

AUSTRALIAN MUSEUM SCIENTIFIC PUBLICATIONS

Lowry, J. K., and H. E. Stoddart, 1992. A revision of the genus *Ichnopus* (Crustacea: Amphipoda: Lysianassoidea: Uristidae). *Records of the Australian Museum* 44(2): 185–245. [14 August 1992].

doi:10.3853/j.0067-1975.44.1992.32

ISSN 0067-1975

Published by the Australian Museum, Sydney

nature culture **discover**

Australian Museum science is freely accessible online at
www.australianmuseum.net.au/publications/
6 College Street, Sydney NSW 2010, Australia



A Revision of the Genus *Ichnopus* (Crustacea: Amphipoda: Lysianassoidea: Uristidae)

J.K. LOWRY & H.E. STODDART

Australian Museum,
PO Box A285, Sydney South, NSW 2000, Australia

ABSTRACT. The uristid genus *Ichnopus* is revised and *Glycerina* included in its synonymy. A key is provided to the world species. *Ichnopus pelagicus* Schellenberg, *I. pseudoserricus* Ledoyer, *I. serricus* Walker, *I. spinicornis* Boeck, *I. taurus* Costa, (type species), *I. tenuicornis* (Haswell), *I. teretis* (Andres) and *I. woodmasoni* (Giles) are redescribed. The new species *I. annasona*, *I. capricornus*, *I. caritus*, *I. comorensis*, *I. cribensis*, *I. malpatun*, *I. parriwi* and *I. wardi* are described. *Ichnopus nossibeensis* Ledoyer is considered to be a synonym of *I. pelagicus*. *Ichnopus macrobetomma* Stebbing is considered to be an unrecognisable species. Two species groups are recognised: the *I. spinicornis* group, in which the ischium and carpus of gnathopod 1 are long and most species are pelagic, probably micropredators; and the *I. taurus* group, in which the ischium and carpus of gnathopod 1 are very long and most species are demersal scavengers. *Ichnopus* is considered to be a tropical to warm temperate Indo-Pacific genus with some remnants in the Mediterranean and the eastern North Atlantic Ocean. The most primitive species in both groups are found in the Mediterranean Sea and the eastern North Atlantic. It appears that the modern genus had its origins in the old Tethyan fauna.

LOWRY, J.K. & H.E. STODDART, 1992. A revision of the genus *Ichnopus* (Crustacea: Amphipoda: Lysianassoidea: Uristidae). Records of the Australian Museum 44(2): 185–245.

Ichnopus is a poorly known genus of uristid lysianassoids which was established by Costa (1853) for *I. taurus* from the Mediterranean Sea. Since then 13 species have been described, five of which are currently considered to be synonyms. Most of these species have been reported in the literature only once or twice. The exceptions are *I. taurus* Costa, 1853, and *I. spinicornis* Boeck, 1861, both of which have been recorded frequently, either from the Mediterranean or the eastern North Atlantic. Little is known about the biology, phylogeny or zoogeography of these animals.

In this paper we redefine the genus, recognise two informal species groups, discuss the habitat preferences of species in each group and discuss the general zoogeographical distribution of the genus. We redescribe eight species and describe eight new species. The genus *Glycerina* Haswell, 1882, is synonymised with *Ichnopus* Costa, 1853, and *I. nossibeensis* Ledoyer, 1986, is synonymised with *I. pelagicus* Schellenberg, 1926. *Ichnopus macrobetomma* Stebbing, 1917 is considered to be an unrecognisable species.

The following abbreviations are used in the text:

AM – Australian Museum, Sydney; BMNH – British Museum (Natural History), London; CSIRO – Commonwealth Scientific and Industrial Research Organisation, Division of Fisheries Research, Hobart; MCSN – Museo Civico di Storia Naturale, Verona; MNHN – Museum National d'Histoire Naturelle, Paris; NMV – Museum of Victoria, Melbourne; NMW – Naturhistorisches Museum, Vienna; SAM – South African Museum, Cape Town; SMF – Forschungsinstitut Senckenberg, Frankfurt am Main; USNM – United States National Museum of Natural History, Washington, D.C.; ZMA – Zoologisch Museum, Amsterdam; ZMB – Zoologisches Museum, Berlin; ZMC – Zoologisk Museum, Copenhagen; ZMUB – Zoologisk Museum, Universitetet i Bergen.

The following abbreviations are used on the plates: A – antenna; EP – epimeron; G – gnathopod; H – head; MD – mandible; MDP – mandibular palp; MP – maxilliped; MPIP – maxilliped inner plate; MPOP – maxilliped outer plate; MPP – maxilliped palp; MX – maxilla; MX1IP – maxilla 1 inner plate; MX1OP – maxilla 1 outer plate; MX1P – maxilla 1 palp; P – pereopod; T – telson; U – uropod; UL – upper lip; l – left; r – right.

Generic Placement

This study has a phylogenetic basis and cladistic terminology is used throughout, but only the taxonomy

of the group is presented here. The phylogenetic and biogeographical analyses will appear in another paper.

Ichnopus belongs to the anonychine group of uristid lysianassoids. The Uristidae, as defined here, comprises taxa with a 7/4 crown spine-tooth arrangement on the outer plate of maxilla 1. Within the Uristidae the anonychine group is characterised by having a mandibular molar which is a setose tongue with no triturating surface. It contains the genera *Anonyx* Krøyer, *Ichnopus* Costa, and *Kyska* Shoemaker.

The 7/4 crown arrangement may be derived from a simple 7/4 arrangement (Fig. 1a) in which 11 distal spine-teeth on the outer plate of maxilla 1 occur in two rows, an apical row of seven spine-teeth (known as ST1 to ST7) and a subapical row of four spine-teeth (known as STA to STD). In the 7/4 crown arrangement (Fig. 1b) the outer plate becomes apically narrowed so that some spine-teeth are displaced down the face of the outer plate. The outer row (containing STA and ST1 to ST6) is curved around the distal margin of the plate and the inner row (containing STB to STD and ST7) extends down the medial face of the plate. The movement of ST7 can be traced from a position opposite STD in *Kyska* to a position beyond STD in *Anonyx* and *Ichnopus*.

The monophyly of *Ichnopus* is based on the following synapomorphies: posterodistal tooth on article 1 of the peduncle of antenna 1; setae or spines in the posterodistal area of the callynophore; distinctive shape of mandibular palp article 3; broadening of maxillipedal palp article 2; unusually long ischium of gnathopod 1;

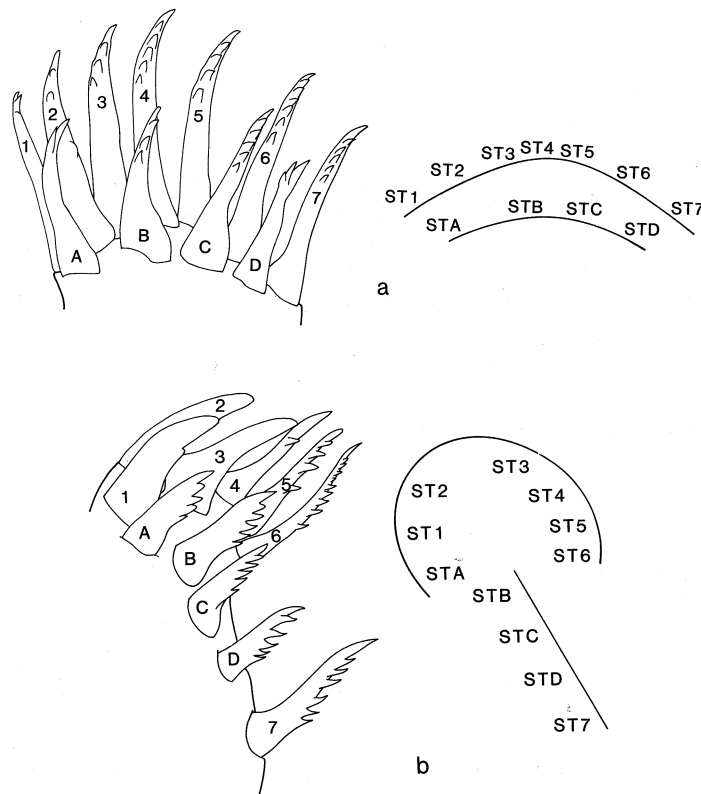


Fig.1. Spine-teeth of maxilla 1 outer plate. a: simple 7/4 arrangement; b: 7/4 crown arrangement.

distinctive cuticular spines on the dactylus of gnathopod 1; and posteroventral notch on epimeron 3.

Ichnopus is divided into two species groups – the *Ichnopus spinicornis* species group and the *Ichnopus taurus* species group. The *I. spinicornis* species group is characterised by: gnathopod 1 with a long ischium and carpus (2.4-2.7 times as long as broad), and short cuticular teeth on the dactylus; a slightly broadened mandibular palp article 2; a medially cuspidate ST7 on the outer plate of maxilla 1; and a strongly spinose molar, except for *I. spinicornis* and *I. comorensis*. Species in the *I. spinicornis* group are: *I. annasona*, *I. comorensis*, *I. malpatun*, *I. pelagicus*, *I. pseudoserricrus*, *I. serricrus*, *I. spinicornis*, *I. wardi* and *I. woodmasoni*.

The *Ichnopus taurus* species group is characterised by: gnathopod 1 with very long ischium and carpus (4-5.8 times as long as broad), with long cuticular teeth on the dactylus; a strongly broadened mandibular palp article 2; a distally cuspidate ST7 on the outer plate of maxilla 1; and a weakly to moderately spinose molar. Species in the *I. taurus* species group are: *I. caritus*, *I. capricornus*, *I. cribensis*, *I. parriwi*, *I. taurus*, *I. tenuicornis*, *I. teretis* and *Ichnopus* sp. of Walker (1904).

Ecology

Ichnopus spinicornis Species Group

Most species in the *I. spinicornis* species group are entirely or at least partially pelagic and may be micropredators in the plankton. Repelin (1978) reported *I. pelagicus* from the tropical western Pacific Ocean. He found that it was an uncommon amphipod confined to the epipelagic zone (above 150 m) where it was most often collected at night. We report *I. pelagicus* from plankton samples taken at night (between 50 and 100 m) in the Austral Isles, central South Pacific. Working in the south-western Indian Ocean Ledoyer (1986) reported *I. pelagicus* (as *I. nossibeensis*) from plankton samples near the surface in nearly 2000 m of water. He also reported *I. pseudoserricrus* from plankton samples collected near the surface in 29 m of water in the same area. Walker (1909) originally reported two specimens of *I. serricrus*, one from surface plankton and one from a dredge. Echelman & Fishelson (1990a, 1990b) reported *I. serricrus* (males and juveniles) from surface plankton samples taken at night, off reef faces, in the northern Gulf of Aqaba. We report *I. annasona* from surface plankton samples taken at night near Elizabeth Reef in the western Tasman Sea (all males), from epipelagic plankton samples taken at night among the Austral Isles, central South Pacific (males and females), and from epibenthic dredge samples on the Taupo Seamount, western Tasman Sea and near New Caledonia. Kaartvedt (1989) recently reported large numbers of *I. spinicornis* (males and females equally represented) from nocturnal plankton samples in Masfjorden, Norway. However, *I. spinicornis* has also been taken

from bottom dredge samples (Chevreux, 1900; Vader, 1969; Marques & Bellan-Santini, 1985; Ledoyer, 1977). Three species with the characters of the *I. spinicornis* group, but with deeply incised basis on peraeopod 5 (a character of the *I. taurus* species group), appear to be demersal. *Ichnopus malpatun* is known from one trap sample taken on the outer reef face at Madang Lagoon, northern Papua New Guinea. An attempt to collect more specimens with a nocturnal plankton tow from a small boat was unsuccessful. *Ichnopus wardi* and *I. woodmasoni* are only known from bottom dredge samples.

Ichnopus taurus Species Group

We consider the species in the *I. taurus* species group to be mainly demersal scavengers. Although their morphology is similar to members of the *I. spinicornis* species group, they are frequently reported from baited traps and as far as we know have never been collected in plankton samples. For instance, we now know that Spandl's (1924) records of *I. taurus* from pelagic samples in the Red Sea represent *I. serricrus*.

Ichnopus taurus has been reported from baited traps in the Mediterranean Sea (Chevreux, 1895, 1903). *Ichnopus teretis* was taken in deep sea traps in the Red Sea (Andres, 1981). In Australian waters *I. capricornus* and *I. parriwi* have only been taken in baited traps. *Ichnopus tenuicornis* has been taken in baited traps on the Great Barrier Reef and in dredge samples on the North West Shelf, Western Australia. Traps have not been set at this location. *Ichnopus caritus* is known only from benthic dredge samples. *Ichnopus cribensis* has been taken in benthic samples and baited traps. *Ichnopus tenuicornis* and *I. capricornus*, which are both common at Lizard Island, Great Barrier Reef, have never been taken in neuston or plankton samples or in pelagic light traps set at night (unpublished data).

To what degree the *I. taurus* group are scavengers we do not know. Sainte-Marie (1986) has shown that, in species where feeding behaviour has been studied in detail, several strategies in addition to carrion feeding usually exist in any one species. Because species such as *I. capricornus* and *I. parriwi* do little damage to the bait even when feeding in large numbers (Keable, personal communication and personal observation) it is possible that they are opportunistic carrion feeders.

Species of the *I. taurus* species group, like its sister taxon *Anonyx*, are mainly demersal scavengers and it is postulated that the common ancestor of these groups was a demersal scavenger. Within the *I. taurus* species group the most significant morphological changes are the long slender gnathopod 1 with its strongly toothed dactylus, the fork-like spine-tooth 7 on maxilla 1 and the deeply serrate posterior margin of the basis on peraeopod 5. It is possible that the modifications to gnathopod 1 are directly related to securing food during scavenging. The same is probably true for spine-tooth 7, but we cannot

easily see a function for the deeply serrate margin of the pereopod 5 basis.

Apparently at sometime in the early history of *Ichnopus* a demersal scavenger became pelagic. This must have occurred before gnathopod 1 became very slender because all species in the *I. spinicornis* species group have a relatively unmodified gnathopod 1 and spine-tooth 7. The main modification in this group is the strongly spinose mandibular molar. Spination in the molar of the *I. taurus* group is absent or weak. It is also absent in *Anonyx* where the molar is considered to act as a tongue for moving pieces of flesh into the mouth (Dahl, 1979). The modified spinose molar of the *I. spinicornis* group is probably used in the same way as a triturating molar, for tearing or grinding microplanktonic prey.

Zoogeography

Ichnopus is basically a shallow water tropical to warm temperate genus of the Pacific and Indian Oceans (Fig.2). Except for the enigmatic *I. spinicornis*, which occurs in the Mediterranean Sea and in eastern North Atlantic waters as far north as Norway, the *I. spinicornis* species group does not occur outside tropical waters. The more primitive species occur in the eastern North Atlantic Ocean, the Red Sea and the western Indian Ocean and the more advanced species occur in Australian waters. One of the most advanced species, *I. pelagicus*, has an Indo-Pacific distribution.

The *I. taurus* species group is almost entirely confined to the tropical and temperate waters of the western Pacific and Indian Oceans. The one exception, *I. taurus*, occurs in the Mediterranean Sea and in eastern North Atlantic waters as far north as the

Bay of Biscay. In southern temperate waters there are three species on the southern coasts of Australia and one species reported from southern Africa. The more primitive species occur in the eastern North Atlantic, Mediterranean Sea and the Red Sea, and the more advanced species occur in the shallow coastal waters of Australia.

Aside from the limited intrusion of *I. spinicornis* and *I. taurus*, the genus has not penetrated the Atlantic Ocean. No species has been found along the well-studied east coast of North America or in the Caribbean Sea. There are no records of *Ichnopus* from the South Atlantic. In the North Pacific there is one record of *I. taurus* from southern Japanese waters (Nagata, 1965). We doubt that this record is *I. taurus* (specimens were not available for study), but it does signal the presence of a species in the *I. taurus* group in the warm western North Pacific. There are no records of *Ichnopus* from the well-studied west coast of North America. *Ichnopus pelagicus* is the only species recorded from the eastern Pacific.

Ichnopus teretis is the only confirmed deep sea species, from 1869 m depth in the central Red Sea. However, Chevreux (1895) reported *I. affinis* (considered to be a synonym of *I. taurus*) from a trap sample at 2620 m depth in the eastern North Atlantic. Unfortunately, these specimens appear to be lost (Mme Defaye, MNHN Paris, *in litt.*). It is possible that *I. affinis* is a valid species, or that the material studied by Chevreux represents an undescribed species.

Ichnopus and *Anonyx* both have species which are scavengers and/or predators. The distribution of the two genera is mutually exclusive except in Norway. *Anonyx* is a northern circumpolar genus with its greatest species diversity in the northern North Pacific (Steele, 1979).

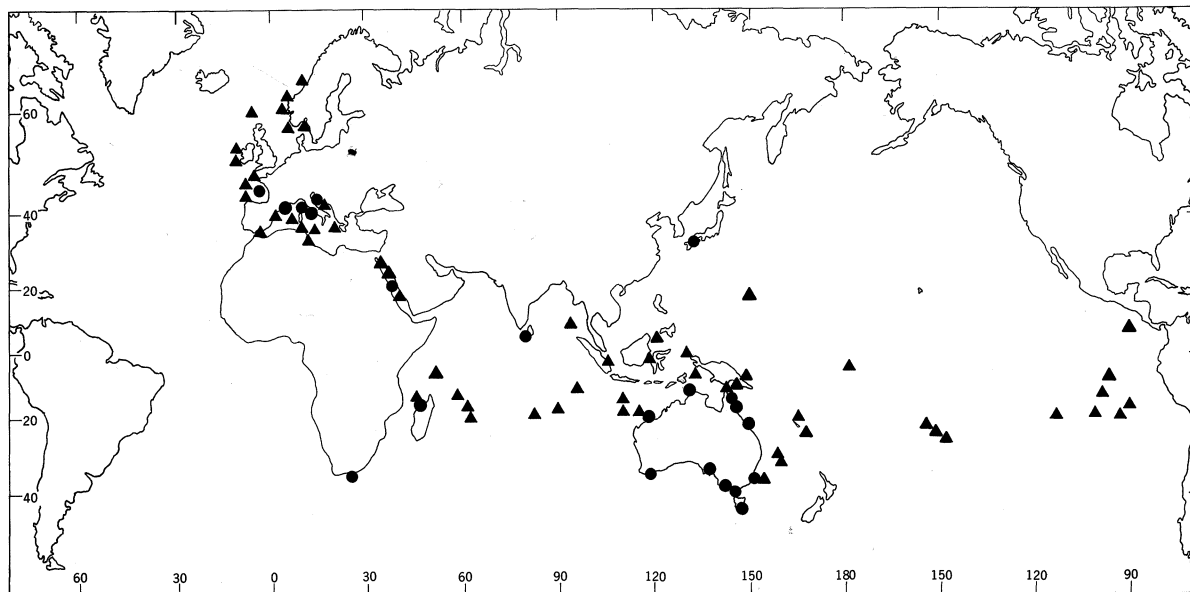


Fig.2. World distribution of the uristid genus *Ichnopus*. Collection areas for the *I. spinicornis* species group are represented by triangles. Collection areas for the *I. taurus* species group are represented by circles.

Systematics

The species diagnoses presented here are based on 17 characters which have been polarised using the outgroup *Anonyx*. *Anonyx* has been thoroughly revised by Steele & Brunel (1968) and is considered to be the sister group of *Ichnopus*. Because the relationships between taxa at any level within the Lysianassoidea are so poorly known we have not formally extended the search for character polarity beyond the immediate sister group. However, the justification for a plesiomorphic state usually goes beyond the outgroup. For instance, outside and within the Uristidae, taxa with fully triturating molars exist and this state is always considered plesiomorphic to a smooth setose tongue molar. A similar case can be made for the constricted inner ramus of uropod 2. It occurs outside and within

the Uristidae and is considered plesiomorphic. The character states are shown in Figure 3, and their occurrences are summarised in Table 1.

Character Description and Polarisation

The characters are arranged as they appear in the diagnoses.

1. *Antenna 1, peduncle, anteroventral tooth*. In *Anonyx nugax* there is no anteroventral tooth on peduncular article 1 of antenna 1 (plesiomorphic). In *Ichnopus* most species have a long anteroventral tooth (apomorphic) (Fig.3, 1a). Occasionally it is short (Fig.3, 1b) or absent (Fig.3, 1c).

2. *Antenna 1, callynophore, setae or spines*. In the plesiomorphic state neither setae nor spines occur on the

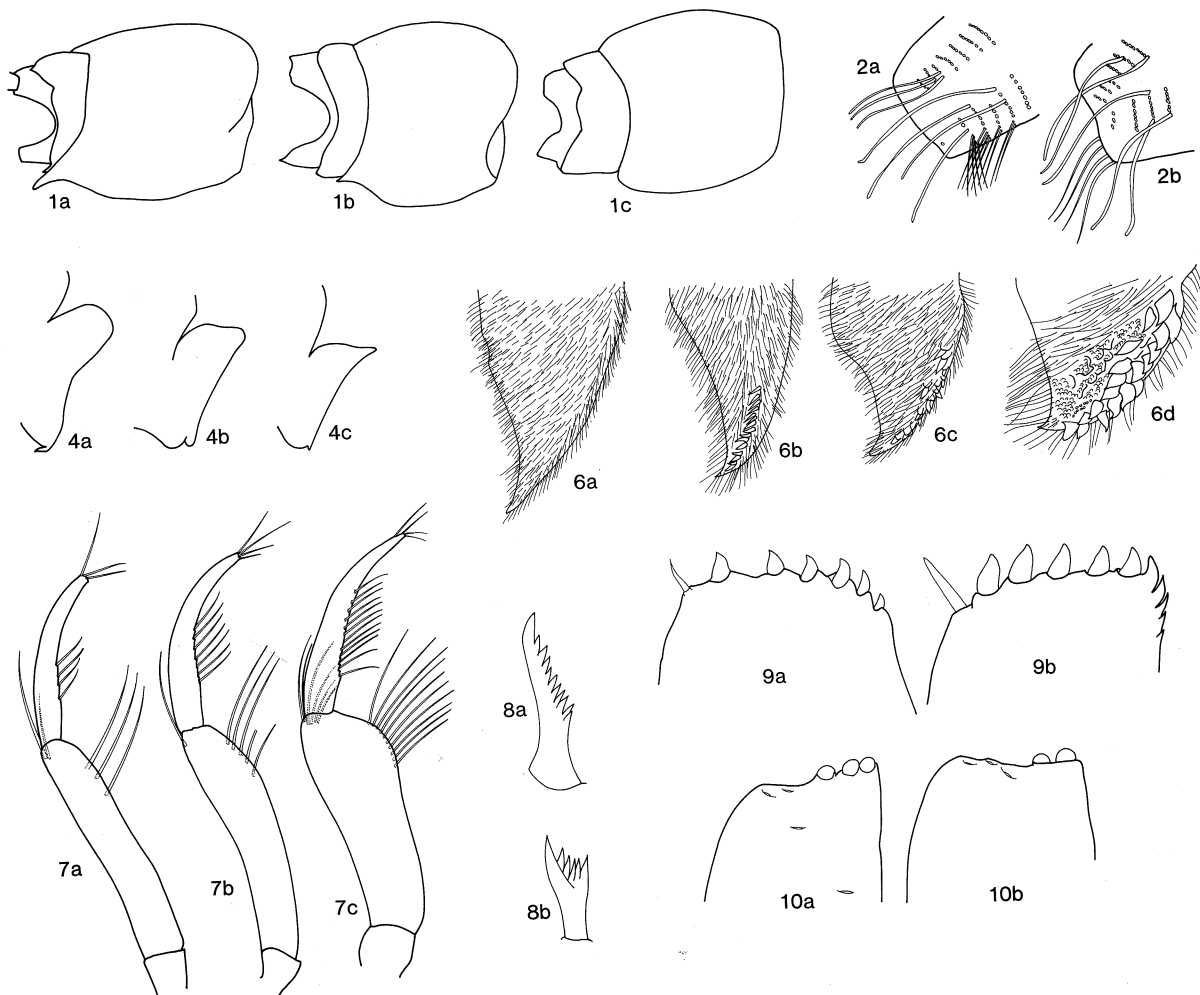


Fig.3a. Taxonomic character states. Antenna 1, peduncular article 1 with long anteroventral tooth (1a); with short anteroventral tooth (1b); without anteroventral tooth (1c). Antenna 1, callynophore with posterodistal setae (2a); with posterodistal spines (2b). Upper lip in profile produced, rounded (4a); produced, subacute (4b); produced, acute (4c). Mandibular molar setose (6a); slightly spinose (6b); moderately spinose (6c); strongly spinose (6d). Mandibular palp article 2 slender (7a); slightly broadened distally (7b); strongly broadened distally (7c). Maxilla 1 with spine-tooth 7 medially cuspidate (8a); distally cuspidate (8b). Maxilla 1 with palp inner distal margin smooth (9a); serrate (9b). Maxilliped, inner plate with 3 nodular spines (10a); with 2 nodular spines (10b).

callynophore. However, according to Steele and Brunel (1968), *Anonyx compactus* Gurjanova, 1962 has a posterodistal spine on the callynophore. In some species of *Ichnopus* setae occur in small rows, similar to the arrangement of aesthetascs, just above the posterior margin (Fig.3, 2a). In other species spines occur on the distal margin just above the posterodistal corner (Fig.3, 2b). These spines are considered to be transformed setae.

3. *Antennae 1 and 2, calceoli*. In *Anonyx calceoli* occur only in mature males (plesiomorphic). In *Ichnopus calceoli* occur either in mature males only or in both males and females (apomorphic). In one species of *Ichnopus calceoli* have not been found in the male, but it is likely that mature males are not known.

4. *Upper lip*. In *Ichnopus* the upper lip/epistome is always separate. In most species of *Ichnopus* the upper lip, in profile, is produced and rounded (plesiomorphic) (Fig.3, 4a). In one species the upper lip is produced but subacute (apomorphic) (Fig.3, 4b); in several other species it is produced and acute (apomorphic)

(Fig.3, 4c).

5. *Mandible, lacinia mobilis*. In *Anonyx nugax* the left lacinia mobilis is present as a small slender spine. In *Ichnopus* the left lacinia mobilis may be present as a small slender spine (plesiomorphic), or absent (apomorphic). It has probably been lost at least once in each species group.

6. *Mandible, molar*. The mandibular molar is a setose tongue in *Anonyx* and occasionally in *Ichnopus* (plesiomorphic) (Fig.3, 6a), but usually it is a setose tongue with one of three apomorphic states: weakly spinose (Fig.3, 6b), moderately spinose (Fig.3, 6c) or strongly spinose (Fig.3, 6d). Dahl (1979) and Saint-Marie (1984) have both discussed the highly derived setose tongue of scavenging lysianassoids such as *Anonyx*. Saint-Marie (1984) has discussed the differences between these molars and the triturating molars of less efficient scavengers such as *Orchomenella pinguis* and *Psammonyx nobilis* and illustrated them with SEM. Saint-Marie considered that rasp-like scales on the molar of *O. pinguis* originated from setae. Oshel &

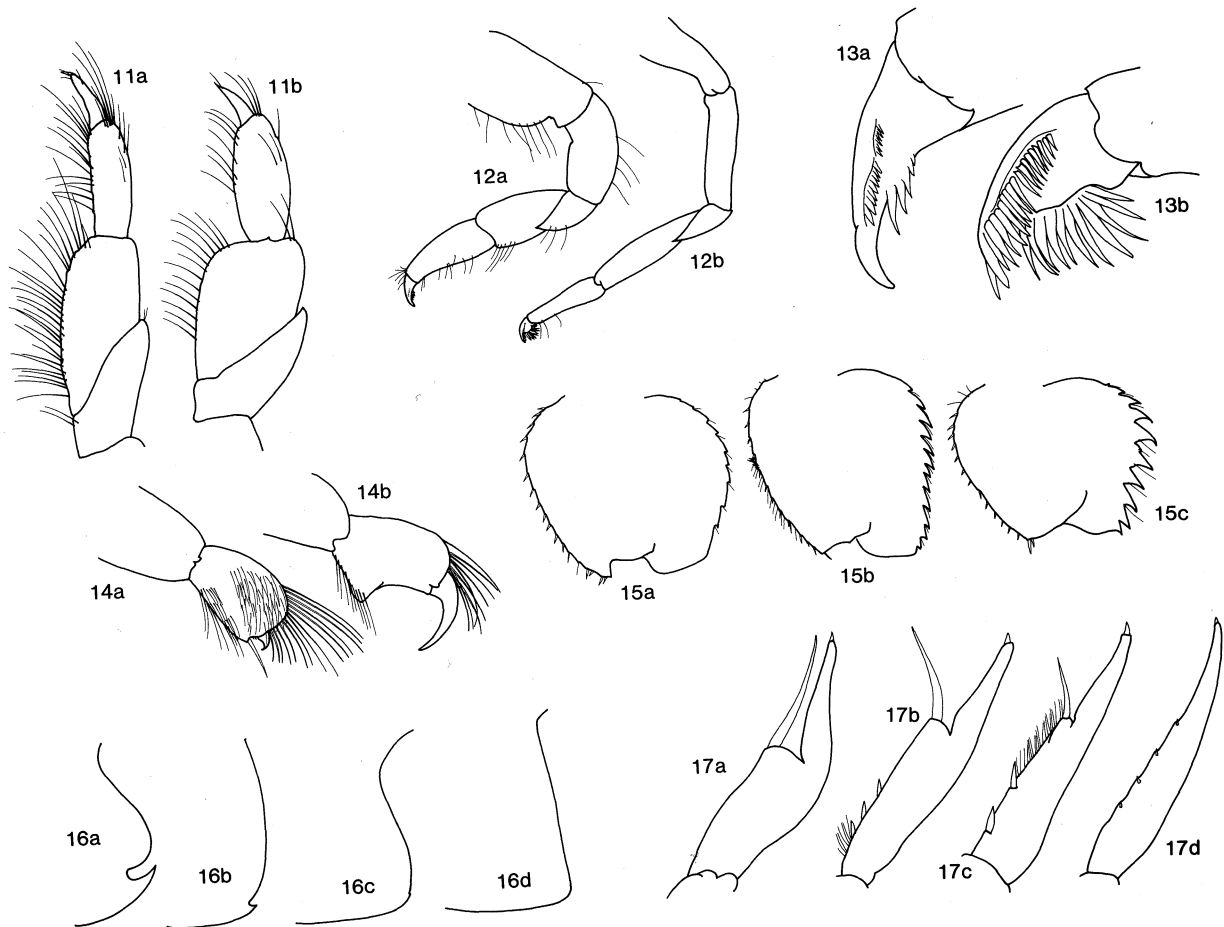


Fig.3b. Taxonomic character states. Maxilliped, palp with broad article 2 (11a); with very broad article 2 (11b). Gnathopod 1 with long ischium and carpus (12a); with very long ischium and carpus (12b). Gnathopod 1 dactylus with short cuticular teeth (13a); with long cuticular teeth (13b). Gnathopod 2 palm and dactylus minute (14a); enlarged (14b). Peraeopod 5 basis with minutely crenate posterior margin (15a); with strongly crenate margin (15b); with deeply serrate margin (15c). Epimeron 3 with large notch (16a); with small notch (16b); with minute notch (16c); with notch absent (16d). Uropod 2 inner ramus strongly constricted (17a); moderately constricted (17b); weakly constricted (17c); not constricted (17d).

Steele (1988) have discussed the comparative morphology of amphipod setae. They consider that 'spines' are merely stout setae and that setae are "...produced by the actions of specialised cells, each of which forms a particular part of the socket-and-seta complex...". In all cases the 'spines' on the *Ichnopus* molar are obviously articulating. In no cases do the 'spines' on the molar bear any resemblance to the triturating molar of other uristids such as *Uristes*. These 'spines' are more similar to setae and are probably derived from the setae of the molar. We therefore consider the spinose state of the setose molar to be a derived condition which reflects a changed function for the molar.

7. *Mandible, palp*. Mandibular palp article 2 may be slender (plesiomorphic) (Fig.3, 7a) to slightly broadened distally (apomorphic) (Fig.3, 7b) or strongly broadened distally (Fig.3, 7c). Occasionally this character is sexually dimorphic, slightly broadened in the female and strongly broadened in the male.

8. *Maxilla 1, spine-tooth 7*. On *Anonyx nugax* spine-tooth 7 is medially cuspidate (plesiomorphic). In *Ichnopus* spine-tooth 7 may have a weak basal cusp with a short medioproximal margin (medially cuspidate, plesiomorphic) (Fig.3, 8a), or a strong basal cusp with a long medioproximal margin (distally cuspidate, apomorphic) (Fig.3, 8b).

9. *Maxilla 1, palp inner margin*. In *Anonyx nugax*, and several species of *Ichnopus*, the inner margin of the maxilla 1 palp is smooth (plesiomorphic) (Fig.3, 9a). In most species of *Ichnopus* it is serrate (apomorphic) (Fig.3, 9b).

10. *Maxilliped, inner plate nodular spines*. In *Anonyx nugax* and most lysianassoids there are 3 small nodular spines on the distal margin of the inner plate (plesiomorphic) (Fig.3, 10a). In some species of *Ichnopus* there are only 2 nodular spines (apomorphic) (Fig.3, 10b).

11. *Maxilliped, palp*. The second article of the maxillipedal palp is slender in *Anonyx* (plesiomorphic), but it is broad (Fig.3, 11a) or very broad (Fig.3, 11b) in all species of *Ichnopus*.

12. *Gnathopod 1, ischium and carpus*. In *Anonyx*, which has a subchelate gnathopod 1, the ischium of gnathopod 1 is short and the carpus is long (plesiomorphic). In *Ichnopus*, which has a simple gnathopod 1, the ischium and carpus may be long (carpus 2.4 to 2.7 times as long as broad) (Fig.3, 12a) or very long (carpus 4.0 to 5.8 times as long as broad) (Fig.3, 12b).

13. *Gnathopod 1, dactylus*. In *Anonyx* the dactylus of gnathopod 1 never has cuticular teeth (plesiomorphic). In *Ichnopus* the dactylus always bears cuticular teeth. They may be short (Fig.3, 13a) or long (Fig.3, 13b).

14. *Gnathopod 2*. In most species of *Ichnopus* gnathopod 2 is minutely subchelate (plesiomorphic), (Fig.3, 14a) but in some species the palm and dactylus become enlarged in the female (apomorphic) (Fig.3, 14b).

15. *Peraeopod 5, basis*. In *Anonyx* and some species of *Ichnopus* the posterior margin of the basis of

peraeopod 5 is minutely crenate (plesiomorphic) (Fig.3, 15a). In other species the posterior margin is either strongly crenate (Fig.3, 15b) or deeply serrate (Fig.3, 15c).

16. *Epimeron 3*. Species of *Anonyx* have an acute tooth above the rounded posteroventral corner of epimeron 3, but no notch (plesiomorphic). In *I. spinicornis* there is a large notch (Fig.3, 16a) in this position. In most other species of *Ichnopus* there is a small (Fig.3, 16b) or minute (Fig.3, 16c) notch near the corner, and in *I. teretis* this notch is absent (Fig.3, 16d).

17. *Uropod 2, inner ramus*. This character has four states: strongly constricted (Fig.3, 17a), moderately constricted (Fig.3, 17b), weakly constricted (Fig.3, 17c) and non-constricted (Fig.3, 17d). Steele (1979) considered that the plesiomorphic condition was non-constricted, which he argued was found in many other lysianassoids. From this condition he derived four variously constricted states. In *Anonyx* and in more distantly related taxa such as *Hirondellea*, the lysianassids and the amaryllidids, constricted and non-constricted states occur. It is more parsimonious to consider the constricted inner ramus of uropod 2 as plesiomorphic and that it is variously reduced or lost in different lineages; otherwise the constricted form must re-evolve in several different lineages. Consequently, within *Anonyx* and *Ichnopus* the strongly constricted state is plesiomorphic and its reduction or loss are derived states.

Ichnopus Costa

Ichnopus Costa, 1853: 169.—Costa, 1857: 188.—Boeck, 1871: 98.—Sars, 1890: 39.—Della Valle, 1893: 800 (in part).—Stebbing, 1906: 52.—Chevreux & Fage, 1925: 46.—Stephensen, 1929a: 60.—Pirlot, 1936: 269.—Gurjanova, 1951: 219.—J.L. Barnard, 1969: 346.—Lincoln, 1979: 94.—Ledoyer, 1986: 760.—Diviacco & Ruffo, 1989: 486.—Barnard & Karaman, 1991: 491. [Type species: *Ichnopus taurus* Costa, 1853, by monotypy.]

Glyceria Haswell, 1879a: 256 (not *Glyceria* Lamarck, 1818, Polychaeta). [Type species: *Glyceria tenuicornis* Haswell, 1879, by monotypy.]

Glycerina Haswell, 1882: 233 [*nom. nov.* for *Glyceria* Haswell, 1879].—Stebbing, 1906: 60.—Pirlot, 1936: 270.—J.L. Barnard, 1969: 345.—Barnard & Karaman, 1991: 488.

Diagnosis. Antenna 1, peduncular article 1 with posterodistal tooth; callynophore with posterodistal setae or spines. Upper lip/epistome separate, upper lip strongly produced. Mandibular palp with slender, falcate third article. Maxilliped outer plate distomedially truncated. Gnathopod 1 simple, ischium and carpus long or very long, dactylus with cuticular teeth on posterior margin. Peraeopods 3 and 4: males with plumose setae on posterior margin of merus and carpus. Gnathopod 2 to peraeopod 6 with strongly pleated gills, peraeopod 7 with tiny smooth gill.

Description. *Head:* slightly deeper than long, lateral cephalic lobe well developed, narrowly to broadly rounded; rostrum absent; eyes reniform, very slightly enlarged to enlarged and meeting dorsally in reproductive male. *Antenna 1:* medium length, about 0.3 times as long as body, subequal to or up to 0.5 times as long as antenna 2; peduncular article 1 short, from as long as deep to 1.8 times as long as deep, with long posterodistal tooth; accessory flagellum 6- to 10-articulate, not forming cap; calynophore, well-developed 2-field in female and male, with posterodistal setae or spines; flagellum long, 10- to 90-articulate; calceoli present in female and male or in male only. *Antenna 2:* about 0.4 times as long as body, occasionally as long as body in male; peduncle with brush setae in female and male, peduncular articles 4 and 5 not swollen in female or male; calceoli present in female and male or in male only.

Mouthpart bundle: subquadrate. *Epistome* and *upper lip:* separate, upper lip produced, rounded, subacute or acute. *Mandible:* incisors symmetrical with slightly convex margins; left lacinia mobilis a small slender spine or absent; accessory spine row, left with 3 or 4 spines, right with 4 spines, rarely more variable; molar a setose tongue with spines absent to well developed, without triturating surface; mandibular palp attached midway; article 1 short, about as long as broad or twice as long as broad; article 2 elongate, slender to strongly broadened distally, with setae along distal third of medial margin and on distolateral corner; article 3 slender, falcate, without A- or B-setae, with D-setae weakly to strongly developed but always proximal, with E-setae. *Maxilla 1:* inner plate small, narrow with 2 apical plumose setae; outer plate extremely narrow, with 11 spine-teeth in a 7/4 crown arrangement, ST1 to ST3 large, stout, without cusps or weakly cuspidate, ST4 to ST6 large, slender, multicuspidate, ST7 short or long, displaced from ST6, multicuspidate medially or distally, STA 0- to 4-cuspidate, STB-STC 2- to 5-cuspidate, STD 1- to 6-cuspidate; palp large, 2-articulate, with 4-9 terminal spines and 1 or 2 flag setae. *Maxilla 2:* inner plate about three quarters as long as outer plate. *Maxilliped:* inner plate large, subrectangular, with 2 or 3 well-developed nodular spines, oblique setal row reduced, with 3-9 plumose setae; outer plate small to medium in size, subovate, distomedially truncated, apical setae and spines absent, medial spines reduced in size, bead-shaped, submarginal setae vestigial; palp well developed, with article 2 weakly to strongly broadened, dactylus well developed, unguis present.

Gnathopod 1: simple; coxa large, anterior margin concave, forming anteroventrally produced corner; ischium long to very long (2.0-4.5 times as long as broad); carpus long (2.4-2.7 times as long as broad) or very long (4.0-5.8 times as long as broad); carpus about 1.4 times as long as propodus; propodus long, subrectangular, about 4 times as long as broad, margins subparallel or slightly tapering, posterior margin smooth, straight, without spines; dactylus with large subterminal tooth, a row of medial spines and a row of cuticular

teeth along posterior margin. *Gnathopod 2:* minutely subchelate, occasionally greatly expanded in female; coxa large, subequal in size to coxa 3; carpus long, posterior margin broadly lobate; propodus subrectangular; palm slightly acute, occasionally broadly transverse and concave; posterodistal corner without spines or occasionally with a minute spine.

