



NEW SPECIES OF AND KEYS TO SOUTH AMERICAN GRIOPTERYGIDAE (PLECOPTERA)

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ABSTRACT

Uncicauda pirata new genus and species and *Alfonsoperla flinti* new genus and species are described. The larvae of the following named species are either described for the first time (1st) or corrected (cd) descriptions given: *Antarctoperla altera* (1st), *Aubertoperla illiesi* (cd), *Aubertoperla kuscheli* (cd), *Claudioperla tigrina* (cd), *Limnoperla jaffueli* (cd), *Rhithroperla rossi* (cd), *Teutoerla spp.* (1st). We also describe larvae of four *Antarctoperlinae* species that cannot be associated with adults; these new larvae are therefore not named. The larvae of the South American Griopterygidae are keyed to genus, and some to species.

Keywords: taxonomy, new genera, new species, larval descriptions, key to larvae, Neotropical region

INTRODUCTION

The South American Plecoptera fauna includes representatives of all four antarctoperlarian families, and also two arctoperlarian families of presumably northern hemisphere origin (Zwick 2000), the Perlidae and the Notonemouridae. The Perlidae are very species rich, especially in the northern half of the subcontinent.

In the Gondwanan part of the subcontinent the Griopterygidae are clearly the dominant family and are apparently more diverse than presently known. Studies of the Plecoptera of the southeastern part of Brazil (Froehlich 1990, 1993, 1994, 1999, 2000, 2001, 2002) significantly increased the number of Griopterygidae known from the area of the Brazilian Shield. There are some recent additions to the Griopterygidae of the Andean-Patagonian realm (McLellan et al. 2005, McLellan et al. 2006, Vera 2005,

2006a, b, Vera & Camousseight 2006) but the revision by Illies (1963) remains the standard publication. It includes excellent habitus illustrations of the known larvae several of which were, however, only tentatively associated with adults. Several larvae can immediately be recognized from the figures, but the identification of others, particularly the smaller, average-looking larvae remains difficult because the descriptions do not contain sufficient detail to separate the taxa reliably.

Benedetto (1975) compiled the first key to South American Plecoptera in Spanish language but abstained from including a generic key to the larvae of Griopterygidae. Three generic keys to Griopterygidae were meanwhile published (Bachmann 1996, Romero 2001, Heckman 2003). All of them are essentially verbal descriptions of Illies' (1963) habitus figures, with no new characters added.

Also, Illies' occasional errors are repeated and his tentative (but incorrect) associations of several larvae accepted. In contrast, Heckman (2003) simply left all larvae out that were not definitely associated with some named taxon which also does not help. Recently, (Vera 2005, Vera 2006a, b) made important additions to knowledge of the South American Gripopterygidae. He first separated the larvae of *Limnoperla* and *Rhithroperla* (2005), recognized that Illies' presumed "*Araucanioperla A*" is the larva of *Neopentura semifusca* Illies and redescribed that species in all life stages (2006a). Vera (2006b) also described a true *Teutoperla*-larva, but the larva tentatively ascribed to this genus by Illies (1963, *Larventyp X*) remained unassociated. It represents a new genus and species which we describe below.

We describe some new taxa, including some unassociated larvae of Antarctoperlinae with very distinctive characters. For the rest we focus on pharate males providing for safe adult-larva associations to sort out the identity of previously only tentatively identified larvae and to find good structural characters distinguishing the difficult smaller members of the family. Instead of presenting formal redescriptions we incorporate the relevant information in a new key to the larvae of South American Gripopterygidae.

We had hoped that our studies would reveal characters grouping the larvae at higher taxonomic level. However, this was not the case and this dashed our hopes that some light would be shed on intergeneric relationships and gripopterygid classification. On the contrary, we found examples of congeners which are very similar in the adult stage but have drastically different larvae (for example, in *Aubertoperla* and *Antarctoperla*), but also very similar larvae belonging to different genera. It is obvious that not only the parameters of some of the present genera need re-adjusting but also the subfamily concept pertaining to South American Gripopterygidae needs reconstruction.

There are sets of characters which have not yet been adequately exploited, for example, mouth part structure. In the past, interest focused on number and length relationships of maxillary palp segments. In contrast, labium shape was never considered but may differ much, compare Figs. 15, 31, and 65; all South American Antarctoperlinae resemble Fig. 31. The apical armatures of lacinia and galea are also not uniform across the family. Observed differences are

probably related to kind of food and feeding mode, but may at the same time be phylogenetically informative. For example, there is a row of setae or spines running close to the dorsal edge of the lacinia for variable distances. Distal elements in this row are usually blade-like and may actually be lacinial teeth because they seem to lack insertion points which are visible in the more basal setae. Usually, the large apical lacinial teeth are exposed (Figs. 66, 67, 89), but in *Limnoperla jaffueli* (Navás) (Fig. 68) and *Potamoperla myrmidon* (Mabille) the palisade-like row of setae runs across the lacinial apex, in front of the apical teeth. The very slender lacinia of *Alfonsooperla flinti* sp. n. (Fig. 71) is apically grooved, like a deep narrow spoon. All South American Antarctoperlinae have a sharply pointed bifid laciniae (Fig. 70). The galea may carry an apical brush of simple straight hairs (Fig. 66), a few irregular spinules (Fig. 67), or spinules arranged in a row (Fig. 68). Several taxa have on the outer face of galea a dense apical brush of small curved setae which intriguingly resembles the scraper-brush with combed setae illustrated for *Brachyptera risi* (Morton) (Taeniopterygidae) (Wichard et al. 2002).

We present only a few examples as an appendix (Figs. 65-71) and suggest further study with scanning electron microscopy which is not available to us. A comparative study must be based on freshly molted specimens, to exclude all effects from wear and tear of scraping mouthparts (Arens 1989a, b). We do not have freshly molted specimens for a number of taxa. The agreement between larval and adult laciniae is great, but there is never a scraping-brush on the adult galea.

MATERIAL

Large collections of South American stoneflies, mainly collected by O. S. and C. M. Flint which we received on loan from USNM provided us with an opportunity to improve the knowledge of the South American Gripopterygidae. We also used the material in the joint Illies and Zwick collections (previously in the Limnologische Flussstation Schlitz-LFS). Because of the great number of specimens and the fact that most of the specimens belonged to known taxa and since the new material does not significantly alter known distributions we do not list records of previously known species.

In this material definitely associated last instar larvae of all taxa mentioned in this paper and

included in the key were available to us, except larvae of *Andiperlodes*, *Tupiperla* and *Guaranyperla* which we know only from literature.

Abbreviations and measurements. Abbreviations of collectors' names: BA = B. Akerberg; DA = D. Akerberg; DD = D. Davis; MD = M. Davis; CC = Cekalovic; CMF = C. M. Flint; OSF = O. S. Flint jnr.; LEP = L. E. Peña; SS = S. Schajovskoy; GB = G. Barria.

In the lists of material, we use gender symbols for adults and the abbreviation LA for larvae. All measurements are in millimetres

DESCRIPTIONS

Gripopterygidae Enderlein, 1909

Uncicauda pirata gen. n., sp. n.

(Figs. 1-5)

Material examined. Holotype ♂, paratype ♂ and ♀ CHILE, Malleco, Nahuelbuta, Los Gringos, 37°48'S; 73°01'W, 15-17 December 1993, CMF&OSF (USNM). Additional paratypes: 1♂, 1♀, CHILE, Malleco, Pino Hachado, 1480 m, 38°39'S; 70°58'W, 8-9 January 1994 CMF&OSF; 2♂, Chile, Cautin, Conquillio, 1200 m, 4-8 February 1988, L. E. Peña.

Dimensions. Male: body length 6.0-7.0, forewing 7.5-8.0; antenna 4.5. Female: body length 8.0; forewing 8.0-9.0; antenna 5.0.

Adult. Small slender light brown animals. Pronotum rectangular, with angles rounded. Head a little paler along sutures, muscle attachments on head and thorax a little darker, no prominent pattern. Ocelli present. Antenna brown, long, slender, individual segments distinctly expanded apically. Palps short, brown. Row of setae runs across apex of lacinia, in front of broad terminal teeth (see Fig. 68). Legs slender, essentially brown, base of femur a little paler, especially in front leg. Front and middle tibiae paler towards apex, hind tibiae with base to subgenital organ dark brown, remainder yellowish. Tibial spurs present.

Wings (Fig. 1): Venation typical of the genus except for a very short fork of Rs without crossvein. The hind wing of specimens from Los Gringos (including the holotype) has the posterior branch of M coalesced with Cu1 for a short distance. In other specimens the veins are separate but connected by a short crossvein. Veins pale brown and membrane with light brown tinge. Forewing with a darker tint

around crossveins and in some specimens a purplish pigment from C to M but without speckles in cells.

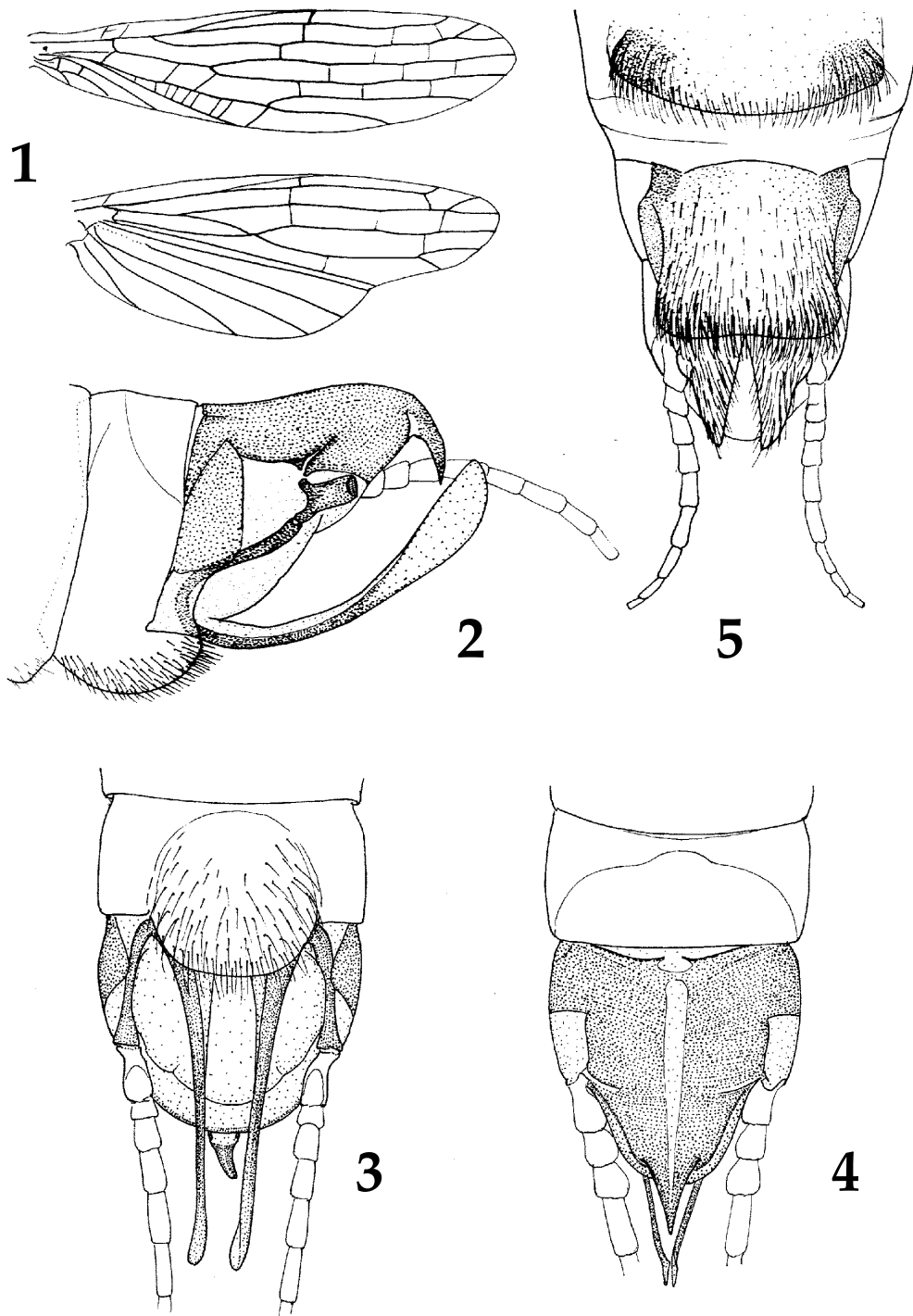
Abdomen sexually dimorphic. Cerci yellowish, short, downcurved with 8-10 segments in males and 9-11 in females. Pilosity inconspicuous.

