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Redescriptions of Some of Salmon's Isotomid Types

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ABSTRACT Type specimens of 12 species of Isotomidae described by Salmon were examined. The genus *Procerura* is redefined and *Papillomurus* is considered a synonym. Supplementary descriptions are give for *Womersleyella, Isotomedia, Tibiolatra, Setocerura* and two species described in *Proisotomurus.*

KEY WORDS Collembola / Isotomidae / New Zealand / taxonomy

Introduction

In the course of preparing keys to the world genera of Isotomidae we found it necessary to reexamine types of some of the genera described from New Zealand by the late John Salmon, in order to add characters not recognized as important at the time of the original description. In publishing this note we are following in the footsteps of Dr. Yoshii, who verified the identity of many uncertain species by redescriptions of the types. We wish here to acknowledge these two late colleagues, to whom all students of Collembola owe so much.

In the work which follows we accepted as valid genera which could be separated using present criteria (see Bellinger, Christiansen, Greenslade and Janssens: http://www.geocities.com/~fransjanssens/) and whose previous descriptions agreed sufficiently with the specimens we examined.

Procerura Salmon, 1941,

Type species *P. violacea:* Salmon 1941, Trans. R. Soc. N.Z. 70: 326 and

Papillomurus Salmon, 1941

Type species *P. fuscus:* Salmon 1941, Trans. R. Soc. N.Z. 70: 330

We had the opportunity of examining types of *Procerura fasciata, serrata, violacea.* and *purpurea* and *Papillomurus fuscus, ochraceus,* and *dissimilis. Procerura purpurea* and *violacea* as well as *Papillomurus ochraceus* would key out to *Papillomurus* in our original WEB page illustrated key to genera of Isotomidae; however the name *Procerura* has page priority in Salmon, 1941. These species do not have true papillate setae but the manubrial, dental, and most body setae have "glandular" bases as was noted by Greenslade (1989). They also all lack dental spines. The holotypes of *serrata* and

fasciata are immature and their position remains in doubt. The four species with adults also share the peculiar feature of having smooth bothriotricha-like setae (here called pseudobothriotricha) on the fifth and sometimes the sixth, but not third or fourth abdominal segments. Until others of Salmon's genera have been re-examined we do not feel safe in using this characteristic for generic distinctions. The only difference we could find between these two genera was that in the paratypes of *Procerura violacea* the anal valves project more than in *Papillomurus fuscus*; however, we feel this character also is inadequate to serve for generic separation. Thus we consider *Papillomurus* and *Procerura* to be synonyms, with the name *Procerura* having priority.

Redefinition of *Procerura* Salmon, 1941 (= ***Papillomurus* Salmon, 1941,** n. syn.)

General appearance *Isotoma* like. PAO distinct, simple and smaller to slightly larger than nearest eyes. Eyes 8+8. Antennae with clear simple truncate pin seta. Labral papillae gable-like. Unguis without or with 2 unpaired inner teeth. Unguiculus with a corner tooth. Tenent hairs varying from acuminate to clavate. Dens about twice as long as manubrium and tapered gradually, with clear dorsal crenulations but without spines. Mucro tridentate, sometimes with an extremely minute apical toothlet. Body setae mostly smooth; largest posterior setae sometimes sparsely ciliate. Fifth and sometimes sixth abdominal segment with long, very slender, slightly tapered smooth pseudobothriotricha. True bothriotricha absent. Most body and appendage setae with clear circular subcuticular "gland" structures.

***Procerura violacea* Salmon, 1941** Figs. 1 A-J

Procerura violacea: Salmon, 1941, Trans. R. Soc. N.Z. 70: 327

Color in life (according to Salmon) violet to purple black to slate colored. Pigment ranging from dark except for legs, furcula and intersegmental membranes, to uniformly pale. Bases of setae almost always with pale spots marking the position of the basal "glands". Pin seta of antenna well developed, simple and apically slightly truncate. No subapical organ seen. Fourth antennal segment clothed with short (0.009-0.018mm) acuminate curved setae, interspersed with straight to very weakly curved longer ($\approx$ 0.025mm) setae. Other segments with similar clothing but with longer setae. Antennae 1.43 to 1.67 times as long as cephalic diagonal. Average antennal segmental ratios as 1: 1.5:1.6: 2.1. First antennal segment without differentiated setae but with "glandular" bases, particularly clear on dorsal surface. PAO oval, clear and distinctly smaller than nearest eye. Labral papillae tent or gable-like. Hind tibiotarsus with two outstanding smooth setae, much longer than others. Ungues with small, narrowly separated, basal lamellae united at small tooth and with one additional unpaired tooth. Unguiculus with a distinct inner tooth. Tenent hairs 2-3-3, ranging from distinctly to faintly clavate. Tenaculum seen on only one specimen, apparently with 8 setae on the corpus. Anal valves on sixth abdominal segment with distinct posterior extensions. Manubrium