Peraeopods 3 to 7: with short, slender dactyli. *Peraeopod 4:* coxa with well-developed posteroventral lobe; male, and sometimes female, merus/carpus with plumose setae. *Peraeopod 5:* coxa bilobate; basis expanded with posterior margin minutely crenate to deeply serrate. *Peraeopod 7:* basis, posterior margin slightly rounded with rounded posteroventral corner and rounded to straight posteroventral margin; merus slender, not expanded posteriorly.

Oostegites: from gnathopod 2 to peraeopod 5. *Gills:* from gnathopod 2 to peraeopod 7, strongly pleated with an expanded sac-like distal end, gill on peraeopod 7 tiny, not pleated.

Epimeron 3: usually with a notched posteroventral corner, notch occasionally absent. *Urosomite 3:* with small dorsolateral spines. *Uropod 1:* with long fine setae; rami subequal in length. *Uropod 2:* with few long fine setae; rami subequal in length, inner ramus with or without constriction. *Uropod 3:* peduncle short, 1.3-1.8 times as long as broad, without lateral flange; rami lanceolate, subequal in length, with long fine setae and minutely serrate margins; plumose setae absent in female and male; outer ramus 2-articulate. *Telson:* longer than broad, deeply cleft, without dorsal spines, distal margins rounded, with 1 large spine on each margin.

Remarks. We find no reason to retain the generic concept of *Glycerina* Haswell. All species in the genus are characterised by the synapomorphies stated in the diagnosis. Within *Ichnopus* there is a tendency among some advanced species to develop very long slender first gnathopods, deeply serrate basis on peraeopod 5 and in the most advanced species, sexually dimorphic second gnathopods.

Ichnopus is placed in the anonychine group because the spine-teeth of maxilla 1 form a 7/4 crown and the molar is a setose tongue. The synapomorphies which distinguish *Ichnopus* from other anonychine genera are the toothed dactylus of the first gnathopod, the distinctive third article of the mandibular palp and the posterodistal spine on the first peduncular article of antenna 1. Synapomorphies within the genus include spines on the mandibular molar, mandibular palp article 2 broadened distally, distally cuspidate ST7 on maxilla 1, very long ischium and carpus of gnathopod 1, dimorphic second gnathopods, deeply serrate posterior margin on basis of peraeopod 5, and non-constricted inner ramus of uropod 2.

Characters such as the simple gnathopod 1, the strongly pleated gills, the produced, rounded upper lip, medially cuspidate ST7 on maxilla 1, plumose setae on peraeopods 3 and 4 and fine setae on the uropods may indicate a relationship with some socarnine lysianassids.

In this case the 7/4 crown of maxilla 1 would have to be considered as a convergent character. Our analyses to date indicate a stronger affinity with the uristids.

Gnathopod 1 has a superficial similarity to the scopelocheirid gnathopod. However, in *Ichnopus* the dactylus is large and bears rows of cuticular teeth and spines; in scopelocheirids the dactylus is usually tiny and the rows of setae and cuticular spines arise mostly from the propodus. *Schisturella* has a posterodistal spine on the callynophore, but this is considered as a homoplastic character. Posterodistal setae also occur on the callynophore of *Podoprion*, which also has a deeply serrate basis on peraeopod 5, but many other characters indicate that the two genera are not closely related and the characters are considered homoplastic.

Within the anonychine group *Anonyx* differs from *Ichnopus* in not having a strong posterodistal tooth on the peduncle of antenna 1, posterodistal setae or spines on the callynophore or a strongly produced upper lip,

and in having article 3 of the mandibular palp long, broad and falcate with D-setae along most of its margin, a subchelate gnathopod 1 with a short ischium, no posterior setae on the merus and carpus of peraeopods 3 and 4, and plumose setae on the rami of uropod 3 in females and males. *Kyska* Shoemaker differs from *Ichnopus* in not having a strong posterodistal tooth on the peduncle of antenna 1 or posterodistal setae or spines on the callynophore, in having a reduced setose molar on the mandible and a chelate gnathopod 1 with short ischium and carpus.

The genus currently contains 16 species: *Ichnopus annasona* n.sp., *I. capricornus* n.sp., *I. caritus* n.sp., *I. comorensis* n.sp., *I. cribensis* n.sp., *I. malpatun* n.sp., *I. parriwi* n.sp., *I. pelagicus* Schellenberg, *I. pseudoserricus* Ledoyer, *I. serricus* Walker, *I. spinicornis* Boeck, *I. taurus* Costa, *I. tenuicornis* (Haswell), *I. teretis* (Andres), *I. wardi* n.sp. and *Ichnopus woodmasoni* (Giles). Insufficient information is available to determine the status of *Ichnopus macrobetomma* Stebbing.

Key to Species of *Ichnopus*

1. Gnathopod 1, ischium and carpus long (Fig.3, 12a).....2
- Gnathopod 1, ischium and carpus very long (Fig.3, 12b).....10
2. Peraeopod 5, posterior margin of basis deeply serrate (Fig.3, 15c).....3
- Peraeopod 5, posterior margin of basis minutely to strongly crenate (Fig.3, 15a,b)5
3. Upper lip rounded (Fig.3, 4a)*I. malpatun*
- Upper lip acutely produced (Fig.3, 4c)4
4. Gnathopod 2 female, minutely subchelate (Fig.3, 14a)*I. wardi*
- Gnathopod 2 female, grossly subchelate (Fig.3, 14b)*I. woodmasoni*
5. Uropod 2, inner ramus constricted (Fig.3, 17a-c).....6
- Uropod 2, inner ramus not constricted (Fig.3, 17d)*I. pelagicus*
6. Peraeopod 5, basis with minutely crenate posterior margin (Fig.3, 15a)7
- Peraeopod 5, basis with strongly crenate posterior margin (Fig.3, 15b)9
7. Epimeron 3 with small or minute posteroventral notch (Fig.3, 16b,c).....8
- Epimeron 3 with large posteroventral notch (Fig.3, 16a)*I. spinicornis*

8. Mandible, molar strongly spinose (Fig.3, 6d), palp strongly setose; maxilla 1, palp inner margin distally serrate (Fig.3, 9b).....*I. annasona*
- Mandible, molar not spinose (Fig.3, 6a), palp weakly setose; maxilla 1, palp inner margin smooth (Fig.3, 9a)*I. comorensis*
9. Maxilla 1 outer plate, ST7 medially cuspidate (Fig.3, 8a); left mandible with 4 accessory spines*I. pseudoserricus*
- Maxilla 1 outer plate, ST7 distally cuspidate (Fig.3, 8b); left mandible with 3 accessory spines*I. serricus*
10. Antenna 1, callynophore with posterodistal setae (Fig.3, 2a) 11
- Antenna 1, callynophore with posterodistal spines (Fig.3, 2b) 14
11. Peraeopod 5, basis with deeply serrate posterior margin (Fig.3, 15c) 13
- Peraeopod 5, basis with minutely crenate posterior margin (Fig.3, 15a) 12
12. Antenna 1, peduncular article 1 with small posterodistal tooth (Fig.3, 1b); mandible, molar with row of small spines, palp article 3 with about 11 proximal D-setae*I. taurus*
- Antenna 1, peduncular article 1 with rounded posterodistal corner (Fig.3, 1c); mandible, molar with row of large spines, palp article 3 with about 4 proximal D-setae*Ichnopus* sp.
13. Peraeopod 7, basis with straight posteroventral margin (Fig.8); epimeron 3 with small notch on posteroventral corner (Fig.3, 16b)*I. capricornus*
- Peraeopod 7, basis with rounded posteroventral margin; epimeron 3 without notch on posteroventral corner (Fig.3, 16d)*I. teretis*
14. Antennae with calceoli only in male 15
- Antennae with calceoli in male and female*I. parriwi*
15. Gnathopod 2, minutely subchelate in male and female (Fig.3, 14a) 16
- Gnathopod 2, grossly subchelate in female (Fig.3, 14b)*I. tenuicornis*
16. Mandible, molar setose only (Fig.3, 5a)*I. caritus*
- Mandible, molar setose and weakly spinose (Fig.3, 5b)*I. cribensis*

A summary of the character states for each species is given in Table 1.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
<i>I. spinicornis</i>																	
species group																	
<i>I. spinicornis</i>	long	+ -	+ +	round	+	absent	strong	medial	smooth	2	broad	long	short	-	+	vlarge	strong
<i>I. pseudoserri</i>	long	+ -	+ ?	round	+	strong	strong	medial	serrate	3	broad	long	short	?	+	small	mod
<i>I. serricrus</i>	long	+ -	+ +	subac	+	strong	strong	distal	serrate	3	broad	long	short	-	+	small	mod
<i>I. annasona</i>	short	+ -	+ +	round	-	strong	strong	medial	serrate	3	v broad	long	short	-	+	minute	strong
<i>I. wardi</i>	long	+ -	+ +	acute	-	strong	strong	medial	serrate	2	v broad	long	short	-	+	small	strong
<i>I. woodmasoni</i>	long	+ -	+ +	acute	-	strong	strong	medial	serrate	2	v broad	long	short	+	+	small	strong
<i>I. comorensis</i>	short	+ -	+ ?	?	+	absent	slender	medial	smooth	2	broad	long	short	?	+	small	strong
<i>I. malpatun</i>	long	+ -	+ +	round	-	strong	strong	medial	serrate	2	broad	long	short	-	+	small	mod
<i>I. pelagicus</i>	short	+ -	+ +	round	-	strong	strong	medial	serrate	2	v broad	long	short	-	+	minute	absent
<i>I. taurus</i>																	
species group																	
<i>I. taurus</i>	short	+ -	+ -	round	+	weak	slight	distal	serrate	3	broad	v long	long	-	+	small	mod
<i>I. capricornus</i>	long	+ -	+ -	round	-	weak	slender	distal	serrate	3	broad	v long	long	-	+	small	weak
<i>I. teretis</i>	short	+ -	- -	round	-	absent	slender	distal	serrate	3	broad	v long	long	-	+	absent	weak
<i>I. caritus</i>	long	- +	+ -	round	-	absent	slender	distal	serrate	3	v broad	v long	long	-	+	small	mod
<i>I. parriwi</i>	long	- +	+ +	round	-	mod	slight	distal	serrate	3	v broad	v long	long	-	+	small	mod
<i>I. tenuicornis</i>	long	- +	+ -	round	-	weak	slight	distal	smooth	3	v broad	v long	long	+	+	small	mod
<i>I. cribensis</i>	long	- +	+ -	round	-	weak	slender	distal	serrate	3	v broad	v long	long	-	+	small	mod

Table 1. Distribution of character states in *Ichnopus* species. Character numbers are: 1. Antenna 1, peduncular article 1; tooth; 2. Antenna 1, callynophore; setae or spines; 3. Calceoli: present in males and/or females; 4. Upper lip; 5. Lacinia mobilis: + = present, - = absent; 6. Molar spines; 7. Mandibular palp, article 2; expansion; 8. Maxilla 1, outer plate, spine-tooth 7: cuspidation; 9. Maxilla 1, palp, inner margin; 10. Maxilliped, inner plate: nodular spines; 11. Maxilliped, palp article 2; expansion; 12. Gnathopod 1, ischium and carpus; 13. Gnathopod 1, dactylar teeth; 14. Female gnathopod 2, palm: - = minutely subchelate, + = enlarged, ? = not known; 15. Peraeopod 5, basis, posterior margin: + = minutely crenate, ++ = strongly crenate, +++ = deeply serrate; 16. Epimeron 3, notch; 17. Uropod 2, inner ramus, constriction.

Ichnopus annasona n.sp.

Figs 4-5

Type material. HOLOTYPE, male, 14 mm, AM P39649, 5 male PARATYPES, AM P39650, Elizabeth Reef, Tasman Sea, 29°55'S 159°05'E, hand net at surface, attracted to light at night, A. Gill & J.K. Lowry on RV *Flamingo Bay*, 12 Dec. 1987, site 42; 3 male PARATYPES, AM P39651, Elizabeth Reef, Tasman Sea, 29°58'S 159°03'E, hand net and spot light at night, A. Gill on RV *Flamingo Bay*, Dec. 1987, site 35b.

Additional material examined. Female, AM P40093, off Lord Howe Island, Tasman Sea, 31°38.03'S 159°03.1'E, calcareous nodules, coral sand, some algae, 44 m, dredged, W. Ponder, J.K. Lowry & F.W. Rowe on HMAS *Kimbla*, 6 Nov. 1976, stn LH2; female, 10 mm, MNHN Am 4438, off New Caledonia, 22°53'S 167°17'E, 570-610 m, N.O. Jean

Charcot, 30 Aug. 1985, BIOCAL stn DW 46; 4 specimens, AM P41008, Taupo Seamount, western Tasman Sea, 33°14.21'S 156°10.68'E, rough marl bottom, 133 m, epibenthic sled, J.K. Lowry *et al.* on RV *Franklin*, 2 May 1989, stn FR 05/89-7; 5 males, 2 females, 1 juvenile, AM P41004, (1 ovigerous female, body translucent, except gut coloured by food, eyes red), off Rurutu, Austral Isles, 22°29'S 151°21'W, plankton tow, 0-50 m, J.M. Poupin & J.K. Lowry on RV *Marara*, 11 Aug. 1991, FRP-20; male, AM P41013, off Tubuai, Austral Isles, 23°19.5'S 149°31.0'W, plankton sample, estimated depth 50 - 100 m, J.M. Poupin & J.K. Lowry on RV *Marara*, 13 Aug. 1991, FRP-37.

Diagnosis. Antenna 1: peduncular article 1 with short posterodistal tooth; callynophore with posterodistal setae. Antennae 1 and 2: calceoli present in male and female. Upper lip rounded. Mandible: left lacinia mobilis absent; accessory spine row, left and right each with 4

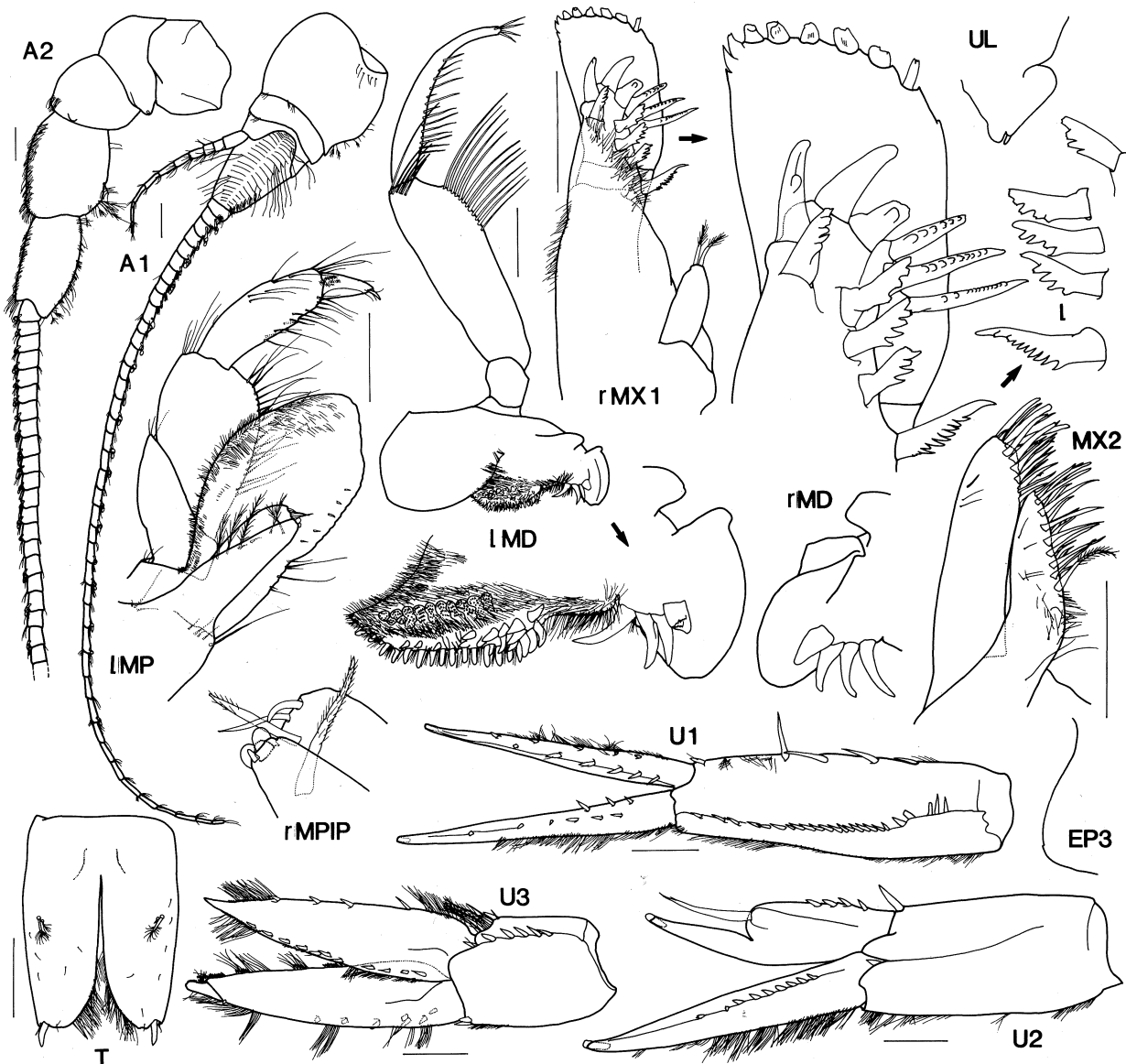


Fig.4. *Ichnopus annasona* n.sp., holotype male, 14 mm, AM P39649, Elizabeth Reef, western Tasman Sea. Scales represent 0.2 mm.

spines; molar setose, strongly spinose; palp article 2 strongly broadened distally. Maxilla 1 with ST7 multicuspidate medially; palp inner margin distally serrate. Maxilliped: inner plate with 3 nodular spines; palp article 2 very broad. Gnathopod 1: ischium and carpus long; dactylus with short cuticular teeth. Gnathopod 2: palm minute in female. Peraeopod 5: basis with posterior margin minutely crenate. Epimeron 3: posteroventral corner with minute notch. Uropod 2: inner ramus with strong constriction.

Description. Based on holotype male, 14 mm and female, 10 mm, MNHN Am 4438. *Head* slightly deeper than long, lateral cephalic lobe well developed, broadly rounded; rostrum absent; eyes reniform, enlarged in reproductive male. *Antenna 1*: medium length, about 0.4 times as long as body, about 0.5 times as long as antenna 2; peduncular article 1 short, about as long as broad, with short posterodistal tooth; accessory flagellum 10-articulate, article 1 slightly elongate, 0.1 times as long

as flagellum; callynophore well-developed 2-field in female and male, with posterodistal setae; flagellum long, 41-articulate; calceoli present in female and male. *Antenna 2*: up to 0.9 times as long as body in male, 0.4 times in female; peduncle with brush setae in female and male, peduncular articles 4 and 5 not swollen in female or male; calceoli present in female and male.

Mouthpart bundle: subquadrate. *Epistome* and *upper lip*: separate, upper lip produced, rounded. *Mandible*: incisors symmetrical with slightly convex margins; left lacinia mobilis absent; accessory spine row, left and right each with 4 spines; molar setose, strongly spinose; mandibular palp attached midway; article 1 short, about as long as broad; article 2 elongate, strongly broadened distally, with 12 setae along distal third of medial margin and row of 7 setae on distolateral corner; article 3 strongly falcate with 13 proximal D-setae and 4 short E-setae. *Maxilla 1*: inner plate small, narrow with 2 apical plumose setae; outer plate extremely narrow, with 11 spine-teeth in a 7/4 crown arrangement, ST1 to ST3

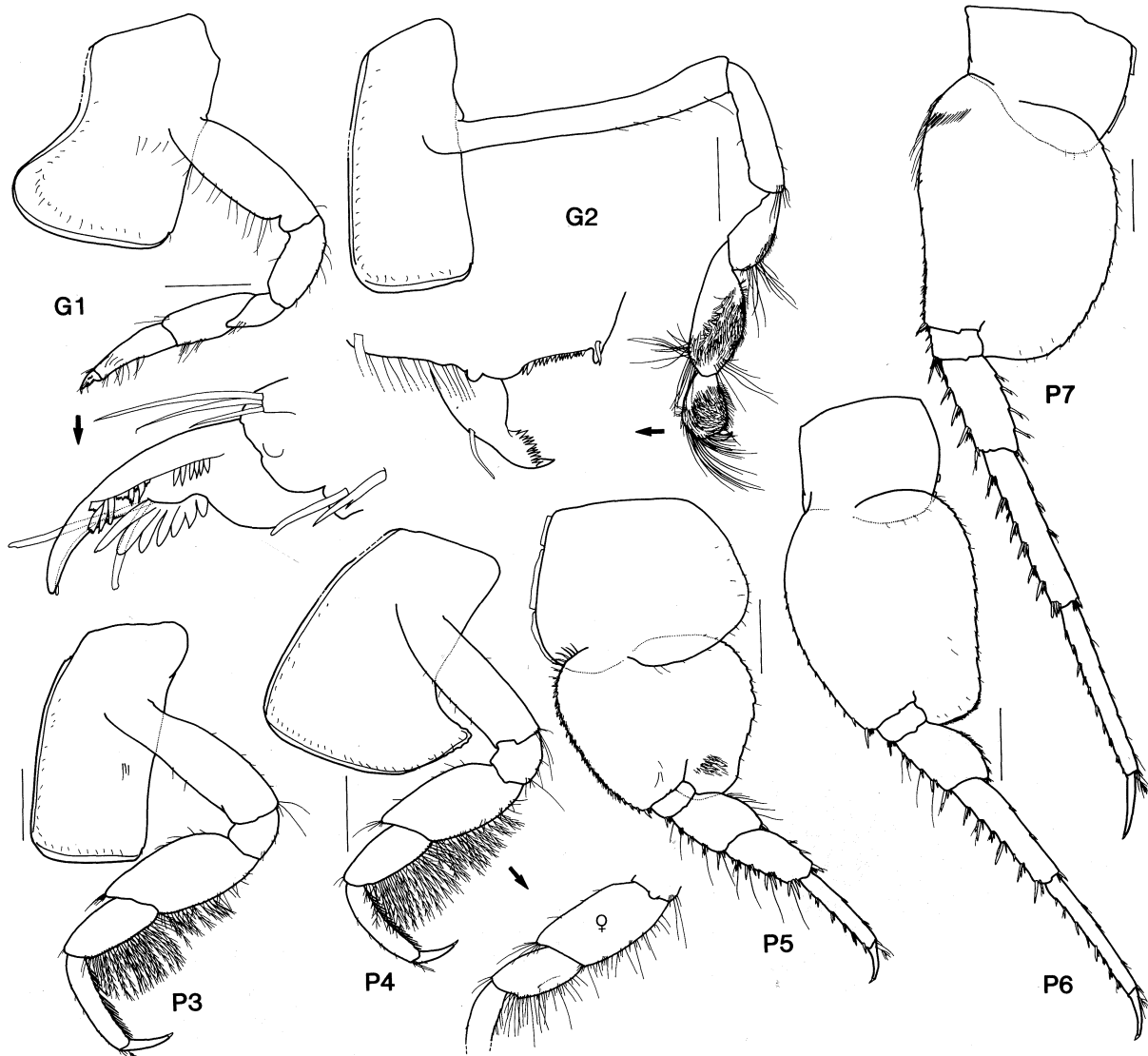


Fig.5. *Ichnopus annasona* n.sp., holotype male, 14 mm, AM P39649, Elizabeth Reef, western Tasman Sea. Scales represent 0.5 mm.

large, stout, weakly cuspidate, ST4 to ST6 large, slender, multicuspidate, ST7 long, multicuspidate medially, STA to STD 3- to 4-cuspidate; palp large, 2-articulate, with 5 terminal spines and 1 flag seta. *Maxilla 2*: inner plate about three quarters as long as outer plate. *Maxilliped*: inner plate large, subrectangular, with 3 well-developed nodular spines, oblique setal row reduced, with 6 plumose setae; outer plate medium size, subovate, apical setae and spines absent, medial spines reduced in size, bead-shaped, 5 vestigial submarginal setae present; palp well developed, article 2 very broad, dactylus well developed, unguis present.

Gnathopod 1: simple; coxa large, anterior margin concave, forming anteroventrally produced corner; ischium long, twice as long as broad; carpus long, 2.3 times as long as broad, 1.1 times as long as propodus; propodus long, 2.8 times as long as broad, tapering distally; posterior margin smooth, straight, without spines; dactylus with large subterminal tooth, a row of about 18 medial spines and a row of 7 cuticular teeth along posterior margin. *Gnathopod 2*: minutely subchelate; coxa large, subequal in size to coxa 3; carpus long, 2.4 times as long as broad, posterior margin broadly lobate; propodus subrectangular, short, 1.6 times as long as broad; palm slightly acute, with straight, minutely serrate margin.

Peraeopod 4: coxa with well-developed posteroventral lobe; male merus/carpus with plumose setae. *Peraeopod 5*: coxa equilobate; basis expanded with posterior margin minutely crenate. *Peraeopod 7*: basis, posterior margin slightly rounded with rounded posteroventral corner and straight posteroventral margin; merus slender, not expanded posteriorly.

Epimeron 3: with a minutely notched posteroventral

corner. *Uropod 1*: with long fine setae; rami subequal in length. *Uropod 2*: with long fine setae; rami subequal in length, inner ramus with strong constriction. *Uropod 3*: peduncle short, 1.6 times as long as broad, without lateral flange; rami lanceolate, subequal in length, with long fine setae and minutely serrate margins, plumose setae absent; outer ramus 2-articulate. *Telson*: longer than broad, deeply cleft (74%), without dorsal spines, distal margins rounded, with 1 large spine on each margin.

Remarks. *Ichnopus annasona* is in the *I. spinicornis* species group and is considered to be the sister taxon of *I. pelagicus*. It differs from *I. pelagicus* in having 3 nodules on the inner plate of the maxilliped and a strongly constricted inner ramus on uropod 2.

Etymology. Named after the steel barque *Annasona*, wrecked on Middleton Reef in 1907.

Distribution. *Ichnopus annasona* is known from surface pelagic waters to 133 m near Taupo Seamount, Lord Howe Island and Elizabeth Reef in the western Tasman Sea, from surface to 610 m depth off New Caledonia, and surface to 100 m depth in pelagic waters among the Austral Isles in the central south Pacific.

Ichnopus capricornus n.sp.

Figs 6-8

Type material. HOLOTYPE, female, 10 mm, non-ovigerous, AM P39644, 35 PARATYPES, AM P39645, Heron Island,

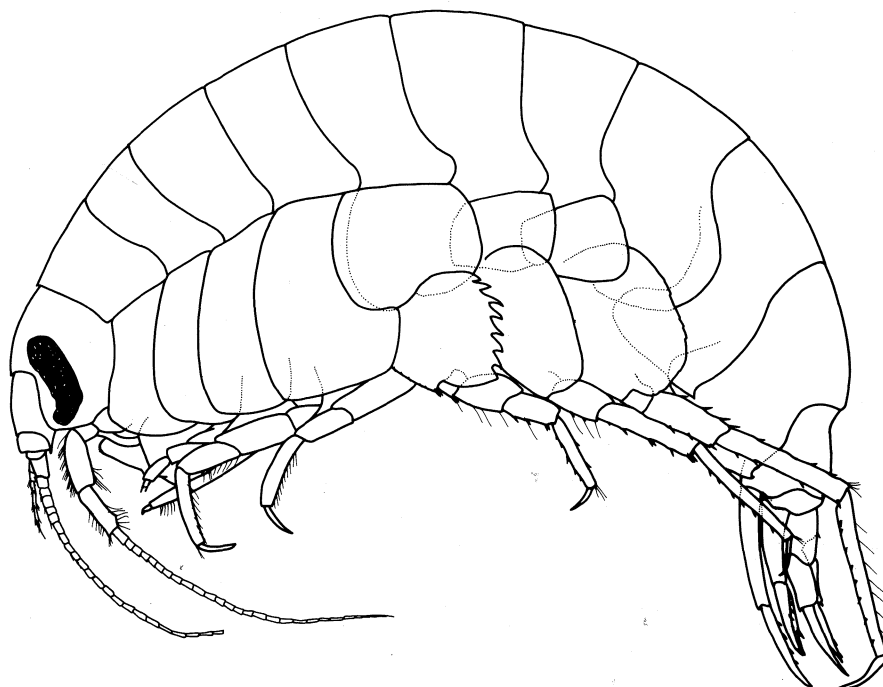


Fig.6. *Ichnopus capricornus* n.sp., paratype female, 10 mm, AM P39645, Heron Island, Great Barrier Reef, Australia.

Queensland, Australia, 23°26'S 151°55'E, baited trap, intertidal, on boulder ridge on north side of island, N.L. Bruce, 25 June 1979, QLD-85; 230 PARATYPES, AM P39646, 10 PARATYPES, BMNH 1990:33:10, 10 PARATYPES, USNM 253719, Heron Island, Queensland, 23°26'S 151°55'E, baited trap on beach rock, low tide level, A.J. Bruce, 12 June 1978, QLD-86.

Additional material examined. 156 specimens, AM P39585, patch reef between Lizard Island and Eagle Island, Queensland, 14°40'S 145°28'E, baited trap at night on sand with coral patches, 8 m, J.K. Lowry & R.T. Springthorpe, 4 Feb. 1987; 13 specimens, AM P39586, lagoon channel

between beach and Bird Islet, Lizard Island, Queensland, baited trap at night on sand at base of coral outcrop, 13 m, J.K. Lowry & R.T. Springthorpe, 7 Feb. 1987; 10 specimens, AM P39675, North Point, Lizard Island, Queensland, baited trap at night on top of coral outcrop, 3 m, J.K. Lowry & R.T. Springthorpe, 9 Feb. 1987; 4 specimens, AM P39676, same data except baited trap at night on coral rubble near large coral outcrop, 8 m; 17 specimens, AM P39677, same data except baited trap on sand patches among coral, 12 m; 20 specimens, AM P39904, reef edge at lagoon channel, off Trawler Beach, Lizard Island, baited trap on sand and coral near large formations of yellow *Turbinaria reniformis* Bernard in 3-4 m, J.K. Lowry & R.T. Springthorpe, 15 Feb. 1987.

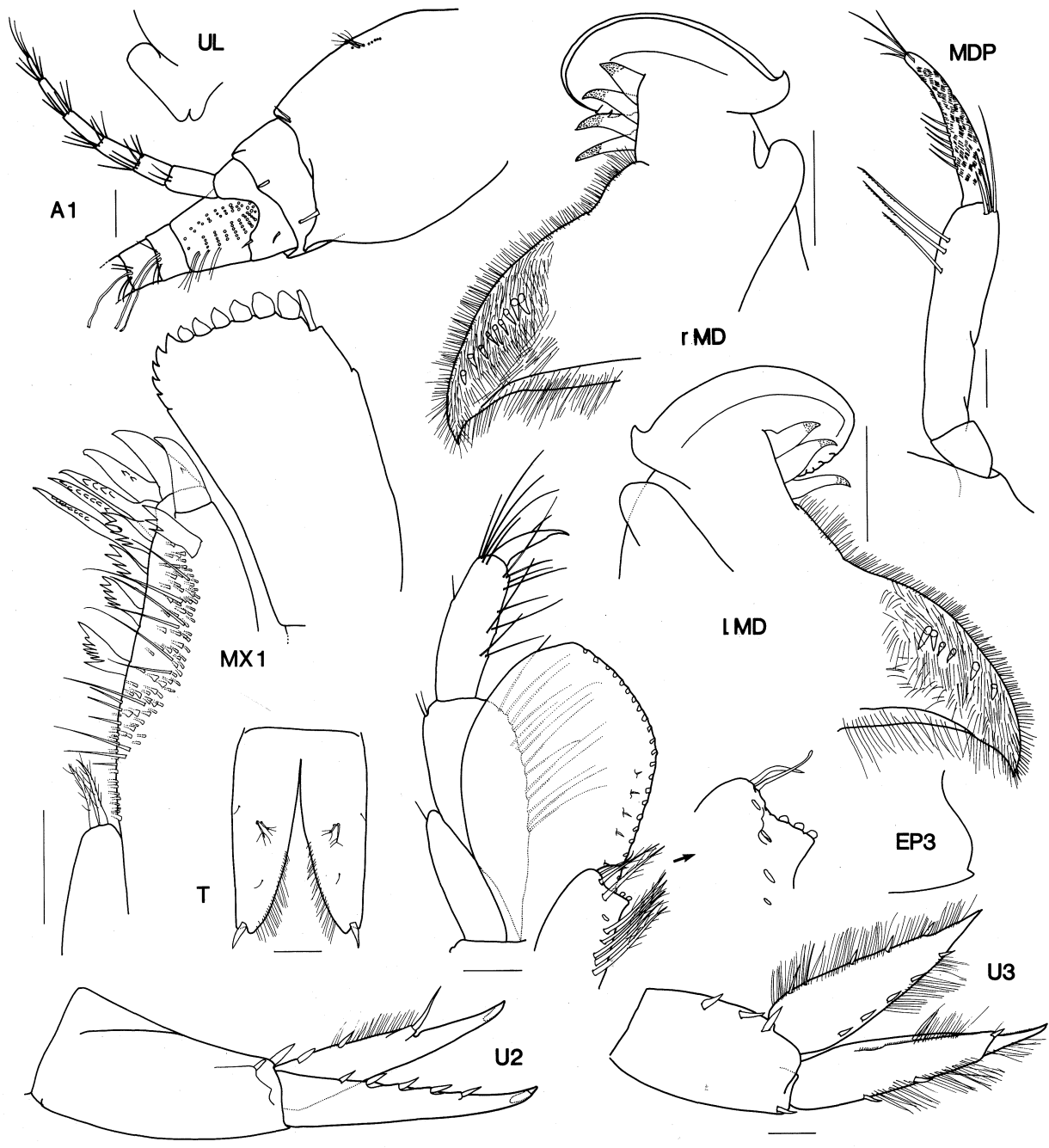


Fig.7. *Ichnopus capricornus* n.sp., holotype female, 10 mm, AM P39644, Heron Island, Great Barrier Reef, Australia. Scales represent 0.1 mm.

Diagnosis. Antenna 1: peduncular article 1 with long posteroventral tooth; callynophore with posterodistal setae. Antennae 1 and 2: calceoli present in male only. Upper lip rounded. Mandible: left lacinia mobilis absent; accessory spine row, left with 3, right with 4 spines; molar setose, weakly spinose; palp article 2 slender. Maxilla 1 with ST7 multicuspidate distally; palp inner margin distally serrate. Maxilliped: inner plate with 3 nodular spines; palp article 2 broad. Gnathopod 1: ischium and carpus very long; dactylus with long cuticular spines. Gnathopod 2: palm minute in female. Peraeopod 5: basis with posterior margin deeply serrate. Epimeron 3: posteroventral corner with small notch. Uropod 2: inner ramus with weak constriction.

Description. Based on holotype female, 10 mm and paratype male, 9.8 mm. *Head*: slightly deeper than long, lateral cephalic lobe well developed, broadly rounded; rostrum absent; eyes reniform, enlarged in reproductive male. *Antenna 1*: medium length, about 0.3 times as long as body, 0.82 times as long as antenna 2; peduncular

article 1 short, as long as broad, with long posterodistal tooth; accessory flagellum 6-articulate (male 7); callynophore, well-developed 2-field in female and male, with posterodistal setae; flagellum long, 26-articulate (male 30); calceoli present in male. *Antenna 2*: about 0.4 times as long as body in female; flagellum 26-articulate (male 34); peduncle with brush setae in female and male, peduncular articles 4 and 5 not swollen in female or male; calceoli present in male.

Mouthpart bundle: subquadrate. *Epistome* and *upper lip*: separate, upper lip produced, rounded. *Mandible*: incisors symmetrical, with slightly convex margins; left lacinia mobilis absent; accessory spine row, left with 3 spines, right with 4 spines; molar setose, sparsely spinose; mandibular palp attached midway; article 1 short, about as long as broad; article 2 elongate, slender, with 3 setae along distal third of medial margin, 3 setae on distolateral corner; article 3 slender, falcate, with 6 proximal D-setae and 4 short E-setae. *Maxilla 1*: inner plate small, narrow with 2 apical plumose setae; outer plate extremely narrow, with 11 spine-teeth in a 7/4

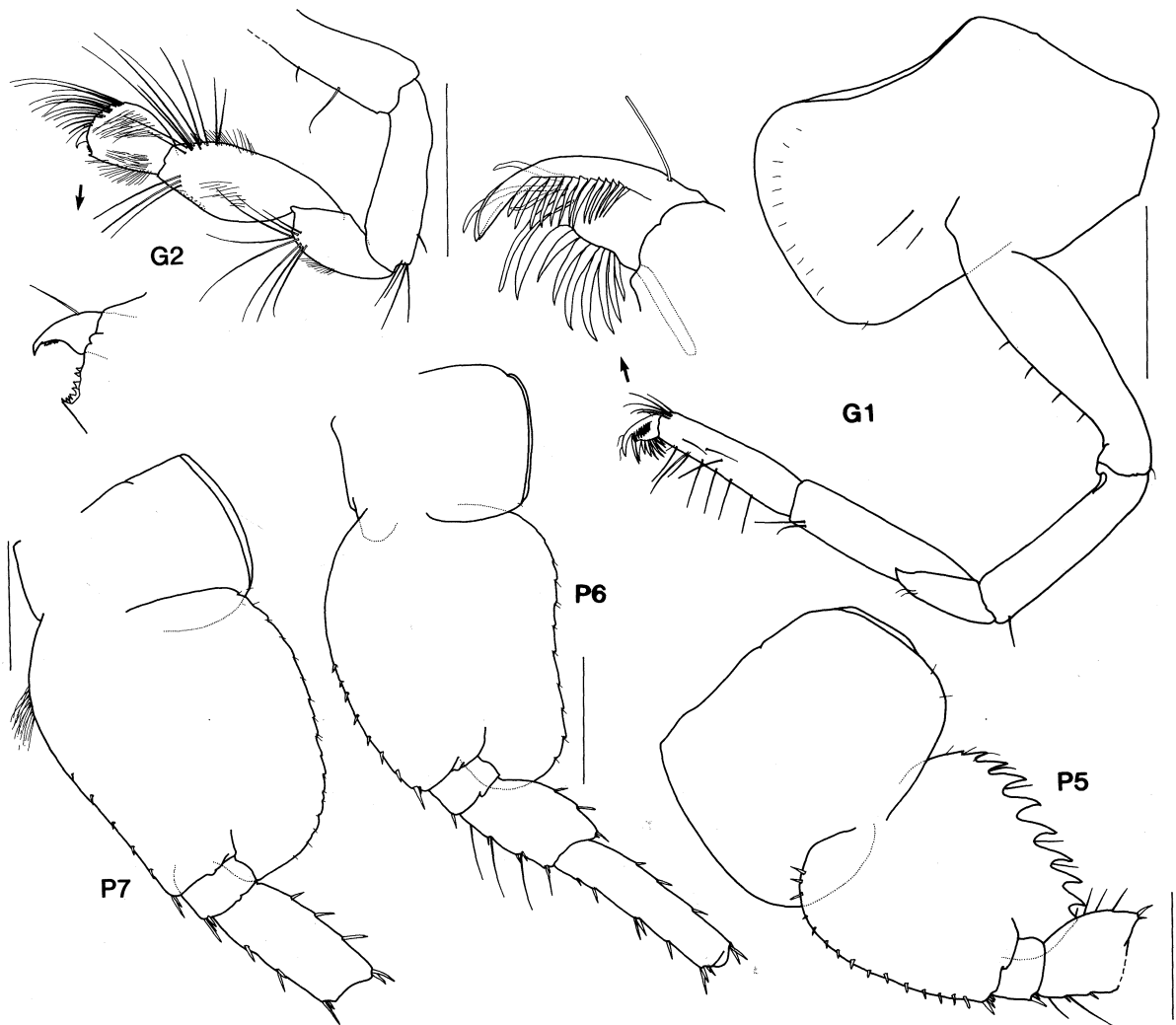


Fig.8. *Ichnopus capricornus* n.sp., holotype female, 10 mm, AM P39644, Heron Island, Great Barrier Reef, Australia. Scales represent 0.5 mm.

crown arrangement, ST1 to ST3 large, stout, weakly cuspidate, ST4 to ST6 large, slender, multicuspidate, ST7 short, multicuspidate distally, STA 2-cuspidate, STB to STD 3- to 4-cuspidate; palp large, 2-articulate, with 6 terminal spines and 1 flag seta. *Maxilla 2*: inner plate three quarters as long as outer plate. *Maxilliped*: inner plate large, subrectangular, with 3 well-developed nodular spines, oblique setal row reduced, with 8 plumose setae; outer plate medium size, subovate, apical setae and spines absent, medial spines reduced in size, bead-shaped, submarginal setae vestigial; palp well developed, article 2 broad, dactylus well developed, unguis present.

