

The Taxonomy of Crangonyctoid Amphipoda (Crustacea) from Australian Fresh Waters : Foundation Studies

W.D. WILLIAMS¹ AND J.L. BARNARD²

¹Department of Zoology, University of Adelaide,
G.P.O. Box 498, Adelaide, SA 5001, Australia

²Smithsonian Institution,
NHB-163, Washington, D.C. 20560, USA

ABSTRACT. A review and inventory of all 26 previously described species of freshwater crangonyctoid amphipods in Australia is given and accompanied by the description of seven new species found mixed in type collections or otherwise associated. All extant types have been examined and redescribed. The Australian crangonyctoids belong in the families Paramelitidae and Neoniphargidae and a new family, Perthiidae. Four new genera are described to align the classification properly. The Australian crangonyctoids are now placed in the families Paramelitidae, with *Austrogammarus*, *Austrocrangonyx*, *Antipodeus* (n.gen.), *Hurleya*, *Uroctena*, *Giniphargus* and *Protocrangonyx*; the Neoniphargidae, with *Tasniphargus* (n.gen.), *Neoniphargus*, *Yulia* (n.gen.) and *Wesniphargus* (n.gen.); and Perthiidae, with *Perthia*. Keys are provided to (1) the world groups of crangonyctoids, (2) Australian crangonyctoids, (3) the genera of each family, and (4) individually for the species of each genus.

Contents

| | |
|--|----|
| Introduction | 3 |
| Methods of Dissection and Description | 3 |
| The Setting | 4 |
| Historical Resumé of Previous Studies | 5 |
| The Crangonyctoid Concept | 6 |
| Definition Key for Crangonyctoids and Counterparts | 11 |
| Crangonyctoids | 11 |
| Key to the World Groups of Crangonyctoids and Counterparts | 11 |
| Keys to the Genera of Australian Crangonyctoids (and <i>Paramelita</i>) | 12 |
| Paramelitidae Bousfield | 15 |
| <i>Austrogammarus</i> Barnard & Karaman | 16 |
| Keys to the Species of <i>Austrogammarus</i> | 18 |
| <i>Austrogammarus australis</i> (Sayce) | 19 |
| <i>Austrogammarus smithi</i> n.sp. | 25 |
| <i>Austrogammarus haasei</i> (Sayce) | 29 |
| <i>Austrogammarus saycei</i> n.sp. | 33 |
| <i>Austrogammarus spinatus</i> n.sp. | 36 |
| <i>Austrogammarus multispinatus</i> n.sp. | 40 |
| <i>Austrocrangonyx</i> Barnard & Karaman | 45 |
| Key to the Species of <i>Austrocrangonyx</i> | 46 |
| <i>Austrocrangonyx barringtonensis</i> (Chilton) | 46 |
| <i>Austrocrangonyx hynesi</i> n.sp. | 51 |

| | |
|--|-----|
| <i>Antipodeus</i> n.gen. | 53 |
| Keys to the Species of <i>Antipodeus</i> | 55 |
| <i>Antipodeus antipodeus</i> (G.W. Smith) | 56 |
| <i>Antipodeus wellingtoni</i> (G.W. Smith) | 62 |
| <i>Antipodeus niger</i> (G.W. Smith) | 66 |
| <i>Antipodeus ripensis</i> (G.W. Smith) | 71 |
| <i>Antipodeus mortoni</i> (Thomson) | 76 |
| <i>Antipodeus franklini</i> n.sp. | 79 |
| <i>Hurleya</i> Straškraba | 85 |
| <i>Hurleya kalamundae</i> Straškraba | 86 |
| <i>Uroctena</i> Nicholls | 90 |
| Keys to the Species of <i>Uroctena</i> | 91 |
| <i>Uroctena affinis</i> Nicholls | 92 |
| <i>Uroctena westralis</i> (Chilton) | 94 |
| <i>Uroctena setosa</i> Nicholls | 100 |
| <i>Uroctena yellandi</i> Nicholls | 103 |
| <i>Giniphargus</i> Karaman & Barnard | 105 |
| <i>Giniphargus pulchellus</i> (Sayce) | 106 |
| <i>Protocrangonyx</i> Nicholls | 109 |
| <i>Protocrangonyx fontinalis</i> Nicholls | 110 |
| Neoniphargidae Bousfield | 114 |
| Key to the genera of Neoniphargidae | 116 |
| <i>Tasniphargus</i> n.gen. | 116 |
| <i>Tasniphargus tyleri</i> n.sp. | 117 |
| <i>Neoniphargus</i> Stebbing | 123 |
| Keys to the species of <i>Neoniphargus</i> | 125 |
| <i>Neoniphargus thomsoni</i> Stebbing | 126 |
| <i>Neoniphargus spenceri</i> (Sayce) | 133 |
| <i>Neoniphargus fultoni</i> Sayce | 138 |
| <i>Neoniphargus obrieni</i> Nicholls | 142 |
| <i>Neoniphargus alpinus</i> G.W. Smith | 144 |
| <i>Neoniphargus exiguus</i> G.W. Smith | 149 |
| <i>Neoniphargus tasmanicus</i> G.W. Smith | 153 |
| <i>Wesniphargus</i> n.gen. | 160 |
| <i>Wesniphargus nichollsi</i> (Straškraba) | 161 |
| <i>Yulia</i> n.gen. | 163 |
| <i>Yulia yuli</i> (G.W. Smith) | 164 |
| Perthiidae n. fam. | 169 |
| <i>Perthia</i> Straškraba | 170 |
| Key to the Species of <i>Perthia</i> | 171 |
| <i>Perthia branchialis</i> (Nicholls) | 172 |
| <i>Perthia acutitelson</i> Straškraba | 175 |
| Acknowledgements | 178 |
| References | 179 |

Introduction

Australian fresh waters are inhabited by many species of Amphipoda, but knowledge of them is constrained at a variety of levels. A major constraint is the absence of a firm and comprehensive taxonomic inventory. It is our intention to provide this in a series of publications based upon our collections from Tasmania, Victoria, New South Wales, South Australia, Western Australia and Queensland.

An essential foundation in the preparation of this inventory is a comprehensive review of all previously described species. The present paper provides this review. In it, all 26 species of hitherto known forms of crangonyctoids (the most diverse amphipod group in Australian fresh waters) are described. Original descriptions appeared between 1893 and 1967, and although a few of them are reasonably complete, many are not, and all lack the complete set of morphological information required fully to address modern questions concerning phylogenetic systematics.

For the most part, the redescription is based on original type material (either whole specimens or microscope slide material); in this case it has been possible to provide reasonably complete redescriptions. For some species, however, no type material apparently survives, and our redescriptions of these are based largely upon original texts and drawings; they remain less complete than desirable. Further material of these latter species is required to complete our set of morphological data on them.

Some new species are also described in this paper, a fact which requires some brief explanation. In all such cases, the descriptions are confined either to material confused with previously known species in type collections, or to material whose identity obfuscated the identity of known species. The major volume of new descriptions will be addressed in subsequent publications.

The work reported in the present publication commenced many years ago when one of us (WDW) began to accumulate collections. A concatenation of reasons has delayed early publication, but not least involved was a hesitation to add to the confusion which has so bedevilled the higher classification of the Amphipoda in recent decades. Further delay, however, can no longer be justified, and, indeed, there are urgent practical reasons why we should more rapidly pursue our quest to describe the Australian freshwater amphipod fauna, viz. the failing environmental scene. Already we can document the case of one species which has apparently become extinct since it was first collected about 1900, viz. *Austrogammarus australis*. This species occurred in the lower part of the Dandenong River near Melbourne, but recent collections have failed to find it in a river which now serves principally as a stormwater drain in suburban Melbourne. This apparent extinction is particularly unfortunate because it involves the only hermaphroditic species we have so far encountered in our studies.

Finally, two other reasons give impetus to our studies. First, the amphipods are an extremely ancient crustacean group whose study can add much to other biogeographical investigations in the southern hemisphere. Several investigations of this sort are in progress. In this connection we note that the taxa discussed in the present paper have close phylogenetic relationships to various genera in South Africa and North America. Moreover, two of the North American genera involved also occur in the Palaearctic and there are potential Australian relationships to some east Asian cold-water genera and some hypogean Madagascan genera. Second, because of the abundance of amphipods in highland waters, that is, in source waters for many Australian reservoirs, we believe that they are an especially significant tool of use to biologists whose task is to monitor water supplies with regard to their management and conservation.

Methods of Dissection and Description

Whole material was examined in 70% alcohol and glycerol, and dissected parts later placed in a small microvial together with, but separate from, the undissected carcass. Dissected material, and all material available only as microscope slide preparations, was drawn with the aid of a camera lucida. To help comparisons, all dissections involved appendages of the left side of the body whenever possible.

The text descriptions are designed essentially to complement the figures and highlight important characters for each species, not as complete descriptions *per se*. Nevertheless, they conform to a set pattern which covers all important characters (except in polytypic genera where we do not include characters and attributes common to all species in the genus and given in the generic diagnosis or in the additional description of the genus).

Much of the available material did not allow us to provide complete descriptions of it. To aid recognition and thus subsequent amplification of descriptions, we include in the descriptions therefore statements about particular characters that require confirmation or correction. Such statements are enclosed in square brackets [], and are prefaced by a question mark (?). They generally involve a likely assumption about a given character, alternative character states (e.g. calceoli [?present or absent]), or hypotheses about a given character. In a formal sense, these statements are not part of our redescriptions; we believe, however, that by placing them where we do, we highlight in the most convenient way those features about which more knowledge is required for a given species.

In several cases, original describers have noted features which are no longer considered important for classification within a modern context. We often report features of this sort separately.

Each description deals first with holotype material, if available, or lectotypes. Syntype material is

considered, if available, only so far as it differs from our "lectotype"-designated material. In some cases, no type material was available. Our descriptions then are based entirely upon published material. Appendages from only one side of the body are described (mostly the left, see remarks above), but where differences between body sides occur (mandibles, maxilla 1 palp) appendages from both sides are described. Likewise, in sequentially similar appendages (gnathopods, pereopods, pleopods) only the first appendage is fully described, and sequential appendages are described only so far as they are different.

Our attitude in describing known species (and new ones associated with them) is essentially conservative; that is, until the extent of intraspecific variation is better known, we have considered that the most appropriate course of action for us to follow when several, consistent differences between described species or collections are discernible is to assume that such differences are of systematic value and separate taxa of at least species-rank level. We recognise, however, that even the use of so-called "stable" morphological characters in amphipod description may still cause problems (see, for example, Pinkster, 1983), and that several of our species groups (genera) require further examination (e.g. those apart from *U. setosa* in the genus *Uroctena*). Some material before us, on the other hand, was unequivocally different, so that our difficulties were twofold. Stebbing (1899: 25) described them well: "The species afford an illustration of two difficulties which not infrequently arise in systematic natural history. Some of them are so like their previously known neighbours that a short-sighted person might think them not worth distinguishing. Others stand oddly apart, with so queer a combination of characters that more than one family must look at them askance, unwilling to embrace, reluctant to repulse, in truth not very well able either "to do with them or without them". Finally, it will be useful if we provide definitions for some terms used by us.

Rastellae are thick, apically curved and pectinate setae. The term Mark, often cited as M. with an appended number, such as M.45, indicates the position of an object as a percentage (here, 45) of the distance from the base or proximal end of an appendage to the apex of the appendage. Variramous, magniramous and parviramous are terms used to describe the relative degree of development of uropod 3. Magniramous refers to the equal extension of both rami, parviramous to the reduction of the inner ramus to a small scale lacking plumose setae (but often bearing thick spines), and variramous refers to clearly intermediate conditions between parviramous and magniramous. Use of the letters A-E in connection with setal patterns on article 3 of the mandibular palp (see Fig. 1) conform to the pattern indicated in Barnard & Barnard (1983, fig. 5A). In descriptions, "s" refers to seta and "S" to spine. In keys and elsewhere, our use of the notation

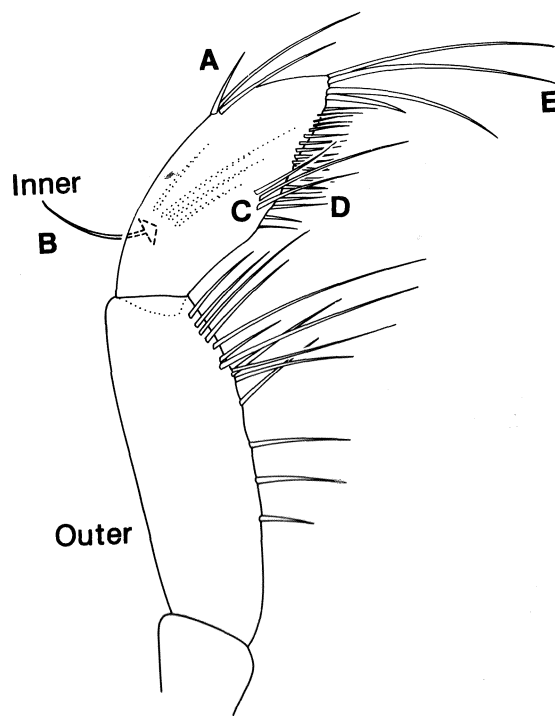


Fig. 1. Nomenclature of setal patterns on mandibular palp. The use of the letters A-E conforms with their use by Barnard & Barnard (1983; fig. 5A).

"2+" (for example) means "2 or more".

The use of terms "eusirid" and "melitid" with reference to types of gnathopod follow Barnard & Barnard (1983). Thus, eusirid gnathopods are those in which article 6 (propodus) is as broad as long and attached to the produced apex of article 5 (carpus). "Antennal sinus" or "head sinus" used herein refers only to the cephalic sinus receiving antenna 2.

A key to the abbreviations we use in Figures 1-104 is as follows: A - antenna; Abd - abdomen; acc. - accessory; art. - article; C - coxa; cox. - coxal; d - dorsal; dact. - dactylus; e - eye; E - epimeron; flag. - flagellum; g - gill; G - gnathopod; Hd - head; i - inner; l - left; lac - lacinia mobilis; lat. - lateral; LL - lower lip; MD - mandible; med. - medial; mol. - molar; MP - maxilliped; MX - maxilla; o - outer; O - oostegite; p. - palp; P - pereopod; PC - prebuccal complex; pl. - plate; post. - posterior; Pp - pleopod; r - right; r. - ramus; ret. - retinaculum; st. - sternal; T - telson; U - uropod; UL - upper lip; v - ventral; 1,2,3...7 - first, second, third...seventh.

The Setting

Australia has more genera (but will probably have fewer species) of freshwater amphipod per square kilometre of habitat than other continents. This discounts the taxal swarm of Lake Baikal and highlights the extremely small area of suitable

environment now available in Australia compared to Eurasia and North America. We believe that the situation in Australia reflects the great age of the faunule (possibly late Palaeocene), the fact that Australian amphipods, like most epigeal freshwater amphipods, are primarily adapted to permanent and non-tropical fresh waters, and that great changes in the nature of the Australian climate have taken place in geological time.

In so far as the climate is concerned, two important phenomena may be noted. First, most of Australia (if not all) formerly lay in much colder or temperate climatic zones, that is, when Australia formed part of Gondwanaland or had recently separated from that southern continent; the subsequent northward drift of Australia greatly restricted the areas suitable for amphipod survival to the south-west and the south-east. Northern and central areas became too hot or arid. Second, numerous climatic fluctuations on a shorter geological time scale have occurred of a sort which have resulted in multiple regressions and expansions of amphipod distributions into and from suitable refuges. These events, coupled with small orogenic movements and sea-level fluctuations leading to inundation or isolation of various parts of the continent, undoubtedly provided discrete areas of distribution of a sort which could have led to the development of genetic diversity. As a result, in our opinion, the specific diversity of Australian crangonyctoids has been much greater in earlier times than now, and the extant fauna is one much restricted by extinctions. Few elements (species) of species groups (genera) survive.

Despite age and isolation, however, Australian crangonyctoids are not markedly distinct from crangonyctoids elsewhere, and they do not provide the degree of taxonomic distinctiveness which characterises several other groups of crustaceans found in Australian fresh waters (e.g. the syncarid anaspids, parastacid crayfish, phreatoicid isopods), nor the restricted southern hemisphere distributions of so many temperate freshwater animals found in Australia. It is true that some Australian crangonyctoids do have a close relationships with *Paramelita* in South Africa, but, aside from that, few other Gondwana links are evident: the crangonyctoid group as a whole in Australia shows no unique distinction from similar groups on other continents.

Most of the generic diversity in Australian crangonyctoids concerns what taxonomists might view as "minor" group character correlatives. We do not see that fact, however, as demonstrating any degree of youthfulness in the faunule; rather we see it as Barnard & Barnard (1983) did, i.e. as indicating that many amphipodan groups are old but stable, and that events producing species groups (genera) occurred only occasionally over many millenia. From our examination of undescribed collections in hand we predict a somewhat higher specific diversity but a generic diversity perhaps double the present one (12).

The Australian faunule would thereby have some five times as many genera as any other major faunal region. Note, however, this apparent diversity is tempered when one considers the internal morphological diversity in North America of such diverse crangonyctoid genera as *Stygebromus*; much of the diversity in Australia involves species groups easily divisible into small genera because of sharp discontinuity of character alternatives, but in *Stygebromus* discontinuity between species groups is low or almost non-existent.

The trends in Australian crangonyctoid morphology are essentially the same as those which have occurred elsewhere. In Australia these trends often took place in species groups which have subsequently become geographically isolated, and stabilised as discontinuous genera. Trends include the loss of sternal gills, the loss of generically distinctive setal and spine patterns (such as loss of maxillary setae, reduction of maxillary spines, loss of dorsal body setation), reduction of the inner ramus on uropod 3, the partial fusion of telsonic lobes, the development of vermiform bodies, and, following colonisation of underground waters, the loss of sexual diversity, eyes and pigment. Unique apomorphies have also evolved, such as the development of eusirid-like gnathopods, or the development of sexually distinctive pediform antenna 2 (shared with *Paramelita* from South Africa). The enlargement of article 2 on the outer ramus of uropod 3, so common in other world taxa, is also found in *Uroctena*. This is an apomorphy clearly developed many times independent of ancestry.

Historical Resumé of Previous Studies

The first freshwater crangonyctoids reported from Australia were *Niphargus mortoni* [now *Antipodeus mortoni*] and *Niphargus montanus* [now *Neoniphargus thomsoni* (because of homonymy)]. They were described by Thomson (1893) from Tasmania together with his classic report of the occurrence of *Anaspides* (Syncarida). Both species were found in southern Tasmania, the first one in a small stream near the township of Franklin and on Mount Wellington (but see later detailed discussion of this taxon), and the second one on top of Mount Wellington. Both were originally placed in the European genus *Niphargus*. However, Stebbing (1899, 1906) recognised the generic distinction of one of the species, *Niphargus montanus*, and described a new genus, *Neoniphargus*, for its reception. The generic position of the other species, *N. mortoni*, has been more volatile. Smith (1909a) assigned it to *Gammarus*, Barnard & Barnard (1983) to *Austrocrangonyx*, and in the present work we assign it to a new genus, *Antipodeus*.

In a series of papers between 1899 and 1902, O.A. Sayce described the following crangonyctoids from Victoria (along with several non-crangonyctoids not mentioned herein): *Gammarus australis* (now in *Austrogammarus*), *Unimelita* (n.gen.) *spenceri*

(*Unimelita* is now a synonym of *Neoniphargus* but as shown below may later need revival), *Gammarus haasei* (*Austrogammarus*), *Neoniphargus fultoni*, and *Niphargus pulchellus* (*Giniphargus*). The descriptions were very comprehensive for their time and have been the basis upon which modern systematists between 1950 and 1983 have assessed the probable classificatory position of these Australian crangonyctoids.

In 1909, Geoffrey Watkin Smith published descriptions of new species and records of others collected during a sojourn in Tasmania between October 1907 and March 1908. A general account of his six months' stay is given in his book "A Naturalist in Tasmania" (Smith, 1909b). The species of crangonyctoids he described, with modern names, are as follows: *Neoniphargus yuli* (now in *Yulia*), *N. exiguus*, *N. tasmanicus*, *N. wellingtoni* (now *Antipodeus*), *N. alpinus*, *Gammarus ripensis* (now *Antipodeus*), and *G. antipodeus* (now *Antipodeus*).

Additionally, he gave further distributional records for Thomson's species *Niphargus montanus* (now *Neoniphargus thomsoni*) and *Niphargus mortoni* (now *Antipodeus*), and Sayce's species *Unimelita spenceri* (now *Neoniphargus spenceri*) and *Gammarus australis* (now *Austrogammarus*). Smith's descriptions were quite inadequate even by the standards which then prevailed, but fortunately his material survives in the Hope Museum, Oxford University, and provides the basis for our redescription of his species. It was re-examined by one of us (WDW) in 1974. A few years after the appearance of Smith's work, Chilton (1916) published a description of *Gammarus barringtonensis* from Barrington Tops, New South Wales, at an altitude of 1400 m. It was assigned to a new genus, *Austrocrangonyx*, by Barnard & Karaman (1983), and we confirm the validity of this by the description of a second species found in material collected near the type locality of *A. barringtonensis*. This is the most northerly (published) record of crangonyctoid amphipods in Australia.

Nicholls (1924) then comprehensively described *Neoniphargus branchialis* from a small creek near the King River, Western Australia. His paper was significant because it was the first record of a freshwater crangonyctoid from western Australia. His species has since been allocated to *Perthia*. Also from western Australia, Chilton (1925) described, though in somewhat less detail, another crangonyctoid, *Neoniphargus westralis* from Darlington. This paper, too, was significant in that it was the first record of a freshwater amphipod unusual in the pediformity of its male antenna 2 and its tendency towards body vermiformity. The paper preceded by one year the description of South African species, later allocated to *Paramelita*, sharing the same characteristics. Later, *N. westralis* was transferred to the genus *Uroctena*.

Nicholls produced a series of important papers in 1926 describing both western and eastern species (Nicholls, 1926a-d). In these, he recognised the generic differences of *N. westralis*, and proceeded to

establish *Uroctena* and describe three further species in the genus (later one of those was synonymised with another, but we have provisionally resurrected it). Nicholls also described the subvermiform and extremely specialised taxon, *Protocrangonyx fontinalis*, collected in a spring near Lesmurdie Falls, Western Australia (Nicholls, 1926a). This strange animal is an ecological analogue of the vermiform *Giniphargus pulchellus* from Victoria, but the two taxa have no immediate phylogenetic connection. From eastern Australia, Nicholls provided a description of *Neoniphargus obrieni* from Mount Buffalo, Victoria, where he had gone exploring in early 1926 (Nicholls, 1926b).

Finally, in this brief resumé, we note that Straškraba (1964, 1966) reviewed certain collections deposited in the Western Australian Museum. Apart from making comments on several previously described species, he (1) described *Neoniphargus nichollsi* from western Australia (which we here assign to the new genus *Wesniphargus*, thus preserving *Neoniphargus* for eastern Australia), (2) erected the new genus *Perthia* (to include Nicholls' *Neoniphargus branchialis* and a new species, *P. acutitelson*), and (3) established the new taxon *Hurleya kalamundae* for material from a well at Kalamunda, Western Australia.

The Crangonyctoid Concept

The nucleus of a crangonyctoid group was developed in the 1930's, especially by Schellenberg (1937a,b), who recognised 'crangonyctoid' group markers in many taxa. The situation up to 1976 has been well reviewed by Holsinger (1977), and we avoid repetition of most of his treatment.

Bousfield (1973) gave a formal name, Crangonyctidae, to a crangonyctoid assemblage of taxa in Holarctica, and later (1977) elevated it to superfamily level as the Crangonyctoidea. At the same time, he completed the revolution in the classification of the suborder Gammaridea by extending the superfamily concept throughout the group. This process was started by Bulycheva (1957) when she established the Talitroidea, and was continued by J.L. Barnard (1972, 1973) who amplified the Talitroidea and revived the Corophioidea concept.

Thus, the Crangonyctoidea, in 1977, included four family groups: the Crangonyctidae, the new families Neoniphargidae and Paramelitidae, and an unnamed family group based on *Phreatogammarus*. The Neoniphargidae included such extraneous genera as *Indoniphargus*, *Eoniphargus* and *Protocrangonyx*. Bousfield (1977) placed *Pseudocrangonyx*, *Procrangonyx*, *Sternophysinx* and *Paracrangonyx* into a superfamily, the Bogidielloidea, along with *Bogidiella* and its closer allies. The *Niphargus* group of genera was also elevated to superfamily level, the Niphargoidea, which then included as family groups: (1) the Niphargidae, (2) a family group composed of *Austrocrangonyx* and *Sandro* (the latter at that time

not having been described at generic level), and (3) a family group composed of the remotely convergent *Pseudoniphargus* and *Allocrangonyx*.

Unfortunately, none of Bousfield's diagnoses of superfamilies was fully discrete, and few of the families were comprehensively diagnosed. However, shortly before Bousfield's elevation of the Crangonyctidae to superfamily, Holsinger (1977) had narrowed our concept of the Crangonyctidae in a well-conceived review. Holsinger's tight diagnosis restricted the family to six Holarctic genera, which today (see Barnard & Barnard, 1983) have been reduced to three genera through synonymies: *Crangonyx*, *Stygobromus* and *Bactrurus*. However, synonymy of *Stygobromus*, *Synurella* and *Lyurella* is not recognised or accepted by all workers (see recent papers by Holsinger, 1986 a, b). Holsinger constrained the family to those taxa with bifid or notched palmar spines on the gnathopods. Although nearly all spines on most amphipods are notched in some way, usually with a thin lateral emergent trigger extending apically, in the three genera mentioned the trigger emerges from a notch and the spines are very thick. Other diagnostic characters of the Crangonyctidae proposed were the 2-articulate accessory flagellum and the short carpi of the gnathopods (which eliminated as a member *Metacrangonyx*). The absence of dorsal urosomal spines in the group precluded entry of *Pseudocrangonyx* (Japan) and all genera with two articles on the outer ramus of uropod 3 were likewise precluded (thus excluding most other freshwater amphipods).

Bousfield (1978, often quoted in literature as 1979) almost immediately rearranged the composition of the Crangonyctoidea and Bogidielloidea by removing the *Pseudocrangonyx-Sternophysix* group from Bogidielloidea and transferring it to the Crangonyctoidea; he also removed the *Phreatogammarus* group to the Gammaroidea despite the presence of sternal gills in some of their members. These "crangonyctoideans" were said to be most readily derivable from pontogeneoidean-like marine ancestors (a view we do not hold because the accessory flagellum and article 2 of the outer ramus on uropod 3 would then need to have been regained after loss).

Bousfield (1982a) subsequently described the superfamilies and various families of Gammaroidea at length in a framework characterised as "Synopsis and Classification of Living Organisms". In this work, the Crangonyctoidea contained the Crangonyctidae, Paramelitidae, Neoniphargidae, Niphargidae and the *Allocrangonyx* group from which *Pseudoniphargus* had been excluded. The extensive diagnoses or descriptions of the family group were again inconsistent, and at times erroneous; moreover, when opportunities existed for the extraction of crucial distinctions, these distinctions were qualified by such words as "usual" or "often". The allocrangonyctids were distinguished by the presence of two kinds of setae on the outer plate of maxilla 2, but there were no

firm and consistent distinctions among the Crangonyctidae, Paramelitidae and Neoniphargidae. By way of example, we note that the Neoniphargidae were said to have deep hind lobes on the carpi of the gnathopods, yet the alternative is not mentioned for the Paramelitidae, and for the Crangonyctidae the carpus is simply cited as "short and deep".

In a separate but contemporaneous publication, Bousfield (1982b) presented a geochronology of amphipods in ten superfamilies for which he mentioned part of their contents, namely, 28 families. Of these, it is known that the Crangonyctidae have Palaeocene fossils and the Gammaridae, Neocene fossils. We are already aware that none of these fossils provides any information on the origin or evolution of amphipods for they belong to extant groups and no organic distinctions are present. Nevertheless, Bousfield proceeded to draw up a table in which lines hypothesised the presumed minimum ages for these 28 families, of which only nine are modified by question marks [?]. He based this table on modern distributions of the groups, on tectonic geochronology of continents, and on his own presumptions concerning the plesiomorphy and apomorphy of amphipod characters (e.g. gnathopod amplexy, an other than 5-dentate left lacinia mobilis, cup-like ornate calceoli [or lost calceoli], heteropodous pereopods, and anterolobate coxae were all regarded as apomorphic characters). Many of his presumptions of this sort are open to debate.

In Bousfield's scheme, the Crangonyctoidea (and Crangonyctidae) have a minimum age in the Jurassic along with the Talitroidea, Eusiroidea and Ingolfiellidea. But, within the Talitroidea and Eusiroidea, no modern family is shown to range back as far as the Jurassic, so that Bousfield is apparently hypothesising the occurrence of some now extinct families in those two groups. More modern groups in his scheme are the Gammaridae, Salentinellidae and Corophiidae (as *Corophium*), Phreatogammaridae (Paleocene, and removed to the Melphidippoidea), Hadziidae and Melitidae (both Palaeocene), and *Bogidiella* and Artesiidae (both late Cretaceous).

The superfamily Crangonyctoidea, then, as formally though sketchily outlined most recently by Bousfield (1983), is regarded by him as conforming to original and subsequent diagnoses but with the following provisions: "Gnathopods weakly or not sexually dimorphic, weakly or not amplexing (male grasps female laterally by coxal plates of one side, not dorsally as in Gammaridae); antennal calceoli usually present, of linear type (basal cup weakly or not developed), in males only, on peduncle and/or flagellum of antenna 2, rarely on antenna 1; mandibular left lacinia 4- or 5-dentate; coxal gills plate-like, usually present on pereopod 7, or lacking; sternal gills usually present, of simple or lobate structure, usually paired variously on sternites 2-7, occasionally on pleon 1, or lacking; brood plates broad or medium broad, occasionally linear in some hypogean members".

Within this ill-defined superfamily, Bousfield (1983) included the Niphargidae, Crangonyctidae, Paramelitidae and Neoniphargidae. He had added *Pseudocrangonyx* and *Eocrangonyx* (meaning *Procrangonyx*) to the Crangonyctidae, *Sternophysinx* to the Paramelitidae, and *Giniphargus*, *Austroniphargus* and *Sandro* to the Neoniphargidae. None of these additions was discussed, and no new family diagnoses were advanced following the additions.

There is much in these rearrangements that we disagree with, besides their lack of justification. Thus, in our view, *Austroniphargus* is so different as to merit separate family status (the differences between it and other neoniphargids are greater than those between the Paramelitidae and Neoniphargidae). *Sternophysinx* and *Falklandella* seem not to fit into their present families so far as these are presently diagnosed. The east Asian genera *Procrangonyx* and *Pseudocrangonyx* have similarities which suggest that excision to a separate group is warranted (but see Barnard & Barnard, 1983). Moreover, Bousfield's inclusion of the Niphargidae (sensu Bousfield, 1978) in the superfamily — which therefore destroys the previously erected Niphargoidea — runs counter to the previously expressed views of one of us (JLB) (Barnard & Barnard, 1983) that the niphargids are better placed, at least temporarily, near some marine ancestral types such as the eriopisellids. If niphargids are indeed "derived" crangonyctoids (as would have to be assumed in Bousfield's rearrangement), they retain little evidence of their ancestry except for attributes widely convergent in other groups. They have lost the crucial crangonyctoid markers such as type 9 calceoli, a coxal gill on pereopod 7, and all sternal gills. Also, their oostegites are narrow. On the other hand, we acknowledge that niphargids do have many attributes convergent with some hypogean crangonyctoids, for example *Giniphargus*; such attributes include a subvermiform body type, short coxae, and an elongate outer ramus on uropod 3 that "usually" has article 2 very elongate (but note: this can be reduced or lost in specialised niphargids such as *Haploginglymus*). One ecological aspect favouring a crangonyctoid ancestry for the niphargids is their general intolerance of saline water (but see, for example, Sket, 1977). Even so, the inclusion of the niphargids in the Crangonyctoidea, without remarks concerning characters or comparisons with eriopisellids and various melitoids, does not persuade us of the inherent crangonyctoid morphological character of niphargids.

It is also apposite at this point briefly to consider Bousfield's views concerning the relative primitiveness and derived nature of the Crangonyctoidea. In his rearrangements of the superfamily (Bousfield, 1983), he considered the degree to which it was primitive or derived based on 12 characters regarded by him as important at the subordinal, superfamily or family level in the Amphipoda. His evaluation was that it was 54 percent apomorphic (100 percent is perfect). On this

basis, he found it more apomorphic than the Eusiroidea, Phoxocephaloidea, Lysianassoidea, Synopioidea, Stegocephaloidea, Pardaliscoidea, etc. However, in our view, Bousfield's calculations are in error for the crangonyctoids (if not for other superfamilies) in at least three characters, viz. those numbered 3 (the presence or absence of 'brush setae' and calceoli as antennal armaments), 8 (structure of uropod 1 and rami), and 10 (nature of the telson). We note for character 3 that the presence of calceoli is one of the few unifying characters of those Crangonyctoidea possessing them; for character 8 we note that both primitive and derived members of the Crangonyctoidea have serially spinose rami on uropods; and for character 10 we further note that both primitive and many derived crangonyctoids have deeply cleft and bilobate telsons in some cases and a notch and spiny apex in yet others. In short, we believe that the method employed by Bousfield to determine degrees of primitiveness and specialisation is defective. Perhaps such a method could be applied to the primitive members of each group, but it should be obvious that the final average will depend vagariously on the extent of elaborations and subsequent extinctions that have occurred in the group in question. So far as the Australian crangonyctoideans are concerned, fluctuations of the climate over long periods of time have undoubtedly caused many extinctions so that the modern fauna is not comprised predominantly of ancient forms. The extent of this will be confirmed when we complete our studies and show the dominance of the Neoniphargidae in the fauna.

Whatever the validity of Bousfield's views concerning the degree of primitiveness of the crangonyctoids, it is clear that the composition of the group has undergone radical changes during the past few years. Indeed, it has suffered more change than perhaps any other amphipod group since 1758. It began as a vaguely defined grouping, then became a small family to which many taxa were added or subtracted in piecemeal fashion. Elevation to superfamily status followed, but without adequate justification. None of these moves was accompanied by morphological investigations that led to any improvement in a definition of a crangonyctoid so that (apart from frequent possession of type-9 calceoli), even now in our view, assignment of material to it is more a matter of subjective assessment, and consideration of what the material is not, than a objective, unequivocal exercise based on crucial characters.

All of this is highly unsatisfactory, and a formal evaluation and comprehensive assessment of the status of the Crangonyctoidea is long overdue. Until this happens, however, the superfamily remains a formally described and legitimate taxon (according to ICZN standards) established by Bousfield in 1977. Since our purpose in the present work is essentially the commencement of an inventory of Australian freshwater amphipods, not a global assessment of the

validity of the higher taxonomic categories to which these amphipods may belong, we accept the concept of a crangonyctoid facies as a useful working hypothesis or 'enabling mechanism', that is, a pragmatic vehicle enabling the early completion of our review. At the present time, and until such time as our studies are more complete, this procedure seems to us to be the most prudent and to add least confusion to an already grossly confused situation.

What, then, is our concept of what constitutes a crangonyctoid amphipod, at least for the purpose in hand? A combination of at least the following characters applies: 1. Calceoli (when present) are of linear form (not cup-shaped). 2. The accessory flagellum of antenna 1 is 2+ articulate. 3. The outer ramus of uropod 3 is usually 2-articulate, but if not the uropod is variramous or parviramous. 4. Coxae 5-7 are smaller than coxa 4. 5. Basofacial spines on peduncle of uropod 1 are absent. 6. Inner lobes of the lower lip are indistinct. 7. The palp of maxilla 1 is 2-articulate. 8. Setae other than E-setae are present on the mandibular palp. 9. Gnathopod 1 is not dominant.

Several other criteria could be invoked (see keys in Barnard & Barnard, 1983) without, however, any significant diagnostic tightening. Likewise, nothing we have found in our studies of Australian crangonyctoids leads us to any improvement in defining a crangonyctoid.

Notwithstanding the sort of difficulties outlined above, thus far we can identify three groups of Australian amphipods which are probably crangonyctoids: Paramelitidae (freshly diagnosed), Perthiidae (n.fam.) and Neoniphargidae (of expanded diagnosis). In the Paramelitidae, we include *Paramelita* from South Africa (but continue to exclude *Paracrangonyx* from New Zealand as a probable derivative of crangonyctoids but distinctive from Australian crangonyctoids in the relative dominance of gnathopod 1), and the following Australian genera: *Austrogammarus*, *Austrocrangonyx*, *Antipodeus*, *Hurleya*, *Uroctena*, *Protocrangonyx* and *Giniphargus*. In the Perthiidae, we place the genus *Perthia*, endemic to Australia. In the Neoniphargidae, also endemic to Australia, we include *Neoniphargus* and three new genera, viz. *Yulia*, *Wesniphargus* and *Tasniphargus*. The geographical distribution of these genera on the basis of material described in this paper is indicated in Fig. 2.

To provide some further substance for our view of what constitutes a crangonyctoid, we note that non-Australian amphipods accepted by us at this point as crangonyctoids are the phreatogammarids (*Phreatogammarus*, New Zealand) (despite variability in gnathopod 1), Crangonyctidae (*Crangonyx*, *Stygobromus*, *Bactrurus*, Holarctic, mostly Nearctic), allocrangonyctids (*Allocrangonyx*, Nearctic), austroniphargids (*Austroniphargus* and *Sandro*, Madagascar), pseudocrangonyctids (*Pseudocrangonyx* and *Procrangonyx*, cool east Asia), and *Sternophysinx* (South Africa), but very debatably *Falklandella*

(Falkland Islands). The bogidielloids have a distinctive uropod 3 remote from most crangonyctoids; Barnard & Barnard (1983) have, in fact, already suggested that many bogidiellids are specialised crangonyctoids, and we observe that their uropod 3 could be a divergent derivation from a magniramous primitive crangonyctoid. Uropod 3 of bogidielloids (except *Paracrangonyx* and *Pseudingolfiella*, see both later) is magniramous and aequiramous, with article 2 on the outer ramus absent, and usually has marginal, non-apical spines attached in tandem singly and not in clusters. A few bogidielloids have spines attached in pairs but the rod-like appearance of the rami, distinctive from crangonyctoid rami, remains. In crangonyctoids, uropod 3 is either parviramous or bears article 2 on the outer ramus, and the outer ramus has spines attached in clusters of two or more. This kind of uropod is also found in *Phreatogammarus* and suggests that the New Zealand genus should be removed from the bogidielloids. A similar uropod 3 is found in the weckeliids, a so-called hadzioid or melitoid group from the Caribbean region.

Pseudingolfiella is a very derived taxon from Chile that appears to be neither bogidielloid nor crangonyctoid, though it could be a derived crangonyctoid if we widened our definition to include taxa with severely reduced pleopods. However, *Pseudingolfiella* has widely separated outer lobes on the lower lip with fused inner lobes and therefore falls perhaps closer to a melitoid ancestry. It is clearly not a bogidielloid because of the presence of article 2 on the outer ramus of uropod 3 (the inner ramus is lost) and the clustered spination. *Paracrangonyx*, from New Zealand is provisionally excluded from crangonyctoids by the loss of lobation on the posterior coxae and the reduction of the pleopods to uniramous condition. *Paracrangonyx* also differs from Australian crangonyctoids in the slender oostegites, lack of ABC-setae on the mandibular palp, and the combination of more or less dominant gnathopod 1 on which the carpus is short. *Paracrangonyx* is not a bogidielloid because uropod 3 is parviramous and bears a second article on the outer ramus.

Allocrangonyctids are included in Crangonyctoidea, despite a loss of some plesiomorphic crangonyctoid attributes, mainly because of their geographic contiguity to other crangonyctoids. Much the same reasoning applies to our inclusion of the austroniphargids (whose nearest crangonyctoid neighbours are *Paramelita* in South Africa). We reject *Indoniphargus* as a crangonyctoid because, *inter alia*, it has basofacial spines on the peduncle of uropod 1. *Metacrangonyx* and its allied genus *Pygocrangonyx* are also rejected; they comprise, perhaps, a sistergroup of the hadzioids. The niphargids are rejected by us as crangonyctoids until a stronger connection can be made between the groups.

Finally, it may also be useful in establishing the unity of those Australian freshwater amphipods we regard as conforming to the crangonyctoid facies if, by relief, as

it were, we outline the characteristics of non-crangonyctoid amphipods known from Australian fresh waters. As far as we can determine from the literature and examination of our own collections, such forms are characterised by a lack of sternal gills and the possession of one or more of the following attributes: 1. Accessory flagellum scale-like to absent. 2. Calceoli cup-shaped. 3. Uropod 1 with basofacial spines. 4. Lower lip with fleshy inner lobes. 5. Gnathopod 1 of

melitid form (see Barnard & Barnard, 1983) or both gnathopods of mittenform shape distinct from that of neoniphargids. 6. Mandibular palp unlike that shown herein for Australian crangonyctoids, generally through the loss of ABCD-setae. 7. Gnathopod 1 clearly dominant over gnathopod 2.

We hereby summarise these points in the following key designed to assist Australian workers to identify crangonyctoids.

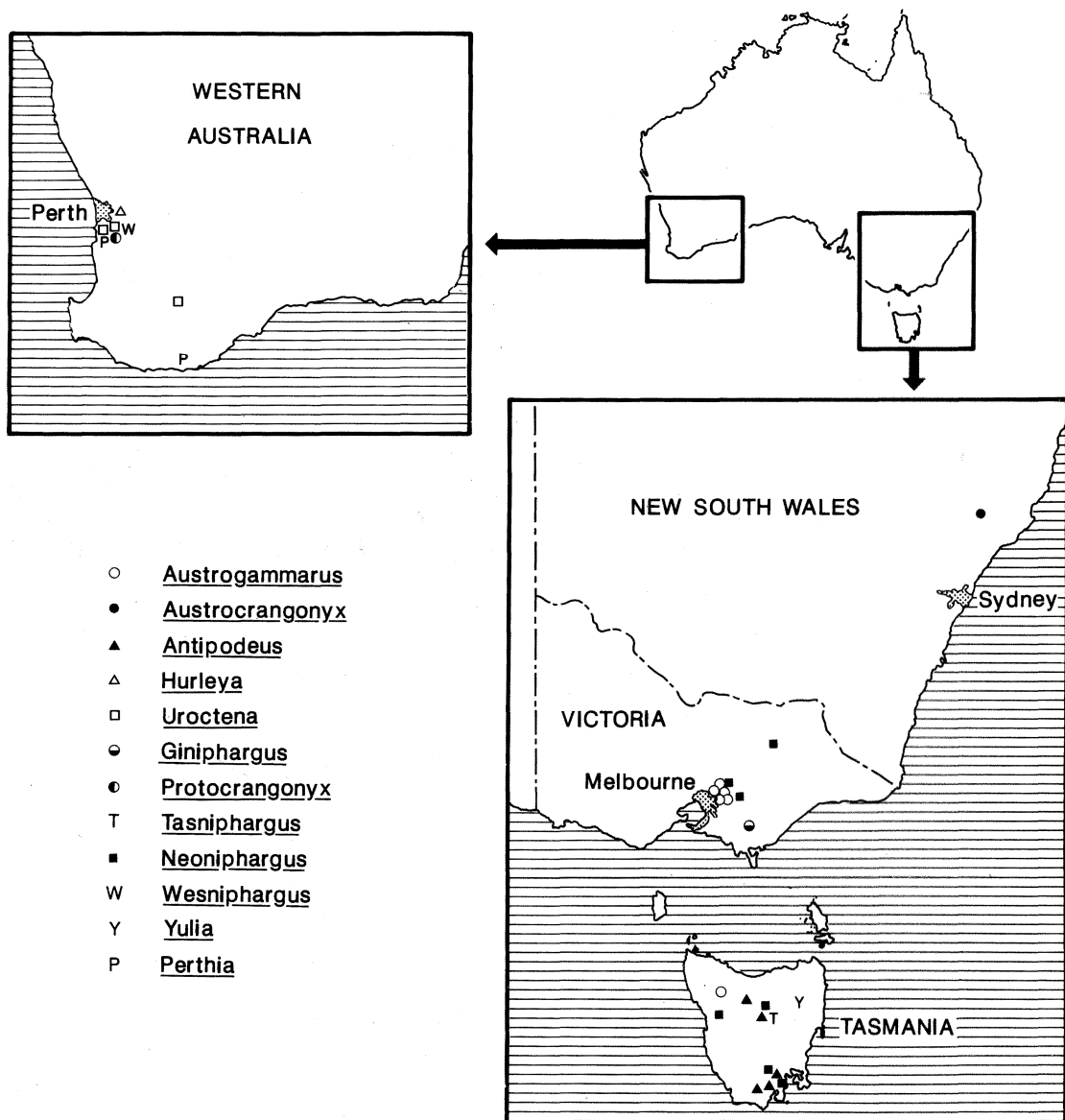


Fig.2. Distribution of genera on the basis of material named in the present paper. Note: symbols may relate to 1 or more occurrences where specific records are geographically close.

Definition Key for Crangonyctoids and Counterparts

1. Mandibular palp absent no
—Mandibular palp present 2
2. Accessory flagellum 0- to 1- articulate no
—Accessory flagellum 2+ articulate 3
3. Calceoli of type-9 form (Lincoln & Hurley, 1981) yes
—Calceoli absent or of form other than type-9 4
4. Calceoli not of linear form no
—Calceoli absent 5
5. Sternal gills present yes
—Sternal gills absent 6
6. Coxae 5–7 not lobate, and/or inner lobes of lower lip distinct 7
—Coxae 5–7 lobate, inner lobes of lower lip indistinct or absent 8
7. Coxae 1–7 subequal in size, uropod 1 lacking basofacial spines *Paracrangonyx*
—Coxae 1–6 incrementally enlarging, coxa 7 minute, uropod 1 bearing basofacial spines *artesiids*
8. Basofacial spines on uropod 1 present no
—Basofacial spines on uropod 1 absent 9
9. Rami of uropod 3 equal to each other, outer ramus lacking article 2 10
—Uropod 3 either parviramous or inner ramus absent, or outer ramus with 2+ articles 11
10. Spines on rami of uropod 3 not clustered, therefore lining lateral margins singly and in tandem *bogidielloids*
—Spines on rami of uropod 3 in clusters *phreatogammarids*
11. Urosomites fused together *austroniphargids*
—Urosomites separate 12
12. Apicolateral corner of outer plate on maxilla 2 with 2 kinds of setae *allocrangonyctids*
—Setae on outer plate of maxilla 1 uniform 13
13. Rami of pleopods absent or vestigial *Pseudingolfiella*
—Rami of pleopods 3+ articulate
..... all other crangonyctoids lacking sternal gills and calceoli

CRANGONYCTOIDS**Key to the World Groups of Crangonyctoids and Counterparts**

1. Palms of gnathopods with stout bifid or notched spines 2
—Palms of gnathopods with stout or thin spines bearing spines unequally split, with thin cilium matching thick part of spine in length 3
2. Coxal gill 2 bifid, outer plate of maxilla 2 with 2 kinds of setae *allocrangonyctids*
—Coxal gill 2 simple, outer plate of maxilla 2 with 1 kind of seta *Crangonyctidae*
3. Urosomites fully fused *austroniphargids*
—Urosomites separate 4

| | |
|---|--|
| 4. Inner ramus of uropod 3 absent | 5 |
| —Inner ramus of uropod 3 present | 7 |
| 5. Sternal gills absent, pleopods vestigial | <i>Pseudingolfiella</i> |
| —Sternal gills present, pleopods ordinary | 6 |
| 6. Gnathopod 1 dominant, large, palm very oblique, carpus short, lobed, accessory flagellum 2-articulate, mandibular molar obsolescent, outer rami of uropods 1–2 shortened, article 2 on outer ramus of uropod 3 short | pseudocrangonyctids |
| —Gnathopods 1–2 alike, small, palms almost transverse, carpi long, unlobed, accessory flagellum 4-articulate, mandibular molar fully tritulative, outer rami of uropods 1–2 as long as inner, article 2 on outer ramus of uropod 3 as long as article 1 | <i>Giniphargus</i> |
| 7. Oostegites slender, gnathopod 1 weakly dominant | 8 |
| —Oostegites expanded, gnathopod 1 not dominant | 10 |
| 8. Sternal gills present | <i>Sternophysinx</i> and <i>Falklandella</i> |
| —Sternal gills absent | 9 |
| 9. Uropod 3 parviramous, outer ramus with 2 articles | <i>Paracrangonyx</i> |
| —Uropod 3 magniramous, outer ramus with 1 article | bogidielloids |
| 10. Sternal gills sausage-shaped or absent | Paramelitidae |
| —Sternal gills dendritic or lumped | 11 |
| 11. Gnathopods large, without rugosities, posterior lobes of coxae 5–7 not dominant... .. | Perthiidae |
| —Gnathopods small, with rugosities, posterior lobes of coxae 5–7 dominant... .. | Neoniphargidae |

Key I to the Genera of Australian Crangonyctoids and *Paramelita*

| | |
|--|------------------------|
| 1. Sternal gills sausage-shaped or absent | (Paramelitidae) 2 |
| —Sternal gills dendritic or bearing lumps | 9 |
| 2. Sternal gills absent | <i>Antipodeus</i> |
| —Sternal gills present | 3 |
| 3. Telson entire | <i>Protocrangonyx</i> |
| —Telson cleft | 4 |
| 4. Inner ramus of uropod 3 moderately elongate (approximately equal to or greater than M.50 outer ramus, vari- or magniramous) | <i>Austrogammarus</i> |
| —Inner ramus of uropod 3 short (generally less than M.50 outer ramus, parviramous) or absent... .. | 5 |
| 5. Body vermiform, inner ramus of uropod 3 absent | <i>Giniphargus</i> |
| —Body not vermiform (but possibly subvermiform), inner ramus of uropod 3 present | 6 |
| 6. Article 2 of outer ramus of uropod 3 large | <i>Uroctena</i> |
| —Article 2 of outer ramus of uropod 3 absent or short | 7 |
| 7. Coxal gill 7 absent | <i>Hurleya</i> |
| —Coxal gill 7 present | 8 |
| 8. Gnathopod 2 in male with slender, non-lobate carpus, propodus subrectangular | <i>Austrocrangonyx</i> |
| —Gnathopod 2 in male with short, weakly lobate carpus, propodus ovate | <i>Paramelita</i> |

9. Rugosities absent from maxilliped palp and gnathopods, gnathopods eusirid in form (Perthiidae) *Perthia*
 —Rugosities present on maxilliped palp and gnathopods, gnathopods not eusirid in form (Neoniphargidae) 10
10. Sternal gills with bud-like lumps, only propodi lacking rugosities *Wesniphargus*
 —Sternal gills fully dendritic, propodi of gnathopods with rugosities 11
11. Antennae 1–2 with long dense setae, basal articles of primary flagella on antennae 1–2 elongate (conjoint) *Tasniphargus*
 —Antennae 1–2 with short sparse setae, basal articles of primary flagella on antenna 1–2 short 12
12. Pleopod peduncles not strongly setose, outer ramus of uropod 1 without long apical spur in male *Neoniphargus*
 —Pleopod peduncles strongly setose, outer ramus of uropod 1 with long apical spur in male *Yulia*

Key II to the Crangonyctoids of Australia

1. Sternal gills sausage-shaped or absent (Paramelitidae) 2
 —Sternal gills dendritic or lumped 8
2. Telson with dorsal setae (besides penicillates) 3
 —Telson lacking supernumerary setae, with tiny penicillates or 1 thick inflexible spine 5
3. Inner ramus of uropod 3 moderately elongate (M.38 or more of outer ramus), coxa 1 with posterior spines, inner plates of maxillae 1–2 fully setose medially...
 *Austrogammarus*
 —Inner ramus of uropod 3 short (generally less than M.25 of outer ramus), coxa 1 lacking posterior spines, inner plates of maxillae 1–2 setose medially halfway or less 4
4. Dactyls of pereopods 3–7 multispinose, male uropod 3 with spinose basolateral swelling, male antenna 2 stout *Uroctena*
 —Dactyls of pereopods 3–7 not multispinose, male uropod 3 lacking basolateral swelling, male antenna 2 slender *Austrocrangonyx*
5. Sternal gills absent *Antipodeus*
 —Sternal gills present 6
6. Dactyls of pereopods 3–7 multispinose *Hurleya*
 —Dactyls of pereopods 3–7 not multispinose 7
7. Telson cleft, inner ramus of uropod 3 absent, article 2 of outer ramus on uropod 3 huge, inner plates of maxillae 1–2 fully setose medially *Giniphargus*
 —Telson entire, inner ramus of uropod 3 present, article 2 of outer ramus on uropod 3 obsolescent or absent, inner plates of maxillae 1–2 not fully setose medially...
 *Protocrangonyx*
8. Gnathopods of eusirid form, lacking rugosities *Perthia*
 —Gnathopods not of eusirid form, with rugosities 9
9. Sternal gills with small lumps only *Wesniphargus*
 —Sternal gills fully dendritic 10
10. Outer ramus of uropod 1 with huge apical spine *Yulia*
 —Outer ramus of uropod 1 with normal apical spine(s) 11

11. Antennae 1–2 with long dense, setae, primary flagellum of antennae 1–2 basally conjoint *Tasniphargus*
 —Antennae 1–2 with ordinary setae, primary flagellum of antennae 1–2 multi-articulate *Neoniphargus*

Key III to the Crangonyctoids of Australia

1. Telson with dorsal setae besides penicillates couplets 3–4 of Key II
 —Telson lacking dorsal setae besides penicillates or thick spines 2
2. Sternal gills absent *Antipodeus*
 —Sternal gills present 3
3. Telson entire *Protocrangonyx*
 —Telson cleft 4
4. Inner ramus of uropod 3 absent, body fully vermiform *Giniphargus*
 —Inner ramus of uropod 3 present, body subvermiform or laterally compressed 5
5. Sternal gills simple or with only small lumps 6
 —Sternal gills fully dendritic 7
6. Sternal gills simple, gnathopod 2 enlarged, telson very short, length 0.6 width...
 *Hurleya*
 —Sternal gills with short lumps, gnathopod 2 not greatly larger than gnathopod 1, telson elongate, length 1.6 width *Wesniphargus*
7. Coxa 1 not tapering, gnathopods 1–2 eusirid, lacking rugosities *Perthia*
 —Coxa 1 tapering, gnathopods 1–2 not eusirid, bearing rugosities couplet 10 of Key II

Key IV to the Crangonyctoids of Australia

1. Length of inner ramus of third uropod M.38 or more length of outer ramus 2
 —Length of inner ramus of third uropod M.25 or less length of outer ramus (or absent) 3
2. Sternal gills sausage-shaped, telson with dorsal setae besides penicillates, dactyls of pereopods 3–7 not multispinose *Austrogammarus*
 —Sternal gills dendritic, telson lacking dorsal setae besides penicillates, dactyls of pereopods 3–7 multispinose *Perthia* (part)
3. Coxa 1 longer than broad 4
 —Coxa 1 shorter than broad couplet 7 of Key II
4. Coxa 1 not tapering apically 5
 —Coxa 1 tapering apically couplet 9 of Key II
5. Dactyls of pereopods 3–7 multispinose 6
 —Dactyls of pereopods 3–7 not multispinose 8
6. Gnathopods eusirid, sternal gills dendritic *Perthia* (part)
 —Gnathopods ordinary, sternal gills not dendritic 7
7. Telson lacking dorsal setae besides penicillates, antenna 2 slender, palm of gnathopod 1 oblique, outer ramus of male uropod 3 ordinary *Hurleya*
 —Telson with dorsal setae besides penicillates, antenna 2 especially stout in male, palm of gnathopod 1 almost transverse (only weakly oblique), outer ramus of male uropod 3 with spinose basolateral swelling *Uroctena*

8. Sternal gills absent *Antipodeus*
 —Sternal gills present 9
9. Sternal gills simple, telson with dorsal setae besides penicillates, gnathopods lacking rugosities, outer plate of maxilla 1 with 9 spines *Austrocrangonyx*
 —Sternal gills with small lumps, telson lacking dorsal setae besides penicillates, gnathopods with rugosities, outer plate of maxilla 1 with 7 spines *Wesniphargus*

Key V to the Crangonyctoids of Australia

1. Dactyls of pereopods 3–7 multispinose 2
 —Dactyls of pereopods 3–7 not multispinose 5
2. Sternal gills fully dendritic 3
 —Sternal gills simple or with small lumps 4
3. Gnathopods 1–2 eusirid, lacking rugosities, coxa 1 not tapering *Perthia*
 —Gnathopods 1–2 ordinary, with rugosities, coxa 1 tapering *Neoniphargus* (part)
4. Sternal gills with lumps, outer plate of maxilla 1 with 6 spines .. (theoretical) *Wesniphargus*
 —Sternal gills simple, outer plate of maxilla 1 with 7–11 spines couplet 4 of Key IV
5. Body vermiform, inner ramus of uropod 3 absent *Giniphargus*
 —Body not vermiform, inner ramus of uropod 3 present 6
6. Telson entire *Protocrangonyx*
 —Telson cleft 7
7. Sternal gills absent *Antipodeus*
 —Sternal gills present 8
8. Telson with dorsal setae besides penicillates, inner plates of maxillae 1–2 with 5+ medial setae, sternal gills simple 9
 —Telson lacking dorsal setules besides penicillates, dorsal spines rarely present, inner plates of maxillae 1–2 with only terminal setae or maxilla 2 with fewer than 2 medial setae, sternal gills dendritic couplet 9 of Key II
9. Coxa 1 with posterior spines, inner ramus of uropod 3 M.38 of length of outer ramus, inner plates of maxillae 1–2 fully setose medially *Austrogammarus*
 —Coxa 1 lacking posterior spines, inner ramus of uropod 3 M.25 or less length of outer ramus, inner plates of maxillae 1–2 setose halfway proximally or less 10
10. Sternal gills sausage-shaped, gnathopods not mittenform, without rugosities ...
 *Austrocrangonyx*
 —Sternal gills dendritic, gnathopods mittenform with rugosities *Neoniphargus*

Paramelitidae Bousfield

Type genus. *Paramelita* Schellenberg, 1926.

Introduction. The family was erected by Bousfield (1977), and then comprised five genera, “*Gammarus*” of Australia, *Uroctena*, *Hurleya*, *Paramelita* and *Falklandella*. The first three of these are Australian, *Paramelita* is South African and *Falklandella* occurs on the Falkland Islands. Subsequently, the original familial diagnosis was added to or emended by Bousfield (1982a).

Our view of what constitutes the important diagnostic characteristics of this family is given below. In this new diagnosis, we have excluded several characteristics formerly included by Bousfield but of little diagnostic value (e.g. antennae usually well developed), amended others in the light of new information (e.g. the sternal gills are best described as sausage shaped or absent), and added yet others now regarded as significant (e.g. rugosities absent on maxillipedal palp article 3 and gnathopods). Even with these numerous changes, however, we recognise the

basic validity of Bousfield's taxon, minus *Falklandella*.

At the same time, we also recognise the need for a more formal rediagnosis and a comparison of the family with others within the crangonyctoidean complex. However, given the major intent of the present paper and the known existence of several undescribed paramelitid taxa (and thus the likelihood of still further familial emendation), we do not consider it apposite to provide this formal diagnosis and comparison here. Our present diagnosis, then, should be regarded essentially as one which emends Bousfield's original and subsequent family diagnosis in order to expedite and accommodate our (re)description of Australian paramelitids.

Diagnosis. Antennal sinus of head well developed or weak. Molar of mandible well developed, tritulative. Outer plate of maxilla 2 with 1 kind of seta apicolaterally. Outer plate of maxilliped of ordinary size. Rugosities absent on maxillipedal palp article 3 and gnathopods. Gnathopods of medium size, first not dominant, carpi of medium length, weakly or not lobate, propodi attached to carpi normally [(syn)axially], spines on palms not of bifid crangonyctid form. Domination of posterior lobes on coxae 5–7 variable. Oostegites broad. Sternal gills sausage shaped or absent. Urosomites separate.

A few further descriptive characteristics, though not universally present nor of familial magnitude, may usefully be added to the above rediagnosis: at least primitive members with sternal gills; primitive members with mostly transverse setation on pleonites; calceoli when present of crangonyctoid form (type 9) (Lincoln & Hurley, 1981); lateral bases of outer rami on pleopods with bifid spines bearing diverse branches.

Composition. As amended above, the family now includes the following genera: *Paramelita* Schellenberg, 1926; *Protocrangonyx* Nicholls, 1926a; *Uroctena* Nicholls, 1926c; *Hurleya* Straškraba, 1966; *Giniphargus* Karaman & Barnard, 1979; *Austrogammarus* Barnard & Karaman, 1983; *Austrocrangonyx* Barnard & Karaman, 1983; *Antipodeus* new genus. We exclude from the family the following genera: *Paracrangonyx* Stebbing, 1899; *Falklandella* Schellenberg, 1931; *Stenophysinx* Holsinger & Straškraba, 1973. A simple key to all the genera included in the family has been given earlier (see Key to the Genera of Australian Crangonyctoids and *Paramelita*).

Austrogammarus Barnard & Karaman

Austrogammarus Barnard & Karaman, 1983: 60–61.

Type species. *Gammarus australis* Sayce, 1901 by original designation.

Introduction. The genus was erected by Barnard & Karaman (1983) to accommodate two Australian species described as species of *Gammarus* but which for long had been regarded as misplaced in that genus (see, e.g. Barnard, 1972; Williams, 1974). The species

in question were *Gammarus australis* described by Sayce in 1901, and *G. haasei* described by the same author in 1902. We concur with the validity of the genus and are now able greatly to expand its diagnosis. This expanded diagnosis follows and is substantially in agreement with the original, shorter one.

Diagnosis. Pleonites with mostly transverse dorsal setation. Rostrum weak to obsolescent, lateral cephalic lobes weakly projecting but strong antennal sinus present. Eyes small [or sometimes as pigmentless trace in alcohol].

Antenna 1 elongate, much longer than antenna 2, ratio of peduncular articles about 3:2:1, accessory flagellum 4–8+ articulate. Antenna 2 flagellum and peduncle of subequal length, male calceoli present or absent interspecifically.

Ratio of mandibular palp articles about 2:6:5, article 2 moderately setose, article 3 falcate, setae = ABDE. Labium lacking inner lobes. Maxillae 1–2 medially setose; inner plate of maxilla 1 triangular, fully setose medially (10+ plumose medial setae), outer plate with 11 spines, palps asymmetric, one side with thin apical spines, other side with thick apical spines often fused to article. Inner plate of maxilla 2 with oblique row of setae weakly submarginal and facial; inner plates of maxillae 1–2 densely covered with long straw-like pubescence. Maxillipedal palp articles 2–3 densely setose laterally, medially or ventrally, article 3 with several scythe-setae basal to dactyl but no organised comb row of spines present.

Coxae 1–4 moderately elongate, coxae 1–3 with row of posterior spines, coxa 1 weakly expanded below, not prominent, coxa 4 deeply emarginate posterodorsally, coxa 5 much shorter than 4. Gnathopods 1–2 small to medium in size, variable, either sexually dimorphic (usually) or not, carpi elongate or not, article 4 usually with medium scythe-spine and lacking hyaline lobe, propodus trapezoidal or rectangular, palms weakly oblique or almost transverse; spines at corner of palm 4 or more; spines along palm numerous (versus *Austrocrangonyx*).

Posterior spine sets on article 6 of pereopods 3–4 evenly spaced. Pereopods 5–7 moderately elongate, article 2 broadly expanded, trapezoidal and lobate on pereopod 5, more or less pyriform and not lobate on pereopods 6–7, dactyls of pereopods 3–7 with only marginal and facial setule (2 total).

Coxae 2–7 with sac-like gill, that on coxa 7 somewhat or significantly reduced. Thoracic segments with lateral sternal gills, none on medial line.

Basomedial setae on inner rami of pleopods 1–3 bifid, branches diverse, one branch with diamond head, other simple; retinacula usually 2, accessory retinacula 1–3.

Several pleonites with dorsal setae and/or spines. Epimera with few ventrofacial spines only, posterior margins weakly setulate. Rami of uropods 1–2 extending subequally, each with 2 rows of spines, uropod 1 lacking basofacial armaments. Uropod 3 extended, variramous, peduncle short, outer ramus 2-

articulate, article 2 short, inner ramus generally reaching to M.67 on article 1 of outer ramus in male but only to M.50 or less in either females or juveniles. Telson short or weakly elongate, fully or deeply (83+ percent) cleft, lobes tumid laterally, with apical and dorsal setation, no basolateral armaments.

Additional description. Flagellum of antenna 1 lacking major armaments. Apical margin of upper lip evenly rounded. Accessory blades (rakers) on mandibles with interraker plumose seta; additional penicillate setae beyond rakers and riding onto base of molar; molar with plumose apical seta; palp article 3 shorter than 2, article 2 with sparse basoanterior setae, then many apicoanterior setae. Both plates of maxilla 2 with rows of long distal setae. Maxilliped palp article 3 with ranks of thin setae on inner edge, apex weakly produced, pubescent; outer plate with row of setose spines distally continuous with row of teeth medially; inner plate with 3 thick spines and plumose setae apically and long medial row of plumose setae. Dactyls of gnathopods reaching ends of palms, with small recumbent inner tooth-spine (mostly fused to dactyl) and several setules at inner nail articulation line. Pereopod 7 shorter than pereopod 6; article 2 of pereopods 5–7 variously setose posteriorly. Sternal processes (Figs 6,15): 6 pairs of fleshy, sausage-shaped, comma-like sternal gills present on thoracic segments 2–7, attached to anterior margins of segments but appearing to be attached to segment anterior to locus. Posteroventral tooth of epimera 1–3 blunter than in *Austrocrangonyx*. Pleopods similar, rami equal. Apicolateral corner of peduncle on uropod 1 with 2+ spines. Usually outer ramus of uropods 1–2 slightly shorter than inner ramus, both rami with 5 apical spines. Uropod 3 extending beyond uropods 1–2 in entire animal; all peduncular spines apical; some medial setae of each ramus on uropod 3 plumose, other setae not plumose. Ventrodistal spine on urosomite 1 at base of uropod 1 short (versus long in *Austrocrangonyx*).

Characters of interspecific value. Calceoli present or absent on flagellum of male antenna 2; setosity of antenna 2 weak to strong; medial oblique row of facial setae on inner plate of maxilla 2 deeply submarginal or close to margin; coxae 1–4 with or without ventral setae in varying degrees interspecifically; spine counts at palmar corners of gnathopods varying between 4 and 11; pereopods 3–4 with varying spine counts on articles 5–6, thus article 5 with few to many spines in specific pattern, article 6 with posterior armament sets composed of setae and attendant spines in groups of 1,2,3 per set, occasionally set 2 adjacent to locking spine set (called set 1) composed only of setae; length and number of setae and density and thickness of posteroventral spines on article 2 of pereopods 5–7 variable, setae on articles 4–6 varying from long and numerous to short and sparse or almost totally evanescent; dorsal armament on pleon of specific

value, setae especially of pleonites 3–5 long and drooping or shorter and stiffer, spines mixed with setae in varying patterns, generally 1 spine on each side of pleonites 5–6 or 6 alone, or pair of spines on each side on pleonites 4–6 with additional mid-dorsal spine(s) on each side on pleonite 5, more complex spine system showing relatively fixed pattern of placements; anteroventral margin of epimeron 1 setose or not; uropods 1–2 often with setae on peduncles and inner rami; apicolateral corner of peduncle on uropod 2 with 1–3 spines; length of inner ramus on uropod 3 relatively fixed in males and females of each species and armaments very specific, thus inner ramus with or without subapical armament or with either medial setae or spines in tandem or clusters, medial margin with or without spine clusters, setal clusters or marginal setae in tandem, apex with setae or spines or both, latter occasionally hooked; proximal article of outer ramus usually with lateral transverse spine clusters with or without several attendant setae, medial margin with similar clusters or with setal clusters only; article 2 small to medium in length, with short or medium apical setae or attendant spinule(s); telson short or slightly elongate, cleft 83–100 percent, with sparse to dense dorsal setation, sparse to dense apicomarginal setation, with or without dorsal spine on each lobe.

Sexual attributes. Females never with calceoli; oostegites generally paddle shaped, with oostegite on coxa 5 smallest, in young or nonbreeding females lacking setae or with rudiments of setal bases marginally, in terminal females oostegites of coxae 2–4 huge, projecting below coxae, oostegite of coxa 5 generally small; maximum egg count 50; hatchlings carried by female after emergence from egg capsules; if male gnathopods enlarged and with shortened carpi, female gnathopods generally much smaller and shorter, thinner and with elongate articles 5–6; uropod 3 of female generally slightly to greatly shorter than in male, lacking any special male attributes such as apically hooked spines and elongate setae at various loci.

Methods of description. The lateral spines on article 5 of pereopods 3–4 include the group members distally, posteriorly or medially.

Relationships. *Austrogammarus* is regarded as the basic (most primitive) genus of Australian paramelitids, and its relationships with other genera in the family are best discussed in subsequent generic discussions.

Composition. This genus now includes six species: *A. australis* (Sayce), *A. smithi* n.sp., *A. haasei* (Sayce), *A. saycei* n.sp., *A. spinatus* n.sp. and *A. multispinatus* n.sp. They are described below in that order. Keys to them, based upon the most prominent specific differences, are as follows.

Key I to the Species of *Austrogammarus*

1. Coxa 4 heavily setose ventrally, uropod 3 (male hermaphrodite) with only setal clusters medially on outer ramus, articles 4–6 of pereopods 5–7 with many long setae *A. australis*
- Coxa 4 poorly setose ventrally, uropod 3 with spines in medial setal clusters on outer ramus, articles 4–6 of pereopods 5–7 with few long setae 2
2. Urosomites with only 1 dorsal spine (or none) on each side, telson short 3
- Some urosomites with 2+ spines on each side, telson elongate 5
3. Epimeron 1 lacking anteroventral setae, thick spines on article 6 of pereopods 3–4 more than 1 per set, uropod 2 lacking setae, telson with dorsal spines *A. smithi*
- Epimeron 1 bearing anteroventral setae, thick spines on article 6 of pereopods 3–4 only 1 per set, uropod 2 bearing seta(e), telson lacking dorsal spines 4
4. Telson cleft 83 percent, inner ramus of female uropod 3 elongate, with lateral spine groups, apex only with setae *A. saycei*
- Telson cleft 100 percent, inner ramus of female uropod 3 short, without lateral spine groups, apex with spine *A. haasei*
5. Pleonite 5 with 3 dorsal spines on each side, pleonite 4 with 2 dorsal spines on each side *A. spinatus*
- Pleonite 5 with 4–5 dorsal spines on each side, pleonite 4 with 3 dorsal spines on each side *A. multispinatus*

Key II to the Species of *Austrogammarus*

1. Telson with 1 dorsal spine on each lobe 2
- Telson without spines 3
2. Pleonites 4–6 each with 2+ dorsal spines on each side, palmar corners of gnathopods with 5 spines *A. spinatus* and *A. multispinatus* (return to Key I, couplet 5)
- Pleonites 4–6 each with 1 dorsal spine on each side, palmar corners of gnathopods with 9+ spines *A. smithi*
3. Epimeron 1 lacking anteroventral setae, outer ramus of uropod 3 with clusters of medial setae, coxa 4 strongly setose *A. australis*
- Epimeron 1 bearing anteroventral setae, outer ramus of uropod 3 with medial spines as well as setae, coxa 4 poorly setose *A. saycei* and *A. haasei* (return to Key I, couplet 4)

Key III to the Species of *Austrogammarus*

1. Epimeron 1 with anteroventral setae ... *A. saycei* and *A. haasei* (return to Key I, couplet 4)
- Epimeron 1 lacking anteroventral setae 2
2. Telson lacking dorsal spines *A. australis*
- Telson with 1 dorsal spine on each lobe 3
3. Pleonites 5–6 with 1 dorsal spine on each side, pleonite 4 lacking spines, palmar corners of gnathopods with 5 spines *A. smithi*
- Pleonites 4–6 with 2+ dorsal spines on each side, pleonite 4 thus with spines, palmar corners of gnathopods with 9+ spines *A. spinatus* and *A. multispinatus* (return to Key I, couplet 5)

Key IV to the Species of *Austrogammarus*

1. Article 6 of pereopods 3–4 with 1 spine in each setal set 2
 —Article 6 of pereopods 3–4 with 2+ spines in each setal set
 *A. smithi*, *A. spinatus*, *A. multispinatus* (return to Key III, couplet 3)
2. Coxa 4 heavily setose below, article 2 of pereopod 7 with long setae posteroventrally
 *A. australis*
 —Coxa 4 naked ventrally, article 2 of pereopod 7 with short spines or setae at
 posteroventral angle *A. saycei* and *A. haasei* (return to Key I, couplet 4)

Austrogammarus australis (Sayce)

Figs 3–7

Gammarus australis Sayce, 1901: 233–237, pl. 39.
 [Supplementary description in Sayce, 1902: 51–53].

Material examined. Museum of Victoria (NMV) TYPE, Dandenong Creek near Bayswater, Vic., composed of 5 specimens; we select as LECTOTYPE newly designated male “a” 10.8 mm (illustrated), other specimens as follows: male “b” 13.2 mm (partly illustrated), specimen “c” 6.05 mm, specimen “d” 6.0 mm, fifth specimen = *Atyloides gabrieli*. We assume our specimens are either hermaphroditic males or the species has a neotenic male without calceoli and with small female-like gnathopods.

Oxford University Museum Ref. No. 9597, COTYPE Freshwater Vic. Australia ?1909, brought over by G.W. Smith, 7 specimens, now wet but previously dried, some dark eyes still visible.

NMV, O.A. Sayce Colln 25.7.11, tributary of Monbulk Creek, 2 specimens and 16 specimens in separate lots.

NMV, in gully halfway to Sassafra, 7 specimens.

Diagnosis (only male known). Flagellum of antenna 2 heavily setose and lacking calceoli. Coxae 1–4 all heavily setose ventrally, coxae 1–3 with several posterior spines. Gnathopods female-like, not enlarged, palmar corners not bent outward, with 4 spines. Posterior spines on article 6 of pereopods 3–4 in single sets, with 1 group of setae placed between spine sets 1 and 2, formula thus 2-s-1-1-1-1-1; lateral spine formulas on article 5 of pereopods 3 and 4 = 4-0-0-0 and 4-2-2-1; article 2 of pereopod 5 with short setae, of pereopods 5–6 with long posterior setae; setae of articles 4–6 of pereopods 5–7 long, of medium density; article 4 of pereopods 5–7 short. Epimeron 1 without anteroventral setae. Urosomal setation dorsally long and drooping (despite figure); only pleonite 6 with 1 dorsolateral spine on each side; uropods 1–2 with setae on peduncles and inner rami, apicolateral corner of peduncle on uropod 1 with setae and 2 spines, on uropod 2 with setae and 1 spine only, medial spines on peduncle of uropod 1 (distal to proximal = 1-1-1-0, setae in same sets = 0-0-1-3, on uropod 2 = 1-0 and 2-2; uropod 3 strongly setose, inner ramus [known only in male] reaching to about M.67 on outer ramus, without subapical spines, apex

with many setae and 2 long spine-setae placed towards medial side, medial margin with setae in tandem, lateral margin with setae in groups; article 1 on outer ramus with spine sets laterally, medial setae arranged in clusters, article 2 of medium size, with long apical setae. Telson fully cleft, lobes separable, densely setose, lacking spines.

Description of lectotype (male). *Body* (Fig. 3): pleon dorsally setose, setation sparse and transverse on pleonites 1–2, but pleonites 3–6 occasionally with several setae weakly ranked longitudinally but generally in transverse band, pleonite 3 with additional setae in front of posterior margin, pleonite 6 with 1 spine on each side in setation rank; length 10.8 mm.

Head (Fig. 3): eyes small, round, faded in alcohol.

First antenna: length 0.75 of body, 2.0 second antenna, flagellum much longer than peduncle, setae sparse; accessory flagellum 8+ articulate (broken), reaching past article 7 of primary flagellum. *Second antenna*: length 0.37 body; peduncle shorter than flagellum, articles 4 and 5 subequal in length, articles 3, 4 and 5 with strong ventral setation; flagellum 30+ articulate, strongly setose ventrally, lacking calceoli.

Left mandible: setae of palp article 3 = 2,5A, 1,1,1,1B, many D, 3E; incisor 5-toothed, lacinia mobilis 4-toothed, 7 setose accessory blades; molar lacking setose spine (possibly broken off). *Right mandible*: incisor 4-toothed; lacinia mobilis (damaged, with 1 adze-shaped blade: other specimens with bifid and weakly denticulate lacinia mobilis); accessory blades of 3 setose spines, vestigial fourth; molar with plumose seta. *Left first maxilla* (Fig. 3): palp article 2 with 10 thin apical spines, several subterminal facial setae; inner plate with 14 widely spread medial setae. *Right first maxilla* (Fig. 3): palp article 2 with 6 thick apical spines fused to segment, 1 articulate apicolateral spine. *Second maxilla* (Fig. 3): outer margin of outer plate with 1 short seta; inner margin of inner plate with weakly submarginal row of many setae.

First gnathopod (Fig. 4): coxal plate densely setose marginally, posterior margin with 3 spines; carpus elongate, unlobed; propodus trapezoidal, longer than wide, posterolateral angle ordinary, palm oblique but straight. *Second gnathopod* (Fig. 4): slightly larger than first gnathopod; coxal plate with 5 posterior spines.

Pereopods (Figs 4,5): coxa 3 with 5 posterior spines,

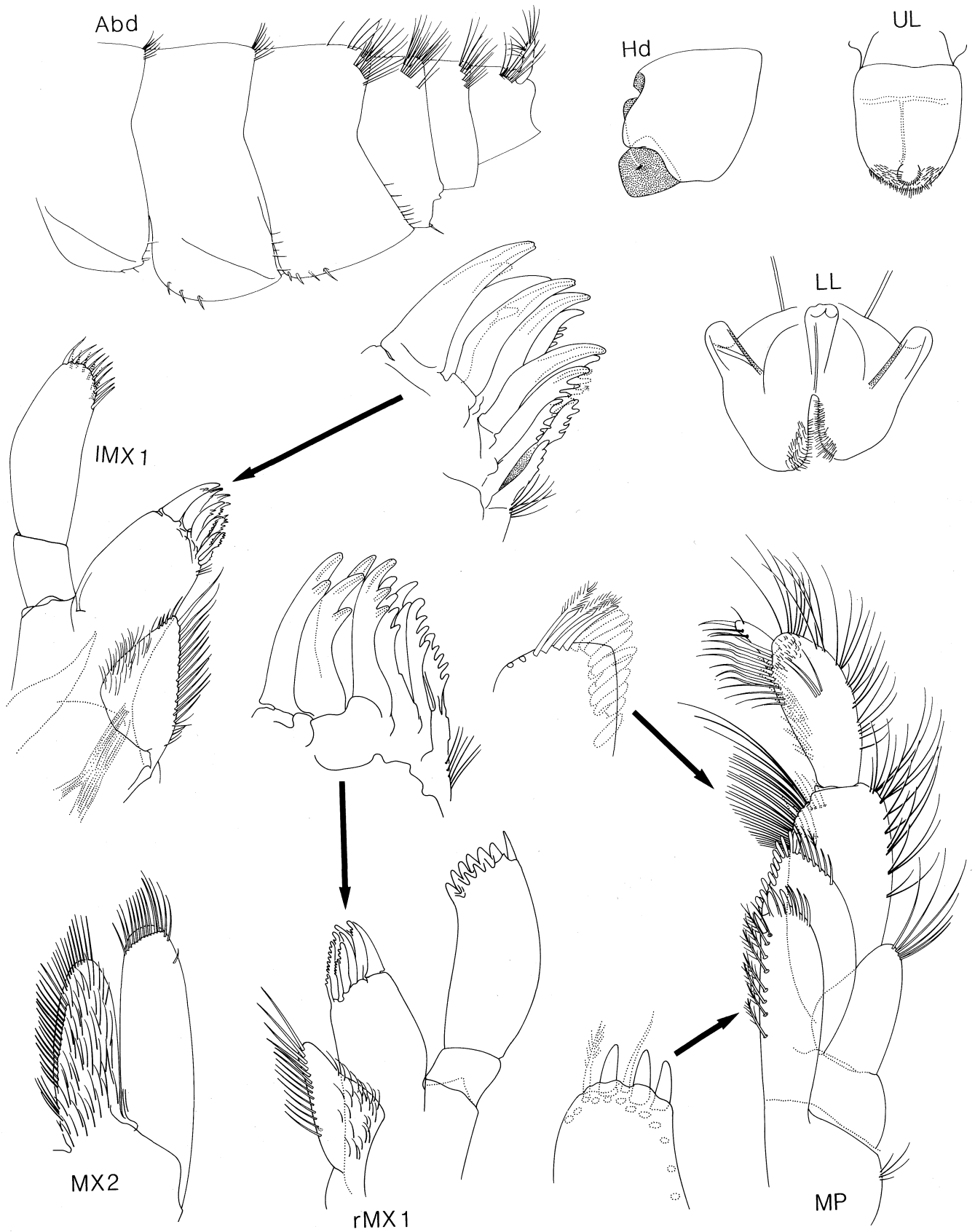


Fig.3. *Austrogammarus australis* (Sayce), lectotype, male "a".

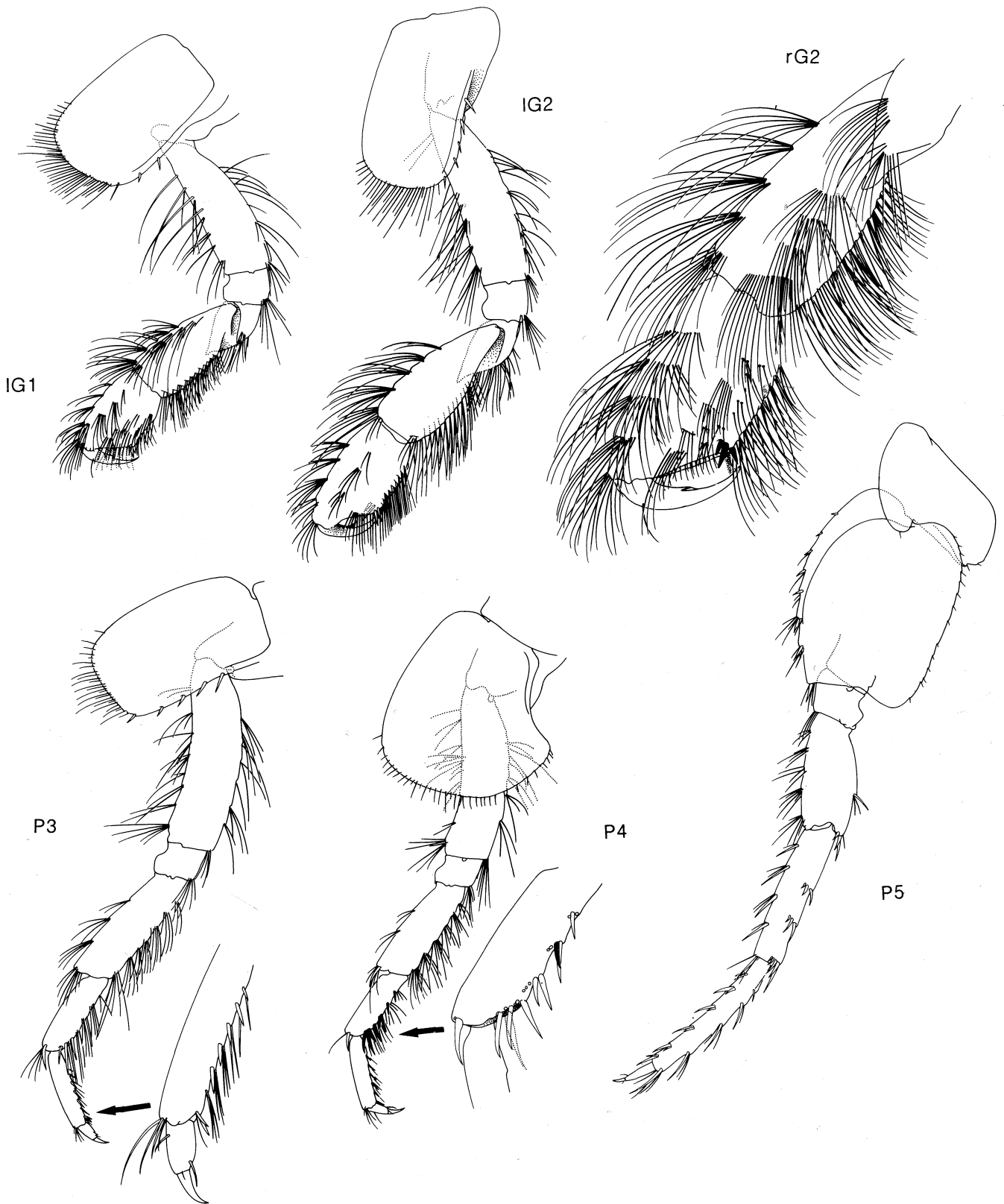


Fig.4. *Austrogammarus australis* (Sayce), lectotype, male "a".

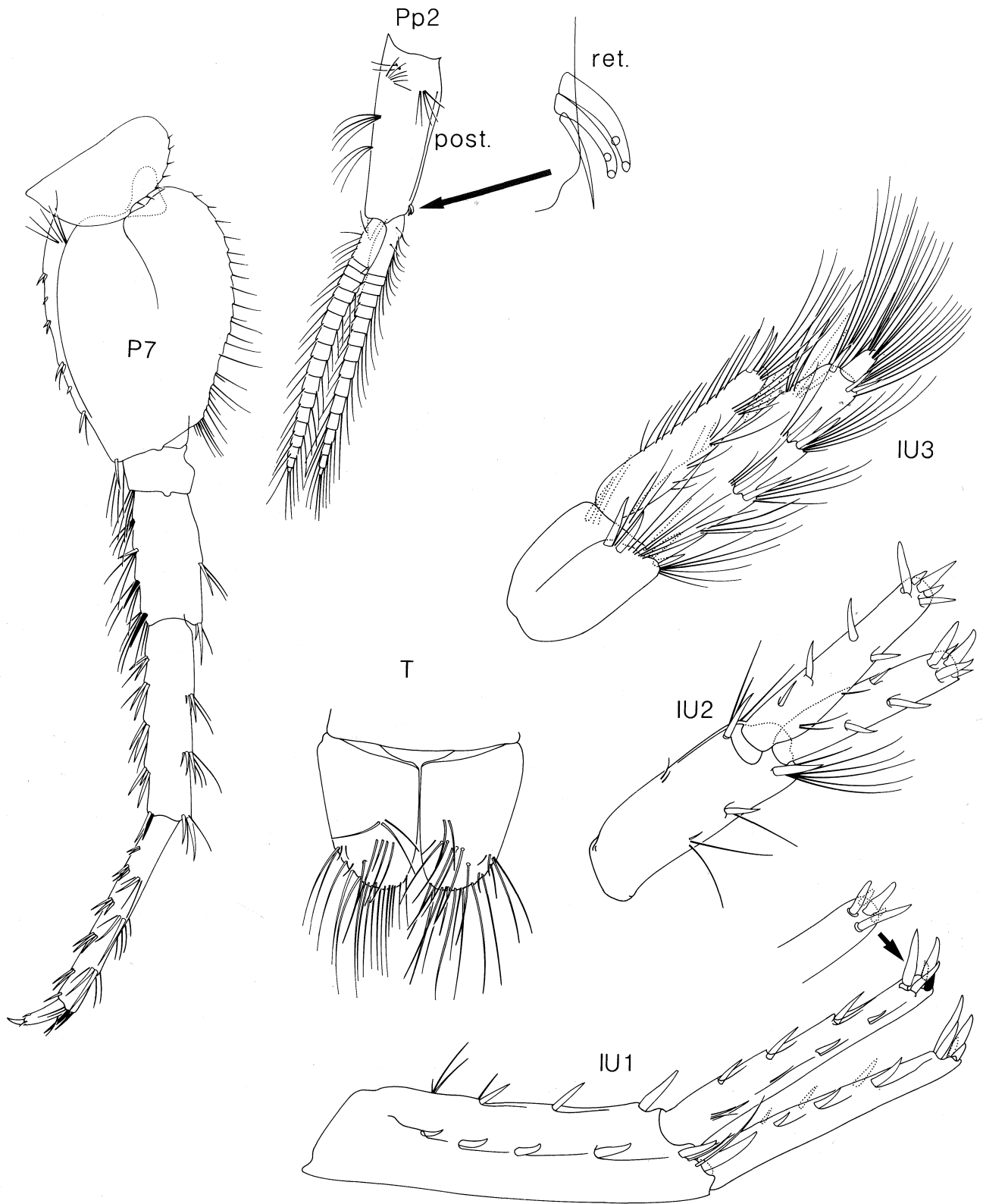


Fig.5. *Austrogammarus australis* (Sayce), lectotype, male "a".

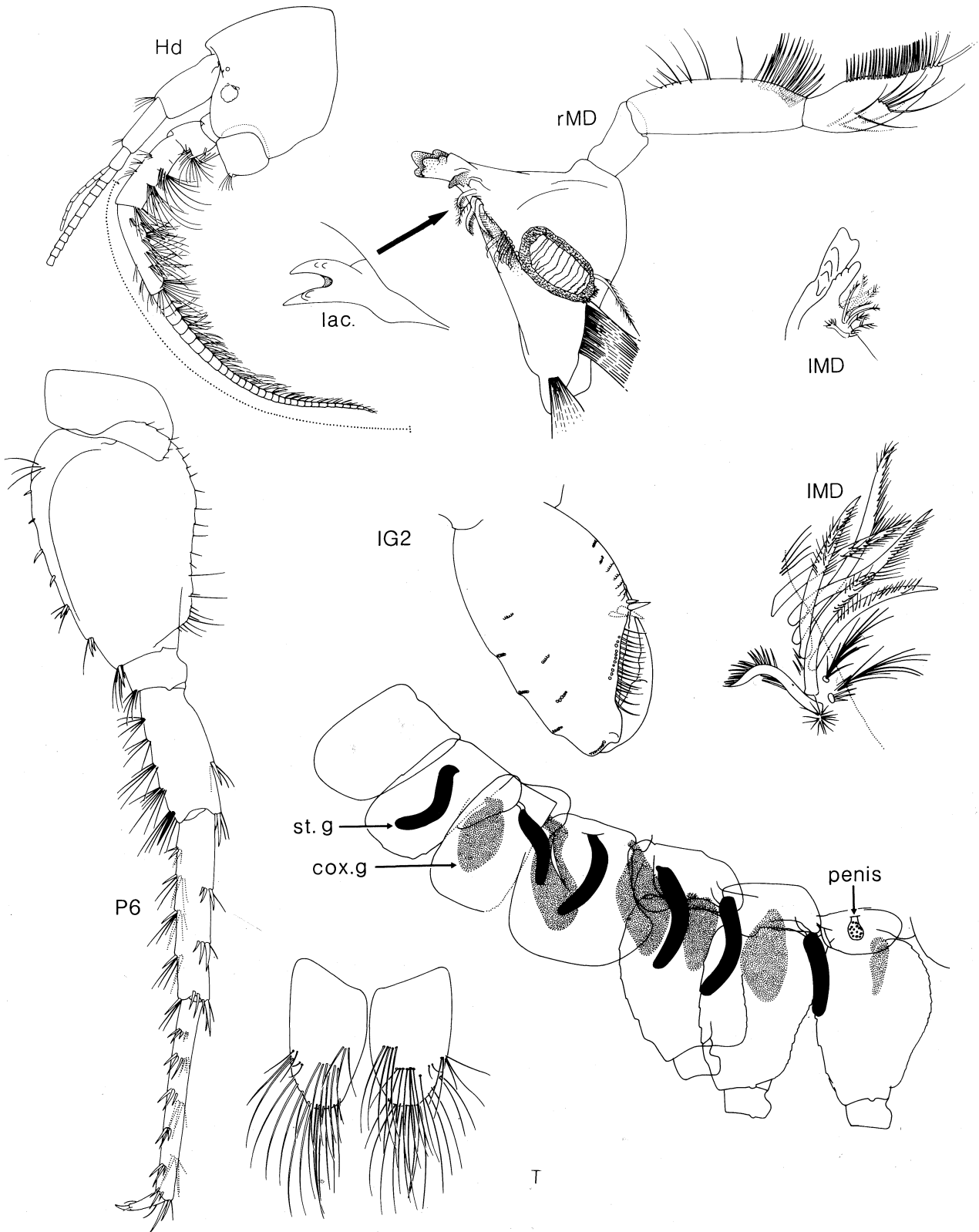


Fig.6. *Austrogammarus australis* (Sayce), syntype, male "b".

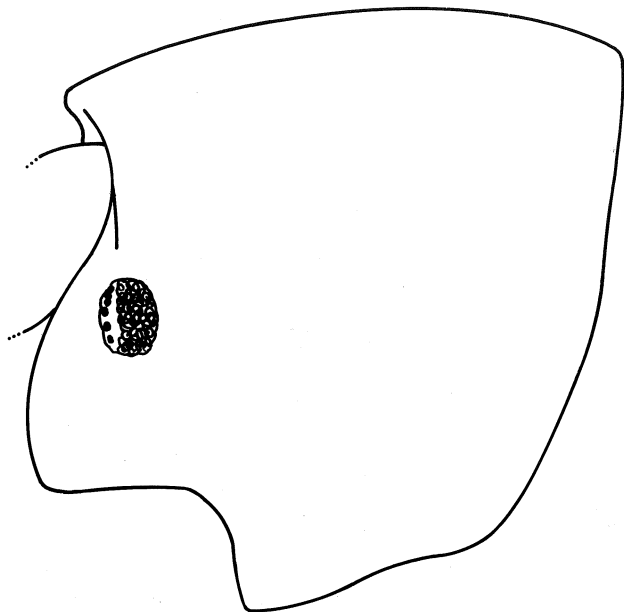


Fig. 7. *Austrogammarus australis* (Sayce), cotype (eye).

coxa 4 densely setose below but lacking posterior spines, deeply emarginate; pereopods 3–4 not longer than gnathopod 2, pereopod 3 longer than 4, articles 4–5 strongly setose posteriorly, article 5 of pereopod 3 with 4-0-0-0 apicoposterior spines, of pereopod 4 with formula of 4-2-2-1 spines, posterior margin of article 6 on pereopod 3 with formula of 2-s-1-1-1-1 (coupled with setal groups) in tandem, on pereopod 4 formula = 2-1-1-1-1-1, lone setal group absent; article 2 of pereopod 5 bearing short posterior setules, that of pereopods 6–7 setose posteroventrally and bearing long posterior setae.

Epimera (Fig. 3): all epimera with small posteroventral tooth, each with sparse posterior setae ventrally, epimeron 1 weakly rounded behind, naked anteroventrally, epimeron 1 with 2 ventral setules posteriorly, epimera 2 and 3 with 3 and 4 ventral spines anteriorly. *Pleon* (Fig. 3): pleonites 1,2,4,5 with few dorsal setae arranged transversely, pleonites 3,6 with both transverse and weakly longitudinal rows of posterior setae arranged transversely, urosomite 6 also with dorsal spine on either side; uropod lengths relative to uropod 1: uropod 2 = 0.67, 3 = 0.67. *Pleopods* (Fig. 5): only pleopod 1 lacking third simple retinaculum.

First uropod (Fig. 5): peduncle length 1.2 rami;

outer margin with apicofacial spine besides strong row of dorsal spines, base with small cluster of setae medially; inner ramus with several basolateral setae. *Second uropod* (Fig. 5): peduncle same length as rami, with sparse groups of setae, 1 large cluster distofacially below main apicodorsal spine; inner ramus with pair of basolateral setae. *Third uropod* (Fig. 5): peduncle length 0.45 outer ramus, about same length as urosomite 3; outer ramus proximal article with 2 transverse spine rows on body; inner ramus length 0.7 of outer, with setose margins and pair of apicomedital spines. *Telson* (Fig. 5): slightly shorter than urosomite 3; fully cleft; apices strongly setose, dorsum of each lobe with numerous setae, none basal.

Description of syntypes. Male “b” (Fig. 6) length 13.2 mm; like lectotype but hands of gnathopods slightly more tumid. Right lacinia mobilis illustrated because of damage to lectotype.

Specimens “c” 6.05 mm and “d” 6.00 mm: accessory flagellum 6-articulate, epimera 2 and 3 with 2 and 3 spines respectively.

Remarks. Only 3 specimens have been examined carefully and the others have been checked cursorily; the main variations encountered are the change during maturation from presence to absence of the dorsal spine on each side of pleonite 5, the absence of both right sided spines of pleonites 5–6, and the preservability of eyes, which in the cotypes of the Oxford University collection retain their pigment and are vertically ovate (Fig. 7). Small individuals bear 2 spines and 1–2 setae on the apicolateral corner of the peduncle on uropod 1 but terminal adults have only 1 spine and many setae.

We have illustrated the urosomal setae in erect fashion but on our specimens they droop.

Relationship. This is the basic species of the group and comparisons to it will be made in the discussions of other species; its position may be determined also in the keys to species given above.

Distribution. Victoria, Dandenong Creek, near Bayswater (locality has become environmentally extinct). Bayswater is now a suburb of Melbourne.

***Austrogammarus smithi* n.sp.**

Figs 8–10

Gammarus australis G.W. Smith, 1909: 78–79 (not *G. australis* Sayce).

Material examined. Oxford University Museum, Ref. No. 5400, Magnet Creek, Tas., 1907–8, G.W. Smith Esq., formerly identified as *Gammarus australis* Sayce, 11 specimens. HOLOTYPE, male “m” 6.8 mm (illustrated); ALLOTYPE female “n” 6.4 mm (partly illustrated), large voucher female “o” 10.5 mm (partly illustrated).

Diagnosis. Flagellum of antenna 2 sparsely setose, bearing calceoli in males. Coxa 1 setose ventrally, coxae 2–3 weakly setose ventrally, coxa 4 lacking ventral setae, with only posterior setae and 1 anteroventral seta, coxae 1–3 with several posterior spines. Gnathopods dimorphic between the sexes, palmar corners bent outward, with 5 spines. Posterior spines on article 6 of pereopods 3–4 in multiple sets, without group of setae placed between spine sets 1 and 2, formula thus 2-3-2-2-2; lateral spine formulas on article 5 of pereopods 3 and 4 = 3+3-1-1 and 3+4-1-1; article 2 of pereopod 5 with medium setae, of pereopods 6–7 with short posterior setae; setae of articles 4–6 of pereopods 5–7 short and sparse; article 4 of pereopods 5–7 short. Epimeron 1 without anteroventral setae. Urosomal setation dorsally medium and stiff; both pleonites 5–6 with 1 dorsolateral spine on each side; uropods 1–2 without setae on peduncles and inner rami, apicolateral corner of peduncle on uropod 1 with 2 spines, on uropod 2 with 2 spines, medial spines on peduncle of uropod 1 (distal to proximal) = 1-1-1-1-1, setae in same sets = 0-0-0-0-0, on uropod 2 = 1-1-1 and 0-0-0; uropod 3 poorly setose, in male inner ramus reaching to about M.67 on outer ramus, with subapical spines, apex with 5 spines, medial margin with setae in tandem, lateral margin with spines in groups or singles; in female inner ramus reaching to about M.33 on outer ramus, apex with 4 spines, lateral margin with 1 seta; article 1 on outer ramus with spine sets laterally and medial spines coupled with setae arranged in clusters, article 2 small, with 3 small apical spines. Telson cleft 93 percent, weakly setose apically, with 1 dorsal spine and several setae on each lobe.

Description of holotype (male). *Body* (Fig. 8): pleon setation sparse and transverse on pleonites 1–6, no longitudinally ranked setae in transverse band, pleonites 3–4 with additional setae in front of posterior margin, pleonites 5–6 with 1 spine on each side in setation rank; length, 6.8 mm.

Head (Fig. 8): eyes small, ovate, faded in alcohol.

First antenna: length 0.50 of body, 2.0 second antenna, flagellum much longer than peduncle, setae sparse; accessory flagellum 4-articulate, reaching past article 4 of flagellum. *Second antenna* (Fig. 8): length 0.25 body; peduncle longer than flagellum, articles 4 and 5 subequal in length, articles 3, 4 and 5 with sparse ventral setation; flagellum 12-articulate, poorly setose ventrally, bearing calceolus each on articles 2, 3, 4, 5, 7.

Left mandible: palp segment 3 setal formula = 5A, 2B, many D, 5E; incisor 5-toothed, lacinia mobilis 4-toothed, 5 setose accessory blades. *Right mandible:* incisor 4-toothed; lacinia mobilis bifid and weakly denticulate; accessory blades of 3 setose spines. *Left first maxilla:* palp article 2 with 8 thin apical spines, 4 weakly subapical setae; inner plate with 13 widely spread medial setae. *Right first maxilla:* palp article 2 with 5 thick apical spines fused to segment, with 1 articulate apicolateral spine, 1 thick apicolateral seta.

Second maxilla: outer plate outer margin with 1 short seta; inner plate inner margin with weakly submarginal row of many setae.

First gnathopod (Fig. 8): coxal plate marginally setose, posterior margin with 2 spines; article 4 with large scythe spine, carpus short, unlobed; propodus trapezoidal, longer than wide, posterolateral angle weakly out-turred, palm transverse, almost straight; dactylus reaching end of palm. *Second gnathopod* (Fig. 8): slightly larger than first gnathopod; coxal plate with 4 posterior spines, weakly setose below.

Pereopods (Fig. 9): coxae 3–4 poorly setose below, coxa 3 with 5 posterior spines [pairing of 2 spines abnormal], coxa 4 lacking posterior spines, deeply emarginate; pereopods 3–4 not longer than gnathopod 2, pereopod 3 as long as 4, article 4 weakly setose posteriorly, article 5 of pereopods 3–4 with formula of 3+3-1-1 and 3+4-3-1-1, lateral spines, posterior margin of article 6 on pereopods 3–4 with formula of 2-2-2-2-2 and 2-3-2-2-2, posterior spines (coupled with setal groups) in tandem; article 2 of pereopod 5 with medium-length setae, that of pereopods 6–7 with 1–2 spinules posteroventrally.

Epimera (Fig. 8): all epimera with small posteroventral tooth, epimeron 1 weakly rounded behind, epimeron 3 straight behind, each with sparse posterior setae ventrally, epimeron 1 with 3 ventral setules posteriorly, epimera 2 and 3 with 3 and 3 ventral spines anteriorly. *Pleon* (Fig. 8): pleonites 1–6 with sparse dorsal setae arranged transversely, pleonites 3–4 with few setae in front of main band, pleonites 5–6 also with dorsal spine on either side; uropod lengths relative to uropod 1: uropod 2 = 0.60, 3 = 0.60. *Pleopods:* retacula variable, mostly 2 regular and 2 accessory simple members but occasionally with only 1 main member and 1–3 accessories.

First uropod (Fig. 9): peduncle length 1.5 rami, outer ramus slightly shorter than inner; outer margin with 2 apicofacial spines besides strong row of dorsal spines, medial margin with row of spines, no setae on uropods 1–2; both rami with 2 rows of marginal spines and 5 apical spines. *Second uropod* (Fig. 9): peduncle same length as rami, apicolateral corner with 2 spines. *Third uropod* (Fig. 9): peduncle length 0.5 outer ramus, about same length as urosomite 3; outer ramus 2-articulate [left uropod 3 aberrantly with regenerating vestigial article 2], proximal article with 4 lateral transverse spine rows on body, 3 medial transverse spine rows; inner ramus length 0.7 of outer, with setose inner margin, several lateral spines, 5 apical spines and several setules, article 2 of outer ramus with 3 short apical spines. *Telson* (Fig. 9): slightly shorter than urosomite 3; cleft 93 percent of its length; apices weakly setose, dorsum of each lobe with spine and several setae, none basal.

Description of female “n”. Antenna 2 of same size and setosity as in male but calceoli absent; gnathopods (Fig. 10) much smaller, with elongate carpi, gnathopod 2 very thin, not larger than gnathopod 1; coxae 2–5

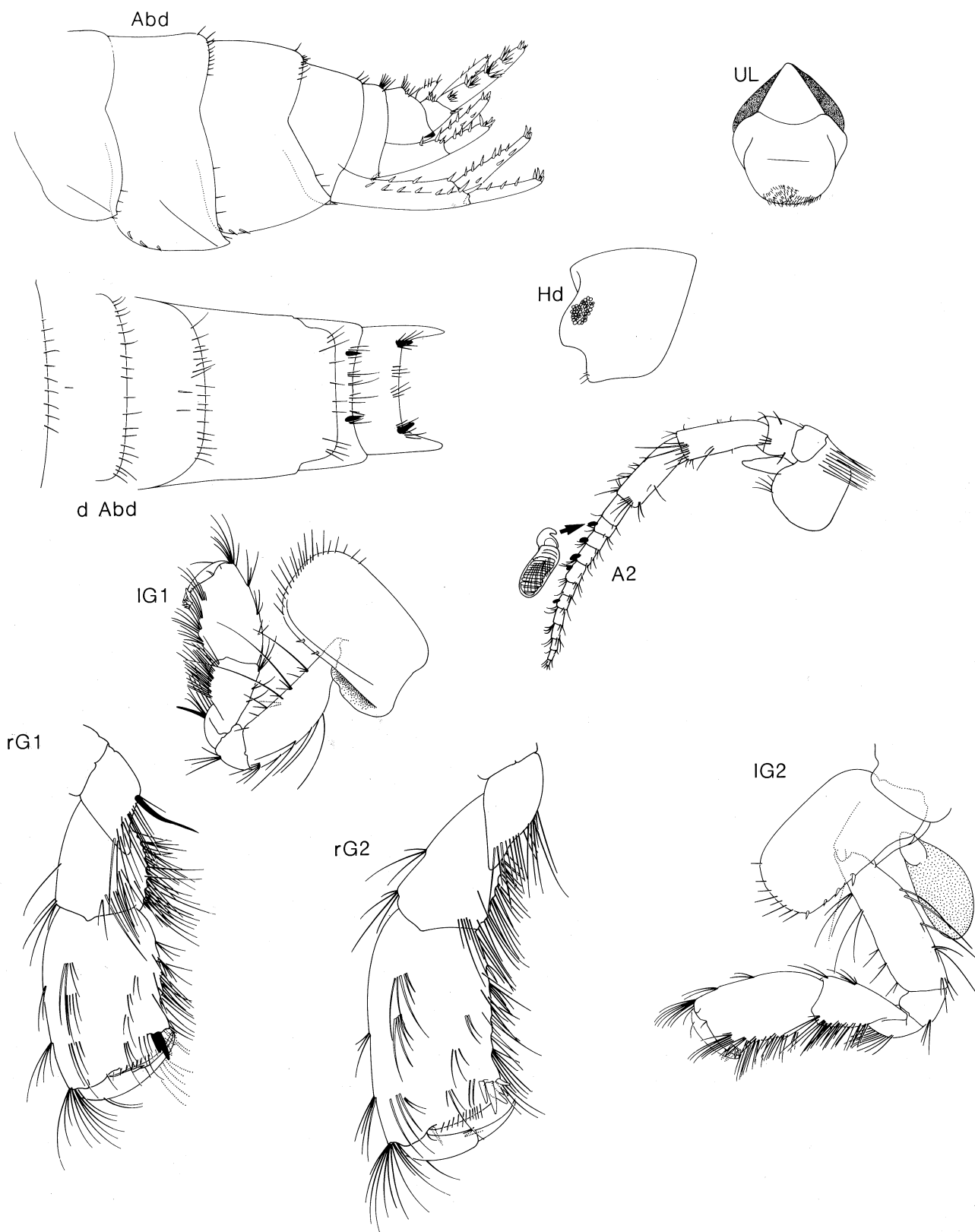


Fig.8. *Austrogammarus smithi* n.sp., holotype, male "m".