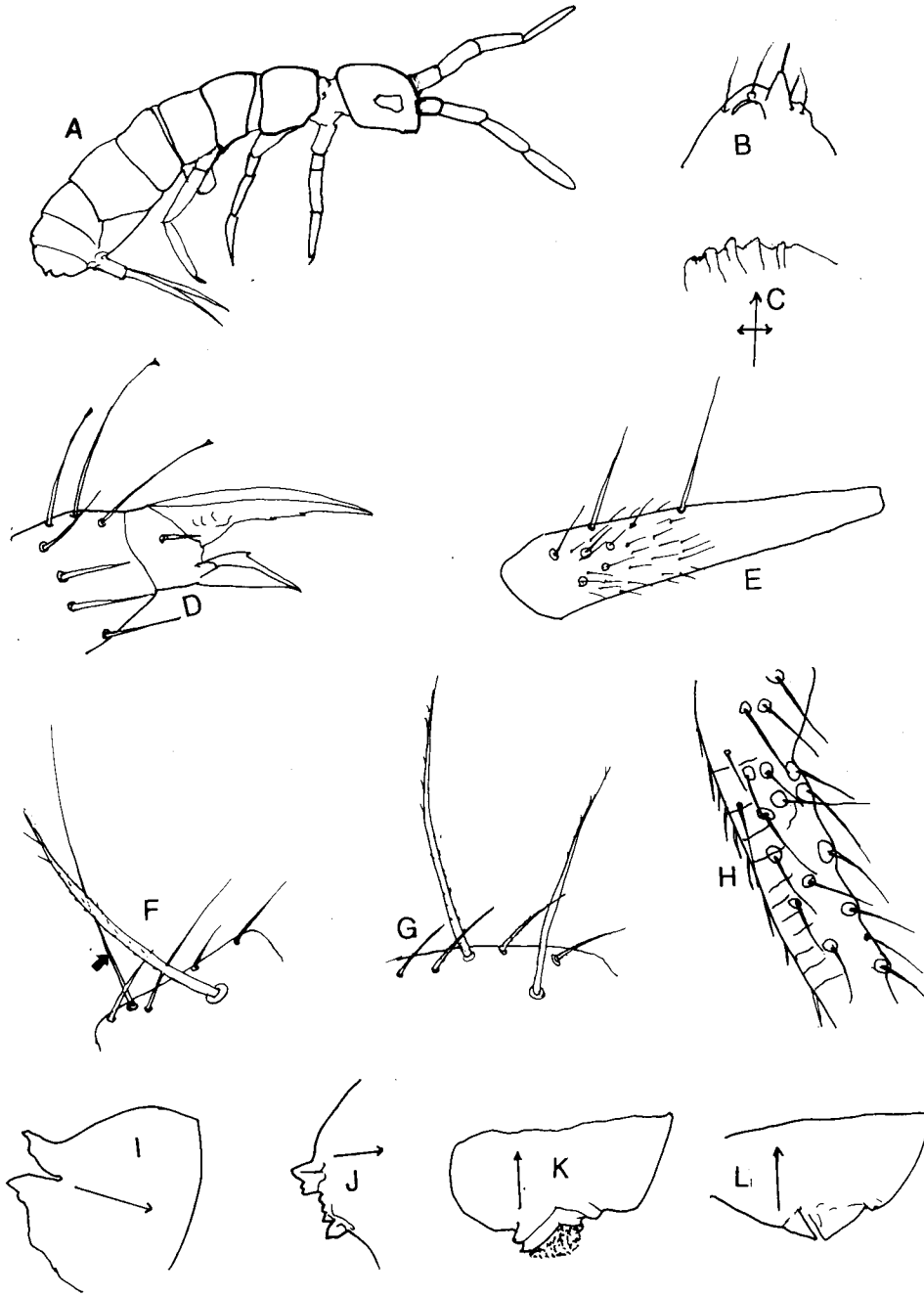

Fig. 1. *Procerura violacea* Salmon: A, habitus; B, apex of antenna; C, labral papillae, seen from above; D, hind foot complex; E, hind tibiotarsus; F, dorsal edge 4th abdominal segment, arrow shows pseudobothriothrix; G, dorsal edge of 5th abdominal segment, arrow showing pseudobothriothrix; H, dorsal surface base of dens, showing basal "glands"; I, J, anal valves.
Procerura fusca Salmon: K, L, anal valves. All figures of paratypes.

