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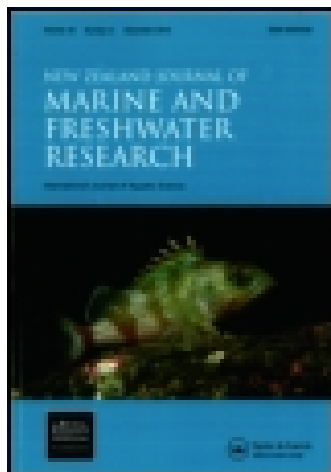
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## New Notodelphyidae (Copepoda: Cyclopoida) from New Zealand solitary ascidians

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The male of *Doropygus platythorax* Jones, 1974 and two new species of *Doropygus* (*D. louisae* and *D. spinosus*) are described and illustrated. The specimens of *Doropygus* described by Schellenberg (1922) as *D. pulex* are assigned to the new species *D. louisae*. Specimens of *Ophioseides* (*Scolecimorpha*) *joubini* described by Schellenberg (1922) have been re-examined together with fresh material, and have been described as a new species, *Ophioseides schellenbergi*.

### INTRODUCTION

The Notodelphyidae are a family of cyclopod copepods usually associated with Tunicata. Although they are very common in New Zealand, the only published information on local species is found in Schellenberg (1922), Stephensen (1927), and Jones (1974).

Schellenberg (1922) described four species from New Zealand waters: *Doropygus novaeseelandius*; *Doropygus pulex*; *Doropygus trisetosus*, and *Ophioseides joubini* Chatton.

In Stephensen (1927), Schellenberg redescribed *D. trisetosus*. On the basis of Schellenberg's description, Illg (1958) reclassified *D. novaeseelandius* and *O. joubini* as *Pygodelphys novaeseelandiae* and *Scolecimorpha joubini* respectively. Bocquet & Stock (1961) returned *S. joubini* to the genus *Ophioseides*. Jones (1974) redescribed *Pygodelphys novaeseelandiae* and described a further two species, *D. oropygus platythorax* and *D. globosus*, all from Wellington Harbour, New Zealand.

This paper describes further specimens from the 1974 material and from additional material collected around Wellington Harbour and the Marlborough Sounds. Specimens were dissected and examined in Berlese mountant, using phase contrast illumination. All drawings were prepared with the aid of a camera lucida.

### Family NOTODELPHYIDAE Dana, 1853

After this manuscript had been submitted for publication, Prof. Paul Illg (University of Washington, Seattle) made the following comment, published here by permission.

"The family Notodelphyidae may not be attributed to Allman, 1847. He published only the generic name. Baird (1850, p. 237) stated that "*Noto-*

*delphys* must form the type of a new family". He placed the genus following the family Cetochilidae and did not expressly cite a family name for *Notodelphys*. Dana (1853, p. 1443) placed *Noto-*  
*delphys* in the Notodelphyinae in his treatment.

The International Code of Zoological Nomenclature does not make a specific statement on just this situation. The many stipulations regarding formation and publication of taxonomic names seems to me to indicate the assumption a name does not exist until it is published. On this basis I prefer to date the Notodelphyidae and Notodelphyinae from Dana, 1853".

### Genus *Doropygus* Thorell, 1859

#### *Doropygus platythorax* Jones, 1974

##### ADULT MALE (Fig. 1)

MATERIAL EXAMINED. Nine ♂♂ from *Cnemidocarpa nisiotis* Brewin dredged from 15 m depth off Ward I., Wellington Harbour (41°10'S, 173°55'E) 15 Mar 1972. All specimens in author's collection.

DESCRIPTION. Length 1.057-1.424 mm. Body cyclopoid (Fig. 1a), prosome 5-segmented, consisting of head and thoracic somites of legs 1-4. Urosome 5-segmented consisting of genital segment and 4 abdominal segments. Caudal rami with reduced ornamentation. Antennule shape similar to ♀, setal formulae 3, 15, 6, 4, 4, 4, 2, 2, 5. No aesthetes. Antenna, mouthparts, as female. Legs 1-5 (Figs. 1b-f) resemble ♀ in segmentation and ornamentation but setae shorter more spinose. Leg 6 (Fig. 1g) represented by 2 small setae on margin of genital segment. Caudal ramus tapers, basal width twice that at tip, length 6 × basal width, 2.25-2.40 × length of terminal segment.

DISCUSSION. Males of *Doropygus* are cyclopoid in shape. They are either free-swimming or are too nimble to be readily caught with ascidians, so are found infrequently, and many species are still undescribed. Sexual dimorphism is more apparent in some species of *Doropygus* than others. In *D. platythorax* the appendages of male and female (Jones 1974) are similar except in minor details of ornamentation.

*Doropygus spinosus* n. sp.

ADULT FEMALE (Figs 2 & 3)

MATERIAL EXAMINED. Six specimens from 2 of 13 *Asterocarpa cera* Sluiter dredged off Ward I., Wellington Harbour (41°10'S, 173°55'E), Feb. 1972, by H. Rotman.

**Holotype** (Z.Cr.2195) and two **paratypes** (Z.Cr. 2196-7) deposited in the National Museum of New Zealand, Wellington. Remaining three paratypes in author's collection.

DESCRIPTION. Body cyclopoid (Fig. 3a). Length of prosome 1.375 mm (0.925-1.950 mm); length of urosome 0.832 mm (range 0.602-1.400 mm). Greatest width 0.475 mm (range 0.307-0.602 mm) based on 5 specimens in 70% ethanol. Prosome 5-segmented, consisting of head, 3 well-developed thoracic somites bearing legs 1-3, and 4th metasome segment expanded into large broodsack bearing legs 4-5. Urosome 5-segmented.

Rostrum (Fig. 2a) triangular, drawing to fine point at apex.

Antennule (Fig. 2b) 9-segmented, elements compact; Setal formula 3, 16, 5, 5, 4, 4, 1, 3, 7.

