J. LAURENS BARNARD

A Review of the Family Synopiidae (=Tironidae), Mainly Distributed in the Deep Sea (Crustacea: Amphipoda)

SMITHSONIAN CONTRIBUTIONS TO ZOOLOGY NUMBER 124

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SMITHSONIAN CONTRIBUTIONS TO
ZOOLOGY

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SMITHSONIAN INSTITUTION PRESS
CITY OF WASHINGTON
1972

ABSTRACT

Barnard, J. Laurens. A Review of the Family Synopiidae (=Tironidae), Mainly Distributed in the Deep Sea (Crustacea: Amphipoda). *Smithsonian Contributions to Zoology,* number 124, 94 pages, 46 figures, 1972.—The family Synopiidae (= Tironidae) comprises 69 species in 14 genera, of which 12 new species and 3 new genera are described herein. Keys and diagnoses to the taxa include all described species. The new genera, *Ileraustroe, Latacunga,* and *Priscosyrrhoe,* are elaborated from species formerly placed in *Austrosyrrhoe* or from new species and were suggested by similarity analysis of generic groups arranged in a dendrogram. Three main evolutionary branches occur in the family, comprising groups typified by *Synopia-Tiron, Syrrhoe,* and *Syrrhoites-Bruzelia* as based on gnathopodal structure. The shallow-water *Synopia-Tiron* group has the most advanced gnathopods but retains eyes in most members. The *Syrrhoe* group, containing shallow and deep-water species, retains eyes in the shallow-water members; but the majority of synopiid species occurs in the anoculate, deep-sea group typified by *Syrrhoites* and *Bruzelia,* having ordinary gnathopods.

The type-genus, *Synopia,* is morphologically remote from other genera in the family, formerly known as Tironidae, but in comparison to related families, it remains close to other tironids and should not be segregated at familial level.

Synopia and *Tiron* and possibly *Syrrhoe,* the only shallow-water tropical genera, are not directly antecedent to the cold-water *Syrrhoites* group but may be the oldest synopiid genera despite the highly evolved gnathopods in *Tiron* and pelagont coxae in *Synopia* and *Syrrhoe*. *Tiron* is a benthic genus but *Synopia* and *Syrrhoe* are nektodemersal. Most synopiids are adapted to epibenthic life though many feed on the benthos. These adaptations make them very successful in the deep sea but not in the hydrologic turmoil of the shallow sea, where amphipods are usually wholly nektonic or wholly fossorial except during male swarming.

Official publication date is handstamped in a limited number of initial copies and is recorded in the Institution's annual report, Smithsonian Year.

Library of Congress Cataloging in Publication Data
Barnard, Jerry Laurens, 1928–
A review of the family Synopiidae (=Tironidae)
(Smithsonian contributions to zoology, no. 124)
Bibliography: p.
1. Synopiidae. I. Title. II. Series: Smithsonian Institution. Smithsonian contributions to zoology, no. 124.
QL1.S54 no. 124 [QL444.A5] 591'.08s [595'.371] 72–1787

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402 - Price $1.25 (paper cover)

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J. Laurens Barnard

A Review of the Family Synopiidae (=Tironidae), Mainly Distributed in the Deep Sea (Crustacea: Amphipoda)

Introduction

The Family Synopiidae (=Tironidae) is reviewed and reorganized and a number of new species and three new genera are described. The materials examined in this study come mainly from deep-sea collections made by the research vessels *Vema* of Lamont Geological Observatory and *Eltanin* of the National Science Foundation. Because individuals of this family are friable and often fragmented, only those specimens in reasonably good condition have been studied. Numerous undescribed species remain to be collected in good condition as evidenced from a cursory examination of fragments in various samples. Hopefully this review of the family will stimulate further collecting and special care in washing mud from bottom samples so as to provide good materials of unknown species.

This work was supported by NSF GB 3285, providing the skilled assistance of Mrs. Elaine R. Hodges, who made the original drawings, later inked by the writer with materials supplied by the Richard Rathbun Fund. Dr. Andrew G. Carey, Jr., of Oregon State University, kindly provided specimens from his deep-sea transect (see J. L. Barnard, 1971, for main study). Dr. John S. Garth and Dr. Olga Hartman of the Allan Hancock Foundation kindly provided specimens of *Tiron* for study.

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Discussion

The Synopiidae are, perhaps, the most diverse of those families primarily confined to deep seas. Only a few genera, such as *Tiron* Liljeborg, *Synopia* Dana, *Syrrhoe* Goës, and *Garosyrrhoe* J. L. Barnard, have species confined to warm shallow seas; the other genera, along with many species of *Syrrhoe,* are primarily confined to deep cold-water.

Key to Legends

Figures are labeled with capital and lower-case letters, the capitals usually indicating the name of a structure and the lower case letters indicating a modification such as orientation or specimen considered.

A, antenna; *B,* upper lip; *C,* coxa; *D,* dactyl of a pereopod; *E,* epimeron; *F,* accessory flagellum; *G,* gnathopod; *H,* head; *I,* inner plate; *J,* various meanings according to specific figure legend, but if unmentioned meaning epistome; *L,* palp; *M,* mandible, *O,* outer plate; *P,* pereopod; *Q,* mandibular molar; *R,* various meanings according to specific legend but if unmentioned meaning lower lip; *S,* maxilliped; *T,* telson; *U,* uropod; *V,* urosome; *W,* pleon; *X,* maxilla; *Y,* prebuccal mouthparts; *Z,* mandibular incisor. *a,* anterior; *d,* dorsal; *e,* various meanings according to specific legend; *i,* inner; *l,* left or lateral; *n,* meaning according to specific legend; *o,* outer or in case of thoracic appendages meaning opposite view of a right-sided appendage; *q,* various meanings; *r,* right; *s,* setae removed or missing; *t,* spine; *u,* half; *v,* ventral; *w,* various meanings according to specific legend; *y,* various meanings; *z,* broken appendage; *8,* rostrum.

The family therefore has not been of much concern until recent explorations of the deep sea have revealed a very diverse assemblage of synopiids. The number of species now totals 69. Extraordinary variations in morphology occur among these species. Many of them are strikingly ornamented with dorsal teeth and lateral carinae. Unfortunately, many of the deep-sea collections made in the past have resulted in scarce individuals, badly fragmented or damaged, and collected in widely scattered basins. Setae are often removed by sandblasting or siltblasting during the washing of mud samples. These defects are slowly being lessened but taxonomists are still beset with a host of species inadequately described. Despite imperfect descriptions, one may recognize the unsatisfactory state of taxonomy in the deep-sea genera. There are two main problems: (1) the recognition of individual groups of species intragenerically and intergenerically and (2) the difficulty of determining the extent to which intraspecific variation is a measure of geographic subspeciation. One must presume that numerous species are yet undescribed but some progress in perfecting the classification can nevertheless be made now.

In the early days of gammaridean taxonomy, even as late as Stebbing's (1906) monograph, only 2 valid species in *Bruzelia* and 3 in *Syrrhoites* were known and all were from the arctic and boreal provinces of the northeastern Atlantic Ocean. Both genera have an enormous, smooth molar dominating the mandible; the entire mandibular body is also extraordinarily enlarged and therefore the palp appears relatively weak. The two genera were distinguished by the presence of a cleft in the telson of *Syrrhoites* and its absence in *Bruzelia*. One of the species of *Syrrhoites, S. fimbriatus* Stebbing and Robertson, has since been shifted by J. L. Barnard (1964) to *Austrosyrrhoe* but that may be an erroneous move, as the mandibular molar is still poorly known.

In 1911, Chevreux described *Bruzeliopsis* from the abyss of the Bay of Biscay but did not specifically mention any characters differentiating it from its obvious relative, *Bruzelia*, as indicated by the absence of a cleft in the telson. In retrospect one may infer that Chevreux considered the absence of serrate palmar spines on the gnathopods and the strong disproportion in coxae 3 and 4 to be generic characters. Unlike the 5 early species of *Bruzelia* and *Syrrhoites*, *Bruzeliopsis alberti* has a very broad coxa 3 with a distinct posterodorsal excavation and very small "comma-shaped" and blunt coxa 4 as in *Syrrhoe*. Article 1 of antenna 1 is elongate and distally cuspiform and articles 2 and 3 relatively short in *Bruzeliopsis*, whereas in the early species of the other genera this is not true.

K. H. Barnard (1925) described *Austrosyrrhoe* from the bathyal of South Africa. The generic diagnosis distinguished the genus from *Syrrhoe* but, without other considerations, essentially gave a picture of a species of *Syrrhoites* having a very robust gnathopod 1. In his further description of the type-species, however, K. H. Barnard noted that the mouthparts resembled *Syrrhoe* and this made possible many years later a better generic diagnosis in which the condition of the mandibular molar was specifically included (J. L. Barnard, 1964). Stephensen (1931) had confirmed the validity of *Austrosyrrhoe* by describing a second species with robust gnathopod 1 and mouthparts like *Syrrhoe* but was understandably hesitant in his classification of it in view of the paucity of illustrations accompanying the description of the type-species. Indeed, Gurjanova (1951) shifted Stephensen's *A.* (?) *septentrionalis* to *Syrrhoites* but it was returned to its proper place by J. L. Barnard (1964). By 1956 only 14 species had been described in the 4 genera.

In 1962, J. L. Barnard described a new species of *Syrrhoites* from the abyss off South Africa and suggested that it might represent K. H. Barnard's *Austrosyrrhoe crassipes*. The type-specimen of the latter had been found to be essentially destroyed through deterioration. J. L. Barnard discussed elongation of the telson in *S. torpens* and the robust gnathopod 1 as possible generic characters, but even though he figured the syrrhoe-like mandible, he failed to note its significance. This error was rectified by J. L. Barnard (1964) and *Syrrhoites torpens, S. fimbriatus, A. crassipes, A. septentrionalis* and a further new species, *A. ilergetes* were united as members of *Austrosyrrhoe*.

The genus *Kindia* was erected by J. L. Barnard (1962a) in the mistaken belief that two species assigned to it were distinguishable from *Syrrhoites* in their simple gnathopods and slightly enlarged fourth coxae but Bonnier (1896) had already described *Syrrhoites walkeri* with these conditions and *S. pusillus* Enequist (1950) was known to have nearly simple gnathopods. J. L. Barnard (1964) dismissed these characters as having no significance and synonymized *Kindia* with *Syrrhoites.*

The host of new species described in these 4 genera now sheds light on further difficulties. If one examines characters such as serration or simplicity of palmar spines on gnathopods, minute differences in shapes of coxae 3–4, spination of uropods, telsonic clefts, and elongation and narrowing of telson, one may detect pairs of species now assigned to *Bruzelia* and *Syrrhoites* which have strong relationships and other species now assigned to *Austrosyrrhoe,* which if given treatment equivalent to that afforded *Syrrhoites* and *Bruzelia,* would be relegated to newly erected genera. There is now considerable doubt that J. L. Barnard (1962a and 1964) had anything at all resembling *Austrosyrrhoe crassipes* when he described *Syrrhoites torpens* and that species presumably must stand. In pursuing this most crucial matter first I have discarded any preconception that *A. torpens* and *A. crassipes* have characters in common and relied entirely on K. H. Barnard's statements that various undescribed characters of *A. crassipes* are "like *Syrrhoe,*" or are "as in *Syrrhoe crenulata*" or "[resemble] . . . *Bruzelia typica.*"

The families Synopiidae and Tironidae were synonymized as late as 1964 by J. L. Barnard. The Synopiidae contained only the genus *Synopia.* That genus bears the following similarities to various members of Tironidae: coalesced eyes, accessory flagellum, conjoint bases of certain flagella, accessory eyes, galeate or ploughing head, narrow space between outer lobes of lower lip, pelagont coxae, powerful abdomen, reduced article 3 of mandibular palp, both extremes of mandibular molar found in Tironidae, and evenly extended pereopods 3–5. Despite these similarities, *Synopia* stands apart from tironids in the short telson, foliaceous maxillipeds, vestigial dactyl of gnathopod 2, and absence of dorsal body ornamentation. The short telson and simple body segments suggest that *Synopia* retains more of the primitive character of a hypothetical early tironid than any other living group of species. In the similarity analysis presented below, *Synopia* stands well apart from many tironids, though it is connected to the *Tiron-Pseudotiron* group by many similarities, such as the simplified gnathopods. The latter character itself is far advanced from the primitive gammaridean and is one of many complications in constructing a parsimonious systematic scheme in which *Synopia* would stand near the base of an elaboration. One would not expect a phyletic scheme to contain a sequence passing from subchelate to simple to subchelate gnathopods. But the subchelate gnathopods of tironids are in no measure comparable to those of primitive gammarideans. The emergence of heavily subchelate gnathopods in evolutionary lines such as corophiideans which passed through many ages of gnathopodal simplicity also refutes the suggestion that once a gnathopod has become simple the genetic complex of the organism has totally lost the capacity to reconstruct a subchelate gnathopod in later evolutionary sequences.

Relationships of the Synopiidae

Synopiids and tironids differ little from the basic gammaridean (J. L. Barnard, 1969a, compare Figures 1–2 with 31). The main difference is the galeate head but even this is occasionally so heavily modified in epibenthic forms as to be unrecognizable. There are many unusual developments in the synopiids that are not found in the basic gammaridean but many of these may also be found in the Gammaridae, the family with presumed closest relationships to the hypothetical basic gammaridean. In most synopiids the telson becomes elongate, thus is considerably longer than the peduncle of uropod 3, but the type-genus *Synopia* is the exception and fits the basic gammaridean in this character. About half of the species in Synopiidae have the telson uncleft and most of the genera have the mandibular palp either grossly enlarged, strongly slenderized, or palp article 3 is very shortened, or, rarely, the palp is lost. About half of the genera have the mandibular molar extraordinarily enlarged, tumid and fuzzy, in contrast to the basic gammaridean. Like other gammaridean families, there is also a progression from subchelate to simple in the gnathopods, these appendages already lacking the primitive conditions of sexual dimorphism and enlargement of gnathopod 2. The coxae of synopiids also exhibit a great variety of disproportionate changes from the basic condition. Uropod 3 often has an elongate peduncle.

But none of these modifications is wholly unique to Synopiidae, and therefore it is sometimes difficult to identify an amphipod as a member of Synopiidae. The galeate head, in combination with the presence of a macroscopic accessory flagellum, nonfleshy telson, reasonably proportional articles 5–6 of pereopods 1–2, well developed molar, elongate telson (with one generic exception), unbroadened mandibular incisors, reasonably short article 3 of gnathopod 2, and slender peduncle of antenna 1 with articles 2 and 3 not strongly shortened or telescoped into article 1, distinguish synopiids from similar members of Haustoriidae, Oedicerotidae, Phoxocephalidae, Argissidae, Eusiridae, (?Vitjazianidae), Astyridae, Stilipedidae, Acanthonotozomatidae, Stegocephalidae and Lysianassidae.

Synopiidae and Oedicerotidae are very similar morphologically. The latter family is presently divisible into two sections, the primitive section containing species with a basic head and paired eyes, the advanced section containing species with a galeate head like that of Synopiidae, and dorsally coalesced eyes like oculate species of Synopiidae. But many species of Oedicerotidae, like Synopiidae, live in the deep sea, have lost the eyes, and certain species have lost the galeate features of the head, the rostrum being severely reduced in size. Primitive oedicerotids occur mainly in shallow waters of the southern hemisphere whereas the oculate advanced oedicerotids dominate shallow waters of the northern hemisphere. In either hemisphere the main distribution occurs in cold-temperate waters.

Synopiids presumably differ from Oedicerotidae in their gross niche category. The Oedicerotidae have weakly to strongly fossorial pereopods and therefore are mainly burrowers in soft bottom. Except in certain species of *Tiron* and *Pseudotiron,* synopiids have elongate, nonfossorial pereopods, powerful pleopods and various other adaptations to epibenthic behavior. The wide tendency for synopiids to have modified coxae 3–4 suggests that even those without modified coxae are poorly fossorial and that the general behavior of synopiids can be called demersal. The modified coxae are hereafter termed "pelagont." The function of this adaptation is unknown but it is associated especially with those species believed to be demersal as evidenced by the kinds of collecting devices in which these organisms have been entrapped. The presence of silt grains in the midgut of various specimens having pelagont coxae suggests deposit feeding but this is believed to be errant (the organisms move from place to place). One may therefore visualize an ordinary deep-sea synopiid skimming above the surface of the bottom in short hops, then descending to the bottom to feed selectively on favorable bottom deposits. Since most synopiids probably do not find shelter in deep burrows they must therefore have powerful escape mechanisms from predators. Certain species have heavily protuberant foreheads suggesting that they plow the mud surface. The shallow-water genus *Tiron* appears to be the strongest exception in the Synopiidae to the ecological picture just painted but it is also very near to the logical concept of a primitive synopiid and therefore it may reflect, more than other genera, the basic nestling behavior of the early gammaridean. The epibenthic modification of certain species of *Tiron* is, however, very striking; species still living, like *Pseudotiron coas,* reflect the morphological transformation so neatly as to confound the generic differences between *Tiron* and *Pseudotiron,* the latter genus containing fully epibenthic (pelagont) species.

Synopiidae also differ from Oedicerotidae in the presence of a large accessory flagellum. Presumably this appendage has some tactile and sensory property no longer necessary to the relative sedentary Oedicerotidae. Some oedicerotids, like *Synchelidium,* are not always sedentary; males of some species of *Synchelidium* are strongly neritic. All Oedicerotidae maintain the primitively short telson which has advanced from the basic gammaridean state by having the lobes coalesced and formed into a small oval plate. In Synopiidae only *Synopia* has a short telson and only in *Synopia variabilis* have the lobes coalesced to form an ovate plate. *Synopia* also bears highly pelagont coxae. If one suggests that Oedicerotidae and Synopiidae have a common ancestor the primitive member would have a large accessory flagellum, ordinary coxae, a short cleft telson, nonfossorial pereopods, and paired eyes. The reduction of accessory flagellum and solidification of telson would then mark one branch, the Oedicerotidae, and the retention of accessory flagellum and clefted telson would mark the Synopiidae. Only one species of *Synopia* then evolved a solidified telson, 2 species retained the short and cleft telson, whereas all descendent synopiids are characterized by an elongate telson which becomes solidified and even more elongate in several advanced genera. In Oedicerotidae some of the primitive members with uncoalesced eyes still live, but as far as is known, those species with uncoalesced eyes in Synopiidae are extinct. The Oedicerotidae developed fossorial appendages whereas the Synopiidae occupied the neritic and demersal niche categories. Generally the Synopiidae have retained more primitive morphological characteristics than the Oedicerotidae but both have certain parallel developments, such as coalesced eyes and the tendency to a solid telson. Oedicerotids universally, except for *Metoediceros* Schellenberg, have a very long styliform uropod 3 with an elongate peduncle. The elongation of the peduncle occurs in a few species of Synopiidae and does not seem to have any generic value attributable to this development.

The Astyridae also appear to be a product of evolutionary divergence from ancestors similar to those of oedicerotids and synopiids. Presumably astyrids, with one genus and 5 species, occupy a niche category similar to that of synopiids because one or two species have the plow-shaped heads of certain synopiids, and the appendages are not visibly fossorial;[1] but astyrids appear to have weaker pleopods than do synopiids and the accessory flagellum is strongly reduced but not as much as in oedicerotids. Uropod 3 has a short peduncle, the telson is short and either cleft or uncleft, the head is ungaleate in primitive astyrids, eyes are absent and the genus is entirely distributed in the deep sea. The gnathopods have the appearance of certain oedicerotid characters; they have article 5 broadly lobed posteriorly and wider than article 6. *Astyra* differs qualitatively from synopiids in the mandible, which bears a heavily and sharply serrate, subflabellate incisor, a swept, conical molar bearing setae and in the lower lip, which has a wide channel between the outer lobes. The mandible has the descriptive characteristics of that in *Synchelidium*, an oedicerotid. The excessively large number of raking spines on the mandible suggests a feeding behavior distinct from the synopiids and more intensely adapted for raking than in most oedicerotids. *Astyra* definitely appears to be another branch of the early divergence between oedicerotids and synopiids but as far as is known the shallow-water lines have become extinct.

The Vitjazianidae, with 2 genera and 3 species, occur in bathyal and abyssal depths. Their mandibles have ordinary triturative molars, the telson is short and cleft, the peduncle of uropod 3 is short, the accessory flagellum is long, and the base of the flagellum on antenna 1 is conjoint as in the majority of synopiids. The lower lip is normal, the raker spines on the mandible are sparse and gnathopod 1 is always simple, raptorial, and very similar to that seen in *Tiron* and *Pseudotiron* of the Synopiidae. The one known species of *Vitjaziana* has a very elongate antenna 2 and pereopods 3–5, suggesting that it is adapted, like *Melphidippa*, of the Melphidippidae, to sit upside down on a soft ooze bottom in a cradle formed of the elongate legs (Enequist, 1950). The posterior margins of those legs have short setae similar to those mentioned for *Astyra* and this enforces the suggestion that *Vitjaziana* comes in contact with bottom sediment. The second genus of Vitjazianidae, *Vemana*, with two species, has short pereopods like certain species of *Tiron;* they are subfossorial. Gnathopod 2 bears a palm. Neither genus of Vitjazianidae has a galeate head but the distinction from Synopiidae is otherwise very unclear. The short telson distinguishes vitjazianids from all but *Synopia* in the Synopiidae. The coxae are extremely short in *Vitjaziana,* like those in the Melphidippidae, but *Vemana* has coxae longer than broad while definitely tending to become discontiguous.

Tracing the phylogeny of synopiids beyond the previous remarks appears fruitless at this time. Such activity is fraught with many difficulties. For example, the Pardaliscidae, Stilipedidae and Hyperiopsidae have many adaptations similar to those of Synopiidae, and the observer could easily develop schemes that included those families in the early evolutionary divergence of synopiids and oedicerotids. The complex of genera variously assigned to such families as Eusiridae, Pontogeneiidae and Calliopiidae has not been mentioned and they offer serious obstacles in clarifying relationships. They are characterized, at least in their primitive members, by greatly reduced accessory flagella (or lost entirely in advanced members), paired eyes, generally short cleft or uncleft telsons variously modified but often elongate in advanced members, and some of these eusirid-pontogeneiid-calliopiid genera appear as good ancestral grades to the Oedicerotidae; some of them have elongate peduncles on uropod 3, others have fossorial pereopods, others have an elongate pereopod 5 like that seen in oedicerotids, so that various primitive oedicerotids appear scarcely distinct from certain

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[1] However the type-species of *Astyra* has posterior setal spines on article 6 of pereopods 3–5 suggesting a weak fossorial adaptation.

calliopiids. The reduction in accessory flagellum becomes a key to gammaridean advancement and the evolutionary distance, in terms of linkages between the primitive synopiid and the primitive oedicerotid, may be vast. A clearer statement might be that if synopiids and oedicerotids did have a direct ancestor, the descendent with reduced accessory flagellum became the ancestor to a far greater diversity of living genera than did the ancestor retaining the long accessory flagellum. The final possibility, and that with the highest probability in logic is that a variety of early gammarideans, of the grade of structure now seen in the Gammaridae, advanced in evolution by loss or reduction of the accessory flagellum and that the similarities now seen between advanced oedicerotids and various primitive synopiids are simply convergences.

One very good example of the possible polyphyly in the eusirid-pontogeneiid-calliopiid group of genera is the obvious relationship of *Gammarellus* in the Gammaridae with *Calliopius* in the Calliopiidae. The two genera have a large number of similarities, yet *Gammarellus* bears a long accessory flagellum and is classified as a member of the Gammaridae while *Calliopius* has a reduced or lost accessory flagellum and forms the type-genus of the Calliopiidae. Neither *Calliopius* nor *Gammarellus* could have been the ancestors to most genera of the pontogeneiids and eusirids because the latter families retain the primitive cleft of the telson whereas *Gammarellus* and *Calliopius* already bear the advanced and nearly solid telson. Other ancestors to various pontogeneiids and eusirids must be sought. Most of the genera other than *Calliopius* assigned to the Calliopiidae also have little relationship to *Calliopius* and, indeed, pairs of species now found in different genera, and in apposite families, should probably be joined together in a common genus by disregarding the degree of telsonic clefting. Classification of eusirids, pontogeneiids and calliopiids is probably the greatest of those problems facing the gammaridean taxonomist. Since the hypothetical ancestor of synopiids has the same characteristics that one imagines belong to the ancestors of eusirids (etc.) one must face the high probability that they did not have a common ancestor except in the remotest context (they probably had the same ancestor at some time if gammarideans themselves are monophyletic).

Evaluation of Generic Similarities

FIGURE 1

Twenty-five characters both of possible generic value and known for most of the species in the family were analyzed in a matrix from which dendrograms were evolved. Each character was assigned a value (+ or 0) for each species and these species were then condensed into 23 groups, each group of species having 24 or 25 character congruencies. Each group, provisionally called an incipient genus, was then compared with every other group so as to produce a matrix of values composed of the number of characters in common between each possible pair. The weighted pair group method of dendrogram evolutions was then performed on the matrix to produce Figure 1. The species groups are labeled with their generic names only if the type-species of a named genus is contained within a group, or with both generic and specific names if no generic name has been proposed for the group. To save space, the characters are marked in Table 1.

The ultimate dendrograms are based on high values, indicating both a success in selecting characters and a fairly tightly related family of incipient genera. No arbitrary dendogrammatic value can be selected to define a genus since the species were preclassified into groups and numerous characters have not been included in the analysis. The analysis is thus below the standards of true phenetics but ultimately has several valuable results.

Several surprising results came from this study. Pelagont coxae and enlarged molars did not grossly influence the digits, whereas the three main branches of the system, *Tiron*, *Syrrhoe* and *Syrrhoites* are mainly distinguishable by gnathopodal characters, the *Tiron* group by simple gnathopods, the *Syrrhoe* group by transverse palms and the *Syrrhoites* group by oblique palms. To some extent an overemphasis occurred in the system because 3 of the 25 character places had to be allotted to the presence of 1, 2 or 4 spines (or total absence) on the palms and three other gnathopodal characters were included. Pelagont coxae and enlarged molars received only one place each.

The four groups of *Austrosyrrhoe* (now called *Austrosyrrhoe* 1, 2, *Ileraustroe, Priscosyrrhoe*), all of which were believed to have a small molar, fall into

TABLE 1.—*List of generic or limiting characteristics in synopiid genera*

The following characters are listed with the genera in which they occur; the alternative to each character occurs in all genera not listed. Asterisks denote characters used in similarity analysis. Parentheses on genera denote weak conditions.

*Forehead protuberant (ploughing head): (*Priscosyrrhoe*), *Pseudotiron, Synopia, Syrrhoe* (part)
Rostrum short and blunt: *Bruzelia* (part), *Bruzeliopsis, Garosyrrhoe, Pseudotiron, Synopia, Tiron* (part)
*Ocular lobe sharp: *Latacunga, Stephobruzelia, Syrrhoe* (part), *Tiron* (part)
*Eyes present: *Garosyrrhoe, Synopia, Syrrhoe* (part), *Tiron*
Accessory eyes present: *Synopia, Tiron*
*Article 1 of antenna 1 elongate or bearing dorsodistal tooth: *Bruzeliopsis, Syrrhoe* (part)
*Article 2 of antenna 1 elongate or bearing dorsodistal tooth: *Austrosyrrhoe* (part), *Priscosyrrhoe, Syrrhoe* (part)
*Mandibular palp absent; *Jeddo*
Mandibular molar fully triturative: *?Austrosyrrhoe, Garosyrrhoe, Synopia, Syrrhoe, Tiron*
Mandibular molar small and partially triturative: *Ileraustroe, Pseudotiron*
Mandibular molar small and nontriturative: *Priscosyrrhoe*
*Mandibular molar large and nontriturative: *Bruzelia, Bruzeliopsis, Ileraustroe, Jeddo, Latacunga, Stephobruzelia, Synopia variabilis, Syrrhoites*
*Maxillipeds folicaeous: *Synopia*
*Coxa 1 tapering distally: *Latacunga*
*Coxae 3–4 pelagont: *Bruzeliopsis, Ileraustroe, Jeddo,* (*Priscosyrrhoe*), *Pseudotiron* (part), *Synopia, Syrrhoe*
*Gnathopods distinctly simple (no palmar defining spines): *Pseudotiron, Synopia, Tiron*
*Gnathopods with transverse palms: *Garosyrrhoe, Syrrhoe*
*Gnathopodal defining spines serrate: *Austrosyrrhoe, Bruzelia, Garosyrrhoe, Ileraustroe, Latacunga, Priscosyrrhoe, Syrrhoe* (part)
*Dactyl of gnathopod 2 vestigial: *Synopia*
*Uropod 3 greatly exceeding uropods 1–2: *Pseudotiron, Synopia, Syrrhoe* (part), *Tiron* (part)
*Peduncle of uropod 3 elongate: *Austrosyrrhoe, Bruzelia* (part), *Bruzeliopsis* (part), *Stephobruzelia, Syrrhoe* (part), *Syrrhoites*
*Telson short, cleft or not: *Synopia*
*Telson elongate and cleft at least one-fourth: *Austrosyrrhoe, Garosyrrhoe, Jeddo, Latacunga, Pseudotiron, Syrrhoe, Syrrhoites, Tiron*
Bruzeliopsis, Ileraustroe, Priscosyrrhoe, Stephobruzelia Telson elongate and entire or cleft one-fifth: *Bruzelia,*
Characters of poor generic value:
*Gnathopodal palmar defining spines 4 in number: *Stephobruzelia*
*Gnathopodal palmar defining spines 2 in number: *Austrosyrrhoe* (part), *Bruzelia* (part), *Bruzeliopsis, Ileraustroe, Latacunga, Syrrhoe* (part), *Syrrhoites* (part)
*Gnathopodal palmar defining spines one in number: *Austrosyrrhoe* (part), *Bruzelia* (part), *Garosyrrhoe, Priscosyrrhoe, Syrrhoe* (part), *Syrrhoites* (part)
*Dactyls of pereopods 3–5 modified or reduced: *Tiron* (part)
*Article 2 of pereopod 5 widely expanded and ventrally truncate: untenable
*Pereopods 3–5 very short: *Tiron* (part)
*Pleonites 1–3 dorsally denticulate: *Syrrhoe* (part), *Tiron* (part)

the main *Syrrhoites* branch otherwise containing genera with an enlarged molar. One might have expected the *Austrosyrrhoe* group to form a branch of its own or fall close to the *Tiron* branch. In Figure 1 the highest similarities among the incipient genera are indicated by dashed lines in order to show the strength of connections giving rise to the phenogram. One of several manipulations was made in testing the system where *Austrosyrrhoe* group 3 (*Priscosyrrhoe*) was removed entirely from the complex in order to find where *Austrosyrrhoe* 1 might then be connected. (In addition the condition of gnathopods in the *Syrrhoites cohasseta* group is changed from simple to subchelate.) Instead of a wide separation from the base of the *Syrrhoites* group, *Austrosyrrhoe* I moved into the *Syrrhoe* branch. To some extent this is a function of the generalized plan in *Garosyrrhoe* but it is also one of the vagaries in dealing with unranked character combinations in a tightly knit group. Nevertheless the unranked analysis focuses on previously unconsidered relationships. Despite its nearly simple gnathopods and pelagont coxae, *Jeddo* falls into the

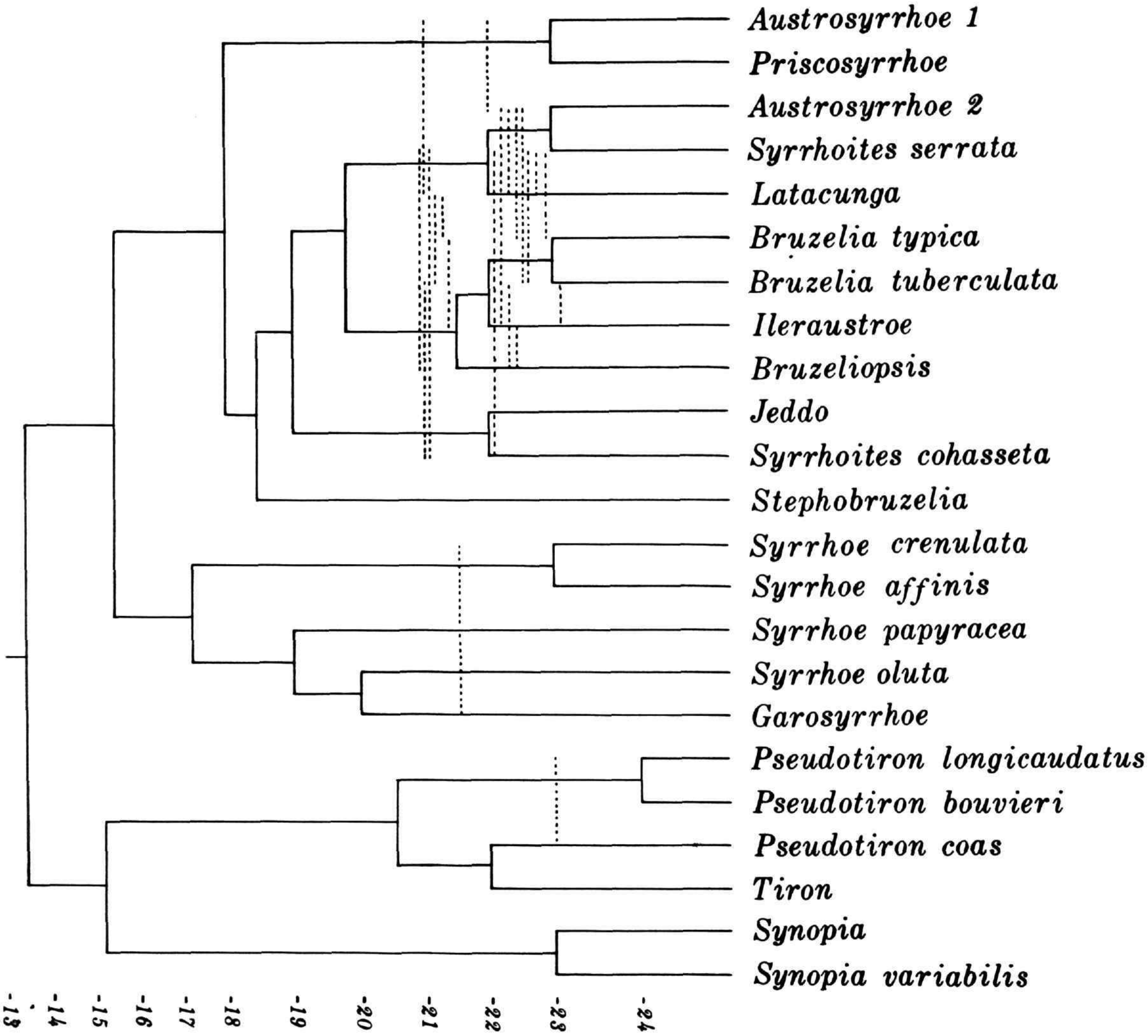

FIGURE 1.—Dendrogram of generic affinities in Synopiidae. Dashed lines denote highest affinities between remote pairs. Twenty-five characters are used and the species fall into 23 generic groups, some of which are invalid from other interpretations.

