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PSEUDOJANIRA INVESTIGATORIS, NEW SPECIES, FROM SOUTHERN AUSTRALIA: SECOND SPECIES IN THE PSEUDOJANIRIDAE (ISOPODA: ASELLOTA) WITH NEW MORPHOLOGICAL INFORMATION AND INTERPRETATIONS

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ABSTRACT

Pseudojanira investigatoris, new species, differs from *P. stenetrioides,* the only other species in the Pseudojaniroidea, in proportions and setation of the body, mouthparts, pereiopods, and pleopods.

The interaction of the penes and male pleopods 1 and 2 in sperm transfer is deduced. The spermatheca opens through a short cuticular organ into a furrow which it shares with the prospective oopore and stylet receptacle on the anteroventral surface of pereionite 5 of the preparatory female. The spermatheca attaches at a single point to the ovary. The spermatheca, cuticular organ, and stylet receptacle are lost in the molt to ovigerous female and only the enlarged oopore remains.

Pseudojanira stenetrioides from South Africa was originally placed in the Janiridae by Barnard (1925) on the basis of one female. Kensley (1977) retained the genus in the Janiridae when describing a single male. Wilson (1986a) redescribed *P. stenetrioides* from the same two specimens. Based on new information about male pleopods 1 and 2, the female cuticular organ, and the spermatheca, he concluded that *Pseudojanira* is so different from other janirids that not only does it not belong in that family, but does not belong in the asellotan superfamily Janiroidea. He established a new family Pseudojaniridae, but left its superfamily placing undecided between Stenetrioidea and Janiroidea. Later, following a cladistic analysis of the major asellotan groupings, Wilson (1987) established a new superfamily Pseudojaniroidea, sister group of Janiroidea. The new superfamily contained *Pseudojanira stenetrioides* only.

Since the holotype female is in poor condition and the male reported by Kensley was partly damaged during the initial dissection, several aspects of importance for discussing the correct placement of *Pseudojanira* and the higher classification of Asellota could not be elucidated. We describe here a second species of *Pseudojanira, P. investigatoris,* widespread along the southern Australian coast. The material at hand was collected over several years by Poore *et al.* and comprises 118 specimens, including fully mature males and females. This study confirms the main findings of Wilson (1986a). It allows us to clarify or correct previous descriptions, and adds new information on several characteristics which bear on the relationships of the Pseudojaniridae to Janiroidea and Stenetrioidea.

The second species of *Pseudojanira* necessitates the removal of certain characters included in Wilson's (1986a) diagnosis of Pseudojaniridae and, by implication *Pseudojanira,* as they are of significance only at the species level. We present a revised diagnosis of the family. The description of *Pseudojanira investigatoris,* new species, is restricted to points of difference from *P. stenetrioides* (with the character condition in the latter shown in parentheses). Following the description of the new species, we discuss our new findings and interpretations of characters important for future consideration of the systematic position of Pseudojaniridae.

Pseudojaniridae Wilson

Pseudojaniridae Wilson, 1986a: 351.

Diagnosis (revised).—Asellota with broad pereional tergites extending laterally and ventrally, hiding coxae from dorsal view. Head with dorsal eyes, broad lateral lappets, and large rostrum. Pleon with pleonite 1 completely free dorsally and ventrally, 2 free only ventrally, and 3 distinctly demarcated

ventrally but fixed to the remaining pleotelson.

Pereiopod 1 robust, with enlarged propodus, setose in male; prehensile between dactylus and propodus; carpus short, quadrangular, setose in male, not participating in grasping.

Male pleopods 1 and 2 together not opercular. Male pleopods 1 with basal segments fused; rami separate ventrally, but fused together proximally and to basal segment dorsally; distolateral corners with dorsal grooves. Male pleopod 2 basal segment enlarged, distally truncate, thickened, with transverse groove; endopod and exopod attached medially; endopod first article with thickened cuticular ridge ventrally; endopod second article stylet-shaped, with open lateral groove and distal barbs; exopod hook-shaped.

Female fused pleopods 2 operculiform.

Pleopod 3 (both sexes) with exopod opercular. Pleopod 4 biramous. Pleopod 5 comprised of a single lobe. Uropods short, biramous, inserted ventrally on each side of exposed posteriorly pointing anus. Anus separated from respiratory chamber by broad cuticular bar.