Antenna (Fig. 2c) 3-segmented; segments 1 and 2 without ornamentation; segment 3 bears seta on inner margin, 3 setae on apex near base of single curved claw, 2 setae below base of claw.

Mandible (Fig. 3b) biramous; masticatory plate with 6 tooth-like projections, all on distal margin; basipodite bears seta on inner margin; expodite bears 5 setae, 5th reduced; endopodite 2 segmented, basal segment bears 4 setae on distal margin, terminal segment rectangular, 4 setae on apex, and 6 on distal margin.

Maxillule (Fig. 2d) protopodite bears long stout seta and short seta on small lateral projection; 2 medial projections—proximal, well developed, bears 9 setae on medial margin, distal bears short spine; protopodite produced at apex, bears 3 setae, expodite 1-segmented, bears 4 setae, endopodite 1-segmented, bears 3 setae.

Maxilla (Fig. 2e) stout, 5-segmented; basal segment large, bears 4 setiferous lobes on medial

margin, setation of lobes (from base) 3, 1, 2, 2; segment 2 bears 2 medial setae and short spine; segments 3 and 4 each bear 1 seta; terminal segment bears 4 setae on apex.

Maxilliped (Fig. 2f) 2-segmented, basal segment bears 9 setae in 2 groups, 5 proximally and 4 distally; terminal segment bears 2 setae and group of fine setules.

Legs 1-4 (Figs 3c-f): Spine and setal formula as follows (Arabic numerals = setae, Roman numerals = spines).

P <sub>1</sub>	coxa 0-1	basis 1-I	exp. I-1, I-1, IV-4 end. 0-1, 1-1, 0-5
P <sub>2</sub>	0-1	1-0	exp. 1-1, 1-1, 4-5 end. II-1, II-2, 3-3
P <sub>3</sub>	0-1	1-0	exp. 1-1, 1-1, 4-5 end. II-1, II-2, 3-3
P <sub>4</sub>	0-1	0-0	exp. 0-1, 0-2, 3-4 end. II-1, II-2, 3-2

The spines indicated on the endopodites of legs 2-4 are spinous processes of the segment and not the usual spines such as are found on leg 1.

Leg 5 (Fig. 3g) 2-segmented; basal segment fused to urosome with row of fine setules below terminal segment; terminal segment free, elongate, width: length ratio 1:4.4, bearing 2 short setae on apex.

Caudal ramus (Fig. 3h) width: length ratio 1:5.6, 2 setae on outer margin as figured; apex with 4 setules.

ADULT MALE unknown.

The name *spinosus* refers to the spiny legs.

DISCUSSION. The only other described species of *Doropygus* without a hook on the second maxilla segment but with a maxillular expodite bearing 4 setae and endopodite bearing 3 setae are: *D. kerguelensis* Schellenberg, 1922; *D. trisetosus* Schellenberg, 1922; *D. rigidus* Ooishi, 1962; *D. elegans* Ooishi, 1963; *D. platythorax* Jones, 1974.

*D. rigidus* and *D. platythorax* have strongly depressed carapaces, and both have only nine setae on the terminal segment of the mandibular endopodite. The "obtusely triangular" rostrum of *D. rigidus* was unfortunately not illustrated by Ooishi (1962). The rostrum of *D. platythorax*, although not described by Jones (1974), was found, upon consulting the holotype, to be a heavily chitinised arc. The rostrum of *D. elegans*, a "semi-circular lobe" (Ooishi 1963) is perhaps better described as parabolic. These are all different from the sharp dagger-like rostrum of *D. spinosus*, which differs further from the above species in possessing prominent spines on the endopodite joints of the legs.

*D. spinosus* closely resembles *D. trisetosus* and *D. kerguelensis* as summarised on page 538.