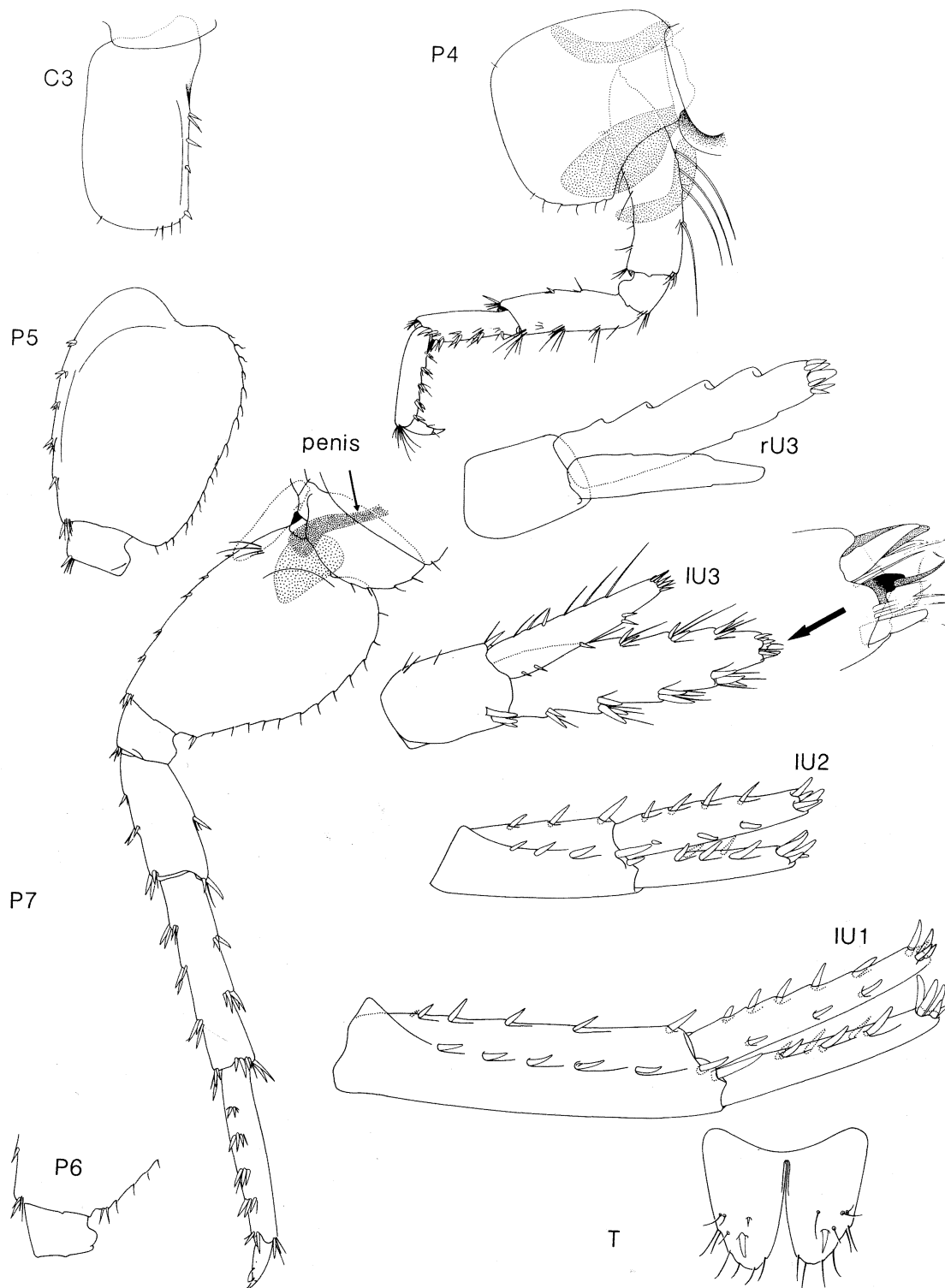


Fig.9. *Austrogammarus smithi* n.sp., holotype, male "m".

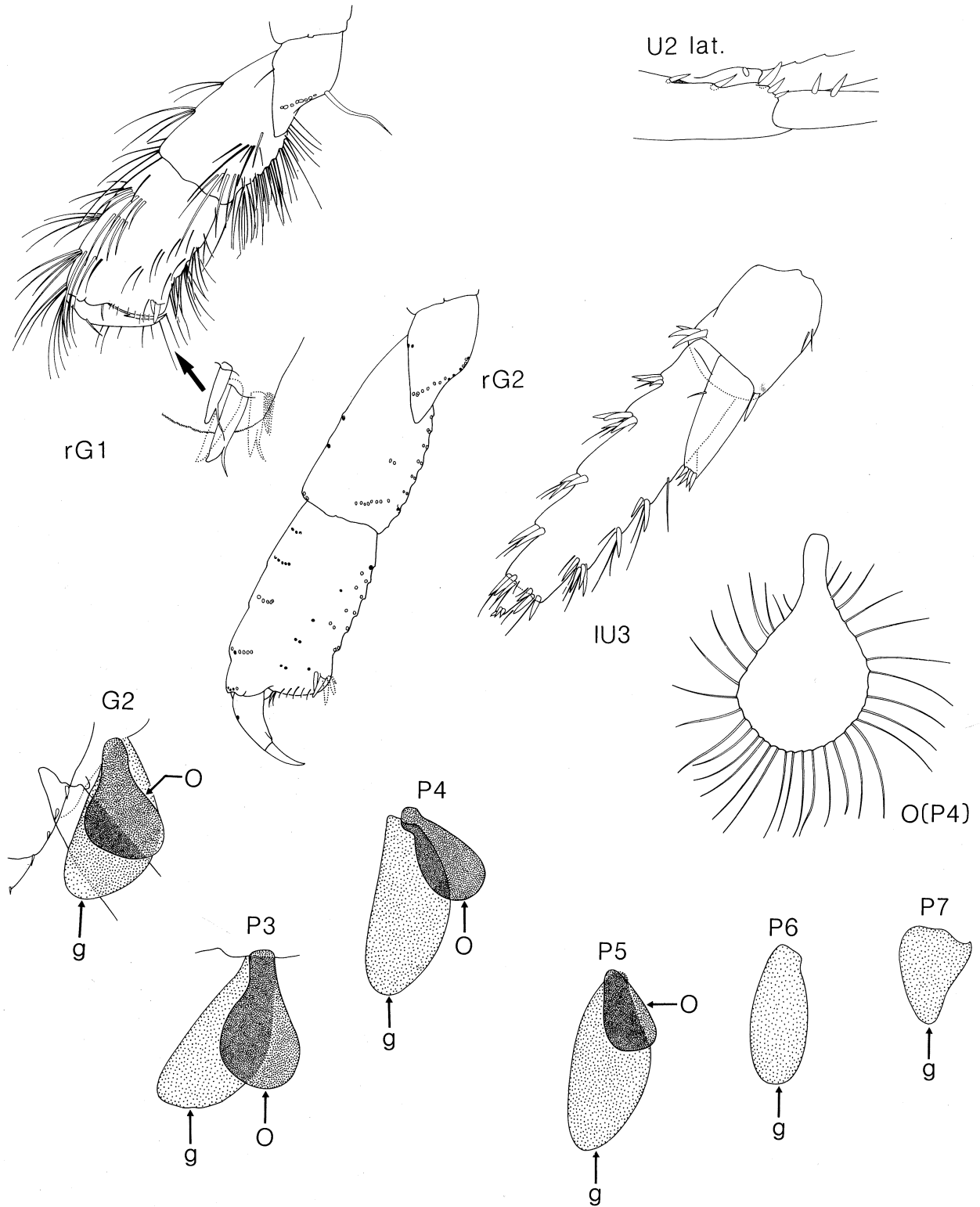


Fig.10. *Austrogammarus smithi* n.sp., allotype, female "n" (all drawings except fully-developed oostegite, O); female "o"(O+of pereopod 4).

with setoseless, paddle-shaped oostegites (as illustrated, Fig. 10), that on coxa 5 smallest; inner ramus of uropod 3 (Fig. 10) only 0.33 as long as outer ramus, almost scale-like, lateral margin with only 1 seta, apex with 4 spines. Non-sexual variables: epimeron 1 with 1 ventral spine; epimeron 3 with 2 spines and thin spinule; apicolateral corner of peduncle on uropod 2 aberrantly with 3 spines.

Description of female "o". Calceoli absent. With fully developed oostegites (Fig. 10). Uropod 3 variable, inner ramus of right 0.35 as long as outer ramus, of left 0.60; article 2 of outer ramus 0.06 as long as article 1. Spines of pleonite 5 absent.

Brood pouch with 16 hatchlings each about 1.5 mm long. One hatchling examined: primary flagellum of antenna 1 with 9 articles, accessory with 2; flagellum of antenna 2 with 4 articles, first article of flagellum as long as article 5 of peduncle; coxae 1–4 each with only 2 setae, 1 anteroventral, 1 posteroventral; article 5 of pereopods 3–4 with only 2 distal setae, no spines, article 6 only with pair of locking spines; epimera lacking armaments, posteroventral teeth rudimentary; spine counts on uropods: apicolateral corners of peduncles on uropods 1–2 with only 1 spine; all rami with 4 apical spines each; inner ramus of uropod 3 short, with 1 apical spine, apex of article 1 on outer ramus with 2 lateral and 2 medial spines, apex of article 2 with 3 spines; telson with 1 spine on each lobe (this being the main identificatory feature of juveniles).

Illustrations. Oostegites of female "o" enlarged to same magnification as male coxae.

Remarks. This species differs from *A. australis* in the presence of sexual dimorphism in calceoli, gnathopods and uropod 3, the calceoli being present in males of *A. smithi* but absent [also presumably in as yet undiscovered females] in males of *A. australis*. The carpi of the gnathopods are much shorter in males of *A. smithi* than in *A. australis*; no setae are present on uropods 1–2 whereas in *A. australis* several setae are present on peduncles and inner rami. Coxae 2–4 are very poorly setose ventrally in *A. smithi* compared to *A. australis*. Articles 5–6 of pereopods 3–4 have higher spine counts than in *A. australis*; article 2 of pereopods 5–7 is subtly narrower than in *A. australis* and article 5 is longer, especially on pereopod 7; setae are much sparser and shorter on pereopods 3–7 than in *A. australis*; on article 2 of pereopod 5 the posterior setules are longer but on pereopods 6–7 shorter than in *A. australis*. Immediately apparent is the sparser and shorter armament of the urosome dorsally, the setae being short and stiff, whereas in *A. australis* they are long and drooping. Uropod 3 in *A. smithi* is much less setose than in *A. australis*; the lateral margin of the inner ramus and the medial margin of the outer ramus have spines and spine pairs in contrast to setal clusters found in *A. australis*; article 2 on the outer ramus is subtly shorter than in *A. australis*.

Distribution. Tasmania, Magnet Creek.

Austrogammarus haasei (Sayce)

Figs 11–13

Gammarus haasei Sayce, 1902: 53–56, pl. 5.

Material examined. TYPES, Museum of Victoria (NMV), Monbulk, Vic., 250 m. We select as LECTOTYPE newly designated male "p" 8.1 mm (illustrated); other specimens as follows: female "q" 12.0 mm (partly illustrated), female "r" 9.5 mm (partly illustrated) and female "s" 7.5 mm.

Oxford University Museum Ref. No. 9598, surface freshwater, Vic., Australia, "brought over by G.W. Smith (?1909)", COTYPE newly designated by us as female "t" 9.0 mm.

Diagnosis. Flagellum of antenna 2 moderately setose in male, heavily setose in female, bearing calceoli in male. Coxae 1–3 moderately setose ventrally, coxa 4 lacking ventral setae, only with posterior setae and few anteroventral setae, coxae 1–3 with several posterior spines. Gnathopods sexually dimorphic, palmar corners bent outward, with 8 spines in male and 5 in female. Posterior spines on article 6 of pereopods 3–4 in single sets, with group of setae placed between spine sets 1 and 2, formula thus 2-s-1-1-1-s; lateral spine formulas on article 5 of pereopods 3 and 4 = 1–0; article 2 of pereopod 5 with medium setae, of pereopods 6–7 with medium posterior setae; setae of articles 4–6 of pereopods 5–7 long and sparse; article 4 of pereopods 5–7 short. Epimeron 1 with anteroventral setae. Urosomal setation dorsally medium to long and drooping; both pleonites 5–6 with 1 dorsolateral spine on each side; uropod 2 only with setae on peduncle, none on inner rami, apicolateral corner of peduncle on uropod 1 with 2 spines, on uropod 2 with 2 spines and 2 setae, medial spines on peduncle of uropod 1 (distal to proximal) = 1-1-1-1, setae in same sets = 0, on uropod 2 = 1-1 and 0; uropod 3 moderately setose, inner ramus in male reaching to about M.67 on outer ramus, with subapical thin medial spines, apex with 2 spines and hooked setule, medial margin with setae in tandem, lateral margin with thin spines and setae in tandem; article 1 on outer ramus with spine sets laterally and medial spines coupled with setae arranged in clusters, article 2 small, with 5 apical setae; inner ramus in female short and scale-like, with 1 apical spine, 1 small apicolateral spine, 1 midlateral spine. Telson cleft 100 percent, moderately to strongly setose, without dorsal spines.

Description of lectotype (male). *Body* (Fig. 11): pleon setation moderately dense and transverse on pleonites 1–6, pleonite 5 with additional setae in front of posterior margin, pleonites 5–6 with 1 spine on each side in setation rank; length, 8.1 mm.

Head (Fig. 11): eyes small, round, faded in alcohol.

First antenna (Fig. 11): length 0.50 of body, 1.5 second antenna, flagellum much longer than peduncle;

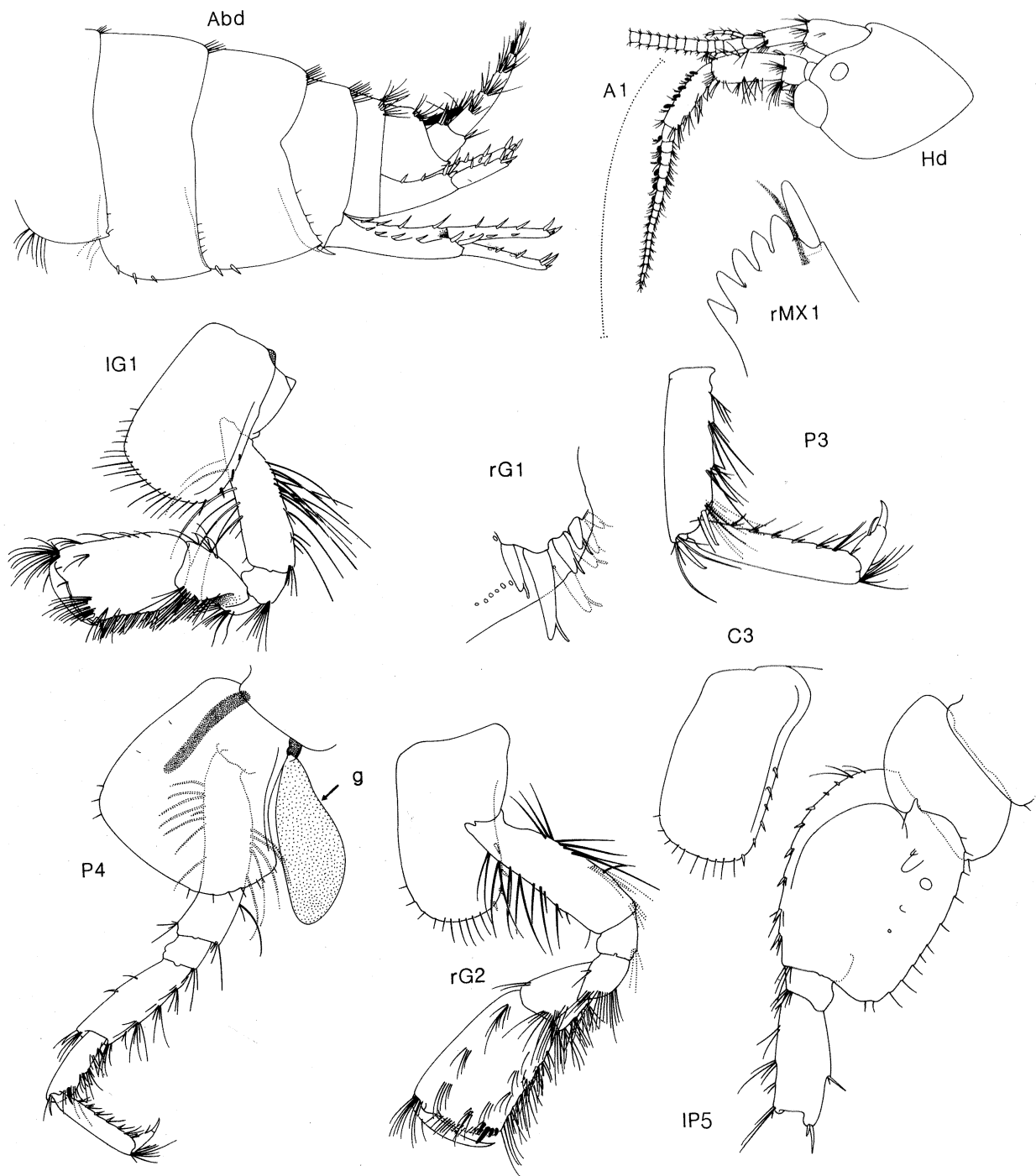


Fig.11. *Austrogammarus haasei* (Sayce), lectotype, male "p".

accessory flagellum 4-articulate, reaching past article 3 of flagellum. *Second antenna* (Fig. 11): length 0.33 body; peduncle longer than flagellum, article 5 shorter than 4, articles 3, 4 and 5 with moderate ventral setation; flagellum 17-articulate, moderately setose ventrally, bearing 5 calceoli on peduncle article 5, 1 each on articles 1-6 of flagellum.

Left mandible: palp segment 3 setal formula = 1,3A, 2,2,1B, many D, 5E; incisor 5-toothed, lacinia mobilis 4-toothed, 8 setose accessory blades. *Right mandible*:

incisor 5+-toothed; lacinia mobilis bifid, bearing surface denticles; accessory blades of 3 setose spines, smaller fourth; setae of palp article 3 = 1,2,1A, 3,2B, 5E. *Left first maxilla*: palp article 2 with 10 thin apical spines, 3 subapical setae; inner plate with 17 widely spread medial setae, 6 outer apical setae on backside. *Right first maxilla* (Fig. 11): palp article 2 with 5 thick apical spines fused to segment, 1 large articulate apicolateral spine, 1 thin subapical lateral spine. *Second maxilla*: outer plate outer margin with 1 short

seta; inner plate inner margin with deeply submarginal row of many setae.

First gnathopod (Fig. 11): coxal plate densely setose marginally, posterior margin with 4 spines; carpus short, unlobed; propodus rectangular, longer than wide, posterolateral angle ordinary, palm oblique but straight. *Second gnathopod* (Fig. 11): slightly larger than first gnathopod, hand trapezoidal, expanding distally; coxal plate with 4 posterior spines.

Pereopods (Figs 11,12): coxa 3 with 6 posterior spines, coxa 4 not setose below and lacking posterior spines, deeply emarginate; pereopods 3-4 not longer than gnathopod 2, pereopod 3 longer than 4, articles 4-5 moderately setose posteriorly, article 5 of pereopods 3-4 with 1 apicoposterior spine, formula on posterior margin of article 6 on pereopods 3-4 = 2-s-1-1-1-1-s and 2-s-1-1-1-1-s; article 2 of pereopod 5 with 2 setae on corner, that of pereopods 6-7 setose and spinose posteroventrally.

Epimera (Fig. 11): all epimera with small posteroventral tooth, epimeron 1 weakly rounded behind, epimeron 3 straight behind, each with sparse

posterior setae ventrally, epimeron 1 with 8 anteroventral setae, epimera 2 and 3 with 3 and 2 ventral spines anteriorly. *Pleon* (Fig. 11): pleonites 1 and 2 with few dorsal setae arranged transversely, pleonites 3-6 with moderately dense and medium-length rows of posterior setae arranged transversely, pleonites 5-6 also with dorsal spine on either side; uropod lengths relative to uropod 1: uropod 2 = 0.67, 3 = 0.67. *Pleopods* (Fig. 12): retinacula and accessory retinacula both varying between 2 and 3.

First uropod: peduncle length 1.33 rami; outer margin with 2 apicolateral spines besides strong row of dorsal spines, medial margin with 4 spines. *Second uropod*: peduncle same length as rami, with sparse group of setae between 2 apicodorsal spines. *Third uropod* (Fig. 12): peduncle length 0.45 outer ramus, shorter than urosomite 3; outer ramus proximal article with 4 transverse spine rows laterally, 2 medially; inner ramus length 0.7 of outer, with lateral setose margin, 2 apical spines and bent setule, lateral margin near apex with row of 6 spines and setae in formula of s-S-S-S-S-s. *Telson* (Fig. 12): as long as urosomite 3; fully

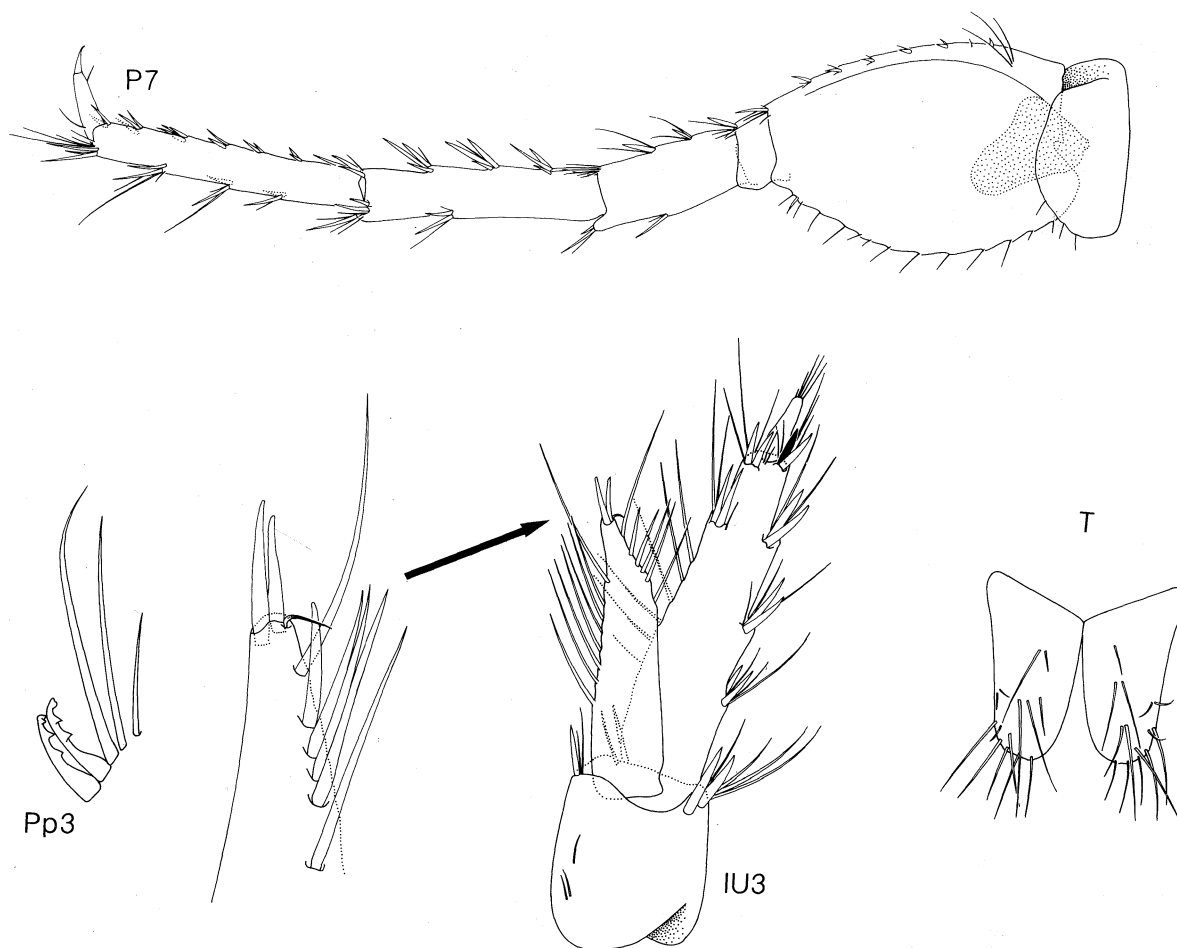


Fig. 12. *Austrogammarus haasei* (Sayce), lectotype, male "p".

cleft; apices strongly setose, dorsum of each lobe with several setae, none basal.

Description of female "r". Like male but differing in the following features: articles 3-5 of peduncle on antenna 2 (Fig. 13) more setose than in male (but other females not necessarily more setose); calceoli absent; gnathopods (Fig. 13) very small, thin, carpi elongate, propodi thin, elongate, with palmar corners outturned slightly, each corner with only 5 spines (2 medial, 3 lateral); setae of gnathopods denser; coxae 2-5 with setoseless juvenoid form of paddle-shaped oostegites; inner ramus of uropod 3 short and scale-like, with 1 main apical spine, 1 apicolateral small spine, 1 midlateral spine, 1 midmedial seta, apex also with 3

setae.

Non-sexual variations include aberrant pereopod 3 (normal in female "q" below), with armament formula on article 6 = 2-s-s-1-2-1-s on right appendage, 2-s-s-s-2-s on left appendage, on pereopod 4 = 2-s-1-1-1-1-1. Epimera 2-3 each with 2 spines. Ventral apex of urosomite 1 at base of uropod 1 with additional second small spine.

Description of female "q" (Fig. 13). Inner ramus of uropod 3 much longer and more like male, with 2 apical spines, many medial setae, 3 lateral sets of spines, 1 set paired; however, oostegites remaining setoseless as in female "r".

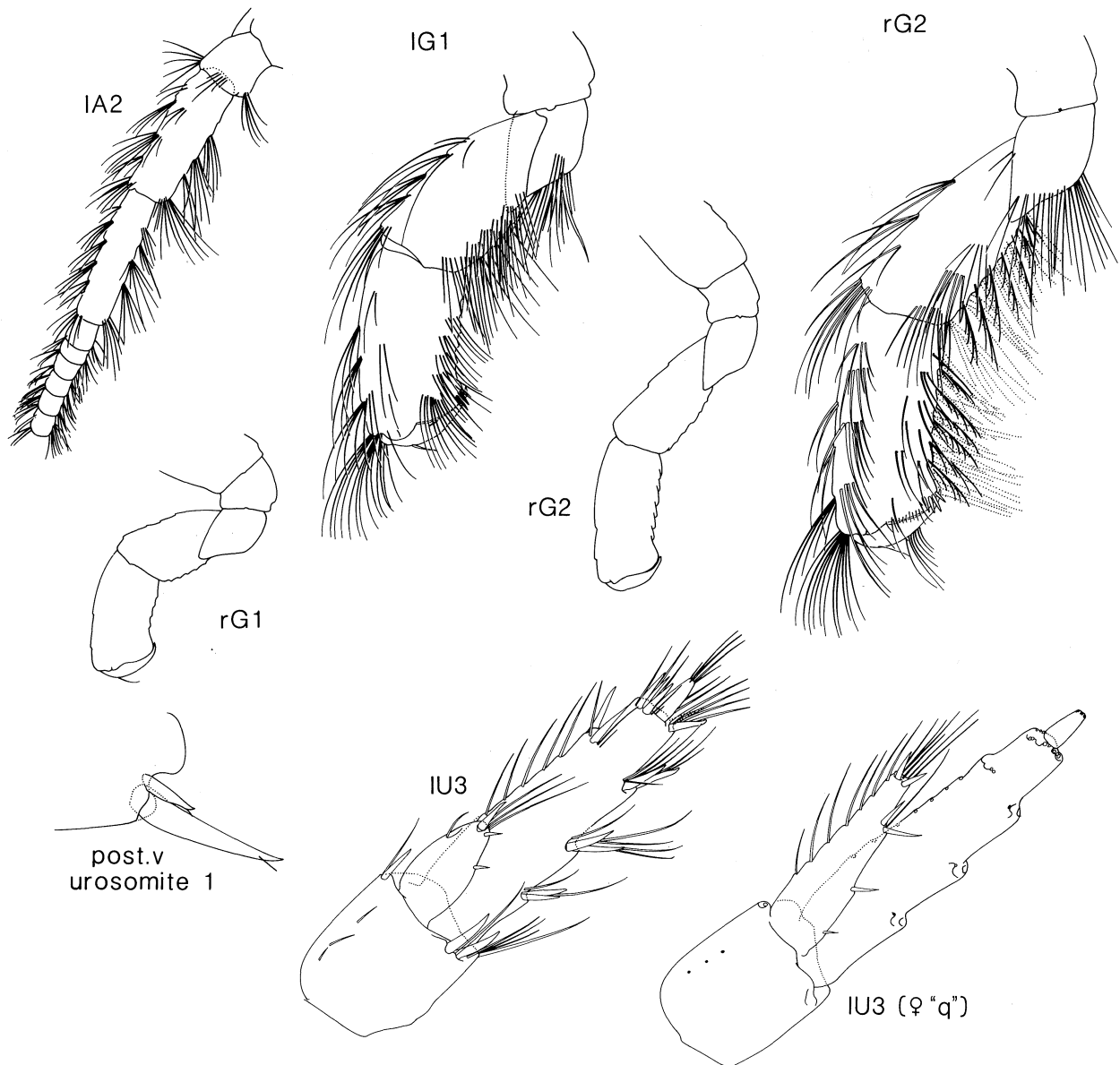


Fig.13. *Austrogammarus haasei* (Sayce), female "r" (all drawings except U3 indicated); female "q" (U3 with spines on outer ramus omitted).

Description of cotype female "t". Pleonite 6 lacking spines, with 9 setae; pleonite 5 with 1 spine on each side; apicolateral corner of peduncle on uropod 2 with 2 spines and 2 setae; inner ramus of uropod 3 with only 1 medial spine.

Illustrations. The enlargement of the inner ramus on male uropod 3 (Fig. 13) has been flattened to spread apart the apical spines. The body appearance, mandibles, gills, oostegites and pereopod 6 have not been illustrated because of their resemblance to other species.

Relationship. This species resembles *A. saycei* and *A. australis* in the presence of only 1 spine in the sets on article 6 of pereopods 3–4 but differs from *A. australis* in male uropod 3 lacking spineless setal clusters (all free setae being arranged singly in tandem), the poorly setose coxa 4, the presence of anteroventral setae on epimeron 1, and the weak spination of article 5 on pereopods 3–4 (1 spine only with 3+ in *A. australis*). There is some sexual dimorphism in the gnathopods, as in *A. saycei*, but note that *A. australis* so far has been found only in a hermaphroditic or possibly protandrous hermaphroditic state, with only female-like gnathopods.

Austrogammarus haasei differs from the very closely related *A. saycei* in the presence of apical spines on the apex of the inner ramus of uropod 3, the fully cleft telson, and the strongly setose antenna 2 in the female (*A. saycei* is known only in the female stage).

Austrogammarus haasei differs jointly from *A. smithi* and *A. spinatus* in the more setose antenna 2, the presence of anteroventral setae on epimeron 1, the presence of only 1 spine (in non-aberrant individuals) in the spine sets on article 6 of pereopods 3–4, the lack of spines on the telson, and the poorly spinose article 5 of pereopods 3–4. There are many other stronger differences between *A. haasei* and either of these 2 species which are developed in the keys, such as spine patterns on urosomites, length of article 4 on pereopod 7, spine-seta patterns on uropod 3 and elongation of telson.

Distribution. Victoria, Monbulk, near Melbourne.

Austrogammarus saycei n.sp.

Figs 14,15

Material examined. Australian Museum, AM P35842, A 46, Sassafras Creek on Old Patch Road, Vic., 4 Aug 1971 to 8 Sept 1971, H.B.N. Hynes collector, HOLOTYPE, female "k" 8.7 mm (illustrated). Unique.

Diagnosis (only female known). Flagellum of antenna 2 well setose ventrally, lacking calceoli. Coxae 1–3 moderately to weakly setose ventrally, coxa 4 lacking ventral setae, only with posterior setae and several anteroventral setae, coxae 1–3 with several posterior spines. Gnathopods [?dimorphic between the sexes], palmar corners weakly out-turned, with 4

spines. Posterior spines on article 6 of pereopods 3–4 in single sets, with group of setae placed between spine sets 1 and 2, formula thus 2-s-1-1-1-1; lateral spine formulas on article 5 of pereopods 3 and 4 = 1-0 and 1-0; article 2 of pereopod 5 with medium setae, of pereopods 6–7 with medium posterior setae; setae of articles 4–6 of pereopods 5–7 short and sparse; article 4 of pereopods 5–7 short. Epimeron 1 with anteroventral setae. Urosomal setation dorsally long and almost drooping; both pleonites 5–6 with 1 dorsolateral spine on each side; uropods 1–2 with setae on peduncles, apicolateral corner of peduncle on uropod 1 with 2 spines and 2 setae, on uropod 2 with 2 spines and 2 setae, medial spines on peduncle of uropod 1 (distal to proximal) = 1-1-1-1, setae in same sets = 0-0-0-0-0, on uropod 2 = 1-1 and 0-0; uropod 3 well setose, inner ramus in female reaching to about M.67 on outer ramus, with subapical spines, apex with 5 setae, medial margin with setae in tandem, lateral margin with spines in groups; article 1 on outer ramus with spine sets laterally and medial spines coupled with setae arranged in clusters, article 2 small, with 4 medium apical setae. Telson cleft 83 percent, apices well setose, without dorsal spines.

Description of holotype (female). *Body* (Fig. 14): pleon dorsally setose, setation moderately dense, transverse on pleonites 1–6, no longitudinally ranked setae in transverse band, pleonite 3 with additional setae in front of posterior margin, pleonites 5–6 with 1 spine on each side in setation rank; length, 8.7 mm.

Head (Fig. 14): eyes seen as small trace in alcohol.

First antenna (Fig. 14): length 0.66 of body, 1.7 second antenna, flagellum much longer than peduncle; accessory flagellum 4-articulate, reaching past article 3 of flagellum. *Second antenna* (Fig. 14): length 0.38 body; peduncle scarcely longer than flagellum, articles 4 and 5 equal in length, articles 3,4 and 5 with strong ventral setation; flagellum 19-articulate, well-setose ventrally, lacking calceoli.

Left mandible: palp article 3 setal formula = 3A, 3-1-1B, many D, 5E; incisor 5-toothed, lacinia mobilis 4-toothed, 9 setose accessory blades. *Right mandible* (Fig. 14): incisor 4-toothed; lacinia mobilis bifid and weakly denticulate; accessory blades of 3 setose spines. *Left first maxilla* (Fig. 14): palp article 2 with 10 thin apical spines, 3 weakly subapical setae; inner plate with 15 widely spread medial setae. *Right first maxilla* (Fig. 14): palp article 2 with 4 thick apical spines fused to segment, with 1 articulate apicolateral spine, 1 small apicomedial articulate spine, 1 thick apicolateral seta. *Second maxilla* (Fig. 14): outer plate outer margin with 1 short seta; inner plate inner margin with strongly submarginal row of many setae.

First gnathopod (Fig. 14): coxal plate moderately setose below, posterior margin with 4 spines; article 4 with medium scythe spine, carpus short, unlobed; propodus rectangular, longer than wide, posterolateral angle weakly out-turned, palm transverse, almost straight. *Second gnathopod* (Fig. 14): much longer and slightly larger than first gnathopod, carpus elongate;

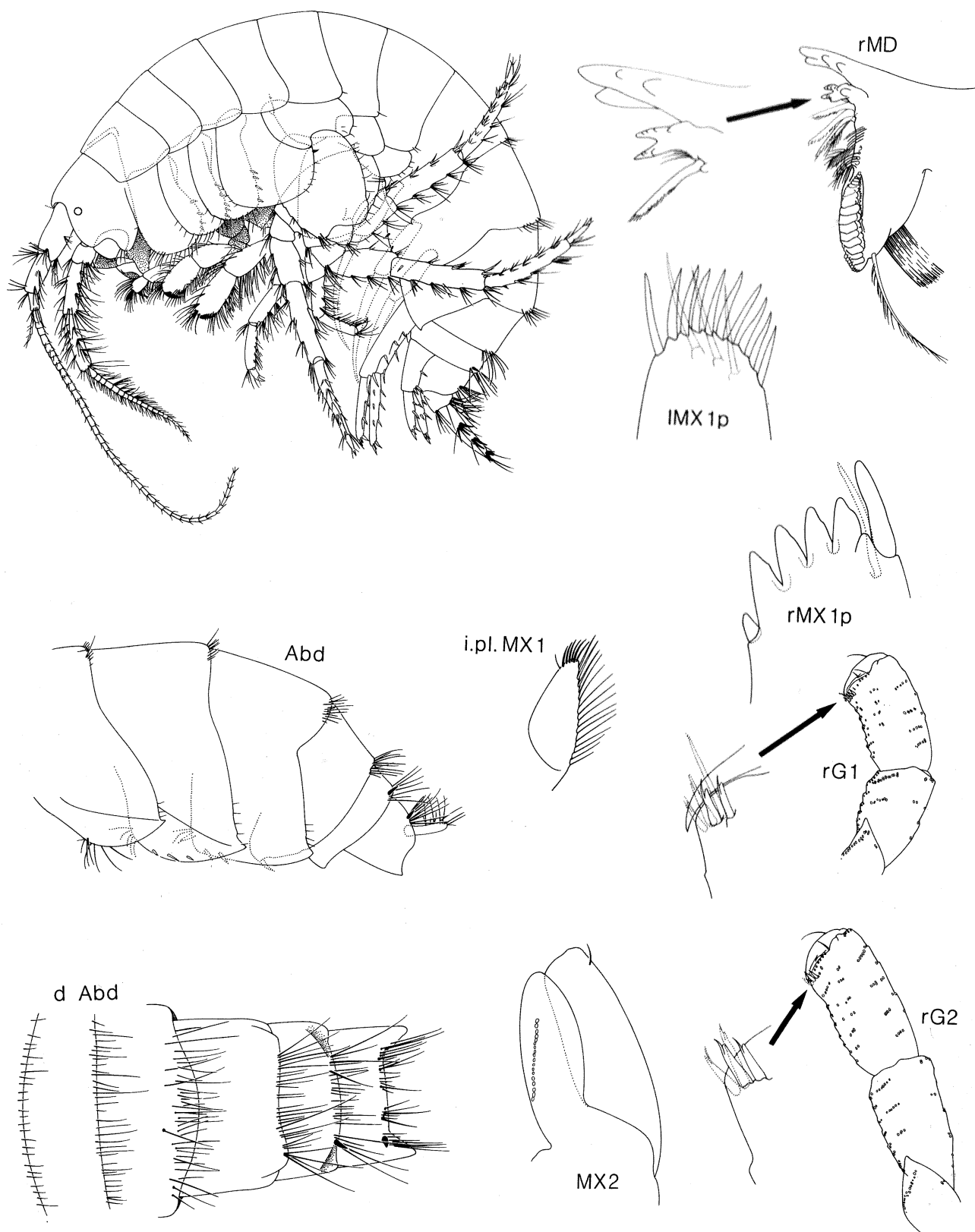


Fig.14. *Austrogammarus saycei* n.sp., holotype, female "k".

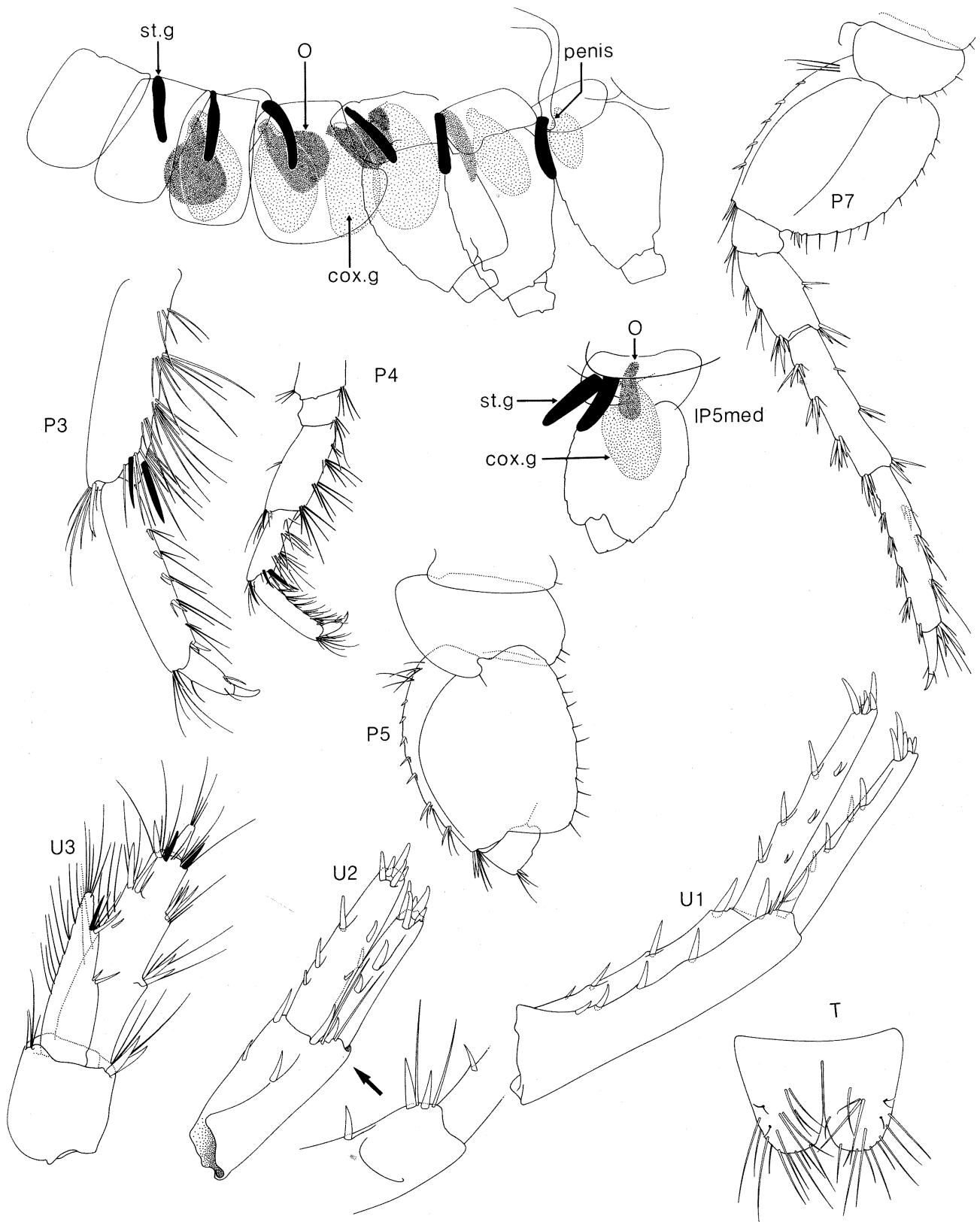


Fig.15. *Austrogammarus saycei* n.sp., holotype, female "k". Note presence of penis and vas deferens. Pereopods 3 and 4 not to same scale.

coxal plate with 5 posterior spines and weakly setose below.

Pereopods (Fig. 15): coxa 3 weakly setose below, coxa 4 not setose below, coxa 3 with 5 posterior spines, coxa 4 lacking posterior spines [actually uppermost seta thick], deeply emarginate; pereopods 3–4 not longer than gnathopod 2, pereopod 3 much longer than 4, article 4 well setose posteriorly, article 5 of pereopods 3–4 with formula of 1-0 posterior spines, posterior margin of article 6 on pereopods 3–4 with formula of 2-s-1-1-1, posterior spines (coupled with setal groups) in tandem, apical set forming pair of small locking spines; article 2 of pereopods 5–7 with medium length posterior setae, that of pereopods 6–7 with 1 spinule posteroventrally.

Oostegites (Fig. 15): rudimentary oostegites on coxae 2,3,4,5, oostegites 2,3,4 of medium size, paddle shaped, oostegite 5 small, like tubercle, each oostegite with rudimentary marginal setal bases; this female also with penial tubercle and vas deferens filled possibly with spermatophore material.

Epimera (Fig. 14): all epimera with small posteroventral tooth, epimeron 1 weakly rounded behind, epimeron 3 straight behind, each with sparse posterior setae ventrally, epimeron 1 with 3 ventral setules posteriorly and 8 long anteroventral setae, epimera 2 and 3 with 3 and 2 ventral spines anteriorly. **Pleon** (Fig. 14): pleonites 1–6 with moderately dense dorsal setae arranged transversely, pleonite 3 with few setae in front of main band, pleonites 5–6 also with dorsal spine on either side; uropod lengths relative to uropod 1: uropod 2 = 0.60, 3 = 0.65. **Pleopods**: retinacula variable, mostly 2 regular and 2 accessory simple members but occasionally with only 1 main member and 1–3 accessories.

First uropod (Fig. 15): peduncle length 1.3 rami, outer ramus slightly shorter than inner; outer margin of peduncle with 2 apicolateral spines and 2 setae besides strong row of dorsal spines, medial margin with row of spines, no setae. **Second uropod** (Fig. 15): peduncle same length as rami, apicolateral corner with 2 spines and 2 setae. **Third uropod** (Fig. 15): peduncle length 0.5 outer ramus, much shorter than urosomite 3; outer ramus proximal article with 2 lateral transverse spine rows plus 1 full and a partial row on medial margin; second article with 4 medium setae; inner ramus length 0.7 of outer, with setose inner margin, 2 pairs of lateral spines, 5 apical setae. **Telson** (Fig. 15): slightly shorter than urosomite 3; cleft 83 percent of its length; apices well setose, dorsum of each lobe with several setae, none basal.

Illustrations. Various illustrations are omitted for this species because complementary examples can be found in other species already illustrated. The upper lip of this individual looks like the illustration given for *Austrogammarus smithi*. Similarly, the lower lip, maxillae (except where noted in text) and maxilliped are like *A. australis*. Only the outline of maxilla 2 is shown for the deeper set of the medial oblique row of setae. Likewise, only the outlines of the gnathopods

are drawn; their general setation resembles *A. australis*. Pereopod 3 is longer and the setae are longer than on pereopod 4. Pereopod 6 is like pereopod 7 but longer.

Aberrancy. Pereonite 6 on the left side bears 2 sternal gills.

Remarks. This species, of which only the female is known, differs from *A. australis*, of which only the male is known, mainly in the gnathopods and uropod 3. The carpus of gnathopod 2 is much shorter than in males of *A. australis*. Additionally, coxae 2–4 are weakly setose ventrally in *A. saycei* compared to *A. australis*. Article 5 of pereopods 3–4 has much lower spine counts than in *A. australis*; setae are much sparser and shorter on pereopods 5–7 than in *A. australis*; on article 2 of pereopod 5 the setules are longer but on pereopods 6–7 shorter than in *A. australis*. Uropod 3 in *A. australis* has setal groups on the inner margin of the inner ramus and the medial margin of the outer ramus, whereas *A. saycei* has spines and spine pairs. Epimeron 3 of *A. saycei* has anteroventral setae in contrast to *A. australis*, and the telson is not fully cleft in *A. saycei*.

Distribution. Victoria, Sassafras Creek on Old Patch Road (Dandenongs).

Austrogammarus spinatus n.sp.

Figs 16–18

Material examined. Australian Museum, AM P35843, A 40, stream 2.4 km north of Croydon, on Maroondah Highway, Vic., 22 July 1961, W.D. Williams, collector, HOLOTYPE male “f” 9.1 mm (illustrated), AM P35844 of above type locality ALLOTYPE female “g” (partly illustrated).

Diagnosis. Flagellum of antenna 2 poorly setose, bearing calceoli in male. Coxae 1–3 weakly setose ventrally, coxa 4 lacking ventral setae, only with posteroventral setae and several anteroventral setae, coxae 1–3 with several posterior spines. Gnathopods sexually dimorphic, palmar corners not bent outward, with 9–10 spines. Posterior spines on article 6 of pereopods 3–4 in sets of 2–3, without group of setae placed between spine sets 1 and 2, formula thus 2-2-2-2-2-2-1 or 2-2-3-2-2-2-1; lateral spine formulas on article 5 of pereopods 3 and 4 = 6-3-3-2-1 and 8-5-4-4; article 2 of pereopod 5 with short setae except apically, of pereopods 6–7 with short posterior setae; setae of articles 4–6 of pereopods 5–7 short and sparse; article 4 of pereopods 5–7 short. Epimeron 1 without anteroventral setae. Urosomal setation dorsally short, stiff; pleonites 4–6 with 2 dorsolateral spines on each side, pleonite 5 with additional mid-dorsal spine on each side; uropods 1–2 without setae on peduncles, apicolateral corner of peduncle on uropod 1 with 2 spines only, on uropod 2 with 3 spines, medial spines on peduncle of uropod 1 (distal to proximal) = 1-1-1-1-1-1, setae in same sets = 0, on uropod 2 = 1-1-1-1 and 0; uropod 3 well setose, inner ramus in female reaching

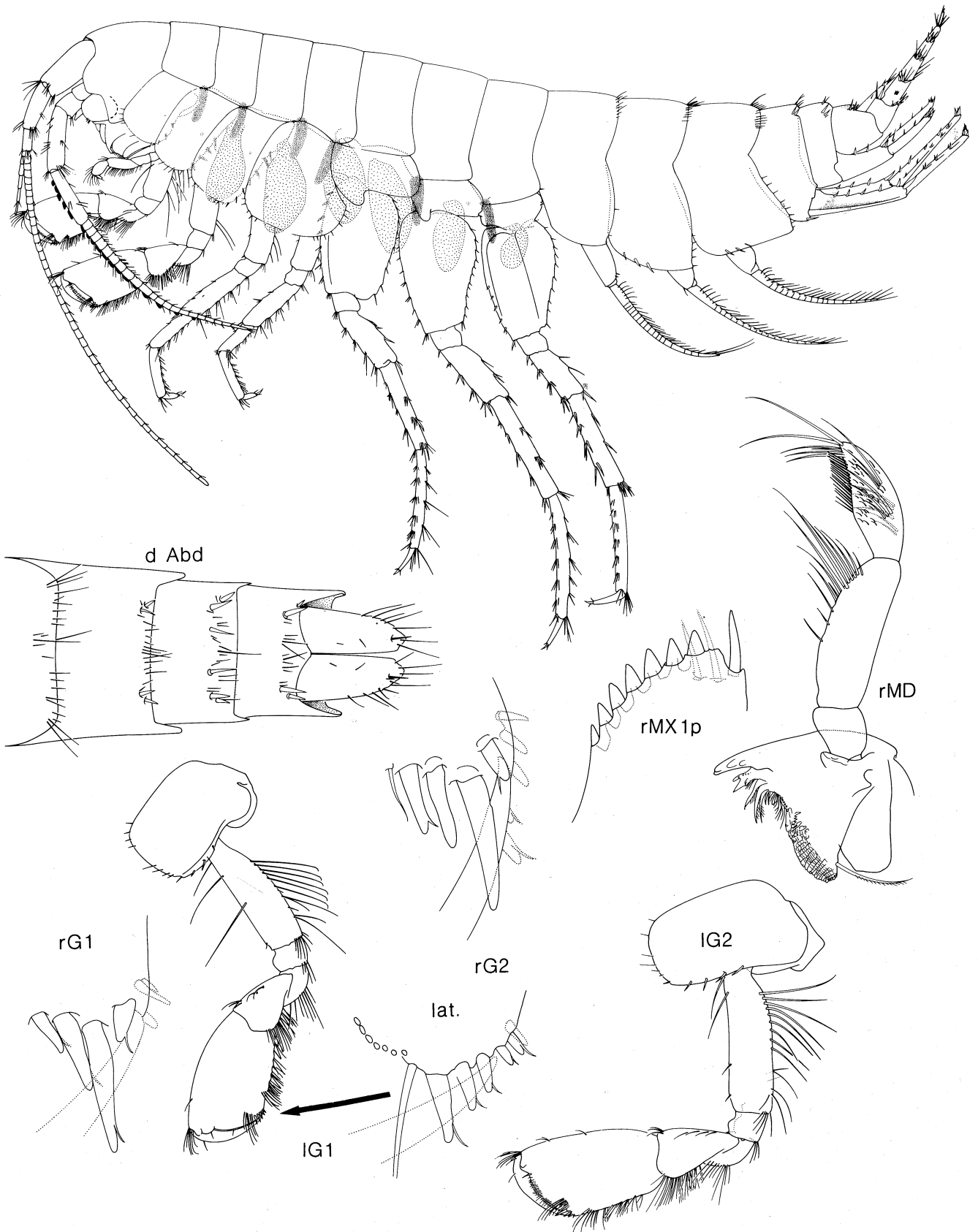


Fig.16. *Austrogammarus spinatus* n.sp., holotype, male "F".

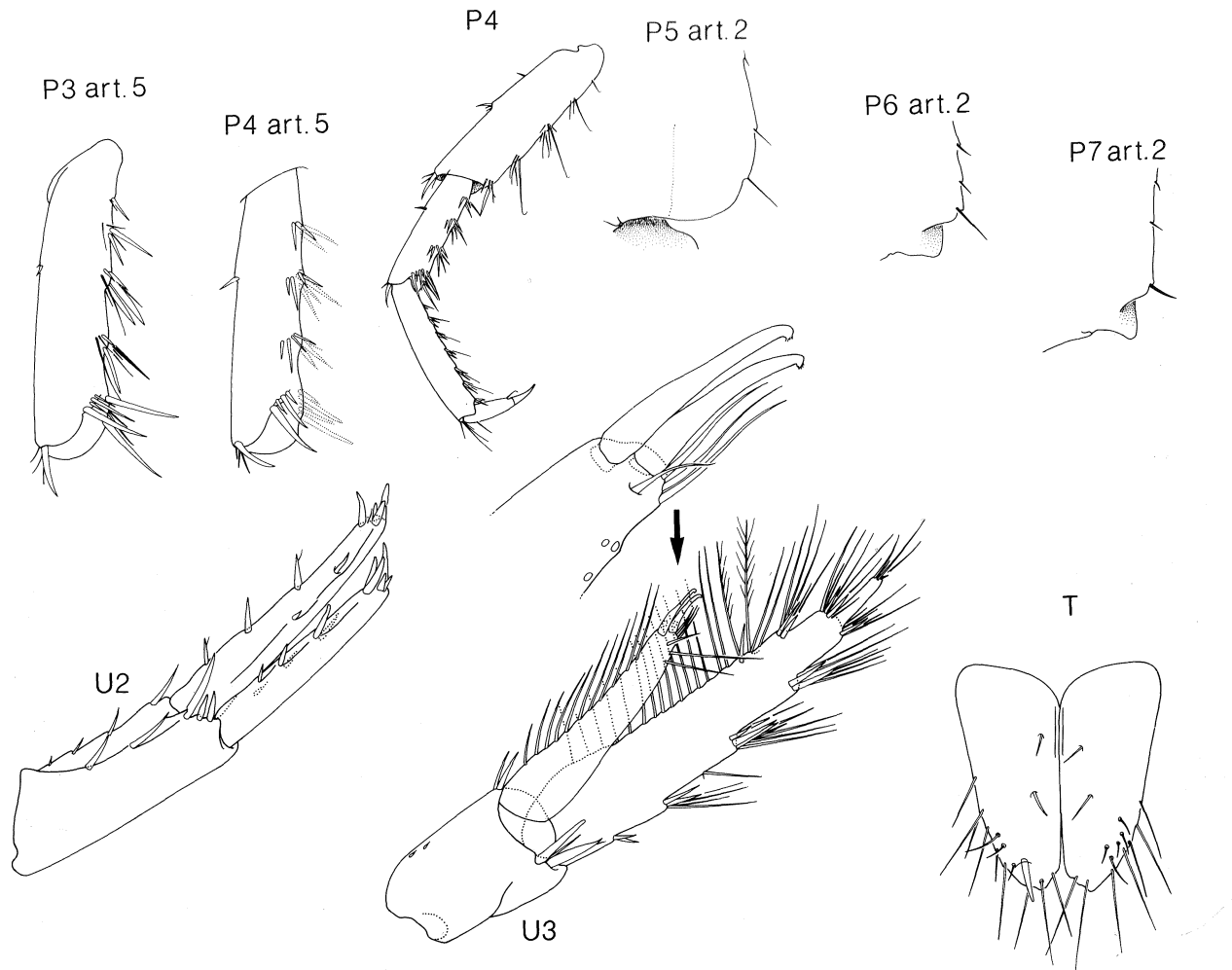


Fig.17. *Austrogammarus spinatus* n.sp., holotype, male "f".

about to M.45 on outer ramus, with 2 apical spines and 5 setae, medial margin with setae in tandem, lateral margin with spines in groups; article 1 on outer ramus with spine sets laterally, medial spines coupled with setae arranged in clusters, article 2 small, with 4 medium apical setae; inner ramus on male extending to M.55 on outer ramus, apex spines hooked, also with apicomедial setae. Telson cleft 100 percent, moderately setose apically but not dorsally, with 1 dorsal spine on each lobe.

Description of holotype (male). *Body* (Fig. 16): pleon dorsally setose, setation moderately dense and transverse on pleonites 1–6, no longitudinally ranked setae in transverse band, pleonite 3 with additional setae in front of posterior margin, pleonites 4–6 with 2 spines on each side in setation rank and pleonite 5 with additional mid-dorsal spine on each side, pleonite 5 with jagged pattern of setae and spines; length, 9.1 mm.

Head (Fig. 16): eyes in alcohol seen as small capsule.

First antenna (Fig. 16): length 0.90 of body, 2.0 second antenna, flagellum much longer than peduncle; accessory flagellum 7-articulate, reaching past article 9 of primary flagellum. *Second antenna* (Fig. 16): length 0.45 body; peduncle scarcely shorter than flagellum, articles 4 and 5 equal in length, peduncle article 5 armed with 5 calceoli, articles 3,4 and 5 with weak ventral setation; flagellum 22-articulate, poorly setose ventrally, with calceoli on articles 1–10, 12 and 14.

Left mandible: palp segment 3 setal formula = 2-1-2A, 3-3B, many D, 5E; incisor 5-toothed, lacinia mobilis 4-toothed, 6 setose accessory blades. *Right mandible* (Fig. 16): incisor 4-toothed; lacinia mobilis bifid and weakly denticulate; accessory blades of 3 setose spines. *Left first maxilla*: palp article 2 with 7 thin apical spines and 3 weakly subapical setae; inner plate with 17 widely spread medial and apicolateral setae. *Right first maxilla* (Fig. 16): palp segment 2 with 7 thick apical spines articulated to segment, with 1 articulate apicolateral spine, 2 thick apicolateral setae. *Second maxilla*: outer plate outer margin with 1 short

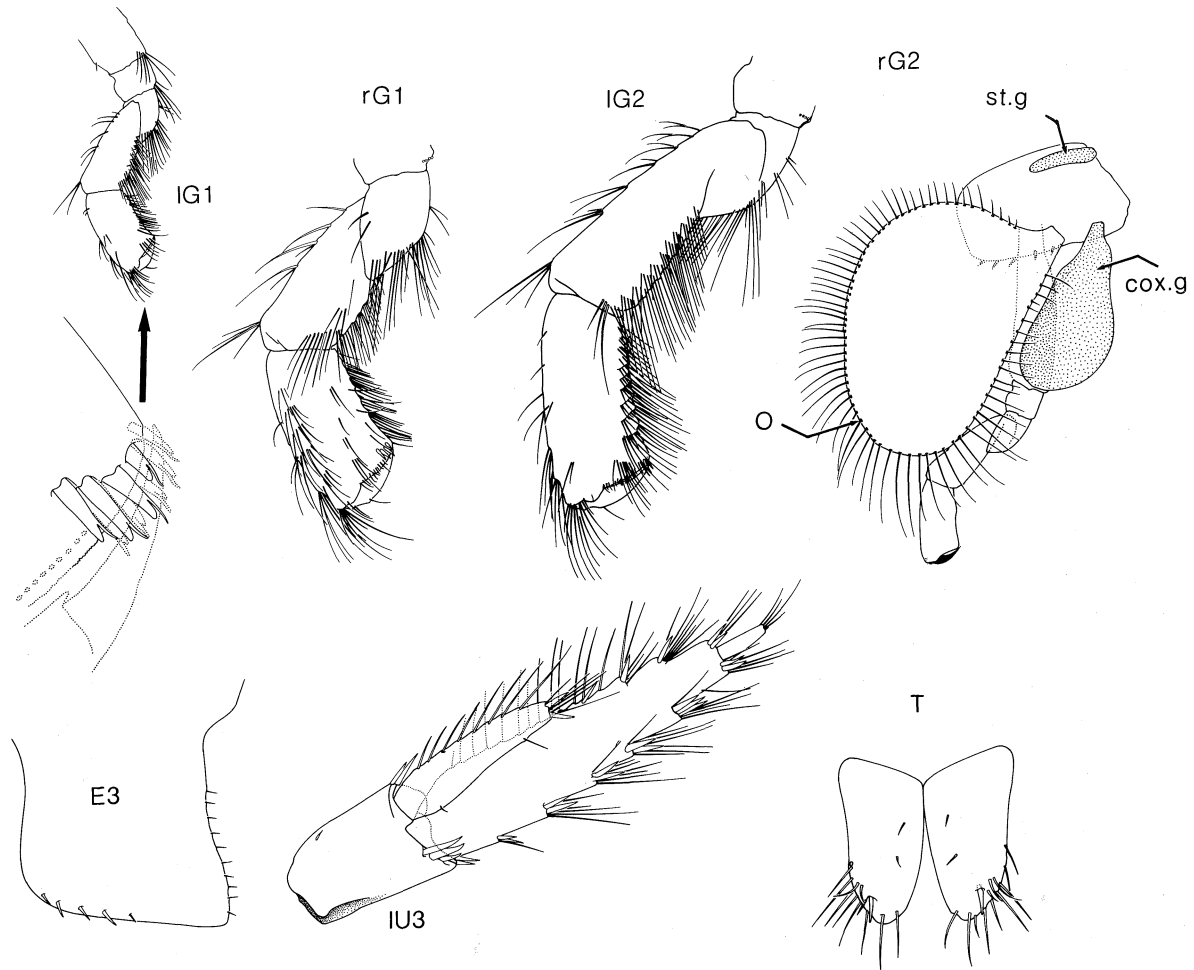


Fig. 18. *Austrogammaurus spinatus* n.sp., allotype, female "g".

seta; inner plate inner margin with strongly submarginal row of many setae.

First gnathopod (Fig. 16): coxal plate poorly setose below, posterior margin with 4 spines; article 4 without medium scythe spine, carpus short, unlobed; propodus broadly trapezoidal, longer than wide, expanding apically, posterolateral angle not out-turned, palm weakly oblique, rounded. **Second gnathopod** (Fig. 16): much longer and slightly larger than first gnathopod, carpus slightly more elongate; coxal plate with 5 posterior spines and weakly setose below.

Pereopods (Fig. 17): coxa 3 weakly setose below, coxa 4 not setose below, coxa 3 with 7 posterior spines, coxa 4 lacking posterior spines, deeply emarginate; pereopods 3-4 not longer than gnathopod 2, pereopod 3 much longer than 4, article 4 moderately setose posteriorly, article 5 of pereopods 3-4 with formula of 6-3-3-2-1 and 8-5-4-4 posterior spines, posterior margin of article 6 on pereopods 3-4 with formula of 2-2-2-2-2-1 and 2-2-3-2-2-2-1 posterior spines (coupled with setal groups) in tandem, apical set forming pair of small locking spines; article 2 of pereopods 5-7 with short posterior setae, that of pereopods 6-7 with 1 spinule

posteroventrally.

Epimera (Fig. 16): epimera 1-2 with small posteroventral tooth, epimeron 1 weakly rounded behind, epimeron 3 slightly falciform behind, each with sparse posterior setae ventrally, epimeron 1 with 3 ventral setules posteriorly and no anteroventral setae, epimera 2 and 3 with 3 and 3 ventral spines anteriorly. **Pleon** (Fig. 16): pleonites 1-6 with moderately dense dorsal setae arranged transversely, pleonite 3 with few setae in front of main band, pleonites 4-6 also with 2 dorsal spines on either side, pleonite 5 with additional mid-dorsal spine on each side and spine-setal pattern jagged; uropod lengths relative to uropod 1: uropod 2 = 0.70, 3 = 0.80. **Pleopods** (Fig. 16): retinacula variable, mostly 2 regular and 2 accessory simple members but occasionally with only 1 main member and 1 accessory.

First uropod (Fig. 16): peduncle length 1.0 rami, outer ramus slightly shorter than inner; outer margin with 2 apicolateral spines besides strong row of dorsal spines, medial margin with row of spines, no setae; [1 ramus with aberrant 6 apical spines]. **Second uropod** (Fig. 17): peduncle 0.90 length of rami, apicolateral

corner with 3 spines. *Third uropod* (Fig. 17): peduncle length 0.4 outer ramus, much shorter than urosomite 3, all spines distal; outer ramus proximal article with 4 lateral transverse spine rows plus 1 full, 1 partial row on medial margin; second article short, with 6 medium setae; inner ramus length 0.55 of outer, with setose inner margin, 3 lateral setae, 3 apical setae and 2 hooked spines. *Telson* (Fig. 17): slightly shorter than urosomite 3; cleft 100 percent of its length; apices moderately setose, dorsum of each lobe with few setae, none basal, each lobe with dorsal spine.

Description of allotype (female). Like male but antenna 2 lacking calceoli; gnathopods (Fig. 18) much smaller and thinner, carpi proportionately longer, propodi thin and elongate; oostegites (Fig. 18) present on coxae 2–5; inner ramus of uropod 3 slightly shorter than in male, 2 apical spines shorter and unhooked (Fig. 18).

In other respects the female has similar head, antennae, coxae, pereopods 3–7, uropods 1–2 and telson (Fig. 18). The teeth of epimera 1–2 are slightly sharper than in the male but this is not a sexual difference; epimera 2–3 (Fig. 18) have 3–4 spines respectively and epimeron 3 has an additional ventral seta posteriorly in the spine row. Uropod 2 also has 3 spines at the apicolateral corner of the peduncle. The dorsal pleonal armament pattern is similar.

Illustrations. Various illustrations are omitted for this species because complementary examples can be found in other species already illustrated. The upper lip of this species looks like the illustration given for *Austrogammarus smithi*. The lower lip, maxillae (except where noted in text) and maxilliped are like *A. australis*. Maxilla 2 has the more deeply set position of the medial oblique row of setae shown for *A. saycei*. The coxa with oostegite (Fig. 18) is drawn at the same magnification as the male coxae (Fig. 16).

Remarks. This species differs most from all other species in the genus by the greater complexity of the dorsal spine pattern on pleonites 4–6. Unlike any other species, lateral spine sets are paired and pleonite 5 has an additional mid-dorsal spine on each side. Also unlike any other species, the telson is quite elongate. The palmar corners of the gnathopods have at least 9 spines (5 and 4 on each face), which is 4 more than in any other previous species. This species appears to be quite remote from *A. australis* as based on the armaments of male uropod 3 (female *A. australis* unknown), the poorly setose coxae 1–4, the multispination of the urosome, the more spinose pereopods 3–4, and poorly setose pereopods 3–5, but it does resemble *A. australis* in the lack of anteroventral setae on epimeron 1, the presence of two odd (though hooked) spines on the inner ramus of uropod 3, the fully cleft telson, and the short article 4 of pereopod 7. Uropod 3 of female *A. spinatus* is quite distinct from *A. smithi*, *A. saycei* and *A. haasei* in spine and setal patterns and relative length of the inner ramus.

Distribution. Victoria, near Croydon, now a suburb of Melbourne.

Austrogammarus multispinatus n.sp.

Figs 19–21

Material examined. Australian Museum, AM P38545, A 41, small pond along Stud Road, approximately 3 km north of Dandenong, Vic., 22 July 1961, J. Lim, collector, HOLOTYPE, male “t” 10.2 mm (illustrated), and AM P38546 ALLOTYPE, ovigerous female “u” 12.5 mm (partly illustrated), AM P38467: male “x” 9.4 mm, male “y” 8.3 mm, male “z” 8.2 mm, and 20+ other males, no other females in collection.

Diagnosis. Flagellum of antenna 2 poorly setose, bearing calceoli in male. Coxae 1–4 weakly to not setose ventrally, coxa 4 lacking ventral setae, only with posteroventral setae and several anteroventral setae, coxae 1–3 with several posterior spines. Gnathopods dimorphic between the sexes, palmar corners not bent outward, with 9 spines. Posterior spines on article 6 of pereopods 3–4 in sets of 1–5, without group of setae placed between spine sets 1 and 2, formulae thus 2-5-4-4-5 and 2-5-4-4-3-1; lateral spine formulas on article 5 of pereopods 3 and 4 = 6-4-3-2 and 6-4-4-3-2; article 2 of pereopods 5–7 with short posterior setae; setae of articles 4–6 of pereopods 5–7 long and of only moderate density; article 4 of only pereopod 7 short. Epimeron 1 without anteroventral setae. Urosomal setation dorsally short and stiff; pleonites 4–6 with 2 (aberrantly 3 on left side of segment 5) dorsolateral spines on each side, pleonite 4 with additional mid-dorsal spine (set) on each side, pleonite 5 with additional 2 (sets of) single discontinuous mid-dorsal spines on each side: formula thus from medial to lateral on 1 side only, pleonite 4 = 0-1-2, pleonite 5 = 1-1-2 (or 1-1-3), pleonite 6 = 0-0-2; only uropod 2 (in female) with 1 apicolateral seta on peduncle, apicolateral corner of peduncle on uropod 1 with 2 spines only, on uropod 2 with 3 (in male) or 2 (in female) spines, medial spines on peduncle of uropod 1 (distal to proximal) = 1-1-1-1-1-1, setae in same sets = 0, on uropod 2 = 1-1-1-1 and s-0-0-0; uropod 3 well setose, in female inner ramus reaching to about M.45 on outer ramus, with 2 apical spines, 2 setae, medial margin with setae in tandem, outer ramus lateral margin with spines in groups; male uropod 3 with inner ramus longer, extending to M.55 on outer ramus, with apical spines hooked, apicomедial margin bearing several long thick setae; article 1 on outer ramus with spine sets laterally, spines coupled with setae arranged in clusters medially, article 2 of medium length, with 5 medium apical setae. Telson elongate, cleft 100 percent moderately setose apically but setae sparse dorsally, with 1 dorsal spine on each lobe.

Description of holotype (male). *Body* (Fig. 19): pleon dorsally setose, setation moderately dense, stiff and transverse on pleonites 1–6, no longitudinally ranked setae in transverse band, pleonite 3 with additional short transverse bands of setae in front of

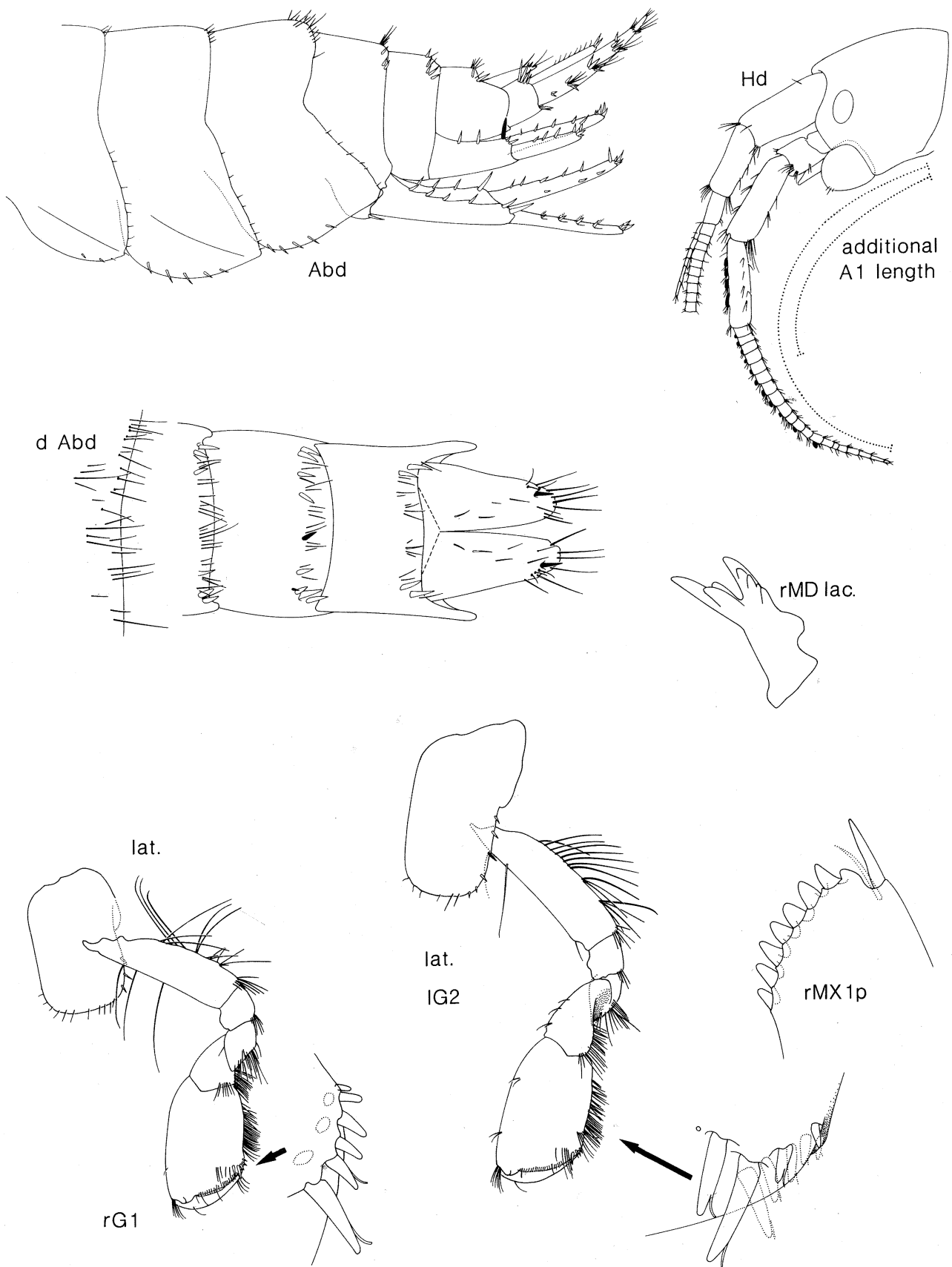


Fig.19. *Austrogammarus multispinatus* n.sp., holotype, male "t".

posterior margin, pleonites 4–6 with 2 spines (aberrantly 3) on each side in setation rank, pleonite 4 with additional mid-dorsal spine on each side, pleonite 5 with weakly jagged pattern of setae and spines and an additional mid-dorsal spine on each side, thus formula of spines from medial to lateral on each segment as follows: pleonite 4 = 0-1-2, pleonite 5 = 1-1-2 (aberrantly 1-1-3), pleonite 6 = 0-0-2; length, 10.1 mm.

Head (Fig. 19): eyes seen as small capsule in alcohol.

First antenna (Fig. 19): length 0.70 of body, 1.8 second antenna, flagellum much longer than peduncle; accessory flagellum 6-articulate, reaching past article 8 of flagellum. *Second antenna* (Fig. 19): length 0.55 body; peduncle subequal to flagellum, articles 4 and 5 equal in length, peduncle article 5 armed with 4 calceoli, articles 3,4 and 5 with weak ventral setation; flagellum 20-articulate, poorly setose ventrally, with calceoli on articles 1–9, 11 and 13.

Left mandible: palp article 3 with 5,2,2A, 5,4B, many D, 6E; incisor 5-toothed, lacinia mobilis 4-toothed, 7 setose accessory blades. *Right mandible* (Fig. 19): incisor 4-toothed; lacinia mobilis bifid and strongly denticulate; accessory blades of 4 setose spines; setal formula on article 3 of palp = 5,3,2A, 7,1B, 6 E. *Left first maxilla*: palp article 2 with 9 thin apical spines, 5 weakly subapical setae; inner plate with 14 widely spread medial and 7 apicolateral setae. *Right first maxilla* (Fig. 19): palp article 2 with 7 thick apical spines articulated to segment, with 1 articulate apicolateral spine, 1 thick apicolateral seta. *Second maxilla*: outer plate outer margin with 1 long seta; inner plate inner margin with strongly submarginal row of many setae.

First gnathopod (Fig. 19): coxal plate sparsely setose below, posterior margin with 3 spines; article 4 without medium scythe spine, carpus short, unlobed; propodus broadly rectangular, longer than wide, not expanding apically, posterolateral angle scarcely out-turned, palm weakly oblique, rounded. *Second gnathopod* (Fig. 19): longer and slightly larger than first gnathopod, carpus slightly more elongate; coxal plate with 6 posterior spines, weakly setose below.

Pereopods (Fig. 20): coxae 3–4 not setose below, coxa 3 with 8 posterior spines, coxa 4 lacking posterior spines, deeply emarginate; pereopods 3–4 not longer than gnathopod 2, pereopod 3 longer than 4, article 4 moderately setose posteriorly, article 5 of pereopods 3–4 with formula of 6-4-3-2 and 6-4-4-3-2 posterior spines, posterior margin of article 6 on pereopods 3–4 with formulae of 2-5-4-4-5 and 2-5-4-4-3-1 posterior spines (coupled with setal groups) in tandem, apical set forming pair of small locking spines; article 2 of pereopods 5–7 with short posterior setae, that of pereopods 6–7 with 1 spinule posteroventrally; pereopods 5–7 generally smaller in relation to coxae than in *A. spinatus*, excavation of coxa 4 therefore larger to fit relatively larger coxa 5.

Epimera (Fig. 19): epimera 1 and 3 with small posteroventral tooth, epimeron 1 weakly rounded

behind, epimeron 3 slightly falciform behind, each with sparse posterior setae ventrally, epimeron 1 with 3 ventral spinules and setules posteriorly, no anteroventral setae, epimera 2 and 3 with 5 and 5 ventral spines anteriorly. *Pleon* (Fig. 19): pleonites 1–6 with moderately dense dorsal setae arranged transversely, pleonite 3 with few setae in front of main band, pleonites 4–6 also with 2 dorsal spines on either side, pleonite 4 with 1 additional and pleonite 5 with 2 additional mid-dorsal spines on each side and spine-setal pattern slightly jagged; uropod lengths relative to uropod 1: uropod 2 = 0.75, 3 = 0.75. *Pleopods* (Fig. 20): retinacula 2 regular and 1–2 accessory simple members.

First uropod: peduncle length 1.0 rami; outer margin with 2 apicolateral spines besides strong row of dorsal spines, medial margin with row of spines, no setae. *Second uropod* (Fig. 20): peduncle 0.83 length of rami, apicolateral corner with 3 spines. *Third uropod* (Fig. 20): peduncle length 0.45 outer ramus, much shorter than urosomite 3; outer ramus proximal article with 5 lateral transverse spine rows plus 2 full rows on medial margin, second article with 5 medium apical setae; inner ramus length 0.63 of outer, with setose inner margin, 5 lateral setae, 3 apical setae, 2 hooked spines. *Telson* (Fig. 19): slightly shorter than urosomite 3; cleft 100 percent of its length; apices moderately setose, dorsum of each lobe with few setae, none basal, each lobe with dorsal spine.

Description of allotype (female). Like male, but antenna 2 lacking calceoli (Fig. 21); gnathopods (Fig. 21) much smaller, thinner, carpi proportionately longer, propodi thin, elongate, palmar corner spines 8–9; large oostegites present on coxae 2–4, with smaller on coxa 5; apicolateral corner of peduncle on uropod 2 with 2 spines and 1 seta (3 spines in male); inner ramus of uropod 3 (Fig. 21) slightly shorter than in male, the 2 apical spines shorter, unhooked, spread apart.

In other respects the female has similar head, antennae, coxae, pereopods 3–7, uropods 1–2 and telson. Spine counts on article 5 of pereopod 3 = 3-1-1-1, article 6 = 2-2-2-2-2-2. Teeth of epimera 1 and 3 are slightly sharper than in male but this may be a varietal difference, not sexual (see *A. spinatus* for similar observation); epimera 2–3 have 6 and 7 spines respectively and epimeron 1 has 2 spines and 2 ventral notches with setules. Dorsal pleonal armament pattern is similar in that pleonite 5 has 3 sets of spines but dorsal spine count for pleonite 4 is 0-0-2, pleonite 5 = 1-1-2, and pleonite 6 = 0-0-3!

This female has 43 eggs in the brood pouch but appears to have lost several before our analysis.

Variables. Males “x”, “y” and “z” are used to note variables; male “z” is the smallest available specimen (8.2 mm). Dorsal spine formulas on pleonites 4,5,6 on male “z” are 0-1-2, 1-1-2, 0-0-2; on male “y” they are 0-1-3, 1-1-3 and 0-0-2; on male “x” they are 0-1-2, 1-1-3 and 0-0-2 (0-0-1 aberrantly). Spine formulas on

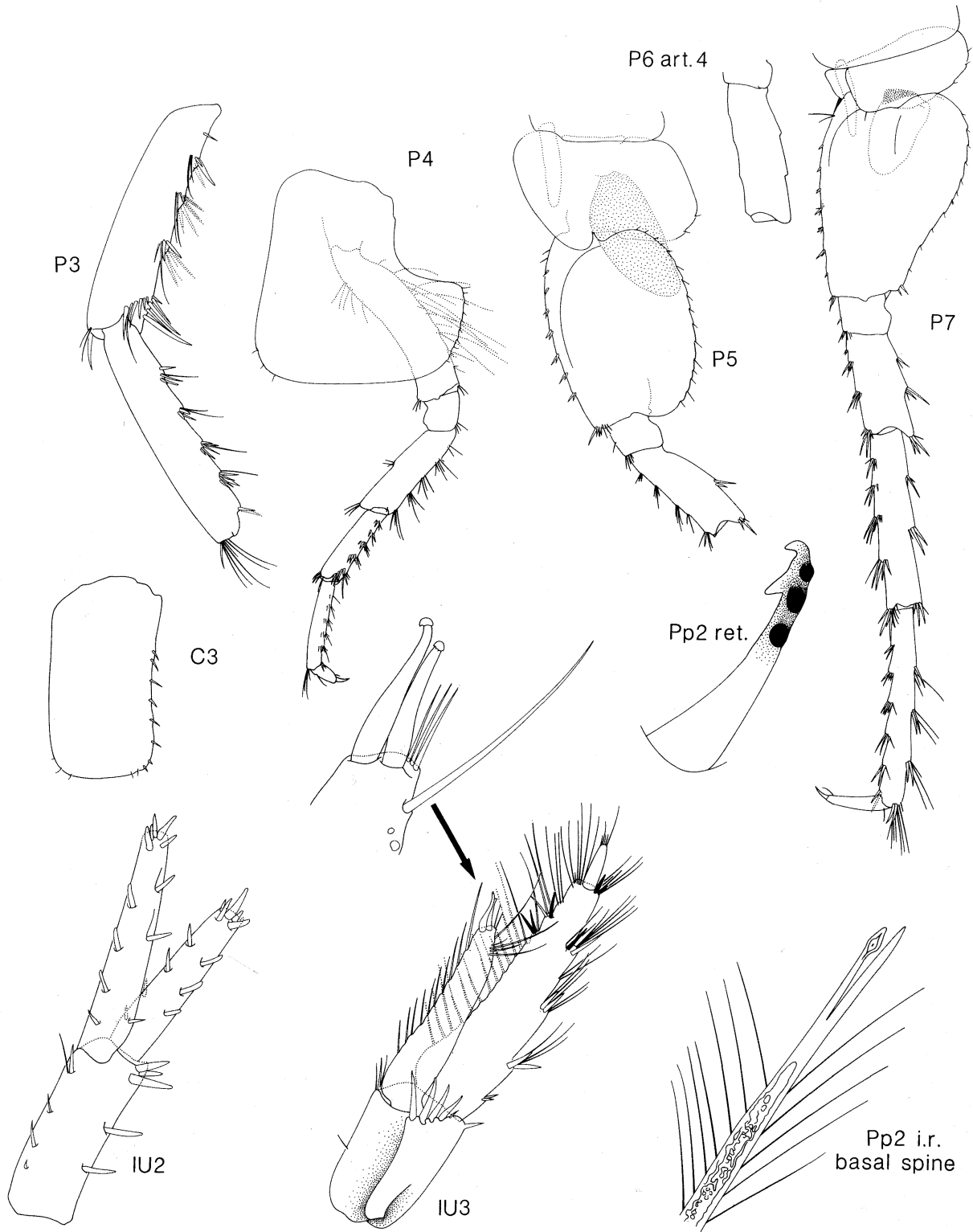


Fig.20. *Austrogammarus multispinatus* n.sp., holotype, male "t".

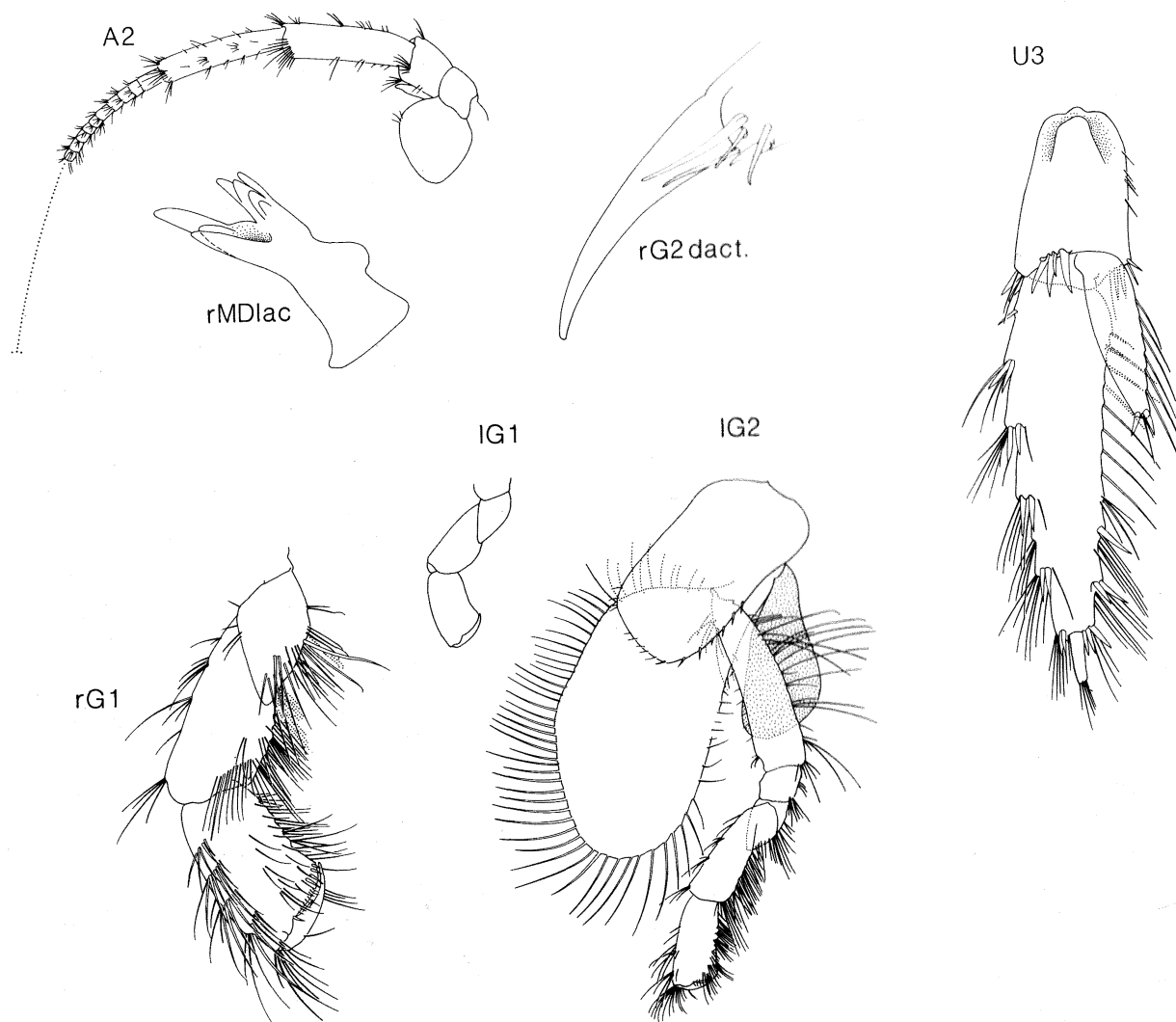


Fig.21. *Austrogammarus multispinatus* n.sp., allotype, female "u". IG1 and IG2 to same scale.

epimera 1,2,3 for male "z" are, epimeron 1 = 2 spines, no notches, epimeron 2 = 4 spines, epimeron 3 = 4 spines; for male "y" these numbers are 2 and 2 notches, 4 and 5; for male "x" they are 2 and no notches, 5 and s + 4 spines. In male "z" 4 calceoli occur on article 5 of antenna 2, 1 calceolus each on flagellar articles 1-7, 9, and 11. Uropod 2 has only 2 apicolateral spines on the peduncle.

The setules on article 2 of pereopods 5-7 are thicker than in other species and should be called spinules.

Illustrations. Various illustrations are omitted for this species because complementary examples can be found in other species already illustrated. The upper lip of this species looks like the illustration given for *Austrogammarus smithi*, though it is somewhat more attenuate below. The lower lip, maxillae (except where noted in text), and maxilliped are like *A. australis*. Maxilla 2 has the deeper set of the medial oblique row

of setae shown for *A. saycei*. The coxa with oostegite (Fig. 21) is drawn at the same magnification as the male coxae (Fig. 19). Uropod 1 is uncomplicated and described as seen attached to the urosome.

Relationship. This species differs from all other species in the genus by the even greater complexity of the dorsal spine pattern on pleonites 4-6 than seen in *A. spinatus*. Pleonite 5 has an additional mid-dorsal spine on each side. Like *A. spinatus*, the telson is elongate.

The palmar corners of the gnathopods in most individuals have at least 9 spines (5 and 4 on each face), which is a condition like *A. spinatus*.

This species differs from *A. spinatus* consistently (even in the smaller males of the size found in *A. spinatus*) in the extra set of spine(s) on pleonite 5, but other attributes are less consistent; for example, the spines on the apicolateral corner of the peduncle on

uropod 2 vary between 2 and 3 and the lateral spines counts on the urosome are too variable for consistent specific distinction.

Distribution. Victoria, near Dandenong, small pond along road. Dandenong is a small town east of Melbourne.

Austrocrangonyx Barnard & Karaman

Austrocrangonyx Barnard & Karaman, 1983: 61.

Type species. *Gammarus barringtonensis* Chilton, 1916 by original designation.

Introduction. This genus was erected by Barnard & Karaman (1983) to accommodate certain (probably 5) Australian species. Only one of these, *A. barringtonensis*, we now regard as properly placed within the genus as here more tightly rediagnosed. The other species previously included are redistributed to the new genus *Antipodeus* (*A. antipodeus*, *A. niger*, *A. ripensis*, *A. mortoni*). Additionally, however, we describe as new a further species within the genus (*A. hynesi*). We concur with the validity of the genus, but on the basis of our redescription of the type species are now enabled to provide a more comprehensive diagnosis than given by Barnard & Karaman (1983). We note that an "original" description of the genus was put forward a second time (Barnard & Barnard, 1983: 422) but that its creation by Barnard & Karaman (1983) has precedence; their paper was published 31 March 1983, whilst Barnard & Barnard's (1983) description was published 10 May 1983. There are no differences between the two generic diagnoses and associated text.

Diagnosis. Urosomites with mostly sparse transverse setation. Rostrum weak to obsolete, lateral cephalic lobes weakly projecting but strong antennal sinus present. Eyes small to medium, ovate.

Antenna 1 elongate, much longer than antenna 2, ratio of peduncular articles about 3:2:1, accessory flagellum 3-4-articulate. Antenna 2 peduncle longer than flagellum [calceoli unknown, only females or juveniles discovered].

Ratio of mandibular palp articles about 2:6:5, article 2 moderately setose, article 3 falcate, setae = ABDE. Labium lacking inner lobes. Maxillae medially setose, inner plate of maxilla 1 ovate, only apical half setose medially, outer plate with 9 spines, palps asymmetric, one side with thin apical spines, other side with thick apical spines often fused to segment. Inner plate of maxilla 2 lacking oblique row of setae on face, though upper member of 4-5 main medial setae slightly submarginal; inner plates of maxillae 1-2 moderately covered with long straw-like pubescence. Maxillipedal palp articles 2-3 moderately setose laterally, medially or ventrally, article 3 with organised rank of thick scythe-spines near base of dactyl.

Coxae 1-4 weakly elongate, coxae 1-3 lacking row of posterior spines, coxa 1 weakly expanded below, not prominent, coxa 4 deeply emarginate posterodorsally,

coxa 5 much shorter than 4. Gnathopods 1-2 small to medium in size, [? sexually dimorphic], carpi weakly elongate, article 4 on gnathopod 1 without medium scythe-spine but bearing posterior hump, propodus rectangular, palms almost transverse, spines at corner of palm 2-4 only; spines along palm sparse (versus *Austrogammarus*).

Posterior spine sets on article 6 of pereopods 3-4 unevenly spaced only in juveniles. Pereopods 5-7 moderately elongate, article 2 expanded, posteroventrally lobate on pereopods 5-7 but more weakly so on pereopods 6-7, dactyls of pereopods 3-7 with only marginal and facial setule (2 total).

Coxae 2-7 with sac-like gill, that on coxa 7 not reduced. Thoracic segments with lateral sternal gills, some anterior segments with additional sternal gill on medial line.

Basomedial setae on inner rami of pleopods 1-3 bifid, branches diverse, of different length and shape but, occasionally 1 branch with diamond head, or both simple; retinacula 3-6, accessory retinacula absent.

Several pleonites with dorsal setae and/or spines. Epimera with few ventrofacial spines only, posterior margins weakly setulate. Rami of uropods 1-2 extending subequally, each with 2 rows of spines, uropod 1 lacking basofacial armaments. Uropod 3 extended, parviramous, peduncle short, outer ramus 2-articulate, article 2 short, inner ramus generally reaching to about M.10 on article 1 of outer ramus. Telson short, cleft about 70-80 percent, lobes tumid laterally, with sparse but elongate apical and dorsal setation, no basolateral armaments.

Additional description. Flagellum of antenna 1 lacking major armaments. Upper lip apical margin evenly rounded. Accessory blades (rakers) on mandibles with interraker plumose seta; very few additional penicillate setae beyond rakers and riding onto base of molar, instead with 2 very large bent basal molarial ragged setae besides regular apical molarial seta; palp article 3 shorter than 2, article 2 with no basoanterior setae but several apicoanterior setae. Both plates of maxilla 2 with row of long distal setae. Maxillipedal palp article 3 apex weakly produced and pubescent; outer plate with a few setose spines distally continuous with row of many tooth-spines medially; inner plate with 3-4 (fourth sometimes apical, sometimes ventrofacial) thick spines and plumose setae apically and long medial row of plumose setae. Dactyls of gnathopods reaching ends of palms, with small recumbent inner tooth-spine and several setules at inner nail articulation line. Pereopod 7 shorter than pereopod 6; article 2 of pereopods 5-7 setose posteriorly. Sternal processes: 5 pairs of fleshy, sausage-shaped, comma-like sternal gills present on thoracic segments 3-7, segments 2 and 3 often with small midline sternal gill besides. Posteroventral tooth of epimera 1-3 less blunt than in *Austrogammarus*. Pleopods similar, rami equal. Apicolateral corner of peduncle on uropod 1 with 2 spines. Both rami of uropods 1-2 with 5 apical spines. Uropod 3 extending

well beyond uropods 1 and 2 in entire animal; all peduncular spines apical; medial setae of outer ramus not plumose. Ventrodiscal spine on urosomite 1 at base of uropod 1 long (versus short in *Austrogammarus*).

Characters of interspecific value. Hyaline hump on article 4 of gnathopod 1 variably developed. Pereopods 3–4 with varying spine counts on articles 5–6, thus article 5 with few to many spines in specific pattern, article 6 with posterior armament sets composed of setae and attendant spines in groups of 1–2 per set, occasionally set 2 adjacent to locking spine set (called set 1) composed only of setae.

Sexual attributes. Females never with calceoli. Oostegites generally paddle shaped, with oostegite on coxa 5 smallest, in young or non-breeding females lacking setae or with rudiments of setal bases marginally, in terminal females oostegites of coxae 2–4 huge, projecting below coxae, oostegite of coxa 5 generally small. Males unknown.

Relationships. *Austrocrangonyx* differs from *Austrogammarus* in many characters, among them, the lack of basomedial setae on the inner plate of maxilla 1, the lack of a facial row and also lack of basomedial setae on the inner plate of maxilla 2, the presence of a hump on article 4 of gnathopod 1, the lack of posterior spines on coxae 1–3, the presence of locking setae as well as locking spines on pereopods 3–4, the larger

number of retinacula and the lack of accessory simple retinacula on the pleopods, the tiny inner ramus of uropod 3 and the sparser representation of setae on the telson.

Of minor degree is the slightly more protuberant posteroventral corners of article 2 on pereopods 5–7, which come to fuller expression in the following genus, *Antipodeus*, where article 2 is more evenly expanded. The ventral spine on urosomite 1 near the base of uropod 1 is longer than in *Austrogammarus*. The posteroventral corners of epimera 1–3 are more extended than in *Austrogammarus*. The space between the rakers and molar has few small penicillate setae; instead 2 large hooked and ragged setae occur on the base of the molar.

Composition. This genus includes two closely related species: *A. barringtonensis* (Chilton) and *A. hynesi* n.sp. Further investigation may reveal that they are conspecific, but, since the material of the two taxa before us is consistently different in at least two characters we judge of interspecific value, we consider it best to describe the taxa as individual species. The limited number of known species (2) in the genus and their close similarity preempts the need for comprehensive species diagnoses and these are therefore not included for this genus.

Key to the Species of *Austrocrangonyx*

1. Hyaline hump on article 4 of gnathopod 1 obvious; dominant spine number in sets of article 6 of pereopods 3–4 = 2 *A. barringtonensis*
- Hyaline hump on article 4 of gnathopod 1 weak; dominant spine number in sets of article 6 of pereopods 3–4 = 1 *A. hynesi*

Austrocrangonyx barringtonensis (Chilton)

Figs 22–24

Gammarus barringtonensis Chilton, 1916: 86–90, figs 4–12.

Material examined. TYPES, AM P.4080, Barrington Tops, near Dungog, NSW, 1400 m, C. Hedley, Dec 1915, composed of 4 specimens; we select as PARALECTOTYPE newly designated juvenile “a” 5.5 mm (illustrated), with apices of pereopods 5–7 missing; 3 other specimens, badly broken or crushed with many parts missing, specimen “b” (half = 6.9 mm), specimen “c” in 2 pieces, 6.1 mm, and broken specimen “d” lacking head, 3.75 mm.

AM P. 4083, newly selected LECTOTYPE, female “i” (partly illustrated), length unknown, slides from above locality, A1 urop + telson, A2 prp + plp, A3 ant. gn. prp., A4 Ant 1 Ant 2 + mouthparts, with oostegite of pereopod 5 extant as proof of sex. [No slide seems to contain parts dissected from the 4 specimens above.]

The lectotype selected, on 4 excellent eosin-stained slides, has only the head capsule and dorsal pleonite

capsule missing. The paralectotype selected has the following parts missing: pereopod 3, right articles 5–6 of pereopod 4, left pereopods 6–7, right articles 5–7 of pereopods 5–7, some apices of right uropods 1–2 and right uropod 3.

Diagnosis. Hyaline hump on article 4 of gnathopod 1 obvious; dominant spine number in sets on article 6 of pereopods 3–4 = 2.

Description of paralectotype (juvenile). *Body* (Fig. 22): smooth but pleon dorsally setose, setation sparse and transverse on pleonites 4–6, but pleonites 1–3 with slightly denser setation, pleonite 6 with 1 spine on each side; setation on pleonites 1–3 continuous dorsally but on pleonites 4–6 situated in groups, thus following formula for 1 side of each segment to mid-dorsal line: pleonite 1 = 5 continuous setae, pleonite 2 = 4–5 continuous, pleonite 3 = 3 continuous, pleonite 4 in groups of 2 and 2, pleonite 5 in groups of 1 and 2 and 2, pleonite 6 in groups of 1 seta and 1 spine; length, 5.5 mm.

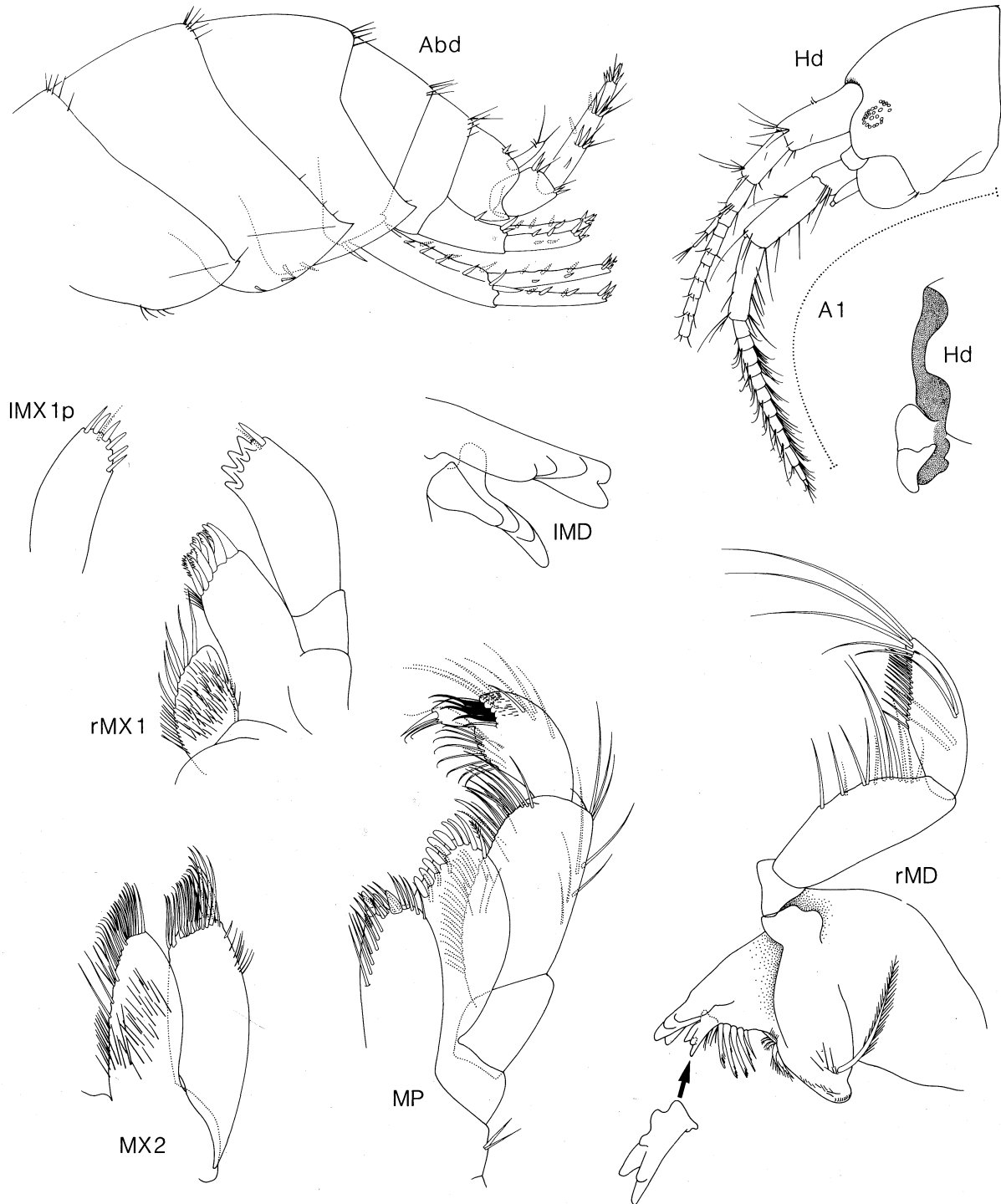


Fig.22. *Austrocrangonyx barringtonensis* (Chilton), paralectotype, juvenile "a".

Head (Fig. 22): eyes medium, ovate, faded in alcohol.

