Anterior margin of pronotum minutely denticulate (Fig. 13c)..... *edmundsi* group

Anterior margin of pronotum without minute denticulations..... 3

3. Anterior margin of pronotum with alternating long and short fine setae (Fig. 13b); case limpet-like, with a peripheral flange extending beyond and curved down from the whorls containing the larval body (Fig. 14 h-k)..... *arenaria* group

Anterior margin of pronotum with fine setae of about equal length (Fig. 13a); case without a lateral flange, snaillike..... *vallonia* group

Vallonia Group

Only the larva of *vallonia* is known, as follows: head, pronotum, tibiae, and tarsi golden yellow, anterior margin of pronotum with relatively short, thin, sparse setae (Fig. 13a). Case minute, 2 mm. in diameter, 0,7 mm high with a very low spire, constructed of fine sand grains, the surface smooth.

On phylogenetic grounds, the larva and case of *kariona* might be similar, certainly they would also be small.

Edmundsi Group

To date, the larvae of only *edmundsi* is known. Along its anterior margin, the pronotum has minute denticulations, in addition to well-spaced hairs. The disc of the pronotum differs from the preceding groups in having a large number of long, fine setae (Fig. 13c). In this respect, this species is a stepping stone morphologically between the *vallonia* group and the *lapidaria* group.

It will be interesting to learn how the larvae of *petersorum* and *asymmetrica* fit into this scheme.

Lapidaria Group

Larvae have been associated with *caledonia* and *lapidaria*. As a group they are readily identified by the row of thorn-like spines along the entire anterior margin of the pronotum and the abundant long thin setae on the disc. This is the commonest type of *Helicopsyche* collected from New Caledonia. The fully constructed cases (those spun up for pupation) vary in size from 2,5 to 14 mm. They are constructed of small pebbles rather than sand grains, or from broken pieces of quartz, and are irregular in outline because of the uneven size of particles used in their construction; typically, they have a high spire canted to one side (Fig. 13, a-e). These characteristics are true also of small individuals. In some larger individuals the spire has been lost, whether destroyed by the occupant or by some other agent. Color of sclerous parts ranges from yellow to dark reddish brown, with all intermediate shades. Color differences are not correlated with size or age within the instar, because they occur in both small individuals and in

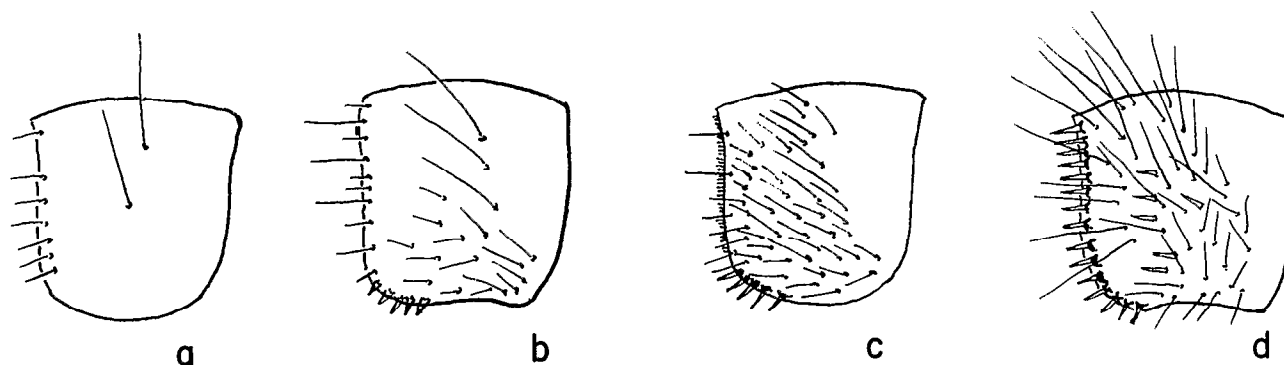


Fig. 13. — Pronota of *Helicopsyche* larvae, lateral. a, *vallonia*; b, *arenaria*; c, *edmundsi*; d, *lapidaria*.

those that have spun up for pupation. Because of these variables, it has not been possible to identify larvae to species.