Male genitalia. (Figs. 2-4): Abdomen brownish or purplish, only slightly sclerotised. Each tergite with an anterior sclerite band that is medially divided on anterior tergites but entire on tergites 9-10, although it is deeply incised from behind on segment 9. Sternites incompletely sclerotised, segments 2-7 with widely separate narrow transverse anterior sclerites plus a continuous sclerite band across posterior third of segment; sternite 8 completely sclerotised. Subgenital plate a broadly rounded transversely oval sclerite almost truncate posteriorly. Tergite 10 well sclerotised, except for a small notch in anterior margin and a median elongate pale band in front of a sharply pointed downcurved posterior sclerite (McLellan 1971). No epiproct. Paraprocts laterally dark brown with pale tips. The long slender sclerotised struts in side view are regularly curved and apically spatulate. Dorsoventrally the paraprocts have a narrow membranous triangular base that tapers until the sclerotised struts remain with their flat apices sometimes against each other. Penis structure not studied.

Female genitalia. (Fig. 5): Abdomen pale, soft, dorsally unsclerotised except tergite 10, which is rounded apically. Sternites resemble those in males but anterior sclerites narrower and on sternite 7 posterior band shaped sclerite split into separate lateral sclerites that are slightly raised. Sternite 8 forming a sclerotised subgenital plate covering the posterior segments. Sides of subgenital plate parallel to slightly diverging posteriorly; distal margin with a broad, shallow excision. Subanal lobes triangular. The posterior sclerites on sternite 7, subgenital plate and ventrolateral face of the subanal lobes with a thick coat of stout curved colourless hairs which form a dense brush along the posterior margin of the subgenital plate.

Larva. Unknown.

Remarks. Sternite 9 of the female paratype is completely telescoped under sternite 8. The generic name describes the hooked (Latin: uncus, hook; cauda, tail) caudal end of the male and the pirate-like hook of tergite 10 posterior sclerite of the male suggested the specific name.



Figs. 1-5. *Uncicauda pirata* sp. n., adult. 1, pair of wings; 2, male abdominal tip, lateral; 3, same, ventral; 4, same, dorsal; 5, female abdominal tip, ventral. Not to scale.

Affinities. The new taxon is a member of Gripopteryginae in the sense of McLellan (1977). The insect has no striking autapomorphies but at the same time fits into none of the existing genera.

Analysis of its affinities is hampered by lack of its larva. Therefore, generic rank as well as placement are somewhat provisional.

The known apomorphic characters of *Uncicauda* suggest relations with some of the smaller genera which Illies (1963) classified as Paragripopteryginae. However, all of the apomorphies in question represent reductions that may have occurred repeatedly and independently, especially shortening of the fork of Rs and of the cerci. Even loss of the male epiproct, although very unusual and known only among South American Gripopterygidae, has occurred independently. Within *Gripopteryx* which, by its bizarre larvae, is undoubtedly monophyletic several species have very small epiprocts, and *G. serrensis* Froehlich lacks it completely (Froehlich 1993). The remaining genera without male epiproct (*Paragripopteryx*, *Tupiperla*, *Guaranyperla* (all NE South American) and *Potamoperla* (Andean)) have a double point of male tergite 10 which is unique in the subfamily and suggests these genera represent a monophylum. We believe the new genus *Uncicauda* with a sharp single point of tergite 10 may be an early member or the sister taxon of this small group of genera.

***Alfonsoperla flinti* gen. n., sp. n.**
(Figs. 6-17, 71)

Paragripopteryginae (*Teutoperla*?) *Larventyp* X Illies, 1963: 195, fig. 24.

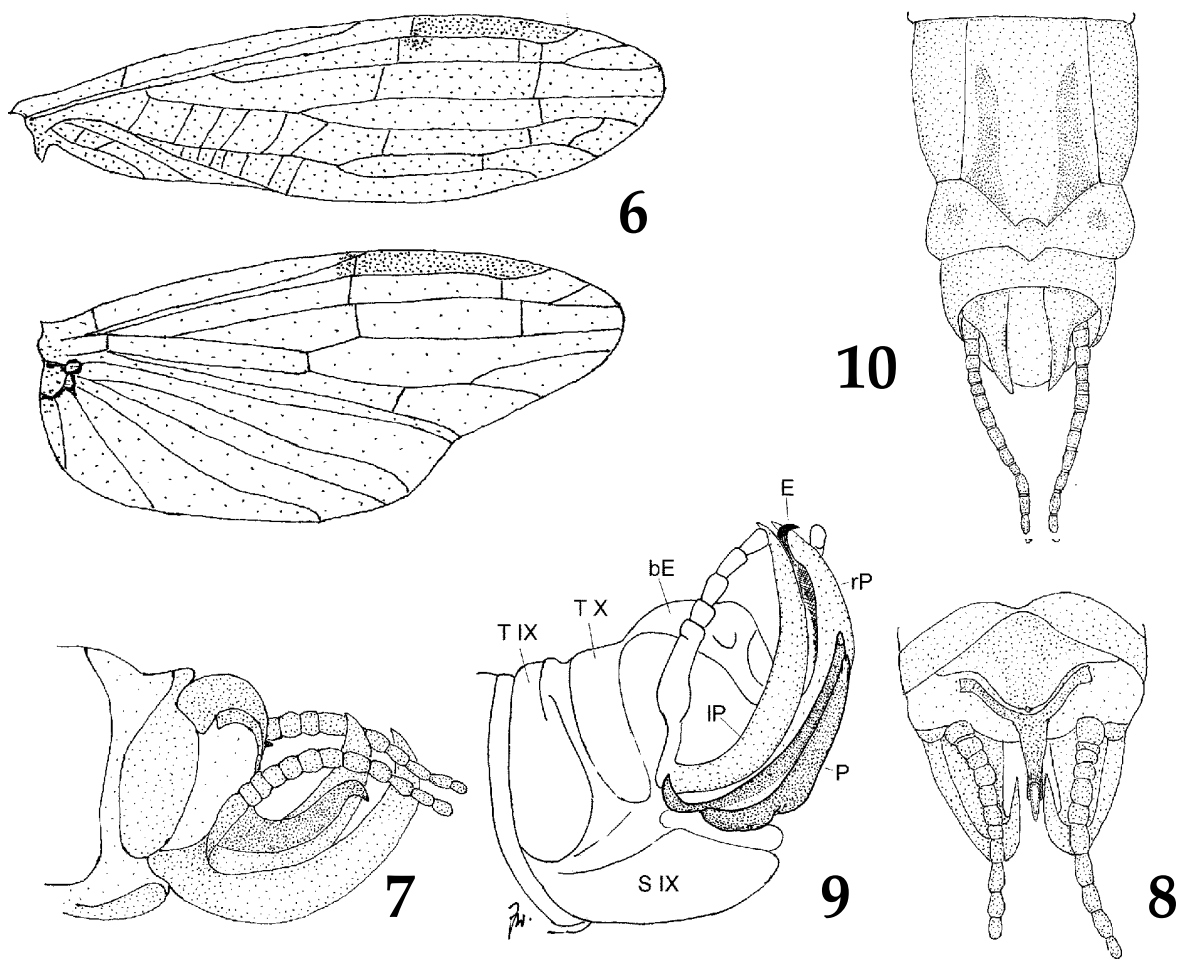
Material examined. Holotype ♂, Chile, Arauco, San Alfonso above Caramavida, 16-17 October 1969, OSF & GB (USNM). Paratypes: ♂ and ♀ and 3 paratype larvae, Chile, Malleco, Pino Hachado, 1480 m, 38°39'S; 70°58'W, 8-9 January 1994, CMF & OSF (USNM); 1m (with everted conical penis), 1♀, Argentina, Neuquen, Lago Lolog, 40°02'S; 71°24'W, Quebrada, 19 km N of San. Martin del Los Andes, 1-3 January 1994, CMF, OSF; 1♂, Chile, Biobio/Malleco, Volcan Callaquen, 5-7 February 1959, LEP. 1♂, Argentina, Neuquen, Rio Litran, 5 km. N. Lago Alumine 1 March 1978 C.MF & OSF; 2?, Chile, Malleco, Nahuelbuta, bog outlet, 37°47'S; 73°01'W, 16-19 December 1993, Malaise trap, CMF & OSF; 1♀, Chile, Palena, Rio Ventisquero, 16 km S Pto. Cardenas, 100 m, 23-24 January 1987, CMF & OSF; 1♀, Chile, Nuble, El Purgatorio, 3 March 1968, OSF, MLP, 1♀, Argentina, Neuquen, brooklet above

Pucara, 1 February 1974, OSF; 1♂, 1♀, Chile, Nuble, Las Cabras, Cordillera Chillan, 8-15 February 1959, LEP. All paratypes (USNM). **Additional material:** 8 LA, Chile, Nuble, Las Trancas, 1300 m, 21km E Recinto, high waterfall ex moss, 17 January 1979, MD, DD, BA; 9 LA (1 small), Chile, Nuble, Las Trancas, 1300 m, 21km E Recinto, high waterfall, ex moss, 17 January 1979, MD&DD & BA; 3 LA, Argentina, Neuquen, cascades, 6 km N Lago Alumine 1100 m, 3 February 1987, CMF & OSF, 1 LA, Chile, Osorno, stream near the Carabino Post in Antillanca, 12 December 1972, MLP; 1 LA, Argentina, Neuquen, Ao Punameco, NW Lago Alumine, 1 March 1978, CMF & OSF; 1 LA, Argentina, Neuquen, Ao Punameco, NW Lago Alumine, 1 March 1978, CMF & OSF.

Dimensions. Male: body length 7.0; forewing 8.0; antenna 5.0. Female: body length 9.0; forewing 9.5; antenna 5.0. Larva (last instar female): body length 8.5; antenna 3.0; cercus 1.7.

Adult. A medium sized stonefly. Head strongly deflexed, narrowed towards down-turned mouthparts. Epicranial suture deeply grooved. Area between 3 distinct ocelli appears raised. Apical segment of maxillary palpus 3X length of penultimate segment. Pronotum rectangular, twice as wide as long, with raised anterior and posterior margins and a paramedian callus on disk. Brown to dark brown with pale stripe along midline and around perimeter. Legs without tibial spurs. Both wings with Rs and Cu1 forks and 6 anal veins in hind wing (Fig. 6). Cerci downcurved, with about 10-12 segments, basal one long.

Male genitalia (Figs. 7-9). Sternite 9 produced into wide, shallowly bilobed subgenital plate. Tergite 10 central sclerite curved downwards at half length to fit neatly between arms of epiproct base. Medially on rounded hind margin of tergite 10 is a minute cone-shaped posterior sclerite. Arms of epiproct curve down and posteriorly, then join and curve upwards and posteriorly, terminating in a downcurved sharp tip. Paraprocts large, about as long as cerci, broadly falcate, inner face from base to about half length forms a triangular membranous sheet. Membranous penis inside sternite 9, visible only in cleared specimens. The everted penis appears relatively dark, apparently through tissue pushed into it by body fluid pressure. It is a large pointed cone slightly curved up between the paraproct bases, lying below the epiproct hook and is partly divided



Figs. 6-10. *Alfonsoperla flinti* gen. sp. n., adult. 6, pair of wings; 7, male abdominal tip, lateral; 8, same, dorsal; 9, same, oblique posterolateral view of specimen with everted penis, only bases of cerci shown; 10, female abdominal tip, ventral. Not to scale. bE, base of epiproct; E, epiproct; IP, left paraproct; P, penis; rP, right paraproct; S IX, sternite 9; T IX, T X, tergites 9, 10.