First antenna (Fig. 22): length 0.60 of body, 1.7 second antenna, flagellum much longer than peduncle; accessory flagellum 3-articulate, reaching past article 3 of flagellum. *Second antenna* (Fig. 22): length 0.36 body; peduncle longer than flagellum, article 4 longer than 5, articles 3, 4 and 5 with moderate ventral

setation; flagellum 12-articulate, strongly setose ventrally, lacking calceoli.

Left mandible (Fig. 22): palp article 3 with 2A, 2B, many D, 4E; incisor 5-toothed, lacinia mobilis 4-toothed, 7 setose accessory blades. *Right mandible* (Fig. 22): incisor 4-toothed; lacinia mobilis trifid, almost quadrifid; accessory blades of 4 setose spines and small fourth. *Left first maxilla* (Fig. 22): palp

article 2 with 6 thin apical spines, 1 subterminal facial seta, apicomedial inner surface of outer plate especially heavily pubescent (probably typical of the genus in contrast to *Austrogammarus*); inner plate with 6 medial setae near apex. *Right first maxilla* (Fig. 22): palp article 2 with 4 thick apical spines fused to segment, 1 articulate apicolateral spine, 1 subterminal facial seta. *Second maxilla* (Fig. 22): outer plate outer margin with 1 short seta; inner plate distal half of inner margin with non-facial row of many setae.

First gnathopod (Fig. 23): coxal plate marginally setose very sparsely, posterior margin without spines; article 4 with posterior hump; carpus weakly elongate, unlobed; propodus rectangular, longer than wide, posterolateral angle weakly out-turned, palm almost transverse but straight. *Second gnathopod* (Fig. 23): much longer than first gnathopod; coxal plate with 5 setae.

Pereopods (Fig. 23): coxa 3 with 6 setae, coxa 4 with 4 anteroventral and 4 posteroventral setae, deeply emarginate; pereopods 3–4 not longer than gnathopod 2, pereopod 3 [?longer than 4, missing], articles 4–5 of pereopod 4 weakly setose posteriorly, article 5 of pereopod 4 with spine formula of 2-1-1, posterior margin of article 6 on pereopod 4 with spine formula of 2s-2-s-2-2, thus with 2 locking setae, 2 locking spines; article 2 of pereopod 5 expanded and lobate posteroventrally, bearing medium-long posterior setules, that of pereopods 6–7 setose posteroventrally and bearing short and long posterior setules respectively.

Sternal processes (Fig. 23): 5 pairs of fleshy sausage-shaped, comma-like sternal gills present on segments 3–7; [presumably segment 2 with small midventral sternal gill also but this was overlooked and probably destroyed].

Epimera (Fig. 22): all epimera with small but sharp posteroventral tooth, each with sparse posterior seta(e) ventrally, epimeron 1 weakly rounded behind, setose anteroventrally, smooth and spineless below, epimera 2 and 3 with 2 ventral spines each. *Pleon* (Fig. 22): pleonites 1–6 with few dorsal setae arranged transversely, densest on pleonites 1–3, pleonite 6 with 1 spine on each side dorsally; uropod lengths relative to uropod 1: uropod 2 = 0.60, 3 = 0.70. *Pleopods* (Fig. 23): retinacula 3 per pleopod, no accessories.

First uropod (Fig. 22): peduncle length 1.2 rami; outer margin with 2 apicofacial spines besides strong row of dorsal spines, with 3 spines medially; rami of subequal length. *Second uropod* (Fig. 22): peduncle same length as rami, with 2 apicodorsal spines. *Third uropod* (Figs 22,23): peduncle length 0.45 outer ramus, about same length as urosomite 3; outer ramus proximal article with 4 transverse spine rows on body, apex of article 2 with mostly emergent large spine and tiny second spinule; inner ramus length 0.12 of outer, with 1 apical setule. *Telson* (Fig. 23): shorter than urosomite 3; cleft 73 percent of its length; apices with 1 apicolateral seta each, dorsum of each lobe with 1–2 setae and 3 penicillate setules in groups of 1 and 2, none

basal.

Description of lectotype (female). This specimen is described in second position because of the lack of head and dorsal pleon and most sternal and coxal gills, and lack of all but one oostegite.

Body: [data in brackets unknown, all dorsal pleonal armament unknown, but quoting from the original description: “Segments of the urus with a few long setae on the dorsal surface, one or two small ones being also found on the last two segments of the pleon; on the last segment of urus there is a small spine in addition to the long setae.” Later: “Segments of the pleon as in *G. australis*.” Later: “Length of largest specimen. (sic) 11 mm.”]

Head: rostrum [?vestigial]; “eyes small, oval”; inferior antennal sinus [?deep].

First antenna: length [“about half the length of the body”]; flagellum much longer than peduncle, setae sparse; accessory flagellum 4-articulate, reaching past article 4 of flagellum, articles uniform, sparsely setulate. *Second antenna*: length [“about half as long as the upper”]; peduncle longer than flagellum, articles 4 and 5 equal in length, articles 3,4 and 5 with moderate ventral setation; flagellum 16-articulate, strongly setose ventrally, lacking calceoli.

Left mandible: palp article 3 shorter than 2, article 2 with medium density basoanterior setae, then dense apical brush of setae, article 3 with 4A, 4,2B, many D, 7E; incisor 5-toothed, lacinia mobilis 4-toothed, 7 setose accessory blades. *Right mandible*: incisor 4-toothed; lacinia mobilis bifid; accessory blades of 5 setose spines. *Left first maxilla*: palp article 2 with 8 thin apical spines and ?3 subterminal facial setae; inner plate with 8 medial setae near apex. *Right first maxilla*: palp article 2 with 5 thick apical spines fused to segment, 1 articulate apicolateral spine, 1 subterminal facial seta. *Second maxilla*: outer plate outer margin with 1 short seta; inner plate distal half of inner margin with non-facial row of 4 main setae, distalmost slightly submarginal. *Maxilliped*: palp article 3 with ranks of thin setae on inner edge, apical part with rank of thick scythe-setae, apex weakly produced and pubescent; outer plate with row of 7 setose spines distally continuous with row of 8 tooth-spines medially; inner plate with 3 (fourth ventrofacial) thick spines and plumose setae apically and long medial row of plumose setae.

First gnathopod: coxal plate marginally setose very sparsely; segment 4 with posterior hump; carpus weakly elongate, unlobed; propodus rectangular, longer than wide, posterolateral angle out-turned, palm almost transverse but straight, corner with 4 spines (2 lateral and 2 medial). *Second gnathopod*: much longer than first gnathopod; coxal plate with 5 setae.

Pereopods: coxa 3 with 10 setae, coxa 4 with 7 anteroventral and 5 posteroventral setae; pereopods 3–4 not longer than gnathopod 2, articles 4–5 of pereopod 4 strongly setose posteriorly, article 5 of pereopod 3 with spine formula of 2 + 1-1-1-1-1-1, of article 6 = 2s-2-1-2-2-2-2-1, pereopod 4 with spine

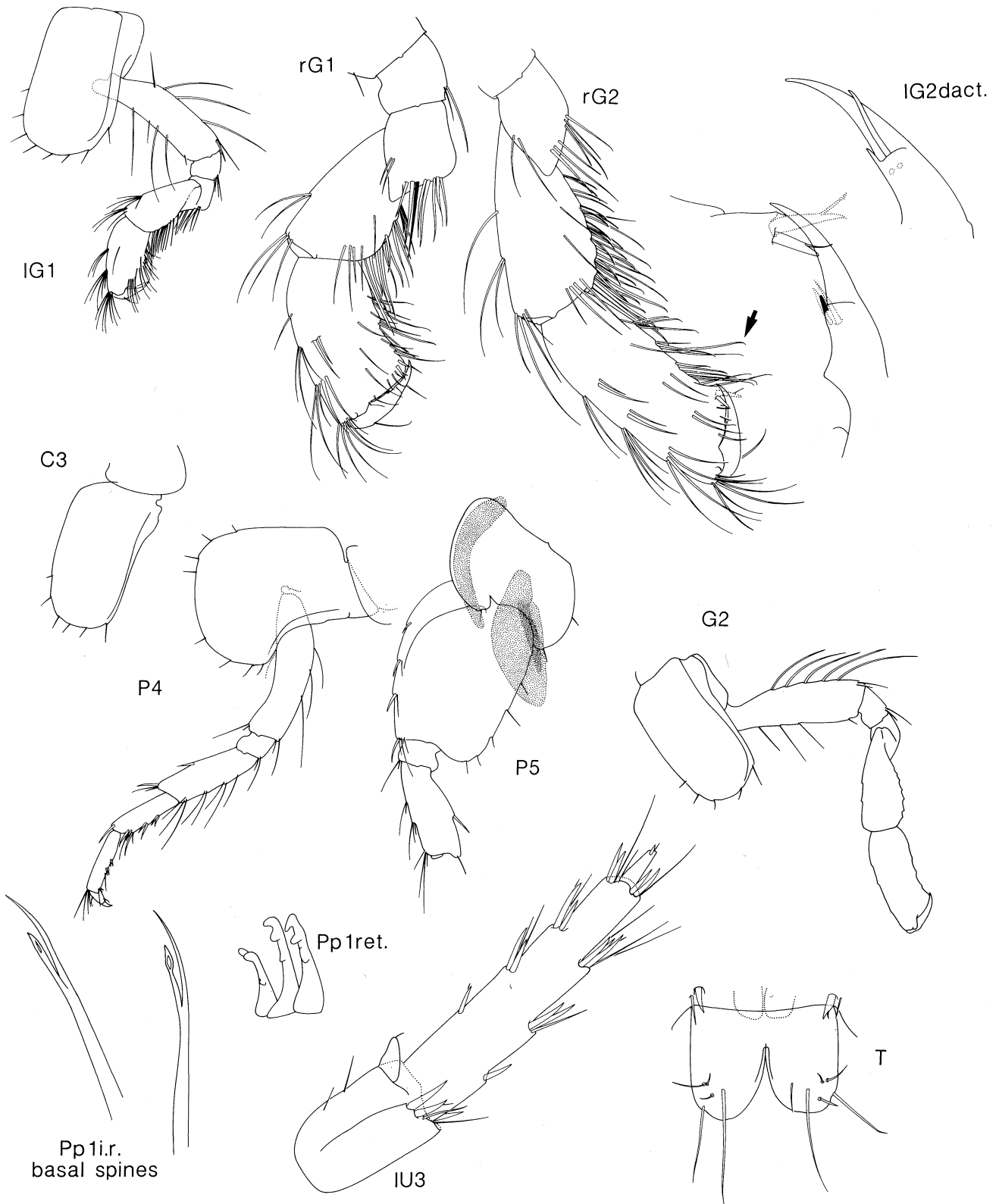


Fig.23. *Austrocrangonyx barringtonensis* (Chilton), paralectotype, juvenile "a".

formula on segment 5 of 2 + 1-1-2-1-2-2, posterior margin of article 6 on pereopod 4 with spine formula of 2s-3-1-2-2-2-2, thus with 2 locking setae, 2 locking spines, spine position 2 (third in set) always with especially long seta as in juvenile; article 2 of pereopod 5 bearing medium-long posterior setules mixed with short setules, that of pereopods 6-7 (Fig. 24) slightly less expanded than pereopod 5, setose posteroventrally and bearing mixture of short and long posterior setules; sac-like coxal gills [presumably on pereopods 2-6, gill of pereopod 7 not reduced].

Sternal processes: [presumably 5 pairs of fleshy sausage-shaped, comma-like sternal gills present on segments 3-7; presumably segments 2-3 with small midventral sternal gill].

Epimera: all epimera with small but sharp posteroventral tooth, each with sparse posterior seta(e) ventrally, epimeron 1 weakly rounded behind, with 1 seta anteroventrally, 1 posterior notch below, 4 posterior setules, lower 1 near tooth elongate, epimera 2 and 3 with 2 ventral spines each and 5 and 2 posterior setules respectively. **Pleon:** [see first part of description, no material available on slides]; uropod 3 [presumably extending well beyond uropods 1 and 2 in entire animal]; uropod lengths relative to uropod 1: uropod 2 = 0.60, 3 = 0.75. **Pleopods:** retinacula 3 per

pleopod, no accessories.

First uropod: peduncle length 1.5 rami; outer margin with 2 apicolateral spines besides strong row of dorsal spines, with 4 spines medially and slight stagger between spine 1 and 2 from distal end. **Second uropod:** peduncle same length as rami, with 3-4 (variable) apicodorsal spines; outer ramus slightly shorter than inner. **Third uropod** (Fig. 24): peduncle length 0.37 outer ramus [presumably same length as urosomite 3]; outer ramus proximal article with 6 lateral transverse spine and setal rows on body and 5 medial transverse spine and setal rows on body interspersed with setal sets in following formula distal to proximal: S-s-S-s-S-s-S-s-S-s-s; apex of article 2 with 1 immersed apical spine; inner ramus length 0.11 of outer, with 1 subapical seta. **Telson:** [presumably shorter than urosomite 3; presumably cleft for most of its length]; apices with 5 apicolateral setae each [original description showing only 4 but 1 extra socket present], dorsum of each lobe with 2-3 setae and 3 penicillate setules in groups of 1 and 2, none basal.

Description of syntypes. Specimen "b". Sex not determined, body missing ahead of thorax 4; apicolateral corner of peduncle on uropod 2 with 3 spines.

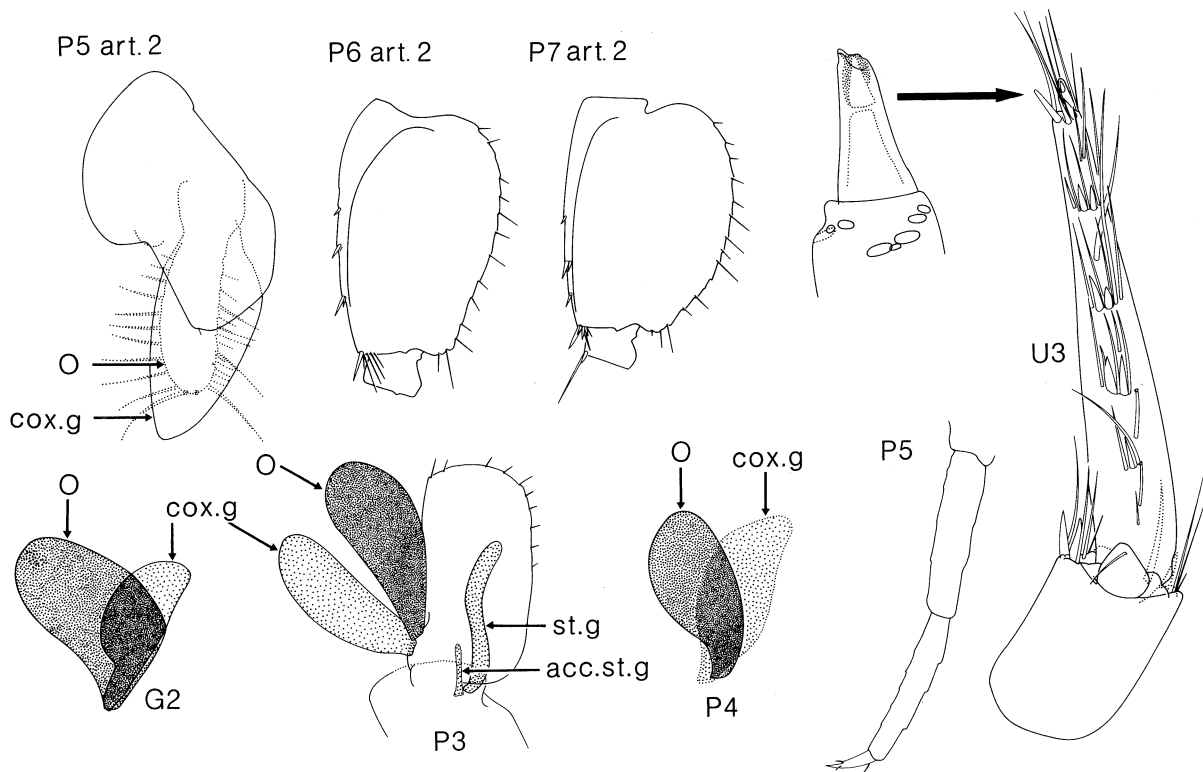


Fig. 24. *Austrocrangonyx barringtonensis* (Chilton), lectotype, female "i" (P5 art. 2, P6 art. 2, P7 art. 2, U3); [female "e" (distal articles P5) and female "f" (oostegite and gill G2, P3, P4) of *A. hynesi* are also illustrated for comparative purposes].

Specimen "c". Sex not determined, anterior end badly crushed; gnathopod 2 with 2 lateral and 1 medial spines at palmar corner; article 6 of pereopods 3–4 with 2 spines dominant in sets; epimeron 1 with 2 anteroventral setae, no posteroventral notch, epimera 2 and 3 each with 1 spine; apicolateral corner of peduncle on uropod 2 with 2 large and 1 small spines.

Specimen "d". Missing thorax except remnants of pereonites 6–7, head present but not definitely of same specimen; epimeron 2 with 3 spines and fourth situated facially above rear ventral member.

Illustrations. The illustrated molar of the paralectotype (Fig. 22) is turned away thereby obscuring the triturative surface. Pereopods 5–7 of the lectotype (female) (Fig. 24) all lack their gills and oostegites and below each, therefore, is an isomagnification of these parts from female "e" of the following species (*A. hynesi*). The only drawings of the lectotype needed to supplement the drawings of the paralectotype are the bases of pereopods 5–7, coxa 5 with its well setose oostegite, and the fully developed uropod 3.

Remarks. Only 2 specimens have been examined carefully; the others are in poor condition and have been checked only cursorily. The main variations encountered are the change during maturation from the presence on the peduncle of uropod 3 of 2 apicolateral spines to 3 or 4, and the development of a spine in the first position beyond the locking spines which in the juvenile has only a long seta (the long seta remains). The lectotype has an apparently aberrant condition on the apex of the outer ramus on uropod 3 because the second article bears only 1 unemergent spine compared with 2 emergent spines in the juvenile and in *A. hynesi*. The adult's telson is much more strongly setose than that of the juvenile. We failed to note the condition of sternites 2–3 sufficient to find median sternal gills.

Relationship. This is the basic species of the group and comparisons to it will be made in the discussions of other species; its position may be determined also in the key to species seen above. It is interesting to note that Schellenberg (1937c: 275) had long ago recognised the possibility that Chilton's species, *Gammarus barringtonensis*, was perhaps a relative of *Paramelita* in South Africa.

Distribution. NSW, Barrington Tops, near Dungog, 1400 m.

***Austrocrangonyx hynesi* n.sp.**

Figs 24,25

Material examined. Australian Museum AM P38548, A155, stream about 15 km from Dingo Fence near Barrington Tops, NSW, on road from Scone to Gloucester near Dungog, 27 July 1978, collected by H.B.N. Hynes, 8 specimens: HOLOTYPE, female "e" 10.1 mm (partly illustrated), with 7 other specimens, AM P38549 of above locality. PARATYPES, the following measured: female "f" 9.7 mm, female "g"

8.0 mm, female "h" 6.9 mm; no males present, hence no allotype designated.

Diagnosis. Hyaline hump on article 4 of gnathopod 1 weak; dominant spine number in sets on article 6 of pereopods 3–4 = 1.

Description of holotype (female). *Body:* pleon dorsally setose, setation sparse and transverse on pleonites 4–6, but pleonites 1–3 with slightly denser setation, pleonite 6 with 1 spine on each side; setation on pleonites 1–3 continuous dorsally but on pleonites 4–6 situated in groups, thus following formula for 1 side of each segment to mid-dorsal line: pleonite 1 = 8 continuous setae, pleonite 2 = 8 continuous, pleonite 3 = 6 continuous, pleonite 4 in groups of 3 and 4, pleonite 5 in groups of 2 + setule and 2, pleonite 6 in groups of 2–3 setae and 1 spine in formulae of sSs or sSs (right and left); length, 10.1 mm.

Head (Fig. 25): eyes medium, ovate, darkly pigmented in alcohol.

First antenna: length 0.65 of body, 1.6 second antenna, flagellum much longer than peduncle, setae of moderate density, slightly denser than shown for *A. barringtonensis* (Fig. 22); accessory flagellum 4-articulate, reaching past article 3 of flagellum, articles uniform, sparsely setulate. *Second antenna:* length 0.40 body; peduncle longer than flagellum, article 4 longer than 5, articles 3, 4 and 5 with moderate ventral setation but denser than shown for *A. barringtonensis* (Fig. 22); flagellum 19-articulate, strongly setose ventrally, lacking calceoli.

Left mandible: palp article 3 with 3A, 3, 1B, many D, 6E; incisor 5-toothed, lacinia mobilis 4-toothed, 8 setose accessory blades. *Right mandible* (Fig. 25): incisor 4-toothed; lacinia mobilis multifid (as illustrated), almost quadrid; accessory blades of 4 setose spines and small fifth. *Left first maxilla:* palp article 2 with 8 thin apical spines and 1 subterminal facial seta; inner plate with 7–8 medial setae near apex. *Right first maxilla:* palp article 2 with 5 thick apical spines fused to segment, 1 articulate apicolateral spine, 1 subterminal facial seta. *Second maxilla:* outer plate outer margin with 2 short setae; inner plate distal half of inner margin with non-facial row of many setae, 5 of these forming main armament, uppermost very weakly submarginal. *Maxilliped:* as in generic description.

First gnathopod (Fig. 25): coxal plate marginally setose sparsely (11 setae); article 4 with weak posterior hump; carpus weakly elongate, unlobed; propodus rectangular, longer than wide, posterolateral angle out-turned, palm almost transverse but straight, with 4 spines at corner (2 lateral, 2 medial). *Second gnathopod:* much longer than first gnathopod; coxal plate with 12 setae.

Pereopods (Fig. 25): coxa 3 with 9 setae, coxa 4 with 6 anteroventral and 4 posteroventral setae, deeply emarginate; pereopods 3–4 not longer than gnathopod 2, pereopod 3 with articles 4–5 strongly and of pereopod 4 less strongly setose posteriorly, article 5 of pereopods 3–4 with spine formula of 1+1-1-1-1-1-2

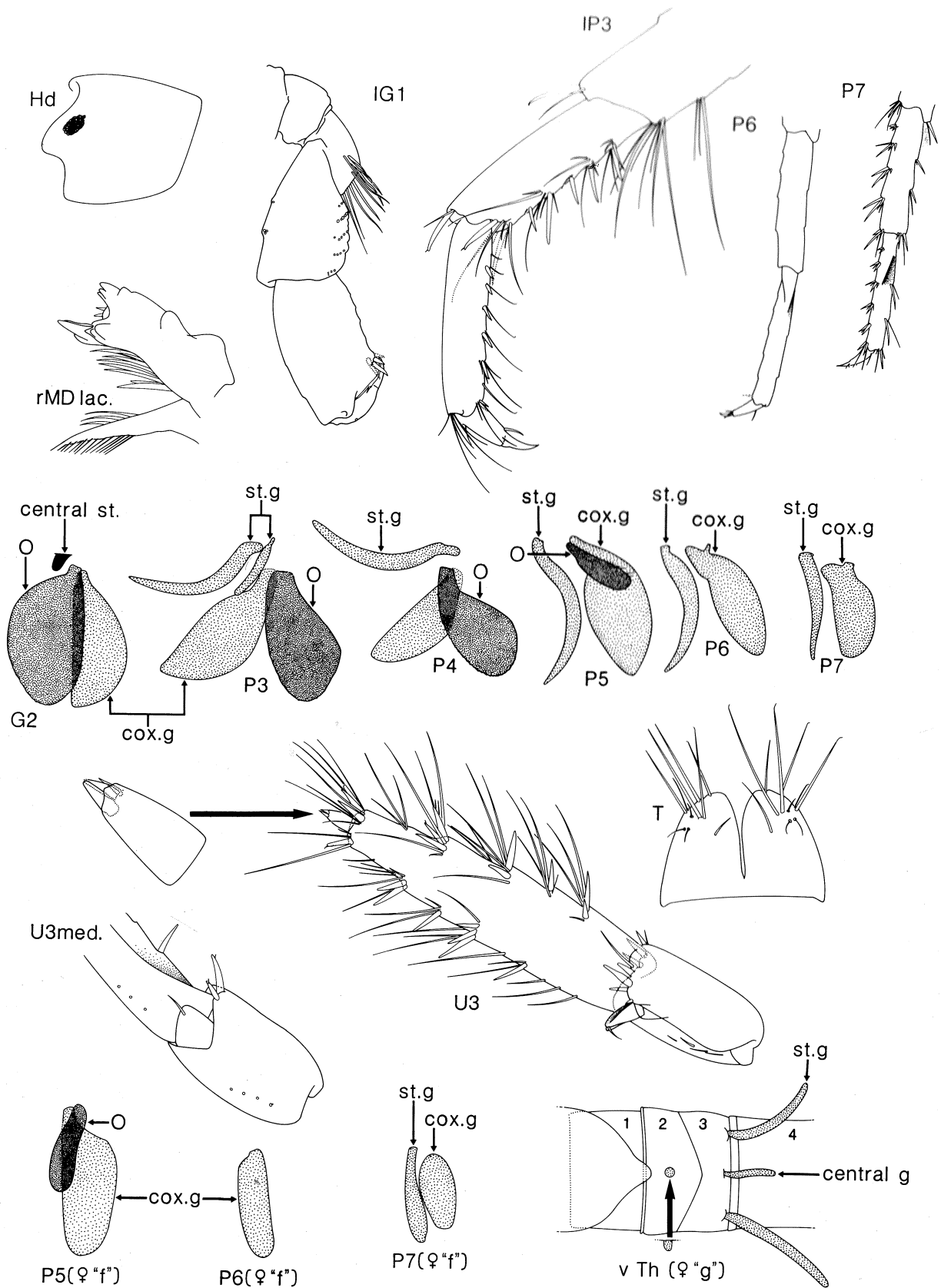


Fig. 25. *Austrocrangonyx hynesi* n.sp., holotype, female "e" (all drawings except those otherwise indicated); paratypes, female "f" and "g" (as indicated).

and 2+1-1-1-1-2-2, posterior margin of article 6 on pereopods 3-4 with spine formula of 2s-2-s-1-1-1-1-1 and 3s-2-s-1-1-1-2-1, thus with 2-3 locking setae, 2 locking spines; article 2 of pereopod 5 bearing medium-long posterior setules, that of pereopods 6-7 weakly pyriform and lobate (like lectotype "i" of *A. barringtonensis* but more than shown for paralectotype "a"), but setose posteroventrally, bearing short and long posterior setules respectively (article 2 of pereopods 5-7 with 12, 13, 16 setae respectively); articles 4-6 of pereopods 5-7 with short and sparse setae.

Sternal processes (Fig. 25): 5 pairs of fleshy sausage-shaped, comma-like sternal gills present on segments 3-7; [presumably segments 2-3 with small midventral sternal gill also but this was overlooked and probably destroyed].

Epimera: all epimera with a small but sharp posteroventral tooth, each with sparse posterior seta(e) ventrally, epimeron 1 weakly rounded behind, setose anteroventrally, smooth and spineless below, epimera 2 and 3 with 2 ventral spines each, epimeron 2 with extra anteroventral facial spine and 7 anterior setae, each epimeron with 2 posterior setules, epimeron 1 with 1 long seta in corner notch (aberrantly with extra seta), setules of epimera 2-3 not at corners.

Pleon: armament as described above, setae arranged transversely, densest on pleonites 1-4, pleonite 6 with 1 spine on each side dorsally; uropod lengths relative to uropod 1: uropod 2 = 0.80, 3 = 0.86. **Pleopods**: retinacula 5-6 per pleopod, no accessories.

First uropod: peduncle length 1.2 rami; outer margin with 2 apicodistal spines besides strong row of dorsal spines, with 4 spines medially; rami of subequal length, both rami with 2 rows of marginal spines and 5 apical spines [aberration, dorsal row on peduncle paired at position 3 from distal end]. **Second uropod**: peduncle 1.2 length of rami, with 3 apicodorsal spines and 2 medial spines; outer ramus slightly shorter than inner. **Third uropod** (Fig. 25): peduncle length 0.45 outer ramus, about same length as urosomite 3; outer ramus proximal article with 5 lateral transverse spine-seta rows on body, with set of setae between last 2 apical sets, medially with 5 spine-setal sets and 3 basal setae in tandem, thus medial formula (proximal to distal) = s-s-s-S-s-3S-S-2S-s-S, apex of article 2 with 2 emergent spines abutted together in pincer-fashion; inner ramus length 0.10 of outer, with 1 apical setule. **Telson** (Fig. 25): shorter than urosomite 3; cleft 83 percent of its length; apices with 4 apicolateral setae each, dorsum of each lobe with 3 setae and 3 penicillate setules in groups of 1 and 2, none basal.

Description of paratypes. Specimen "f": female: pereonite 3 with only median sternal gill, segment 2 lacking median gill.

Specimen "g": female: pereonite 3 with long median fleshy sternal gill, pereonite 2 with rudimentary short median capsule representing sternal gill (Fig. 25).

Specimen "h": female: both pereonites 2 and 3 with long fleshy median sternal gill.

Illustrations. Because this species is so similar to *A. barringtonensis*, the only illustrations necessary to indicate specific and varietal differences are as follows: head (to show dark eyes in better preserved material), right lacinia mobilis, gnathopod 1, pereopod 3, distal articles of pereopods 5-7, oostegites, and coxal and sternal gills (of females "e", "f" and "g").

Relationship. This species differs from *A. barringtonensis* essentially in the reduction of numbers of spines on article 6 of pereopods 3-4 as indicated in the diagnosis. The type locality is close to the type locality of *A. barringtonensis*.

Distribution. Barrington Tops, NSW, on road near Dungog.

Antipodeus n.gen.

Type species. *Gammarus antipodeus* Smith, 1909.

Diagnosis. Pleonites and often pereonites with dorsal armaments, sometimes weak. Rostrum short, lateral cephalic lobes weakly projecting, weak to strong antennal sinus present, defined below by tooth in type species. Eyes present, small to large, oval, oblong or weakly reniform in shape.

Antenna 1 elongate, about twice as long as antenna 2, peduncular article 1 slightly longer than or subequal to article 2, article 3 usually shortest, but occasionally as long as articles 1 or 2; accessory flagellum 2-3-articulate. Flagellum of antenna 2 usually shorter than peduncle, sometimes subequal, calceoli usually absent in males (all but one species), always in females.

Ratio of mandibular palp articles about 3:12:12, 3:9:9, 3:10:5, 3:9:7, article 2 strongly to moderately setose, article 3 weakly falcate, setae = apparently ABCDE. Labium lacking inner lobes. Inner plates of maxillae 1-2 medially setose on distal halves; inner plate of maxilla 1 ovatotriangular, with 4-7 plumose medial setae, outer plate with 9-11 spines, palps asymmetric, left side with several thin apical spines, right side with fewer thick apical spines often fused to article. Inner plate of maxilla 2 lacking oblique row of setae on face, though upper member of 3-7 main medial setae often slightly submarginal.

Coxae 1-4 moderately elongate, numerous to sparse setae ventrally, ventral setae very short to long, coxa 1-3 lacking row of posterior spines, coxa 1 evenly rounded or rectangular below, coxa 4 emarginate, coxa 5 much shorter than 4. Gnathopods 1-2 of small to medium size, sexually dimorphic or not, carpi short to elongate, weakly lobate or not, article 4 without hyaline lobe, palms more or less transverse to oblique, excavate (males of some species), or straight (males of other species, all females), lacking rugosities, spines not symmetrically bifid, rather with small subapical trigger-like extensions; spines at corner of palm 3+; spines along palm also with triggers.

Pereopods 5-7 moderately elongate, pereopod 6 slightly longer than pereopod 7, article 2 broadly expanded on pereopods 5-7 (but subtly less so on 6), ovate or trapezoidal and posteroventrally lobate on all,

dactyls of pereopods 3–7 with only marginal and facial setule (2 total).

Coxae 2–7 with gills, gill 7 reduced. Sternal gills absent. Oostegites broad.

Epimera with few ventrofacial spines only, posterior margins weakly setulate. Peduncles of uropods 1–2 with only 1 lateral apicodorsal spine besides dorsolateral row, rami extending subequally, margins with 2 rows of spines each, uropod 1 lacking basofacial armaments. Uropod 3 weakly to moderately extended, parviramous, peduncle short, outer ramus 1-2-articulate, article 2 short or absent, inner ramus generally reaching to M.25 or less on article 1 of outer ramus in both sexes. Telson moderately to very short, cleft 50 percent or more, sometimes fully, lobes tumid laterally or not, with apical spination and/or setation only, no basolateral armaments except for pair of lateral penicillate setules about M.60–80 on each side.

Additional description. Apical margin of upper lip uniform, rounded but weakly asymmetrical. Accessory blades (rakers) on mandibles usually with inter-raker plumose seta, or these also enlarged; molar with large plumose seta, very few additional penicillate setae beyond rakers and riding onto base of molar. Both plates of maxilla 2 with long apical setae; inner plates of maxillae 1–2 with facial and marginal areas of pubescence. Maxillipedal inner plate with distal row of a few plumose setae and *ca.* 3 blunt naked spines and medial row of plumose setae; outer plate with distal row of few plumose setae continuous with distal row of blunt naked tooth-spines; palp articles 2–3 poorly setose laterally, well-setose medially, article 3 with organised clusters of setal-spines near base of dactyl, no rugose lobe. Dactyls of gnathopods with or without small recumbent inner tooth-spine at nail articulation line. Gnathopod 1 without rastellae on article 4. Pleopods similar, peduncles moderately setose to not; rami extending subequally; [?basomedial setae on inner rami of pleopods 1–3 bifid, branches diverse, of different length and shape but, occasionally 1 branch with diamond head, or both simple]; retinacula 2, accessory retinacula present or absent. Posteroventral tooth of epimera 2–3 short or absent. Lateral setae of outer ramus on uropod 3 sparse or absent, usually some setae on medial inner margin not plumose (males). [?Ventreodistal spine on urosomite 1 at base of uropod 1 short].

Characters of interspecific value. Head with anteroventral tooth or not. Eye size variable, round or reniform, small to medium (but not here used for species distinctions). Article 2 of peduncle on antenna 1 usually as long as article 1, but occasionally shorter, article 3 strongly variable. Antennae 1–2 heavily to sparsely setose or not. Mandibular palp article 2 longer or shorter than article 3. Outer plate of maxilla 1 with 11 or 9 spines. Palms of gnathopods in males excavate or not. Posterior spine sets on article 6 of pereopods 3–4 evenly spaced or not, occasionally with setal set between spine sets. Article 2 of pereopods 5–7

narrower and uniform or broader and slightly lobate, posterior setae long to short; setae on articles 5–6 distinct among several species. Marginal spines on uropod 1 long or short. Apical spines on rami of uropod 2 elongate or not. Outer ramus of uropod 3 long or short. Telson short or long, cleft 50–100 percent of length, apical setae long, short or absent.

Sexual attributes. Females never with calceoli; oostegites generally paddle shaped, only moderately broad, with oostegite on coxa 5 smallest, in young or nonbreeding females lacking setae or with rudiments of setal bases marginally, in terminal females oostegites of coxae 2–4 huge, projecting below coxae, oostegite of coxa 5 generally small; male gnathopod 2 often slightly enlarged and with elongated carpi, palms straight or excavate (when gnathopods sexually dimorphic), female gnathopods generally smaller, shorter and thinner; uropod 3 of female often shorter than in male, lacking any special male attributes such as medial plumose setae on outer ramus.

Relationships. *Antipodeus* differs from the basic *Austrogammarus* in the smaller number of articles in the accessory flagellum of antenna 1 (2–3 as opposed to 4–8), loss of much medial and facial setation on the maxillae, in the loss of sternal gills, the loss of dorsal telsonic spination (except for the regular lateral pairs of penicillate setules), the fully parviramous condition of uropod 3, the lack of posterior coxal spines, the slightly better developed posteroventral lobation and general expansion of article 2 on pereopods 5–7, and the presence of C-setae on palp article 3 of the mandible. Except for the parviramous uropod 3, the absence of posterior coxal spines and poorly setose maxillae, these differences are also those between *Austrocrangonyx* and *Antipodeus*.

Antipodeus is much closer to *Austrocrangonyx* than to *Austrogammarus* because of the short inner ramus on uropod 3, the lack of coxal spines, the better lobate article 2 on pereopods 6–7 and the poorly setose maxillae. It differs from *Austrocrangonyx*, however, in the following characters: the presence of heavy apical spination on the telson, the presence of only 1 lateral apicodistal spine on the peduncle of uropods 1–2, the presence of only 2 hooked retinacula sometimes coupled with simple retinacula on the pleopods, the absence of a posterior hump on article 4 of gnathopod 1, and the reduction of article 2 on the outer ramus of uropod 3 to a vestige. Some minor characters include the closer resemblance of the space between rakers and molar on the mandibles to *Austrogammarus* than to *Austrocrangonyx*.

Several characters of *Antipodeus* anticipate more specialised genera related to *Neoniphargus*, such as the reduced maxillary setation, parviramous uropod 3, vestigial article 2 on the outer ramus of uropod 3, major armaments on the telson shifted to the apex, reduction of apicolateral spination on the peduncles of uropods 1–2 to 1 spine each, loss of major setae on pereopods 5–7, and development of better lobation on article 2 of pereopods 5–7. Both *Austrocrangonyx* and

Antipodeus have the telsonic lobes basally fused as in derived genera but even several species of *Austrogammarus* bear that condition also.

Composition. Although the 6 species of this genus could be divided several ways into 2 genera we believe the cross mixture of characters is so great that they should all remain in a single genus for the present. The

diversity of form in the species suggests that *Antipodeus* is a polyphyletic genus. Thus, the species at present included are as follows: *A. antipodeus* (G.W. Smith), *A. wellingtoni* (G.W. Smith), *A. niger* (G.W. Smith), *A. ripensis* (G.W. Smith), *A. mortoni* (Thomson) and *A. franklini* n.sp. Two keys to distinguish them follow.

Key I to the Species of *Antipodeus*

1. Telson cleft 50 percent, lobe apices broadly rounded, without setae; antennae 1–2 moderately setose, setae long; mandibular palp article 2 with long setae; uropod 3 peduncle and outer ramus of subequal length *A. wellingtoni*
—Telson cleft >50 percent, otherwise without the above combination of characters 2
2. Posterodorsal part of body well-armed with many spines and setae; antennae 1 very setose, setae long; mandibular palp article 2 with long setae, telson lacking apical setae *A. ripensis*
—Without the above combination of characters 3
3. Coxae 1–4 marginal setae long to moderately long; pereopods 3–7 articles 2–6 with long spines; uropods 1–2 spines elongate *A. niger*
—Without the above combination of characters 4
4. Posterodorsal part of body more or less smooth (unarmed); antennal sinus well defined; males without calceoli; gnathopods sexually dimorphic; telson cleft 75 percent *A. antipodeus*
—Without the above combination of characters 5
5. Males with calceoli; maxilla 1 inner plate with 7 plumose setae; gnathopods sexually dimorphic; telson cleft 70 percent *A. franklini*
—[?Males with calceoli]; maxilla 1 inner plate with 5 plumose setae; gnathopods not sexually dimorphic; telson cleft 100 percent *A. mortoni*

Key II to the Species of *Antipodeus*

1. Posterior setae on article 2 of pereopods 5–7 long; long setae present on articles 2–6 of pereopods 5–7; coxae 1–3 with long ventral setae *A. niger*
—Posterior setae on article 2 of pereopods 5–7 short; long setae absent on articles 2–6 of pereopods 5–7; coxae 1–3 with only short ventral setae 2
2. Ventral setae of antennae 1–2 long and dense; telson very short, apical setae absent 3
—Ventral setae on antennae 1–2 short to long and sparse to numerous (but never long and dense); telson not very short, with apical setae 4
3. Gnathopods sexually dimorphic; article 6 of pereopods 3–4 with evenly spaced spine sets; rami of uropods 1–2 with long marginal and apical spines *A. wellingtoni*
—Gnathopods not sexually dimorphic; article 6 of pereopods 3–4 with unevenly spaced spine sets; rami of uropods 1–2 with short marginal and apical spines *A. ripensis*
4. Article 2 of mandibular palp only slightly longer than article 3; gnathopods not sexually dimorphic; telson cleft 100 percent *A. mortoni*
—Article 2 of mandibular palp distinctly longer than article 3; gnathopods sexually dimorphic; telson cleft about 70 percent 5
5. Ventral setae on antennae 1–2 short and numerous; calceoli absent on male antenna 2; basodactylar spines and setae of pereopods 5–7 short; setae on article 2 of mandibular palp mostly short *A. antipodeus*
—Ventral setae on antennae 1–2 long and sparse; calceoli present on male antenna 2; basodactylar spines and setae of pereopods 5–7 long; setae on article 2 of mandibular palp mostly long *A. franklini*

Antipodeus antipodeus (G.W. Smith)

Figs 26–31

Gammarus antipodeus Smith, 1909a: 78, pl. 14, figs 17–22.

Type locality. Tasmania, Mole Creek.

Type material. Material clearly attributed to this

species by Smith is located in the Hope Museum, Oxford. Labels read: (1) Amphipoda 4 specimens, Oxford University Museum, Dept. of Zoology and Comparative Anatomy, "*Gammarus antipodeus* Smith "Cotypes" Loc. Mole Creek, Tasmania. Ref. No. 5399. Source Coll'd & pres. by G.W. Smith, Date 1907–1908."; (2) "Mole Creek"; (3) "*Gammarus*

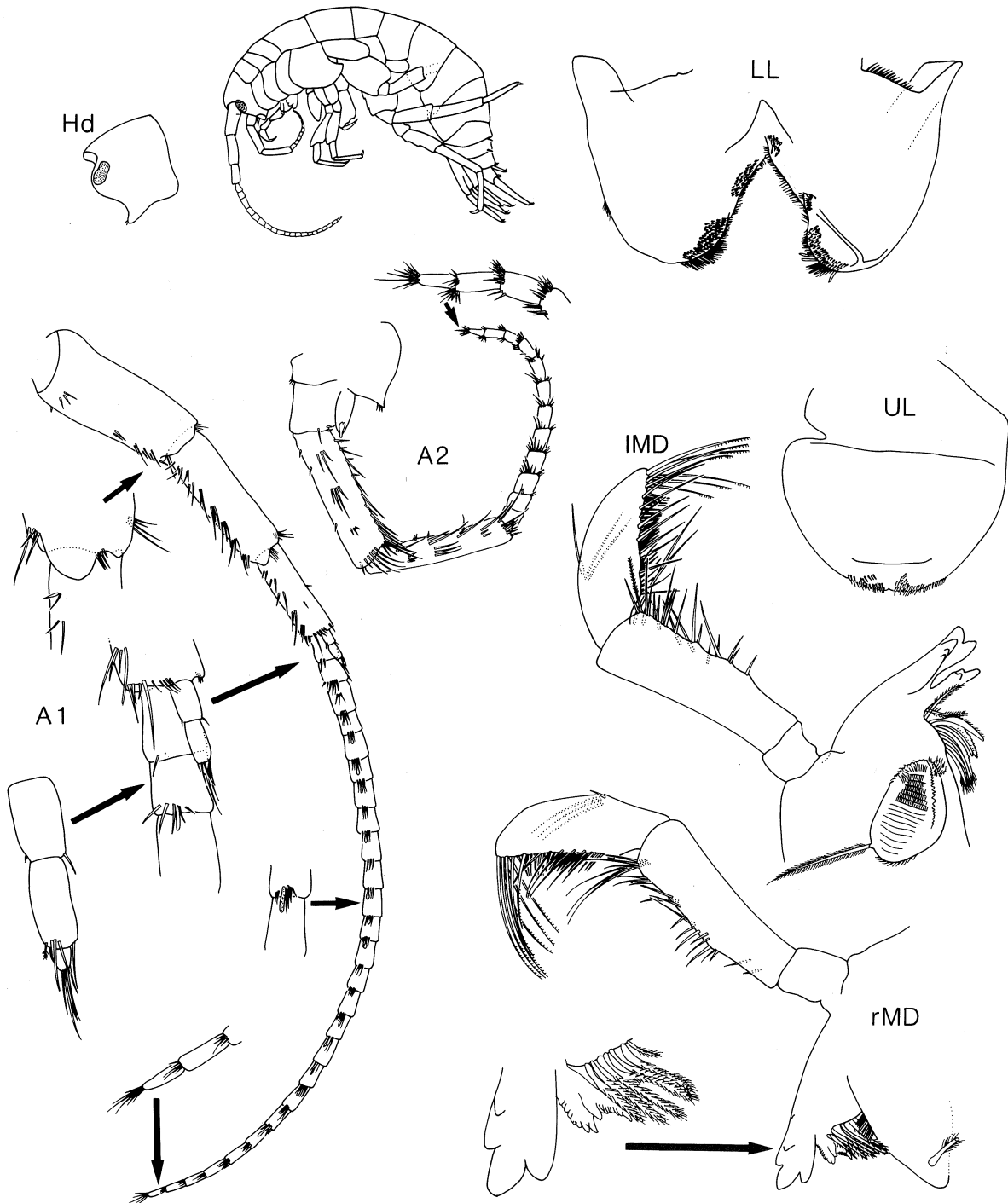


Fig. 26. *Antipodeus antipodeus* (G.W. Smith), lectotype, male.

antipodeus"; (4) "*Gammarus antipodeus*, Mole Creek, Tasmania, 1907-8 Ref. No. 5399." The material comprised 4 specimens: 1 badly damaged putative male, 1 damaged male, 1 undamaged male, 1 slightly damaged non-ovigerous female. The undamaged male was selected as lectotype and fully dissected. The female was also fully dissected.

Diagnosis. Setae on antennae 1-2 short but numerous. Calceoli absent from male antenna 2. Antennal sinus distinct, defined by tooth below. Article 2 of mandibular palp longer than article 3, with

numerous short to moderately long setae. Inner plate of maxilla 1 with 7 plumose setae, outer plate with 11 spines. Ventral setae on coxae 1-4 short but numerous. Gnathopods sexually dimorphic; palms on male gnathopods excavate, female palms more or less straight. Posterior setae on article 2 of pereopods 5-7 short but numerous. Pereonites 6-7 and pleonites 1-3 naked or poorly setose dorsally. Spines on rami of uropods 1-2 short and dispersed. Outer ramus of third uropod 3 times length of peduncle. Telson cleft 75 percent of its length, with 1 short apical spine and several short setules on each lobe.

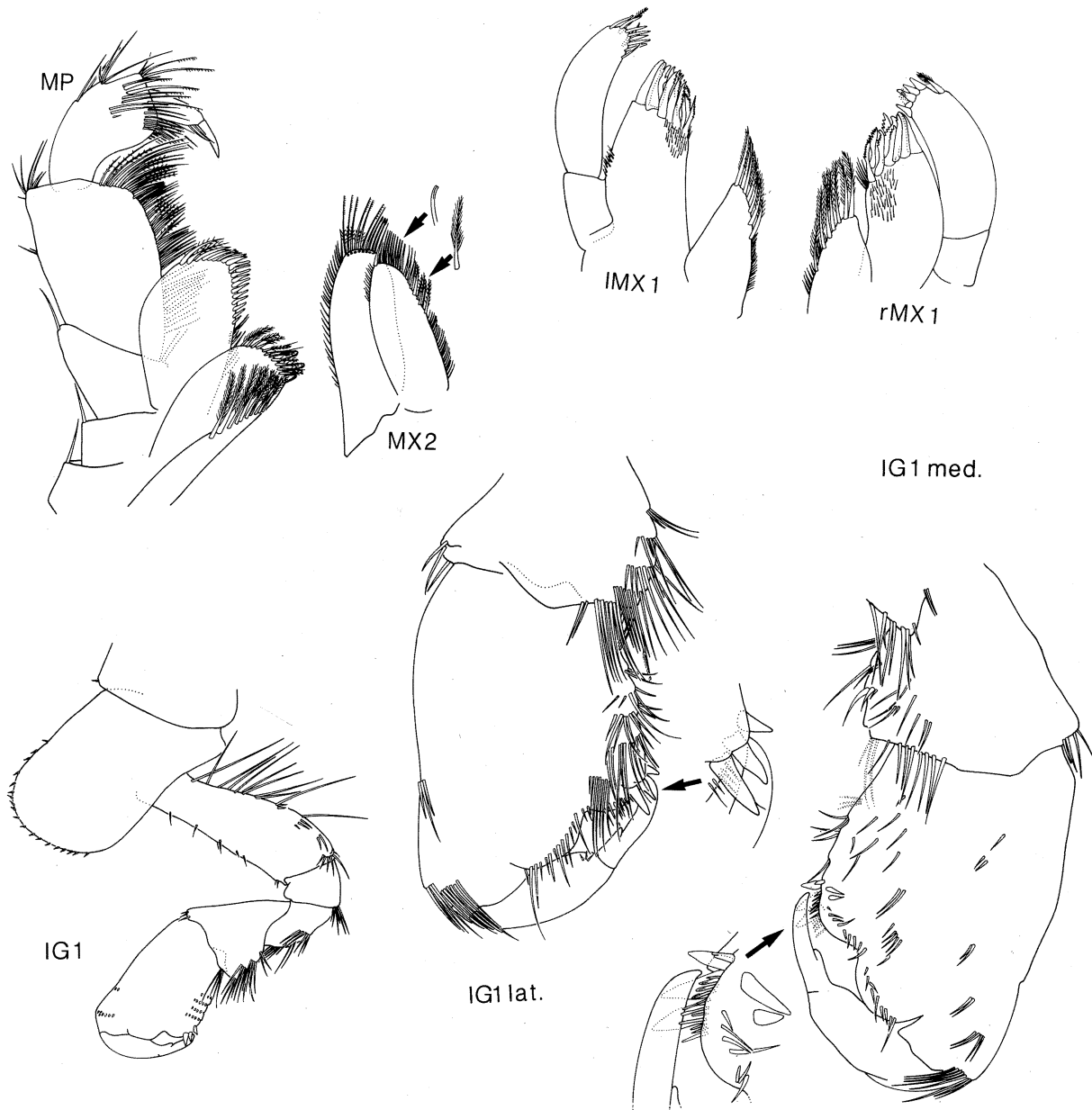


Fig.27. *Antipodeus antipodeus* (G.W. Smith), lectotype, male.

Description of lectotype (male). *Body* (Fig. 26): smooth, lacking spines except for several on posterior dorsal margins of pleon segment 3 and urosomites; length 20 mm.

Head (Fig. 26): rostrum distinct, short; eyes large, oval; inferior antennal sinus distinct, guarded by anteroventral tooth.

First antenna (Fig. 26): length 0.5 body, 2.0 second antenna; peduncle length 0.6 flagellum, articles 1 and 2 subequal, article 2 with flange on medial distal margin, article 3 length 0.7 articles 1 and 2, all articles with numerous short spines on ventral margins; accessory flagellum 3-articulate, reaching well-beyond flagellum article 1. *Second antenna* (Fig. 26): length 0.25 body; peduncle longer than flagellum, articles 4 and 5 subequal in length, with numerous short setae on ventral and lateral surfaces; flagellum 12-articulate,

lacking calceoli.

Left mandible (Fig. 26): palp article 3 slightly shorter than 2, article 3 setal formula = 3A, many C, many D, many E, article 2 moderately setose on inner edge; incisor 5-toothed; lacinia mobilis 4-toothed; 11 large setose accessory blades; molar with 1 long basal setose spine and basal pubescence. *Right mandible* (Fig. 26): incisor 4-toothed; lacinia mobilis with 2 serrate cutting edges, almost trifold; accessory blades of 6 large and 1 small setose spines.

Left first maxilla (Fig. 27): palp article 2 with 8 long blunt spines and 2 subapical setae distally; outer plate with 11 apical spines, some denticulate; medial margin of inner plate with 7 plumose setae distally, inner margin pubescent. *Right first maxilla* (Fig. 27): palp article 2 with 5 short, conical spines, 1 thinner plumose spine distally. *Second maxilla* (Fig. 27): inner plate

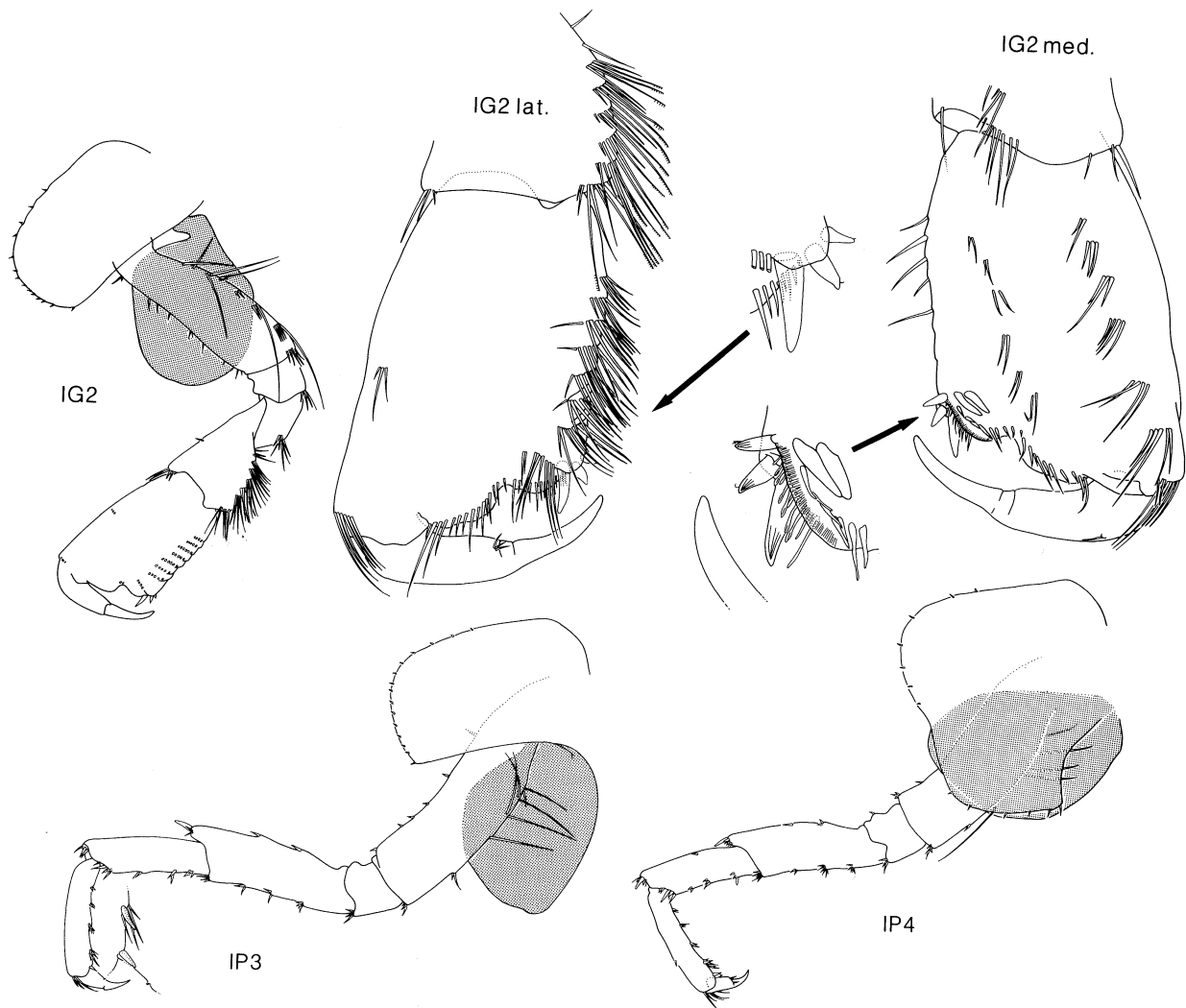


Fig. 28. *Antipodeus antipodeus* (G.W. Smith), lectotype, male.

with numerous plumose setae on distal medial margin. *Maxilliped* (Fig. 27): inner plate with 3 large spines on distal margin.

First gnathopod (Fig. 27): coxal plate even, with row of small setules on anterior and ventral margins; carpus triangular, weakly lobate, length 1.1 width, with several transverse rows of long, distally serrate spines near posterior margin, without rugosity; propodus almost rectangular, length 1.4 width, palm sinuous, several rows of moderately long setae near posterior margin, postero-lateral angle with 3 lateral spines and 3 medial spines. *Second gnathopod* (Fig. 28): slightly larger than first gnathopod; carpus triangular, length 1.5 width; propodus length 1.5 width.

Pereopods (Figs 28,29): length longest pereopod (6) 1.8 gnathopod 2; pereopod lengths (relative to pereopod 6): pereopod 3 = 0.8, 4 = 0.7, 5 = 0.9, 7 = 0.95; setae of coxae 2-3 like coxa 1, coxa 4 with short bare area on ventral margin; pereopods 3 and 4 similar,

spines on all articles short, including basodactylar armaments; posterior spine formula on article 5 of pereopods 3-4 = 4-2-2-2 and 4-2-2-2, on article 6 = 2-1-2-1-1 and 2-1-2-1-1; pereopods 5-7 similar, spines on all articles short, including basodactylar armaments.

Epimera (Fig. 30): epimera 1-3 posteroventrally subquadrate, epimeron 1 anterodistal region almost straight, with several long simple setae and 1 short spine, ventral margin bare, posterior angle rounded; subventral margins of epimera 2 and 3 with 2 short spines. *Pleopods* (Fig. 30): peduncles moderately setose. *Urosome* (Fig. 30): urosomites 1-3 with several small spines on posterodorsal margins; uropod 3 extending slightly beyond uropods 1 and 2 on entire animal, but uropod lengths (relative to uropod 1): uropod 2 = 0.7, 3 = 0.7.

First uropod (Fig. 30): peduncle length 1.1 inner ramus, lateral and medial margins with several short robust spines, medial and lateral distal angles each with

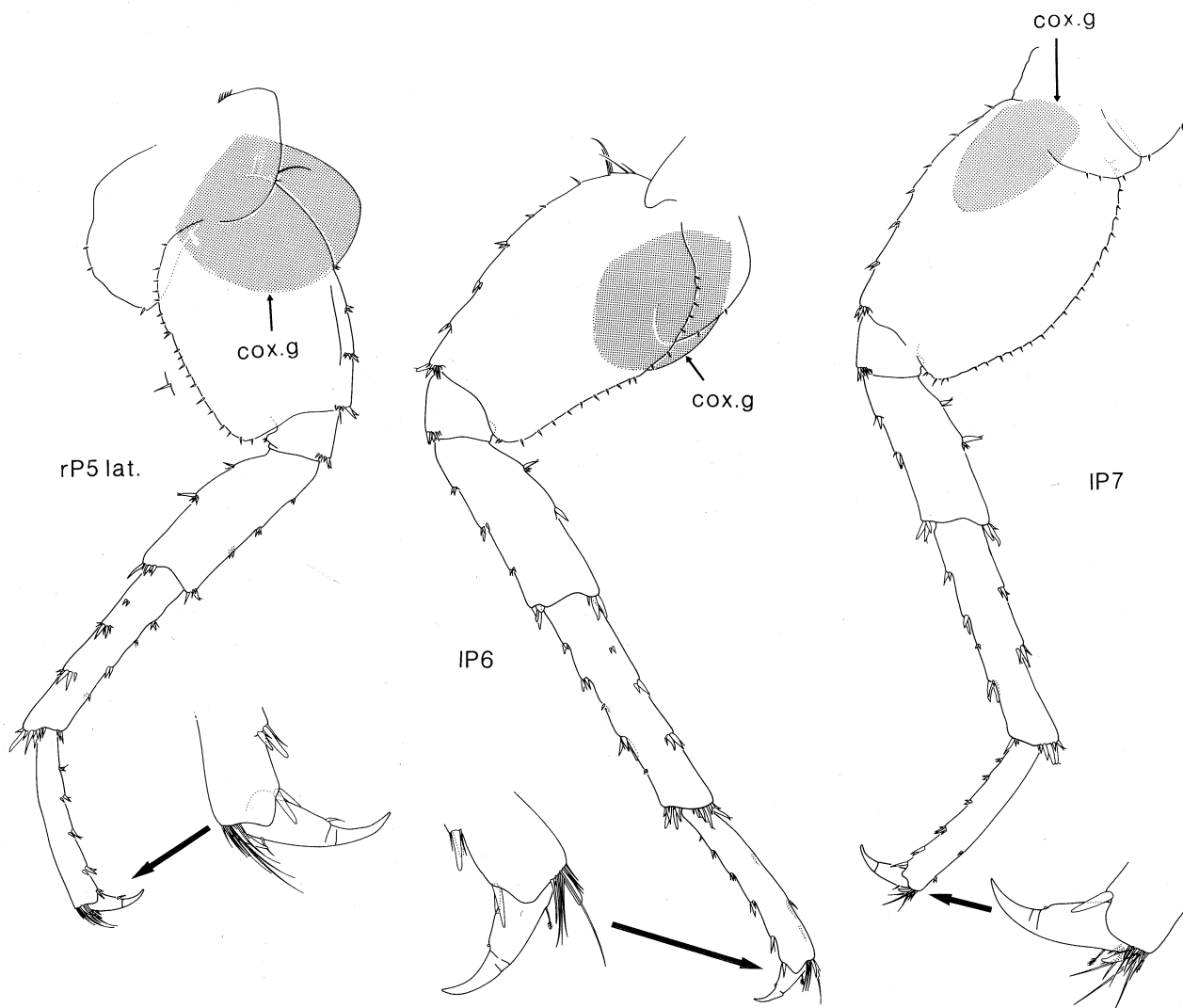


Fig.29. *Antipodeus antipodeus* (G.W. Smith), lectotype, male.

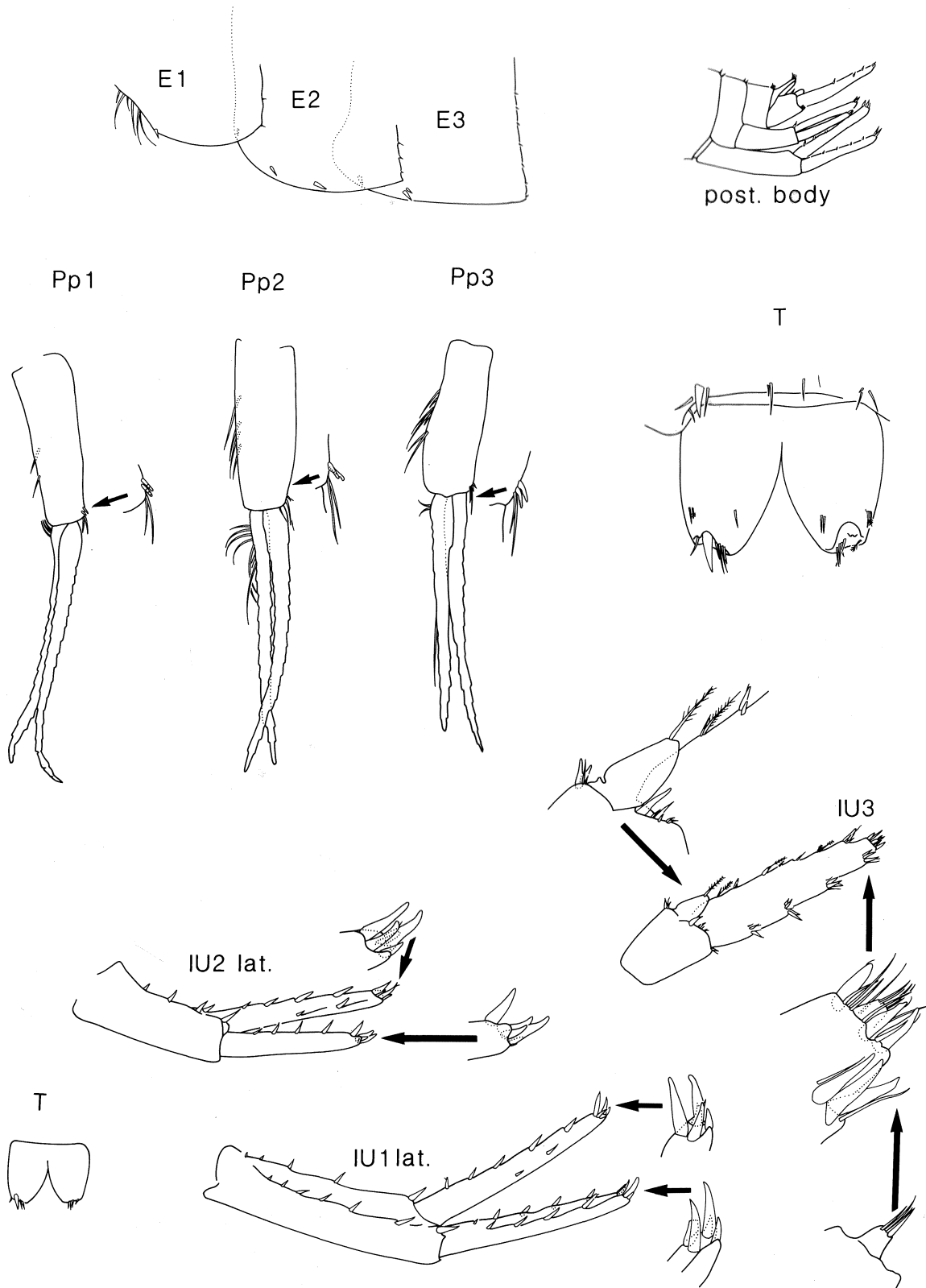


Fig.30. *Antipodeus antipodeus* (G.W. Smith), lectotype, male. Small T to same scale as U1-3.

robust spine; inner ramus slightly (1.1) longer than outer ramus, both rami with several short medial and lateral marginal spines and a terminal group of 5 spines. *Second uropod* (Fig. 30): peduncle slightly shorter (0.95) than inner ramus; inner ramus longer than outer ramus, both rami with several short medial and lateral marginal spines and a terminal group of 5 longer spines. *Third uropod* (Fig. 30): peduncle length 0.4 outer ramus, with several strong spines on distal margin; outer ramus distal article vestigial, proximal article with groups of medial and lateral spines and medial plumose setae; inner ramus 0.2 length outer ramus, scale-like, oval, with single plumose distal seta.

Telson (Fig. 30): length 0.8 width; cleft extending 75 percent length telson; lobes truncate, with 1 robust spine distally, 4–6 associated smaller spines and setules, with 2 groups of penicillate setules dorsolaterally and dorsomedially at M.80.

Description of syntype (non-ovigerous female).

Body: length 19 mm.

First antenna (Fig. 31): accessory flagellum 2-articulate, scarcely reaching beyond flagellar article 1.

Left and right first maxillae: inner plate with 6 medial plumose setae distally.

First and second gnathopods (Fig. 31): palms more or less straight. Oostegites broad.

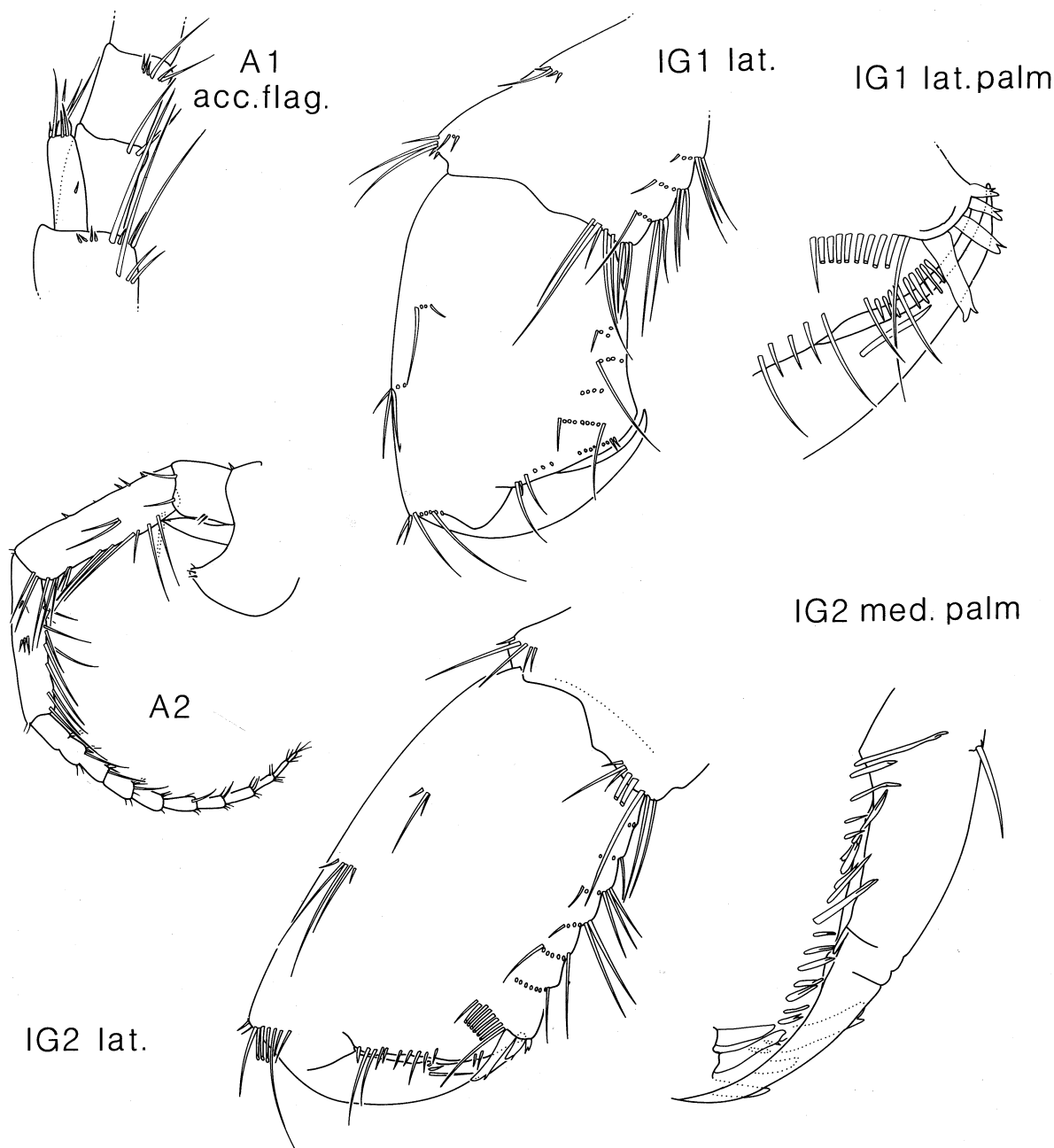


Fig. 31. *Antipodeus antipodeus* (G.W. Smith), syntype, female.

Relationship. This is the type species and its relationships will be considered subsequently.

Distribution. Tasmania, Mole Creek.

Antipodeus wellingtoni (G.W. Smith)

Figs 32–35

Neoniphargus wellingtoni Smith, 1909: 75, pl. 14, figs 9–12.

Type locality. Mount Wellington, Pinnacle Track Creek, Tas.

Type material. Material attributed to this species by Smith is located in the Hope Museum, Oxford. Labels read: (1) “*Neoniphargus wellingtoni* SMITH Pinnacle Track Creek, Mount Wellington, Tasmania, Dec. 1907. G.W. Smith Esq. REF. NO. 5395. Cotypes”; (2) “*Neoniphargus wellingtoni*”; (3) “Pinnacle Track Creek Mt. Wellington. Dec./07.”

The material comprised 21 specimens, in at least 3 different taxa.

One taxon (5 specimens) was of material clearly referable to the Talitridae; specimens had convoluted gills and greatly reduced pleopods and therefore seem likely to be a terrestrial talitrid species accidentally netted by Smith.

A second taxon (3 specimens), whilst clearly a crangonyctoid, was not referable to *N. wellingtoni* as briefly described by Smith; it differed in particular from Smith’s description in that its first and second antennae were not ‘very setose’ and the accessory flagellum of the first antenna was 3-articulate. Several other characters distinguish this taxon from the other species of crangonyctoid described from Mount Wellington, viz. *Neoniphargus thomsoni* Stebbing (= *Niphargus montanus* Thomson), particularly the lack of rugose areas on the maxillipeds and gnathopods. It is also not referable to any other taxon described by Smith (1909a) and redescribed here, though affinities are obvious with *Antipodeus niger* and *A. antipodeus*.

A third taxon (12 specimens) agreed broadly with those characters briefly mentioned by Smith as distinguishing *Neoniphargus wellingtoni*, and accordingly this material was regarded as syntype material for this species. It comprised 6 males, 2 ovigerous females, 4 non-ovigerous females. A large undamaged male was selected as lectotype and fully dissected. Also dissected were 1 further male and 1 ovigerous female. Many of the specimens in this series were slightly to severely damaged.

A single specimen amongst the material was not referable with certainty to any of the 3 taxa noted above. It lacked a head and was otherwise severely damaged.

Diagnosis. Setae on antennae 1–2 long and dense. Antennal sinus weak. Article 2 of mandibular palp not significantly longer than article 3, with only a few short (but many long) setae. Inner plate of maxilla 1 with 5–8 plumose setae, outer plate with 9 spines. Ventral setae on coxae 1–3 very short but numerous. Gnathopods sexually dimorphic; palms on male gnathopods excavate; female palms not excavate. Posterior setae

on article 2 of pereopods 5–7 short but numerous. Pereonites 6–7 and pleonites 1–3 naked or poorly setose dorsally. Spines on rami of uropods 1–2 elongate and crowded. Outer ramus of third uropod 0.9 length of peduncle. Telson cleft 50% of its length, lobe apices broadly rounded, with 2 medium sized apical spines on each lobe.

Description of lectotype (male). *Body:* pereon smooth, but pleon and urosome with several dorsal spines; length 18 mm.

Head (Fig. 32): rostrum short; eyes relatively small and oval.

First antenna (Fig. 32): length 0.5 body, 2.0 second antenna; peduncle 0.8 length of flagellum, all peduncular articles with dense fringe of long setae on lower margin; accessory flagellum 2-articulate but distal article minute, not reaching to distal margin of flagellum article 1; flagellar article 1 longer than wide. *Second antenna* (Fig. 32): length 0.2 body; peduncle slightly longer than flagellum, articles 4 and 5 subequal and with a dense fringe of long setae on lower margin; flagellum 9-articulate, with long setae on lower margins of articles, lacking calceoli.

Left mandible (Fig. 32): palp articles 2 and 3 subequal, article 2 with many long and a few short setae on inner edge, setal formula on article 3 = 2A, 2, 1B, 6+C, some D, 6E; incisor 5-toothed; lacinia mobilis 4-toothed; about 13 serrate to plumose accessory blades arranged in a reasonably regular row; molar with anterior brush of fine setae, 1 basal plumose spine.

Right mandible (Fig. 32): incisor 4-toothed; lacinia mobilis with 2 serrate cutting edges; 8 setose accessory blades in semi-regular row. *Left first maxilla* (Fig. 32): palp article 2 with 9 long, thin, blunt spines distally, 1 apicolateral disjunct spine, 1 subapical seta; outer plate apparently with 9 denticulate spines distally; inner plate with 8 plumose medial setae on distal half, both inner and outer margins pubescent. *Right first maxilla* (Fig. 32): palp article 2 with 4 short tooth-like spines, 1 sparsely plumose and longer disjunct spine apicolaterally, 1 subdistal seta; inner plate with 9 medial plumose setae on distal half. *Second maxilla* (Fig. 32): outer plate outer margin setose; inner plate with medial row of many long setae on distal half, inner edge finely pubescent. *Maxilliped* (Fig. 32): inner plate with 3 short blunt spines distally.

First gnathopod (Fig. 33): coxal plate with many short setae on rounded distal and straight anterior margins; carpus triangular, length 1.75 width, with several short rows of long spines near posterior margin, without rugose lobe; propodus almost rectangular, length 1.3 width, palm sinuous, several rows of long setae near posterior margin, posterodistal angle with 4 lateral large, blunt spines and 2 smaller medials. *Second gnathopod* (Fig. 33): larger than first gnathopod; carpus triangular, length 1.9 width; propodus almost rectangular, length 1.7 width, posterodistal outer angle with 3 large, blunt spines and 2 smaller medials.

Pereopods (Fig. 34): length longest pereopod (6) 1.5

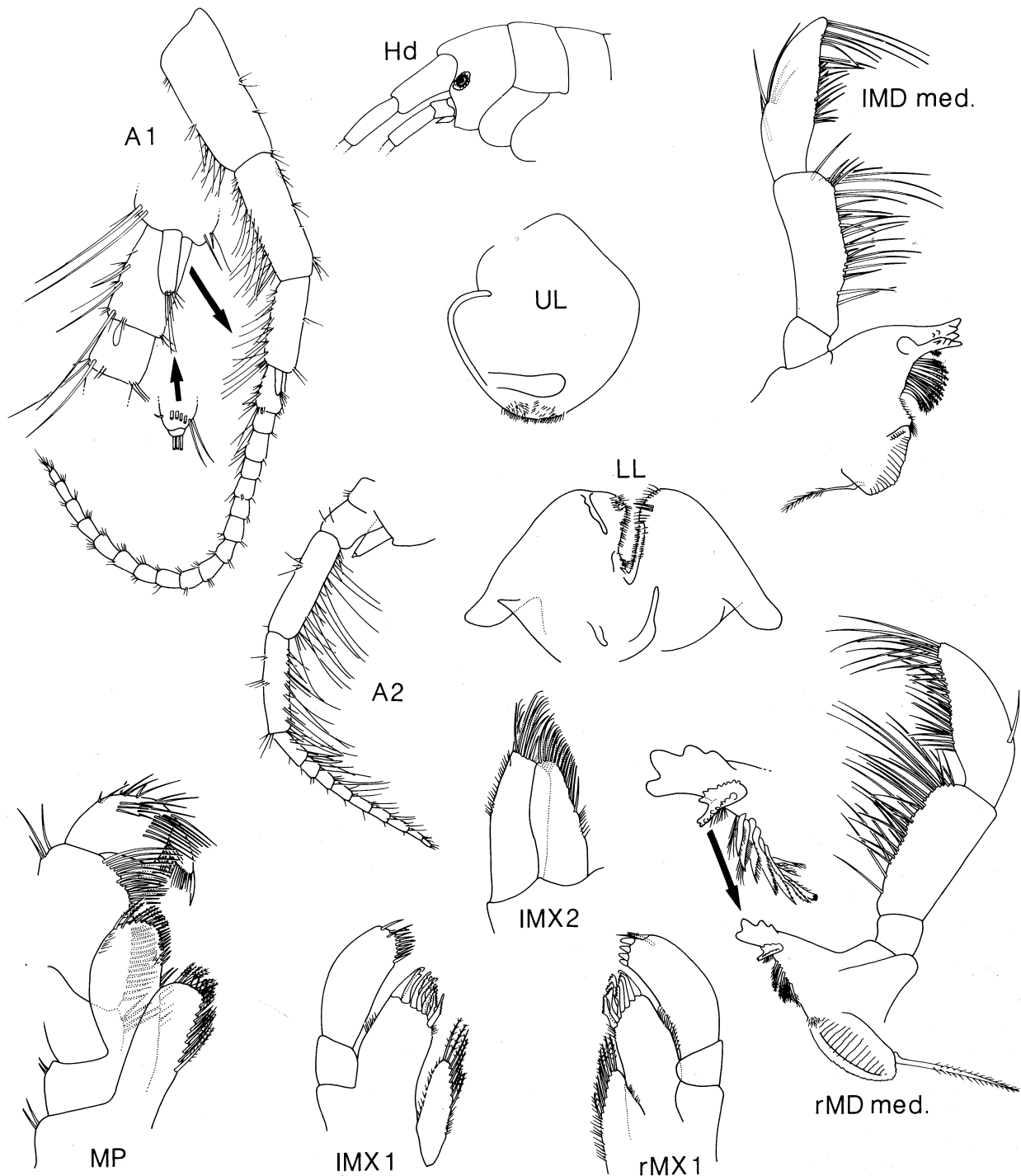


Fig.32. *Antipodeus wellingtoni* (G.W. Smith), lectotype, male.

gnathopod 2; pereopod lengths (relative to pereopod 6): pereopod 3 = 0.8, 4 = 0.7, 5 = 0.9, 7 = 0.95; pereopods 3 and 4 similar, propodi with few relatively short spines on posterior margins, basodactylar armaments short; spine formulas on article 5 of pereopods 3-4 = 4-2-2 and 4-3-2, on article 6 = 2-1-1-1 and 2-s-2-2-2; pereopods 5-7 similar, articles 4-6 poorly setose on posterior margins, anterior margins of

propodi (5,6) with 3 groups of spines besides locking spines, but none of these long and fine, basodactylar armaments as long as dactylus and associated (6,7) with a large and robust spine.

Epimera (Fig. 34): epimera 1-3 with bluntly quadrate posteroventral corners; epimeron 1 anterior angle rounded, with several short setae, posterior angle almost square; epimera 2 and 3 subquadrate,

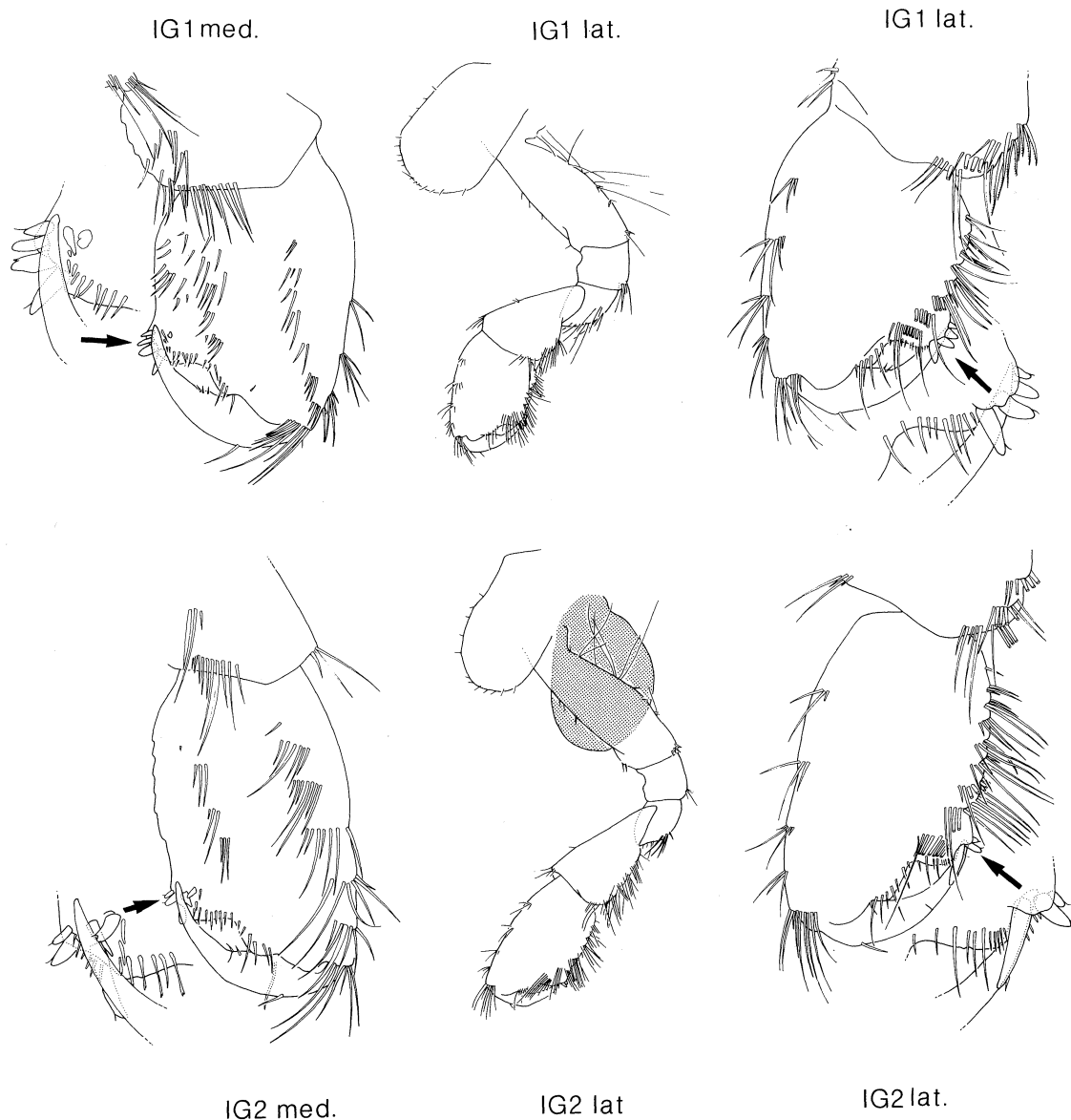


Fig.33. *Antipodeus wellingtoni* (G.W. Smith), lectotype, male.

with 2 and 1 short submarginal distal spines, respectively. *Urosome* (Fig. 35): urosomites 1–3 with several scattered dorsal spines; uropod 3 not extending beyond uropods 1 and 2 in entire animal; uropod lengths (relative to uropod 1): uropod 2 = 0.7, 3 = 0.5. *Pleopods* (Fig. 34): peduncles sparsely setose.

First uropod (Fig. 35): peduncle length 1.3 inner ramus, lateral margin with several robust spines, medial margin bare, medial and lateral distal angles each with robust spine; inner and outer rami subequal, margins with several relatively long spines, and a group of 4–5 spines terminally. *Second uropod* (Fig. 35): peduncle same length as inner ramus, with 2 lateral marginal spines, apicodistal corners with 1 spine each; inner ramus longer than outer ramus, both rami with

few relatively long marginal spines, group of 4–5 similar spines terminally; these spines and those on inner ramus of uropod 1 almost intermingling, thus rami almost continuously spinose to apex. *Third uropod* (Fig. 35): peduncle slightly longer than outer ramus, with several long and robust spines on distal margin; outer ramus 1-articulate, without trace of distal article, with 2 transverse lateral and 1 transverse medial row of spines and apical group of similar spines, no medial plumose setae present; inner ramus length 0.25 outer ramus, scale like, broadly triangular, with 1 short, strong distal spine. *Telson* (Fig. 35): very short, thus length 0.5 width, cleft extending 50 percent length; lobes broadly rounded, each with 2 medium sized spines and 1 penicillate setule distally and pair of

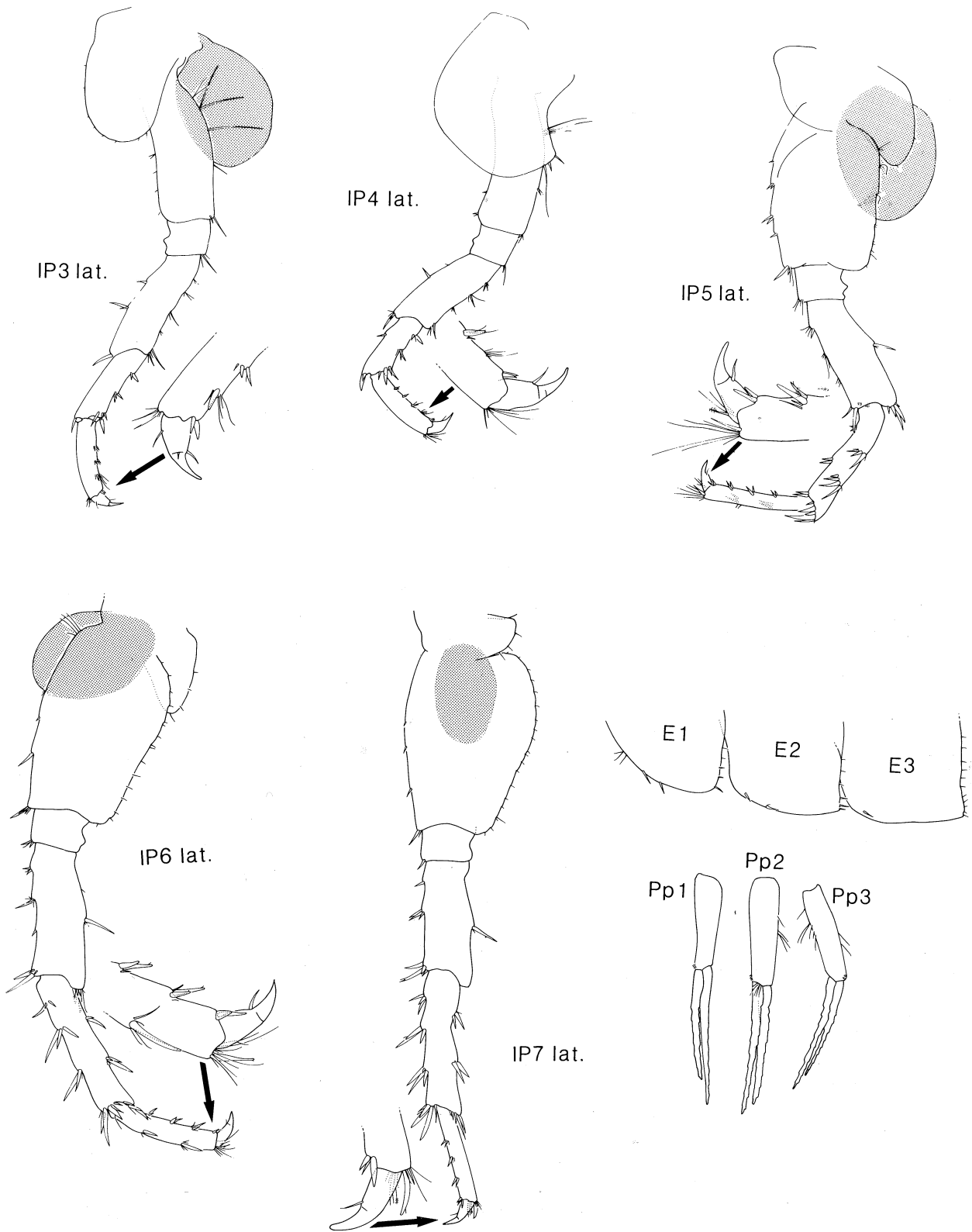


Fig.34. *Antipodeus wellingtoni* (G.W. Smith), lectotype, male.

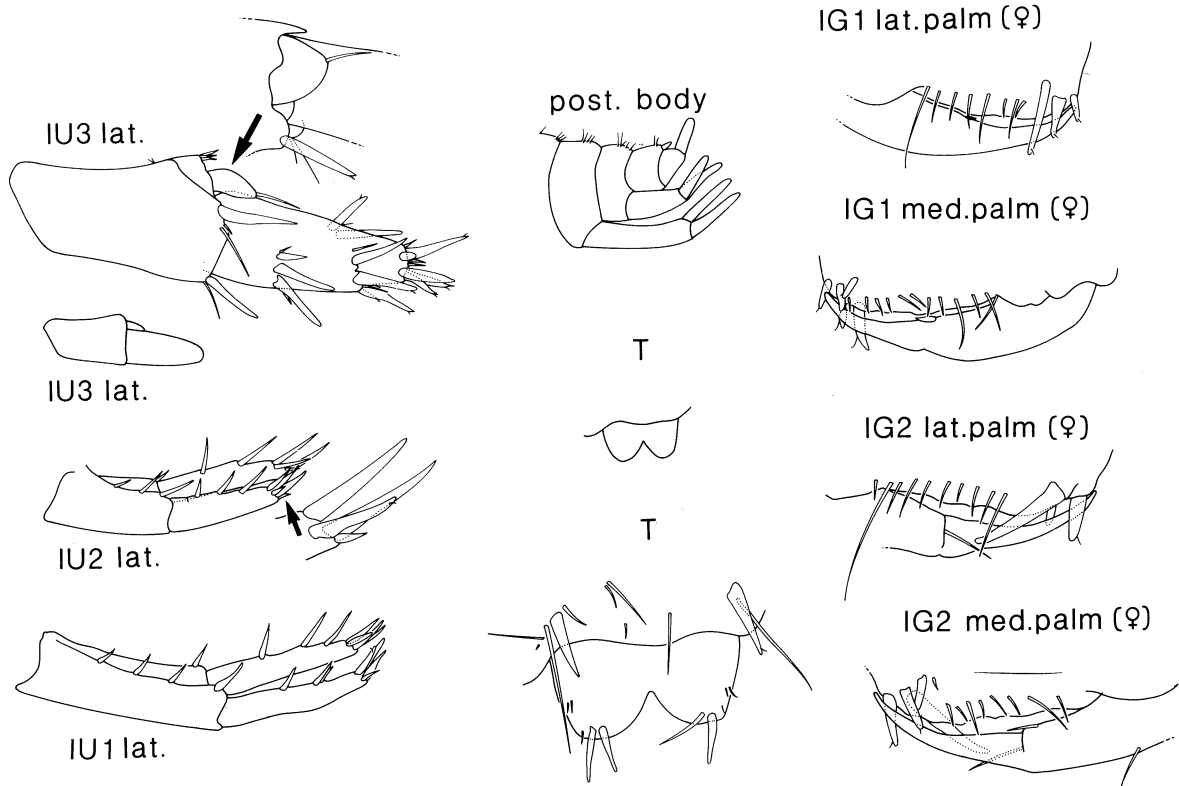


Fig.35. *Antipodeus wellingtoni* (G.W. Smith), lectotype, male (all drawings except palms of G1, G2); syntype, female (palms). Small U3 and T to same scale as U2, U1.

penicillate dorsolateral setules about M.60.

Description of syntype (male). *Body:* length 12 mm.

First antenna: length 0.45 body, 1.8 second antenna; peduncle as long as flagellum.

First maxillae: left inner plate with 6 plumose setae distally; right inner plate with 5.

First gnathopod: propodus posterodistal lateral angle with 3 large, blunt spines. *Second gnathopod:* propodus posterodistal lateral angle with 2 large, blunt spines.

Description of syntype (ovigerous female). *Body:* length 14 mm.

First antenna: length 0.4 body, 1.6 second antenna; peduncle as long as flagellum.

First maxillae: left inner plate with 6 plumose spines distally; right inner plate with 7.

First and second gnathopods (Fig. 35): palms more or less straight.

Partial description of remaining 4 male syntypes.

Body: length 9–16 (\bar{x} = 13) mm.

First antenna: length 0.4–0.45 (\bar{x} = 0.42) body, 1.6–1.7 (\bar{x} = 1.6) second antennae. *Second antenna:* length 0.2–0.3 (\bar{x} = 0.25) body.

Urosome: uropod length (relative to uropod 1): uropod 2 = 0.5–0.8 (\bar{x} = 0.7), 3 = 0.3–0.5 (\bar{x} = 0.45).

Partial description of remaining 5 female syntypes.

Body: length 12–15 (\bar{x} = 13.5) mm.

First antenna: length 0.28–0.34 (\bar{x} = 0.31) body, 1.2–1.9 (\bar{x} = 1.5) second antennae. *Second antenna:* length 0.21–0.25 (\bar{x} = 0.23) body.

Urosome: uropod length (relative to uropod 1): uropod 2 = 0.62–0.67 (\bar{x} = 0.65), 3 = 0.42–0.45 (\bar{x} = 0.43).

Relationship. This species differs most significantly from *A. antipodeus* in the 2-articulate (versus 3) accessory flagellum, the 9 (versus 11) spines on the outer plate of maxilla 1, the long basodactylar armaments of pereopods 5–7, the longer spines on the rami of uropods 1–2, and the short and less deeply cleft telson. Its distinguishing features from all other species of *Antipodeus* are indicated in Key I (above).

Distribution. Tasmania, Mount Wellington, Pinnacle Track Creek.

***Antipodeus niger* (G.W. Smith)**

Figs 36–39

Neoniphargus niger G.W. Smith, 1909a: 76, pl. 15, figs 1–4.

Type locality. Hartz Mountains, Lake Perry, Tas.

Type material. Material attributed to this species by Smith is located in the Hope Museum, Oxford. Labels read: (1) “*Neoniphargus niger*, SMITH Lake Perry

Hartz Mts. Tasmania Nov. 1907 G.W. Smith, Esq. REF. NO. 5397 Cotypes"; (2) "*N. niger*"; (3) "Lake Perry Hartz Nov 27".

The material consisted of only 2 specimens: 1 slightly damaged non-ovigerous female, and 1 severely damaged putative male (lacking gnathopoda, uropoda, telson). The female was selected as LECTOTYPE. Both specimens were fully dissected.

Diagnosis. Setae on antennae 1–2 of short to medium length, but dense only on flagellum of antenna 2. Antennal sinus [?weak], [?defined by tooth below]. Article 2 of mandibular palp much longer than article 3, with many short and a few long setae. Inner plate of maxilla 1 with 5–6 plumose setae, outer plate with 11 spines. Ventral setae on coxae 1–4 long and

moderately dense. Gnathopods [?sexually dimorphic]; palms on male gnathopods [?excavate]; female palms straight or weakly sinuous. Posterior setae on article 2 of pereopods 5–7 long and numerous. Pleonites 1–3 and urosomites 1–3 setose dorsally. Spines on rami of uropods 1–2 elongate and dispersed. Outer ramus of third uropod 1.7 times length of peduncle. Telson cleft 80 percent of length, each lobe apically with 2 long spines and 2 long setae plus 2 short setae.

Description of lectotype (non-ovigerous female).

Body: pereon smooth, but pleon and urosome setose dorsally (Fig. 38); length 11 mm.

Head (Fig. 36): rostrum short; eyes small and oval; inferior antennal sinus [?weak].

First antenna (Fig. 36): length 0.4 body, 2.2 second

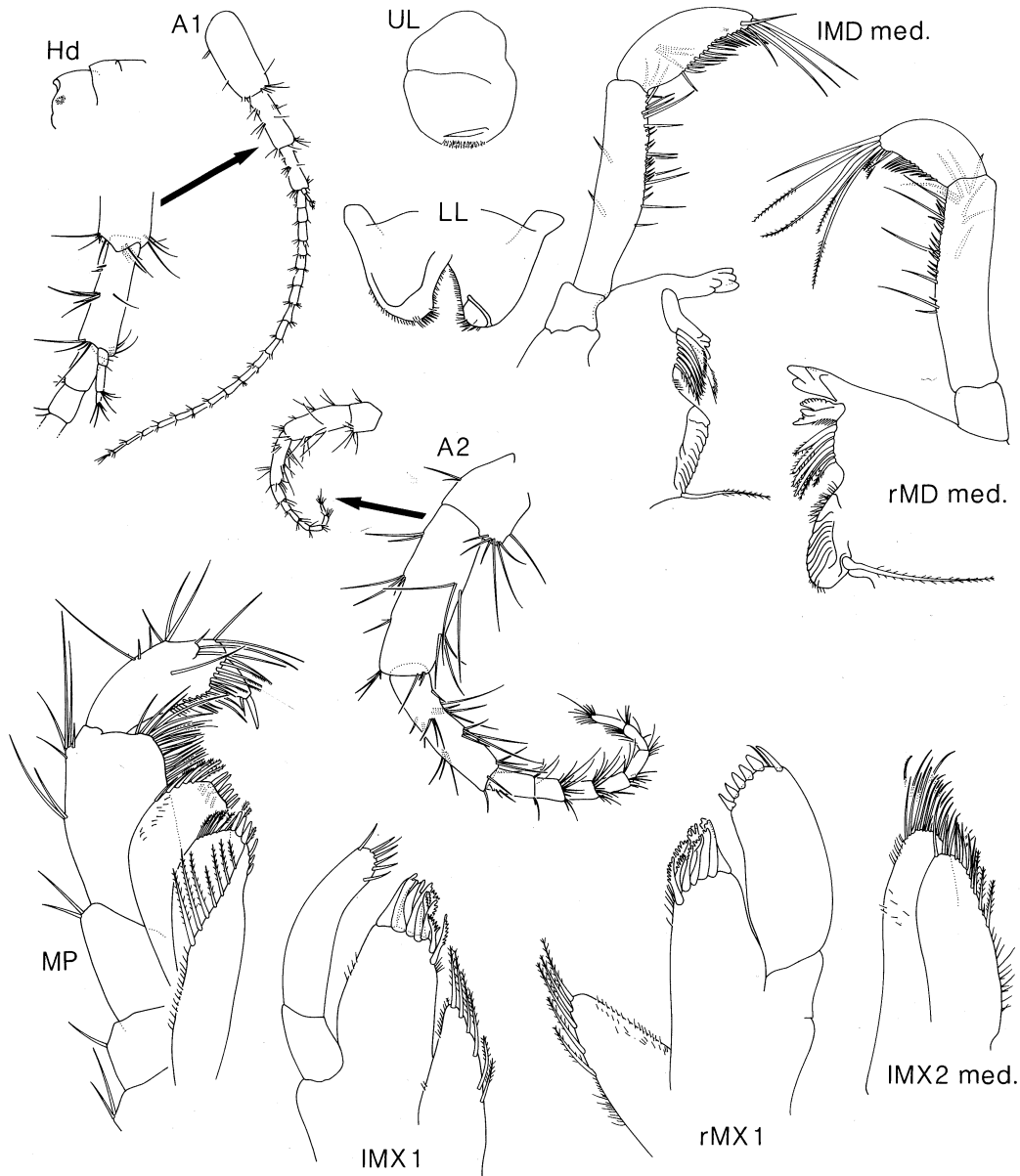


Fig.36. *Antipodeus niger* (G.W. Smith), lectotype, female. Small A2 to same scale as full A1.

antennae; peduncle length 0.35 flagellum, article 1 stout and largest, article 3 shortest, all articles with clusters of moderately short setae; accessory flagellum 3-articulate, reaching just beyond distal margin of flagellum article 1; flagellum article 1 slightly longer than wide. *Second antenna* (Fig. 36): length 0.2 body; peduncle distinctly longer than flagellum, article 4 stouter and longer than 5, both articles 4 and 5 (and distal margin of 3) with clusters of medium sized long setae; flagellum 7-articulate, each article with many setae on distal margin, lacking calceoli.

Left mandible (Fig. 36): palp article 3 much shorter than 2, article 2 many short and a few long setae, setal

formula on article 3 = 3A, many D, 6E; incisor 5-toothed; lacinia mobilis 4-toothed; about 8 serrate to plumose accessory blades. *Right mandible* (Fig. 36): incisor 4-toothed; lacinia mobilis with 2 serrate cutting edges, almost trifid; 6 accessory blades. *Left first maxilla* (Fig. 36): palp article 2 with 5 long, thin, blunt spines, 1 thinner apicolateral spine, 1 subapical seta; outer plate with 11 spines, some denticulate, medial and lateral margins pubescent in part; inner plate with 6 medial plumose setae distally, lateral margin pubescent. *Right first maxilla* (Fig. 36): palp article 2 with 5 short, blunt spines, 1 longer apicolateral spine, 1 subapical seta; outer plate with 11 spines, some

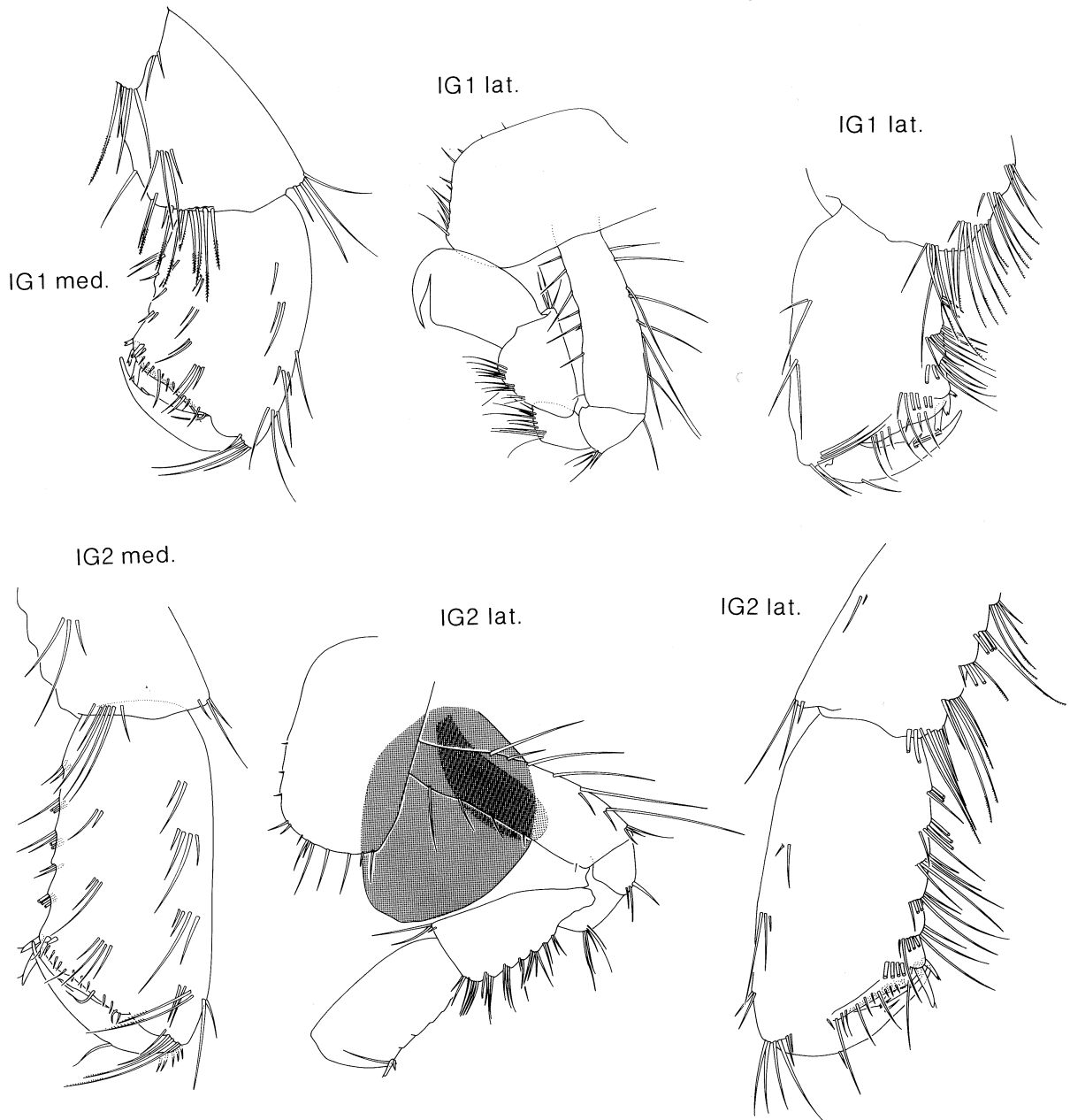


Fig.37. *Antipodeus niger* (G.W. Smith), lectotype, female.

denticulate; inner plate with 5 plumose medial setae distally, both inner and outer margins pubescent. *Second maxilla* (Fig. 36): outer plate outer distal margin pubescent; inner plate with inner distal row of plumose setae, inner proximal margin pubescent.