Two collections of this group contain unusual large cases of up to 22 mm in diameter, and having large stones attached radially to the case (Fig. 14 f, g). Presumably these represent a distinct species, possibly *hollowayi* or *boularia*, the two largest species in New Caledonia.

Arenaria Group

Both species of this group have been associated with its distinctive case (Fig. 14, h-k), but to date differences between the species have not been found. The sclerous parts of the head and thorax are cream color, except the dark mandibles. The pronotum (Fig. 13 b) has only fine setae along the anterior margin, some much longer than the others; the disc has a moderate number of hairs ventrally and a few longer ones apically.

Dr. STARMÜHLNER'S COLLECTIONS

Dr. Starmühlner collected *Helicopsyche* from 86 stations and substations. Most collections contained cases with larvae or early stage or female pupae, some had only empty cases, a few had cases with mature male pupae. The first two categories were identifiable to one of the four species groups, and are so recorded in the tabulation that follows. The few mature male pupae are identified to species, which is indicated by a numbered series of superscripts.

Not included in the tabulation are the two accessions 114 and 115. These are the only two from the Isle of Pines; they contain 22 and 21 specimens, respectively, all belong to the species *edmundsi*.

In the following tabulation, the numbers in columns 2, 3, and 4 refer to the number of individuals of each group collected in each accession. The station

numbers in column 1 are those of Dr. Starmühlner, and are explained fully in his listing of these in 1968, to which the reader is referred.

Tabulation of numbers of individuals

Station No	Vallonia Group	Lapidaria Group	Arenaria Group
4		23	
5/1		5	
11/1		7	
11/2		1	
12		1	
15		4	
18		13	2
20		29	13
22/1		4	
23/1		7	1
23/2		2	
24		6	
25		1	
26		10	3
29/2		14 ²	
30		2	
31/2		6	
32		32	
35		15	9
37		22 ¹	1
39	2		
41/1			6
42/1		44	2
52/1		5	12
53		20	4
55		11	
56	1	15	
57		3	
58/1		21	15
59/1		42	19
59/2	1		
61/1		23	3
61/2		4	