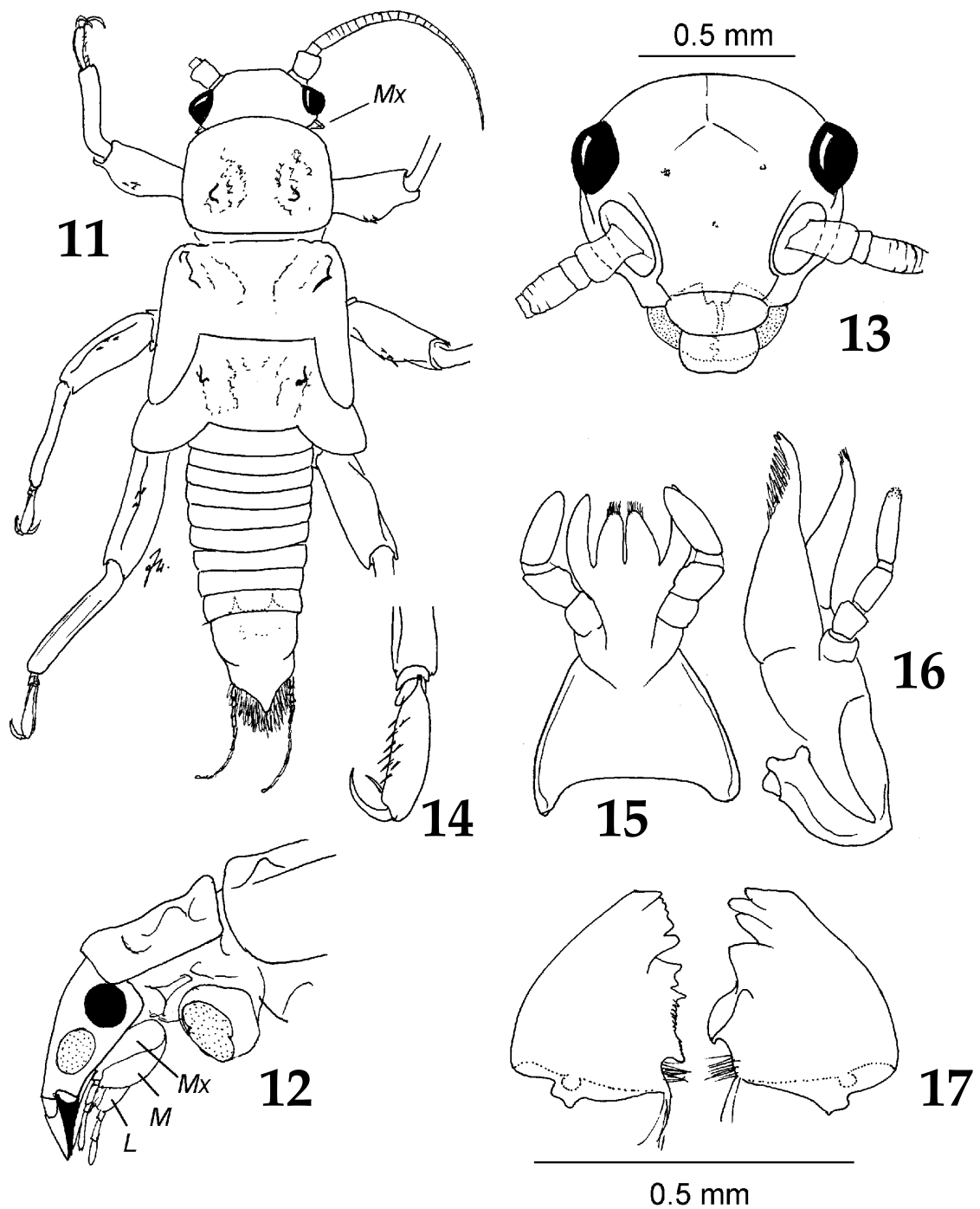
longitudinally by a lateral fold (Fig. 9). A tiny gonopore apparently at tip of slightly longer anterior part. A small triangular wing embracing base of paraproct observed only on the left side of body of the single specimen with everted penis.

Female genitalia. (Fig. 10). Sternite 8 with well developed subgenital plate, with 2 lateral dark bands, tapers to a rounded or double pointed tip extending on to sternite 9. Subanal lobes slender, pointed. Cerci short, of 12 segments. Tip of tergite 10 produced, rounded.

Larva. (Figs. 11-17). Short, stout, hairless and dusty brown. Surface matt because of numerous shallow pupillate punctures.

Head curved down, with shallow central

depression between ecdysial suture and indistinct ocelli. Head capsule much narrowed from wide base to narrow front i.e. wedge shaped, genae in front view visible as flat surfaces below and in front of eyes and antennal foramen. Clypeus and labrum narrow. Mandible base (Fig. 13, stippled) prominently exposed. Mandibles (Fig. 17) exceptionally flat, their long apices blade-like, the sharp serrate edges of the pair interdigitate. Base of mandible with distinct setal rosette, mola far from mandible base. Left mola serrate anteriorly, right mola concave. Maxillae (Fig. 16) long, with strongly elbowed base often quite visible in dorsal view; apparently, the maxilla can reach far forward. Maxillary palpus 4-segmented, apex of last segment



Figs. 11-17. *Alfonsoperla flinti* gen. sp. n., larva. 11, last instar specimen, habitus; 12, fore body, lateral, legs and antennae not shown, mandible black; 13, head, frontal, mandibles stippled; 14, last tarsal segment; 15, labium, ventral; 16, left maxilla, ventral; 17, mandibles, ventral. Figs 11, 12 not to scale, 14-17 to same scale. L, labium; M, mentum; Mx, maxilla.

soft, sometimes folded inward. Galea and lacinia unusually slender. Galea with apical rosette of

sensilla, lacinia with few narrow well sclerotised apical teeth and a series of translucent fairly wide

subterminal setae. Glossae shorter than simple paraglossae, with apical hair rosette (Fig. 15). 2nd segment of labial palpus medially swollen and strongly sclerotised. Hypopharynx inconspicuous and smooth.

Pronotum subrectangular, wider than long; hind margins of mesonotum and metanotum convex. Thoracic tergites with relief of grooves and ridges whose outlines are difficult to define precisely because of rough matt surface and best seen in side view (Fig. 12). A raised cone near base of wingpad on meso- and metanotum.

Femora short and stout, dorsally crested, a raised spinulate hump mid-dorsally. Tibia lacks spurs. Tarsal segments 1 and 2 both extremely short, segment 2 dorsally divided by narrow base of long 3rd segment, ventral face of 3rd tarsal segment spinose (Fig. 14). Tergites and sternites of abdominal segments 1 and 2 divided, those of 3 incompletely divided, with anterior notch. Abdominal tergite 10 produced and pointed, more so in males. Subanal lobes narrow, long, triangular. Cerci short, about 18 segments. Retractable anal gill rosette of many filaments with subanal lobes able to close over it.

Remarks. The genus is named for the first locality from which the species was recorded. This species is dedicated to Carol and Oliver Flint who not only collected the types but also were responsible for collecting a sizeable portion of all the material we examined.

The male epiproct, paraprocts and the bilobed penis are characteristic of the Australian Dinotoperlinae and the wing venation with forks in Rs and Cu1 is characteristic of *Trinotoperla* and *Illiesoperla* in that subfamily. Lack of tibial spurs is uncommon but despite this the other characters point more to the inclusion of the genus in Dinotoperlinae rather than Gripopteryginae or Antarctoperlinae.

A young wingless larva of this species was illustrated and briefly described by Illies (1963), as "Larventyp X (*Teutoperla* n. gen.?)". The general shape, the spinose, dorsally raised femora (Illies' text refers to 'tibiae' by mistake but his figure is correct), the pointed tergite 10, the long triangular paraprocts, the narrow maxilla and its 4-segmented palpi clearly indicate the conspecificity of his specimens with ours. Our interpretation is also confirmed by specimens in the Illies collection. The larva of this species was verified by dissection of a mature male larva.

Illies (1963) found the larvae in moss at the

bottom of streams or on rocks. The present material additionally suggests that the larvae dwell in or at least near waterfalls. The exceptional shape of head capsule and mouthparts suggested some special food, but the fore-gut of a single penultimate instar larva (from Neuquen Cascades) was filled with fine particulate matter, including many small diatom valves, fungal hyphae and spores, fragments of macrophyte tissue with tracheae, fine mineral particles, but no recognisable animal remains. The larva appears to be a gatherer, possibly obtaining its food from special microsites.

Antarctoperlinae Enderlein, 1909

This subfamily is well supported, also by larval characters. These include the very rounded massive head with a frontal depression, ring-shaped abdominal segments lacking a soft pleural area, the long parallel-sided posteriorly extended segment X which covers the retracted gills and the paraprocts from above, and the modified cerci. The cerci are short and thin, the apical section is thread-like. The terrestrial *Megandiperla* with its very short but thick conical cerci is the only exception. Larvae and adults lack tibial spurs. However, larvae of some other South American taxa also lack them (see the key). Additional characters characteristic of larvae of Antarctoperlinae but not shared by all of them are the thickened and often very pilose base of antennal flagellum, prominent or extended pronotal corners, paired dorsal processes on head, pronotum and/or abdomen, and camouflage of detritus containing fine sand firmly attached to body hairs.

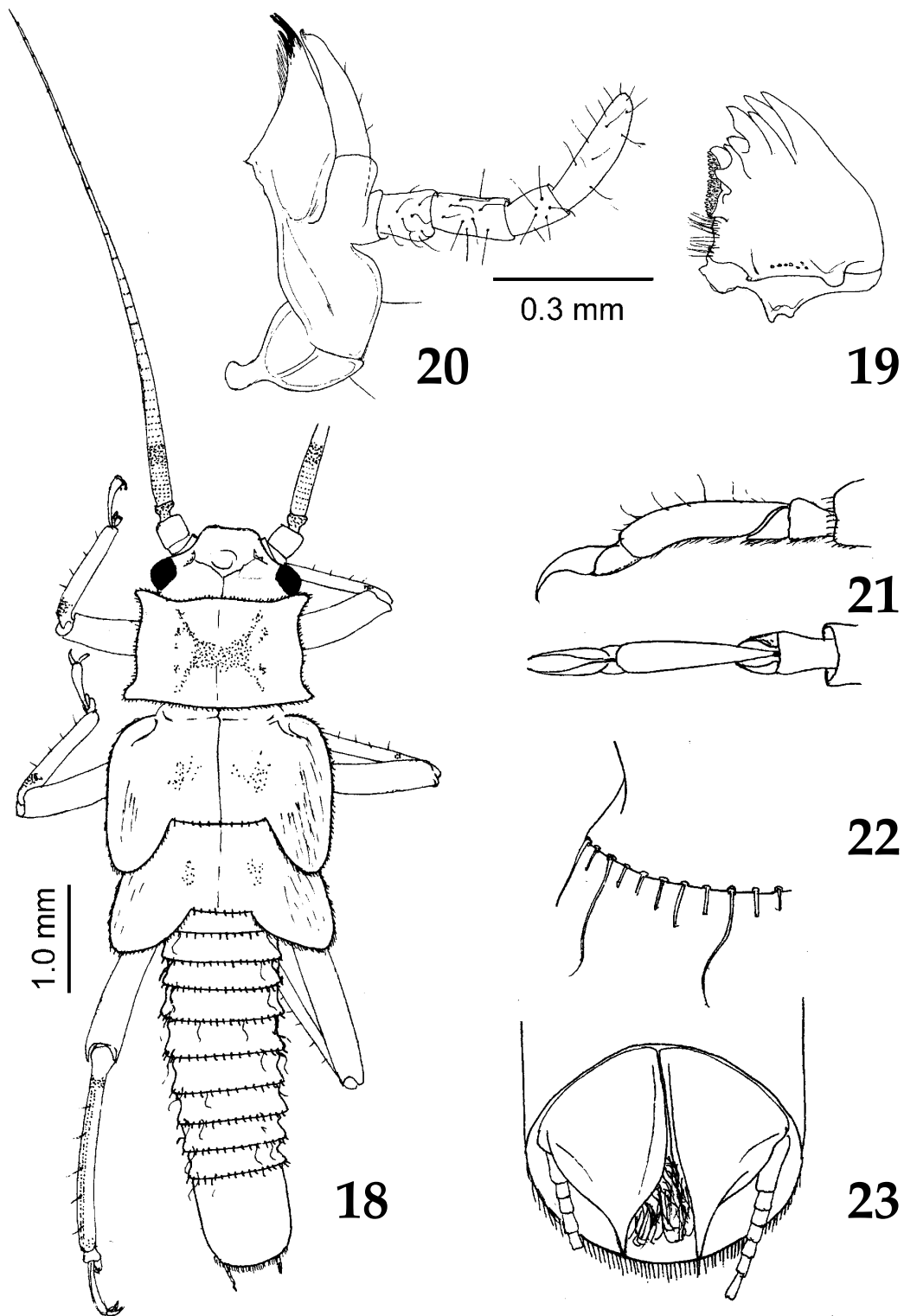
Unassociated Larvae

In the Flint collection there are Antarctoperlinae larvae without associated adults. Several are last instar specimens but none is sufficiently mature to dissect the pharate adult. These larvae are described below, under informal designations.