Gnathopod 1: simple; coxa large, anterior margin concave, forming anteroventrally produced corner; ischium very long, about 4.3 times as long as broad; carpus very long, 4 times as long as broad, 1.2 times as long as propodus; propodus long, subrectangular, 3.8 times as long as broad, margins subparallel; posterior margin smooth, straight, without spines; dactylus with large subterminal tooth, a row of about 13 medial spines and a row of 9 cuticular teeth along posterior margin. *Gnathopod 2*: minutely subchelate; coxa large, subequal in size to coxa 3; carpus long, 2.6 times as long as broad, posterior margin broadly lobate; propodus subovate, short, 1.3 times as long as broad; palm transverse, with slightly concave, serrate margin.

Peraeopod 4: coxa with well-developed posteroventral lobe, anterior and posterior margins subparallel; male merus/carpus with plumose setae. *Peraeopod 5*: coxa equilobate; basis expanded with posterior margin deeply serrate. *Peraeopod 7*: basis, posterior margin slightly rounded with rounded posteroventral corner and straight posteroventral margin; merus slender, not expanded posteriorly.

Epimeron 3: with a small notch on posteroventral corner. *Uropod 1*: with long fine setae; rami subequal in length. *Uropod 2*: with long fine setae; rami subequal in length, inner ramus with weak constriction. *Uropod 3*: peduncle short, 1.76 times as long as broad, without lateral flange; rami lanceolate, subequal in length, with long fine setae and minutely serrate margins, plumose setae absent in female and male; outer ramus 2-articulate. *Telson*: longer than broad, deeply cleft (85%), without dorsal spines, distal margins rounded, with 1 large spine on each margin.

Remarks. *Ichnopus capricornus* is a member of the *I. taurus* species group. It appears to be most closely related to *I. teretis*. They differ in the shape of peraeopod 7 basis and the posteroventral notch on epimeron 3. Both species have a weak constriction on the inner ramus of uropod 2.

Ichnopus capricornus is a tropical nocturnal scavenger which lives on shallow hard bottoms often covered with *Acropora* plates.

Etymology. The species takes its name from the Tropic of Capricorn.

Distribution. *Ichnopus capricornus* is known only from Heron Island and Lizard Island, Great Barrier Reef, Australia, in less than 30 m depth.

Ichnopus caritus n.sp.

Figs 9-10

Type material. HOLOTYPE, female, ovigerous (7 eggs), 10 mm, AM P39652, 13 PARATYPES, AM P39653, off Possession Point, King George Sound, Western Australia, 35°02.5'S 117°55'E, sand and detritus from bases of seagrasses, 10 m, R.T. Springthorpe & J.K. Lowry, 14 Dec. 1983, WA-131.

Additional material examined. One specimen, NMV J19736, 23 km east of Cape Rochon, Three Hummock Island, Tasmania, 40°22.2'S 145°17'E, sand, 40 m, M. Gomon & G.C.B. Poore on FRV *Sarda*, 3 Nov. 1980, cruise 80-Sa-1, stn BSS-112; 3 specimens, AM P39654, 25 km north-east of Deal Island, Tasmania, eastern Bass Strait, 39°16.8'S 147°33.2'E, sand, 57 m, epibenthic sled, R. Wilson on RV *Tangaroa*, 18 Nov. 1981, cruise 81-T-1, stn BSS-174S; 1 specimen, NMV J19737, same data except 39°16.8'S 147°33.2'E, grab, stn BSS-174G; 1 specimen, NMV J19738, 15 km east of Cape Wellington, Wilsons Promontory, Victoria, eastern Bass Strait, 39°03.2'S 146°39.5'E, muddy fine sand, 55 m, epibenthic sled, R. Wilson on RV *Tangaroa*, 18 Nov. 1981, cruise 81-T-1, stn BSS-179S; 10 specimens, NMV J19739, 8 km south of South East Point, Wilsons Promontory, Victoria, central Bass Strait, 39°12.9'S 146°27.3'E, medium sand, 65 m, epibenthic sled, R. Wilson on RV *Tangaroa*, 18 Nov. 1981, cruise 81-T-1, stn BSS-180S; 3 specimens, NMV J19740, 26 km south-east of Aireys Inlet, Victoria, central Bass Strait, 38°39.8'S 144°18.2'E, very fine sand, 79 m, R. Wilson on RV *Tangaroa*, 19 Nov. 1981, cruise 81-T-1, stn BSS-181S; 2 specimens, NMV J19741, 40 km south-south-west of Lakes Entrance, Victoria, 38°18.0'S 147°37.0'E, muddy fine shell, 55 m, epibenthic sled, M. Gomon & R. Wilson on FV *Silver Gull*, 31 July 1983, cruise 83-SG-1, stn BSS-209S.

Diagnosis. Antenna 1: peduncular article 1 with long posteroventral tooth; calypophore with posterodistal spines. Antennae 1 and 2: calceoli in male only. Upper lip rounded. Mandible: left lacinia mobilis absent; accessory spine row, left with 3, right with 4 spines; molar setose, without spines; palp article 2 slender. Maxilla 1 with ST7 multicuspidate distally; palp inner margin distally serrate. Maxilliped: inner plate with 3 nodular spines; palp article 2 very broad. Gnathopod 1: ischium and carpus very long; dactylus with long cuticular spines. Gnathopod 2: palm minute in female. Peraeopod 5: basis with posterior margin deeply serrate. Epimeron 3: posteroventral corner with small notch. Uropod 2: inner ramus with moderate constriction.

Description. Based on holotype female, 10 mm, and paratype male, 6 mm. *Head*: slightly deeper than long, lateral cephalic lobe well developed, broadly rounded; rostrum absent; eyes reniform, slightly enlarged in

reproductive male. *Antenna 1*: medium length, 0.3 times as long as body, subequal in length to antenna 2; peduncular article 1 short, about as long as broad, with

long posterodistal tooth; accessory flagellum 8-articulate (male 6); callynophore, well-developed 2-field in female and male with 2 large posterodistal spines; flagellum

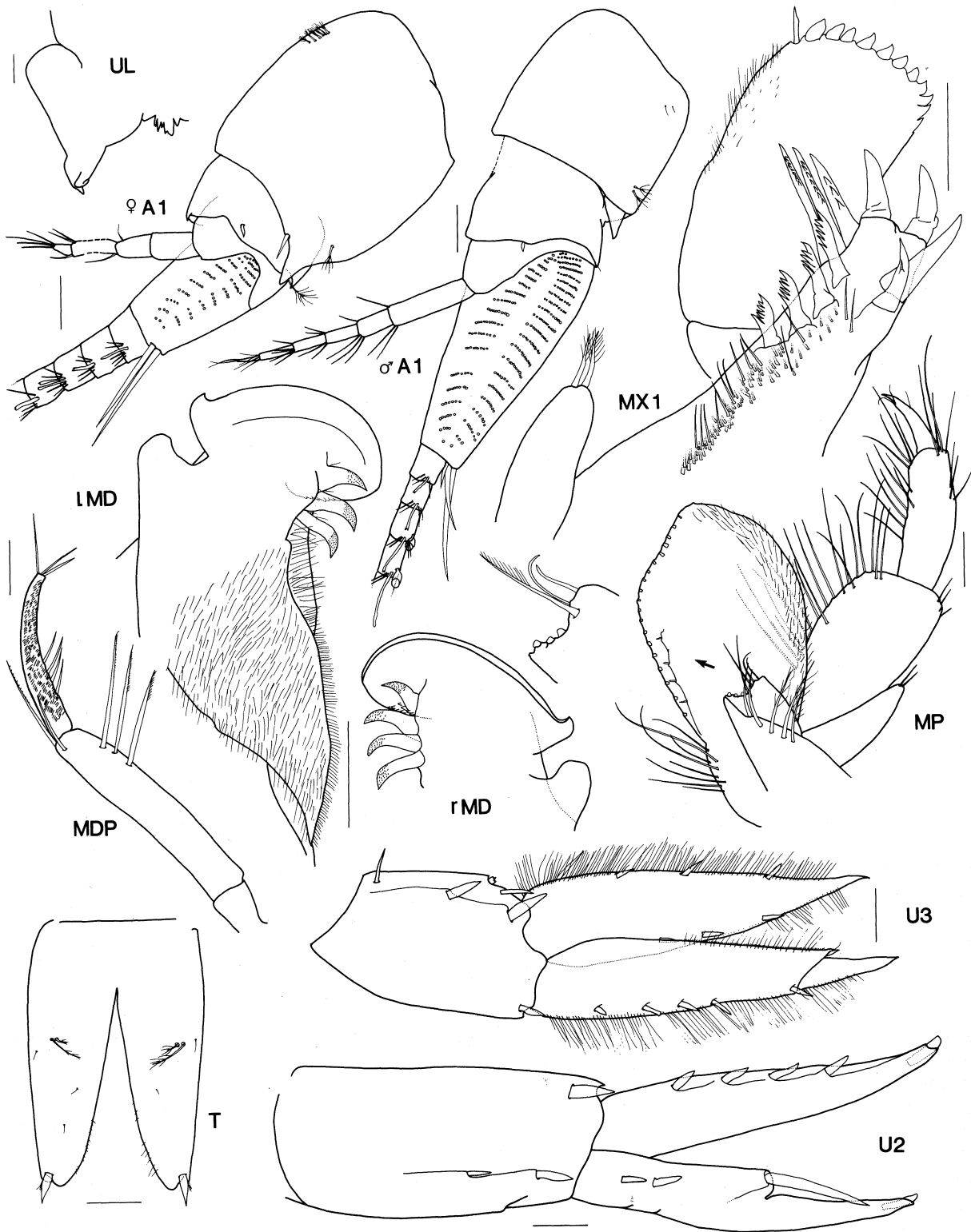


Fig.9. *Ichnopus caritus* n.sp., holotype female, 10 mm, AM P39652, paratype male, 6 mm, AM P39653, off Possession Point, King George Sound, Western Australia. Scales represent 0.1 mm.

long, 24-articulate (male 14); calceoli present in male. *Antenna 2*: about 0.3 times as long as body in female; flagellum 26-articulate (male 16-articulate); peduncle with brush setae in female and male, peduncular articles 4 and 5 not swollen in female or male; calceoli present in male.

Mouthpart bundle: subquadrate. *Epistome* and *upper lip*: separate, upper lip produced, rounded. *Mandible*: incisors symmetrical with slightly convex margins; left

lacinia mobilis absent; accessory spine row, left with 3 spines, right with 4 spines; molar setose, without spines; mandibular palp attached midway; article 1 short, about as long as broad; article 2 elongate, slender, with 3 setae along distal third of medial margin, 2 setae on distolateral corner; article 3 slender, falcate, with 4 proximal D-setae and 3 short E-setae. *Maxilla 1*: inner plate small, narrow with 2 apical plumose setae; outer plate extremely narrow, with 11 spine-teeth in a 7/4 crown arrangement,

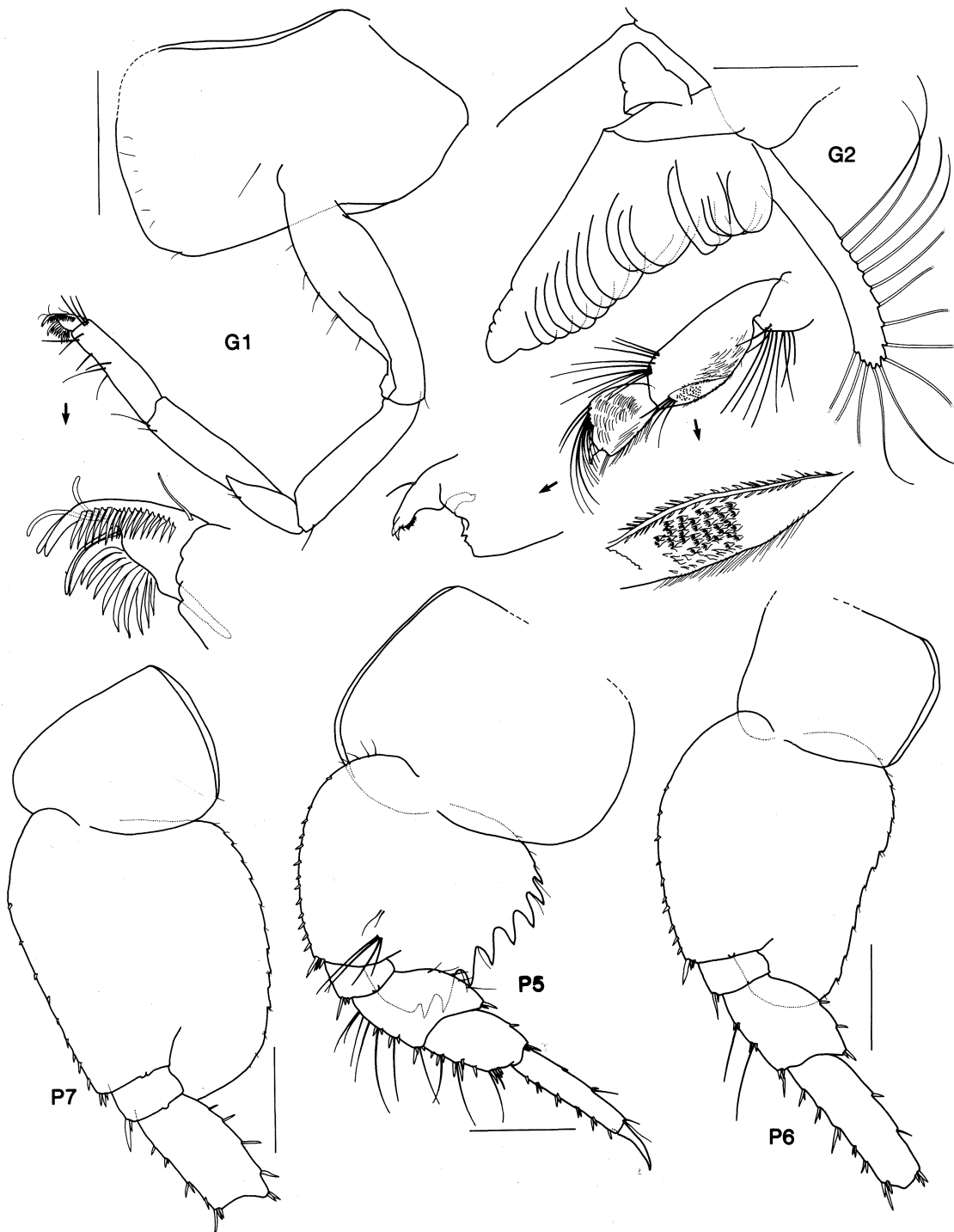


Fig.10. *Ichnopus caritus* n.sp., holotype female, 10 mm, AM P39652, off Possession Point, King George Sound, Western Australia. Scales represent 0.5 mm.

ST1 to ST3 large, stout, without cusps, ST4 to ST6 large, slender, multicuspidate, ST7 short, multicuspidate distally, STA 1-cuspidate, STB to STD 4- to 5-cuspidate; palp large, 2-articulate, with 7 terminal spines and 1 flag seta. *Maxilla 2*: inner plate three quarters as long as outer plate. *Maxilliped*: inner plate large, subrectangular, with 3 well-developed nodular spines, oblique setal row reduced, with 6-7 plumose setae; outer plate medium size, subovate, apical setae and spines absent, medial spines reduced in size, bead-shaped, 4 vestigial submarginal setae present; palp well developed, article 2 very broad, dactylus well developed, unguis present.

Gnathopod 1: simple; coxa large, anterior margin concave, forming anteroventrally produced corner; ischium very long, about 4.1 times as long as broad; carpus very long, 4.0 times as long as broad, 1.4 times as long as propodus; propodus long, subrectangular, 3 times as long as broad, margins subparallel; posterior margin smooth, straight, without spines; dactylus with large subterminal tooth, a row of 18 medial spines and a row of 10 cuticular teeth along posterior margin. *Gnathopod 2*: minutely subchelate; coxa large, subequal in size to coxa 3; carpus long, 2.6 times as long as broad, posterior margin broadly lobate; propodus subovate, short, 1.3 times as long as broad; palm transverse, with straight, slightly serrate margin.

Peraeopod 4: coxa with well-developed posteroventral lobe, anterior and posterior margins subparallel; male merus/carpus without plumose setae (possibly immature). *Peraeopod 5*: coxa bilobate, anterior margin slightly produced ventrally; basis expanded with posterior margin deeply serrate. *Peraeopod 7*: basis, posterior margin slightly rounded with rounded posteroventral corner and straight posteroventral margin; merus slender, not expanded posteriorly.

Epimeron 3: with small notch on posteroventral corner. *Uropod 1*: with long fine setae; rami subequal in length. *Uropod 2*: with long fine setae; rami subequal in length, inner ramus with moderate constriction. *Uropod 3*: peduncle short, 1.6 times as long as broad, without lateral flange; rami lanceolate, subequal in length, with long fine setae and minutely serrate margins, plumose setae absent in female and male; outer ramus 2-articulate. *Telson*: longer than broad, deeply cleft (75%), without dorsal spines, distal margins rounded, with 1 large spine on each margin.

Remarks. *Ichnopus caritus* is a member of the *I. taurus* species group. It is the sister taxon of a group of Australian species which have moderately spinose molars. It has no spines on the mandibular molar. *Ichnopus caritus* and *I. parriwi* both have three accessory spines on the left mandible, but *I. parriwi* has calceoli in the male and female. *Ichnopus caritus* and *I. cribensis* differ only in the spination of the molar and the spination of the accessory spine row. *Ichnopus tenuicornis* has spines on the molar and an enlarged palm on female gnathopod 2.

Etymology. The latin word *caritus* means 'lacking or

devoid of', in reference to the complete absence of spines on the mandibular molar.

Distribution. *Ichnopus caritus* is known along the south coast of Australia from Albany to Bass Strait in 10 to 79 m depth.

Ichnopus comorensis n.sp.

Figs 11-12

Ichnopus spinicornis.—Ledoyer, 1986: 764, fig.297.

Type material. HOLOTYPE, sex not known, 5 mm, MNHN Am 4150, south of South Reef, Ile de Mayotte, Comores Archipelago, Indian Ocean, 13°05.2'S 45°07.9'E, beige organogenic sand with much debris and madreporites, 400-520 m, dredged, 27 Mar. 1977, Mission Benthedi, stn DS 42.

Diagnosis. Antenna 1: peduncular article 1 with short posteroventral tooth; callynophore with 1 small posterodistal seta. Antennae 1 and 2: calceoli present. Upper lip rounded. Mandible: left lacinia mobilis present; accessory spine row, left with 4, right with 3 spines; molar setose, without spines; palp article 2 slightly broadened distally. Maxilla 1 with ST7 multicuspidate medially; palp inner margin distally smooth. Maxilliped, inner plate with 2 nodular spines; palp article 2 broad. Gnathopod 1: ischium and carpus long; dactylus with short cuticular spines. Gnathopod 2: palm minute. Peraeopod 5: basis with posterior margin minutely crenate. Epimeron 3: posteroventral corner with small notch. Uropod 2: inner ramus with strong constriction.

Description. Based on holotype (sex not known), 5 mm, MNHN Am 4150. *Head*: deeper than long; lateral cephalic lobe well developed, narrowly rounded; rostrum absent; eyes reniform. *Antenna 1*: medium length; peduncular article 1 short, 1.2 times as long as broad, with short posterodistal tooth; accessory flagellum short, 5-articulate, article 1 at least twice as long as article 2; flagellum of medium length, 13-articulate; callynophore weakly developed 2-field, with 1 small posterodistal seta; calceoli present. *Antenna 2*: peduncle without brush setae; peduncular articles 4 and 5 not enlarged; flagellum 13-articulate; calceoli present.

Mouthpart bundle: subquadrate. *Epistome* and *upper lip*: separate, profile not known. *Mandible*: incisors symmetrical, large, both with slightly convex margins; left lacinia mobilis a spine; accessory spine row, left with 4, right with 3 short, slender, simple spines, without intermediate setae; molar a setose tongue; mandibular palp attached midway, article 1 short, about as long as broad, without setae; article 2 elongate, slightly broadened distally, 4.2 times as long as broad, 1.4 times as long as article 3, without setae on medial surface, with 2 setae on distal third of medial margin, 1 seta

on distolateral corner; article 3 slender, falcate, long, 4.6 times as long as broad, with 2 proximal D-setae and 4 apical E-setae. *Maxilla 1*: inner plate not known; outer plate extremely narrow with 11 spine-teeth in 7/4 crown arrangement; ST1 to ST3 large, stout, weakly cuspidate, ST4 large, stout, 4-cuspidate, ST5 large, slender, 5-cuspidate, ST6 large, multicuspidate, ST7 short, multicuspidate medially; STA large, slightly displaced from STB-STD, 3-cuspidate, STB long, broad, 4-cuspidate, STC long, broad, 5-cuspidate, STD small, 6-cuspidate; palp large, 2-articulate, with 3 terminal spines, flag seta present on distolateral corner, distomedial margin smooth. *Maxilla 2*: not known. *Maxilliped*: inner plate large, subrectangular, with 2 well-developed nodular spines, oblique setal row reduced with 1 simple seta; outer plate small, subovate, apical setae and spines absent, medial spines present, bead-shaped, submarginal setae vestigial; palp well developed, 4-articulate, article 2 broad, 1.9 times as long as broad, 1.3 times as long as article 3; article 3 long, slender, 2.3 times as long as broad; dactylus well developed, with 1 subterminal seta, unguis present.

Gnathopod 1: simple; coxa large, anterior margin concave, forming anteroventrally produced corner, posterior margin straight; basis long, slender, 2.9 times

as long as broad, without setae along anterior margin; ischium long, 2.3 times as long as broad; carpus subtriangular, long, 2.1 times as long as broad, 1.25 times as long as propodus; propodus large, subtriangular, 2.2 times as long as broad, margins tapering distally, posterior margin smooth, straight, without spines; palm absent; dactylus complex, with large subterminal tooth, a row of 4 medial spines and a row of 6 short cuticular teeth along posterior margin. *Gnathopod 2*: minutely subchelate; coxa large, subequal in size to coxa 3; ischium long, 3.5 times as long as broad; carpus long, 2.7 times as long as broad, posterior margin broadly lobate; propodus subquadrate, short, 1.6 times as long as broad; palm acute, with concave, smooth margin, posterodistal corner without spines.

Peraeopod 4: coxa with well-developed posteroventral lobe, anterior and posterior margins subparallel; merus-carpus without plumose setae; propodus with 3 setae and 1 pair of distal spines along posterior margin; dactylus long, slender. *Peraeopod 5*: coxa equilobate; basis expanded with posterior margin minutely crenate; merus slightly expanded posteriorly. *Peraeopod 6*: coxa small, not lobate posteriorly; basis expanded posteriorly with minutely crenate posterior

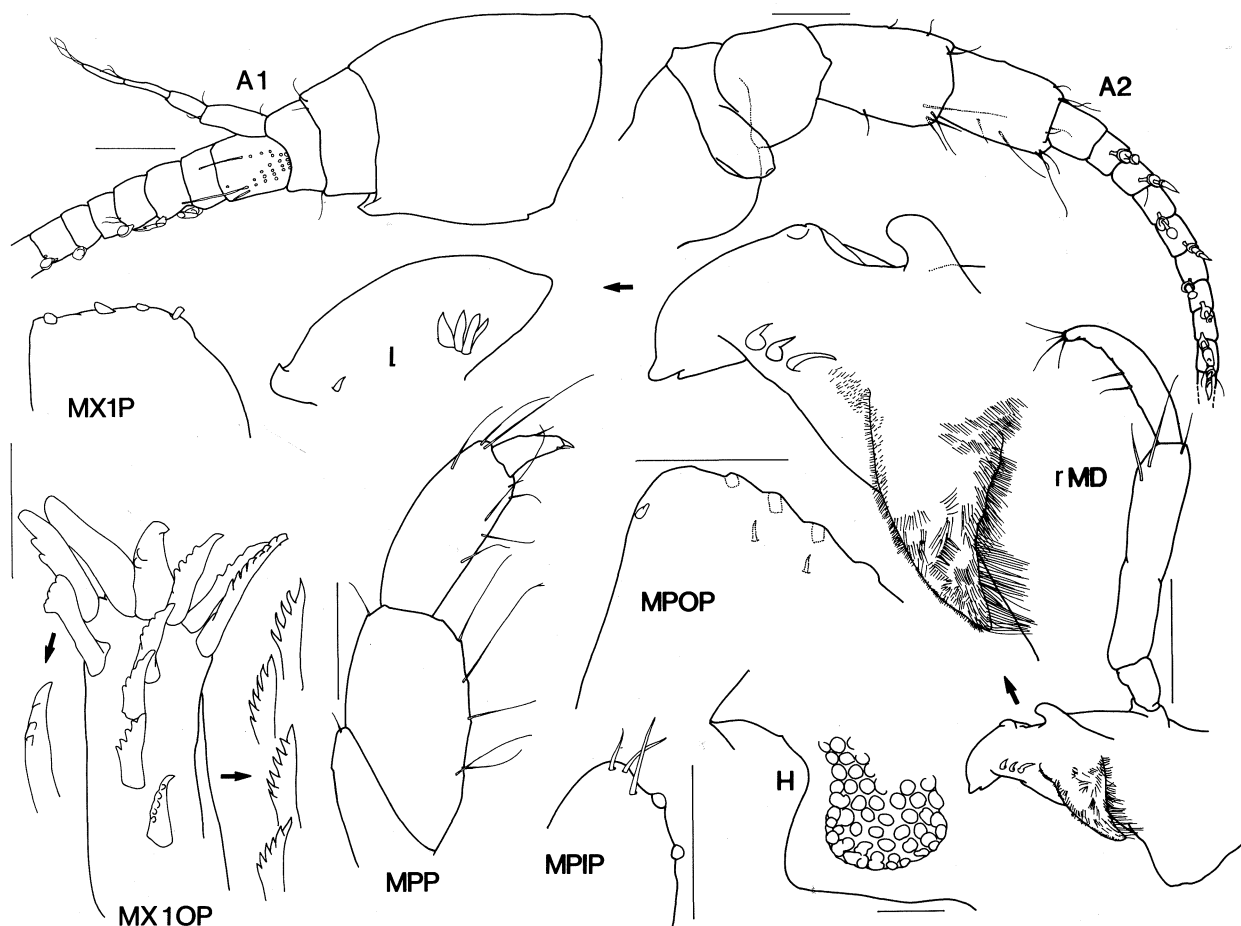


Fig.11. *Ichnopus comorensis* n.sp., holotype, sex not known, 5 mm, MNHN Am 4150, off Mayotte Island, Comores Archipelago, western Indian Ocean. Scales for MX1OP, MX1P, MPIP, MPOP represent 0.5 mm; remainder represent 0.1 mm.

margin; merus slightly expanded posteriorly. *Peraeopod* 7: basis expanded posteriorly, posterior margin almost straight, minutely crenate, posteroventral corner

subquadrate, posteroventral margin rounded; merus not expanded posteriorly; propodus with 3 spines along anterior margin and 2 setae along posterior margin;

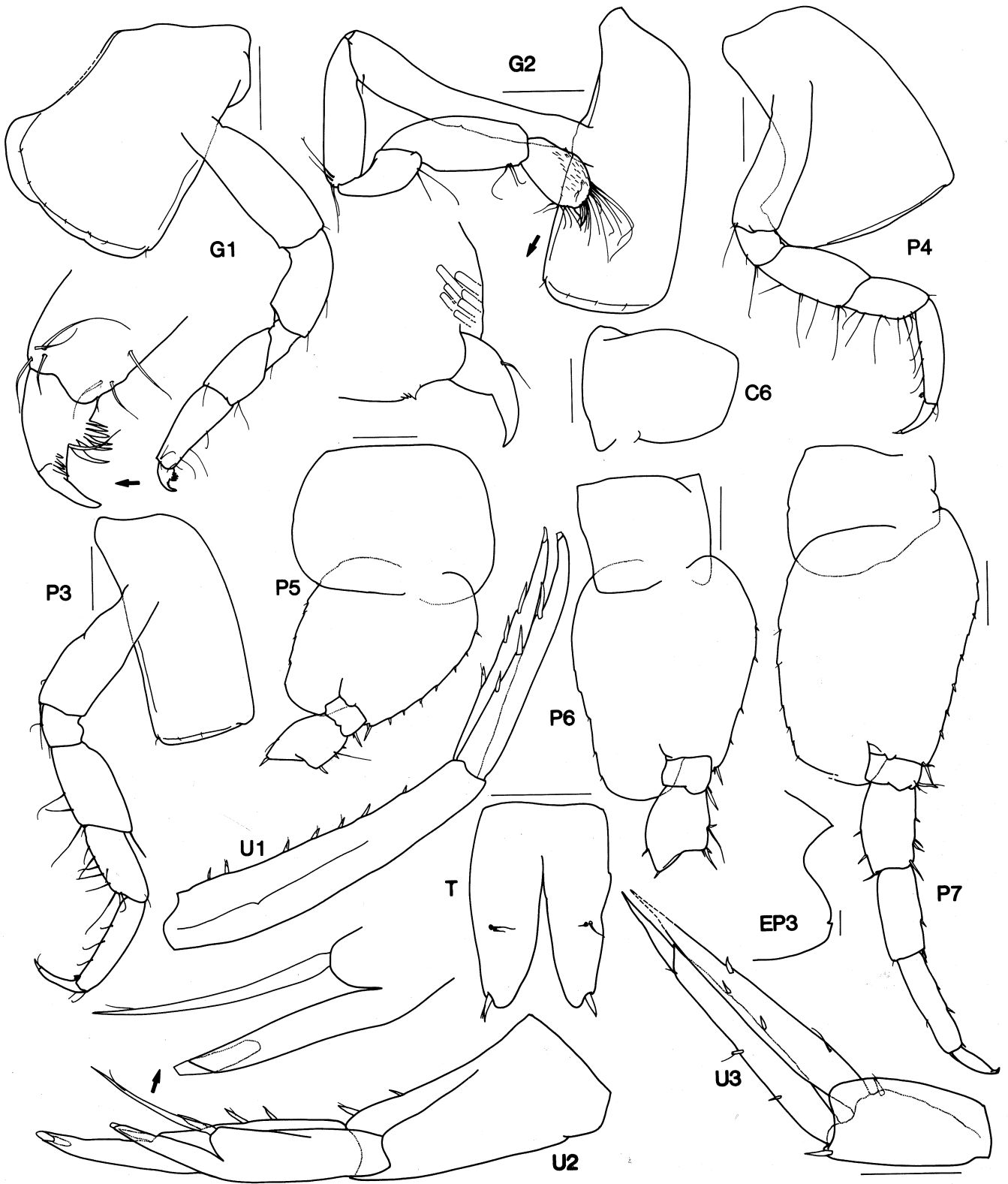


Fig.12. *Ichnopus comorensis* n.sp., holotype, sex not known, 5 mm, MNHN Am 4150, off Mayotte Island, Comores Archipelago, western Indian Ocean. Scales for G1-2, P3-4 represent 0.2 mm; remainder represent 0.1 mm.

dactylus short, stocky.

Oostegites: not known. *Gills*: not known.

Epimeron 3: posteroventral corner with small notch.

Uropod 1: without fine setae; peduncle with 7 dorsolateral spines; rami subequal in length; outer and inner rami each with 3 spines. *Uropod 2*: without fine setae; with 1 dorsolateral and 1 distolateral spines, with 1 dorsomedial and 1 distomedial spines; outer ramus slightly longer than inner ramus; outer ramus with 3 spines, inner ramus with 1 long spine above strong constriction. *Uropod 3*: peduncle long, 2.2 times as long as broad, with 1 distolateral spine; rami lanceolate, subequal in length; outer ramus 2-articulate, article 2 short, with 2 lateral spines, inner ramus with 2 medial and 1 lateral spines; plumose setae absent. *Telson*: 1.5 times as long as broad, deeply cleft (71%), without dorsal spines, distal margins rounded, with 1 pair of emarginate spines.

Remarks. This species was originally reported by Ledoyer (1986) as *Ichnopus spinicornis*. Although the two species are closely related *I. comorensis* differs from *I. spinicornis* as follows: significantly fewer articles in the accessory flagellum and the antennal flagella; significantly fewer D-setae on mandibular palp article 3; smoother posterior margin on the basis of pereopod 5; significantly fewer spines on the outer ramus of uropod 2; a much smaller notch on epimeron 3.

Etymology. Named after the Comores Archipelago where the species was first discovered.

Distribution. Off Mayotte Island, Comores Archipelago, south-western Indian Ocean, in 400 to 520 m depth.

Ichnopus cribensis n.sp.

Figs 13-14

Type material. HOLOTYPE, female, 11 mm, NMV J19735, 2 PARATYPES, male, 16.5 mm, juvenile, 5.5 mm, NMV J3640, Crib Point, Western Port, Victoria, Australia, 38°21'S 145°14'E, 5 m, Smith-McIntyre grab, Marine Studies Group, Victorian Fisheries & Wildlife Department, 14 July 1964, Crib Point Benthic Survey, stn CPBS A1.

Additional material examined. 112 specimens, NMV J13736, NMV J3641 to NMV J3685 and AM P39673, from 26 stations, Crib Point, Western Port, Victoria, Australia, 38°20-21'S 145°13-15'E, 2-19 m, Smith-McIntyre grab, Marine Studies Group, Victorian Fisheries & Wildlife Department, Feb.-Mar. 1965, Crib Point Benthic Survey; 10 specimens, NMV J3686 to J3688, from 3 stations, Western Port, Victoria, 38°16-25'S 145°18-24'E, sand, 10-14 m, Marine Studies Group, Jan.-Nov. 1973, Westernport Bay Environmental Study; 1 specimen, NMV J3337, Western Port, Victoria, A.O. Sayce collection; 1 male, NMV J19734, 32 km north-west of Devonport, Tasmania, 40°49.8'S 146°31.3'E to 40°48.2'S 146°33.7'E, mud, 68-70 m, otter trawl, M.F. Gomon, G.C.B.

Poore & C.C. Lu on FRV *Hai Kung*, 4 Feb. 1981, Bass Strait Survey stn BSS-134T; 2 specimens, AM P41005, 200 m off small shingle beach, north end of Tower Bay, D'Entrecasteaux Channel, Tasmania, 43°23.6'S 147°01.7'E, baited trap, 30 m, J.K. Lowry & S.J. Keable on the *Flying Scud*, 20-21 Apr. 1991, TAS-220; 6 specimens, AM P41006, 300 m off small shingle beach, north end of Tower Bay, D'Entrecasteaux Channel, Tasmania, 43°23.6'S 147°2.1'E, baited trap, 40 m, J.K. Lowry & S.J. Keable on the *Flying Scud*, 20-21 Apr. 1991, TAS-221; 12 specimens, AM P41007, 400 m off small shingle beach, north end of Tower Bay, D'Entrecasteaux Channel, Tasmania, 43°23.6'S 147°2.4'E, baited trap, 40 m, J.K. Lowry & S.J. Keable on the *Flying Scud*, 20-21 Apr. 1991, TAS-222; 1 immature female, AM P39674, Blanche Harbour, Spencer Gulf, South Australia, 32°42'S 137°46'E, 9 m, K. Sheard on FL *Whyalla*, 8 March 1938; 1 female, AM P18152, east of Bald Island, south-east Western Australia, 34°55'S 119°00'E, 76 m, benthic grab, R.J. MacIntyre for CSIRO on HMAS *Gascoyne*, 7 Aug. 1962, stn G3/150/62, sample 2B.

Diagnosis. Antenna 1: peduncular article 1 with long posterodistal tooth; callynophore with posterodistal spines. Antennae 1 and 2: calceoli in male only. Upper lip rounded. Mandible: left lacinia mobilis absent; accessory spine row, left and right each with 4 spines; molar setose, weakly spinose; palp article 2 slender. Maxilla 1 with ST7 multicuspidate distally; palp inner margin distally serrate. Maxilliped: inner plate with 3 nodular spines; palp article 2 very broad. Gnathopod 1: ischium and carpus very long; dactylus with long cuticular spines. Gnathopod 2: palm minute in female. Pereopod 5: basis with posterior margin deeply serrate. Epimeron 3: posteroventral corner with small notch. Uropod 2: inner ramus with moderate constriction.

Description. Based on holotype female, 11 mm and paratype male, 16.5 mm. *Head*: slightly deeper than long, lateral cephalic lobe well developed, broadly rounded; rostrum absent; eyes reniform, slightly enlarged in reproductive male. *Antenna 1*: medium length, about 0.25 times as long as body, 0.8 times as long as antenna 2; peduncular article 1 short, about as long as broad, with long posterodistal tooth; accessory flagellum 7-articulate (male 9), article 1 elongate; callynophore, well-developed 2-field in female and male with 4-5 large posterodistal spines; flagellum long, 20-articulate (male 30); calceoli present in male. *Antenna 2*: about 0.3 times as long as body in female; flagellum 26-articulate, 0.4 times as long as body in male (54-articulate); peduncle with brush setae in female and male (not present in juvenile), peduncular articles 4 and 5 not swollen in female or male; calceoli present in male.

Mouthpart bundle: subquadrate. *Epistome* and *upper lip*: separate, upper lip produced, rounded. *Mandible*: incisors symmetrical with slightly convex margins; left lacinia mobilis absent; accessory spine row, left and right with 4 spines; molar setose, weakly spinose; mandibular palp attached midway; article 1 short, about as long as broad; article 2 elongate, slender, with 4 setae along distal third of medial margin, (male slightly expanded distally with 9 setae), 2 (male 4) setae on distolateral

corner; article 3 slender, falcate, with 8 (male 12) proximal D-setae and 3 (male 4) short E-setae. *Maxilla 1*: inner plate short, narrow with 2 apical plumose setae;

outer plate extremely narrow, with 11 spine-teeth in a 7/4 crown arrangement, ST1 to ST3 large, stout, without cusps, ST4 to ST6 large, slender, multicuspidate, ST7

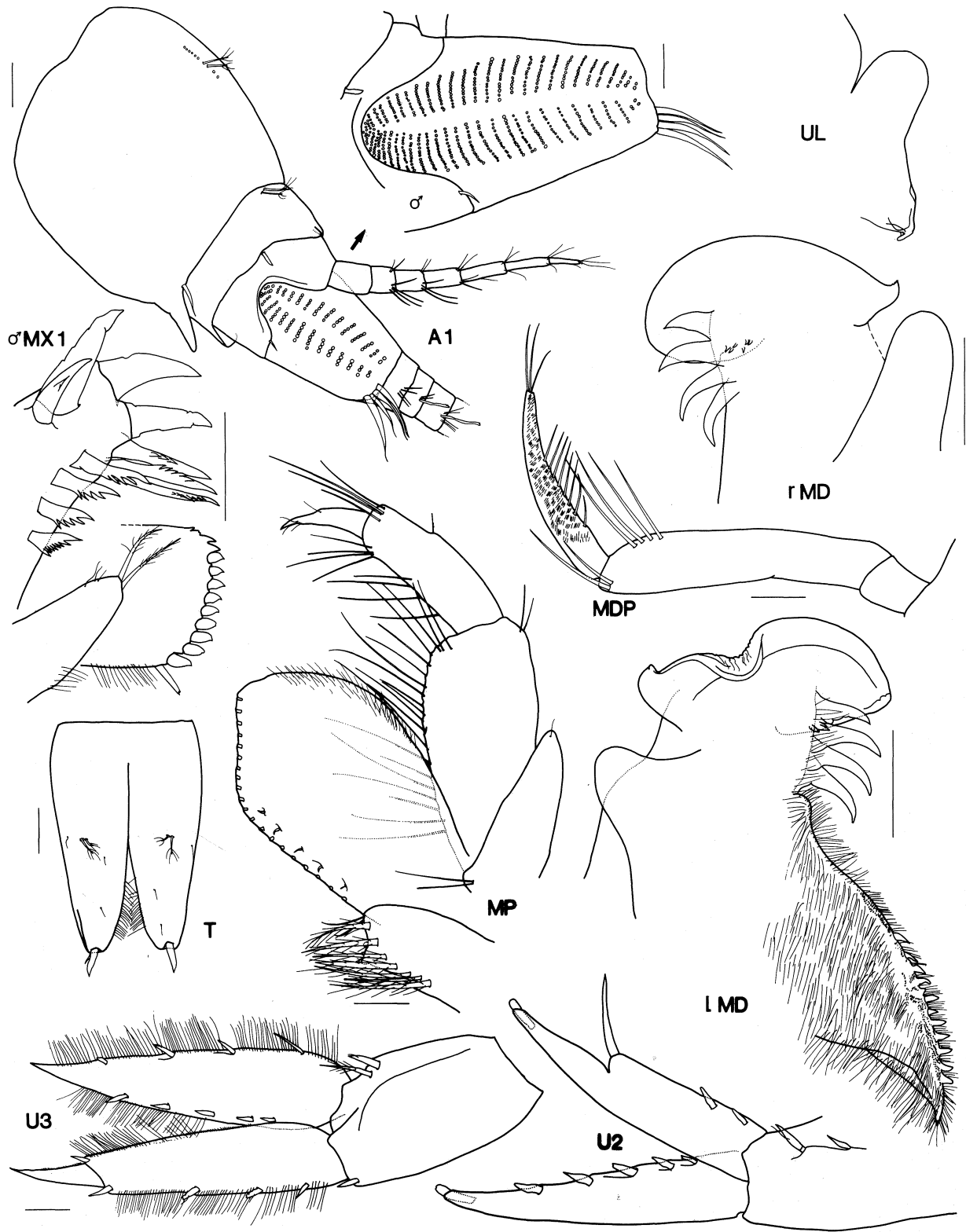


Fig.13. *Ichnopus cribensis* n.sp., holotype female, 11 mm, NMV J19735, paratype male, 16.5 mm, NMV J3640, Western Port, Victoria, Australia. Scales represent 0.1 mm.

short, multicuspidate distally, STA 1-cuspidate, STB to STD 4-cuspidate; palp large, 2-articulate, with 9 terminal spines and 1 flag seta. *Maxilla 2*: inner plate three quarters as long as outer plate. *Maxilliped*: inner plate large, subrectangular, with 3 well-developed nodular spines, oblique setal row reduced, with 7 plumose setae; outer plate medium size, subovate, apical setae and spines absent, medial spines reduced in size, bead-shaped, 5 vestigial submarginal setae present; palp well developed, article 2 very broad, dactylus well developed, unguis present.