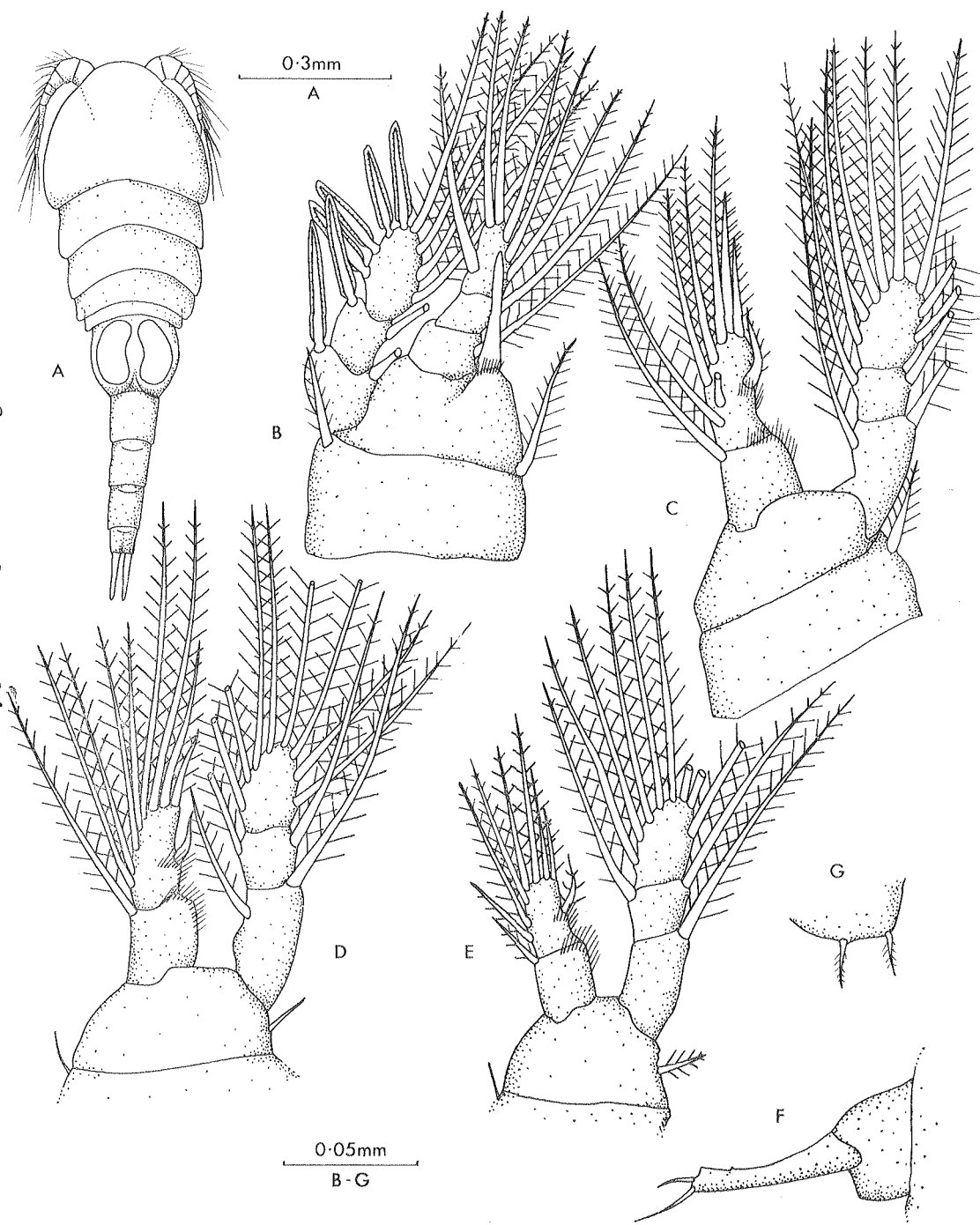


Fig. 1. *Doropygus platythorax*, ♂: (A) dorsal view, (B) leg 1, (C) leg 2, (D) leg 3, (E) leg 4, (F) leg 5, (G) leg 6

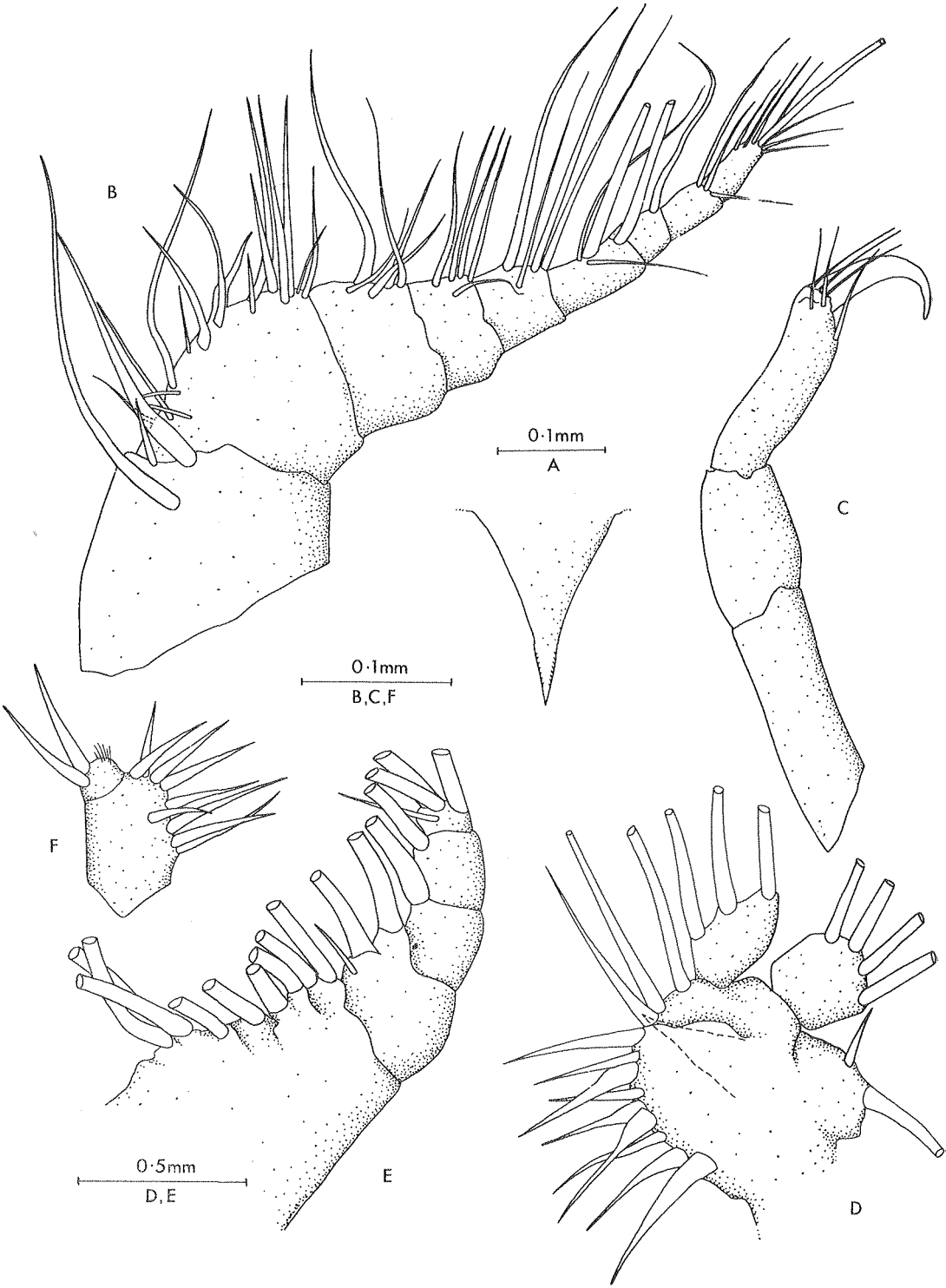


Fig. 2. *Doropygus spinosus* n.sp., ♀: (A) rostrum, (B) antennule, (C) antenna, (D) maxillule, (E) maxilla, (F) maxilliped.