Antarctoperlinae gen. sp. I

(Figs. 18-23)

Material examined. 1 LA Chile, Malleco, Vegas Blancas, 27 km W Angol, 700 m, 17 January 1987, CMF&OSF; 1 LA Chile, Llanquihue Prov., a stream 15 km SW of Las Quemadas 17 December 1972, MLP; 1 LA Chile, Osorno, Rio El Gringo Park, Puyehue, 1075



Figs. 18-23. Antartoperlinae gen.sp. I, larva.18, habitus; 19, left mandible, ventral; 20, left maxilla, ventral; 21, tarsus, lateral and dorsal; 22, lateral part of tergal hair fringe; 23, abdominal tip, ventral. Figs 19-21 to same scale, 22-23 not to scale.

m, 13 December 1972, MLP; 2 female LA, Chile, Malleco, Vegas Blancas, 27 km W Angol, 700 m, 17 January 1987, CMF&OSF.

Dimensions. Larva (last instar): body length, 9.0-10.0; antenna, 5.0-7.0; cerci, 1.0.

Larva. Pale brown, with a sand like matt surface; indistinct muscle attachments on head and thorax a darker brown; a brown ring across widest part of antennal flagellum, subgenual rings and apices of tibiae dark grey. Hairless, except as mentioned below.

Head: Rounded, massive. Eyes large, no ocelli. Unpaired cephalic suture long, well visible, its fork distinct; depression in front of fork deep. Frons bulging over downwardly directed clypeus and labrum. Mandible (Fig. 19) with large sharp pointed teeth ventrally and a dorsal elongate oval spiny mola and a faint prosthecal hair brush but no other hairs; a transverse row of sensilla inward from ventral condyle. Maxilla (Fig. 20) with 5-segmented simple palp, basal segment very short, in ventral view not easily distinguished from palpiger. Galea simple, a few outwardly turned elongate sensilla at apex, medial face closely appressed to lacinia. Lacinia very broad at base, especially from lateral view, strongly tapered to narrow tip which has three very dark sharp slender teeth. Basally from teeth along mediodorsal edge are a series of pale setae with about five of the apical ones modified into large spike-like structures. Antennae (Fig. 18) almost as long as body, scape large, and pedicel dark and basally strongly constricted. Flagellum distinctly enlarged basally with a dark band, segments on wide part very short and transverse, scarcely discernable, only distinguished by rings of curved short setae; distal segments narrow, almost twice longer than wide, hairless.

Thorax. Dorsum flat and much wider than parts below. Laterally flanged with a sharp edge, along which there is a row of small sharp pale setae. Pronotum with all four angles produced into prominent angular lobes. Mesothoracic wing pads with parallel sides and free distal parts only about as long as wide. Metathoracic wing pads divergent and shorter. Legs simple, long, with inconspicuous pilosity. Outer face of tibiae with a series of 4-7 long pale hairs along a narrow bare longitudinal space between two regular rows of very short setae. No tibial spurs, but a few stronger setae ventrally at apex. Tarsi (Fig. 21) ventrally with fine hair brushes,

dorsally with some thin hairs. First segment longer than wide with narrow base, Segment 2 incomplete, a ventral lobe dorsally divided completely by insertion of segment 3; segment 3 longer than first two together.

Abdomen formed of 10 complete segmental rings, each of the first nine medially strongly constricted, with fringe of setae arising from dark spots along bulging distal edge (Fig. 22). Most setae are short, truncate, of variable length but some long, extending into a soft pale filament which is probably broken in the truncate setae. Ventrally, the distal bulges are less prominent, setae are shorter, soft, pale, appearing woolly. Segment 10 (Fig. 23) forms a distally obliquely truncate cylinder and bears a regular fringe of short setae posteriorly along its upper edge. The ventrodistal opening of the segment is almost completely covered by the flat, hard subanal lobes from which rise a short hard apical spine. Cerci minute, pale and sparsely pilose; the longer one with seven segments but both are probably broken. The pale tips of numerous retracted gill filaments project between the subanal lobes.

Remarks. The width and seeming shortness of the wing pads results from their flanged nature; the adult is probably fully winged. The mandibular mola resembles the "Stachelmola" as illustrated for *Brachyptera*, Wichard et al., 1995.

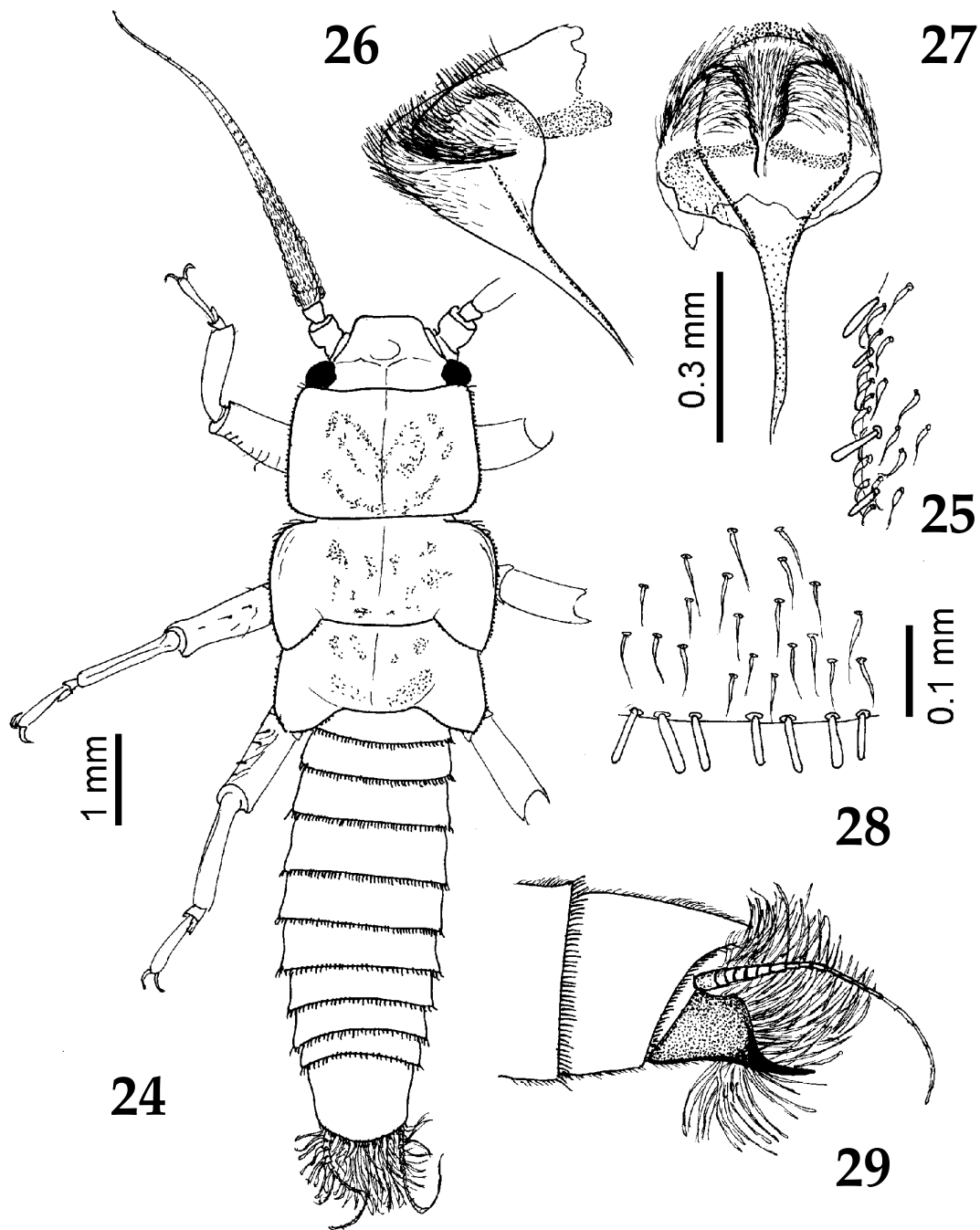
Antarctoperlinae gen. sp. II

(Figs. 24-29)

Material examined. 2 LA, Argentina, Neuquen, Rio Litran, 5 km. N. Lago Alumine 1 March. 1978 CMF & OSF; 8 LA, Argentina, Neuquen, Ao. Purumeco, NW Lago Alumine 1 March 1978 CMF & OSF; 1 LA, Chile, Malleco, small stream 20 km E. Liucura, 1750 m, 4 February 1987, CMF&OSF, (February 97 in LFS); 1 LA, Argentina, Neuquen, small stream, 10 km S. Pino Hachado, 4. February 1987, CMF & OSF, (February 97 in LFS); 4 LA, Chile, Malleco Prov., Cordillera de las Raices, 37 km E Curacautin, 5-6 February 1979, 1100 m, DD,MD & DA (97 in LFS); 39 LA, Chile, Malleco, small stream, 9 km W Lonquimay, 5 February 1987, CMF&OSF (3 remain as duplicates in LFS). 8 LA "9/12 o" among unsorted material in coll. Illies, locality and date unknown.

Dimensions. Larva (last instar): body length 12.5-13.0; antenna 7.0; cerci 2.5.

Larva. Dark brown, muscle attachments on head and



Figs. 24-29. Antartoperlinae gen.sp. II, larva. 24, habitus; 25, detail of pronotal lateral margin; 26, hypopharynx, lateral; 27, same, dorsal; 28, rear part of an abdominal tergite, with surface pilosity and caudal setal fringe; 29, abdominal tip, lateral.

thorax darker. Scape and pedicel plus some flagellar segments (about segments 7-12) darker brown than rest of antenna. Similarly, tip of first cercus segment and the next 6-8 segments distinctly darker brown

than rest of cercus. Clothed with short dark procumbent setae (Fig. 25) except side edges of thorax and caudal edges of abdominal segments which have setal fringes as described below.

Head: Massive, dorsal face flat, occipital area strongly downcurved. Eyes large, no ocelli. Central depression shallow, indistinct. Unpaired cephalic suture long, branches initially diverging at right angle, then bent abruptly sideways, meeting inner edge of eyes and curving forward alongside them, behind antennae. Frons descending stepwise to clypeus, labrum with large articulation membrane. Genae as high as the large antennal scape and cut off and rounded level with the scape. Mouthparts similar to *Antarctoperlinae* gen. sp. I. Antennae about half as long as body, scape large, pedicel dark, basally strongly constricted. Base of flagellum distinctly expanded, segments on wide part of flagellum very short and distinguished by rings of strong short setae whose tips curve back against flagellum; narrow distal segments almost twice longer than wide, hairs hardly noticeable.

Thorax. Notum flanged, the edges with a fringe of prominent setae with truncate tips. Pronotum as wide as head, wider than long, almost rectangular with a short blunt extension of the anterior angles. Wingpads short and triangular. Legs. Short, hind legs shorter than the abdomen and clothed dorsally with a few dark setae. Tibiae triangular with a sharp outer edge. Tarsi with the usual short segment 1 and 2 and large claws.

Abdomen short and wider medially, the segments are complete rings, their hind margins with a fringe of prominent dark setae. Hind margin of tergite 10 rounded. Subanal lobes each with a long pointed projection. Cerci short and threadlike, their extremities clothed with a ring of short setae.

Remarks. The short triangular wing pads probably indicate that some adults may be short winged. Both *Antarctoperlinae* gen.sp. I and II have a broad flanged thorax and long, almost straight paraproctal spines. The prominent pronotal corners and long setae of the abdominal hair fringes distinguish sp. I from sp. II. The latter has blunt corners of pronotum and short peg-like setae in abdominal fringes.

***Antarctoperlinae* gen. sp. III** (Figs. 30-35)

Material examined. 1 LA, Chile, Magal., Penin. Cordova Ba.Borja 7. October.69 OSF; another larva from the same locality is additionally labelled "pond"; 2 LA (partly dissected, parts on slide), Chile, Magal., I. Desolacion, Pto. Churruca, 5 October 1969,

OSF.