Females with oostegites on pereiopods 1–4; cuticular spermatheca present, cuticular organ short broad, opening on anterior surface of pereionite 5, separate from but situated in a common groove with ventral oopore.

Pseudojanira Barnard

Pseudojanira Barnard, 1925: 406, fig. 5; Kensley, 1977: 251, figs. 9, 10; Wilson, 1986a, figs. 1–3.

Diagnosis.—With the characters of the family.

Type Species.—*Pseudojanira stenetrioides* Barnard, 1925 (by monotypy).

Additional Species.—*P. investigatoris,* new species.

Pseudojanira investigatoris, new species
Figs. 1–4

Material Examined.—Holotype. South Australia, northeastern side of Topgallant Island, Investigator Group (33°43.0'S, 134°36.6'E), among tufted calcareous bryozoans under ledge, 15 m, SCUBA, K. Brandon and G. C. B. Poore on FV *Limnos,* 21 April 1985 (station SA 79), Museum of Victoria (NMV) J16986 (male, 4.1 mm, 6 slides).

Paratypes. South Australia. Type locality, NMV J16988 (1 ♀), NMV J16989 (1 ovigerous ♀), NMV J16987 (1 ♂), NMV J16990 (2 ♀♀), NMV J16991 (1 ♂, 1 ♀), NMV J16992 (7 ♂♂, 6 ♀♀). Northeastern side of Topgallant Island, Investigator Group (33°43.0'S, 134°36.6'E), among red algae, sponges, bryozoans in cave, 7 m, SCUBA, K. Brandon and G. C. B. Poore on FV *Limnos,* 21 April 1985 (station SA 78), NMV J16995 (1 ♂, 5 ♀♀). West Island, northeastern end (35°37'S, 138°36'E), among red algae, sponges, and bryozoans, 12 m, SCUBA, G. C. B. Poore and H. M. Lew Ton, 20 March 1985 (station SA 42), South Australian Museum C4204 (1 ♂, 5 ♀♀). Pearson Island, eastern side in bay (33°57.3'S, 134°15.7'E), among bryozoans, sponges, etc., on shaded surface, 20 m, SCUBA, G. C. B. Poore on FV *Limnos,* 17 April 1985 (station SA 55), NMV J16993 (2 ♂♂, 1 ♀). Flinders Island, "The Hotspot" reef, 5 nautical miles west of Flinders Island (33°40.8'S, 134°22.5'E), among tufted red algae and soft erect bryozoans, 21 m, SCUBA, G. C. B. Poore on FV *Limnos,* 20 April 1985 (station SA 72), NMV J16994 (2 ♀♀). Flinders Island, "The Hotspot" reef, 5 nautical miles west of Flinders Island (33°40.8'S, 134°22.5'E), among erect hard bryozoans on vertical rock face, 21 m, SCUBA, G. C. B. Poore on FV *Limnos,* 20 April 1985 (station SA 71), National Museum of Natural History, Smithsonian Institution (USNM 243383; 2 ♂♂, 7 ♀♀).

Victoria. Western Port, off Crib Point (38°22.06'S, 145°14.10'E), from reef sponge, 13 m, Smith-McIntyre grab, Marine Studies Group on RV *Melita,* 5 March 1965 (station CPBS-S 33), NMV J2958 (5 ♂♂, 8 ♀♀).

Western Australia. Two Peoples Bay, point at northern end of Little Beach (34°58.2'S, 118°10.8'E), among sponges, red algae, 7 m, SCUBA, G. C. B. Poore and H. M. Lew Ton, 18 April 1986 (station SWA 78), NMV J17000 (4 ♀♀). North Lumps, 2 km off Mullaloo (31°47.3'S, 115°42.8'E), among sponges, mixed algae on reef top, 1 m, SCUBA, G. C. B. Poore and H. M. Lew Ton, 2 May 1986 (station SWA 111), NMV J16996 (1 ♂), NMV J16998 (1 ♂, 1 slide), NMV J16997 (1 ♂, 1 slide), NMV J16999 (5 ♀♀, 1 slide). Same locality, from red algal turf on top of reef (stations SWA 107 and 108), Western Australian Museum 814–89 (1 ♀), WAM 813–89 (1 ♂). Same locality, from bryozoans, 8 m (station SWA 112), NMV J16792 (6 ♀♀), Zoological Museum, University of Copenhagen (5 ♂♂, 8 ♀♀).