First gnathopod (Fig. 37): coxal plate with anterior and posterior margins parallel, several moderately long setae on distal margin; carpus triangular, unlobed, length 1.4 width, with 3 short rows of long spines near posterior margin, without rugose lobe; propodus rectangular, length 1.6 width, palm almost transverse and straight, several rows of very long setae near posterior margin, posterodistal angle with 3 bifid

spines (1 small, 1 medium, 1 large) and 2 medials. *Second gnathopod* (Fig. 37): larger than first gnathopod; carpus triangular, elongate, length 2.3 width; propodus rectangular, length 2.0 width, lateral posterodistal angle with 2 large, blunt spines, medial with 2 smaller.

Pereopods (Figs 38,39): length longest pereopod (6) 1.6 gnathopod 2; pereopod lengths (relative to pereopod 6): pereopod 3 = 0.65, 4 = 0.6, 5 = 0.8, 7 = 0.9; pereopods 3 and 4 similar, merus with groups of relatively long spines on posterior margin, basodactylar armaments short, formulas of spines on article 5 of pereopods 3-4 = 2-2-1 and 2-2-2, article 6

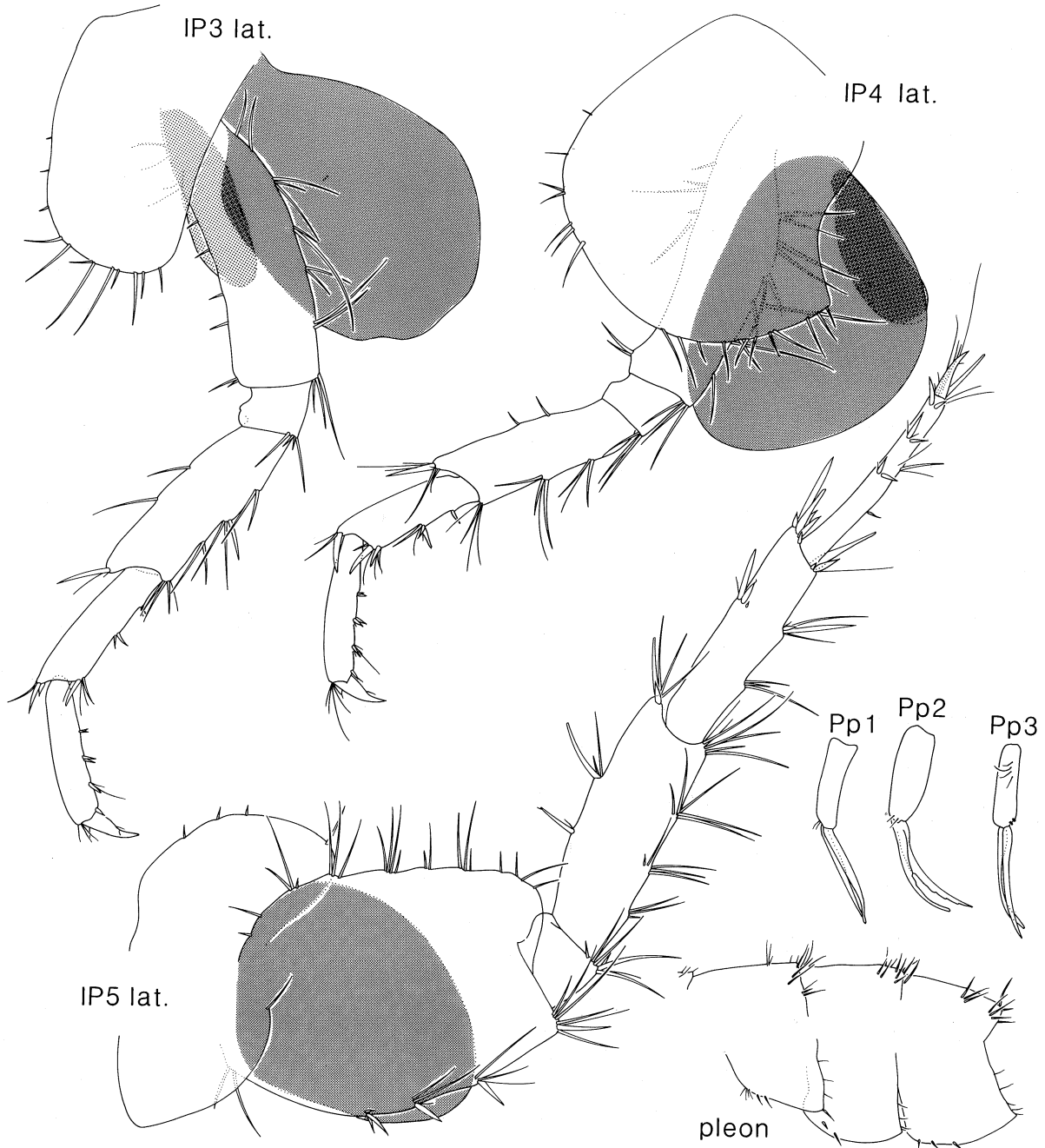


Fig.38. *Antipodeus niger* (G.W. Smith), lectotype, female.

= 2-2-2-2 and 2-2-2-2; pereopods 5-7 similar, article 2 expanded and lobate, all with very long posterior setae, articles 4-6 with long anterior setae and strongly spinose; carpus and/or propodus with some long, finer spines; basodactylar armaments longer than dactyli and associated with large and robust spine.

Epimera (Fig. 38): epimeron 1 anterior distal corner shallowly angled, with several moderately long setae and few spines, posterior angle almost square,

posterior margin with few moderately long setae; epimera 2 and 3 subquadrate, anteroventral margin with a few spines, posterior margins with a few setae.

Urosome (Fig. 39): urosomites 1-3 with numerous dorsal setae in groups, several groups anteriorly placed; uropod 3 clearly extending beyond uropods 1 and 2 in entire animal; uropod lengths (relative to uropod 1): uropod 2 = 0.6, 3 = 0.6.

First uropod (Fig. 39): peduncle length 1.3 inner

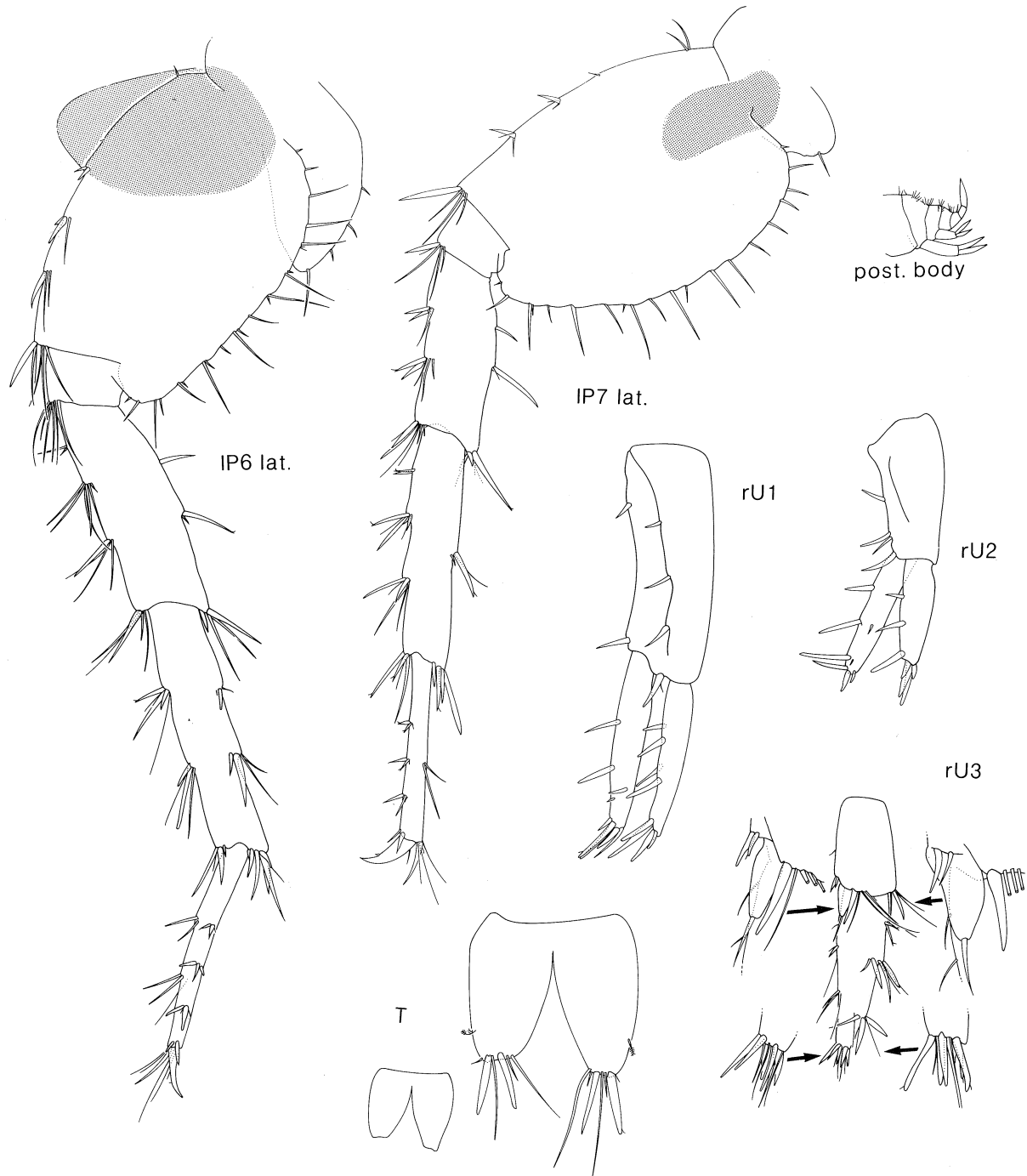


Fig.39. *Antipodeus niger* (G.W. Smith), lectotype, female. Small T to same scale as U1-3.

ramus, lateral margin with 3 spines, medial margin with 1 basal spine, medial and lateral apicodistal angles each with 1 spine; inner ramus slightly longer than outer ramus, both rami with a few moderately long spines on medial and lateral margins and 4–5 long spines terminally. *Second uropod* (Fig. 39): peduncle slightly (1.1) longer than inner ramus, with a few marginal spines; inner ramus slightly longer than outer ramus, both rami with a few long marginal spines, and a group of 4–5 long spines apically. *Third uropod* (Fig. 39): peduncle length 0.6 outer ramus, with several long robust spines on distal margin; outer ramus 1-articulate, without trace of distal article, with a few, short transverse (mostly lateral) rows of relatively long robust spines on body of ramus and apical group of similar spines; inner ramus 0.2 length of outer ramus, scale-like, roughly triangular, with 1 distal spine. *Telson* (Fig. 39): as long as wide, cleft extending 70 percent length; lobes truncate, each with 2 robust spines and 4 setae apically.

Description of syntype (putative male). *First antenna*: peduncle length 0.5 flagellum; accessory flagellum 2-articulate.

Left first maxilla: palp article 2 with 9 long blunt spines distally; inner and outer plates with both outer and inner margins pubescent.

Relationship. This species differs most from *A. ripensis* in those elements indicated in Key I to the Species (couplet 2). It differs from *A. antipodeus* in the more elongate setae of coxae 1–4 and article 2 of pereopods 5–7, in the more elongate spines on the rami of uropods 1–2, and the presence of long setae on the telson. Indeed, the distinguishing features of this species from all other species of *Antipodeus* concern the elongate spines and/or setae on various appendages (notably article 2 pereopods 5–7, articles 3–6 pereopods 5–7, and the ventral margins of coxae 1–3).

Distribution. Tasmania, Hartz Mountains, Lake Perry.

Antipodeus ripensis (G.W. Smith)

Figs 40–43

Gammarus ripensis Smith, 1909a: 77–78, pl. 14, figs 23–26.

Type locality. Tasmania, Great Lake.

Type material. Material attributed to this species by Smith is located in the Hope Museum, Oxford. Labels read: (1) “Amphipoda 22 specimens Oxford University Museum, Dept. of Zoology and Comp. Anatomy, *Gammarus ripensis* Smith ‘Cotypes’ Loc. Great Lake, Tasmania. Ref. No. 5398 Source Colled by & presented by G.W. Smith Date 1907–1908”; (2) “*Gammarus ripensis*, Smith Great Lake, Tasmania. 1907–1908. G.W. Smith, Esq. Ref. No. 5398 Cotypes”; (3) “The Great Lake”; (4) “*Gammarus ripensis*”.

The material comprised 22 specimens, some badly damaged. Two distinct taxa were present. The more numerous taxon (19 specimens) agreed with Smith’s

description of *Gammarus ripensis* in most (but not all) described characters. The least numerous one (3 specimens) differed significantly from this description, but could be referred to the second (undescribed) taxon present in Smith’s material of *Neoniphargus tasmanicus*, also collected from the Great Lake (see later notes on type material of *Tasniphargus tyleri* and *N. tasmanicus*).

The more numerous taxon was regarded as syntype material, and comprised 7 males and 12 non-ovigerous females. An undamaged male was selected as LECTOTYPE and fully dissected. Also fully dissected were one additional male and a female.

Diagnosis. Setae on antennae 1–2 long and dense. Antennal sinus [?weak], [?defined by tooth below]. Article 2 of mandibular palp subequal in length to article 3, setae numerous and mostly long. Inner plate of maxilla 1 with 4–7 setae, outer plate with [?11] spines. Ventral setae on coxae 1–4 sparse and of medium length. Gnathopods not sexually dimorphic; palms of male and female gnathopods straight or weakly sinuous. Posterior setae on article 2 of pereopods 5–7 of short to medium length. Pereonites 6–7 and pleonites 1–3 with numerous spines and setae dorsally. Spines on rami of uropods 1–2 short to moderately elongate and dispersed. Outer ramus of third uropod 1.7 times length of peduncle. Telson cleft 70 percent of length, each lobe with 1–2 short apical spine(s).

Description of lectotype (male). *Body* (Figs 40,42): posterior dorsal margins of pereonites 6 and 7 and all pleonites with numerous spines and setae; length 10 mm.

Head (Fig. 40): rostrum short; eyes large, oval; inferior antennal sinus weak.

First antenna (Fig. 40): length 0.75 body, 2.1 second antenna; peduncle length 0.7 flagellum, articles 1 and 2 subequal, article 3 slightly shorter, all articles with a dense fringe of long setae on lower margins; accessory flagellum 2-articulate, but distal article minute, not reaching to end of distal margin of flagellum article 1; flagellum article 1 length 2.0 width. *Second antenna* (Fig. 40): length 0.35 body; peduncle distinctly longer than flagellum, articles 4 and 5 subequal in length and with a dense fringe of long setae on lower margins; flagellum 10-articulate, with long setae on inner margin of proximal articles, lacking calceoli.

Left mandible (Fig. 40): palp articles 2 and 3 subequal, article 2 with numerous long setae and few short setae, setal formula of article 3 = 10+ A, many C, many D, many E; incisor 5-toothed; lacinia mobilis 4-toothed; about 8 more or less regularly arranged serrate to plumose accessory blades. *Right mandible* (Fig. 40): incisor 4-toothed; lacinia mobilis with 2 serrate cutting edges; 7 setose accessory blades. *Left first maxilla* (Fig. 40): palp article 2 with 5 long, thin, blunt spines distally and 4 subapical setae; outer plate with [?11] spines, some denticulate; inner plate with 4 plumose setae distally, and both medial and lateral

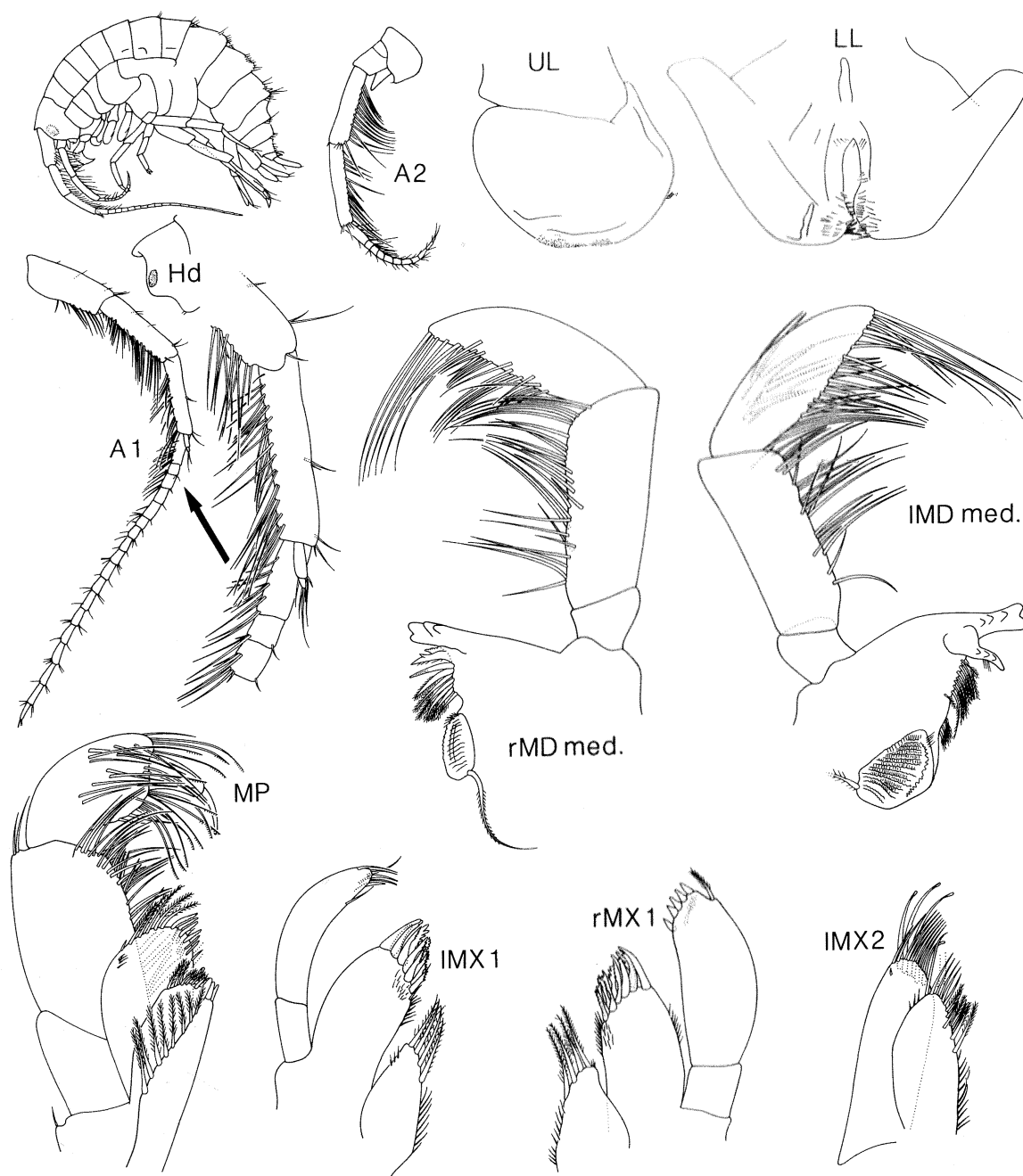


Fig.40. *Antipodeus ripensis* (G.W. Smith), lectotype, male.

margins pubescent. *Right first maxilla* (Fig. 40): palp article 2 with 5 short, blunt, tooth-like spines, 1 plumose spine in apicolateral notch, 1 subapical seta; outer plate medial and lateral margins pubescent. *Second maxilla* (Fig. 40): inner plate with distal half of medial margin setose, 1 seta slightly submarginal.

First gnathopod (Fig. 41): coxal plate even, with several short setae on rounded distal margin; carpus triangular, length 1.8 width, with several short rows of long spines near posterior margin, without rugose lobe; propodus almost rectangular, length 1.5 width,

palm straight, several short rows of long setae near posterior margin, posterodistal angle with 3 large, blunt spines and 2 medials. *Second gnathopod* (Fig. 41): larger than first gnathopod; carpus triangular, length 2.2 width; propodus almost triangular, length 1.8 width, posterodistal angle with 3 blunt lateral spines (1 small) and 2 medials.

Pereopods (Figs 42,43): length longest pereopod (6) 1.6 gnathopod 2; pereopod lengths (relative to pereopod 6): pereopod 3 = 0.8, 4 = 0.6, 5 = 0.9, 7 = 0.95; pereopods 3 and 4 similar, basodactylar spines

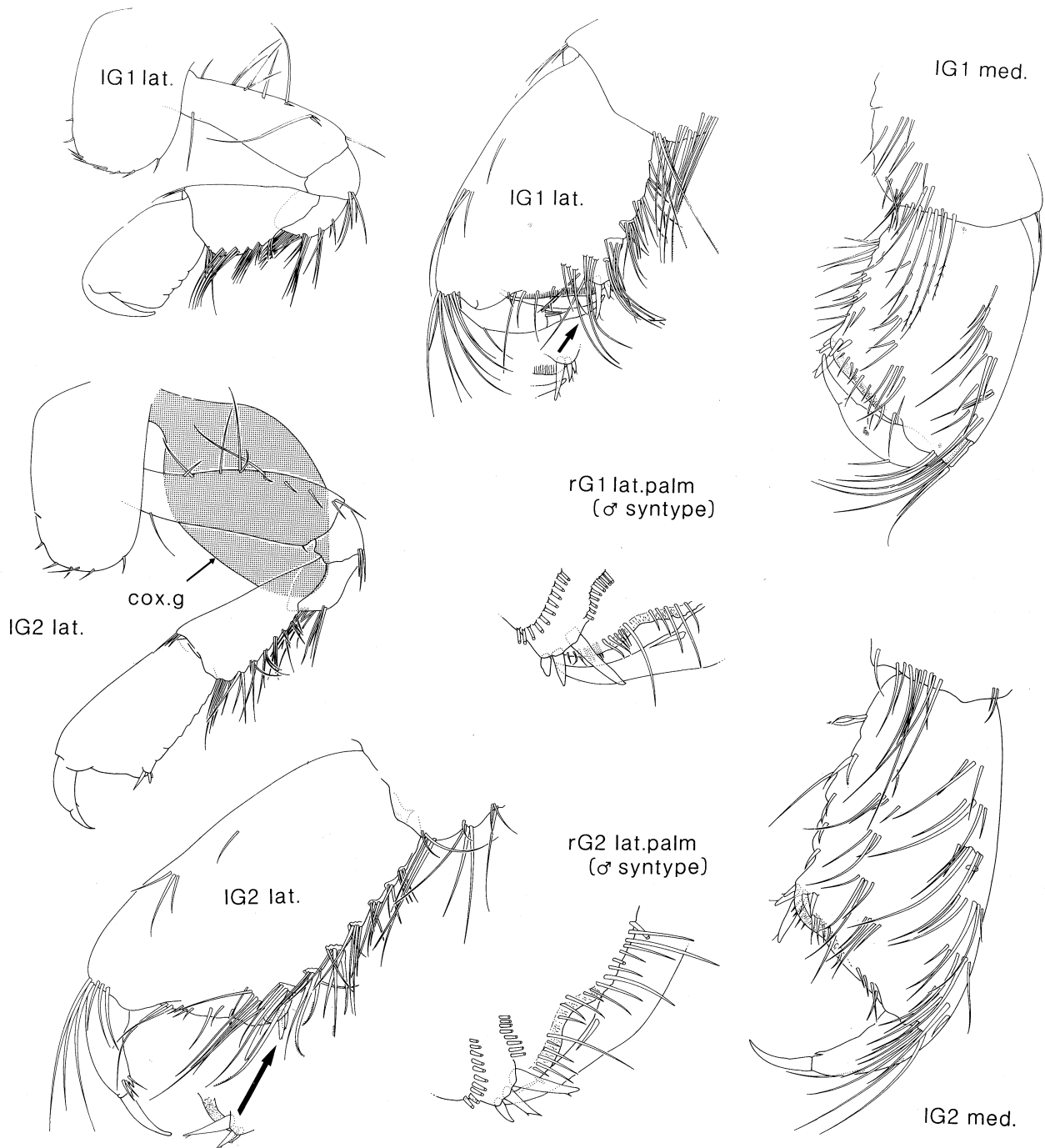


Fig.41. *Antipodeus ripensis* (G.W. Smith), lectotype, male (all drawings except those indicated); syntype, male (G1 and G2 palms as indicated).

short; spine formulas of article 5 on pereopods 3–4 = 4-1-1 and 3-1-1, article 6 = [?1-1-1-1] and [?1-1]; pereopods 5–7 similar, article 2 rather narrow but lobate, posterior setae of medium to short length, posterior margins of propodi with 1+ group(s) of spines at least some (pereopod 5) long and fine, basodactylar armaments very long, but a few shorter robust spines also present.

Epimera (Fig. 42): epimeron 1 anterior angle rounded, ventral margin with 2 setal-spines, posterior angle rounded; epimera 2 and 3 subquadrate, with tiny posteroventral tooth, ventral margins with 2 and 3 strong spines. *Urosome* (Fig. 42): urosomites 1–3 with several scattered dorsal spines and setae; uropod 3 not extending beyond uropods 1 and 2 in entire animal; uropod lengths (relative to uropod 1): uropod 2 = 0.7,

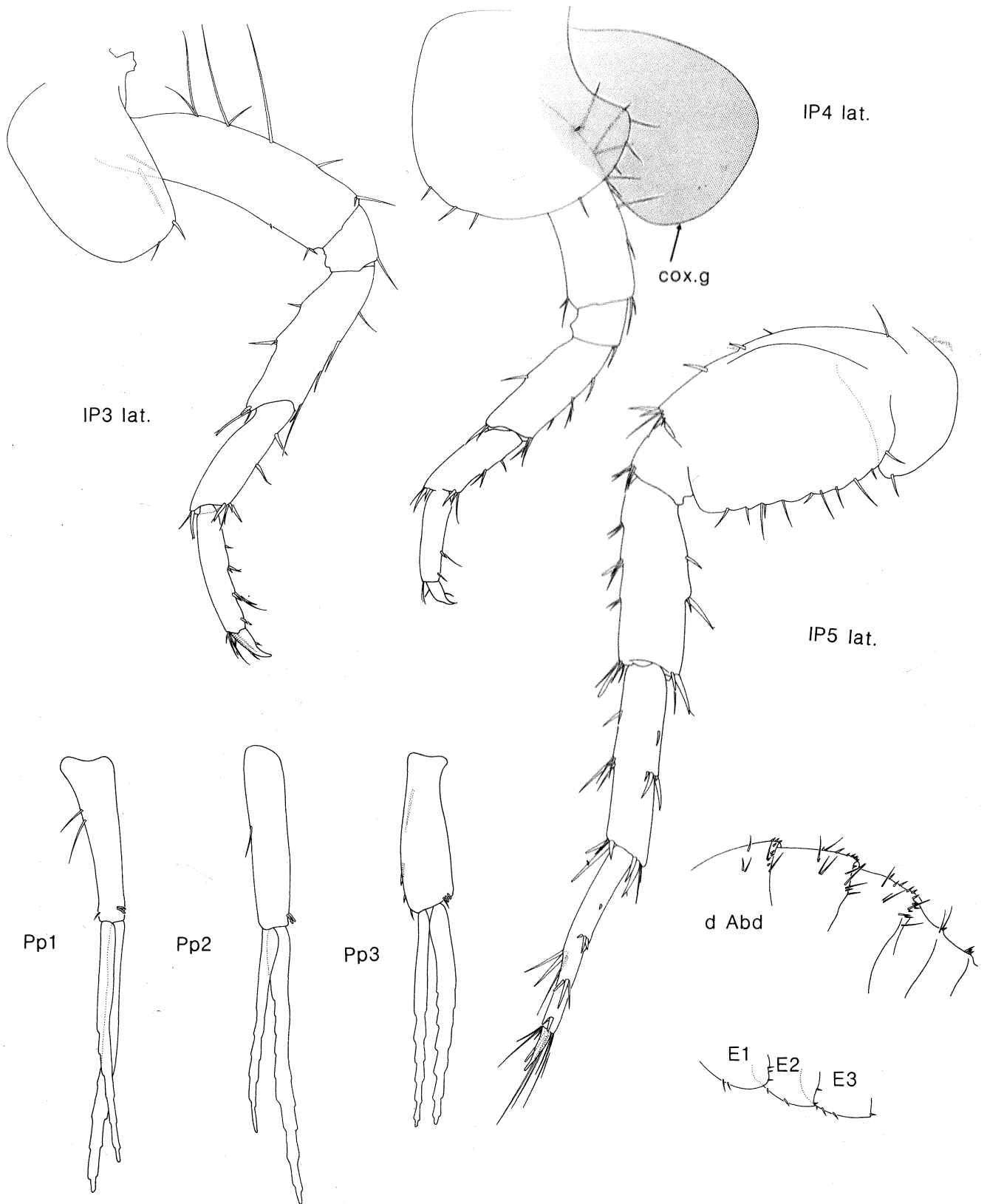


Fig.42. *Antipodeus ripensis* (G.W. Smith), lectotype, male.

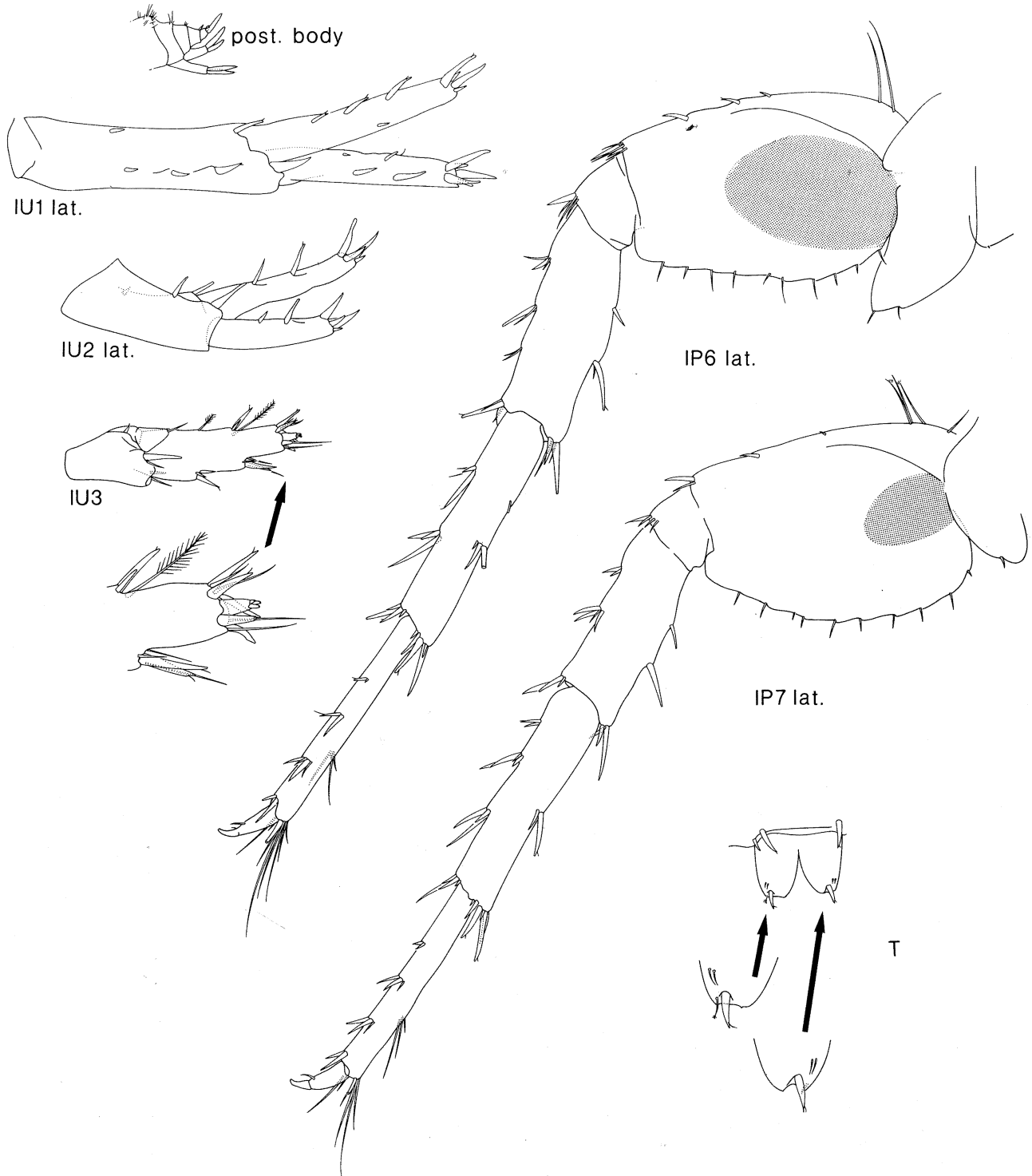


Fig.43. *Antipodeus ripensis* (G.W. Smith), lectotype, male.

3 = 0.5.

First uropod (Fig. 43): peduncle length 1.2 inner ramus, lateral margin with 3 spines, medial margin with 1, medial and outer lateral apicodistal angles each with robust spine; inner ramus slightly (1.1) longer than outer ramus, medial and lateral margins of both rami with a few short to medium spines, with 4–5 longer spines apically. *Second uropod* (Fig. 43): peduncle same length as inner ramus, with 2 lateral marginal spines and 1 medial apical spine; inner ramus slightly (1.2) longer than outer ramus, both rami with 2 relatively long marginal spines, and 4 similar spines apically. *Third uropod* (Fig. 43): peduncle length 0.6 outer ramus, with several robust spines on distal margin; outer ramus distal article minute, proximal article with 2 lateral transverse spine rows, 1 medial spine row and medial plumose setae; inner ramus 0.2 length outer ramus, scale-like, triangular, with 1 distal seta. *Telson* (Fig. 43): length 0.7 width, cleft extending 70 percent length; lobes truncate, each with 1 spine and 1 penicillate setule apically, 2 penicillate setules on lobe body at M.85.

Description of syntype (male). *Body*: length 7.5 mm.

First antenna: length 0.6 body, 1.5 second antenna; peduncle slightly longer than flagellum.

Left first maxilla: palp article 2 with 11 long, thin spines distally and 5 subapical setae; inner plate with 7 plumose setae on distal half of medial margin. *Right first maxilla*: palp article 2 with 6 short, blunt, tooth-like spines, 1 thinner apicolateral spine, 2 subapical setae.

First and second gnathopods (Fig. 41): palm slightly sinuous.

Third uropod: inner ramus with 2 distal spines.

Telson: each lobe with 2 spines.

Description of syntype (non-ovigerous female). *Body*: length 11 mm.

Left and right first maxillae: inner plates with 5 medial setae on distal half.

Third uropod: no plumose medial setae on proximal article of outer ramus.

Telson: 1 lobe with 1 robust and 2 fine spines apically, 1 lobe with 3 fine spines apically.

Partial description of remaining 5 male syntypes. *Body*: length 9–16 (\bar{x} = 11) mm.

First antenna: length 0.6–0.7 (\bar{x} = 0.67) body, 1.7–2.2 (\bar{x} = 2.0) second antenna. *Second antenna*: length 0.3–0.35 (\bar{x} = 0.32) body.

Urosome = uropod lengths (relative to uropod 1): uropod 2 = 0.4–0.65 (\bar{x} = 0.58), 3 = 0.4–0.5 (\bar{x} = 0.47).

Partial description of remaining non-ovigerous female syntypes. *Body*: length 8.5–16 (\bar{x} = 12) mm.

First antenna: length 0.6–0.8 (\bar{x} = 0.66) body, 1.8–2.3 (\bar{x} = 2.1) second antenna. *Second antenna*: length 0.3–0.36 (\bar{x} = 0.32) body.

Urosome: uropod lengths (relative to uropod 1): uropod 2 = 0.5–0.7 (\bar{x} = 0.63), 3 = 0.4–0.6 (\bar{x} = 0.47).

Relationships. *Antipodeus ripensis* differs from *A.*

antipodeus in the short article 2 of the mandibular palp, the non-excavate palms of the male gnathopods, and the more dense dorsal body setation. It closely resembles *A. wellingtoni* but differs from that species also in the non-excavate palms of male gnathopods, the deeper cleft of the telson and the denser dorsal body setation. It differs from *A. niger* in the short article 2 of the mandibular palp, lack of apical setae on the telson, and the weak setation on coxae 1–4 and article 2 of pereopods 5–7. Its most distinctive features within the genus are the uneven spacing of spine sets on article 6 of pereopods 3–4, the narrower appearance of article 2 of pereopods 5–7, and the numerous long setae on mandibular palp article 2.

Distribution. Tasmania, Great Lake.

Antipodeus mortoni (Thomson)

Fig. 44

Niphargus mortoni Thomson, 1893: 68–70, pl. 4, figs 11–12, pl. 5, figs 1–5.

Gammarus mortoni G.W. Smith, 1909a: 77.

Type locality. Thomson noted that material of *A. mortoni* was first found by him in a small stream above Franklin, Tasmania, at an elevation of 200–300 feet (61–91 m) above tidemarks. Additional material, Thomson noted, was later found at The Springs, Mt. Wellington, at an elevation of 2000 feet (610 m). He did note “some slight diversity” between the two sets of material, but discarded it as unimportant. In our view, and given the differences we have found between alleged cotype material and his published description of *A. mortoni*, it is clear that he was dealing with a mixture of species. We assume, however, that only one species forms the basis of his description of *A. mortoni* in that he is likely to have used only a single specimen to prepare his description (but not the alleged cotype). It is not possible to decide unequivocally where this specimen came from, but as the small stream above Franklin was the first locality from which material was collected, it seems reasonable to assume that it came from that locality. We regard this locality as the restricted type locality.

Type material. No deposition of type material is indicated in Thomson’s original description, but we were able to locate a single microscope slide in the Canterbury Museum, Christchurch, New Zealand, labelled “*Niphargus mortoni* ♀ Tasmania cotype from G.M. Thomson”. Unfortunately, comparison of appendages mounted on this slide with Thomson’s published description (text and drawings) pointed to several differences between them, indicating that the alleged cotype is not conspecific with the material actually described by Thomson. In particular, we note that the taxon described by Thomson had small eyes, the antenna 2 flagellum was almost destitute of setae, the maxilla 1 inner plate had 4 plumose setae, the uropod 3 outer ramus was 3 times the length of the peduncle, and the telson was said to be cleft into two

distinct divisions. In the alleged cotype, on the other hand, the eyes are large, the antenna 2 flagellum has many small setae, the maxilla 1 inner plate has 7 plumose spines, the uropod 3 outer ramus is only about 2 times the length of the peduncle, and the telson is about 70 percent cleft. Additionally, the alleged cotype is regarded by us as conspecific with a taxon collected by one of us (WDW) at one of the localities from which Thomson obtained material for his description of *A. mortoni* (viz. a small stream above Franklin, Tasmania). This taxon has sexually dimorphic gnathopods, a feature which Thomson said was "quite wanting" in *A. mortoni*. The material from above Franklin, and the alleged cotype of *A. mortoni*, we regard as a new species (see later description of *A. franklini*). No type material of *A. mortoni*, therefore, seems to exist.

Species recognition. Although Thomson's description of *A. mortoni* is incomplete, we believe that he described sufficient attributes to enable rediscovery and recognition of his species. We do not regard his species as a *nomen dubium*.

The description and diagnosis we provide of known characters of the species is based entirely on the text and drawings of Thomson (1893). The degree to which it is incomplete provides difficulty in generic assignment, and although we assign the species to *Antipodeus* for the present, we do so only tentatively. Pending the discovery of new material that can be regarded as conspecific, we think this the most prudent course to follow.

Diagnosis. Setae on antennae 1–2 sparse. Antennal sinus indistinct. Article 2 of mandibular palp slightly longer than article 3, with many short medial setae. Inner plate of maxilla 1 with 5 plumose setae; outer plate with 9 spines. Setae on coxae 1–4 [?sparse and of medium length]. Gnathopods not sexually dimorphic; palms of gnathopods straight. Posterior setae on article 2 of pereopods 5–7 [?short and sparse]. Pereonites lacking setae, but pleonites 1–6 sparsely setose dorsally. Spines on rami of uropods 1–2 short and dispersed. Outer ramus of third uropod 3 times length of peduncle. Telson cleft 100 percent of length, each lobe with 3 long apical setae.

Description (from Thomson, 1893). *Body* (Fig. 44): apparently pleon sparsely armed dorsally, few short setae on pleonites 1–4; length, 14 mm.

Head (Fig. 44): rostrum short; eyes small, oblong, close to front margin of head.

First antenna (Fig. 44): length 0.7 of body, 2.0 second antenna, flagellum longer than peduncle, peduncular article 1 longest, article 2 almost as long as 1, article 3 shortest, setae sparse; accessory flagellum 3-articulate, primary flagellar articles with few setae. *Second antenna* (Fig. 44): length 0.3 body, peduncle as long as flagellum, article 4 rather longer than 5, setation [unknown]; flagellum 12-articulate, poorly setose ventrally, calceoli [unknown].

Left mandible (Fig. 44): palp article 3 shorter than

2, article 2 with many short setae on medial margin, article 3 with several A, possibly B and C setae, many D and several E setae; incisor [?5-toothed], lacinia mobilis [?4-toothed, ?3 setose accessory blades; ?molar bearing plumose seta, ?3 penicillate hooked brushy basal setae, ?1 chisel spine]. *Right mandible*: incisor [?4-toothed]; lacinia mobilis [?bifid, denticulate, 1 denticulation strongly extended, accessory blades of ?2 plumose spines and ?1 chisel spine, setae of palp segment 3 = unknown]. *Left first maxilla* (Fig. 44): palp article 2 with about 7 thin apical spines and possibly 2 subapical facial setae; outer plate with 10 spines; inner plate with 4 apicomedial plumose setae. *Right first maxilla*: palp article 2 with [?thick apical spines articulated to segment, ?1 apicolateral thin spine, ?1 subterminal apicolateral facial seta]. *Second maxilla*: outer plate lateral margin [?1 small spinule, apicomedial corner of inner plate with ?2 weakly submarginal thick setae]. *Maxilliped* (Fig. 44): palp article 3 with ranks of thin setae on inner edge, apical part with rank of thicker [?scythe]-setae, apex not produced; inner plate with [?2] thick spines and plumose setae apically, [no long medial row of plumose setae evident].

First gnathopod (Fig. 44): article 4 [?with] posterior hump; carpus elongate, not lobate; propodus subquadrate, longer than wide, posterolateral angle rounded, palm obliquely transverse but straight, defined by stout spine; dactylus reaching end of palm. *Second gnathopod* (Fig. 44): scarcely larger than first gnathopod; carpus elongate, not lobed; palmar corner with 1 spine; [?sac-like coxal gill present].

Pereopods (Fig. 44): coxa 3 [?with] ventral setae, coxa 4 deeply emarginate; pereopods 3–4 longer than gnathopod 2, pereopod 3 not longer than 4, article 4 weakly setose posteriorly, article 5 of pereopods 3–4 weakly setose posteriorly, posterior margin of article 6 on pereopods 3–4 with spine formulas [unknown]; pereopods 5–7 similar, coxae [?lacking] spines on ventral margin of posterior lobe, article 2 expanded and lobate posteroventrally, bearing [?short posterior setules], article 2 of pereopods 5–6 slightly narrowed; [?gill of pereopod 7 reduced].

Sternal processes: [?no sternal gills present].

Epimera (Fig. 44): each epimeron [?with tiny] posteroventral tooth, posterior margins almost straight, epimera 1 and 2 each [?with 1 anteroventral spine]. *Pleon* (Fig. 44): each dorsolateral posterior margin of pleonites 1–6 with following spinule formula: ?-?-?-1-1-4, setae = 0; uropod 3 extending beyond uropods 1 and 2 on entire animal, uropod lengths relative to uropod 1: uropod 2 = 0.75, 3 = 0.63. *Pleopods*: retinacula [?2] per pleopod, accessories [?present]; each peduncle with [?1+] seta.

First uropod (Fig. 44): peduncle length 1.3 rami, lateral margin with 2 apicodistal spines and weak row of marginal spines, with [?0] medial spines; rami of subequal length, both rami with [?2] rows of marginal spines, and several apical spines. *Second uropod* (Fig. 44): peduncle length about 0.8 rami, with 4

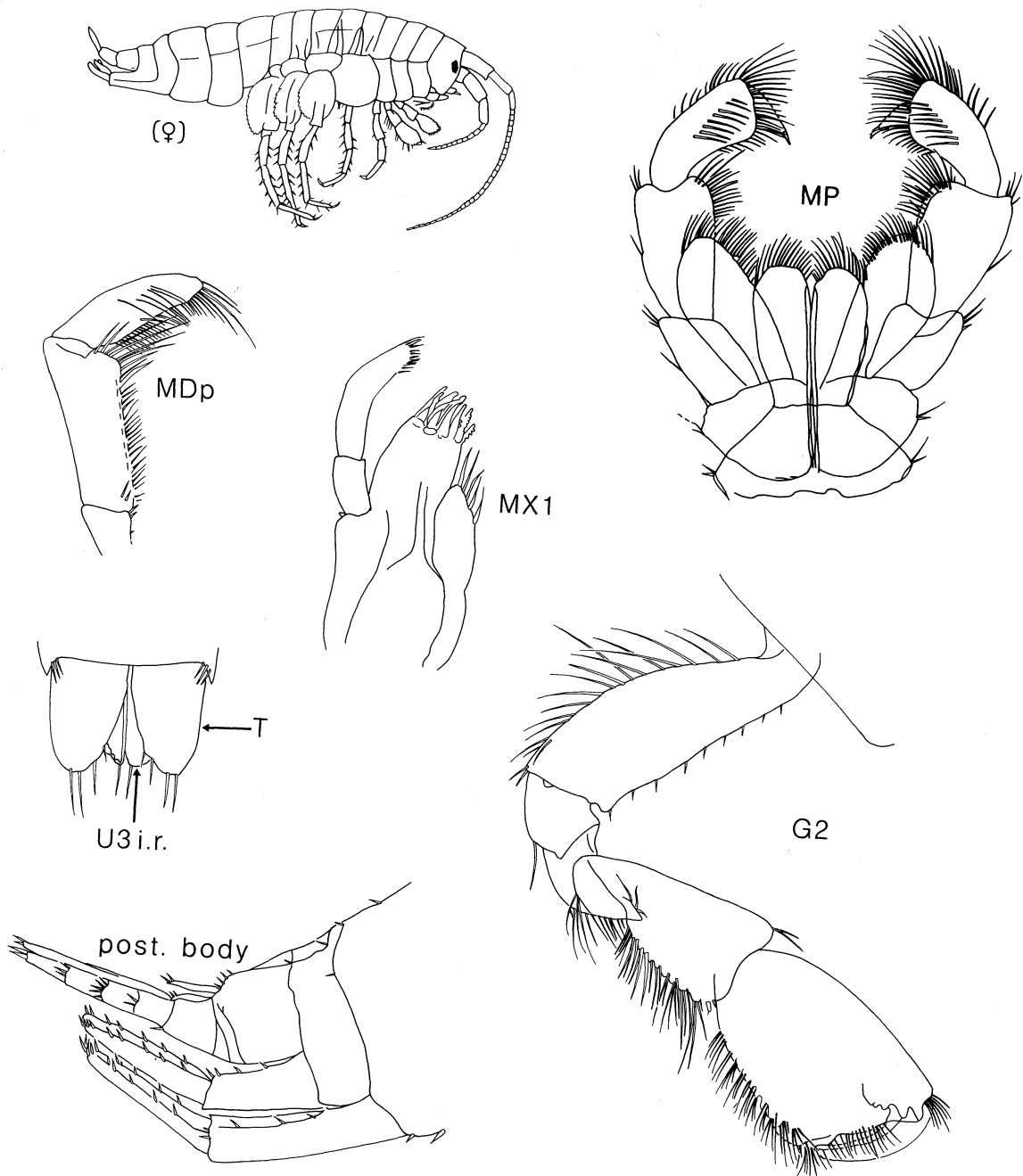


Fig. 44. *Antipodeus mortoni* (Thomson), all drawings rearranged and re-inked from Thomson (1893, pl. iv [figs 11,12] and pl. v [figs 1-5]).

dorsolateral spines including 1 apical; outer ramus as long as inner, both with [?] strong row(s) of marginal spines, apices with [?] and [?] spines. *Third uropod* (Fig. 44): peduncle length 0.3 outer ramus, shorter than urosomite 3, with [?] facial, subdistal spines besides apical cluster; outer ramus 1-articulate, with 3 transverse lateral spine rows on body, medial margin with [?] sets of setae and spines; inner ramus "very short", with [?] apical and [?] apicomедial plumose setae. *Telson* (Fig. 44): short, shorter than urosomite 3; cleft 100 percent of length; apices each with 3 setae

in 1 row, each lobe triangular, with [?pair] of penicillate setules dorsolaterally at [M. ?].

Relationship. In the absence of a complete description of this species, it is premature to attempt to describe its intrageneric relationships. However, it is distinguished from all other species of *Antipodeus* on the available description in its fully cleft telson. From *A. antipodeus* it is distinguished by the absence of sexually dimorphic gnathopods and by the presence of long apical setae on the telson, from *A. wellingtoni* and *A. niger* by the short length of its marginal and apical

spines on uropods 1–2, and from *A. ripensis* and *A. franklini* by the presence of only short setae on article 2 of the mandibular palp. Other interspecific differences are noted and have been incorporated in(to) the two keys for species of the genus.

Distribution. Tasmania, small stream at 61–91 m altitude, on the Huon River, above Franklin.

***Antipodeus franklini* n.sp.**

Figs 45–49

Not *Niphargus mortoni* Thomson, 1893: 68–70, pl. 4, figs 11–12, pl. 5, figs 1–5.

Type locality. Tasmania, “small stream above Franklin, on the Huon River, at an elevation of 200 to 300 feet [61–91 m] above tide-marks...under little stones and bits of wood...”. Topotypic material was collected from a fast flowing small stream above Franklin, Tas., by one of us (WDW) on 3 Oct 1973.

Type material. As indicated above in our discussion of the type material of *Antipodeus mortoni*, the alleged residual cotype of Thomson for “*Niphargus mortoni*” in the Canterbury Museum, New Zealand, does not in our view, correspond with Thomson’s description of this taxon. Accordingly, we allocate Thomson’s material to a new species; we name this *Antipodeus franklini*. Thomson’s slide material therefore becomes the holotype. It comprises parts of a female specimen (female “a”), length unknown, with the following parts missing: carcass of body, thus dorsal pleon and epimera, pereopods 3–7, several coxae. Canterbury Museum, Christchurch, New Zealand.

Some material collected from either the type locality or close by, and regarded by us as conspecific with female “a”, is also available. We regard these specimens as topotypes. They comprise male “b” (partly illustrated), young male “c” 10.4 mm, young female “d” 10.4 mm, female “e” 16.2 mm. TOPOTYPES have been deposited in the Australian Museum.

Diagnosis. Setae on antennae 1–2 short to long, antenna 2 with several long setae on peduncle article 4, flagellar setae moderately dense, with calceoli in male. Antennal sinus distinct, [?defined by tooth below]. Article 2 of mandibular palp usually slightly longer than 3, with many long and a few short setae. Inner plate of maxilla 1 with 7 setae, outer plate with 9–11 spines. Ventral setae on coxae 1–4 short (sometimes medium sized) and numerous. Gnathopods sexually dimorphic; female palm straight; male palm excavate. Posterior setae on article 2 of pereopods 5–7 short and numerous. Pereonites 6–7 and pleonites moderately to densely setose dorsally. Spines on rami of uropods 1–2 short and dispersed. Outer ramus of third uropod about twice length of peduncle. Telson cleft about 70 percent of length, each lobe apically with 2–3 (1 in male) medium spines and 2+ setae longer than spines and occasionally with

shorter setae.

Description of holotype (female). *Body:* [?apparently pleon with numerous setae dorsally, as described for male topotype below].

Head: rostrum [?short]; eyes [?small, weakly reniform]; inferior antennal sinus [?distinct].

First antenna (Fig. 45): length [?0.6] of body, 1.7 second antenna; peduncle much shorter than flagellum, article 1 longest, article 3 shortest, setae short and sparse; accessory flagellum 3-articulate, distal article minute, reaching past article 3 of main flagellum; flagellum articles uniform, sparsely setulate. *Second antenna* (Fig. 45): length [?0.4] body; peduncle longer than flagellum, article 4 longer than 5, articles 4 and 5 with strong ventral setation; flagellum 11-articulate, moderately setose ventrally, lacking calceoli.

Left mandible (Fig. 45): palp article 3 slightly shorter than 2, article 2 with sparse array of short basoanterior setae, then slightly denser apical array of long setae, article 3 with 0A, possibly 6+3B, 6C, many D and 5–6E setae; incisor 5-toothed; lacinia mobilis 4-toothed; 5+ setose accessory blades; molar bearing plumose seta. *Right mandible* (Fig. 45): incisor 4-toothed; lacinia mobilis bifid, denticulate; accessory blades of 5 plumose spines and naked sixth. *Left first maxilla* (Fig. 45): palp article 2 with 10 thin apical spines and 4 subterminal facial setae; outer plate with 11 spines; inner plate with [?] apicomedial setae. *Right first maxilla* (Fig. 45): palp article 2 with 6 thick apical spines articulated to segment, 1 apicolateral thin spine and 1 subterminal apicolateral facial seta; inner plate with 7 medial setae near apex. *Second maxilla* (Fig. 45): outer plate lateral margin with 1 short seta; inner plate medial distal margin with non-facial row of many setae. *Maxilliped* (Fig. 45): palp article 3 with ranks of thin setae on medial edge, apical part with rank of rastellate setae, apex not produced; inner plate with 3 thick spines and several plumose setae apically, 1 medial plumose seta evident.

First gnathopod (Fig. 46): coxal plate densely setose apically, setae short, posterior margin without spines, anterior margin with short sparse setae; article 4 without posterior hump; carpus not elongate; propodus trapezoidal, slightly longer than wide, posterolateral angle not out-turned, palm weakly oblique, straight, with 4 spines at corner; dactylus reaching end of palm. *Second gnathopod* (Fig. 46): longer than first gnathopod; palmar corner with 5 spines; coxal plate also well-setose.

Pereopods: coxa 3 with [?] ventral setae, coxa 4 [?deeply emarginate, with anteroventral and posterior setae]; pereopods 3–4 [?longer] than gnathopod 2, pereopod 3 [?not] longer than 4, article 4 [?weakly] setose posteriorly, article 5 of pereopods 3–4 [?weakly] setose posteriorly, posterior margin of article 6 on pereopods 3–4 with spine formulas [unknown]; pereopods 5–7 [?similar], coxae [?lacking] spines on ventral margin of posterior lobe, article 2 [?expanded and lobate posteroventrally, bearing short posterior

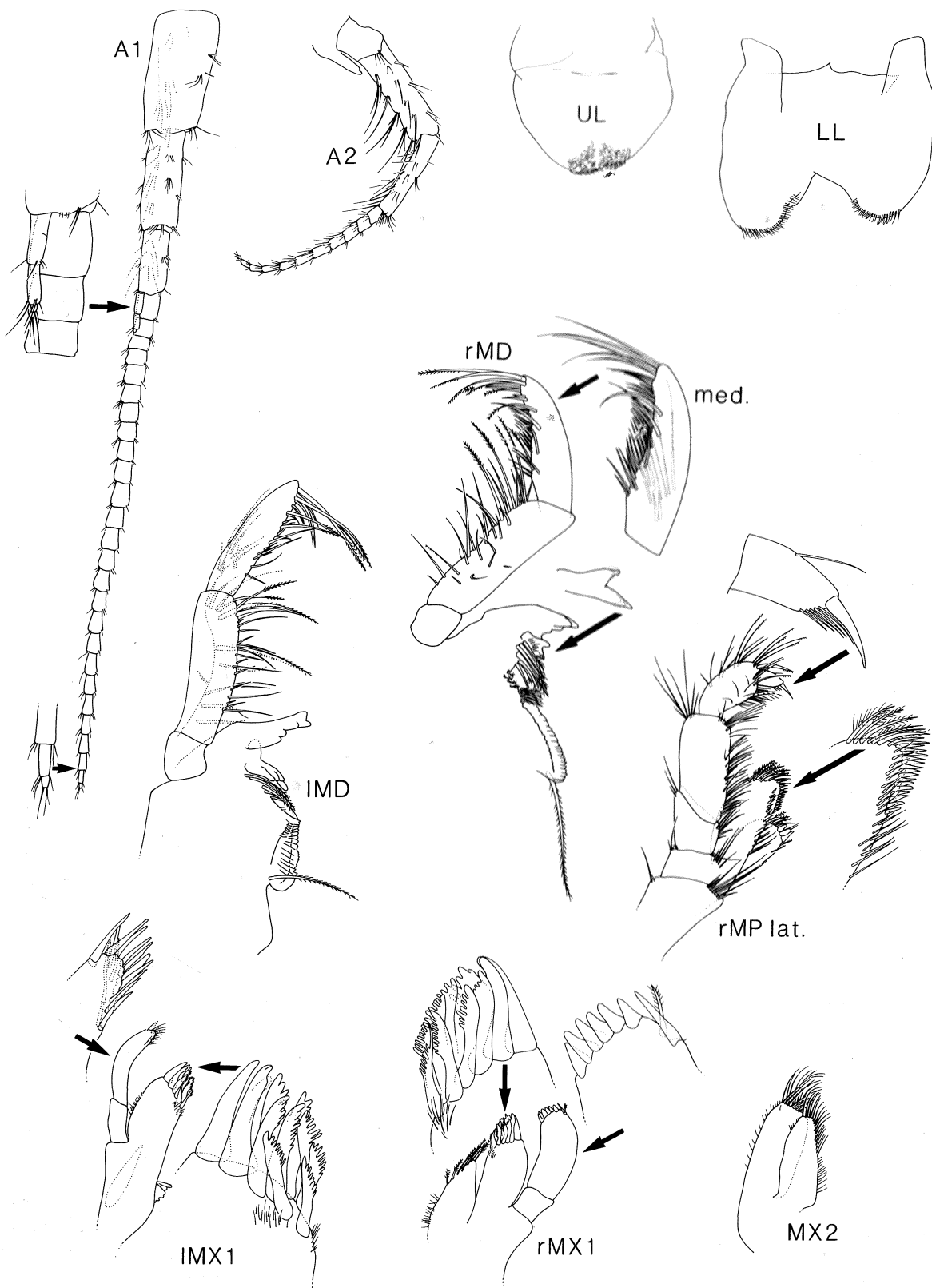


Fig.45. *Antipodeus franklini* n.sp., holotype, female "a".

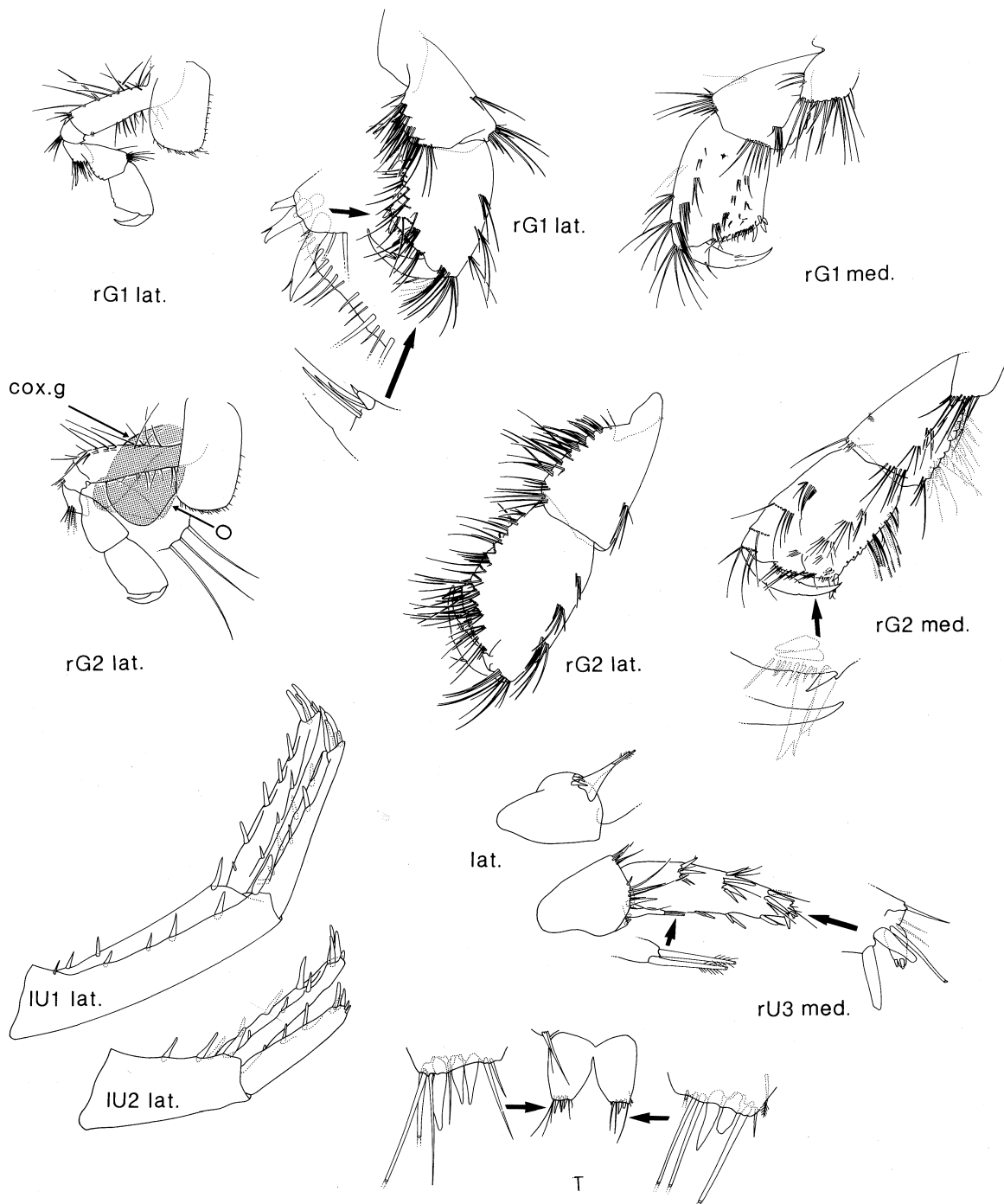


Fig.46. *Antipodeus franklini* n.sp., holotype, female "a".

setules], article 2 of pereopods 5–6 [?slightly narrowed]; gill of pereopod 7 [?strongly reduced].

Sternal processes: sternal gills [?absent].

Epimera: each epimeron [?with tiny] posteroventral tooth, posterior margins [?almost straight], epimera 1 and 2 each [?with 1] anteroventral spine. *Pleon*: each dorsolateral posterior margin of pleonites 1–6 with [?many] setae and spines of formula [?]; uropod 3

extending [?slightly] beyond uropods 1 and 2 on entire animal, uropod lengths relative to uropod 1: uropod 2 = 0.7, 3 = 0.6. *Pleopods*: retinacula [?] per pleopod, [?no] accessories; each peduncle with [?] seta.

First uropod (Fig. 46): peduncle length 1.4 rami, lateral margin with 1 large apicodistal spine and strong row of dorsal spines, with 4 spines medially (large gap between medial spines 1 and 2, thus last 3 medial spines

strongly basal); rami of subequal length, both rami with 2 rows of short marginal spines, both rami with 5 apical spines. *Second uropod* (Fig. 46): peduncle 1.2 length of rami, with 1 apicodistal spine; outer ramus slightly shorter than inner, each with 2 rows of marginal spines, apices with 5 spines. *Third uropod* (Fig. 46): peduncle length 0.52 outer ramus, [?shorter] than urosomite 3; outer ramus proximal article with 4 transverse lateral spine rows on body, mixing setae and spines, from proximal to distal spines = 3-4-3-?3, setae = 3-4-3-4, medial margin with 4 sets of armaments, apex of tiny article 2 with 2 apical short spinules; inner ramus length 0.22 of outer, with 2 apical plumose setae. *Telson* (Fig. 46): short, [?shorter] than urosomite 3; cleft 70 percent of length; apices each with 2-3 spines and 5-6 setae in 1 row, each lobe with [?1-2] penicillate setules near lateral apex, none basal.

Description of topotype male "b". Length unknown. Included in the illustrations (Figs 47,48) are

parts missing from the holotype (such as pereopods 3-7 and pleonites). *Second antenna*. Flagellum with 1 calceolus each on articles 2-6.

Left and right mandibles: with 9 and 7 rakers respectively; right lacinia mobilis with third branch; palp article 3 with 8-2B or 8-1, 4-5C, 5-6E.

First and second gnathopods (Fig. 47). Larger than in female; propodi stouter; palms with lunar excavation in middle, palmar corners generally with 5 spines.

Pereopods (Fig. 48): coxa 3 with 12+ ventral setae, coxa 4 deeply emarginate, with 11 anteroventral and 13 posteroventral setae; pereopods 3-4 longer than gnathopod 2, pereopod 3 longer than 4, articles 4-5 of pereopods 3-4 weakly setose posteriorly, article 5 of pereopods 3-4 with spine formulae of 4-2-1-1 and 6-2-2-2, posterior margin of article 6 on pereopods 3-4 with spine formulae of 2-s-1-2-2-2-1 and 2-s-1-2-2-2; pereopods 5-7 similar, article 2 expanded and weakly

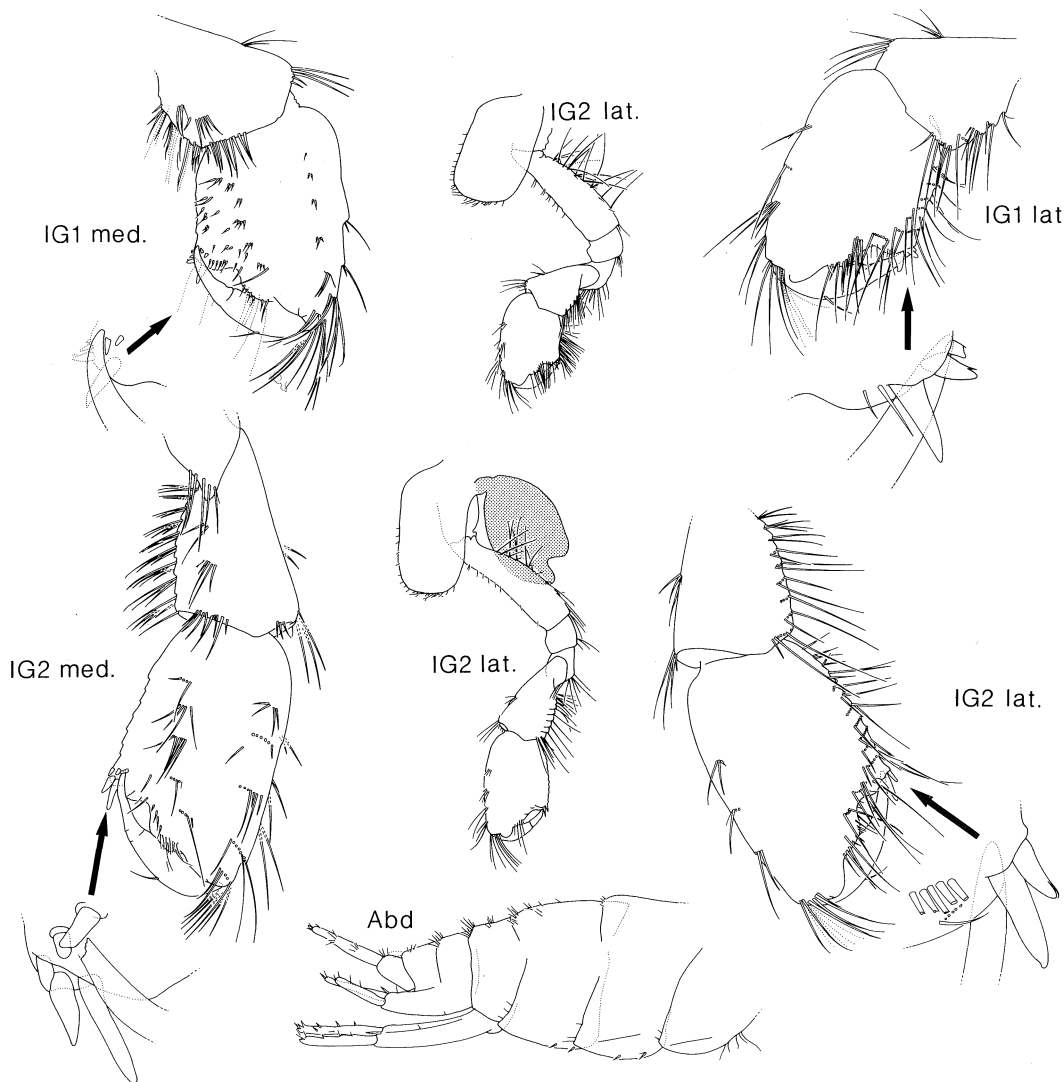


Fig. 47. *Antipodeus franklini* n.sp., topotype, male "b".

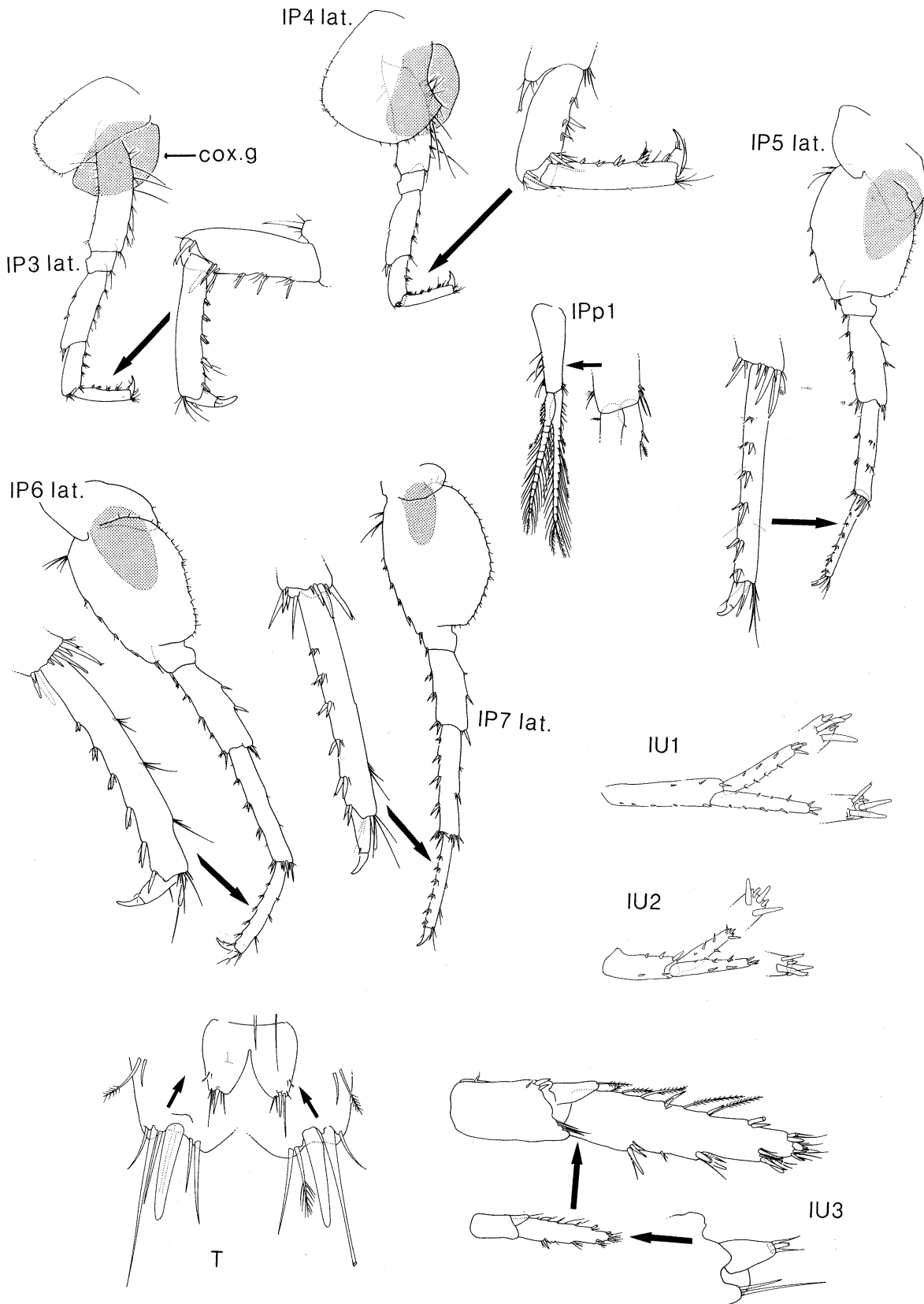


Fig.48. *Antipodeus franklini* n.sp., topotype, male "b".

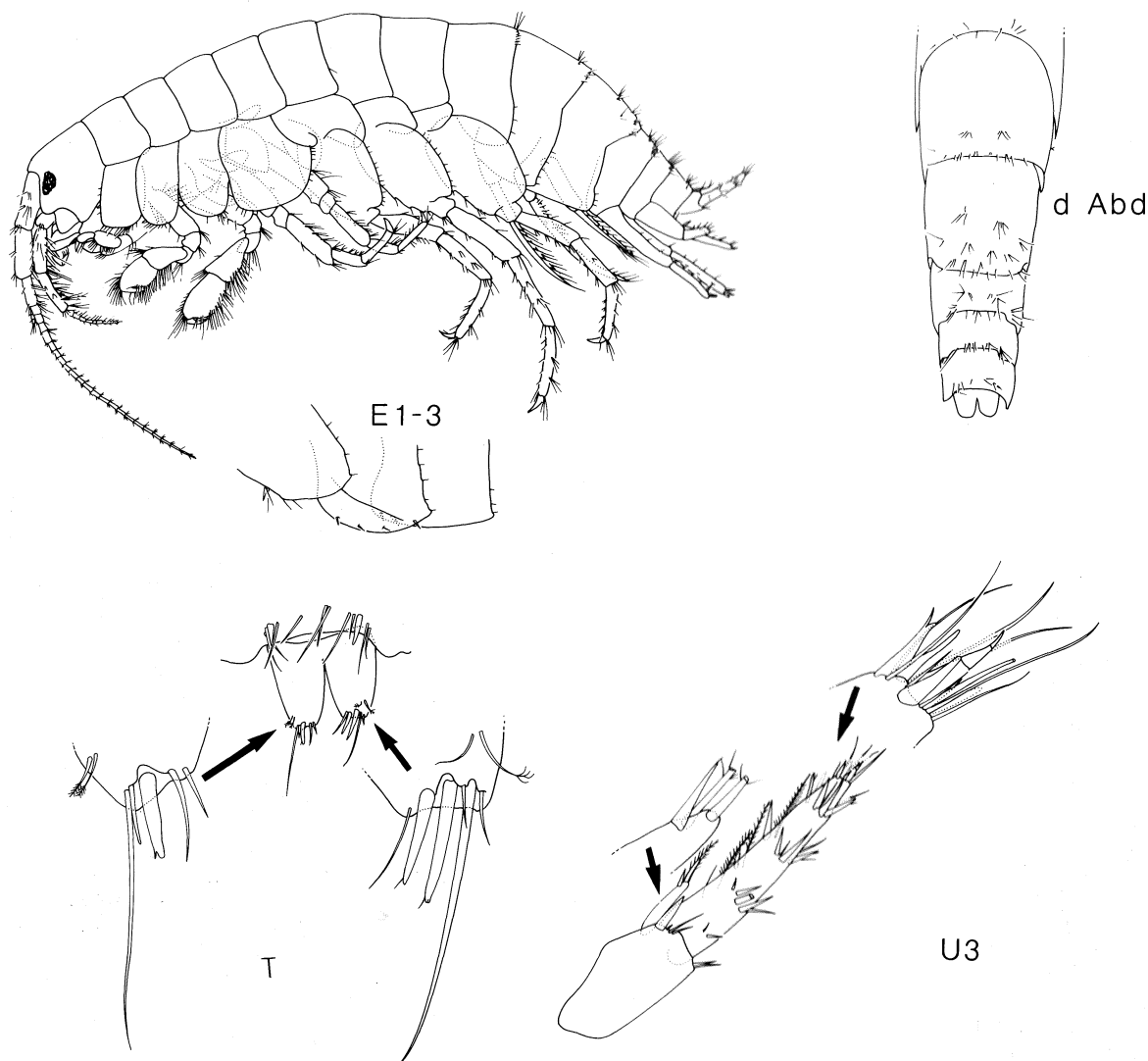


Fig.49. *Antipodeus franklini* n.sp., toptype, female "e".

lobate posteroventrally, bearing short posterior setules, article 4 short on pereopod 7 only, setae of article 4–6 sparse and short; gill of pereopod 7 reduced.

Pleon (Fig. 47): pleonites 1–2 and 6 with several dorsal setae arranged transversely, denser on pleonites 3–5, with dense extra setal patches on dorsum ahead of posterior margin on pleonites 3–4, pleonite 6 with [?] spine on each side dorsally; uropod 3 not extending beyond uropods 1–2 in entire animal, but uropod lengths relative to uropod 1: uropod 2 = 0.65, 3 = 0.62. **Pleopods** (Fig. 48): similar; peduncles sparsely setose; rami equal; retinacula 2 per pleopod, with 2 simple accessories.

Uropods (Fig. 48): uropod 1 medial margin of peduncle with 5 spines evenly distributed (unlike holotype), each ramus with 5 apical spines; peduncle of uropod 2 with 2 medial spines, each ramus with 5 apical spines. Outer ramus of uropod 3 longer than in

female, with several plumose medial setae besides spine groups, both interspersed between spine groups and occurring in tandem alone near base; inner ramus with 1 apical seta; article 2 on outer ramus with 3 apical spines. **Telson** (Fig. 48): lobes each with 1 apical spine, 3–4 apical setae, 1 apicolateral penicillate setule, pair of penicillate setules dorsolaterally at M.77.

Description of toptype male "c". Length 10.4 mm. Like male "b" but much younger. Palm of gnathopod 2 scarcely excavate, and armament counts much fewer; palmar corners of gnathopods with 4 spines. Accessory flagellum of first antenna 2-articulate. Epimeron 1 with 5 anteroventral setae in 3 groups; ventral spines on epimera 2–3 = 3 and 3.

Description of toptype female "c". Length 10.4 mm. Aberrant specimen with subapical spines on peduncle of uropod 3 and stunted left telsonic lobe.

Description of topotype female "e" (Fig. 49). Length 16.2 mm. Rostrum small; inferior antennal sinus distinct; eyes small, weakly reniform, dark. Antenna 1 half as long as body; antenna 2 half as long as antenna 1. Accessory flagellum of first antenna 3-articulate. Maxilla 1 outer plate with 9 spines. Palmar corners of gnathopods 1–2 with 5 and 4 spines respectively. Oostegites weakly developed. Each lobe of telson (Fig. 49) with 4 apical setae. Pattern of dorsal pleonal setation as shown in Fig. 49. Each epimeron (Fig. 49) with small, posteroventral tooth, posterior margins with 4-5-3 setule notches, epimeron 1 with 4 and 2 anteroventral setae, epimera 2–3 with 3 and 3 anteroventral spines. Uropod 3 (Fig. 49) essentially similar to holotype.

Relationships. The differences of this species from others in the genus have been alluded to in previous discussions of specific differences. Keys I and II contain a summary of these differences. The single most distinctive feature of this species is its possession of calceoli in males.

The variation in spine number (9–11) on the outer plate of maxilla 1 is worrisome and will be pursued when we analyse the large unidentified Tasmanian collections to be reported upon in the future.

Distribution. Tasmania, above Franklin.

Hurleya Straškraba

Hurleya Straškraba, 1966: 291.

Type species. *Hurleya kalamundae* Straškraba, 1966 by monotypy.

Introduction. The genus was erected by Straškraba (1966) to accommodate material sent him from a well near Perth, Western Australia.

This material was regarded as belonging to a single species-rank taxon and named *H. kalamundae*. Thus far the genus remains monotypic. We support the validity of the genus. On the basis of our re-examination of type material we provide an expanded generic diagnosis which, however, simply adds to rather than alters the original diagnosis of Straškraba (1966) and its later expansion by Barnard & Barnard (1983).

Diagnosis. [Note: terminal males are unknown]. Pleonites with weak dorsal armaments. Rostrum vestigial, lateral cephalic lobes distinct and moderate antennal sinus present. Eyes absent.

Antenna 1 elongate, much longer than antenna 2, ratio of peduncular articles about 4:3:2, accessory flagellum 4–5 articulate. Antenna 2 flagellum much shorter than peduncle; calceoli absent (terminal male unknown).

Ratio of mandibular palp articles about 7:17:11, article 2 poorly setose, article 3 falcate, setae = DE. Labium lacking inner lobes. Maxillae 1–2 not medially setose; inner plate of maxilla 1 ovatotriangular, with 2 apicomedial plumose setae, outer plate with 9 spines, palps asymmetric, one side with thin apical spines,

other side with thick apical spines often fused to segment. Inner plate of maxilla 2 lacking oblique row of setae on face, setae on distal margin only, proximal part of plate with long pubescence, outer plate with 9 spines. Maxillipedal palp articles 2–3 sparsely setose laterally, more setose medially, article 3 with slightly produced apex and several long medial setae clearly organised in rows.

Coxae 1–4 of medium length, coxae 2–3 with 1 weak posterior spine, coxa 1 somewhat shortened but almost quadrate, coxa 4 only weakly emarginate, coxa 5 much shorter than 4. Gnathopods 1–2 large, [?not sexually dimorphic], carpi short, lobate, article 4 on both gnathopods bearing posterior hump but lacking scythespines, palms oblique, lacking rugosities, spines not symmetrically bifid, rather with small subapical trigger-like extensions; spines at corner of palm 4+; spines along palm short, dense and with triggers.

Pereopods 5–7 elongate, pereopod 7 slightly longer than pereopod 6, article 2 of pereopod 6 barely expanded, rectilinear, not posteroventrally lobate, even less strongly expanded on pereopod 7. Dactyls of pereopods 3–7 multispinose with supernumary inner marginal spines besides normal setule and facial setule.

Coxae 2–6 with gills, gill 6 not reduced. Thoracic segments 6–7 with lateral sternal gills of sausage form.

Basomedial setae on inner rami of pleopods 1–3 bifid, branches diverse, of different length and shape but, occasionally, 1 branch with diamond head, or both simple; retinacula 2, accessory retinacula absent.

Pleonites sparsely armed dorsally. Epimera 2–3 with few ventrofacial spines only, posterior margins sparsely spinulate. Outer rami of uropods 1–2 shortened, each ramus with 2 rows of spines, uropod 1 lacking basofacial armaments; apicolateral corner of peduncles on uropods 1–2 with 2 spines. Uropod 3 not extended, parviramous, peduncle short, outer ramus 2-articulate, article 2 very short, inner ramus generally reaching to M.30 on article 1 of outer ramus. Telson short, cleft about 65 percent, lobes tumid laterally, with only apical spination arranged in random sets, no major setation, no basolateral armaments except for pair of lateral penicillate setules about M.65 on each side.

Additional description. Upper lip uniform, rounded but asymmetrically attached to epistome. Accessory blades (rakers) on mandibles; many penicillate setae beyond rakers and riding onto base of molar, as well as 2 penicillate hooked brushy setae and regular apical molarial seta. Both plates of maxilla 2 with long apical setae. Maxillipedal inner plate with distal row of a few plumose setae and 3 blunt naked spines and medial row of plumose setae; outer plate with distal row of few plumose setae continuous with distal row of blunt naked toothspines. Dactyls of gnathopods with small recumbant inner toothspine and with stiff spinules or setules at inner nail articulation line and often with 1 additional spinule along inner dactylar margin. Posterior spine sets on article 6 of pereopods 3–4 evenly spaced. Pleopods similar, peduncles poorly

setose; rami extending subequally, inner rami longer by length of 1 long article than other rami. Posteroventral tooth of epimera 1–3 indistinct or absent. Apicolateral corner of peduncles on uropods 1–2 with 2 spines; apical spines of rami longer than marginal spines. Ventrodistal spine on urosomite 1 at base of uropod 1 short.

Sexual attributes. Terminal male unknown; female with paddle-shaped oostegites on coxae 2–4, tiny ovate oostegite on coxa 5.

Characters of interspecific value. None. The genus is presently monotypic.

Relationships. *Hurleya* clearly appears to have more affinities with paramelitid genera than with neoniphargid and perthiid genera. Above all, this is indicated by the sausage-shaped (not dendritic) sternal gills, the absence of rugosities on the maxilliped and gnathopods, and by the absence of subapical spines on the peduncle of uropod 3.

Hurleya differs from *Austrogammarus* in the loss of maxillary and telsonic setae, in the form of its gnathopods (with shorter lobed carpi and larger propodi), and especially, of course, by the parviramous condition of uropod 3. *Hurleya* differs from *Austrocrangonyx* and *Antipodeus* in its loss of telsonic setae, and in the presence of sternal gills, weak setation on mandibular palp article 2, loss of either A, B or C setae on article 3 of the mandibular palp, the poorly expanded article 2 of pereopods 5–7, and the loss of coxal gill 7. *Hurleya* differs from *Austrogammarus*, *Austrocrangonyx* and *Antipodeus* (as well as *Protocrangonyx* and *Giniphargus*, but not *Uroctena*) in the presence of supernumerary dactylar spines on pereopods 3–7. *Inter alia*, its cleft telson distinguishes it from *Protocrangonyx*, its small article 2 on the outer ramus of uropod 3 from *Uroctena*, and its non-vermiform body from *Giniphargus*. As Straškraba (1966) noted, *Hurleya* is not a typical crangonyctoid in the old sense of Schellenberg (1936) and Shoemaker (1942) because its accessory flagellum has more than 3 articles. This is one more point suggesting that its descendance from an “*Austrogammarus*” ancestor is more likely than from a “*Neoniphargus*” one.

***Hurleya kalamundae* Straškraba**

Figs 50–52

Hurleya kalamundae Straškraba, 1966: 292–294, pls 56–57.

Material examined. WAM No. 404/6–1954, from well at Kalamunda (township east of Perth, WA), determined by Straškraba in 1965. HOLOTYPE, here newly labeled as female “p” 7.21 mm (newly measured); also PARATYPES female “q” 5.21 mm (illustrated) and male “r” 4.70 mm. The holotype consists of a carcass with left sided legs, upper lip, left mandible, no telson; paratype “q” is complete except for the lack of pereopod 5 and left pereopods 6–7.

Diagnosis. With the characters of the genus. Unique.

Description of paratype “q” (female). *Body* (Fig. 50): pereon and pleon sparsely armed dorsally, generally with 1 dorsolateral feeble seta per segment, except urosomites 2–3 each with dorsolateral spine; length 5.21 mm.

Head (Fig. 50): rostrum vestigial; eyes absent.

First antenna (Fig. 50): length 0.5 of body, 1.5 second antenna, flagellum much longer than peduncle, peduncular article 1 longest, article 3 shortest, setae sparse; calceoli absent; accessory flagellum 4-articulate, reaching past article 3 of flagellum, articles uniform, sparsely setulate. *Second antenna* (Fig. 50): length 0.33 body; peduncle longer than flagellum, article 4 longer than 5, articles 3, 4 and 5 with sparse ventral setation; flagellum 9-articulate, weakly setose ventrally, lacking calceoli.

Upper lip (Fig. 50): apical margin evenly rounded but connection to epistome and epistome itself slightly asymmetrical. *Left mandible* (Fig. 50): palp article 3 much shorter than 2, article 2 with only 6 outer marginal setae, article 3 setal formula = 7D, 4E; incisor 5-toothed, lacinia mobilis 4-toothed, 4 setose accessory blades; molar bearing plumose seta, 2 penicillate hooked brushy basal setae and many penicillate setules. *Right mandible* (Fig. 50): incisor 4-toothed; lacinia mobilis bifid, denticulate, 1 denticulation strongly extended (towards viewer in illustration); accessory blades of 2 main plumose spines and stout interracers. *Left first maxilla* (Fig. 50): palp article 2 with 6 thin apicomedial spines, 2 subterminal facial setae (darkened in illustration), outer plate with 9 spines, most denticulate; inner plate with 2 apicomedial plumose setae. *Right first maxilla* (Fig. 50): palp article 2 with 5 thick apical spines mostly fused to segment, 2 apicolateral thin spines, 1 subterminal apicolateral facial seta. *Second maxilla* (Fig. 50): outer plate outer margin with 1 small spinule, apicomedial corner of inner plate with 1 weakly submarginal thick plumose seta.

First gnathopod (Fig. 51): coxal plate with 6 setae anteroventrally, 1 posteroventral corner spinule; article 4 with posterior hump; carpus short and lobate, lobe thick, setose apically, not rugose; propodus trapezoidal, scarcely longer than wide, posterolateral angle rounded, not rugose, with 1 medial and 3–4 lateral spines, 1 lateral spine elongate; palm oblique but straight, weakly scalloped; dactylus reaching end of palm. *Second gnathopod* (Fig. 51): much larger than first gnathopod; carpal lobe not thicker; coxal plate also with 1 posterior spinule.

Pereopods (Fig. 51): coxa 3 with 4 anterior setae, 1 ventral long, 1 posteroventral corner seta and 1 posterior spinule, coxa 4 weakly emarginate, with general antero- and posteroventral setation; pereopods 3–4 longer than gnathopod 2, pereopod 3 longer than 4, article 4 weakly setose posteriorly, article 5 of pereopods 3–4 both weakly setose posteriorly, posterior margin of article 6 on pereopods

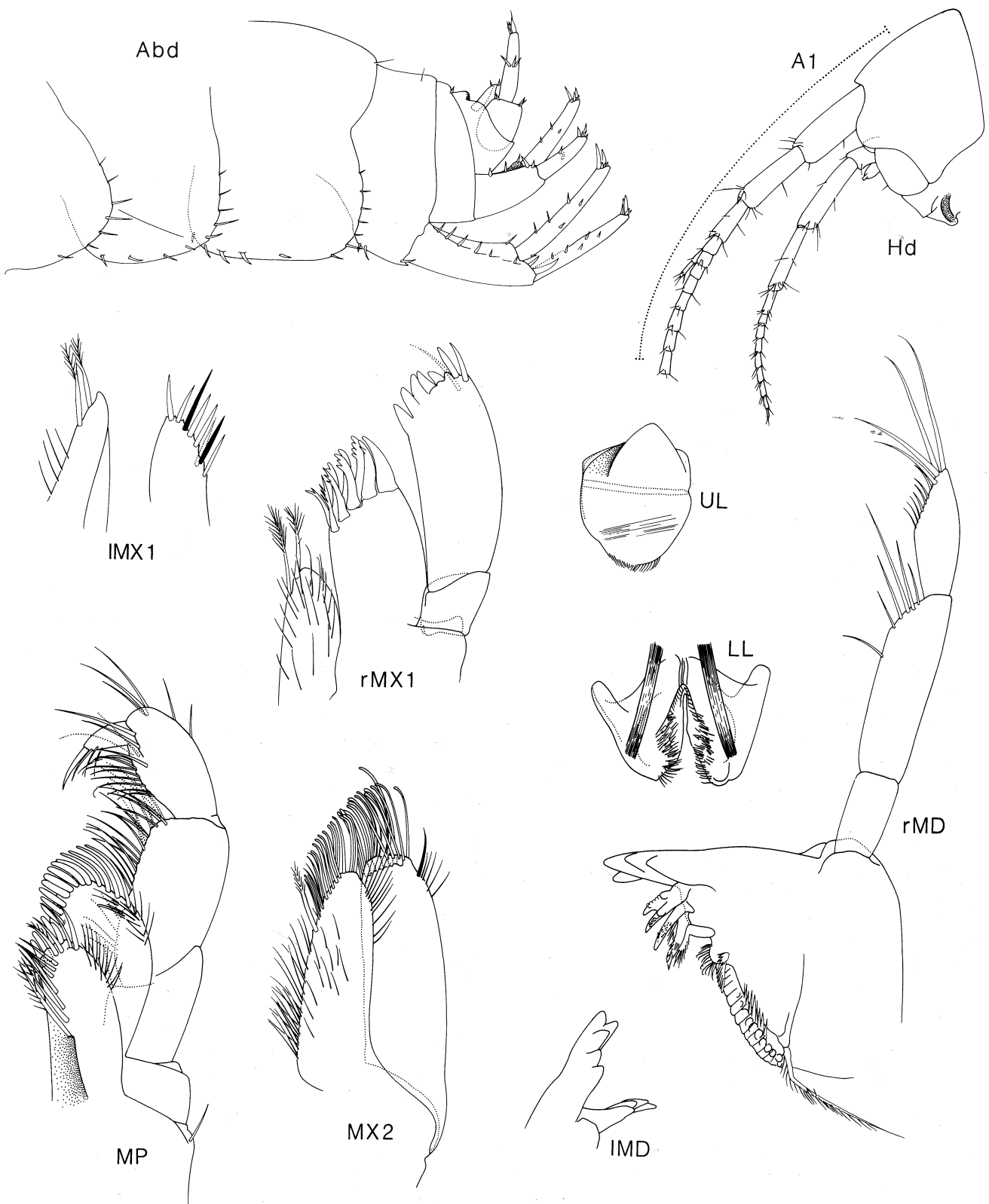


Fig.50. *Hurleya kalamundae* Straškraba, paratype, female "q".

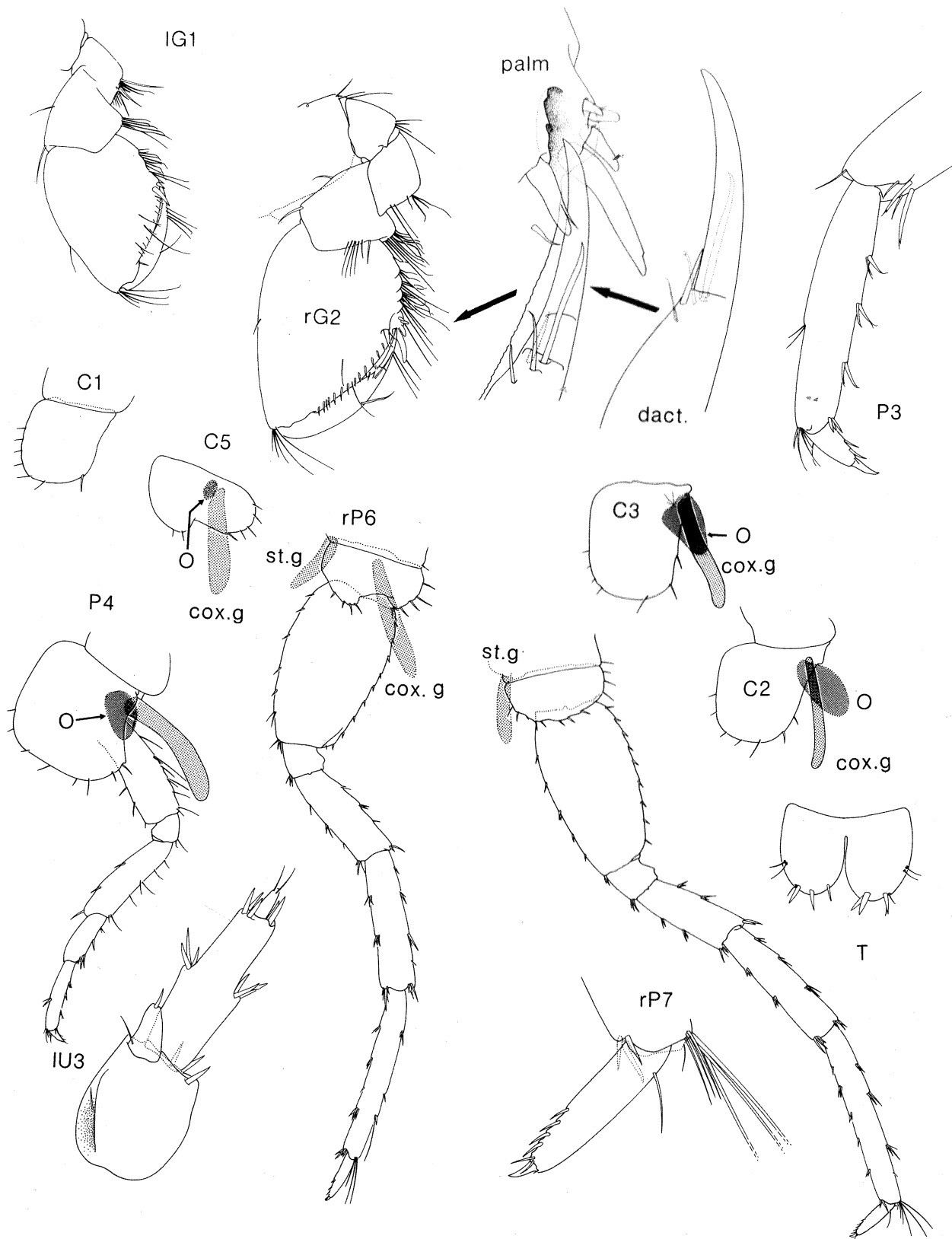


Fig.51. *Hurleya kalamundae* Straškraba, paratype, female "q".

3-4 with spine formulas of 3-2-2-2; pereopods 5-7 similar [using holotype also as example, pereopod 5 missing on "r"], coxae bearing spines on ventral margin of both lobes, however, anterior spines of coxa 5 very weak, article 2 scarcely expanded and not lobate posteroventrally, thinner on pereopod 7 than others, bearing short thick posterior spinules; coxal gill of pereopod 7 absent.

Sternal processes (Fig. 51): 2 pairs of fleshy sausage-shaped sternal gills present on segments 6-7, attached to anterior of lateral edge of each segment. Oostegites rudimentary on coxae 2-5.

Epimera (Fig. 50): each epimeron with indistinct posteroventral tooth, posterior margins of epimera 1-2 almost straight, of epimeron 3 broadly rounded; epimera 1 and 2 each with a few marginal spinules on posterior border, epimeron 3 with setae; epimera 2-3 with 4-5 submarginal ventral spines. *Pleon* (Fig. 50): each dorsolateral posterior margin of pleonites 1-4 with 1 feeble seta, pleonites 5-6 each with 1 lateral spine; uropod 3 not extending beyond uropods 1 and 2 in entire animal, uropod lengths relative to uropod 1: uropod 2 = 0.60, 3 = 0.54. *Pleopods*: retinacula 2 per pleopod, no accessories; only peduncle of pleopod 3 with 3 apical setae disjunct from retinacula.

First uropod (Fig. 50): peduncle length 1.0 rami; outer margin with 2 apicodistal spines besides strong row of dorsal spines, with 1 spine medially; outer ramus shortened, both rami with 2 rows of marginal spines, each ramus with 5 apical spines. *Second uropod* (Fig. 50): peduncle about 0.8 length of inner ramus, with 4 dorsolateral spines including 2 apicals; outer ramus shorter than inner, both with 2 weak rows of marginal spines, apices with 5 spines. *Third uropod* (Figs 50,51): peduncle length 0.63 outer ramus, longer than urosomite 3, with pair of apical spines; outer ramus proximal segment with 2 each transverse lateral and medial spine rows on body, setae absent, apex of tiny segment 2 with 2 apical short stiff setae; inner ramus length 0.27 of outer, with 1 apical spine, 1 basomedial seta. *Telson* (Fig. 51): short, shorter than urosomite 3; cleft 65 percent of its length; apices each with 3 spines in random sets, 1 apicolateral setule and each lobe with pair of penicillate setules dorsolaterally at M.65.

Description of female "p" (holotype). As described by Straškraba; gnathopod 2 much larger and better developed than in paratype "q" (see Fig. 50); sternal gills present on pereonites 3-7, 3 shortest, 5 slightly

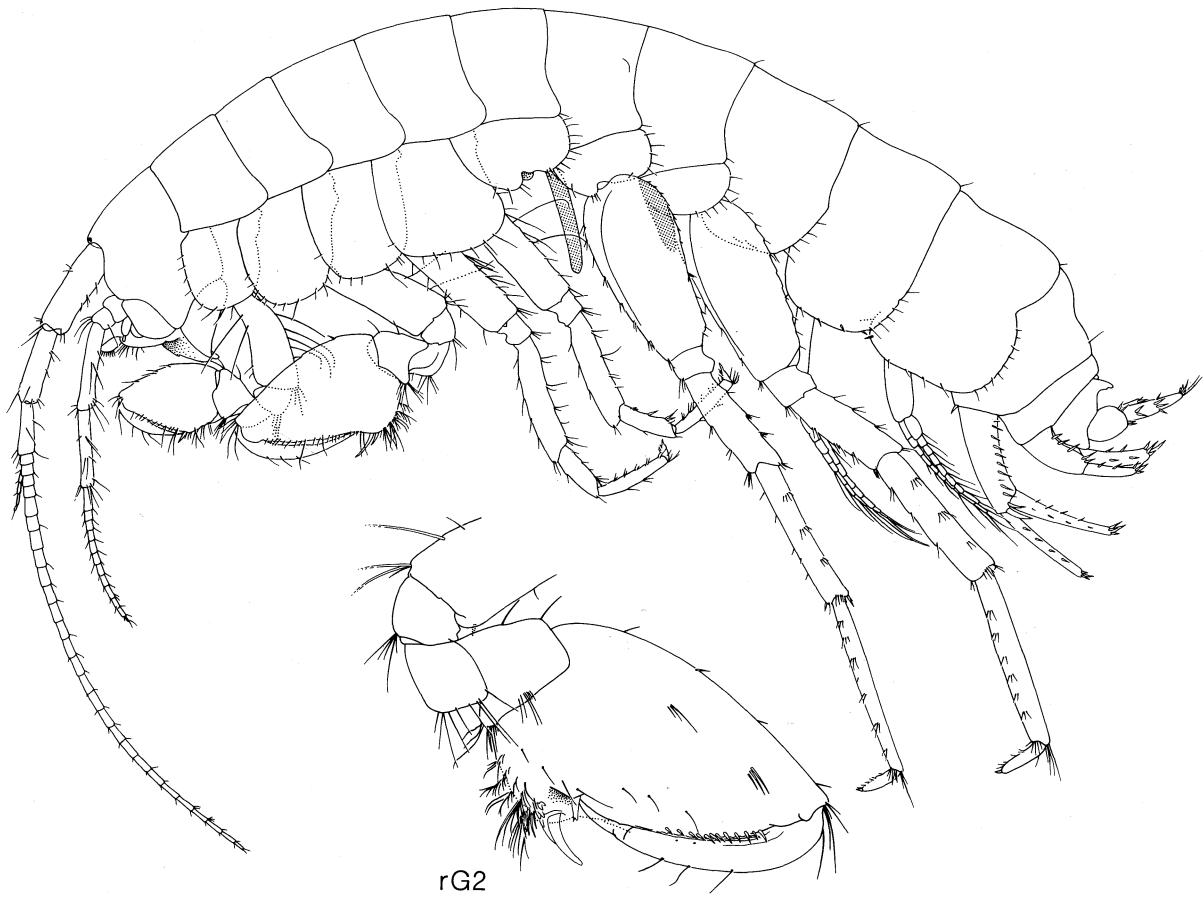


Fig. 52. *Hurleya kalamundae* Straškraba, holotype, female "p".

longer, 7 longest; coxa 4 with huge setose oostegite, coxa 5 with tiny but setose oostegite.

Description of male "r". With penial processes on pereonite 7; specimen very young, without discernible sexual dimorphism, gnathopod 2 less developed than female "q"; with full complement of sternal gills; coxal gill 7 absent as in other specimens.

Illustrations. Pereopod 5 missing on both sides of paratype "q" but shape confirmed from Straškraba's drawings and available holotype, like pereopod 6 but much shorter.

Distribution. Well at Kalamunda, a small township east of Perth, WA.

Uroctena Nicholls

Uroctena Nicholls, 1926c: 106.

Type species. *Uroctena affinis* Nicholls, 1926 by original designation.

Introduction. The genus was erected by Nicholls (1926c) to accommodate material examined by him and collected from several localities in Western Australia. At the same time, Nicholls noted that a species previously described by Chilton (1925) as a species of *Neoniphargus* (viz. *N. westralis*) was better accommodated in the new genus. We support the validity of Nicholls' genus and the inclusion in it of the species described by Chilton (1925). On the basis of our comprehensive reexamination of type material of *U. westralis*, of the slide material of possible types of *U. setosa*, and of the original descriptions of all four species of the genus presently known, we provide the following rediagnosis of the genus. This, we note, comprehensively adds to but does not substantially alter the original generic diagnosis of Nicholls (1926c) and its later expansion by Barnard & Barnard (1983).

Diagnosis. Pleonites with several dorsal setae. Rostrum small or absent, lateral cephalic lobes obvious and strong antennal sinus present. Eyes small to large, poorly pigmented, or absent.

Antenna 1 elongate, longer than antenna 2, ratio of peduncular articles about 3:2:1, accessory flagellum 4+ articulate. Antenna 2 male stout, often pediform, flagellum much shorter than peduncle, calceoli absent.

Ratio of mandibular palp articles about 2:6:5, article 2 poorly setose, article 3 weakly falcate, setae = ABDE. Labium lacking inner lobes. Maxillae barely setose medially, inner plate of maxilla 1 ovatotriangular, with 3 apicomedial setae, outer plate with 11 spines, palps asymmetric, one side with thin apical spines, other side with thick apical spines often fused to segment. Inner plate of maxilla 2 lacking oblique row of setae on face, though 2 distal medial setae slightly submarginal.

Coxae 1–4 short, but slightly longer than broad, coxae 1–3 lacking row of posterior spines, coxa 1 expanded weakly below, coxa 4 weakly emarginate, coxa 5 shorter than 4. Gnathopod 1 small, gnathopod 2 large in male, small in female, thus sexually dimorphic, carpi short only on gnathopod 2, lobate on

gnathopod 2, slightly or not on gnathopod 1, fourth article on both gnathopods lacking hyaline lobe, palms weakly (1) to strongly (2) oblique, lacking rugosities, spines not symmetrically bifid, rather with small subapical trigger-like extensions; spines at corner of palm 2–3; small setae along palm dense and simple.