Gnathopod 1: simple; coxa large, anterior margin concave, forming anteroventrally produced corner; ischium very long, about 4.2 times as long as broad; carpus very long, 4.2 times as long as broad, 1.3 times as long as propodus; propodus long, subrectangular, 3 times as long as broad, margins subparallel, posterior margin smooth, straight, without spines; dactylus with

large subterminal tooth, a row of 19 medial spines and a row of 10 long cuticular teeth along posterior margin. *Gnathopod 2*: minutely subchelate; coxa large, subequal in size to coxa 3; carpus long, 2.75 times as long as broad, posterior margin broadly lobate; propodus subquadrate, short, 1.5 times as long as broad; palm transverse, with straight, slightly serrate margin.

Peraeopod 4: coxa with well-developed posteroventral lobe; male merus/carpus with plumose setae. *Peraeopod 5*: coxa bilobate, anterior margin slightly produced ventrally; basis expanded with posterior margin deeply serrate. *Peraeopod 7*: basis, posterior margin slightly rounded with rounded posteroventral corner and straight posteroventral margin; merus slender, not expanded posteriorly.

Epimeron 3: with small notch on posteroventral corner. *Uropod 1*: with long fine setae; rami subequal in length. *Uropod 2*: with long fine setae; rami subequal

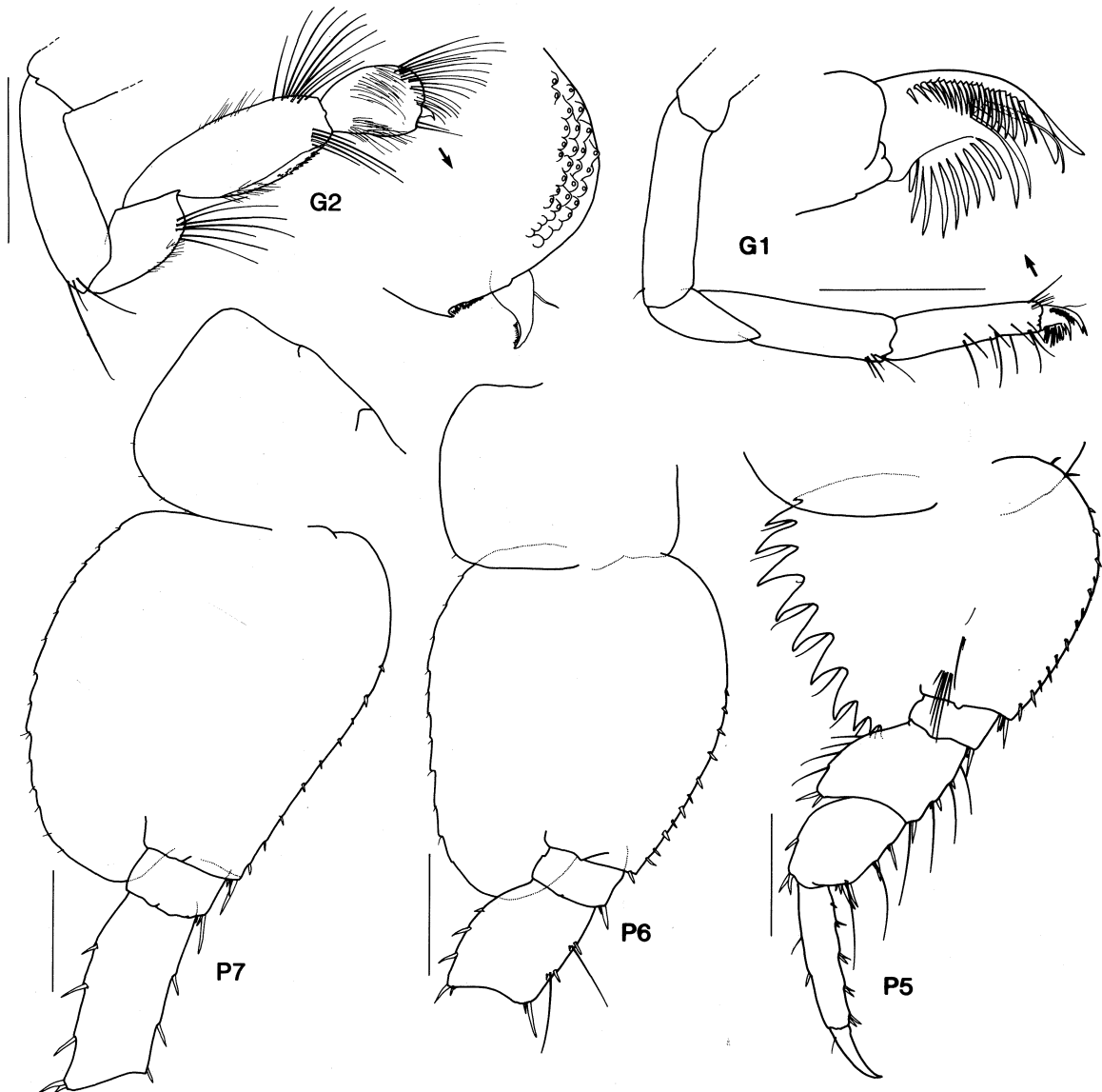


Fig. 14. *Ichnopus cribensis* n.sp., holotype female, 11 mm, NMV J19735, Western Port, Victoria, Australia. Scales represent 0.5 mm.

in length, inner ramus with moderate constriction. *Uropod 3*: peduncle short, 1.75 times as long as broad, without lateral flange; rami lanceolate, subequal in length, with long fine setae and minutely serrate margins, plumose setae absent in female and male; outer ramus 2-articulate. *Telson*: longer than broad, deeply cleft (82%), without dorsal spines, distal margins rounded, with 1 large spine on each margin.

Remarks. The relationship of *I. cribensis* to its sibling, *I. caritus*, has been discussed under that species.

Etymology. Named after Crib Point, the type locality.

Distribution. *Ichnopus cribensis* is known from Western Port in Victoria, off Devonport and in the D'Entrecasteaux Channel, Tasmania, Spencer Gulf in South Australia and east of Bald Island, south-east Western Australia, in 5 to 76 m depth.

Ichnopus macrobetomma Stebbing

Ichnopus macrobetomma Stebbing, 1917: 38, pl.96.

Type material examined. HOLOTYPE, ?male, SAM A19391, off East London, south-eastern South Africa, 33°09.5'S 28°03'E, 86 m.

All that remains of the type material is one slide which contains gnathopods 1 and 2, and peraeopods 3, 4, 6 and 7. The species cannot be fully redescribed and should be considered dubious until new material can be collected and studied. The type specimen is assumed to be a male, because of the very large eyes.

Partial description. Based on holotype ?male. *Head*: slightly deeper than long, lateral cephalic lobe well developed, broadly rounded; rostrum absent; eyes reniform, greatly enlarged in reproductive male. *Antenna 1*: medium length, about 0.3 times as long as body, 0.8 times as long as antenna 2; peduncular article 1 short, slightly longer than deep, with short posterodistal tooth; accessory flagellum 10-articulate; callynophore, well-developed 2-field in male; flagellum long, about 40-articulate. *Antenna 2*: about 0.4 times as long as body in male; peduncle with brush setae in reproductive male, peduncular articles 4 and 5 not swollen.

Mouthpart bundle: subquadrate. *Mandible*: left incisor with slightly convex margin; accessory spine row with 3 spines; molar setose with spines; mandibular palp attached midway; article 1 about twice as long as broad; article 2 elongate, slightly widened distally, with about 7 setae along distal third of medial margin, 1-2 setae on distolateral corner; article 3 slender, falcate, with about 9 proximal D-setae and short E-setae. *Maxilliped*: inner plate large, subrectangular; outer plate medium size, subovate, apical setae and spines absent; palp well developed, article 2 broad, dactylus well developed.

Gnathopod 1: simple; coxa large, anterior margin

concave, forming anteroventrally produced corner; ischium very long 3.5 times as long as broad; carpus very long, 4.0 times as long as broad, about 1.3 times as long as propodus; propodus very long, subrectangular, about 3.3 times as long as broad, margins subparallel; posterior margin smooth, straight, without spines; dactylus with large subterminal tooth, a row of about 20 medial spines and a row of about 10 cuticular teeth along posterior margin. *Gnathopod 2*: minutely subchelate; coxa large, subequal in size to coxa 3; carpus long, 2.2 times as long as broad, posterior margin broadly lobate; propodus subrectangular, short, 1.8 times as long as broad; palm transverse, with convex margin.

Peraeopod 4: coxa with well-developed posteroventral lobe, male merus/carpus with plumose setae. *Peraeopod 5*: coxa bilobate; basis expanded with posterior margin minutely crenate. *Peraeopod 7*: basis, posterior margin slightly rounded, with rounded posteroventral corner and straight posteroventral margin; merus slender, not expanded posteriorly.

Epimeron 3: with a notched posteroventral corner. *Uropod 3*: rami lanceolate, subequal in length; plumose setae absent in male; outer ramus 2-articulate. *Telson*: longer than broad, deeply cleft (81%), without dorsal spines, distal margins rounded, with 1 large spine on each margin.

Remarks. From our limited information, *I. macrobetomma* belongs in the *I. taurus* species group. It appears to be most closely related to *I. taurus* and has been placed in synonymy with it by Griffiths (1974: 309). However, it should remain separate until new material is collected and studied. It appears to differ from *Ichnopus* sp. of Walker, 1904, in having a slight posterodistal tooth, more articles in the accessory flagellum and more D-setae on article 3 of the mandibular palp.

Distribution. South-eastern Africa, 86 m.

Ichnopus malpatun n.sp.

Figs 15-16

Type material. HOLOTYPE, male, 10.5 mm, AM P41009, face of outer barrier between Rasch Pass and Wongat Island, Madang Lagoon, Papua New Guinea, 5°08.7'S 145°49.7'E, baited trap on coarse sand bottom next to vertical face of ?*Montipora* coral and sponges, 95 m, J.K. Lowry & J. Mizeu, 31 Jan.-1 Feb. 1990, JKL/PNG-120; PARATYPE, female, 10 mm, non-ovigerous, setose oostegites, MNHN Am 4401, Grand Passage, New Caledonia, 19°07.6'S 163°22.7'E, Waren Dredge, 165 m, RV *Vauban*, 14 Sept. 1985, MUSORSTOM IV, stn 0149.

Diagnosis. Antenna 1: peduncular article 1 with long posterodistal tooth; callynophore with posterodistal setae. Antennae 1 and 2: calceoli present in male and female. Upper lip rounded. Mandible: left lacinia mobilis absent;

accessory spine row, left and right each with 4 spines; molar setose, strongly spinose; palp article 2 strongly broadened distally. Maxilla 1 with ST7 multicuspitate medially; palp inner margin distally serrate. Maxilliped: inner plate with 2-3 nodular spines; palp article 2 broad.

Gnathopod 1: ischium and carpus long; dactylus with short cuticular spines. Gnathopod 2: palm minute in female. Peraeopod 5: basis with posterior margin deeply serrate. Epimeron 3: posteroventral corner with small notch. Uropod 2: inner ramus with moderate constriction.

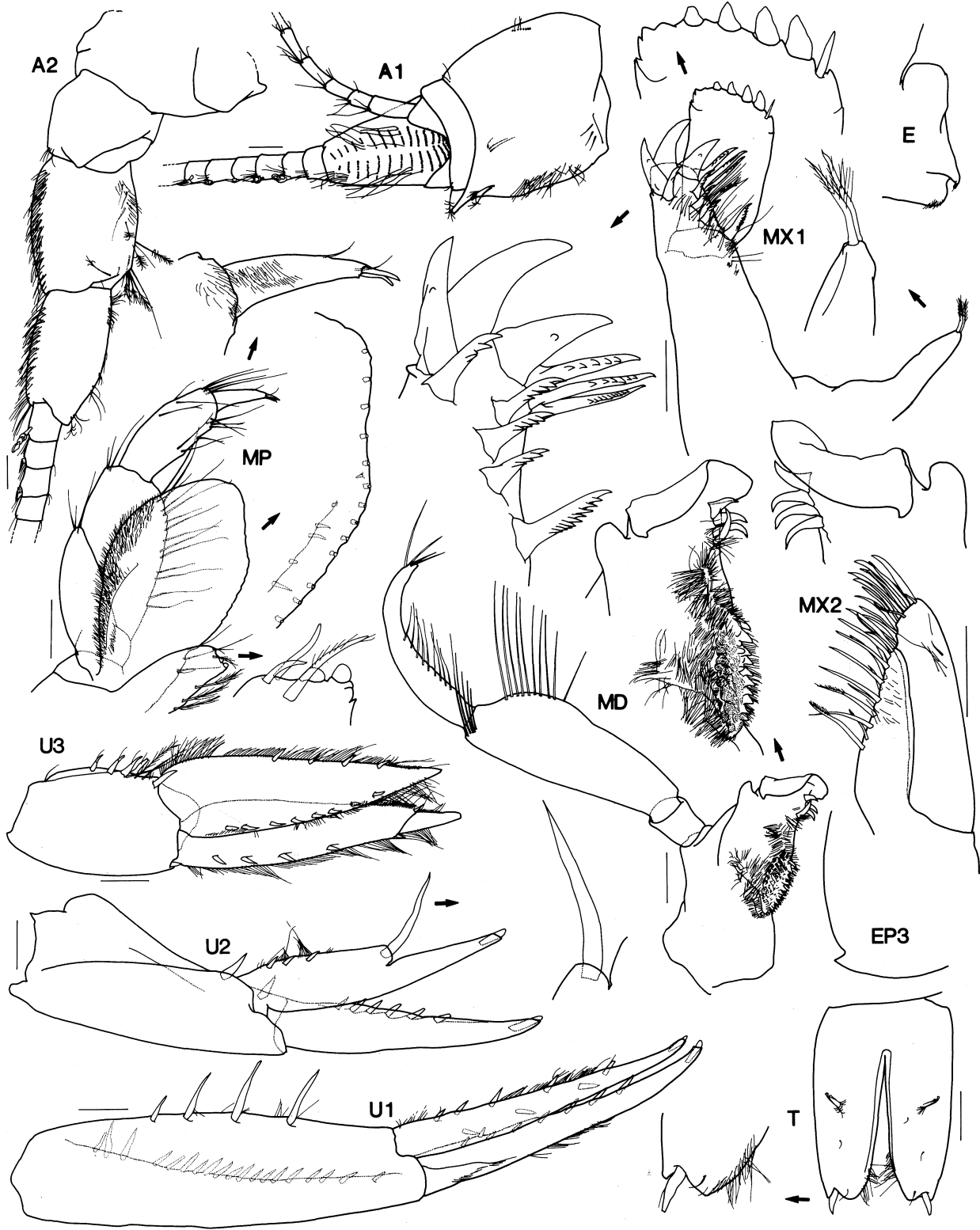


Fig.15. *Ichnopus malpatun* n.sp., holotype male, 10.5 mm, AM P41009, face of outer barrier, Madang Lagoon, Papua New Guinea. Scales represent 0.1 mm.

Description. Based on holotype male, 10.5 mm and paratype female, 10 mm. *Head*: slightly deeper than long, lateral cephalic lobe well developed, narrowly

rounded; rostrum absent; eyes reniform, slightly enlarged in reproductive male. *Antenna 1*: medium length, about 0.3 times as long as body, 0.5 times as

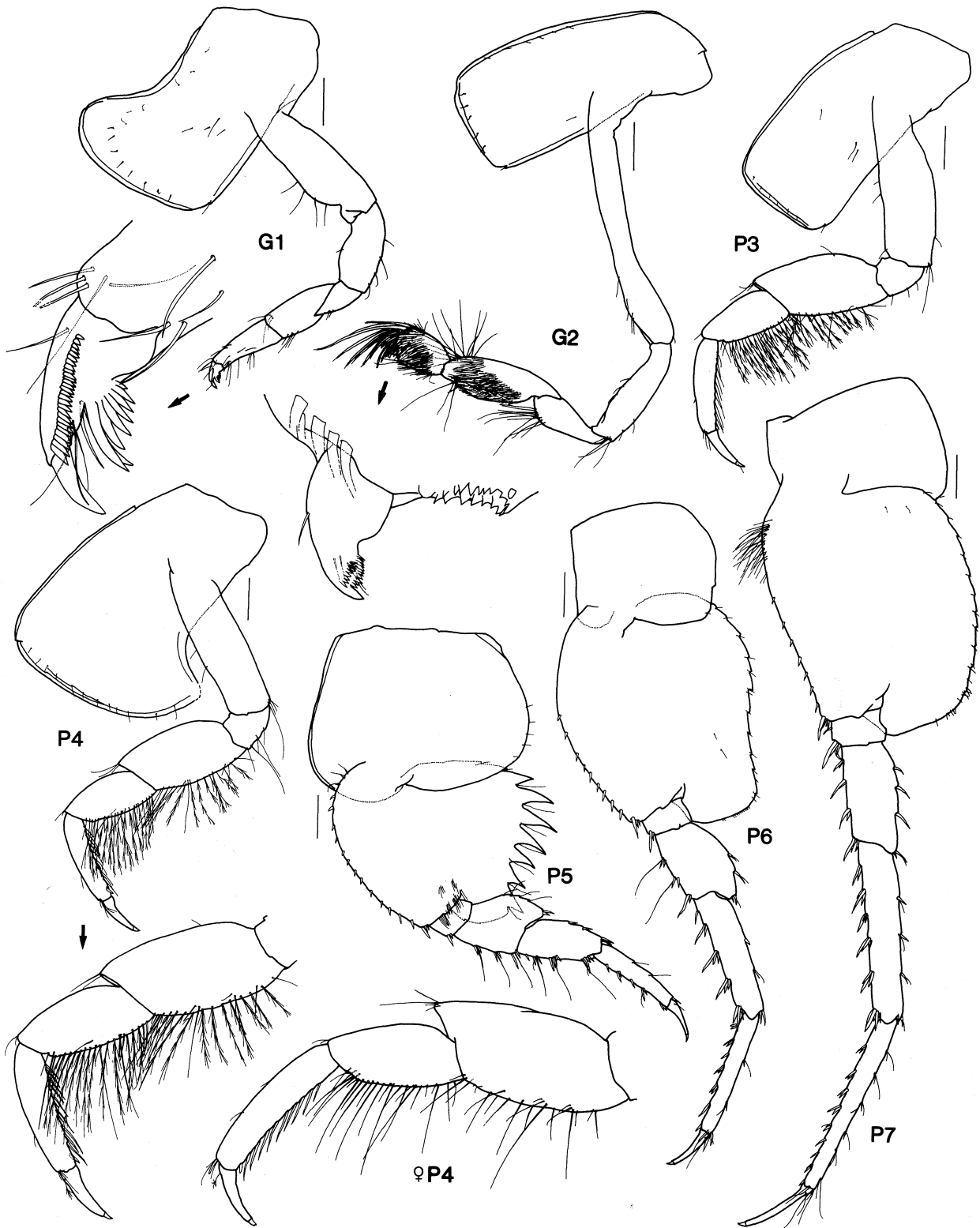


Fig.16. *Ichnopus malpatun* n.sp., holotype male, 10.5 mm, AM P41009, face of outer barrier, Madang Lagoon, Papua New Guinea. Paratype female, 10 mm, MNHN Am 4401, Grand Passage, New Caledonia. Scales represent 0.2 mm.

long as antenna 2; peduncular article 1 short, about as long as broad, with long posterodistal tooth; accessory flagellum 8-articulate, article 1 slightly elongate; callynophore, well-developed 2-field in male and female, with posterodistal setae; flagellum long, 28-articulate (female 23); calceoli present in male and female. *Antenna 2*: about 0.7 times as long as body in male, 0.4 times as long as body in female; peduncle with brush setae in male and female, peduncular articles 4 and 5 not swollen in male or female; calceoli present in male and female.

Mouthpart bundle: subquadrate. *Epistome* and *upper lip*: separate, upper lip produced, rounded. *Mandible*: incisors symmetrical with slightly convex margins; left lacinia mobilis absent; accessory spine row, left and right each with 4 spines; molar setose, strongly spinose; mandibular palp attached midway; article 1 about as long as broad; article 2 elongate, strongly broadened distally, with 10 setae along distal third of medial margin, 5 setae on distolateral corner; article 3 slender, falcate, with 9 proximal D-setae and 4 short E-setae. *Maxilla 1*: inner plate small, narrow with 2 apical plumose setae; outer plate extremely narrow, with 11 spine-teeth in a 7/4 crown arrangement, ST1 to ST3 large, stout, with 0-1 cusp, ST4 to ST6 large, slender, multicuspidate, ST7 large, multicuspidate medially, STA 2-cuspidate, STB to STD 3- to 4-cuspidate; palp large, 2-articulate, with 4 terminal spines and 1 flag seta. *Maxilla 2*: inner plate three quarters as long as outer plate. *Maxilliped*: inner plate large, subrectangular, with 2 (female, left 2, right 3) well-developed nodular spines, oblique setal row reduced with 4-6 plumose setae; outer plate medium size, subovate, apical setae and spines absent, medial spines reduced in size, bead-shaped, 4 vestigial submarginal setae present; palp well developed, article 2 broad, dactylus well developed, unguis present.

Gnathopod 1: simple; coxa large, anterior margin concave, forming anteroventrally produced corner; ischium long, 2.4 times as long as broad; carpus long, 2.5 times as long as broad, 1.1 times as long as propodus; propodus long, subrectangular, 2.6 times as long as broad, tapering distally, posterior margin smooth, straight, without spines; dactylus with large subterminal tooth, a row of 28 medial spines and a row of 7 cuticular teeth along posterior margin. *Gnathopod 2*: minutely subchelate; coxa large, subequal in size to coxa 3; carpus long, 2.6 times as long as broad, posterior margin broadly lobate; propodus subrectangular, short, 1.4 times as long as broad; palm slightly acute, with straight, minutely serrate margin.

Peraeopod 4: coxa with well-developed posteroventral lobe, anterior and posterior margins subparallel; male merus/carpus with dense plumose setae, female merus/carpus with sparse simple setae. *Peraeopod 5*: coxa bilobate, anterior lobe slightly produced ventrally; basis expanded with posterior margin deeply serrate. *Peraeopod 7*: basis, posterior margin slightly rounded with sharply rounded posteroventral corner and straight posteroventral margin; merus slender, not expanded posteriorly.

Epimeron 3: with small notch on posteroventral corner. *Uropod 1*: with long fine setae; rami subequal in length. *Uropod 2*: with few long fine setae; rami subequal in length, inner ramus with moderate constriction. *Uropod 3*: peduncle short, 1.5 times as long as broad, without lateral flange; rami lanceolate, subequal in length; with long fine setae and minutely serrate margins, plumose setae absent in male and female; outer ramus 2-articulate. *Telson*: longer than broad, deeply cleft (76%), without dorsal spines, distal margins rounded, with 1 large spine on each margin.

Remarks. *Ichnopus malpatun* is a member of the *I. spinicornis* species group. Within this group it forms a subgroup with two other species, *I. wardi* and *I. woodmasoni*, all of which have a deeply serrate posterior margin on the basis of peraeopod 5, a character otherwise found wholly among the *I. taurus* species group. *Ichnopus wardi* and *I. woodmasoni* are easily distinguished from *I. malpatun* by their acutely produced upper lips. There are other minor differences: in *I. malpatun* the palm of gnathopod 2 is not as oblique and not enlarged as in *I. woodmasoni*; the corners of the basis of peraeopods 6 and 7 are more sharply rounded; and the inner ramus of uropod 2 is more slender and not as deeply constricted.

Etymology. 'Malpatun' is from the language of the Riwo people who live on the shores of the Madang Lagoon. It means 'outside the reef', and refers to the habitat of this species.

Distribution. *Ichnopus malpatun* is known only from the northern coast of New Guinea and the Grand Passage, northern New Caledonia, in 95 to 165 m depth.

Ichnopus parriwi n.sp.

Figs 17-18

Type material. HOLOTYPE, female, 11.5 mm, AM P39655, 95 PARATYPES, AM P39656, between Parriwi Point and Rosherville Beach, Middle Harbour, Port Jackson, New South Wales, Australia, 33°48.6'S 151°14.8'E, baited trap at night on mud bottom, 20 m, S. Keable, D. Townsend & J.K. Lowry on the *Flying Scud*, 3-4 July 1988, site 14; 17 PARATYPES, AM P39657, Parriwi Point, Middle Harbour, Port Jackson, New South Wales, Australia, 33°48.5'S 151°14.8'E, baited trap at night on muddy sand bottom, 8 m, S. Keable & J.K. Lowry on the *Flying Scud*, 23-24 Sept. 1988, site 49; 9 PARATYPES, AM P39658, off Clontarf, Middle Harbour, Port Jackson, New South Wales, Australia, 33°48.5'S 151°14.9'E, baited trap at night, 12 m, S. Keable, J.K. Lowry & D. Townsend on the *Flying Scud*, 16-17 July 1988, site 41.

Additional material examined. One male, AM P39659, Watsons Bay, Port Jackson, New South Wales, Australia, 33°51'S 151°16'E, K. Sheard, 11 Feb. 1938.

Diagnosis. Antenna 1: peduncular article 1 with long posterodistal tooth; callynophore with posterodistal spines. Antennae 1 and 2: calceoli in female and male. Upper lip rounded. Mandible: left lacinia mobilis absent; accessory spine row, left with 3, right with 4 spines; molar setose, moderately spinose; palp article 2 slightly broadened distally. Maxilla 1 with ST7 multicuspitate distomedially; palp inner margin distally serrate. Maxilliped: inner plate with 3 nodular spines; palp article 2 very broad. Gnathopod 1: ischium and carpus very long; dactylus with long cuticular spines. Gnathopod 2: palm minute in female. Peraeopod 5: basis with posterior margin deeply serrate. Epimeron 3: posteroventral corner with small notch. Uropod 2: inner ramus with

moderate constriction.

Description. Based on holotype female, 11.5 mm and paratype male, 10.5 mm. *Head*: slightly deeper than long, lateral cephalic lobe well developed, broadly rounded; rostrum absent; eyes reniform, very slightly enlarged in reproductive male. *Antenna 1*: medium length, about 0.3 times as long as body, 0.6 times as long as antenna 2; peduncular article 1 short, as long as deep, with long posterodistal tooth; accessory flagellum 9-articulate (male 7); callynophore, well-developed 2-field in female and male with 6 posterodistal spines; flagellum long, 25-articulate (male 36); calceoli present in female and male. *Antenna 2*:

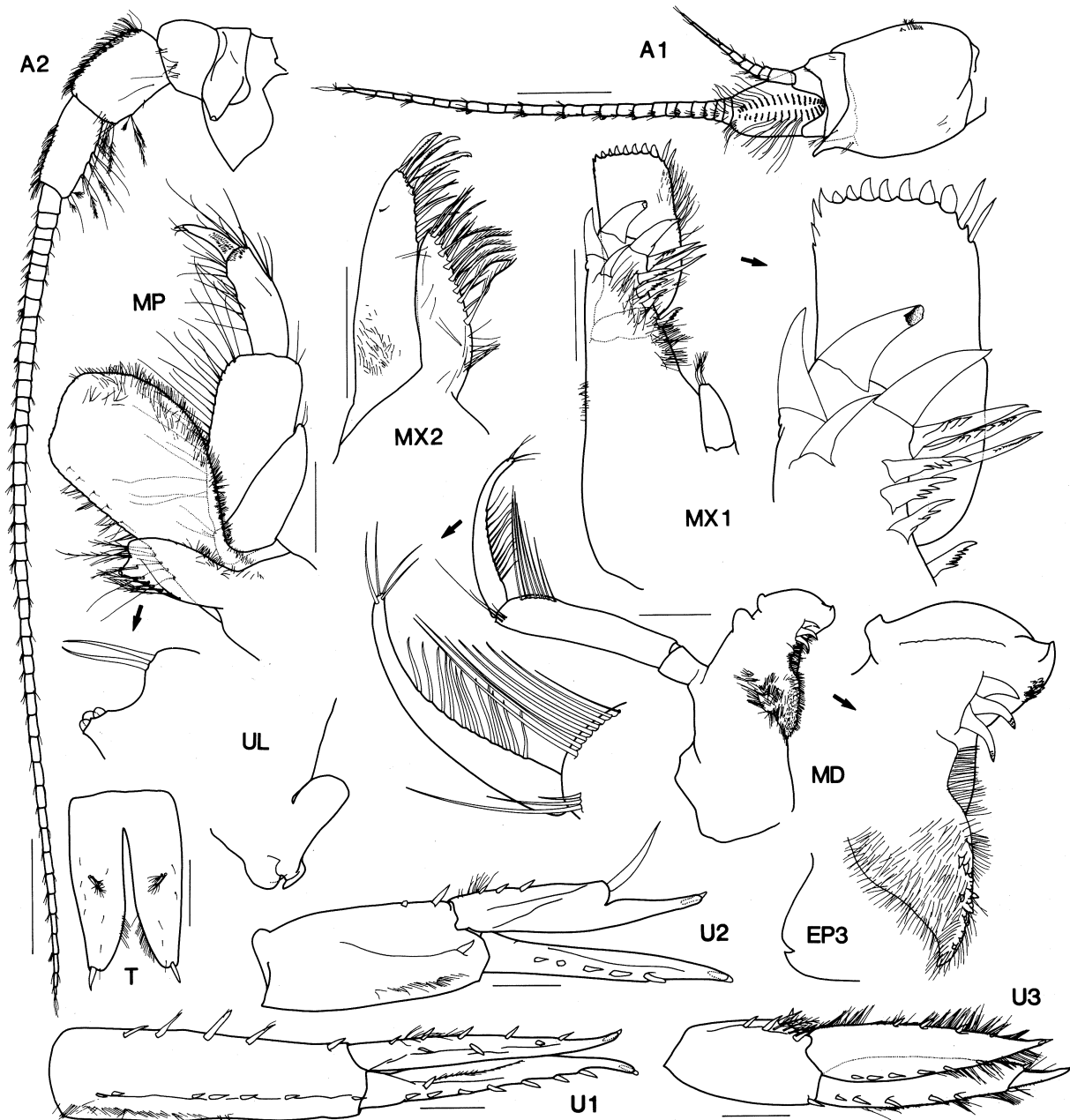


Fig.17. *Ichnopus parriwi* n.sp., holotype female, 11.5 mm, AM P39655, Port Jackson, New South Wales, Australia. Scales for A1,2 represent 0.5 mm, remainder represent 0.2 mm.

about 0.4 times as long as body in female; flagellum 44-articulate and about 0.5 times as long as body in male (52-articulate); peduncle with brush setae in female and male, peduncular articles 4 and 5 not swollen in female or male; calceoli present in female and male.

Mouthpart bundle: subquadrate. **Epistome** and **upper lip:** separate, upper lip produced, rounded. **Mandible:** incisors symmetrical with slightly convex margins; left lacinia mobilis absent, accessory spine row, left with 3 spines, right with 4 spines; molar setose, moderately spinose; mandibular palp attached midway; article 1 short, about as long as broad; article 2 elongate, slightly broadened distally, with 8 setae along distal third of medial margin (male slightly expanded distally, with 6 setae), 3 setae on distolateral corner; article 3 slender, falcate, with 12 (male 9) proximal D-setae and 4 short E-setae. **Maxilla 1:** inner plate small, narrow with 2 apical plumose setae; outer plate extremely narrow, with 11 spine-teeth in a 7/4 crown arrangement, ST1 to ST3 large, stout, without cusps, ST4 to ST6 large, slender, multicuspidate, ST7 short, multicuspidate distomedially,

STA without cusps, STB to STD 3-cuspidate; palp large, 2-articulate, with 7 terminal spines and 2 flag setae. **Maxilla 2:** inner plate three quarters as long as outer plate. **Maxilliped:** inner plate large, subrectangular, with 3 well-developed nodular spines, oblique setal row reduced, with 7 plumose setae; outer plate medium size, subovate, apical setae and spines absent, medial spines reduced in size, bead-shaped, submarginal setae vestigial; palp well developed, article 2 very broad, dactylus well developed, unguis present.

Gnathopod 1: simple; coxa large, anterior margin concave, forming anteroventrally produced corner; ischium very long, about 4.9 times as long as broad; carpus very long, 4.7 times as long as broad, 1.4 times as long as propodus; propodus long, subrectangular, 4 times as long as broad, margins subparallel; posterior margin smooth, straight, without spines; dactylus with large subterminal tooth, a row of 23 medial spines and a row of 10 long cuticular teeth along posterior margin. **Gnathopod 2:** minutely subchelate; coxa large, subequal

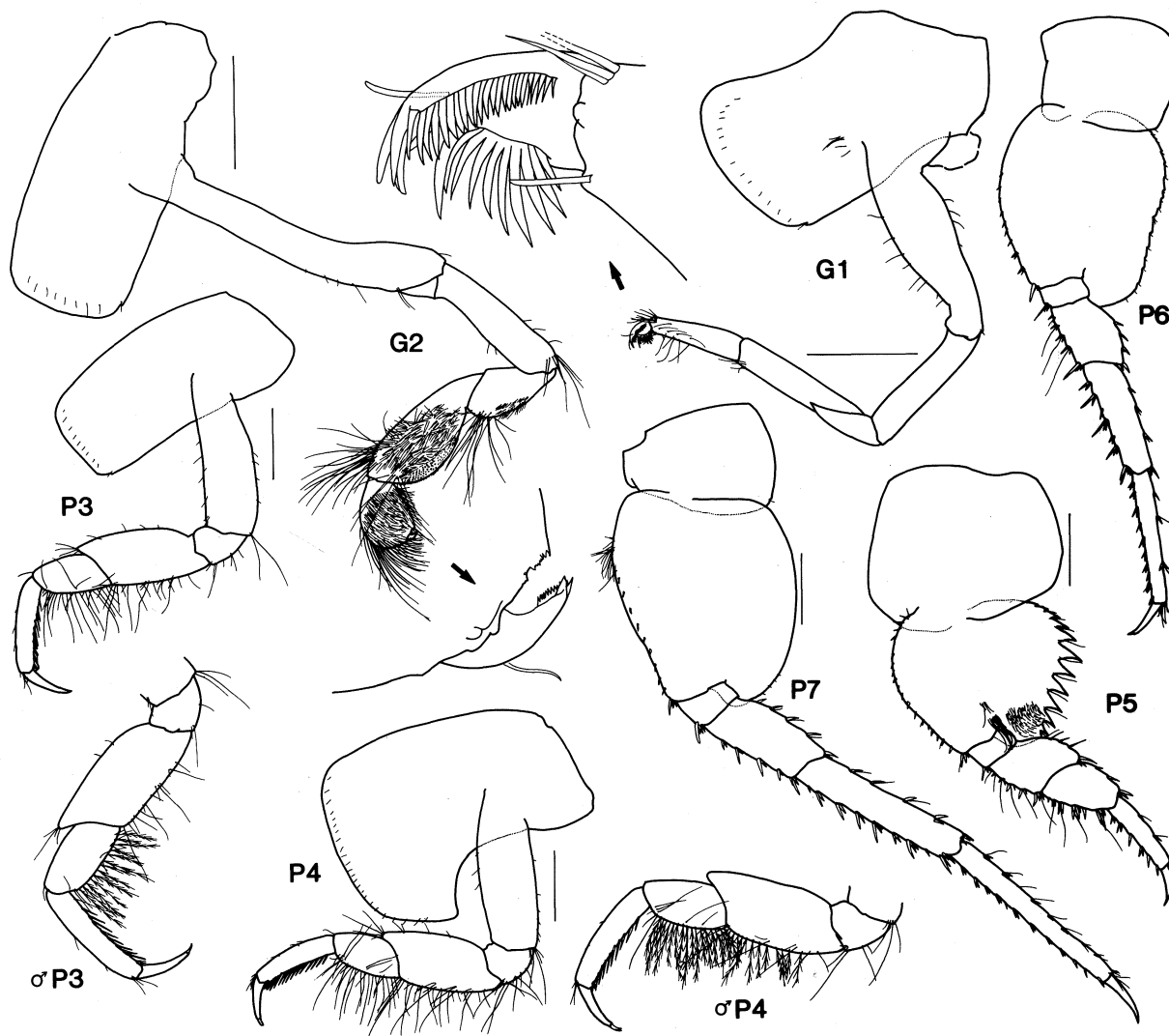


Fig.18. *Ichnopus parriwi* n.sp., holotype female, 11.5 mm, AM P39655, paratype male, 10.5 mm, AM P39656, Port Jackson, New South Wales, Australia. Scales represent 0.5 mm.

in size to coxa 3; carpus long, 2.5 times as long as broad, posterior margin broadly lobate; propodus subrectangular, short, 1.5 times as long as broad; palm slightly acute, with straight, serrate margin.

Peraeopod 4: coxa with well-developed posteroventral lobe, male merus/carpus with plumose setae. *Peraeopod 5*: coxa bilobate, anterior lobe slightly produced ventrally; basis expanded with posterior margin deeply serrate. *Peraeopod 7*: basis, posterior margin slightly rounded with rounded posteroventral corner and rounded posteroventral margin; merus slender, not expanded posteriorly.

Epimeron 3: with small notch on posteroventral corner. *Uropod 1*: with long fine setae; rami subequal in length. *Uropod 2*: with long fine setae; rami subequal in length, inner ramus with moderate constriction. *Uropod 3*: peduncle short, 1.75 times as long as broad, without lateral flange; rami lanceolate, subequal in length with long fine setae and minutely serrate margins; plumose setae absent in female and male; outer ramus 2-articulate. *Telson*: longer than broad, deeply cleft (81%), without dorsal spines, distal margins rounded, with 1 large spine on each margin.

Remarks. *Ichnopus parriwi* is a member of the *I. taurus* species group. It is most closely related to *I. tenuicornis* and *I. cribensis* among the species with posterodistal spines on the callynophore. It differs from all species in that group in having calceoli in both males and females.

Ichnopus parriwi appears to be a nocturnal scavenger on muddy bottoms. It has only been found in a small muddy basin surrounded by the sand bottom of Middle Harbour, Port Jackson.

Etymology. Named after Parriwi Point, Middle Harbour, which is very near the type locality.

Distribution. *Ichnopus parriwi* is known only from Port Jackson, Australia in about 20 m depth.

Ichnopus pelagicus Schellenberg

Figs 19-21

Ichnopus pelagicus Schellenberg, 1926: 218.—Schellenberg, 1929: 196.—Birstein & Vinogradov, 1964: 163.—J.L. Barnard, 1964: 11, fig.6.—Repelin, 1978: 25, 31, 65, 70, 112, 129, 261, fig.130, tables 1, 2, 5, 7, 13, 17, 49, 61.

? *Socarnes longicornis* Birstein & Vinogradov, 1960: 185, fig.7.—Gurjanova, 1962: 433.

? *Ichnopus nossibeensis* Ledoyer, 1986: 761, figs 294, 295.