Syrrhoites branch and remains close to *Syrrhoites cohasseta* despite changing one character in *S. cohasseta* in another test of goodness. The latter group is remarkably distinct from the type of *Syrrhoites* despite changing this one character value.

The most readily apparent case of intermediacy (or straight-line evolution) lies in the pairing of *Tiron* and *Pseudotiron coas,* then connecting them to remaining members of *Pseudotiron* at low level. *Pseudotiron coas* distinctly combines characters of *Tiron* and typical *Pseudotiron.* By analogy one might use this case as a standard for evaluating similar cases in the other branches except that the *Tiron* branch is obviously a group different from the other branches and the same taxonomic developments cannot be said to occur in the other branches nor to have value equal to those in the *Tiron* branch. Since this universal dilemma of taxonomists, the uneven evolution of attributes occurs even within a family or genus or species, the taxonomist must gather several alternative methods of analysis and draw conclusions from all them, in the process making value judgments and ranking characters ultimately. For example, in Figure 1, one might conclude that the reversal in molar enlargement is a polyphyletic situation since this character (pair) occurs alternately with small molars in the otherwise closest pairs and triads of genera (*Austrosyrrhoe* 2 with *Syrrhoites, Ileraustroe* (=*Austrosyrrhoe* 4) with 2 groups of *Bruzelia*). Uncleft telsons are highly significant as generic characters.

Relationships According to Least Differences (Six-Character Analysis)

FIGURE 2

Six valuable generic attributes occur among the synopiid genera if one disregards eyes. Some of these attributes are complex, being composed of two or more parameters occurring together and counted as a single character. The six characters are: (1) the enlargement of coxa 3 ("pelagont"), its quadrate shape and posterodorsal excavation combined with a reduced and comma-shaped coxa 4; the alternative is an ordinary rectangular, unexcavate coxa 3 with or without an anteroventral point combined with a reasonably large, adz-shaped coxa 4; (2) the elongation of either article 1 or 2 on antenna 1 and the prolongation of a dorsodistal tooth easily seen from lateral view; the alternative is a regularly short article and the absence of a tooth or the development of a tooth hidden on the medial edge of article 1 only; (3) telson entire; the alternative, telson cleft at least one-third of its length; (4) three alternatives of the gnathopods, either transversely subchelate, obliquely subchelate, or simple; (5) the presence or absence of conspicuous palmar spines on the gnathopods, whether one, two or four spines are present and whether or not one or more of these spines is serrate; (6) the enlargement of the mandibular molar and the loss of ridges and teeth; the alternative is the ordinary gammaridean molar with trituration surface or remnants of that surface.

The synopiid genera are arranged in Figure 2 according to the least number of differences among them in terms of the 6 complex characters cited above. The figure has been constructed parisimoniously on a grid so that the lines connecting genera represent those only having one difference between pairs. Any two noncontiguous genera will have at least as many, if not more differences between them than between the most closely adjacent pairs. Boxes are drawn to encompass genera: (1) with eyes; (2) with pelagont coxae 3–4; (3) with enlarged and fuzzy molar; (4) with entire telson.

This system is imperfect because so few characters

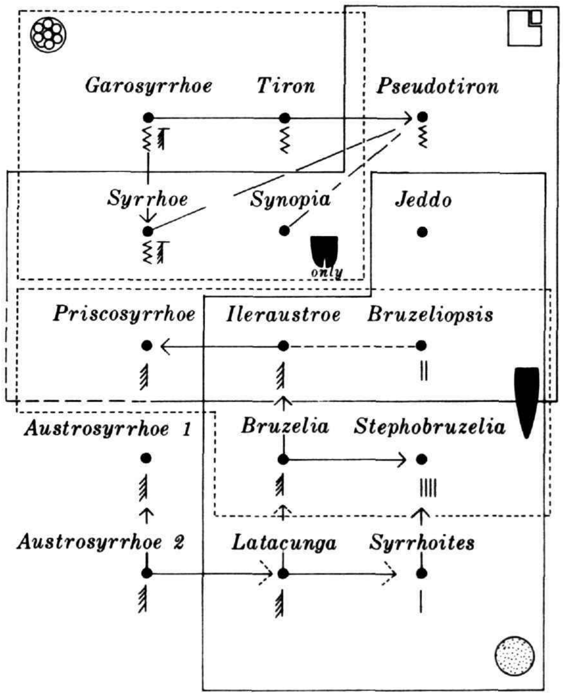

FIGURE 2.—Grid of 15 genera or generic groups arranged so that each genus, as marked by a connecting line, stands as close as possible to a similar genus having only one difference among the 6 complex characters stated in the text. If an arrow terminates the line, an evolutionary direction is suggested but only in a remote sense that the ancestor stands close to a hypothetical ancestor of the descendent genus. The descendent genera have specializations considered to be irreversible. Boxes enclose genera with common characters in 4 categories marked with symbols, eyes present (upper left), molar enlarged and fuzzy (bottom right), coxae pelagont (upper right), telson long and entire (middle right). Symbols near generic names denote conditions of palmar defining spines on gnathopods; no symbol=spines absent and gnathopods simple; vertical line=spines simple; vertical line with flags=spines serrate; flagged line with top horizontal bar=bar palm transverse. *Synopia* (upper middle) is the only genus with short telson. Zigzag lines near 4 genera denote dorsal serrations on pleonites 1–3; certain species in these genera have lost the serrations.

are being utilized but the method reveals how the *Syrrhoites-Bruzelia* group is generally divorced from the *Austrosyrrhoe* group except between *Latacunga* and *Austrosyrrhoe* 2. It shows how all pelagont genera including *Bruzeliopsis* have similarities among themselves and it brings the oculate genera reasonably close to one another. A pattern distinct from that seen in Figure 1 is therefore apparent and one obtains a rudimentary phyletic scheme in which the pelagont coxae assume a direct significance. A series of stages can be visualized in which the enlarged molar becomes a character of specialization rather than primitivity but insoluble difficulties emerge, as one must explain several reversions of characters, for example, return of *Synopia* to shortened telson, and return of the *Bruzelia* line to nonpelagont coxae.

Evolution from Oculate Ancestors

Figure 2

If one assumes that the loss of eyes in deep-sea amphipods is irreversible, and because a few littoral synopiids today bear eyes, one must then assume that the immediate ancestors of synopiids carried eyes and lived in shallow seas. Synopiids may have found especially favorable ground for evolution in deep water, or the present shallow-water members may be a fragment of a former diverseness now retracted perhaps in favor of the more abundant Oedicerotidae, Haustoriidae and Phoxocephalidae, which have similar ecological adaptations. The Oedicerotidae also have galeate heads but the accessory flagellum is vestigial, pereopod 5 is greatly extended, the peduncle of uropod 3 is elongate and the telson is very short and entire.

The hypothetical ancestor of the synopiids thus had eyes, a short telson, a normally triturative mandibular molar, regular anterior coxae, subchelate gnathopods and was probably a shallow sublittoral benthic organism. No living synopiid quite fits that definition, although *Synopia,* a neritic, if not a pelagic genus, has the eyes, short telson, and weakly subchelate gnathopods; but the coxae are pelagont, the ecological position is wrong, and the maxillipeds are heavily foliaceous and setiferous. The latter mouthparts suggest *Synopia* is a bottom feeder and therefore the ecological position alluded to above may be correct.

Tiron, a sublittoral benthic genus, appears closely related to *Synopia* in eyes and accessory eyes, but like all other synopiids has the telson elongate. Coxae 3–4 are reasonably basic, the maxillipeds are basic, but the gnathopods are simple and therefore highly advanced.

Garosyrrhoe, a 2-species genus from the eastern Pacific Ocean also occurs sublittorally, though we are uncertain whether it is actually of neritic provenance since so few specimens have yet been collected in bottom grabs, a sign that they were only accidentally obtained on the bottom. *Garosyrrhoe* also has eyes, no accessory eyes, ordinary coxae and maxillipeds, but the telson is elongate, and the mandibular molar is poorly triturative. The gnathopods, though small and elongate, are transversely subchelate and have a spine similar to the dactyl that gives the appearance of chelateness to the gnathopods. *Garosyrrhoe* is the logical precursor to the final genus bearing eyes, *Syrrhoe.* Presumably *Syrrhoe* is an epibenthic genus extending from sublittoral to abyssal depths; some of its members have apparently lost their eyes, although there is some suggestion that certain members with weak eyes are actually strong vertical migrators. *Syrrhoe* differs from *Garosyrrhoe* in the enlarged and excavate coxa 3 and small coxa 4 typical of *Synopia.* This coxal arrangement also occurs in *Jeddo, Bruzeliopsis, Pseudotiron* and weakly in certain members of the *Austrosyrrhoe* complex *(Priscosyrrhoe)* so as to suggest that the stronger coxal condition marks true pelagonts whereas the weaker condition marks weakly epibenthic species that may spend time both on the bottom and in the nekton, perhaps darting and swimming from one benthic feeding station to another. Momentarily, I have disregarded the presence of this coxal arrangement as a special mark of phyletic affinity mainly on the grounds developed in Figure 1. On the surface it rather appears as a case of repeated adaptation to nonbenthic existence. One good exception to this opinion however is the smaller difference between *Syrrhoe* and *Pseudotiron* than between *Syrrhoe* and its presumed ancestral line represented by *Garosyrrhoe. Syrrhoe* and *Pseudotiron* differ mainly in the chelate and simple gnathopods respectively.

In retrospect, *Synopia* differs from the hypothetical ancestor by one main character, advanced coxae, whereas *Tiron* differs, like all other synopiids, by the elongate telson but also by the fully simple gnathopods. *Garosyrrhoe* differs in the elongate telson and poorly triturative molar.

Pseudotiron appears to be an advancement from *Syrrhoe* in which the eyes have been lost, the gnathopods simplified and frequently a shovel-like or sharknose head has been developed. Since specimens of *Pseudotiron* are frequently caught in benthic samplers and their midguts contain silt grains, one might assume they plow the substrate but also swim epibenthically. In contrast, the chelate gnathopods of *Syrrhoe* suggest that, as pelagonts, members of that genus may grasp some other member of the nekton. But gut contents of *Syrrhoe* are unstudied.

The next increment of specialization proceeds via loss of eyes to *Austrosyrrhoe*, which is considered to be closer to the main line of specialization than later branches characterized by changes in gnathopods. *Austrosyrrhoe* is the first anoculate genus with subchelate gnathopods, reasonably ordinary coxae, and a small molar. *Austrosyrrhoe* is divided into 2 genera or subgenera and unfortunately the type-species of *Austrosyrrhoe* is not necessarily the least advanced. One must construct an hypothetical ancestor to this group that has a deeply cleft telson, 1–2 serrate spines on the palms of the gnathopods, unmodified antenna 1, apically spinose outer rami of uropods 1–2, posteriorly unexcavate coxa 3 (basic gammaridean) and large coxa 4.

Group 2 of *Austrosyrrhoe* (*rinconis* and *septentrionalis*) is closest to this ancestor, differing only in the slightly reduced comma-shaped coxa 4. Group 1, composed only of the type-species (*crassipes*) differs in 3 characters: loss of one spine on the gnathopods, the development of a tooth on antenna 1, and probably the loss of apical spines on the outer rami of uropods 1–2. Group 3 (*Priscosyrrhoe*) has an especially elongate telson in which the lobes are nearly fused, but otherwise it appears close respectively to groups 1 and 2, possibly as a separate descendent group. Group 3 differs from group 1 mainly in the telson and shares the gnathopodal spine (one), tooth on antenna 1, naked rami of uropods and coxae 3–4 (presumably). A fourth group is removed to a new genus, *Ileraustroe*, as developed in the phenogram (Figure 1). One presumes that certain character developments are irreversible and proceed in this direction: cleft to uncleft telson; loss of spines on uropodal outer rami; posterior excavation on coxa 3; and loss of one palmar spine on the gnathopods. However the development of a tooth on antenna 1 may be reversible (later lost) as also may be the changes noted in coxa 3. If all of these character alternatives are reversible in evolution, the relationships of species will be very difficult to detect. Because coxa 3 is partially modified in the pelagont condition of *Syrrhoe, Synopia* and *Pseudotiron,* the species of *Ileraustroe* may be more powerful swimmers than groups 1 to 3 of *Austrosyrrhoe.* Coxal modifications may also correlate with improved benthic ploughing during food ingestion. The development of an antennal tooth and loss of one palmar spine on the gnathopods suggests that groups 1 and 3 (*Priscosyrrhoe*) have improved adaptations to plowing mud and may spend more time on the bottom than *Ileraustroe* or *Austrosyrrhoe.* If the number of swimming journeys is reduced the function of grasping something upon alighting would be reduced and the palmar spine might not be required.

The next stage implies a single phyletic change, the enlargement of the mandibular molar so as to dominate the mandible entirely. Six genera are characterized by a fully enlarged molar and they are considered to have a common ancestor although this problem has not yet been studied thoroughly and the assumption is based mainly on the existing parsimony. One can thus better establish a tree of relationships having fewer gross differences among the branches for the six genera than if one aggregates the differences among all of the six genera to distinguish them from the various other synopiids. For example, *Jeddo* differs by 3 generic characters from *Syrrhoe,* 2 from *Pseudotiron; Bruzeliopsis* differs in 3 characters from *Priscosyrrhoe* and *Bruzelia* differs from either *Ileraustroe* or *Priscosyrrhoe* by 2 characters each. Except for the closeness between *Jeddo* and *Pseudotiron,* none of the 6 genera with an enlarged molar has fewer connections outside the 6 than with its immediate relative within the 6, a linkage suggesting parsimony within the 6 genera. I strongly suggest, however, that this question be examined from time to time as more species are discovered. For example, members of *Austrosyrrhoe* may be on the direct and independently assorted ancestral lines to various species of *Bruzeliopsis, Bruzelia, Latacunga* and *Syrrhoites,* but in each case this might require independent enlargement of the molar. See next section on "Enlarged Molar Theory."

Syrrhoites appears to be the most primitive member of the group with an enlarged molar, as it bears reasonably normal coxae, simple spines on the gnathopods and a cleft telson. *Latacunga* is more advanced in the tapering of coxa 1 but also has serrate spines on the gnathopods like *Austrosyrrhoe*. *Latacunga* differs from *Austrosyrrhoe* in the enlarged mandibular molar and tapering coxa 1 and may be an independent evolutionary line direct from *Austrosyrrhoe*. *Jeddo* is very advanced in having the syrrhoe-like pelagont coxae, no mandibular palp and simple gnathopods without spines, but otherwise it seems closest to *Syrrhoites* because of the cleft telson.

The next major single step is the fusion of the telsonic lobes. Again this may be confuted as a single precursorial event by the knowledge that it has occurred twice in the *Austrosyrrhoe* complex (*Priscosyrrhoe* and *Ileraustroe*). Thus *Bruzelia*, with an entire telson, resembles *Latucunga* more than it does *Syrrhoites* mainly because of the serrate gnathopodal spines; it therefore also resembles certain members of *Priscosyrrhoe* and *Ileraustroe*, though the latter two have only one serrate spine on the palms of the gnathopods and *Bruzelia* has 2. *Bruzeliopsis* resembles *Priscosyrrhoe* and group 1 of *Austrosyrrhoe* in the tooth of antenna 1, but in having the coxae fit those of *Ileraustroe*, *Bruzeliopsis* is even closer to that group than to the others because of the uncleft telson. The solution to these relationships is presently difficult; in any case the enlargement of the molar would have to occur independently more times than the development of pelagic coxae.

Enlarged Molar Theory

This section pursues an earlier discussion of (1) the multiple evolution of molars and (2) the possibility that the enlarged molar preceded the small molar. I am not convinced that these two theses have any great merit but a few hazy precedents are available to support them. Since amphipod taxonomists find it necessary to think about evolutionary simplifications, in the sense that many families of amphipods recurrently demonstrate an evolutionary course from complex to simple morphology, this discussion is deemed valuable for future reference as more species are discovered. J. L. Barnard (1969a) has discussed briefly the process of simplification found in gammarideans, from the basic gammaridean with complex, sexually dimorphic gnathopods, to the majority of families with monomorphic gnathopods, from the presence to the absence of an accessory flagellum, and many other examples including cephalization and pygidization.

The hypothetical progress (Figure 2), from synopiid ancestors having enlarged molars to those descendents having normally triturative molars of the basic gammaridean, implies that a basic synopiid developed the enlarged molar first while retaining the short telson so that *Synopia variabilis* (the aberrant *Synopia*) with its advanced coxae, and bulbous molar, can be divided off immediately. Thereafter all synopiids except two species of *Synopia* descended from a stage in which the telson became elongate. If one uses the precedent of molarial reversal one could also use telsonic reversal and derive *Synopia* from the *Garosyrrhoe* line. Improbabilities already increase in this scheme.

A certain logic nevertheless prevails from the next hypothetical stage onward because one presupposes that the fully blown synopiid is represented here by the large molar, elongate telson and serrate spines on the gnathopods. *Syrrhoites* stands near this stage but no shallow-water oculate genus is anywhere near it and this alone is a serious fault; however the complexity of spinal representations proceeds more smoothly through this scheme as one generally goes from complex to simple.

Under most circumstances this scheme would seem ludicrous if the very close relationship between the 4 groups of *Austrosyrrhoe* (including *Ileraustroe* and *Priscosyrrhoe*) and 4 genera of the enlarged molar group did not occur (Figure 2, four genera lower right) In this simplified scheme *Bruzeliopsis* and *Ileraustroe* have only one distinction, the spines on the gnathopods. *Bruzelia* and *Priscosyrrhoe* also have only 2 distinctions, the molar and article 1 of antenna 1. Only 2 distinctions occur between *Latacunga* and *Austrosyrrhoe* 1 or between *Latacunga* and *Austrosyrrhoe* 2. This tight assortment of generic differences involving telsonic clefts, spinal serrations, tooth presence or tooth placement on article 1 of antenna 1 and presence or absence of apical spines on the outer rami of uropod 2 suggests a high degree of polytypy. That the molarial difference between the main groups above and below has been selected for the major division would have no value to a pheneticist. The especially close relationship in coxae between *Bruzeliopsis* and *Ileraustroe* is a good showpiece of the morphologist unable to decide whether coxae signify closer relationships than do molars. If change in molars occurred in a single phyletic funnel then *Bruzeliopsis* and *Ileraustroe* evolved in parallel. But if advanced coxae are made the base of a single evolutionary group, then, in the whole scheme, enlarged molars must have evolved at least twice.

The Direction of Evolution in Characters

FIGURES 1–2

The patterns developed in Figures 1–2 demonstrate how complicated, if not impossibly so, are the relationships among the synopiids. Ultimately the phyletics must consider the absurdity of numerous reversals in evolutionary direction. As obvious evolutionary trends can be seen I suggest in these patterns that the following ultimate conditions in character developments are irreversible: (1) uncleft telson; (2) simple gnathopods; (3) simple palmar spines (except once)[2]; (4) loss of palmar spines entirely; (5) blindness; (6) pelagont coxae; (7) loss of mandibular palp (*Jeddo*).

But I am unable to suggest any logic as to whether: (1) the enlarged fuzzy mandibular molar, once developed, can revert to a normal molar or at least to the small molar of *Austrosyrrhoe* and *Priscosyrrhoe* bearing weak indications of triturative surface; (2) transversely subchelate gnathopods are reversible towards subchelate and simple conditions; (3) elongate telsons can revert to shortened telsons as seen in *Synopia*.

If one accepts the development of the enlarged fuzzy molar as a single evolutionary event confined to one ancestor of the 6 bruzelian genera, then one is confronted with the development of pelagont coxae in at least 3 distinct evolutionary lines and the development of an uncleft telson several times. If, in Figure 2, the pelagont coxae are considered as descendent from one ancestor one is forced to conclude that enlarged molars, simple gnathopods and simple palmar spines developed twice, and uncleft telsons developed several places independently.

The connecting lines in Figure 2 suggest evolutionary directions only in the remotest context. The arrows do suggest that the descendent genus could not have been the ancestor in any pair, as specialized characters occur in the genera marked as descendents. For example, *Stephobruzelia* is more highly specialized than *Bruzelia* in palmar spines and though *Bruzelia* is not necessarily the living ancestor of *Stephobruzelia*, it stands in a pool of taxa which may have been ancestral to *Stephobruzelia*. *Syrrhoites* is more specialized than *Latacunga* in the palmar spines if we accept the thesis that serrate palmar spines were an early development lost in later evolution, but *Latacunga* cannot be a direct ancestor of *Syrrhoites* because coxa 1 is specialized. *Latacunga* therefore stands in a pool of taxa ancestral to *Syrrhoites*.

Synopiidae

DIAGNOSIS.—Gammaridean with galeate head or with plough-shaped protuberance on forehead; accessory flagellum of antenna 1 large, multiarticulate; upper lip fleshy, ventrally truncate, rounded or weakly incised, usually with small marginal hairs; mandibles with 3-articulate palp (3 exceptions), molar present and never amalgamated with spine row, latter often vestigial; lower lip with well developed mandibular lobes, inner lobes present and separate from each other, no extraordinarily wide space occurring between outer lobes; maxillae 1–2 well developed but setation variable, palp of maxilla 1 biarticulate; inner and outer plates and palp of maxilliped well developed, palp usually 4-articulate, rarely 3; coxae 1 and 2 large and unhidden by posterior coxae, except coxa 1 rarely narrowed; gnathopod 1 present, 7-articulate; gnathopods not sexually dimorphic, gnathopod 2 not enlarged; pereopods 3–5 basic, pereopod 5 not grossly longer than 4 as in Oedicerotidae; uropods 1–3 present, all strongly biramous; telson present.

VARIABLES (Table 1).—Head generally galeate, almost as long as pereonites 1–3 together (except in *Tiron*), with a rostrum like that of a Roman helmet, but many species have an extremely protuberant forehead presumably used for ploughing mud, the rostrum then being reduced in prominence; lateral cephalic lobes broad, rounded or with sharp corner; eyes present or absent, when present composed of numerous ommatidia in two main eyes tightly appressed, if not coalesced dorsally; occasional genera

[2] Meaning that complex spines developed from simple spines once within the family.

like *Tiron* and *Synopia* have an accessory eye on each side below main eye, composed of one or more ommatidia, appressed or segregated; eyes are present only in *Tiron, Syrrhoe, Synopia, Garosyrrhoe* and possibly some species of *Pseudotiron*.

Antennae generally elongate; peduncular articles of antenna 1 untelescoped, of variable length, article 3 long or short, occasionally either article 1 or 2 also becoming elongate and bearing apicodorsal tooth or not; most genera with apicomedial tooth on article 1 (this tooth hidden from lateral view and not otherwise considered taxonomically herein, in contrast to apicodorsal tooth); accessory flagellum large, generally at least 2-articulate if not further articulate, basal article often elongate in males (conjoint); basal part of primary flagellum usually conjoint in males and bearing brushes of setules or setae (or ?aesthetascs); articles 4–5 of antenna 2 elongate but especially so in many males, dorsal margins often with short brushes of setules, flagellum also elongate in many males.

MANDIBLES.—In *Tiron, Synopia* and *Pseudotiron* the molar is columnar and triturative as in the basic gammaridean, the incisor projects and is weakly toothed; the lacinia mobilis occurs on both mandibles (right and left) and also is toothed, the spine row contains a normal number of spines (example, 8). In *Synopia variabilis,* however, the spines are lost; in *Syrrhoe* and *Garosyrrhoe* the molar becomes less triturative, the spines fewer and the incisors and lacinia mobili poorly toothed. In *Priscocyrrhoe* and *Austrosyrrhoe* the molar is nontriturative, if not minutely fuzzy. In the remaining genera such as *Bruzelia, Bruzeliopsis, Jeddo, Syrrhoites, Stephobruzelia, Latacunga* and *Ileraustroe,* the molar is enlarged, fuzzy and nontriturative; the lacinia mobilis, spines and incisor become less distinct from one another, although they remain distinct in *Ileraustroe* while almost fully amalgamated in *Bruzelia;* remnants remain in *Jeddo* and certain species of *Bruzelia.* In the latter genus the mandible is extremely bulky and the molar dominates the mandible entirely; the incisor is untoothed or nearly so in *Bruzelia, Syrrhoites* and *Latacunga.* The mandibular palp is absent in *Jeddo* and two species of *Tiron* but otherwise present and 3-articulate, article 3 being very short in all but *Bruzeliopsis* and apparently always shorter than article 1; the palp is heavily dominated by the mandibular body in those genera with extremely enlarged molar.

LOWER LIP.—The main variable appears to be the apical division of the outer lobes in all species of *Syrrhoites* and certain species of *Bruzelia.*

MAXILLA 1.—Generally the inner plate is richly furnished with marginal setae but one species of *Tiron* lacks setae on the inner plate; the outer plate is basic and the palp 2-articulate.

MAXILLA 2.—The inner plate usually has a long, medial, submarginal row of setae except in one species of *Tiron.*

MAXILLIPEDS.—*Synopia* has a foliaceous maxilliped with 3-articulate palp in one species or article 4 extremely reduced in the others.

COXAE.—Coxa 1 is generally broad except in *Latacunga;* the ordinary condition of coxa 3 is rectangular but in many species the anteroventral margin either extends to a point or the coxa becomes widely expanded apically, the posterior margin becoming deeply excavate and in the ultimate condition known as "pelagont," the coxa becomes a shield similar to coxa 4 in many other gammaridean families; coxa 4 in synopiids is ordinarily adz-shaped, never becomes an enlarged shield as in other gammarideans except in a small way in *Garosyrrhoe;* in the ultimate pelagont condition coxa 4 is reduced in size, is dominated by coxa 3, fits the posterodorsal margin of coxa 3 and is usually comma-shaped. The pelagont condition usually follows generic lines but tendencies towards its development can be seen in species of nonpelagont genera. For example *Pseudotiron coas* falls between the ordinarily nonpelagont *Tiron* and the typical fully pelagont members of *Pseudotiron.*

GNATHOPODS.—Article 6 is slender, simple, and elongate in *Tiron* and *Pseudotiron,* but not as elongate as article 5; in *Synopia* article 6 varies from slightly to strongly tumid, from simplicity to apparent subchelation but no spines define the heavily setose palm; in the remaining genera article 6 is considered as subchelate because a palm defined by spines is present, although in *Jeddo* and some species of *Syrrhoites* the hand is very slender and appears simple except for the presence of the defining spine(s); in *Syrrhoe* and *Garosyrrhoe* the palm is nearly transverse and the defining spine so enlarged as to form a chela; in various genera the defining spine(s) are either simple or serrate; the simple spines generally have a setal trigger; the main evolutionary lines of synopiids appear to be defined by simple, obliquely palmate and transversely palmate gnathopods. In

Synopia the dactyl of gnathopod 2 becomes vestigial.

PEREOPODS 1–2.—Few gross taxonomic features occur on these appendages; variation in setation or spination of article 5 is especially apparent and certain species have article 6 slightly inflated and heavily setose, tending towards prehensibility.

PEREOPODS 3–5.—The main variables concern quantitative distinctions in length relative to body size in different species or genera, in the degree of expansion and ventral truncation of article 2 on pereopod 5 (especially) and in *Tiron* the alternatives between reasonably ordinary dactyls and the kind herein called stubby, in which the dactyl becomes very shortened, almost gnarled, though it may then bear sharp setiferous extensions.

UROPODS 1–2.—The outer rami are slightly to strongly shorter than the inner rami and the latter may become excessively elongate and broad. The posteriorwards extension of these uropods is generally a function of the length of uropod 3 or the length of urosomite 3, although together they may be shortened or uropod 1 alone may be shortened; in these cases they do not extend posteriorly as far as uropod 3. The outer rami particularly vary from group to group, especially in *Austrosyrrhoe, Ileraustroe* and *Priscosyrrhoe* in the presence or absence of apical spines; this may prove to have generic significance.

UROPOD 3.—The peduncle may be very short and the rami elongate, and broadly lanceolate, or the peduncle is often elongate and the rami become more strongly styliform, resembling the typical condition of oedicerotids. The degree of posteriorwards extension of uropod 3 depends on the elongation of its parts and the elongation of urosomite 3 or instead the short-

Key to the Genera of Synopiidae

1. Both telson and peduncle of uropod 3 very short and subequal in length, mandibular palp extremely stout .... ***Synopia***
   Telson elongate, exceeding peduncle of uropod 3 even when peduncle elongate, mandibular palp not extremely stout 2
2. Gnathopods simple, sixth articles elongate 3
   One or both gnathopods subchelate, sixth articles short 4
3. Rostrum with sharp apex, eyes present, uropod 1 reaching apex of uropod 2 .... ***Tiron***
   Rostrum with blunt apex, eyes absent, uropod 1 failing to reach apex of uropod 2 .... ***Pseudotiron***
4. Gnathopodal palms transverse or nearly so, defined by enlarged spine(s) 5
   Gnathopodal palms oblique and defined by enlarged spine(s) 6
5. Coxae 3–4 pelagont .... ***Syrrhoe***
   Coxae 3–4 not pelagont .... ***Garosyrrhoe***
6. Mandibular molar of medium size, occasionally smooth and minutely fuzzy but usually triturative and generally columnar or subcolumnar, body of mandible stout but not extraordinarily bulky or subglobular, palp relatively strong 8
   Mandibular molar very large and smooth, minutely setulose or fuzzy, molar completely dominating mandible, body of mandible bulky, subglobular, together with molar often dwarfing palp (exceptions in *Ileraustroe* and *Jeddo*) 8
7. Telson very long and narrow, entire .... ***Priscosyrrhoe***
   Telson of medium length, broad, cleft about halfway .... ***Austrosyrrhoe***
8. Coxae 3–4 pelagont 9
   Coxae 3–4 not pelagont 11
9. Telson deeply cleft, mandibular palp absent .... ***Jeddo***
   Telson cleft one-fourth or less, mandibular palp present 10
10. Antenna 1 with apicodorsal tooth on article 1, telson entire or apical cleft vestigial .... ***Bruzeliopsis***
    Antenna 1 lacking apicodorsal tooth on article 1, telson cleft about one-fifth. ***Ileraustroe***
11. Telson cleft one-third or more 12
    Telson entire 13
12. Palms of gnathopods bearing 1–2 serrate spines, coxa 1 narrow and tapering distally .... ***Latacunga***
    Palms of gnathopods bearing 1–2 simple spines, coxa 1 not tapering .... ***Syrrhoites***
13. Palms of gnathopods bearing 1–2 serrate spines .... ***Bruzelia***
    Palms of gnathopods bearing about 4 simple spines .... ***Stephobruzelia***

ening of uropods 1–2. The outer ramus of uropod 3 may be 1- or 2-articulate, that second article may be long or short and the rami may be moderately setose, only setulose, or spinose. Males may or may not have increased setosity.

TELSON.—The telson is highly distinct among the various groups of genera. It is very short in *Synopia,* not exceeding the apex of the peduncle on uropod 3; it is as broad as long and either cleft or entire and trifoliate. All remaining genera have a moderately to fully elongate telson, longer than broad, and exceeding the peduncle of uropod 3 even if that peduncle is elongate. In *Syrrhoites* the telson is broad and strongly cleft, in *Bruzelia* it is broad and entire; in *Ileraustroe* it is very elongate, narrow and cleft one-fifth; and finally in *Priscosyrrhoe* it is like that in *Ileraustroe* but uncleft. These represent the present extent of variations found in the family.

BODY SEGMENTS.—Pereonites 1–3 or 1–4 are generally very short, whereas pleonites 1–3 are very long and massive; some kind of dorsal ornamentation occurs in all synopiids except *Synopia* and extremely weak posterodorsal teeth occur in at least one species of that genus. Dorsal teeth are most strongly developed in *Bruzelia* and *Syrrhoites.* Double teeth in tandem occur on some posterior segments of certain species of *Bruzelia;* teeth may or may not occur on urosomites; if they do occur they are usually larger on pleonite 5 in males than in females but this is a point needing additional study. Few species have lateral bulges or teeth on pleonites and pereonites; occasionally coxae also have bulges or ridges and teeth. Posterodorsal serrations occurring transversely are developed on certain species of *Tiron, Pseudotiron, Syrrhoe* and *Garosyrrhoe.* Epimera vary widely in terms of teeth, serrations, bulges and quadrate corners. The elongation of urosomite 3 is especially developed in *Pseudotiron.*

Austrosyrrhoe K. H. Barnard, revised

Austrosyrrhoe K. H. Barnard, 1925: 354.—J. L. Barnard, 1964: 26

DIAGNOSIS.—Forehead not protuberant, lateral cephalic lobe not sharp; eyes absent; mandible with palp, molar of medium size and not dominating mandible, weakly to strongly triturative; articles 1–2 of antenna 1 either basic or article 2 elongate and bearing apical tooth; coxa 1 ordinary; coxae 3–4 not pelagont or weakly so; gnathopods typically subchelate, palms oblique and bearing at least one serrate spine, occasionally gnathopod 2 with obsolescent transverse palm; dactyl of gnathopod 2 usually normal; pereopods 3–5 elongate, dactyls elongate, article 2 of pereopod 5 weakly or strongly expanded, rounded or truncate ventrally; pleonites 1–3 not denticulate; uropod 3 not grossly exceeding uropods 1–2, peduncle elongate; telson of medium length and cleft halfway.