without any unusually heavy or spine like setae. Dens tapering gradually and with clear dorsal crenulations, 1.9-2.2 times as long as manubrium. Smaller dental setae straight but larger ones are slightly curved. No spines or spine like setae present. Mucro tridentate with basal teeth varying from side by side to one slightly in back of the other. Head and body setae mostly smooth and acuminate. Common body setae weakly curved and varying from 0.018 to 0.06 mm. Larger (> 0.06mm) setae on anterior body straight; mostly curved on posterior parts, largest with very sparse ciliations. Fifth and sometimes sixth abdominal segments with long, very slender, slightly tapering, straight or slightly curved pseudobothriotricha. Almost all setae with clearly demarcated circular subcuticular areas usually called glands. On the dens and sometimes the manubrium distinctly distorting the cuticular surface, forming small humps.

Specimens seen: 4 paratypes: 3/522 Huiaru Range 32000' 6-XII-1937; 3/521 Marui valley, 9-II-1940; 3/520 Butterfly creek, 14-X-1937; 3/519 Akatarawa 1400' 11-VII-1937.

Remarks The subcuticular "glands" are very striking and easy to see. The mucro shows considerable variation in structure. There is much variation in the segmentation of the parafurcular lobes and on one specimen the 4th abdominal segment appears to be subdivided. On another specimen a pseudobothriothrix can be seen on the sixth abdominal segment as well as the fifth. The distribution of pigment differs on each of the four paratypes we saw.

We also studied other species of *Procerura* and *Papillomurus*, and notes concerning these are given below.

Procerura purpurea Salmon, 1941,

Procerura purpurea: Salmon, 1941, Trans. R. Soc. N.Z. 70: 328

This is very similar to *P. violacea* but lacks clearly clavate tenent hairs and ciliate body setae. Salmon describes it as having a single clavate tenent hair but while there is a single long tenent hair the tip is questionably truncate to slightly clavate. It also appears to have only one outstanding seta on the hind tibiotarsus.

Specimen seen: Holotype.

Procerura serrata Salmon, 1941

Procerura serrata: Salmon, 1941, Trans. R.S.N.Z. 70: 329

The single specimen seen is immature. It appears to have a short pseudobothriothrix on the first abdominal segment but none on the fifth or 6th segments. There are no clavate tenent hairs or inner ungual teeth. The larger setae on the posterior abdomen are clearly though sparsely ciliate.

Specimen seen: Holotype.

Procerura fasciata Salmon, 1941

Procerura fasciata: Salmon, 1941, Trans. R. Soc. N.Z. 70: 329

The single specimen is immature. It lacks glandular setae, clavate tenent hairs and pseudobothriotricha. It also lacks a clear unguiculus corner tooth. It is probably a member of the genus *Desoria.*

Specimen seen: Holotype

Procerura fusca (Salmon, 1941), **n. comb.** Fig. 1 K & L

Papillomurus fuscus: Salmon, 1941, Trans. R. Soc. N.Z. 70: 331

This species is very similar to *Procerura violacea.* It has weakly clavate tenent hairs, toothed unguiculus, and very weak inner ungual teeth but clear "glandular" seta bases, 2 outstanding setae on hind tibiotarsus, 3 mucronal teeth and pseudobothriotricha on the 5th abdominal segment. It lacks ciliate setae on the body. The corpus tenaculi was not seen.

Specimens seen: 3 paratypes: 3/503 Haast Pass, summit, 1-I-1940; 3/504 Waiha Gorge 19-II-1940; Opepe bush Taupo, 24-II-1939.

Procerura ochracea (Salmon, 1949), **n. comb.**

Papillomurus ochraceus: Salmon, 1949, Dept. sci. indust. Res. Cape Exped. Ser. Bull. 4: 27

This species is very similar to *P. fusca.* It differs in lacking internal ungual teeth. The apical toothlet described by Salmon could be seen unilaterally on only 2 of the four specimens. The corpus tenaculi has 11-12 setae.

Specimens seen: 4 paratypes: 3/1919, 3/1967 Campbell Island, 1943; 3/1942 Campbell Island, Soutrh coast below Mt. Dumas, 7-XI-1945; 3/1980 Campbell Island, Tucker cove, 29-IV-1945.