Other material. Central Bass Strait, 20 km east-northeast of Bold Head, King Island, Tasmania (40°0.00'S, 144°20.90'E), 45 m, rough bottom, 20-m otter trawl, M. F. Gomon *et al.* on RV *Hai Kung,* 2 February 1981 (station BSS 127), NMV J17685 (3 specimens); 33 km south of Deal Island, Tasmania (39°48.3'S, 147°19.2'E), 60 m, muddy sand, R. Wilson on RV *Tangaroa,* 14 November 1981 (station BSS 161), NMV J17687 (2 specimens); 25 km south of Deal Island, Tasmania (39°43.7'S, 147°19.6'E), 59 m, muddy sand, R. Wilson on RV *Tangaroa,* 13 November 1981 (station BSS 160), NMV J17684 (12 specimens). Western Bass Strait, 11 km southwest of Cape Otway, Victoria (38°57'S, 143°27'E), 49 m, coarse sand, G. C. B. Poore, on HMAS *Kimbla,* 8 October 1980 (station BSS 52), NMV J17686 (1 specimen); 5 km south of Point Reginald, Victoria (38°48.0'S, 143°14.5'E), 47 m, hard rocky bottom, R. Wilson on RV *Tangaroa,* 20 November 1981 (station BSS 185), NMV J17688 (5 specimens).

Description.—Differing from type species *P. stenetrioides* Barnard, 1925 (not examined by us) in:

Rostrum triangular, with denticulate margin (apically rounded in *P. stenetrioides*); lateral margins of body and dorsum with long setae among many fine setules (setules only); pleotelson 1.6 times as wide as long (1.4 times) and with sharp, minute lateral marginal hooks (no hooks).

Antenna 1 flagellum with short basal article, long second article, and 3 terminal articles as long as second (only 2 terminal articles half length of second).

Pereiopod 1 propodus 1.3 times as long as wide (1.5 times), palm transverse-oblique (oblique-axial), opposing dactylar and propodal margins each with up to 15 spines plus unguis and defining palmar spine (7 or 8 spines only).

Molar surface with transverse groove partly surrounded by teeth, with cluster of spines anterodistally, and setal row posterodistally (apparently distorted in Wilson's, 1986a, fig. 1G, probably of similar construction). Apex of maxillipedal endite with 1 spine on medial corner, 4 fan-shaped setae and 4 setulate setae on narrow distal margin (only setulate setae distally; Kensley, 1977, fig. 10).

Preparatory female stylet receptacle short, conical, situated between cuticular organ opening and prospective oopore (long, narrow, lateral to oopore).

Male pleopod 1 ramus 3.3 times as long as width at midpoint (2.3 times), with rounded apex extending beyond distolateral stylet grooves (apex truncate, not extended). Male pleopod 2 basal segment only slightly expanded beyond exopod (strongly expanded); exopod with slight separation of 2 articles (articles completely fused), with one long apical seta (no long seta), endopod stylet tip with many tiny barbs (few large). Pleopod 3 endopod with subacute apex (truncate apex). Pleopod 4 exopod with article 2 much longer than wide (little longer than wide); medial margin concave (straight). Pleopod 5 with 5 distal plumose setae (without plumose setae).

Distal margin of pleotelson gently convex between distolateral hooks so that end of uropodal peduncles and all rami are clearly visible dorsally (distal margin strongly convex, without distolateral hooks, so that only tips of uropodal rami are visible dorsally).

Size.—Largest male: length 4.1 mm; range of brooding females: 3.2–3.8 mm.

Sexual Dimorphism.—Female pereiopod 1 distinctly smaller than in males and lacking dense medial fields of long setae, but otherwise of similar shape.

Distribution.—Western Port, central and western Bass Strait (Victoria and Tasmania) to Perth (Western Australia); depth 1–60 m.

Etymology.—For HMS *Investigator* in which Matthew Flinders (1774–1814) explored the southern coast of Australia in 1801.