TYPE-SPECIES.—*A. crassipes* K. H. Barnard, 1925.

REMARKS.—This genus remains confounded because of uncertainties in the type-species, the unique type specimen of which has deteriorated (letter from the late K. H. Barnard and my examination of it in Capetown, November 1968). *Austrosyrrhoe* remains a catchall of species with presumed unenlarged molar distinct from that of *Ileraustroe* and *Bruzelia,* bears a deeply cleft telson and oblique gnathopodal palms with one enlarged serrate spine. Species of *Austrosyrrhoe* and *Priscosyrrhoe* are of vital interest in attempting to determine whether the small mandibular molar is an evolutionary apex with origins in the *Bruzelia* group or whether the *Austrosyrrhoe* molar represents the condition primordial to the later evolution of the *Syrrhoites-Bruzelia* complex. The members of *Austrosyrrhoe* are the only species in Synopiidae with distinctly oblique palms that lie outside the *Bruzelia* complex; the *Tiron* group has simple gnathopods, the *Syrrhoe* group has transverse palms and *Synopia* is problematical.

Two groups of species occur in *Austrosyrrthoe.* Two groups, now placed in *Ileraustroe* and *Priscosyrrhoe* were removed after similarity analysis (Figure 1). Some of the species now placed in *Austrosyrrhoe* were formerly in *Syrrhoites.* Because the precise shape of coxa 3 and armaments on uropods 1–2 are unknown in the type-species, it seems unwise to divide the two groups generically; many more species of deep-sea synopiids undoubtedly remain to be described.

DIAGNOSES OF SUBGENERIC GROUPS IN *Austrosyrrhoe.*—

1. Article 2 of antenna 1 bearing apical tooth; coxa 3 not adequately known; coxa 4 apparently large and adz-shaped; gnathopods with one palmar spine; outer rami of uropods 1–2 not definitely known but presumed from the description to have simple outer rami but much room for doubt is possible in light of other similarities to group II .... ***A. crassipes***
2. Article 2 of antenna 1 simple; coxa 3 subquadrate and scarcely excavate posteriorly, coxa 4 medium and

strongly adz-shaped; gnathopods with 2 palmar spines (male of *A. fimbriatus* aberrant and female not definitely known in this regard); outer rami of uropods 1–2 apically spinose.

A. rinconis, septentrionalis, ?fimbriatus

Austrosyrrhoe crassipes K. H. Barnard

Austrosyrrhoe crassipes K. H. Barnard, 1925: 354–355, pl. 34, fig. 11.

DIAGNOSIS.—Rostrum large (but sharpness unknown); article 2 of antenna 1 with apical tooth; coxa 3 with acute anteroventral corner, (posterior margin unknown); coxa 4 large, thick, (presumably adz-shaped); gnathopod 2 with palm; article 2 of pereopod 5 scarcely expanded, rounded posteroventrally; (outer rami of uropods 1–2 not definitely known and originally compared with *Syrrhoe crenulata,* in which outer rami are simple); telson short and broad (presumably in the context of this genus), cleft nearly halfway; (epimeron 3 unknown); pleonites 1–4 each with small dorsal tooth.

Off Cape Point, South Africa, 700 fms.

Austrosyrrhoe rinconis J. L. Barnard

Austrosyrrhoe rinconis J. L. Barnard, 1967: 160–162, fig. 79.

DIAGNOSIS.—Rostrum thick and sharp; article 2 of antenna 1 simple; coxa 3 with acute anteroventral corner, not excavate posteriorly; coxa 4 large, thick, adz-shaped; gnathopod 2 with palm; article 2 of pereopod 5 moderately expanded, rounded posteroventrally; outer rami of uropods 1–2 spinose apically; telson short and broad, cleft nearly halfway; epimeron 3 with slightly enlarged blunt posteroventral tooth; pleonites 1–3 and 5 each with dorsal tooth.

Hand of gnathopod 1 narrow; article 2 of antenna 1 longer than article 1.

REMARKS.—The three species of group 2 are all closely similar to one another; the appended diagnostic sentence above helps distinguish them.

Baja California, 1095–1205 m.

Austrosyrrhoe septentrionalis Stephensen

Austrosyrrhoë (?) *septentrionalis* Stephensen, 1931: 259–260, fig. 74

DIAGNOSIS.—Rostrum medium, with slightly blunted apex; article 2 of antenna 1 simple; coxa 3 with slightly acute anteroventral corner, posterior margin weakly excavate; coxa 4 large, thick, adz-shaped; gnathopod 2 with palm; article 2 of pereopod 5 expanded, subtruncate posteroventrally; outer rami of uropods 1–2 spinose apically; telson short and broad, cleft halfway; epimeron 3 with slightly enlarged, sharp tooth; pleonites 1–2 each with dorsal tooth.

Hand of gnathopod 1 very stout, article 2 of antenna 1 shorter than article 1.

Arctic North Atlantic, 885–2702 m.

Austrosyrrhoe fimbriatus (Stebbing and Robertson)

Syrrhoë fimbriatus Stebbing and Robertson, 1891: 34–36, pl. 5 B.
Syrrhoites fimbriatus.—Stebbing, 1906: 280–281.

DIAGNOSIS.—Rostrum large and sharp; article 2 of antenna 1 simple; coxa 3 slightly attenuate but softly rounded anteroventrally, not excavate posteriorly; coxa 4 large, thick, adz-shaped; female gnathopod 2 with normal oblique palm, in male hand linear, rectangular, palm transverse; article 2 of pereopod 5 moderately expanded, rounded posteroventrally; outer rami of uropods 1–2 spinose apically; telson short and broad, cleft halfway or more; epimeron 3 with slightly enlarged, sharp posteroventral tooth; pleonites 1–2 and 5 each with dorsal tooth.

Hand of gnathopod 1 slender; article 2 of antenna 1 shorter than article 1.

Firth of Clyde; Irish Sea (Calf of Man), depths unknown.

Bruzelia Boeck

Bruzelia Boeck, 1871: 149.—Stebbing, 1906: 274.

DIAGNOSIS.—Forehead weakly protuberant in type but not in others, lateral cephalic lobe not sharp; eyes absent; mandible with palp, molar greatly enlarged, not triturative, fuzzy; mouthparts basic; articles 1–2 of antenna 1 basic; coxa 1 ordinary; coxae 3–4 not pelagont, coxa 3 not strongly expanded distally except for acute anteroventral cusp and not posteriorly excavate, coxa 4 variable, excavate posteriorly (rarely weak), and slightly smaller or slightly larger than coxa 3; gnathopods typically subchelate, palms oblique, defined by 1–2 serrate spines, second spine if present occasionally simple; dactyl of gnathopod 2 normal; pereopods 3–5 weakly to strongly elongate, dactyls weakly elongate, article 2 of pereopod 5 typically rounded posteroventrally but truncate in

Key to the Species of *Bruzelia*

1. Pereonites 2–7 with distinct dorsal teeth ... 2
   Only a few posterior segments of pereon with distinct teeth or teeth absent ... 4
2. Pereon and pleon with lateral teeth below dorsal teeth ... ***B. ascua***
   Pereon sometimes with lateral bulges just above coxae but subsidiary teeth otherwise absent ... 3

3a. Article 1 of antenna 1 with small cusp; pleonites 1–2 with lateral carina; dorsal teeth large and sharp ... ***B. australis***
b. Article 1 of antenna 1 lacking cusp; no lateral carina on pleonites 1–2; dorsal teeth large and sharp ... ***B. guayacura***
c. Article 1 of antenna 1 lacking cusp; pleonites 1–2 with lateral carina; dorsal teeth forming low crests ... ***B. tuberculata***

4. Pereonite 7 with small dorsal tooth ... 5
   Pereonite 7 lacking dorsal tooth ... 6
5. Palm of gnathopods 1–2 bearing one spine, pleonites 2 and 5 with dorsal tooth ... ***B. poton***
   Palm of gnathopods 1–2 bearing 2 spines, pleonites 2 and 5 smooth ... ***B. diodon***
6. Coxa 4 comma-shaped; article 2 of pereopod 5 forming large, apically expanded and truncate trapezoid ... ***B. popolocan***
   Coxa 4 adz-shaped; article 2 of pereopod 5 ovatorectangular ... 7
7. Pleonites 1–3 with weak dorsal rugosities, no teeth; article 1 of antenna 1 strongly hatchet-shaped; outer rami of uropods 1–2 apically spinose ... ***B. pericu***
   One or more of pleonites 1–3 with dorsal tooth; article 1 of antenna 1 scarcely hatchet-shaped; outer rami of uropods 1–2 apically simple ... 8
8. Only pleonite 3 with large dorsal tooth ... ***B. typica***
   Pleonites 1–2 and 5 with small dorsal tooth ... ***B. inlex***

B. tuberculata and *B. popolocan;* pleonites 1–3 not denticulate; uropod 3 not exceeding uropods 1–2, peduncle typically short but elongate in *B. tuberculata* and *B. popolocan;* telson elongate, entire.

TYPE-SPECIES.—*B. typica* Boeck (1871).

REMARKS.—The diagnoses do not properly account for the presence or absence of a dorsal tooth on pleonite 5 as a sexual difference. *Bruzelia typica* is known to have this present in males and absent in females; because in other species based only on females this tooth is present, it may not be a consistent sexual difference.

Unusual characters are appended as separate sentences in the diagnoses.

Bruzelia ascua J. L. Barnard

Bruzelia ascua J. L. Barnard, 1966: 94, figs. 45,46; 1967: 162.

DIAGNOSIS.—Gnathopod 1 with 2 palmar spines, gnathopod 2 with 1 palmar spine; coxa 3 with sharp and attenuate anteroventral corner; coxa 4 much shorter than coxa 3 and with posteroventral margin excavate; coxae 5–6 with posterolateral tooth (unusual); article 2 of pereopods 3–5 with flat posterior margin bearing 2–3 enlarged serrations; epimera 2–3 each with long, thin posteroventral tooth; pereonites 2–7 and pleonites 1–3 with large dorsal tooth; pleonites 4–5 with small dorsal tooth; pereonites 1–7 and pleonites 1–3 with dorsolateral tooth; pereonites 1–7 with fully lateral tooth; pleonites 1–3 with second, lower, dorsolateral tooth.

California, 1687–1720 m.

Bruzelia australis Stebbing

Bruzelia australis Stebbing, 1910: 590–592, pl. 50.

DIAGNOSIS.—Gnathopods 1–2 with 2 palmar spines; coxa 3 acute anteroventrally; coxa 4 as long as coxa 3, adz-shaped, posteroventral margin straight; article 2 of pereopods 3–5 ovatorectangular and with 6+ enlarged posterior serrations; epimeron 2 with small posteroventral tooth; epimeron 3 with medium sharp posteroventral tooth; pereonites 1–7 and pleonites 1–2 with dorsal tooth; pleonites 1–2 with lateral carina.

Article 1 of antenna 1 with small cusp.

Off eastern Australia, 54–59 fms.

Bruzelia diodon K. H. Barnard

Bruzelia diodon K. H. Barnard, 1916: 168–169.—J. L. Barnard, 1962a: 54, figures 44–45.

DIAGNOSIS.—Gnathopods 1–2 with 2 palmar spines; coxa 3 acute anteroventrally; coxa 4 as long as coxa 3, thick, adz-shaped, posteroventral margin straight or slightly concave; article 2 of pereopods 3–5 ovatorectangular, posterior serrations small; epimeron 2 posteroventrally quadrate and slightly produced; epimeron 3 with medium sharp tooth; pereonite 7 and pleonite 1 with dorsal tooth.

Off South Africa, 1189–2972 m.

Bruzelia guayacura, new species

FIGURES 3, 4

DIAGNOSIS.—Gnathopods 1–2 with 2 palmar spines; coxa 3 acute anteroventrally; coxa 4 as long as coxa 3, adz-shaped, posteroventral margin straight or slightly concave; article 2 of pereopods 3–5 rectangular, posterior serrations of medium size; epimeron 2 with large sharp posteroventral tooth; epimeron 3 with large blunt posteroventral tooth; pereonites 2–7 with medium-sized, blunt dorsal tooth and with lateral bulge just above coxae; pleonites 1–2 also with blunt dorsal tooth; pleonite 5 with small sharp dorsal tooth.

DESCRIPTION.—Rostrum of medium length, slender, straight, slightly exceeding lateral cephalic lobes, latter broadly adz-shaped; article 1 of antenna 1 weakly hatchet-shaped, bluntly produced ventrodistally, article 2 subequal to 1 in length, moderately thick, article 3 shorter than 2; coxa 1 expanded distally, anterodistal corner blunt; anteroventral corner of coxa 3 strongly produced and acute; coxa 4 scarcely smaller than coxa 3, ventral margin slightly oblique, posterodistal lobe short, broad, distally blunt, coxae 5–6 each with ventrolateral ridge; article 2 of pereopods 3–5 slender, anterior and posterior margins parallel except pereopod 5 with slight distad expansion, posterior margins sparsely and strongly serrate, remaining articles slender, posteroventral lobe of article 2 on pereopod 5 truncate ventrally; palms of gnathopods defined by 2 large spines, one serrate; posterior margin of article 6 of pereopods 1–2 with several short setae but no pectinae; body with strong dorsal ornamentation, pereonite 1 with weak dorsal crest, following segments with increasingly larger crests ending in blunt posterodorsal tooth, teeth becoming more acute posteriorly, pleonites 1–2 with sharp dorsal tooth, pleonite 3 with dorsal crest but no teeth, pleonite 4 dorsally smooth, 5 with small, sharp tooth; no segment with dorsolateral ridges or teeth; pereonites 2–7 with blunt, ridgelike ventrolateral tooth; lateral projection of pleonite 4 above insertion of uropod 1 weak, softly rounded; pleonal epimeron 1 forming trapezoid with softly rounded corners, with distinct posteroventral corner bearing strong, sharp tooth, epimeron 3 with slightly convex posterior margin and slightly upturned, slender posteroventral tooth; uropods apically damaged, peduncles of uropods 1–2 with distolateral cusps; rami of uropod 1 and outer ramus of uropod 2 apparently with weak, nearly fused distal spine; telson very broad and apically acute.

HOLOTYPE.—USNM 136594, female, 3.2 mm.

TYPE-LOCALITY.—*Eltanin* 50, off southern Peru, 16°12′S, 74°41′W, 2599–2858 m, 15 June 1962.

MATERIAL.—8 specimens from the type-locality.

RELATIONSHIP.—The affinities of this species lie with *Bruzelia australis* Stebbing (1910) from Wata Mooli, Australia, 54–59 fms. There are no strong characters distinguishing the 2 species and if abyssal Peru were not so far geographically and bathymetrically from sublittoral Australia I should have considered I had *B. australis* in hand. The two species resemble each other in dorsal ornamentation, coxae, gnathopods, pereopods, uropods, telson and mouthparts and generally in antennae. *Bruzelia guayacura* differs from *B. australis*, however, in the following proportions: (1) the ventrodistally rounded (not slightly cuspidate) apex of article 1 on antenna 1; (2) the absence of a "point directed over the head" on pereonite 1; (3) the absence of a lateral carina on pleonites 1–2. The first 2 characters may be subject to different interpretations by different students and the third character therefore is that of qualitative distinction between the 2 species. Stebbing mentions the ventrolateral carina of the pereon occurring in *B. australis* but he does not mention the carinae on coxae 5 and 6 and this may be another character of discrimination between the two species. Stebbing draws the posteroventral lobe on article 2 of pereopod 5 as a sharp cusp above a concave ventral margin but this may be an erroneous interpretation as that

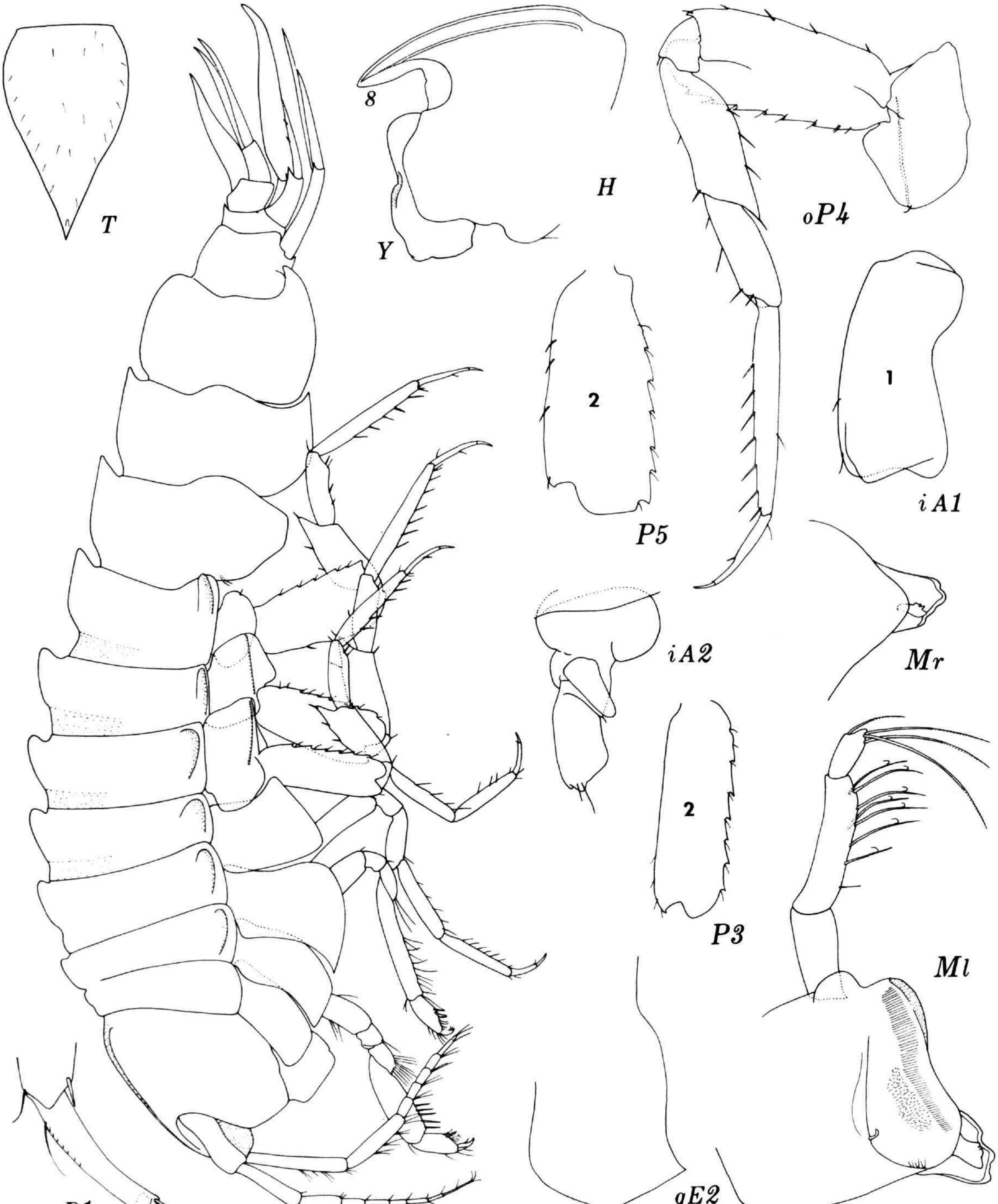

FIGURE 3.—*Bruzelia guayacura,* new species, holotype, female, 3.2 mm, *Eltanin* 50; q=juvenile, 2.9 mm.

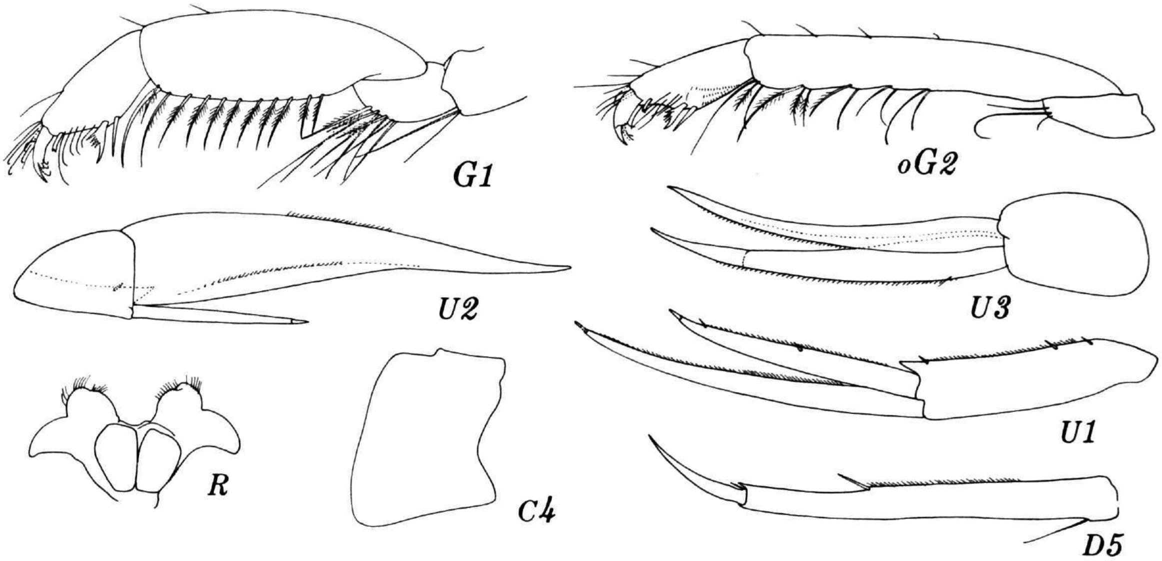

FIGURE 4.—*Bruzelia guayacura*, new species, holotype, female, 3.2 mm, *Eltanin* 50.

lobe in *B. guayacura,* unless visually separated from the underlying article 4, has the same appearance. The posterior serrations on pereopods 3–5 of *B. australis* appear to be more irregular and tightly packed than they are in *B. guayacura.*

The tooth on pleonal epimeron 2 of *B. guayacura* is larger in the holotype than it is on *B. australis* but juveniles of *B. guayacura* have a much smaller tooth (see Figure 3) and shallower posterior sinuosity above the tooth.

I have not illustrated the accessory flagellum of *B. guayacura* on the lateral view of the specimen; it is 2-articulate, slightly longer than article 1 of the primary flagellum and article 2 is very small. *Bruzelia australis* was described as having a uniarticulate accessory flagellum.

The dorsal teeth of *B. guayacura* are slightly weaker than those of *B. australis* but this characterization often varies in Amphipoda phenotypically. Small specimens (2.0–2.5 mm) have a slightly better defined dorsal carina of urosomite 4 than does the adult holotype.

Maxillipeds and maxillae are like those of *Bruzelia pericu,* new species, in contrast to those of *B. typica* (see figures herein).

Peru, 2599–2858 m.

Bruzelia inlex J. L. Barnard

Bruzelia inlex J. L. Barnard, 1967: 162–164, figure 80.

DIAGNOSIS.—Gnathopods 1–2 with 2 palmar spines; coxa 3 with sharp and attenuate anteroventral corner; coxa 4 as long as coxa 3, thick, adz-shaped, posteroventral margin rounded; article 2 of pereopods 3–4 rectangular, of pereopod 5 ovatorectangular, posterior serrations small; epimeron 2 with small posteroventral tooth; epimeron 3 with medium sharp posteroventral tooth; only pleonites 1–2 and 5 with small dorsal tooth.

Baja California, 1748–2398 m.

Bruzelia pericu, new species

FIGURES 5, 6

DIAGNOSIS.—Gnathopods 1–2 with 2 palmar spines; coxa 3 anteroventrally acute; coxa 4 as long as coxa 3, weakly adz-shaped, with elongate posteroventral lobe, posteroventral margin straight; article 2 of pereopods 3–5 ovatorectangular, posterior serrations small; epimeron 2 with small sharp posteroventral tooth; epimeron 3 with medium sharp posteroventral tooth; pleonites 1–3 with weak dorsal rugosities, no teeth; pleonite 5 with dorsal tooth.

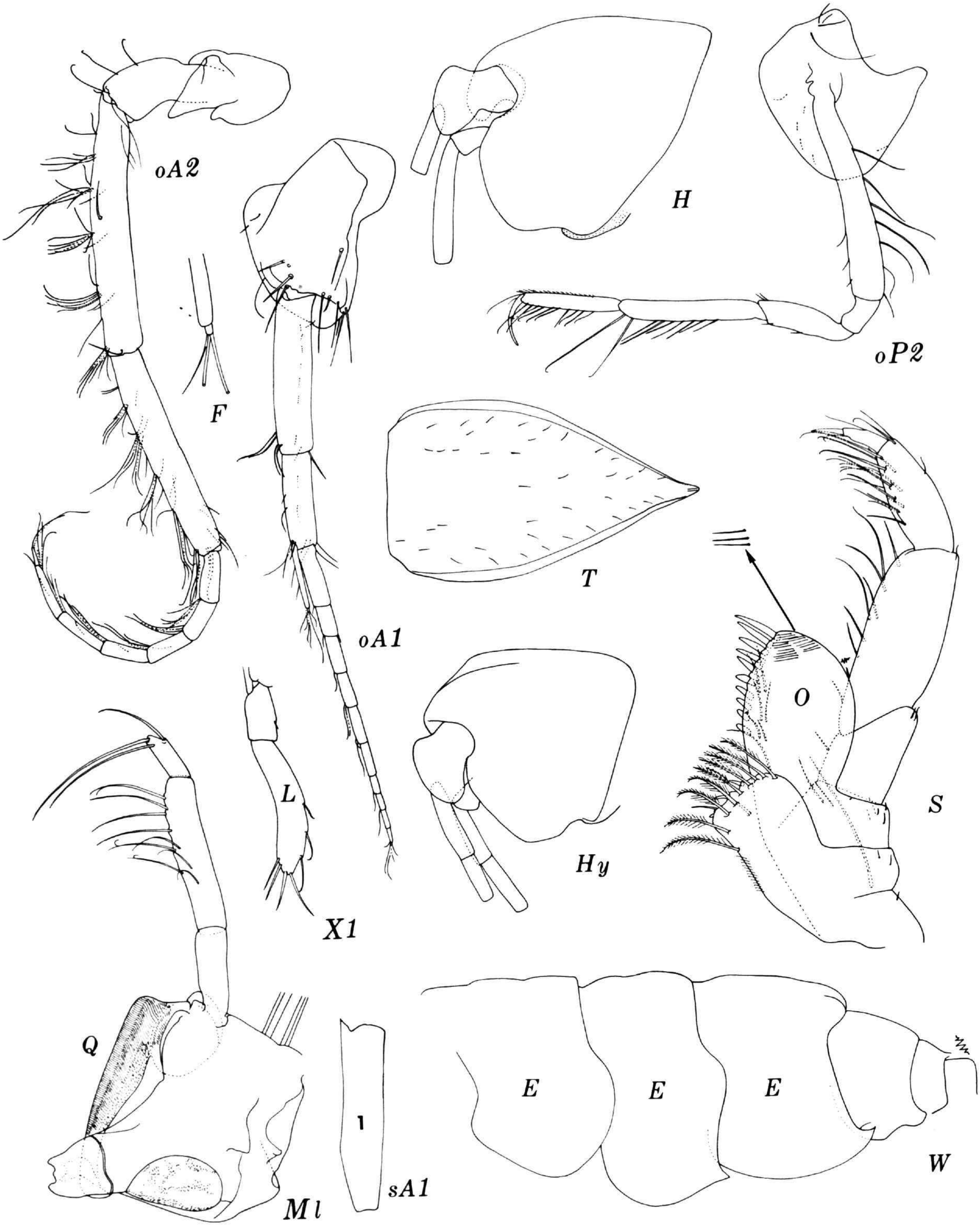

FIGURE 5.—*Bruzelia pericu*, new species, holotype, female, 4.3 mm, *Vema* 15-20; y=damaged version of head.

Article 1 of antenna 1 strongly hatchet-shaped.

DESCRIPTION.—Rostrum short, stout, beaklike, downturned, not exceeding lateral cephalic lobes, latter beveled dorsally, anterior margin long, broadly convex; article 1 of antenna 1 strongly hatchet-shaped, article 2 subequal to 1 in length, but thin, attached to article 1 subdistally, article 3 shorter than 2; coxa 1 distally expanded, anterodistal corner blunt; anteroventral corner of coxa 3 strongly produced and acute; coxa 4 scarcely smaller than 3, ventral margin

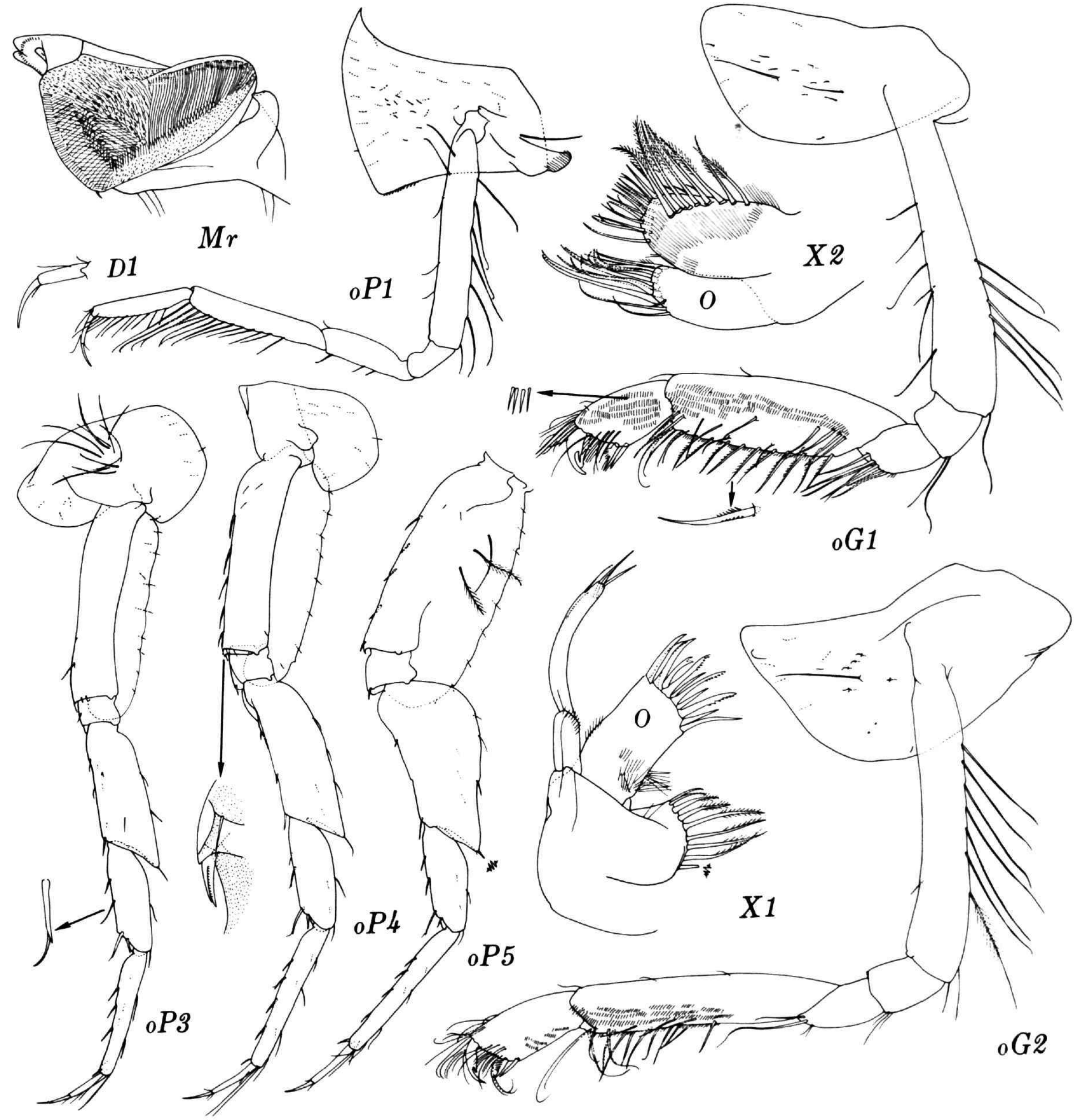

FIGURE 6.—*Bruzelia pericu*, new species, holotype, female, 4.3 mm, *Vema* 15–20.

straight, posterodistal lobe large, thin, blunt distally; article 2 of pereopods 3–5 slender, anterior and posterior edges parallel, posterior margin sparsely and weakly notched; no other articles especially broad except article 4 of pereopod 5 with strong proximal tumidity, posteroventral lobe of article 2 rounded ventrally; palms of gnathopods defined by 2 large spines, one serrate and one simple; posterior margin of article 6 of pereopods 1–2 with numerous long setal spines; body almost without dorsal ornamentation, pleonites 1–3 with very weak dorsal rugosities, pleonite 3 with weak posterodorsal bilateral humps, pleonite 5 with thin (broken) posterodorsal tooth; posterolateral margin of pleonite 4 with small mammilliform cusp above insertion of uropod 1; pleonal epimeron 1 broadly convex posteriorly, lacking distinct posteroventral corner, epimeron 2 with strong posterior sinuosity below bulge, posteroventral corner with medium-sized tooth, epimeron 3 with straight posterior margin and slightly upturned tooth of medium size at posteroventral corner; uropods badly damaged but similar to those shown by Sars (1895) for *Bruzelia tuberculata* Sars, except outer ramus of uropod 1 about three fourths as long as inner, distolateral corners of peduncles of uropods 1–2 with small, petiolate cusp, apices of outer rami of uropods 1–2 and inner ramus of uropod 1 with 2–3 medium-sized spines; telson typical of genus in overall shape but slightly stouter than normal.

HOLOTYPE.—AMNH 14,401, female, 4.3 mm. Unique.