Procerura dissimilis (Salmon, 1944), **n. comb.**

Papillomurus dissimilis: Salmon, 1944, Rec. Dominion Mus. 1: 146

This species is very similar to *Procerura purpurea* and may be a synonym. The single long tenent hair is weakly clavate but given the variation in this seen in *Procerura violacea* this is a weak separation. *P. dissimilis* has two outstanding hind tibiotarsal setae, and on this basis the two species could be considered distinct.

Specimens seen: 1 paratype: 3/1333 D'Urville island. 3-XI-1942.

Supplementary descriptions for *Womersleyella niveata, Isotomedia triseta, Tibiolatra latonigra* and *Setocerura rubenota.*

Salmon's figures and description are generally accurate. In the descriptions below

we deal with structures where observations differed from Salmon's or where we saw features he did not describe or figure.

Womersleyella Salmon, 1944. Monobasic.

Womersleyella niveata: Salmon, 1944, Rec. Dominion Mus. 1: 142. Fig. 2 A-C

Fourth antennal segment as described and figured by Salmon, except that we could only see 3 thickened setae in the posterior half. No pin seta was seen. Labral papillae unique, 3 in number, elongate and apically with ciliate expanded tips. Prelabral setae difficult to see but apparently all smooth. Maxillary palp with 4 prelobal hairs and an unusual number of setae on the dorsum of the lobe. Head (and body) with numerous spherical bodies just below integument which can easily be mistaken for eyes. Ventral surface of head unclear. Unguis and unguiculus as described by Salmon except that small basal setae are present on the pre-unguis. The tenent hair is acuminate on five legs and has what appears to be a small piece of debris on the sixth. The ventral tube has 5+5 setae on the distolateral lobes and six setae on the anterior face, all smooth. The posterior face could not be clearly seen. Tenaculum with 2 setae on corpus. Chaetotaxy of thorax and abdomen obscured by gut contents and spherical inclusions except for 4th-6th abdominal segments. These as well as other body segments are covered with acuminate, smooth, straight or slightly curved setae, 0.01 to 0.02mm in length, with a few on the fifth and sixth segments reaching 0.03mm. In addition the fourth segment has a pair of erect slender 0.04 mm long median setae resembling the pseudobothriotricha of other New Zealand Isotomidae. The 4th and 5th abdominal segments have blunt, cylindrical, "sensory" setae. The 4th segment has 2+2 short (0.01mm) such setae in the posterior row; the 5th segment has 1+1 in the posterior row and 2+2 such setae, 0.036 mm long, in front of this row. These can be seen clearly on the left side which is on the upper surface of the mount (see Fig. 2C) but only one can be seen on the right surface. The chaetotaxy of the furcula differs from that described and figured by Salmon; the dorsolateral surface of the manubrium has about 12 setae and the ventral surface has a distal row of 6 and two small median setae. The dens has 11 ventral setae and 5 dorsal setae. The mucro is as shown by Salmon.

Specimen seen: Holotype.

Remarks: Apparently only the single type specimen exists (although Salmon says "Length up to 1.2mm"). Salmon notes a number of plates on the dens; however what exists is a darkened band along the ventral surface of the dens. More specimens would be required to determine its character. The specimen is an adult female; however the lateral view of the animal prevents us from seeing much detail on the genital opening. The peculiar labral papillae are evocative of these seen in some Neelidae and unlike anything we have seen in the Isotomidae.