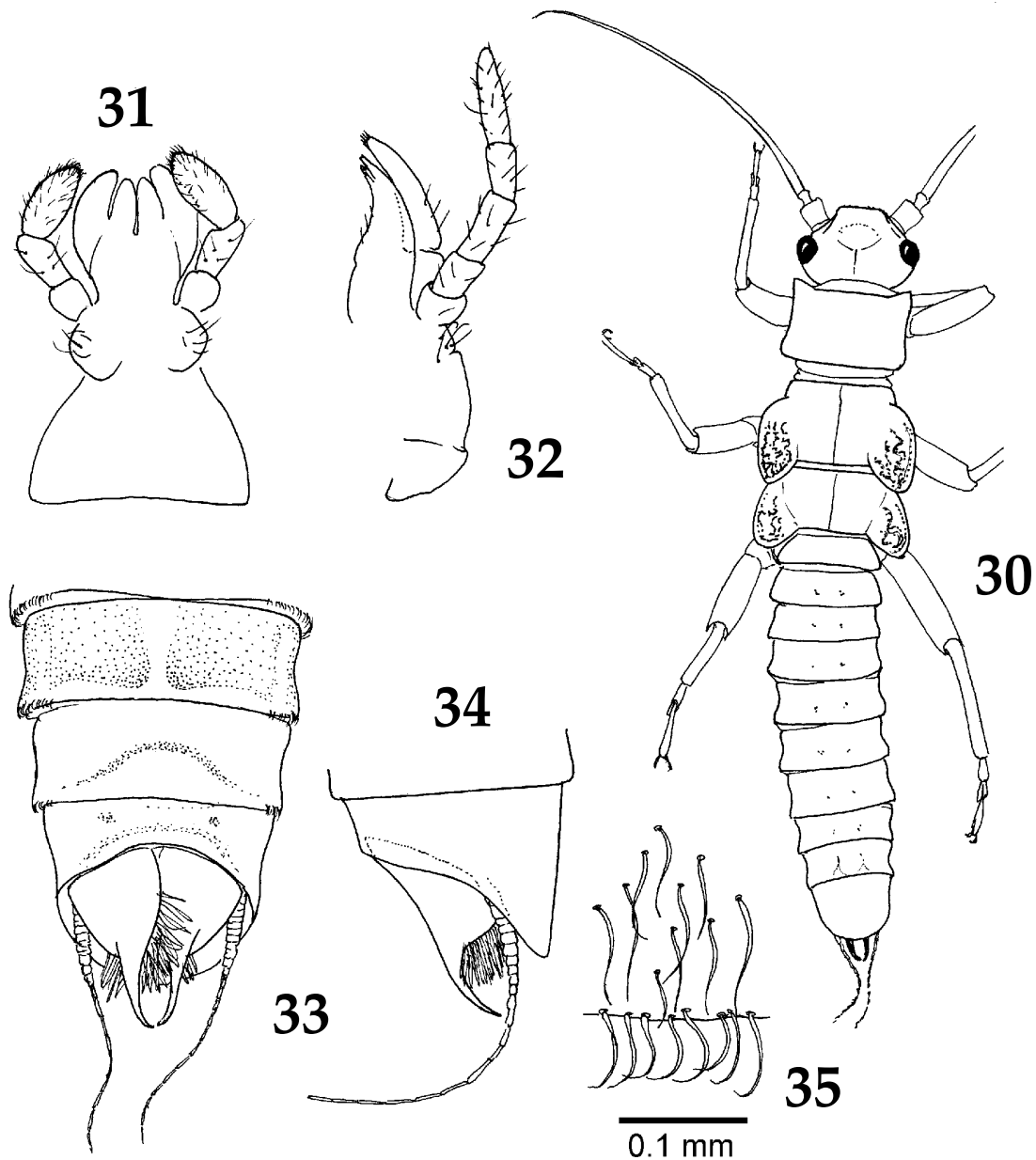
Dimensions. Larva (final instar): body length 12.0-13.0; antenna 6.0; cerci 1.5.

Larva. A moderately slender species, uniformly light brown and shining; the larva appears to be hairless under the dissecting microscope, except for colourless short hair fringes along the front edge of the clypeus and the rear edge of tergite 10. However, when pieces of integument are studied with a compound microscope and under transmitted light, the body is found to be covered by very fine, colourless hairs. Hairs on tergites are curved and strongly tapered towards the tip, being almost whip-like on basal segments. Apices of hairs along distal segment margins are strongly curved inwards, towards the body. Floriform chloride cells on intersegmental membranes at basal abdominal segments numerous, each resembling a goblet with long basal stalk.

Head massive, simple, with distinct shallow central depression, eyes small, and ocelli indistinct. Antennae seemingly bare, with large squarish scape and narrow bell-shaped pedicel; basal third of flagellum indistinctly inflated. Genae normal, simple; frons gently bulging down to the short clypeus, labrum trapezoidal, with narrow base. Sclerotised mouthparts worn, details of molar structure no longer visible, lacinial apex apparently with only a few blunt massive scoop-like apical teeth. Galea longer than lacinia, with apical group of small rod-shaped sensillae. Palpus simple, segment 4 a little shorter than both segments 3 and 5. Labium normal, except terminal segment of palpi wide, distinctly ovoid, fairly densely pilose.

Thorax. Pronotum a little wider than long, the anterior angles a little produced forward but barely outward. Rear angles pronounced but blunt, not produced. Meso- and metanotum simple, with short wing pads. Legs short, stout, hind tarsi not reaching abdominal tip. Tibiae simple, no crests or keels. Tarsi with segment 2 short, dorsally completely divided by the basal part of distal segment.

Abdominal segments ring-shaped, a little constricted just forward of the middle of each so that the segment contour appears bell-shaped. Two minute dark spots on tergites 2-9 appear to be part of the adult pattern rather than larval marks; the narrowly triangular apophyses of the antecosta of tergite 10 faintly visible by transparency. Segment 10 large, with protruding rounded posterior edge; bases

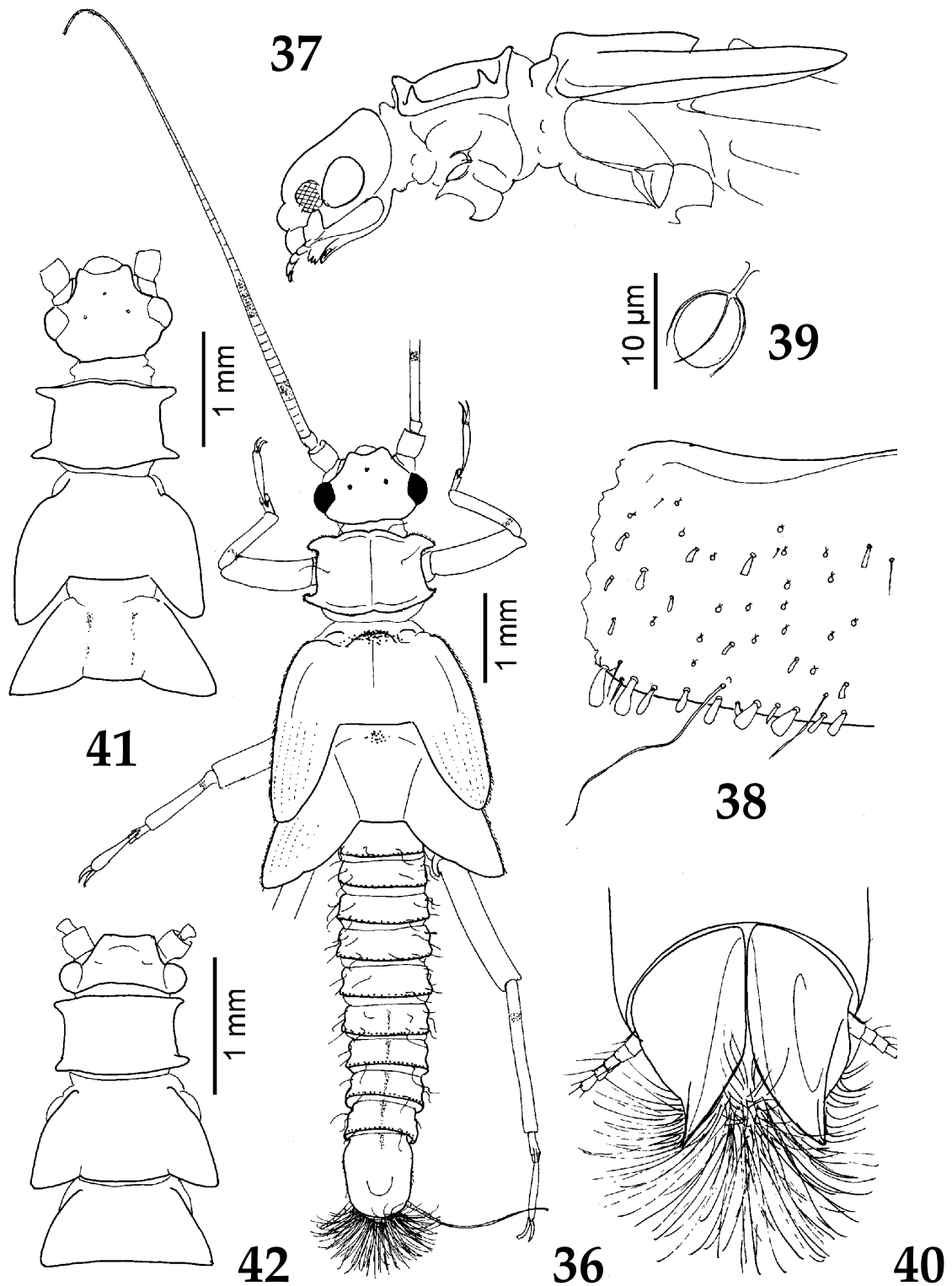


Figs. 30-35. Antarcticoperlinae gen.sp. III, larva. 30, habitus; 31, labial segment, ventral; 32 left maxilla, ventral; 33, abdominal tip, ventral; 34, same, lateral; 35, part of abdominal tergite, with pilosity. Figs 31-34 not to scale.

of cerci and paraprocts concealed inside last segment. Cerci of about 20 segments but very short, downcurved, the apical part extremely fine, narrow and translucent. Paraprocts with sclerotised, medially partly overlapped bases from which rises a sharply pointed upcurved process; in dorsal view, the two processes appear like the forceps of an earwig (Dermaptera) while in side view the basal two thirds of their ventral edge are slightly concave to

nearly straight. Gill rosette large, many fine filaments but contracted in the specimens examined.

Adult. Not known; however, a few traits of the developing adult were visible by transparency or were dissected out from the larvae from Isola Desolación. The wings are about 3 mm long when artificially extended in hot lactic acid. Wings were insufficiently developed to recognize details of the much reduced venation; however, Rs and M are



Figs. 36-42. Antartoperlinae gen.sp. IV. 36, habitus of last instar larva; 37, fore body of same, lateral; 38, detail of 5th abdominal tergite, with setation and chloride cells; 39, chloride cell; 40, abdominal tip, ventral; 41, fore body of presumed penultimate instar; 42, fore body of presumed antepenultimate instar. Figs. 37, 38 and 40 not to scale.

distinctly forked, crossveins are not visible. Both mature larvae are females; a pale median strip and darker paramedian lobes that probably extend backward in the emerged adult are visible by transparency inside sternite 8. Sternite 9 contains a deeply forwardly arched darker structure.

Antarctoperlinae gen. sp. IV
(Figs. 36-42)

Material examined. 3 LA, Prov. Linares, Catillo, 29 March 1975, CC (in coll. Zwick).

Dimensions. Larva (last instar): body length 9.0; antenna 6.0; cercus 1.5.

Larva. Slender, fully winged, long-legged, larva. Pale matt brown, a narrow sharply delimited median longitudinal line on the abdomen. Antennae very long and slender with a darker ring in basal quarter and another just before mid-length. Subgenual rings on tibiae dark brown. Pilosity not obvious, but very complex and varied at high magnification.

Head not distinctive, dorsally a little concave but depression in front of occipital fork not deep; frons bulging over downwardly directed clypeus and labrum. Eyes large, distinct ocelli. Genae distinct, not as deep as width of antennal scape. Mandibles, maxillae and labium resembling *Antarctoperlinae* II, but hypopharynx simple, no distinct lobes. Antennae about 2/3 body length, structurally simple, no swollen or conspicuously setose parts, distal segments very thin and several times longer than wide, no distinct setae.