Morphology and Function

Male Pleopod 1.—The rami bear middorsal proximal locking tabs (terminology from Wilson, 1987: 264) similar to those found in members of the Janiroidea. Locking tabs have not been described in *Pseudojanira stenetrioides.*

Male Pleopod 2.—Wilson (1986a, 1987) described the open sperm groove as being on the ventral surface of the male stylet (pleopod 2 endopod article 2) of *P. stenetrioides.* Our observation differs. The sperm groove has a well-defined ventral entrance between concave flanges at the junction of the two articles, but is lateral for 70% of its length on article 2. In its proximal half the sperm groove is covered by an opposing groove on article 1.

We believe this arrangement will be found to be similar in *P. stenetrioides.* The ventral groove described by Wilson (1986a, fig. 2D) is, in our opinion, the result of the stylet having been rotated about 90 degrees during mounting.

Sperm Transfer.—The following account is based only on fixed material. Living specimens have not been seen. The long penes are immovable. When the pleotelson is held in the same plane as the rest of the body the penes curve into the ventral groove in the fused peduncles of pleopods 1, presumably held in place by the rows of setae along their margins. In this position the penes tips do not quite reach the sperm groove entrances of pleopods 2 (Fig. 3), but a small ventrad flick of the pleotelson, or of the locked pleo-