TYPE-LOCALITY.—*Vema* 15–20, Caribbean Panama, 09°46.5′ N, 79°37.5′ W, 825–860 m, 10 November 1958.

RELATIONSHIP.—Apparently all species of *Bruzelia* have a slight tendency to develop a hatchet-shape on article 1 of antenna 1 but this species is the most strongly developed so far reported. *Bruzelia pericu* bears strong resemblance to *B. tuberculata* Sars (1895: pl. 139, figure 2) because of the weakly developed if almost nonexistent dorsal body ornaments but *B. pericu* differs from *B. tuberculata* in the development of a dorsal tooth on pleonite 5 in the female (a character generally restricted to males), in the stronger anteroventral tooth of coxa 3, the non-excavate ventral margin of coxa 4, the slenderness of article 2 on pereopods 3–5, the absence of sharp protrusions on the midposterior margins of pleonal epimera 1–2 and in the presence of distal spines on the outer rami of uropods 1–2 and inner ramus of uropod 1.

Bruzelia diodon K. H. Barnard (1916, and *see* J. L. Barnard, 1962a) is very similar to *B. pericu* because of resemblance in coxae, pereopods 3–5 and pleonal epimera but *B. diodon* has 2 very distinct dorsal teeth, on pereonite 7 and pleonite 1.

Bruzelia inlex J. L. Barnard (1967) has close affinities withh *B. pericu* but has distinct dorsal teeth on pleonites 1–2, no distal spines on the rami of uropods 1–2 and a relatively unmodified article 1 of antenna 1.

Caribbean, 825–860 m.

Bruzelia (?) popolocan, new species

FIGURES 7, 8

DIAGNOSIS.—Gnathopods 1–2 with 2 palmar spines; coxa 3 with anteroventral corner rounded; coxa 4 as long as coxa 3, comma-shaped but large, scarcely excavate posteriorly; article 2 of pereopods 3–4 ovate, of pereopod 5 very broadly expanded and subtruncate ventrally, posterior serrations small; epimeron 2 with middle posterior hump, margin then sweeping concavely to quadrate posteroventral corner; epimeron 3 with small, thick sharp posteroventral tooth; pleonites 1–2 with small dorsal tooth.

Article 1 of antenna 1 with sharp tooth; peduncle of uropod 3 elongate.

NOMENCLATURE.—This species does not belong to *Bruzeliopsis* because coxa 3 is not excavate and article 1 of antenna 1 is not elongate; it does not belong to *Latacunga* because coxa 1 is normally expanded; and it is excluded from *Syrrhoites* because one palmar spine on gnathopods 1–2 is serrate.

The relationship to *Bruzeliopsis* however appears also in the expanded article 2 of pereopod 5 but the palp of the mandible is excessively large and article 3 exceptionally short, while the rostrum is thinner and straighter than in *Bruzeliopsis*.

DESCRIPTION.—Rostrum of medium length, thin, acute, downturned, beaklike; lateral cephalic lobes very broad, scarcely extended forward, almost smoothly convex anteriorly; article 1 of antenna 1 scarcely adz-shaped, with reverted medial cusp, article 2 as long but thinner than article 1, attached normally to article 1, article 3 shorter than 2; coxa 1 rectangular, not distally expanded, anterodistal corner blunt;

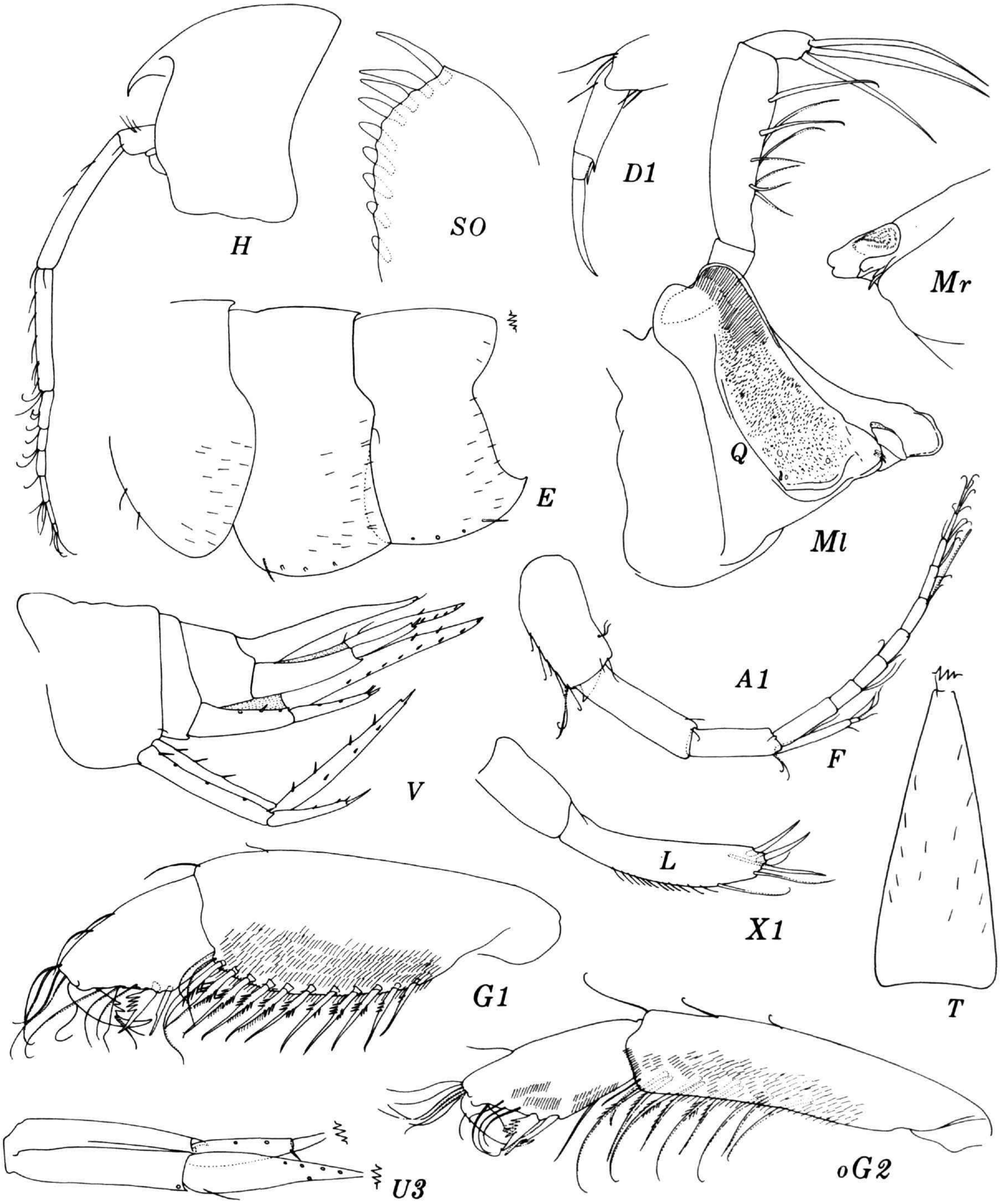

FIGURE 7.—*Bruzelia popolocan,* new species, holotype, juvenile, 2.7 mm, *Vema* 15–55.

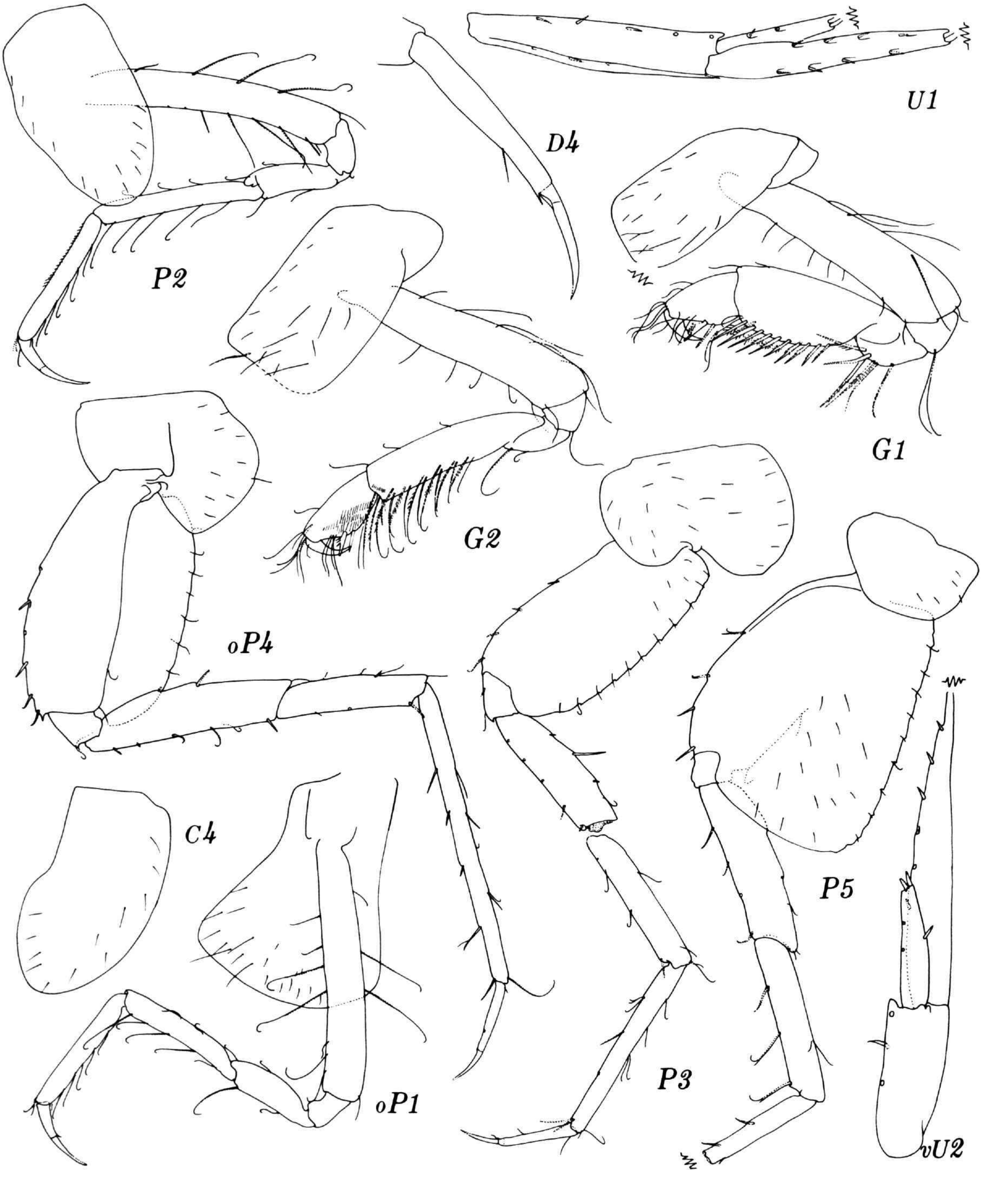

FIGURE 8.—*Bruzelia popolocan*, new species, holotype, juvenile, 2.7 mm, *Vema* 15–55.

anteroventral corner of coxa 3 blunt and rounded; coxa 4 slightly smaller than coxa 3 and scarcely lobed posterodistally; article 2 of pereopods 3–5 increasingly broadened, that of pereopods 3–4 ovate, that of pereopod 5 extremely broad, trapezoidal, expanding distally and truncate ventrally; notches on posterior margins of medium density; articles 3–7 of pereopods 3–5 slender; palms of gnathopods defined by 2 large spines, one serrate and one simple; posterior margin of article 6 of pereopods 1–2 with 5–6 slender setae, no comb, weak comb on anterior margin; body almost without dorsal ornamentation, only pleonites 1–2 each bearing one small posterodorsal tooth; posterolateral margin of pleonite 4 with no tooth above insertion of uropod 1; pleonal epimeron 1 convexly tapering ventrally, posteroventral corner of epimeron 2 with quadrate corner scarcely projecting, epimeron 3 with medium-sized posteroventral tooth, slightly sinuous posterior margin and no serrations; both rami of uropods 1–2 and outer ramus of uropod 2 with apical spines, rami of uropod 2 not as strongly disproportionate as in most species of *Bruzelia,* distolateral corners of peduncles scarcely toothed, outer ramus of uropod 3 clearly 2-articulate; telson not as strongly broadened as and longer than that of most species of *Bruzelia.*

HOLOTYPE.—AMNH 14,403, juvenile, 2.7 mm. Unique.

TYPE-LOCALITY.—Vema 15-55, off Pacific Nicaragua, 12°45′ N, 88°38′ W, 3777–3950 m, 11 November 1958.

RELATIONSHIP.—This species has affinities with *Bruzelia inlex* J. L. Barnard (1967) from the Cedros Trench of Baja California because of the reduction of the dorsal cuspidation to small teeth on pleonites 1–2 but differs from that species in the absence of a distinct tooth on pleonal epimeron 2, the presence of a reverted cusp on antenna 1, the absence of a tooth on pleonite 5, the stouter gnathopods, the very weak rostrum and the very much broader expansion of article 2 of pereopods 4–5, and the presence of distal spines on some of the rami of uropods 1–2.

The present unique specimen of *B. popolocan,* new species, is about the same size as *B. poton,* new species, and they resemble each other in many ways but one would have to presume they are opposite sexes of the same species in order to unite them. *Bruzelia popolocan* differs from *B. poton* in the very thin rostrum, the presence of 2 and not one locking spines on the gnathopods, the presence of a strong cusp on article 1 of antenna 1, the absence of dorsal teeth on pereonite 7 and pleonite 5, and the basally broad but distally narrow pereopods 3–5.

Bruzelia popolocan differs from *B. pericu* J. L. Barnard by characters of the same magnitude as those stated for *B. poton* and in addition by the normally developed article 1 of antenna 1 which is hatchet-shaped in *B. pericu.*

The shapes of coxa 4 and article 2 on pereopod 5 are unusual in this genus. The tooth on article 1 of antenna 1 is shared with *B. australis.*

Pacific Nicaragua, 3777–3950 m.

Bruzelia poton, new species

FIGURE 9

DIAGNOSIS.—Gnathopods 1–2 with one palmar spine; coxa 3 acute anteroventrally; coxa 4 slightly shorter than coxa 3, weakly adz-shaped, posteroventral margin straight; article 2 of pereopods 3–5 ovato-rectangular, posterior serrations small; epimeron 2 with tiny sharp posteroventral tooth; epimeron 3 with medium thick sharp posteroventral tooth; pereonite 7 with small dorsal tooth; pleonites 1–2 and 5 with small dorsal tooth.

DESCRIPTION.—Rostrum of medium length, stout, beaklike, downturned, scarcely exceeding lateral cephalic lobes, latter rounded anterodorsally, anterior margin long, scarcely convex; article 1 of antenna 1 weakly hatchet-shaped, ventrodistally and bluntly produced, article 2 subequal to 1 in length, but thin, attached distally to article 1, article 3 shorter than 2; coxa 1 distally expanded, anterodistal corner blunt; anteroventral corner of coxa 3 strongly produced and acute; coxa 4 scarcely smaller than 3, ventral margin slightly oblique, posterodistal lobe of medium length, broad, distally blunt; article 2 of pereopods 3–5 slender, anterior and posterior margins parallel, posterior margins sparsely and strongly serrate, of remaining articles only article 5 especially stout, posteroventral lobe of pereopod 5 rounded ventrally; palms of gnathopods defined by one large serrate spine; posterior margin of article 6 of pereopods 1–2 with one long seta and numerous minute pectinae; body with weak dorsal ornamentation, pereonite 7 and pleonites 1–2 each with weak posterodorsal tooth, pleonite 5 with weak dorsal tooth; posterolateral mar-

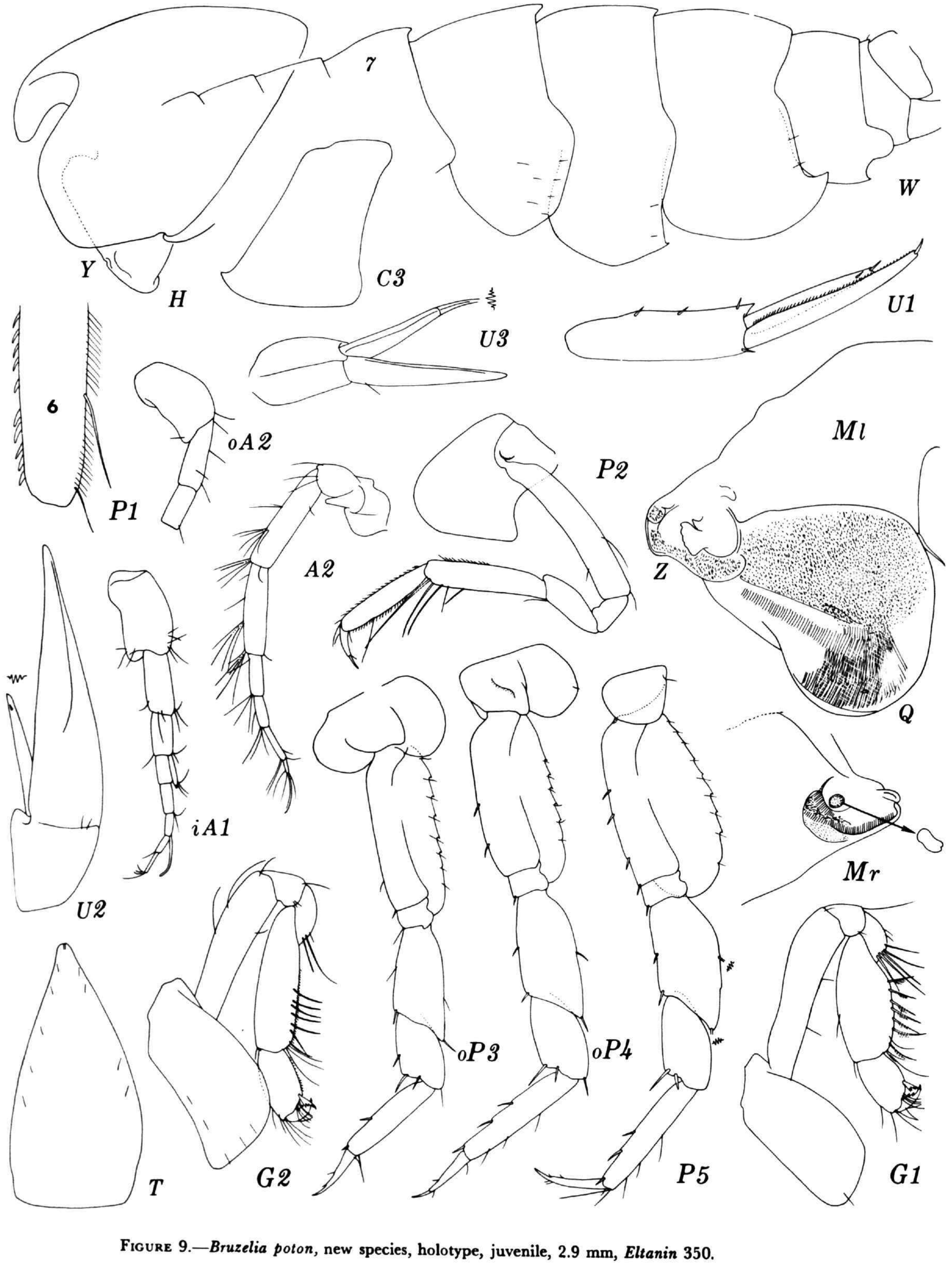

FIGURE 9.—*Bruzelia poton*, new species, holotype, juvenile, 2.9 mm, *Eltanin* 350.

gin of pleonite 4 with medium-sized tuberous cusp above insertion of uropod 1; pleonal epimeron 1 trapezoidal, with softly rounded corners, with distinct posteroventral corner, epimeron 2 with weak sinuosity below bulge, posteroventral corner with minute, sharp tooth, epimeron 3 with slightly convex posterior margin and slightly upturned tooth of medium size at posteroventral corner; uropods apically damaged, peduncles with distolateral cusps, rami of uropod 1 with 1 (? or more) distal spines, outer ramus of uropod 2 possibly with spine (damaged); telson typical of genus, of medium width.

HOLOTYPE.—USNM 136596, juvenile, 2.9 mm. Unique.

TYPE-LOCALITY.—*Eltanin* 350, east of Tierra del Fuego, 55°03′S, 58°57′W, 2452 m, 4 December 1962.

RELATIONSHIP.—This species bears affinities with *Bruzelia pericu,* new species, *B. diodon* K. H. Barnard (1916, and *see* J. L. Barnard, 1962a) and *B. inlex* J. L. Barnard (1967). It differs from all of them in having a dorsal tooth on all three segments, pereonite 7 and pleonites 1–2, whereas the other species have a lesser number of teeth on those segments. *Bruzelia pericu* is distinguished markedly by the hatchet-shaped article 1 of antenna 1. The weakness of the dorsal tooth on pleonite 2 of *B. poton* and the congruence of almost all other characters suggests a very close affinity to *B. diodon. Bruzelia poton* has only one defining spine on the gnathopodal palms whereas *B. diodon* has 2 but this may reflect only age differences. The developmental morphology of *Bruzelia* is poorly known and many of the above-mentioned character differences used to distinguish the species may simply reflect different stages of maturity in individuals of a single species.

All of the species of *Bruzelia, Syrrhoites* and *Austrosyrrhoe* studied in this project have a marginal armament of small setal scales on the anterior edge of article 6 of pereopod 2 but not on pereopod 1. *Bruzelia poton,* unlike the others, also has these scales on article 5 of pereopod 2.

Article 5 of pereopods 3–5 is especially stout in the new species and may be a tumidity characteristic of juvenility, rather than a character of specific importance.

Maxillae and maxillipeds similar to those of *B. pericu* but much less setose and spinose, possibly because of smaller size of holotype.

Off Tierra del Fuego, 2452 m.

Bruzelia tuberculata Sars

Bruzelia tuberculata Sars, 1895:397–398, pl. 139, fig. 2.—Stebbing, 1906:275.—Stephensen, 1931:252; 1938:232.—Gurjanova, 1951:589, fig. 395.—J. L. Barnard, 1962b: 73; 1966:94.

DIAGNOSIS.—Gnathopods 1–2 with 2 palmar spines; coxa 3 with weakly attenuate and slightly blunt anteroventral corner; coxa 4 as long as coxa 3, thick, adz-shaped, posteroventral margin excavate; article 2 of pereopod 3 ovatorectangular, of pereopods 4–5 irregularly ovate, posterior serrations small; epimeron 2 with small sharp posteroventral tooth; epimeron 3 with medium tooth bearing ventral serrations; pereonites 3–7 with weak dorsal crest; pleonites 1–3 with enlarged dorsal crest; pleonites 1–2 with lateral carina.

Peduncle of uropod 3 elongate.

Arctic-North Atlantic, 82–309 fms; California, 121–565 m.

Bruzelia typica Boeck

FIGURES 10, 11

Bruzelia typica Boeck, 1871:150; 1876:478–480, pl. 10, fig. 3.—Sars, 1895:395–397, 696, pl. 138, 139, fig. 1.—Norman, 1895:488.—Stebbing, 1906: 274–275.—Stephensen, 1926:87; 1928:229–230, fig. 46 (12–14); 1929:122, fig. 29, 195.—Oldevig, 1933:143.—Stephensen, 1938: 232.—Gurjanova, 1951:588–589, fig. 394.—Oldevig, 1959:62.—J. L. Barnard, 1964:29.

DIAGNOSIS.—Gnathopods 1–2 with 2 spines; coxa 3 with sharp, attenuate anteroventral corner; coxa 4 as long as coxa 3, thick, adz-shaped, posteroventral margin rounded; article 2 of pereopods 3–5 ovatorectangular, posteriorly smooth; epimeron 2 with small, sharp posteroventral tooth; epimeron 3 with medium thick posteroventral tooth; in female, only pleonite 3 with sharp dorsal tooth; male pleonite 5 also with tooth.

MATERIAL.—*Vema* 14–58 (4).

REMARKS.—These specimens are approximately 4.0 mm in length and differ in minor ways from the figures of Sars (1895), but none of these small variations has ever been used as a specific character in this genus. Most of the extremely sharp corners of the coxae and pleonite 3 are blunt in these specimens. The posterolateral corners of pereonites 6 and 7 project more strongly, are blunter and have stronger

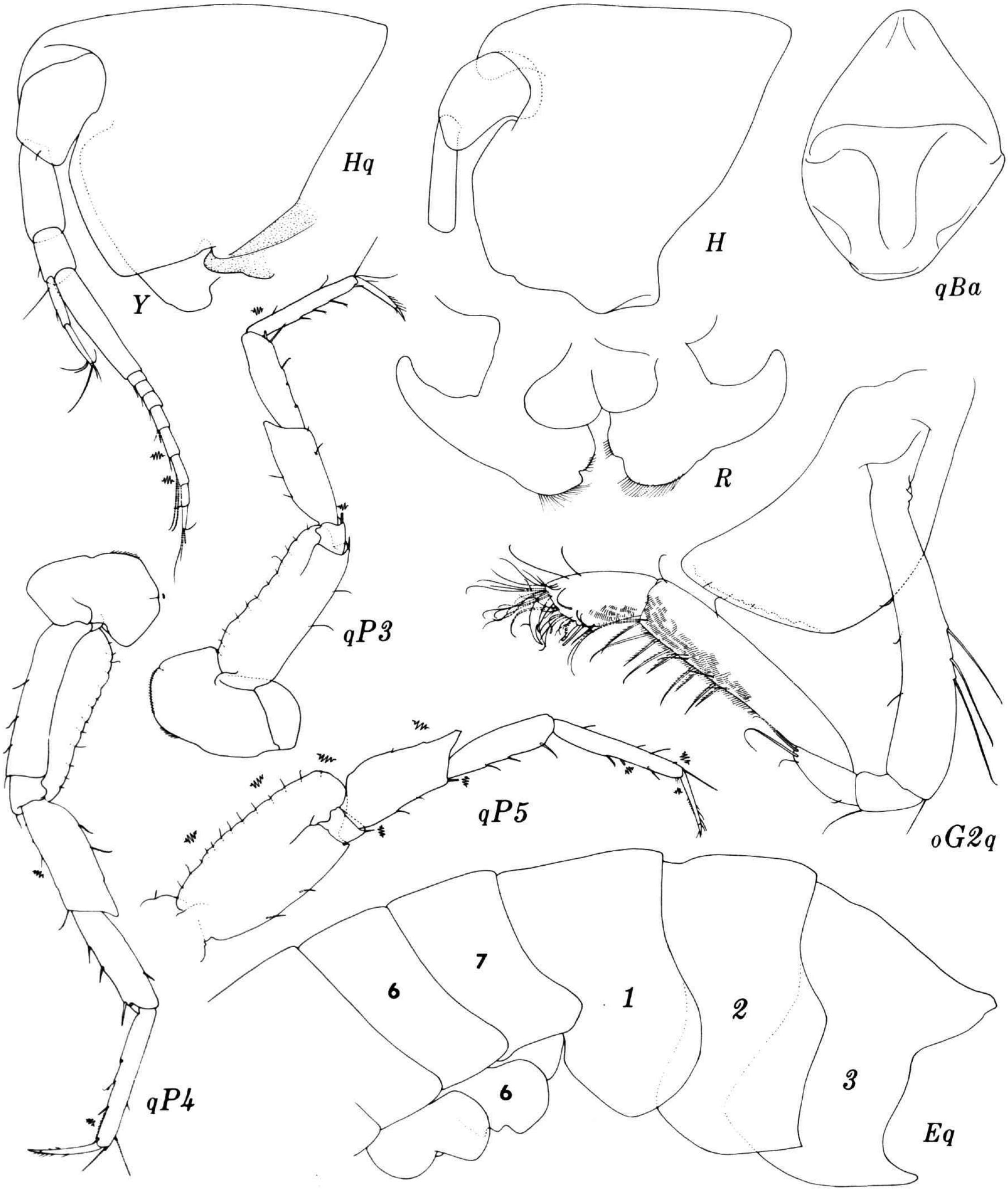

FIGURE 10.—*Bruzelia typica* Boeck, male, 3.9 mm, *Vema* 14–58; *q*=female, 4.0 mm.

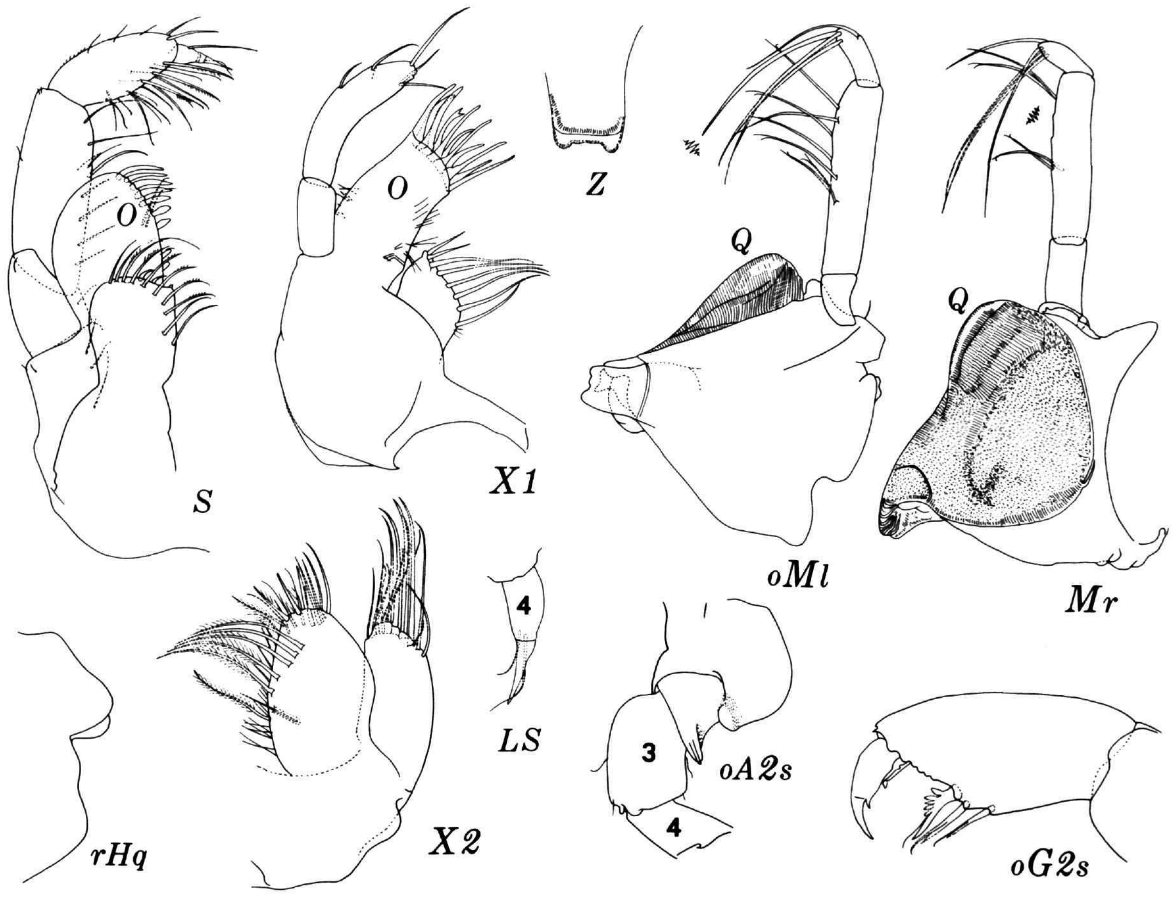

FIGURE 11.—*Bruzelia typica* Boeck, male, 3.9 mm, *Vema* 14–58; *q*=female, 4.0 mm.

lateral eminences than those figured by Sars. The posterior edge of pleonal epimeron 3 is slightly more convex and the second articles of pereopods 3–4 are more slender than in northern *B. typica.*

The lower lip has strong medial notches on the outer lobes; on one specimen the notches are even deeper than shown for *Syrrhoites serrata* Sars (1895, pl. 137) but on the other three they are rather shallow; perhaps they vary according to differential effects of preservation or according to the nearness of molting; when the lower lip is strongly flattened by a cover slip the notches practically disappear. Article 3 of the mandibular palp varies in length from side to side.

One of the 2 males at hand is like that shown by Sars (pl. 139), the erect protuberance of pleonite 6 being fully developed. The male figured herein lacks that protuberance but has the rudimentary dorsal tooth of pleonite 5 and the second antennal flagellum is just commencing its elongation.

The ventral cephalic notch is highly variable. On the 3.9 mm figured male the notch is easily discernible from lateral view; it is really composed of a posteroventral invagination of sclerotized tissue from one of the mouthpart somites (either maxilla 2 or maxilliped or a combination of the two) overlain by a thin sheet of slightly invaginated marginal cephalic chitin. In the 4.0 mm female the notch is not visible on the left from lateral view (see figures) but is slightly evident from an oblique ventral view. The notch on the right side is like that shown for the male. The outlines of lateral cephalic lobes and rostra very considerably from specimen to specimen. The extremes have been illustrated in choosing the male and female to be figured. Presumably there is no connection between cephalic variation and sexual dimorphism. To some extent it appears as if notch morphology is disturbed by large posteroventral concretions which occur irregularly in the 4 specimens available.

RECORD.—Western Mediterranean Sea, off Oran, 2070 m. Northeastern Atlantic along Norway coastline from Skraven southward, and south to British Isles, about 160–600 m, Mediterranean Sea, 1938–2070 m.

Bruzeliopsis Chevreux

Bruzeliopsis Chevreux, 1911:3–7.

DIAGNOSIS.—Forehead not protuberant, lateral cephalic lobe not sharp; eyes absent; mandible with weak palp, molar greatly enlarged, not triturative, fuzzy; mouthparts basic; article 1 of antenna 1 elongate and bearing dorso (antero) distal tooth, article 2 lacking tooth; coxa 1 ordinary; coxae 3–4 pelagont; gnathopods weakly subchelate, palms oblique, with 1–2 nonserrate defining spines; dactyl of gnathopod 2 normal; pereopods 3–5 elongate, dactyls elongate, article 2 of pereopod 5 posteroventrally truncate, weakly so in *B. cuspidata;* pleonites 1–3 not denticulate; uropod 3 not exceeding uropods 1–2, peduncle typically long but short in *B. turba;* telson elongate, entire, or very weakly cleft.