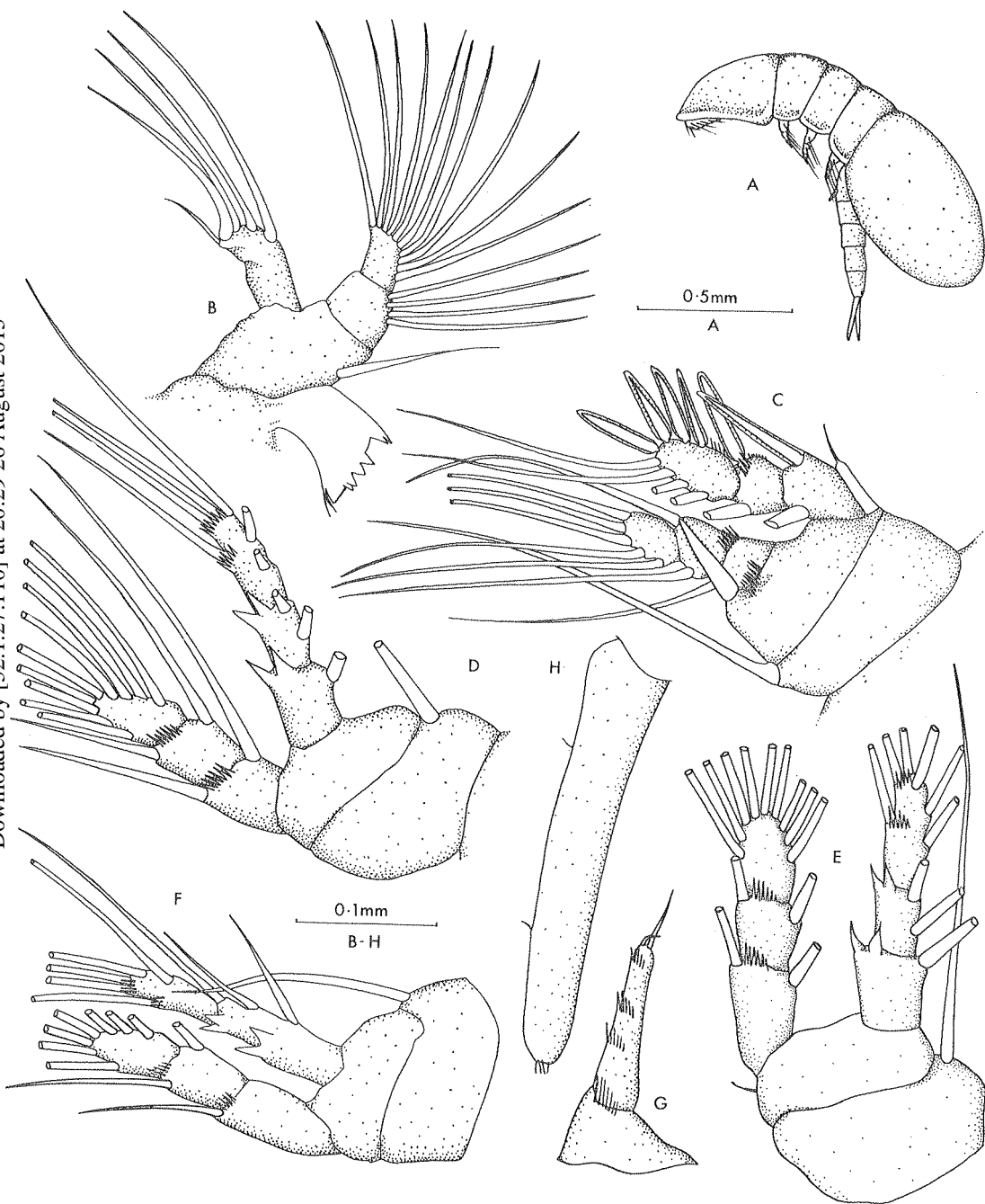


Fig. 3. *Doropygus spinosus* n.sp. ♀: (A) left lateral view, (B) mandible, (C) leg 1, (D) leg 2, (E) leg 3, (F) leg 4, (G) leg 5, (H) caudal ramus.

	<i>trisetosus</i>	<i>spinosus</i>	<i>kerguelensis</i>
length (mm)	1.8–3.5	1.5–3.3	3.7
antennule setae	9	9	?
mandible exp. setae	4	4½	4½
mandible end. setae	9	10	?
caudal ramus setae	1	3	4
leg endopodites	bimerous	tri- merous	?
spines on endopodites	yes	yes	not recorded
ratio caudal ramus to terminal urosome segment	3:2	2:1	2:1

*Doropygus kerguelensis* was described by Schellenberg (1922) as a subspecies of *D. trisetosus*. Illg (1958) raised *D. kerguelensis* to specific rank, and this has been accepted by subsequent authors. Inquiries at the Zoologisches Museum, Berlin (recorded as the type repository) and the Zoologisches Institut und Museum, Hamburg, have failed to locate the type. The status of *D. kerguelensis* must therefore remain doubtful until further specimens are recovered.

The two syntype specimens of *D. trisetosus* are kept in the Zoologisches Institut und Museum, Hamburg (K-14772). Both are in good condition, and both were examined. The total lengths were 2.06 mm and 1.63 mm. The endopodites were 2-segmented as described, but did have small spines similar to those of *D. spinosus* though smaller and more numerous. The rostrum was an equilateral triangle, quite distinct from that of *D. spinosus*. The presence of only one seta on the caudal ramus was confirmed.

*Doropygus louisae* n.sp.  
ADULT FEMALE (Figs 4 & 5)

MATERIAL EXAMINED. 31 specimens collected from *Pyura cancellata* Brewin, Elie Bay, Marlborough Sounds (41°08'S, 173°57'E), in mid-littoral zone, 2 Apr 1973.