Posterior spine sets on article 6 of pereopods 3–4 evenly spaced. Pereopods 5–7 moderately elongate, pereopod 6 not longer than pereopod 7, article 2 moderately to broadly expanded, ovate or trapezoidal and posteroventrally lobate; dactyls of pereopods 3–7 with 2–5 spinules on inner edge besides ordinary 1 setule (latter said to be lost in some species).

Coxae 2–6 each with gill, gill 6 not reduced. Thoracic segments 2–7 with lateral or occasionally midventral sternal gills of sausage form.

Basomedial setae on inner rami of pleopods not bifid; retinacula 3, accessory retinacula absent.

Epimera posterior margins setose; some epimera with facial spines and setae near ventral margin. Apicolateral corner of peduncles on uropods 1–2 with 1+ spine(s), dorsal margins spinose, medial margin of uropod 1 spinose; rami of uropod 1 extending subequally, outer ramus of uropod 2 shortened, margins spinose, uropod 1 lacking basofacial armaments; both rami of uropods 1–2 with 2 spine rows. Uropod 3 well extended, peduncle short, parviramous, outer ramus 2-articulate, article 2 large, inner ramus generally reaching to M.50 or less on article 1 of outer ramus; outer ramus of male with basolateral comb of spines. Telson ordinary, cleft about 50–80 percent, lobes not tumid laterally, with apical spination and setation and occasional dorsal setation, no basolateral armaments except for pair of lateral penicillate setules about M.70 on each side.

Additional description. Upper lip uniform, rounded and symmetrical below. Accessory blades (rakers) on mandibles very few (2–3), usually with interraker plumose seta between each main raker, or these also enlarged; few additional penicillate setae beyond rakers and riding onto base of molar, also with large basal molarial ragged setae besides regular apical molarial seta. Both plates of maxilla 2 with long apical setae; inner plates of maxillae 1–2 and medial and lateral margins of maxilla 2 poorly covered with pubescence. Maxillipedal inner plate very long, with distal row of several plumose setae and 3 blunt naked spines (in groups of 2 and 1), and medial row of plumose setae; outer plate small, with distal row of few plumose setae continuous with medial row of blunt naked tooth-spines; palp articles 2–3 poorly setose laterally, article 2 well setose medially, article 3 lacking organised comb row of spines near base of dactyl, apex barely produced, not rugose. Dactyls of gnathopods without small recumbant inner tooth-spine but with stiff spinules or setules at inner nail articulation line and rarely with additional spinules along inner dactylar margin. Gnathopod 1 without one rastellate seta of article 4 enlarged and scythe-like. Pereopods 3–4 especially short and thin relative to pereopods 5–7.

Pleopods similar, peduncles moderately setose; outer rami extending equally in male, slightly shortened in female. Posteroventral tooth of epimera 1–3 absent. Medial setae of outer ramus on uropod 3 absent or sparse, any other setae not plumose; both sexes usually with subdistal peduncular seta(e). Ventrodorsal spines or setae on urosomite 1 at base of uropod 1 moderately developed.

Characters of interspecific value. Eyes present or absent; antennae densely setose or not, setae long and drooping or short and stiff; degree of thickness (pediformity) of male antenna 2 variable from species to species; anterior margins of carpi and propodi on gnathopods densely setose or not; article 2 of male gnathopod 2 with strong, moderate or no development of facial and anterior spination; posterior margin of propodus of gnathopod 2 with or without large spines; telson cleft 50–80 percent, apical and dorsal armaments variable.

Sexual attributes. Male antenna 2 usually pediform, thus 1.5–2.0 times as thick as antenna 1, appearing similar to some corophioids; setae of antennae scarcely longer than in female; gnathopod 2 of male enlarged and occasionally complexly ornamented on palm; basolateral margin of outer ramus in male with comb of armaments and often with subdistal armaments on peduncle.

Relationships. *Uroctena* has strong affinities with *Paramelita* from South Africa because of similarities in sternal gill form, the form of gnathopods, oostegites, telson, epimera, urosomal setosity, head sinus, maxillae, spinose dactyls of the pereopods, and the frequent pediformity of male antenna 2. *Uroctena* differs from *Paramelita* in the absence of coxal gill 7, the enlarged article 2 of uropod 3 and the long comb of spines on the outer ramus of male uropod 3. The last two of these characters, together with the tendency to pediformity in the male antenna 2, also distinguish the genus from *Austrogammarus* and *Antipodeus*.

Uroctena differs from *Hurleya* in the plesiomorphic 11 spines on the outer plate of maxilla 1, the apparently stronger dimorphism in gnathopods, the pediformity of male antenna 2, the spine comb on the outer ramus of male uropod 3, the presence of setae on uropods 1–2

and the deeper head sinus.

Uroctena and *Giniphargus* share the large article 2 on the outer ramus of uropod 3 but otherwise differ in many characters: *Giniphargus* lacks spinosity on the pereopodal dactyls, has well-developed medial setae on the maxillae, slender, non dimorphic gnathopods, no facial epimeral armaments and lacks setae on uropods 1–2.

From *Protocrangonyx*, *Uroctena* is distinguished, *inter alia*, by its cleft telson, the large distal article of the outer ramus of uropod 3, and the greater spinosity of the pereopodal dactyls.

Speciation. Straškraba (1964: 133) found a wide variation in *U. westralis* from the original locality, enough indeed to persuade him to synonymise *U. affinis* with *U. westralis*. He demonstrated in his figures 6A,E, a degree of intergradation between thin setae and stout spines on the anterior margin of article 2 on male gnathopod 2. He also showed long setae on coxa 1 and short setae on coxa 2 (but our male specimen does not demonstrate this). In his figures 6A,B, there is variation in the length of setae on male coxa 2 between medium and short correlated with thin setae and thicker setal spines on the anterior margin of article 2 on male gnathopod 2. We have also examined a few extraneous specimens of *Uroctena* from other localities and agree with Straškraba about the general difficulty of separating species-rank taxa in this genus. However, we do not have enough material adequately to study development within the males of the various putative species. Until such a study can be undertaken, we prefer to retain as valid the several species of *Uroctena* despite the flimsy distinctions we can detect as shown in the keys below. There is, however, no doubt that *U. setosa* is very distinct from the group of *U. westralis-affinis-yellandi*.

Characters to be explored include especially the armament patterns on male gnathopod 2, coxae 1–4, pereopods 3–7, uropods 1–2, epimera and the medial face of article 1 on antenna 1.

Composition. With our resurrection of *U. affinis*, the genus at present comprises 4 species: *U. affinis* Nicholls, *U. westralis* (Chilton), *U. setosa* Nicholls, and *U. yellandi*. Two keys to separate these species follow.

Key I to the Species of *Uroctena*

1. Antennae 1–2 densely setose, setae long, telson cleft halfway, gnathopods of both sexes bearing long anterior setae on carpus and propodus, article 2 of male gnathopod 2 lacking stout spines *U. setosa*
—Antennae 1–2 not densely setose, setae short and stiff, telson cleft 70+ percent, gnathopods of both sexes lacking long anterior setae on carpus and propodus, article 2 of male gnathopod 2 with stout spines 2
2. Article 2 of male gnathopod 2 with stout anterior spines *U. affinis*
—Article 2 of male gnathopod 2 with thin anterior spines or setae 3
3. Article 2 of male gnathopod 2 with about 10 lateral facial spines, eyes absent *U. westralis*

—Article 2 of male gnathopod 2 with about 6 lateral facial spines, eyes well developed but white *U. yellandi*

Key II to the Species of *Uroctena*

- 1. Eyes present, antenna 2 of male only weakly pediform or not pediform 2
- Eyes absent, antenna 2 of male strongly pediform 3
- 2. Propodus of gnathopod 1 (both sexes) with stout spines on posterior margin, anterior margin of article 2 of male gnathopod 2 lacking strong spines *U. yellandi*
- Propodus of gnathopod 1 (both sexes) lacking stout spines on posterior margin, anterior margin of article 2 of male gnathopod 2 with several strong spines *U. affinis*
- 3. Antennae 1–2 densely setose, gnathopods 1–2 setose, article 2 of male gnathopod 1 lacking large facial spines *U. setosa*
- Antennae 1–2 not very setose, gnathopods 1–2 not very setose, article 2 of male gnathopod 1 with several large facial spines *A. westralis*

***Uroctena affinis* Nicholls**
Fig. 53

Not *Neoniphargus westralis* Chilton, 1925: 82–83, pls 4–5 (= valid species, see below).
Uroctena affinis Nicholls, 1926c: 109–111, pl. 13, figs 10–15.

Material examined. Types not extant; they do not exist among the collections of the WAM where some other type material of G.E. Nicholls does exist (see Jones, 1986). Type locality, WA, small springs around Darlington and Mundaring (east of Perth). See our discussion of *U. yellandi* for comments on a specimen misidentified as *U. affinis*. In the absence of type material, our description is drawn from the text and drawings of Nicholls (1926c).

Diagnosis. Small, degenerate eyes present. Male antenna 2 weakly pediform; propodus of male gnathopod 1 lacking stout posterior spines; article 2 of male gnathopod 2 with 14 stout posterolateral facial spines in 4 sets and 10 giant anterior spines; gnathopods of both sexes not as setose as in *U. setosa*; telson cleft 75 percent, each apex with 1–2 spines and 3–4 setae.

Description (male). *Body:* urosome sparsely armed dorsally; length, up to 9.0 mm.

Head: rostrum [?small]; eyes in life small, chalk-white, occasionally tinted pink.

First antenna: length 0.5 of body, [?longer than second antenna, flagellum as long as peduncle, peduncular article 1 longest, article 3 shortest, setae sparse, apparently each with aesthetasc]; accessory flagellum 4–6-articulate, [?articles uniform, sparsely setulate]. *Second antenna* (Fig. 53): [?relation to body length]; “not as stout as in *U. westralis*,” peduncle much longer than flagellum, article 4 longer than 5, articles 3,4 and 5 with weak ventral setation; flagellum 10-articulate, weakly setose ventrally, bearing calceolus on article 9.

Left mandible: palp article 3 [?shorter] than 2, article 2 with [?few] inner marginal setae, article 3 with [?]A, [?]B, [?]C, [?many]D, [?]E setae; incisor [?]toothed, lacinia mobilis [?]toothed, [?few] setose accessory blades; molar [?bearing] plumose seta, penicillate hooked brushy basal setae and [?]1 chisel spine. *Right mandible:* incisor [?]toothed; lacinia mobilis [?bifid, denticulate, 1 denticulation strongly extended]; accessory blades of [?] plumose spines and [?]1 chisel spine, setae of palp article 3 = [?]A, [?]B, [?]C, [?many]D, [?]E setae. *Left first maxilla:* palp article 2 with [?] thin apical spines and [?] subterminal facial setae, outer plate with [?]spines, [?most denticulate]; inner plate with [?] apical setae. *Right first maxilla:* palp article 2 with [?] thick apical spines articulated to segment, [?]1 apicolateral thin spine and [?]1 subterminal apicolateral facial seta. *Second maxilla:* outer plate outer margin with [?] large seta, apicomedial corner of inner plate with [?] weakly submarginal thick seta and [?] other marginal setae. *Maxilliped:* palp article 3 [?with] ranks of thin setae on inner edge, apical part [?with] rank of thicker bifid-setae, apex [?not] strongly produced, [?not] rugose; inner plate with [?] thick spines and plumose setae apically, [?long] medial row of plumose setae, and [?] ventrofacial spine.

First gnathopod (Fig. 53): coxal plate with long setae apically; article 4 without posterior hump; carpus well developed but shorter than in *U. westralis*, narrow and not lobate; propodus ovatotrapezoidal, about as long as wide, posterolateral angle of palm rounded with apparently 3 thick spines, anteromedial end of palm deeply incised, posterior edge of propodus with acclivity and 2 sets of setae, with [?] medial and [?] lateral elongate spines, palm slightly oblique, convex; dactylus not reaching end of palm. *Second gnathopod* (Fig. 53): much larger than first gnathopod; article 2 with 10 giant anterior spines, posterolateral face with 14 spines in 4 sets, article 5 short and lobate, article 6

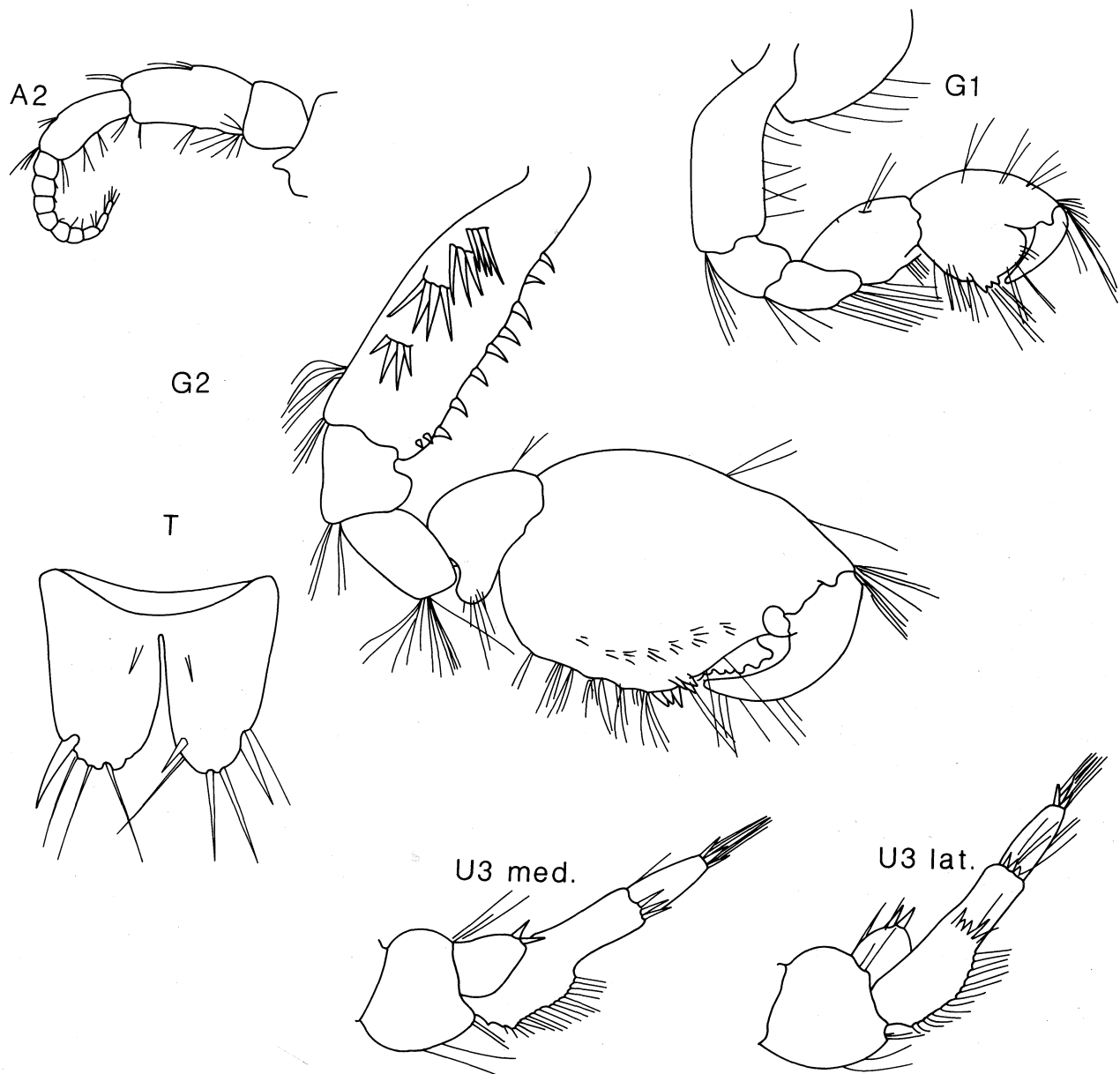


Fig. 53. *Uroctena affinis* Nicholls, male, all drawings rearranged and re-inked from Nicholls (1927b, pl. xiii [figs 10–15]; note: fig. 10 wrongly captioned).

hugely ovate, palm oblique, sculptured, palmar corner with 3 lateral and 3 medial spines; dactyl strongly curved, not fitting nor reaching end of palm; coxal plate [?well] setose.

Pereopods: coxae 1–4 not elongate, coxa 3 with [?] setae, coxa 4 slightly emarginate, with [?] anteroventral and [?] posterior setae; pereopods 3–4 [?not] longer than gnathopod 2, pereopod 3 [?not] longer than 4, article 4 [?weakly] setose posteriorly, article 5 [?more strongly] setose posteriorly, posterior spine formula = [?] and [?], posterior margin of article 6 on pereopods 3–4 with spine formula of [?] and [?]; pereopods 5–7 [?similar], coxae [?bearing] spines on ventral margin of posterior lobe, article 2 [?expanded

and lobate] posteroventrally [?bearing] short thick posterior setules; gill of pereopod 6 [?not] reduced.

Sternal processes: [?] pairs of fleshy dendritic, sternal gills present on (“several”) segments [?–?], attached to [?front of lateral edge] in each segment. Oostegites on coxae [?2–5], that on coxa 5 [?minute].

Epimera: epimera posteroventrally [?rounded], posterior margins [?convex, notched and setose], epimeron 1 with [?] ventral setae, epimera 2–3 with spine and seta formula of [?] and [?]. *Pleon:* pleonites 1–6 with setal formula: [?], spine formula [?]; uropod 3 extending beyond uropods 1 and 2 in entire animal, uropod lengths relative to uropod 1: uropod 2 = [?], 3 = [?]. *Pleopods:* retinacula [?] per pleopod, [?no]

accessories; peduncles [?]with] setae.

First uropod: peduncle [?]longer] than rami; lateral outer margin with [?] apicodistal spines besides [?]strong] row of dorsal spines, with [?] spines medially; rami of [?]subequal] length, both rami with [?]2] rows of marginal spines, outer ramus with [?] apical and inner ramus with [?] apical spines. *Second uropod*: peduncle [?]about same] length as rami, with [?] dorsolateral spines including [?] apical; rami extending [?]equally], both with [?]2]rows of marginal spines, apices with [?] spines each. *Third uropod* (Fig. 53): peduncle length 0.30 outer ramus, [?]equal] to length of urosomite 3, with 2 lateral setae besides apical cluster of 2 or 3 setae; outer ramus proximal article with transverse lateral spine-seta row on body, medial margin apparently without armaments, basolateral swelling with row of about 15 elongate setae, apex of large distal article with 3 apical spines and about 6 setae; inner ramus length 0.27 of outer, with 2 apical spines. *Telson* (Fig. 53): of ordinary length, [?]longer] than urosomite 3; cleft 75 percent of length; apices each with spine in lateral notch, 2–3 apical and apicolateral setae, 1 lobe with apicomедial spine, each lobe with mediodorsal spine-seta, and [?]pair of penicillate setules dorsolaterally at M. ?].

Female. Not described.

Relationship. This is the type species of the genus and its distinguishing features are best described in conjunction with other species. Nicholls (1926c) specifically distinguished this species from *U. westralis* on the possession of chalk-white degenerate eyes, yellow brown, somewhat translucent body color, faintly pink ovary, salmon pink eggs and more slender male antenna 2.

Distribution. Western Australia, small springs around Darlington and Mundaring.

Uroctena westralis (Chilton)

Figs 54–57

Neoniphargus westralis Chilton, 1925: 82–83, fig. 1, pls 4–5. non *Uroctena affinis* Nicholls, 1926c: 109–111, pl. 13, figs 10–15.

Material examined. Syntypes essentially extant – though not listed by Jones (1986); WAM 10661, Western Australia, Darlington, Brook A, L. Glauert, 15 Sept 1923, 6 specimens. Of these specimens, we designate male “r” 5.77 mm as the lectotype (although posterior legs badly broken, uropod 3 mostly missing), female “s” 4.61 mm as alloparalectotype. The remaining syntype material was only partially studied, namely, female “t”, headless, (oostegites studied), and male “u” 4.33 mm (uropod 3, gnathopod 1 and telson studied; Fig. 55). Another tube, with the same label, held 3 specimens. Additional material we attribute to this species is as follows: WAM 11061/2, Darlington, L. Glauert, 23 Oct 1922, 1 juvenile [not absolutely identified]. WAM 10015, part, Darlington, WA, Prof. Nicholls, 1 large male. WAM 10667,

Darlington, Brook B, L. Glauert, 4 specimens (of these, two young adults, “v” and “w”, were examined with regard to their sternal gills). WAM 11124, Kelmscott, large male and 2 other specimens. WAM 474–86, G.E. Nicholls, 3 slides.

Diagnosis. Eyes absent. Setae of peduncles of antennae 1–2 sparse and short; male antenna 2 strongly pediform, flagellum very setose, peduncle about twice as thick as antenna 1; female antenna 2 slender and flagellum setose. Gnathopods sexually dimorphic; propodus of male gnathopod 1 lacking stout posterior spines; article 2 of male gnathopod 2 lacking stout anterior spines, posterolateral face with about 11–13 spines (or accompanying setae) in 5 sets; gnathopods of both sexes not of setose form as noted in original description of *U. setosa*; telson cleft 75–80 percent [originally shown as 100 percent], each apex with 1 spine and 2 setae.

Description of lectotype (male). *Body* (Fig. 54; redrawn from Chilton, 1925, fig. 1): urosome sparsely armed dorsally; length, 5.77 mm.

Head (Fig. 54): rostrum small; eyes absent.

First antenna (Fig. 54): length 0.63 of body, 1.2 second antenna, flagellum almost twice as long as peduncle, peduncular article 1 longest, article 3 shortest, setae sparse; flagellar articles with 1 aesthetasc each starting on article 15 to apex (article 25); accessory flagellum 5-articulate, not reaching past article 6 of main flagellum, articles uniform, sparsely setulate. *Second antenna* (Fig. 54): length 0.38 body, strongly pediform; peduncle longer than flagellum, article 4 longer than 5, articles 3,4 and 5 with weak ventral setation; flagellum 10-articulate, strongly setose ventrally, lacking calceoli.

Left mandible (Fig. 54): palp article 3 shorter than 2, article 2 with 7 inner marginal setae, article 3 with 1A, 2B, many D, 3E; incisor 4-toothed, lacinia mobilis 4-toothed, 3 setose accessory blades; molar bearing plumose seta and several penicillate hooked brushy basal setae. *Right mandible* (Fig. 54): incisor 4-toothed; lacinia mobilis bifid, denticulate, 1 denticulation strongly extended; accessory blades of 2 plumose spines, setae of palp article 3 = 1A, 1B, 9D, 3E. *Left first maxilla* (Fig. 54): palp article 2 with 6 thin apical spines, 3 subterminal facial setae, outer plate with 11 spines, most denticulate; inner plate with 3 apicomедial plumose setae. *Right first maxilla* (Fig. 54): palp article 2 with 6 thick apical spines articulated to segment, 1 apicolateral thin spine, no subterminal facial setae. *Second maxilla* (Fig. 54): outer plate outer margin without large seta, apicomедial corner of inner plate with 2 weakly submarginal thick setae (1 plumose). *Maxilliped* (Fig. 54): palp article 3 with rather few thin setae on inner edge, apical face with rank of 3 setae, apex scarcely produced and not rugose; inner plate with 3 thick spines and 5 plumose setae apically, long medial row of 6 plumose setae, and ventrofacial spine.

First gnathopod (Fig. 55): coxal plate with 15

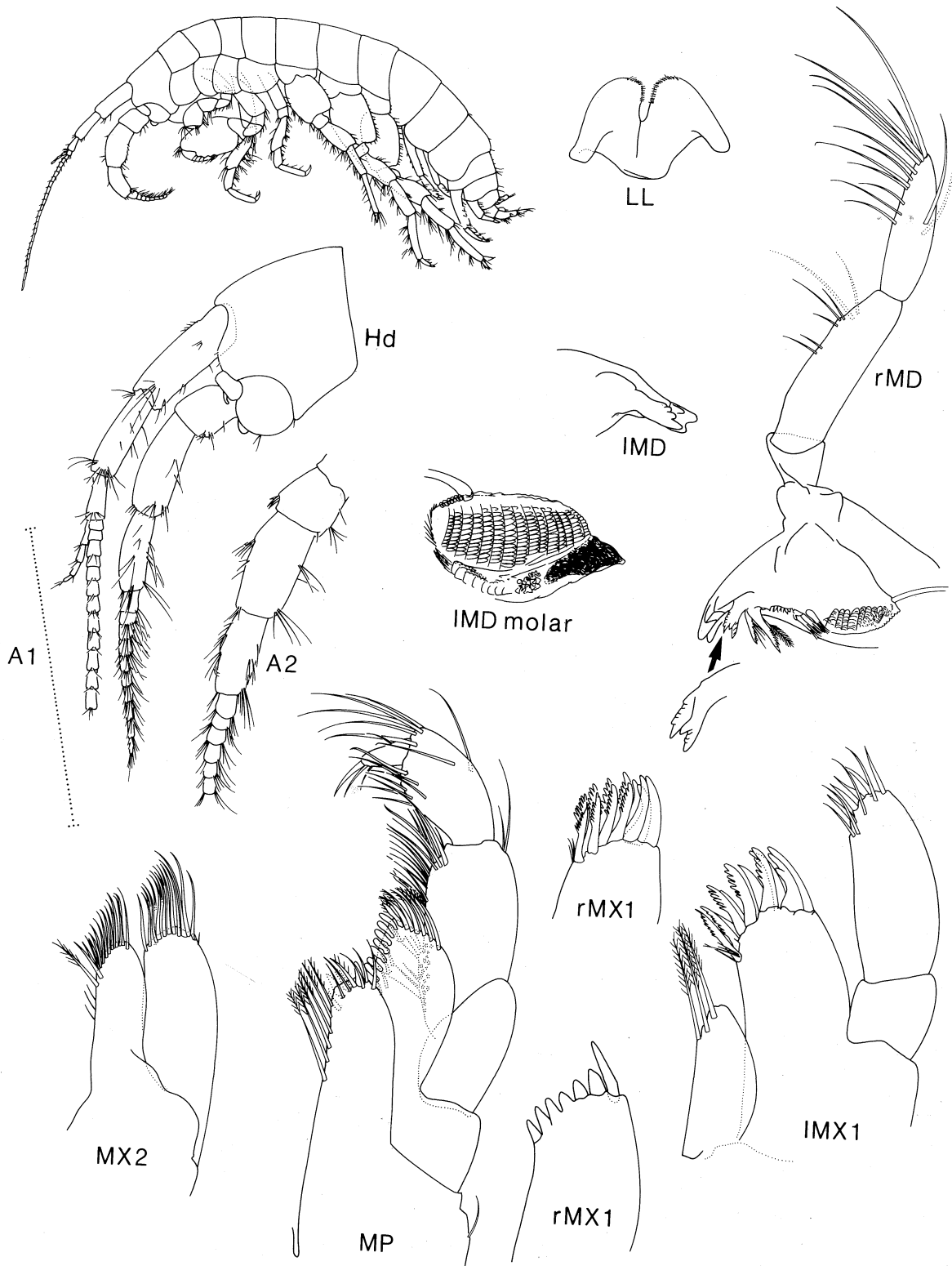


Fig. 54. *Uroctena westralis* (Chilton), lectotype, male "r" (all drawings except body form); body form redrawn and re-inked from Chilton (1925, fig. 1).

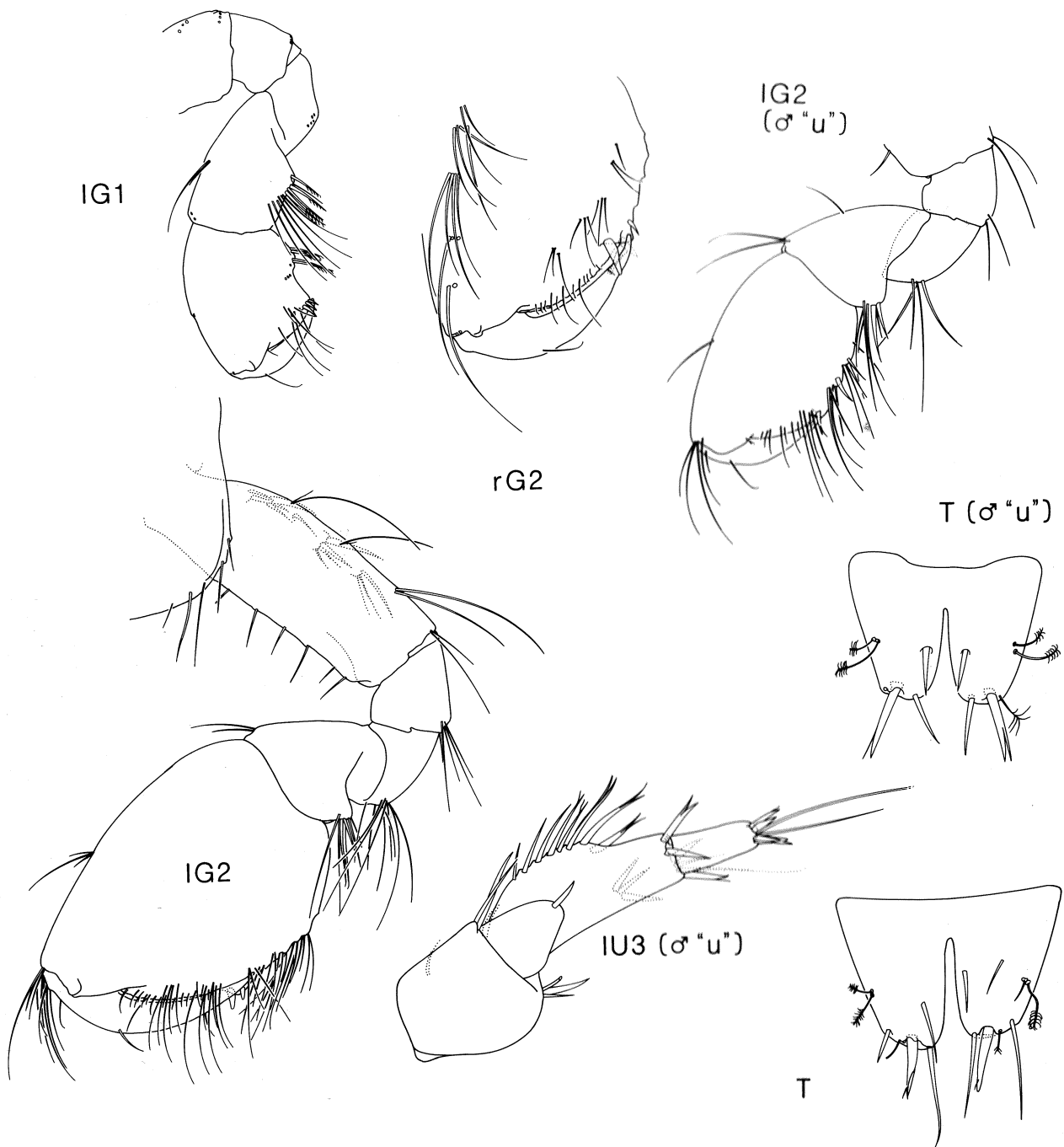


Fig. 55. *Uroctena westralis* (Chilton), lectotype, male "r" (all drawings except those indicated); male "u" (IG2, IU3, T as indicated).

medium setae ventrally; article 4 without posterior hump; carpus well developed, moderately long and not lobate; propodus subquadrate, slightly longer than wide, posterior edge with setose acclivity, posterolateral angle rounded, with 1 medial and 2 lateral spines, lateral spine not elongate, palm slightly oblique, convex; dactylus reaching end of palm. *Second gnathopod* (Fig. 55): much larger than first

gnathopod; article 2 with proximal to distal formula of posterofacial spines/setae in 5 sets of 2-3-1-4-3; carpus short and lobate; propodus huge, ovate, palm very oblique, posterior margin acclivate and setose; palmar corner with 2 spines; coxal plate with 9 ventral setae.

Pereopods: coxa 3 with [?] setae, coxa 4 scarcely emarginate, with 3 anteroventral and 13 posterior setae; pereopods 3-4 not longer than gnathopod 2,

pereopod 3 not longer than 4, articles 4-5 weakly setose posteriorly, posterior margin of article 5 proximal to distal spines = 1-2 gap 4 and 2-3 gap 4, posterior margin of article 6 on pereopods 3-4 with spine (S) and seta (s) formulas of s-sS-sS-sSS-sSS and s-sS-sSS-sSS-sSS; dactyls with 3 main marginal spines; pereopods 5-7 similar, [mostly missing], 5 shortest, coxae bearing spinules on ventral margin of posterior lobe, article 2 expanded and lobate posteroventrally, bearing thin medium posterior setules.

Sternal processes: [basic number in small adults on segments 2-7, left side only, = 1-1-1-2-2-1]; (this male formula left side segments 2-7 = 1-1-2-1-2-1, thus segment 4 with 2 pairs, segment 5 with 1 pair but set centrally, behind seventh sternal gills pair of recumbant penial processes slightly smaller than gills and pointing medially); sternal gills sausage-shaped [in small adults attached to front of lateral edge of each segment].

Epimera: each epimeron posteroventrally rounded, posterior margins convex, weakly serrate, with medium length setae in notches, epimeron 1 with 1 ventral seta, anteroventral facial formula on epimera 2-3 = sSSs-sS and sS-sS-sS. *Pleon*: dorsal posterior margins of pleonites 3-6 with 3-5 dorsal groups of setae each; uropod 3 [?moderately extending] beyond uropods 1 and 2 in entire animal, uropod lengths relative to uropod 1: uropod 2 = 0.60, 3 = [?] (missing). *Pleopods* (cf. female, Fig. 56): male retinacula 3 per pleopod, no accessories; each peduncle with several setae, unlike female; outer rami almost as long as inner, number of outer and inner rami on pleopods 1-3 = 12-9, 10-8, 9-8.

First uropod: peduncle length 1.5 rami; outer margin with 3 apicodistal spines, 1 seta besides strong row of dorsal spines in group of 8s-Ss, with 4 spines medially; rami of subequal length, both rami with 2 rows of 2 each marginal spines, each ramus with 5 apical spines. *Second uropod*: peduncle about 1.15 length of rami, with 5 dorsolateral spines and 5 setae in formula of S-Ss-SS-Sssss; outer ramus shortened; both rami with 2 rows of marginal spines, outer with 1-1, inner with 2-1, apices with 4 and 5 spines. *Third uropod* (of male "u", Fig. 55): [third uropod missing on lectotype]: peduncle length 0.50 outer ramus, as long as urosomite 3, with 1 facial, subdistal seta besides apical clusters of 3 and 3; outer ramus proximal article with comb of 8 lateral spine-setae, medial margin face with 2-3 spines in transverse row, apex with 4 spines and 2 setae, apex of large article 2 with 4 spines and 2 setae; inner ramus length 0.27 of outer, with 1 apical spine. *Telson* (Fig. 55): ordinary, shorter than urosomite 3; cleft 72 percent of its length; apices each 1 main spine, 1 apicolateral seta or spine, 1 apicomедial seta, 1-2 dorsal setae, and each lobe with pair of penicillate setules dorsolaterally at M.67.

Description of alloparalectotype (female "s"). Representing species through figures of pleon, epimera, pleopods, uropods, some pereopods. *Second antenna* (Fig. 56): very slender, not pediform.

First gnathopod (Fig. 56): like male. *Second gnathopod* (Fig. 56): an enlarged version of gnathopod 1, carpus relatively shorter, propodus relatively larger, with 3 setose posterior acclivities, 2 large defining spines (medial and lateral).

Pereopods (Fig. 56): spine counts on article 5 of pereopods 3-4 = 0-2-3 and 2-2-4, on article 6 = 1-1-s-2-s and 1-2-2-2.

Oostegites (Fig. 57): huge on coxae 2-3, smaller on coxa 4, tiny on coxa 5.

Sternal gills (Fig. 57): [analysis imperfect owing to mushiness of sternites, following is estimate]: sternite 1, 2 tiny pairs side by side; sternite 2, 1 pair; sternite 3, 2 pairs; sternite 4 would be normally 2 pairs but one side with 3, opposite side with 1; sternite 5, 1 pair lateral; sternite 6, 1 pair medial; sternite 7, 1 pair lateral. Gills increasing front to rear from tiny to medium in size.

Pleopods (see Fig. 56).

Third uropod (Fig. 57): peduncle length 0.55 outer ramus, as long as urosomite 3, with 1 basofacial seta, apical clusters of 4 and 1 spines, outer ramus proximal article with 4 transverse lateral spine-seta rows on body, medial margin with 2 sets of spines, from proximal to distal lateral spines = 1-2-4-4, setae = 0-0-1-3, medial spines = 2-5, apex of large article 2 with 7 spines and 4 setae; inner ramus length 0.50 of article 1 on outer ramus, with 3 apical spines. *Telson* (Fig. 57): (regenerant on 1 side), cleft 60 percent, normal side with 1 stout apicolateral spine, 1 thin apicomедial spine, 1 middle slightly submarginal thin spine, 1 dorsal seta, 1 penicillate setule lateral to spine, then plain seta, then pair of penicillate setae laterally at M.70.

Description of further material. Male "u": uropod 3 described above under lectotype (Fig. 55). *Second antenna*: like female.

Second gnathopod (Fig. 55): of form intermediate between female and terminal male, carpus especially shortened and lobe better defined. Penial processes present behind sternal gill on pereonite 7.

Brook A: small specimen: sternal gills, left side of pereonites 2-7 = 0-1-(1+1)-(1+1)-(1+1)-1. Second specimen = 0-1-(1+1)-2-2-1.

Brook B: 2 small specimens: sternal gills as follows (left side only of pereonites 2-7): 1-1-1-2-2-1.

WAM 474-86, 3 slides. Present are 2 antenna 1, 3 antenna 2, right and left mandibles, both maxilla 1, maxilla 2, maxilliped (at edge of slide), gnathopod 2 and 2 telsons. None of these corresponds with Chilton's original figures. The mouthparts have no valuable information at present but can be re-evaluated once fresh material of *Uroctena* has been studied. Article 2 of gnathopod 2 has the following posterolateral spine formula: 3-3-3-4; coxa 2 bears 7 short ventral setae; the dactyl reaches the end of the palm; defining spines are 2 lateral and 1 medial; there is extended sculpture on the palm.

The single uropod 2 has a strangely hooked and barbed spine apicomедially on the peduncle. Because

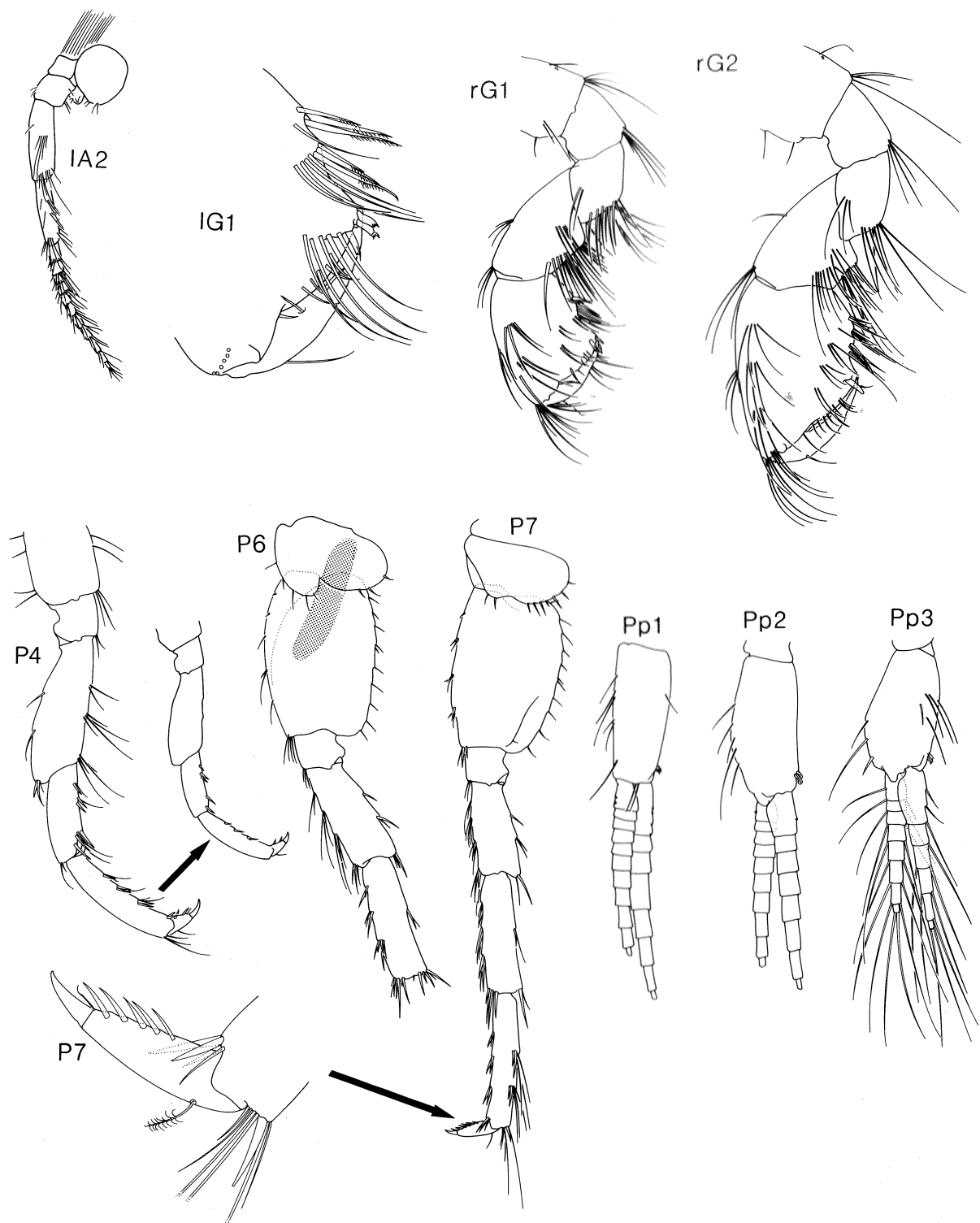


Fig.56. *Uroctena westralis* (Chilton), alloparalectotype, female "s".

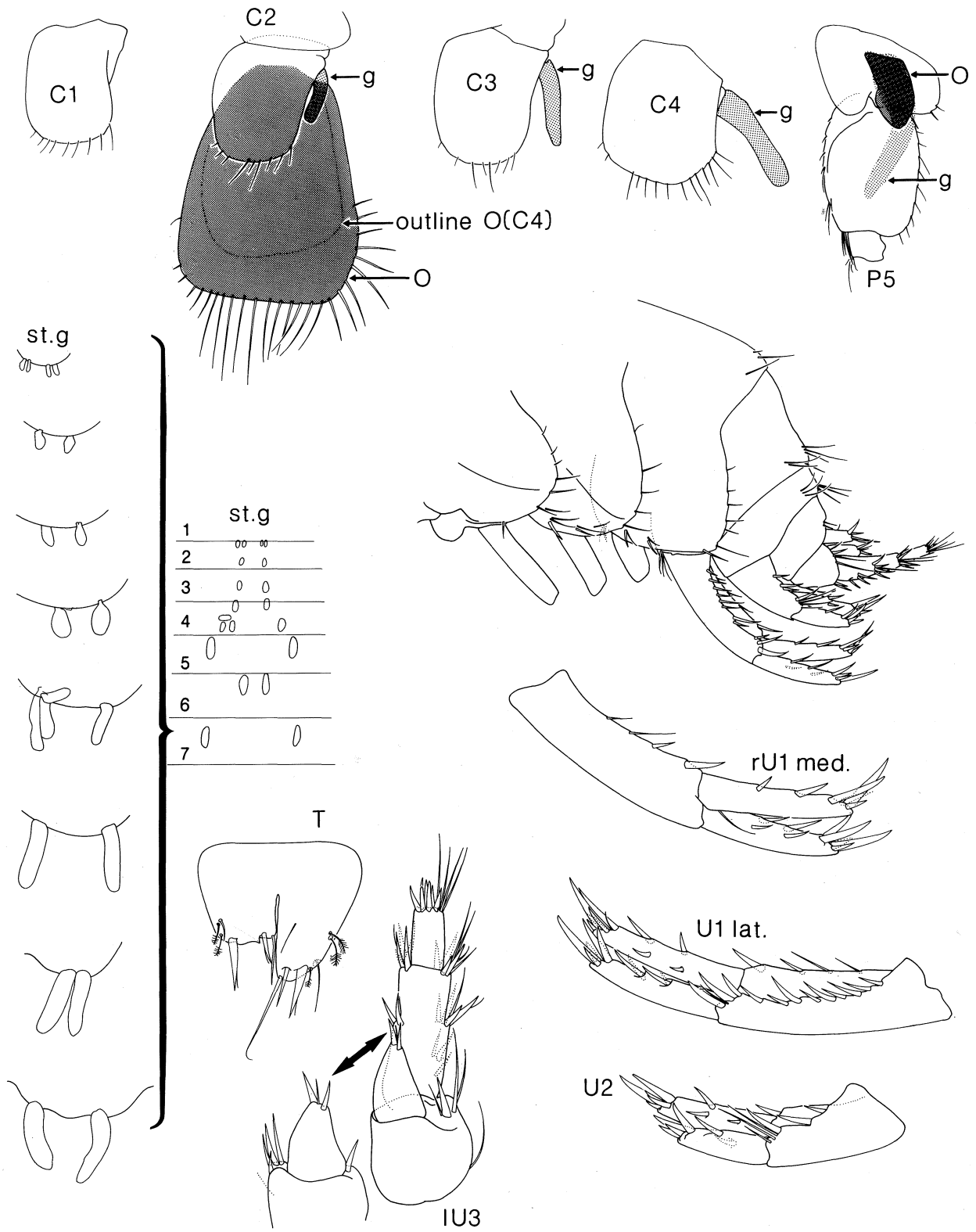


Fig.57. *Uroctena westralis* (Chilton), alloparalectotype, female "s".

we lacked the urosome for the male lectotype we cannot determine the character value of this item but we have examined other material of *Uroctena* from caves in Western Australia and have found males with this kind of hooked spine.

The first telson has on 1 lobe at least 1 spine, 2 apical setae, 1 apicolateral seta, 1 dorsomedial seta and no penicillates visible (probably owing to poor condition of slide). The second telson has on 1 lobe at least 1 spine, 2 apical setae, 1 dorsomedial seta or setal spine, 1 penicillate apicolaterally and 2 penicillates at M.65. This telson is cleft almost to the base.

Remarks. None of the specimens at hand was adequate for reillustration of body form, hence the original by Chilton is presented as a reinked and reversed figure (Fig. 54).

The dactyls of the pereopods generally have a single subfacial setule at the line of nail articulation. The female telson is aberrant and regenerate. No specimen has a fully cleft telson as shown in the original figure by Chilton.

Relationships. We do not believe this species is the same as *U. affinis* from which it differs in its lack of eyes, of large thick spines on the anterior margin of article 2 on male gnathopod 2, and its strongly pediform male antenna 2.

Uroctena westralis differs from *U. setosa* in its poorly setose antennae and gnathopods, its longer telsonic cleft (75 against 50 percent), and the presence of large spines on the face of article 2 of the male gnathopod 2. It differs from *U. yellandi* in the more numerous posterofacial lateral spines on article 2 of male gnathopod 2 and the sparsity of marginal setae on the carpus and propodus of both gnathopods in both sexes; *U. yellandi* apparently also has very thick spines on the posterior margin of the propodus of gnathopod 1. Additionally, unlike *U. yellandi*, the medial face of article 1 on antenna 1 has only 2–3 setae, no spines.

Distribution. Western Australia, brooks near Darlington and Kelmscott, near Perth.

Uroctena setosa Nicholls

Figs 58,59

Uroctena setosa Nicholls, 1926c: 107–108, pl. 12, figs 1–6, pl. 13, figs 7–9; ?Straškraba, 1964: 128–130, figs 4–5.

Material examined. Types not extant; they do not exist among the collections of the WAM where some other type material of G.E. Nicholls does exist (see Jones, 1986). Type locality, Western Australia, amongst *Chara* sp., growing near edge of a large reservoir at Katanning, a small township about 150 km north of Albany. Possible types: WAM 478-86, 1 slide, male with antenna 1, antenna 2, 1 gill, gnathopod 2, uropod 3, part of gnathopod 1, and WAM 481-86, *Uroctena setosa* female, 3 slides with complete gnathopods 1–2, pereopods 3–4, most of pereopods 5–7, part of maxilliped, squashed lower lip, all in poor condition, lacking head, antennae, uropods or body.

We should like to reserve judgement on these as type materials until we can study the whole complex of species in Western Australia in case we find character patterns in setal or spine distributions we do not discern at this time. In the absence of definitive type material, our description is drawn from the text and drawings of Nicholls (1926c).

We do not accept the amplification by Straškraba (1964) of the original description of this species based on material collected from a creek flowing into the Canning River near Victoria Reservoir (i.e. not the type locality). Although Straškraba (1964: 128–129) notes that his specimens "...agree very well with the diagnosis and detailed description and figures of Nicholls..." he presents no evidence that this was so. In the circumstances, the proper course and most prudent action is to disregard his amplifications. This we have done.

Diagnosis. Eyes absent. Setae of antennae 2 dense and long; male antenna 2 strongly pediform, about twice as wide as antenna 1, female antenna 2 not pediform; propodus of male gnathopod 1 lacking stout posterior spines, article 2 of male gnathopod 2 lacking stout spines; gnathopods sexually dimorphic, but in both sexes strongly setose anteriorly and posteriorly on carpus and propodus; telson cleft 50 percent, each apex with 2–3 spines and 1–3 setae.

Description (male). *Body:* urosome sparsely armed dorsally; length, 9.0 mm.

Head: rostrum [?small]; eyes absent.

First antenna: length less than 0.50 of body, [?] length of second antenna; peduncular article 1 [?longest], article 3 [?shortest], setae [?sparse]; flagellum 1.75 as long as peduncle, not very setose, primary flagellum with 26 articles, accessory flagellum 4-articulate, reaching to article 4 of main flagellum. *Second antenna* (Fig. 58): length [?] body, almost pediform; peduncle longer than flagellum, article 4 as long as 5, articles 3,4 and 5 with dense ventral setation; flagellum 9-articulate (10 in original text), densely setose, lacking calceoli.

Left mandible: palp article 3 [?shorter] than 2, article 2 with [?] outer marginal setae, article 3 with [?]A, [?]B, [?many]D, [?]E setae; incisor [?]-toothed, lacinia mobilis [?]-toothed, [?] setose accessory blades; molar [?bearing] plumose seta, [?] penicillate hooked brushy basal setae. *Right mandible:* incisor [?]-toothed; lacinia mobilis [?bifid, denticulate, 1 denticulation strongly extended]; accessory blades of [?] plumose spines, setae of palp article 3 = [?]A, [?]B, [?many]D, [?]E. *Left first maxilla:* palp article 2 with [?thin] apical spines and [?] subterminal facial setae, outer plate with [?] spines, [?most] denticulate; inner plate with [?] apical setae. *Right first maxilla:* palp article 2 with [?] thick apical spines articulated to segment, [?1] apicolateral thin spine and [?1] subterminal apicolateral facial seta. *Second maxilla:* outer plate outer margin with [?1] large seta, apicomедial corner of inner plate with [?] weakly

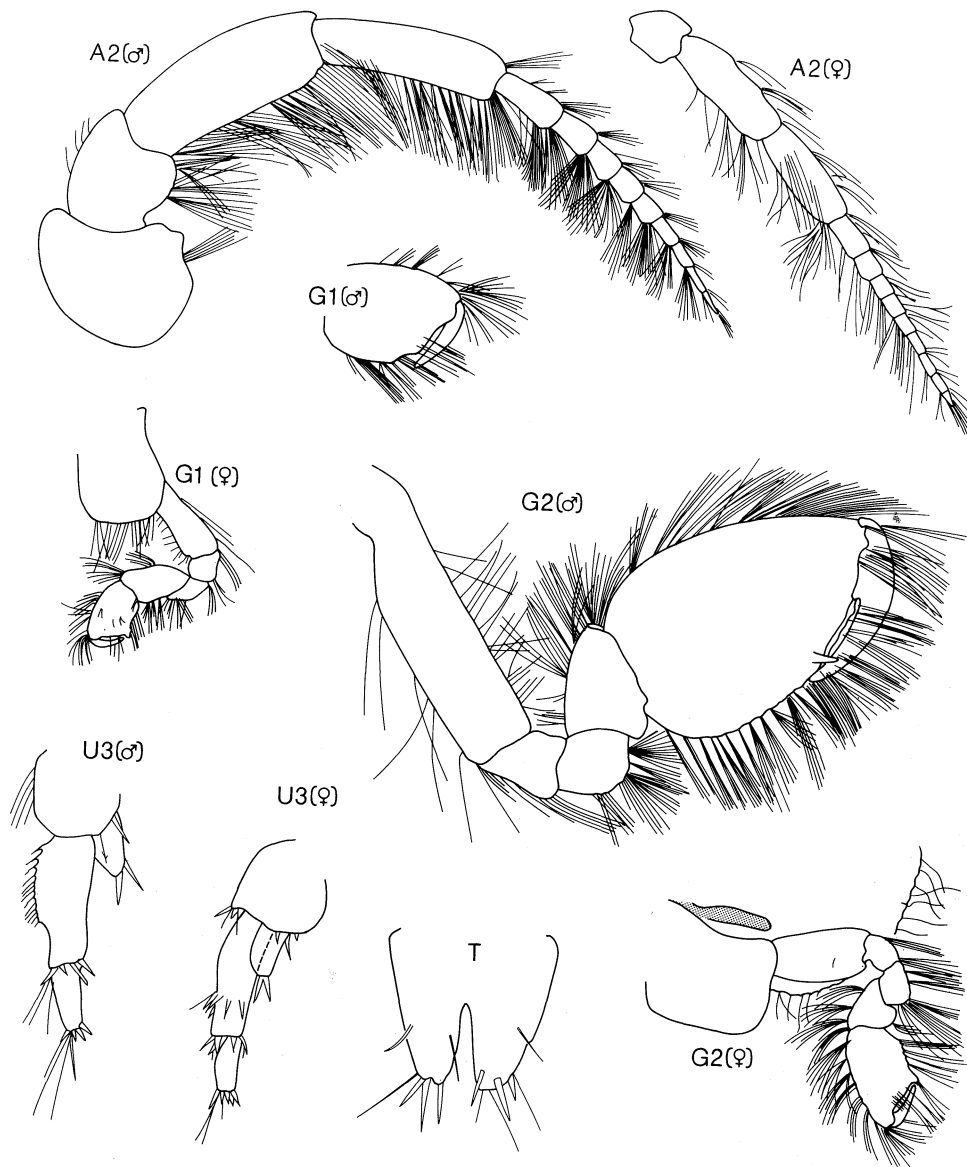


Fig. 58. *Uroctena setosa* Nicholls, all drawings rearranged and re-inked from Nicholls (1927b, pl. xii [figs 1–6] and pl. xiii [figs 7–9]; note: figs 1, 2 wrongly captioned).

submarginal thick seta and [?] other marginal setae. *Maxilliped*: palp article 3 [?]with] ranks of thin setae on inner edge, apical part [?]with] rank of thicker bifid setae, apex [?]poorly] produced and [?]not] rugose; inner plate [?]with] thick spines and plumose setae apically, long medial row of plumose setae, and [?] ventrofacial spine.

First gnathopod (Fig. 58): coxal plate with many long setae ventrally; article 4 without posterior hump; carpus (like *U. westralis*) well developed, long and not lobate; propodus ovatotrapezoidal, slightly longer than wide, posterior edge with heavily setose acclivity, posterolateral angle rounded, with [?] medial and [?] lateral spines, lateral spine [?]elongate], palm slightly

oblique, straight; dactylus exceeding end of palm. *Second gnathopod* (Fig. 58): much larger than first gnathopod; article 2 lacking large spines; carpus short, weakly lobate; propodus huge, ovate, posterior margin acclivate and setose, palm very oblique, palmar corner with large spine; very long setae (unlike *westralis*) fully present on anterior margins of carpus and propodus and on posterior margins of merus and propodus; coxal plate setose.

Pereopods: ventral margins of coxae rounded, with numerous long setae, coxa 4 slightly emarginate, with [?] anteroventral and [?] posterior setae; pereopods 3–4 [?]longer] than gnathopod 2, pereopod 3 [?]not] longer than 4, article 4 [?]weakly] setose posteriorly, article 5

[?more strongly] setose posteriorly, posterior margin of article 6 on pereopods 3–4 with spine formulas of [?] and [?]; pereopods 5–7 [?similar], coxae [?lacking] spines on ventral margin of posterior lobe, article 2 [?expanded] and [?lobate] posteroventrally, bearing [?short thick] posterior setules.

Sternal processes: [?] pairs of fleshy, sausage-shaped sternal gills present on segments [?], attached to [?front of lateral edge of each segment].

Epimera: each epimeron posteroventrally [?rounded] posterior margins [?serrate and setose], epimeron 1 with [?] ventral seta, formula of anterofacial spines-setae on epimera 2–3 = [?] and [?].

Pleon: dorsolateral posterior margin of pleonites 1–6 sparsely setose with following setal formula: [?], spines = [?]; uropod 3 [?extending beyond] uropods 1 and 2 in entire animal, uropod lengths relative to uropod 1: uropod 2 = [?], 3 = [?]. **Pleopods:** retinacula [?] per pleopod, [?] accessories; each peduncle with [?] seta.

First uropod: peduncle length [?] rami; outer margin with [?] apicodistal spine besides [?strong row] of dorsal spines, with [?] spines medially; rami of [?subequal] length, both rami with [?] rows of marginal spines, outer ramus with [?] apical and inner ramus with [?] apical spines. **Second uropod:** peduncle [?about same] length as rami, with [?] dorsolateral spines including [?] apical; rami extending [?equally], both with [?] rows of marginal spines, apices with [?] and [?] spines. **Third uropod** (Fig. 58): peduncle length 0.55 outer ramus, as broad as long, [?shorter] than urosomite 3, with 4 lateral long setae besides apicomedial spine and seta; outer ramus proximal article lacking transverse lateral spine-seta rows on body, lateral margin with comb of about 13 short stiff setae on flange, distal margin with 4 spines and 3 long setae, distal article large, with 4 apical spines and 4 long setae; inner ramus length 0.30 of outer, with 2 apical spines. **Telson** (Fig. 58): of ordinary length, [?longer] than urosomite 3; cleft 50 percent of its length; apices each with 3 spines and 1–3 setae; each lobe with 1–2 dorsal setae, and [?pair] of penicillate setules dorsolaterally at M.[?].

Description (female). Up to 7.5 mm long. **Second antenna** (Fig. 58): slender, densely setose but less so than in male, article 4 of peduncle slightly longer than article 5, flagellum with 10 articles; not pediform.

First gnathopod (Fig. 58): smaller even than male gnathopod 1, propodus less expanded. **Second gnathopod:** somewhat larger than gnathopod 1. Gnathopods 1–2 much more setose than in female of *U. westralis*, with especially long tufts of setae anteriorly on carpus and propodus and posteriorly on merus. Coxa 2 with large oostegite and a "...large branchia and a small simple accessory branchia..." [latter probably a sternal gill].

Description of additional material. WAM 478-86, 1 male slide (Fig. 59). This may have been the slide from which Nicholls took his drawing; if so we present a new drawing of propodus and dactyl to illustrate the proper configuration of spines defining the palm.

WAM 481-86, female 3 slides. Parts on slides more or less arranged as drawn by Nicholls but clearly not precisely the specimen he illustrated because of angles between coxa and remainder of gnathopod 2 and carpus with 5 anterior bundles of setae (not 4), propodus with 5 or 6 anterofacial and distal setal bundles, with 2 additional sets directly anterior; locking spines 1 long medial and 1 short lateral; posterior margin of propodus with 4 sets of setae slightly shorter than shown by Nicholls; merus with only 2 posterior sets of setae including apical largest set; ischium with only 1 posterodistal set of setae; basos with 5 posterior sets of setae (1+). Coxa 2 with about 15, mostly long, setae (not shown by Nicholls). Gnathopod 1 with 2 lateral (1 slightly elongate) spines and 1 medial (thickest of all); posterior margin of propodus with 2 sets of setae, anterior margin with 2 facial and 2 marginal sets of setae besides distal bundle; carpus with 1 anterior set, 1 distoanterior set of setae; merus and ischium each with only posterodistal setal seta; basos with about 6 posterior setal sets (1+).

Relationship. Differing from all other species of *Uroctena* in the lack of facial spines on article 2 of male

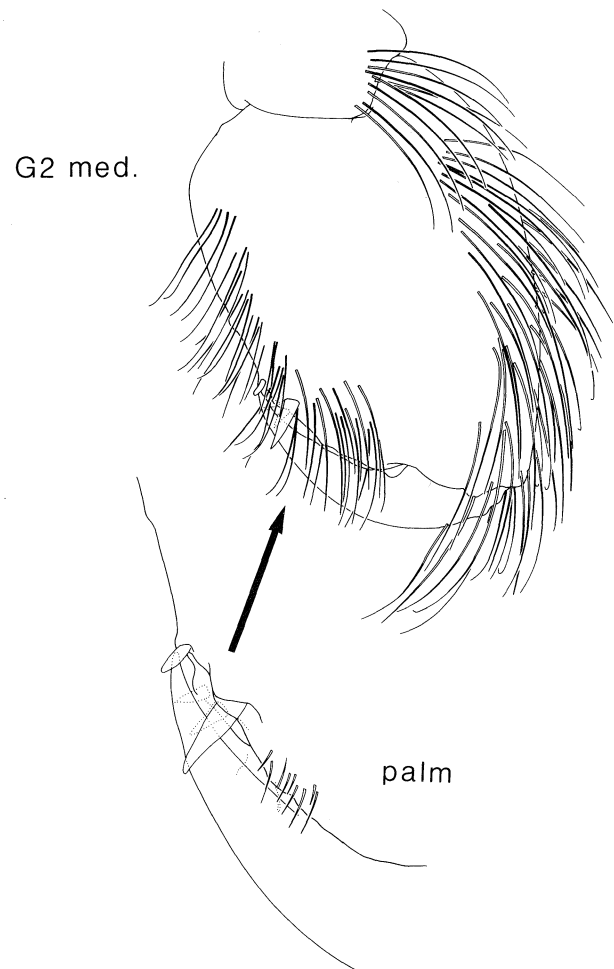


Fig. 59. *Uroctena setosa* Nicholls, WAM 478-86, male.

gnathopod 2 and the much higher degree of setation on the gnathopods and antennae 1–2 of both sexes. Article 2 of male gnathopod 2 does possess many setae, but no stiff thick spines.

Distribution. Western Australia, reservoir at Katanning.

Uroctena yellandi Nicholls

Fig. 60

Uroctena yellandi Nicholls, 1926d: 113–115, fig. 1, pl. 14.

Material examined. Confirmed and labelled types are not extant; they do not exist among the collections of the WAM where some other type material of G.E. Nicholls does exist (see Jones, 1986). Possible original “paratype” or cotype material is: WAM 482-86, squash of body of 1 specimen, 483-86, 1 slide of dissected parts from a second specimen. Also of interest is WAM 477-86, slide labelled first *Uroctena affinis*, then appended as *U. westralis*; this is provisionally assigned to *U. yellandi* until the status of the *U. westralis-affinis-yellandi* complex can be elucidated. Type locality, Western Australia, in a creek some kilometres south of Armadale, under stones and in tufts of grass. In the absence of definitive type material, our redescription is drawn from the text and drawings of Nicholls (1926d).

Diagnosis. Eyes small, round, white. Setae of antennae 1–2 sparse to moderately dense; male antenna 2 slender (not pediform), less than 1.5 times as thick as antenna 1; propodus of male gnathopod 1 bearing stout posterior spines, article 2 of male gnathopod 2 with 6 stout lateral spines in 3 sets, none anteriorly; gnathopods sexually dimorphic, but in both sexes not as setose as noted in description of *U. setosa*; telson cleft 70 percent, each apex with 2–3 spines and 4–5 setae.

Description (male). *Body* (Fig. 60): urosome sparsely armed dorsally, pleonites 2–5 with long setae, urosomites with lateral “spinous setae”, lateral “tubercle near margin” of pleonites 1–3; length, 8.0 mm.

Head (Fig. 60): rostrum absent; eyes well developed, small, white and conspicuous.

First antenna (Fig. 60): length 0.6 of body (0.75 in original text), 1.5 second antenna, flagellum much longer than peduncle, peduncular article 1 longest, medial face spinose, article 3 shortest, setae sparse, accessory flagellum 4-articulate, not reaching past article 5 of flagellum; flagellum articles uniform, moderately setose on ventral margin. *Second antenna* (Fig. 60): length 0.37 body; moderately stout but not pediform; peduncle longer than flagellum, article 4 slightly longer than 5, articles 3,4 and 5 with weak ventral setation; flagellum 10-articulate, moderately setose.

Left mandible: palp article 3 [?shorter] than 2, article 2 with [?] outer marginal setae, article 3 with [?]A, [?]B, [?]many]D, [?]E; incisor [?]-toothed,

lacinia mobilis [?]-toothed, [?] setose accessory blades; molar [?bearing] plumose seta, [?] penicillate hooked brushy basal setae. *Right mandible*: incisor [?]-toothed; lacinia mobilis [?bifid, denticulate, 1 denticulation strongly extended]; accessory blades of [?] plumose spines, setae of palp article 3 = [?]A, [?]B, [?]many]D, [?]E. *Left first maxilla*: palp article 2 with [?thin] apical spines and [?] subterminal facial setae, outer plate with [?] spines, [?most] denticulate; inner plate with [?] apical setae. *Right first maxilla*: palp article 2 with [?] thick apical spines articulated to segment, [?]1 apicolateral thin spine and [?]1 subterminal apicolateral facial seta. *Second maxilla*: outer plate outer margin with [?]1 large seta, apicomедial corner of inner plate with [?] weakly submarginal thick seta and [?] other marginal setae. *Maxilliped*: palp article 3 [?with] ranks of thin setae on inner edge, apical part [?with] rank of thicker bifid-setae, apex [?weakly produced] and [?not] rugose; inner plate [?with ?] thick spines and plumose setae apically, long medial row of plumose setae, and [?] ventrofacial spine.

First gnathopod (Fig. 60): coxal plate with numerous setae ventrally; article 4 [?without] posterior hump; carpus well developed, long, not lobate; propodus subquadrate, longer than wide, posterior edge with 3 spinose acclivities, posterolateral angle rounded, with [?] medial and lateral spines, palm slightly oblique, convex; dactylus reaching end of palm. *Second gnathopod* (Fig. 60): much larger than first gnathopod; article 2 with 3 sets of paired spines on medial posterior face; carpus short, strongly lobate; propodus huge, ovate, posterior margin acclivate and setose, palm convex, very oblique and sculptured, palmar corner with 2 huge spines; coxal plate with 11 ventral spines and setae.

Pereopods (Fig. 60): coxae 1–4 with numerous ventral setae, coxa 4 weakly emarginate, with [?] anteroventral and [?] posteroventral setae; pereopods 3–4 not longer than gnathopod 2, pereopod 3 [?longer] than 4, article 4 [?weakly] setose posteriorly, article 5 [?more strongly] setose posteriorly, posterior margin of segment 6 on pereopods 3–4 with spine formulas of [?] and [?]; pereopods 5–7 similar, but pereopod 5 shortest, coxae bearing spines or setae on ventral margin of posterior lobe, article 2 expanded and lobate posteroventrally, bearing sparse medium posterior setules; dactyls with up to 5 marginal spines, basodactylar armaments on article 6 very long.

Sternal processes: [?] pairs of fleshy dendritic, sternal gills present on segments [?–?], attached to [?front of lateral edge of each segment]. “Two or three of the pereopods bear simple (unbranched) accessory branchiae”.

Epimera (Fig. 60): each epimeron posteroventrally rounded, posterior margins convex, [?setose], epimera 1–3 with numerous ventral setae, formula of anteroventral facial spines and setae on epimera 2–3 = [?] and [?]. *Pleon* (Fig. 60): each dorsolateral posterior margin of pleonites 1–6 with setae and/or spines; setal

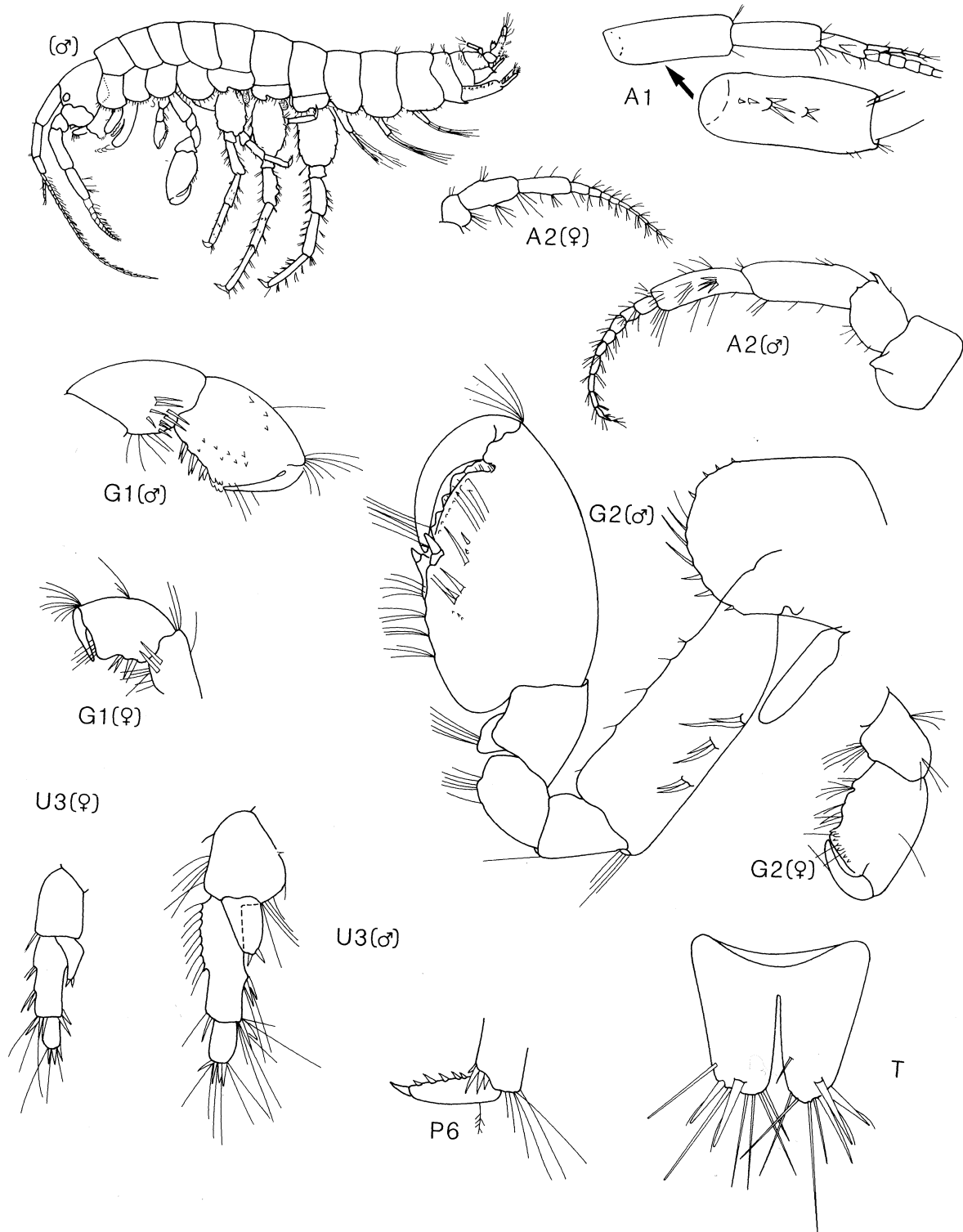


Fig.60. *Uroctena yellandi* Nicholls, all drawings rearranged and re-inked from Nicholls (1927c, fig. 1 and pl. xiv [figs 1-10]).

formula = [?], spines [?]; uropod 3 strongly extending beyond uropods 1 and 2 in entire animal, uropod lengths relative to uropod 1: uropod 2 = 0.5, 3 = 0.6; urosome with laterally placed spine-setae. *Pleopods*: retinacula [?] per pleopod, [?] accessories; each peduncle with [?] seta.

First uropod (Fig. 60): peduncle length 1.8 rami; outer margin with [?] apicodistal spine besides weak row of dorsal spines, with [?] spines medially; inner ramus slightly longer than outer ramus, both rami with [?] rows of marginal spines, outer ramus with [?] apical and inner ramus with [?] apical spines. *Second uropod* (Fig. 60): peduncle about same length as rami, with [?] dorsolateral spines including 1 apical; rami subequal, both with [?] rows of marginal spines, apices with [?] and [?] spines. *Third uropod* (Fig. 60): peduncle length 0.5 outer ramus, as broad as long, shorter than urosomite 3, with 5 lateral long setae (and 1 short seta) besides apicomедial cluster of long setae; outer ramus proximal article without transverse lateral spine-seta rows on body, with long basolateral comb of about 9 stiff setae on flange, medial margin with 2 sets of armaments, mixing setae and spines, from proximal to distal spines = [?], setae = [?], distal article large, with 4 apical spines and 6 long setae; inner ramus length 0.35 of outer, with 2–3 apical spines. Telson (Fig. 60): ordinary, about as long as urosomite 3; slightly broader than long; cleft 70 (original text says 60) percent of its length; apices subtruncate, each with 2–3 spines, 0–1 apicolateral setae, 4–5 apical setae, 0–1 dorsomedial setae, and each lobe with [?pair] of penicillate setules dorsolaterally at M.[?].

Description (female). Smaller than male. *Second antenna* (Fig. 60): smaller and more slender than male antenna 2, articles 4–5 equally long, flagellum longer relative to peduncle than in male, with 9 articles.

First gnathopod (Fig. 60): more slender than in male, but also with large spines on posterior margin of propodus. *Second gnathopod* (Fig. 60): carpus much shorter than propodus relative to gnathopod 1, propodus somewhat elongate, posterior margin only setose.

Third uropod (Fig. 60): apparently lacking peduncular setae; article 1 of outer ramus with 3 lateral sets of spines, 1 apicomедial set, no basolateral setal comb; apex of article 2 with 3 spines and 3 setae.

Description of additional material examined. WAM 482-86, 483-86. If these are original materials used by Nicholls in the establishment of this species, the following contributions to his description can be made: coxa 1 has 2 stout spines posteroventrally, coxa 2 also with stout spines as shown by Nicholls; the stout spines drawn for articles 5–6 of gnathopod 1 are grossly exaggerated and are no thicker than in other species; article 2 of male gnathopod 2 has on one appendage 6 spines in 3 pairs and on the other appendage 4 pairs of spines on the posterolateral face (this is only 2 short of the minimum number of spines defining *U. westralis*); see remarks included after description of genus

Uroctena.

Relationship. This species differs from *U. westralis* in the fewer spines on article 2 of gnathopod 2 in the male, and from this and all other species of *Uroctena* in its non-pediform, slender male antenna 2 and the occurrence of stout spines on the posterior margin of gnathopod 2.

Distribution. Western Australia, south of Armadale, near Perth.

Giniphargus Karaman & Barnard

Giniphargus Karaman & Barnard, 1979: 150.

Type species. *Niphargus pulchellus* Sayce, 1899 by original designation.

Introduction. The genus was erected by Karaman & Barnard (1979) to accommodate a species discovered by Sayce (1899) and placed by him in the genus *Niphargus*. Better definition of this genus led to the exclusion of Sayce's species, and accordingly a new genus, *Giniphargus*, was created to receive it. The new genus was shortly thereafter slightly rediagnosed by Barnard & Barnard (1983). On the basis of our re-examination of Sayce's original material, we are now in a position to define the genus more comprehensively. Our rediagnosis, we note, adds to but does not substantially alter the original and subsequent generic descriptions of Karaman & Barnard (1979) and Barnard & Barnard (1983).

Diagnosis. Body very thin and elongate (vermiform), all coxae short and barely overlapping; pereonites and pleonites with sparse transverse dorsal setation. Rostrum absent, lateral cephalic lobes strongly projecting, antennal sinus deep. Eyes absent.

Antenna 1 elongate, much longer than antenna 2, ratio of peduncular articles about 8:7:3, accessory flagellum 4-articulate. Antenna 2 flagellum much shorter than peduncle; calceoli absent in male.

Ratio of mandibular palp articles about 1:3:2, article 2 poorly setose, article 3 falcate, setae = BDE. Labium lacking inner lobes. Maxillae medially setose, inner plate of maxilla 1 ovatotriangular, fully setose, outer plate with 11 spines, palps [?asymmetric, one side with thin apical spines, other side with thick apical spines, present specimen, aberrant; Sayce did not differentiate palps]. Inner plate of maxilla 2 bearing oblique row of setae on face; inner plates of maxillae 1–2 moderately covered with long straw-like pubescence. Maxillipedal dactyl long, with long nail and several accessory setae.

Coxae short, poorly setose, coxa 1 bevelled posteroventrally, coxa 4 not lobate nor excavate, coxae 6–7 slightly shorter than coxa 5. Gnathopods 1–2 small [sexual dimorphism unknown], only carpus of gnathopod 1 elongate, fourth article on gnathopods 1–2 with faint rugose area and hump, palms transverse, bearing weak rugosities, spines weakly bifid; spines at corner of palm 4–5 only; spines along palm sparse.

Posterior setal sets on article 6 of pereopods 3–4

evenly spaced. Only pereopod 7 moderately elongate, article 2 of pereopods 5–7 not markedly expanded, trapezoidal and not posteroventrally lobate; dactyls of pereopods 5–6 geniculate, dactyls of pereopods 3–7 with marginal and facial setule (2 total).

Coxal gills present on coxae 2–6, last not reduced. Thoracic segments 6–7 with small, sausage-shaped lateral sternal gills.

Basomedial setae on inner rami of pleopods 1–3 bifid, branches diverse, of different length and shape but, occasionally, 1 branch with diamond head, or both simple; retinacula 2, 2 accessory retinacula.

Several pleonites with dorsal setae. Epimera lacking ventrofacial spines, posteroventral margins weakly setulate. Rami of uropods 1–2 extending subequally, only outer ramus of uropod 1 with 2 rows of spines, uropod 1 lacking basofacial armaments. Uropod 3 immensely extended, peduncle short, outer ramus 2-articulate, article 2 huge, inner ramus absent. Telson short, cleft about 50 percent, lobes tumid laterally, with 3 apical spines in ill-defined set on each lobe, with midlateral armaments in form of pair of penicillate setules on each side.

Additional description. Accessory blades (rakers) on mandibles without interraker plumose seta; very few additional penicillate setae beyond rakers and riding onto base of molar, instead with 1 very large bent basal molarial ragged seta in form of scale besides regular apical molarial seta. Maxillipedal palp articles 2–3 poorly setose laterally, only moderately setose medially, article 3 with 2 pairs of facial setae. Dactyls of gnathopods with small recumbant inner tooth-spine and several setules at inner nail articulation line. Gnathopod 1 without one seta of article 4 enlarged and scythe-like.

Sexual attributes. Unknown, females not described.

Relationship. *Giniphargus* is so derived within its geographic area that it is difficult to find ancestral relationships. Sayce's fine description did not include mention of the two pairs of sternal gills which led Barnard & Barnard (1983) to cast relationships with eriopisellids. The presence of these gills, however, suggests affinities with crangonyctoids, i.e., the local austrogammarid-neoniphargid fauna of Australia. If this relationship is valid, then *Giniphargus* represents an independent example wherein has occurred an immense development of uropod 3 (paralleling the eriopisellid-niphargid line). It may, of course, also indicate that niphargids belong with crangonyctoids where Bousfield (1983) recently submerged them from their former level of superfamily. *Giniphargus*, if a prototypical niphargid, has actually diverged strongly by the loss of the inner ramus of uropod 3 independent of the Mediterranean-surround members in Palearctica which have also lost this ramus. Casting this relationship would mean niphargids arose in the early Mesozoic before Pangaea broke up.

Giniphargus pulchellus (Sayce)

Figs 61,62

Niphargus pulchellus Sayce, 1899: 153–159, pls 15,16.

Material examined. Museum of Victoria (NMV), type, Thorpdale (Gippsland), Vic. LECTOTYPE newly designated by us as male "a" 6.5 mm (illustrated); apparently this is the specimen from which Sayce drew the body shown in his plate 15, but the other 2 specimens mentioned by him do not appear to be extant.

Diagnosis. With the characters of the genus.

Description of lectotype (male). *Body* (Fig. 61): pereon and pleon dorsally setose, setation sparse and transverse on pereonites 3–7 and pleonites 1–5; length, 6.5 mm.

Head (Fig. 61): rostrum absent; eyes absent; inferior antennal sinus deep.

First antenna (Fig. 61): length 0.65 of body, 1.8 second antenna; peduncle much shorter than flagellum, article 1 longest, article 3 shortest, but second article 87 percent as long as 1, setae sparse; accessory flagellum 4-articulate, reaching past article 3 of flagellum; flagellum articles uniform, sparsely setulate. *Second antenna* (Fig. 61): length 0.35 body; peduncle longer than flagellum, article 4 longer than 5, articles 3,4 and 5 with sparse ventral setation and some large medial spines; flagellum 8-articulate, weakly setose, lacking calceoli.

Upper lip (Fig. 61): apical margin unevenly rounded. *Lower lip* (Fig. 61): inner lobes absent. *Left mandible* (Fig. 61): palp article 3 much shorter than 2, article 2 with sparse midanterior setae, article 3 with 3,1B, many D, 4E; incisor 5-toothed, lacinia mobilis 4-toothed, 5 setose accessory blades, no interrakers; molar bearing setose spine and brushy basal scale and few small penicillate setules between rakers and molar. *Right mandible* (Fig. 61): incisor 4-toothed; lacinia mobilis trifid; accessory blades of 3 setose spines. *Left first maxilla* (Fig. 61): palp article 2 with 5 moderately thin apical spines, 1 apicolateral elongate spine in notch, 1 subterminal facial seta, outer plate with 11 spines, some denticulate, apicomедial inner surface of outer plate especially heavily pubescent; inner plate with 9 medial plumose setae covering full medial margin. *Right first maxilla* (Fig. 61): palp article 2 aberrant (see figure). *Second maxilla* (Fig. 61): both plates with row of long thick, apically hooked setae distally, outer margin with 1 short seta; inner plate with strong oblique facial row of setae. *Maxilliped* (Fig. 61): palp article 3 with 2 pairs of facial setae, some thinner medial setae, apex weakly produced and pubescent; outer plate with row of 4 setose spines distally continuous with row of 7 tooth-spines medially; inner plate with 3 thick spines and plumose setae apically and long medial row of plumose setae.

First gnathopod (Fig. 62): coxal plate setose very sparsely; article 4 with posterior hump, faintly rugose; carpus elongate, unlobed, strongly setose; propodus

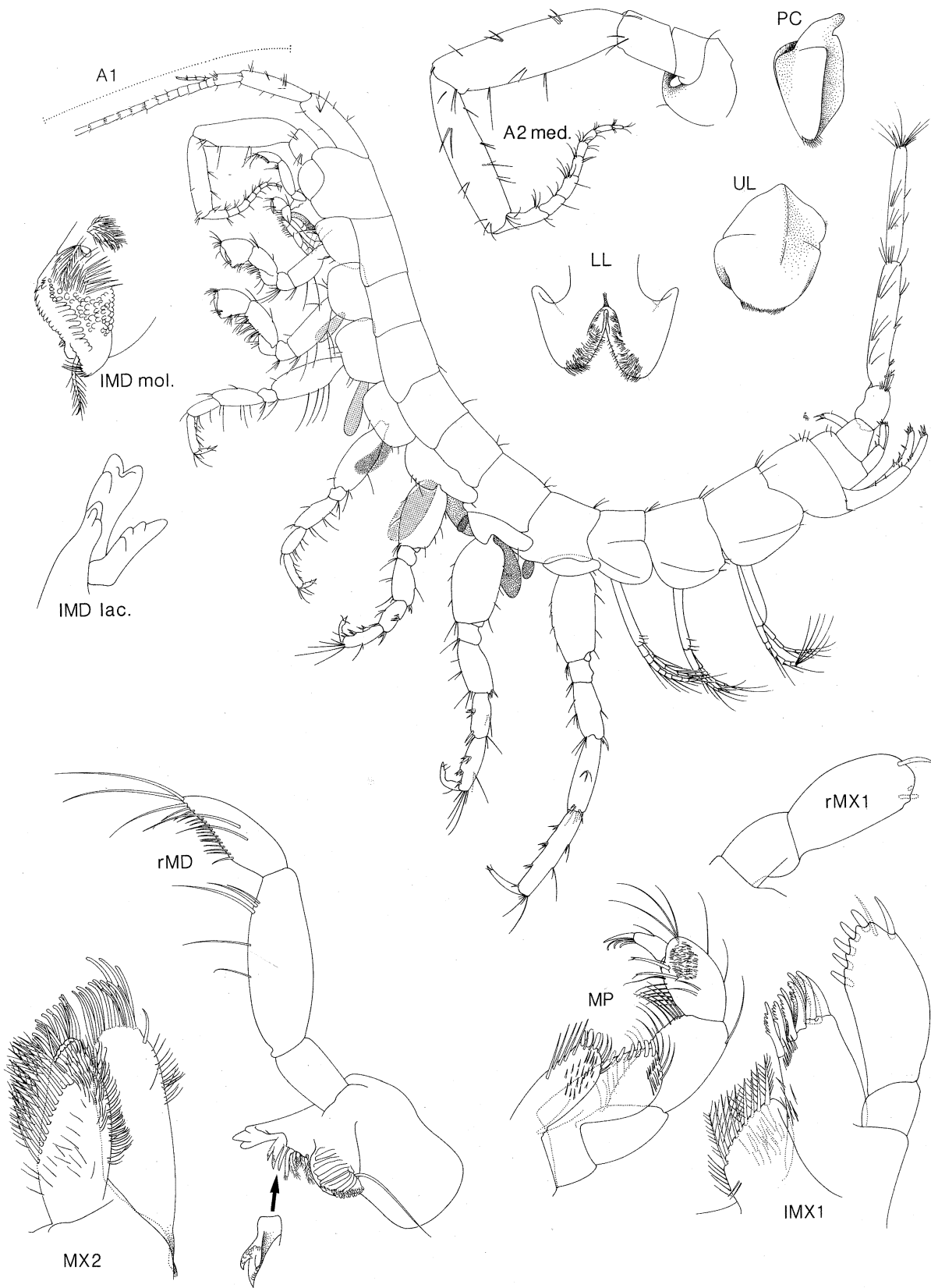


Fig.61. *Giniphargus pulchellus* (Sayce), lectotype, male "a".

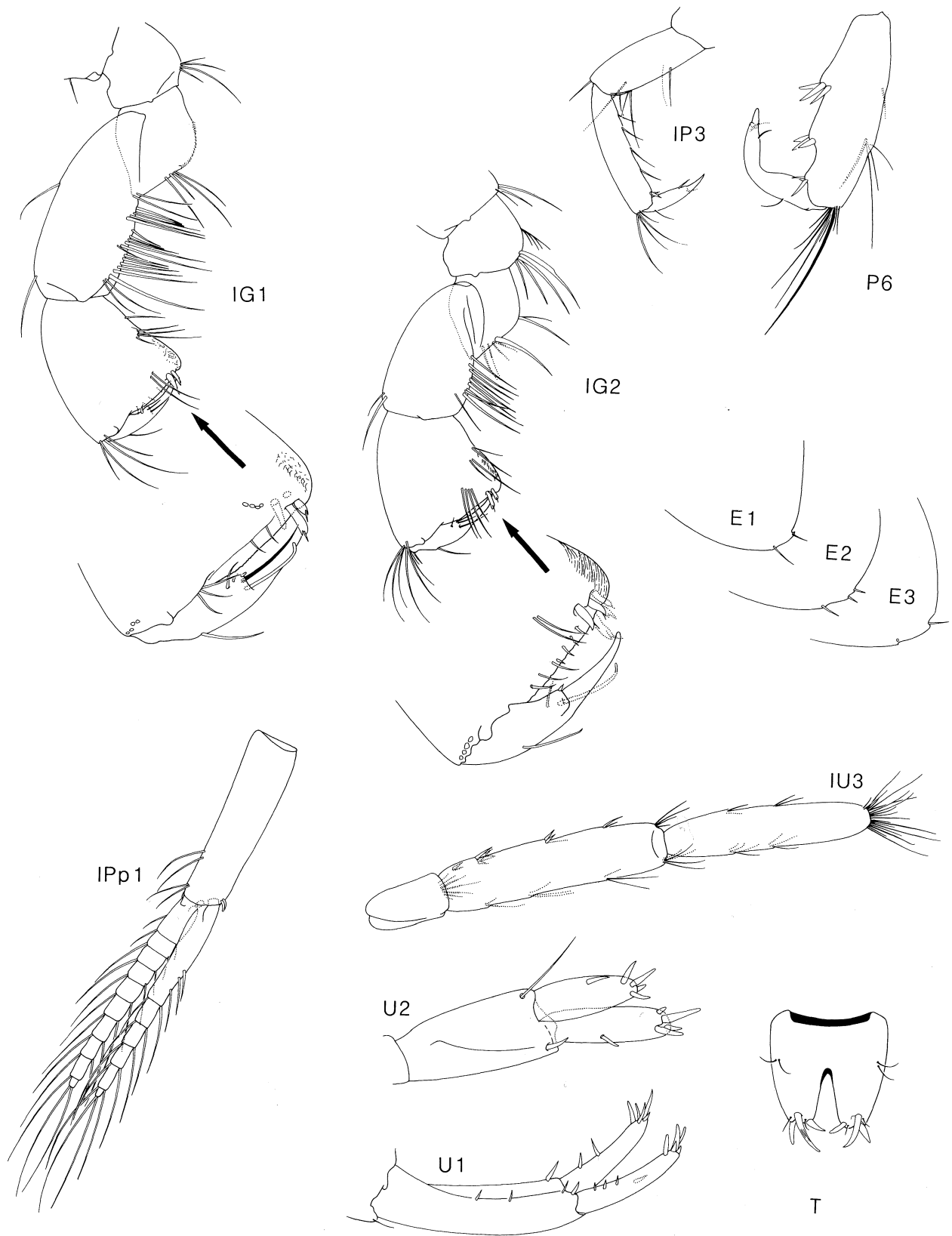


Fig.62. *Giniphargus pulchellus* (Sayce), lectotype, male "a".

trapezoidal, longer than wide, posterolateral angle tumid and faintly rugose, palm almost transverse but straight, defined by hump and 4 spines (2 medial, 2 lateral); dactylus not reaching end of palm. *Second gnathopod* (Fig. 62): slightly smaller than first gnathopod, carpus shorter, propodus scarcely narrower, posterior hump of segment 4 weaker and bearing 2 apogeeal setae.

Pereopods (Figs 61,62): coxa 3 with 4 setae, coxa 4 with 1 anteroventral and 2 posteroventral setae, not emarginate; pereopods 3–4 longer than gnathopod 2, article 4 of pereopods 3–4 weakly setose posteriorly, posterior margin of article 6 on pereopods 3–4 with spine-seta formula of 2-s-s-s-s and 2-s-s-s, thus with 2 locking spines; pereopods 5–7 diverse, successively increasing greatly in length, article 2 of pereopod 6 more expanded than others, none lobate posteroventrally, bearing medium-long posterior setules, that of pereopods 5 and 7 narrower, more rectangular; dactyls with 1 marginal and 1 facial setule, dactyls of pereopods 5–6 strongly bent in middle; sac-like coxal gills on pereopods 2–6, gill of pereopod 6 not reduced.

Sternal processes (Fig. 61): 2 pairs of fleshy sausage-shaped, very small sternal gills present on segments 6–7.

Epimera (Figs 61,62): all epimera with small but sharp posteroventral notch, then epimera 2–3 produced or lobate behind above notch and with 2 and 1 posterior setule notches respectively, smooth and spineless below. *Pleon* (Fig. 61): pleonites 1–5 with few dorsal setae arranged transversely, densest on pleonites 3–4; uropod 3 immensely extended beyond uropods 1 and 2 in entire animal, uropod lengths relative to uropod 1: uropod 2 = 0.5, 3 = 2.6. *Pleopods* (Fig. 62): similar; rami equal but outer rami more articulate, outer rami of pleopods 1–3 with 10, 6 and 6 articles, inner rami with 6, 5 and 5 articles; retinacula 2 per pleopod with 2 simple accessory setae, basal medial setae of inner ramus bifid, branches simple, asymmetrical, one shorter than other.

First uropod (Figs 61,62): peduncle length 2.0 rami; outer margin with 2 apicodistal spines besides weak row of dorsal spines, with 1 spine apicomediaally; rami of subequal length, only outer ramus with 2 weak rows of marginal spines, outer dorsal spines basal, inner ramus with 2 dorsal spines, rami with 5 apical spines. *Second uropod* (Figs 61,62): peduncle longer than rami, with 1 apicolateral spine and 1 apicomediaal seta; inner ramus shorter than outer, each with 1 marginal spine on opposite sides from each other, with 4 apical spines. *Third uropod* (Figs 61,62): peduncle length 0.20 outer ramus, longer than urosomite 3, all setae distal; outer ramus 2-articulate, proximal article with 5 transverse spine and setal rows medially, 4 setal rows laterally, article 2 more than 0.90 as long as article 1, with 2 rows of setae on each side, apex with dense brush of setae; inner ramus absent; no setae plumose. *Telson* (Fig. 62): subequal to urosomite 3; cleft 50 percent of length; lobes tumid laterally, apices with 3

large spines each, 1 apicolateral and 1 apicomediaal setule each, dorsum of each lobe with 2 penicillate lateral setules at M.45.

Illustrations. Except for a few enlargements, the body drawing (Fig. 61) serves to illustrate most of the larger appendages. Pleopod 3 on the body is drawn with the peduncle turned outward and it is not wider than the others in proper lateral aspect.

Distribution. Thorpdale, Gippsland, Victoria, freshwater pool (area now developed for human habitation).

Protocrangonyx Nicholls

Protocrangonyx Nicholls, 1926a: 72.

Type species. *Protocrangonyx fontinalis* Nicholls, 1926 by monotypy.

Introduction. The genus was erected by Nicholls (1926a) to accommodate a species discovered by him and not accommodated in any genus then described. Its validity was upheld by Barnard & Barnard (1983) who extended the original generic diagnosis on the basis of the original published description of the species involved (*P. fontinalis*). We do likewise but on the basis of a thorough re-examination of original type material. Thus, we support the validity of the genus and extend its diagnosis. Our rediagnosis does not substantially emend the original generic description. At present the genus remains monotypic.

Diagnosis. Body tending to subvermiform. Pleonites with weak dorsal armaments. Rostrum tiny, lateral cephalic lobes weakly projecting and strong antennal sinus present. Eyes absent.

Antenna 1 weakly elongate, scarcely longer than antenna 2, ratio of peduncular articles about 3:2:1, accessory flagellum 2-articulate. Antenna 2 flagellum not much shorter than peduncle, calceoli absent.

Ratio of mandibular palp articles about 2:5:4, article 2 poorly setose, article 3 not falcate, setae = DE. Labium lacking inner lobes. Maxillae not medially setose, inner plate of maxilla 1 ovatotriangular, with 1 apical seta, outer plate with 9 spines, palps asymmetric, one side with thin apical spines, other side with thick apical spines fused to segment; inner plate of maxilla 2 lacking oblique row of setae on face, though upper member of 1–2 main medial setae slightly submarginal.

Coxae short, very poorly setose, only coxae 5–7 with small posterior spines, coxa 1 subquadrate, coxa 4 not emarginate, coxa 5 scarcely shorter than 4. Gnathopods 1–2 of medium size, [?not sexually dimorphic, terminal males unknown], carpi short, weakly lobate, fourth article on both gnathopods lacking hyaline lobe but with minor rugosity, palms oblique, only faintly rugose, spines not symmetrically bifid, rather with small subapical trigger-like extensions; spines at corner of palm 4; spines along palm sparse and also with triggers.

Posterior spine sets on article 6 of pereopods 3–4

evenly spaced. Pereopods 6–7 moderately elongate, pereopod 5 short, pereopod 7 longer than pereopod 6, article 2 weakly expanded, subrectangular and sublinear, not lobate; dactyls of pereopods 3–7 with both marginal and facial setule (2 total).

Coxae 2–6 with gills. Thoracic segments 3–6 with medial sternal gills of sausage form, attached close together and with flat sides aimed anteriorly.

Basomedial setae on inner rami of pleopods 1–3 essentially absent; setae simple; retinacula 2, accessory retinacula absent.

Posteroventral tooth of epimera 2–3 tiny. Some epimera with facial spines and setae near ventral margin, posterior margins weakly setulate. Apicolateral corner of peduncles on uropods 1–2 with 1 spine; outer rami of uropods 1–2 shortened, margins spinose, uropod 1 lacking basofacial armaments; only inner rami of uropod 2 with 2 spine rows, outer rami with 1 spine row. Uropod 3 feeble, not extended, parviramous, peduncle short, outer ramus 1-articulate, inner ramus generally reaching to M.35 or less on outer ramus. Telson short, uncleft, tumid laterally, with only apical spination, no major setation, no basolateral armaments except for pair of lateral penicillate setules about M.55 on each side.

Additional description. Upper lip uniform, rounded but weakly asymmetrical below. Accessory blades (rakers) on mandibles with interraker plumose setae; very few additional penicillate setae beyond rakers and riding onto base of molar, instead with 1 very large bent basal molarial ragged setae besides regular apical molarial seta. Both plates of maxilla 2 with long apical setae; inner plates of maxillae 1–2 and medial and lateral margins of maxilla 2 moderately covered with pubescence. Maxillipedal inner plate with distal plumose seta, 3 blunt naked spines and medial row of plumose setae; outer plate with distal row of few plumose setae continuous with distal row of blunt naked tooth-spines; palp articles 2–3 poorly setose laterally, moderately setose medially, article 3 with row of spines near base of dactyl, apex not produced but faintly rugose. Dactyls of gnathopods with small recumbant inner tooth-spine and with stiff spinules or setules at inner nail articulation line. Gnathopod 1 without one seta of article 4 enlarged and scythe-like. Pleopods similar, peduncles almost naked; inner rami shortened and outer ramus with 6 or fewer articles. Medial setae of outer ramus on uropod 3 absent, no plumose armaments on uropod 3. Ventrodistal spine on urosomite 1 at base of uropod 1 absent.

Sexual attributes. Unknown.

Variables. None. Unique.

Relationship. *Protocrangonyx* differs from the basic *Austrogammarus* in the loss of medial and facial setation on the maxillae, the modification of sternal gills to a more central side-by-side arrangement with orientation of the flat sides to the longitudinal body axis, the loss of dorsal telsonic armaments (except the regular lateral pairs of penicillate setules), the short

coxae and subvermiform body, the short carpi of the gnathopods, the fully parviramous uropod 3, the lack of coxal spines, the poorly developed posteroventral lobation and general expansion of article 2 on pereopods 5–7, the reduction to 1 row of spines on the outer rami of uropods 1–2, the lack of A,B,C setae on palp article 3 of the mandible, the poorly setose article 2 of the mandibular palp, and the lack of major dorsal armaments on the pleon. Except for the parviramous uropod 3 and poorly setose maxillae, these differences also generally hold between *Protocrangonyx* and other paramelitid genera.

Thus, *Protocrangonyx* differs from *Antipodeus* in the subvermiform body, absence of eyes, weaker antenna 1, shorter flagellum of antenna 2, weaker setation on article 2 of the mandibular palp, loss of ABC setae, the loss of medial setae on the inner plates of the maxillae, the faint rugosity on the apex of article 3 of the maxillipedal palp, the shorter and non-emarginate coxa 4, the more elongate pereopod 7, poorly lobate article 2 of pereopods 5–7, loss of coxal gill 7, presence of sternal gills, shortened inner rami of the pleopods, and the shortened outer rami of uropods 1–2.

In addition to several of these characters, *Protocrangonyx* differs above all from *Hurleya* and *Uroctena*, as well as *Antipodeus*, by its uncleft telson and complete lack of a distal article on the outer ramus of uropod 3.

Despite superficial resemblances, *Protocrangonyx* has little relationship with *Giniphargus*. The sternal gills of *Protocrangonyx* are distinctive, antenna 1 is short, the mandibular palp has only DE setae, the maxillae lack medial setae, the palms of the gnathopods are oblique, the carpus of gnathopod 2 is short, article 2 on the outer ramus is absent (versus huge) and the telson is entire.

Paracrangonyx from New Zealand has superficial resemblance to *Protocrangonyx* in the thin body, short coxae, deep head sinus and the lack of coxal gill 7, but *Protocrangonyx* differs from *Paracrangonyx* in the triturative, non-plaque-form of the mandibular molar, the presence of strong maxillipedal plates, and biramous pleopods.

Protocrangonyx fontinalis Nicholls

Figs 63–66

Protocrangonyx fontinalis Nicholls, 1926a: 72–77, pl. 8.

Material examined. AM P.8800, Valley of Yule Brook, Darling Range, WA, Mar. 1927, Prof. G.E. Nicholls, 10 specimens. As LECTOTYPE we select female “m” 3.55 mm (illustrated); also examined, female “n” 2.90 mm, female “o” 2.61 mm, male “z” 2.38 mm (smallest specimen); all other specimens females. WAM 10662, WA, Darlington, Brook A, 15 Sep 1923, C[oll.] L. G.[lauer], 5 specimens, including female “w” 2.70 mm (Illustrated); this material formerly identified as *Neoniphargus westralis* Chilton, n.s.

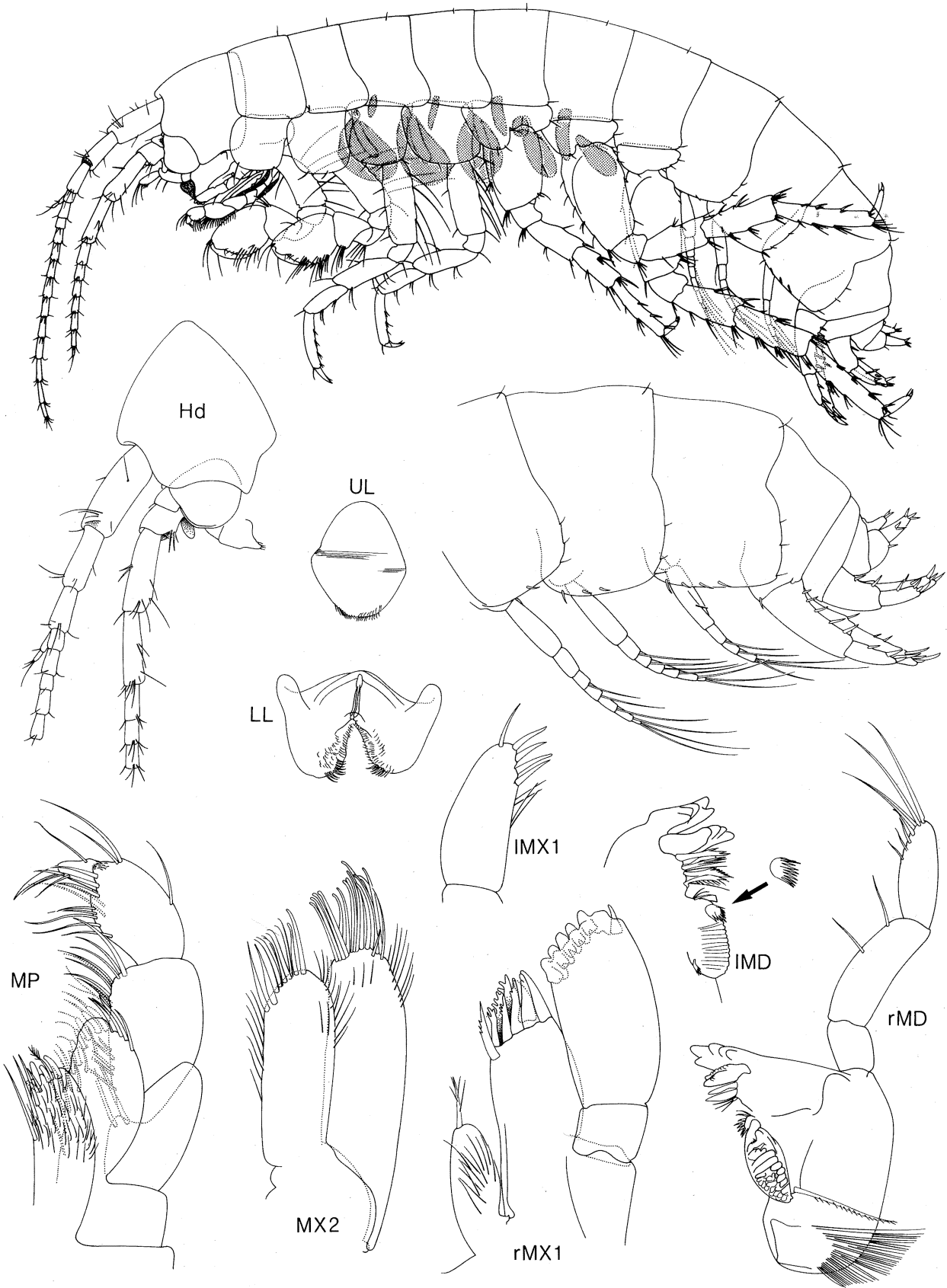


Fig.63. *Protocrangonyx fontinalis* Nicholls, lectotype, female "m".

Diagnosis. With the characters of the genus.

Description of lectotype (female). *Body* (Fig. 63): pereonites and pleonites 1–3 each armed with 1 dorsolateral seta, urosome bare.

Head (Fig. 63): rostrum tiny; eyes absent.

First antenna (Fig. 63): length 0.43 of body, 1.4 second antenna, flagellum much longer than peduncle, peduncular article 1 longest, article 3 shortest, setae sparse; calceoli absent; accessory flagellum 2-articulate, reaching past article 1 of flagellum, articles uniform, sparsely setulate. *Second antenna* (Fig. 63): length 0.33 body; peduncle longer than flagellum, article 4 slightly longer than 5, articles 3,4 and 5 with sparse ventral setation; flagellum 13-articulate, weakly setose ventrally.