Type material examined. LECTOTYPE, male, 10.5 mm, ZMB 20652a, eastern Pacific Ocean, 7°47.5'S 94°05.5'W, 0-550 m, 0800 hours, 31 Dec. 1904, USS *Albatross*, stn 4711; PARALECTOTYPE male, 11 mm, ZMB 22040, *Albatross* stn 4711 (see notes below); PARALECTOTYPE, female, 11 mm, ZMB 22039, eastern Pacific Ocean, 19°00.4'S 125°05.4'W, 0-550 m, 0800 hours, 23 Jan. 1905, USS *Albatross* stn 4736; 3 PARALECTOTYPES, juveniles, 5-8 mm, ZMB 20652b, Indian Ocean, 10°08'S 97°15'W, 0-2400 m, 18 Jan. 1899, German Deep-Sea Expedition, *Valdivia* stn 182.

Schellenberg (1926) originally described this species in the reports of the German Deep-Sea Expedition on the *Valdivia*. He did not specify any type material but recorded three juveniles from *Valdivia* stn 182 and mentioned that the species also occurred in the *Albatross* collections from the eastern Pacific Ocean (listed in Schellenberg, 1929). We borrowed material of *Ichnopus pelagicus* from the Zoological Museum, Berlin. The three *Valdivia* juveniles, ZMB 20652b, (of which one is a male) have at some time dried out and are not in good condition. They had not been dissected. In a separate vial in the same jar was one extensively dissected specimen labelled "4711 male". It seems that this male is the specimen on which Schellenberg based his description

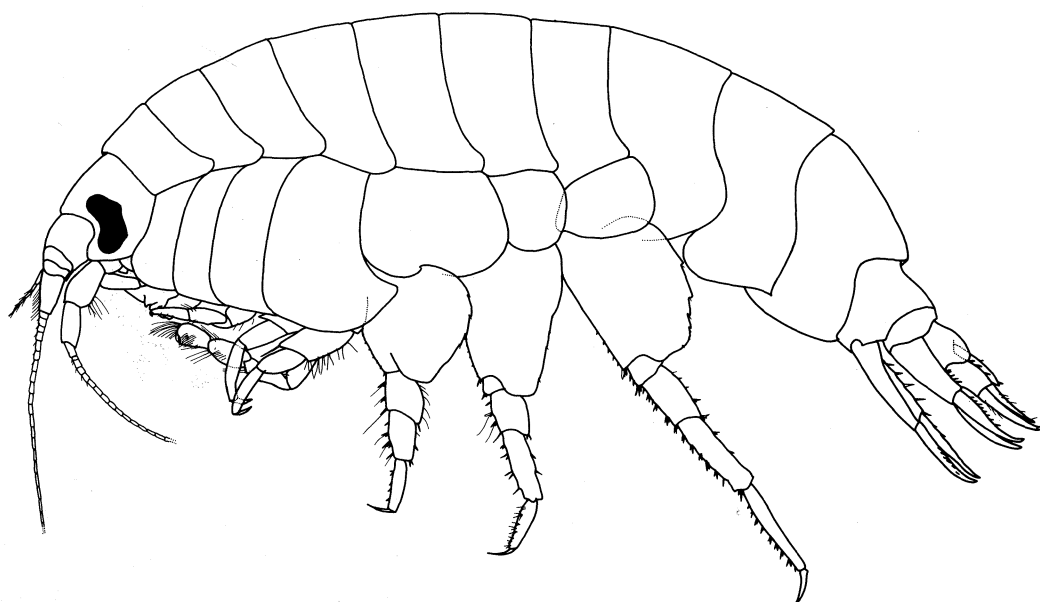


Fig.19. *Ichnopus pelagicus* Schellenberg, female, 10.5 mm, AM P39617, eastern Indian Ocean.

of the species. We have designated it as the lectotype. The mouthparts had been removed but are not in the vial, nor were there any microscope slides. We base our redescription of the species on two other *Albatross* specimens. The juvenile male from *Valdivia* stn 182 has also been dissected and closely compared with the *Albatross* specimens.

Additional material examined. One female, with setose oostegites, 10.5 mm, AM P39617, eastern Indian Ocean, 23°S 110°E, vertical plankton haul, 0-200 m, CSIRO staff on HMAS *Diamantina*, Aug. 1963, Cruise Dm 3/63, stn 118, sample S.1846E; 2 females and 1 immature male, AM P39618, as above except 14°S 110°E, 17 July 1963, stn 102, sample S.1761E, 0755 hours; 1 female, AM P39619, as above except 15°30'S 110°E, 5 Aug. 1963, stn 113, sample S.1815E, 0730 hours; 1 female, AM P39620, as above except 18°30'S 110°E, 6 Aug. 1963, stn 115, sample S.1827E, 0730 hours; 1 specimen, AM P39900, east of Cape York Peninsula, Coral Sea, 10°35.83'S 144°30.65'E, epibenthic sled, 1108-1161 m, P. Hutchings and party on RV *Franklin*, 21 Aug. 1988, stn FR 06/88, stn 6; 2 females and 3 males, AM P40476, 2 females and 2 males, MNHN Paris, Coral Sea, 18°S 164°20'E, R. Repelin, 8 Nov. 1970, Diaphus 1, LN 2; 9 specimens (1 ovigerous female) AM P41010, north-east side of Maria Island, Austral Isles, 21°48.2'S 154°44.2'W, plankton tow, 60 m, J.M. Poupin & J.K. Lowry on RV *Marara*, 8 Aug. 1991, FRP-5; 1 ovigerous female, AM P41011, off Rurutu, Austral Isles, 22°29'S 151°21'W, plankton tow, 0-50 m, J.M. Poupin & J.K. Lowry on RV *Marara*, 11 Aug. 1991, FRP-20; 1 male, AM P41012, off Tubuai, Austral Isles, 23°19.5'S 149°31.0'W, plankton sample, estimated depth 50-100 m, J.M.

Poupin & J.K. Lowry on RV *Marara*, 13 Aug. 1991, FRP-37.

Diagnosis. Antenna 1: peduncular article 1 with short posterodistal tooth; callynophore with posterodistal setae. Antennae 1 and 2: calceoli present in female and male. Upper lip rounded. Mandible: left lacinia mobilis absent; accessory spine row, left and right each with 4 spines; molar setose, strongly spinose; palp article 2 strongly broadened distally. Maxilla 1 with ST7 multicuspidate medially; palp inner margin distally serrate. Maxilliped: inner plate with 2 nodular spines; palp article 2 very broad. Gnathopod 1: ischium and carpus long; dactylus with short cuticular spines. Gnathopod 2: palm minute in female. Peraeopod 5: basis with posterior margin minutely crenate. Epimeron 3: posteroventral corner with small notch. Uropod 2: inner ramus without constriction.

Description. Based on paralectotype female, 11 mm and paralectotype male, 11 mm. *Head*: slightly deeper than long, lateral cephalic lobe well developed, narrowly rounded; rostrum absent; eyes reniform, slightly enlarged in reproductive male. *Antenna 1*: medium length, about 0.3 times as long as body; peduncular article 1 short, about as long as broad, with posterodistal tooth; accessory flagellum broken (male 7-articulate, article 1 elongate); callynophore, well-developed 2-field

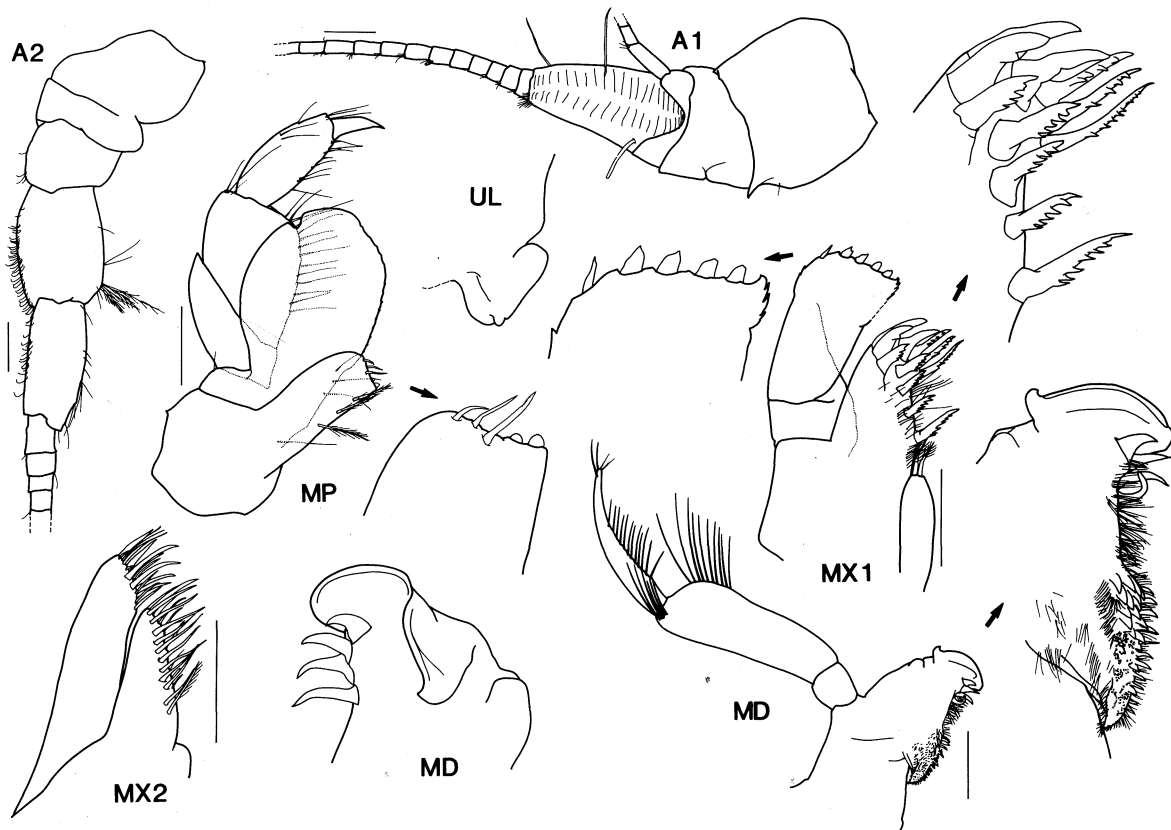


Fig. 20. *Ichnopus pelagicus* Schellenberg, paralectotype female, 11 mm, ZMB 22039, eastern Pacific Ocean. Scales represent 0.2 mm.

in female and male with posterodistal setae; flagellum broken at article 15, (long, 34-articulate in male), calceoli present in male (flagellum articles 6, 9, 10, 12-18) and female (a calceolus on article 6). *Antenna 2*: half as long as body in female; flagellum 52-articulate, at least 0.6 times as long as body in male (at least 44-articulate); peduncle with brush setae in female and male, peduncular articles 4 and 5 not swollen in female or male; calceoli present in male on flagellum articles 1-3, 5-7, 11, 15, 19, 21, 27, 29, 31, 32, 34, 37, 39.

Mouthpart bundle: subquadrate. *Epistome* and *upper*

lip: separate, upper lip produced, rounded. *Mandible*: incisors symmetrical with slightly convex margins; left lacinia mobilis absent; accessory spine row, left and right each with 4 spines; molar setose, strongly spinose; mandibular palp attached midway; article 1 short, about as long as broad; article 2 elongate, strongly broadened distally, with 10 (male 12) setae along distal third of medial margin, 6 (male 7) setae on distolateral corner; article 3 strongly falcate with 4 short E-setae, 12 (male 12) proximal D-setae, B-setae absent. *Maxilla 1*: inner plate small, narrow with 2 apical plumose setae; outer

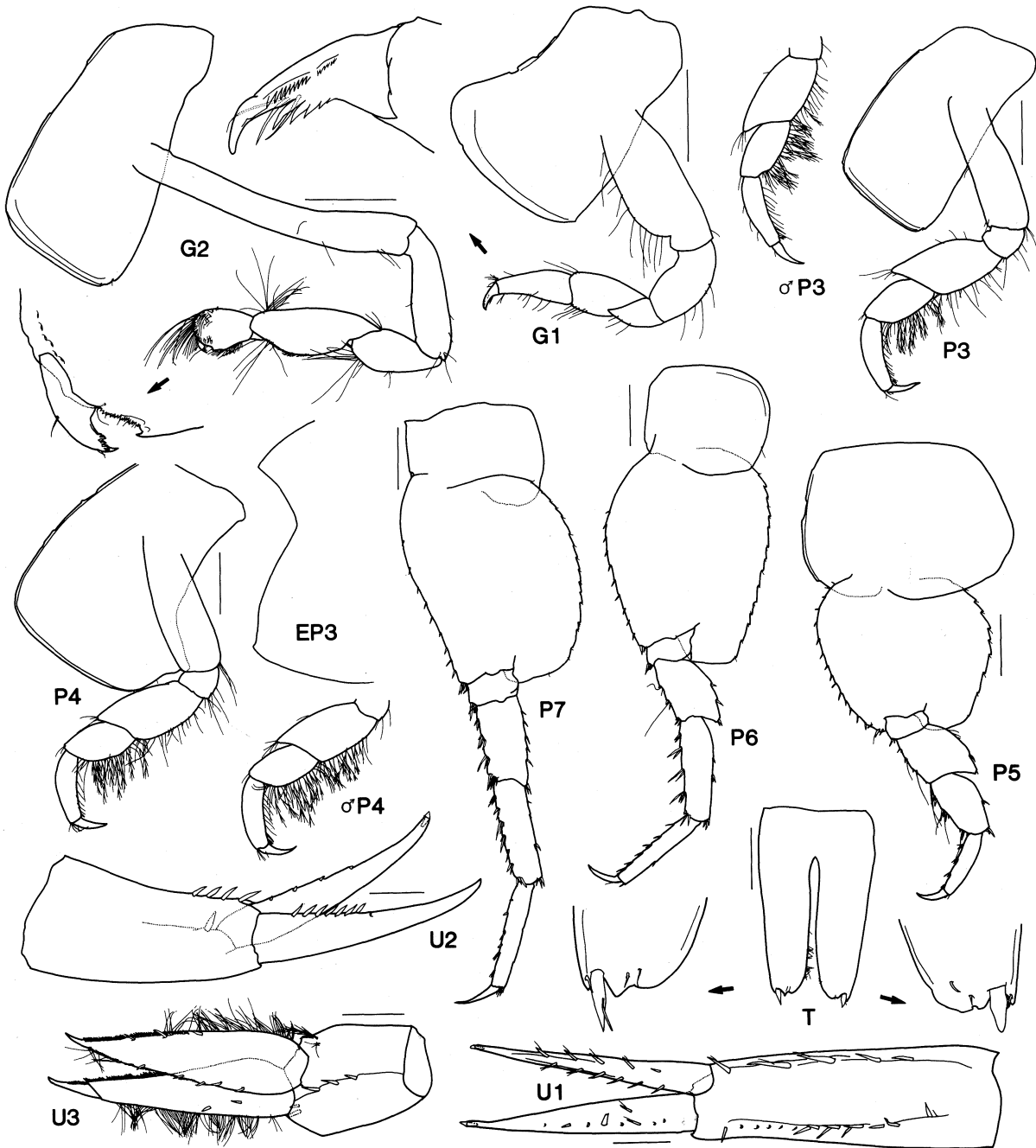


Fig.21. *Ichnopus pelagicus* Schellenberg, paralectotype female, 11 mm, ZMB 22039, paralectotype male, 11 mm, ZMB 22040, eastern Pacific Ocean. Scales for U1-3, T represent 0.2 mm, remainder represent 0.5 mm.

plate extremely narrow, with 11 spine-teeth in a 7/4 crown arrangement, ST1 to ST3 large, stout, weakly cuspidate, ST4 to ST6 large, slender, multicuspidate, ST7 long, multicuspidate medially, STA 2- to 3-cuspidate, STB to STD 5-cuspidate; palp large, 2-articulate, with 4 terminal spines and 1 flag seta. *Maxilla 2*: inner plate about three quarters times as long as outer plate. *Maxilliped*: inner plate large, subrectangular, with 2 well-developed nodular spines, oblique setal row weakly developed, with 3 plumose setae; outer plate medium size, subovate, apical setae and spines absent, medial spines reduced in size, bead-shaped, 3 vestigial submarginal setae present; palp well developed, article 2 very broad, dactylus well developed, unguis present.

Gnathopod 1: simple; coxa large, anterior margin concave, forming anteroventrally produced corner; ischium long, twice as long as broad; carpus long, twice as long as broad, as long as propodus; propodus long, 2.3 times as long as broad, tapering distally; posterior margin smooth, straight, without spines; dactylus with large subterminal tooth, a row of about 15 small medial spines and a row of 5 small cuticular teeth along posterior margin. *Gnathopod 2*: minutely subchelate; coxa large, subequal in size to coxa 3; carpus long, 2.6 times as long as broad, posterior margin broadly lobate; propodus subrectangular, short, 1.3 times as long as broad; palm slightly acute, with concave, minutely serrate margin.

Peraeopod 4: coxa with well-developed posteroventral lobe, male and female merus/carpus with plumose setae. *Peraeopod 5*: coxa equilobate; basis expanded with posterior margin minutely crenate. *Peraeopod 7*: basis, posterior margin slightly rounded with rounded posteroventral corner and straight posteroventral margin; merus slender, not expanded posteriorly.

Epimeron 3: posteroventral corner with a tiny notch.

Uropod 1: with few long fine setae; rami subequal in length. *Uropod 2*: without long fine setae; rami subequal in length, inner ramus without constriction. *Uropod 3*: peduncle short, 1.3 times as long as broad without lateral flange; rami lanceolate, subequal in length, with long fine setae and minutely serrate margins, plumose setae absent in female and male; outer ramus 2-articulate. *Telson*: longer than broad, deeply cleft (75%), without dorsal spines, distal margins rounded, with 1 large spine on each margin.

Remarks. There is not enough material of *Ichnopus pelagicus* available for study to be certain about its species limits. We have seen specimens from the eastern and western South Pacific Ocean, the Coral Sea and the eastern and western Indian Ocean and although there are slight differences in populations from different areas they do not appear to us to be separate species. Calceoli are scarce on the female antennae and occasionally absent. The posteroventral notch on epimeron 3 is weak, but always present. Consequently we have left *I. longicornis* Birstein & Vinogradov in

synonymy and also included *I. nossibeensis* Ledoyer. Ledoyer (1986) thought that the weak cuticular spines on the posterior margin of the dactylus in gnathopod 1 would distinguish the south-western Indian Ocean population from *I. pelagicus*, but our figures of *I. pelagicus* from the eastern Pacific and from the eastern Indian Ocean are extremely similar to those of *I. nossibeensis*. However, the mouthparts of *I. longicornis* and *I. nossibeensis* are not well known. Until these characters are fully studied we cannot be certain.

Within the *I. spinicornis* species group *I. pelagicus* is most closely related to *I. annasona*, but they are easily distinguished because *I. annasona* has a strongly constricted inner ramus on uropod 2.

Repelin (1978) commented on the ecology of *I. pelagicus* as part of his monograph on the pelagic amphipods of the western and central Pacific Ocean. He found that: *I. pelagicus* was a tropical epipelagic species taken most frequently at night; although it was not common compared with hyperiidean amphipods it was the most frequently occurring lysianassoid amphipod; and it was an occasional food item of the hatchet fish *Sternoptyx diaphana* Hermann.

Distribution. *Ichnopus pelagicus* is known from pelagic waters in the eastern and western South Pacific Ocean and from the eastern and western Indian Ocean. Repelin (1978) did not find it in his collections from the central Pacific. Farthest north collections are those of Birstein & Vinogradov (1960) from 19°N, east of Mariana Islands in the western Pacific, and farthest south is 23°S in both the Indian and Pacific Oceans, in upper 200 m of water.

Ichnopus pseudoserricrus Ledoyer

Fig. 22

Ichnopus pseudoserricrus Ledoyer, 1986: 763, fig.296.

Material examined. 3 specimens, largest 6.5 mm, sex not determinable, MNHN Am 2223, Nosy Bé, Madagascar, western Indian Ocean [approx. 13°22'S 48°16'E], plankton tow, stn NBH 14.

Diagnosis. Antenna 1: peduncular article 1 with long posterodistal tooth; callynophore with posterodistal setae. Antennae 1 and 2: calceoli present. Upper lip rounded. Mandible: left lacinia mobilis present; accessory spine row, left and right each with 4 spines; molar setose, strongly spinose; palp article 2 strongly broadened distally. Maxilla 1 with ST7 multicuspidate medially; palp inner margin distally serrate. Maxilliped: inner plate with 3 nodular spines; palp article 2 broad. Gnathopod 1: ischium and carpus long; dactylus with short cuticular spines. Gnathopod 2: palm not known for female. Peraeopod 5: basis with posterior margin strongly crenate. Epimeron 3: posteroventral corner

with small notch. Uropod 2: inner ramus with moderate constriction.

Remarks. Ledoyer (1986) was misled by Walker's (1909) poor description of *I. serricus*, particularly his description of the telson. Nonetheless, the 6.5 mm specimen of *I. pseudoserricus* which we have examined differs from *I. serricus* in having 4 accessory spines on the left mandible, maxilla 1 outer plate with ST7 large, multicuspitate medially, STA 1-cuspitate, STB to STD 2-cuspitate. It also has calceoli on antennae 1 and 2, a 2-field callynophore with posterodistal setae and a produced, rounded upper lip.

Ichnopus pseudoserricus is a member of the *I. spinicornis* species group. *Ichnopus pseudoserricus* and *I. serricus* appear to be sister taxa, one with an extensive distribution and the other with a limited distribution. Both species are easily distinguished from other species in the group because they have a strongly crenate posterior margin on the basis of pereopod 5.

Distribution. *Ichnopus pseudoserricus* is known only from surface plankton off Nosy Bé, Madagascar.

Ichnopus serricus Walker

Figs 23-24

Ichnopus serricus Walker, 1909: 328, pl.43 fig.1.—Thurston & Allen, 1969: 359.—Echelmann & Fishelson, 1990a: 182 (table 2), 185.—Echelmann & Fishelson, 1990b: 70 (table 1).

Ichnopus taurus.—Spandl, 1924: 43, fig.15.

Type material. LECTOTYPE, male, 10 mm, BMNH 1909.1.29:14-16 and 1909.2.13:3 (slide), Amirante Islands, Indian Ocean [approx. 6°00'S 53°10'E], dredged, 40-155 m, J.S. Gardiner on HMS *Sealark*, 11 Oct. 1905, stn E10; PARALECTOTYPE, female, 8 mm, BMNH 1909.1.29:14-16, Coco Island, Cargados Islands, Indian Ocean [approx. 16°35'S 59°40'E] plankton tow at surface, J.S. Gardiner on HMS *Sealark*, 30 Aug. 1905, stn (i).

Walker (1909) recorded his material as two males. We have examined his syntype material and found that the specimen from Coco Island is a female with non-setose oostegites. The male from Amirante Islands, here designated as lectotype, is the specimen Walker partially dissected and illustrated. There are some discrepancies between Walker's account of the species and our observations. Antenna 2 of the male does have calceoli. The telson does have distal spines, set in a slight notch, although the left lobe of the male is damaged. Both third uropods are missing from both specimens and none are mounted on the slide. This makes Walker's account of the urosome somewhat dubious. It appears that his description of uropod 3 is based on a misinterpretation of uropod 2: the "2nd joint" is really the distal section of the inner ramus of uropod 2, beyond the deep constriction; the "curved spine" is obvious in uropod 2.

Additional material examined. 114 specimens from 17 collections, off Elat, Gulf of Aqaba, Red Sea, [approx. 29°30'N 34°57'E], plankton tows, collected by L. Fishelson, as follows: 2 males, 1 female, 1 juvenile, AM P39626, surface tow, 13 Oct. 1985, stn RS 85-02; 2 males, 16 juveniles, AM P39627, surface tow, 13 Oct. 1985, stns RS 85-14, 15, 16; 3 males, AM P39628, surface tow, 12 Dec. 1985, stn RS 85-114; 2 males, BMNH 1990:34:2, surface tow, 12 December 1985, stn RS 85-128; 5 males, L. Fishelson collection, surface tow offshore, 12 Dec. 1985, stn RS 85-134; 38 males, 2 immature females, 14 juveniles, AM P39629, surface tow at night, 5 Dec. 1985, stns RS 85-145, 149; 1 male, AM P39630, vertical haul, 0-100 m, night, 21 Nov. 1985, stn RS 85-174;

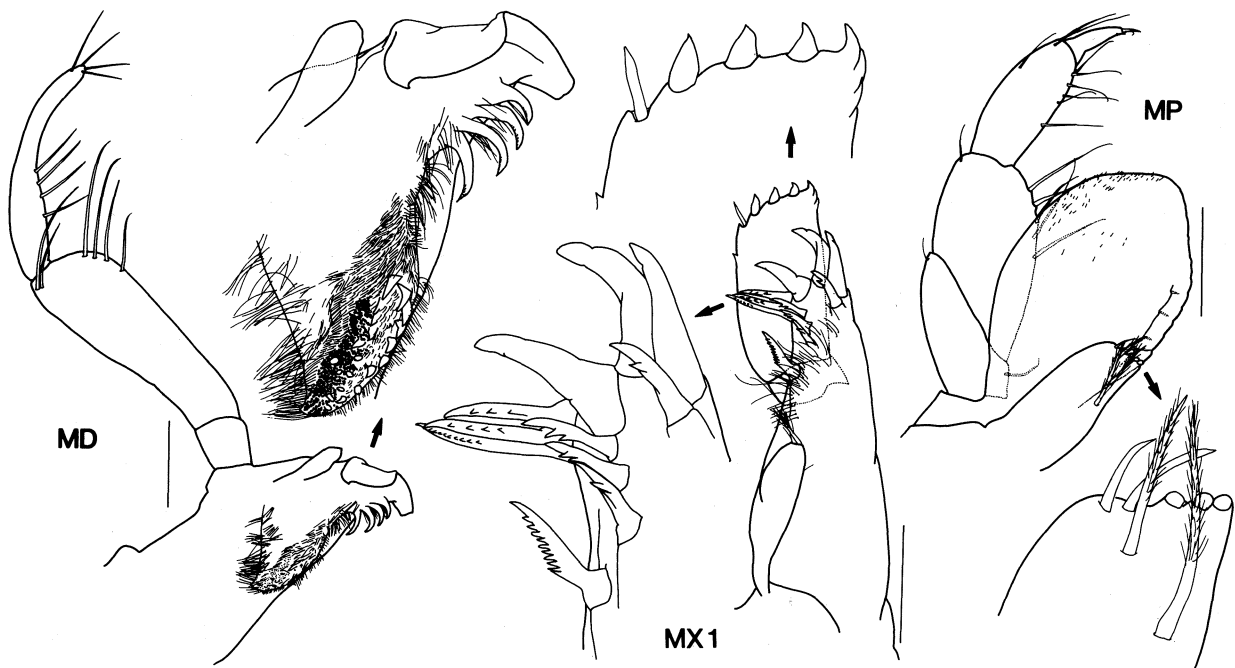


Fig.22. *Ichnopus pseudoserricus* Ledoyer, unknown sex, 6.5 mm, MNHN Am 2223, Madagascar, western Indian Ocean. Scales represent 0.1 mm.

1 ?female, 10 juveniles, AM P39631, surface tow at night, 21 Nov. 1985, stns RS 85-182, 183, 184; 1 immature male, AM P39632, vertical haul, 0-100 m, night, 12 Dec. 1985, stn RS 85-189; 10 males, AM P39633, surface tow at night, 12

Feb. 1986, stn RS 86-204; 2 males, USNM 253720, surface tow at night, 12 Feb. 1986, stn RS 86-205; 3 juveniles, AM P39634, surface tow at night, 12 Dec. 1985, stn RS 85-176.

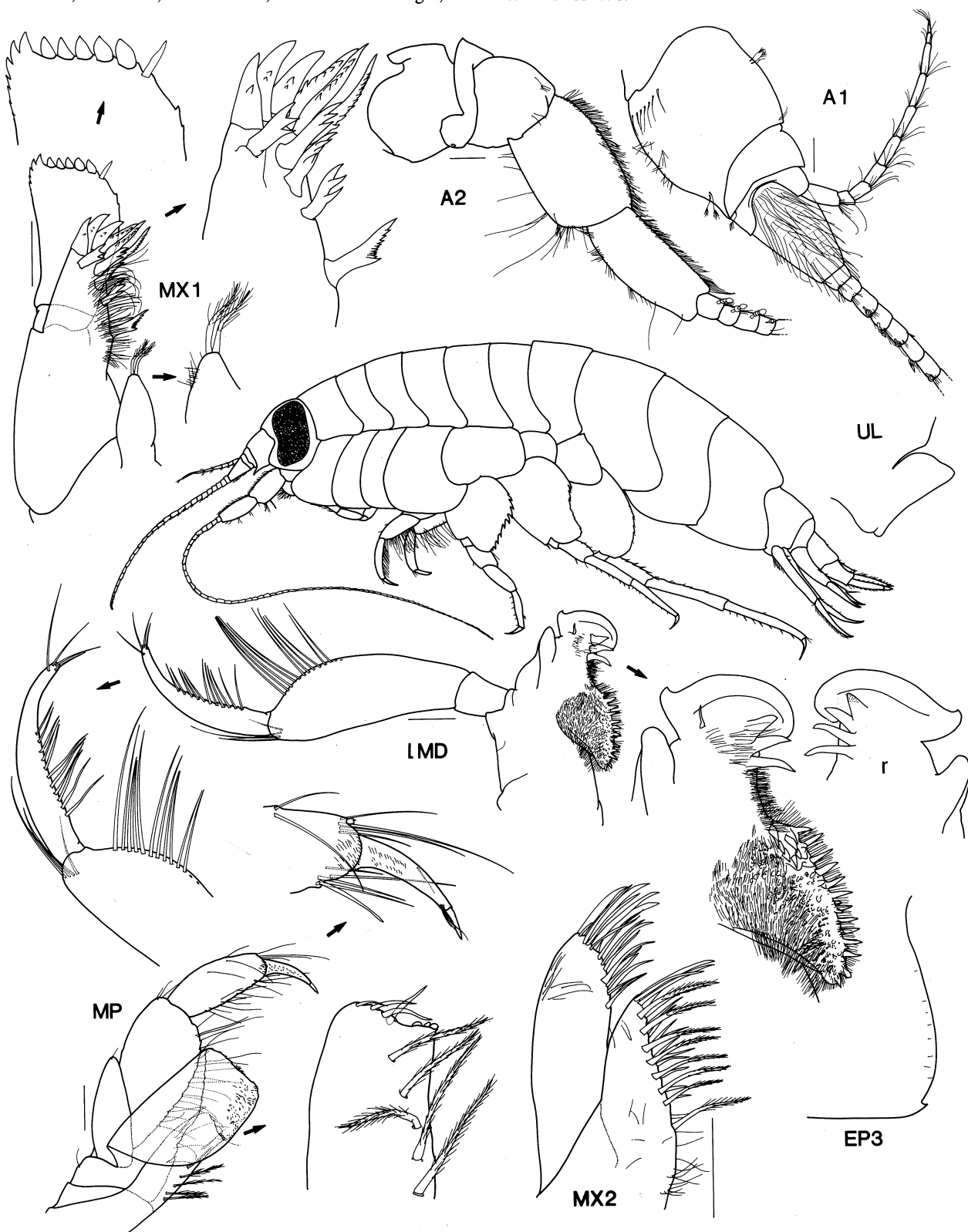


Fig.23. *Ichnopus serricus* Walker, lectotype male, 10 mm, BMNH 1909.1.29:14-16, Amirante Islands, Indian Ocean; whole animal: male, 9 mm, AM P39626, Gulf of Aqaba, Red Sea. Scales represent 0.1 mm.

22 specimens from 9 collections, off Elat, Gulf of Aqaba, Red Sea, [approx. 29°30'N 34°57'E], surface plankton tows, collected by T. Echelman, as follows: 12 specimens, AM P39635, 1500 m offshore, 1500 hours, 21 Nov. 1985, stn TE-12; 2 specimens, AM P39636, 100 m offshore, 1805 hours, 12 Dec. 1985, stn TE-28; 4 specimens, AM P39637, 2000 m offshore, 1905 hours, 13 Feb. 1986, stn TE-67; 1 specimen, AM P39638, 100 m offshore, 2030 hours, 29 May 1986, stn TE-90; 2 specimens, AM P39639, 2000 m offshore, 1945 hours, 1 Dec. 1986, stn TE-131; 2 specimens, AM P39640, 2000 m offshore, 1951 hours, 17 Dec. 1986, stn TE-148; 1 specimen, AM P39641, 2000 m offshore, 1930 hours, 3 Jan. 1987, TE-160; 1 specimen, AM

P39642, 40 m offshore, 2007 hours, 17 Feb. 1987, TE-204; 2 specimens, 1000 m offshore, 2143 hours, 24 Mar. 1987, stn TE-216.

6 specimens, NMW, from 5 plankton collections, *Pola*-Expedition to Red Sea, 1896-1898, as follows: 1 male, stn 77, 27°34'N 34°56'E; 1 specimen, stn 82, 26°44'N 35°09'E; 2 females, stn 89, 28°40'N 32°57'E; 1 female, stn 100, 26°57'N 34°12'E; 1 specimen, stn 158, 24°58'N 35°46.7'E.

1 ?female, MNHN Paris, off La Réunion, Indian Ocean, 21°5.6'S 55°13.3'E, Charcot-Picard dredge, 80-83 m, black sand, 22 Aug. 1982, MS *Marion-Dufresne*, campagne MD-32, stn DC 54.

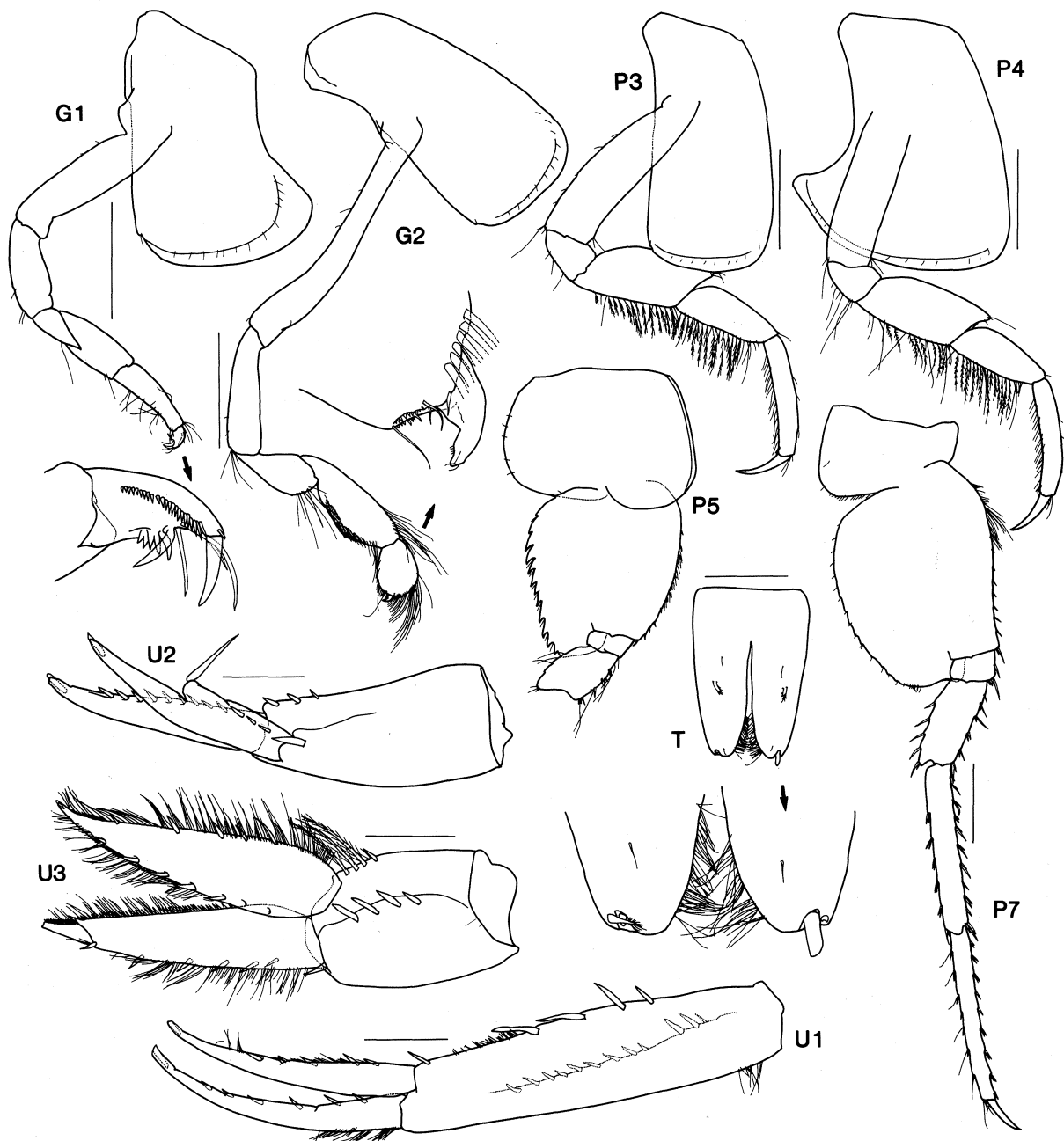


Fig.24. *Ichnopus serricus* Walker, lectotype male, 10 mm, BMNH 1909.1.29:14-16, Amirante Islands, Indian Ocean; P7, U3: male, 9 mm, AM P39626, Gulf of Aqaba, Red Sea. Scales for U1-3, T represent 0.2 mm, remainder represent 0.5 mm.

Diagnosis. Antenna 1: peduncular article 1 with long posterodistal tooth; callynophore with posterodistal setae. Antennae 1 and 2: calceoli present in male only. Upper lip subacute. Mandible: left lacinia mobilis present; accessory spine row, left with 3, right with 4 spines; molar setose, strongly spinose; palp article 2 strongly broadened distally. Maxilla 1 with ST7 multicuspidate distally; palp inner margin distally serrate. Maxilliped: inner plate with 3 nodular spines; palp article 2 broad. Gnathopod 1: ischium and carpus long; dactylus with short cuticular spines. Gnathopod 2: palm minute in female. Peraeopod 5: basis with posterior margin strongly crenate. Epimeron 3: posteroventral corner with small notch. Uropod 2: inner ramus with moderate constriction.

Description. Based on lectotype male, 10 mm and paralectotype female, 8 mm; characters not known from type material based on 7.5 mm female and 9 mm male from the Red Sea, AM P39626. *Head:* slightly deeper than long, lateral cephalic lobe well developed, rounded; rostrum absent; eyes reniform, enlarged in reproductive male. *Antenna 1:* medium length, about 0.36 times as long as body, 0.60 times as long as antenna 2; peduncular article 1 short, about as long as broad, with long posterodistal tooth; accessory flagellum 10-articulate, article 1 not elongate; callynophore, well-developed 2-field in female and male, apparently without posterodistal setae or spines (setae may be present; the callynophore is exceptionally dense and obscures the posterodistal corner; material from La Réunion and the Red Sea has posterodistal setae); flagellum long, at least 27-articulate in male, 31-articulate in female; calceoli present in male (articles 4-20, 22, 24), not present in female. *Antenna 2:* elongate (flagellum 53-articulate in male), 0.6 times as long as body in reproductive male; peduncle with brush setae in male and female, peduncular articles 4 and 5 not swollen in female or male; calceoli present on most articles in male.

Mouthpart bundle: subquadrate. *Epistome* and *upper lip:* separate, upper lip produced, subacute. *Mandible:* incisors symmetrical, with slightly convex margins; left lacinia mobilis present, a tiny spine; accessory spine row, left with 3 spines, right with 4 spines; molar setose, strongly spinose; mandibular palp attached midway, article 1 short, about as long as broad; article 2 elongate, strongly broadened distally, with 13 setae along distal third of medial margin; article 3 slender, falcate, with 11 proximal D-setae and 4 short E-setae. *Maxilla 1:* inner plate small, narrow with 2 apical plumose setae; outer plate extremely narrow, with 11 spine-teeth in a 7/4 crown arrangement, ST1 to ST3 large, stout, weakly cuspidate, ST4 to ST6 large, slender, multicuspidate, ST7 large, multicuspidate distally, STA to STD 2- to 3-cuspidate; palp large, 2-articulate, with 5 terminal spines and 1 flag seta. *Maxilla 2:* inner plate 0.8 times as long as outer plate. *Maxilliped:* inner plate large, subrectangular, with 3 well-developed nodular spines,

oblique setal row reduced, with 8 plumose setae; outer plate medium size, subovate, apical setae and spines absent, medial spines reduced in size, bead-shaped, 4 vestigial submarginal setae present; palp well developed, article 2 broad, dactylus well developed, unguis present.

Gnathopod 1: simple; coxa large, anterior margin concave, forming anteroventrally produced corner; ischium long, about 2.5 times as long as broad; carpus long, 2.5 times as long as broad, 1.1 times as long as propodus; propodus long, subrectangular, 3 times as long as broad, tapering distally; posterior margin smooth, straight, without spines; dactylus with large subterminal tooth, a row of 23 medial spines and a row of 6 short cuticular teeth along posterior margin. *Gnathopod 2:* minutely subchelate; coxa large, subequal in size to coxa 3; carpus long, 2.7 times as long as broad, posterior margin broadly lobate; propodus subquadrate, short, 1.2 times as long as broad; palm acute, with straight, minutely serrate margin.