Thorax. Pronotum with all four angles conspicuously horned laterally, the anterior horns curved posteriorly and the posterior ones curved anteriorly. Anterior and posterior margins convex, hind margin with rough short modified hairs. Raised anteromedially part of meso- and metanotum with similar pilosity. Both wing pads divergent, well developed, adult obviously fully winged. Legs simple, long (apex of hind femur reaching to tergite VI), almost hairless, no keels, spines or tibial spurs. Tarsi similar to other *Antarctoperlinae*, but slender, first segment twice as long as wide.

Abdominal segments ring-shaped, middle and posterior ones strongly constricted medially, with dark spots along bulging distal edge; the setae in these insertion points are very short, club-shaped to almost spatulate with the wide apices pale and

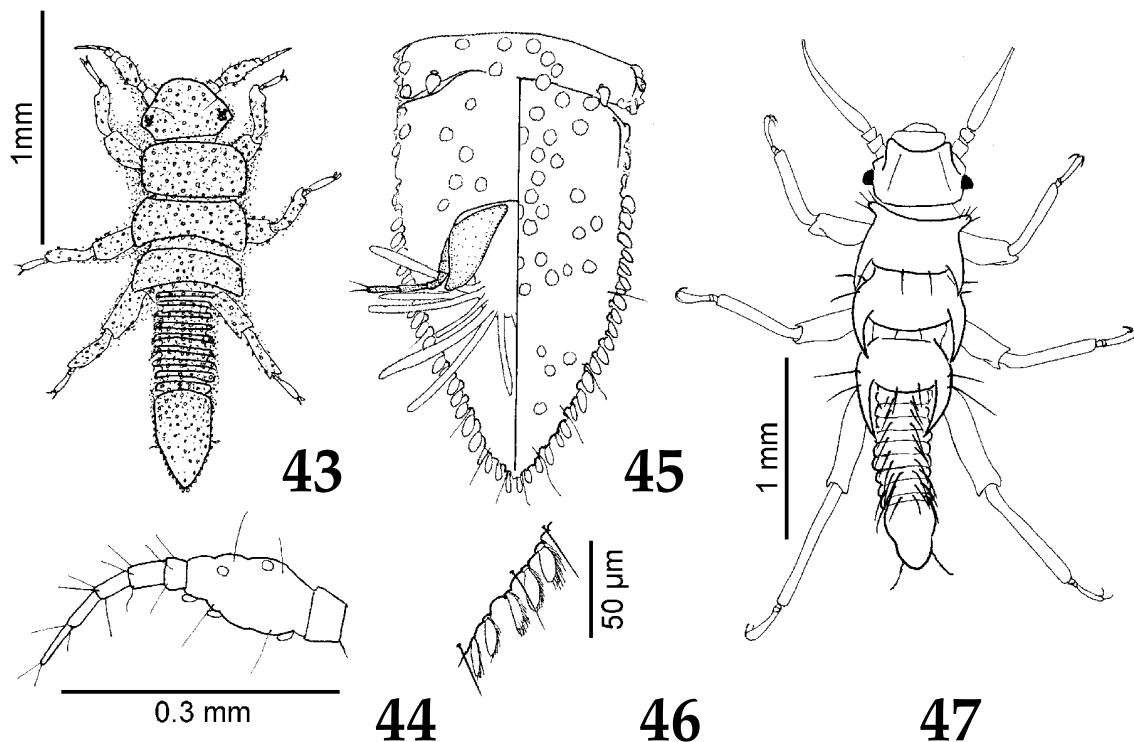
transparent. Interspersed with the setae are a few long thin twisted or curled pale hairs which are best seen in slanting light and then give the larva an untidy appearance. On the tergal surfaces, in transmitted light, between the few pale club-shaped setae are numerous minute thinly stalked floriform chloride cells which have only a few delicate cuticular rods surrounding the central vesicle (normally, there is a dense basket-like arrangement of cuticular rods around it). Segment 10 with its distal dorsal edge regularly rounded and fringed with short setae, its ventro-distal face covered by elongate triangular, prominently pointed, sclerotised subanal lobes. In side view, the ventral edge of the subanal lobe forms a straight line, from base to tip. Cerci directed postero-laterally. They are basally light brown, regularly segmented and sparsely pilose but distally completely pale, indistinctly segmented and hairless. Gill rosette large, purplish.

Remarks. The male larva is insufficiently developed to show distinct secondary sexual characters, except for an indistinctly bilobed slight mediobasal extension of sternite 9. The dark dorsal line is most distinct and longest in the smallest larvae, but least developed in the largest specimen. However, this may be related to the condition of the specimens rather than being typical of given instars. By the shape of their wing pads, the three available larvae belong to the last three instars; their body proportions suggest wing development is in three steps, as in most Plecoptera (Zwick 2003).

Slender shape and pronotal angles suggest this may be the larva of some *Plegoperla* species. However adult *Plegoperla* have forwardly directed anterior angles of pronotum and the short extension of the posterior angles is directed backward. Also, *Plegoperla* adults have very long antennal scapes and tibial spurs which are lacking in the *Antarctoperlinae* IV larva.

Key to larvae of South American Gripopterygidae

Family diagnosis. Gripopterygidae are distinguished by a supra-anal retractable rosette of unsegmented, often purplish gill filaments. Only *Notoperla* lacks gills but can be separated from the gill-less South American family, *Notonemouridae*, by its large furcasternum widely separating the coxae and by furcal pits located far from the spina. In



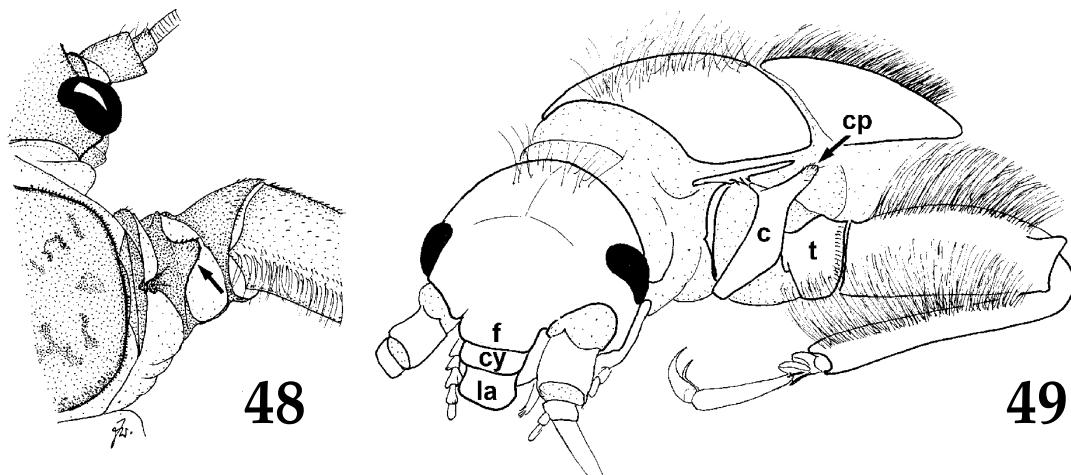
Figs. 43-47. Early larval instars of *Ceratoperla schwabei* Illies (from a single sample from Chile, Malleco, Nahuelbuta, Los Gringos, 37°48'S, 73°01'W, 15-17 December 1993, C&O Flint, Jr.; identified after Illies, 1963, fig. 36d, and Caamaño Mora, 1985, fig. 12). 43, first instar, habitus; 44 antenna of same; 45, combined ventral and dorsal views of segments 9 and 10; 46, detail of marginal hairs on tergite 10; 47, slightly larger specimen. Conspecificity of specimens was suggested by identical surface structure and body vestiture.

Notonemouridae, the furcasternum is very small, coxae are close together, and furcal pits are adjacent to the spina.

The larva of *Andiperlodes* is unknown. Taxa that may or may not be dirt covered are identified by their morphology, not mainly by the dirt cover. There is little information on morphological change during larval development of South American Gripopterygidae, which may be important (Figs 43-47). Change may also concern changes in late instars that are not related to wing development, for example *Antarctoperlinae* sp. II and IV. The key is to last instar larvae.

- 1 No gills; all coxae with an almost triangular projection next to articulation with thorax (Fig. 48-49); large sprawling larvae with prominent hair fringes on legs; tibial spurs only in final instar (McLellan et al. 2005) *Notoperla* spp.

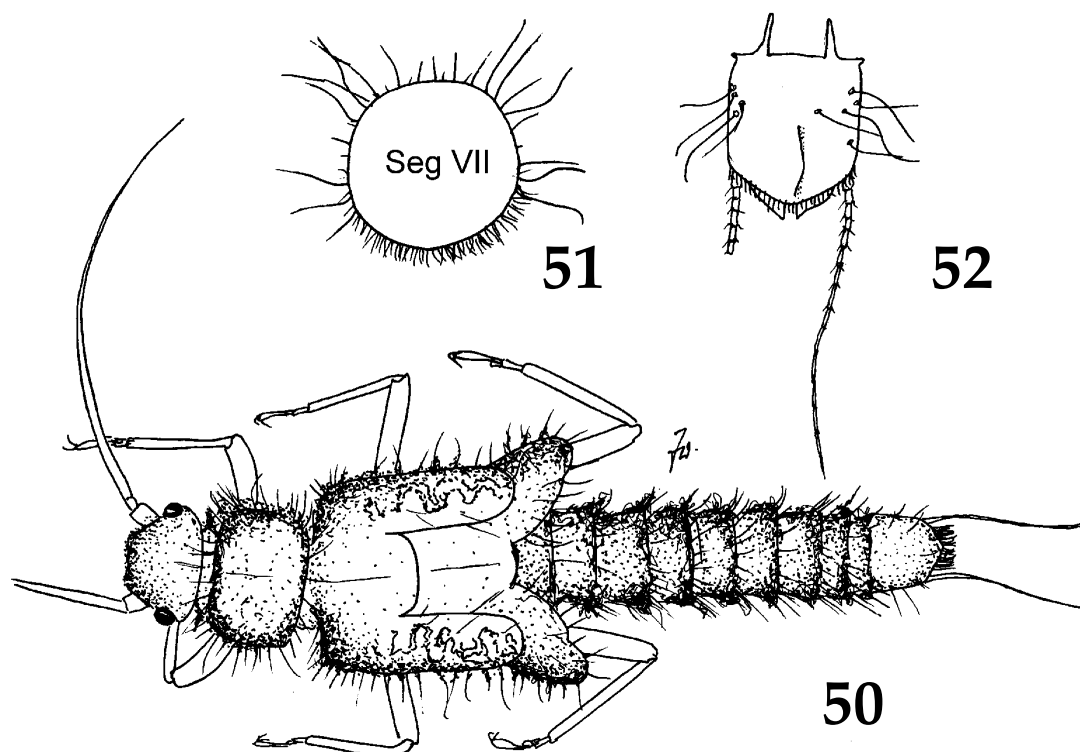
- 1' Anal gill rosette present, all coxa simple 2
- 2 Dorsal face of abdomen with raised processes 3
- 2' Dorsal face of abdomen at most with slightly elevated middle portion of rear margins but without raised processes, mostly completely simple 7
- 3 Abdominal processes unpaired 4
- 3' Abdominal processes paired 5
- 4 Sprawler habitus, distinct hair fringes on legs, gill rosette small; abdominal processes small, on some segments indistinct, thorax simple; abdominal sternites with dense cover of short erect hairs (friction pad?); lower face of all coxae entirely unsclerotised, a soft transparent membrane through which the muscles are clearly visible *Senzilloides panguipullii* (Navás)
- 4' Perambulatory larvae, no distinct hair fringes; dorsal processes on abdomen and thorax very variable between species, and sometimes apparently also between sexes of a species; only eastern South America *Gripopteryx* spp.
- 5 Head unarmed, anterior pronotal angles elongate, with pluridentate apex, posterior angles sharply pointed,



Figs. 48-49. *Notoperla archiplatae* (det. J. Illies, larva from Lo Valdes), late instar larva. 48, slightly oblique dorsal view of right half of fore body; 49, oblique anterior view of larval fore body from left side; note hair flanges on leg and along middorsal line. Arrow points at coxal projection; not to scale. c, coxa; cp, coxal projection; cy, clypeus; f, frons; la, labrum; t, trochanter.