TYPE-SPECIES.—*B. alberti* Chevreux, 1911.

REMARKS.—See *Bruzelia popolocan* for remarks on similarities of that species to *Bruzeliopsis*.

Bruzeliopsis alberti Chevreux

Bruzeliopsis alberti Chevreux, 1911:5–7, figures, 2, 3.

DIAGNOSIS.—Article 3 of mandibular palp as long as article 2 and nearly as long as article 1; tooth on article 1 of antenna 1 reaching about three-fourths along article 2; coxa 4 as long as broad; article 2 of pereopod 5 beveled posteroventrally; epimera 1–2 rounded posteroventrally; epimeron 3 with very large posteroventral tooth; dorsal teeth on pleonites 1–2 very large; pereon and pleonite 3 lacking dorsal teeth.

Northeastern Atlantic, 4380 m.

Bruzeliopsis cuspidata (J. L. Barnard)

Bruzelia cuspidata J. L. Barnard, 1962a:54, figure 43.

DIAGNOSIS.—Article 3 of mandibular palp shorter than article 2, as long as article 1; tooth on article 1 of antenna 1 reaching about halfway along article 2; coxa 4 longer than broad; article 2 of pereopod 5 rounded posteroventrally; epimera 2–3 with medium posteroventral tooth; pereonites 6–7, pleonites 1–3 with small dorsal tooth.

Off South Africa, 4050 m.

Bruzeliopsis turba J. L. Barnard

FIGURE 12

Bruzeliopsis turba J. L. Barnard, 1964:29, figure 23.

DIAGNOSIS.—Article 3 of mandibular palp much shorter than article 2 or article 1; tooth on article 1 of antenna 1 reaching about one-fourth along article 2; coxa 4 slightly longer than broad; article 2 of pereopod 5 beveled posteroventrally; epimera 2–3 with small posteroventral tooth; pleonites 1–3 with very small dorsal tooth (may appear absent in damaged specimens), reverted on pleonites 2–3.

MATERIAL.—*Vema* 15-20, ?male, 2.9 mm. Caribbean Panama 09°46.3′N, 79°37.5′W, 825–860 m, 10 November, 1958.

REMARKS.—This specimen comes from a sample taken at the precise type-locality of this species. In some parts it is better preserved than the holotype and

Key to the Species of *Bruzeliopsis*

1. Pleonites 1–2 lacking teeth or teeth extremely small; tooth on article 1 of antenna 1 reaching about one fourth along article 2; (article 2 of pereopod 5 beveled posteroventrally; pleonite 3 lacking dorsal tooth) .... ***B. turba***
   Pleonites 1–2 with distinct dorsal teeth; tooth on article 1 of antenna 1 reaching halfway or more along article 2 2
2. Article 2 of pereopod 5 rounded posteroventrally; teeth of pleonites 1–2 small, pleonite 3 with dorsal tooth; coxa 4 longer than broad .... ***B. cuspidata***
   Article 2 of pereopod 5 beveled posteroventrally; teeth of pleonites 1–2 very large, pleonite 3 lacking dorsal tooth; coxa 4 as broad as long .... ***B. alberti***

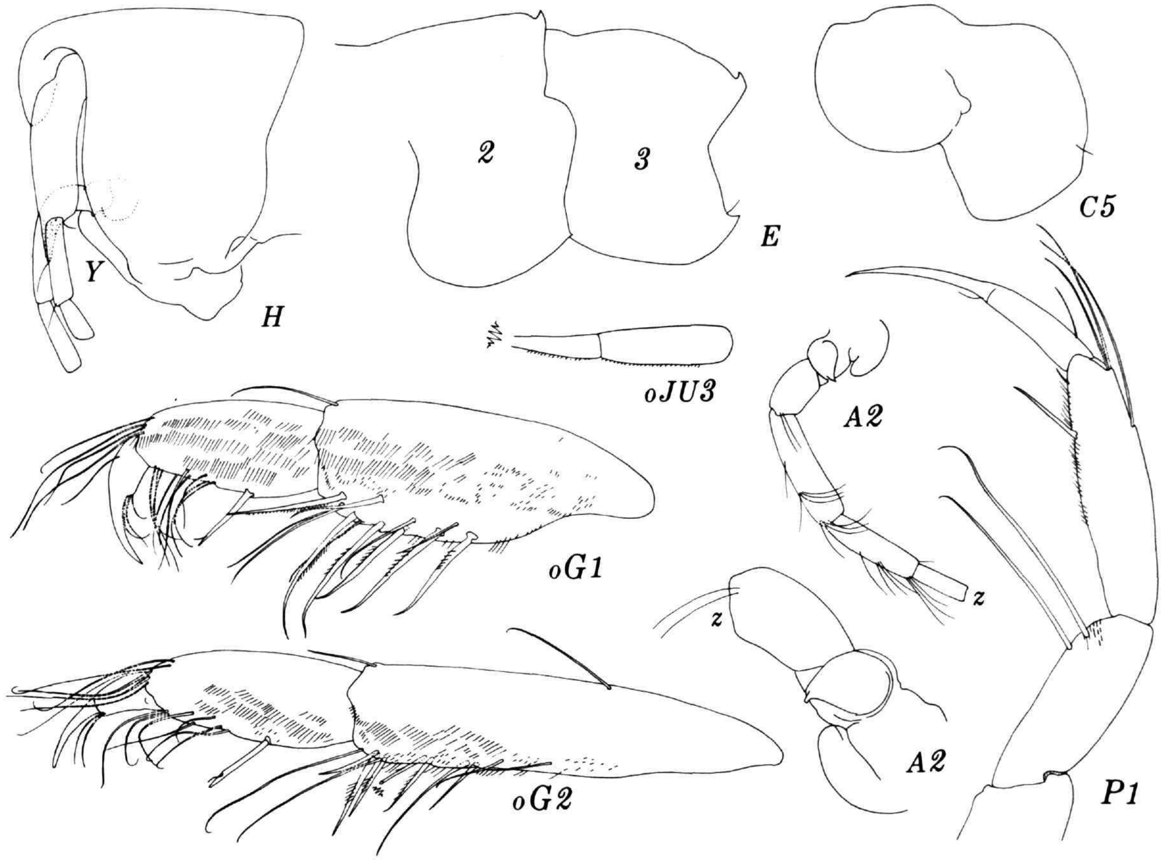

FIGURE 12.—*Bruzeliopsis turba* J. L. Barnard, male, 2.9 mm, *Vema* 15–20; *J*=ramus.

thus some refinement of details not adequately outlined in the holotype can be made. As it is much smaller than the female holotype and possibly a male, some of the differences might be attributed to these circumstances. It distinctly has had a small reverted tooth (now damaged) on the dorsal sides of pleonites 2 and 3 that were not seen in the holotype and pleonal epimeron 3 is deeper. It has only one locking spine on the palms of the gnathopods but this is probably a result of its juvenility. The outer ramus of uropod 3 is distinctly 2-articulate, a feature probably overlooked in the holotype, a frequent happening in such poorly preserved individuals. The head is in much better condition than it was in the holotype but that reconstruction is relatively accurate.

Caribbean Sea, 825–975 m.

***Garosyrrhoe* J. L Barnard**

Garosyrrhoe J. L. Barnard, 1964:29.

DIAGNOSIS.—Forehead not protuberant; lateral cephalic lobe not sharp; mandible with palp, molar of medium size, weakly triturative or fuzzy; mouthparts basic; articles 1–2 of antenna 1 basic; coxa 1 ordinary; coxae 3–4 not pelagont, coxa 3 softly rectangular, posterior margin nearly parallel with anterior, and nonexcavate, coxa 4 expanded midposteriorly, posterodorsal margin sloping, not concave but appearing excavate, coxa 4 larger than 3; gnathopods subchelate, palms nearly transverse, defined by large serrate spine giving hand chelate appearance; dactyl of gnathopod 2 normal; pereopods 3–5 elongate, dactyls elongate, article 2 of pereopod 5 rounded

Key to the Species of *Garosyrrhoe*

Pleonites 1–2 and pereonite 7 each with pair of dorsal teeth .... ***G. disjuncta***
Pleonites 1–2 and pereonite 7 each with single dorsal tooth .... ***G. bigarra***

posteroventrally; pleonites 1–3 not denticulate or very weakly so; uropod 3 not exceeding uropods 1–2, peduncle elongate; telson elongate, deeply cleft.

TYPE-SPECIES.—*Syrrhoites bigarra* J. L. Barnard (1962b).

RELATIONSHIP.—The gnathopods relate this genus to *Syrrhoe* but coxae 3 and 4 are distinct. In *Syrrhoe* coxa 3 is very large and posterodorsally excavate while coxa 4 is much shorter and narrower. *Syrrhoites* has oblique palms on the gnathopods and the palmar spines are relatively simple. *Syrrhoites* has the enlarged form of mandibular molar. *Austrosyrrhoe* has oblique palms on the gnathopods, coxa 4 is slightly smaller than coxa 3 and is distally adz-shaped, and the telson is never deeply cleft.

Garosyrrhoe bigarra (J. L. Barnard)

Syrrhoites bigarra J. L. Barnard, 1962b:73–75, figure 1.
Garosyrrhoe bigarra.—J. L. Barnard, 1966:94.

DIAGNOSIS.—Rostrum bluntly rounded apically; pereonite 7 and pleonites 1–2 each with one dorsal tooth.

Southern and Baja Californias, sublittoral.

Garosyrrhoe disjuncta J. L. Barnard

Garosyrrhoe disjuncta J. L. Barnard, 1969b:224–225, figure 30.

DIAGNOSIS.—Rostrum sharp apically; pereonite 7 and pleonites 1–2 each with pair of blunt dorsal teeth transversely adjacent to one another.

Upper Gulf of California, sublittoral.

Ileraustroe, new genus

DIAGNOSIS.—Forehead not protuberant, lateral cephalic lobe not sharp; eyes absent; mandible with palp, molar classified as enlarged but not strongly so, not triturative or weakly so, fuzzy; mouthparts basic; articles 1–2 of antenna 1 basic; coxa 1 ordinary; coxae 3–4 pelagont or tending to be so, coxa 3 expanded distally and posterodorsal margin excavate, coxa 4 small and intermediate between adz- and comma-shaped; gnathopods typically subchelate, palms oblique, defined by one serrate and one simple spine; dactyl of gnathopod 2 normal; pereopods 3–5 elongate, dactyls elongate, article 2 of pereopod 5 subtruncate posteroventrally in type, rounded in second species but generally expanded; pleonites 1–3 not denticulate; uropod 3 not exceeding uropods 1–2, peduncle elongate; telson highly elongate, cleft about one-fifth its length.

TYPE-SPECIES.—*Austrosyrrhoe ilergetes* J. L. Barnard, 1964 (here selected).

REMARKS.—The type-species and *Syrrhoites torpens* J. L. Barnard (1962a) were at first placed by me in *Austrosyrrhoe* as a fourth section during the early part of this study but after establishing the dendrograms based on indices of total affinity, the generic distinctions of these two species were recognized. Despite my initial interpretation of the mandibular molar as belonging to the columnar or triturative class, the two species were shown to have their greatest affinities to species of *Bruzelia* in all other characters. The molars are definitely not columnar and are scarcely triturative so that they may be classed in the enlarged and fuzzy category.

Ileraustroe differs from *Bruzelia* in the telsonic elongation, the slight cleft in the telson, the subpelagont coxae. Whether the telsonic cleft is a secondary acquisition after having passed through a stage like that of *Bruzelia* is unknown. The telson is much more elongate than that of *Bruzelia; Ileraustroe* may therefore have evolved from ancestors with cleft telson independent from *Bruzelia.*

The affinities with *Bruzeliopsis* are very strong, especially with *Bruzeliopsis cuspidata* which has a weak apical cleft on the telson. The telson is highly elongate in typical species of *Bruzeliopsis* but not in *B. turba*. The type-species of *Ileraustroe* and *Bruzeliopsis* have the truncate kind of article 2 on pereopod 5 but the bevelment is oblique in *Bruzeliopsis.* Other members of the two genera do not, however, share precisely similar pereopod 5 so that this characteristic is not highly valuable generically in the present interpretation. *Bruzeliopsis* has fully pelagont coxae and article 1 of antenna 1 is elongate and bears an anterodistal tooth. The gnathopods of *Bruzeliopsis* are nearly simple like those in *Jeddo* but they do bear two simple defining spines whereas the gnathopods of *Ileraustroe* are fully subchelate and bear at least one serrate spine. The molars of *Bruzeliopsis* are also fully enlarged.

Ileraustroe ilergetes (J. L. Barnard)

FIGURES 13–15

Austrosyrrhoe ilergetes J. L. Barnard, 1964:27–28, figure 21.
Austrosyrrhoe ilergetes inconstans J. L. Barnard, 1967:155–157, figure 77.

DIAGNOSIS.—Article 2 of antenna 1 simple; coxa 3 with acute anteroventral corner; article 2 of pereopod 5 expanded, slightly truncate posteroventrally; epimeron 3 with small bifidation at posteroventral corner; pleonites 1–5 each with dorsal tooth.

Article 6 of pereopods 1–2 tumid or not.

MATERIAL.—*Vema* 15–58 (4), 15–62 (1); *Eltanin* 75 (1).

REMARKS.—Presumably *I. ilergetes* occurs throughout the world in deep bathyal (and ?abyssal) depths for it has been recorded from the Mediterranean Sea, off California and now from Chile. The typical subspecies, from Mediterranean waters, is characterized by slightly inflated sixth articles of pereopods 1–2, an evenly rounded sinus above the tooth on pleonal epimeron 3, a slightly oblique ventral edge on article 2 of pereopod 5, and a long article 5 and short article 6 on gnathopod 2. *Ileraustroe ilergetes inconstans* (J. L. Barnard, 1967) from Baja California has a slender sixth article of pereopods 1–2, a quadrate sinus on pleonal epimeron 3, a horizontal ventral margin on article 2 of pereopod 5, and articles 5–6 of medium length on gnathopod 2. The *Eltanin* form has an evenly rounded but weak sinus on pleonal epimeron 3, a ventrally truncate edge on article 2 of pereopod 5, and on gnathopod 2 has article 5 of medium length but a long article 6. The *Eltanin* form also differs from the Mediterranean type by the longer article 3 of antenna 1.

Ileraustroe ilergetes differs from *I. torpens* (J. L. Barnard) in the acute point at the anteroventral corner of coxa 3, the presence of a sinus on the margin above the tooth of the third pleonal epimeron, and the presence of a small notch on the ventral margin of article 2 on pereopod 5. *Ileraustroe torpens* still requires a more exacting analysis than has been possible heretofore.

Mediterranean, 1938 m; Baja California to Middle Chile, 1363–5690 m.

Ileraustroe torpens (J. L. Barnard)

Syrrhoites torpens J. L. Barnard, 1962a:61, figures 52, 53.
Austrosyrrhoe ?torpens.—J. L. Barnard, 1964:28–29, figure 22.

DIAGNOSIS.—(Article 2 of antenna 1 presumably simple); coxa 3 with softly quadrate anteroventral corner; article 2 of pereopod 5 expanded, deeply rounded posteroventrally; epimeron 3 with acute, simple posteroventral corner; pleonites 1–5 each with dorsal tooth but also teeth obsolescent on certain segments (possibly owing to damage).

Cape Basin, 2972–3045 m; ?Puerto Rico Trench, 5451–5419 m.

Jeddo J. L Barnard

Jeddo J. L. Barnard, 1962a:54–55.

DIAGNOSIS.—Forehead not protuberant, lateral cephalic lobe not sharp; eyes absent; mandible lacking palp, molar greatly enlarged, not triturative, fuzzy; mouthparts basic; articles 1–2 of antenna 1 basic; coxa 1 ordinary; coxae 3–4 pelagont; gnathopods simple, lacking distinctive spines; dactyl of gnathopod 2 normal; pereopods 3–5 elongate, dactyls elongate, article 2 of pereopod 5 rounded posteroventrally; pleonites 1–3 not denticulate; uropod 3 not exceeding uropods 1–2, peduncle elongate; telson elongate and cleft.

TYPE-SPECIES.—*J. simplisyrrhis* J. L. Barnard (1962a).

Jeddo simplisyrrhis J. L. Barnard

Jeddo simplisyrrhis J. L. Barnard, 1962a:57, figures 46, 47.

South Africa, 1861 m.

Latacunga, new genus

DIAGNOSIS.—Forehead not protuberant, lateral cephalic lobe sharp; eyes absent; mandible with palp, molar greatly enlarged, not triturative, fuzzy; mouth-

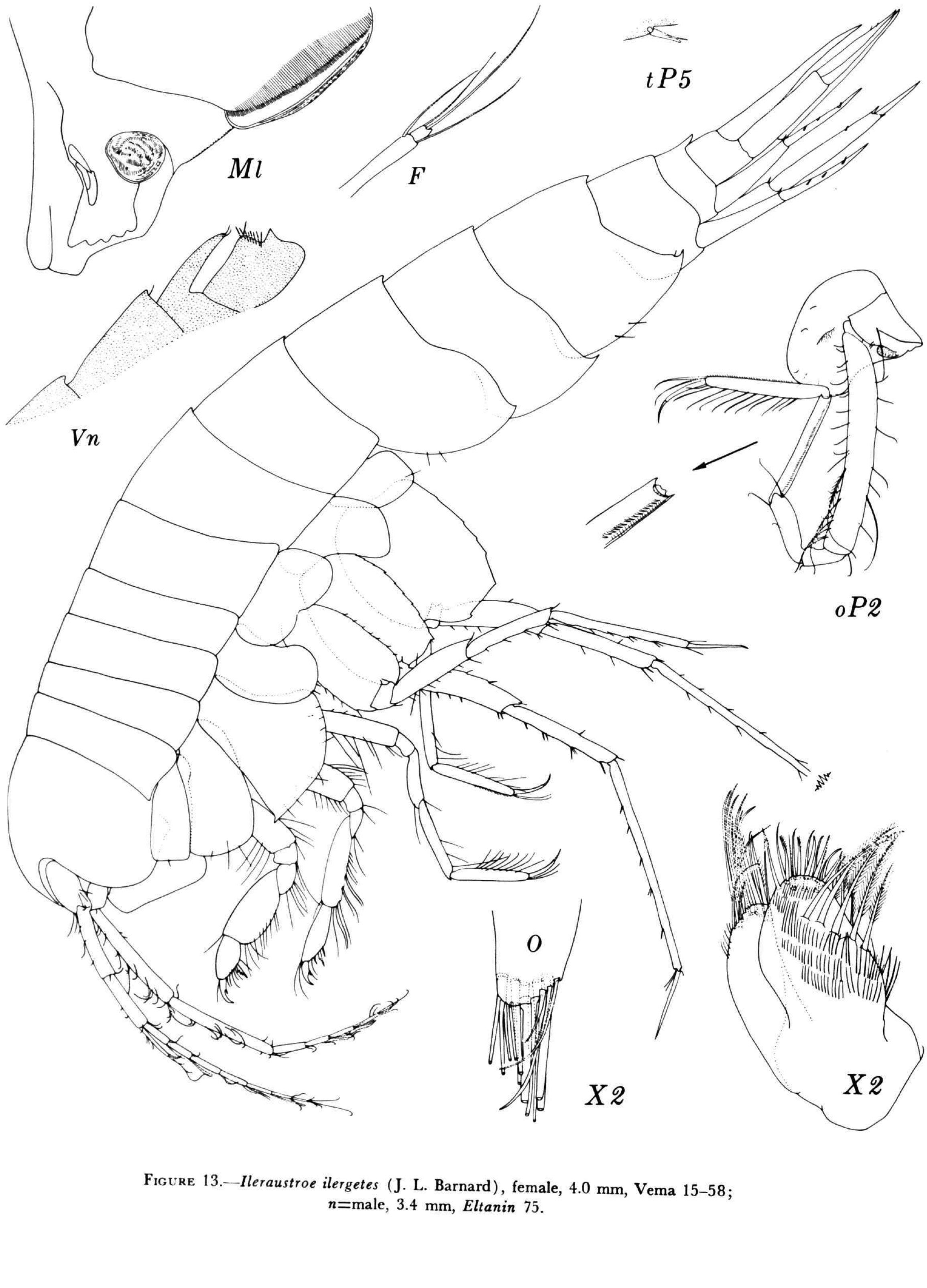

FIGURE 13.—*Ileraustroe ilergetes* (J. L. Barnard), female, 4.0 mm, Vema 15–58; *n*=male, 3.4 mm, *Eltanin* 75.

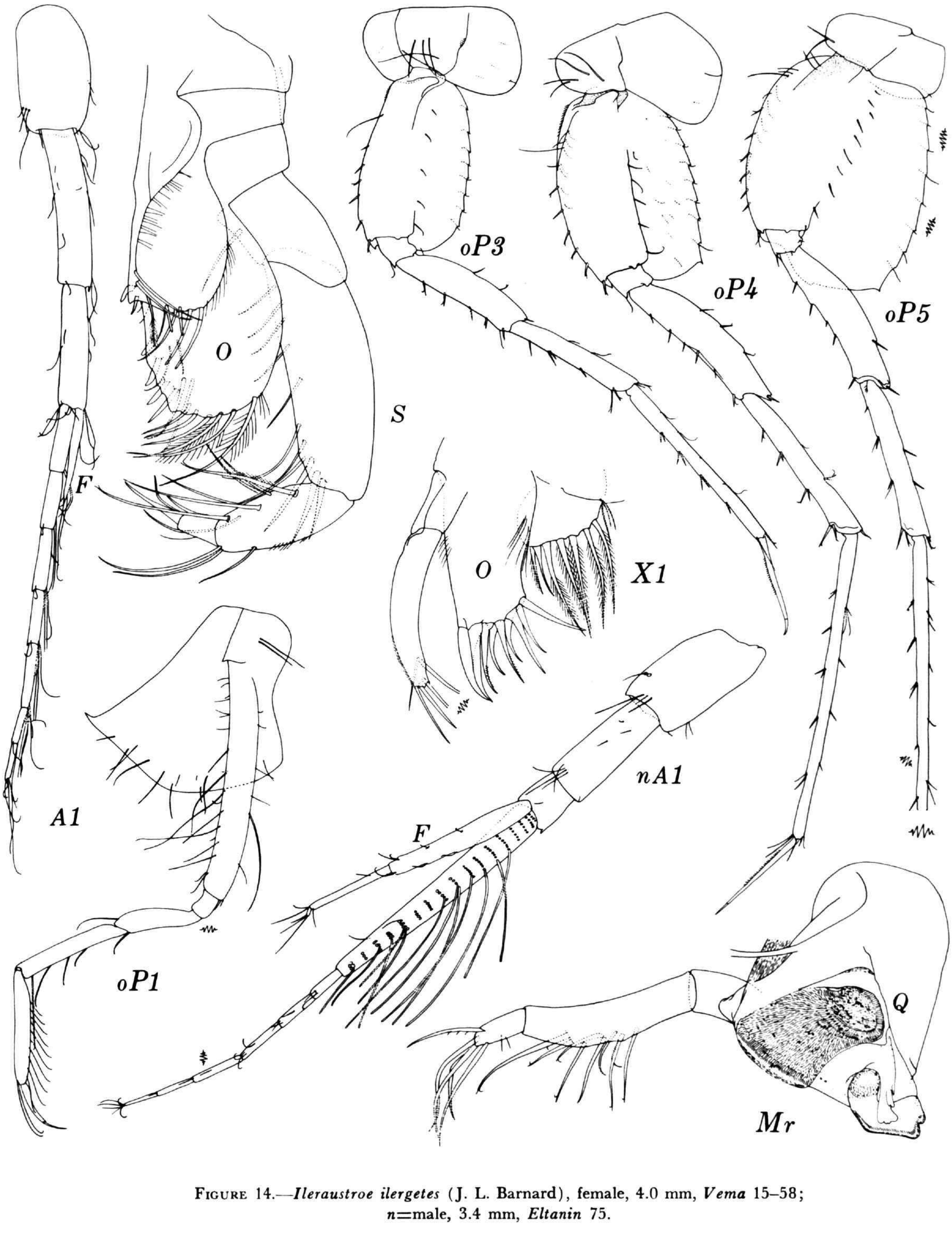

FIGURE 14.—*Ileraustroe ilergetes* (J. L. Barnard), female, 4.0 mm, *Vema* 15–58; *n*=male, 3.4 mm, *Eltanin* 75.

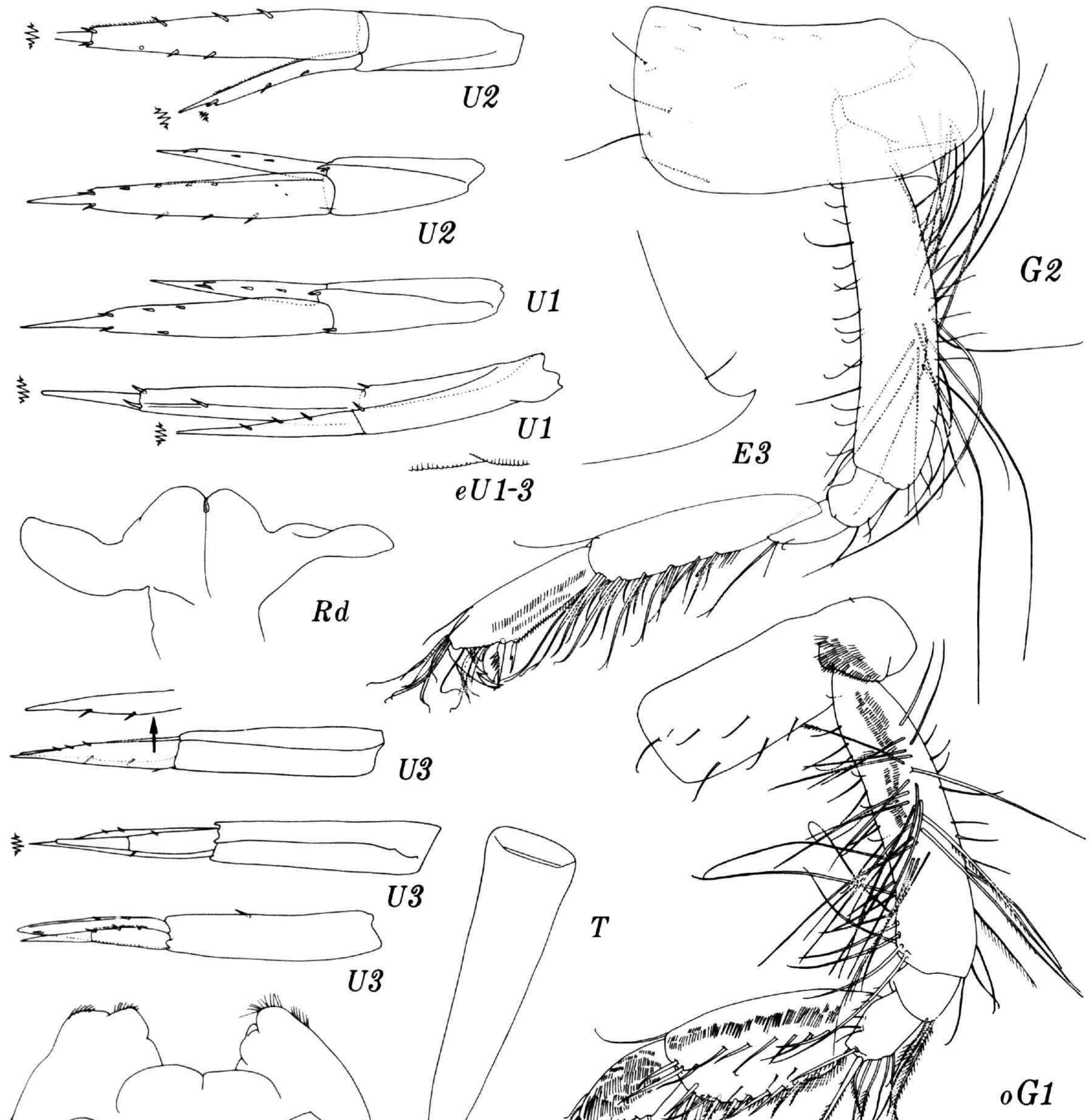

FIGURE 15.—*Ileraustroe ilergetes* (J. L. Barnard), female, 4.0 mm, *Vema* 15–58; *Eltanin* 75; *e*=edge.

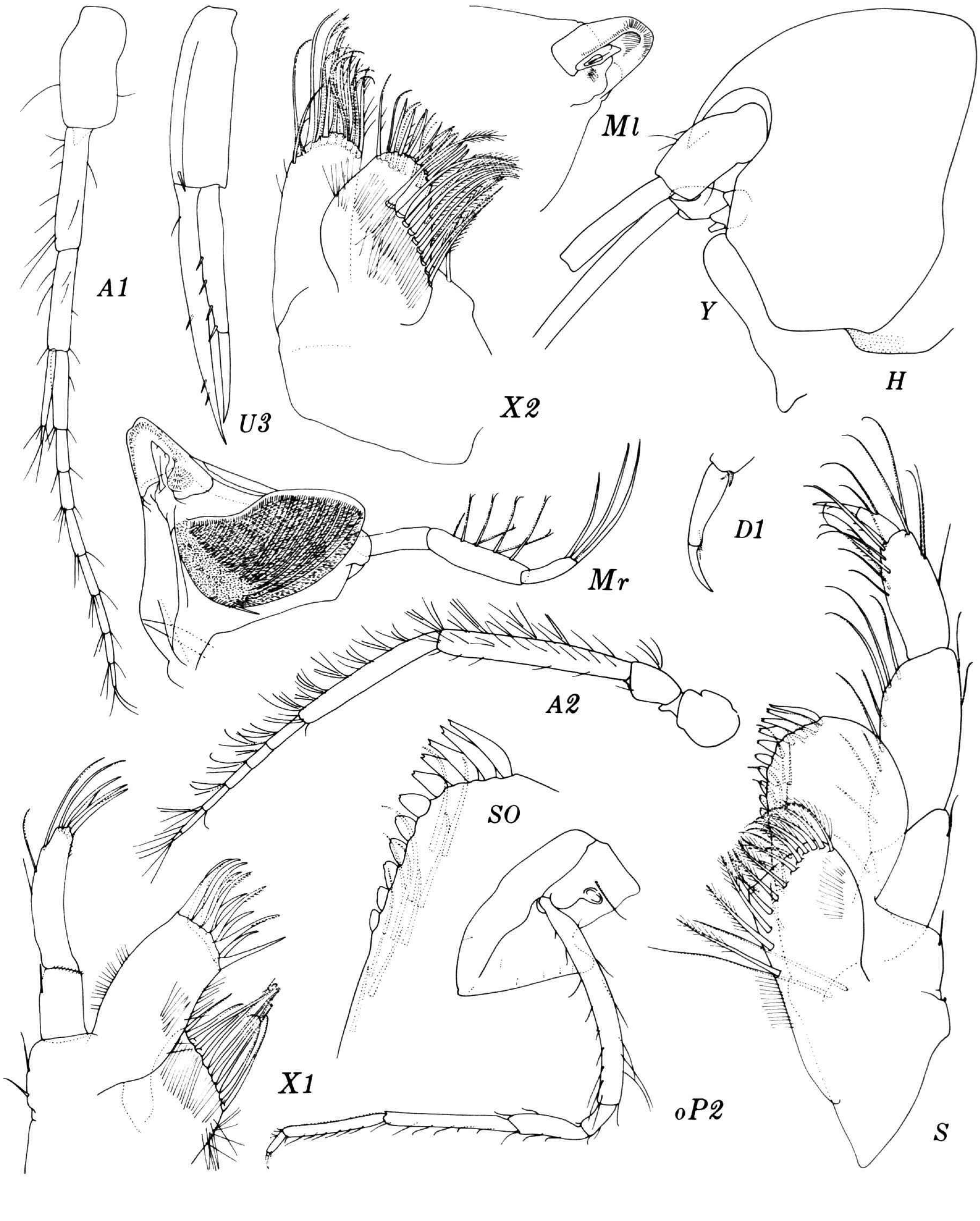

FIGURE 16.—*Latacunga latacunga*, new genus, new species, holotype, female, 3.5 mm, *Vema* 15-62.