Upper lip (Fig. 63): apical margin evenly rounded but connection to epistome and epistome itself slightly asymmetrical. *Left mandible* (Fig. 63): palp article 3 shorter than 2, article 2 with 4 inner marginal setae, article 3 with 4D, 4E; incisor 5-toothed, lacinia mobilis 4-toothed, 4 setose accessory blades and 4 interrakers; molar bearing plumose seta, 3 penicillate hooked basal setae, 1 chisel spine. *Right mandible* (Fig. 63): incisor 5-toothed; lacinia mobilis bifid, denticulate; accessory blades of 2 almost naked spines and 2 interrakers. *Left first maxilla* (Fig. 63): palp article 2 with 4 thin apical spines on apical end of medial edge, 1 thinner disjunct apical spine, 4 simple medial setae; outer plate with 9 spines, most denticulate; inner plate with 1 apical seta. *Right first maxilla* (Fig. 63): palp article 2 with 5 thick apical tooth-spines fused to article, 1 apicolateral thinner spine in disjunct notch, no apicolateral facial seta. *Second maxilla* (Fig. 63): apicomedial corner of inner plate with 2 weakly submarginal thick setae. *Maxilliped* (Fig. 63): palp articles 2–3 medially setose in moderate degree, dactyl short and stubby, with long apical nail, several attendant setae; inner plate with 3 thick spines and plumose setae apically, long medial row of plumose setae, 1 ventrofacial spine.

First gnathopod (Fig. 64): coxal plate with 3 setae apically; article 4 with minor posterior rugosity; carpus short and lobate, lobe thick and faintly rugose; propodus trapezoidal, short but longer than wide, palm oblique, posterolateral angle rounded, faintly rugose, with 1 medial and 3 lateral spines, 1 spine on each side elongate; dactylus reaching end of palm. *Second gnathopod* (Fig. 64): scarcely larger than first gnathopod; carpal lobe thicker.

Pereopods (Figs 63,64): coxae 3–4 with 2 setae; pereopods 3–4 longer than gnathopod 2, pereopod 3 slightly longer than 4, article 4 weakly setose posteriorly, article 5 of pereopods 3–4 weakly setose posteriorly, posterior margin of article 6 on pereopods 3–4 with spine formulas of 2-2-2-2 and 2-1-2-2; pereopods 5–7 similar, coxae bearing spines on ventral margin of posterior lobe, article 2 scarcely expanded, not lobate posteroventrally, bearing sparse posterior setae; pereopod 5 with 3 locking spines, pereopod 6 with 4; gill of pereopod 7 absent.

Sternal processes (Fig. 64): 5 pairs of small fleshy

sausage-shaped sternal gills present on segments 3–6, attached to center of each segment and facing towards head, belly hanging down to lower margins of coxae. Oostegites expanded, paddle-shaped, very small on coxa 5.

Epimera (Fig. 63): each epimeron with tiny posteroventral tooth, posterior margins convex, setulate, epimera 1–3 with 1,3,4 ventral spines. *Pleon* (Fig. 63): each dorsolateral posterior margin of pleonites 1–6 with 1 feeble seta; uropod 3 short, not extending beyond uropods 1 and 2 in entire animal, uropod lengths relative to uropod 1: uropod 2 = 0.7, 3 = 0.37. *Pleopods* (Fig. 65): retinacula 2 per pleopod, no accessories; each peduncle with 0–1 seta; number of articles on outer rami of pleopods 1–3 = 6-6-4, inner rami = 3-3-2.

First uropod (Fig. 65): peduncle length 1.4 rami; outer margin with 1 apicodistal spine besides strong row of dorsal spines, with 1 spine medially; outer ramus short, both rami with 1 row of marginal spines, outer ramus with 4 apical and inner ramus with 5 apical spines. *Second uropod* (Fig. 65): peduncle about same length as rami, with 2 dorsolateral spines including 1 apical; outer ramus much shorter than inner, only inner with 2 weak rows of marginal spines, apices with 4 and 5 spines. *Third uropod* (Fig. 65): peduncle length 1.2 outer ramus, longer than urosomite 3, with 1 apicoventral spine; outer ramus proximal article with 1 transverse lateral spine row on body, medial margin with 1 spine, apex with 4 spines, article 2 absent; inner ramus length 0.33 of outer, naked. *Telson* (Fig. 65): short, entire, not longer than urosomite 3, with 3 apical spines and 2 or 3 apicolateral penicillate setules.

Description of additional material examined.

Female “w”. Body segments are more compacted in this specimen, whose appearance is shown in toto view (Fig. 66). The cross section of pereonite 5 is drawn to show the position of gills (Fig. 66). The plan section (Fig. 66) illustrates the relative positions of the coxae, gills and oostegites.

Female “n”. Our examination confirms the occurrence of multiple locking spines on pereopods 5–7 (each with 3); armament formula on article 6 of pereopods 3–4 = 2-1+s-1+s-s; telson with 2 spines as in Nicholl’s original description (see Fig. 66).

Female “o”. This specimen had a variable number of locking spines, pereopods 5–6 with 3, pereopod 7 with 2; armament formula on article 6 of pereopods 3–4 = 2-1+s-s; outer ramus of uropod 3 with 1 medial and pair of lateral marginal spines and 3 apicals.

Male “z”. This was the smallest specimen in the sample, and not significantly different from females but oostegites absent, and pereonite 7 with 2 penial processes; antenna 1 slightly longer relative to antenna 2 in other specimens but no calceoli present; flagellum of antenna 2 with 5 articles; epimera 1–3 with 1,2,3 spines each; outer rami of pleopods 1–3 with 4,4,3 articles, inner rami with 3,3,1 articles; apex of outer ramus on uropod 3 with 4 spines; telson with 2 spines.

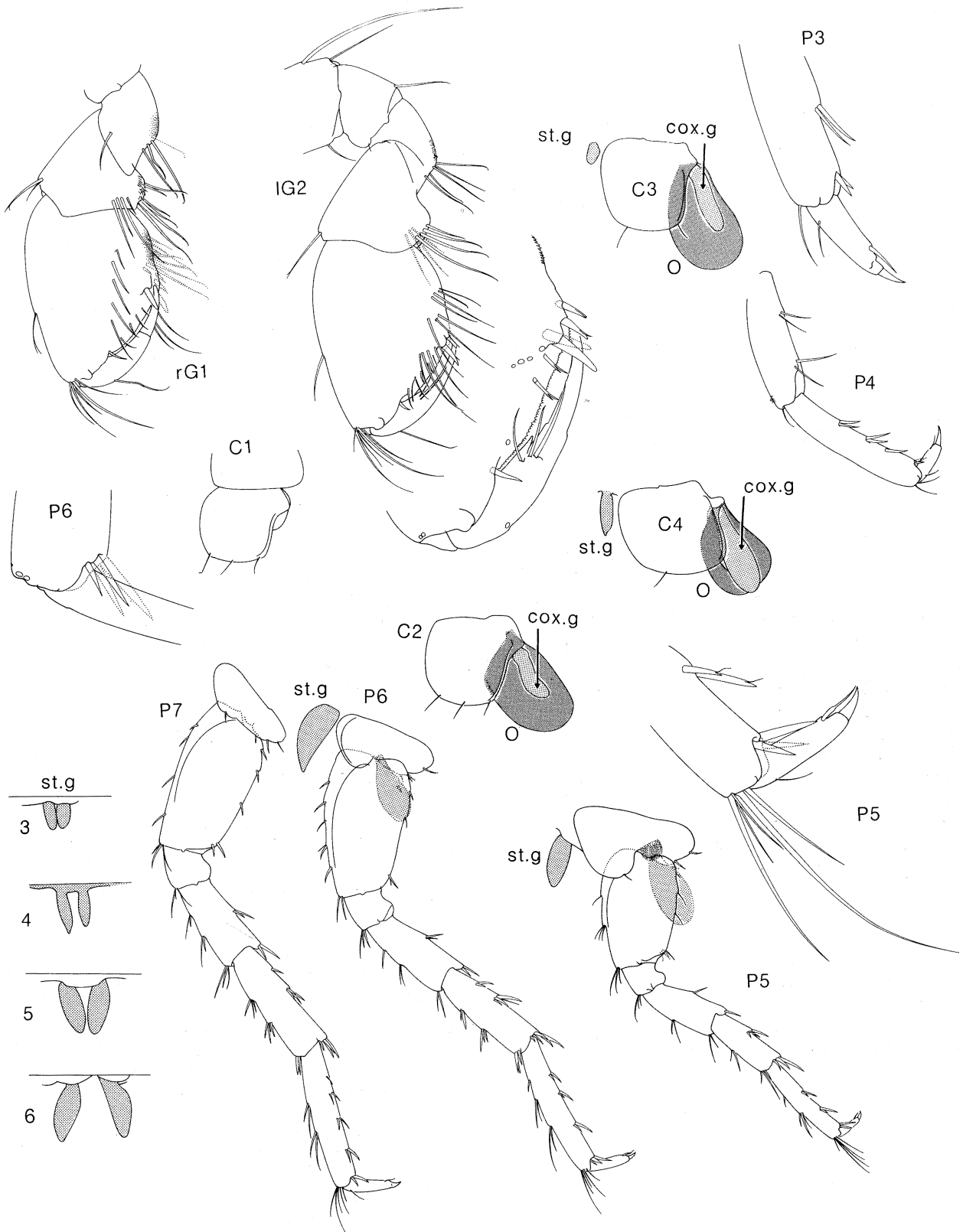


Fig.64. *Protocrangonyx fontinalis* Nicholls, lectotype, female "m".

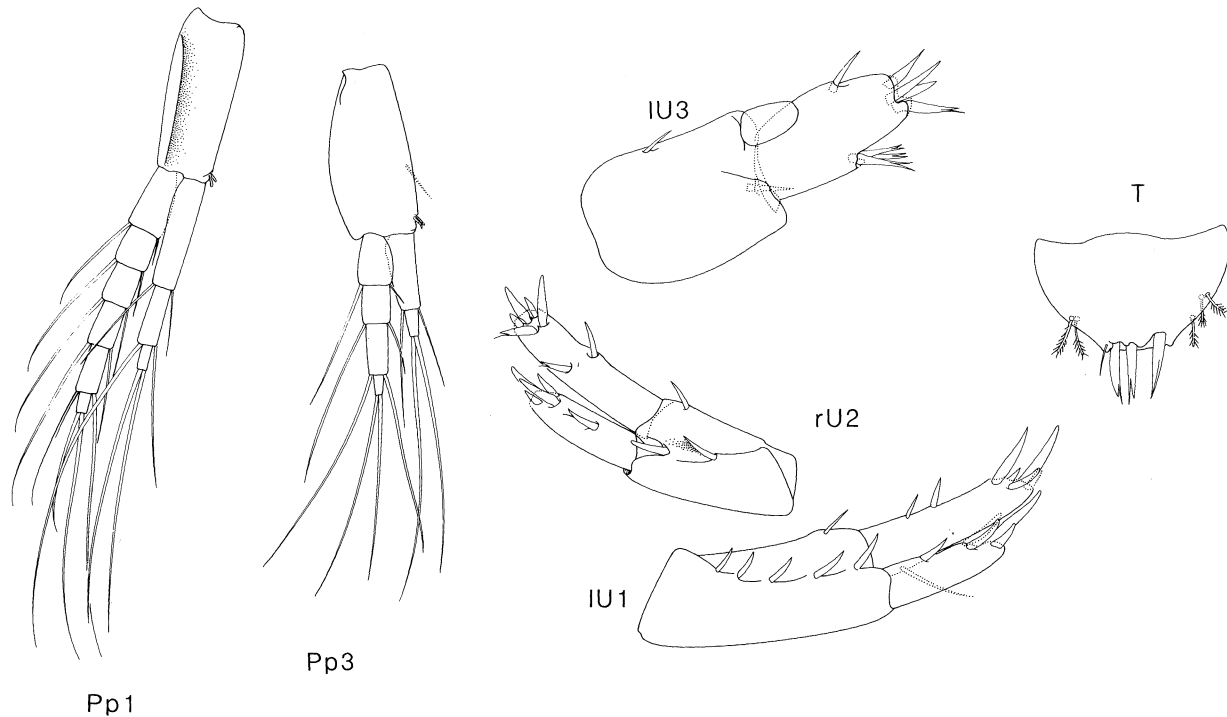


Fig.65. *Protocrangonyx fontinalis* Nicholls, lectotype, female "m", IU3 and T to same scale.

Illustrations. Body view (Fig. 63) with stippled sternal gills moved upwards (they normally hang slightly below coxae because of tumid sternites). Sternal gills also drawn enlarged next to their limbs but exerted (Fig. 64).

Distribution. Western Australia, Darling Range, Valley of Yule Brook.

Neoniphargidae Bousfield

Type genus. *Neoniphargus* Stebbing, 1899.

Introduction. The family was created by Bousfield (1977) to accommodate what he regarded as a heterogeneous groups of apomorphic, mainly epigeic crangonyctoideans of antitropical fresh waters. He included five genera, some doubtfully, viz. *Neoniphargus*, ?*Indoniphargus*, ?*Eoniphargus*, ?*Protocrangonyx* and *Perthia*. He recognised the diversity within the family and foreshadowed subfamily splitting. Straškraba (1964, table 1) had much earlier recognised the dissimilarities between *Neoniphargus* and 'related' genera (*Perthia*, *Eoniphargus*, *Uroctena*). Later, Bousfield (1982a) added two further genera so that the family then comprised: 4 genera from Australia (*Neoniphargus*, *Giniphargus*, *Perthia* and *Protocrangonyx*), 2 from Madagascar (*Sandro* and *Austroniphargus*) [Bousfield's text, p. 262, has the genera from Madagascar and Australia erroneously transposed], and 1 from India (*Indoniphargus*). These additions

were accompanied by a lengthier definition of the family which added to but did not substantially alter Bousfield's concept of the family.

We have previously criticised the nature of Bousfield's familial diagnoses (see section above: The Crangonyctoid Concept), and find much to disagree with in connection with his concept of the family Neoniphargidae. Thus, we believe that *Sandro*, *Austroniphargus* and *Perthia* are sufficiently distinct to deserve separate family status (but see our new family, Perthiidae, below). *Giniphargus* and *Protocrangonyx* we believe better placed in the Paramelitidae and *Indoniphargus* we reject as a crangonyctoid. Thus, the only remaining genus described thus far in Bousfield's family is *Neoniphargus*. Together with some new genera we describe below (*Tasniphargus*, *Wesniphargus* and *Yulia*), we believe it still sufficiently distinct to merit family status within the crangonyctoidean complex. We accept, therefore, the essential validity of the family Neoniphargidae. In doing so, however, we find the need to emend the original and subsequent diagnoses of Bousfield (1977, 1982a), noting in particular two important family characters we now include: the presence of rugosities on the maxillipedal palp article 3 and on the gnathopods, and the presence of dendritic (sometimes only lumped) sternal gills.

As in the case of the rediagnosed Paramelitidae, we recognise the case for a more formal rediagnosis of the Neoniphargidae as here emended by us (and its

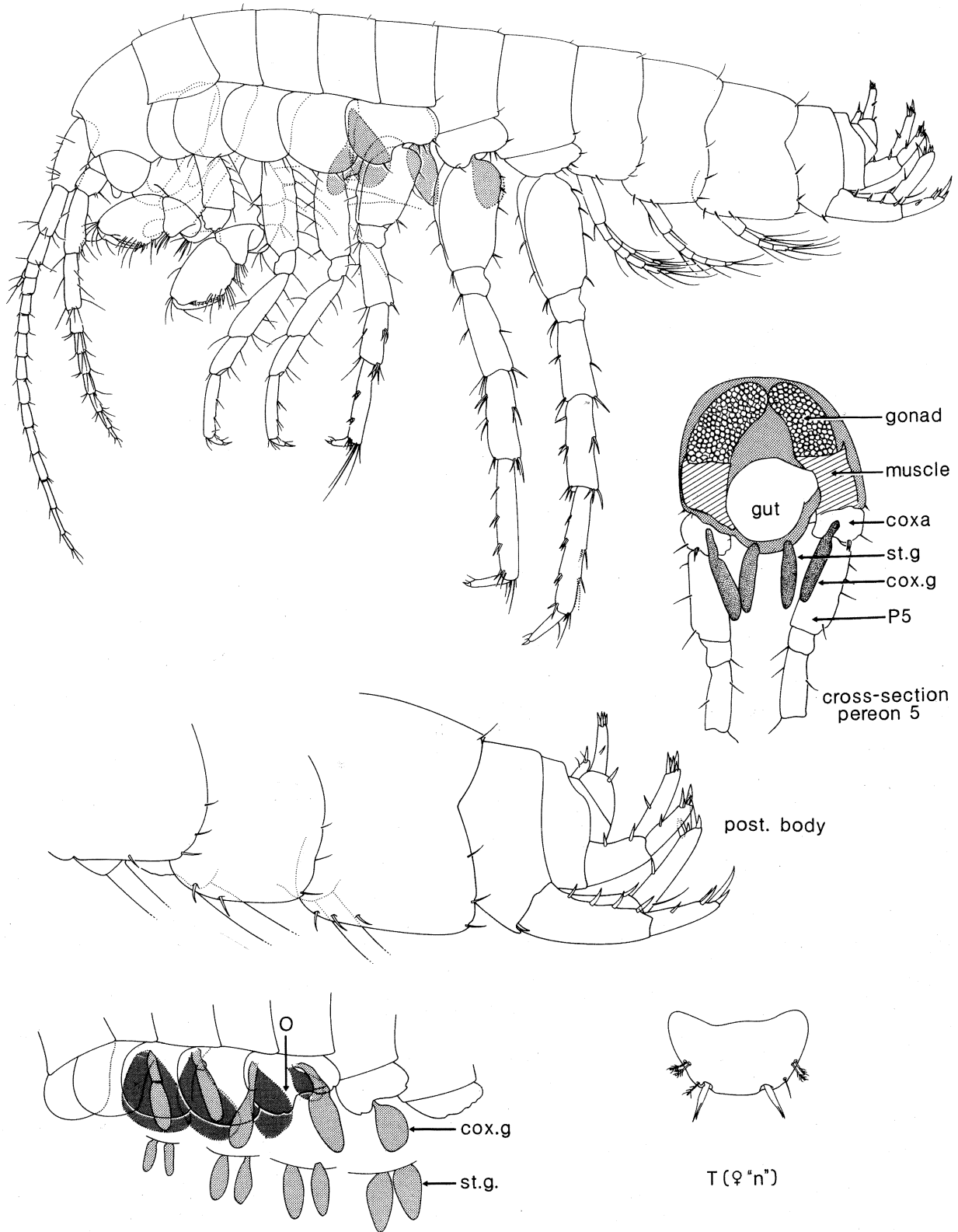


Fig.66. *Protocrangonyx fontinalis* Nicholls, WAM 10662, female "w" (except drawing indicated); female "n" (T).

comparison with other families of the crangonyctoidean complex); but again, given the likelihood of discovery of further neoniphargid species in Australia (and thus familial emendation), we do not consider it appropriate to do this at present. The new diagnosis of the Neoniphargidae we give below, then, represents our working modification of Bousfield's diagnoses so that the family accommodates better the genus *Neoniphargus* and 3 related new genera on the basis of our now much more taxonomically comprehensive knowledge of this group of amphipods.

Diagnosis. Antennal sinus of head weak or absent. Molar of mandible well developed, tritulative. Outer plate of maxilla 2 with 1 kind of seta apicolaterally. Outer plate of maxilliped of ordinary size. Rugosities present on maxillipedal palp article 3 and gnathopods. Gnathopods small or of medium size, almost mittenform, first not dominant, carpi short and lobate,

propodi attached to carpi normally, spines on palms not of bifid crangonyctid form. Posterior lobes of coxae 5–7 but especially of coxa 6, dominant. Oostegites broad to medium width. Sternal gills dendritic or bearing small lumps. Urosomites separate. Inner ramus of uropod 3 present.

Composition. As amended above, the family now includes the following genera: *Neoniphargus* Stebbing, 1899; *Tasniphargus* n.gen.; *Wesniphargus* n.gen.; *Yulia* n.gen. We exclude the following genera: *Giniphargus* Karaman & Barnard, 1979; *Perthia* Straškraba, 1964; *Protocrangonyx* Nicholls, 1926; *Sandro* Karaman & Barnard, 1979; *Austroniphargus* Monod, 1925; and *Indoniphargus* Straškraba, 1967. Simple keys to the genera of the family were given earlier as part of keys to the genera of Australian crangonyctoids (and *Paramelita*), but for convenience one is reproduced in isolation below.

Key to the Genera of Neoniphargidae

1. Sternal gills with bud-like lumps (not fully dendritic), only propodi lacking rugosities *Wesniphargus*
—Sternal gills without bud-like lumps (fully dendritic), propodi with rugosities 2
2. Antennae 1–2 with long dense setae, basal articles of primary flagella on antennae 1–2 elongate (conjoint) *Tasniphargus*
—Antennae 1–2 with short sparse setae, basal articles of primary flagella on antennae 1–2 short 3
3. Pleopod peduncles not strongly setose, outer ramus of uropod 1 without long apical spur in male *Neoniphargus*
—Pleopod peduncles strongly setose, outer ramus of uropod 1 with long apical spur in male *Yulia*

Tasniphargus n.gen.

Type species. *Tasniphargus tyleri* n.sp.; here selected.

Diagnosis. Pleonites with weak dorsal armaments. Rostrum distinct but small, lateral cephalic lobes weakly projecting and weak antennal sinus present. Eyes large, darkly pigmented, reniform.

Antenna 1 elongate, much longer than antenna 2, ratio of peduncular articles about 9:11:8, articles 2 and 3 densely setose ventrally; accessory flagellum 2-articulate; flagellum basal articles conjoint. Antenna 2 peduncle articles 4–5 and flagellum densely setose ventrally; flagellum not much shorter than peduncle; basal articles conjoint; calceoli absent.

Ratio of mandibular palp articles about 1:5:5, article 2 moderately setose, article 3 weakly falcate, setae = ACDE. Labium lacking inner lobes. Maxilla 1 not medially setose, maxilla 2 partly setose medially, inner plate of maxilla 1 ovate, with 2 apical setae, outer plate with 7 spines, palps almost symmetric, one side with thin apical spines, other side with thinner apical spines; inner plate of maxilla 2 bearing partial oblique row of

6 setae on face. Palp article 3 of maxilliped with weakly rugose apical lobe.

Coxae 1–4 elongate, poorly setose ventrally, coxae 1–3 lacking row of posterior spines, coxa 1 tapering below, coxa 4 emarginate, coxa 5 much shorter than 4. Gnathopods 1–2 small, sexually dimorphic (male palms excavate), carpi short, lobate, fourth article on both gnathopods bearing rugose lobe, palms oblique, bearing rugosities, spines not symmetrically bifid, rather with small subapical trigger-like extensions; spines at corner of palm about 6; spines along palm dense and also with triggers.

Posterior spine sets on article 6 of pereopods 3–4 evenly spaced. Pereopods 5–7 moderately elongate, pereopod 6 longer than pereopod 7, article 2 broadly expanded, ovate or trapezoidal and posteroventrally lobate on all of pereopods 5–7 but less strongly expanded on pereopods 5–6. Dactyls of pereopods 3–7 with marginal spine and [?facial] setule (? total).

Coxae [?2]–6 with gills, gill 6 reduced. Thoracic segments [?2–6, only 2,3,5 confirmed], with lateral sternal gills of dendritic form, becoming [?more]

dendritic posteriorly.

Basomedial setae on inner rami of pleopods 1–3 [?bifid, branches diverse, of different length and shape but, occasionally 1 branch with diamond head, or both simple]; retinacula 2, accessory retinacula absent. Posteroventral tooth of epimera 1–3 tiny; epimera 2–3 with facial spines and setae near ventral margin, not in pairs side by side, posterior margins weakly setulate. Apicolateral corner of peduncles on uropods 1–2 with 1 spine; rami of uropods 1–3 extending subequally, margins spinose, uropod 1 lacking basofacial armaments; rami of uropods 1–2 with 1 spine row. Uropod 3 strongly extended, parviramous, peduncle short, outer ramus 2-articulate, medial setae of outer ramus on uropod 3 absent, article 2 very short, inner ramus generally reaching to M.20 or less on article 1 of outer ramus in both sexes. Telson slightly elongate, cleft about 60 percent, lobes not tumid laterally, with only apical spination, no major setation, no basolateral armaments except for pair of lateral penicillate setules about M.60 on each side.

Additional description. Upper lip uniform, sinuous and weakly asymmetrical below. Accessory blades (rakers) on mandibles usually with interraker plumose setae; many additional penicillate setae beyond rakers and riding onto base of molar, and with large bent basal molarial ragged setae besides regular apical molarial seta. Lower lip uniform, inner lobes absent. Both plates of maxilla 2 with long apical setae; inner plates of maxillae 1–2 and medial and lateral margins of maxilla 2 moderately covered with pubescence. Maxillipedal inner plate with distal row of a few plumose setae and 2 blunt naked spines and medial row of plumose setae; outer plate with distal row of few plumose setae continuous with medial row of blunt tooth-spines; palp articles 2–3 poorly setose laterally, well setose medially, article 3 with organised row of non-comb spines near base of dactyl, apex produced and weakly rugose. Dactyls of gnathopods without small recumbant inner tooth-spine or spinules or setules. Gnathopod 1 without one seta of article 4 enlarged and scythe-like. Pleopods similar, peduncles not strongly setose; rami extending equally. Ventrodistal spine on urosomite 1 at base of uropod 1 [?short].

Sexual attributes. Oostegites 2–4 broad, 5 reduced. Coxa 4 of female small, narrow, poorly lobate. Male gnathopods with excavate palms, those of female with non-excavate palms.

Characters of interspecific value. None. Unique.

Relationships. *Tasniphargus* differs from other genera in the Neoniphargidae in its strongly setose antennae, with the basal articles of the flagellum on antennae 1–2 elongate (or conjoint), in the relative symmetry of the palps on maxilla 1, and in the presence of a distinct though short apicomedial row of setae on the inner plate of maxilla 2. In addition to these characters, it differs from *Yulia* most noticeably in the absence of a long spur on the outer ramus of the

male first uropod, and from *Wesniphargus* in its fully dendritic sternal gills and the presence of rugosities on the gnathopod propodi.

Tasniphargus tyleri n.sp.

Figs 67–71

Type material. Oxford University Museum, in tube with 3 labels as follows: (1) “*Neoniphargus tasmanicus*, Smith, Great Lake, Tasmania, 1907–8, G.W. Smith, Esq. Ref. No. 5394, cotypes”; (2) “Great Lake”; (3) “*Neoniphargus tasmanicus*”.

Present in the tube were 11 males, 6 ovigerous females and 5 non-ovigerous females. Preliminary examination indicated that specimens were clearly variable *inter alia* in antennal length (relative to body), length of uropod 3 and degree of setation on the antennae (especially antenna 2). Closer examination revealed the occurrence of two distinct species. Specimens which were not setose (12) were identifiable as *N. tasmanicus* and were set aside (but see later discussion). The remaining 7 males and 3 females of the setose specimens were declared a new species. The least damaged male amongst them was dissected, illustrated, and declared as HOLOTYPE; the least damaged female was dissected, illustrated and declared as ALLOTYPE; another male was also dissected, analysed and illustrated.

Diagnosis. With the characters of the genus.

Description of holotype (male). *Body* (Fig. 67): pleon sparsely armed dorsally, few or no setae on pleonites 1–4, 1 spine on each side of pleonite 5, 1 spine on each side of pleonite 6; length, 13.5 mm.

Head (Fig. 67): rostrum small; eyes large, subreniform, dark.

First antenna (Fig. 67): length 0.65 of body, 2.0 second antenna; peduncle shorter than flagellum, article 2 longest, article 3 shortest but barely shorter than article 1, ventral setae dense and long; first few flagellar articles fused together (conjoint), 1 aesthetasc each on distal articles; accessory flagellum 2-articulate, not reaching past half of article 1 on primary flagellum, articles uniform, sparsely setulate. *Second antenna* (Fig. 67): length 0.32 body; peduncle longer than flagellum, article 4 longer than 5, articles 4 and 5 with dense, long ventral setation; flagellum 9-articulate, basal articles conjoint, strongly setose ventrally, calceoli absent.

Left mandible (Fig. 67): palp article 3 as long as 2, latter with many inner marginal setae, article 3 with 6A, 0B, many C, many D, 4E; incisor 5-toothed; lacinia mobilis 4-toothed; 3 setose accessory blades; molar bearing plumose seta, several penicillate hooked brush basal setae, 1 chisel spine. *Right mandible* (Fig. 67): setae of palp article 3 = 10A, 0B, many C, many D, 4E; incisor 4-toothed; lacinia mobilis bifid, denticulate, no denticulation strongly extended; accessory blades of 1 large plumose spine, 2 chisel spines. *Left first maxilla* (Fig. 67): palp article 2 with

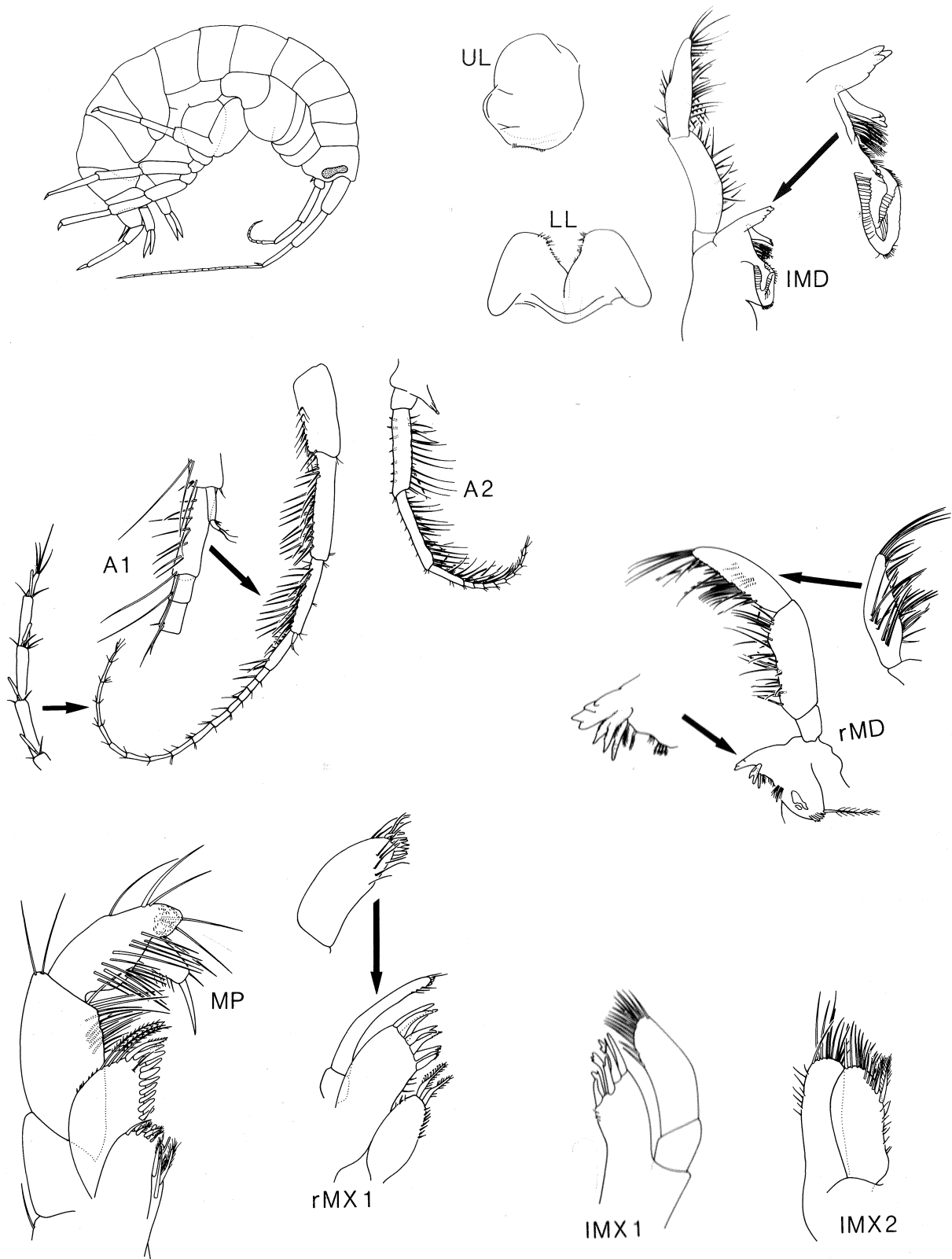


Fig.67. *Tasniphargus tyleri* n.sp., holotype, male.

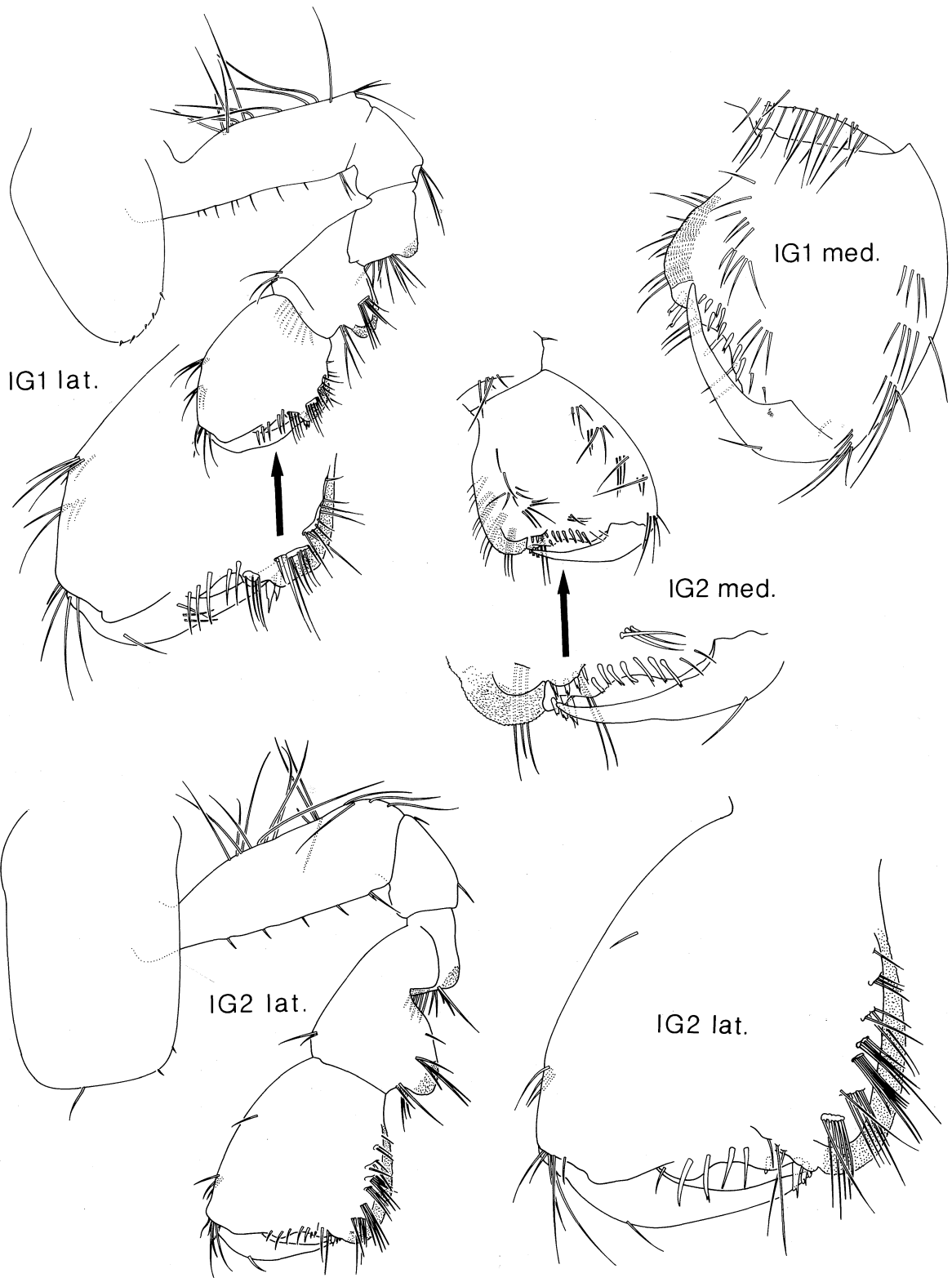


Fig.68. *Tasniphargus tyleri* n.sp., holotype, male.

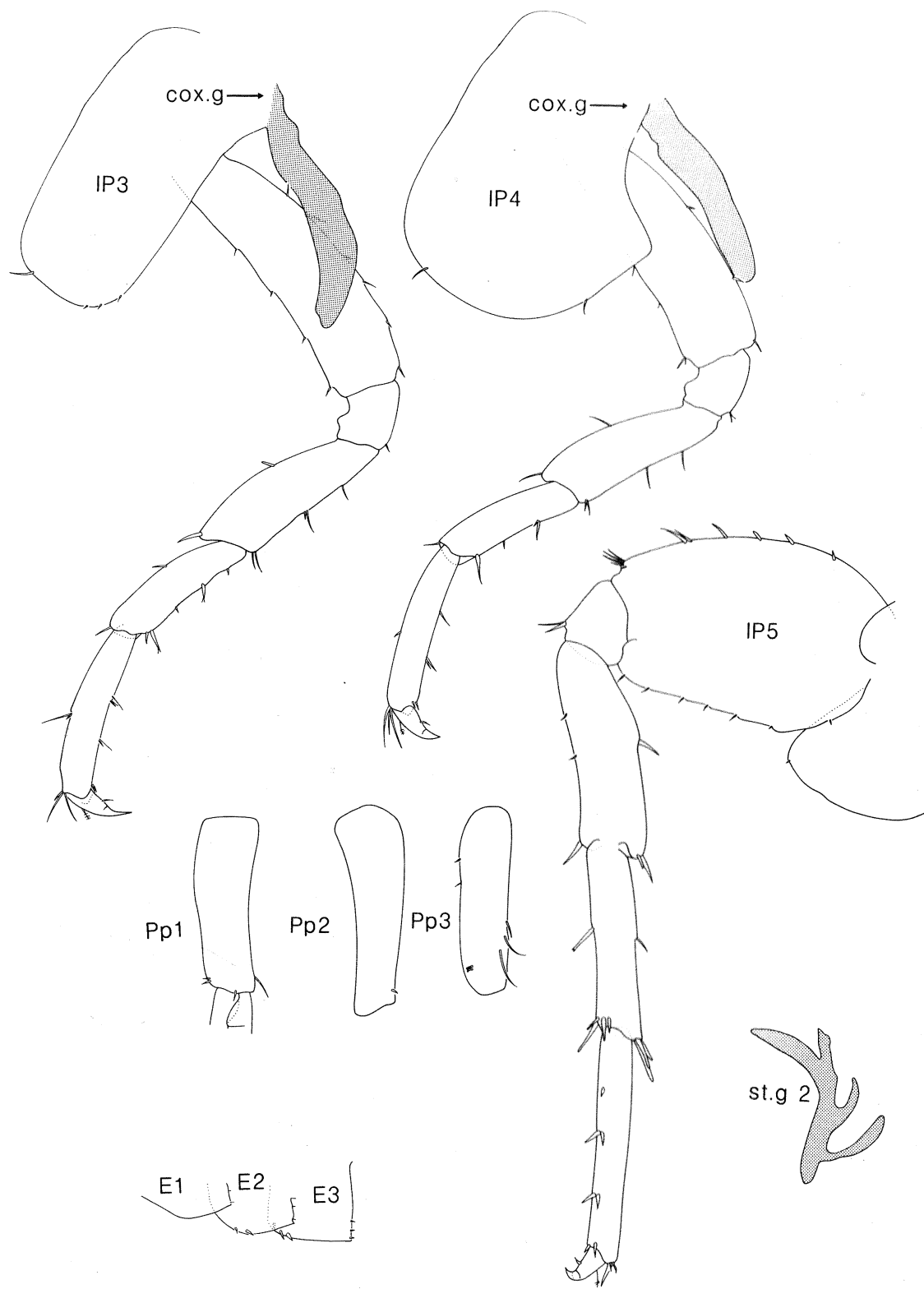


Fig.69. *Tasniphargus tyleri* n.sp., holotype, male.

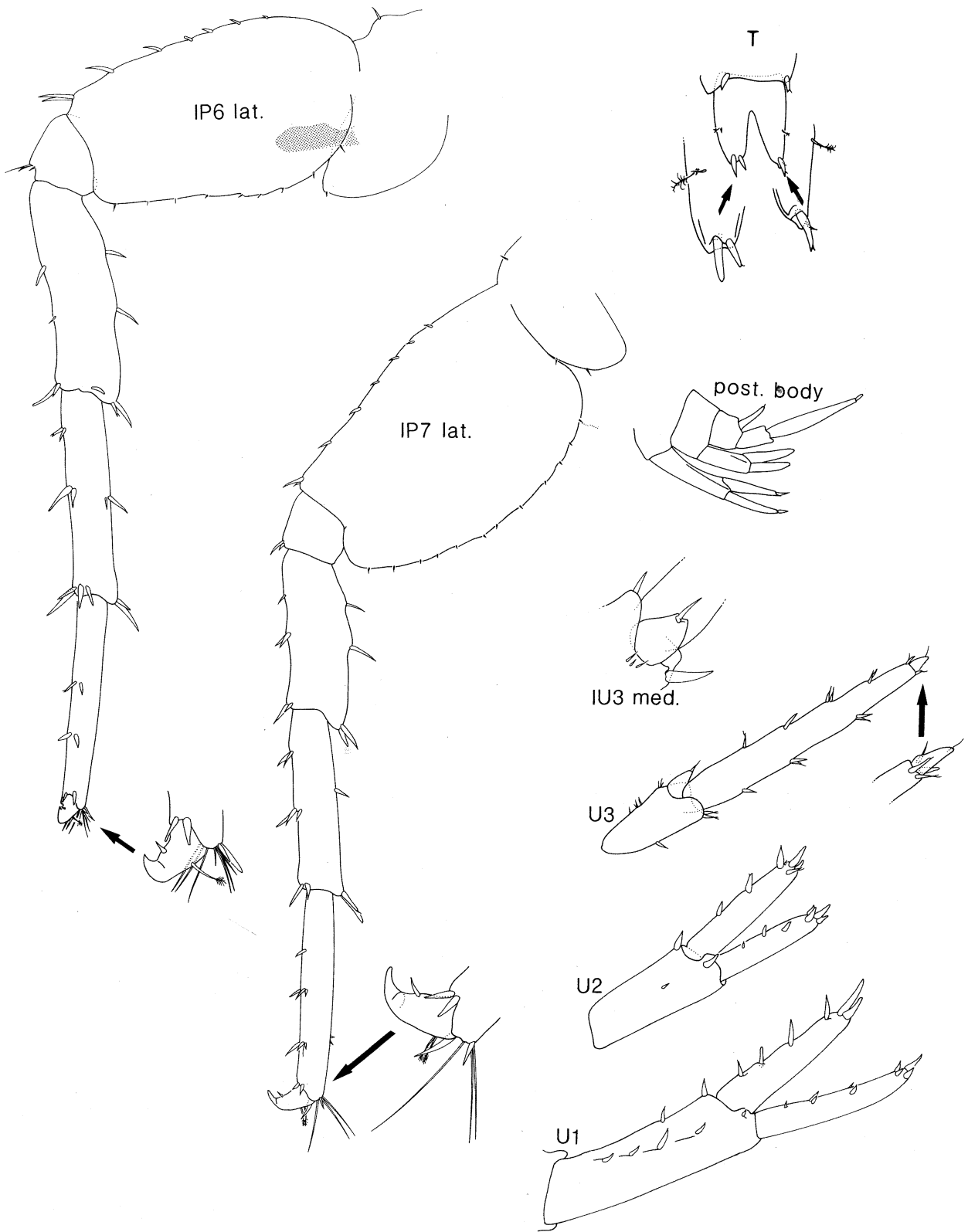


Fig.70. *Tasniphargus tyleri* n.sp., holotype, male.

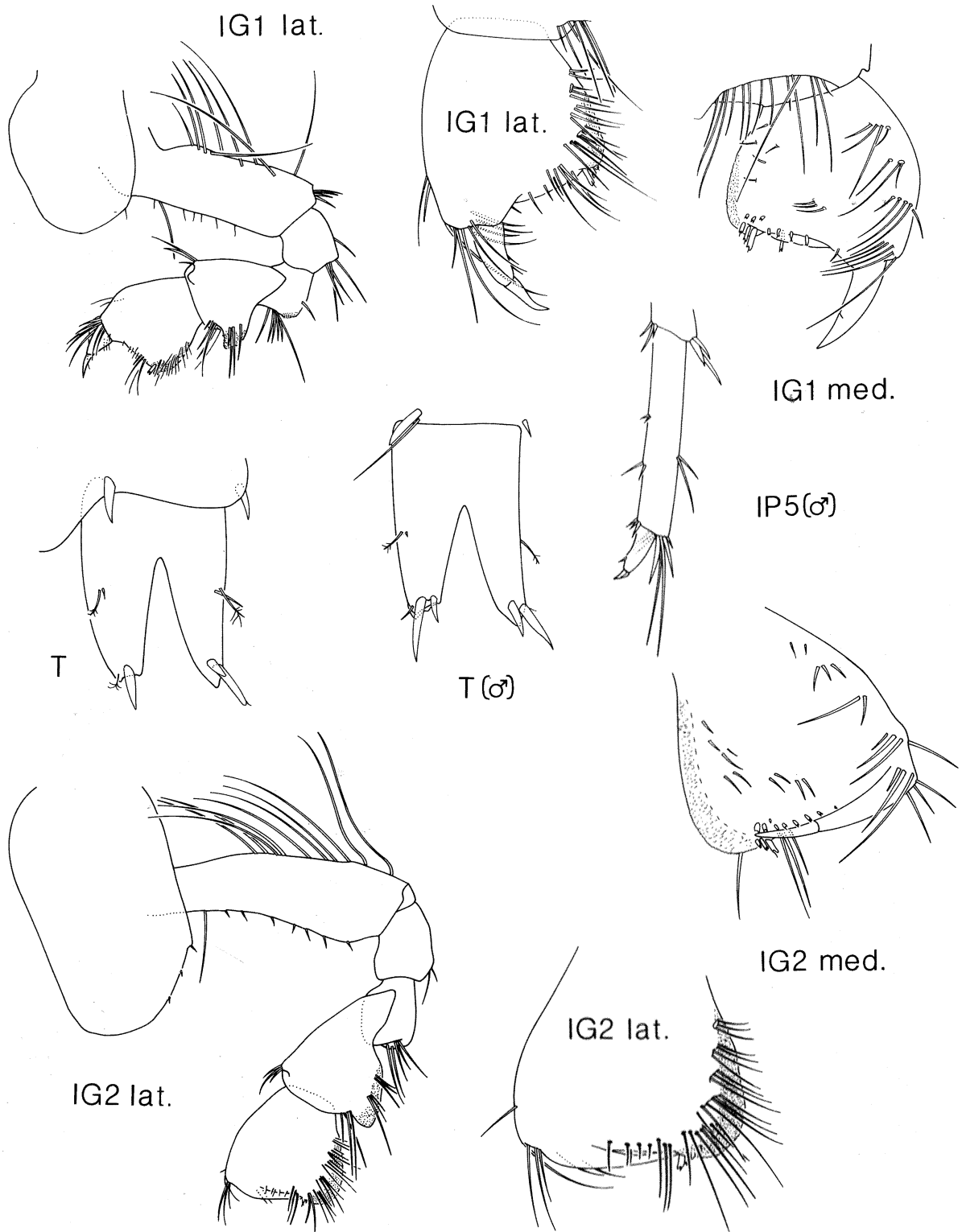


Fig.71. *Tasniphargus tyleri* n.sp., allotype, female (all drawings except those indicated); syntype, male (IP5, T).

12 thin apical setae, 2 subterminal facial setae, outer plate with 7 spines, most denticulate; [inner plate missing]. *Right first maxilla* (Fig. 67): palp article 2 with 7 moderately thin apical spines articulated to segment, 1 apicolateral longer spine, 6 subterminal apicolateral facial setae; inner plate with 2 apical plumose setae. *Second maxilla* (Fig. 67): outer plate outer margin without small spinule, apicomedial corner of inner plate with 6 weakly submarginal thick setae, some plumose. *Maxilliped* (Fig. 67): palp article 3 with thin setae on inner edge, apical part with rank of thicker bifid-setae, apex strongly produced and weakly rugose; inner plate with 2 thick spines and plumose setae apically, medial row of few plumose setae, and 1 ventrofacial spine.

First gnathopod (Fig. 68): coxal plate with 5 very short setae apically; article 4 with posterior rugose hump; carpus short and lobate, lobe straight and not setose apically, rugose; propodus trapezoidal, longer than wide, posterolateral angle rounded and produced, rugose, with 3+ medial and 2 lateral spines, 1 lateral spine slightly elongate, palm oblique and excavate; dactylus reaching end of palm. *Second gnathopod* (Fig. 68): larger than first gnathopod; carpal lobe thicker; palmar corner with 7 spines (4 medial and 3 lateral); coxal plate with 3 apical setae.

Pereopods (Figs 69,70): coxa 3 with 4 apical setae, coxa 4 deeply emarginate, with 1 anteroventral and 2 posterior setae; pereopods 3–4 longer than gnathopod 2, pereopod 3 about as long as 4, article 4 weakly setose posteriorly, article 5 of pereopods 3–4 weakly setose posteriorly, posterior margin of article 6 on pereopods 3–4 with spine formulas of 2-2-2 and 2-2-2; pereopods 5–7 similar, coxae lacking spines on ventral margin of posterior lobe, article 2 weakly expanded and lobate posteroventrally, bearing few small posterior setules, that of pereopods 5–6 slightly narrowed.

Sternal processes (Fig. 69): [?5] pairs of fleshy dendritic, sternal gills present on segments [?2–6], attached to middle of lateral edge of each segment (gills on 2,3,5 confirmed).

Epimera (Fig. 69): each epimeron with tiny posteroventral tooth, posterior margins almost straight, 2–3 setule notches each, epimera 2 and 3 with 2 and 3 anteroventral facial spines. *Pleon*: each dorsolateral posterior margin on pleonites 1–6 with sparse setation of the following setal formula: [?1-1-2-1-1-0, spines = 0-0-0-0-0-1]; uropod 3 extending well beyond uropods 1 and 2 in entire animal, uropod lengths relative to uropod 1: uropod 2 = 0.70, 3 = 1.00. *Pleopods* (Fig. 69): retinacula 2 per pleopod, no accessories; each peduncle with 1–4 setae.

First uropod (Fig. 70): peduncle length 1.4 rami; outer margin with 1 apicodistal spine besides row of 4 dorsal spines, with 2 spines medially; rami of subequal length, outer ramus with 2 rows of marginal spines, inner with 1 confirmed row, outer ramus with 4 apical and inner ramus with 3 apical spines (perhaps some broken off). *Second uropod* (Fig. 70): peduncle about same length as rami, with 2 dorsolateral spines

including 1 apical; outer ramus slightly shorter than inner, both with 1 row of marginal spines, apices with 4 and 5 spines. *Third uropod* (Fig. 70): peduncle length 0.39 outer ramus, as long as urosomite 3, with 1 facial, subdistal spine besides apical cluster of 2; outer ramus proximal article with 4 transverse lateral spine rows on body, medial margin with 5 sets of armaments, not mixing setae and spines, lateral spines from proximal to distal = 2-2-2-1, setae = 0, apex of tiny article 2 with 1 apical short stiff seta; inner ramus length 0.17 of outer, with 1 apical spine. *Telson* (Fig. 70): slightly elongate, as long as urosomite 3; cleft 64 percent of length; apices each with 1–2 spines in 1 row, no apicolateral setae and each lobe with pair of penicillate setules dorsolaterally at M.60.

Description of allotype (ovigerous female). *Head*: eyes as large as in male.

Gnathopods (Fig. 71): much smaller than in male, meri lacking distinctive lobe, carpal lobes narrower and sharper, propodi smaller and short, palms more transverse.

Pereopods: coxa 4 smaller, narrow and less deeply emarginate than in male.

Third uropod: outer ramus of uropod 3 shorter than in male.

Oostegites: present at least on coxae 2–4, that on 4 very small.

Appendages and epimera: generally less setose and less spinose than in male.

Description of paratype (male). *Pereopods* (Fig. 71): basodactylar armaments on pereopod 5 longer than dactyl (this is probably the normal case, and the shortened armaments of the holotype are aberrant).

Telson (Fig. 71): a pair of spines on the apex of each telson lobe.

Distribution. Tasmania, Great Lake.

Neoniphargus Stebbing

Neoniphargus Stebbing, 1899: 424.

Unimelita Sayce, 1901: 237–238.

Type species. *Neoniphargus thomsoni* Stebbing, 1899 (= *Niphargus montanus* Thomson, 1893, a homonym).

Introduction. This genus was erected by Stebbing (1899) to accommodate a species named *Niphargus montanus* by Thomson (1893). Stebbing took this action because Thomson's name was preoccupied and a homonym of *Niphargus montanus* (Costa) described earlier (1857) [and originally as *Gammarus montanus*]. At the same time, Stebbing (1899) "...doubtfully..." assigned a second species to *Neoniphargus* originally described as *Gammarus puteanus* by Moniez (1889) and then generically reassigned to *Niphargus* by Wrzesniowski (1890). This species is no longer considered a neoniphargid.

Various authors added species to Stebbing's genus (notably, Sayce, 1902, Smith, 1909a, Nicholls, 1924, 1926b, Chilton, 1925, and Straskraba, 1964). Although several were subsequently reassigned, by the time of

Bousfield's review (1977), the genus was regarded as containing 10 species, all Australian. The more recent and comprehensive review of Barnard & Barnard (1983) included 11, again all Australian.

We support the validity of the genus, and now provide an extended rediagnosis of it based on an examination of type material of *N. thomsoni* (see later discussion) and other material. Our rediagnosis is in substantial agreement with Stebbing's original concept of the genus.

Diagnosis. Pleonites with weak dorsal armaments. Rostrum small, lateral cephalic lobes weakly projecting and weak antennal sinus present. Eyes vestigial, or small to large size, ovate to reniform.

Antenna 1 elongate, much longer than antenna 2, ratio of peduncular articles about 10:8:5 or 10:11:6, accessory flagellum 2-articulate, calceoli rarely present. Antenna 2 flagellum shorter than peduncle, calceoli present or absent interspecifically.

Ratio of mandibular palp articles about 8:25:23 or as little as 8:20:24, article 2 poorly to moderately setose, article 3 weakly falcate, setae = BCDE or ACDE [apparently some species lack C-setae]. Labium lacking inner lobes. Inner plates of maxillae not medially setose; inner plate of maxilla 1 ovatotriangular, with 2–4 apical plumose setae, outer plate with 7(–9) spines, palps asymmetric, one side with thin apical spines, other with thick apical spines often fused to article. Inner plate of maxilla 2 lacking oblique row of setae on face, though upper member of 1–2 main medial setae slightly submarginal. Palp article 3 of maxilliped with rugose apical lobe.

Coxae 1–4 elongate, sparsely to moderately setose ventrally, coxae 1–3 lacking row of posterior spines, coxa 1 weakly tapering below, coxa 4 deeply emarginate (shallowly in males of one species), coxa 5 much shorter than 4. Gnathopods 1–2 small, sexually dimorphic (unusually) or not (usually), carpi short, lobate, fourth article on both gnathopods bearing rugose lobe, palms transverse, excavate in males when gnathopods sexually dimorphic, bearing rugosities, spines not symmetrically bifid, rather with small subapical trigger-like extensions; spines at corner of palm 6+; spines along palm dense and also with triggers.

Posterior spine sets on article 6 of pereopods 3–4 evenly spaced. Pereopods 5–7 moderately elongate, pereopod 6 longer than pereopod 7, article 2 broadly expanded, ovate or trapezoidal and posteroventrally lobate on all of pereopods 5–7 but less strongly expanded on pereopod 6 (or 5). Dactyls of pereopods 3–7 with 1 (usual) or 3 marginal and 1 facial setule.

Coxae 2–7 or 2–6 with gills, when 2–7 gill 7 reduced. Thoracic segments 2–6 or 3–6 [?1–5, ?3–7] with 4–5 pairs of lateral sternal gills of dendritic form, becoming more dendritic towards the posterior.

Basomedial setae on inner rami of pleopods 1–3 bifid, branches diverse, of different length and shape but occasionally 1 branch with diamond head, or both simple; retinacula 2, accessory retinacula absent.

Posteroventral tooth of epimera 1–3 short or absent; some epimera with facial spines and setae near ventral margin, occasionally in irregular patterns, posterior margins weakly setulate. Apicomedial corner of peduncles on uropods 1–2 with 1 spine, sometimes very long (= spur) and with complex tip; rami of uropods 1–2 extending subequally, margins spinose, uropod 1 lacking basofacial armaments; inner rami of uropods 1–2 with 2 spine rows, outer rami with 1–2 spine rows; occasionally spination on uropods 1–2 so dense as to appear '...continuously spinose...' on certain rami. Uropod 3 not extended in type species but strongly so in other species, parviramous, peduncle short; outer ramus 2-articulate, article 2 very short or vestigial, medial setae of article 1 sparse or absent, any other setae except those on inner margin not plumose; inner ramus reaching to M.30 or less on article 1 of outer ramus in both sexes. Telson short or elongate, cleft to about 60 percent, lobes not tumid laterally, with only apical spination in some species but with midlateral spination in others, no major setation, no basolateral armaments except for pair of lateral penicillate setules about M.60 on each side.

Additional description. Upper lip uniform, rounded but weakly asymmetrical below. Accessory blades (rakers) on mandibles usually with interraker plumose setae; very few additional penicillate setae beyond rakers and riding onto base of molar, instead with 2–4 very large bent basal molarial ragged setae besides regular apical molarial seta. Lower lip uniform, inner lobes indistinct or absent. Both plates of maxilla 2 with long apical setae; inner plates of maxillae 1–2 and medial and lateral margins of maxilla 2 moderately covered with pubescence. Maxillipedal inner plate with distal row of a few plumose setae and 2–3 blunt naked spines and medial row of plumose setae; outer plate with distal row of few plumose setae continuous with distal row of blunt naked tooth-spines; palp articles 2–3 poorly setose laterally, well to moderately setose medially, article 3 with row of non-comb spines near base of dactyl. Dactyls of gnathopods without small recumbant inner tooth-spine but with stiff spinules or setules at inner nail articulation line and sometimes with additional spinules along inner dactylar margin. Gnathopod 1 without 1 special enlarged rastellar seta on article 4. Pleopods similar, peduncles not strongly setose; rami extending subequally. Ventrodiscal spine on urosomite 1 at base of uropod 1 short.

Sexual attributes. Oostegites broad. Calceoli sometimes present on male antenna 2, never on female antenna 2. Sexual differences in gnathopods minor or absent or male palms excavate and female palms not excavate. Apicomedial spine on peduncle of uropod 1 sometimes very long in male, short in female.

Characters of interspecific value. Article 2 of peduncle on antenna 1 shorter than article 1 or subequal. Calceoli present or absent on antenna 2 and rarely present on antenna 1. Article 3 of mandibular

palp with A- or B-setae but not both, palp article 2 shorter or longer than article 3. Palms of gnathopods excavate in males or not; distinctive palmar corner spines present medially or not. Coxa 4 deeply excavate in all females but not all males. Dactyli of pereopoda 3–7 with many or 1 spine on inner margin. Posterior margins of propodi of pereopods 5–7 with long fine setae or not. Coxal gills 2–6 or 2–7. Spines on posterior lobes of coxae 5–7 weak or strong. Submarginal spines on epimera 1–2–3 many (5-5-2) or few. Uropod 3 extending beyond uropods 1–2 in whole animal or not. Most marginal spines on peduncle and rami of uropods 1–2 short or long. Apicomedial spine on peduncle of uropod 1 in males very long with complex tip (= spur) or shorter and with simple tip. Spines on outer ramus of uropod 3 in multiples (type) or singles, lateral rows few (3–4) or many (6), medial rows few (0–4) or many (5+), medial margin with plumose setae or not; peduncle uropod 3 shorter or much shorter than outer ramus; inner ramus uropod 3 shorter or much shorter than outer ramus (0.3–0.15), with 1 or 2+ apical spines. Telson elongate or short, with a few dorsolateral spines or not, each lobe of apex with 1–3 spines.

Relationships. *Neoniphargus* differs from the basic paramelitid genus (*Austrogammarus*) in the reduction of spines on the outer plate of maxilla 1 from 11 to 9 or 7, the loss of most medial and facial setation on the maxillae, in the modification of sternal gills to the dendritic form, the loss of most dorsal telsonic armaments (except the regular lateral pairs of penicillate setules), the tapering coxa 1, the subapical row of spines on the peduncle of uropod 3, the short and lobate carpi of the gnathopods, their general mittenform shape, the rugose palmar corners of the gnathopods, the fully parviramous uropod 3, the general lack of coxal spines and the slightly better developed posteroventral lobation and general expansion of article 2 on pereopods 5–7, the lack of

accessory simple retinacula on the pleopods, the (usual) reduction to one row of spines on the outer rami of uropods 1–2, the lack of A or B setae and presence of C-setae on palp article 3 of the mandible, and the poorly setose article 2 of the mandibular palp. Except for the parviramous uropod 3 and poorly setose maxillae, these differences also hold between *Austrocrangonyx* and *Neoniphargus*.

Antipodeus is a somewhat closer primitive relative to *Neoniphargus* in that *Antipodeus* also has a fully parviramous uropod 3, few or no dorsal armaments on the telson, poorly setose maxillae, non-spinose coxae, and lobate pereopods 6–7; but otherwise *Antipodeus* retains the plesiomorphic characters of non-tapering coxa 1, the lack of extra subapical spines on the peduncle of uropod 3, regular gnathopods with elongate unlobed carpi, and non-rugose palmar corners. *Antipodeus* has however lost its sternal gills.

Uroctena, *Protocrangonyx*, *Giniphargus* and *Hurleya* represent more specialised paramelitid genera which thereby have more distant relationships with *Neoniphargus*.

Within the Neoniphargidae, *Neoniphargus* appears to represent the most primitive of the 4 genera at present described. *Tasniphargus*, however, is obviously closely related. *Yulia*, with its remarkable male spur on uropod 1, seems to be a derived sidebranch from an ancestor which also produced *Neoniphargus*. From *Wesniphargus*, *Neoniphargus* differs *inter alia* most in the occurrence of rugosities on its gnathopod propodi, the asymmetry of spine sizes in the palps of maxilla 1, the dominance of gnathopod 2 over 1, and the presence of dendritic sternal gills.

Composition. The species at present included in the genus are: *N. thomsoni* Stebbing, *N. spenceri* (Sayce), *N. fultoni* Sayce, *N. obrieni* Nicholls, *N. alpinus* G.W. Smith, *N. exiguus* G.W. Smith, and *N. tasmanicus* G.W. Smith. Simple keys to distinguish these species follow.

Key I to the Species of *Neoniphargus*

1. Dactyls of pereopods 3–7 multispinose on inner margin, uropod 3 inner ramus with 2–3 apical spines, posterior lobes of coxae 5–7 with strong spines *N. spenceri*
 —Dactyls of pereopods 3–7 not multispinose on inner margin, uropod 3 inner ramus with 0–1 apical spine, posterior lobes of coxae 5–7 with weak spines 2
2. Gnathopods sexually dimorphic (male palms excavate); coxa 4 not deeply emarginate in males; spines on outer ramus of proximal article uropod 3 arranged singly *N. tasmanicus*
 —Gnathopods not sexually dimorphic (male palms not excavate); coxa 4 deeply emarginate in males; spines on outer ramus of proximal article uropod 3 arranged in multiples 3
3. Uropod 3 not extending beyond uropods 1–2, spines on uropods 1–2 long *N. thomsoni*
 —Uropod 3 extending beyond uropods 1–2, spines on uropods 1–2 short or medium sized 4

4. Calceoli present on both antennae 1–2 in males, medial margin of outer ramus proximal article of uropod 3 with several plumose setae in male *N. fultoni*
 —Calceoli not present on antenna 1 (sometimes in antenna 2) in males, medial margin of outer ramus proximal article of uropod 3 without several plumose setae in male 5
5. Antenna 2 without calceoli in male, long setae present on posterior margins of propodi of pereopods 5–7 *N. alpinus*
 —Antenna 2 with calceoli in males, long setae lacking on posterior margins or propodi of pereopods 5–7 6
6. Uropod 3 peduncle with very long apicomedial spine (spur) in male, telson short *N. exiguus*
 Uropod 3 peduncle with only short apicomedial spine in male, telson elongate .. *N. obrieni*

Key II to the Species of *Neoniphargus*

1. Males with long spine (spur) at apicomedial angle of uropod 1 peduncle 2
 —Males without long spine (spur) at apicomedial angle of uropod 1 peduncle 4
2. Mandibular palp article 3 setae BCDE, uropod 3 not extending beyond uropods 1–2, no medial spines on proximal article of outer ramus uropod 3 *N. thomsoni*
 —Mandibular palp article 3 setae ACDE, uropod 3 extending beyond uropods 1–2, medial spines present on proximal article of outer ramus uropod 3 3
3. Mandibular palp article 3 shorter than article 2, coxal gills 2–6, telson lacking dorsolateral spines *N. alpinus*
 —Mandibular palp article 3 longer than article 2, coxal gills 2–7, telson with dorsolateral spines *N. exiguus*
4. Telson short, strong spines on posterior lobes of coxae 5–7, dactyls of pereopods 3–7 multispinose *N. spenceri*
 —Telson elongate, only weak spines on posterior lobes of coxae 5–7, dactyls of pereopods 3–7 not multispinose 5
5. Mandibular palp article 3 setae BCDE, telson with dorsolateral spines *N. obrieni*
 —Mandibular palp article 3 setae ACDE, telson without dorsolateral spines 6
6. Males with calceoli on antennae 1–2, without excavate palms on gnathopods 1–2 *N. fultoni*
 —Males without calceoli on antenna 1 or 2, with excavate palms on gnathopods 1–2 *N. tasmanicus*

Neoniphargus thomsoni Stebbing Figs 72–76

Niphargus montanus Thomson, 1893: 70–72, pl. 6, figs 1–13
 (homonym to *N. montanus* Costa, 1857).
Neoniphargus thomsoni Stebbing, 1899: 425.

Historical. This species was originally described as *Niphargus montanus* Thomson (1893), a homonym to *N. montanus* Costa, 1857. Subsequently, Stebbing (1899) pointed out the preoccupation of the name, put forward *thomsoni* as a replacement, and established it as type species of a new genus, *Neoniphargus* (see discussion above).

Material examined. Thomson's description was based on material obtained from amongst the roots of sedges on swampy ground near the summit of Mount Wellington, Tasmania, at 1200 m. Additional material, regarded by Thomson as of the same species, was later obtained from frozen pools at the same location. It is not clear from Thomson's text on which set of specimens he based his description, or whether or not both sets were used to provide the description.

The original description is too brief for unequivocal recognition of the species, and no mention of any deposition of type material is made in the original description. However, acting on advice from Dr D.E.

Hurley (personal communication, 26 Feb 1974), the Director of the Canterbury Museum, New Zealand, was approached. Subsequently, Dr G.A Tunncliffe, of that institution, indicated (12 Mar 1974) that material apparently used by Thomson in describing the species was held. This material was made available. It comprises 4, excellently preserved, eosin-stained slides of a non-ovigerous female. However, the body (thus dorsal pleon armament and length unknown) and maxilla 2 are absent, the coxal and sternal gill series are incomplete, the epimera are damaged, and the head is crushed onto one slide. This material is in substantial agreement with the incomplete description provided by Thomson; we feel justified in regarding it as syntype material and designate it as lectotype material.

Topotypic material is also available, namely 83 specimens collected by one of us (WDW) from small

pools on the summit of Mount Wellington on 29 Jan 1963. It comprises numerous males, ovigerous and non-ovigerous females, and juveniles. From this material one large non-ovigerous female and three large males were dissected and examined, both to confirm the identity of the material and to amplify the description of the species. This material, also, is in substantial agreement with the incomplete description of the species given by Thomson, and all important features of the female specimen agree with those of the lectotype. The topotypic material is considered by us as conspecific with the lectotype of *N. thomsoni*.

Lectotype material has been returned to the Canterbury Museum, Christchurch, New Zealand. Representative topotypic material has been donated to the Smithsonian Institution, Washington, D.C., USA, and the Australian Museum, Sydney.

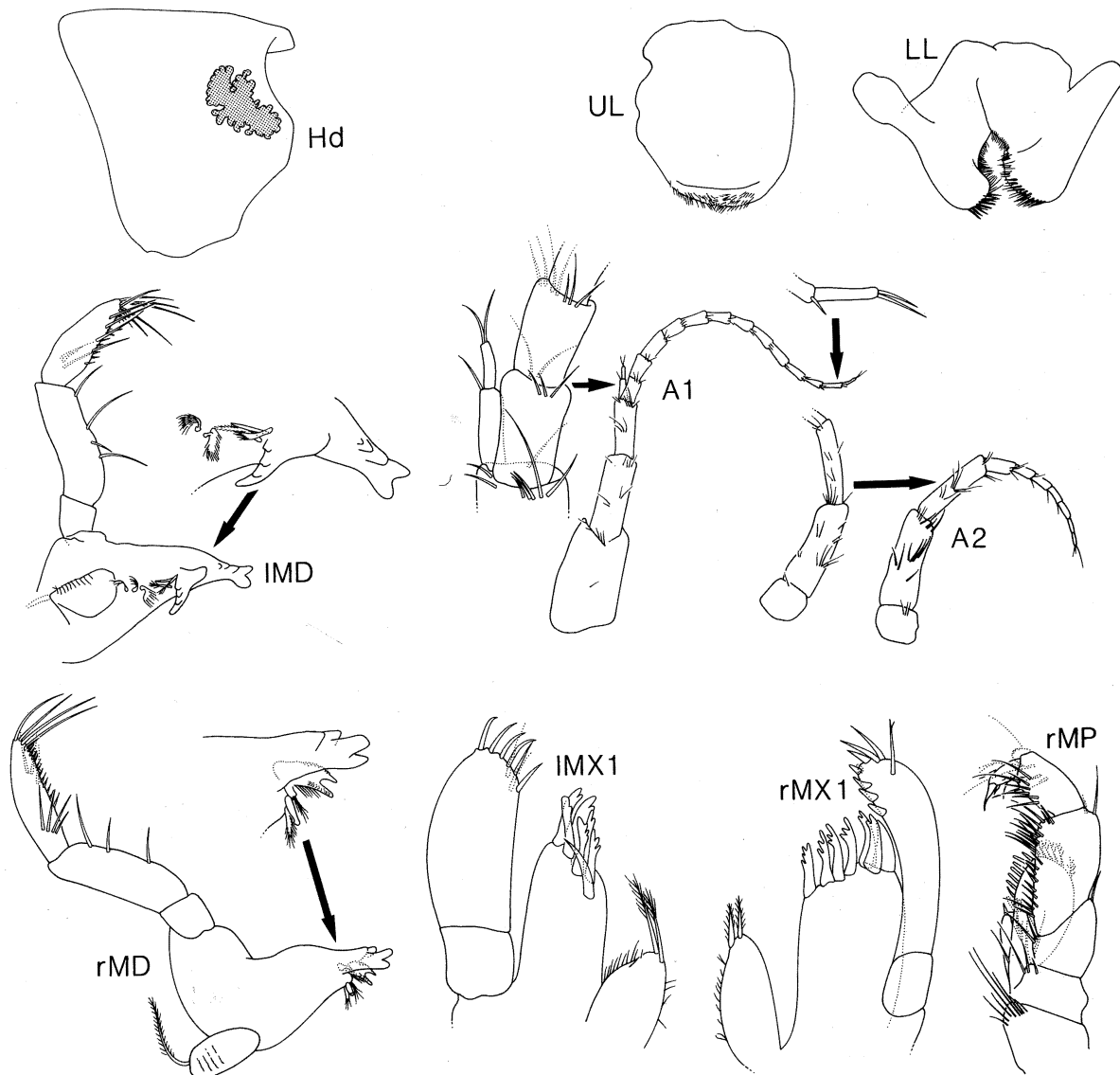


Fig.72. *Neoniphargus thomsoni* Stebbing, lectotype, non-ovigerous female "a".

Canterbury Museum, Christchurch, apparent syntype now designated LECTOTYPE by us, non-ovigerous female "a", length unknown, Mt Wellington, slides 1-4, excellent eosin-stained slides, lacking only body (thus no dorsal pleon), and maxilla 2; head crushed onto one slide.

Diagnosis. Article 1 of peduncle antenna 1 longer than article 2. Antenna 2 with calceoli in males. Article 2 of mandibular palp as long as article 3 and poorly setose, article 3 with BCDE setae. Palms of gnathopods not excavate in males, palmar corner with special medial spines in both sexes. Dactyli of pereopods 3-7 with 1 spine on inner margin. Articles 4-6 of pereopods 5-7 almost setoseless except for elongate basodactylar setae on pereopod 5; anterior margins of article 6 with 3-4 spine sets (besides locking spines); coxae 5-7 with weak spines on posterior lobe. Coxal gills 2-[?]. Epimera 2 with 5+ facial spines. Uropod 3 not extending markedly beyond uropods 1-2 in whole animal. All spines on uropods 1-2 moderately long. Peduncle of uropod 1 in males with very long apicomedial spine (spur) with complex tip. Uropod 3 peduncle 0.7 outer ramus; outer ramus spines not singly arranged, in few lateral rows, none medially, no plumose medial setae; inner ramus 0.3 outer ramus, with 1 apical setule. Telson short, cleft more than halfway, each lobe with 2-8 apical spines in 1-2 rows, lacking dorsolateral spines.

Description of lectotype (non-ovigerous female).

Body: [pleon apparently unarmed dorsally, see topotypes below]; length, [unknown].

Head (Fig. 72): rostrum small; eyes medium, ovate or possibly reniform, dark, crushed; antennal sinus shallow.

First antenna (Fig. 72): length [?] of body, 1.6 second antenna; peduncle slightly shorter than flagellum, article 1 longest, article 3 shortest, setae sparse; accessory flagellum 2-articulate, reaching past article 1 of flagellum, latter 13-articulate, articles uniform, sparsely setulate. *Second antenna* (Fig. 72): length [?] body; peduncle longer than flagellum, article 4 longer than 5, articles 3, 4 and 5 with moderate ventral setation; flagellum 7-articulate, weakly setose ventrally, lacking calceoli.

Lower lip (Fig. 72): inner lobes indistinct. *Left mandible* (Fig. 72): palp article 3 as long as 2, article 2 with 4 outer marginal setae, article 3 with 0A, 3B, 5C, many D, 6E setae; incisor 5-toothed, lacinia mobilis 4-toothed, 3 setose accessory blades; molar bearing long setose spine and 2 penicillate, hooked, scaly basal setae. *Right mandible* (Fig. 72): incisor 4-toothed; lacinia mobilis bifid, denticulate; accessory blades of 2 plumose spines, 1 tooth-like spine; setae of palp article 3 = 0A, 4B, C4, many D, E4. *Left first maxilla* (Fig. 72): palp article 2 with 6 thin apical spines, 2 subterminal facial setae, outer plate with 7 spines, mostly denticulate; inner plate with 2 plumose apical setae. *Right first maxilla* (Fig. 72): palp article 2 with 8 apical spines articulated to segment, 1 subterminal

apicolateral plumose facial seta. *Second maxilla:* [unknown, see topotypical description below, typical of generic description]. *Maxilliped* (Fig. 72): palp article 3 with ranks of thin setae on medial edge, apical part with scythe-setae, apex strongly lobed and weakly rugose; outer plate with row of 4-5 plumose spines distally continuous with row of 10 tooth-spines medially; inner plate with 2 thick spines and plumose setae apically, long medial row of plumose setae, 2 ventrofacial spines.

First gnathopod (Fig. 73): coxal plate marginally setose apically; article 4 with slightly rugose posterior hump; carpus short and lobate, lobe not setose apically, rugose; propodus trapezoidal, as long as wide, posterolateral angle rounded, rugose, with 6 or 7 (right and left) bifid tooth-spines, palm transverse but straight; dactylus reaching end of palm. *Second gnathopod* (Fig. 73): slightly larger than first gnathopod; carpal lobe slightly larger, less bent.

Pereopods (Fig. 74): coxa 3 well setose apically, coxa 4 deeply emarginate, with 2 anteroventral and 10 posteroventral setae; pereopods 3-4 longer than gnathopod 2, pereopod 3 longer than 4, article 4 moderately setose posteriorly, article 5 of pereopods 3-4 with spine formulas (proximal-distal) of 2-2-3-2-4 and 2-2-3-5, posterior margin of article 6 on pereopods 3-4 with spine formulas of 1-2-2-2-2-2 and 2-2-2-2-2; pereopods 5-7 similar, pereopod 6 longer than 5, coxae with many spines and setae on ventral margin of posterior lobe, article 2 expanded and lobate posteroventrally, bearing medium-long posterior setules, that of pereopod 6 slightly narrowed, that of pereopod 5 broadened; posterior margins of propodi lacking long setae; dactyls of pereopods 3-7 with only 1 marginal spine; gill of pereopod 7 [?not reduced, missing, only sac-like gills of pereopods 4 and 5 present].

Sternal processes (Fig. 74): [?5 pairs of fleshy dendritic, sternal gills present on segments 3-6, all missing except 1 pair of fleshy dendritic gills on pereonite 5].

Epimera (Fig. 75): [damaged, ill-sorted, see better description for topotype, female "l", below] epimera 2-3 each with small sharp posteroventral tooth, epimeron 2 with 6 posterior setule notches, epimeron 3 with 3 notches, epimeron 2 with 7 facial spines in 5 positions, 2 positions with spines paired, epimeron 3 with pair of anterofacial spines. *Pleon:* [absent from material, see topotypes below]; uropod 3 [?not] extending beyond uropods 1 and 2 in entire animal, uropod lengths relative to uropod 1: uropod 2 = 0.57, 3 = 0.47. *Pleopods* (Fig. 75): retinacula [?] per pleopod, [?no] accessories.

First uropod (Fig. 75): peduncle length 1.6 rami; outer margin with 1 apicodistal spine besides strong row of long dorsal spines, with 1 spine medially; rami of subequal length, with 3-4 apical spines, apparently only inner rami with 2 rows of long marginal spines. *Second uropod* (Fig. 75): peduncle same length as rami, with 4 dorsolateral spines including 1 apical; rami

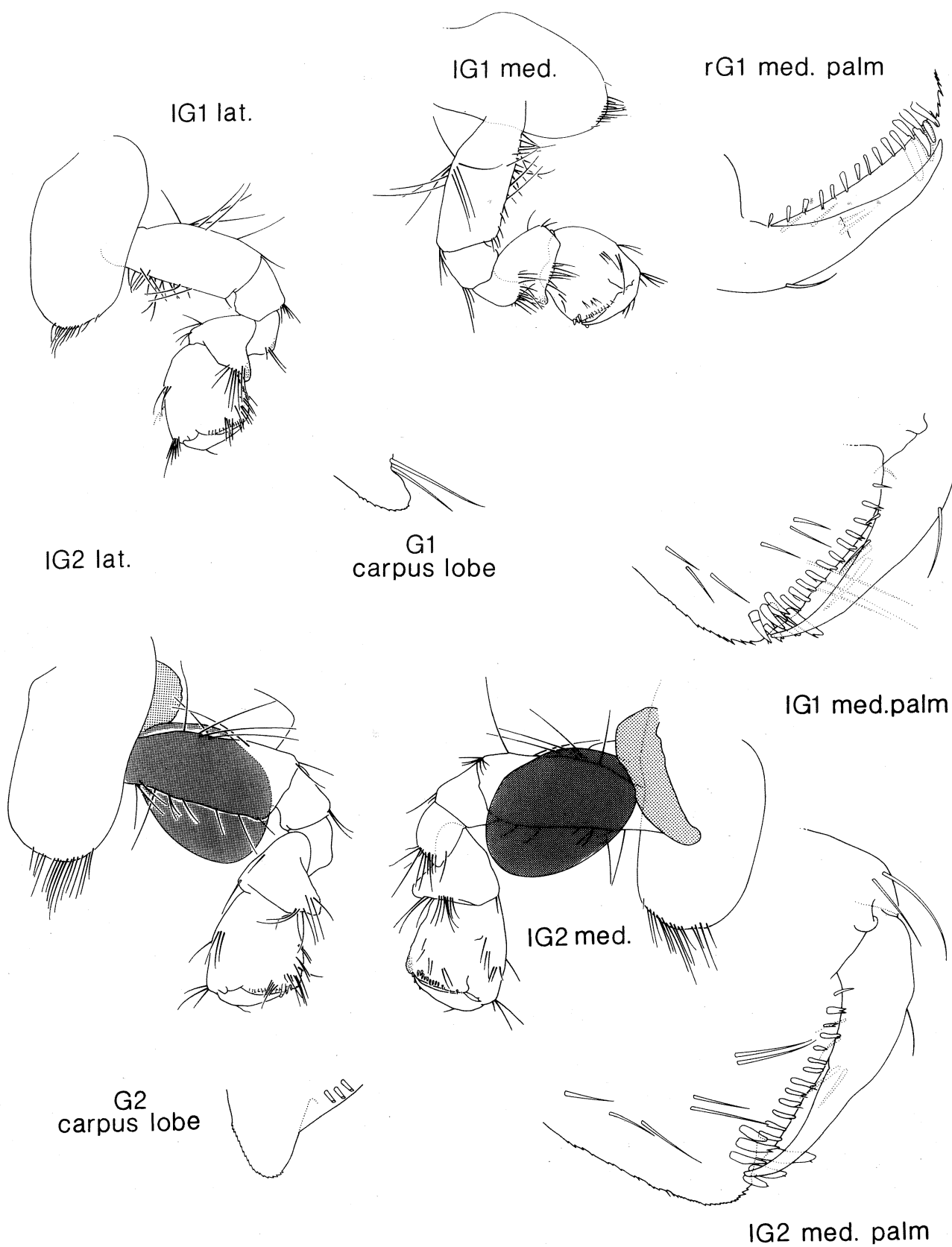


Fig.73. *Neoniphargus thomsoni* Stebbing, lectotype, non-ovigerous female "a".

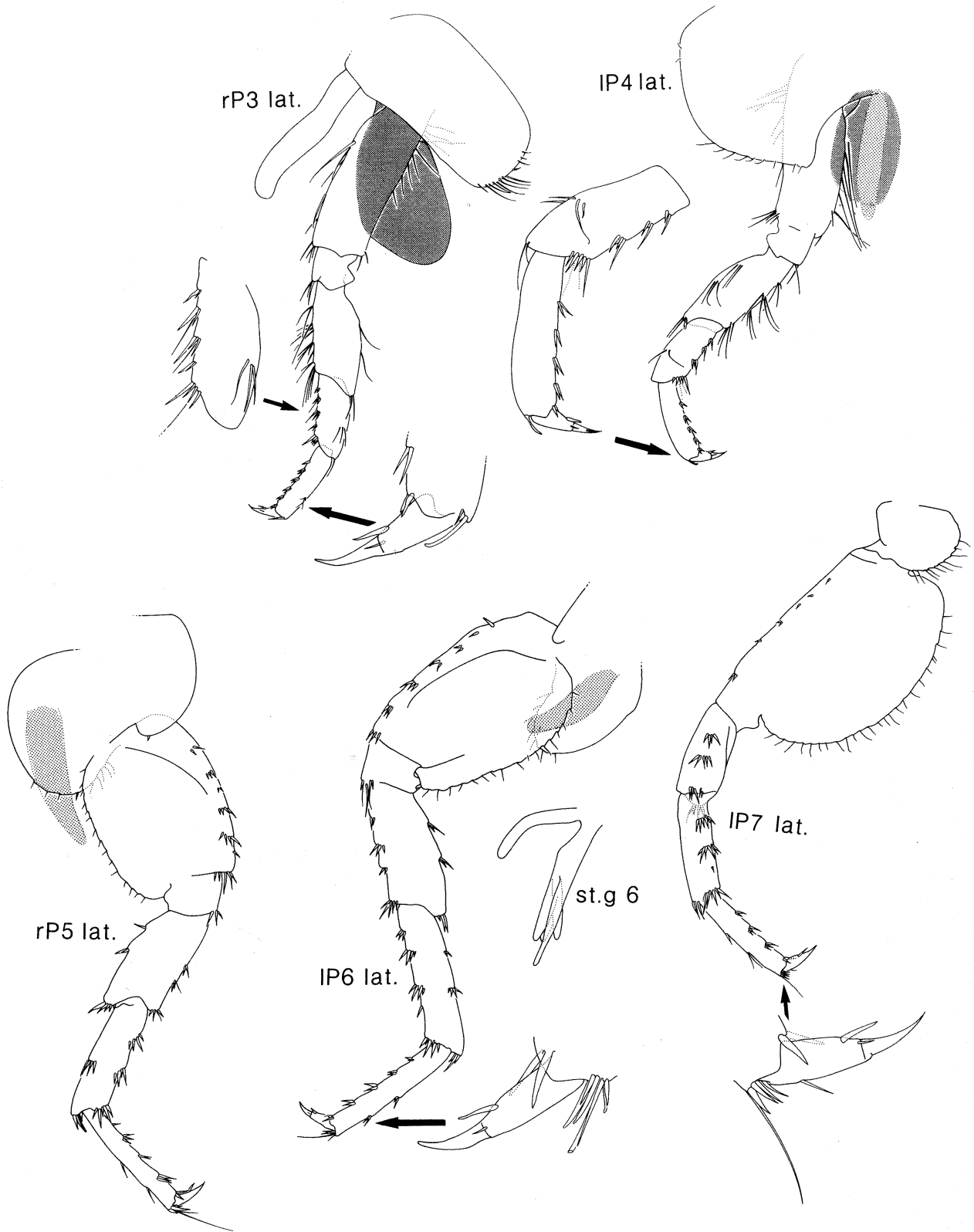


Fig.74. *Neoniphargus thomsoni* Stebbing, lectotype, non-ovigerous female "a".

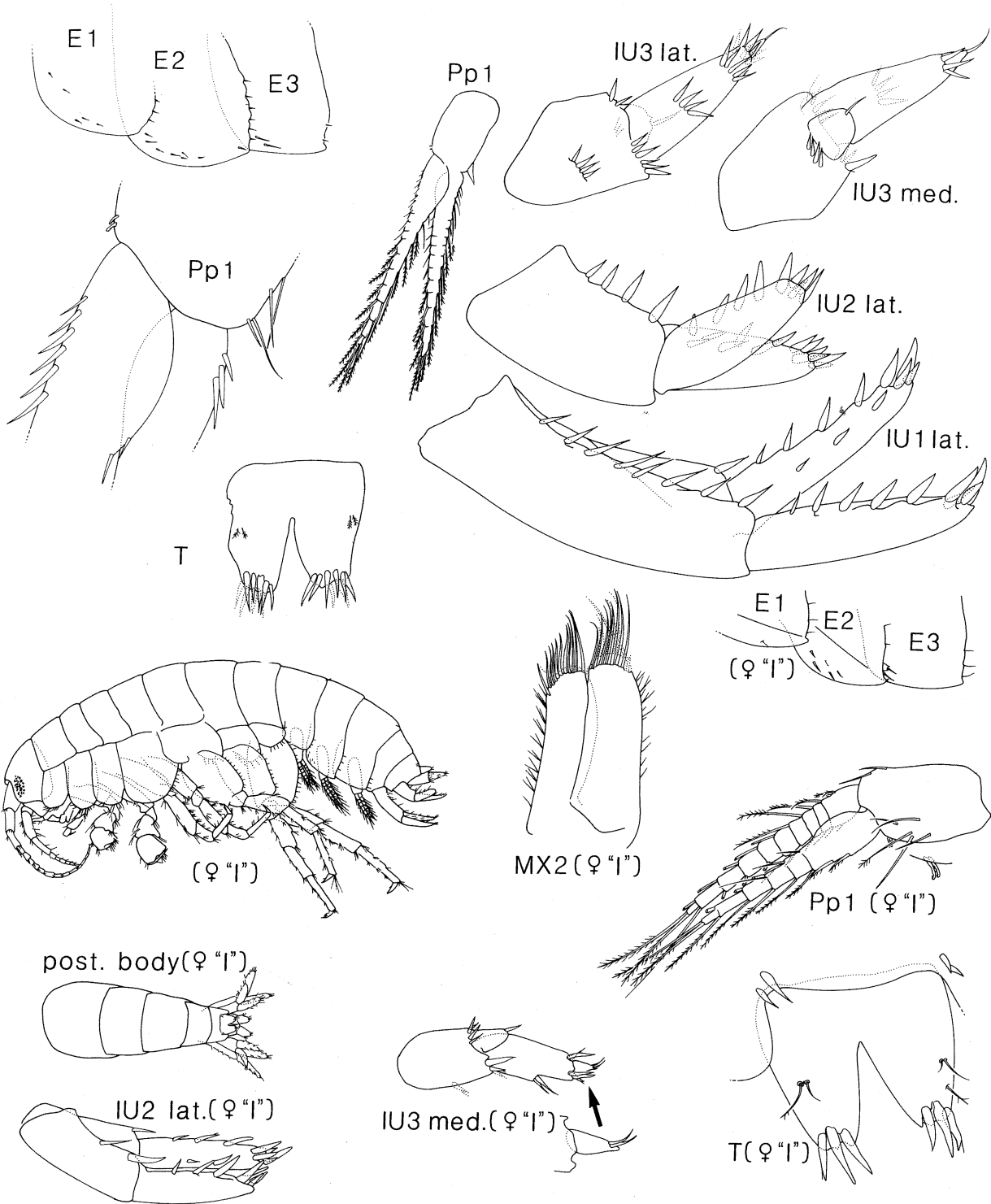


Fig.75. *Neoniphargus thomsoni* Stebbing, lectotype, non-ovigerous female "a" (all drawings except those indicated for ♀ "1"); topotype, non-ovigerous female "1" (drawings as indicated).

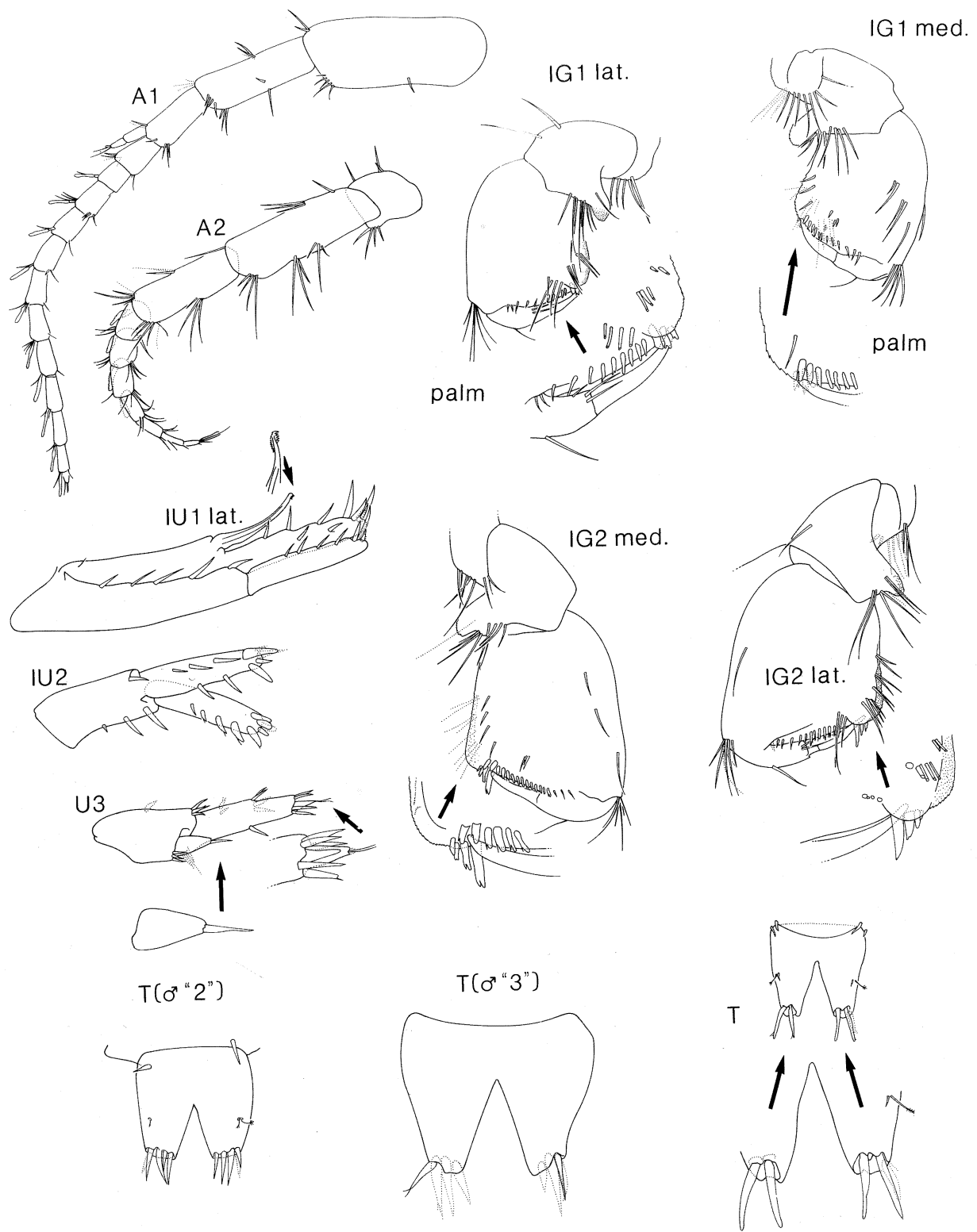


Fig.76. *Neoniphargus thomsoni* Stebbing, topotype, male "1" (all drawings except those indicated); topotypes, males "2" and "3" (T as indicated).

of equal length, apparently only inner with 2 rows of sparse marginal spines, apices with 4 and 5 spines. *Third uropod* (Fig. 75): peduncle length 0.7 outer ramus, [?about same] length as urosomite 3, with row of facial spines besides apical cluster; outer ramus proximal article with 3 transverse lateral spine rows on body, no medial armaments, apex of tiny article 2 with 2 short stiff setae; inner ramus length 0.3 of outer, subcircular, with 1 simple apical setule. *Telson* (Fig. 75): [?shorter] than urosomite 3; short, as long as broad; cleft 50 percent of its length; apices each with 8 spines in 2 rows, dorsal and ventral, dorsal rows larger, with 5–6 spines, ventral rows with 2–3 spines [we assume this represents 2 instars with previous molt retained]; each lobe with pair of penicillate setules dorsolaterally at M.60.

Description of topotype (female “1”, non-ovigerous). *Body* (Fig. 75): smooth, lacking spines except a few on posterior dorsal margins of urosomites 1 and 3; length, 12.8 mm. Eyes large, vaguely reniform.

First antenna: length 1.5 second antenna.

Left mandible: palp article 3 with 0A, 3B, 3C, many D, 4 E setae; 5 variously setose accessory blades (3 rakers, 2 interrakers), penicillate seta at base of lacinia mobilis. *Right mandible*: palp article 3 with 0A, 3B, 3C, many D, 5E setae, accessory blades of 2 plumose and 2 vaguely denticulate spines. *Left first maxilla*: palp article 2 with 6 thin apical spines and 1 plumose spine at distolateral angle. *Right first maxilla*: palp article 2 with 5 thick apical spines. *Second maxilla* (Fig. 75): outer plate with row of long spines distally, outer margin sparsely setose; inner plate with row of similar spines distally, inner margin sparsely setose.

Pereopods: pereopods 3–4 with spine formulae on article 5 of 3-2-2 and 4-2-2-1, on article 6 of 2-2-2-2-1 and 2-2-2-2-1, sac-like coxal gills on all pereopods, reduced on pereopod 7.

Sternal processes: paired sternal gills on pereonites 2–6, anterior members simple and sausage shaped, becoming more dendritic posteriorly.

Epimera (Fig. 75): epimera 1–3 with small sharp posteroventral tooth, ventroposterior margins each with 3-4-3 setule notches, epimeron 1 with 1 ventral spine, epimeron 2 with 5 facial spines in 3 groups, epimeron 3 with pair of anterofacial spines.

Pleopods (Fig. 75): inner basal setae of inner rami with bifid tips; peduncle with scattered facial spines. *Pleon* (Fig. 75): without dorsal armament except for 2 pairs of spines at posterodorsal margin of urosomite 3; uropod 3 not projecting beyond uropods 1–2, uropod 2 not projecting beyond uropod 1.

First uropod: peduncle length 1.2 rami; both rami with 4 apical spines. *Second uropod* (Fig. 75): peduncle with only 2 dorsolateral spines, including 1 strong apical spine. *Third uropod* (Fig. 75): proximal article of outer ramus with only 2 transverse spine rows on body. *Telson* (Fig. 75): cleft 60 percent of length; apices of each lobe with 3 spines in single dorsal row.

Description of topotype (male “1”). *Body*: length 5.2 mm.

First antenna (Fig. 76): length 1.5 second antenna; accessory flagellum not reaching past article 1 of flagellum, latter 12-articulate, with aesthetascs. *Second antenna* (Fig. 76): flagellar articles with calceoli.

Left first maxilla: palp article 2 with 8 thin apical spines. *Right first maxilla*: palp article 2 with 4 thick apical spines and 2 longer spines at outer distal angle.

First and second gnathopods (Fig. 76): essentially similar to female gnathopods.

Pereopods: pereopods 3 and 4 subequal, with spine formulae on article 5 of 3-3-2-3 and 1-3-3-5, on article 6 of 2-2-2-2-2 and 1-3-1-3-1-1-2; sac-like coxal gills on coxae 2–7, small on 7.

Sternal processes: paired gills on pereonites 2–6, anterior members sausage shaped, posterior members dendritic.

Epimera: essentially similar to those of topotypic female “1”.

First uropod (Fig. 76): peduncle length 1.9 rami, outer margin with relatively small apicodistal spines besides strong row of spines, inner medial angle with very long spine (0.5 length of peduncle), bearing complex terminal comb; rami of subequal length, with 4–5 long apical spines; inner ramus with 2 rows of marginal spines, outer ramus with single marginal row. *Second uropod* (Fig. 76): peduncle slightly shorter than rami, with 3 dorsolateral spines. *Third uropod* (Fig. 76): inner ramus triangular. *Telson* (Fig. 76): cleft 60 percent of length; apices of lobes each with 2–3 spines.

Description of topotypes (males “2” and “3”). Only those features in which this material differed significantly from topotype male “1” are noted. *First antenna*: accessory flagellum reaching past article 1 of flagellum, latter 13-articulate.

Second uropods: peduncles slightly longer than rami. *Third uropod* (male “2” only): inner ramus subcircular. *Telson* (Fig. 76): clefts 60 and 50 percent of lengths; apices of lobes with 4/4 and 5/5 spines arranged in 2 rows (dorsal and ventral).

Relationships. This is the type species and relationships will be drawn from discussions of relationships in other species.

Distribution. Tasmania, Mount Wellington, 1200 m.

Neoniphargus spenceri (Sayce)

Figs 77–80

Unimelita spenceri Sayce, 1901: 238–242, pl. 40.

Material examined. There is no mention in the original description of any specimens deposited as type material. However, material labelled as “type” is held in the National Museum of Victoria. It comprises three microscope slides, all clearly of one specimen, a non-ovigerous female, and all bearing the labelling: “448 Wallaby Creek *Unimelita spenceri* Sayce (type).”

Sayce (1901: 239) noted that his material was "...from amongst spongy moss at the source of a spring running into Wallaby Creek, Plenty Ranges, Victoria. Altitude about 2000 feet [600 m]." The material had been collected by J. Shepherd. In the absence of any other material labelled as type, the three microscope slides constitute the HOLOTYPE.

Comparison of the material on the type slide with the original and reasonably complete species description given by Sayce indicated no significant differences. The description provided here, therefore, is based on Sayce's original description, but modified or amplified where necessary or possible by observations of the type material.

Except for the figure of the whole animal (redrawn without modification from Sayce's pl. 40), all figures are based on the holotype.

Diagnosis (only female known). Article 1 of peduncle antenna 1 longer than article 2. Antenna 2 [?with] calceoli in males. Article 2 of mandibular palp longer than article 3 and moderately setose, article 3 with BCDE setae. Palms of gnathopods in males [?not] excavate, palmar corner without special medial spines. Coxa 4 deeply emarginate [?in both sexes]. Dactyli of pereopods 3–7 with several spines on inner margin. Articles 4–6 of pereopods 5–7 almost setoseless except for elongate basodactylar setae on pereopod 5; anterior margins of article 6 with about 6 spine sets (besides locking spines); coxae 5–7 with strong spines on posterior lobe. Coxal gills 2–7, [?7 reduced]. Epimeron 2 with [?] facial spines. Uropod 3 extending beyond uropods 1–2 in whole animal. All spines on uropods 1–2 short. Peduncle of uropod 1 in males with [?only short] spine at apicomedial corner. Uropod 3 peduncle 0.5 outer ramus; outer ramus spines arranged in multiples, in several (about 6) lateral and medial rows, [?no] plumose medial setae; inner ramus 0.2 outer ramus, with 2–3 apical spines and 1 facial seta. Telson cleft more than halfway, each lobe with 3 apical spines in 1 row and 2 dorsal pairs of spines.

Description of holotype (non-ovigerous female).

Body (Fig. 77): pleon [?not] armed dorsally, [?few] setae on pleonites 1–4, [?spine] on each side of pleonite 5, [?spines] on each side of pleonite 6; length, 10.5 mm.

Head (Fig. 77): rostrum small; eyes large, roughly reniform.

First antenna (Fig. 77): length 0.5 of body, 1.4 second antenna, peduncle shorter than flagellum, article 1 longest, article 3 shortest, setae sparse; calceoli and aesthetascs absent; accessory flagellum 2-articulate, not reaching past article 1 of flagellum; flagellar segments uniform, sparsely setulate. *Second antenna* (Fig. 77): length 0.3 body; peduncle much longer than flagellum, articles 4 and 5 subequal, articles 3, 4 and 5 with moderate ventral setation; flagellum 9-articulate, weakly setose ventrally, calceoli absent.

Left mandible (Fig. 77): palp article 3 shorter than

2, falcate, article 2 with 8 inner marginal setae, article 3 with 0A, 4B, 4C, many D, 3E; incisor 5-toothed, lacinia mobilis 4-toothed, accessory blades of 4 chisel spines, 4 plumose spines; molar bearing plumose seta, 2 penicillate hooked brushy basal setae, [?1] chisel spine. *Right mandible* (Fig. 77): palp article 3 with 0A, 4B, 4C, many D, 3E; incisor 4-toothed, lacinia mobilis bifid, denticulate; accessory blades of 2 chisel spines and 1 plumose spine. *Left first maxilla* (Fig. 77): palp article 2 with 6 thin apical spines and 2 subterminal facial setae; outer plate with 7 spines, most denticulate; inner plate with [?2] plumose setae. *Right first maxilla* (Fig. 77): palp article 2 with 4 thick apical spines articulated to segment, 1 apicolateral thin spine, 1 subterminal apicolateral facial seta; inner plate with 2 plumose apical setae. *Second maxilla* (Fig. 77): outer plate outer apical margin with 1 small spinule, apicomedial corner of inner plate with 2 weakly submarginal thick setae. *Maxilliped* (Fig. 77): palp article 3 with ranks of thin setae on inner ventral face, outer apical part with rank of thicker setae, apex strongly produced and rugose; inner plate with 2 thick tooth-like spines, several plumose setae and simple setae apically, long medial row of plumose setae, and 1 ventrofacial spine.

First gnathopod (Fig. 78): coxal plate with sparse row of short to medium long setae apically; article 4 with small posterior and slightly rugose hump; carpus short and lobate, lobe rounded and not setose apically, rugose; propodus trapezoidal, slightly longer than wide; posterolateral angle rounded, faintly rugose, with 3 short medial and 3–4 short to long lateral strong spines; palm transverse, straight; dactylus reaching end of palm. *Second gnathopod* (Fig. 78): slightly larger than first gnathopod; carpal lobe slightly more pronounced; palmar corner more expanded than in first gnathopod, with 2–3 short medial and 3 short to long lateral strong spines; dactylus not quite reaching end of palm; sac-like coxal gill present; coxal plate sparsely setose apically.

Pereopods (Fig. 79): coxa 3 with sparse row of short to medium long setae apically, coxa 4 deeply emarginate, with 2 anteroventral and 5 posterior setae; pereopods 3–4 longer than gnathopod 2, pereopods 3 and 4 of subequal length, article 4 spinose posteriorly, article 5 of pereopods 3–4 spinose posteriorly, posterior margin on article 6 on pereopods 3–4 with spine formulae of 1-2-2-2-2-2-2 and 2-2-2-2-2-2-2; pereopods 5–7 [? similar], coxae with 4–6 spines on ventral margin of posterior lobe, article 2 expanded and lobate posteroventrally, bearing medium-long thick posterior setules, that of pereopod 6 slightly narrowed, that of pereopod 5 broadened and strongly lobate; posterior margins of propodi lacking long setae; dactyls of pereopods 3–7 with several marginal spines; gill of pereopod 7 [?strongly reduced].

Sternal processes: [?5 pairs of fleshy dendritic, sternal gills present on segments 3–6, attached to middle of lateral edge of each segment].