**Holotype** (Z.Cr.2193) and 25 **paratypes** (Z.Cr. 2194) deposited in the National Museum of New Zealand, Wellington. Five paratypes in author's collection.

DESCRIPTION. Total length 1.7 mm (1.32–2.08 mm) measured along line from anterior cephalosome to posterior of broodsack. Length of urosome 0.98 mm (0.75–1.25 mm). All measurements from 10 specimens in 70% ethanol. Prosome and urosome 5-segmented (Fig. 4a). Urosome tucked under swollen genital segment, which extends to tip of caudal rami.

Rostrum (Fig. 4b) parabolic in outline, without ornamentation.

Antennule (Fig. 4c) 9-segmented, S- or Z-shaped; segments 1 and 2 wider than long, together equalling length of segments 4–9; setal formula uncertain owing to great difficulty of working with contorted appendage, but approximately 4, 13, 4, 5, 6, 2, 1, 6.

Antenna (Fig. 4d) 3-segmented, basal segment bears small seta on distal inner margin. 2nd segment without ornamentation; 3rd segment bears stout hook and 3 short setae on apex.

Mandible (Fig. 4e) biramous; masticatory plate has 5 tooth-like projections, saw edge of fine denticles, and 2 seta-like projections, all on distal margin; exopodite 1-segmented, bears 4 setae and (on some specimens) an additional fine seta; endopodite 2-segmented, basal segment bears 4 setae on distal margin, terminal segment rectangular, with 3 setae on apex and 4 on distal margin.

Maxillule (Fig. 4f) protopodite bears long stout seta on short lateral projection. Two medial projections: proximal well developed, bears 9 setae on medial margin; distal, behind proximal, bears short spine. Protopodite produced at apex, bears 3 setae. Endopodite 1-segmented, 2 setae on apex. Exopodite 1-segmented, 4 setae on apex.

Maxilla (Fig. 4g) stout, 5-segmented. Basal segment large, bears 4 setiferous lobes. Basal lobe bears 3 setae, 2nd bears 1 seta, 3rd and 4th lobes bear 2 setae each. Segment 2 bears 2 medial setae. Segments 3 and 4 each bear 1 seta. Terminal segment bears 3 setae on apex.

Maxilliped (Fig. 4h) 2-segmented. Basal segment bears 9 marginal setae. Terminal segment bears 2 stout setae on apex.

Legs 1–4 (Figs 5a–d). Spine and setal formula as follows (Roman numerals = spines, Arabic numerals = setae).

P <sub>1</sub>	coxa 0–1	basis 1–1	exp. I–1, I–1, IV–4 end. 0–1, 0–1, 1–5
P <sub>2</sub>	0–1	1–0	exp. 1–1, 1–1, 4–5 end. 0–1, 5–3
P <sub>3</sub>	0–1	1–0	exp. 1–1, 1–1, 4–5 end. 0–1, 5–3
P <sub>4</sub>	0–1	0–1	exp. 1–1, 1–1, 4–4 end. 0–1, 4–3

Leg 5 (Fig. 1e) 2-segmented. Basal segment fused to urosome, terminal segment elongate, width to length ratio 2:5, bears 2 short setae on apex.

Caudal ramus (Fig. 5f) length 3 × basal width, which is 2½ × width at tip. Ramus twice length of terminal urosome segment, with 4 setules on apex. This species (*louisae*) has been named after the daughter of a colleague.