Peraeopod 4: coxa with well-developed posteroventral lobe, male and female merus/carpus with plumose setae. *Peraeopod 5:* coxa equilobate; basis expanded with posterior margin strongly crenate. *Peraeopod 7:* basis, posterior margin slightly rounded with rounded posteroventral corner and straight posteroventral margin; merus slender, not expanded posteriorly.

Epimeron 3: with small notch on posteroventral corner. *Uropod 1:* with long fine setae; rami subequal in length. *Uropod 2:* without long fine setae; rami subequal in length, inner ramus with moderate constriction. *Uropod 3:* peduncle short, 1.3 times as long as broad without lateral flange; rami lanceolate, subequal in length, with long setae and minutely serrate margins, plumose setae absent in female and male; outer ramus 2-articulate. *Telson:* longer than broad, deeply cleft (70%), without dorsal spines, distal margins rounded, with 1 large spine on each margin.

Remarks. *Ichnopus serricus* is a member of the *I. spinicornis* species group. Aside from its sibling relationship with *I. pseudoserricus*, discussed under that species, it shows no strong relationship to any other member of the group. *Ichnopus serricus* is easily distinguished from other species in the group, except for *I. pseudoserricus*, by the strongly crenate posterior margin on the basis of peraeopod 5.

Echelman & Fishelson (1990) found that *I. serricus* was the third most abundant gammaridean amphipod in their study of the community structure of surface plankton near the reef in the Gulf of Aqaba. They found that *I. serricus* was more abundant 2 km off the reef than it was near the reef indicating that it is a true pelagic species.

Distribution. *Ichnopus serricus* is an inshore species known in the western Indian Ocean from Madagascar to the Gulf of Aqaba.

Ichnopus spinicornis Boeck

Figs 25-26

Ichnopus spinicornis Boeck, 1861: 645.—Boeck, 1871: 98.—Chevreux, 1888: 39.—Sars, 1890: 40, pl.15.—Sars, 1895: 675.—Norman, 1895: 479.—Chevreux, 1898: 476.—Chevreux, 1900: 15.—Norman, 1900: 142.—Stebbing, 1906: 52, fig.10.—Walker, 1910: 159.—Nordgaard, 1911: 21.—Sexton, 1911: 200.—Tattersall, 1913: 3.—Stephensen, 1915: 35.—Stephensen, 1923: 78.—Chevreux & Fage, 1925: 47, figs 28, 29.—

Chevreux, 1927: 56.—Stephensen, 1929a: 61.—Stephensen, 1929b: 2.—Stephensen, 1935: 64.—Cecchini & Parenzan, 1935: 162, fig.6.—Chevreux, 1935: 36.—Stephensen, 1942: 472.—Gurjanova, 1951: 220, fig.86.—Reys, 1960: 90.—Toulmond & Truchot, 1964: 6.—Macquart-Moulin, 1968: 313.—Poizat, 1969: 402.—Vader, 1969: 6.—Bellan-Santini & Ledoyer, 1973: 919.—Krapp-Schickel, 1974: 322, 337.—Ledoyer, 1977: 374.—Drago *et al.*, 1978: 75.—Vader & Johannessen, 1978: 336.—Lincoln, 1979: 94, fig.38.—Mattson, 1981: 115 (table 1).—Macquart-Moulin, 1984: 185.—Marques & Bellan-Santini, 1985: 323, 349.—Tully & Ó Céidigh,

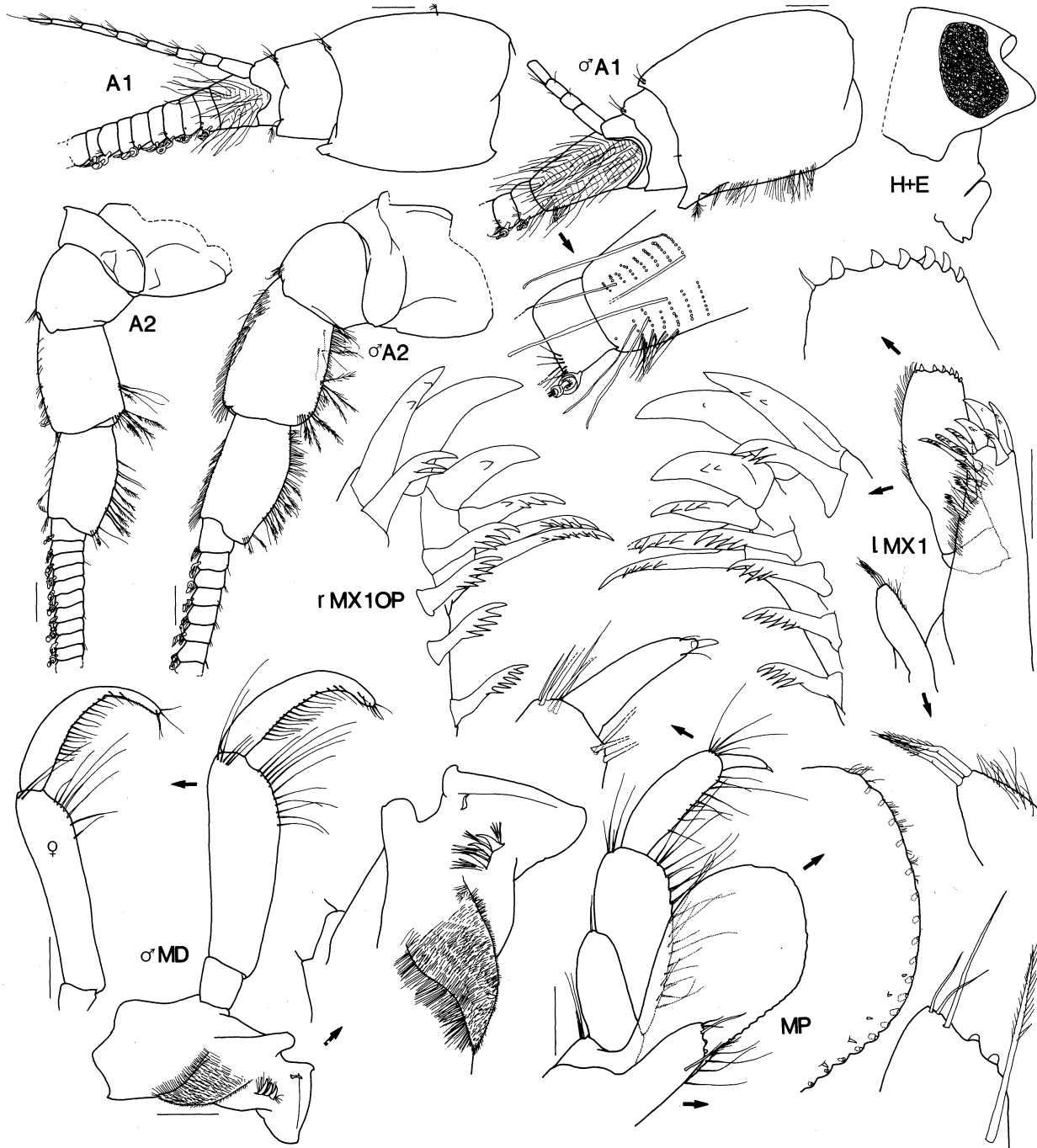


Fig.25. *Ichnopus spinicornis* Boeck, female, 14.5 mm, male, 15.5 mm, AM P40072, Masfjorden, Norway. Scales represent 0.2 mm.

1987: 62.—Dauvin & Toulemon, 1988: 218 (table 1).—
 Costello *et al.*, 1989: 33.—Diviacco & Ruffo, 1989: 486,
 fig.329.—Kaarvedt, 1989: 189.—Palerud & Vader, 1991: 36.
Lysianassa spinicornis.—Lilljeborg, 1865a: 20.—Lilljeborg,

1865b: 11.
Ichnopus calceolatus Heller, 1866: 20, pl.2 figs 26-28.—
 Marion, 1883: 44.—Krapp-Schickel, 1974: 322, 337.
Ichnopus minutus Boeck, 1871: 99.

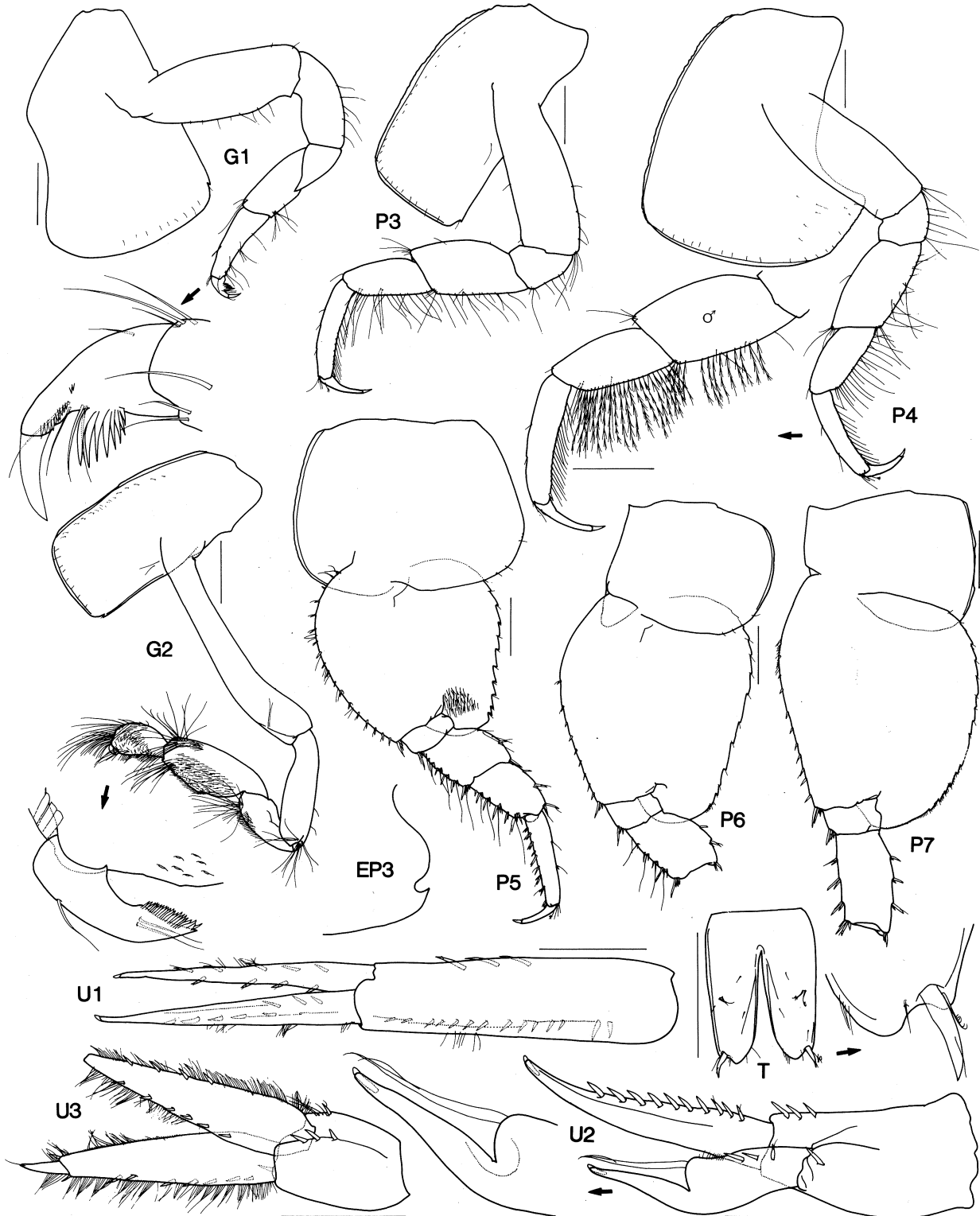


Fig.26. *Ichnopus spinicornis* Boeck, female, 14.5 mm, male, 15.5 mm, AM P40072, Masfjorden, Norway. Scales represent 0.5 mm.

Ichnopus taurus.—Della Valle, 1893: 801, pl.27 figs 1-22 (in part).
not *Ichnopus spinicornis*.—Ledoyer, 1986: 764, fig.297 (= *I. comorensis*).

Material examined. 16 females, 15 males, 10 juveniles, AM P40066 to P40074, P40076, Masfjorden, western Norway, approximately 60°49'N 5°23'E, pumped at night, 36-75 m over bottom depth of 80-85 m, S. Kaartvedt on RV *Håkon Mosby*, Dec. 1986 and Apr. 1987; 1 specimen, ZMUB 9569, Lyrenes, Byford, Norway, coll. Nordgaard; 1 specimen, ZMUB 17486, Bergen, Norway; 1 specimen, ZMUB 19873, Filjar, Norway, 20-40 m, June 1890, coll. Grieg; 1 specimen ZMUB 46456, west of Sandtorg, Norway, 15-35 m, Tams - Lyche, 29 June 1954, stn M-17/62; 2 specimens, ZMUB 58917, Narøy-Vikso, Korsfjorden, Norway, shelly sand, stone, *Laminaria*, 8.5 m, 14 Apr. 1965, stn B.S. 392-65; 1 specimen ZMUB 58918, Korsfjorden, Norway, 690 m, 11 Apr. 1969, stn E129-69; 1 female, 2 males, 1 juvenile, ZMUB 58919, Liholmstennen, Raunefjord, Norway, 100-130 m, 5 Apr. 1972, stn E51-72; 1 specimen, ZMUB 61196 south-west of Bjellandsøene, Husnesfjord, Norway, 59°49'N 5°41'50"E, 120 m, 29 Nov. 1961, stn Z.14/61.

One ovigerous female, 15.5 mm, AM P40477, Bendo Palummo, Gulf of Naples, Mediterranean Sea, 105 m, U. Schiecke, 23 Dec. 1974; 1 ovigerous female, 9.5 mm, MCSN Verona, Ischia - P.S. Pancrazio, Gulf of Naples, Mediterranean Sea, 40 m, U. Schiecke, 19 Sept. 1969.

Diagnosis. Antenna 1: peduncular article 1 with long posterodistal tooth; callynophore with posterodistal setae. Antennae 1 and 2: calceoli present in female and male. Upper lip rounded. Mandible: left lacinia mobilis present; accessory spine row, left with 3, right with 4 spines; molar setose, without spines; palp article 2 slightly broadened distally in female, more strongly in male. Maxilla 1 with ST7 multicuspidate medially; palp inner margin distally smooth. Maxilliped, inner plate with 2 nodular spines; palp article 2 broad. Gnathopod 1: ischium and carpus long; dactylus with short cuticular spines. Gnathopod 2: palm minute in female. Peraeopod 5: basis with posterior margin minutely crenate. Epimeron 3: posteroventral corner with large notch. Uropod 2: inner ramus with strong constriction.

Description. Based on female, 14.5 mm and male, 15.5 mm, AM P40072 and fully mature male, 20 mm, ZMUB 58919. *Head*: slightly deeper than long, lateral cephalic lobe well developed, narrowly rounded; rostrum absent; eyes reniform, slightly enlarged in reproductive male. *Antenna 1*: medium, about 0.3 (male 0.5) times as long as body, 0.7-0.8 times as long as antenna 2; peduncular article 1 short, 1.4 times as long as broad, with long posterodistal tooth; accessory flagellum 8-articulate (male 10), article 1 slightly elongate; callynophore, well-developed 2-field in female and male, with posterodistal setae; flagellum long, 65-articulate (male 86); calceoli present in male and female. *Antenna 2*: elongate, as long as body in reproductive male; peduncle with brush setae in male and female, peduncular articles 4 and 5 not swollen in male or female; calceoli present in male and female.

Mouthpart bundle: subquadrate. *Epistome* and *upper lip*: separate, upper lip produced, rounded. *Mandible*: incisors symmetrical, slightly convex margins; left lacinia mobilis a tiny slender spine; accessory spine row, left with 3 and right with 4 spines; molar setose, without spines; mandibular palp attached midway; article 1 short, about as long as broad; article 2 elongate, slightly broadened distally (male more so), with 7 (male 11) setae along distal third of medial margin and 2 (male 5) setae on distolateral corner; article 3 slender, falcate, with about 16 (male 19, extending to tip of article 3) proximal D-setae, and 3 short E-setae. *Maxilla 1*: inner plate small with 2 apical plumose setae; outer plate extremely narrow with 11 spine-teeth in a 7/4 crown arrangement, ST1 to ST3 large, stout, with 0-1 cusp, ST4 to ST6 large, slender, multicuspidate medially, ST7 large, multicuspidate medially, STA to STD short, 2- to 5-cuspidate; palp large, 2-articulate, with 4 terminal spines and 1 flag seta. *Maxilla 2*: inner plate nearly as long as outer plate. *Maxilliped*: inner plate large, subrectangular, with 2 well-developed nodular spines, oblique setal row reduced, with 1 plumose seta; outer plate medium size, subovate, apical setae and spines absent, medial spines present, reduced in size, bead-shaped, vestigial submarginal setae present; palp well developed, article 2 broad, dactylus well developed, unguis present.

Gnathopod 1: simple; coxa large, anterior margin concave, forming anteroventrally produced corner; ischium long, 2.3 times as long as broad; carpus long, 2.4 times as long as broad, 1.2 times as long as propodus; propodus long, subrectangular, 3 times as long as broad, tapering distally, posterior margin smooth, straight, without spines; dactylus with large subterminal tooth, a row of 10 medial spines and a row of 8 cuticular teeth along posterior margin. *Gnathopod 2*: minutely subchelate; coxa large, subequal in size to coxa 3; carpus long, 2.8 times as long as broad, posterior margin broadly lobate; propodus subrectangular, short, 1.8 times as long as broad; palm acute, with straight minutely serrate margin.

Peraeopod 4: coxa with well-developed posteroventral lobe; male merus/carpus with plumose setae. *Peraeopod 5*: coxa equilobate; basis expanded with posterior margin minutely crenate. *Peraeopod 7*: basis, posterior margin slightly rounded with rounded posteroventral corner and straight posteroventral margin; merus slender, not expanded posteriorly.

Epimeron 3: with strong notch above posteroventral corner. *Uropod 1*: with long fine setae; rami subequal in length. *Uropod 2*: with long fine setae; rami subequal in length, inner ramus with strong constriction. *Uropod 3*: peduncle short, 1.8 times as long as broad, without lateral flange; rami lanceolate, subequal in length, with long fine setae and minutely serrate margins, plumose setae absent in female and male; outer ramus 2-articulate. *Telson*: longer than broad, deeply cleft (76%), without dorsal spines, distal margins rounded, with 1 large spine on each margin.

Remarks. *Ichnopus spinicornis* has many

plesiomorphic character states. It differs from other members of the *I. spinicornis* species group in not having spines on the mandibular molar, and does not appear to be closely related to any member of the group except *I. comorensis*. Specimens collected from Masfjorden, Norway show an almost equal sex ratio indicating that *I. spinicornis* is a true pelagic species.

The *I. spinicornis* of Ledoyer (1986), described here as *I. comorensis* n.sp., differs from *I. spinicornis* in having significantly fewer articles in the flagella of antennae 1 and 2, in the shape of the carpus of gnathopod 1 and in the small notch on the posteroventral margin of epimeron 3. The smaller of the two females in our material examined from the Gulf of Naples differs from other material of *I. spinicornis* in eye colour, size of adult female and number of cusps on maxilla 1 STA. It may indicate the presence of more than one *I. spinicornis*-like species in the Mediterranean Sea.

Distribution. *Ichnopus spinicornis* is known from Norway to the Mediterranean Sea in depths from 15 to 690 m.

Ichnopus taurus Costa

Figs 27-28

Ichnopus taurus Costa, 1853: 172.—Costa, 1857: 189, pl.1 fig.3.—Marion, 1883: 44.—Della Valle, 1893: 801, pl.3 fig.1, pl.27 figs 1-22 (in part).—Stebbing, 1906: 53.—Chevreux & Fage, 1925: 48, fig.30.—Chevreux, 1935: 36, pl.6 fig.4.—Cecchini & Parenzan, 1935: 163, fig.7.—Ruffo, 1946: 50.—*Nagata, 1965: 149.—*Nayar, 1966: 134.—*Griffiths, 1974: 309.—Krapp-Schickel, 1974: 322, 337.—*Griffiths, 1976: 56, 100, fig.31G.—Ledoyer, 1977: 374.—Diviacco & Ruffo, 1989: 488, figs 330, 331.—Palerud & Vader, 1991: 36.

Ichnopus affinis Heller, 1866: 19, pl.2 figs 19-25.—*Chevreux, 1895: 425.—Chevreux, 1903: 84.—Chevreux, 1935: 35.—Thurston & Allen, 1969: 359.—Krapp-Schickel, 1974: 322, 337.

Not *I. taurus*.—Walker, 1904: 238, pl.1 fig.3 (= *Ichnopus* sp.).

Not *I. taurus*.—K.H. Barnard, 1916: 123.

Not *I. taurus*.—Spandl, 1924: 43, fig.15 (= *I. serricrus*).

References marked with an asterisk are records which, because of their geographic location or depth, may represent species other than *I. taurus*. We have not examined the material.

We have examined the material of K.H. Barnard (1916) SAM A138 and it is not *I. taurus* because it has a long ischium and carpus on gnathopod 1. It therefore belongs in the *I. spinicornis* group. Unfortunately there are no mouthparts available and the material cannot be studied further.

Material examined. Female, 15 mm, Postillipo, Gulf of Naples, Mediterranean Sea, 40°46'N 14°14'E; male, 12 mm, AM P35699, Porto Caruso, north-western Ischia, Gulf of Naples, Mediterranean Sea, 40°45'N 13°50'E, 80 m, U. Schiecke, 29 Oct. 1969.

Diagnosis. Antenna 1: peduncular article 1 with short posterodistal tooth; callynophore with posterodistal setae. Antennae 1 and 2: calceoli in male only. Upper lip rounded. Mandible: left lacinia mobilis present; accessory spine row, left with 3, right with 4 spines; molar setose, weakly spinose; palp article 2 slightly broadened distally. Maxilla 1 with ST7 multicuspidate distally; palp inner margin distally serrate. Maxilliped: inner plate with 3 nodular spines; palp article 2 broad. Gnathopod 1: ischium and carpus very long; dactylus with long cuticular spines. Gnathopod 2: palm minute in female. Peraeopod 5: basis with posterior margin minutely crenate. Epimeron 3: posteroventral corner with small notch. Uropod 2: inner ramus with moderate constriction.

Description. Based on female, 15 mm, AM P35698, and male, 12 mm, AM P35699. **Head:** slightly deeper than long, lateral cephalic lobe well developed, broadly rounded; rostrum absent; eyes reniform, very slightly enlarged in reproductive male. **Antenna 1:** medium length, about 0.2 times as long as body, 0.7 times as long as antenna 2; peduncular article 1 short, as long as broad, with short posterodistal tooth; accessory flagellum at least 5-articulate (male 10); callynophore, well-developed 2-field in female and male, with 5 small posterodistal setae; flagellum long, 30-articulate (male 35); calceoli present in reproductive male. **Antenna 2:** 0.4 times as long as body in female, 0.75 times as long as body in male; peduncle with brush setae in female and male, peduncular articles 4 and 5 not swollen in female or male; flagellum 40-articulate, (male 57-articulate); calceoli present in reproductive male.

Mouthpart bundle: subquadrate. **Epistome** and **upper lip:** separate, upper lip produced, rounded. **Mandible:** incisors symmetrical with slightly convex margins; left lacinia mobilis a small, slender spine; accessory spine row, left with 3 spines, right with 4 spines; molar setose with a few small spines distally; mandibular palp attached midway; article 1 short, about as long as broad; article 2 elongate, slightly broadened distally, with 6 (male 8) setae along distal third of medial margin and 7 setae on distolateral corner; article 3 slender, falcate, with 12 (male 15) proximal D-setae, and 4 short E-setae. **Maxilla 1:** inner plate small, narrow with 2 apical plumose setae; outer plate extremely narrow, with 11 spine-teeth in a 7/4 crown arrangement, ST1 to ST3 large, stout, weakly cuspidate, ST4 to ST6 large, slender, multicuspidate, ST7 short, multicuspidate distally, STA 1-cuspidate, STB to STD 2- to 3-cuspidate; palp large, 2-articulate, with 8 terminal spines and 1 flag seta. **Maxilla 2:** inner plate half length of outer plate. **Maxilliped:** inner plate large, subrectangular, with 3 well-developed nodular spines, oblique setal row reduced, with 9 plumose setae; outer plate medium size, subovate, apical setae and spines absent, medial spines reduced in size, bead-shaped, submarginal setae vestigial; palp well developed, article 2 broad, dactylus well developed, unguis present.

Gnathopod 1: simple; coxa large, anterior margin

concave, forming slight anteroventrally produced corner; ischium very long, about 3.4 times as long as broad; carpus very long, 4.1 times as long as broad, 1.5 times as long as propodus; propodus long, subrectangular, 3.2 times as long as broad, margins

subparallel; posterior margin smooth, straight, without spines; dactylus with large subterminal tooth, a row of medial spines and a row of 9 cuticular teeth along posterior margin. *Gnathopod 2*: minutely subchelate; coxa large, subequal in size to coxa 3; carpus long, 2.8

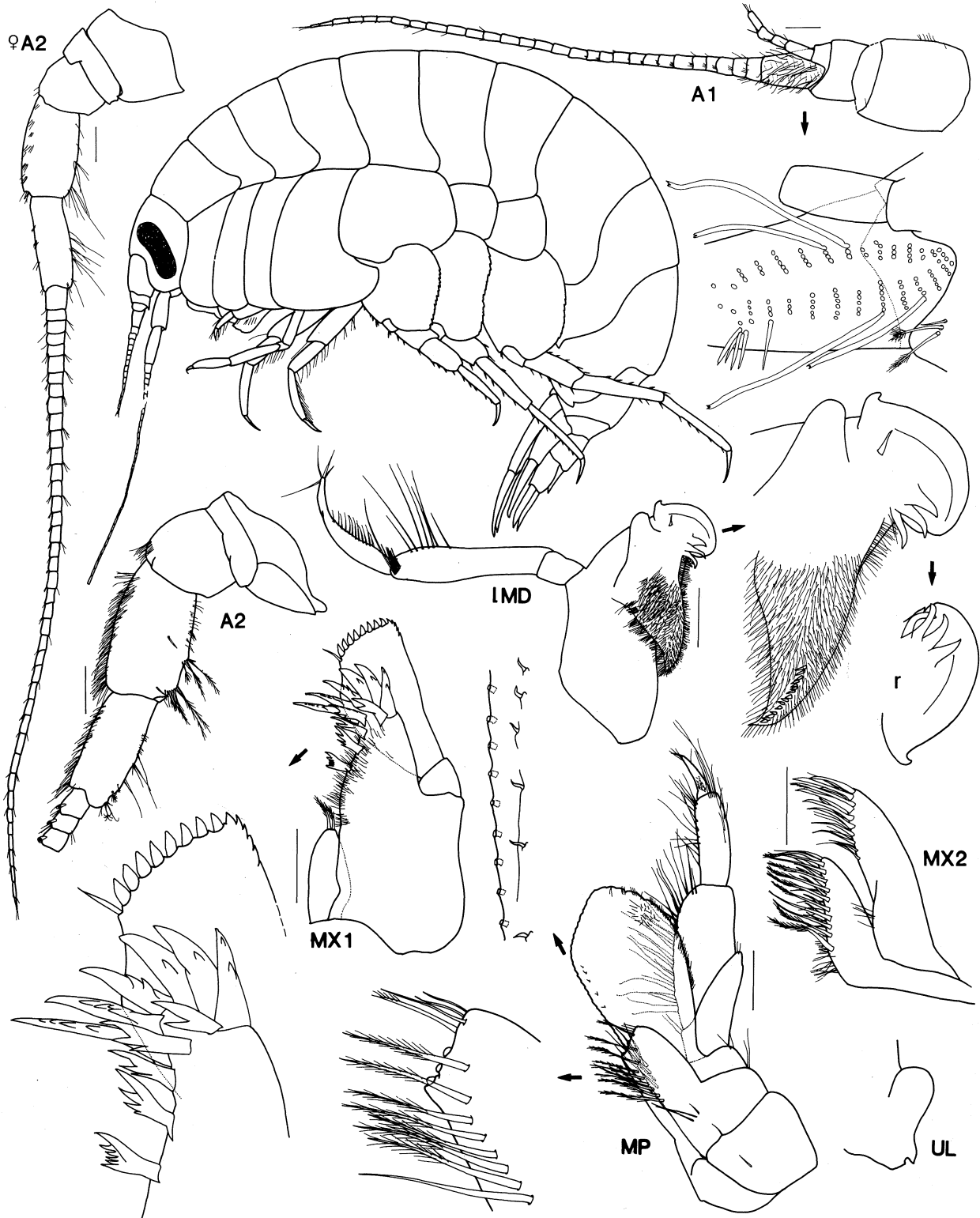


Fig.27. *Ichnopus taurus* Costa, female, 15 mm, AM P35698, male, 12 mm, AM P35699, Gulf of Naples, Mediterranean Sea. Scales represent 0.2 mm.

times as long as broad, posterior margin broadly lobate; propodus subovate, short, 1.6 times as long as broad; palm transverse, with straight, serrate margin.

Peraeopod 4: coxa with well-developed

posteroventral lobe, male merus/carpus with plumose setae. *Peraeopod 5*: coxa bilobate, anterior lobe slightly produced ventrally; basis expanded with posterior margin minutely crenate. *Peraeopod 7*: basis, posterior

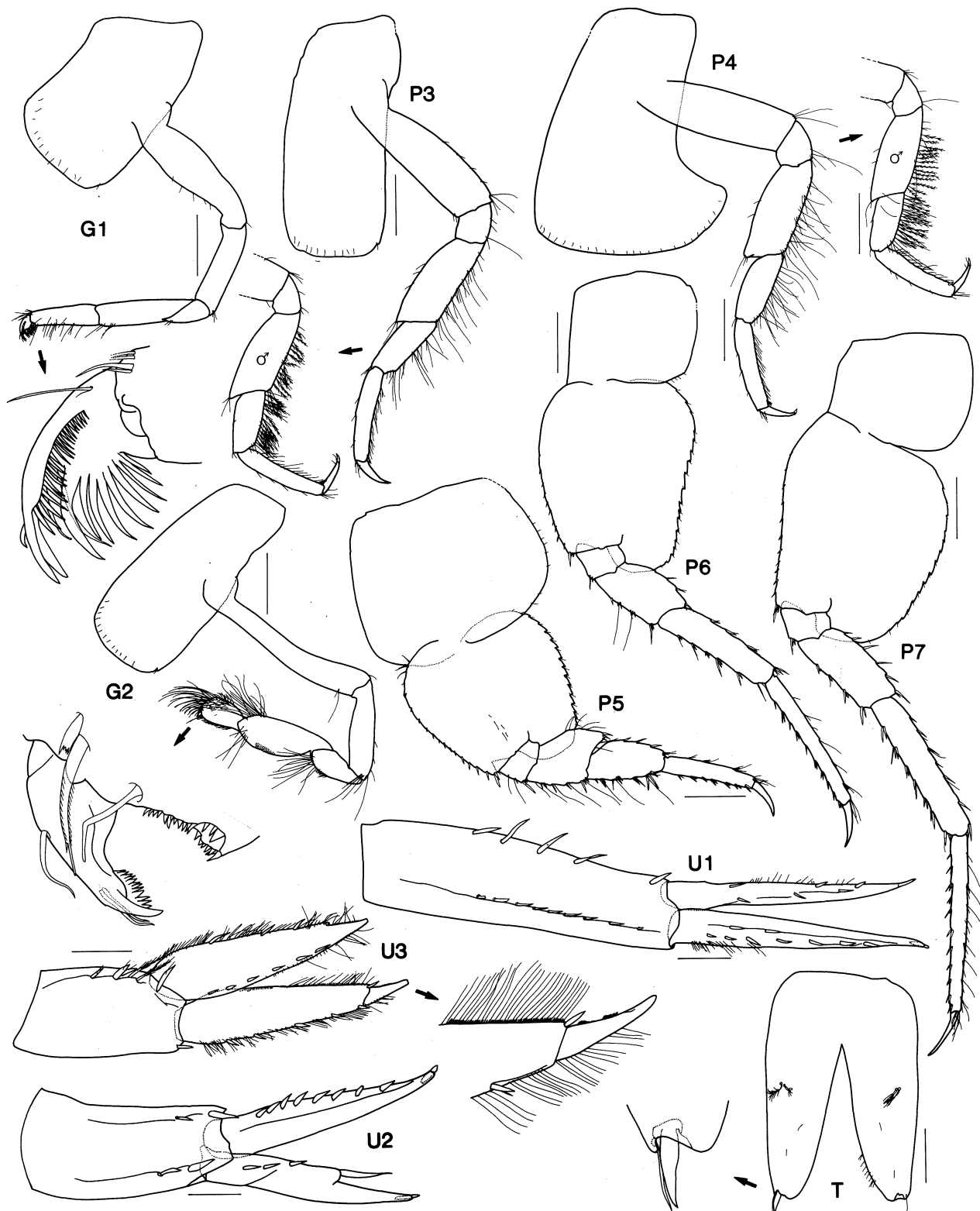


Fig.28. *Ichnopus taurus* Costa, female, 15 mm, AM P35698, male, 12 mm, AM P35699, Gulf of Naples, Mediterranean Sea. Scales for U1-3, T represent 0.2 mm, remainder represent 0.5 mm.

margin slightly rounded with rounded posteroventral corner and straight posteroventral margin; merus slender, not expanded posteriorly.

Epimeron 3: with small notch on posteroventral corner. *Uropod 1*: with long fine setae; rami subequal in length. *Uropod 2*: with long fine setae; rami subequal in length, inner ramus with moderate constriction. *Uropod 3*: peduncle short, 1.75 times as long as broad without lateral flange; rami lanceolate, subequal in length with long fine setae and minutely serrate margins; plumose setae absent in female and male; outer ramus 2-articulate. *Telson*: longer than broad, deeply cleft (78%), without dorsal spines, distal margins rounded, with 1 large spine on each margin.

Remarks. *Ichnopus taurus* appears at the base of the *I. taurus* species group. Its relationship to *I. macrobetomma* is not well understood, but it is considered to be the sister taxon of *Ichnopus* sp. (Walker, 1904, as *I. taurus*) from Sri Lanka. They are the only species in the group with a left lacinia mobilis, and along with *I. macrobetomma*, they are the only species in the group with a minutely crenate posterior margin on the basis of pereopod 5. *Ichnopus taurus* differs from *Ichnopus* sp. in having a small posterodistal tooth on the first peduncular article of antenna 1 (lost in *Ichnopus* sp.), significantly more D-setae on mandibular palp article 3 and smaller spines on the mandibular molar. These minute differences probably reflect a recent vicariant event in the history of these animals, such as the closing of the Arabian Peninsula about 5 million years ago.

Distribution. *Ichnopus taurus* is known from the Mediterranean Sea, in depths of 50 to 400 m. Records from the Bay of Biscay, North Atlantic and the North Pacific Ocean probably represent other species.

Ichnopus tenuicornis (Haswell) new combination

Figs 29-31

Glyceria tenuicornis Haswell, 1879a: 256, pl.8 fig.6.—Della Valle, 1893: 849.

Glycerina tenuicornis.—Haswell, 1882: 234, pl.4 fig.3.—Stebbing, 1906: 61.

? *Glyceria tenuicornis*.—Haswell, 1879b: 322.

? *Glycerina tenuicornis*.—Stebbing, 1888: 643.—Whitelegge, 1889: 55.—J.L. Barnard, 1974: 141.

not *Glycerina tenuicornis*.—Pirlet, 1936: 271, figs 106, 107 (= *I. wardi*).

Haswell's original material of *Glycerina tenuicornis*, from the Howick Group, Great Barrier Reef, has been located among material from the Macleay Museum, University of Sydney, which was on loan to Keith Sheard at the time of Sheard's death. This material is now deposited in the Australian Museum, Sydney, and is described below.

As recorded by Barnard (1974) there is also a sample from Port Jackson. This sample (AM G5414) has been labelled as "Types". Since the original description gave only "Howick Group" as locality, the material from Port Jackson cannot be regarded as type material. The sample contains two partial specimens, in poor condition: one lacks the maxilliped and both sets of gnathopods; the other is an immature female with the entire head missing but with the enlarged palm of

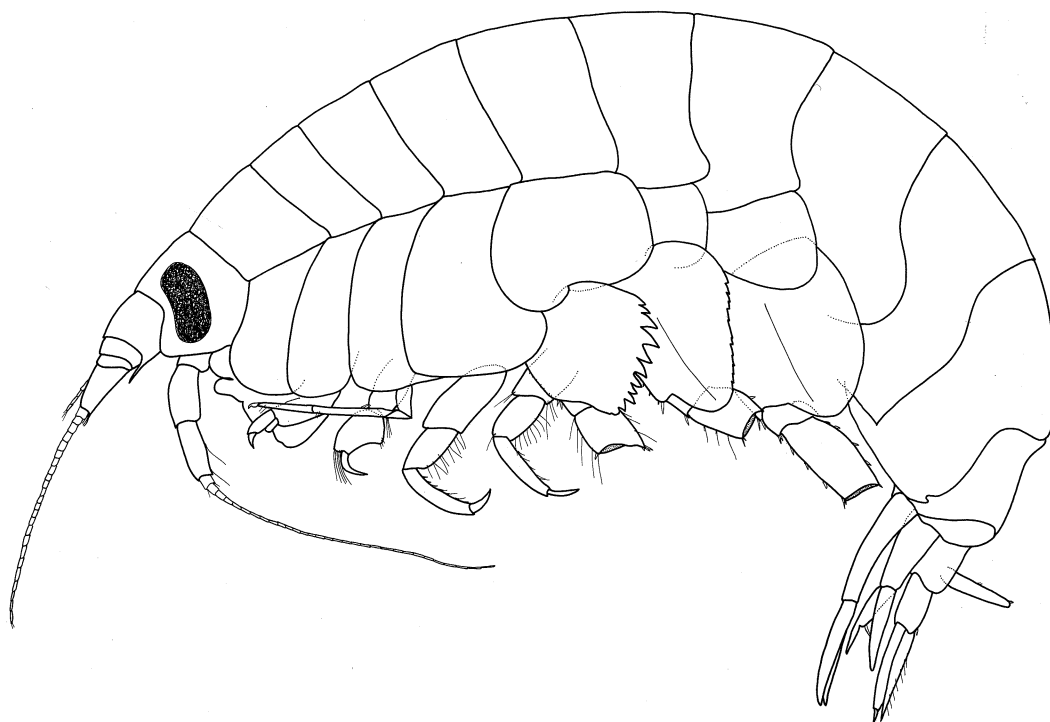


Fig.29. *Ichnopus tenuicornis* (Haswell), lectotype female, 10.5 mm, AM P39547, Howick Group, Great Barrier Reef, Australia.

gnathopod 2 described below for *I. tenuicornis*. It is not possible to identify with certainty either specimen, and recent collecting in Port Jackson has not yielded any specimens with an enlarged palm on gnathopod 2.