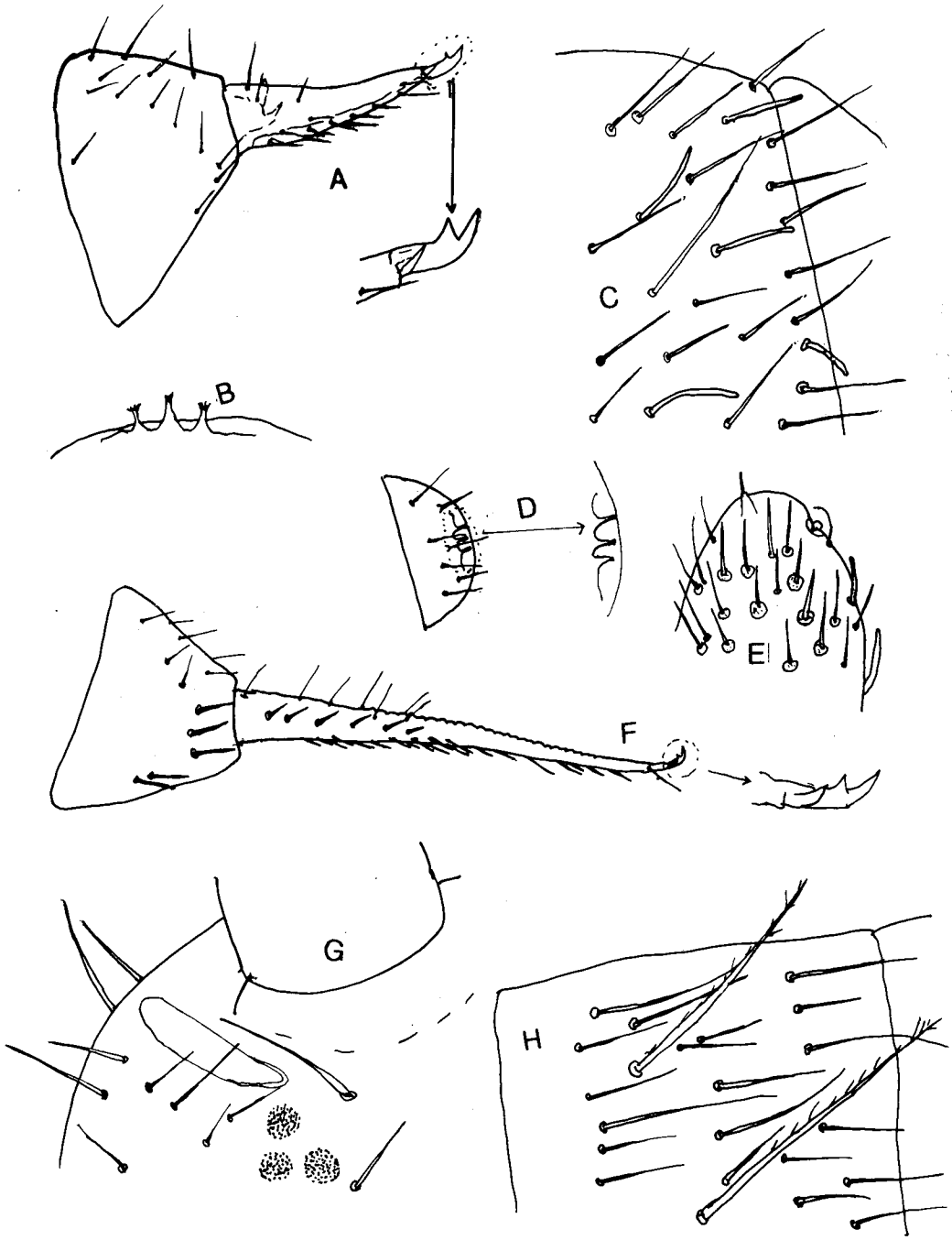

Fig. 2. *Womersleyella niveata* Salmon: A, furcula, seen from side, enlargement showing basal tooth; B, labral papillae; C, right half dorsum 5th abdominal segment. *Isotomedia triseta* Salmon: D, labrum and labral papillae; E, apex of antenna, showing basal "glands"; F, manubrium, inner surface of right dens and mucro; G, region of antennal base, left side; H. Right half of dorsum 4th abdominal segment. All figures of holotypes.

Isotomedia Salmon, 1944. Monobasic

***Isotomedia triseta*:** Salmon, 1944, Rec. Dominion Mus. 1: 148, Fig. 2 D-H

Fourth antennal segment and apex of third segment as shown by Salmon except that there is a small simple acuminate pin seta. Most antennal setae have subcuticular "glands" which have no surface swelling. Labral papillae three, similar to those seen in *Womersleyella* except not so expanded apically and with the basal portion of the labrum extending beyond them. Labral setae 4-5-4, and 4 prelabral setae, all smooth. The anterior row of labral setae and the mid seta of the second row are set on strong papillae; the latter seta is advanced to between the line of the first and second rows. The P.A.O. is as shown by Salmon; however 2+3 of what appear to be vestigial eyes, in the form of colorless corneae, can be seen just below the surface of the cuticle. Body setae mostly smooth and acuminate, ranging from .02 to .15 mm in length. On each abdominal segment there are 2-4 coarsely unilaterally serrate large setae and a few additional very weakly serrate large setae. No thin walled or blunt setae were seen. Fifth and sixth abdominal segments completely fused. Ventral tube with 4+4 distolateral setae, 2 posterior and 4 anterior setae, all smooth and acuminate. Tenaculum unclear but with few (probably 4) setae. Manubrium dorsally unclear but probably with 7+7 or 8+8 setae; ventrally with a distal row of 3+3 slender spines and 3 (probably normally 2+2) medial somewhat longer ones. Dens with many ($\approx$ 30) ventral, short acuminate setae, the longest being the distalmost ones and six inner dorsal slender spines on basal half.