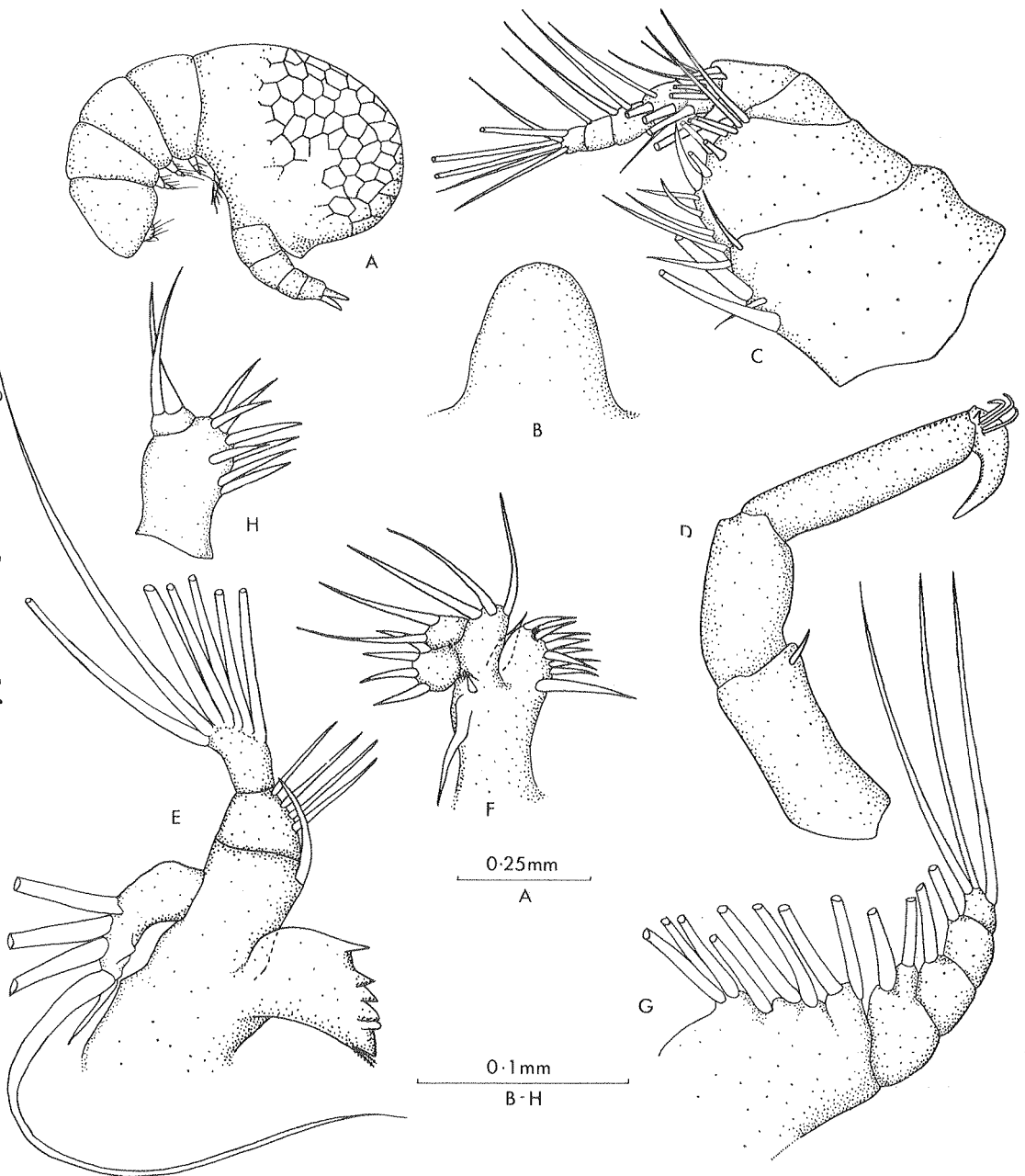


Fig. 4. *Doropygus louisae* n.sp., ♀: (A) left lateral view, (B) rostrum, (C) antennule, (D) antenna, (E) mandible, (F) maxillule, (G) maxilla, (H) maxilliped.

ADULT MALE. Only two specimens have been found; the male will therefore remain undescribed until more material is available.

DISCUSSION. The other known species of *Doropygus* which lack a hook on the second maxillary segment, but which have a maxillular endopodite bearing two setae and an expodite with four setae are: *D. pulex* Thorell, 1859; *D. longimatrix* Schellenberg, 1922; *D. pulex pinguis* Ooishi, 1962; *D. dakarensis* Monniot, 1966; *D. humilis* Stock, 1967; *D. apicatus* Stock, 1967; *D. catalai* Ilg, 1970; *D. curvipes* Gotto, 1975; and *D. flexus* Gotto, 1975.

*D. dakarensis* is unique among these species in having three rather than two stout terminal setae on the maxilliped (Monniot 1966).

*D. catalai*, *D. apicatus*, and *D. longimatrix* form a closely related group, and may be genetically related (Ilg 1970). They may be distinguished from the remaining species by the five well developed setae on the mandibular expodite.

*Doropygus pulex* has been described from a wide range of hosts, and these descriptions show a considerable degree of variation demonstrating "a complex of populations with various degrees of morphological distinction correlated with occurrence in particular hosts" (Ilg & Dudley 1965). These authors restricted the type hosts of *D. pulex* to tunicates of the family Ascidiidae (Ilg & Dudley 1961, 1965), pending a re-evaluation of the Scandinavian forms from which Thorell described the type.

The species here described, together with *D. humilis*, *D. curvipes*, *D. flexus*, and *D. pulex pinguis* come from ascidians of the family Styelidae. It is therefore advisable to give distinct names to such species at this time, rather than confuse the concept of *D. pulex* further. It may well be that when the problem of *D. pulex* is finally resolved these species will become subspecies or even synonyms of *D. pulex*.

*Doropygus humilis*, *D. curvipes*, *D. flexus*, and *D. pulex pinguis* differ from *D. louisae* as shown in Table 1.

STATUS OF SCHELLENBERG'S SPECIMENS OF *D. pulex*. Schellenberg (1922) described *D. pulex* from two New Zealand specimens, a female from Tauranga and a female from Rangitoto. Both were deposited in the Zoologisches Institut und Museum, Hamburg. However, inquiries of the museum revealed three specimens: K14768 and K14777, both female *Doropygus* from "*Alloecarpa thilenii* Mchlsn, Tauranga, New Zealand" (K14777 is headless and is presumably that dissected by Schellenberg (1922) who wrote "V Borste des Mandibularexpoditen sehr dünn und nur etwa 1/3 so lang wie IV Borste"); and K14780, a female *Doropygus* from *Pyura trita* (Sluiter), Rangitoto, (also headless).

All three specimens appeared identical to *D. louisae*. The fifth leg and caudal ramus were examined carefully and conformed to those of *D. louisae*. Since no dissection was attempted, the mouthparts of the complete specimen were not examined.

Genus *Ophioseides* Gerstaecker, [1870-71]

For a review of the history of this genus, and a redescription of the type species, see Bocquet & Stock (1961).

*Ophioseides schellenbergi* n.sp.  
ADULT FEMALE (Fig. 6)

MATERIAL EXAMINED. Eight females from *Pyura cancellata* Brewin, Ward I., Wellington Harbour (41° 10'S, 173°55'E) 15 Mar 1972, depth 15 m. **Holotype** (Z.Cr.2191) and 4 **paratypes** (Z.Cr.2192) National Museum of New Zealand, Wellington. Three paratypes in author's collection.

From Schellenberg's collection, held at Zoologisches Institut und Museum, Hamburg: 2 females (one badly damaged and headless) from *Pyura trita* Sluiter, New Plymouth, New Zealand (K14779). 9 females, (5 complete, 4 bodies, 2 heads) from *Cnemidocarpa cerea* Sluiter, Queen Charlotte Sound, N.Z. (K14781). Now designated paratypes.