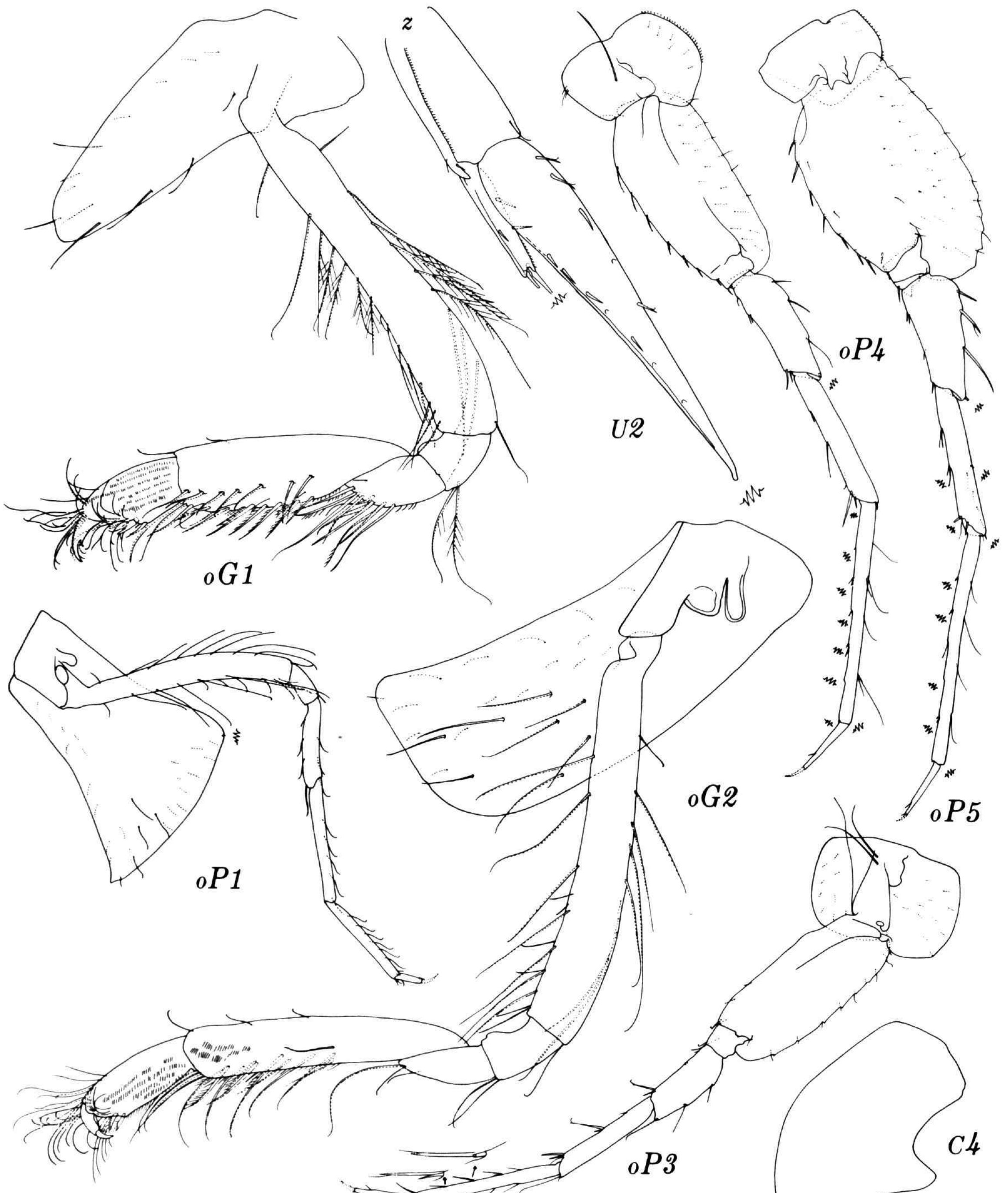

FIGURE 17.—*Latacunga latacunga*, new genus, new species, holotype, female, 3.5 mm, *Vema* 15-62.

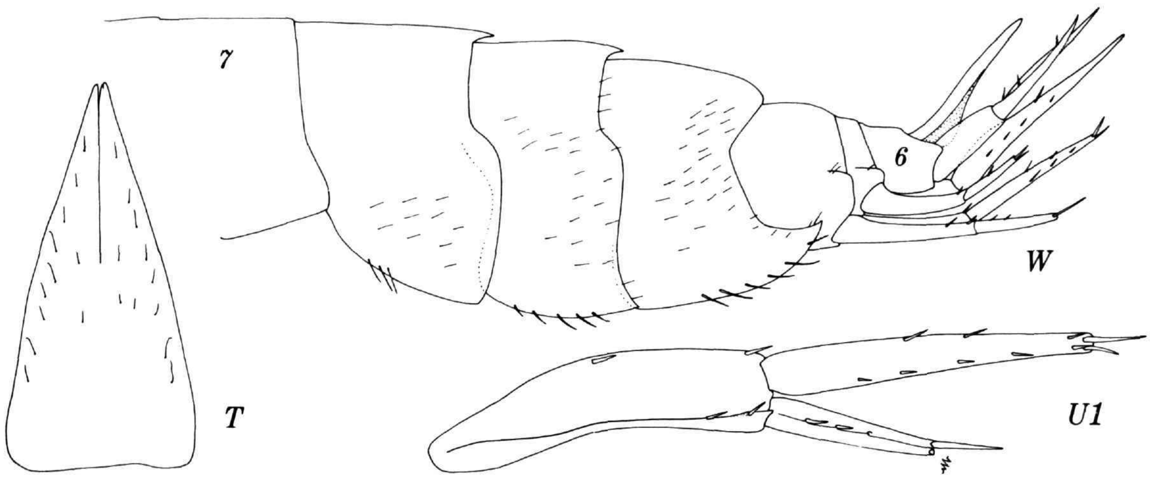

FIGURE 18.—*Latacunga latacunga*, new genus, new species, holotype, female, 3.5 mm, *Vema* 15-62.

parts basic; articles 1–2 of antenna 1 basic, article 1 with small mediotermininal tooth; coxa 1 tapering distally; coxae 3–4 not pelagont, coxa 3 not expanded distally except for anteroventral cusp, posterior margin nearly parallel with anterior margin and not excavate, coxa 4 nearly as long as 3, surface area subequal to 3, adz-shaped; gnathopods ordinarily subchelate, defined by 1–2 serrate spines; dactyl of gnathopod 2 normal; pereopods 3–5 elongate, dactyls elongate, article 2 of pereopod 5 rounded postoventrally; pleonites 1–3 not denticulate; uropod 3 not exceeding uropods 1–2, peduncle elongate; telson elongate, deeply cleft.

TYPE-SPECIES.—*Latacunga latacunga*, new species (here designated).

Latacunga latacunga, new species

FIGURES 16–18

DIAGNOSIS OF FEMALE.—Rostrum of medium length, slender, lateral cephalic lobes narrowly truncate anteriorly; body scarcely toothed or carinate, only pleonites 1 and 2 with small posterodorsal tooth each; pleonites 4 and 5 each with small, posterolateral hump above insertions of uropods; pleonal epimeron 1 large, posteroventrally quadrangular, epimeron 2 with posterior margin swept into medium-sized tooth, epimeron 3 with large but simple posteroventral tooth; article 1 of antenna 1 with one mediodistal subconical process; posterior lobe of coxa 5 weak; one of 2 locking spines of gnathopod 1 simple, other serrate, both spines of gnathopod 2 serrate; dactyls of pereopods 1–2 about one-fourth as long as sixth articles; article 2 of pereopods 3–5 of medium width; fifth article of pereopods 3–5 scarcely longer than fourth article and that of pereopod 4 two-thirds as long as article 2; article 4 of pereopod 5 strongly inflated proximally; outer rami of uropods 1–2 distally spinose; outer ramus of uropod 3 with article 2 about 40 percent of total length of article 1; telson, triangular, tapering its full length, cleft slightly less than halfway.

HOLOTYPE.—AMNH 14,393, female, 3.5 mm.

TYPE-LOCALITY.—*Vema* 15–62, off Ecuador, 01°30′S, 82°19′W, 1363–1369 m, 3 December 1958.

MATERIAL.—2 specimens from the type-locality. Ecuador, 1363–1369 m.

Latacunga comanita, new species

FIGURES 19, 20

DIAGNOSIS OF MALE.—Rostrum of medium length, stout, lateral cephalic lobes narrowly truncate anteriorly; body without dorsal teeth except for long tooth often typical of male synopiids on pleonite 5; pleonite 4 with very small ventrally pointing cusp above insertion of uropod 1; pleonal epimeron 1 large, posteroventrally subquadrangular, epimeron 2 with posterior margin swept into medium-sized tooth, epimeron 3 with medium-sized simple posteroventral tooth; coxa 5 with strong posterior lobe; article 1 of antenna 1 with one mediodistal subconical process; both locking spines of gnathopod 1 simple, of gnathopod 2 serrate; dactyls of pereopods 1–2 half as long as their sixth articles; article 2 of pereopods 3–5 of medium width; fifth article of pereopods 3–5 conspicuously longer than fourth article and that of pereopod 4 as long as article 2; article 4 of pereopod 5 strongly inflated proximally; outer rami of uropods 1–2 distally spinose; outer ramus of uropod 3 with article 2 about 50 percent of total length of article 1; telson subrectangular, tapering only in

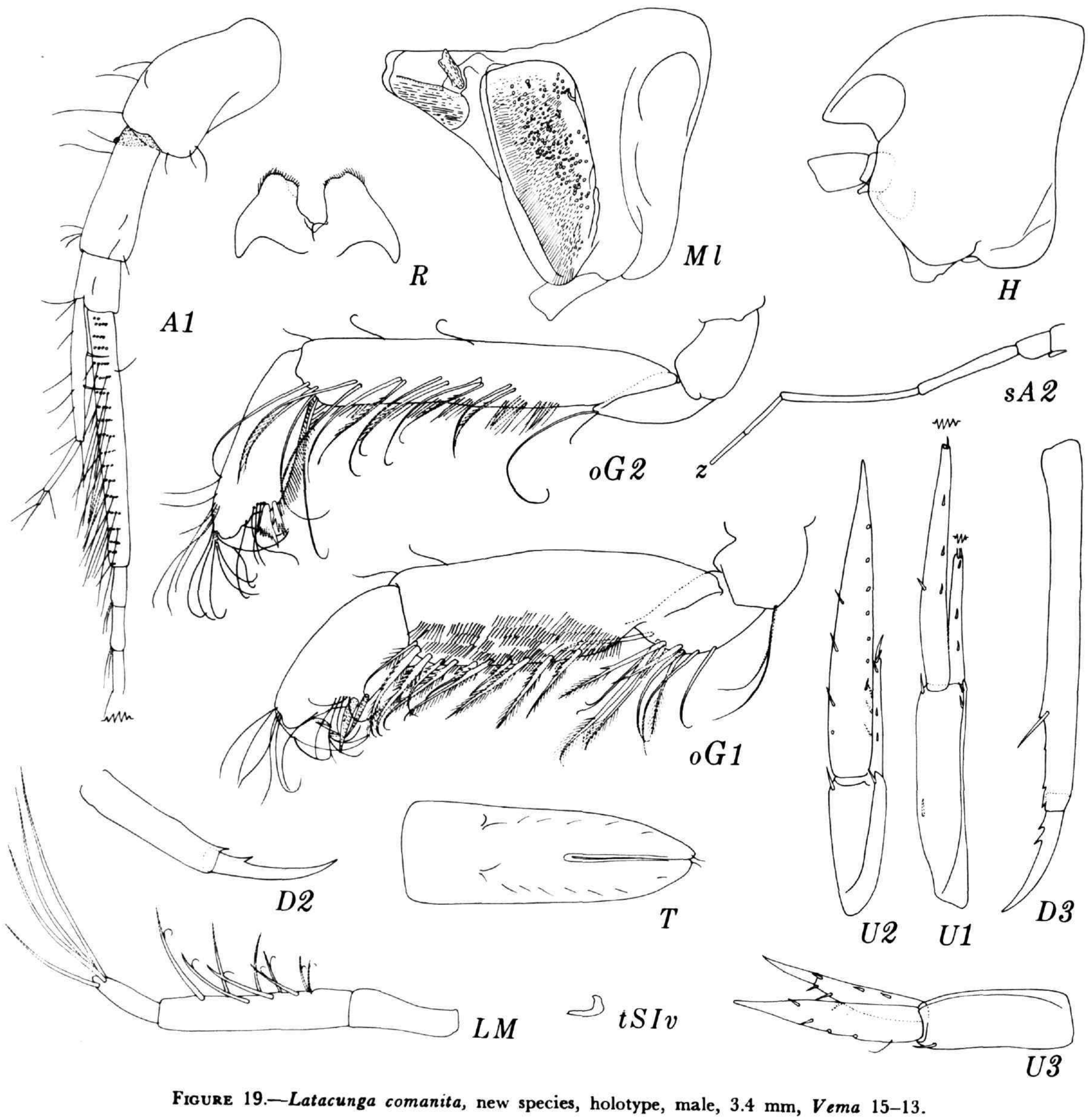

FIGURE 19.—*Latacunga comanita,* new species, holotype, male, 3.4 mm, *Vema* 15–13.

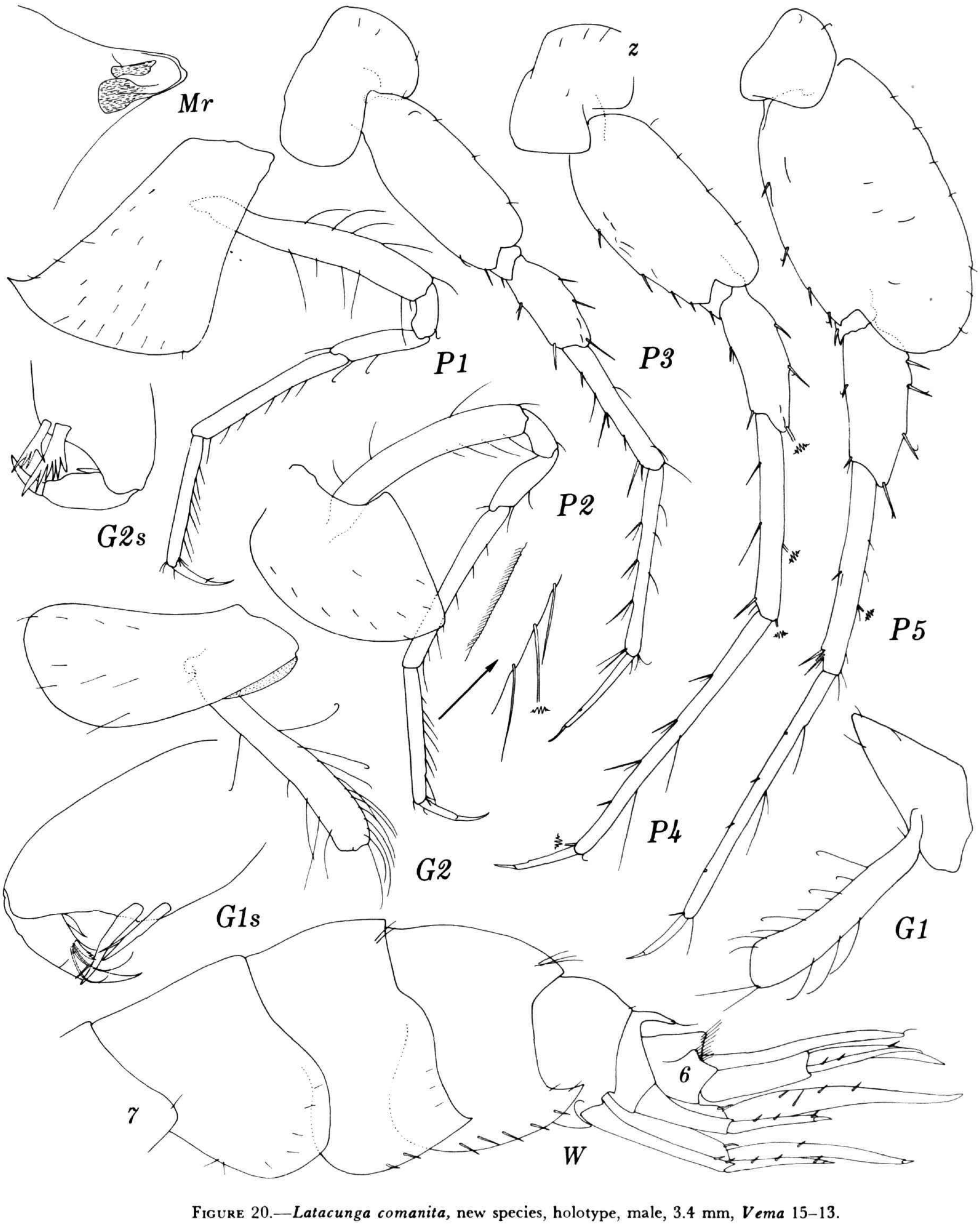

FIGURE 20.—*Latacunga comanita,* new species, holotype, male, 3.4 mm, *Vema* 15–13.

distal one-third of its length, cleft slightly less than halfway.

MOUTHPARTS.—Resembling those of *L. latacunga*, new species, but the palp of maxilla 1 with a few more setae on its lateral margin than in *L. latacunga;* small details of the mandibles differing as shown in the drawings.

HOLOTYPE.—AMNH 14,391, male, 3.4 mm. Unique.

TYPE-LOCALITY.—*Vema* 15–13, off Caribbean Colombia, 11°30′N, 75°50′W, 2875–2944 m, 8 November 1958.

RELATIONSHIP.—This species differs from the type-species in the following characters: lack of teeth on pleonites 1–2; stouter rostrum; the nonserrate condition of either spine on gnathopod 1, the longer fifth articles of pereopods 3–5; the longer posterior lobe of coxa 5; the longer dactyls of pereopods 1–2; and the more rectangular, less triangular telson. Until males and females of both species have been studied one must assume that the presence of a tooth on pleonite 5 and the absence of humps on pleonites 4–5 above the insertions of uropods 1–2 are characters of sexual dimorphism in *L. comanita.* These species should be considered as an analogous Pacific-Caribbean pair.

Caribbean, 2875–2944 m.

Priscosyrrhoe, new genus

DIAGNOSIS.—Forehead weakly protuberant, lateral cephalic lobe not sharp; eyes absent; mandible with palp, molar small and not dominating mandible, triturative surface obsolescent; article 2 of antenna 1 elongate and bearing apicodorsal tooth; coxa 1 ordinary; coxae 3–4 weakly pelagont; gnathopods typically subchelate, palms oblique and bearing one large serrate spine; dactyl of gnathopod 2 normal; pereopods 3–5 elongate, article 2 of pereopod 5 weakly expanded and ventrally rounded; pleonites 1–3 not denticulate; uropod 3 not exceeding uropods 1–2, peduncle elongate; telson highly elongate, entire.

TYPE-SPECIES.—*Austrosyrrhoe priscis* J. L. Barnard (1967) (here designated).

RELATIONSHIP.—This monotypic genus differs from *Austrosyrrhoe* in the elongate and uncleft telson but it resembles the type-species of *Austrosyrrhoe* in the tooth on article 2 of antenna 1 whereas it differs from all other species now remaining in *Austrosyrrhoe* by the weakly pelagont coxae; the coxae of the type-species of *Austrosyrrhoe* are unknown.

This genus is erected on my interpretations of the similarity analysis (Figure 1). The elongate, narrow and entire telson is considered to be a generically significant character. This same characteristic is typical of *Ileraustroe* but in that genus a small cleft occurs on the apex of the telson. *Priscosyrrhoe* also differs from *Ileraustroe* in the small molar and the tooth on article 2 of antenna 1.

Priscosyrrhoe priscis (J. L. Barnard)

Austrosyrrhoe priscis J. L. Barnard, 1967:157–160, figures 52 i–k, 78.

DESCRIPTION.—Rostrum large, medium, sharp; coxa 3 with acute anteroventral corner, posterior margin weakly excavate; coxa 4 relatively large, thick, subquadrate and scarcely comma-shaped; gnathopod 2 with palm, gnathopods each with only one palmar spine; article 2 of pereopod 5 moderately expanded, subtruncate posteroventrally; outer rami of uropods 1–2 simple; telson entire, if not obscurely trifoliate; epimeron 3 with sharp posteroventral tooth below sinus; pleonites 1–5 each with dorsal tooth.

Article 6 of pereopods 1–2 slightly tumid.

Baja California, 842–1720 m.

Pseudotiron Chevreux

Pseudotiron Chevreux, 1895:166–170.—Stebbing, 1906:284.

DIAGNOSIS.—Forehead protuberant, lateral cephalic lobe not sharp; eyes absent; mandible with palp, molar of medium size, columnar and triturative; mouthparts basic; articles 1–2 of antenna 1 basic; coxa 1 ordinary; coxae 3–4 pelagont or weakly so or not pelagont in *P. coas;* gnathopods simple, lacking distinctive spines; dactyl of gnathopod 2 normal; pereopods 3–5 typically elongate but short in *P. coas,* article 2 of pereopod 5 typically rounded posteroventrally but truncate in *P. longicaudatus;* pleonites 1–3 typically denticulate dorsally but apparently smooth in *P. golens;* uropod 3 greatly exceeding apices of uropods 1–2, peduncle short; telson elongate, deeply cleft. Pleonite 6 elongate.

Uropod 1 not reaching apex of uropod 2 (see *Tiron*).

TYPE-SPECIES.—*P. bouvieri* Chevreux (1895).

The cyphos angle (modified from Bowman and McCain, 1967) on the forehead refers to the generally acute angle between the anteroposterior cephalic

Key to the Species of *Pseudotiron*

1. Dactyls of pereopods 4–5 elongate, scarcely curved and bearing extremely weak subterminal inner seta, posteroventral corner of article 2 on pereopod 5 softly quadrate. ***P. longicaudatus***
   Dactyls of pereopods 4–5 short, curved, claw-shaped, bearing large inner seta at middle, posteroventral corner of article 2 on pereopod 5 rounded 2
2. Coxa 3 small, rectangular, and scarcely excavate posteriorly .... ***P. coas***
   Coxa 3 large, trapezoidal to L-shaped, posteriorly excavate 3
3. Coxa 3 angularly and regularly L-shaped .... ***P. bouvieri***
   Coxa 3 with sweeping posterodorsal curve 4
4. Posteroventral angle of coxa 3 softly quadrate, posteroventral tail of coxa 4 as long as basal portion, anterior margin of coxa 1 straight, uropod 1 reaching end of uropod 2. ***P. pervicax***
   Posteroventral angle of coxa 3 rounded, posteroventral tail of coxa 4 twice as long as base, anterior margin of coxa 1 concave, uropod 1 reaching less than halfway along rami of uropod 2 .... ***P. golens***

axis and the oblique anteroventral margin of the lateral cephalic lobe.

Diagnostic values of antennae are incomplete and mentioned by sex where known.

Pseudotiron bouvieri Chevreux

Pseudotiron Bouvieri Chevreux, 1895:166–170.—J. L. Barnard, 1964: 29–30, figure 24.

DIAGNOSIS.—Cyphos angle approximately 75–85°; article 1 of flagellum on female antenna 1 less than half as long as accessory flagellum, in male this article elongate and about as long as accessory flagellum, latter 3-articulate; article 1 of flagellum on antenna 2 not elongate; anterior margin of coxa 1 concave; coxa 3 large and evenly L-shaped, as long as coxa 2; pereopods 3–5 progressively more elongate; posteroventral corner of article 2 on pereopod 5 rounded and slightly serrate; article 7 of pereopods 3–5 short, curved, claw-shaped, with large inner seta at middle; lengths of uropods 1–2 poorly known but uropod 1 apparently reaching more than halfway along uropod 2; pleonites 1–3 posterodorsally denticulate, pleonite 4 with 3 small posterodorsal teeth, pleonite 5 with one long tooth.

Mediterranean Sea, 170–1938 m.

Pseudotiron coas J. L. Barnard

Pseudotiron (?) *coas* J. L. Barnard, 1967:164–167, figure 81.

DIAGNOSIS.—Cyphos angle approximately 70°; article 1 of flagellum on male antenna 1 more than twice length of accessory flagellum, latter 2-articulate; article 1 of flagellum on male antenna 2 not elongate; anterior margin of coxa 1 slightly concave; coxa 3 abnormal for genus, nearly evenly rectangular and scarcely excavate posteriorly, coxa 4 thus not strongly smaller than coxa 3; pereopods 3–4 short, pereopod 5 slightly elongate, posteroventral corner on article 2 of pereopod 5 rounded, softly quadrate on pereopods 3–4, article 7 of pereopods 3–5 short, weakly claw-shaped, with large inner seta near middle; uropods 1–2 poorly known; pleonites 1–3 posterodorsally denticulate, pleonites 4–5 each with small posterodorsal tooth.

Baja California, 2667–2706 m.

Pseudotiron golens J. L. Barnard

Pseudotiron golens J. L. Barnard, 1962a:57, figures 50, 51.

DIAGNOSIS.—Cyphos angle approximately 65°; article 1 of flagellum on female-like antenna 1 as long as accessory flagellum, latter approximately 3-articulate; article 1 of flagellum on female-like antenna 2 elongate; anterior margin of coxa 1 concave; coxa 3 as short as coxa 2, broadly comma-shaped, posterodorsal margin curving, not angular; pereopods 3–5 short, similar to each other in length, posteroventral corner of article 2 on pereopods 3–5 rounded, article 7 short, weakly claw-shaped, with large inner seta near middle; uropod 1 reaching about halfway along uropod 2; pleonites 1–3 apparently smooth dorsally, pleonites 4–5 each with small posterodorsal tooth (latter phrase corrected from original diagnosis).

South Africa, 4893 m.

Pseudotiron longicaudatus Pirlot

FIGURES 21–23

Pseudotiron longicaudatus Pirlot, 1934:185–189, figures 73–75.
Reference: *P. l. greteus* J. L. Barnard, 1967:167–170, figures 82, 83.

DIAGNOSIS.—Cyphos angle approximately 45°; article 1 of flagellum on female antenna 1 half length of accessory flagellum, in male article 1 very elongate and twice as long as accessory flagellum, latter 3-articulate; article 1 of flagellum on female antenna 2 not elongate; anterior margin of coxa 1 concave; coxa 3 conspicuously longer than coxa 2, angularly L-shaped; pereopods 4–5 (3 unknown) long, pereopod 5 longer than pereopod 4; posteroventral corner on article 2 of pereopods 4–5 softly quadrate; article 7 of pereopods 4–5 elongate, not claw-shaped, with weak seta distally; uropod 1 exceeding uropod 2; pleonites 1–3 posterodorsally denticulate; pleonites 4–5 each with small posterodorsal tooth.

MATERIAL.—*Vema* 15-46 (3), 15-49 (1), 15-51 (2), 15-52 (1), 15-53 (3), 15-59 (5), 15-153 (2).

REMARKS.—These specimens resemble the holotype, described from a depth of 835 meters in the Indonesian tropics, more than do specimens reported from the northeastern Pacific Ocean by J. L. Barnard (1967). There are significant differences in the sexes, not heretofore shown, and a few details not described by Pirlot, which may have subspecific importance. Since these details have not been described for tropical specimens it is prudent not to segregate *Vema* specimens nomenclaturally.

Specimens at hand range in length from 4.25 mm to 13.0 mm. Sexual maturity appears to be reached at a length of about 6.5 mm when males and females become distinguishable. Individuals of both sexes, when smaller than about 8.0 mm, have the typical attenuated head, but large females have the head slightly foreshortened and deeper than do juveniles and large males. The attenuated head is the kind described by Pirlot for the holotype.

Extensive variation occurs in the shapes of the processes on the anteroventral midcephalic line; apparently these variations have no relationship to sexual dimorphism. The epistomal keel (marked "E" in the figures) varies from sharp and beaklike to blunt to nearly obsolescent, from specimen to specimen. The process on the upper lip also varies from strongly projecting to evanescent; usually the two processes, epistomal and labral, are synmorphic, both being either sharp or blunt simultaneously. Pirlot did not illustrate these processes for the holotype. *Pseudotiron l. greteus* is shown by Barnard (1967) to have strongly projecting processes.

Coxa 3 of *Vema* specimens resembles that of the Indonesian holotype, whereas coxa 3 of *P. l. greteus* is strongly shortened.

Pereopod 5, article 2 of males has a different shape than that of females (see figures herein). The female holotype described by Pirlot has article 2 resembling that drawn herein for females, whereas the male holotype of *P. l. greteus* has article 2 resembling that of males herein. This difference in shape must therefore be a consistent sexual difference in this epigenotype.

The process on the dorsoposterior margin of pleonite 5 is elongate in males but short in females, a sexual difference common to synopiids and pardaliscids.

The lower lip is well preserved in *Vema* specimens and is illustrated herein. Apparently that drawn by Pirlot was crushed, for the inner lobes are more discrete than shown by him and have basolateral winglike projections.

An increase in length of the dactyls of pereopods 1–2 occurs with increasing size of the specimens at hand.

Indonesia, 835 m; Baja California, 1720–1748 m; Pacific Costa Rica and Panama, 1746–3563 m.

Pseudotiron pervicax J. L. Barnard

Pseudotiron pervicax J. L. Barnard, 1967:170–172, figure 84.

DIAGNOSIS.—Cyphos angle approximately 75°; article 1 of flagellum on male antenna 1 elongate but accessory flagellum of about 4 articles also elongate and longer than article 1; article 1 of flagellum on male antenna 2 not elongate; anterior margin of coxa 1 straight; coxa 3 slightly longer than coxa 2, neither L-shaped nor comma-shaped, apically expanded and posterodorsal margin evenly curved; pereopods 3–5 very short, 4–5 of equal length; posteroventral corner of article 2 on pereopods 3–5 rounded; article 7 of pereopods 3–5 short, claw-shaped, with large inner seta near middle; uropod

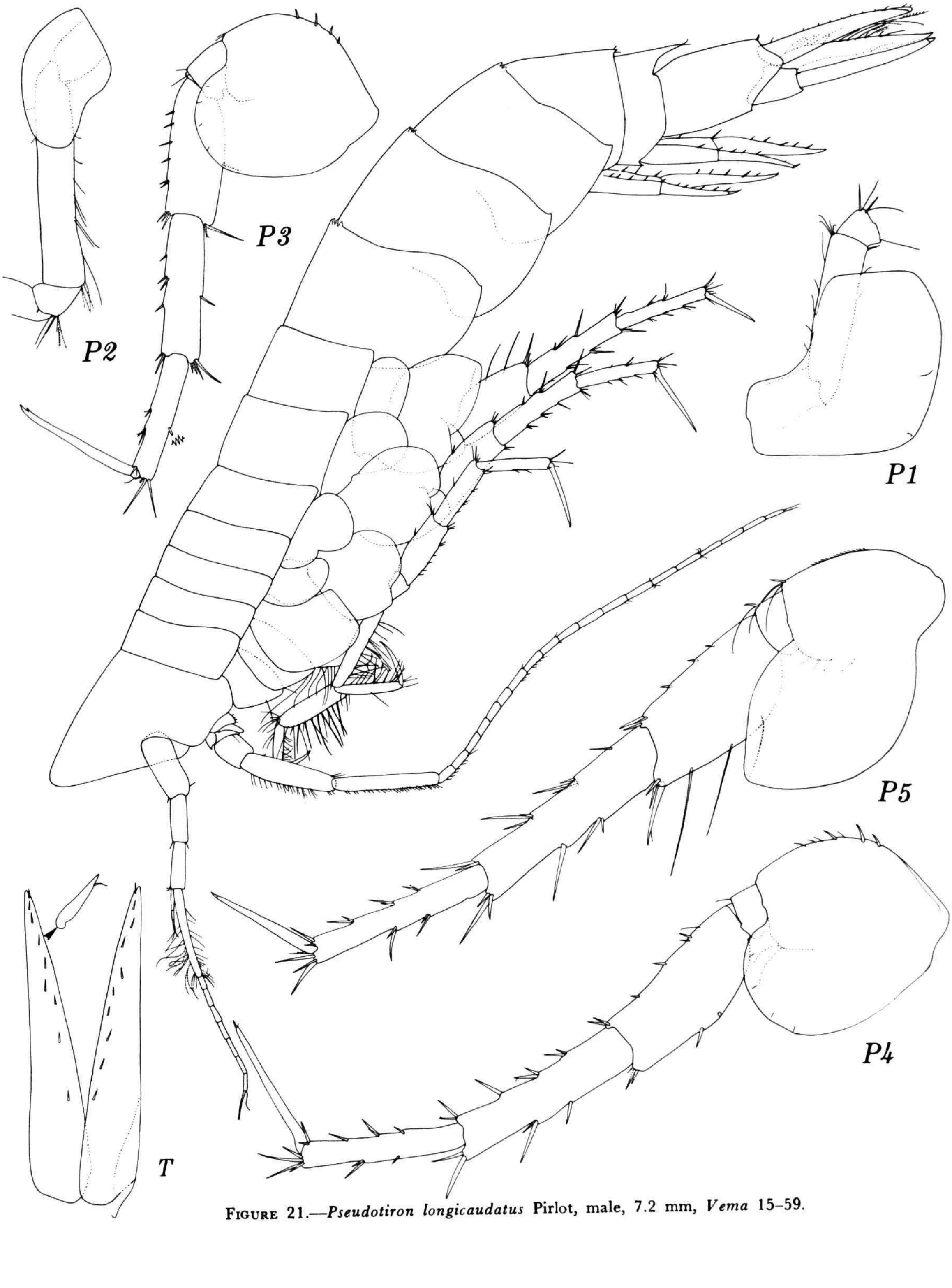

FIGURE 21.—*Pseudotiron longicaudatus* Pirlot, male, 7.2 mm, *Vema* 15-59.

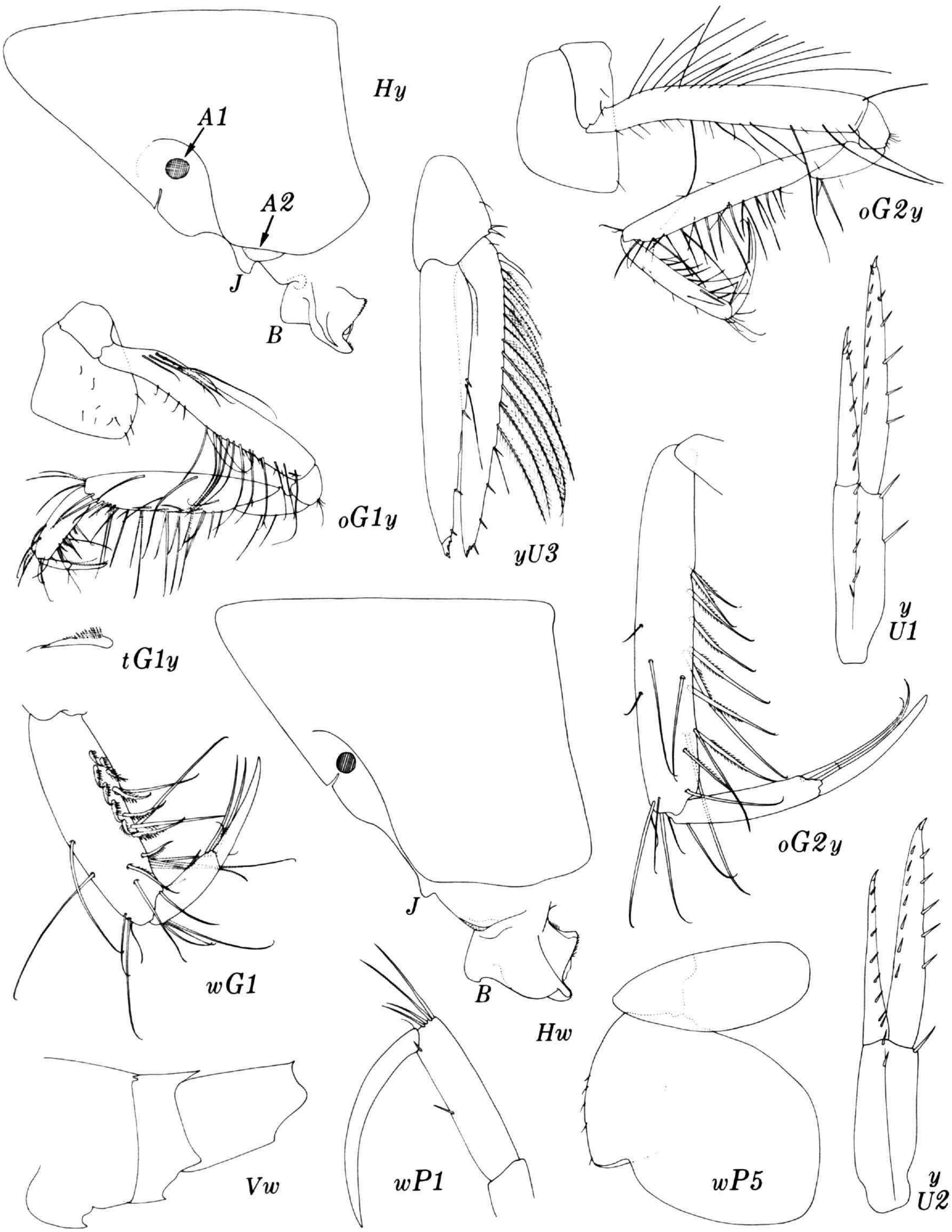

FIGURE 22.—*Pseudotiron longicaudatus* Pirlot, w=female, 12.0 mm, *Vema* 15–53; y=male, 7.2 mm, *Vema* 15–59.