Epimera: each epimeron [?with] small

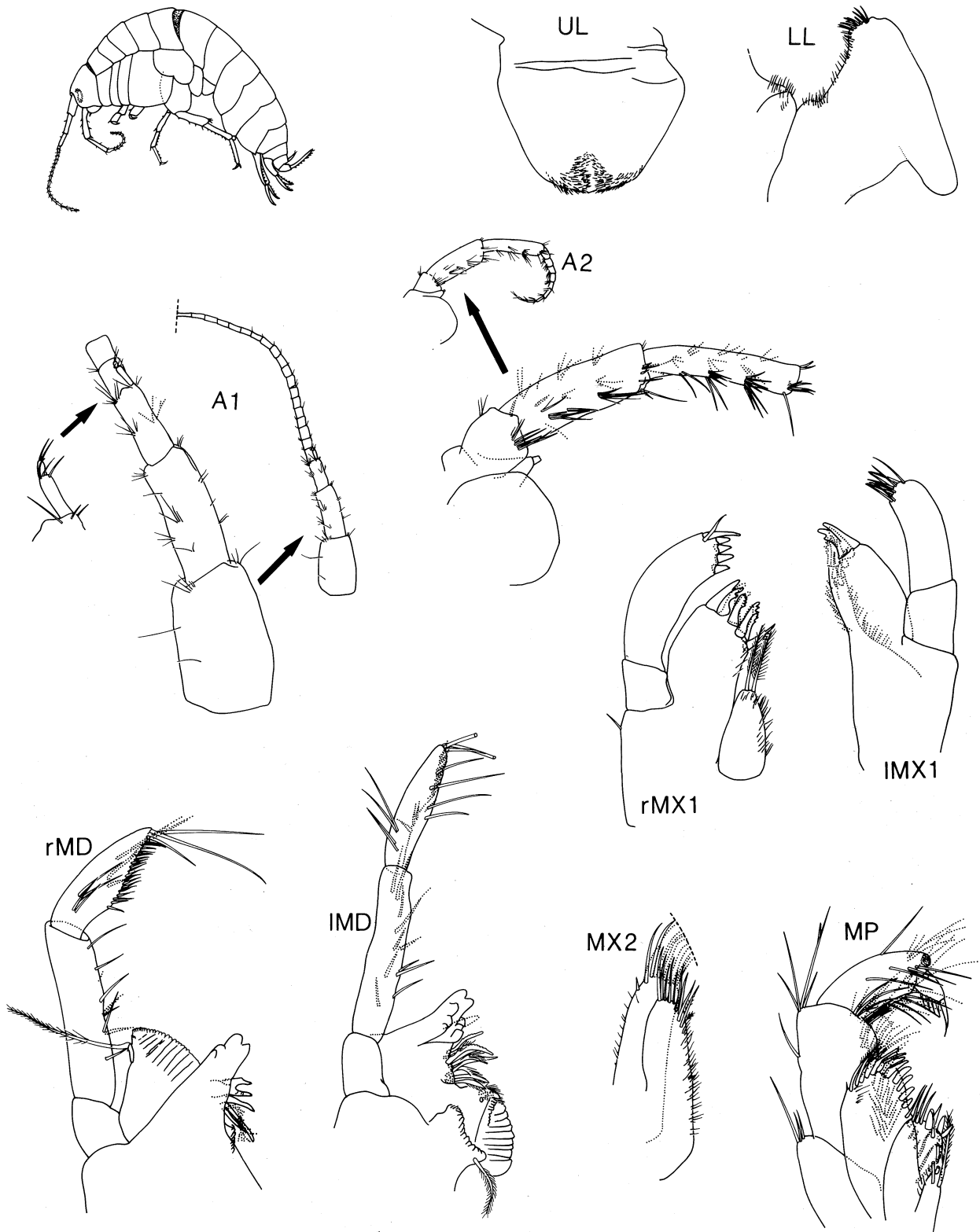


Fig.77. *Neoniphargus spenceri* (Sayce), holotype, non-ovigerous female.

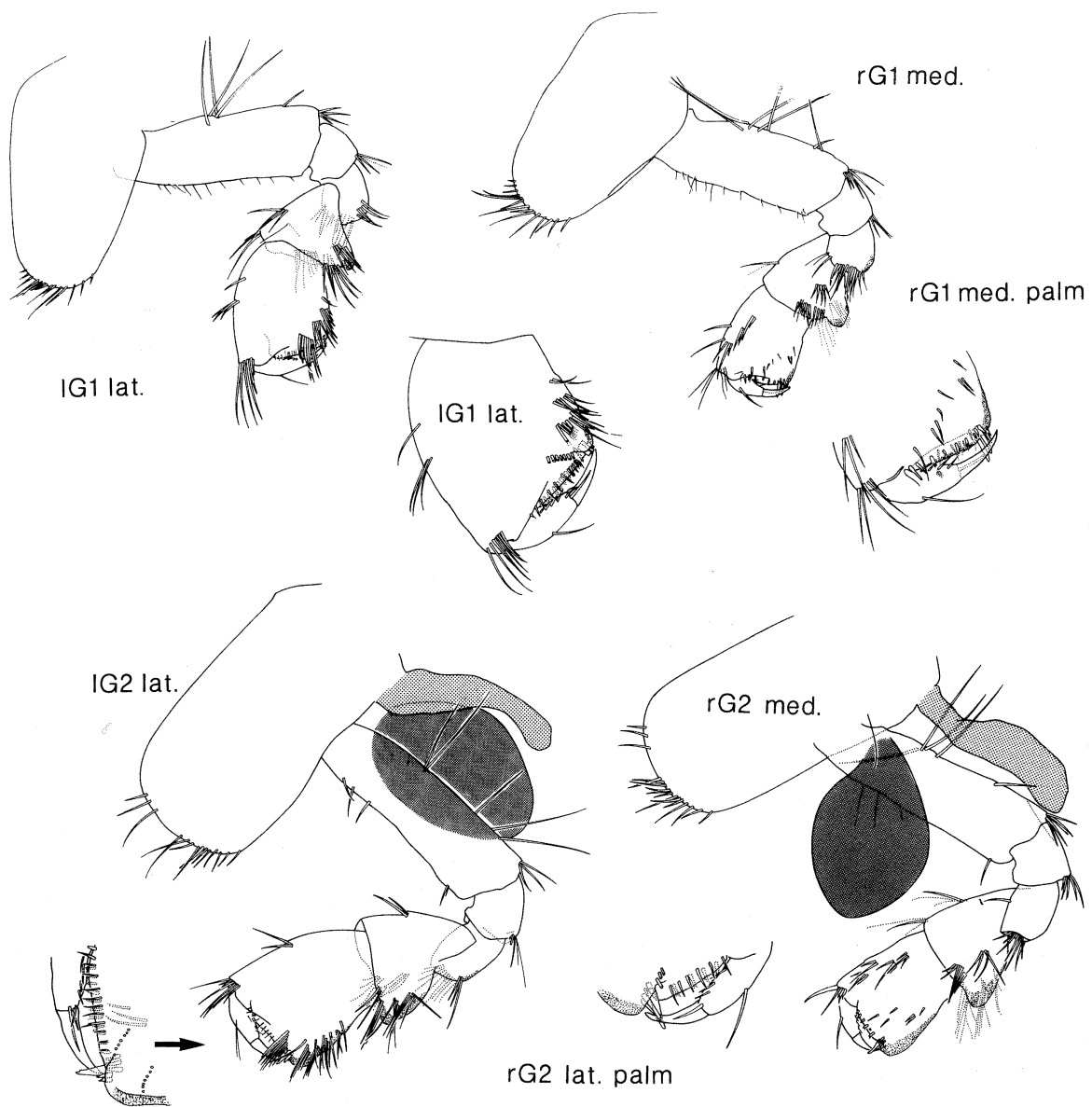


Fig. 78. *Neoniphargus spenceri* (Sayce), holotype, non-ovigerous female.

posteroventral tooth, posterior margins almost straight, epimera 1 and 2 with [?1+] anteroventral spines. *Pleon*: dorsolateral posterior margin of pleonites 1–6 with setal formula: [?], spines = [?]; uropod 3 extending well beyond uropods 1 and 2 in entire animal, uropod lengths relative to uropod 1: uropod 2 = 0.68, 3 = 0.77. *Pleopods* (Fig. 80): retinacula 2 per pleopod, no accessories, each peduncle with several setae.

First uropod (Fig. 80): peduncle length 1.5 rami, outer margin with 1 apicodistal spine besides row of short dorsal spines, with 3 spines on medial margin; rami of subequal length, both rami with 2 rows of short marginal spines, outer ramus with 3 apical spines, inner

ramus with 4 apical spines. *Second uropod* (Fig. 80): peduncle about same length as rami, with 3 short dorsolateral spines including 1 apical; outer ramus slightly shorter than inner, both with 2 rows of short marginal spines, apices with 4 and 5 spines. *Third uropod* (Fig. 80): peduncle length 0.5 outer ramus, as long as urosomite 3, with several facial spines and distolateral spine row; outer ramus proximal article with 6 transverse lateral spine rows on body, medial margin with 5 sets of armaments, mixing setae and spines, from proximal to distal, spines = 0-1-2-2-1-3, setae = 1-1-1-1-1-0 (other third uropod, spines = 0-0-1-2-3-3, setae = 1-1-1-1-0-0), apex of tiny article 2 with 2 apicomедial short setae; inner ramus length 0.18 of

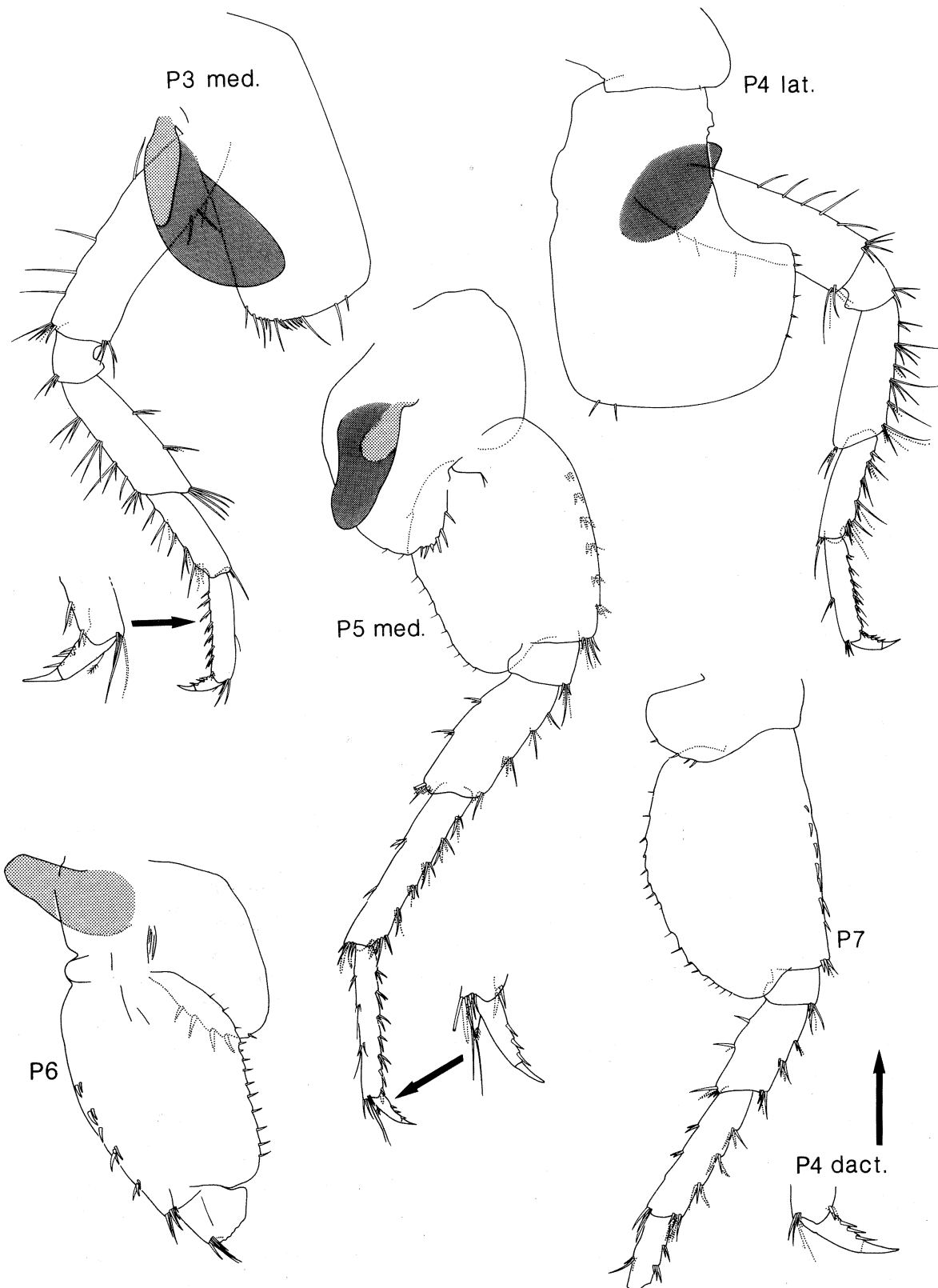


Fig.79. *Neoniphargus spenceri* (Sayce), holotype, non-ovigerous female.

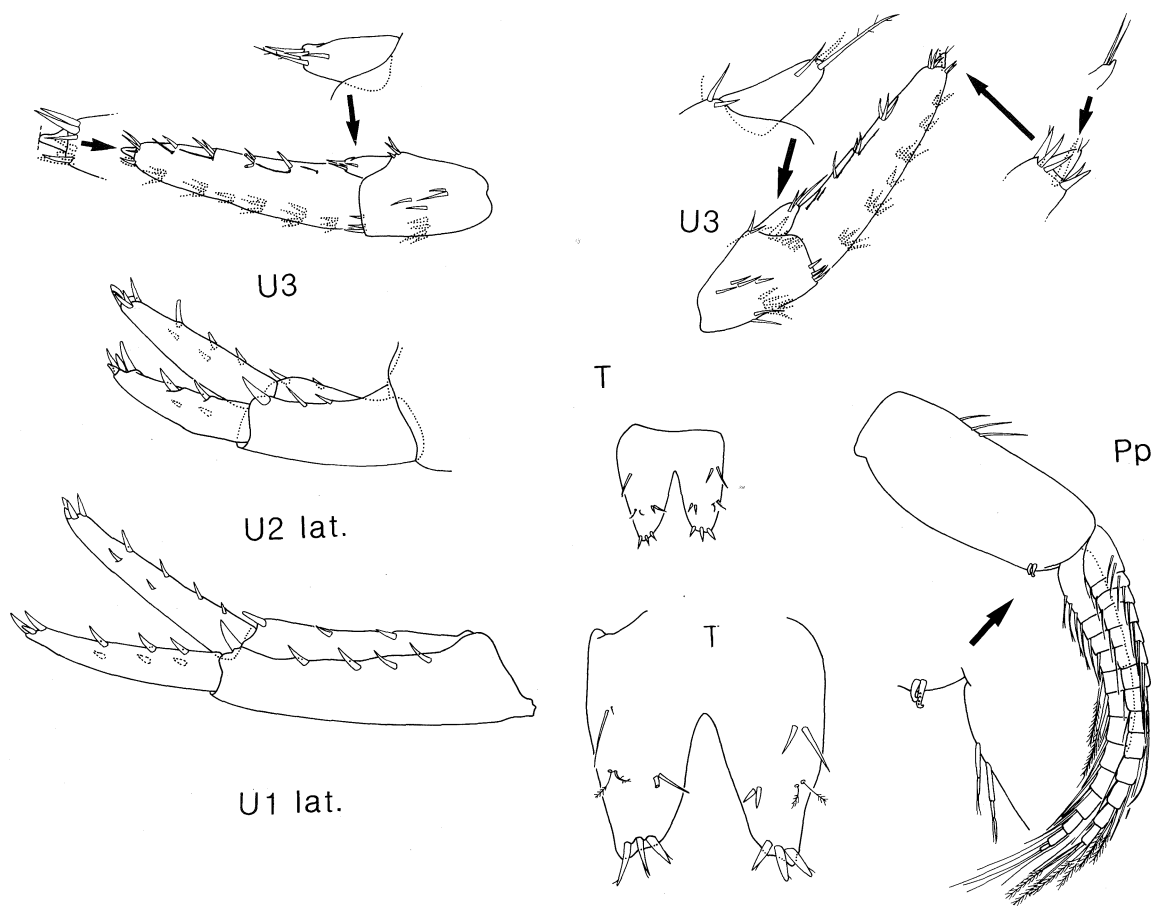


Fig. 80. *Neoniphargus spenceri* (Sayce), holotype, non-ovigerous female. Two aspects of U3 drawn.

outer, with 2–3 simple apical setae or spines (1 sparsely setose) and 1 simple apicomedial spine. *Telson* (Fig. 80): short, as long as broad; cleft 56 percent of its length; apices each with 3 short spines in 1 row, 2 short spines mediadorsally at M.70, 2 spines laterodorsally at M.40, 1 pair of penicillate setules dorsolaterally at M.70.

Relationships. *Neoniphargus spenceri* is distinguished from all other known species of *Neoniphargus* in that its dactyli of pereopods 3–7 have more than 1 spine on their inner margins, its inner ramus of uropod 3 has 2–3 apical spines and 1 facial spine, and there are strong (not weak) spines on the posterior lobes of coxae 5–7. Whether or not these attributes have generic value and would necessitate revival of *Unimelita* must await further study.

Additionally, it differs from *N. thomsoni* in the following characters: in *N. spenceri* article 2 of the mandibular palp is longer than article 3 (not subequal), there are no special medial spines at the palmar corner of the ganthopods, uropod 3 extends beyond uropods 1–2 in whole animals, there is only a short apicomedial spine on the peduncle of uropod 1 in males, spines on uropods 1–2 are short (not long), there are about 6

medial and lateral transverse spine rows on the outer ramus of uropod 3, and the telson has some dorsal spines.

The short telson distinguishes *N. spenceri* from *N. fultoni*, *N. obrieni* and *N. tasmanicus* (in these species the telson is elongate). From *N. alpinus*, *N. spenceri* differs (aside from unique characters for the species) in its lack of long setae on the posterior margins of article 4–6 of pereopods 5–7, and from *N. exiguus* in that article 2 of the mandibular palp is longer than article 3.

Distribution. Victoria, spring running into Wallaby Creek, Plenty Ranges, altitude 600 m.

Neoniphargus fultoni Sayce

Figs 81,82

Neoniphargus fultoni Sayce, 1902: 57–58, pl. 7.

Material examined. Museum of Victoria (NMV), types, Collins Coach Stage near Warburton [Sayce: "...from a spring...near to Wood's Point..."], Vic. Altitude about 900 m. Collected by Mr S.W. Fulton. LECTOTYPE here selected, male "k", 6.4 mm (illustrated), second specimen, "j", 5.1 mm, not dissected, not manipulated.

Diagnosis. Article 1 of peduncle antenna 1 longer than article 2. Antennae 1–2 with calceoli in males. Article 2 of mandibular palp longer than article 3 and sparsely setose, article 3 with ACDE setae. Palms of gnathopods in males not excavate, palmar corner with special medial spines. Coxa 4 deeply emarginate in [?both] sexes. Dactyli of pereopods 3–7 with only 1 spine on inner margin. Article 6 of pereopods 5–7 with some long setae on posterior margin, basodactylar spines long on pereopods 5–6; anterior margins of article 6 of pereopods 5–7 with 5 spine sets (besides locking spines); coxae 5–7 with no or only weak spines on posterior lobe. Coxal gills 2–7, 7 reduced. Epimeron 2 with 1 facial spine. Uropod 3 extending beyond uropods 1–2 in whole animal. All spines on uropod 1–2 of only moderate length. Peduncle of uropod 1 in males with only medium sized spine at apicomedial corner. Uropod 3 peduncle 0.5 outer ramus; outer ramus spines arranged in multiples, in several (5–6) lateral and medial rows, with medial plumose setae; inner ramus 0.2 outer ramus, with 1 apical and 1 subapical plumose seta. Telson elongate, cleft nearly 75 percent, each lobe with 2 apical spines in 1 row, and 1 apicolateral setule.

Description of lectotype (male). *Body* (Fig. 81): pleon sparsely armed dorsally, few setae on pleonites 1–4, 1 spine on each side of pleonite 5, 2 spines on each side on pleonite 6; length, 6.4 mm.

Head (Fig. 81): rostrum small; eyes small [ovate in original description].

First antenna (Fig. 81): length 0.5 of body, 1.5 second antenna; peduncle much shorter than flagellum, article 1 longest, article 3 shortest, setae sparse but with medioposterior calceolus; first 5 flagellar articles each with calceolus, 1 aesthetasc each on articles 4 to penultimate article; accessory flagellum 2-articulate, not reaching past article 1 of flagellum; flagellum articles uniform, sparsely setulate. *Second antenna* (Fig. 81): length [?0.33] body; peduncle longer than flagellum, article 4 longer than 5, articles 3, 4 and 5 with moderate ventral setation; flagellum 9-articulate, weakly setose ventrally, bearing calceolus on articles 1–6.

Left mandible (Fig. 81): palp article 3 shorter than 2, article 2 with 4 outer marginal setae, article 3 with 1–2A, 0B, 4C, many D, 4E; incisor 5-toothed, lacinia mobilis 4-toothed, 3 setose accessory blades; molar bearing plumose seta, 3 penicillate hooked brushy basal setae, 1 chisel spine. *Right mandible* (Fig. 81): incisor 4-toothed; lacinia mobilis bifid, denticulate, 1 denticulation strongly extended (towards viewer in illustration); accessory blades of 2 plumose spines, 1 chisel spine, setae of palp article 3 = 1–2A, 0B, 3C, many D, 4E. *Left first maxilla* (Fig. 81): palp article 2 with 7 thin apical spines, 2 subterminal facial setae, outer plate with 9! spines, most denticulate; inner plate with 2 apical setae. *Right first maxilla* (Fig. 81): palp article 2 with 4 thick apical spines articulated to segment, 1 apicolateral thin spine, 1 subterminal apicolateral facial seta. *Second maxilla* (Fig. 81): outer

plate outer margin with 1 small spinule, apicomedial corner of inner plate with 2 weakly submarginal thick plumose setae. *Maxilliped* (Fig. 81): palp article 3 with ranks of thin setae on inner edge, apical part with rank of thicker bifid-setae, apex strongly produced and weakly rugose; inner plate with 2 thick spines and plumose setae apically, long medial row of plumose setae, 1 ventrofacial spine.

First gnathopod (Fig. 82): coxal plate sparsely setose, with 5 setae apically; segment 4 with posterior hump; carpus short and lobate, lobe straight and not setose apically, faintly rugose; propodus trapezoidal, as long as wide, posterolateral angle rounded, faintly rugose, with 4 medial and 2 lateral spines, 1 lateral spine elongate, palm transverse but straight; dactylus reaching end of palm. *Second gnathopod* (Fig. 82): slightly larger than first gnathopod; carpus lobe thicker; palmar corner with either 6 or 7 spines (right and left); coxal plate also sparsely setose.

Pereopods (Fig. 82): coxa 3 with 4 setae, coxa 4 deeply emarginate, with 1 anteroventral and 6 posterior setae; pereopods 3–4 longer than gnathopod 2, pereopod 3 not longer than 4, article 4 weakly setose posteriorly, article 5 of pereopods 3–4 weakly setose posteriorly, posterior margin of article 6 on pereopods 3–4 with spine formulas of 2-1-2-2-2-2-1 and 2-2-2-2-2-2; pereopods 5–7 similar, coxae lacking spines on ventral margin of posterior lobe, article 2 expanded and lobate posteroventrally, bearing medium-long thick posterior setules, that of pereopod 6 slightly narrowed, that of pereopod 5 broadened and strongly lobate; posterior margins of propodi of pereopods 5–6 with a few long setae, pereopod 7 lacking these setae; dactyls of pereopods 3–7 with only 1 marginal seta; gill of pereopod 7 strongly reduced.

Sternal processes (Fig. 82): 5 pairs of fleshy dendritic, sternal gills present on segments 2–6, attached to middle of lateral edge of each segment.

Epimera (Fig. 81): each epimeron with tiny posteroventral tooth, posterior margins almost straight, epimera 1 and 2 each with 1 anteroventral spine. *Pleon* (Fig. 81): each dorsolateral posterior margin of pleonites 1–6 with following setal formula: 1-1-2-1-0-0, spines = 0-0-0-0-1-2; uropod 3 extending beyond uropods 1 and 2 on entire animal, uropod lengths relative to uropod 1: uropod 2 = 0.60, 3 = 0.75. *Pleopods*: retinacula 2 per pleopod, no accessories; each peduncle with 1 seta.

First uropod (Fig. 82): peduncle length 1.5 rami; outer margin with 1 apicodistal spine besides strong row of dorsal spines, with 2 spines medially; rami of subequal length, both rami with 2 rows of marginal spines, outer ramus with 4 apical and inner ramus with 5 apical spines. *Second uropod* (Fig. 82): peduncle about same length as rami, with 3 dorsolateral spines including 1 apical; outer ramus slightly shorter than inner, both with 2 strong rows of marginal spines, apices with 4 and 5 spines. *Third uropod* (Fig. 82): peduncle length 0.50 outer ramus, longer than urosomite 3, with pair of facial, subdistal spines besides

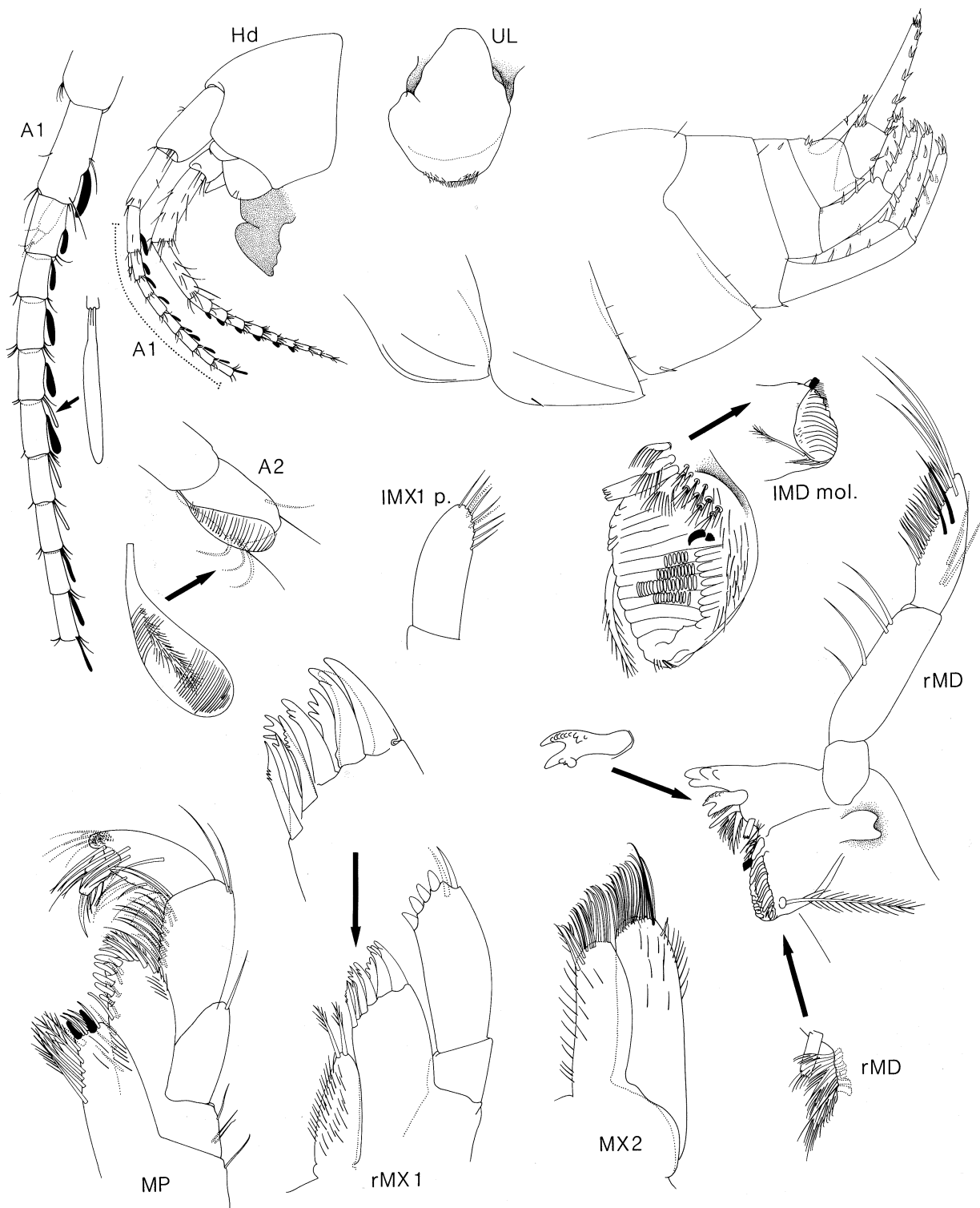


Fig.81. *Neoniphargus fultoni* Sayce, lectotype, male "k".

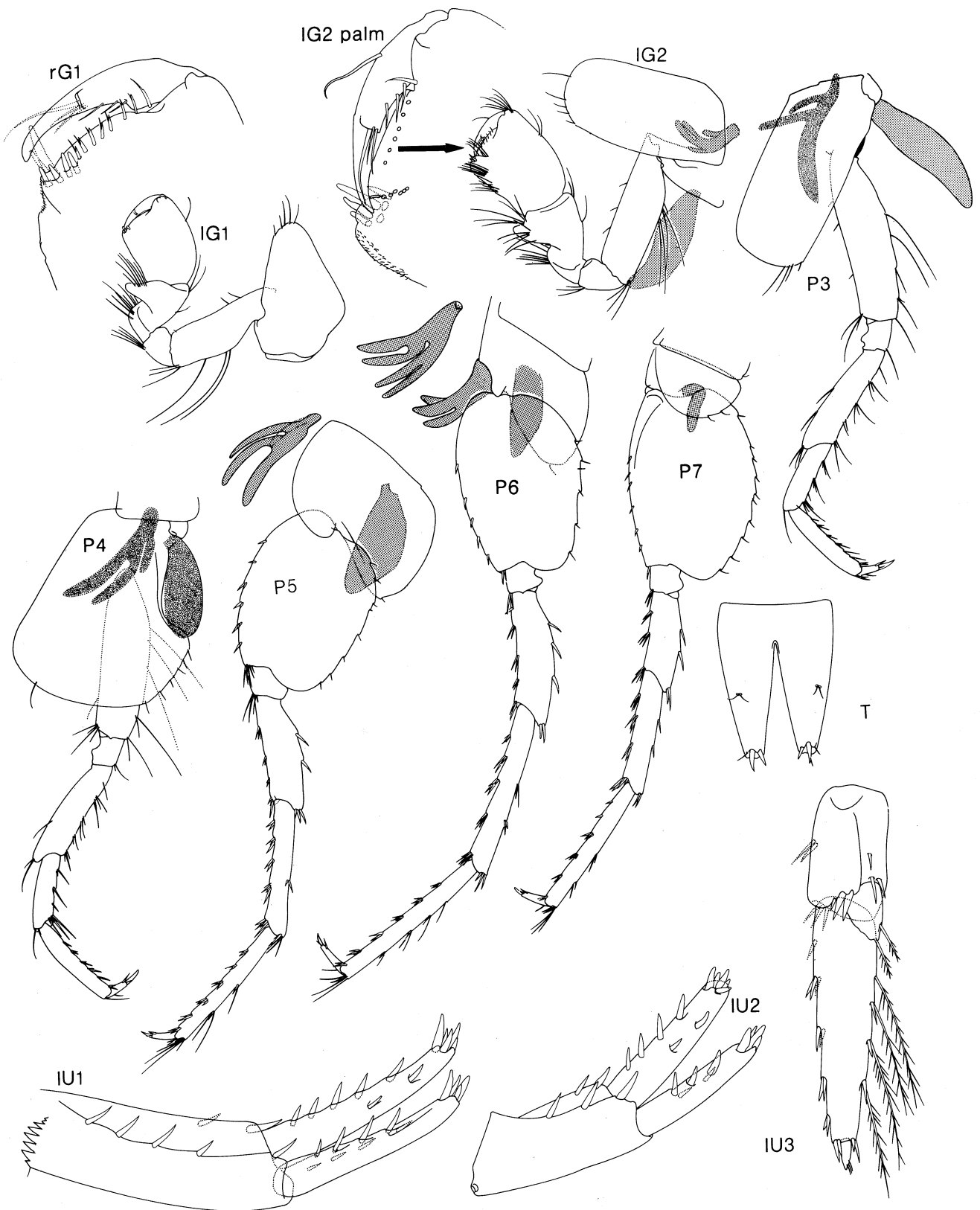


Fig.82. *Neoniphargus fultoni* Sayce, lectotype, male "k".

apical cluster; outer ramus proximal article with 6 transverse lateral spine rows on body, medial margin with 5 sets of armaments, mixing long plumose setae and spines, from proximal to distal spines = 0-1-1-1-2, setae = 1-1-1-1-0; apex of tiny article 2 with 3 apicomedial short stiff setae; inner ramus length 0.22 of outer, with 1 apical and 1 apicomedial plumose setae. *Telson* (Fig. 82): elongate, longer than urosomite 3; cleft 75 percent of its length; apices each with 2 spines in 1 row, 1 apicolateral seta, each lobe with pair of penicillate setules dorsolaterally at M.60.

Description of topotype (specimen "j"). Confirming pleonite 6 with 2 spines on each side, rami of uropods 1-2 with 4 outer and 5 inner apical spines.

Illustrations. Lower lip like other Australian neoniphargids.

Relationships. At present, *N. fultoni* is uniquely distinguished within *Neoniphargus* by the occurrence of calceoli on both antennae 1 and 2, and, less certainly, by the occurrence of medial plumose setae on the outer ramus of uropod 3 in males. From *N. thomsoni* it is also distinguished by the following main characters: in *N. fultoni* article 2 of the mandibular palp is longer than article 3 (not subequal), and article 3 has ACDE setae, epimeral facial armature is reduced, uropod 3 extends beyond uropods 1-2 in whole animals, the apicomedial spine on the peduncle of uropod 1 in males is short, there are about 6 lateral and medial transverse spine rows on the outer ramus of uropod 3, and in uropod 3 the inner ramus is only 0.2 of the outer ramus, and the telson is elongate. The outer plate of maxilla 1 has 9 spines (versus 7 in the type species).

The elongate telson, as well as the short apicomedial spine on the peduncle of uropod 3 in males also distinguish *N. fultoni* from *N. alpinus* and *N. exiguus*. From *N. tasmanicus* it differs in the lack of sexual dimorphism in the gnathopods, and from *N. obrieni* by the lack of dorsal spines on the telson.

Distribution. Victoria, Collins Coach Stage near Warburton, from a spring near Wood's Point, altitude about 900 m.

Neoniphargus obrieni Nicholls

Fig. 83

Neoniphargus obrieni Nicholls, 1926b: 81-86, figs 1,2, pl. 9 (figs 1-10).

Material examined. Type material not extant. Type locality. Victoria, associated with *Phreatoicus* sp., beneath the surface of a bogmass, at the head of a creek draining into Lake Catani, altitude 1460 m [near a spring], Mt Buffalo. In the absence of definitive type material, our redescription is drawn from the text and illustrations of Nicholls (1926b). Nicholls did not apparently deposit any type material in the Western Australian Museum (Jones, 1986).

Diagnosis. Article 1 of peduncle antenna 1 longer than article 2. Antenna 2 with calceoli in males [? and

antenna 1]. Article 2 of mandibular palp longer than article 3 and sparsely setose, article 3 with BCDE setae. Palms of gnathopods in males [?not] excavate, palmar corner with special medial spines. Coxa 4 deeply emarginate in both sexes. Dactyli of pereopods 3-7 with only 1 spine on inner margin. Articles 4-6 of pereopods 5-7 [?almost setoseless except for elongate basodactylar setae on pereopod 5]; anterior margins of article 6 with about [?] spine sets (besides locking spines); coxae 5-7 without strong spines on posterior lobe [only coxa 6 confirmed]. Coxal gills 2-[?6]. Epimeron 2 with 2 facial spines. Uropod 3 extending beyond uropods 1-2 in whole animal. All spines on uropods 1-2 short. Peduncle of uropod 1 in males with [?only short] spine at apicomedial corner. Uropod 3 peduncle 0.55 outer ramus; outer ramus spines arranged in multiples, in rather few (3) lateral and medial rows, [?no] medial plumose setae; inner ramus 0.3 outer ramus, with 1 apical spine. Telson elongate, cleft more than halfway, each lobe with 3 apical spines in 1 row, no dorsolateral spines.

Description (female). *Body* (Fig. 83): pleon sparsely armed dorsally, 2 setae on pleonite 2, no spine on each side on pleonite 5, 1 spine on each side on pleonite 6; length, up to 5.0 mm.

Head: rostrum [?small]; eyes vestigial, white in life.

First antenna (Fig. 83): length 0.4 of body, 1.7 second antenna; peduncle much shorter than flagellum, article 1 longest, article 3 shortest, setae sparse, article 3 without medioposterior calceolus; flagellar articles lacking calceoli, 1 aesthetasc each on articles 5 to penultimate article (ultimate = 14); accessory flagellum 2-articulate, not reaching past article 2 of flagellum; flagellum articles uniform, sparsely setulate. *Second antenna* (Fig. 83): length 0.33 body; peduncle longer than flagellum, article 4 scarcely longer than 5, articles 3,4 and 5 with weak ventral setation; flagellum 7-articulate, weakly setose, lacking calceoli.

Left mandible (Fig. 83): palp article 3 shorter than 2, article 2 with 5 inner marginal setae, article 3 with 0A, 1B, 2C, many D, 5E; incisor 5-toothed, lacinia mobilis 4-toothed, 4 setose accessory blades; molar [?bearing] plumose seta, and [?] penicillate hooked brushy basal setae. *Right mandible* (Fig. 83): incisor [?3]-toothed; lacinia mobilis bifid, denticulate, [?1 denticulation strongly extended]; accessory blades of 2 plumose spines, setae of palp article 3 [unknown]. *Left first maxilla* (Fig. 83): palp article 2 with 6 thin apical spines and [?1] subterminal facial seta; outer plate with 7 spines, most denticulate; inner plate with 2 apical setae. *Right first maxilla* (Fig. 83): palp article 2 with 5 thick apical spines articulated to segment, 1 apicolateral thinner spine, 1 subterminal apicolateral facial seta. *Second maxilla* (Fig. 83): outer plate outer margin naked, apicolateral corner with long plumose seta, apicomedial corner of inner plate naked. *Maxilliped* (Fig. 83): palp article 3 with [?ranks] of thin setae on inner edge, [?apical part with rank of thicker bifid-setae], apex weakly produced and [?weakly

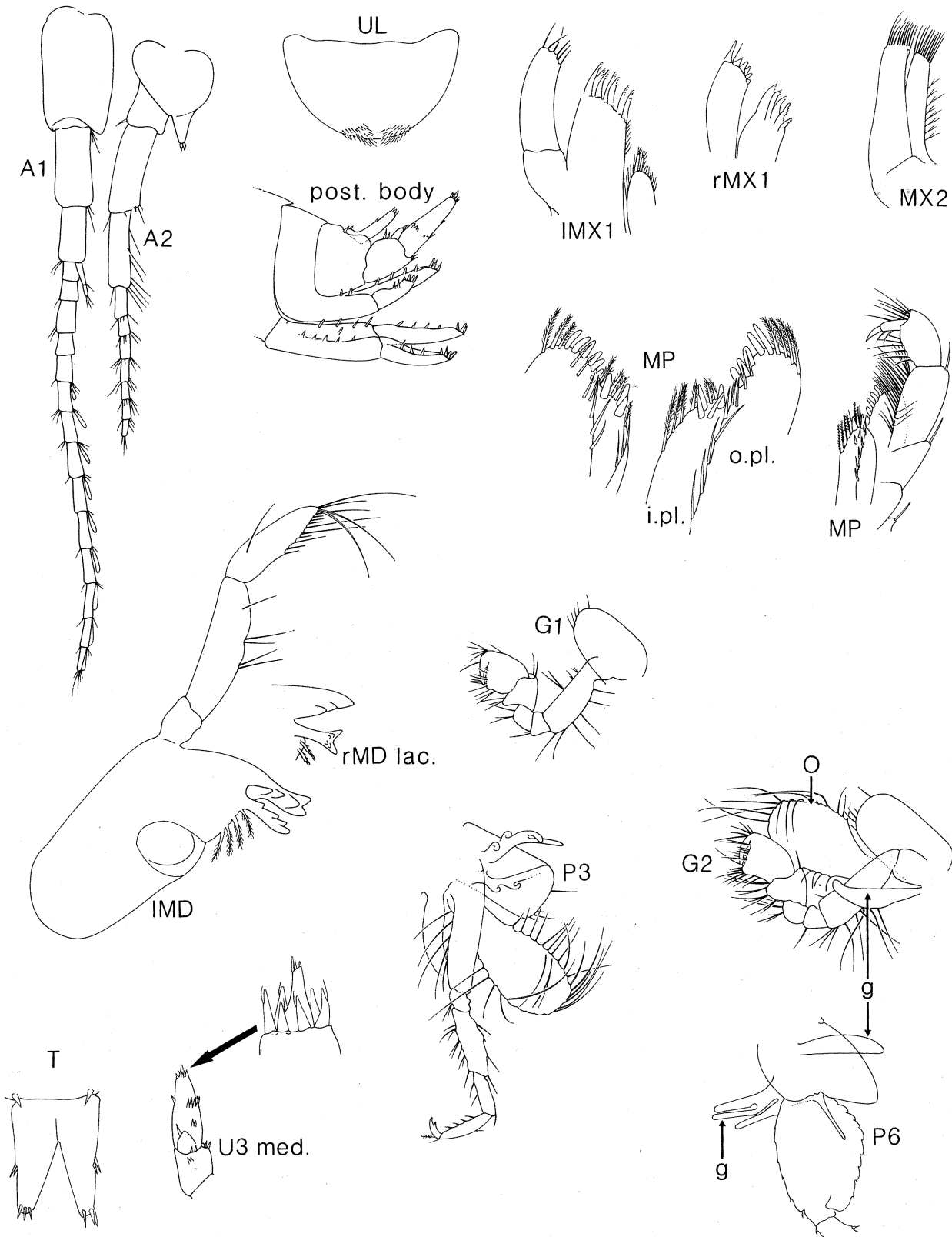


Fig.83. *Neoniphargus obrieni* Nicholls, female, all drawings rearranged and re-inked from Nicholls (1927a, figs 1, 2 and pl. ix [figs 1-10]).

rugose]; inner plate with 2-gap-1 thick spines and several plumose setae apically, medial row of 4 plumose setae, and [?] ventrofacial spine.

First gnathopod (Fig. 83): coxal plate with 5 setae apically; article 4 without posterior hump; carpus short and lobate, lobe straight and setose apically, [?faintly rugose]; propodus trapezoidal, not longer than wide, posterolateral angle rounded, [?faintly rugose], with [?] medial and [?] lateral spines, 1 lateral spine [?elongate], palm subtransverse, weakly convex; dactylus reaching end of palm. *Second gnathopod* (Fig. 83): slightly larger than first gnathopod; carpal lobe thicker, palm straight; palmar corner with [?] spines; coxal plate with 5 setae.

Pereopods (Fig. 83): coxa 3 with 4 ventral setae, coxa 4 deeply emarginate, with 1 anteroventral and [?] posterior setae; pereopods 3-4 longer than gnathopod 2, pereopod 3 [?not] longer than 4, article 4 weakly setose posteriorly, article 5 of pereopods 3-4 weakly setose posteriorly, posterior margin of article 6 on pereopods 3-4 with spine formulas of [?]1-1-1-?] and [?]; pereopods 5-7 similar, coxae lacking spines on ventral margin of posterior lobe, article 2 expanded and lobate posteroventrally, [?bearing] medium-long thick posterior setules, that of pereopod 6 slightly narrowed, that of pereopod 5 broadened and strongly lobate; posterior margins of propodi of pereopods 5-7 [?lacking] long setae; dactyls of pereopods 3-7 with only [?] marginal seta (pereopod 3 confirmed). Coxal gills apparently [2-6]. Oostegites broad.

Sternal processes (Fig. 83): 5 pairs of dendritic, sternal gills present on segments 3-6, [?attached to middle of lateral edge of each segment].

Epimera: epimera 1,3, with angular posteroventral corner, epimeron 2 with small posteroventral tooth, posterior margin of epimeron 2 sinuous, of epimeron 3 notched, [?almost straight, epimera 1 and 2 each with 1 anteroventral spine] "...near anterior corner of the inferior margin of the pleon segments are a couple of stout setae, notched subapically and set with a cilium (male segment 2 with 3 of the setae)." *Pleon*: pleonites 1-6 with following setal formula: 0-2-0-0-0-0, spines = 0-0-0-0-0-1; uropod 3 extending well beyond uropods 1 and 2 in entire animal, uropod lengths relative to uropod 1: uropod 2 = 0.75, 3 = 0.60. *Pleopods*: retinacula [?] per pleopod, [?no] accessories; each peduncle with [?] seta.

First uropod (Fig. 83): peduncle length 1.25 rami, outer margin with [?no] apicodistal spine but strong row of 5 short dorsal spines, with 4 spines medially; outer ramus shortened, both rami with [?] rows of 3 and 4 marginal spines, outer ramus with 4 and inner ramus with 3 apical spines [possibly some overlooked]. *Second uropod* (Fig. 83): peduncle about same length as inner ramus, with 2 dorsolateral spines [?and 1 apical]; outer ramus much shorter than inner, both with [?] strong row of 2 and 4 marginal spines, apices with 4 and 3 spines [?some overlooked]. *Third uropod* (Fig. 83): peduncle length 0.55 outer ramus, as long as urosomite 3, with pair of upper, subdistal spines

besides apical cluster of [?]; outer ramus proximal article with [?] transverse lateral spine rows on body, medial margin with 3 sets of spines, from proximal to distal spines = 2-4-6, setae = 0, apex of tiny article 2 with 3 apical short stiff setae; inner ramus length 0.26 of outer, with 1 apicolateral spine. *Telson* (Fig. 83): elongate, as long as urosomite 3; cleft 60 percent of its length; apices each with 3 spines in 1 row, lateral margins each with 2 spines, each lobe [?with pair of penicillate setules dorsolaterally at M. ?].

Description (male). Calceolus on each of articles 3-6 of flagellum on antenna 2; calceoli also apparently present on antenna 1; epimeron 3 with 3 facial spines.

Illustrations. It is not certain if all mouthparts figured by Nicholls were from a female, but it is likely that they were from the same specimen upon which the other drawings were based and clearly captioned as female.

Relationships. There are no features of *N. obrieni* which uniquely distinguish it from other species of *Neoniphargus*; rather, it is the given combination of characters (and the absence of characters uniquely specific to certain species) which isolate it. *N. alpinus* and *N. exiguus* are similarly distinguished. However, from these two species, in particular, *N. obrieni* is distinguished by its elongate telson, the apparent absence of a large apicomedia peduncular spur on the male first uropod, BCDE setae on article 3 of the mandibular palp, and the occurrence of special medial setae at the palmar corner of the gnathopods.

From the type species of the genus, *N. thomsoni*, *N. obrieni* differs *inter alia* in its extensive uropod 3, which extends in the whole animal beyond uropods 1-2, by the short spines on uropods 1-2, and by its elongate telson with some dorsal spines. From *N. thomsoni*, as well as from *N. spenceri*, *N. fultoni* and *N. tasmanicus*, it differs of course, in those characters which uniquely distinguish these species (as discussed *seriatim* in our consideration of the relationships of these species).

Distribution. Victoria, Mt Buffalo, 1460 m, beneath surface of bogmass.

Neoniphargus alpinus G.W. Smith

Figs 84-86

Neoniphargus alpinus Smith, 1909a: 75, pl. 14, figs 13-16.
Not *Neoniphargus alpinus* Smith. Straškraba 1964: 125-126, fig. 1.

Type material. Material attributed to this species by Smith is located in the Hope Museum, Oxford. Labels read: (1) "*Neoniphargus alpinus*, Smith. Mount Read Tarn. Tasmania. 1907-8. G.W. Smith Esq. Ref. No. 5396. Cotypes"; (2) "*Neoniphargus alpinus*"; (3) "Mt. Read Tarn".

The material comprised 25 specimens, many damaged: 16 males, 5 non-ovigerous females, and 4 ovigerous females. Of these, 3 males and 1 ovigerous female were dissected. Examination of dissected material suggested the occurrence of two species; the

most notable indicator was the presence in 2 males of a very large apicomedial spine or spur on uropod 1, and the absence of such a spur in the other male. Examination of all males in the material available yielded a ratio of 5:11 for males with and without a first uropodal spur. Smith's original description of *N. alpinus* is very meagre, so that it is not possible to decide unequivocally which of the taxa before us had been described by him. However, on balance, it seems that males with a first uropodal spur can best be regarded as belonging to the taxon described by Smith, and in the interests of stabilizing the position on this matter we have selected one of the spurred males as the lectotype of *N. alpinus*.

With regard to the female selected, few differences could be discerned between it and the LECTOTYPE now designated, but again it is not possible to be certain as to which of the two taxa apparently present it belonged. This female, all other females, and all non-spurred males were set aside and are not described in this paper. For the present, our redescription of *N. alpinus* rests only upon our examination of the selected lectotype and one further syntype (spurred) male. Straškraba's (1964) additional notes on the species are of no diagnostic value; indeed his material was not *N. alpinus* on the basis of his meagre description. Its identity remains indeterminate.

Diagnosis. Articles 1 and 2 of peduncle antenna 1 subequal. Antenna 2 without calceoli in males. Article 2 of mandibular palp longer than article 3 and almost setoseless, article 3 with BCDE setae. Palms of gnathopods in males not excavate, palmar corner without special medial spines. Coxa 4 deeply excavate in [?both] sexes. Dactyli of pereopods 3–7 with only 1 spine on inner margin. Articles 4–6 of pereopods 5–7 with several long setae on posterior margins as well as elongate basodactylar setae; anterior margins of article 6 with about 4 sets of thin setae-spines (besides locking spines); coxae 5–7 with weak spines on posterior lobes. Coxal gills 2–6, 7 absent. Epimeron 2 with 2 facial spines. Uropod 3 extending beyond uropods 1–2 in whole animal. All spines on uropods 1–2 short or of only medium size. Peduncle of uropod 1 in males with very long spine (spur) with complex tip at apicomedial corner. Uropod 3 peduncle 0.45 outer ramus; outer ramus spines arranged in multiples, in 3–4 lateral and medial rows, no medial plumose setae; inner ramus 0.2 outer ramus, with 1 apical spine. Telson short, cleft about halfway, each lobe with 2 apical spines in 1 row, 1 apicolateral setule and no dorsolateral spines.

Description of lectotype (male). *Body:* smooth, except for a few spines on the dorsal part of the urosome; length 8 mm.

Head (Fig. 84): rostrum short; eyes very large, reniform, situated close to anterior margin of head; inferior antennal sinus shallow (not illustrated).

First antenna (Fig. 84): length 0.4 body, 1.6 second antennae; peduncle length 0.8 flagellum, articles 1 and 2 subequal, article 3 length 0.8 articles 1 and 2, all

articles with several short marginal setae; accessory flagellum 2-articulate, reaching well-beyond flagellum article 1; flagellum 14-articulate, articles 6–13 with aesthetascs. *Second antenna* (Fig. 84): length 0.2 body; peduncle longer than flagellum, article 4 longer than 5, both 4 and 5 with a few short setae; flagellum 8-articulate, moderately setose, lacking calceoli.

Left mandible (Fig. 84): palp article 3 slightly shorter than 2, article 3 setal formula = 0A, 3B, 2C, many D, 3E, article 2 with only 2 moderately long setae on inner edge; incisor 5-toothed; lacinia mobilis 4-toothed; 4–5 large setose accessory blades; molar with sparse basal armament. *Right mandible* (Fig. 84): incisor 4-toothed; lacinia mobilis with 2 serrate cutting edges; accessory blades of 3 setose spines. *Left first maxilla* (Fig. 84): palp article 2 with 5 long thin spines and 2 subapical setae; outer plate with 7 denticulate spines distally; inner plate with 3 plumose spines distally. *Right first maxilla* (Fig. 84): palp article 2 with 3 short conical spines distally, 1 longer apicolateral spine; inner plate with 2 plumose setae distally. *Second maxilla* (Fig. 84): outer plate with apicolateral seta, inner plate with 5 apicomedial setae, distalmost slightly submarginal. *Maxilliped* (Fig. 84): palp article 3 with distal rugose lobe and several facial setae in 2 rows; inner plate with 3 tooth-spines distally, 1 ventrofacial spine.

First gnathopod (Fig. 85): coxal plate with 4 setae on distal margin; carpus with bent rugose lobe at posterodistal angle; propodus subquadrate, length 1.25 width, palm almost straight, posterior margin rugose, posterodistal angle with 4 lateral spines (short to long), no distinctive medial ones. *Second gnathopod* (Fig. 85): larger than first gnathopod; propodus almost rectangular, length 1.3 width.

Pereopods (Fig. 86): coxa 3 with 5 ventral setae, coxa 4 deeply emarginate, with 1 anteroventral and 4 posterior setae; length longest pereopod (6) 1.2 gnathopod 2; pereopod lengths (relative to pereopod 6): pereopod 3 = 0.6, 4 = 0.6, 5 = 0.9, 7 = 0.8; pereopods 3 and 4 similar, basodactylar armaments short, dactyli long and slender; pereopods 5–7 similar, basodactylar armaments long and fine, dactyli long and slender with 1 inner marginal spine, posterior margins of propodi (6,7) with a few long and extremely fine setae; posterior margins of article 2 with short setules; coxal gills on pereopods 2–6.

Sternal processes (Fig. 86): 5 pairs of dendritic processes on sterna of pereon segments 2–6 [?3–7].

Epimera (Fig. 85): posterodistal corners of epimera 1 and 3 with tiny tooth, of epimeron 2 square, ventral margin of epimeron 1 with 1 spine; anteroventral submargins of epimera 2 and 3 with 2 strong spines.

Urosome (Fig. 85): urosomites 2 and 3 with a few dorsal spines; uropod 3 extending beyond uropods 1 and 2 on entire animal, but uropod lengths (relative to uropod 1): uropod 2 = 0.7, 3 = 0.73. *Pleopods* (Fig. 86): retinacula 2, no accessory retinacula; peduncular setae sparse.

First uropod (Fig. 85): peduncle length 1.4 inner

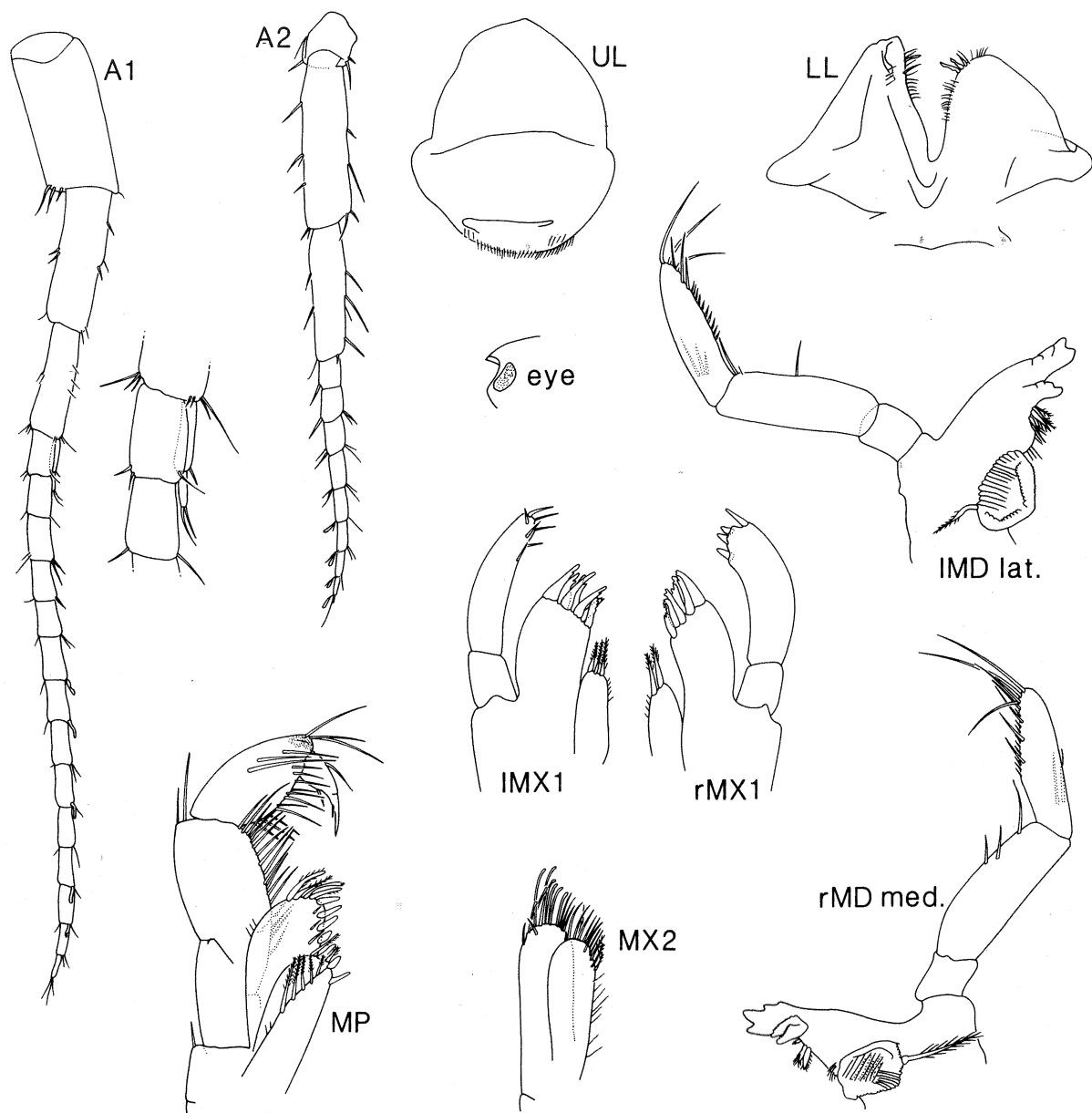


Fig. 84. *Neoniphargus alpinus* G.W. Smith, lectotype, male.

ramus, inner and outer margins with several strong spines, inner distal corner with very long spur (0.5 length of inner ramus) with tip of complex structure; inner ramus longer than outer ramus, both rami with several strong medium-sized spines on dorsal margins [?in single row on outer ramus] with 4 and 5 apical spines, some elongate. *Second uropod* (Fig. 85): peduncle slightly (1.1) longer than inner ramus, with prominent apicolateral spine; inner ramus slightly longer than outer ramus, both rami with several strong short spines on dorsal margins [?in single rows] and 4 or 5 apical spines, 1 slightly elongate. *Third uropod* (Fig. 85): peduncle length 0.45 outer ramus, with some long spines on distal margin and 3 on body; outer ramus length about 6 inner ramus, distal article small,

proximal article with 3–4 short transverse rows of robust spines on lateral and medial margins, none plumose; inner ramus 0.17 length outer ramus, scale-like, oval, with single distal spine. *Telson* (Fig. 85): short, as long as wide; cleft extending 50 percent length; each lobe with 2 robust spines distally and 1 apicolateral and 1 midlateral setule about M.65.

Description of syntype (male). *Body*: length 9 mm.

First antenna: length 1.9 second antenna.

Left first maxilla: inner plate with 4 plumose setae distally, inner margin pubescent. *Right first maxilla*: palp article 2 with 5 short conical spines distally; inner plate with 5 plumose setae distally.

First uropod: large spine (spur) on apicomedial

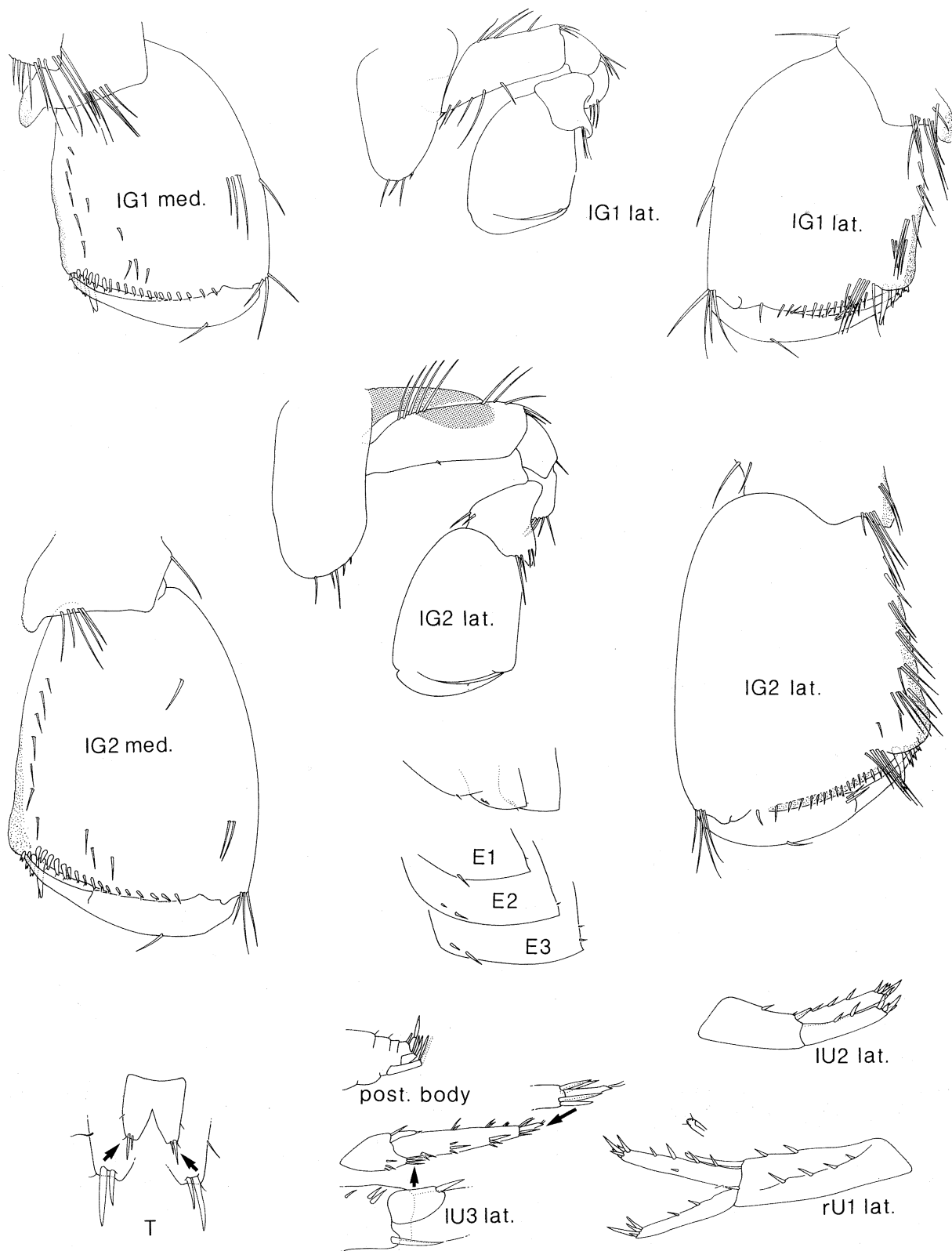


Fig.85. *Neoniphargus alpinus* G.W. Smith, lectotype, male.

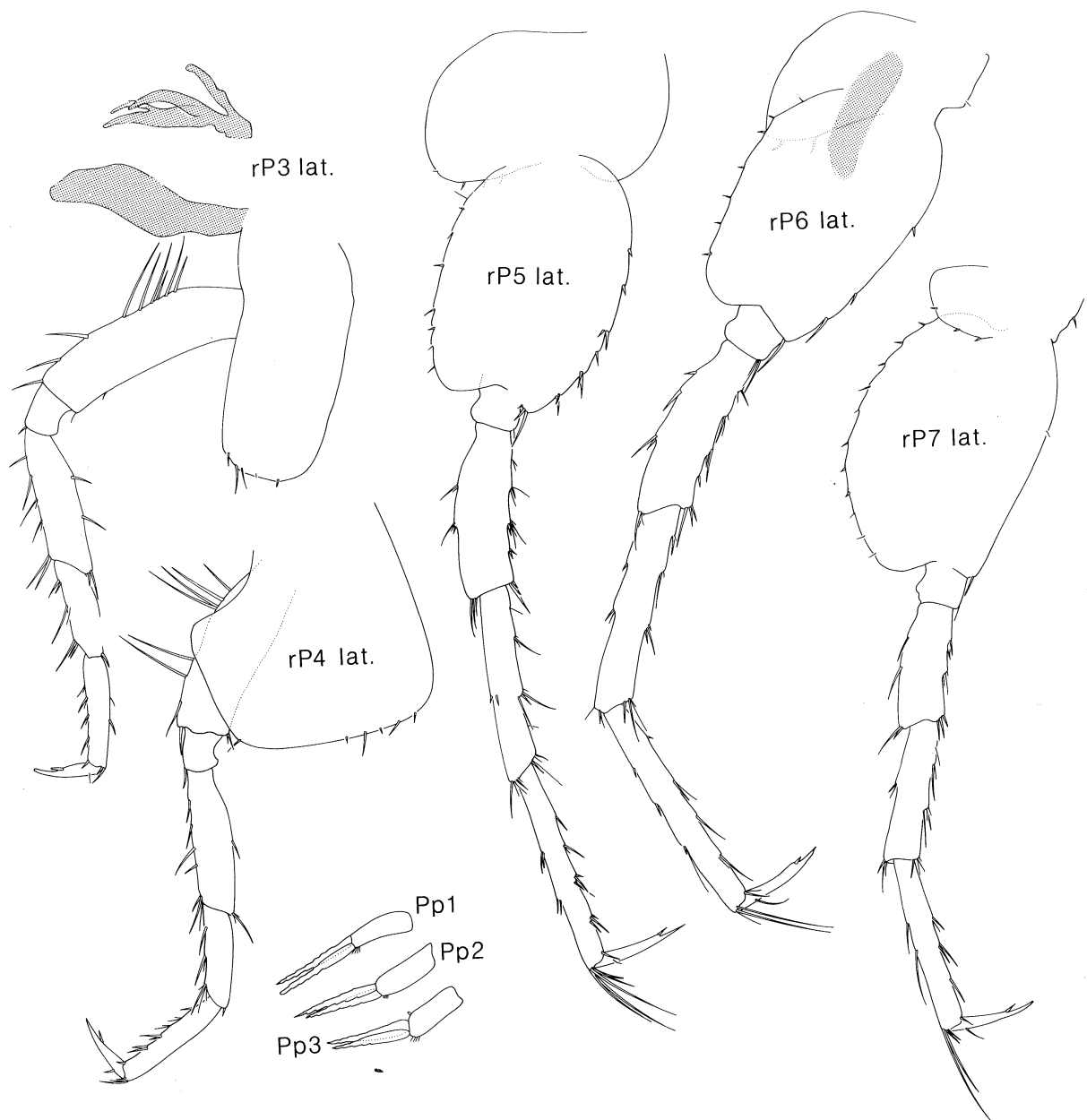


Fig.86. *Neoniphargus alpinus* G.W. Smith, lectotype, male.

corner of peduncle.

Relationships. As noted in our discussion of the relationships of *N. obrieni*, *N. alpinus* does not appear to have any uniquely specific characters which isolate it from other species in the genus (see above).

From *N. thomsoni*, the type species, however, it is distinguished especially by its lack of calceoli in males, the presence of long setae on articles 4–6 of pereopods 5–7, its lack of coxal gill 7, its short spines on uropods 1–2, and its extensive uropod 3.

The presence of a long peduncular spur with a complex tip on uropod 1 of males is the most obvious difference between *N. alpinus* and *N. spenceri*, *N.*

fultoni, *N. tasmanicus* and (perhaps) *N. obrieni*. These species do not have this spur. The species to which *N. alpinus* appears most closely related is *N. exiguus*. Smith (1909a), too, noted the close resemblance of the two species. According to him, however, the two differed by having "...joints of pereopods, as a whole, longer and thinner." Point by point comparison of his descriptions of the two species in fact provided 11 characters by which they apparently differed. However, of these, only two withstood a comparison using our redescriptions of syntype material, namely, the presence or absence of long setae on the posterior margins of the propodi of pereopods 5–7 in *N. alpinus*,

and the presence of dorsolateral spines on the telson of *N. exiguus*. Our comparison elicited no differences between the two species in the dimensions of pereopod articles. Two important distinguishing characters not noted by Smith are the presence or absence of calceoli on the second antennae of males, and the presence or absence of coxal gill 7. Thus, these two species are most reliably distinguished by the following four characters:

| | <i>N. exiguus</i> | <i>N. alpinus</i> |
|---|-------------------|-------------------|
| (1) calceoli on antenna 2 (male) | present | absent |
| (2) long fine setae on posterior margins of propodi of pereopods 5–7 or 6 and 7 | absent | present |
| (3) dorsolateral spine(s) on telson | present | absent |
| (4) coxal gill 7 | present | absent |

Distribution. Tasmania, Mt Read Tarn.

Neoniphargus exiguus G.W. Smith

Figs 87–89

Neoniphargus exiguus Smith, 1909a: 74, pl. 14, figs 1–4.

Type material. Material attributed to this species by Smith is located in the Hope Museum, Oxford. Labels read: (1) “Oxford University Museum, Amphipoda [*Neoniphargus*] *exiguus* Smith [Ref. No.] 5393 ... Cotypes”; (2) “*Neoniphargus exiguus*, Smith. Coffee Creek, Huntingfields, Tasmania, Dec. 1907. G.W. Smith Esq., Ref. No. 5393, Cotypes”; (3) “Coffee Creek, Huntingfields, Dec. 07”; (4) “*Neoniphargus exiguus*”.

The material comprised 26 specimens, some slightly damaged: 14 males, 4 ovigerous females, 7 non-ovigerous females, and 1 specimen of indeterminate sex. A large undamaged male was selected as the LECTOTYPE and fully dissected. Also dissected were 1 male and 1 non-ovigerous female.

Diagnosis. Articles 1 and 2 of peduncle antenna 1 subequal. Antenna 2 with calceoli in males. Article 2 of mandibular palp shorter than article 3 and moderately setose, article 3 with BCDE setae. Palms of gnathopods in males not excavate, palmar corner without special medial spines. Coxa 4 deeply excavate in [?both] sexes. Dactyli of pereopods 3–7 with only 1 spine on inner margin. Articles 4–6 of pereopods 5–7 almost setoseless except for elongate basodactylar setae on pereopod 5; anterior margins of article 6 with about 6 spine sets (besides locking spines); coxae 5–7 with weak spines on posterior lobe. Coxal gills 2–7. Epimeron 2 with 3 facial spines. Uropod 3 extending beyond uropods 1–2 in whole animal. All spines on uropods 1–2 short. Peduncle of uropod 1 in males with very long spine (spur) with complex tip at apicomedial corner. Uropod 3 peduncle 0.6 outer ramus; outer ramus spines arranged in multiples, in a few (about 3) lateral and medial spine rows, no medial plumose setae; inner ramus 0.25 outer ramus, with 1 apical spine. Telson short, cleft more than halfway, each lobe

with 2–3 apical spines and 1 midlateral spine.

Description of lectotype (male). *Body* (Fig. 87): smooth; length 9 mm.

Head (Fig. 87): eyes large and reniform.

First antenna (Fig. 87): length 0.3 body, 1.4 second antenna; peduncle slightly shorter than flagellum, articles 1 and 2 subequal, article 3 shortest; accessory flagellum 2-articulate, reaching slightly beyond distal margin of flagellum article 1; no article of antenna markedly setose. *Second antenna* (Fig. 87): length 0.15 body; peduncle longer than flagellum, article 5 distinctly shorter than article 4, articles 3–5 with a few short setae; flagellum 6-articulate, sparsely setose, with basal 3 articles bearing calceoli.

Left mandible (Fig. 87): palp article 3 longer than 2, 2 with a few setae on inner edge, 3 with setal formula of 0A, 4B, 3C, many short D, 2E; incisor and lacinia mobilis 4-toothed; about 3 major accessory blades of serrate teeth to plumose spines; molar with anterior brush of fine setae. *Right mandible* (Fig. 87): incisor vaguely 4-toothed; lacinia mobilis with 2 serrate cutting edges; 2 serrate accessory blades and 2 interraker plumose spines. *Left first maxilla* (Fig. 87): palp article 2 with 7 long thin blunt spines distally; outer plate with 7 denticulate spines distally; inner plate with 4 plumose setae distally and inner and outer margins finely pubescent. *Right first maxilla* (Fig. 87): [palp lost]. *Second maxilla* (Fig. 87): inner plate lacking any medial setae besides pubescence. *Maxilliped* (Fig. 87): palp article 3 with rugose lobe and sparse medial setae; outer plate ovate with distal to medial margins bearing row of plumose spine-teeth grading to large blunt non-plumose spine-teeth.

First gnathopod (Fig. 88): coxal plate with several setae, some long, on distal rounded margin; carpus with rugose lobe at posterodistal angle; propodus subrectangular, length 1.3 width, posterolateral angle and distal half of posterior margin rugose with several groups of small setae, palm slightly convex, with 4–5 spines at lateral posterodistal angle of propodus. *Second gnathopod* (Fig. 88): larger than first gnathopod; carpus with rugose lobe at posterodistal angle; propodus rectangular, length 1.4 width, posterodistal angle and distal half of posterior margin rugose, with 4 spines.

Pereopods (Figs 88,89): coxa 3 with about 8 medium ventral setae, coxa 4 emarginate with several anteroventral and posterior setae; length longest pereopod (6) 1.7 gnathopod 2; pereopod lengths (relative to pereopod 6): pereopod 3 = 0.7, 4 = 0.7, 5 = 0.8, 7 = 0.7; pereopods 3 and 4 similar, propodi with row of short single spines on posterior margin, basodactylar spines (from distal margin of propodus) not long; pereopods 5–7 similar, posterior setules of article 2 short, propodi with 6 anterior sets of short spines, several short (not long) posterior spines, basodactylar spines (especially on pereopod 5) fine and long, but other spines not long; dactyli of pereopods 3–7 with 1 inner marginal spine and in pereopods 5–7 also with setule at nail articulation. Coxal gills on

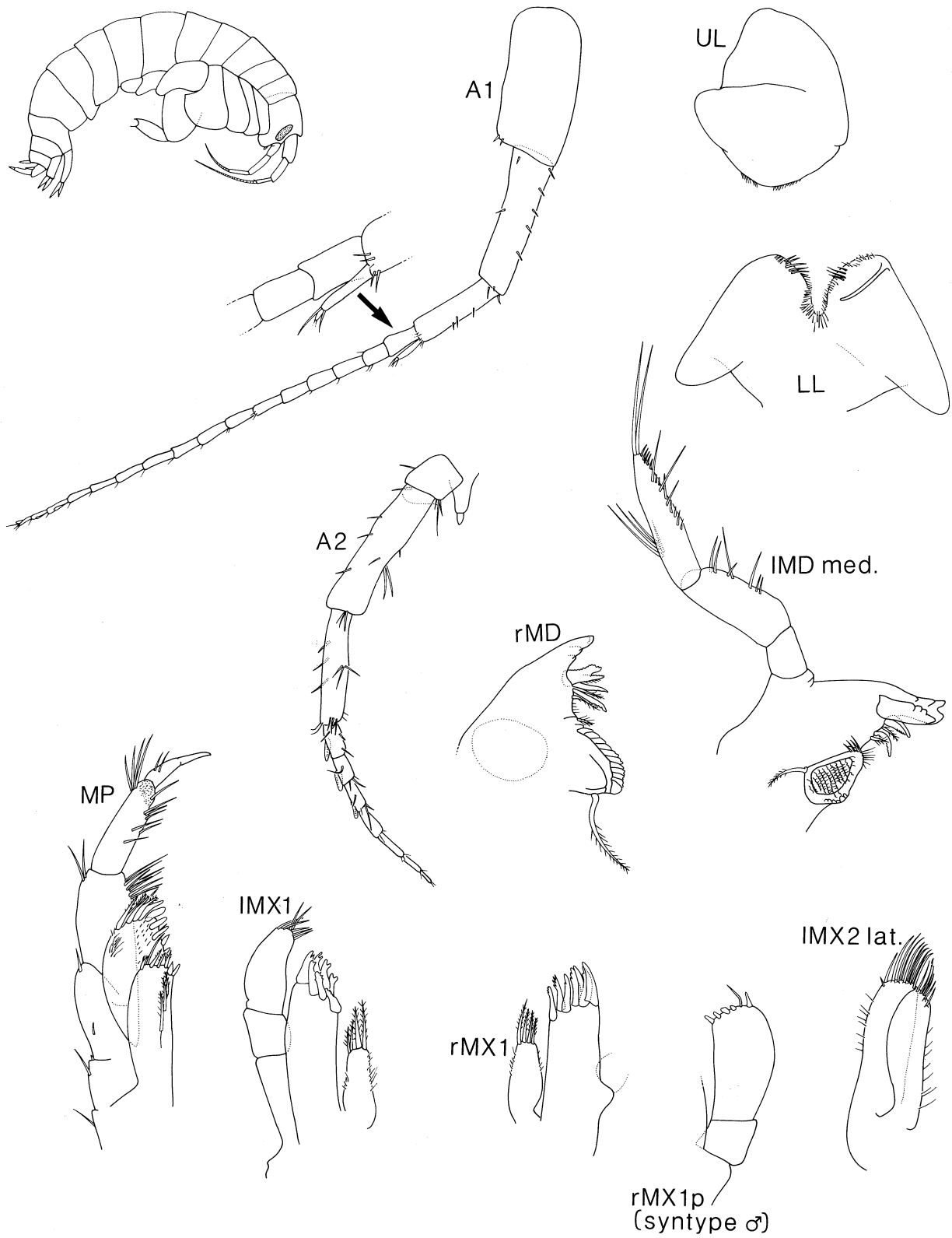


Fig.87. *Neoniphargus exiguus* G. W. Smith, lectotype, male (all drawings except one indicated); syntype, male (rMX1p).

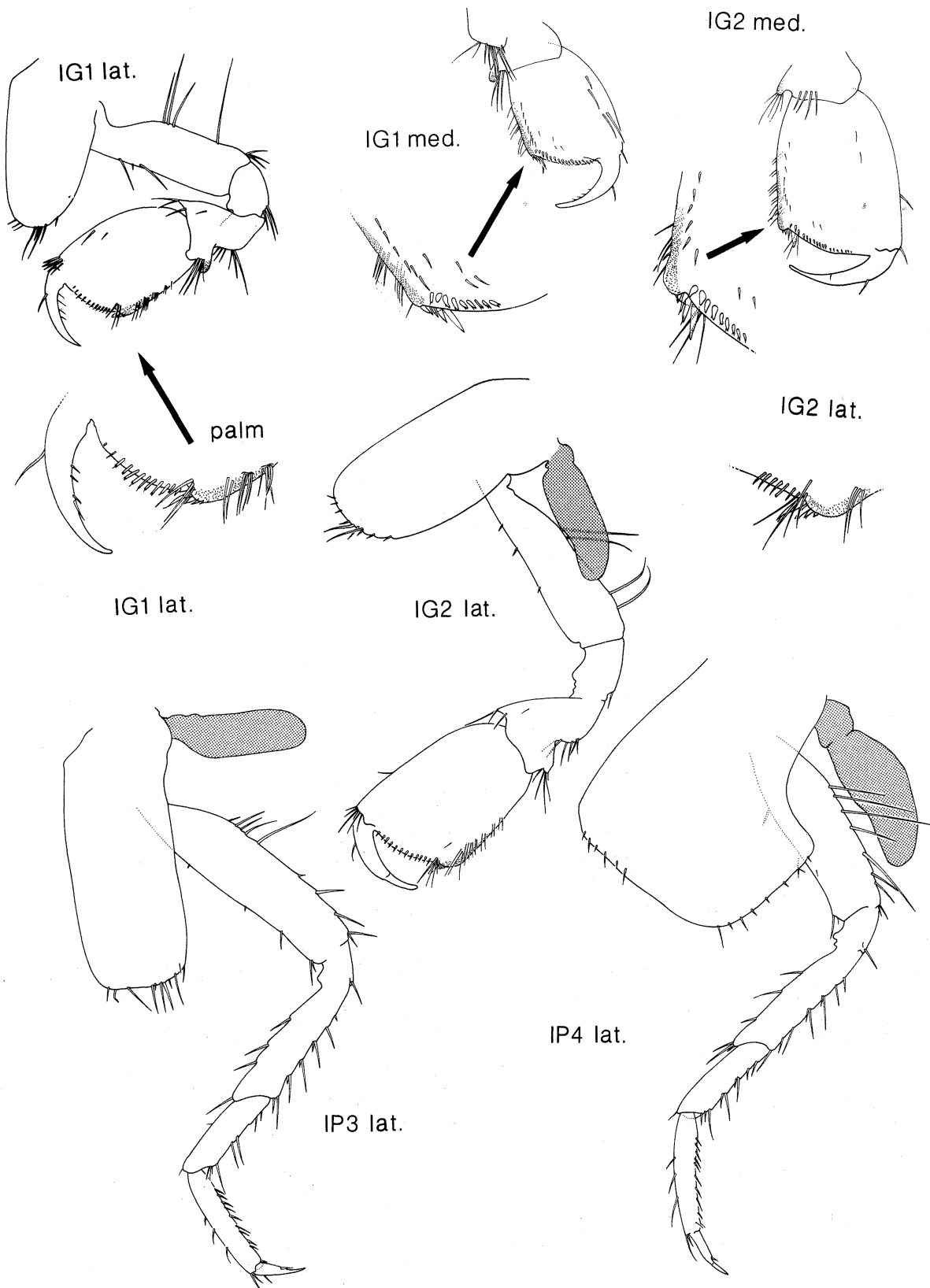


Fig.88. *Neoniphargus exiguus* G.W. Smith, lectotype, male.

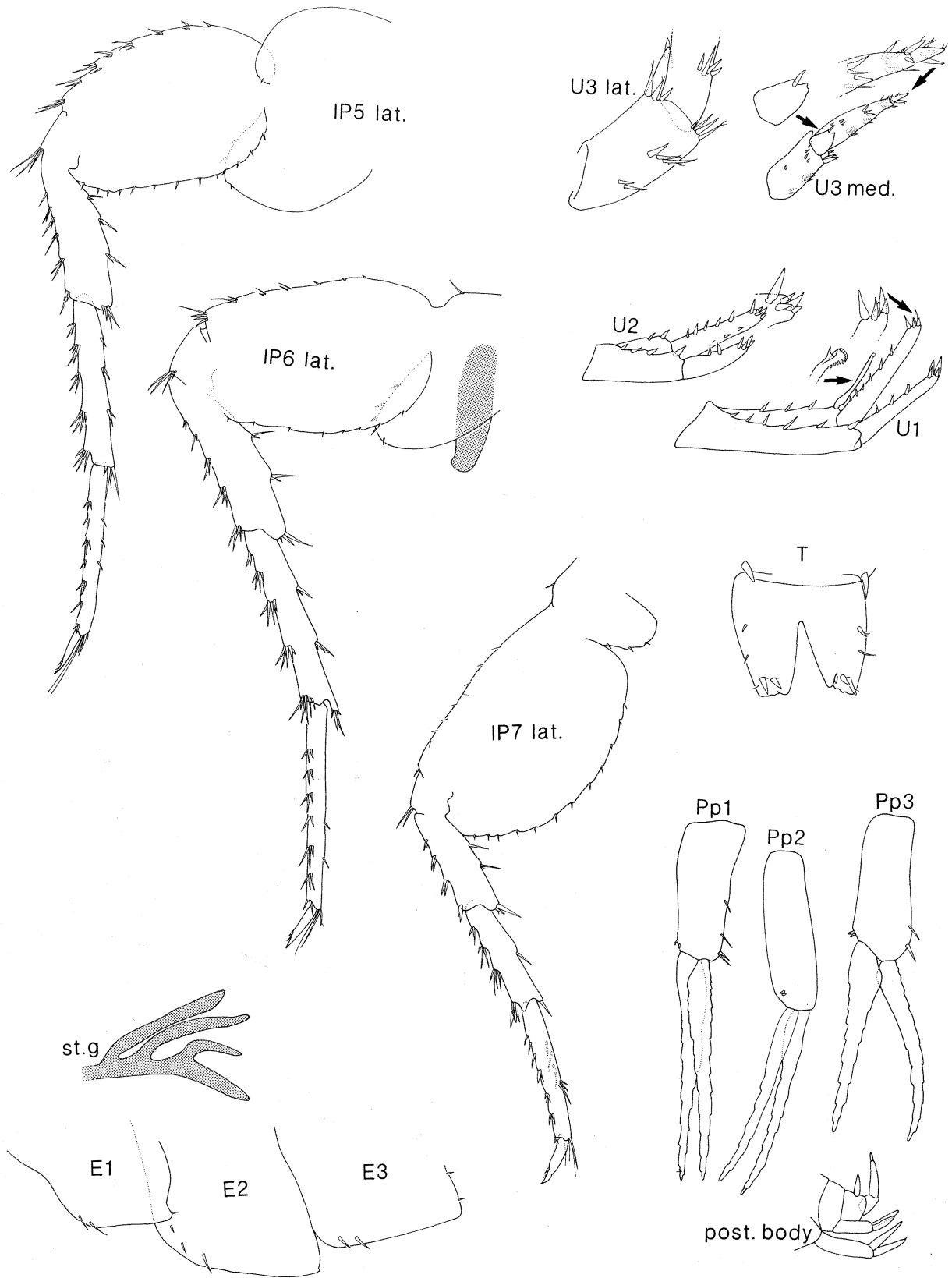


Fig.89. *Neoniphargus exiguus* G.W. Smith, lectotype, male.

pereopods 2–7, gill 7 somewhat reduced.

Sternal processes (Fig. 89): 4 pairs of sternal dendritic processes on pereonites 3–6.

Epimera (Fig. 89): epimeron 1 anterodistal angle with 2 spines, posterodistal angle with blunt tooth; epimera 2 and 3 subquadrate, anterodistal faces with 3 and 2 submarginal spines respectively. *Urosome* (Fig. 89): uropod 3 extending beyond uropods 1 and 2 on entire animal, but uropod lengths (relative to uropod 1): uropod 2 = 0.6, 3 = 0.56. *Pleopods* (Fig. 89): retinacula 2, no accessories, peduncles poorly setose.

First uropod (Fig. 89): peduncle length 1.4 inner ramus, medial and lateral margins with several strong spines, inner distal angle bearing extremely long spur (0.6 length of inner ramus) with complex terminal structure; inner ramus distinctly longer than outer ramus, both rami with several short marginal spines [in ?2 rows] and group of apical spines. *Second uropod* (Fig. 89): peduncle same length as inner ramus, with 4 lateral and 2 medial marginal spines; inner ramus distinctly longer than outer ramus, both rami with several short marginal spines [in ?2 rows] and group of apical spines. *Third uropod* (Fig. 89): peduncle length 0.6 outer ramus, with several strong spines on distal margin and 2 ventral groups of facial spines; outer ramus length about 4 inner ramus, 2-articulate, distal article quite distinct, proximal article with 3 medial and lateral transverse rows of short spines; inner ramus scale-like, triangular, with 1 short, strong distal spine. *Telson* (Fig. 89): slightly broader than long, cleft extending 0.7 length; lobes truncate, each with 2 or 3 distal spines and 1 midlateral submarginal spine, plus penicillate setule near M.67.

Description of syntype (male). *Body*: length 7 mm; posterodorsal margins of urosomites with several spines.

Right first maxilla (Fig. 87): palp article 2 with 4 short spines, 1 longer apicolateral spine distally, 1 subapical facial seta.

Pereopods: propodi of pereopods 5–7 with a few long setae on posterior margins.

Description of syntype (non-ovigerous female). *Body*: length 11 mm; posterior dorsal margins of urosomites with a few spines.

Second antenna: no calceoli on flagellum.

Left first maxilla: inner plate with 5 plumose spines distally. *Right first maxilla*: palp article 3 with 6 short teeth distally; inner plate with 5 plumose spines distally.

Pereopods: propodi of pereopods 3 and 4 with a few long setae on posterior margins.

First uropod: peduncle lacking long spur at medial distal angle.

Partial description of remaining 12 male syntypes. *Body*: lengths 7–10 (\bar{x} = 7.5) mm.

First antenna: length 0.3–0.5 (\bar{x} = 0.35) body, 1.3–1.9 (\bar{x} = 1.6) second antennae. *Second antenna*: length 0.14–0.28 (\bar{x} = 0.2) body.

Urosome: uropod lengths (relative to uropod 1):

uropod 2 = 0.5–0.8 (\bar{x} = 0.6), 3 = 0.5–0.9 (\bar{x} = 0.6).

Partial description of remaining 10 female syntypes.

Body: lengths 9.8–11 (\bar{x} = 10.3) mm.

First antenna: length 0.3 body, 1.2–1.8 (\bar{x} = 1.5) second antennae. *Second antenna*: length 0.17–0.25 (\bar{x} = 0.20) body.

Urosome: uropod lengths (relative to uropod 1): uropod 2 = 0.6–0.8 (\bar{x} = 0.7), 3 = 0.4–0.8 (\bar{x} = 0.6).

Relationships. Our remarks on the relationships of the preceding species, *N. alpinus*, are also generally applicable to *N. exiguus*. Thus, this species too has no uniquely specific characters; it differs from *N. thomsoni inter alia* in the occurrence of short spines on its uropods 1–2 and extensive uropod 3; the presence of a long peduncular spur on uropod 3 of males most obviously distinguishes it from *N. spenceri*, *N. fultoni*, *N. tasmanicus* and (perhaps) *N. obrieni*; and it appears closely related to *N. alpinus* (but see our previous tabulation and discussion of differences between *N. alpinus* and *N. exiguus*).

Distribution. Tasmania, Huntingfields, Coffee Creek.

Neoniphargus tasmanicus G.W. Smith

Figs 90–94

Neoniphargus tasmanicus Smith, 1909a: 74–75, pl. 14, figs 5–8.

Non *Neoniphargus tasmanicus* Smith. Straškraba 1964: 126–128, fig. 2.

Type material. Material attributed to this species by Smith is located in the Hope Museum, Oxford. Labels read: (1) “*Neoniphargus tasmanicus*, SMITH Great Lake, Tasmania 1907–8 G.W. Smith Esq. REF. NO. 5394 Cotypes”; (2) “Great Lake”; (3) “*Neoniphargus tasmanicus*”.

The material comprised 22 specimens, in two distinct taxa. One taxon (10 specimens) was not referable to *N. tasmanicus* as briefly described by Smith; of significant differences, the greater numbers of setae on the antennae and other appendages were the most obvious. This taxon was declared a new genus and species (see previous discussion of *Tasniphargus tyleri*). The other taxon (12 specimens) was in general accord with Smith’s description in so far as it agreed with the few characters described by him. This taxon was regarded as syntype material, and comprised 2 males, 3 ovigerous females (1 incomplete), and 7 non-ovigerous females. A large undamaged non-ovigerous female was selected as LECTOTYPE and fully dissected. Also fully dissected were the 2 male syntypes, designated males “m” and “n”. One of us (JLB) is of the opinion that these males may be neotenic males of another species. This matter remains for final resolution; for the present they are regarded as conspecific with the lectotype. A further syntype (an ovigerous female) was partially dissected.

We note that the material examined by Straškraba (1964) and identified by him as *N. tasmanicus* is

certainly not this species: Straškraba's material had calceoli on antenna 2 whereas *N. tasmanicus* lacks calceoli in males. Straškraba's description is too meagre for us to be able to assign his material to any described species of *Neoniphargus*. Indeed, the few characteristics he did mention suggest that his material may be a new species in that no known species combines all these features.

Diagnosis. Articles 1 and 2 of peduncle antenna 1 subequal. Antenna 2 without calceoli in males. Article 2 of mandibular palp longer than article 3 and poorly setose, article 3 with ACDE setae. Palms of gnathopods in males excavate, palmar corner with special medial spines and large rugose lobe. Coxa 4 not deeply excavate in males. Dactyli of pereopods 3–7 with 1 spine on inner margin. Articles 4–6 of pereopods 5–7 with 1–2 long setae and elongate basodactylar setae on pereopod 5; anterior margins of article 6 with 3–4 sets of spines (besides locking spines); coxae 5–7 with weak spines on posterior lobe. Coxal gills 2–6. Epimeron 2 with 3 strong and 1 normal ventral facial spines. Uropod 3 extending beyond uropods 1–2 in whole animal. All spines on uropods 1–2 short. Peduncle of uropod 1 in males with moderately long stout spine with simple tip at apicomedial corner. Uropod 3 peduncle 0.4 outer ramus; outer ramus spines arranged in multiples, in about 4 lateral and medial rows, medial plumose setae present in females; inner ramus 0.15 outer ramus, with 1 apical spine. Telson elongate, cleft more than halfway, each lobe with 1 apical spine, no dorsal spines.

Description of lectotype (non-ovigerous female).

Body (Fig. 90): smooth except for a few spines on the dorsal part of urosome; length 10 mm.

Head (Fig. 90): rostrum distinct, short; eyes large and oval.

First antenna (Fig. 90): length 0.5 body, 2.3 second antenna; peduncle about half length of flagellum, articles 1 and 2 subequal, article 3 distinctly shorter, all articles with a few short setae; accessory flagellum 2-articulate, reaching well beyond distal margin of flagellum article 1. *Second antenna* (Fig. 90): length 0.2 body; peduncle length about 2 flagellum, article 5 slightly shorter than 4, articles 3–5 each with several moderately long setae; flagellum 7-articulate, sparsely setose, lacking calceoli.

Left mandible (Fig. 90): palp article 3 distinctly shorter than 2, article 2 with only a few short spines on medial edge, article 3 with setal formula of 4A, 2+C, many D, 3–4E; incisor 5-toothed; lacinia mobilis 4-toothed; about 5 serrate and setose accessory blades; molar with anterior brush of fine setae. *Right mandible* (Fig. 90): palp article 2 with several short spines near inner edge; incisor 4-toothed; lacinia mobilis with 2 serrate cutting edges; accessory blades of 3 major elements and several interakers. *Left first maxilla* (Fig. 90): palp article 2 with 5 long thin blunt spines distally, 1 apicolateral setose spine, 1 subapical seta; inner plate with 3 plumose setae distally. *Right first*

maxilla (Fig. 90): palp article 2 with 5 blunt tooth-like spines and 3 subapical setae; inner plate pubescent on inner and outer margins. *Second maxilla* (Fig. 90): outer plate outer edge pubescent; inner plate inner edge pubescent, apicomedial corner with long seta. *Maxilliped* (Fig. 90): palp article 3 with distal rugose lobe; inner plate with 2 plumose spines and 4 blunt teeth distally.

First gnathopod (Fig. 91): coxal plate with only 4 setae on distal rounded margin; carpus with rugose area at posterodistal angle; propodus subquadrate, length 1.2 width, lacking rugose areas, palm more or less straight and with 5 spines (1 very large) at posterodistal angle. *Second gnathopod* (Fig. 91): larger than first gnathopod; coxal plate with 5 setae; carpus with rugose lobe at posterodistal angle; propodus subquadrate, as long as wide, posterodistal angle with a prominent and well-defined rugose lobe.

Pereopods (Figs 92,93): coxa 3 with 5 ventral setae, coxa 4 emarginate with 1 anteroventral seta and 4 posterior ones; length longest pereopod (6) 1.9 gnathopod 2; pereopod lengths (relative to pereopod 6): pereopod 3 = 0.7, 4 = 0.6, 5 = 0.9, 7 = 0.8; coxa 3 with 5 setae, coxa 4 with 1 anteroventral seta and 4 posterior setules; pereopods 3 and 4 similar, propodi with medium setae paired near distal ends with short spinules, thus formula of pereopod 3 = 2-2-2-1-1, of pereopod 4 = 2-2-2-1 (first pair locking spines), basodactylar armaments short; pereopods 5–7 similar, anterior margins of propodi with 3–4 sets of spines besides locking spines, posterior margins of propodi of pereopods 6–7 with 1–2 long spines, these absent in pereopod 5; basodactylar armaments as long as dactylus; dactyli with 1 spine on inner margin. Coxal gills on pereopods 2–6.

Sternal processes: 5 pairs of dendritic processes on sterna of pereonites 2–6 [?3–7].

Epimera (Fig. 92): all epimera with tiny posteroventral tooth; epimeron 1 anterodistal angle rounded, bare, posterodistal angle almost square; epimera 2 and 3 subquadrate, epimeron 2 with several robust submarginal spines ventrally, epimeron 3 with fewer and finer submarginal spines ventrally. *Urosome* (Fig. 93): urosomite 3 with a few dorsal spines; uropod 3 extending beyond uropods 1 and 2 in entire animal, but uropod lengths (relative to uropod 1): uropod 2 = 0.6, 3 = 0.6. *Pleopods* (Fig. 92): retinacula 2; no accessories, peduncles poorly setose.

First uropod (Fig. 93): peduncle same length as inner ramus, medial and lateral margins with several short spines, inner and outer distal angles with 1 longer spine, medial longest; inner ramus scarcely longer than outer ramus, both rami with a few short marginal spines [in ?2 rows] and a group of short apical spines. *Second uropod* (Fig. 93): peduncle slightly shorter than inner ramus, with 3 lateral marginal spines; inner ramus distinctly longer than outer ramus, both rami with a few short marginal spines [in ?2 rows] and a group of short apical spines. *Third uropod* (Fig. 93): peduncle length 0.4 outer ramus, with a few strong

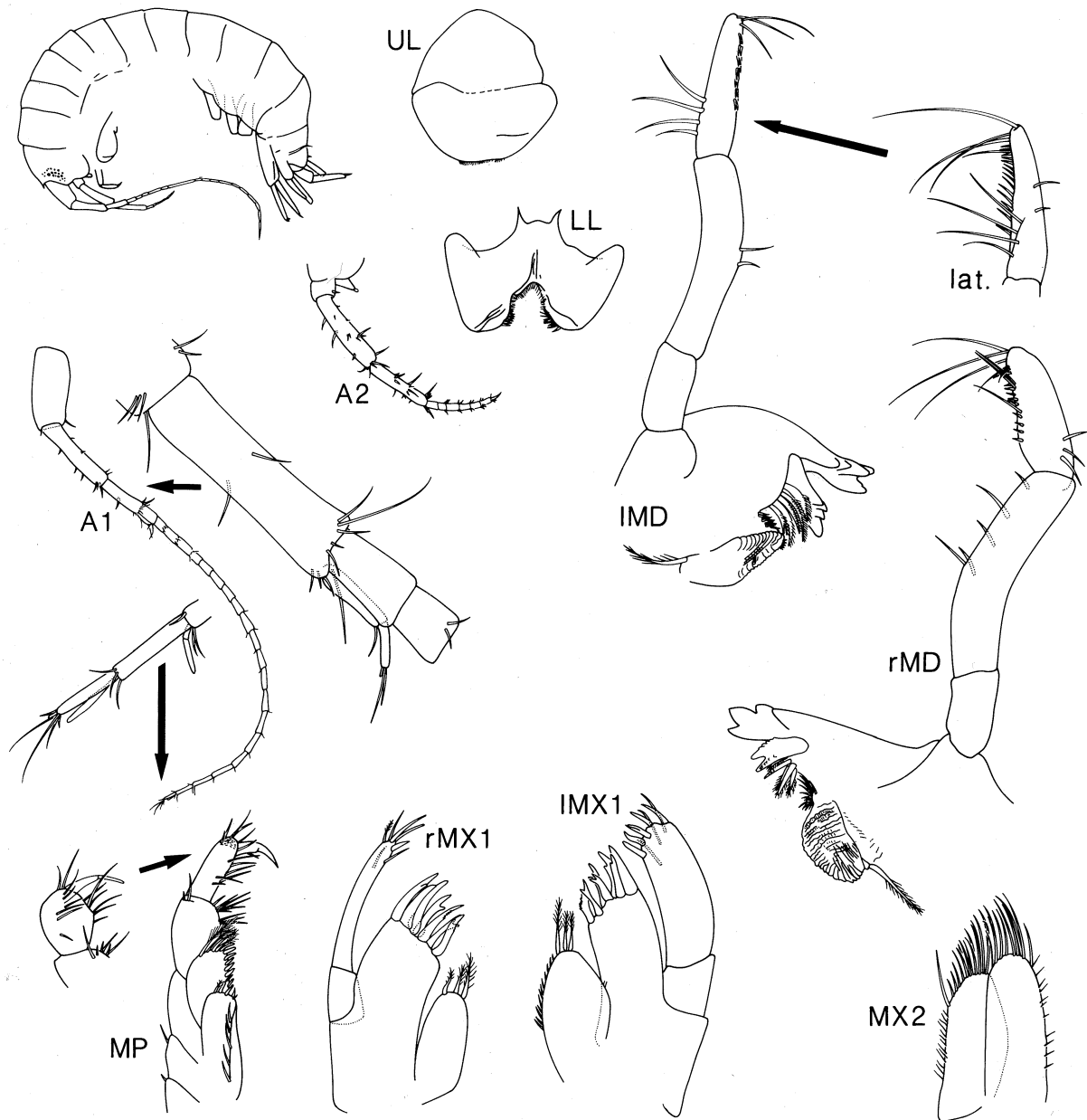


Fig.90. *Neoniphargus tasmanicus* G.W. Smith, lectotype, non-ovigerous female.

spines on distal margin and a similar group on midventral margin; outer ramus length about 6 of inner ramus, 2-articulate, distal article quite distinct, proximal article with a few short spines ventrally and 3 plumose spines on inner (dorsal) margin; inner ramus, scale-like, triangular, with 1 short, strong distal spine. *Telson* (Fig. 93): length 1.5 width; elongate, cleft extending 0.7 length; lobes pointed, each with a single terminal large spine, and pair of penicillate setules midlaterally at M.70.

Description of syntype (ovigerous female). *Body:*

length 10 mm.

First antenna: length 2.1 second antenna.

First gnathopod: carpus with distinct rugose lobe at posterodistal angle; posterodistal angle of propodus with a small rugose area.

Description of syntype (male "m"). *Body:* length 9 mm.

First antenna: accessory flagellum just reaching to distal margin of flagellum article 1. *Second antenna:* lacking calceoli.

Left first maxilla: inner plate with 2 plumose setae

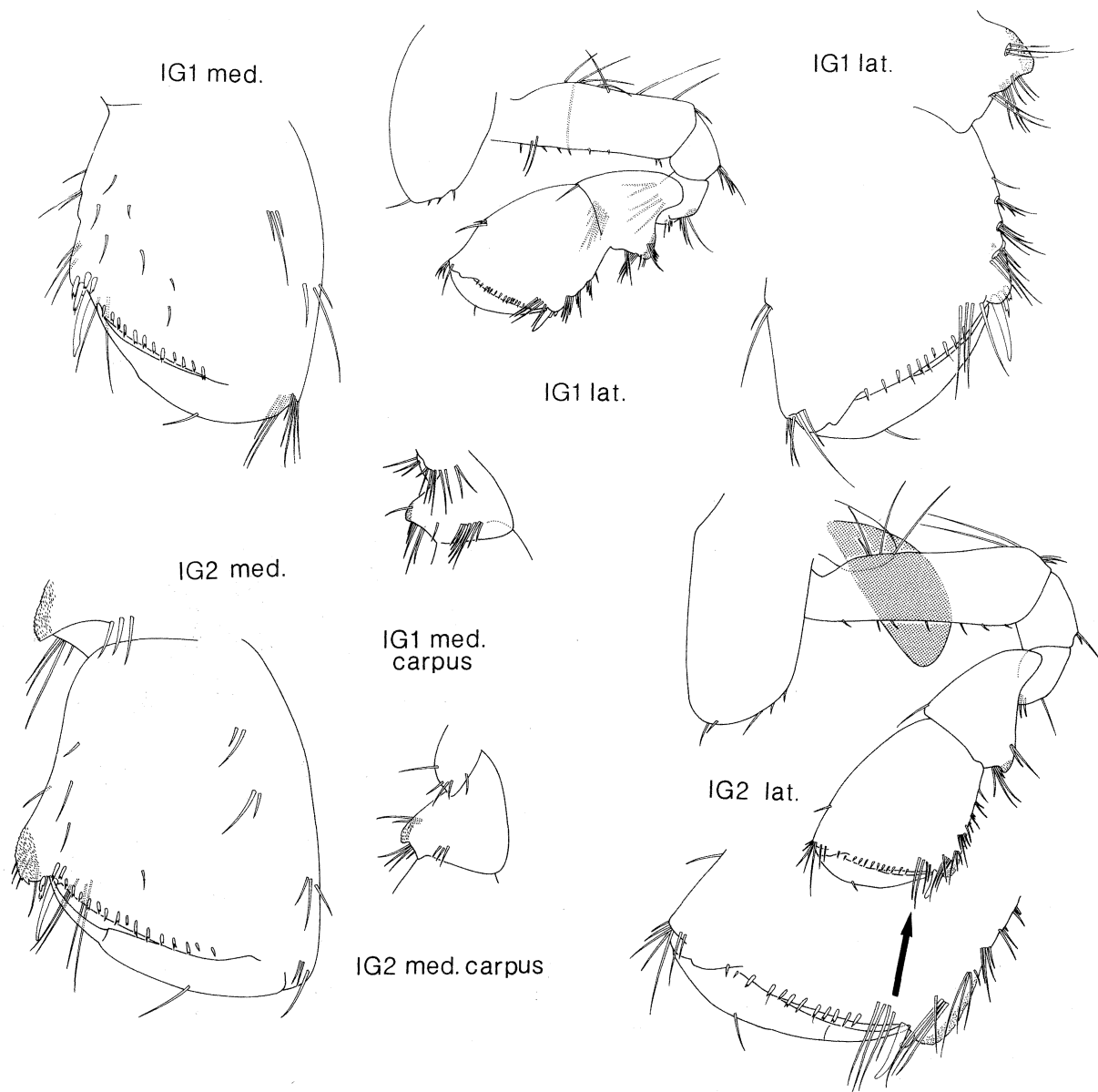


Fig.91. *Neoniphargus tasmanicus* G.W. Smith, lectotype, non-ovigerous female.

distally, inner margin setose. *Right first maxilla*: palp article 2 with 6 teeth-like spines and 1 fine spine distally; inner plate with 2 plumose setae distally.

First gnathopod (Fig. 94): merus with rugose area at posterodistal angle; carpus with well-defined rugose lobe at posterodistal angle; propodus ovate, as long as wide, well-developed rugose areas along posterior margin, palm excavate. *Second gnathopod* (Fig. 94): propodus ovate, as long as wide, palm excavate.

Fourth pereopod (Fig. 94): coxal plate with only slightly excavate posterior margin.