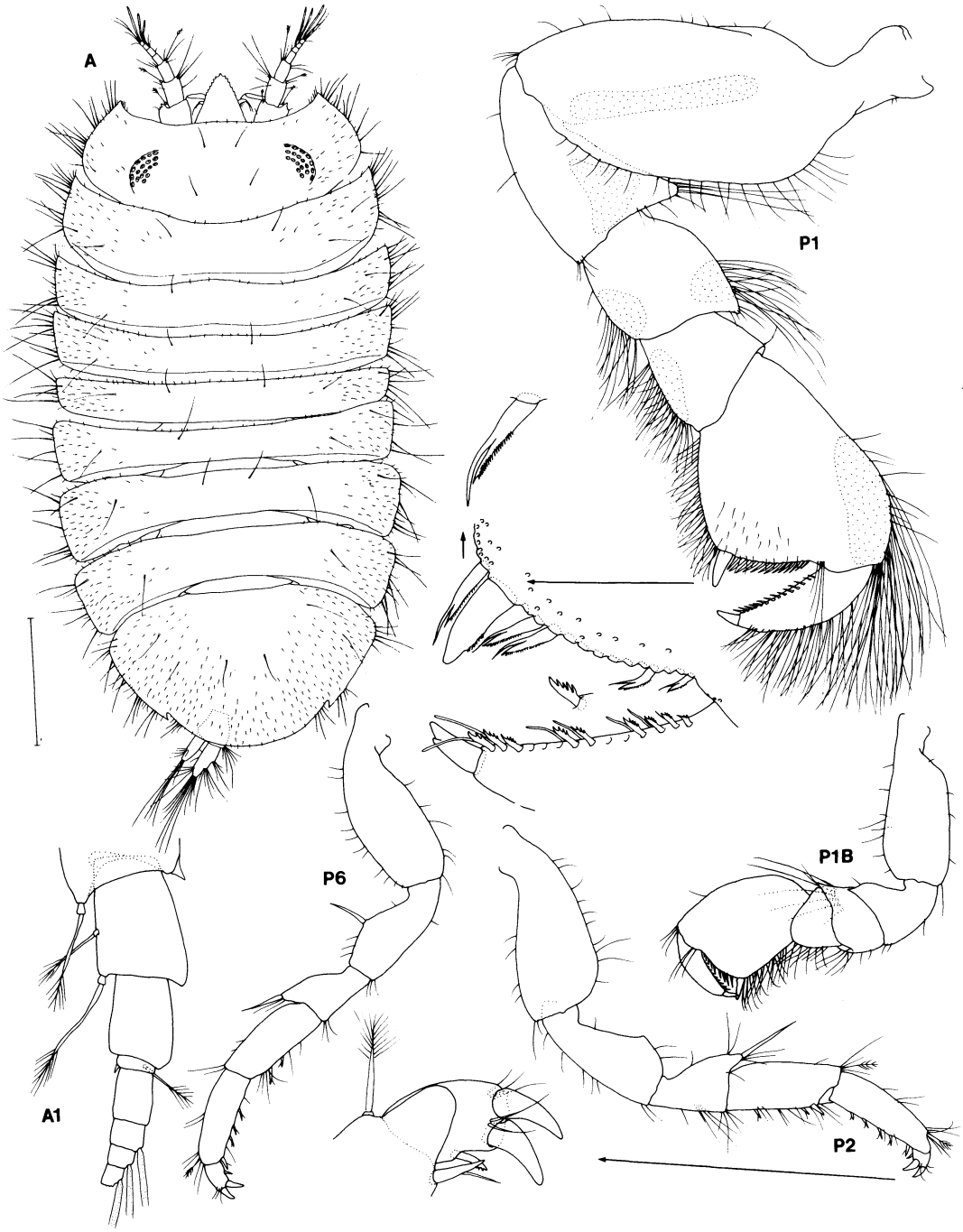

Fig. 1. *Pseudojanira investigatoris,* new species. A, male paratype, 2.7 mm, J16996: habitus (scale = 0.5 mm). B, female paratype, 3.4 mm, J16989: pereiopod 1 (P1 B) (same magnification as other pereiopods). Other figures, male holotype, 4.1 mm, J16986: antenna 1 (A1), pereiopods 1, 2, 6 (P1 P2 P6).