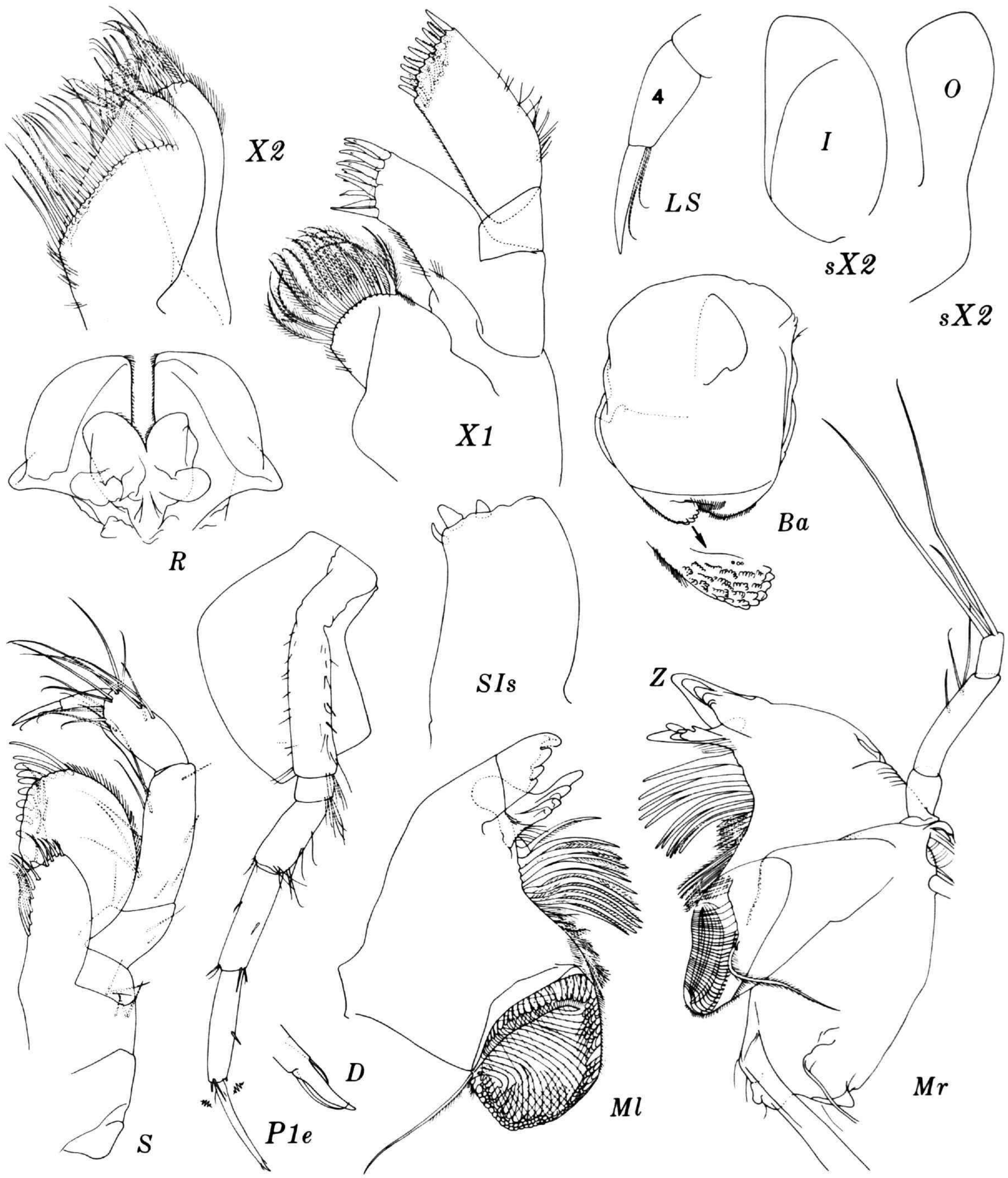

FIGURE 23.—*Pseudotiron longicaudatus* Pirlot, female, 12.0 mm, *Vema* 15–53; e=female; 7.5 mm, *Vema* 15–51.

1 reaching apex of uropod 2; pleonites 1–3 with single posterodorsal tooth, denticulations obsolete, pleonite 4 with small posterodorsal tooth, pleonite 5 (male) with elongate tooth.

Baja California, 1095–1205 m.

Stephobruzelia J. L. Barnard

Stephobruzelia J. L. Barnard, 1969a:461–462.

DIAGNOSIS.—Forehead not protuberant, lateral cephalic lobe sharp or weakly so; eyes absent; mandible with palp, molar greatly enlarged, not triturative, fuzzy; mouthparts basic, articles 1–2 of antenna 1 basic; coxa 1 ordinary; coxae 3–4 not pelagont, coxa 3 rectangular, not distally expanded except for anteroventral cusp, posterior margin parallel with anterior and not excavate, coxa 4 as long as and as large as coxa 3, subrectangular, posteroventrally excavate but ventral margin truncate, with midposterior tooth; gnathopods typically subchelate, palms oblique, defined by about 4 simple spines; dactyl of gnathopod 2 normal; pereopods 3–5 elongate, dactyls elongate, article 2 of pereopod 5 rounded posteroventrally; pleonites 1–3 not denticulate; uropod 3 not exceeding uropods 1–2, peduncle elongate; telson elongate, entire.

TYPE-SPECIES.—*Bruzelia dentata* Stephensen (1931).

Stephobruzelia dentata (Stephensen)

Bruzelia dentata Stephensen, 1931:252–255, fig. 73.

Norwegian Basin, 1096–1996 m.

Synopia Dana

Synopia Dana, 1852:315.—Stebbing, 1906:271.

DIAGNOSIS.—Forehead protuberant, lateral cephalic lobe not sharp; eyes present, accessory eyes present; mandible with palp, molar large, columnar, triturative (type) or swollen and pillowlike and poorly triturative (*S. variabilis*); mouthparts, especially maxillipeds, subfoliaceous; articles 1–2 of antenna 1 basic; coxa 1 ordinary (if small, not tapering); coxae 3–4 pelagont; gnathopods simple, hands slender or tumid, often heavily setose but lacking defining spines, tumid hands appearing subchelate; dactyl of gnathopod 2 vestigial or very small; pereopods 3–5 elongate, dactyls elongate, article 2 of pereopod 5 weakly basic or tending towards truncation; pleonites 1–3 not denticulate; uropod 3 greatly exceeding apices of uropods 1–2, peduncle short; telson short, cleft, or entire and trifoliate.

TYPE-SPECIES.—*S. ultramarina* Dana (1853).

REMARKS.—The molar in *S. variabilis* may be interpreted as swollen but not grossly dominating the mandible; since the molar is nontriturative and the telson is uncleft, *S. variabilis* may deserve a distinct generic name.

The species of this genus are not well known and have not been reviewed since Bovallius (1886), except by Spandl (1924) who described an obviously valid new species, *S. variabilis*, but relied on the literature for his systematic review. Stebbing (1906) recognized 2 valid species and 3 dubious species. Bovallius was able to write a key to all 6 species described at that time, only *S. variabilis* being added since 1886. Stebbing synonymized *S. gracilis* with *S. ultramarina* but there does not seem to be any justification for accepting that decision until a wide series of materials from all oceans can be studied. Smithsonian collections appear to have only a few specimens of what is presumed to be *S. ultramarina*, several of which have been dissected but little knowledge can be added since this is the best known of the several species and it generally fits Bovallius' concept. One important fact is that this, the type-species of the genus, has a strongly columnar and heavily triturative mandibular molar, whereas *S. variabilis*, as illustrated by J. L. Barnard (1965), has a swollen spheroid molar which is poorly triturative. Presumably this genus is widely represented in nearshore epipelagic net collections in various plankton laboratories and probably a large series of specimens could be assembled by studying these collections. Whether the characteristics of several species pointed out by Bovallius are valid would be the first problem to attack.

Two keys are given below, the first modified after Bovallius to include *S. variabilis* and to eliminate the belief that *S. gracilis* is simply a male of *S. ultramarina*, as indicated in synonymy by Stebbing (1906). I have found in another genus, *Parelasmopus*, that Dana's perception of species or at least of strong character differences among groups of specimens was very good and thus I am willing to accept his differences in illustrations, poor as they are, until other

Key to Seven Species of *Synopia*

1. Telson entire .... ***S. variabilis***
   Telson cleft 2
2. Forehead not protuberant .... ***S. orientalis***
   Forehead protuberant 3
3. Article 2 of pereopods 3–4 rectangular or with quadrate posteroventral corners 4
   Article 2 of pereopods 3–4 ovate or with rounded posteroventral corners 5
4. Article 2 of pereopod 3 narrowly rectangular, scarcely twice as broad as article 3 and with scarcely protruding posteroventral corner .... ***S. angustifrons***
   Article 2 of pereopod 3 widely rectangular, nearly thrice as broad as article 3 and with strongly protruding posteroventral corner .... ***S. gracilis***
5. Flagellar articles 2, 3, 4 . . . n, of antenna 1 with long hairs .... ***S. caraibica***
   Flagellar articles 2, 3, 4 . . . n, of antenna 1 lacking long hairs 6
6. Telson scarcely longer than broad, apicolateral margins smooth, each apex with one stout spine .... ***S. scheeleana***
   Telson much longer than broad, apicolateral margins serrate, each apex with at least 2 setae .... ***S. ultramarina***

Key to Three Species of *Synopia*

1. Telson entire and apically trifoliate .... ***S. variabilis***
   Telson cleft 2
2. Telson about 1.25+ times as long as broad, each lobe with one apical spine, apicolateral margins of lobes smooth .... ***S. scheeleana***
   Telson about twice as long as broad, each lobe with at least two apical setae, one seta short, apicolateral margins of lobes serrate .... ***S. utramarina***

good evidence is found that *Synopia* has only 3 valid species. The second key considers only the 3 species currently accepted.

Synopia angustifrons Dana

Synopia angustifrons Dana, 1853: 998, pl. 68, figure 8a–d.—Bovallius, 1886:20–21, pl. 2, figures 36–39 (after Dana)

Tropical Pacific.

Synopia caraibica Bovallius

Synopia caraibica Bovallius, 1886: 14–15, pl. 2, figure 30.

Caribbean Sea.

Synopia gracilis Dana

Synopia gracilis Dana, 1853: 995, pl. 7a–c.—Bovallius, 1886: 18–19, pl. 2, figures 31–35 [after Dana].

Stebbing (1906) indicates this is the male of *S. ultramarina* but one may note how the quadrate second articles of pereopods 3–4 separate this species from *S. ultramarina* in the key to seven species written above.

Tropical Atlantic.

Synopia orientalis Kossmann

Synopia orientalis Kossmann, 1880: 137, pl. 15, figures 11–13 (not seen).—Bovallius, 1886: 21.

Red Sea.

Synopia scheeleana Bovallius

Synopia Scheeleana Bovallius, 1886: 16–18, pl. 2, figures 22–29.
?*Synopia scheeleana*.—Stebbing, 1888: 799–804, pl. 52.

Stebbing may be correct that his Pacific specimens are identifiable with the Atlantic *S. scheeleana* but he did not see the coxae clearly and he shows apically notched telsonic lobes whereas Bovallius shows evenly rounded lobes.

Tropical Atlantic, especially off the Barbadoes (Bovallius); tropical Pacific (Stebbing).

Synopia ultramarina Dana

Synopia ultramarina Dana, 1853: 955, pl. 68, figure 6a–h.—Bovallius 1886: 6–13, pl. 1, figures 1–21.

I have examined reputed specimens of this species in Smithsonian collections. They fit Bovallius' drawings and descriptions favorably except that in Bovallius' in toto view coxae 1–2 are erroneously attached too tightly on the long sides to the pereonites thus obfuscating the crescentic curve these coxae make with the ventral margin of coxa 3, which in Bovallius' drawing hangs disjunctly below the level of coxae 1–2. Bovallius' separate drawings of coxae 1–2 are adequate. Male antenna 1 is longer than that of the female.

MATERIAL.—Smithsonian: USNM Acc. 57608, Crustacea Cat. 53778, Cape San Antonio, Cuba, 25 May 1914, Thomas-Barrera Exped., coll. Henderson-Bartsch, id. C. R. Shoemaker (10 specimens); USNM Acc. 11568, Run Bay, Bahamas, no date, surface (20 specimens).

Tropical Atlantic.

Synopia variabilis Spandl

Synopia variabilis Spandl, 1923 (not seen); 1924: 48–50, figure 17a–g.—J. L. Barnard, 1965: 494, figure 9.

Red Sea to Micronesia.

Syrrhoe Goës

Syrrhoë Goës, 1866: 527.—Stebbing, 1906: 281–282.

DIAGNOSIS.—Forehead in type-species not protuberant but strongly so in 3 other species, lateral cephalic lobe sharp in type but rounded in species with protuberant forehead and others; eyes typically present but occasionally absent, accessory eyes absent; mandible with palp, molar small, weakly triturative; mouthparts basic; articles 1–2 of antenna 1 usually basic but in type article 1 bearing large posteroterminal tooth and article 2 in *S. papyracea* with weak tooth, peduncle slightly elongate (female); coxa 1 ordinary; coxae 3–4 pelagont; gnathopods with transverse or subtransverse palms bearing enlarged serrate defining spine giving chelate appearance to hand, spine possibly unserrate in *S. affinis;* dactyl of gnathopod 2 normal; pereopods 3–5 elongate, dactyls elongate, second articles heavily serrate or not, article 2 of pereopod 5 typically rounded posteroventrally but in few other species becoming truncate; pleonites 1–3 typically denticulate dorsally but often smooth or

Key to the Species of *Syrrhoe*

1. Cephalon extended as a forehead, forming protrusive appearance as in Figure 24 2
   Cephalon with anterodorsal margin curving hemispherically, dorsal and anterior margins of head nearly perpendicular 4
2. Coxa 1 strongly broadened, distal margin about twice as broad as proximal margin ***S. oluta***
   Coxa 1 not broadened, anterior and posterior margins nearly parallel 3
3. Telson of medium length and cleft halfway .... ***S. papyracea***
   Telson long and cleft about three-fourths of its length .... ***S. longifrons***
4. Pereonite 7 and pleonites 1–3 each with middorsal nodule in addition to posterodorsal carinal tooth, pereonites 6–7 each with lateral nodulocarina .... ***S. nodulosa***
   Supernumerary nodules absent 5
5. Pleonites 1–2 with strong serrations on posterodorsal and posterolateral margins, no distinct middle teeth 6
   Pleonites 1–2 with one distinct posterodorsal tooth and few or no rudimentary serrations or widely separated teeth 7
6. Posterior margin of pleonite 3 including both epimera fully serrate .... ***S. crenulata***
   Posterior margin of pleonite 3 with gap in serrations represented by a smooth margin on each dorsoposterior epimeron .... ***S. affinis*** and ***S. psychrophila*** (see diagnoses)
7. Coxa 1 distally expanded, coxa 2 distally tapering, posterior lobe of coxa 3 more than half as broad as full depth of coxa .... ***S. serrima***
   Coxae 1 and 2 evenly extended, posterior lobe of coxa 3 less than half as broad as full depth of coxa or lobe indistinct 8
8. Proximal serration on palmar spine of gnathopods enlarged, blunt posterior lobe of coxa 3 not readily distinct from remainder, posteroventral angle not truncate .... ***S. tuberculata***
   Proximal serration on palmar spine of gnathopods small and pointed, posterior lobe of coxa 3 readily distinguished, posteroventral angle with truncate vertical margin ***S. semiserrata***

bearing single dorsal tooth, uropod 3 not exceeding apices of uropods 1–2 (possible exception in *S. longifrons* group), peduncle short (except *S. nodulosa*); telson elongate, deeply cleft.

TYPE-SPECIES.—*S. crenulata* Goës (1866).

REMARKS.—*Syrrhoe* appears to be the most diverse genus of Synopiidae in terms of character similarities picked for the affinity study (Figure 1). From that study one would assume at least 3 genera are represented by several species now assigned to *Syrrhoe* but the division, if it ever was necessary, is not now prudent because no definite disjunctions seem apparent. Undoubtedly more species remain undescribed. *Syrrhoe* is divisible into 2 groups based on protuberant forehead and basic forehead. Two subgroups in the category of protuberant forehead are represented by (1) *Syrrhoe oluta* and *S. longifrons* and (2) *S. papyracea*. The latter differs from the type-species group (*S. crenulata*) in the head, short telson, presence of 2 palmar spines, unmodified antenna 1, and slightly toothed article 2 of antenna 1. Group 1 differs from the type group also in the head, the elongate uropod 3, basic antenna 1, dorsally unserrate pleonites and the slightly truncate ventral margin of pereopod 5 article 2. Various of the noncephalic characters however occur one at a time or two at a time in the typical group of *Syrrhoe*, such as the weak dorsal serrations and development of discrete teeth in *S. nodulosa* and *S. tuberculata*. *Syrrhoe affinis* differs from the type group in the absence of eyes and the presumed unserrate palmar spines.

Syrrhoe affinis Chevreux

Syrrhoe affinis Chevreux, 1908: 7–9, figure 4.

DIAGNOSIS.—Head not protuberant, lateral cephalic lobe sharp (assumed); eyes absent; article 1 of antenna 1 not elongate, with distomedial tooth, article 2 lacking tooth; coxa 1 slightly expanded distally, coxa 2 tapering, coxa 3 with posterior lobe about half total coxal height; gnathopodal palms with one spine, apparently simple (from drawing), palm of gnathopod 2 especially oblique; article 2 of pereopod 5 weakly truncate posteriorly, generally ovate, hind teeth of medium size to large; pleonites 1–3 dorsally serrate (1–2 assumed); epimeron 3 posteriorly serrate on lower two thirds, with smooth gap between lower epimeral serrations and upper body serrations; uropod 3 apparently not exceeding uropods 1–2, peduncle apparently short; telson elongate, cleft about three-fourths its length.

SPECIAL CHARACTER (compare *S. psychrophila*).—Coxa 2 about one-third as broad as long, with long tapering extension.

East Atlantic, off Morocco, 851 m.

Syrrhoe crenulata Goës

Syrrhoe crenulata Goës, 1866: 527, pl. 40, figure 25.—Sars, 1895: 390–391, pl. 136.—Stebbing, 1906: 282–283.—Shoemaker, 1930: 73.—Stephensen, 1931: 257–258.

DIAGNOSIS.—Head not protuberant, lateral cephalic lobe sharp; eyes present; article 1 of antenna 1 elongate and with posterodistal tooth, article 2 lacking tooth; coxae 1–2 scarcely tapering distally, posterior lobe of coxa 3 less than half total coxal height; gnathopodal palms with one serrate spine; article 2 of pereopod 5 truncate posteroventrally, posterior teeth large; pereonite 7 and pleonites 1–3 dorsally serrate; epimera 1–2 each with small to medium posteroventral tooth, epimeron 3 fully serrate posteriorly (smooth gap very small); uropod 3 not exceeding uropods 1–2, peduncle short; telson elongate, cleft two-thirds or three-fourths.

MATERIAL.—Oregon 51 (1), off Oregon, Columbia River, 150 m.

North boreal, south to about Skagerrak, New England, Japan Sea, Oregon, generally 40–200 m.

Syrrhoe longifrons Shoemaker

Syrrhoe longifrons Shoemaker, 1964: 404–405, figure 7.

DIAGNOSIS.—Forehead protuberant, lateral cephalic lobe blunt; eyes present; article 1 of antenna 1 not elongate but with small anterodistal tooth, article 2 also with small tooth; coxae 1–2 scarcely expanded distally, posterior lobe of coxa 3 half total coxal height; gnathopodal palms with one serrate spine; article 2 of pereopod 5 apparently expanded and ventrally truncate, posterior teeth medium to large; pereonite 7 and pleonites 1–3 apparently dorsally serrate; epimeron 3 apparently posteriorly serrate; uropod 3 apparently not exceeding uropods 1–2; telson apparently elongate and cleft two-thirds to three-fourths.

British Columbia, shallow water.

Syrrhoe nodulosa K. H. Barnard

Syrrhoe nodulosa K. H. Barnard, 1932: 150–151, figure 88.

DIAGNOSIS.—Head not protuberant, lateral cephalic lobe sharp; eyes present; article 1 of antenna 1 keeled dorsally and with mediodistal tooth; article 2 lacking tooth; coxa 1 slightly expanded distally, coxa 2 evenly extended, posterior lobe of coxa 3 half total coxal height; gnathopodal palms with one serrate spine; article 2 of pereopod 5 expanded, angular, then weakly rounded ventrally, posterior teeth small; pereonite 7 and pleonites 1–3 each with 2 dorsal teeth in tandem, anterior member noduliform, posterior member bifid transversely, pleonites 1–4 and epimera 1–3 fully serrate posteriorly; uropod 3 scarcely exceeding uropods 1–2, peduncle elongate; telson elongate, cleft almost to base.

The elongate peduncle of uropod 3 is unusual in *Syrrhoe*.

Antarctic, tows between 160 and 500 m.

Syrrhoe oluta, new species

FIGURES 24–28

DIAGNOSIS.—Forehead protuberant, lateral cephalic lobe not sharp; eyes absent; article 1 of antenna 1 not elongate and lacking tooth, article 2 elongate and with mediodistal tooth; coxa 1 extremely broadened apically and acutely produced forward, coxa 2 scarcely tapering, posterior lobe of coxa 3 half or more total coxal height; gnathopodal palms with one serrate spine; article 2 of pereopod 5 expanded and ventrally truncate, posterior teeth small to medium; pereonite 7 and pleonites 1–5 each with one small to medium dorsoposterior tooth; epimera 1–2 with small posteroventral tooth, epimeron 3 with small double tooth; uropod 3 not exceeding uropods 1–2, peduncle short; telson elongate, cleft more than 85 percent its length.

DESCRIPTION.—Cephalon with strong forehead, anterior and dorsal margins forming acute angle, rostrum sharp and pointing ventrally, rostral base forming proximal keel separated from secondary midsagittal keel projecting anteriorly by falciform notch; articles 1 and 2 of antenna 1 subequal in length, article 3 about half as long, article 1 with rudimentary (type) or strong (Oregon) distomedial cusp, article 2 with strong reverted cusp; article 4 of antenna 2 much shorter than article 5, gland cone weak; coxa 1 strongly produced forward by means of anterior conical process but unlike other syrrhoes, coxa 1 broadly expanded, thus coxa 2 not bent forward and coxa 3 not extended forward by anteroventral prolongation to fit unusual posterior margin of coxa 1 in sequence; coxa 2 tapering slightly distally and 2-serrate distally; coxa 4 comma-shaped; gnathopod 1 of medium stoutness for genus, gnathopod 2 extremely slender and elongate; article 6 of pereopods 1–2 stout and bearing very dense brush of distal setae; posterior margins of second articles on pereopods 3–5 coarsely and sparsely serrate, posteroventral corners more (Oregon) or less (Colombia) protruding; distolateral peduncular margins of uropods 1–2 with long and short cusp respectively, outer rami distally simple; telson elongate and cleft almost to base; body essentially without serrations, only dorsoposterior angles of pereonites 7 and pleonites 1–5 with one tooth each, that on pleonite 3 larger than on others; no nodules present; pleonal epimera 1–2 with small posteroventral point, epimeron 3 with sinuous posterior margin and apparently bifid at posteroventral corner.

HOLOTYPE.—AMNH 14,402 male, 7.0 mm, pereopod 5 missing.

TYPE-LOCALITY.—*Vema* 15–38, off Pacific Colombia, 05°00'N, 79°04'W, 3023–3251 m, 15 November 1958.

MATERIAL.—The holotype and Oregon 81 (1); Oregon 82 (1).

RELATIONSHIP.—This species has closest affinities with *S. papyracea* Stebbing (1888) in view of its head, but the following strong differences occur in the new species: (1) the telson is elongate and more deeply cleft; (2) coxa 1 is broadly expanded ventrally and therefore coxa 2 is not bent forward and coxa 3 follows suit; coxa 3 has a smooth posterior margin and coxa 4 is more comma-shaped; (3) no accessory serrations occur on the pleonites; (4) the outer ramus of uropod 1 lacks a distal spine; (5) article 4 of antenna 2 is relatively much shorter and the gland cone is much weaker; (6) pereopods 1–2 are more strongly developed, article 6 is stouter and the distal setal brush is more highly elaborated; (7) the posterior margin of article 2 on pereopod 3 (and usually 4–5) protrudes more strongly.

Most of the differences noted above also apply to *S. longifrons* Shoemaker (1964) except that the latter has a deeply cleft telson like *S. oluta*.

Oregon to Colombia, 2798–3251 m.

Syrrhoe papyracea Stebbing

Syrrhoe papyracea Stebbing, 1888: 789–793, pl. 50.

DIAGNOSIS.—Forehead protuberant, lateral cephalic lobe not sharp; eyes absent; article 1 of antenna 1 not elongate and with small mediodistal tooth, article 2 lacking tooth; coxa 1 narrow and evenly expanded base to apex, coxa 2 scarcely tapering, posterior lobe of coxa 3 half or slightly more total coxal height; gnathopodal palms with one serrate and one bifid spine; article 2 of pereopod 5 weakly expanded and rounded ventrally, posterior teeth medium in size; pereonite 7 and pleonites 1–4 dorsally serrate; epimeron 1 with small posteroventral tooth, epimeron 2 with large tooth, epimeron 3 with medium tooth, no posterior serrations; uropod 3, if exceeding uropods 1–2, not strongly so (broken), peduncle short, telson of medium length, cleft halfway.

Culebra Island, West Indies, 390 fms.

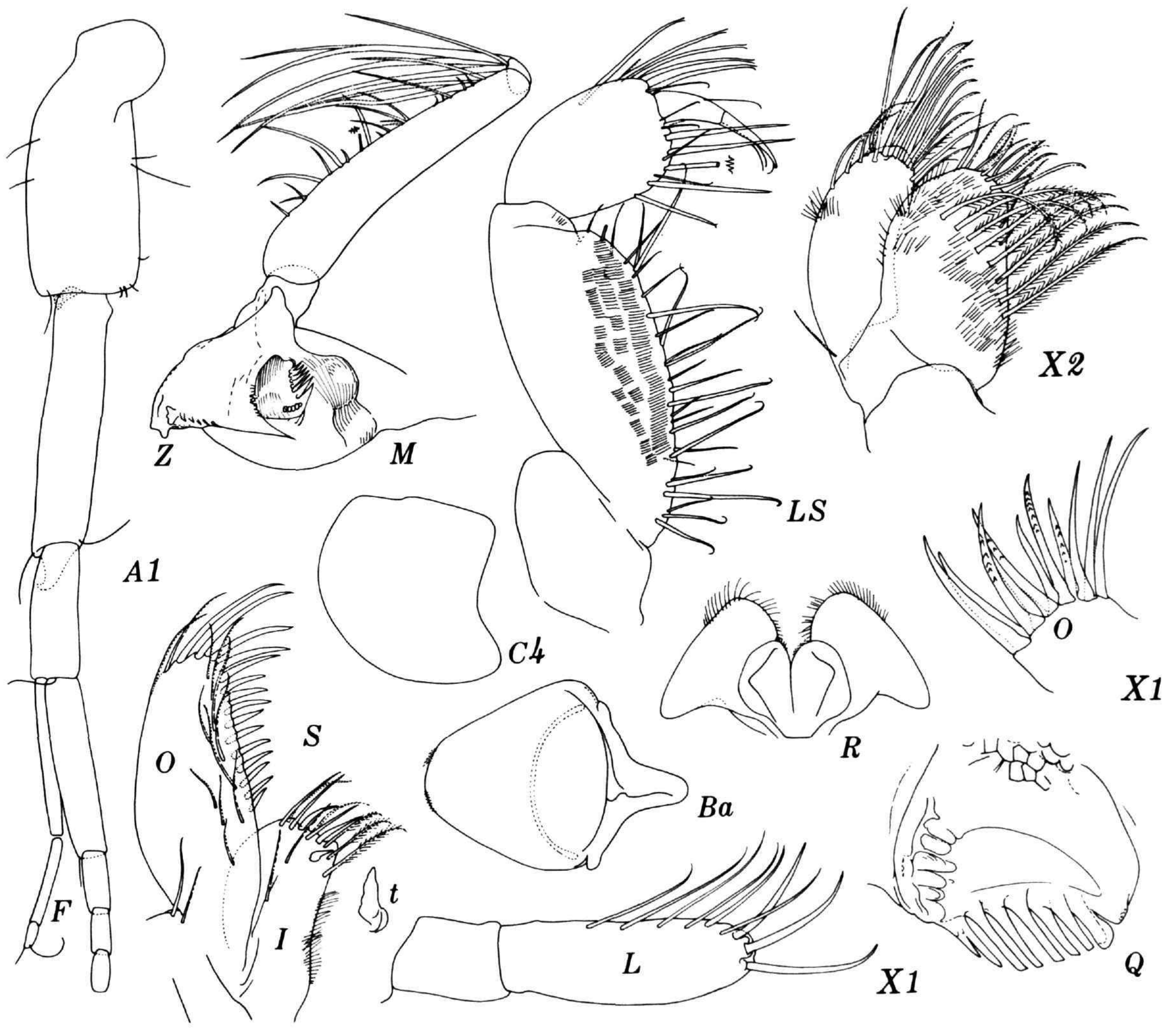

FIGURE 24.—*Syrrhoe oluta*, new species, holotype, male, 7.0 mm, *Vema* 15–38.

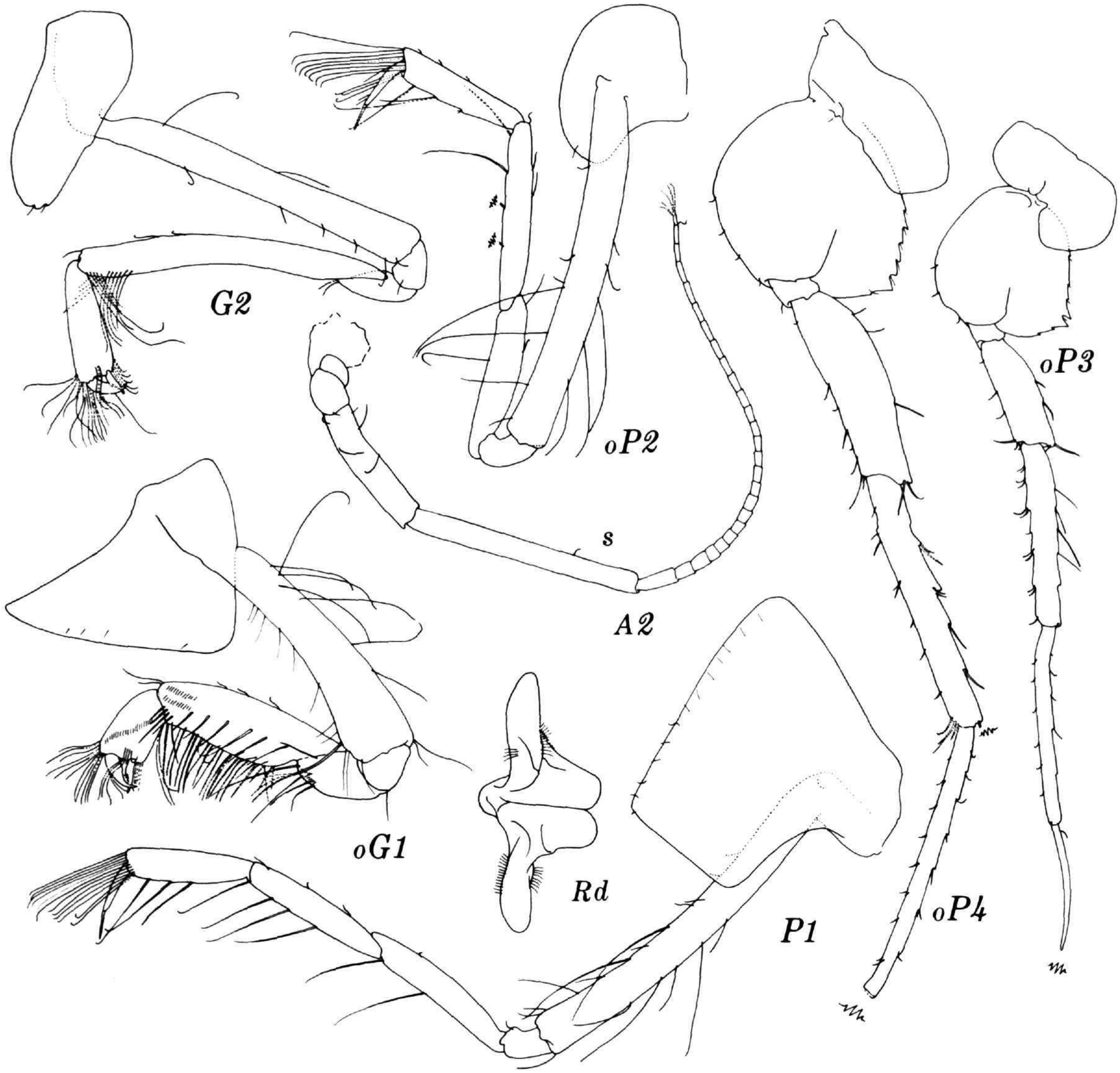

FIGURE 25.—*Syrrhoe oluta*, new species, holotype, male, 7.0 mm, *Vema* 15-38.