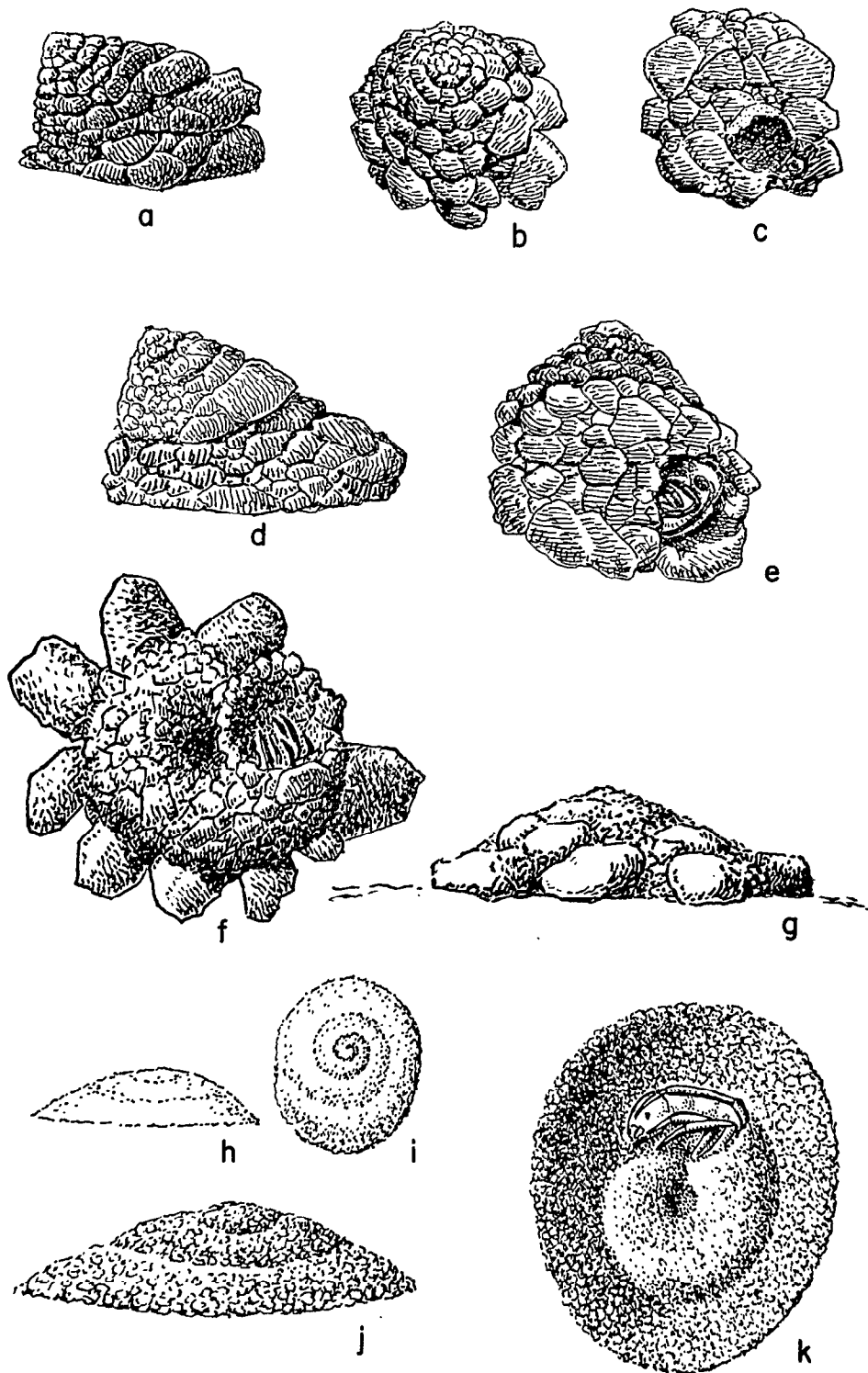


Fig. 14. — Cases of *Helicopsyche*. a-c, *caledonia*; d-e, *lapidaria*; f, g, "ballast-stone" case; h-k, *arenaria*. a-i, drawn to same scale; j, k, more enlarged. a, d, g, h, j, lateral; b, i, dorsal; c, f, k, ventral.

Station No.	Vallonia Group	Lapidaria Group	Arenaria Group
62/1		25	11
62/2		4	
63		8	
64/1		4	7
64/2		23	4
66/1		17	1
66/2		8	
67/1		45	11
67/2		8	4
67/3		22	1
68/2		28	
71/2		24	
71/3		2	
72/2		6	
75		28 ⁶	
77		41	
79/2		75	11
79/4		19	5
80/1		21 ²	8
82/1			68
84/2		2 ¹	
85/1		18	8
85/2		20	2
86		3	35
87		1	
88		1 ¹	14
93		24	
94/1		15	62
94/2		3	25
94/3			13
95			31 ⁴
97	9 ³	35	
98		31	
100		27	3
102	2	33	
103		34	

Station No.	Vallonia Group	Lapidaria Group	Arenaria Group
104	13	5	1
105/1		3	11
105/2		32 ²	6
105/3			3
107		22	
110			9 ⁵
111/1		3	1
111/2		82	5
117		9	
119	11.	3	
120/1		1	
120/2		17	1
121/1		13 ⁸	1
121/2		82	3
124		7	
Total No. of Collections	7,	76	43

¹ Includes male pupa of *starmuehlneri*.

² Includes male pupa of *caledonia*.

³ Includes male pupa of *vallonia*.

⁴ Includes male pupa of *arenaria*.

⁵ Includes male pupa of *koumaka*.

⁶ Includes male pupa of *lapidaria*.

⁷ Minute cases, 2.5 mm. in diameter.

⁸ Large cases with "ballast" stones.

From this tabulation it is obvious that the *lapidaria* group is the dominant component of the *Helicopsyche* fauna of New Caledonia, with the *arenaria* group next. The *vallonia* group appears to be rare, but occasionally locally abundant.

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