Table 1. Differences between *Doropygus curvipes*, *D. flexus*, *D. humilis*, *D. louisae*, and *D. pulex pinguis*. (All show differences in the setation of antenna and caudal rami)

	<i>D. curvipes</i>	<i>D. flexus</i>	<i>D. humilis</i>	<i>D. louisae</i>	<i>D. pulex pinguis</i>
Length (mm)	1.8-2.1	1.7-2.3	1.48-1.67	1.32-2.08	2.7
Locality	Australia	Australia	Red Sea	New Zealand	Japan
Antennule segments	9	8	9	9	7
Maxillary segment 2 setation	2	2	3	2	3
Maxilliped segments	1	1	1	2	2
Leg 5: emarginations	?	3	3	2 (obscure)	4
Terminal setae	Shorter than free segment		As long as free segment	Shorter than free segment	
Rostrum shape	U	U	V	U	?
Mandible endopodite setation	4, 8	4, 8	4, 7	4, 7	4, 8

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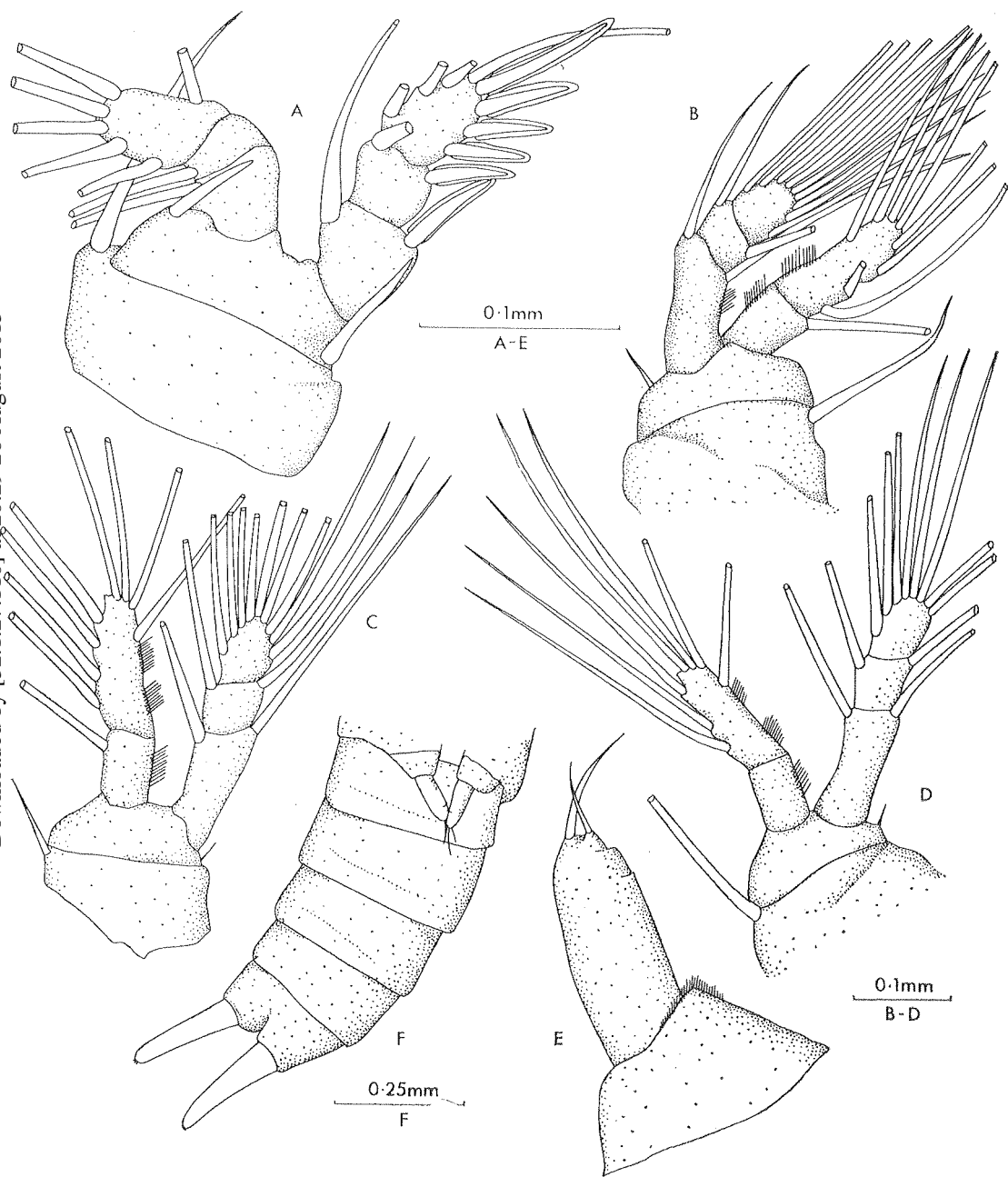


Fig. 5. *Doropygus louisae* n.sp., ♀: (A) leg 1, (B) leg 2, (C) leg 3, (D) leg 4, (E) leg 5, (F) urosome.