Type material examined. LECTOTYPE, female, 10.5 mm, non-ovigerous, AM P39547, PARALECTOTYPE, male, 9 mm, AM P39548, 10 PARALECTOTYPES, AM P39549, Howick Group, Great Barrier Reef, north-eastern Queensland,

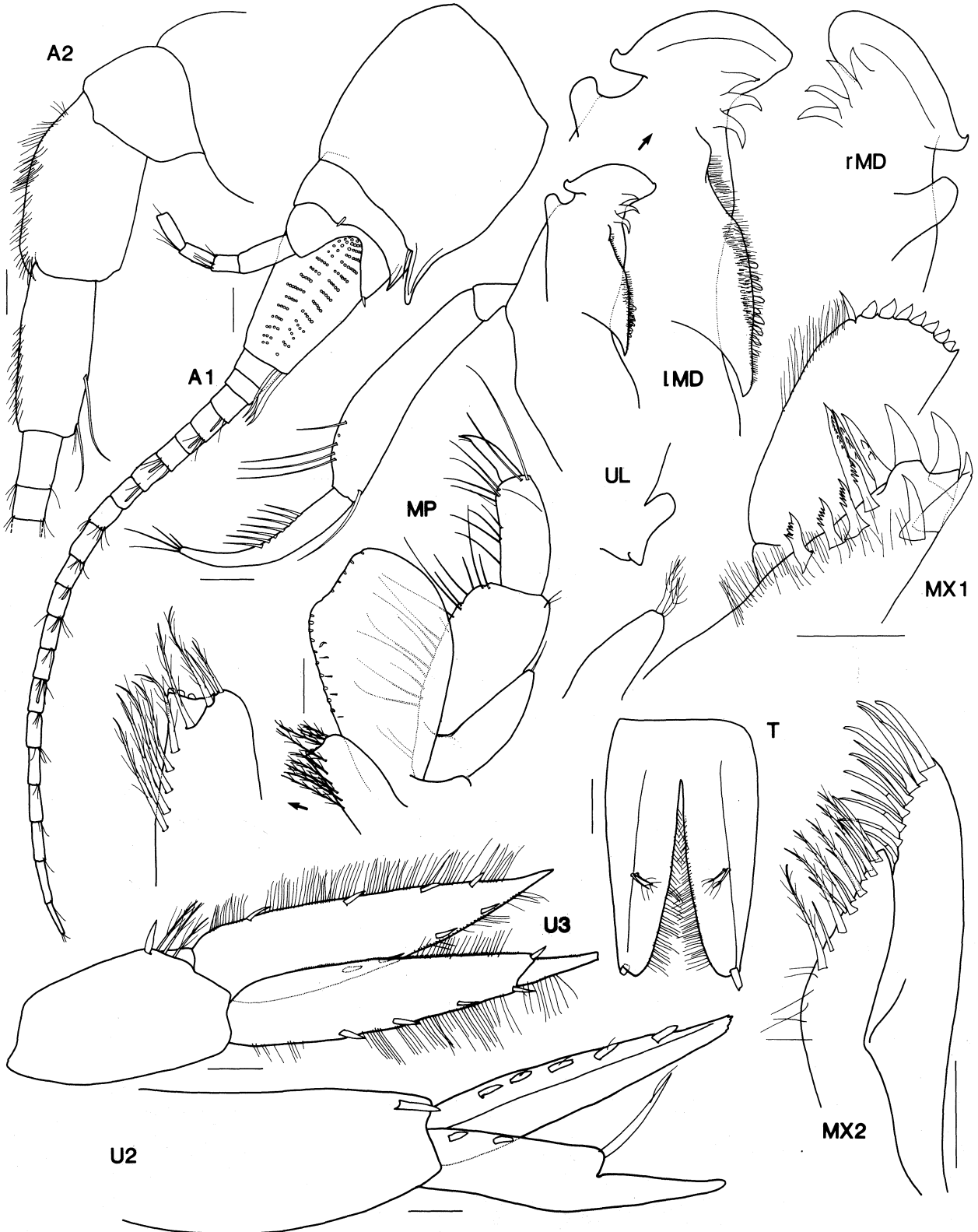


Fig.30. *Ichnopus tenuicornis* (Haswell), lectotype female, 10.5 mm, AM P39547, Howick Group, Great Barrier Reef, Australia. Scales represent 0.1 mm.

Australia, [approximately 14°29'S 144°55'E].

Additional material examined. 26 females, 35 males, 10 immature specimens, AM P39550 to P39584, 1 male, 1 female, BMNH 1990:36:2, 1 male, 1 female, USNM 253721, from 37 stations, North West Shelf, Western Australia, 19-20°S 117-119°E, epibenthic sled, 37-86 m, T. Ward for CSIRO on RV *Soela*, Dec. 1982-Oct. 1983; 3 specimens, AM P41014, west side of Oxley Island, Northern Territory, Australia, 11°00'S 132°49'E, muddy sand, 14 m, J.K. Lowry & G.C.B. Poore, 12 Oct. 1982, stns NT-85 and NT-88; 2 females, 1 male, AM P39587, off reef face between Bird Islet and South

Island, Lizard Island, north Queensland, 14°40'S 145°28'E, baited trap at night on *Halimeda* beds, 30 m, J.K. Lowry & R.T. Springthorpe, 12 Feb. 1987, QLD-117; 1 juvenile, AM P39902, Mrs Watsons Bay, off Chinamans Ridge, Lizard Island, Queensland, baited trap on sand at night, 9-12 m, J.K. Lowry & R.T. Springthorpe, 15 Feb. 1987, QLD-119.

Diagnosis. Antenna 1: peduncular article 1 with long posterodistal tooth; callynophore with posterodistal spines. Antennae 1 and 2: calceoli in male only. Upper lip rounded. Mandible: left lacinia mobilis absent;

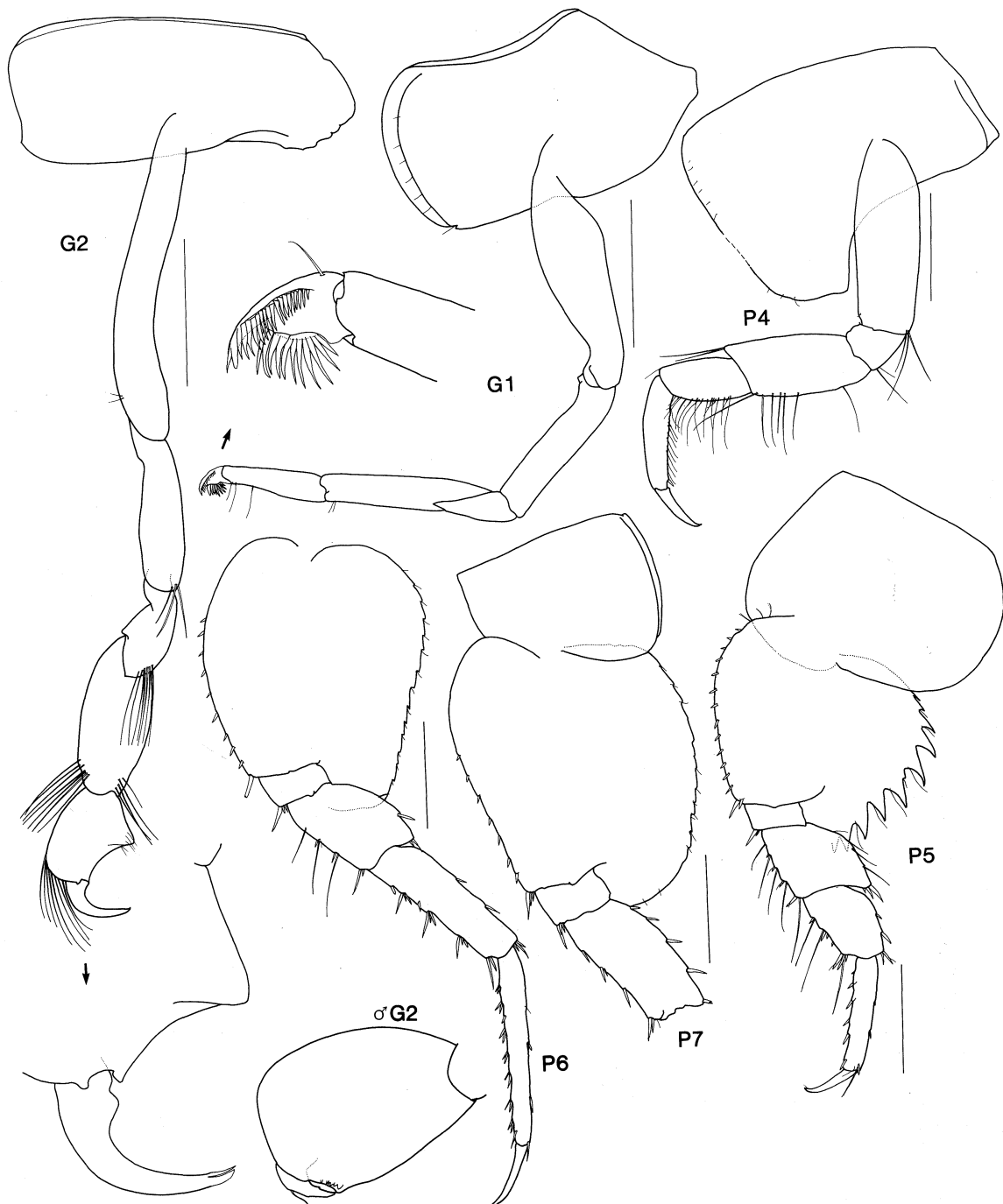


Fig.31. *Ichnopus tenuicornis* (Haswell), lectotype female, 10.5 mm, AM P39547, paralectotype male, 9 mm, AM P39548, Howick Group, Great Barrier Reef, Australia. Scales represent 0.5 mm.

accessory spine row, left with 2-4, right with 4-5 spines; molar setose, weakly spinose; palp article 2 slightly broadened distally. Maxilla 1 with ST7 multicuspidate distally; palp inner margin distally smooth. Maxilliped: inner plate with 3 nodular spines; palp article 2 very broad. Gnathopod 1: ischium and carpus very long; dactylus with long cuticular spines. Gnathopod 2: palm enlarged in female. Peraeopod 5: basis with posterior margin deeply serrate. Epimeron 3: posteroventral corner with small notch. Uropod 2: inner ramus with moderate constriction.

Description. Based on lectotype female, 10.5 mm and paralectotype male, 9 mm. *Head*: slightly deeper than long, lateral cephalic lobe well developed, narrowly rounded; rostrum absent; eyes reniform, slightly enlarged in reproductive male. *Antenna 1*: medium length, about 0.2 times as long as body, 0.75 times as long as antenna 2; peduncular article 1 short, as long as broad, with long posterodistal tooth; accessory flagellum at least 4-articulate (male at least 6); callynophore, well-developed 2-field in female and male, with 3 posterodistal spines; flagellum long, 22-articulate (male 25); calceoli present in reproductive male. *Antenna 2*: about 0.3 times as long as body in female; flagellum 36-articulate, about 0.6 times as long as body in male (46-articulate); peduncle with brush setae in female and male, peduncular articles 4 and 5 not swollen in female or male; calceoli present in reproductive male.

Mouthpart bundle: subquadrate. *Epistome* and *upper lip*: separate, upper lip produced, rounded. *Mandible*: incisors symmetrical, with slightly convex margins; lacinia mobilis absent; accessory spine row, left with 3 spines, right with 4 spines; molar setose, weakly spinose; mandibular palp attached midway; article 1 short, about as long as broad; article 2 elongate, slightly broadened distally (slightly more in male than female), with 5 (male 8) setae along distal third of medial margin, 4 setae on distolateral corner; article 3 slender, falcate, with 7 (male 9) proximal D-setae and 4 E-setae. *Maxilla 1*: inner plate small, narrow with 2 apical plumose setae; outer plate extremely narrow, with 11 spine-teeth in a 7/4 crown arrangement, ST1 to ST3 large, stout, without cusps, ST4 to ST6 large, slender, multicuspidate, ST7 short, multicuspidate distally, STA without cusps, STB to STD 4- to 5-cuspidate; palp large, 2-articulate, with 7 terminal spines and 1 flag seta. *Maxilla 2*: inner plate three quarters as long as outer plate. *Maxilliped*: inner plate large, subrectangular, with 3 well-developed nodular spines, oblique setal row reduced, with 9 plumose setae; outer plate large, subovate, apical setae and spines absent, medial spines reduced in size, bead-shaped, submarginal setae vestigial; palp well developed, article 2 very broad, dactylus well developed, unguis present.

Gnathopod 1: simple; coxa large, anterior margin concave, forming anteroventrally produced corner; ischium very long, about 4.5 times as long as broad; carpus very long, 5.7 times as long as broad, 1.7 times as long as propodus; propodus long, subrectangular, 3.3 times as long as broad, slightly tapering distally, posterior

margin smooth, straight, without spines; dactylus with large subterminal tooth, a row of about 20 medial spines and a row of 11 long cuticular teeth along posterior margin. *Gnathopod 2*: minutely subchelate, grossly subchelate in female; coxa large, subequal in size to coxa 3; carpus elongate, 2.2 times as long as broad, posterior margin broadly lobate; propodus subquadrate, short, 1.4 (male), 1.2 (female) times as long as broad; male palm acute, with slightly concave margin, female palm acute with enlarged concave margin guarded by a large blunt tooth.

Peraeopod 4: coxa with well-developed posteroventral lobe, anterior and posterior margins subparallel; male merus/carpus with plumose setae. *Peraeopod 5*: coxa bilobate, anterior lobe slightly produced ventrally; basis expanded with posterior margin deeply serrate. *Peraeopod 7*: basis, posterior margin slightly rounded with rounded posteroventral corner and straight posteroventral margin; merus slender, not expanded posteriorly.

Epimeron 3: with small notch on posteroventral corner. *Uropod 1*: with long fine setae; rami subequal in length. *Uropod 2*: with few long fine setae; rami subequal in length, inner ramus with moderate constriction. *Uropod 3*: peduncle short, 1.8 times as long as broad, without lateral flange; rami lanceolate, subequal in length with long fine setae and minutely serrate margins; plumose setae absent in female and male; outer ramus 2-articulate. *Telson*: longer than broad, deeply cleft (77%), without dorsal spines, distal margins rounded, with 1 spine on each margin.

Variation. *Ichnopus tenuicornis* shows some variation in the number of accessory spines on the mandible. The 9 mm paralectotype male has the usual 3 accessory spines on the left mandible, but 5 on the right. One adult male from the North West Shelf and a female from Lizard Island have 4 on both the left and right, and an adult male from Lizard Island has 2 on the left and 4 on the right. These specimens were not distinctive in any other character.

The enlarged palm of gnathopod 2 does not occur in juveniles or immature females.

Remarks. *Ichnopus tenuicornis* is a member of the *I. taurus* species group. Within this group it belongs to a group of four species (including *I. caritus*, *I. cribensis* and *I. parriwi*) which have spines instead of setae posterodistally on the callynophore. It differs from all species in this group in having the palm of gnathopod 2 enlarged in the female. In this regard it is similar to *I. woodmasoni*. But *I. woodmasoni* does not have a very long ischium and carpus on the first gnathopods. It differs from *I. parriwi* in not having calceoli in the female, from *I. caritus* in having spines on the mandibular molar and from *I. caritus* and *I. cribensis* in having a slightly expanded mandibular palp article 2.

Ichnopus tenuicornis appears to be a nocturnal scavenger. At Lizard Island it occurs in *Halimeda* beds on sand bottoms below 9 m.

Distribution. *Ichnopus tenuicornis* is a tropical species known from the North West Shelf of Western Australia, north of Cobourg Peninsula in the Northern Territory and the Great Barrier Reef of Queensland in depths of 9 to 86 m. One record of this species from Port Jackson cannot be substantiated.

Ichnopus teretis (Andres) new combination

Fig.32

Glycerina teretis Andres, 1981: 430, figs 1, 2.

Type material examined. HOLOTYPE male, SMF 9193 (as 1 slide) and PARATYPE female, SMF 9194b (as 1 slide), central Red Sea, 21°18.6'N 38°3.82'E, baited trap, 1869 m, Thiel & Türkay, 20 Oct. 1977, MESEDA I, stn So-02/50 FF.

Diagnosis. Antenna 1: peduncular article 1 with short posterodistal tooth; callynophore with posterodistal setae. Antennae 1 and 2: calceoli absent. Upper lip rounded. Mandible: left lacinia mobilis absent; accessory spine row, left with 3-4, right with 4 spines; molar setose, without spines; palp article 2 slender. Maxilla 1 with ST7 multicuspidate distally; palp inner margin distally serrate. Maxilliped: inner plate with 3 nodular spines; palp article 2 broad. Gnathopod 1: ischium and carpus very long; dactylus with long cuticular spines. Gnathopod 2: palm minute in female. Peraeopod 5: basis with posterior margin deeply serrate. Epimeron 3: posteroventral corner without notch. Uropod 2: inner ramus with weak constriction.

Remarks. *Ichnopus teretis* is a member of the *I. taurus* species group. The relationship of *I. teretis* to *I. capricornus* is discussed under that species. *Ichnopus teretis* has been well described by Andres (1981). For comparison with descriptions of new species in this paper we add the following characters. *Antenna 1*:

callynophore 2-field, with at least one posterodistal seta, no posterodistal spines. *Mandible*: molar setose, without spines. *Maxilla 1*: outer plate extremely narrow, with 11 spine-teeth in a 7/4 crown arrangement, ST1 to ST3 large, stout, weakly cuspidate, ST4 to ST6 large, slender, multicuspidate, ST7 short, multicuspidate distally, STA 2- to 3-cuspidate, STB to STD 4- to 5-cuspidate.

Distribution. Central Red Sea in 1869 m depth.

Ichnopus wardi n.sp.

Figs 33-35

?*Glycerina tenuicornis*.—Pirlot, 1936: 271, figs 106, 107.

Type material. HOLOTYPE, female, 12.5 mm (with 13 embryos), AM P39588, PARATYPE, male, 13.5 mm, AM P39589, PARATYPE, male, AM P39590, North West Shelf, Western Australia, 18°59.3'S 118°45.8'E to 18°59.1'S 118°46.0'E, epibenthic sled, 84 m, T. Ward for CSIRO on RV *Soela*, 7 Dec. 1982, Cruise 06, Stn B5S; PARATYPES, 2 females, 2 males, AM P39591, North West Shelf, Western Australia, 18°56.6'S 118°44.9'E to 19°57.1'S 118°45.0'E, epibenthic sled, 86-88 m, T. Ward for CSIRO on RV *Soela*, 7 Dec. 1982, Cruise 06, Stn B4S; PARATYPES, 3 females, 1 immature female, AM P39592, North West Shelf, Western Australia, 19°2.0'S 118°47.2'E to 19°1.7'S 118°47.1'E, epibenthic sled, 82 m, T. Ward for CSIRO on RV *Soela*, 7 Dec. 1982, Cruise 06, Stn B6S; PARATYPES, 1 male, 1 female, BMNH 1990:35:2, North West Shelf, Western Australia, 19°08.4'S 119°02.4'E to 19°08.6'S 119°02.7'E, epibenthic sled, 78 m, T. Ward for CSIRO on RV *Soela*, 11 Dec. 1982, Cruise 06, Stn B10S; PARATYPES, 1 male, 1 female, USNM 253722, North West Shelf, Western Australia, 19°03.0'S 119°00.6'E to 19°04.1'S 119°01.1'E, epibenthic sled, 78-80 m, T. Ward for CSIRO on RV *Soela*, 11 Dec. 1982, Cruise 06, Stn B11S.

Additional material examined. 43 specimens, AM P39593 to AM P39615, from 23 stations, North West Shelf,

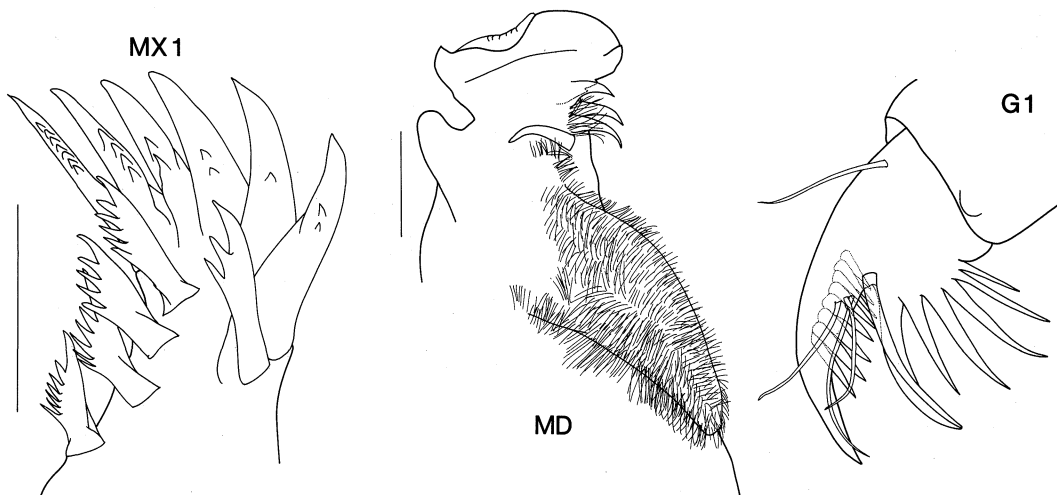


Fig.32. *Ichnopus teretis* (Andres), paratype female, SMF 9194b, central Red Sea. Scales represent 0.1 mm.

Western Australia, 19-20°S 117-119°E, epibenthic sled and beam trawl, 40-84 m, T. Ward for CSIRO on RV *Soela*, Feb.-Oct. 1983; 5 specimens, NMV J19731 to J19733, North West Shelf, Western Australia, 19°39'S 116°22-43'E to 20°1'S 117°11-18'E, dredged, 46-48 m, G.C.B. Poore and H.M. Lew Ton on RV *Soela*, 2-11 June 1983, stns NWS-5, 33 & 48; 1 specimen, AM P39616, outer barrier, Horseshoe Reef, Bootless Inlet, Papua New Guinea, approx. 9°32'S 147°16'E, steep sand and shell slope at base of front face of reef, 30 m, S. Arnam, 28 Oct. 1980, stn PNG-19; 1 male, as 14 slides, ZMA 965-978, near Waigeo Island, Indonesia, 0°03.8'N 130°02.5'E, fine sand and broken shell, 141 m, 14 Aug. 1899, *Siboga* stn 152; 1 juvenile, as 6 slides, ZMA 980-985, off Donggala, Celebes, Indonesia, [approx. 0°40'S 119°44'E], grey mud, 36 m, 18-19 June 1899, *Siboga* stn 86; 1 specimen, ZMC, Kei Islands, Indonesia, [approx. 5°35'S 132°45'E], sand and coral, trawled, 85 m, 9 May 1922, Danish Expedition to the Kei Islands stn 53; 1 mature male, ZMC, off Jolo, Mindanao, Philippines, [approx. 6°04'N 121°00'E], hard bottom, 1 m, dredge, Th. Mortensen, 17 Mar. 1914.

Diagnosis. Antenna 1: peduncular article 1 with long posterodistal tooth; callynophore with posterodistal setae. Antennae 1 and 2: calceoli present in male and female. Upper lip acute. Mandible: left lacinia mobilis absent; accessory spine row, left and right each with 4 spines; molar setose, strongly spinose; palp article 2 strongly broadened distally. Maxilla 1 with ST7 multicuspitate medially; palp inner margin distally serrate. Maxilliped: inner plate with 2 nodular spines; palp article 2 very broad. Gnathopod 1: ischium and carpus long; dactylus with short cuticular spines. Gnathopod 2: palm minute in female. Peraeopod 5: basis with posterior margin deeply serrate. Epimeron 3: posteroventral corner with small notch. Uropod 2: inner ramus with strong constriction.

Description. Based on holotype female, 12.5 mm and paratype male, 13.5 mm. *Head*: slightly deeper than long, lateral cephalic lobe well developed, narrowly rounded; rostrum absent; eyes reniform, slightly enlarged in reproductive male. *Antenna 1*: medium length, about 0.3 times as long as body, 0.56 times as long as antenna 2; peduncular article 1 short, about as long as broad, with long posterodistal tooth; accessory flagellum 10-

articulate, article 1 slightly elongate, 0.2 times as long as flagellum; callynophore, well-developed 2-field in female and male, with posterodistal setae; flagellum long, 27-articulate (male 39); calceoli present in female and male. *Antenna 2*: about 0.6 times as long as body in female, 0.75 times as long as body in male; peduncle with brush setae in female and male, peduncular articles 4 and 5 not swollen in female or male; calceoli present in female and male.

Mouthpart bundle: subquadrate. *Epistome* and *upper lip*: separate, upper lip produced, acute. *Mandible*: incisors symmetrical with slightly convex margins; left lacinia mobilis absent; accessory spine row, left and right each with 4 spines; molar setose, strongly spinose; mandibular palp attached midway; article 1 about twice as long as broad; article 2 elongate, strongly broadened distally, with 12 setae along distal third of medial margin, 8 setae on distolateral corner; article 3 slender, falcate, with 16 proximal D-setae and 4 short E-setae. *Maxilla 1*: inner plate small, narrow with 2 apical plumose setae; outer plate extremely narrow, with 11 spine-teeth in a 7/4 crown arrangement, ST1 to ST3 large, stout, without cusps, ST4 to ST6 large, slender, multicuspitate, ST7 large, multicuspitate medially, STA 3-cuspitate, STB to STD 4- to 5-cuspitate; palp large, 2-articulate, with 5 terminal spines and 1 flag seta. *Maxilla 2*: inner plate three quarters as long as outer plate. *Maxilliped*: inner plate large, subrectangular, with 2 well-developed nodular spines, oblique setal row reduced, with about 6 plumose setae; outer plate medium size, subovate, apical setae and spines absent, medial spines reduced in size, bead-shaped, 4 vestigial submarginal setae present; palp well developed, article 2 very broad, dactylus well developed, unguis present.

Gnathopod 1: simple; coxa large, anterior margin concave, forming anteroventrally produced corner; ischium long, 2.3 times as long as broad; carpus long, 2.6 times as long as broad, 1.3 times as long as propodus; propodus long, subrectangular, 3 times as long as broad, tapering distally, posterior margin smooth, straight, without spines; dactylus with large subterminal tooth, a row of 27 medial spines and a row of 7 cuticular teeth along posterior margin. *Gnathopod 2*: minutely subchelate; coxa large, subequal in size to coxa 3; carpus

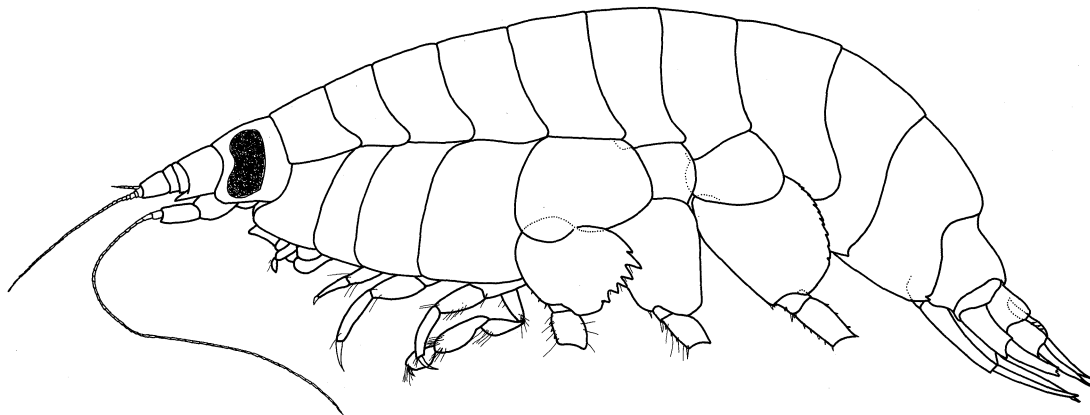


Fig.33. *Ichnopus wardi* n.sp., male, 12.0 mm, NMV J19733, North West Shelf, Western Australia.

long, 2.4 times as long as broad, posterior margin broadly lobate; propodus subrectangular, short, 1.6 times as long as broad; palm acute, with straight, minutely serrate margin.

Peraeopod 4: coxa with well-developed posteroventral lobe, anterior and posterior margins

subparallel; male and female merus/carpus with plumose setae. *Peraeopod 5*: coxa equilobate; basis expanded with posterior margin deeply serrate. *Peraeopod 7*: basis, posterior margin slightly rounded with rounded posteroventral corner and straight posteroventral margin; merus slender, not expanded posteriorly.

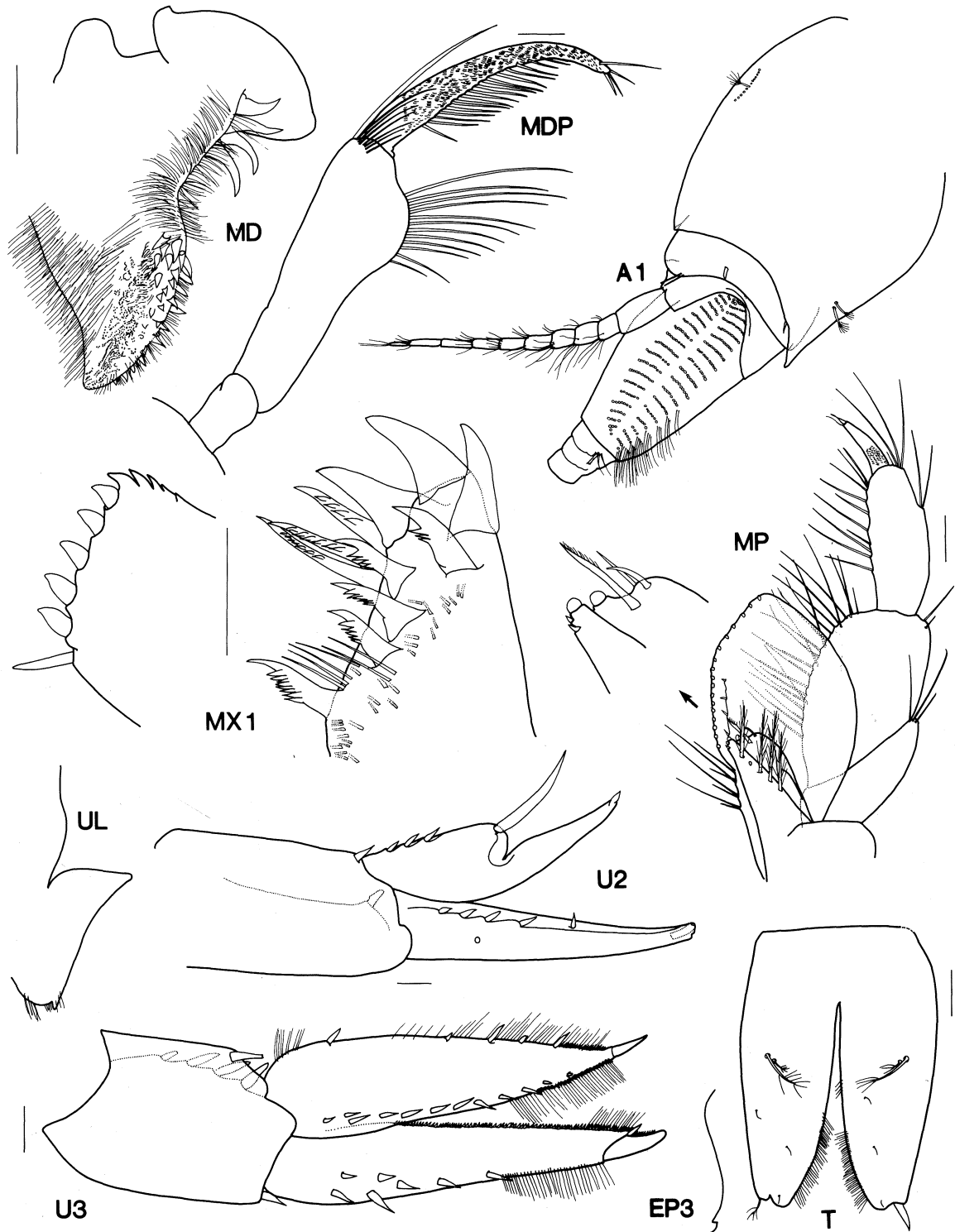


Fig.34. *Ichnopus wardi* n.sp., holotype female, 12.5 mm, AM P39588, North West Shelf, Western Australia. Scales represent 0.1 mm.

Epimeron 3: with small notch on posteroventral corner. *Uropod 1*: with long fine setae; rami subequal in length. *Uropod 2*: with few long fine setae; rami subequal in length, inner ramus with strong constriction. *Uropod 3*: peduncle short, 1.75 times as long as broad, without lateral flange; rami lanceolate, subequal in length; with long fine setae and minutely serrate margins, plumose setae absent in female and male; outer ramus 2-articulate. *Telson*: longer than broad, deeply cleft (74%), without dorsal spines, distal margins rounded, with 1 large spine on each margin.

Remarks. *Ichnopus wardi* is a peculiar member of the *I. spinicornis* species group. It differs from other members in having an acute upper lip (except *I. woodmasoni*) and a deeply serrate posterior margin (except *I. malpatun* and *I. woodmasoni*) on the basis of pereopod 5. *Ichnopus wardi* differs from *I. woodmasoni* in having a minutely subchelate palm on the female gnathopod 2. Because *I. wardi* and *I. woodmasoni* can only be distinguished by the adult female, our identification of material from Indonesia and the Philippines is tentative. This material consists only of males and juveniles and its identification is based on

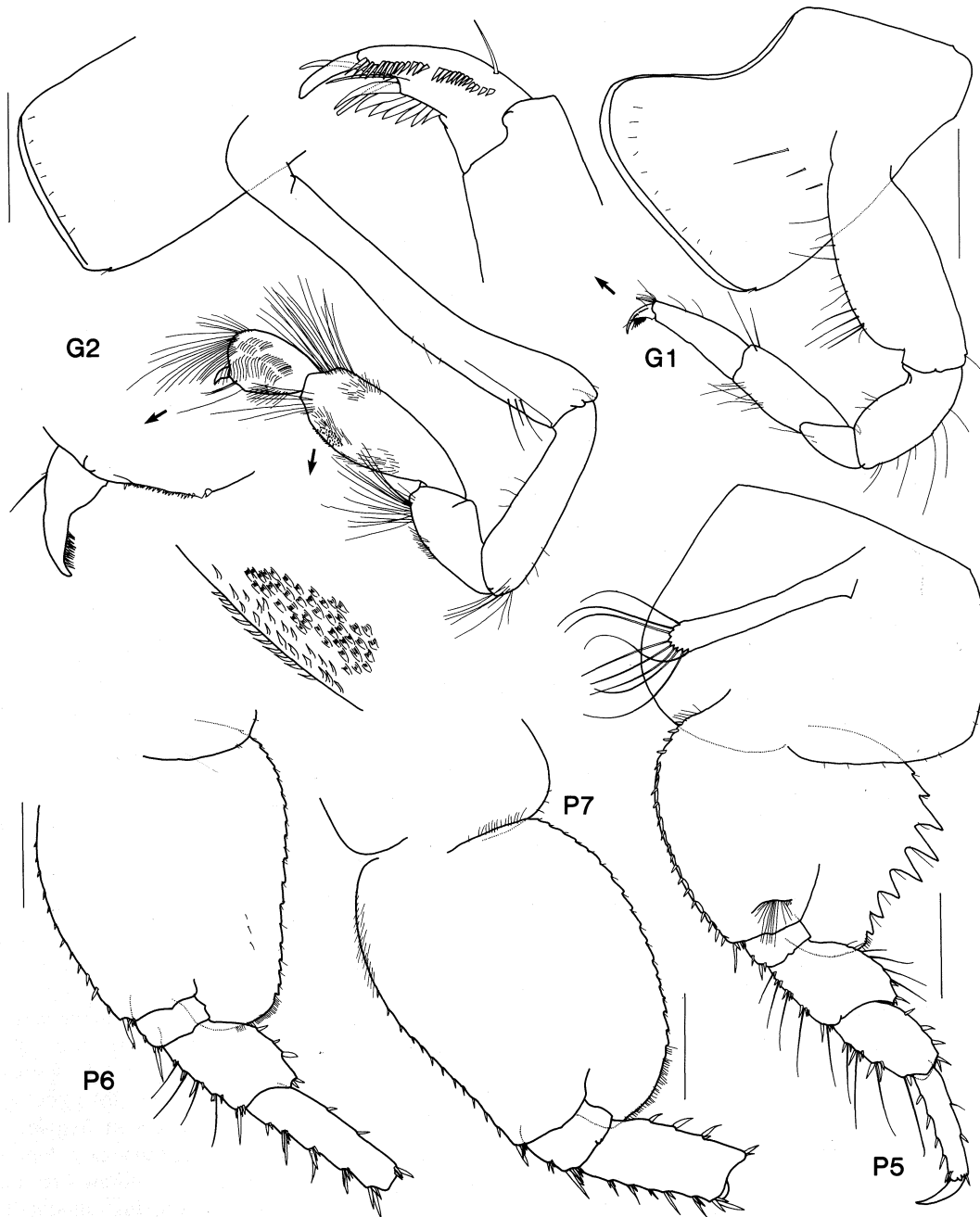


Fig.35. *Ichnopus wardi* n.sp., holotype female, 12.5 mm, AM P39588, North West Shelf, Western Australia. Scales represent 0.5 mm.

locality as much as morphology.

Etymology. This species is named after Dr Trevor Ward (CSIRO), who donated the North West Shelf amphipod collections to the Australian Museum.

Distribution. *Ichnopus wardi* is known from the North West Shelf, Western Australia; Bootless Inlet, Papua New Guinea and probably from Celebes, Waigeo Island and Kei Islands, Indonesia; and Jolo, Mindanao, Philippines; in 1 to 88 m depth.

***Ichnopus woodmasoni* (Giles) new combination**

Figs 36-37

Lysianassa wood-masoni Giles, 1890: 68, pl.2 fig.4.

Lysianassa woodmasoni.—Stebbing, 1906: 88.—Thurston & Allen, 1969: 361.

Glycerina woodmasoni.—Barnard & Karaman, 1991: 488.

Type material examined. HOLOTYPE, female, 8 mm, BMNH 1968:53, Macpherson's Strait, Andaman Islands, Andaman Sea [approximately 11°30'N 92°40'E] dredged, coral sand bottom, 34 m, HMIMSS *Investigator*.

This specimen had remained, since Giles studied it, as a whole animal microscope mount. From the slide we were able to make a whole animal illustration and describe nearly all of the external morphology, but we could not describe the mouthparts or determine the sex. With the kind permission of Joan Ellis (BMNH) we were able to remove the specimen from the slide by dissolving the mounting medium with xylene. The specimen was in perfect condition and we were able to dissect (5 new slides) and illustrate it in detail. This remains the only collected specimen known.

Diagnosis. Antenna 1: peduncular article 1 with long posterodistal tooth; callynophore with posterodistal setae. Antennae 1 and 2: calceoli present in female, presumed present in male. Upper lip acute. Mandible: left lacinia mobilis absent; accessory spine row, left and right each with 4 spines; molar setose, strongly spinose; palp article 2 strongly broadened distally. Maxilla 1 with ST7 multicuspidate medially; palp inner margin distally serrate. Maxilliped: inner plate with 2 nodular spines; palp article 2 very broad. Gnathopod 1: ischium and carpus long; dactylus with short cuticular spines. Gnathopod 2: palm grossly subchelate in female, not known for male. Peraeopod 5: basis with posterior margin deeply serrate. Epimeron 3: posteroventral corner with small notch. Uropod 2: inner ramus with strong constriction.

Description. Based on holotype, female, 8 mm; male not known. *Head and body:* colour semi-transparent. *Head:* deeper than long; lateral cephalic lobe large, narrowly rounded; rostrum absent; eyes reniform, colour deep purple. *Antenna 1:* medium length, 0.25 times body, peduncular article 1 short, length 1 times breadth, with

long posterodistal tooth; peduncular article 2 short, 0.2 times article 1; accessory flagellum short, 0.3 times primary flagellum, 6-articulate, article 1 long, 2.7 times article 2; flagellum 17-articulate; callynophore strong 2-field in female, with some small posterodistal setae; calceoli present in female. *Antenna 2:* 0.36 times body length; peduncular article 3 short, 0.7 times article 4, peduncle with weak brush setae in female; peduncular articles 4 and 5 not enlarged in female; flagellum 30-articulate; calceoli present in female.

Mouthpart bundle: subquadrate. *Epistome* and *upper lip:* separate, upper lip produced, acute; *Mandible:* incisors symmetrical, large, with slightly convex margins; left lacinia mobilis absent; accessory spine row, left and right with 4, short, slender, simple spines; molar a setose tongue, strongly spinose; mandibular palp attached midway; article 1 short, length 1.2 times breadth, without setae; article 2 elongate, strongly broadened distally, length 3.2 times breadth, 1.2 times article 3, with 5 setae on distal third of medial margin, and 4 setae near distal margin; article 3 slender, falcate, length 5.3 times breadth, with 6 proximal D-setae and 3 apical E-setae. *Maxilla 1:* inner plate narrow with 2 plumose apical setae; outer plate extremely narrow with 11 spine-teeth in 7/4 crown arrangement; ST1 to ST3 large, stout, without cusps, ST4 large, slender, 3-cuspidate, ST5 large, slender, 4-cuspidate, ST6 long, slender, multicuspidate, ST7 short, multicuspidate medially; STA large, displaced from STB-STD, 4-cuspidate, STB to STD short, slender, 4-cuspidate; palp large, 2-articulate, with 4 terminal spines; flag seta present on distolateral corner; distomedial margin serrate. *Maxilla 2:* inner and outer plates narrow; inner plate three quarters length of outer plate. *Maxilliped:* inner plate large, subrectangular, with 2 nodular spines, oblique setal row reduced with 2 plumose setae; outer plate medium size, subovate, without apical setae or spines, medial spines present, bead-shaped, submarginal setae vestigial; palp large, 4-articulate, article 2 very broad, length 1.8 times breadth, 1.5 times article 3; article 3 long, slender, length 2.1 times breadth, dactylus well developed, unguis present.