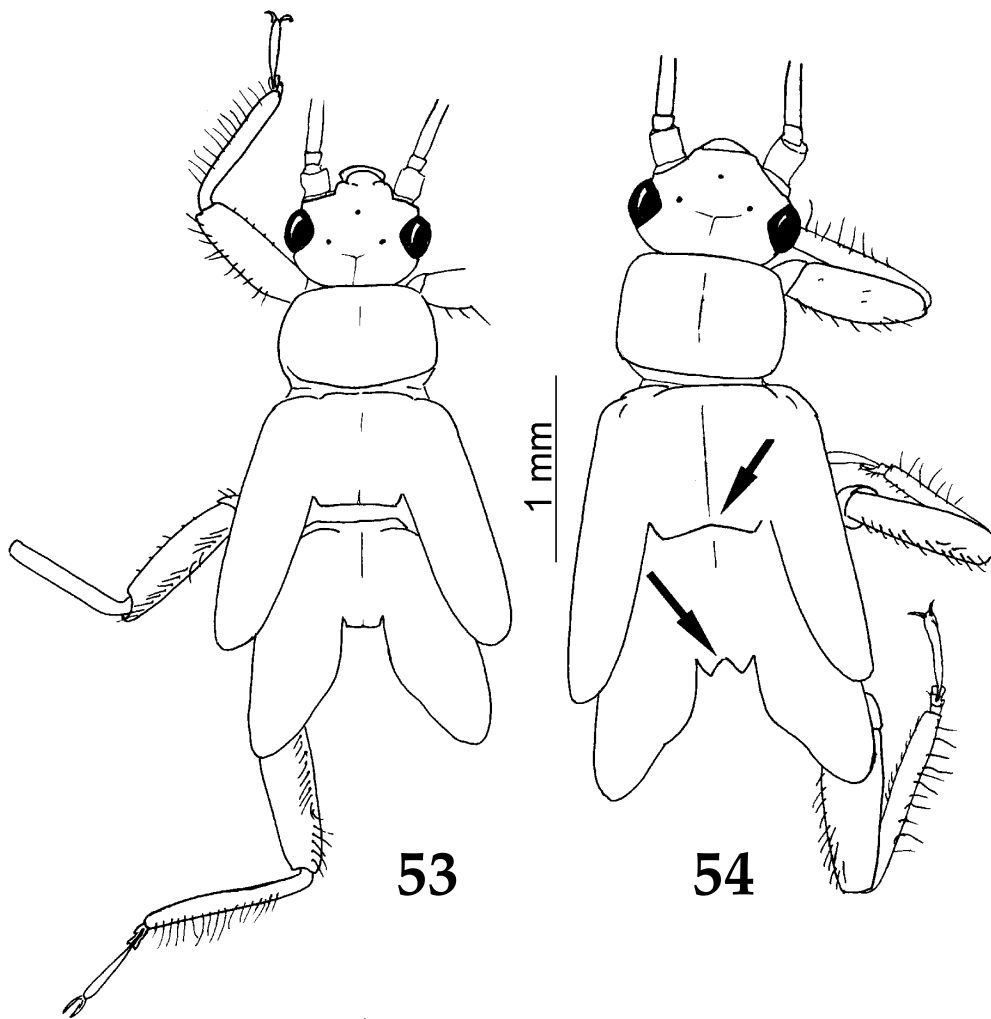
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| <p>raised; sometimes brachypterous, vestigial wingpads simple; abdominal processes smooth, simple, short, paraprocts ending in a strong downcurved spine, cercus short, base closely adjoined to dorsal paraproct edge <i>Neopentura semifusca</i> Illies 1</p> <p>5' Head with paired processes above antennal insertions or on vertex; other characters variable 6</p> <p>6 Processes above bases of antennae are short simple cones; frontal depression anteriorly delineated by a horseshoe-shaped blunt ridge; pronotum with sharply pointed extended corners, wing normal but ending in sharply pointed tip; abdominal processes small, simple; apex of paraproct narrow, tongue-shaped <i>Ceratoperla fazi</i> (Navás)</p> <p>6' Processes on vertex, on all four corners of pronotum and on abdominal segments very long, narrow, spinose; wing pads with several marginal denticles and groups of setae; frontal depression very wide, no ridge in front of it; paraprocts sharply pointed <i>Larventyp B (Araucanioperla?)</i> of Illies, 1963</p> <p>7 Prominent bulging eyes, no ocelli; gill very small <i>Andiperla willinki</i> Aubert</p> <p>7' Eyes normal, late instar larvae with at least</p> | <p>rudimentary ocelli; large gill rosette 8</p> <p>8 No tibial spurs 9</p> <p>8' Tibial spurs present; pleural membranes separate tergites from sternites on at least first three abdominal segments; cerci variable, often very long 20</p> <p>9 Femora and tibiae with prominent caudal hair fringes; cerci slender with dorsal and ventral fringes of numerous hairs per segment; antennae long, bare; ocellar area of flat head with a depression; frons bulging distinctly forward above the clypeus on either side, next to the antennal foramen; labrum directed downward, at approximately right angle to flat top of head; maxillary palpus 5-segmented; tergite 10 caudally rounded; paraprocts short, truncate; slender larvae with rough integument; medium-sized (12-13 mm) <i>Notoperlopsis femina</i> Illies</p> <p>9' No hair fringes; cerci short, less than half abdomen 10</p> <p>10 Basal abdominal segments with soft pleurae separating tergites from sternites; legs stout, femora with spinulose dorsal bulge; tarsus segments 1 and 2 subequal, barely longer than wide, 3rd segment long, ventrally spinulose; tergite 10 sharply pointed; head wedge-shaped in side view, with almost straight upper contour line; maxillary palpus 4-segmented, last segment long; a sharp raised cone near base of wingpads, similar smaller cones on pronotum; paraprocts long, narrow, upcurved (<i>Larventyp X (Teutop?)</i> of Illies) <i>Alfonsoperla</i> gen. n.</p> <p>10' Abdominal tergites and sternites forming continuous rings, no abdominal pleurites (Fig. 51); legs normal, femora simple, tarsi slender, basal segment much</p> |
|---|--|

1 *Larventyp A (Araucanioperla?)* of ILLIES, 1963. We agree with Vera (2006a) that *Neopentura* resembles, particularly in its male genitalia, the genus *Zelandobius* (McLellan, 1993) from New Zealand, more than other South American genera. However it differs from *Zelandobius* by its peculiarly forked male paraprocts and the appendage on the tip of the female subanal lobes. We have seen rich material, including adults, from several sites in Neuquen, Argentina.



Figs. 50-52. *Antarctoperla altera* Zwick, last instar larva. 50, habitus; 51, abdominal segment 10 and cerci, dorsal; 52, optical cross section through abdominal segment 7. Not to scale.

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| <p>longer than wide and distinctly longer than 2nd, 3rd segment not spinulose; remaining <i>Antarctoperlinae</i> ...</p> <p>11 Sides of meso- and metanotum flanged; flanges have kinks and extensions mimicking early wing pads; they are bifid on metathorax; apex of paraproct blunt; cerci stout, shorter than last segment, basally thick, conically tapered, curved upward; large [up to 25 mm long], wingless; terrestrial larva (Illies 1960)</p> <p>11' Sides of meso- and metanotum not flanged, wingpads normal, sometimes with sharply pointed apex; cerci thin, neither conical nor downcurved</p> <p>12 Heavy detrital coating concealing body contour, except strikingly clean segment 10; dorsal surface without ground pilosity, bare except for localized patches or lines of long setae; base of antennal flagellum much thickened, with dense cover of long curled hairs</p> <p>12' Body contour remains clearly visible even if some dirt is trapped in variable pilosity; segment 10 not strikingly cleaner than others; base of antennae not much thickened but may be densely pilose</p> <p>13 Front corners of pronotum anterolaterally projecting; groups of long setae on front corners of pronotum, shoulders of mesothorax, tips of hind wing pads, and on abdominal tergites 1-9 which lack regular setal</p> | <p>fringes</p> <p>..... "Larval type C (<i>Araucanioperla?</i>)" of Zwick, 1972</p> <p>13' All four corners of pronotum rounded; long hairs in rows along outer edges of thorax (including wing pads) and caudally on abdominal tergites 1-9</p> <p>..... <i>Pelurgoperla personata</i> Illies 2</p> <p>14 Paraprocts broad, apex rounded; fringes of straight setae around perimeter of pronotum, a few along shoulders, and along distal margins of abdominal segments; ventral face with soft, often curly hairs; pilosity may trap some mud</p> <p>..... <i>Chilenoperla</i> spp.</p> <p>14' Paraprocts terminate in a point; point varies in length</p> <p>..... 15</p> <p>15 Paraprocts obliquely truncate, medial tip short</p> <p>..... <i>Antarctoperla</i> spp..... 16</p> <p>15' Paraprocts with prolonged distinctly offset spine ... 17</p> <p>16 Dorsal side with many long, curly (not straight) hairs which may trap dirt; ventral face with pale short very dense hair cover; tergite X with long dorsolateral setae and a short apical setal fringe (Figs. 50-52). Males with shallow posteromedial keel on tergite 10; pronotal</p> |
|--|--|
- 2 Hairs on antenna are curved, not straight as in fig. 43b of Illies (1963).



Figs. 53-54. Fore bodies of last instar larvae of *Rhithroperla* cf. *rossi* Illies (53) and *Linnoperla jaffueli* (Navás) (54).

- corners rounded *Antarctoperla altera* Zwick
- 16' Dorsal side without dense long pilosity; pronotal corners a little produced but blunt; tergal fringes consist of blunt or club-shaped pale setae shorter than intersegmental membranes; paramedian brown bands lengthwise on pronotum and over wingpads, a median brown band along middle of abdomen *Antarctoperla michaelsoni* (Klap.)
- 17 Rear pronotal corners rectangular, not projecting or even horn-like; no long hairs on body 18
- 17' Rear pronotal corners prominent, sometimes resembling short horns; at least some long hairs on body 19
- 18 Stout larva; sides of pronotum straight, anteriorly slightly converging, corners rounded; paraproct truncate, medial edge extended into long, almost straight spine; regular fringes of short dark blunt setae along caudal edges of abdominal segments; base of antennal flagellum somewhat thickened, densely setose; present specimens short-winged but may be

- penultimate instar (Figs. 24-29)
 *Antarctoperlinae* gen. sp. II
- 18' Slender larva; sides of pronotum parallel and slightly concave. Front pronotal corners a little extended; abdominal fringes of slender pale hairs with tips curved against body; paraproct caudally narrowed, obliquely truncate, inner edge blending into a long, upcurved spine; micropterous (Figs. 30-36)
 *Antarctoperlinae* gen. sp. III
- 19 Wing pads normal, not flanged; abdominal fringes composed of inconspicuous short spatulate setae; contour of abdominal segments in dorsal view sinuous; pronotal horns pointing sideways in immature larvae, slightly convergent in last instar; 3 dark rings on antennae, each about 3 segments long; caudal margins of abdominal tergites with short spatulate setae and long interspersed hairs. A dark narrow median line from rear margin of pronotum to tip of abdomen; paraproct with short sharp dark point (Figs. 37-43) ...
 *Antarctoperlinae* gen. sp. IV

- 19' Wing pads flanged, very wide; pronotal horns slightly divergent, apparently a little variable with instar; erect bristles along edges of abdominal tergites; contour of abdominal segments in dorsal view strongly bell-shaped, widening from narrow base in a convex curve, then again constricted in front of even wider, bulging distal edge; no dark longitudinal line; a dark very sharp point on paraproct (Figs. 18-23) Antarcticoperlinae gen. sp. I
- 20 Hind margin of metanotum and also mesonotum re-entrant, angularly excised (Fig. 54) *Limnoperla jaffueli* (Navás)
Slender larva, cerci about half as long as abdomen. Body pilosity very fine, barely visible. Sparse setation on dorsal side of femora somewhat irregular (Fig. 64). Tibial hair fringe fine, sparse.
- 20' Hind margin of thoracic nota straight to slightly convex (Fig. 53); larvae of various shapes 21
- 21 Slender, very hairy larvae; long, soft, pale pilosity may trap dirt; antenna and legs with prominent setal fringes, also along upper and lower edges of cerci *Potamoperla myrmidon* (Mabille)
- 21' Body lacks apparent pilosity; hair fringes, if present, sparse, no long hairs on antenna 22
- 22 Paraproct tongue-shaped, wide, in ventral view concealing basis of cercus; stout larvae 23
- 22' Paraproct of various shapes, not laterally expanded, cercus base in ventral view exposed 24
- 23 Femora simple, slender (length/width ~ 3.7); an elongate bulge at wingbase; large triangular apophyses on front margin of tergite X are easily seen by transparency..... *Aubertoperla illiesi* (Froehlich)
Tiny stout peg-like setae on occiput, near midline and anterior margin of meso- and metanotum and along distal edges of abdominal tergites; sparse elsewhere, absent from head in front of occipital suture and from antennae and legs. Body surface in addition to pegs with fine, indistinct pilosity, hairs with wide bases and narrow long apices. Paraprocts short and wide, in ventral view covering the cercus base. Cerci long, segment 5 or 6 distinctly longer than wide.
- 23' Femora wide and flattened (length/width ~ 3.2), triangular in cross section, the fore femur in particular, posterodorsal edge crest-like; no distinct bulge at wingbase; tergite X without anterior apophyses; integument densely covered with only short peg-like setae, no interspersed slender hairs *Aubertoperla kuscheli* Illies
- 24 Each femur with a (sometimes small) ventral spine; no hair fringes on legs and antennae; only eastern South America 25