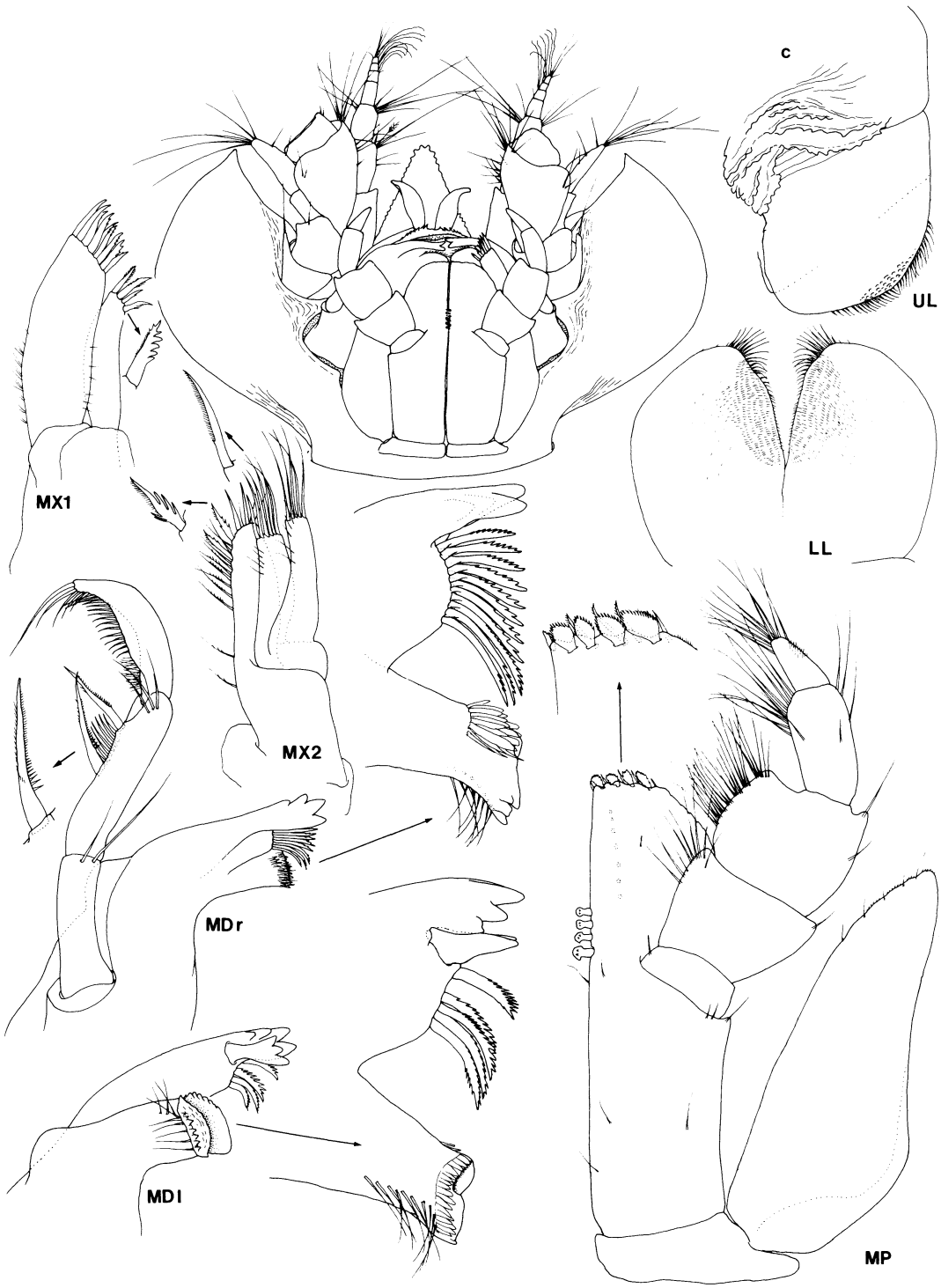

Fig. 2. *Pseudojanira investigatoris*, new species. Male holotype, J16986: ventral surface of head with mouthparts in situ; clypeus (c) and upper lip (UL) viewed obliquely from anterior left; right mandible (MDr) with detail of molar, spine row, and incisor; distal left mandible (MD1) with detail; lower lip (LL); maxillae 1 (MX1) and 2 (MX2); maxilliped (MP) with detail of endite.