Gnathopod 1: simple, coxa large; anterior margin concave, anteroventral corner produced, posterior margin straight; basis long, slender, length 2.5 times breadth, with simple setae along anterior margin; ischium long, length 2.5 times breadth; carpus subrectangular, long, length 2.4 times breadth, 1.1 times as long as propodus; propodus large, subtriangular, length 2.75 times breadth, tapering distally, posterior margin smooth, straight, without spines, palm absent; dactylus complex, with large subterminal tooth, row of 18 medial spines and row of 5 short cuticular teeth along posterior margin. *Gnathopod 2:* grossly subchelate in female; coxa large, subequal in size to coxa 3; ischium long, length 3.8 times breadth; carpus long, length 2.8 times breadth, posterior margin broadly lobate; propodus subquadrate, short, length 1.4 times breadth, palm extremely acute, with concave, smooth margin, posterodistal corner without spines.

Peraeopod 3: coxa large; merus weakly expanded anteriorly; female merus-carpus with plumose setae. *Peraeopod 4*: coxa with large posteroventral lobe, anterior margin rounded, posterior margin sloping anteriorly; merus weakly expanded anteriorly; female merus-carpus with plumose setae. *Peraeopod 5*: coxa equilobate; basis expanded with posterior margin deeply serrate; merus expanded with rounded posterior margin. *Peraeopod 6*: coxa small; basis expanded posteriorly with minutely crenate posterior margin; merus expanded

with rounded posterior margin. *Peraeopod 7*: basis expanded posteriorly, posterior margin slightly rounded, minutely crenate, posteroventral corner rounded, posteroventral margin straight; merus not expanded posteriorly.

Epimeron 3: posteroventral corner with small notch. *Uropod 1*: with long fine setae; peduncle with 7 dorsolateral, 1 apicolateral, 4 dorsomedial and 1 apicomедial spines; rami subequal in length, outer ramus with 4 lateral spines, inner ramus with 2 medial and 3 lateral spines. *Uropod 2*: with long fine setae;

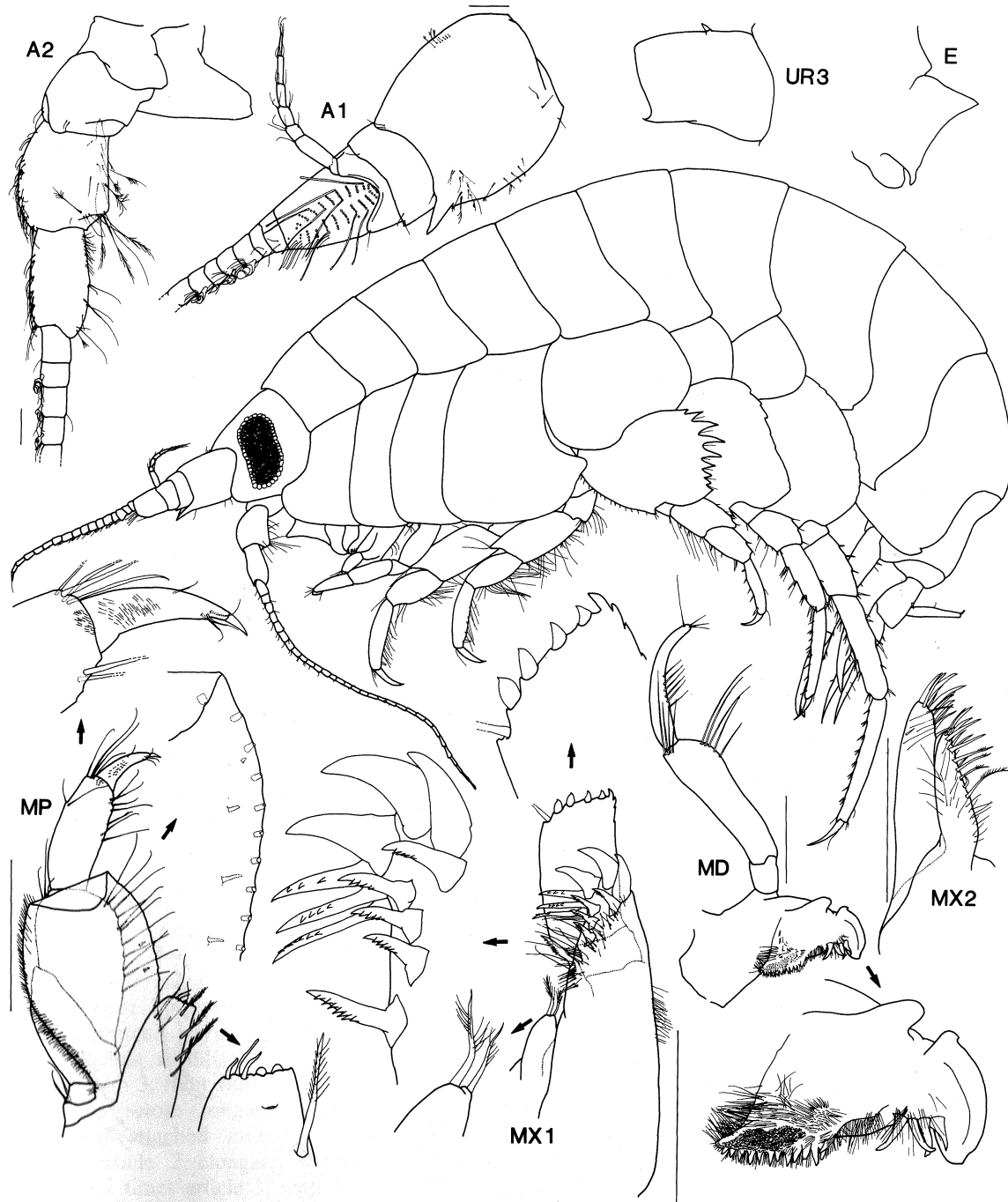


Fig.36. *Ichnopus woodmasoni* (Giles), holotype female, 8 mm, BMNH 1968:53, Macpherson's Strait, Andaman Islands, Andaman Sea. Scales represent 0.1 mm.

peduncle with 1 apicolateral and 1 apicomедial spines; rami subequal in length, outer ramus with 4 dorsal spines, inner ramus with 2 proximal dorsal spines and 1 large spine above strong constriction. *Uropod 3*: peduncle short, length 1.6 times breadth, with 2 apicolateral and 1 apicomедial spines; rami lanceolate, subequal in length, with long fine setae; outer ramus 2-articulate, article 2 short, with 3 lateral

spines, inner ramus with 4 medial and 3 lateral spines. *Telson*: 1.5 times as long as broad, deeply cleft (73%), without dorsal spines, distal margins rounded, with 1 marginal spine on each lobe.

Remarks. *Ichnopus woodmasoni* is most closely related to *I. wardi* and *I. malpatun*. It differs from both of these species in the reduced number of D-setae on

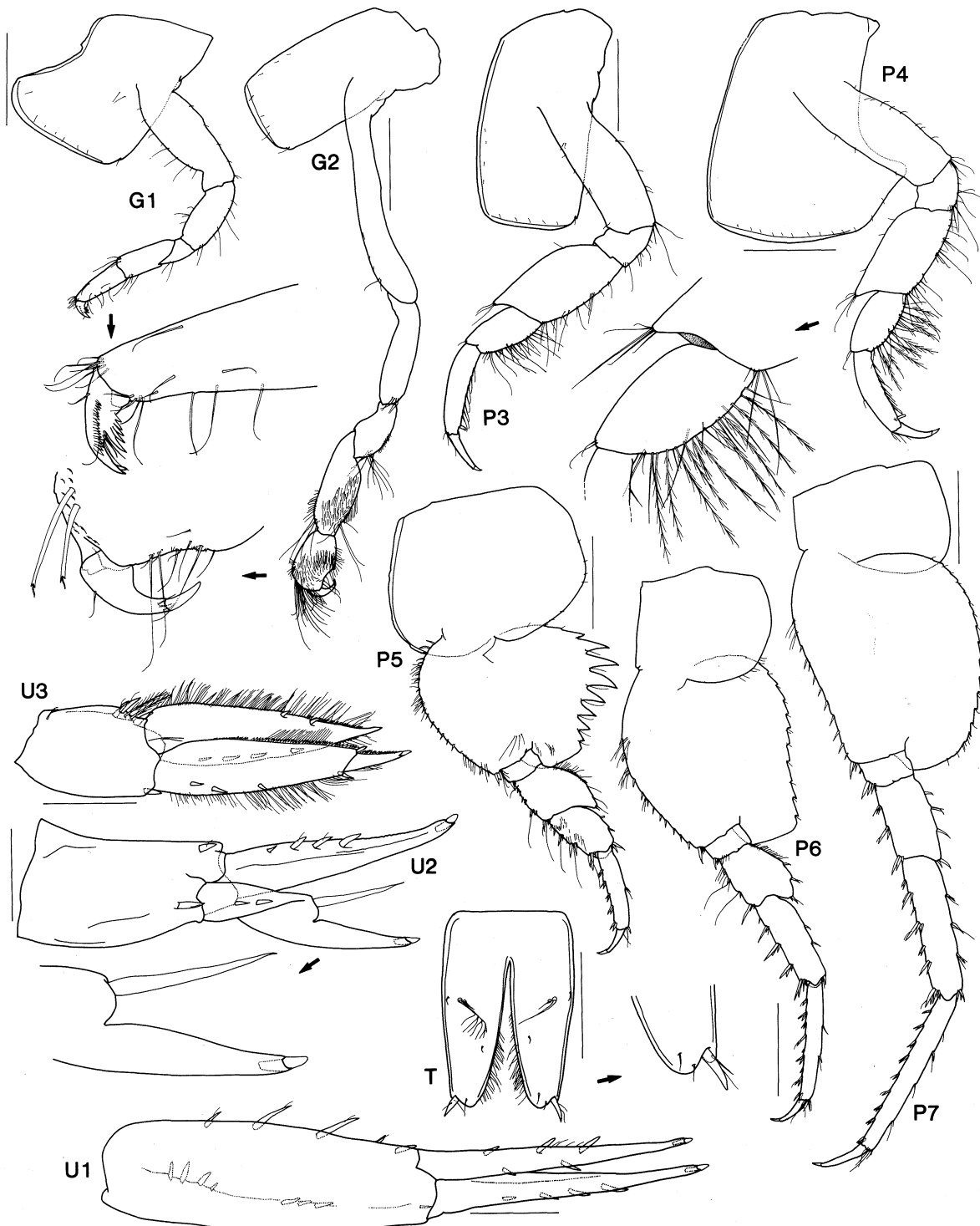


Fig.37. *Ichnopus woodmasoni* (Giles), holotype female, 8 mm, BMNH 1968:53, Macpherson's Strait, Andaman Islands, Andaman Sea. Scales represent 0.2 mm.

the mandibular palp and in the female gnathopod 2 which is grossly subchelate. It differs from *I. malpatun* in the acute upper lip.

Distribution. *Ichnopus woodmasoni* is known only from Macpherson's Strait, Andaman Islands, Andaman Sea in 34 m depth.

Ichnopus sp.

Fig. 38

Ichnopus taurus.—Walker, 1904: 238, pl.1 fig.3.

Material examined. One specimen, ?male, BMNH 1905.2.18:9 (carcass) and 1905.2.18:304 (1 slide), about 12 miles south of Galle, Sri Lanka (approximately 5°50'S 80°02.5'E), dredged with masses of calcareous branched and ramifying foraminiferal tubes (*Ramulina* sp.), about 200 m, W.A. Herdman and J. Hornell aboard S.S. *Lady Havelock*, 18 Feb. 1902, stn XLI.

Diagnosis. Antenna 1: peduncular article 1 without posterodistal tooth; callynophore with posterodistal setae. Antennae 1 and 2: calceoli present. Upper lip rounded. Mandible: left lacinia mobilis present; accessory spine row, left with 3, right with 4 spines; molar setose, weakly spinose; palp article 2 slender. Maxilla 1 with ST7 multicuspidate distally; palp inner margin distally serrate. Maxilliped: inner plate with 3 nodular spines, palp article 2 slender. Gnathopod 1: ischium and carpus very long; dactylus with long cuticular spines. Gnathopod 2: palm minute. Peraeopod 5: basis with posterior margin minutely crenate. Epimeron 3: posteroventral corner with small notch. Uropod 2: inner ramus not known.

Description. *Head:* deeper than long; lateral cephalic lobe large, broadly rounded; rostrum absent; eye shape not known. *Antenna 1:* medium length, peduncular article 1 short, length subequal to breadth, without posterodistal tooth; accessory flagellum short, 6-articulate, article 1 long, 2 times article 2; flagellum 39-articulate; callynophore strong 2-field, with 3 small posterodistal setae; calceoli present. *Antenna 2:* not known.

Mouthpart bundle: subquadrate. *Epistome* and *upper lip:* separate; upper lip produced, rounded; *Mandible:* incisors symmetrical, large, with slightly convex margins; left lacinia mobilis a small spine; accessory spine row, left with 3, right with 4 short, slender, simple spines; molar a setose tongue, moderately spinose; mandibular palp attached midway, article 1 short, without setae, article 2 elongate, slender, length 4.2 times breadth, 1.2 times article 3, with 3 setae on distal third of medial margin and 3 setae near distal margin, article 3 long, slender, falcate, length 5.5 times breadth, with 4 proximal D-setae and 4 apical

E-setae. *Maxilla 1:* inner plate narrow with 2 plumose apical setae; outer plate extremely narrow with 11 spine-teeth in 7/4 crown arrangement; ST1 to ST3 large, stout, weakly cuspidate, ST4 large, slender, 3-cuspidate, ST5 large, slender, 4-cuspidate; ST6 large, slender, multicuspidate; ST7 short, multicuspidate distally, STA large, slightly displaced from STB-STD, 1 or 2-cuspidate, STB to STD 2- to 3-cuspidate; palp large, 2-articulate, with 5-6 terminal spines; flag seta present on distolateral corner; distomedial margin serrate. *Maxilla 2:* not known. *Maxilliped:* inner plate subrectangular with 3 nodular spines, oblique setal row reduced with 2 plumose setae; outer plate subovate, without apical setae or spines, medial spines vestigial, submarginal setae vestigial; palp large, 4-articulate, article 2 broad, length 2.2 times breadth, 1.4 times article 3; article 3 long, slender, length 2.5 times breadth; dactylus well developed, with 2 subterminal setae, unguis present.

Gnathopod 1: simple; coxa large, anterior margin concave, anteroventral corner produced, posterior margin straight; basis long, slender, length 3.9 times breadth, without setae along anterior margin; ischium very long, length 4 times breadth; carpus subtriangular, long, length 3.75 times breadth, 1.25 times as long as propodus; propodus large, subrectangular, length 3.5 times breadth, margins subparallel, posterior margin smooth, straight; dactylus complex, with large subterminal tooth, row of 19 medial spines and row of 6 long cuticular teeth along posterior margin. *Gnathopod 2:* minutely subchelate; coxa large, subequal in size to coxa 3; ischium long, length 3.4 times breadth; carpus long, length 2.5 times breadth, posterior margin broadly lobate; propodus subquadrate, short, length 1.3 times breadth; palm acute, with concave, smooth margin, posterodistal corner without spines.

Peraeopods 3-4, 6-7: not known. *Peraeopod 5:* basis expanded with posterior margin minutely serrate; merus expanded with straight posterior margin; propodus with 5 spines and 1 distal pair of locking spines along anterior margin; dactylus long, slender.

Oostegites: not known. *Gills:* not known.

Epimeron 3: posteroventral corner strongly notched. *Uropods 1 to 3:* not known. *Telson:* longer than broad, deeply cleft, without dorsal spines, distal margins truncated, with 1 marginal spine on each lobe.

Remarks. This species was originally reported by Walker (1904) as *Ichnopus taurus*. Although the peraeopods and uropods no longer exist it is possible from the remaining parts to determine that it is an undescribed species closely related to *I. taurus*. The differences between the two taxa are discussed under *I. taurus*.

Distribution. This species is known from the benthic shelf off Sri Lanka in about 200 m depth.

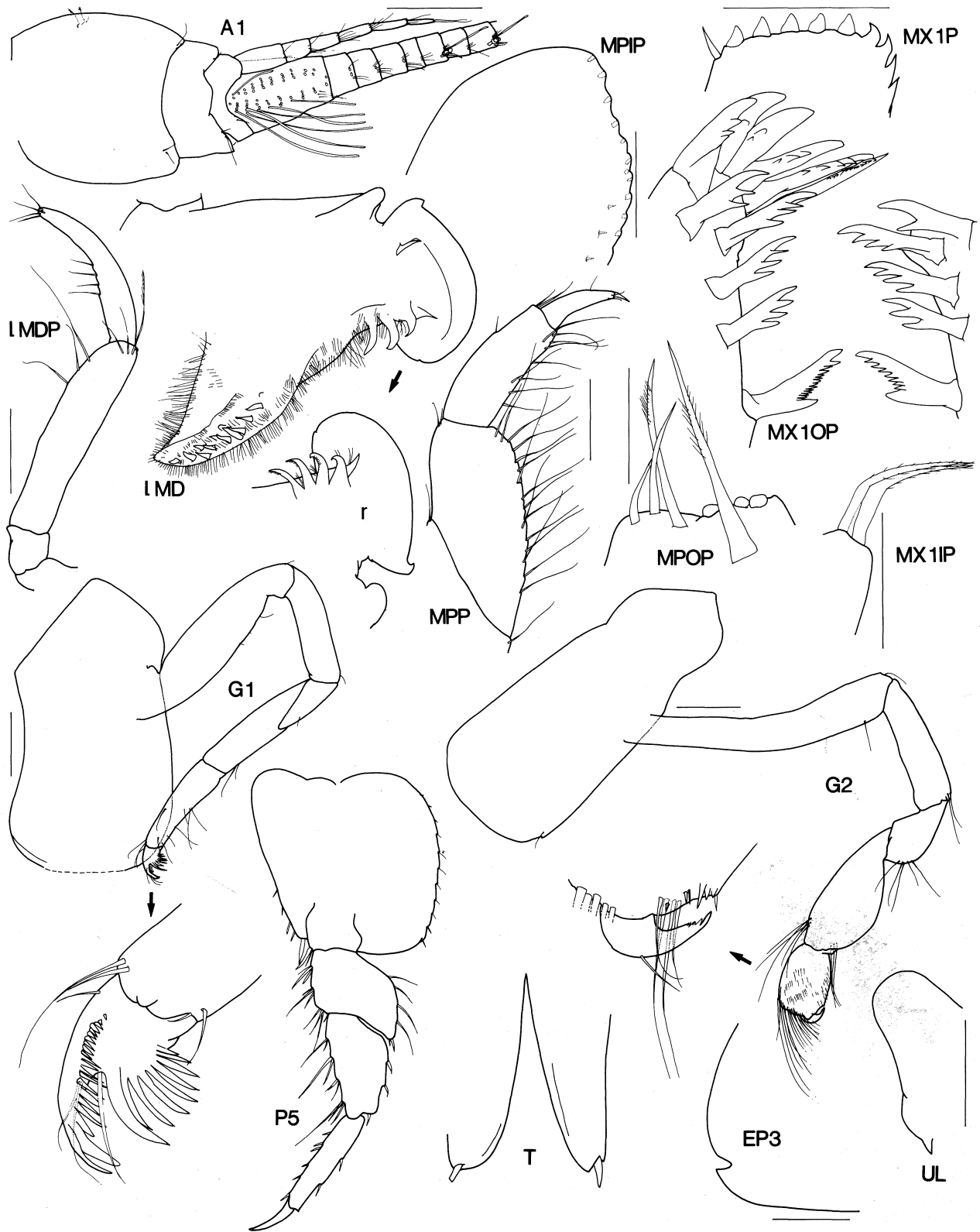


Fig.38. *Ichneopus* sp., ?male, BMNH 1905.2.18:9 and 1905.2.18:304, south of Galle, Sri Lanka. Scales for MX1IP, MPIP represent 0.05 mm; for E, G1-2, EP3 represent 0.2 mm; remainder represent 0.1 mm. P5 after Walker, 1904.

ACKNOWLEDGMENTS. We thank the following colleagues for the generous gifts and loans of material used in this study: Dr A. Fincham and Ms Joan Ellis, British Museum (Natural History), London; Professor L. Fishelson and Dr T. Echelman, Tel Aviv University; Professor J. Forest and Dr A. Crosnier, Musée National d'Histoire Naturelle, Paris; Dr H.-E. Gruner, Zoologisches Museum, Berlin; Dr S. Kaartvedt, Universitetet i Bergen; Ms E. Louw, South African Museum, Cape Town; Dr G.C.B. Poore, Museum of Victoria, Melbourne; Dr G. Pretzmann and Ms Verena Stagl, Naturhistorisches Museum, Vienna; Professor S. Ruffo, Museo Civico di Storia Naturale, Verona; Prof. J. Stock, Zoologisch Museum, Amsterdam; Dr M. Türkay, Forschungsinstitut Senckenberg, Frankfurt; Dr T. Ward, CSIRO, Division of Fisheries Research, Hobart; Dr E. Willassen Zoologisk Museum, Universitetet i Bergen and Dr T. Wolff, Zoologisk Museum, Copenhagen. We thank Joseph Poupin, Service Mixte de Contrôle Biologique, Tahiti, for arranging for one of us to participate in a cruise to the Austral Isles aboard the RV *Marara*, and for his tireless efforts in helping us to obtain, among other things, *I. annasona* and *I. pelagicus* from this very remote area. We thank Drs H.G. Andres, J. Cassis, A. Gill, M. Mickevich and M. Thurston, all of whom made comments which greatly improved the manuscript. We thank Dr M. Grygier who translated relevant parts of Birstein & Vinogradov (1960, 1964) for us. We thank Stephen Keable for assisting with the illustrations and Roger Springthorpe for making the plates. This work was supported in part by a grant from the Australian Research Council.

References

- Andres, H.G., 1981. Lysianassidae aus dem Abyssal des Roten Meeres. Bearbeitung der Köderfänge von FS "Sonne" - MESEDA I. (1977) (Crustacea: Amphipoda: Gammaridea). Senckenbergiana Biologica 61(5/6): 429-443.
- Barnard, J.L., 1964. Deep-sea Amphipoda (Crustacea) collected by the R/V "Vema" in the eastern Pacific Ocean and the Caribbean and Mediterranean seas. Bulletin of the American Museum of Natural History 127: 1-46.
- Barnard, J.L., 1969. The families and genera of marine gammaridean Amphipoda. United States National Museum Bulletin 271: 1-535.
- Barnard, J.L., 1974. Gammaridean Amphipoda of Australia, Part II. Smithsonian Contributions to Zoology 139: 1-148.
- Barnard, J.L. & G.S. Karaman, 1991. The families and genera of marine gammaridean Amphipoda (except marine gammaroids). Records of the Australian Museum, Supplement 13: 1-866.
- Barnard, K.H., 1916. Contributions to the crustacean fauna of South Africa. 5. -The Amphipoda. Annals of the South African Museum 15: 105-302, pls 26-28.
- Bellan-Santini, D. & M. Ledoyer, 1973. Inventaire des amphipodes gammariens récoltés dans la région de Marseille. Téthys 4(4): 899-934.
- Birstein, J.A. & M.E. Vinogradov, 1960. Pelagicheskie gammaridy tropicheskoi chasti Tixogo Okeana. Trudy Instituta Okeanologii. Akademiya Nauk SSSR 34: 165-241.
- Birstein, J.A. & M.E. Vinogradov, 1964. Pelagicheskie gammaridy severnoi chasti Indiiskogo Okeana. Trudy Instituta Okeanologii. Akademiya Nauk SSSR 65: 152-195.
- Boeck, A., 1861. Bemaerkninger angaaende de ved de norske kyster forekommende Amphipoder. Forhandlingar ved de Skandinaviske Naturforskeres, Ottende Møde: 631-677.
- Boeck, A., 1871. Crustacea Amphipoda borealia et arctica. Forhandlingar i Videnskabs-Selskabet i Christiana, Aar 1870: 83-280, i-viii [index].
- Cecchini, C. & P. Parenzan, 1935. Anfipodi del Golfo di Napoli. Pubblicazioni della Stazione Zoologica di Napoli 14: 153-250.
- Chevreaux, E., 1888. Sur quelques crustacés amphipodes provenant d'un dragage de l'*Hirondelle* au large de Lorient. Bulletin de la Société Zoologique de France 13: 39-42.
- Chevreaux, E., 1895. Les amphipodes des premières campagnes de la *Princess-Alice*. Mémoires de la Société Zoologique de France 8: 424-435.
- Chevreaux, E., 1898. Révision des amphipodes de la côte océanique de France. Comptes rendus de l'Association Française pour l'avancement des Sciences, 1898, Nantes, pp. 474-484.
- Chevreaux, E., 1900. Amphipodes provenant des campagnes de l'*Hirondelle* (1885-1888). Résultats des Campagnes Scientifiques Accomplies sur son Yacht par Albert Ier Prince Souverain de Monaco 16: i-iv, 1-195, pls I-XVIII.
- Chevreaux, E., 1903. Note préliminaire sur les amphipodes de la famille des Lysianassidae recueillis par la Princesse-Alice dans les eaux profondes de l'Atlantique et de la Méditerranée. Bulletin de la Société Zoologique de France 28: 81-97.
- Chevreaux, E., 1927. Crustacés Amphipodes. Expéditions Scientifiques du "Travailleur" et du "Talisman" pendant les années 1880, 1881, 1882, 1883. Malacostracés (suite) 9: 41-152, pls 1-14.
- Chevreaux, E., 1935. Amphipodes provenant des campagnes du Prince Albert Ier de Monaco. Résultats des Campagnes Scientifiques Accomplies sur son Yacht par Albert Ier Prince Souverain de Monaco 90: 1-214, pls 1-16.
- Chevreaux, E. & L. Fage, 1925. Amphipodes. Faune de France 9: 1-488.
- Costa, A., 1853. Relazione sulla memoria del Dottor Achille Costa, di ricerche su' crostacei anfipodi del regno di Napoli. Rendiconti dell'Accademia delle Scienze Pisiche e Matematiche de Naples 2: 167-178.
- Costa, A., 1857. Ricerche sui crostacei Anfipodi del regno di Napoli. Memorie della Reale Accademia de Scienze di Napoli 1: 165-235, pl. 1-IV.
- Costello, M.J., J.M.C. Holmes, D. McGrath & A.A. Myers, 1989. A review and catalogue of the Amphipoda (Crustacea) in Ireland. Irish Fisheries Investigations, Series B (Marine) 33: 1-70.
- Dahl, E., 1979. Deep-Sea carrion feeding amphipods: evolutionary patterns in niche adaptation. Oikos 33(2): 167-175.
- Dauvin, & Toulemont, 1988. Données préliminaires sur les amphipodes de l'Iroise et de ses abords, leurs affinités biogéographiques. Aspects Récents de la Biologie des Crustacés. Actes de Colloques, IFREMER 8: 217-221.
- Della Valle, A., 1893. Gammarini del Golfo di Napoli. Fauna und Flora des Golfes von Neapel 20: 1-948, pls 1-61.
- Diviacco, G. & S. Ruffo, 1989. Family Lysianassidae. Pp 469-576. In S. Ruffo (ed.) The amphipoda of the Mediterranean. Part 2. Gammaridea (Haustoriidae to Lysianassidae). Mémoires de l'Institut Océanographique, Monaco 13: 365-576.
- Drago, N., G. Albertelli & M. Cattaneo, 1978. Osservazioni faunistiche sul bentos dell'isola di Capraia. Annali del Museo Civico di Storia Naturale, Giacomo Doria 82: 72-77.
- Echelman, T. & L. Fishelson, 1990a. Surface zooplankton dynamics and community structure in the Gulf of Aqaba

- (Eilat), Red Sea. Marine Biology 107: 179-190.
- Echelman, T. & L. Fishelson, 1990b. Surface zooplankton dynamics in the northern Gulf of Aqaba (Elat), Red Sea. Pp. 67-77. In J. Godeaux (ed.). A Propos des Migrations Lessepsiennes. Bulletin de l'Institut océanographique, Monaco No. 7.
- Giles, G.M., 1890. Natural history notes from H.M. Indian Marine Survey Steamer 'Investigator', Commander Alfred Carpenter, R.N., D.S.O., commanding. No. 15. Descriptions of seven additional new Indian amphipods. Journal of the Asiatic Society of Bengal 59(2): 63-74, pl 2.
- Griffiths, C.L., 1974. The Amphipoda of southern Africa. Part 4. The Gammaridea and Caprellidea of the Cape Province east of Cape Agulhas. Annals of the South African Museum 65(9): 251-336.
- Griffiths, C.L., 1976. Guide to the Benthic Marine Amphipods of Southern Africa. Trustees, South African Museum, Cape Town, 106 pp.
- Gurjanova, E., 1951. Bokoplavy morej SSSR i sopredel'nykh vod (Amphipoda-Gammaridea). Akademiya Nauk SSSR, Opredeliteli po Faune SSSR 41: 1-1029.
- Gurjanova, E., 1962. Bokoplavy severnoi chasti Tixogo Okeana (Amphipoda-Gammaridea) chasti'1. Akademiya Nauk SSSR, Opredeliteli po Faune SSSR 74: 1-440.
- Haswell, W.A., 1879a. On Australian Amphipoda. Proceedings of the Linnean Society of New South Wales 4(3): 245-279, pls 7-12.
- Haswell, W.A., 1879b. On some additional new genera and species of amphipodous crustaceans. Proceedings of the Linnean Society of New South Wales 4(4): 319-350, pls 18-24.
- Haswell, W.A., 1882. Catalogue of the Australian Stalk- and Sessile-eyed Crustacea. Australian Museum, Sydney, 324 pp, pls 1-4.
- Heller, C., 1866. Beitrage zur Naheren Kenntniss der Amphipoden des Adriatischen Meeres. Denkschriften der Akademie der Wissenschaften, Wien 26(2): 1-62, pls 1-4.
- Kaartvedt, S., 1989. Nocturnal swimming of gammaridean amphipod and cumacean Crustacea in Masfjorden, Norway. Sarsia 74: 187-193.
- Krapp-Schickel, G., 1974. Camill Hellers Sammlung adriatischer Amphipoden - 1866 und heute. Annalen Naturhistorischen Museums in Wien 78: 319-379.
- Ledoyer, M., 1977. Contribution à l'étude de l'écologie de la faune vagile profonde de la Méditerranée nord occidentale I. Les gammariens (Crustacea, Amphipoda). Bollettino del Museo Civico di Storia Naturale, Verona 4: 321-421.
- Ledoyer, M., 1986. Crustacés Amphipodes Gammariens. Familles des Haustoriidae à Vitjazianidae. Faune de Madagascar 59(2): 599-1112.
- Lilljeborg, W., 1865a. On the *Lysianassa magellanica* H. Milne Edwards, and on the Crustacea of the suborder Amphipoda and subfamily Lysianassina found on [sic] the coast of Sweden and Norway. Transactions of the Scientific Society at Upsala 6(1): 1-38, pls 1-5.
- Lilljeborg, W., 1865b. Bidrag till kannedomen om underfamilien Lysianassina inom underordningen Amphipoda bland kraftdjuren. Uppsala Universitets Årsskrift 1865:1-25.
- Lincoln, R.J., 1979. British Marine Amphipoda: Gammaridea. British Museum (Natural History), London, i-v, 1-658.
- Macquart-Moulin, C., 1968. Les amphipodes benthoplanctoniques du Golfe de Marseille. Analyse des captures faites au cours de peches nocturnes régulières (année 1963-1964). Recueil des Travaux, Station Marine d'Endoume 59 (Bull. 43): 311-332.
- Macquart-Moulin, C., 1984. La phase pelagique nocturne et les comportements migratoires des amphipodes benthiques (Méditerranée nord-occidentale). Téthys 11(2): 171-196.
- Marion, A.F., 1883. Considérations sur les faunes profondes de la Méditerranée d'après les dragages opérés au large des côtes méridionales de France. Annales du Musée d'Histoire Naturelle de Marseille, Zoologie 1(2): 1-50.
- Marques, J.C. & D. Bellan-Santini, 1985. Contribution à l'étude systématique et écologique des amphipodes (Crustacea - Amphipoda) des côtes du Portugal. Premier inventaire des espèces (Gammariens et Caprelliens). Ciência Biologica, Ecologica, e Sistemática (Portugal) 5: 299-353.
- Mattson, S., 1981. The food of *Galeus melastomus*, *Gadiculus argenteus thori*, *Trisopterus esmarkii*, *Rhinonemus cimbricus*, and *Glyptocephalus cynoglossus* (Pisces) caught during the day with shrimp trawl in a west Norwegian fjord. Sarsia 66: 109-127.
- Nagata, K., 1965. Studies on marine gammaridean Amphipoda of the Seto Inland Sea. I. Publications of the Seto Marine Biological Laboratory 13(2): 131-170.
- Nayar, K. N., 1966. On the gammaridean Amphipoda of the Gulf of Mannar, with special reference to those of the pearl and chank beds. Proceedings of the Symposium on Crustacea held at Ernakulam from January 12 to 15, 1965. Marine Biological Association of India 1: 133-168.
- Nordgaard, O., 1911. Faunistiske og biologiske iakttagelser. Kongelige Norske Videnskabers Selskab Skrifter, Trondhjem, 1911(6): 20-24.
- Norman, A.M., 1895. A month on the Trondhjem Fiord, ctd. Annals and Magazine of Natural History, Series 6, 15: 476-494.
- Norman, A.M., 1900. British Amphipoda of the tribe Hyperiidæ and the families Orchestiidae and some Lysianassidae. Annals and Magazine of Natural History, Series 7, 5: 126-144.
- Oshel, P.E. & D.H. Steele, 1988. Comparative morphology of amphipod setae, and a proposed classification of setal types. Crustaceana, Supplement 13: 90-99.
- Palerud, R. & W. Vader, 1991. Marine Amphipoda Gammaridea in north-east Atlantic and Norwegian Arctic. Tromsø, Naturvitenskap 68: 1-97.
- Pirlot, J.M., 1936. Les amphipodes de l'expédition du Siboga. Deuxième partie: Les amphipodes gammarides, II. - Les amphipodes de la mer profonde. 3: Addendum et partie generale. III. - Les amphipodes littoraux. 1: Lysianassidae - Gammaridae. Siboga-Expeditie, Monograph 33e: 237-328.
- Poizat, C., 1969. Le débouché des calanques entre Marseille et la Ciotat: étude des peuplements et des sédiments. Recueil des Travaux, Station Marine d'Endoume 61(Bull. 45): 367-436.
- Répelin, R., 1978. Les Amphipodes pélagiques du Pacifique occidental et central. Travaux et Documents de l'O.R.S.T.O.M. 86: 1-381.
- Reys, J.P., 1960. Étude de la nourriture de quelques poissons démersaux du golfe du Lion. Recueil des Travaux de la Station Marine d'Endoume 33 (Bull. 20): 65-97.
- Ruffo, S., 1946. Studi sui Crostacei anfipodi. XI. Gli anfipodi bentonici di Rovigno d'Istria (nota prev.). Bollettino Società Entomologica Italiana 76(7-8): 49-56.
- Sainte-Marie, B., 1984. Morphological adaptations for carrion feeding in four species of littoral or circalittoral lysianassid amphipods. Canadian Journal of Zoology 62(9): 1668-1674.
- Sainte-Marie, B., 1986. Feeding and swimming of lysianassid amphipods in a shallow cold-water bay. Marine Biology 91: 219-229.
- Sars, G.O., 1890. An account of the Crustacea of Norway,

- with short descriptions and figures of all species. Vol. I. Amphipoda. Parts 1-3. Alb. Cammermeyer, Christiana 1890: 1-68, pls 1-24.
- Sars, G.O., 1895. An account of the Crustacea of Norway, with short descriptions and figures of all species. Vol. I. Amphipoda. Parts 31-32. Appendix. Alb. Cammermeyer, Christiana 1895: 673-711, pls 1-8.
- Schellenberg, A., 1926. Amphipoda 3: Die Gammariden der Deutschen Tiefsee-Expedition. Wissenschaftliche Ergebnisse der Deutschen Tiefsee-Expedition auf dem Dampfer "Valdivia" 1898-1899 23(5): 193-243, pl. 5.
- Schellenberg, A., 1929. Die abyssale und pelagische Gammariden. Bulletin of the Museum of Comparative Zoology at Harvard College 69(9): 191-201, pl. 1.
- Sexton, E.W., 1911. The Amphipoda collected by the "Huxley" from the north side of the Bay of Biscay in August, 1906. Journal of the Marine Biological Association of the United Kingdom 9(2): 199-227.
- Spandl, H., 1924. Die Amphipoden des Roten Meeres. Expeditionen S.M. Schiff "Pola" in das Rote Meer nordliche und sudliche Halfte 1895/96 - 1897/98. Zoologische Ergebnisse XXXV. Denkschriften der Akademie der Wissenschaften, Wien. Mathematisch - Naturwissenschaftlichen Klasse 99: 19-73, figs 1-23.
- Stebbing, T.R.R., 1888. Report on the Amphipoda collected by H.M.S. Challenger during the years 1873-1876. Report on the Scientific Results of the Voyage of H.M.S. Challenger during the years 1873-76, Zoology, 29: 1-1737, pls 1-210.
- Stebbing, T.R.R., 1906. Amphipoda. I. Gammaridea. Das Tierreich 21: 1-806.
- Stebbing, T.R.R., 1917. South African Crustacea. (Part IX of S.A. Crustacea, for the Marine Investigations in South Africa). Annals of the South African Museum 17: 23-46, pls 1-8.
- Steele, D.H., 1979. Zoogeography of the genus *Anonyx* (Crustacea, Amphipoda). Bulletin of the Biological Society of Washington 3: 47-53.
- Steele, D.H. & P. Brunel, 1968. Amphipoda of the Atlantic and Arctic coasts of North America: *Anonyx* (Lysianassidae). Journal of the Fisheries Research Board of Canada 25(5): 943-1060.
- Stephensen, K., 1915. Isopoda, Tanaidacea, Cumacea, Amphipoda (excl. Hyperiidea). Report of the Danish Oceanographic Expeditions 1908-10 to the Mediterranean and Adjacent Seas 2, Biology, D 1: 1-53.
- Stephensen, K., 1923. Crustacea Malacostraca, V: (Amphipoda, I). Danish Ingolf-Expedition 3(8): 1-100.
- Stephensen, K., 1929a. Amphipoda. Tierwelt N.-u. Ostsee 14(XF): 1-88.
- Stephensen, K., 1929b. Marine Crustacea Amphipoda. Zoology of the Faroes 23: 1-40.
- Stephensen, K., 1935. The Amphipoda of N. Norway and Spitsbergen with adjacent waters. Tromsø Museums Skrifter 3(1): 1-140.
- Stephensen, K., 1942. The Amphipoda of N. Norway and Spitsbergen with adjacent waters. Tromsø Museums Skrifter 3(4): 363-526.
- Tattersall, W.M., 1913. Clare Island survey. 42. Amphipoda. Proceedings of the Royal Irish Academy 31B: 1-24.
- Thurston, M.H. & E. Allen, 1969. Type material of the families Lysianassidae, Stegocephalidae, Ampeliscidae and Haustoriidae (Crustacea: Amphipoda) in the collections of the British Museum (Natural History). Bulletin of the British Museum (Natural History), (Zoology) 17: 347-388.
- Toulmond, A. & J.P. Truchot, 1964. Inventaire de la faune marine de Roscoff: Amphipodes - Cumacés. Travaux de la Station Biologique de Roscoff, New Series, 15(Supplement): 1-42.
- Tully, O. & P. Ó Céidigh, 1987. Investigations of the plankton of the west coast of Ireland - VIII. The neustonic phase and vertical migratory behaviour of benthic peracaridea in Galway Bay. Proceedings of the Royal Irish Academy 87B: 43-64.
- Vader, W., 1969. Notes on a collection of Amphipoda from the Trondheimsfjord area. Kongelige Norske Videnskabers Selskabs Skrifter 3: 1-20.
- Vader, W. & P.J. Johannessen, 1978. Notes on Norwegian marine Amphipoda. 6. *Menigratopsis svennilssoni* (Lysianassidae) an amphipod new to the Norwegian fauna. Sarsia 63: 335-336.
- Walker, A.O., 1904. Report on the Amphipoda collected by Professor Herdman, at Ceylon, in 1902. Ceylon Pearl Oyster Fisheries - 1904 - Supplementary Reports 17: 229-300, pls 1-8.
- Walker, A.O., 1909. Amphipoda Gammaridea from the Indian Ocean, British East Africa, and the Red Sea. Transactions of the Linnean Society of London, Series 2, Zoology 12(4): 323-344, pls 42-43.
- Walker, A.O., 1910. Crustacea collected by the late Mr. R.L. Ascroft and Mr. Harvey in the north of the Bay of Biscay. Annals and Magazine of Natural History, Series 8, 5: 158-161.
- Whitelegge, T., 1889. List of the marine and fresh-water invertebrate fauna of Port Jackson and the neighbourhood. Journal and Proceedings of the Royal Society of New South Wales 23: 163-323.