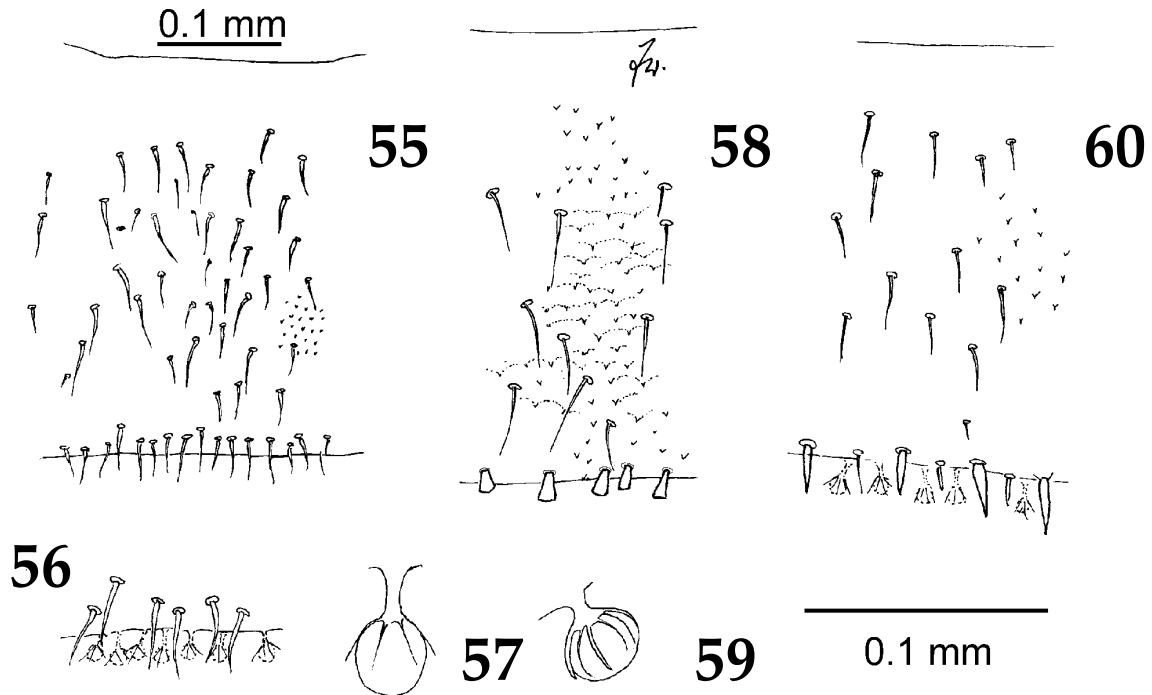
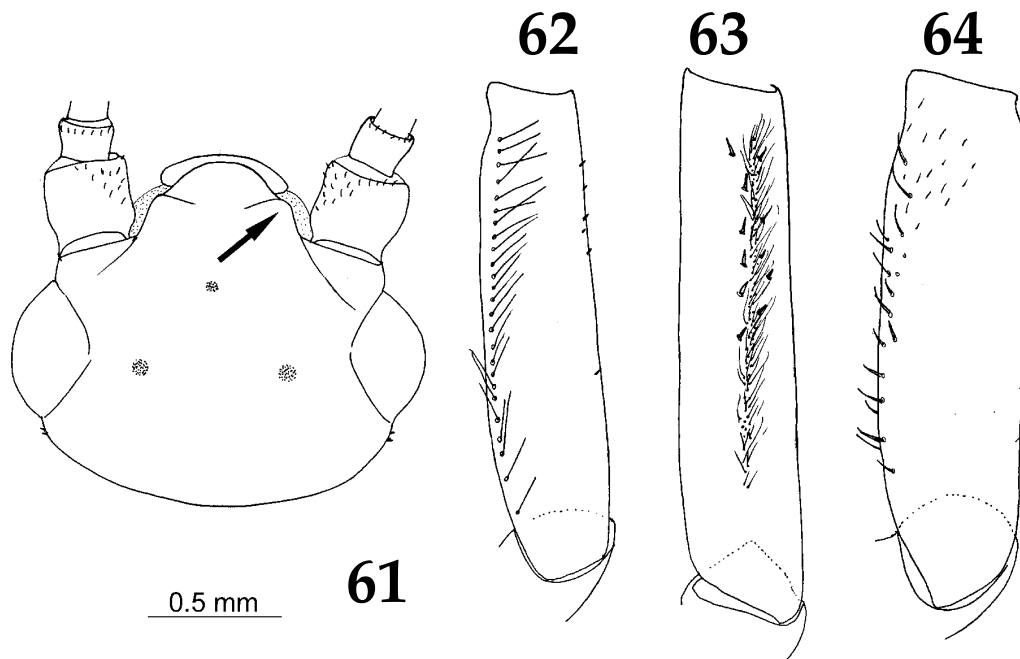
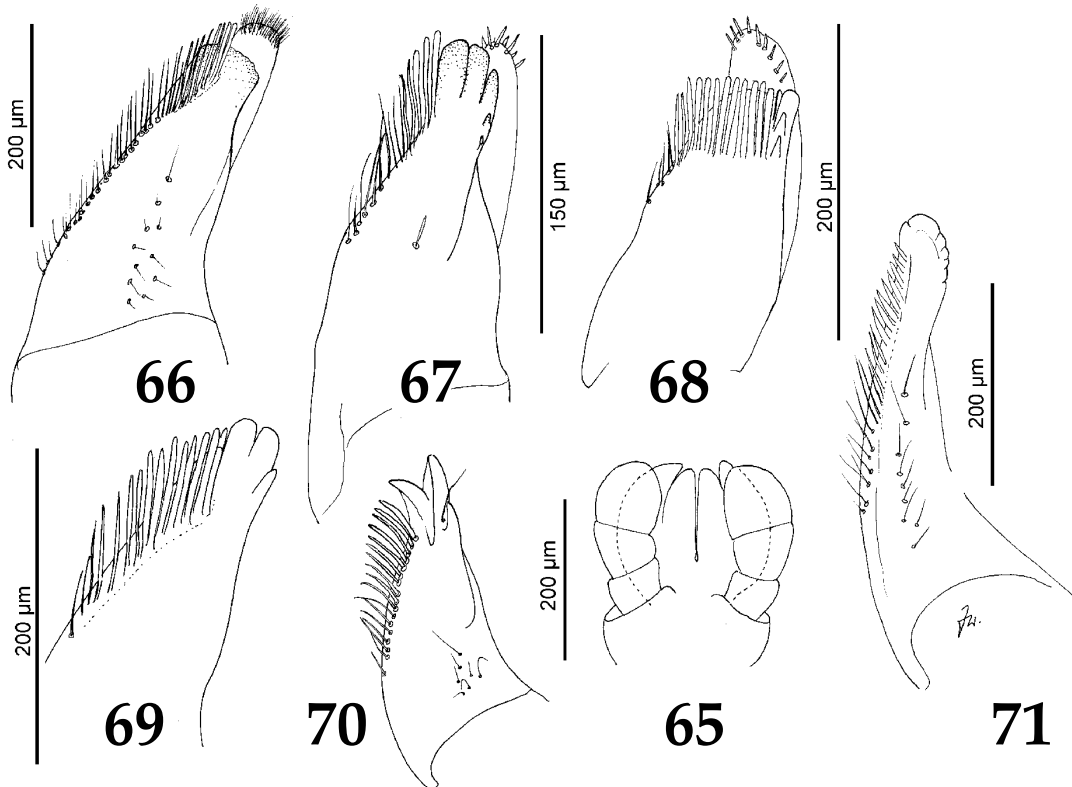


Fig. 55-60. Pilosity and chloride cells (57, 59; not to scale) in the paramedian area of tergite 8 of larval *Claudioperla tigrina* (55-57), *Rhithroperla rossi* (58, 59) and *Teutoperla brundini* (60). Figures 56, 58, 59 are to same scale.



Figs. 61-64. 61, *Rhithroperla rossi*, larval head; arrow marks prominent corners of clypeus. Pilosity on top of larval hind femur: *Rhithroperla rossi* (62), *Teutoperla brundini* (63), *Limnoperla jaffueli* (64); not to scale



Figs. 65-71, larval mouthparts. 65, *Limnoperla jaffueli*, ventral view of labium. 66-71, medial view of left lacinia, in 66-68 with apex of galea in the background; the dorsal face is to the left of each figure: 66, *Notoperla tunelina* (det. J. Illies; Cerro-Guido-Bach); 67, *Aubertoperla illiesi*; 68, *Limnoperla jaffueli*; 69, *Gripopteryx pinima* Froehlich; 70, *Ceratoperla fazi*; 71, *Alfonsoperla flinti*. Figures 65 and 70 are to the same scale.

- 24' Femora structurally simple; hair fringes present or absent 26
- 25 Slender narrow larvae of normal habitus, with long antennae and legs *Tupiperla* Froehlich
- 25' Stout larvae, thorax much widened, head set between anteriorly extended pronotal corners
..... *Guaranyperla* Froehlich
- 26 Stout larvae; body, perimeter of pronotum, scape, pedicel, and legs covered with small spine- or peg-like setae *Paragripopteryx* Enderlein spp.
We studied P. anga Froehlich, *P. blanda* Froehlich, *P. klapaleki* Enderlein, and *P. munoai* Benedetto.
- 26' Slender larvae 27
- 27 Aculeate setae cover body and edges of nota; wingless
..... *Falklandoperla kelper* McLellan
Falkland Islands only
- 27' No setation along edge of pronotum, hairs on body minute, often only visible under a compound microscope 28
- 28 Maxillary palpus 4-segmented, with long last segment; legs without hair fringes; cerci glabrous except for short apical whorls of setae (Figs. 55-57)
..... *Claudioperla tigrina* (Klapálek)
Pronotal and mesonotal pilosity (requires high magnification!) consists of setae with oval base tapering abruptly towards a much longer, filiform distal section. Setation on anterior abdominal segments similar, difference between wide base and flagellum-like apex of setae becomes successively less pronounced on posterior abdominal segments. Setae on TX almost unmodified. Intersegmental membrane with numerous floriform chloride cells on long pedicels. Integument finely shagreened, with isolated asperities.
- 28' Maxillary palpus 5-segmented; hair fringes on legs present but not obvious; one dorsal and one ventral seta in each apical whorl on cercus segments long, forming regular sparse vertical fringes 29
- 29 Frontoclypeal suture medially interrupted, frons forms little lateral bulges (Fig. 61); femur and tibia with single regular row of erect hairs; femur with very few minute spines along ventral edge (Fig. 62); marginal setae of abdominal segments very short, truncate, spatulate, very different from hairs on tergite; no chloride cells along tergal intersegmental membranes, the few spotted on thoracic membranes with much shorter pedicel *Rhithroperla*
(our material includes a mature male of R. rossi)
- 29' Frontoclypeal suture entire, clypeus completely separate from frons; hair fringe on femur plurilinear, dense, some short spines to outside of fringe (Fig. 60) also present, also on tibia; body hairs with thickened base and narrow apex, marginal setae a little larger but otherwise similar; shagreen consists of sparse isolated cuticular asperities; numerous chloride cells on tergal

intersegmental membrane, pedicel shorter than in *Claudioperla* *Teutoperla*
We studied pharate males of T. rothi Illies, 1963 and *T. brundini* Illies, 1963.

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