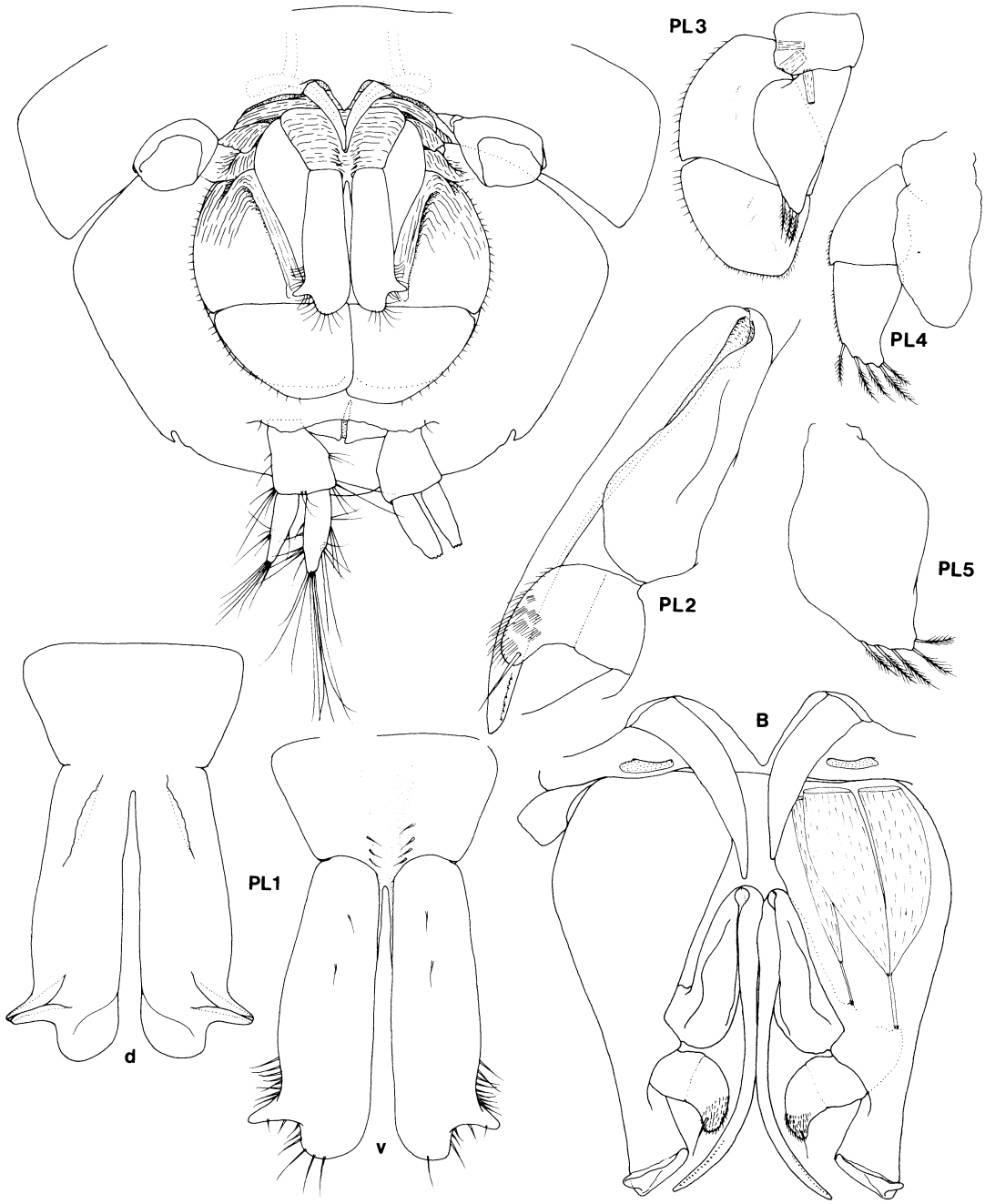

Fig. 3. *Pseudojanira investigatoris,* new species. Male paratype, J16997, pleopods 1 (PL1) in dorsal (d) and ventral (v) views. B, male paratype, J16987, penes and pleopods 2 in situ (pleopods 1 removed) to show their juxtaposition. Other figures, male holotype, J16986: ventral pereionite 7 and pleotelson showing vasa deferentia, penes, pleopods 1, 2, and 3, and uropods in situ; rami of left pleopod 2 (PL2), ventral view; pleopods 3, 4, and 5 (PL3, PL4, PL5).

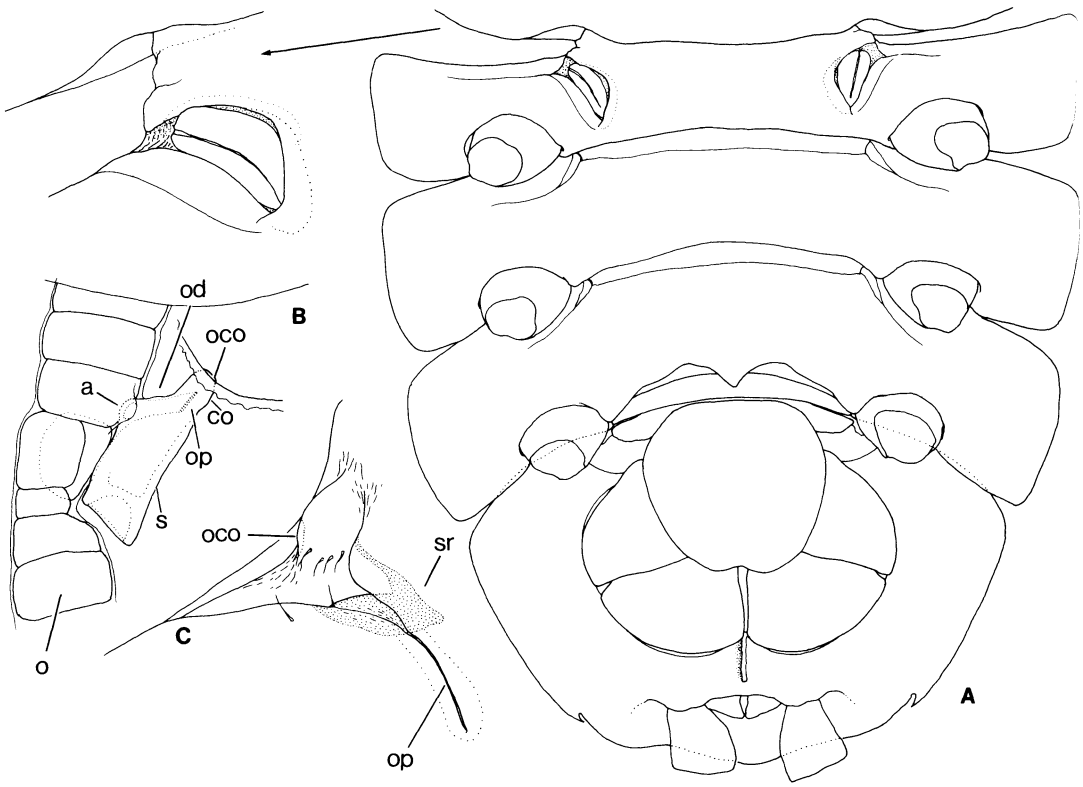

Fig. 4. *Pseudojanira investigatoris,* new species. A, ovigerous female paratype, J16991, ventral view of pereionites 5–7 and pleotelson with enlargement of right oopore in its furrow (stylet receptacle and cuticular organ lost in previous molt). B, preparatory female, J16988 (with additions from 2 other females); dorsal view of dissected pereionite 5 with right ovary (o), right spermatheca (s) attached (a) to ovary near base of oviduct (od), the spermatheca duct or cuticular organ (co) and its opening (oco). C, ventral view of right reproductive opening showing opening to cuticular organ (oco), stylet receptacle (sr) with rows of setae near its opening, and prospective oopore (op).