Urosome (Fig. 94): uropod 3 extending well beyond uropods 1 and 2 in entire animal; uropod lengths (relative to uropod 1): uropod 2 = 0.75; 3 = 1.0.

First uropod (Fig. 94): peduncle length 1.5 inner

ramus, spines at medial and lateral distal angles not large; rami of subequal length, some apical spines of both rami very long. *Second uropod* (Fig. 94): peduncle slightly longer than inner ramus. *Third uropod* (Fig. 94): peduncle length 0.35 outer ramus, lacking spines on midventral margin; outer ramus length 8 inner ramus, proximal article without plumose setae on inner margin.

Description of syntype (male "n"). *Body*: length 9 mm.

First antenna (Fig. 94): peduncle article 3 only half length article 2. *Second antenna*: lacking calceoli.

Left first maxilla: palp article 2 with 6 long thin blunt spines distally. *Right first maxilla*: inner plate with 3

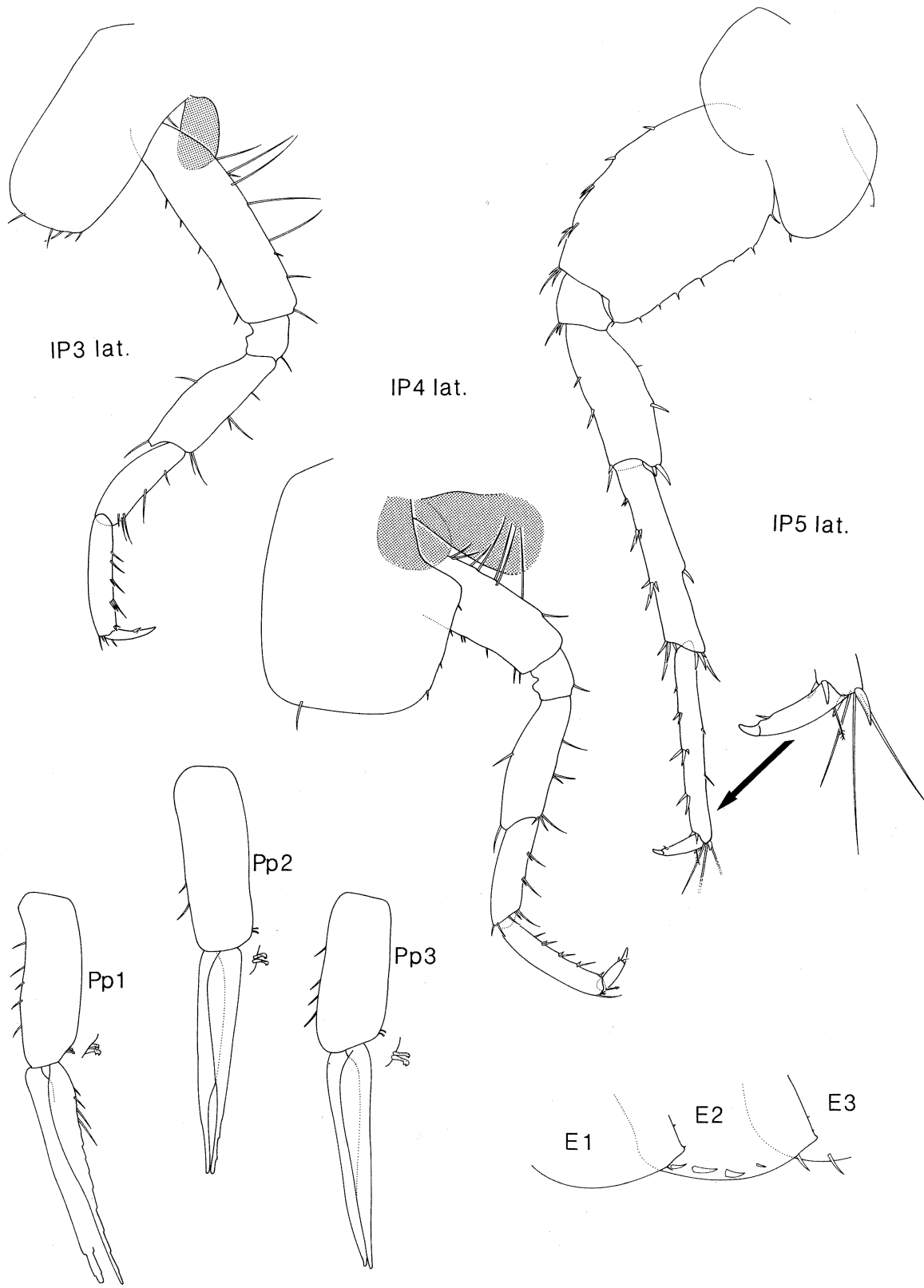


Fig.92. *Neoniphargus tasmanicus* G.W. Smith, lectotype, non-ovigerous female.

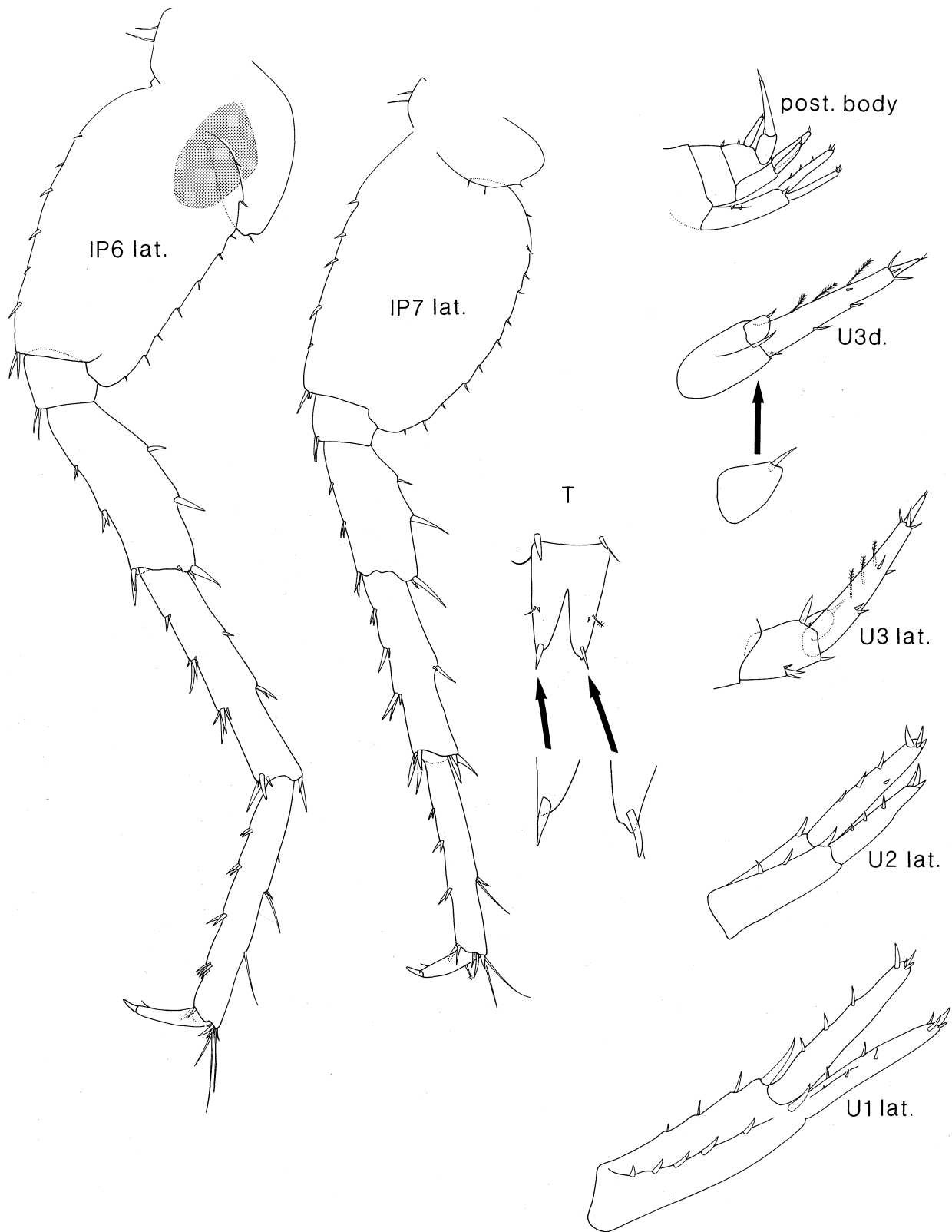


Fig.93. *Neoniphargus tasmanicus* G.W. Smith, lectotype, non-ovigerous female.

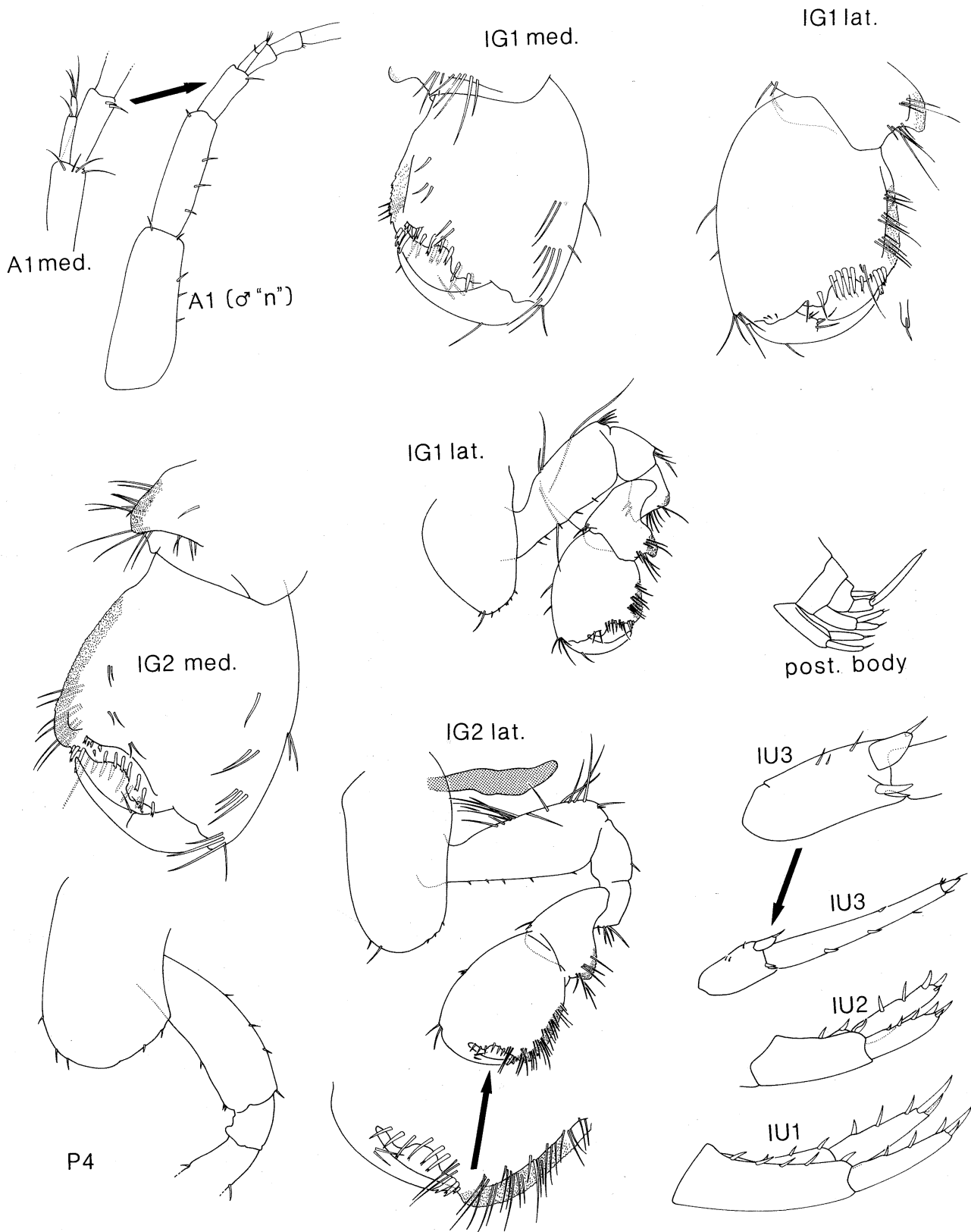


Fig.94. *Neoniphargus tasmanicus* G.W. Smith, syntype, male "m" (all drawings except that indicated); male "n" (A1).

plumose setae distally.

Third uropod: peduncle length 0.5 outer ramus, with 1 spine on midventral margin; outer ramus length 6 inner ramus, proximal article lacking plumose setae.

Partial description of remaining 7 undamaged female syntypes. *Body*: length 8–12 (\bar{x} = 9.6) mm.

First antennae: length 0.4–0.6 (\bar{x} = 0.5) body, 1.8–2.9 (\bar{x} = 2.3) second antennae. *Second antennae*: length 0.2–0.3 (\bar{x} = 0.22) body.

Urosome: uropod lengths (relative to uropod 1): uropod 2 = 0.5–0.7 (\bar{x} = 0.6); 3 = 0.4–1.0 (\bar{x} = 0.7).

Relationships. *Neoniphargus tasmanicus* has several specifically unique characters. It is the only known species of *Neoniphargus* with sexually dimorphic gnathopods, with males whose fourth coxa is only shallowly emarginate, with a distinctly lobed as well as rugose palmar corner on its gnathopods, and in which spines on the outer ramus of uropod 3 are essentially arranged singly.

From the type species of the genus, *N. thomsoni*, it also differs in that it lacks calceoli on antenna 2 in males, has short spines on uropods 1–2, lacks a very long apicomedial peduncular spur with complex tip in males (but, note, it does have a moderately long apicomedial peduncular spine with a simple tip), and has an elongate telson.

Some of these (and other) non-unique characters also distinguish *N. tasmanicus* from other *Neoniphargus* species. The most obvious of these are its elongate telson separating it from *N. spenceri*, *N. alpinus* and *N. exiguus*, and its lack of calceoli on male antenna 2 separating it from *N. fultoni* and *N. obrieni*.

Distribution. Tasmania, Great Lake.

Wesniphargus n.gen.

Type species. *Neoniphargus nichollsi* Straškraba, 1964.

Diagnosis. Pleonites with weak dorsal armaments. Rostrum small, lateral cephalic lobes weakly projecting and weak antennal sinus present. Eyes large, darkly pigmented.

Antenna 1 elongate, [?longer] than antenna 2, ratio of peduncular articles about 4:3:2, accessory flagellum 2-articulate. Antenna 2 flagellum shorter than peduncle, and with very large calceoli in male.

Ratio of mandibular palp articles about 2:6:6, article 2 moderately setose, article 3 falcate, setae = BCDE. Labium lacking inner lobes. Maxillae not medially setose on inner plates; inner plate of maxilla 1 subrectangular, with 2–4 apical plumose setae; outer plate with 7 spines, palps essentially symmetric, both sides with thin apical spines.

Inner plate of maxilla 2 lacking oblique row of setae on face, apicomedial edge with one medial seta at margin. Palp article 3 of maxilliped with rugose apical lobe.

Coxae 1–4 elongate, sparsely setose ventrally, coxae 1–3 lacking row of posterior spines, coxa 1 not obviously tapering below, coxa 4 emarginate, coxa 5

much shorter than 4. Gnathopods 1–2 small, [?not sexually dimorphic], carpi short, lobate, fourth article on both gnathopods bearing rugose surface, propodi not expanding apically, palms weakly oblique, lacking rugosities, spines not symmetrically bifid; spines at corner of palm 4, with small subapical triggers, spines along palm moderately dense and [?with] triggers; armament along posterior margin of propodus on gnathopod 1 composed of single spines in tandem.

Posterior spine sets on article 6 of pereopods 3–[?4] evenly spaced. Pereopods 5–7 [?moderately elongate], pereopod 6 [?longer] than pereopod 7, article 2 broadly expanded, ovate and posteroventrally lobate on all of pereopods 5–7; dactyls of pereopods 3–7 with [?1] marginal and [?1 facial] setule [?2] total (confirmed for pereopod 3 only).

Coxae 2–6 with gills, gill 6 reduced. Thoracic segments 2–6 with lateral sternal gills of incipient dendritic form, but fingers reduced to small lumps.

Basomedial setae on inner rami of pleopods 1–3 bifid, branches dissimilar, of different length and shape, occasionally 1 branch with diamond head, or both simple; retinacula 2, accessory retinacula present or absent.

Posteroventral tooth of epimera 1–3 tiny; some epimera with facial spines and setae near ventral margin, not paired, posterior margins very weakly setulate. Apicolateral corner of peduncles on uropods 1–2 with 1 spine; inner margin of peduncle on uropod 2 with unusual condition of apical spine and basal spines strongly discontinuous; outer rami of uropod 2 shorter than inner, margins spinose, uropod 1 lacking basofacial armaments; all rami of uropods 1–2 with 2 spine rows. Uropod 3 [?extended], [?parviramous], peduncle short, outer ramus 2-articulate, medial setae sparse (any other setae except some on inner margin) not plumose, article 2 very short, inner ramus [?absent]. Telson elongate, cleft about 75 percent, lobes not tumid laterally, with only apical spination, no major setation, no basolateral armaments except for pair of lateral penicillate setules about M.70 on each side.

Additional description. Upper lip uniform, rounded below. Accessory blades (rakers) on mandibles usually with interraker plumose setae; many additional penicillate setae beyond rakers and riding onto base of molar, also with larger basal molarial ragged setae besides regular apical molarial seta. Lower lip uniform, inner lobes absent. Both plates of maxilla 2 with long apical setae; inner plates of maxillae 1–2 and medial and lateral margins of maxilla 2 weakly covered with pubescence. Maxillipedal inner plate with distal row of few plumose setae and 2 blunt naked spines and medial row of 2 plumose setae; outer plate with distal row of few plumose setae continuous with medial row of blunt naked tooth-spines; palp articles 2–3 poorly setose laterally, moderately setose medially, article 3 with row of non-comb spines near base of dactyl, apex produced and rugose. Dactyls of gnathopods without small recumbant inner tooth-spine but with stiff

spinules or setules at inner nail articulation line and often with additional spinules along inner dactylar margin. Gnathopod 1 without one seta of article 4 enlarged and scythe-like. Pleopods similar, peduncles naked; rami extending equally. Ventrodistal spine on urosomite 1 at base of uropod 1 [?short].

Sexual attributes. Oostegites [?broad], sexual distinctions unknown.

Characters of interspecific value. Unknown. Genus unique.

Relationships. *Wesniphargus* differs from *Neoniphargus* in the loss of rugosity on the propodi of the gnathopods, the lack of apical expansion on the propodi, the presence of only single spines in tandem along the posterior margin of the propodus on gnathopod 1, the lack of asymmetry in the spine sizes on the palps of maxilla 1, the longer carpus of gnathopod 2 and in the fact that gnathopod 1 is slightly stouter than gnathopod 2, though gnathopod 2 is longer than gnathopod 1.

The essential symmetry of the maxilla 1 palps in *Wesniphargus*, together with the absence of rugosities on the propodi of the gnathopods and the lumped (not fully dendritic) form of the sternal gills, uniquely distinguish this genus from other neoniphargid genera in addition to (as well as) *Neoniphargus*. The low antennal setosity, lack of conjoint basal flagellar articles in antenna 1–2, and absence of any oblique row of setae on the inner plate of maxilla 2 also distinguishes *Wesniphargus* from *Tasniphargus*. *Wesniphargus* is also distinguished from *Yulia* by its lack of a first uropod spur in males and the loss of the coxal gill in pereopod 7.

***Wesniphargus nichollsi* (Straškraba)**

Figs 95,96

Neoniphargus nichollsi Straškraba, 1964: 128, fig. 3

Material examined. WAM No. 11781, [data from Straškraba, 1964: Creek at Cannington, WA, HOLOTYPE, male no. 1]. The holotype was remeasured by us at 3.54 mm (originally quoted at 5 mm); it is missing most of antenna 2, all of uropod 3, apices of pereopods 3–7, and has been now fully dissected by us. Our description of missing parts is derived from Straškraba's original description.

Diagnosis. With the characters of the genus.

Description of holotype (male). *Body* (Fig. 95): pleon sparsely armed dorsally, few setae on pleonites 1–4, 1 spine on each side on pleonite 5, 2 spines on each side on pleonite 6; length, 6.4 mm.

Head (Fig. 95): rostrum small; eyes large, dark, reniform.

First antenna (Fig. 95): length 0.45 of body, [?] second antenna; peduncle much shorter than flagellum, article 1 longest, article 3 shortest, setae sparse; flagellum, calceoli absent, with 12 articles each with 1 aesthetasc (apparently confused by Straškraba with calceoli); accessory flagellum 2-articulate, not

reaching past article 2 of main flagellum, articles uniform, sparsely setulate. *Second antenna* (Fig. 95): length [?] body; peduncle longer than flagellum, article 4 longer than 5, articles 3,4 and 5 with sparse ventral setation; flagellum 6-articulate, weakly setose ventrally, bearing giant calceoli on articles 1–4.

Upper lip: apical margin evenly rounded.

Left mandible (Fig. 95): palp article 3 scarcely shorter than 2 (ratio = 22:23), article 2 with 8 outer marginal setae, article 3 with 1B, 3C, many D, 4E, incisor 5-toothed, lacinia mobilis 4-toothed, 3 setose accessory blades; molar bearing plumose seta, several penicillate hooked brushy basal setae. *Right mandible* (Fig. 95): incisor 4-toothed; lacinia mobilis bifid, denticulate; accessory blades of 2 plumose spines, setae of palp article 3 = same as left. *Left first maxilla* (Fig. 95): palp article 2 with 4 thin apical spines and two subterminal facial setae; outer plate with 7 spines, most denticulate; inner plate with 2 apical plumose setae. *Right first maxilla* (Fig. 95): palp article 2 with 5 thick apical spines, 1 apicolateral thin spine, 2 subterminal apical facial setae. *Second maxilla* (Fig. 95): outer plate apicolateral corner with 1 small spinule, apicomedial corner of inner plate with 1 weakly submarginal thick seta. *Maxilliped* (Fig. 95): palp article 3 with several thick setae on inner edge, apical part with rank of 1–2 thick setae, apex strongly produced and rugose; inner plate with 2 thick spines and plumose setae apically, short medial row of 2 plumose setae, [?] ventrofacial spine.

First gnathopod (Figs 95,96): coxal plate with 4 setae apically; article 4 with rugose posterior surface; carpus short and lobate, lobe tilted and setose apically, rugose; propodus subrectangular, not expanding apically, longer than wide, posterolateral angle rounded, not rugose, with 2 medial and 2 lateral spines, 1 lateral spine elongate, palm subtransverse, convex; dactylus reaching end of palm. *Second gnathopod* (Fig. 96): longer and narrower than first gnathopod; carpus longer, lobe thicker; palmar corner with 2 lateral and 2 medial spines; coxal plate poorly setose.

Pereopods: coxa 3 with 2 long and 4 short setae, coxa 4 deeply emarginate, with 8 short and 2 long ventral and 4 short posterior setae; pereopods 3–4 [?longer] than gnathopod 2, pereopod 3 [?not] longer than 4, article 4 weakly setose posteriorly, article 5 of pereopods 3–4 [?weakly] setose posteriorly, posterior margin of article 6 on pereopods 3–4 with seta-spine formulas of 1-1-1-[?] and [?]; pereopods 5–7 [?similar], coxae lacking spines on ventral margin of posterior lobe, article 2 expanded and very broadly lobate posteroventrally, bearing short thin posterior setules; dactyli of pereopods 3–7 with only 1 spine on inner margin; gill of pereopod 6 strongly reduced, coxal gill absent.

Sternal processes (Fig. 95): 5 pairs of fleshy lumped, sternal gills present on segments 2–6, attached to lateral edge of each segment.

Epimera (Fig. 95): each epimeron with tiny posteroventral tooth, smaller on epimeron 3, posterior

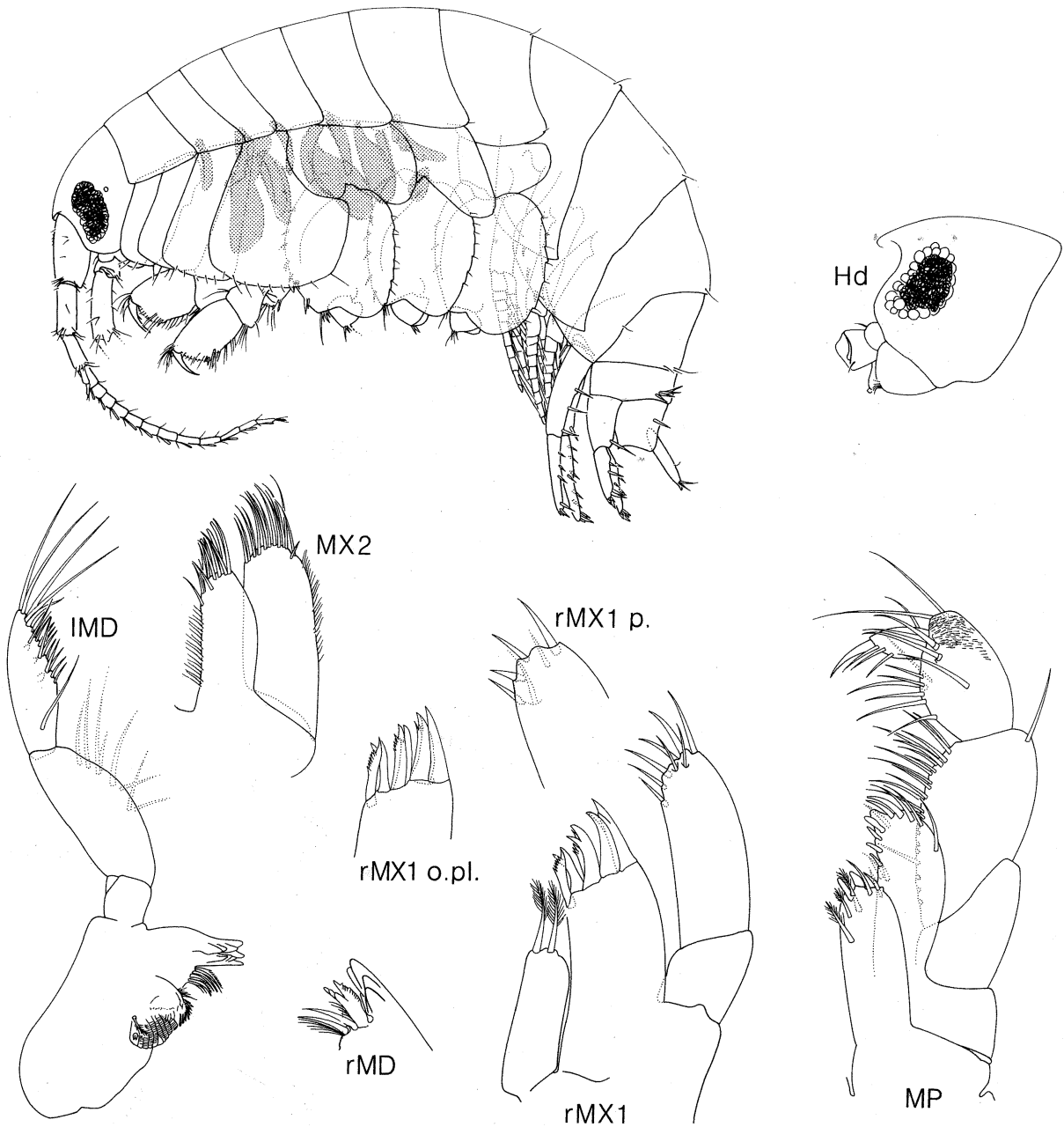


Fig.95. *Wesniphargus nichollsi* (Straškraba), holotype, male.

margins almost straight, epimera 2 and 3 each with 3 and 2 anteroventral spines. *Pleon* (Fig. 95): each dorsolateral posterior margin of pleonites 1-6 with following setal formula: 1-1-1-3-0-0, spines = 0-0-0-0-4-1; uropod 3 extending beyond uropods 1 and 2 in entire animal, uropod lengths relative to uropod 1: uropod 2 = 0.70, 3 = [?]. *Pleopods*: retinacula 2 per pleopod, 1 accessory on pleopod 2 only; peduncles lacking setae.

First uropod (Fig. 96): peduncle length 1.1 rami, outer margin with 1 apicolateral spine besides weak row of 2 dorsolateral spines, with 1 large apical and 2

small basal spines medially; rami of subequal length, both rami with 2 rows of marginal spines, outer ramus with 4 apical and inner ramus with 5 apical spines. *Second uropod* (Fig. 96): peduncle about 0.80 length of inner ramus, with 1 dorsolateral apical spine; outer ramus shorter than inner, both with 2 strong rows of marginal spines, apices with 6 and 5 spines. *Third uropod*: peduncle length 0.40 outer ramus, [?] longer than urosomite 3, without facial, subdistal spines besides apical cluster of 3; outer ramus proximal article with 5 transverse lateral spine rows, medial margin with 6 sets of armaments, mixing setae (some plumose)

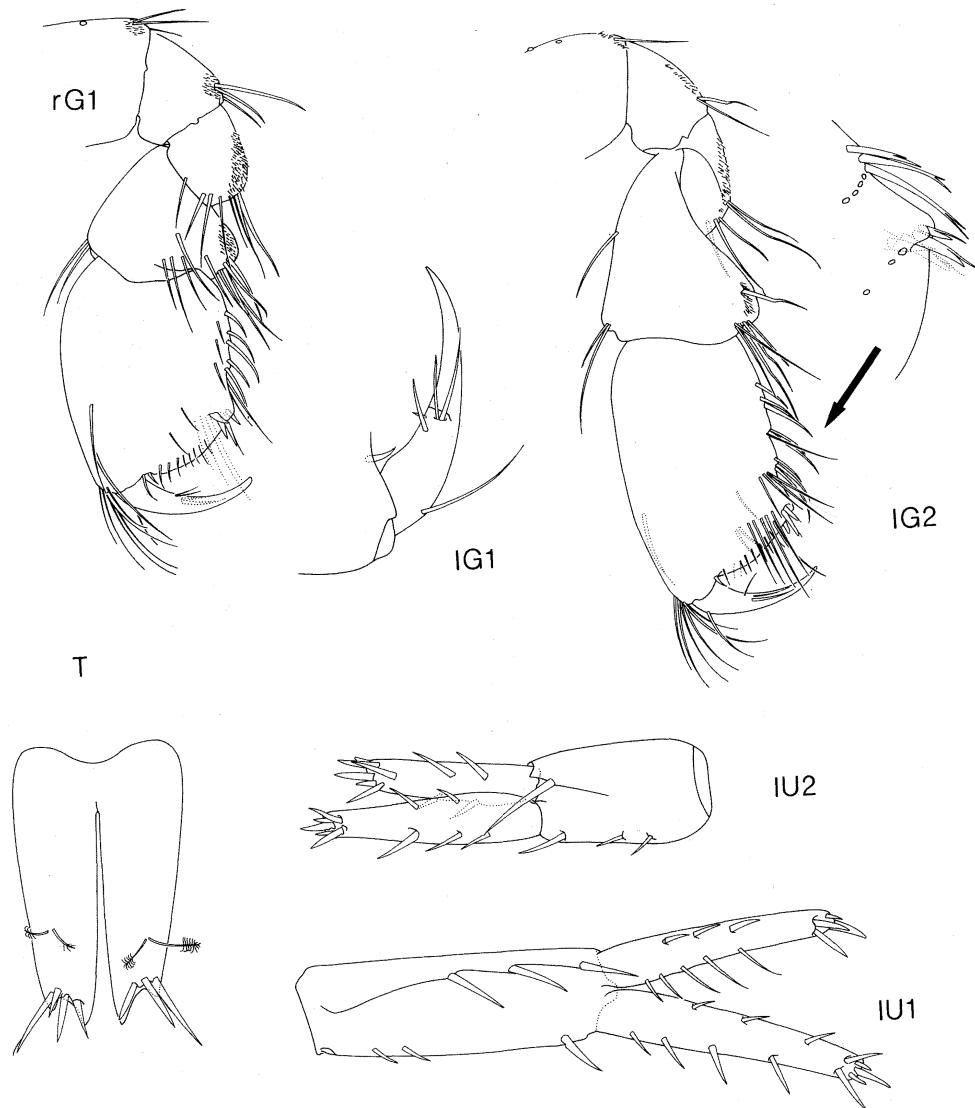


Fig.96. *Wesniphargus nichollsi* (Straškraba), holotype, male.

and spines, lateral spines from proximal to distal = 2-2-2-2-1, setae = 0, medial spines = 0-0-0-1-1-3, setae = 1-1-1-1-1-0; apex of small article 2 with 1 apicolateral short stiff seta; inner ramus presence not confirmed [neither mentioned nor illustrated by Straškraba], presumably absent. *Telson* (Fig. 96): elongate, longer than urosomite 3; cleft 75 percent of length; apices each with 3 or 4 spines in 1 row, no apicolateral setae, each lobe with pair of penicillate setules dorsolaterally at M.70.

Remarks. Our assessment of sternal and coxal gills on sternite 7 may be erroneous because of difficulties in dissecting the specimen which had friable chitin, mushy sternites but hard muscles. We estimated that pereonite 7 lacked any gills.

Distribution. Western Australia, creek at Cannington, a suburb of Perth.

Yulia n.gen.

Type species. *Neoniphargus yuli* G.W. Smith, 1909.

Diagnosis. Urosomites with a few scattered dorsal spinules. Rostrum small and sharp, lateral cephalic lobes weakly projecting in triangular fashion, antennal sinus indistinct. Eyes large, reniform.

Antenna 1 not elongate, longer than antenna 2, ratio of peduncular articles about 4:3:2, accessory flagellum 2-articulate. Antenna 2 flagellum shorter than peduncle, calceoli present in male.

Ratio of mandibular palp articles about 2:5:4, article 2 weakly setose, article 3 weakly falcate, setae = BDE.

Labium lacking inner lobes. Maxillae only apically setose, inner plate of maxilla 1 triangular, with about 4 apical setae, outer plate with 9 spines, palps asymmetric, one side with thin apical spines, other side with thick apical spines. Inner plate of maxilla 2 lacking oblique row of setae on face, though upper member of 2 main medial setae slightly submarginal; inner plates of maxillae 1–2 sparsely covered with pubescence.

Coxae 1–4 elongate, moderately setose ventrally, coxae 1–3 lacking row of posterior spines, coxa 1 weakly tapering below, coxa 4 emarginate, coxa 5 much shorter than 4; at least some of coxae 5–7 setose posteroventrally. Gnathopods 1–2 small to medium in size, variable, not sexually dimorphic, carpi short, lobate and rugose, article 4 on gnathopod 1 bearing rugose lobe, palms weakly oblique, bearing rugosities; spines at corner of palm 8; spines along palm dense, many bifid.

Posterior spine sets on article 6 of pereopods 3–4 evenly spaced. Pereopods 5–7 elongate, pereopod 7 shortest, pereopod 6 longest, article 2 broadly expanded on pereopods 5 and 7, less so on pereopod 6, posteroventrally lobate but more weakly so on pereopods 6–7; dactyls with marginal and facial setule (2 total).

Coxae 2–7 with gills, coxal gill 7 reduced in size. Thoracic segments with [?5 pairs] of lateral sternal gills of dendritic form.

Peduncles of pleopods strongly setose marginally; basomedial setae on inner rami of pleopods 1–3 bifid, branches diverse, of different length and shape but, occasionally 1 branch with diamond head, or both simple; retinacula and accessory retinacula [?absent].

Epimera 1 and 3 with a few ventrofacial spines only, epimeron 2 more strongly spinose facially, posterior margins weakly setulate. Rami of uropods 1–2 extending subequally, except for outer ramus of uropod 2 each with 2 rows of spines; uropod 1 lacking basofacial armaments; with gap between most apical and next basad dorsolateral spine on peduncle of uropod 1, this spine row especially dense and spine sizes sexually dimorphic, in male apicolateral and apicomedial spine of peduncle enlarged, outer ramus with only 2 tiny basal spines, 2 medium apical spines and huge subapical spur-spine; apicomedial spine of peduncle on uropod 2 enlarged; spines on inner rami of female uropods 1–2 spaced so closely apically as to be termed “continuous dorsal spination.” Uropod 3 barely extended, parviramous, setae absent, peduncle short, bearing midventrofacial cluster of spines besides apical spines, outer ramus 2-articulate, article 2 short, inner ramus generally reaching to M.35 or less on article 1 of outer ramus in both sexes. Telson short, cleft about 60 percent, lobes not tumid laterally, with about 5 apical spines on each lobe in 2 rows, dorsal and ventral.

Additional description. Accessory blades (rakers) on mandibles with interraker plumose setae; several to many additional penicillate setae beyond rakers and riding onto base of molar, with regular apical molarial

seta. Maxillipedal palp articles 2–3 moderately setose medially, article 3 with rugose lobe and row of spines near base of dactyl. Dactyls of gnathopods without small recumbant inner tooth-spine and only occasional setules at inner nail articulation line. Gnathopod 1 without one seta of article 4 enlarged and scythe-like.

Sexual attributes. Females never with calceoli; oostegites paddle-shaped, with oostegite on coxa 5 smallest, in young or nonbreeding females lacking setae or with rudiments of setal bases marginally, in terminal females oostegites of coxae 2–4 huge, projecting below coxae, oostegite of coxa 5 generally small; several spines on male uropod 1 enlarged, outer ramus with very long spur; outer ramus of male uropod 3 more elongate than in female.

Relationships. *Yulia* appears to be a sidebranch of an hypothetical ancestor which also gave rise to *Neoniphargus*. Strong sexual dimorphism occurs on uropods 1–2 which appears to be an apomorphism, but *Yulia* retains 9 spines on the outer plate of the first maxillae which we consider to be a plesiomorphic character. *Yulia* has lost the C-setae on mandibular palp article 3 (typically present in *Neoniphargus*). The two genera continue to share a large number of characters, however, including the tapered coxa 1, subapical set of peduncular spines on uropod 3, the poorly setose medial margins of the inner plates on the maxillae, and the dendritic sternal gills. However, *Yulia* has strongly setose peduncles on the pleopods in contrast to *Neoniphargus*.

Yulia is set apart from other neoniphargid genera (*Tasniphargus*, *Wesniphargus*) not only by the unique features of these genera but also by its own unique combination of characters. Thus, from *Tasniphargus*, *Yulia* is distinguished by its poor setosity of antennae 1–2, lack of conjoint basal articles in the flagella of antennae 1–2, asymmetrical palps of maxilla 1, lack of sexual dimorphism, and retention of coxal gill 7. *Yulia* is distinguished from *Wesniphargus* above all by its asymmetrical maxilla 1 palps, retention of 9 denticulate spines on the outer plate of maxilla 1, the presence of rugosities on the propodi of the gnathopods, and the occurrence of fully dendritic sternal gills.

Yulia yuli (G.W. Smith)

Figs 97–100

Neoniphargus yuli Smith, 1909a: 73–74, pl. 13, fig. 1.

Type material. Material clearly attributed to this species by Smith is located in the Hope Museum, University of Oxford. Labels read: (1) “*Neoniphargus yuli*, Smith, Yule’s Lake, Ben Lomond about 4000 ft, Tasmania, Dec. 25 1907, G.W. Smith, Esq. Ref. No. 5392 Cotypes”; (2) “*Neoniphargus Yuli*” [sic]; (3) “Yules Lake Ben Lomond Dec. 25th/07”.

The material comprised 53 specimens: 24 males, 19 ovigerous females, 4 non-ovigerous females, 6 juveniles. A large undamaged male was selected as the

LECTOTYPE and fully dissected. Also dissected were 2 ovigerous females ("a", "b") and 1 further male specimen ("y").

Diagnosis. Unique. With the characters of the genus.

Description of lectotype (male). *Body* (Fig. 97): smooth, lacking spines except a few on posterior dorsal margins of urosomites 1, 2; length, 14.7 mm.

Head (Fig. 97): rostrum distinct, short; eyes large, reniform; inferior antennal sinus indistinct.

First antenna (Fig. 97): length 0.3 body, 1.6 second

antenna; peduncle slightly shorter than flagellum, article 1 longest, article 3 shortest, setae sparse; accessory flagellum 2-articulate, reaching slightly beyond flagellum article 1, but article 1 slightly shorter than flagellum article 1, both articles with large setae on distal margins. *Second antenna* (Fig. 97): length 0.2 body; peduncle longer than flagellum, articles 4 and 5 subequal in length, articles 3, 4 and 5 with distal marginal spines, article 5 with middle circlet of setae; flagellum 7-articulate with prominent calceoli on articles 1-5.

Lower lip (Fig. 97): inner lobes indistinct.

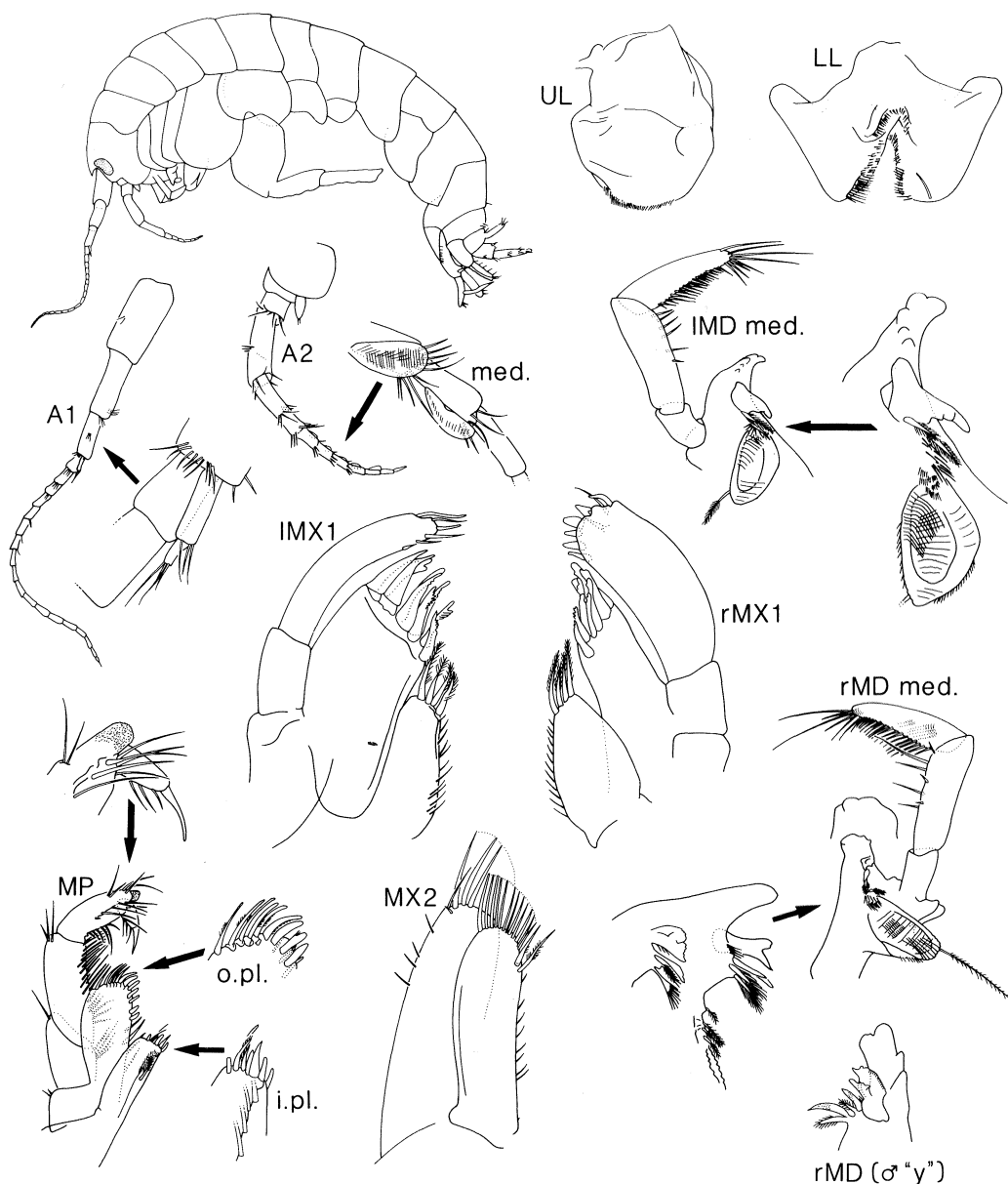


Fig. 97. *Yulia yuli* (G.W. Smith), lectotype, male (all drawings except that indicated); syntype, male "y" (part of rMD as indicated).

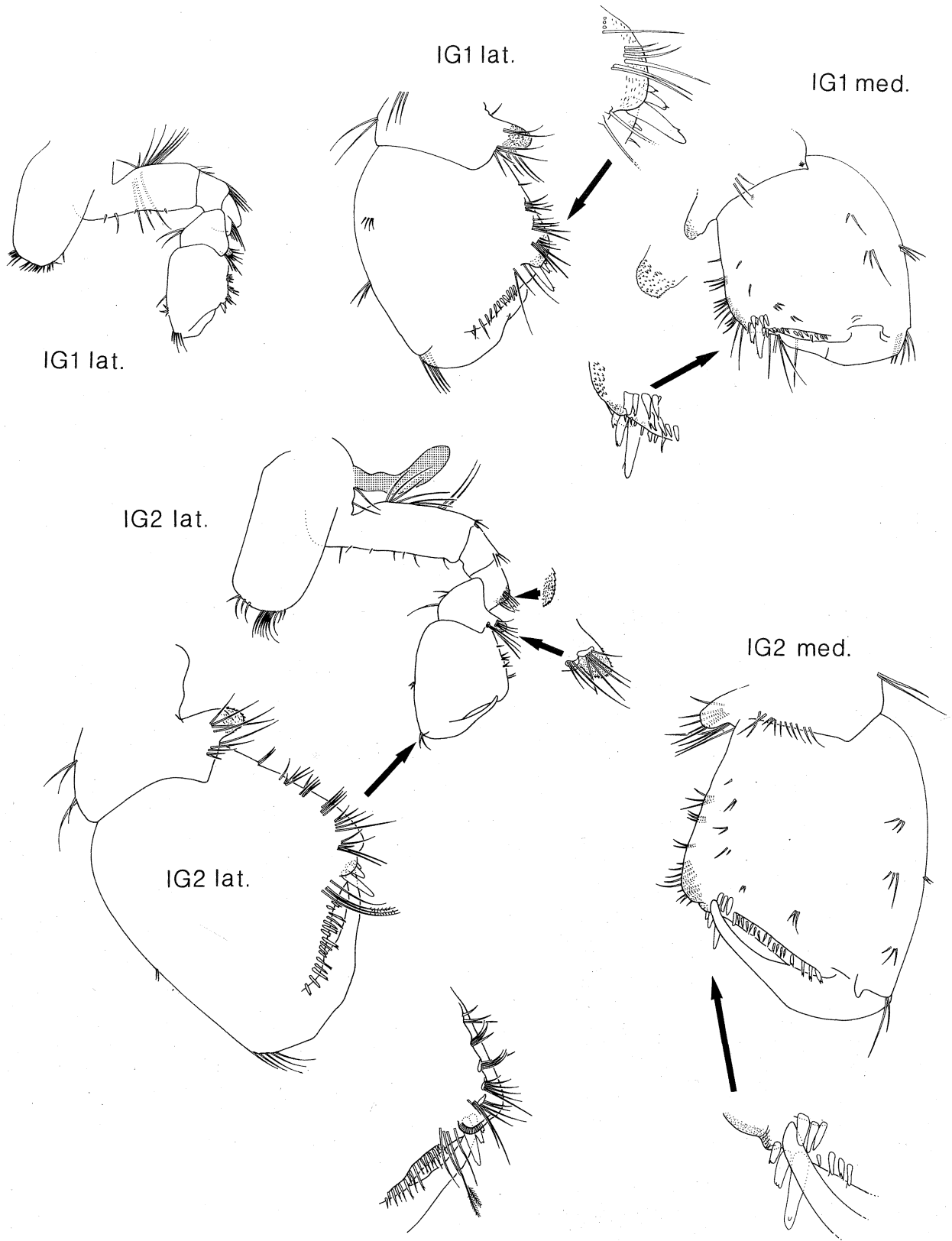


Fig.98. *Yulia yuli* (G.W. Smith), lectotype, male.

Left mandible (Fig. 97): palp articles 2 and 3 subequal, article 2 with only few short spines on inner edge, formula of setae on article 3 = 0A–C, many D, 8E; incisor 5-toothed; lacinia mobilis 4-toothed; 2 setose accessory blades; molar with 1 long basal setose spine. *Right mandible* (Fig. 97): incisor vaguely 3-toothed; lacinia mobilis with 2 serrate cutting edges; accessory blades of 2 setose spines and tooth; palp article 3 with 2,5B setae besides D and E setae. *Left first maxilla* (Fig. 97): palp article 2 with 6 long spines distally; outer plate with 9 denticulate spines distally; inner plate with 4 setose spines distally, inner margin pubescent. *Right first maxilla* (Fig. 97): palp article 3 with 6 short, teeth-like spines, 1 apicolateral thinner spine in notch, 1 apicolateral subdistal facial seta. *Second maxilla* (Fig. 97): both plates with row of many long setae distally, outer margin of outer plate and inner margin of inner plate sparsely pubescent; inner plate with 2 plumose apicomedial setae distinctly on medial margin. *Maxilliped* (Fig. 97): palp article 3 with a few long spines on inner margin and body, with distal rugose lobe; outer plate with row of setose spines distally continuous with row of tooth-spines medially; inner plate with several plumose spines and 3 naked spines distally plus ventrofacial spine set apicomediaally.

First gnathopod (Fig. 98): coxal plate apically setose; carpus with rugose lobe at posterodistal angle; propodus almost square, as long as wide, posterolateral angle rugose, palm straight, corner spines 3 lateral and 5 medial; dactylus not reaching end of palm. *Second gnathopod* (Fig. 98): larger than first gnathopod; merus and carpus with rugose areas at posterolateral angles.

Pereopods (Fig. 99): coxa 3 with few anteroventral setae, brush of longer posteroventral setae, coxa 4 with short ventral and posterior setae, coxae 5–7 with posteroventral spines; length longest pereopod (6) about 2 gnathopod 2; pereopod lengths (relative to pereopod 6): pereopod 3 = 0.7, 4 = 0.7, 5 = 0.8, 7 = 0.8; pereopods 3 and 4 similar, with 6 doubled spine groups on posterior margins of propodi; pereopods 5–7 similar, article 4 of pereopod 7 relatively short, setae on articles 4–6 sparse; propodi without fine spines. Coxal gills 2–7 present [only 2–5 confirmed].

Sternal processes (Fig. 98): 5 pairs of sternal dendritic processes on pereonites 2–6 [only 3–6 confirmed].

Epimera (Fig. 100): epimeron 1 posterodistal angle rounded, with anteroventral and ventral setae; epimeron 2 subquadrate, anterodistal face with several scattered spines; epimeron 3 subquadrate, 2 spines near anterodistal angle, posterior margin with some small setules. *Urosome* (Fig. 100): urosomites 1 and 2 with a few dorsal spines; uropod 3 extending slightly beyond uropods 1 and 2 on entire animal, but uropod lengths relative to uropod 1: uropod 2 = 0.75, 3 = 0.7. *Pleopods* (Fig. 100): similar; rami equal; peduncles especially setose laterally; both retinacula and accessories apparently absent.

First uropod (Fig. 100): peduncle length 1.5 rami, lateral margin with row of strong spines near base, medial margin with fewer spines, apicolateral area bare, 1 long inter-ramal spine; rami of subequal length; outer ramus with very long spur (longer than ramus) near distal end, marginal spines 2 in 2 rows, 2 strong distal spines; inner ramus with inner marginal and several (longer) distal spines, no lateral spines. *Second uropod* (Fig. 100): peduncle same length as rami, with several marginal spines, most apical slightly enlarged; rami of equal length and similar spination; each ramus with several strong marginal and distal spines. *Third uropod* (Fig. 100): peduncle length 0.7 outer ramus, about same length as urosomite 3, with several strong spines on distal margin and a facial row near midventral point; outer ramus length about 6.0 inner ramus, 2-articulate, distal article small, proximal article with 3 lateral and 1 medial transverse spine rows on body; inner ramus scale-like, ovate, with single strong apical spine. *Telson* (Fig. 100): slightly longer than urosomite 3; cleft extending 60 percent telson; lobes with 5 strong distal spines, no dorsal spination.

Description of syntype (ovigerous female “a”).

Second antenna: no calceoli present.

Left mandible: incisor 4-toothed; 3 large setose accessory blades. *Right mandible*: incisor 4-toothed.

First maxillae: inner plate with 3 setose spines distally.

First uropod (Fig. 100): peduncle as long as rami; inter-ramal spine not long; outer ramus lacking spur but with 2 rows of strong marginal spines. *Third uropod* (Fig. 100): peduncle length 0.85 outer ramus; outer ramus length about 3 inner ramus.

Oostegites: large, paddle-shaped on pereon segments 2–5, last much smaller.

Partial description of 22 male syntypes. *Body*: length 11–16 (\bar{x} = 14.1) mm.

First antennae: length 0.2–0.4 (\bar{x} = 0.31) body, 1.1–1.75 (\bar{x} = 1.5) second antennae. *Second antennae*: length 0.2–0.3 (\bar{x} = 0.21) body.

Urosome: uropod lengths (relative to uropod 1): uropod 2 = 0.6–0.8 (\bar{x} = 0.71), 3 = 0.6–0.8 (\bar{x} = 0.67).

Partial description of 4 non-ovigerous female syntypes. *Body*: length 12–16 (\bar{x} = 12.8) mm.

First antennae: length 0.3–0.4 (\bar{x} = 0.34) body, 1.4–1.9 (\bar{x} = 1.7) second antennae. *Second antennae*: length 0.15–0.3 (\bar{x} = 0.20) body.

Urosome: uropod lengths (relative to uropod 1): uropod 2 = 0.6–0.7 (\bar{x} = 0.65), 3 = 0.48–0.5 (\bar{x} = 0.49).

Partial description of 17 ovigerous female syntypes. *Body*: length 12–14 (\bar{x} = 13.3) mm.

First antennae: length 0.3–0.4 (\bar{x} = 0.36) body, 1.3–2.1 (\bar{x} = 1.6) second antennae. *Second antennae*: length 0.2–0.3 (\bar{x} = 0.23) body. No calceoli.

Urosome: uropod lengths (relative to uropod 1): uropod 2 = 0.6–0.7 (\bar{x} = 0.67), 3 = 0.4–0.7 (\bar{x} = 0.47).

Partial description of 6 immature syntypes. *Body*: length 6–10 (\bar{x} = 7.0) mm.

First antennae: length 0.25–0.3 (\bar{x} = 0.29) body, 1.3–

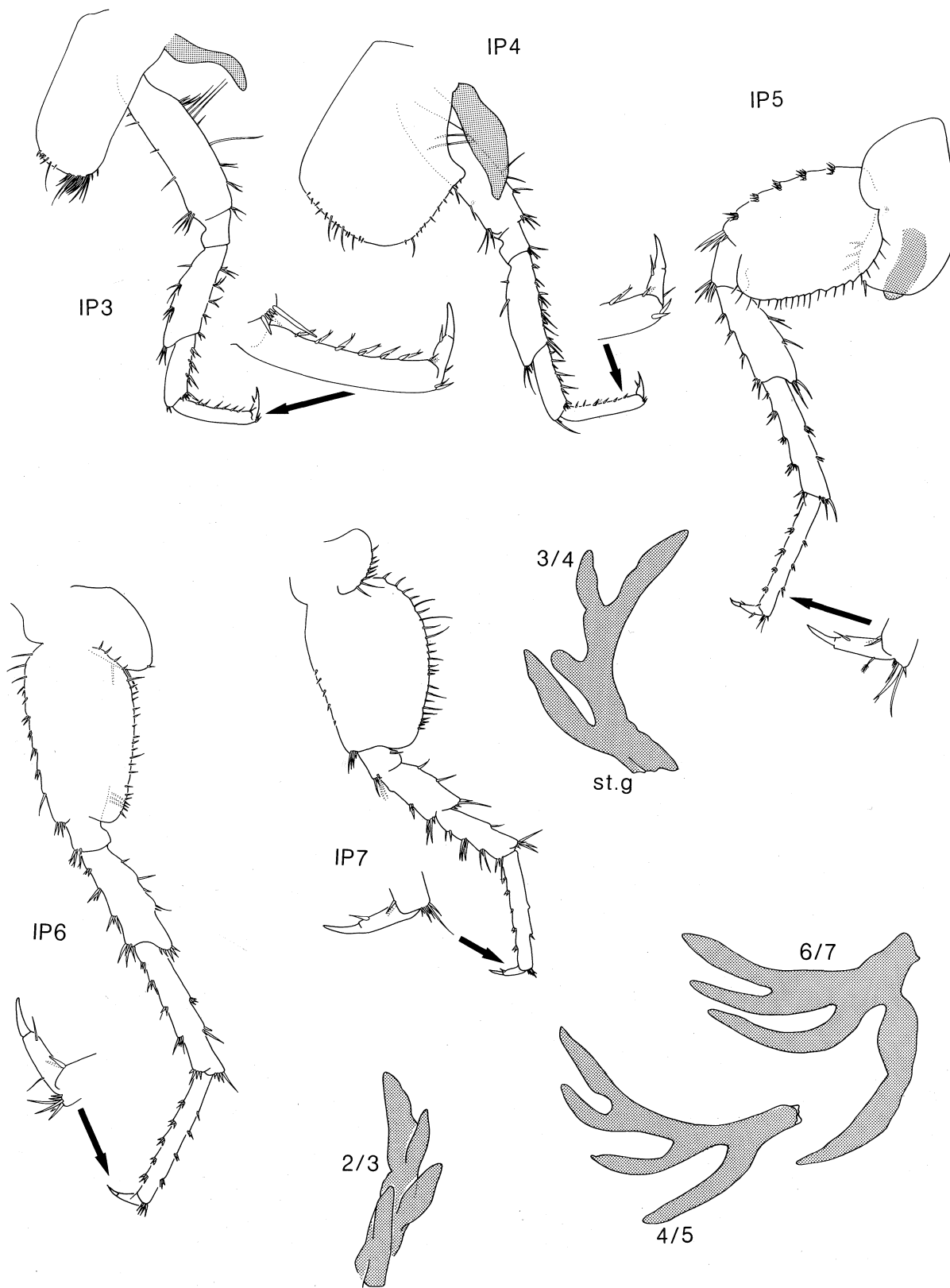


Fig.99. *Yulia yuli* (G.W. Smith), lectotype, male.

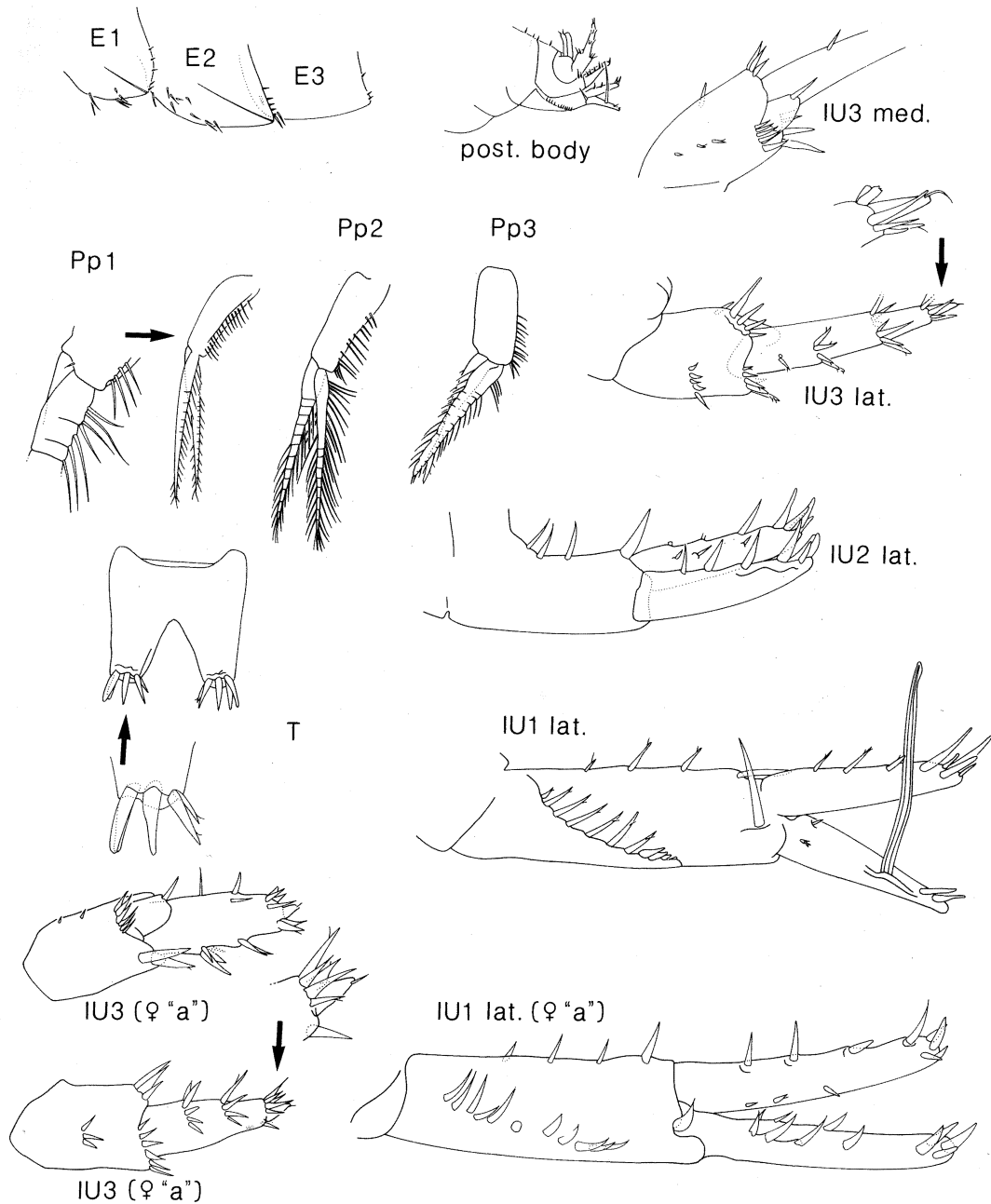


Fig.100. *Yulia yuli* (G.W. Smith), lectotype, male (all drawings except those indicated); syntype, female "a" (IU1 and IU3 as indicated).

1.7 ($\bar{x} = 1.5$) second antennae. *Second antennae:* length 0.18–0.2 ($\bar{x} = 0.19$) body.

Urosome: uropod lengths (relative to uropod 1): uropod 2 = 0.7–0.8 ($\bar{x} = 0.75$), 3 = 0.6–0.7 ($\bar{x} = 0.65$).

Distribution. Tasmania, Ben Lomond, Yule's Lake, about 1200 m altitude.

Perthiidae n.fam.

Type genus. *Perthia* Straškraba, 1964.

Introduction. The genus *Perthia* created by Straškraba to accommodate a species described by him (*P. acutitelson*) and one created earlier by Nicholls (1924) (as *Neoniphargus branchialis*) is itself not readily accommodated in either of the two known Australian crangonyctoid families, whilst having a combination of characters supporting its crangonyctoid affinities. These affinities are indicated in *Perthia* by its apparently linear calceoli, 2-articulate accessory flagellum of antenna 1, 2-articulate outer

ramus of uropod 3, the smaller size of coxae 5–7 vis-à-vis coxa 4, the lack of basofacial spines on the peduncle of uropod 1, the 2-articulate palp of maxilla 1, the occurrence of other than E setae on the mandibular palp, and the lack of a clear dominance of gnathopod 1 over gnathopod 2.

From both the Paramelitidae and Neoniphargidae, *Perthia* is excluded because of the short length of antenna 1, the non-tritulative nature of the mandibular molar, the small size of the outer plate of the maxilliped, the nature of attachment of the propodi to the carpi in the gnathopods (of a "eusirid" type), the occurrence of a well-developed antennal sinus, and its relatively larger gnathopods 1–2. Additionally, it is excluded from the Neoniphargidae by the lack of rugosities on the maxilliped and gnathopods; and from the Paramelitidae it is also excluded by the presence of dendritic sternal gills. No other crangonyctoid family can accommodate the combination of characters shown by *Perthia* and accordingly we propose a new family, Perthiidae.

Diagnosis. Antennal sinus of head moderately developed. Antenna 1 not significantly longer than 2. Mandibular molar reduced, almost simple. Outer plate of maxilliped very small. Outer plate of maxilla 2 with one kind of seta apicolaterally. Rugosities absent on maxillipedal palp article 3 and gnathopods. Gnathopods large, carpi short and deeply lobate, propodi attached to carpi in eusirid fashion, spines on palms not of bifid crangonyctid form. Posterior lobes of coxae 5–7 weakly but variably dominant. Oostegites [?broad, poorly known]. Sternal gills dendritic. Urosomites separate. Inner ramus of uropod 3 present.

Perthia Straškraba

Perthia Straškraba, 1964: 133.

Type species. *Neoniphargus branchialis* Nicholls, 1924 by original designation.

Diagnosis. Pleonites with weak dorsal armaments. Rostrum small, lateral cephalic lobes moderately projecting and weak antennal sinus present. Eyes of medium size, darkly pigmented, reniform.

Antenna 1 not elongate, scarcely longer or shorter than antenna 2 (if base of antenna 2 inside head counted), ratio of peduncular articles about 13:10:7 or 16:13:6, accessory flagellum 2-articulate. Flagellum of antenna 2 much shorter than peduncle, calceoli present in male.

Mandibular molar not tritulative, instead spinose; ratio of mandibular palp articles about 5:18:15, article 2 moderately setose, setae widely spread along margin, article 3 weakly falcate, setae = ADE. Labium bearing faint inner lobes in form of appressed plaques. Maxillae barely setose medially, inner plate of maxilla 1 ovatotriangular, with 2 apical (1 weakly apicomедial) setae, outer plate with 7 spines, palps symmetric, both sides with thin apical spines. Maxilla 2 smaller than in other freshwater Australian crangonyctoid species,

inner plate lacking oblique row of setae on face, apicomедial corner with weakly medial seta or not. Inner plates of maxilliped lacking apical setae, with spines only, outer plates very small.

Coxae 1–4 elongate, coxae 1–3 lacking row of posterior spines, coxa 1 expanded weakly below, coxa 4 lobate, coxa 5 much shorter than 4. Gnathopods 1–2 large, not sexually dimorphic, carpi short, lobate, with hand attached to anterodistal end of wrist at narrow juncture, thus gnathopods of eusirid form, fourth article on both gnathopods lacking hyaline lobe, article 3 of gnathopod 1 in one species with rugose posterior lobe, palms weakly oblique, lacking rugosities, spines not grossly bifid; spines at corner of palm 6+; setae along palm dense but triggers evanescent.

Pereopods 5–7 elongate, pereopod 6 longer than pereopod 7, article 2 broadly expanded, ovate or trapezoidal and posteroventrally lobate on all of pereopods 5–7 but less strongly expanded on pereopod 7; dactyls of pereopods 3–7 with 3–7 additional spinules on inner edge besides ordinary 1 setule.

Coxae 2–6 with gills, gill 6 reduced. Thoracic segments 2–6 with lateral sternal gills of dendritic form, 1 lobe of several gills pointing medially.

Uropod 3 strongly extended, peduncle short, outer ramus 2-articulate, article 2 very short, inner ramus variable in extension. Telson elongate, cleft about 75 percent, lobes not tumid laterally, with only apical spination in type species but with mid-dorsal axially aligned spination in other species, no major setation, no basolateral armaments except for pair of lateral penicillate setules about M.60 on each side.

Additional description (many items based on acutitelson). Upper lip uniform, rounded but weakly asymmetrical below. Accessory blades (rakers) on mandibles with interraker plumose seta between each main raker; very few additional penicillate setae beyond rakers and riding onto base of molar, instead with 2–3 small bent basal molarial ragged setae besides regular apical molarial seta, latter with about 5–7 accessory spines; molar otherwise not tritulative. Inner lobes of lower lip distinct but small. Maxilla 2 both plates with long apical setae; inner plates of maxillae 1–2 and medial and lateral margins of maxilla 2 lacking pubescence, instead midlateral face of outer plate on maxilla 2 with pubescence of tiny prickles. Maxillipedal inner plate with distal row of 2 thin spines and 2 blunt naked spines and medial row of very few thick plumose setae; outer plate very small, with apicolateral row of few plumose setae continuous with medial row of elongate thin spines; palp articles 2–3 poorly setose laterally, well setose medially, article 3 with organised row and groups of spines near base of dactyl, apex produced and wide area weakly rugose. Dactyls of gnathopods without small recumbant inner tooth-spine but with extended inner flange and stiff spinules or setules at inner nail articulation line. Palms of gnathopods lined with simple setae. Gnathopod 1 without one seta of article 4 enlarged and scythe-like. Posterior spine sets on article 6 of pereopods 3–4

evenly spaced. Dactyls of pereopods 3–7 with marginal and facial spinule (2 total) besides supernumerary inner spinules. Pleopods similar, peduncles moderately setose; rami extending subequally; basomedial setae on inner rami of pleopods 1–3 bifid, branches diverse, of different length and shape but, often 1 branch with diamond head, or both simple; retinacula 2, accessory retinacula present. Posteroventral tooth of epimera 2–3 short or absent. Some epimera with facial spines and setae near ventral margin, posterior margins weakly setulate. Apicolateral corner of peduncles on uropods 1–2 with 1 spine; rami of uropods 1–2 extending subequally, margins with 2 spine rows, uropod 1 lacking basofacial armaments. Medial setae of outer ramus on uropod 3 dense, any lateral setae not plumose. Ventrodistal spine on urosomite 1 at base of uropod 1 short.

Sexual attributes. Lack of full knowledge of sexual differences in one species precludes firm statements on this subject. Further studies are required, particularly with regard to the form of gnathopods, the occurrence of calceoli on antennae 2, and of uropodal armature in the two sexes. Oostegites on female coxa 2–5, very small.

Characters of interspecific value. Carpus and merus of pereopods setose or not; inner ramus of uropod 3 extending from 33 to 68 percent of outer ramus; telson with or without dorsal spines.

Unusual characters. In addition to our previous listing of diagnostic characters displayed by *Perthia* which easily separate it from the Paramelitidae and Neoniphargidae, it may help further studies of this most remarkable family if we list here comprehensively those attributes not found in other Australian freshwater crangonyctoids: the relatively short antenna 1; the non-triturative mandibular molar; the lack of significant pubescence on the maxillae and the presence of minor prickle-like pubescence on the outer plate of maxilla 2 in the middle of the face; the symmetrical palps of maxilla 1 (but see *Wesniphargus*); the small maxilla 2 with suborbicular plates; the poorly armed inner plate of the maxilliped, with no apical plumose setae and only 4 armaments; the reduced outer plate of the maxilliped; the strongly spinulose (“pectinate”) dactyl of the maxilliped; the eusirid gnathopods; the slightly extreme density and thickness of elements in the armament clusters on articles 5–6 of

pereopods 3–4 and the anterior margin of article 2 on pereopods 5–7; and the small but distinctly shorter extension on the inner rami of the pleopods.

Relationships. *Perthia* has affinities with *Neoniphargus* because of the dendritic sternal gills but could stand on neither a primitive nor a derived line of descent to *Neoniphargus*. Apomorphic characters of *Perthia* would seem to be the small outer plate of the maxilliped, and the elongate telson (also found in some *Neoniphargus*). The eusirid form of gnathopods in *Perthia* we assume cannot be derived from the smaller mittenform gnathopods of *Neoniphargus*; thus, both genera have divergent apomorphic gnathopods from the more basic kind perhaps represented by *Austrogammarus*.

Perthia differs from *Hurleya* in the presence of dendritic sternal gills, the small outer plate of the maxilliped and the eusirid form of gnathopods. Both genera share, however, the common character of spinose dactyls on the pereopods. It is therefore not certain as to whether or not dendritic sternal gills or spinose dactyls mark divergent evolutionary lines. They are not correlative which may indicate that the form of sternal gills is quite plastic in an evolutionary sense if the presence of spinose dactyls marks common ancestry. Spinose dactyls are also present in one species of *Neoniphargus*.

Perthia also shares pectinate (spinulose) pereopodal dactyls with *Uroctena* but again differs from *Uroctena* in the dendritic sternal gills, in the fully eusirid gnathopods (which in *Uroctena* are rudimentarily of this form) and in the lack of long apical setae on the telsonic lobes.

Perthia has many unusual features. For example, unlike other Australian genera, the inner rami of the pleopods are the shorter, the gland cone of antenna 2 points downward, coxa 4 has tiny, wispy ventral setules, the gnathopodal palms bear a hard herringbone ornamentation, the anterior margins of the second articles on pereopods 5–7 are more spinose than in other taxa, the posterior margins of the fourth articles on pereopods 3–4 have especially dense setal clusters, the dactyls of the gnathopods lack an articulation between proximal and distal parts and have an inner flange, antenna 1 is especially short for a genus with long coxae, the first article of antenna 2 is suspended below the head sinus, and the gnathopods of course are fully eusirid.

Key to the Species of *Perthia*

1. Uropod 3 parviramous, inner ramus short; telson without dorsal spines; carpus and metacarpus of pereopods 3–7 with long setae *P. branchialis*
- Uropod 3 variramous, inner ramus long; telson with dorsal spines; carpus and metacarpus of pereopods 3–7 without long setae *P. acutitelson*

Perthia branchialis (Nicholls)

Figs 101, 102

Neoniphargus branchialis Nicholls, 1924: 105–109, pls 10–11.

Material examined. There is no mention in the original description of any type deposition, and early enquiries to the Western Australian Museum (where Nicholls had deposited some type material of other species) indicated that no type material of *Neoniphargus branchialis* appeared to have been deposited by him (S.M. Slack-Smith, personal communication, 5 Dec 1973). Subsequent correspondence with R. George supported that conclusion (personal communication, 5 Mar 1974). [Straškraba's (1964: 133–134) remarks on material that he thought conspecific with Nicholls' taxon were based on material that was neither original type material nor from the type locality; it was collected in 1928 from the Albany district.] Because of this, our redescription of this species proceeded on the basis that types were lost, and it derived from Nicholls' original text and figures. However, shortly after our paper was more or less complete, a listing of type material of Crustacea held by the Western Australian Museum was published and included reference to *Neoniphargus branchialis* (Jones, 1986). According to Jones, type material of this species is held by the Western Australian Museum and comprises 4 SYNTYPES: 3 whole specimens and 1 specimen in two halves (WAM 249-64, WAM 11781).

Given the relatively complete original description of the species and the timing of the discovery of type material, no attempt has been made to examine this material and include the results in this paper. A planned survey of Western Australian freshwater amphipods, however, will include the results of a re-examination of it. The description below, then, is based entirely upon the original one and our figures 99 and 100 are simply re-inked exact reproductions of Nicholls' plates 10 and 11. We note that, in his description, Nicholls did not unequivocally state the sex of parts described, but since some of his drawings were clearly of a female specimen (pereopods and gnathopod had oostegites = "marsupial plates") it is likely that most of his drawings at least were of female parts (not antenna 2). Some differences between the sexes, however, were noted in his text. Type locality, Western Australia, King River, associated with *Phreatoicus lintoni* and occurring in waters of shallow swamp and beneath leafy liverwort clothing banks of small creek draining swamp and emptying into King River.

Diagnosis. Uropod 3 parviramous, inner ramus short; telson lacking dorsal spines; carpus and merus of pereopods 3–7 bearing setae.

Description (non-ovigerous female). *Body* (Fig. 101): smooth, urosome sparsely armed dorsally; length, 8.0 mm.

Head (Fig. 101): rostrum small; eyes large, dark, reniform.

First antenna (Fig. 101): length 0.4 of body, 1.1 second antenna; peduncle as long as flagellum, article 1 longest, article 3 shortest, setae sparse; each flagellar article except first and last with aesthetasc; accessory flagellum 2-articulate, not reaching past article 2 of flagellum, articles uniform, sparsely setulate. *Second antenna* (Fig. 101): length 0.35 body; peduncle longer than flagellum, article 4 longer than 5, articles 3, 4 and 5 with weak ventral setation; flagellum 8-articulate, weakly setose ventrally, lacking calceoli.

Upper lip: apical margin evenly rounded. *Lower lip* (Fig. 101): inner lobes rather distinct. *Left mandible*: palp article 3 shorter than 2, article 2 with 4 outer marginal setae, article 3 with 0A–C, many D, 3E; incisor 4-toothed, lacinia mobilis [?4]-toothed, [?2] setose accessory blades; molar [?not triturative], [?bearing] plumose seta, [? penicillate hooked brushy basal setae, 1 chisel spine]. *Right mandible* (Fig. 101): incisor 4-toothed; lacinia mobilis bifid, denticulate, 1 denticulation strongly extended; accessory blades of [?] plumose spines and [?1] chisel spine, setae of palp article 3 = 0A–C, many D, 4E (right and left mandibles are said to have 4–5 rakers, but interrakers are apparently also counted). *Left first maxilla* (Fig. 101): palp article 2 with 7 thin apical spines and [?2] subterminal facial setae, outer plate with 7 spines, most denticulate; inner plate with 2 apical simple setae. *Right first maxilla*: palp article 2 with [?thick] apical spines articulated to article, [?1] apicolateral thin spine and [?1] subterminal apicolateral facial seta. *Second maxilla* (Fig. 101): outer plate outer lateral apical margin with 1 large seta, apicomедial corner of inner plate with 1 weakly submarginal seta and 2 other marginal setae. *Maxilliped* (Fig. 101): palp article 3 with ranks of thin setae on inner edge, apical part with rank of thicker setae, apex produced and [?not] rugose; inner plate with 5 thick spines and [?no plumose setae] apically, medial row of 3+ plumose setae, and 1 ventrofacial spine; outer plate small.

First gnathopod (Fig. 101): "eusirid" in form of attachment; coxal plate setoseless apically; article 4 without posterior hump; carpus short, narrow and with thin posterior lobe inserted between articles 4 and 6; propodus ovatotrapezoidal, longer than wide, posterolateral angle rounded, with 2 medial and 2 lateral spines, 1 lateral spine elongate, palm oblique, convex; dactylus reaching end of palm. *Second gnathopod* (Fig. 101): "eusirid" in form of attachment; scarcely larger than first gnathopod; palmar corner with 2 and 2 spines (right and left); coxal plate with 1 seta.

Pereopods (Fig. 102): coxa 3 with 1 ventral and 2 posteroventral setae, coxa 4 deeply emarginate, with 1 anteroventral and 4 posterior setae; pereopods 3–4 not longer than gnathopod 2, pereopod 4 slightly longer than 3, articles 4–5 weakly setose posteriorly, posterior margin of article 6 on pereopods 3–4 with spine formulas of 2-3-2-2-? and 2-2-2-2-?, dactyls with 5 and 4 spines on inner margins; pereopods 5–7 similar, coxae lacking more than 1 spine on ventral margin of

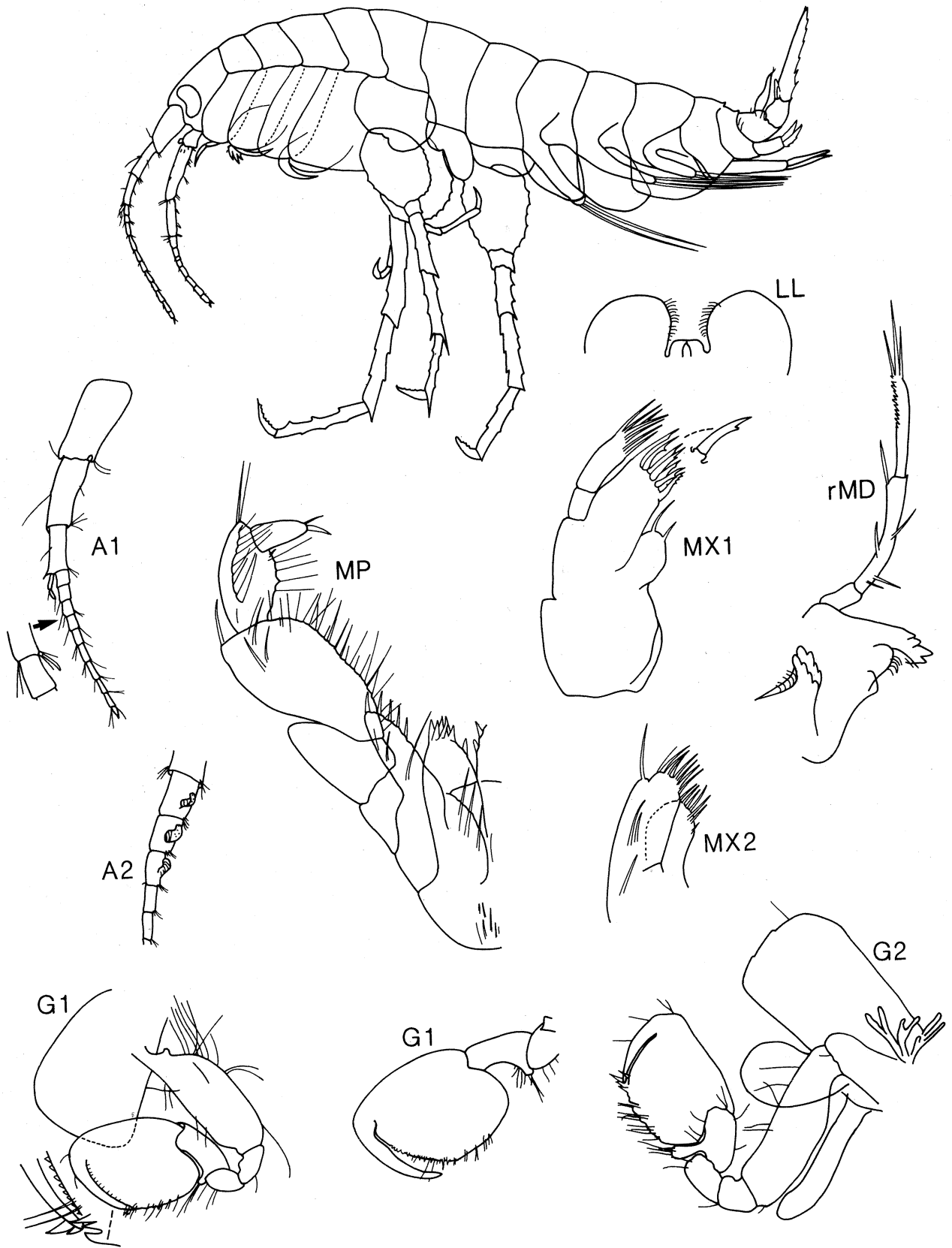


Fig.101. *Perthia branchialis* (Nicholls), female [see text], all drawings rearranged and re-inked from Nicholls (1924, pl. x).

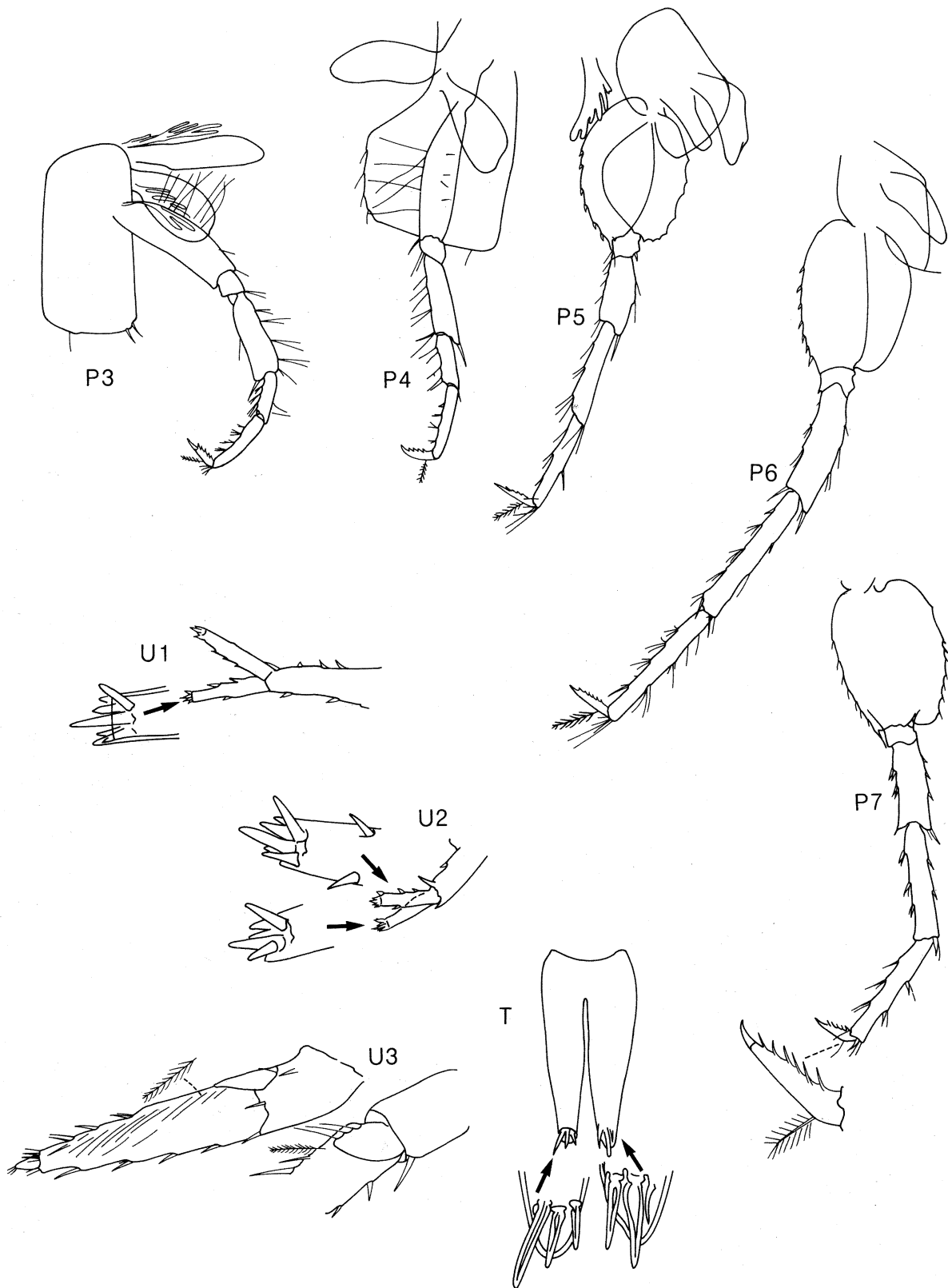


Fig.102. *Perthia branchialis* (Nicholls), female [see text], all drawings rearranged and re-inked from Nicholls (1924, pls x and xi).

posterior lobe, article 2 expanded and lobate posteroventrally, bearing short thick posterior setules, dactyls with up to 6 spines on inner margins; sac-like coxal gills on pereopods 2–6, those of pereopods 5–6 slightly reduced.

Sternal processes (Fig. 102): 4 pairs of fleshy dendritic, sternal gills present on segments 2–5, attached to front of lateral edge of each segment.

Oostegites (Figs 101, 102): broad and well-developed on coxae 2–4, small on coxa 5.

Epimera (Fig. 101): each epimeron with angular posteroventral corner, posterior margins almost straight, epimera 1, 2, 3 each with [?] anteroventral spine, epimera 1–2 slightly and epimeron 3 deeply notched posteriorly. *Pleon* (Fig. 101): dorsolateral posterior margin of pleonites 1–6 with following setal formula: 0, spines = 0-0-0-0-2; uropod 3 strongly extending beyond uropods 1 and 2 in entire animal, uropod lengths relative to uropod 1: uropod 2 = 0.50, 3 = 1.1. *Pleopods*: retinacula [?] per pleopod, [?] accessories; each peduncle with [?] seta.

First uropod (Fig. 102): peduncle length 1.3 rami; outer margin with 1 apicodistal spine besides weak row of 3 dorsal spines, with 2 spines medially; rami of subequal length, [?both] rami with 2 rows of marginal spines, outer ramus with [?5] apical and inner ramus with 6 apical spines. *Second uropod* (Fig. 102): peduncle about same length as rami, with 2 dorsolateral spines including 1 apical; rami extending equally, [?both] with 2 rows of marginal spines, apices with 5 and 6 spines. *Third uropod* (Fig. 102): peduncle length 0.50 outer ramus, as long as urosomite 3, with 1 facial, subdistal spine besides apical clusters of 1 and 1; outer ramus proximal article with 5 transverse lateral spine-seta rows on body, medial margin with 3+ sets of armaments, mixing long plumose setae and short spines, lateral spines from proximal to distal = 1-1-2-1-2, lateral setae = 0-0-0-0-0, apex of small article 2 with 3 apical short stiff setae; inner ramus triangular, length 0.24 of outer, with 3 apicomедial setae. *Telson* (Fig. 102): elongate, longer than urosomite 3; cleft 80 percent of length; apices each with 3 spines in 1 row, no apicolateral setae, each lobe [?with pair] of penicillate setules dorsolaterally at M.[?].

Description (male). *Body*: length, 6.0 mm.

Second antenna (Fig. 101): flagellum with 6–7 articles, articles 1–3 or 2–4 bearing calceoli.

First and second gnathopods: apparently not sexually dimorphic.

Relationships. This is the type species of the genus and the relationships will be found with *P. acutitelson*.

Distribution. King River, southwestern Western Australia, in side creek and swamp.

Perthia acutitelson Straškraba

Figs 103, 104

Perthia acutitelson Straškraba, 1964: 134–137, figs 8–9.

Material examined. In Straškraba's original

description of *Perthia acutitelson*, reference is made to a holotype ("male") collected from a creek at Cannington (WAM 11781). One female is also recorded for the same collection. Additional material regarded as conspecific with the holotype is noted in Straškraba's description, viz. WAM 10939, 17 specimens, 9 mm, from Lake Yangebup, Iandakot (= Jandakot), WAM 159/163–37, 8 specimens, 11 mm, from Big Brook, Pemberton, T. Gregory. Straškraba's meagre description is obviously based upon a consideration of all material since his illustrations in fact relate to material other than the holotype (from Yangebup and Pemberton). Thus, all his material other than the holotype constitute the type series, and all specimens other than the holotype constitute paratypes. We designate the HOLOTYPE as specimen "v", 11.1 mm, and designate 3 PARATYPES from the material collected by T. Gregory at Big Brook, Pemberton, as female "s", 8.4 mm, female "t", 7.8 mm, and female "u", 6.8 mm. We here fully describe female "s", and partially describe the holotype, and females "t" and "u". The holotype, regarded as a male by Straškraba seems to be a gerontic female (see below). Thus, the male of this species remains undescribed.

Diagnosis. Uropod 3 variramous, inner ramus long, over half as long as outer ramus; telson bearing dorsal spines; articles 4–5 of pereopods 3–7 lacking setae.

Description of paratype (female "s"). *Body* (Fig. 103): pleon sparsely armed dorsally, few setae on pleonites 1–4, 1 spine on each side on pleonite 5, 2 spines on each side on pleonite 6; length, 8.4 mm.

Head (Fig. 103): eyes medium, reniform, dark.

First antenna (Fig. 103): length 0.3 of body, 0.82 second antenna; peduncle slightly longer than flagellum, article 1 longest, article 3 shortest, setae sparse; accessory flagellum 2-articulate, reaching end of article 2 of flagellum, articles uniform, sparsely setulate. *Second antenna* (Fig. 103): length 0.35 body; peduncle longer than flagellum, article 4 longer than 5, articles 3, 4 and 5 with moderate ventral setation; flagellum 12-articulate, weakly setose ventrally, lacking calceoli.

Upper lip (Fig. 103): apical margin evenly rounded but connection to epistome and epistome itself slightly asymmetrical. *Left mandible* (Fig. 103): palp article 3 shorter than 2, article 2 with 9 widely spread outer marginal setae, article 3 with setal formula of 3A, 0B, 0C, many D, 4E; incisor 4-toothed, lacinia mobilis 4-toothed, 3 setose accessory blades and 2 interrakers; molar bearing plumose seta jointly with 7 spines, and 3 penicillate hooked brushy basal setae, not tritritative. *Right mandible* (Fig. 103): incisor 4-toothed; lacinia mobilis complex, palmate, denticulate, 2 denticulations strongly enlarged; accessory blades of 2 plumose spines and 3 interrakers, setae of palp article 3 = 2A, many D, 4E; molar not tritritative. *Left first maxilla* (Fig. 103): palp article 2 with 10 thin apical spines and 2 subterminal facial setae, outer plate with

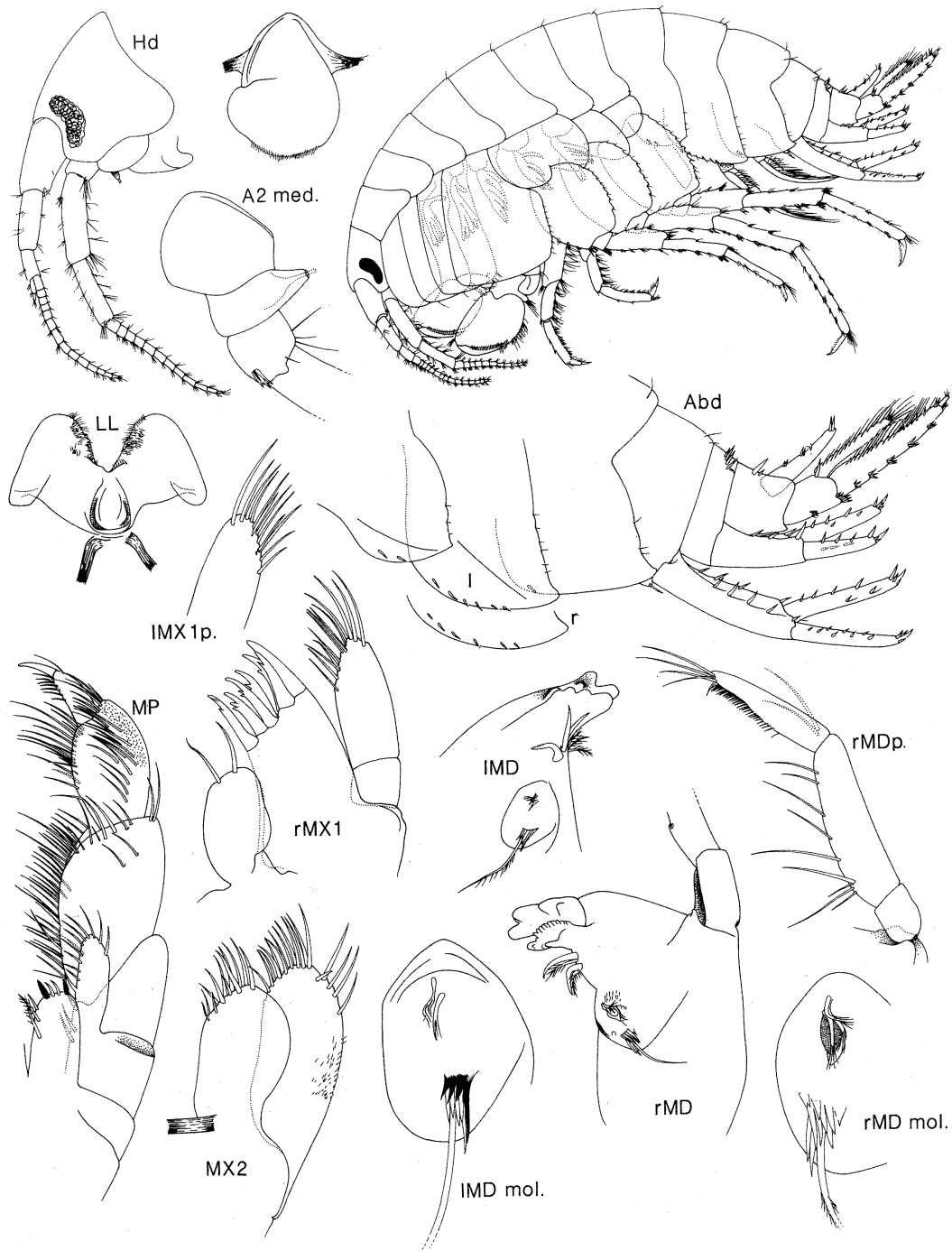


Fig.103. *Perthia acutitelson* Straškraba, paratype, female "s".

7 spines, most denticulate; inner plate with 2 apical naked setae. *Right first maxilla* (Fig. 103): palp article 2 with 8 thin apical spines and 3 subterminal setae. *Second maxilla* (Fig. 103): outer plate outer margin with 5 large setae, apicomedial corner of inner plate marked by 1 small setae. *Maxilliped* (Fig. 103): palp article 3 with 6 ranks of 16 thick setae on face, apex weakly produced and weakly rugose; dactyl body weakly long, inner edge with 7 spinules in form similar

to pereopodal dactyls, nail medium; inner edge of inner plate with 2 thick spines and 2 thinner spines apically, 1 apicomedial small spine, 2 medial plumose setae, 2 ventrofacial spines; small outer plate with 4 apicolateral setal spines, 8 long sharp medial spines plus 1 thin slightly submarginal seta.

First gnathopod (Fig. 104): "eusirid" in form; coxal plate with 3 setae apically; article 3 with posterior hump; carpus short and lobate, lobe straight and setose

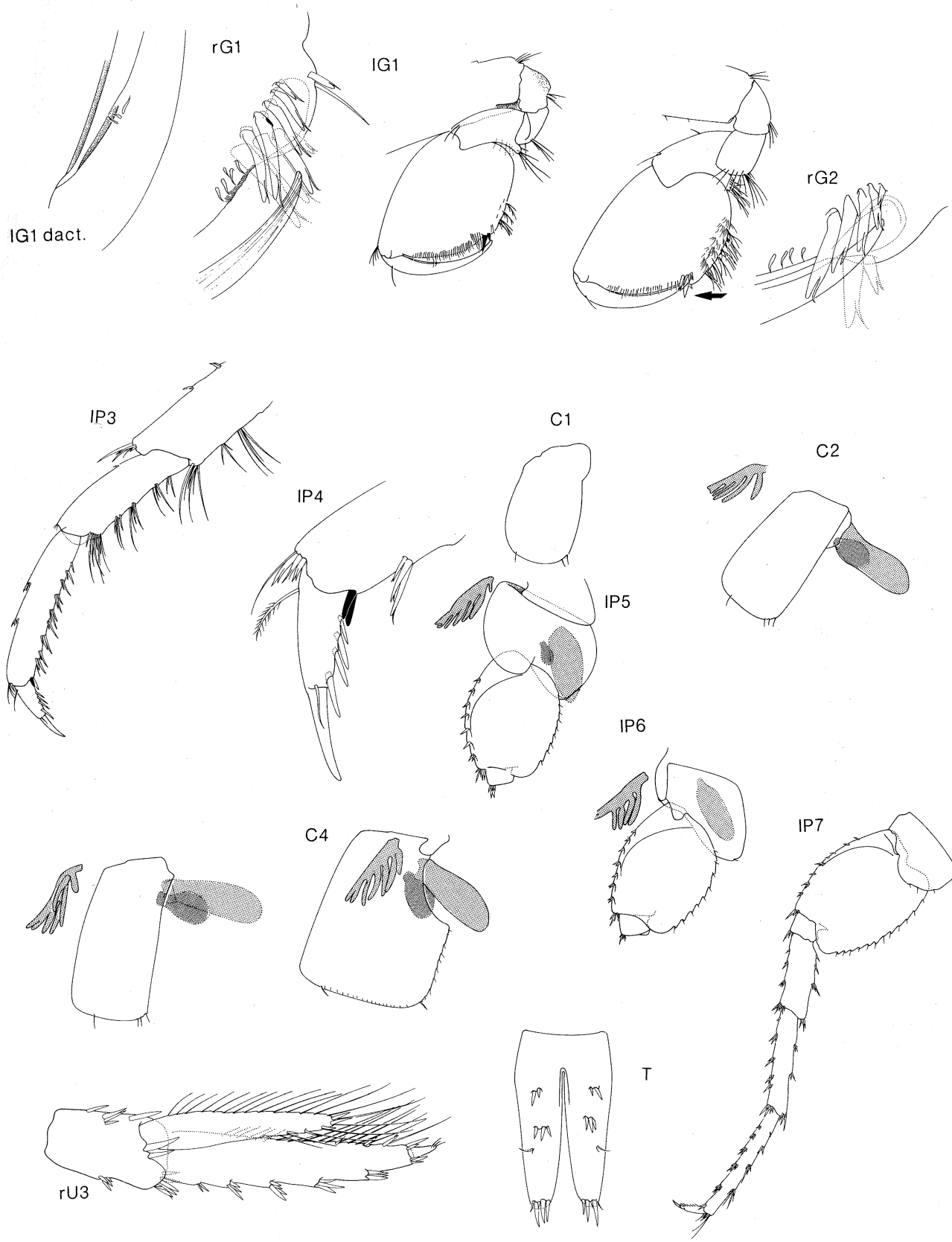


Fig.104. *Perthia acutitelson* Straškraba, paratype, female "s".

apically; propodus ovatotrapezoidal, longer than wide, posterolateral angle rounded, with 4 medial and 2 lateral spines (on left, right side aberrantly with 4 lateral, 4 medial, 1 extra tiny spines), 1 lateral spine elongate, palm oblique, convex, with herringbone pattern of perpendicular ridges making extra tough grasping edge; dactylus reaching end of palm, pocket for reception large, dactylus deeply ridged longitudinally, with inner flange and 3 setules near hypothetical articulation line of incipient nail; this nail absent. *Second gnathopod* (Fig. 104): "eusirid" in form; slightly larger than first gnathopod; lobe of article 3 absent; carpal lobe thicker; palmar corner with either 4-5 medial and 2 lateral spines; coxal plate with 4 setae.

Pereopods (Figs 103,104): coxa 3 with 4 setae, coxa 4 deeply emarginate, with 1 anteroventral and 10 posterior setules, ventral margin with tiny setules marked as dots in illustration; pereopods 3-4 longer than gnathopod 2, pereopod 3 not longer than 4, article 4 moderately setose posteriorly, article 5 of pereopods 3-4 with 4-5 dense setal clusters posteriorly, posterior margin of article 6 on pereopods 3-4 with spine formulas of 2-3-2-3-2-3-3-2-2-1 and 2-4-3-3-2-3-3-2-1; pereopods 5-7 similar, coxae lacking spines on ventral margin of posterior lobe, article 2 expanded and lobate posteroventrally, bearing medium length setae, anterior margins somewhat more heavily spinose than in other Australian genera; coxal gills on pereopods 2-6, gill of pereopod 6 slightly reduced. *Oostegites* (Fig. 104): coxae 2-4 with small setoseless oostegites, coxa 5 with tiny member.

Sternal processes (Fig. 104): 5 pairs of fleshy dendritic sternal gills present on segments 2-6, attached to front of lateral edge of each segment; some sternal gills with branch pointing medially, otherwise fingers pointing posteriorly.

Epimera (Fig. 103): epimeron 1 with tiny posteroventral tooth, epimera 2-3 with larger blunt tooth, posterior margin of epimeron 2 almost straight, of others weakly convex, ventral spine formula of epimera 1-3 = 2-6-1.

Pleon (Fig. 103): each dorsolateral posterior margin of pleonites 1-3 with 1 feeble seta, pleonite 4 with 2, pleonites 5 and 6 with 4 and 2 dorsolateral spines each; uropod 3 extending beyond uropods 1 and 2 in entire animal, uropod lengths relative to uropod 1: uropod 2 = 0.65, 3 = 0.85. *Pleopods*: retinacula 2 per pleopod, 2 simple accessories; peduncles of pleopods 1-3 with 10 (5 groups near basofacial rear), 6, and 14 (widely spread along medial margin) respectively; inner ramus of each pleopod shorter by length of 2 main articles than outer, number of outer articles on pleopods 1-3 = 22-22-20, inner = 17-18-17.

First uropod (Fig. 103): peduncle length 1.3 rami; outer margin with 1 apicodistal spine besides strong row of dorsal spines, with 5 spines medially; rami of subequal length, both rami with 2 rows of marginal spines, each ramus with 4-5 apical (4 being aberrational) spines. *Second uropod* (Fig. 103):

peduncle about same length as rami, with 3 dorsolateral spines including 1 apical; outer ramus slightly shorter than inner, both with 2 strong rows of marginal spines, apices with 4 and 5 spines (5 normal). *Third uropod* (Figs 103,104): peduncle length 0.45 outer ramus, as long as urosomite 3, with group of outer facial, subdistal spines and 2 medial groups besides apical cluster; outer ramus proximal article with 6 transverse lateral spine rows on body, medial margin with 4 spines in tandem plus long row of setae, apex of tiny article 2 with 3 apicomedia short stiff setae; inner ramus length 0.68 of outer, with 2 apical and 3 lateral spines plus many setae on both margins. *Telson* (Fig. 104): elongate, longer than urosomite 3; cleft 80 percent of length; apices each with 3 spines in 1 row, 1 apicolateral seta, 2 dorsal sets of 2 and 3 spines each, and each lobe with pair of penicillate setules dorsolaterally at M.67.

Description of paratype material (female "t").

Dactyls of pereopods 3-4 with only 3 inner spinules; epimeron 2 with 3 spines; pleonites 5 and 6 with 4 and 1 spines; telson with 3 sets of dorsal spines.

Female "u". Dactyls and epimeron 2 like "t"; pleonites 5 and 6 with 3 and 2 spines; telson with only 1 set of dorsal spines.

Description of holotype (specimen "v"). Largest known specimen at 11.1 mm; probably gerontic female; oostegites no better developed than in younger females; inner ramus of uropod 3 extending 80 percent along outer ramus; all pereopodal dactyls with only 1 inner spine; pleonites 5-6 with 3 and 1 spines.

Illustrations. Uropods 1-2 not enlarged, see enlargement of pleon; illustration of mandibular palp reduced to 67 percent of mandibular body.

Relationships. This species differs most notably from *P. branchialis* in the presence of dorsal telsonic spines, the elongate inner ramus of uropod 3, and the sparsity or lack of long setae on the carpus and merus of pereopods 5-7.

Distribution. Western Australia, creek at Cannington; Big Brook at Pemberton; Lake Yangebup, Jandakot. All localities are in southwestern Western Australia.

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