Specimen seen: Holotype.

Remarks: The body of the single specimen is locally obscured by gut contents or fat bodies making description of chaetotaxy incomplete. The "eyes" we saw are not typical corneae, since they lie below the cuticular surface; they might easily be overlooked. At first we thought they were internal inclusions, but their occurrence on both sides of the head in the same position, where eyes would normally occur, make it probable that they are eye vestiges. The spines on the dens and more particularly on the manubrium are sufficiently long and slender that they might be considered as setae. Salmon describes all setae as serrate or ciliate but the great majority are smooth. He also correctly describes the fifth and sixth abdominal segments as fused, while his illustration shows them as separate. The labral papillae of both this genus and *Womersleyella* could be the expanded tops of very narrow labral folds, but a side view of a specimen would be needed to determine this.

Tibiolatra Salmon, 1941 Monobasic.

***Tibiolatra latronigra*:** Salmon, 1941, Trans. R. Soc. N.Z. 70: 320, Fig. 3 A-H

Pigment as shown and described in Salmon except that no lateral pigment is seen on the third through the fifth abdominal segments. Fourth antennal segment not subdivided but with weak annulations, marked by irregular paler bands on the distal 1/3;

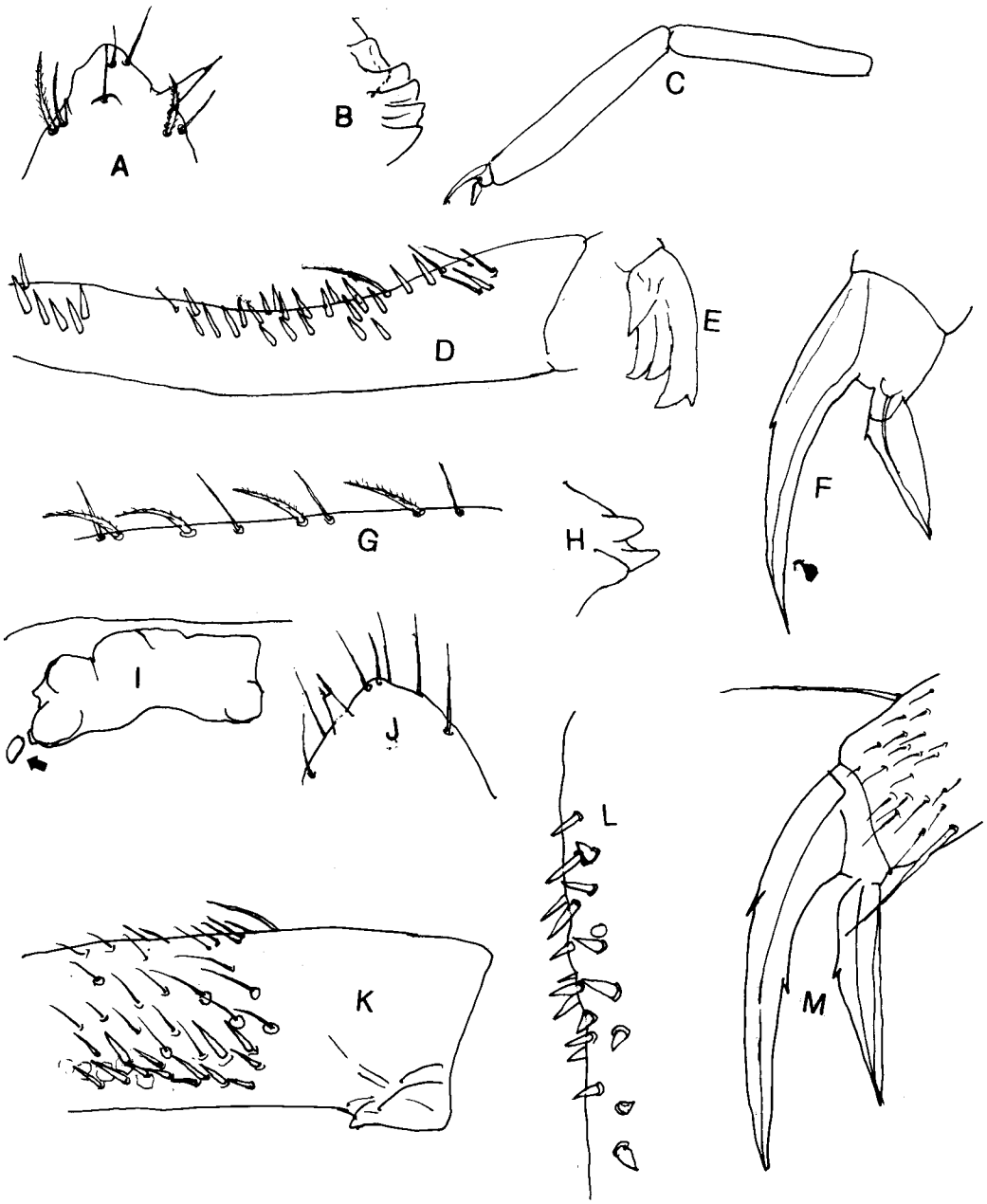

Fig. 3. *Tibiolatra latonigra* Salmon: A, apex of antenna; B, labral papillae; C, hind femur, tibiotarsus and claw; D, dental spines; E, mucro (angled); F, hind unguis and unguiculus; G, setae along margin of 4th antennal segment; H, anal valves. All figures of holotype.
Setocerura rubenota Salmon: I, left eyepatch and PAO (at arrow); J. tip of antenna; K, base of left dens; L, dental spines of another specimen; M, hind foot complex. All figures of type specimens.

with a strong simple pin seta. Setae not in clear whorls and on the third and fourth segments consisting of short (≈ 0.018mm), stout curved unilaterally ciliate setae and interspersed slender slightly longer straight smooth setae. Similar but somewhat longer setae are present on the basal two segments. Antennal base clearly separated from the head, looking like a small basal antennal segment. Labral papillae arched and roof like. Eyepatches large, but we could not see how many eyes were present. PAO unclear but apparently small, as shown by Salmon. Head clothed with numerous small (0.008-0.025mm) setae similar to those on the antennae, and a number of somewhat larger acuminate, ciliate curved setae (0.05mm) near the posterior margin and a single posterior row of larger (0.15mm) setae. Thorax and first 3 abdominal segments clothed mostly with similar short setae and somewhat larger (0.06-0.10mm) similar setae posteriorly. Abdominal segments 4-6 with common setae similar to those on other segments but longer (0.03-0.05mm). Larger (0.07-0.13mm) similar setae scattered over fourth abdominal segment. Fifth segment with a pair of posterior macrochaetae (only insertions seen). Hind trochanter with numerous inner short straight smooth setae, evocative of trochanteral organs. Tibiotarsi of mid and hind legs slightly thicker than femora; hind tibiotarsi with long (0.2mm), straight smooth setae, an anterior row of 4 and a posterior row of 2 (seen only as setal bases). Somewhat shorter similar setae are seen on the inner face. No setae seen on the corpus of the tenaculum, but a single apical seta base was seen. End of the abdomen with short papillate projections from the anal valves. Dentes with clear spines in 1-4 irregular rows. Mucro with 4 large teeth and a small apical tooth; the three apical large teeth have clear lamellae.

Specimen seen: Holotype.

Remarks: Salmon uses as generic characteristics the enlarged tibiotarsi and annulate antennae. As Greenslade noted (1989), neither feature is usable. The tibiotarsi are only slightly thicker than the femora and the antennal annulations are unclear. The single known specimen is the holotype and the mucrones are at such an angle that the clear picture shown by Salmon cannot be seen. They have more than one lamella and this plus the heavily ciliate antennal and body setae allow an easy separation between this genus and *Setocerura.*

Setocerura Salmon, 1949

Setocerura: Salmon, 1949, Dept. sci. indust. Res. Cape Exped. Ser. Bull. 4: 33. Type species *Tomocerura rubenota: Salmon,* 1941

Setocerura rubenota: Salmon, 1941, Trans. R. Soc. N.Z. 70: 325. Fig. 3 I-M

Antennae with strong pin seta of type 1 (see Christiansen & Bellinger, 1998, Fig. 645A), with truncate apical seta and distinct lateral basal spinule. Apical two thirds of fourth antennal segment clothed with small (≈ 0.016mm) curved, acuminate, stout smooth setae and with scattered slender straight somewhat longer (≈ 0.025mm) setae; basal one-third of segment with somewhat longer curved setae (0.020-0.029mm).