pods 1 and 2 alone (cf. *Jaera italica,* see Veuille, 1978, fig. 5), will inject the penes tips directly into the sperm groove entrances. Ejected sperm move down the groove protected in its proximal part by the first article of the endopod. Transfer of the sperm mass from this protected part to the distalmost part of the groove may be effected by a stroke of the exopod with its setulose tip running in the groove. The musculature of that limb is strong enough to produce a powerful posteriad movement of the exopod tip while the corresponding flexors are weak. In Wilson's illustration (1986a, fig. 2D) the exopod is at its flexed (rest?) position; in our Fig. 3 the exopod is fixed in a fully extended position. The ventroapical groove on the basal segment of pleopod 2 is directly opposite the dorsal pleopod 1 stylet guide and together form a tunnel for the stylet. During sperm transfer to the female, the tip of the pleopod 2 stylet is pushed through the stylet guide on pleopod 1. The extending exopod will push the sperm mass into this tunnel and exert pressure for the final transfer of sperm into the female spermatheca.

Preparatory Female.—We are able to confirm Wilson's (1986a, b) observations that the spermatheca has a cuticular lining. In our dissected specimens it is wine-bottle-shaped (complete with deeply concave end) with a middorsomedial bulge, and opens, through a very short neck (=cuticular organ), on the anterior surface of pereionite 5 anterior to the ventrally situated oopore. The two openings are in a common furrow with the stylet receptacle in between. The prospective oopore is a narrow cuticular slit

(Fig. 4, op). Although in close contact with the ovary, the spermatheca is connected with the ovary only at the tip of its dorsomedial bulge through a lateral projection of the ovary wall (as also indicated in Wilson, 1986a, fig. 3A). The oviduct arises from the ovary immediately ventral to the spermatheca/ovary attachment. In preparatory females the oviduct is a very thin flattened structure which, for most of its length, is closely adpressed to the ventromedial surface of the spermatheca. These observations were made on three dissected preparatory females with and without lactic acid clearing.

Ovigerous Female.—The oopore is a large pear-shaped opening with two soft-walled flaps. It is covered by the posterior margin of the posteriormost oostegite (pereiopod 4). Spermathecae, cuticular organs, and stylet receptacles are absent. We assume that at the time of the final molt the spermatheca ruptures at the point of contact (or fusion) with the ovary, thus releasing sperm into the oviduct immediately prior to the release of ova into the marsupium. The cuticular wall of the entire spermatheca/cuticular organ and the stylet receptacle are lost in the final ecdysis.

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LITERATURE CITED

Barnard, K. H. 1925. Contributions to the crustacean fauna of South Africa. 9. Further additions to the list of Isopoda.—Annals of the South African Museum 20: 381–412.

Kensley, B. 1977. New records of marine Crustacea from South Africa.—Annals of the South African Museum 72: 239–265.

Veuille, M. 1978. Biologie de la reproduction chez *Jaera* (Isopode Asellote) II. Évolution des organes reproducteurs femelles.—Cahiers de Biologie Marine 19: 385–395.

Wilson, G. D. F. 1986a. Pseudojaniridae (Crustacea: Isopoda), a new family for *Pseudojanira stenetrioides* Barnard, 1925, a species intermediate between the asellote superfamilies Stenetrioidea and Janiroidea.—Proceedings of the Biological Society of Washington 99: 350–358.

———. 1986b. Evolution of the female cuticular organ in the Asellota (Crustacea, Isopoda).—Journal of Morphology 190: 297–305.

———. 1987. The road to the Janiroidea: comparative morphology and evolution of the asellote isopod crustaceans.—Zeitschrift für zoologische Systematik und Evolutionsforschung 25: 257–280.

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