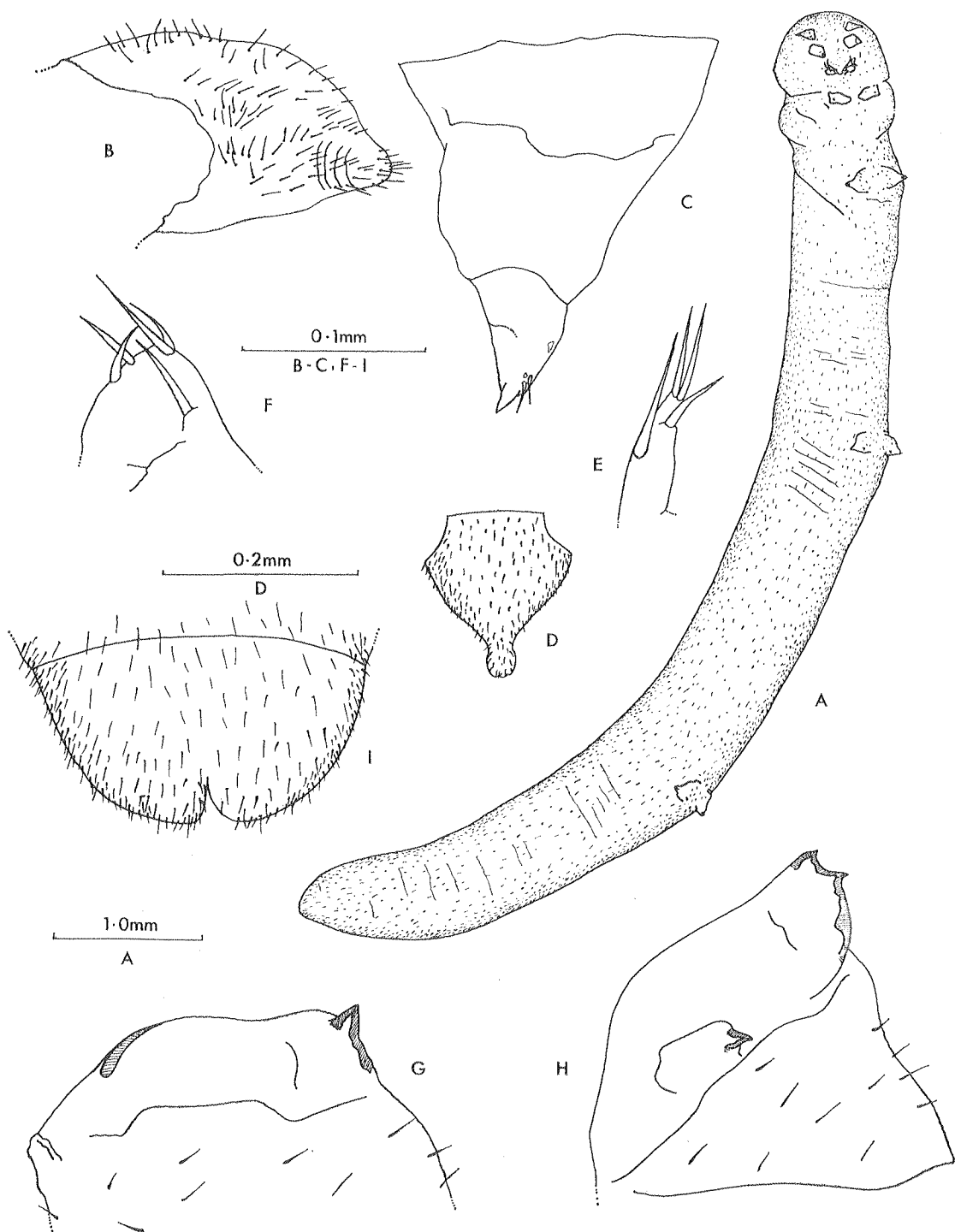


Fig. 6. *Ophioseides schellenbergi* n.sp., ♀: (A) ventro-lateral view, (B) antennule, (C) antenna, (D) labrum, (E) first mouthpart, (F) second mouthpart, (G) leg 1, (H) leg 3.

DESCRIPTION. Body vermiform (Fig. 6a), length 8.0 mm (4.5–12.0 mm) width 0.6 mm (0.3–1.0 mm) based on 6 specimens in 70% ethanol. Body divided into 4 regions: Cephalosome, covered dorsally by heart-shaped carapace; segment bearing 1st pair of legs; metasome segments fused bearing legs 2–4; 1-segmented urosome. Cuticle covered with small hairs.

Antennule (Fig. 6b) represented by unsegmented cone entirely covered with cuticular hairs of varying length.

Antenna (Fig. 6c) bimerous, proportional lengths of segments (basal to distal) 1.7:1.0. Basal segment unarmed. Terminal segment triangular, terminating in chitinous hook; small seta on outer margin, 1 seta on terminal margin near hook.

Labrum (Fig. 6d) large, triangular shaped lobe with terminally bilobed structure above mouth. Covered with cuticular hairs.

First mouthpart (Fig. 6e) located at lateral margin of labrum; elongate single segment with large seta at lateral third, seta at lateral two-thirds and 2 terminal setae.

Second mouthpart (Fig. 6f) single segment bearing 4 setae about apex, seta on lateral margin; surface covered with cuticular spines.

Leg 1 (Fig. 6g) protopodite large with single lobe on outer terminal margin, bearing stout claw; endopodite represented by chitin bar.

Legs 2–4 (Fig. 6h) all similar. large protopodite with 2 terminal lobes representing rami. endopodite with 1 hook, exopodite with 2 hooks.

Urosome (Fig. 6i) single bilobed segment covered with cuticular hairs. No caudal rami.

MALE unknown.

The name chosen for this species commemorates Professor A. Schellenberg, who first described notodelphyids from New Zealand.

DISCUSSION. There are three recognised species of *Ophioseides*: *O. cardicephalus* Gerstaecker, 1870-71; *O. joubini* Chatton, 1909; and *O. elongatus* Stock, 1967.

Giard (1873) described a species that he assigned to this genus, *Ophioseides apoda*, which has not been found since the original description and is of doubtful generic status. Bocquet & Stock (1961) tentatively place it in the genus *Ophiodelphys*.

Both *Ophioseides cardicephalus* and *O. joubini* have been redescribed in recent times (Bocquet & Stock 1961, Illg & Dudley 1961).

*O. schellenbergi* differs from *O. joubini* in having only one hook on each first leg instead of two. The structure of the first mouthpart differs from *O. joubini* in having two lateral and two terminal setae instead of three terminal setae, and the margins of

the cephalosome are rounded, rather than triangular as in *O. joubini*.

*Ophioseides cardicephalus* has an inner hookless lobe on the first leg; *O. schellenbergi* has none. The two short spines on the anterior margin of the second mouthpart are both absent in *O. schellenbergi*.

*Ophioseides elongatus* may be distinguished from *O. schellenbergi* by its much more slender antenna and extremely elongated body, from which the specific name derives (Stock 1967).

Finally, the geographic separation involved (the other species are all from the northern hemisphere) perhaps also indicates that the New Zealand *Ophioseides* is a separate species.

#### ACKNOWLEDGMENTS

I am grateful to the staff of the Zoologisches Institut und Museum, Hamburg University, who made Schellenberg's type material available.

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