Segments 1-3 with more varied setae, progressively longer toward base; longest setae on first to third segments; 0.11, 0.09 and 0.055 mm, respectively. Head and body densely clothed with similar short smooth setae, on head and thorax ≈ 0.02mm and somewhat longer on abdomen (0.037-0.05mm). Smooth acuminate mostly straight macrochaetae (0.20-0.33mm) occur on head and all body segments. Labral papillae not clearly visible but they appear to be arched. PAO very small and close to anterior edge of eyepatch. Dental spines stout, short and straight, in holotype and single large paratype, in 3-4 rows basally and 1-2 rows distally. They cover the basal 1/2 to 2/3 of dens. Small specimens with two rows basally and one distally. Many spines and some setae of dens, but not manubrium or body, with distinct "glandular" bases. Tenent hair long and acuminate to very weakly truncate.

Specimens seen: Holotype and four **paratypes**: 3/510, Lake Brunner, 2-II-1940 (figured paratype); 3/511, Weheka, 17-III-1940; 3/513, Lake Ianbhe, 20-II-1940; 3/516 Type locality.

Remarks: Salmon indicates that there are, on abdominal segments 3-6 "several long setae irregularly and exceedingly coarsely ciliated". We found no such setae; however, there are a number of setae so positioned that the short setae underlying them give the appearance under low magnification that they are very heavy ciliations. Salmon also mentions dorsal ciliate setae on the dens; however we saw no such setae. The type series we saw probably includes several species. The holotype and large paratype (slide 3/510, used by Salmon for his drawings) are here considered the same species. The antennal ratios and head-antennae ratios are slightly different from those described by Salmon, being approximately 1-2-2-3 and 1- 2.7 respectively. A small paratype from the type locality is basically similar except for relatively shorter antennae (1-2.1). A third small paratype (slide no. 3/513) has very different antennal ratios (1-1.7-1.6- 2.3) but is otherwise similar. The fourth paratype (slide 3/511) is large and very different, lacking any visible pin seta. The type 1 pin seta in the main series is unique among the New Zealand Isotomidae we have seen. It is problematic which of the non New Zealand species which have been placed in *Setocerura* are in fact members of this genus.

Proisotomurus Womersley, 1934

Type species *Proisotomurus papillatus* Womersley, 1934, Trans. R. Soc. S. Australia 54: 93

The genus *Proisotomurus* was created by Womersley for species resembling *Isotomurus* but with spined dentes. Greenslade (1989) examined the type series of *P. papillatus*, discovered that they had no dental spines, and thus synonymized the genus with *Isotomurus*. Salmon has described 5 species of the genus from New Zealand and the Campbell Islands. We examined types of two of these species and discovered that they too lacked dental spines and basically fell within the generally accepted definition of *Isotomurus*.

Isotomurus lineatus (Salmon), 1941, **n. comb.** and
Isotomurus novaezealandiae (Salmon, 1941), **n. comb.**

Proisotomurus lineatus: Salmon, 1941, Trans. R. Soc. N.Z. 70: 322
P. novaezealandiae: Salmon, 1941, Trans. R. Soc. N.Z. 70: 321

Specimens seen Four paratypes each-*P. lineatus*: 3/476 & 477 Waikaremoana, 4-II-1939; 3/480 Kelburn, 17-X-1937; Newberry, 6-IX-1933. *P. novaezealandiae*: 3/492 & 3/493 Lake Rotamahana, 20-XII-1937; 3/496 Lake Waikaremoana, 4-II-1937; 3/558 Akatarewara, 27-II-27 1938.

Remarks: Deharveng and Lek (1993) extensively modified the taxonomy of this genus and most importantly used the chaetotaxy of the fifth abdominal segment as a taxonomic tool. Christiansen & Bellinger (1998) followed this system in their treatment of Nearctic members of the genus. Neither New Zealand species we examined had recognizable sensory setae on the fifth abdominal segment. This characteristic separates these species from any studied by either Deharveng & Lek or Christiansen & Bellinger. Further study is required to determine whether or not the generotypic Australian species of *Proisotomurus* also lacks these setae. Since all the other features of the genus *Isotomurus* are found in the two New Zealand species of *Proisotomurus* the generic status of these forms remains in doubt. The characteristic states typical of *Isotomurus* found in the two studied species are shown below (see Christiansen & Bellinger 1998 for character types).

Character	*I. lineatus*	*I. novaezealandiae*
PAO/nearest eye	≈	< ≈
Tenaculum corpus setae	18	?
Ventral tube distolateral setae	6	6
Inner unguis/basal width	2.7 – 3.2	≈ 3.0
Unguiculus tooth	+	–
Dental dorsum type	B – D	B
Mucro seta	–	–
Mucro lamellae	–	–
Common body setae	smooth	smooth
Outstanding metatibiotarsal setae*	3	2*

*This is the condition seen in the specimens showing the largest number of such setae.

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