Syrrhoe psychrophila Monod

Syrrhoe crenulata var. *psychrophila* Monod, 1926: 54, figure 52 A-H.

Syrrhoe psychrophila. Schellenberg, 1931, 159, figure 83.—K. H. Barnard, 1932: 149-150, figure 87.

DIAGNOSIS.—Head apparently not protuberant, lateral cephalic lobe apparently sharp; eyes present (Schellenberg); article 1 of antenna 1 not elongate, with mediodistal tooth, article 2 probably without tooth; coxae 1-2 presumably extended evenly but K. H. Barnard and Schellenberg state coxa 2 tapering at least anteroventrally and coxa 1 expanded slightly apically vide Schellenberg; posterior lobe of coxa 3 presumably about one-third or one-half total coxal height; gnathopodal palms with one serrate spine; article 2 of pereopod 5 slightly expanded and ventrally truncate (Schellenberg), posterior teeth

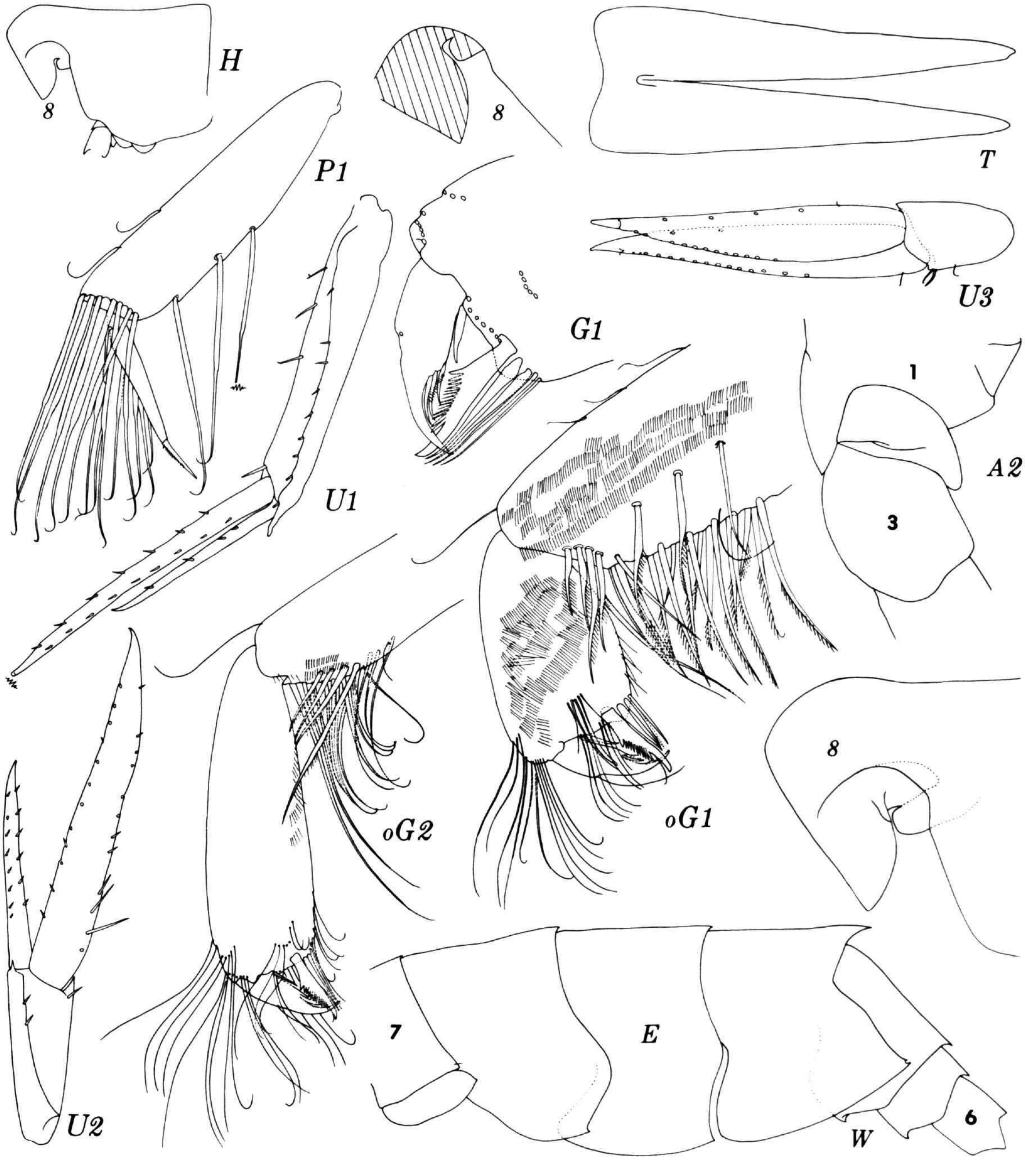

FIGURE 26.—*Syrrhoe oluta,* new species, holotype, male, 7.0 mm, *Vema* 15–38.

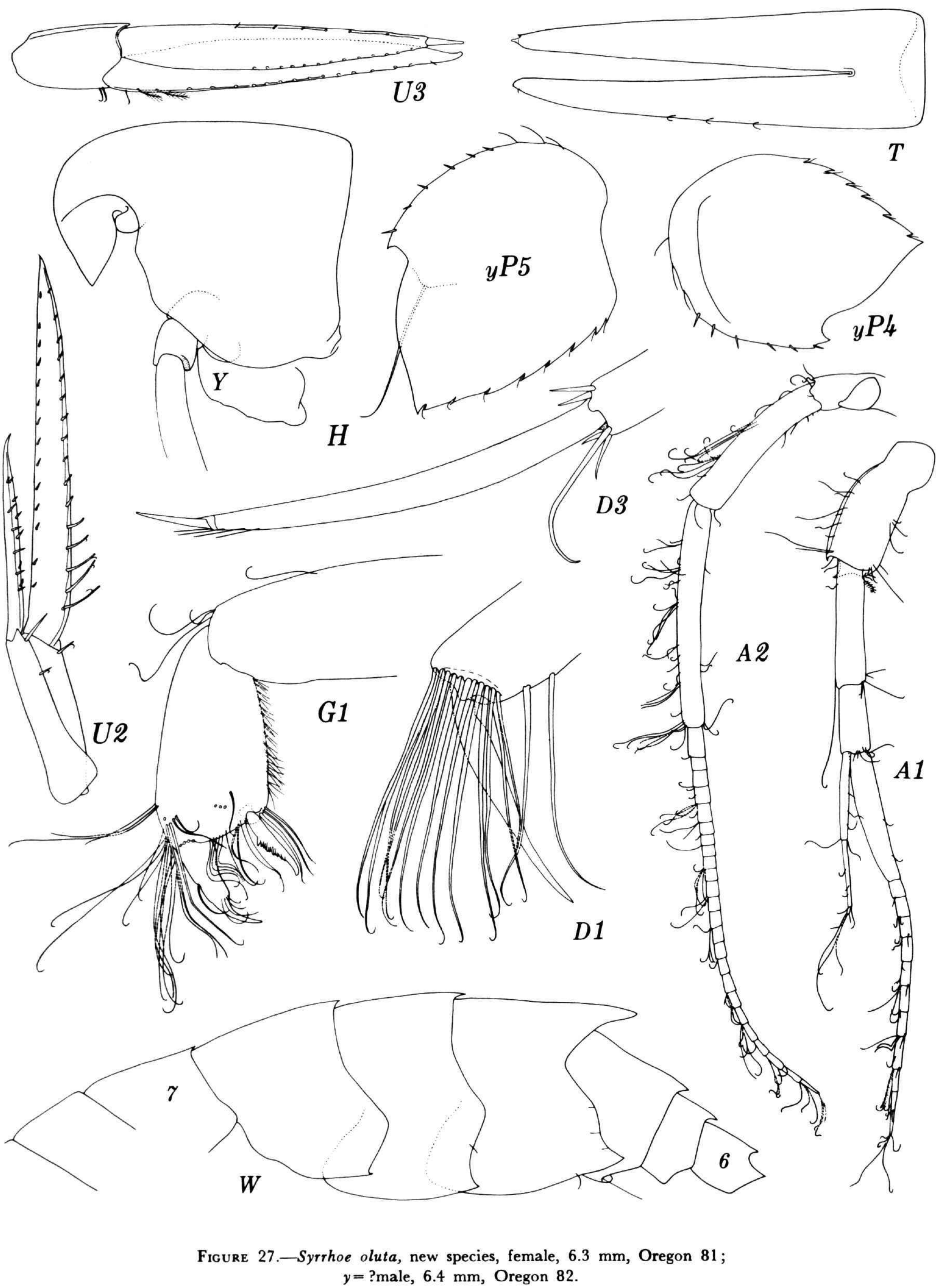

FIGURE 27.—*Syrrhoe oluta,* new species, female, 6.3 mm, Oregon 81; *y* = ?male, 6.4 mm, Oregon 82.

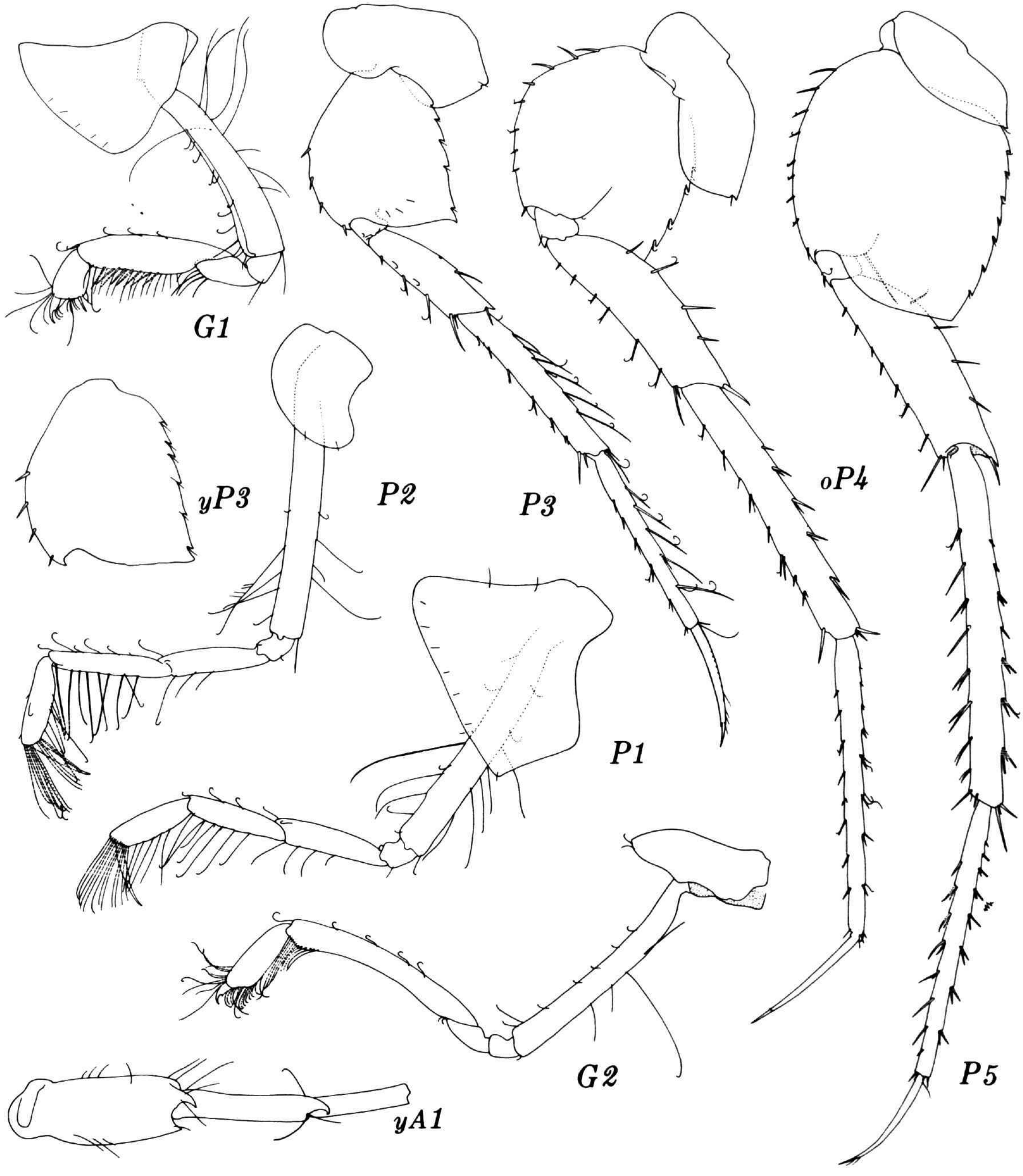

FIGURE 28.—*Syrrhoe oluta*, new species, female, 6.3 mm, Oregon 81; y= ?male, 6.4 mm, Oregon 82.

small (K. H. Barnard), pleonites 1–3 presumably serrate dorsally (K. H. Barnard states pereonite 7 smooth); epimeron 3 posteriorly serrate on lower two-thirds, long smooth gap between there and dorsal serrations; uropod 3 presumably not exceeding uropods 1–2, peduncle presumably short; telson elongate, cleft three-fourths its length.

SPECIAL CHARACTER.—Coxa 2 about two-thirds as broad as long (see *S. affinis*).

Antarctica, about 136 to 400 m.

Syrrhoe semiserrata Stebbing

Syrrhoe semiserrata Stebbing, 1888: 793–797, pl. 51.—Schellenberg, 1938: 34.

DIAGNOSIS.—Head not protuberant, lateral cephalic lobe rounded; eyes present; articles 1–2 of antenna 1 not elongate, lacking teeth (male); coxae 1 and 2 not tapering, posterior lobe of coxa 3 about one-third total coxal height; gnathopodal palms with one serrate spine; article 2 of pereopod 5 of medium expansion, rounded ventrally, posterior teeth small; pereonite 7 and pleonites 1–2 with one small dorsal tooth each, pleonite 3 apparently with small dorsal denticle(s); epimeron 1 lacking posteroventral tooth, epimeron 2 with medium tooth, epimeron 3 with lower half of posterior margin serrate; uropod 3 not exceeding uropod 2 but uropod 2 exceeding uropod 1, peduncle of uropod 3 short or medium in length; telson long and deeply cleft, perhaps three-fourths its length.

SPECIAL CHARACTER.—Proximal serration on spine of gnathopods enlarged and blunt.

Melbourne, Victoria, 33 fms; Bass Strait.

Syrrhoe serrima, new species

FIGURES 29–31

DIAGNOSIS.—Head not protuberant, lateral cephalic lobe sharp; eyes apparently present; article 1 of antenna 1 not elongate, with distomedial tooth, article 2 as long as article 1 but lacking tooth; coxa 1 slightly expanded distally, coxa 2 tapering distally, posterior lobe of coxa 3 about half or more total coxal height; gnathopodal palms with one serrate spine; article 2 of pereopod 5 expanded and subtruncate ventrally, posterior teeth medium to large; pleonites 1–2 each with small dorsoposterior tooth; epimera 1–2 each with small posteroventral tooth; epimeron 3 with lower half of posterior margin serrate; uropods poorly known; telson elongate, cleft about three-fourths its length.

DESCRIPTION.—Cephalon without extended forehead, anterodorsal margin evenly hemispherical, rostrum sharp and pointing ventrally, rostral base with midsagittal keel separated from secondary keel on main body of head by deep notch; article 1 of antenna 1 with reverted distal tooth, article 2 as long as 1, article 3 about two-thirds as long as article 2; coxa 1 extended forward and distally expanded but relatively narrow (compared with *S. oluta*), anteroventral corner rounded, posteromedial margin with strong declivity, coxa 2 tapering distally, very narrow, also with posterior declivity; anteroventral corner of coxa 3 slightly extended but rounded, posterior lobe broad and quadrate; coxa 4 comma-shaped but with posteroventral oblique truncation, coxa 7 with posterior incision; gnathopods 1–2 of medium stoutness for genus, large locking spine of each palm almost evenly serrate; article 6 of pereopods 1–2 slender and bearing distal brush of setae of medium density, dactyls long and anteriorly serratopinnate; article 2 of pereopods 3–5 with sparse and coarse posterior serrations, posteroventral corner scarcely protruding, pereopods 3–4 with one bulbous castellation at that corner; peduncles of uropods 1–2 with long and medium distolateral cusps respectively, outer rami slender, tapering, distally simple (otherwise uropods 1–2 in poor condition); telson elongate and cleft about three-fourths of its length, lobes tapering distally; body essentially without serrations, only pleonites 1–2 each with weak dorsoposterior tooth and several accessory serrations, epimeron 1 with strongly quadratoconvex posterior margin and small posteroventral tooth, epimeron 2 with weaker posterior bulge, sinuous posterior margin and small posteroventral tooth, epimeron 3 with subquadrate posteroventral plate deeply serrate on ventral half of posterior margin.

HOLOTYPE.—AMNH 14,397, ?male, 5.8 mm.

TYPE-LOCALITY.—*Vema* 15–131, east of Bahia Blanca, Argentina, 40°14.6′ S, 55°24.7′ W, 1475 m, 3 April 1959.

MATERIAL.—Two specimens from the type-locality, sex unclear.

RELATIONSHIP.—Even though this species is repre-

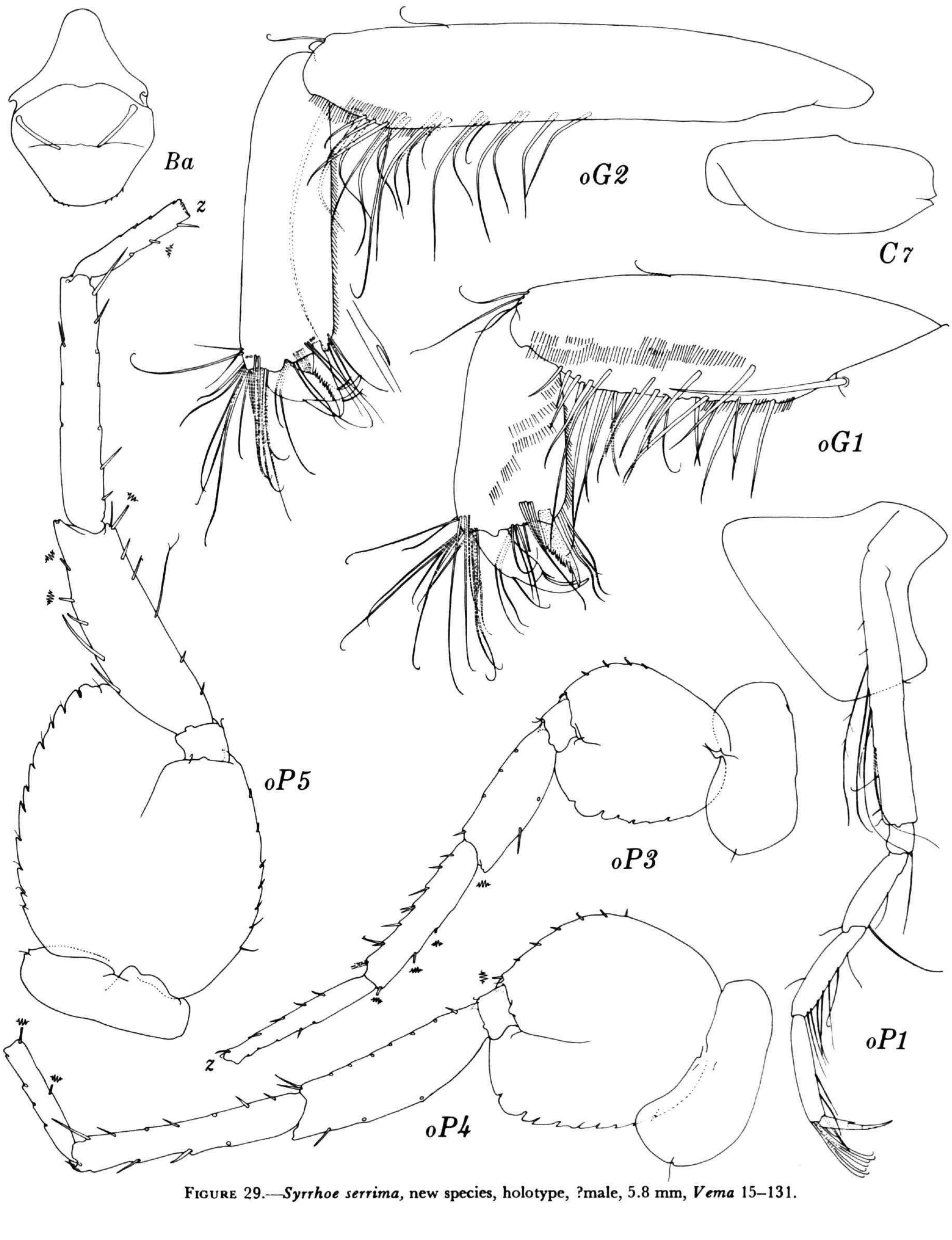

FIGURE 29.—*Syrrhoe serrima,* new species, holotype, ?male, 5.8 mm, *Vema* 15–131.

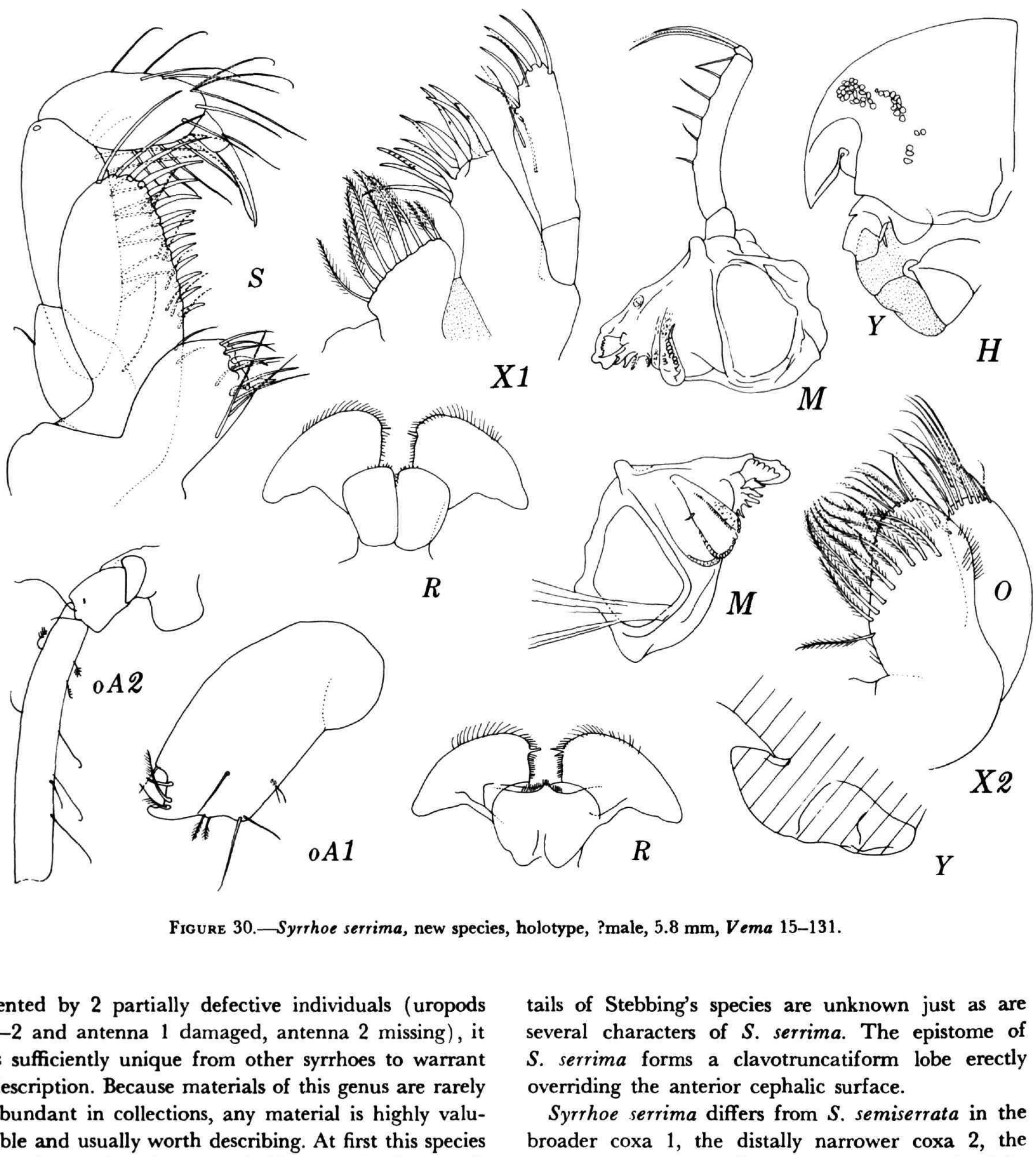

FIGURE 30.—*Syrrhoe serrima*, new species, holotype, ?male, 5.8 mm, *Vema* 15–131.

sented by 2 partially defective individuals (uropods 1–2 and antenna 1 damaged, antenna 2 missing), it is sufficiently unique from other syrrhoes to warrant description. Because materials of this genus are rarely abundant in collections, any material is highly valuable and usually worth describing. At first this species was believed to be an individual of *Syrrhoe semiserrata* Stebbing (1888, Bass Strait and Bismarck Archipelago, 60–(160) m), but numerous small differences point to its specific identity. If the present species has eyes they have been dispersed into 2 masses, possibly by preservational effects. A few details of Stebbing's species are unknown just as are several characters of *S. serrima*. The epistome of *S. serrima* forms a clavotruncatiform lobe erectly overriding the anterior cephalic surface.

Syrrhoe serrima differs from *S. semiserrata* in the broader coxa 1, the distally narrower coxa 2, the weaker anterior extension and broader posterior lobe of coxa 3 and apparently by the less posteriorly directed coxa 4 extension; coxa 7 also has a posterior notch not shown for *S. semiserrata*. The large palmar spine of the gnathopods is almost evenly serrate in *S. serrima* whereas in *S. semiserrata* it has one large

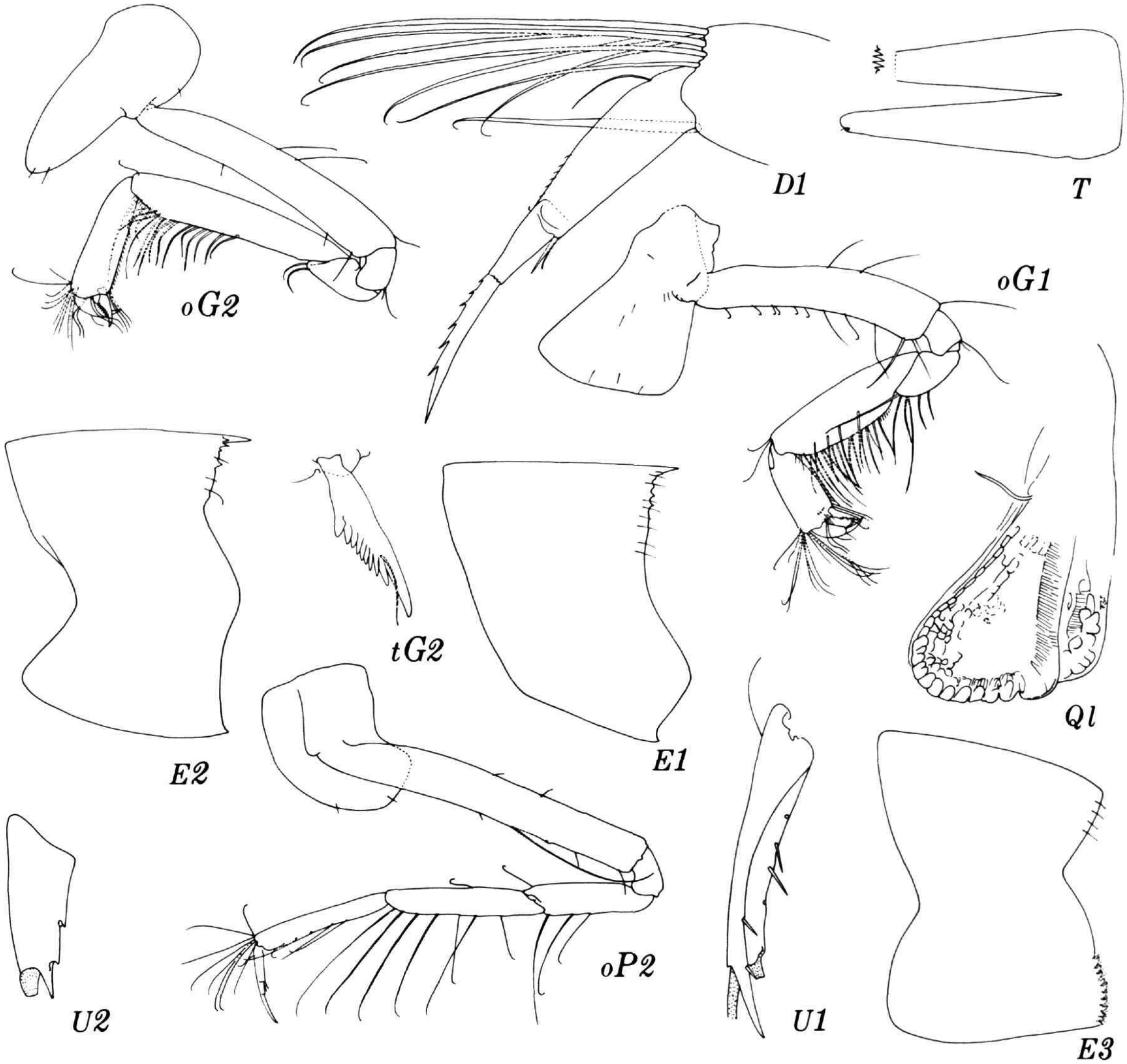

FIGURE 31.—*Syrrhoe serrima*, new species, holotype, ?male, 5.8 mm, *Vema* 15–131.

proximal cusp plus serrations. Pereonite 7 of *S. serrima* is evenly truncate posterodorsally whereas on *S. semiserrata* it appears to be slightly cuspidate. Uropods 1–2 of the new species have large distolateral cusps on the peduncle in contrast to weak or absent cusps on *S. semiserrata*. The telson of *S. serrima* has strongly tapering lobes, not truncate as in *S. semiserrata*. The latter species is based on a fully adult male whereas *S. serrima* is based on specimens possibly of subadult male character and thus generally like females. Some of the character differences might therefore be of sexual dimorphism, a subject poorly understood in Synopiidae.

Argentina, 1475 m.

Syrrhoe tuberculata Dahl

Syrrhoe tuberculata Dahl, 1954: 290–292, figures 36–41.

DIAGNOSIS.—Head not protuberant, lateral cephalic lobe unknown; eyes present; article 1 of antenna 1 not elongate, with mediodistal tooth, article 2 apparently basic; coxa 1 evenly extended, coxa 2 apparently evenly extended, coxa 3 widely expanded apically but lacking distinctive posterior lobe because posterior margin extended obtusely and not truncate; gnathopodal palms with one serrate spine; article 2 of pereopod 5 expanded, ventrally truncate, anteroventral corner especially projecting, posterior teeth small; pereonites 6–7 and pleonites 1–4 each with bifid dorsal tooth, posterior borders of pereonites 6–7 and pleonites 1–3 with other large teeth; epimera 1–2 with weak or sharp posteroventral tooth; epimeron 3 with lower two-thirds of posterior margin bearing wavy serrations; uropod 3 not exceeding uropods 1–2, peduncle unknown; telson elongate, cleft almost to base.

Ross Sea, 550 m.

Syrrhoites Sars

Syrrhoites Sars, 1895: 391–392.—Stebbing, 1906: 279.

DIAGNOSIS.—Forehead not protuberant, lateral cephalic lobe not sharp; eyes absent; mandible with palp, molar greatly enlarged, not triturative, fuzzy; mouthparts basic; articles 1–2 of antenna 1 basic, article 1 with small medioterminal tooth; coxa 1 ordinary; coxae 3–4 not pelagont, coxa 3 rectangular, not distally expanded, posterior margin parallel with anterior margin and not excavate, coxa 4 nearly as long as 3, with subequal surface area, adz-shaped; gnathopods typically subchelate, palms oblique, defined by 1–2 unserrate spines but majority of species with palms obsolescent though distinguished by spine(s); dactyl of gnathopod 2 normal; pereopods 3–5 elongate, dactyls elongate, article 2 of pereopod 5 typically basic but posteroventrally truncate in *cohasseta-redox* group; pleonites 1–3 not denticulate; uropod 3 not exceeding other uropods (or rarely in slight degree), peduncle elongate; telson elongate and deeply cleft. Uropod 1 short in *S. pusillus*.

TYPE-SPECIES.—*Bruzelia serrata* Sars (1879).

In the following key, *Syrrhoites* species A is placed in several positions with incorrect antecedents in order to show its several points of relationship.

Extraordinary characters in certain diagnoses are placed in separate paragraphs.

Key to the Species of *Syrrhoites*

1. Pleonite 3 dorsally bidentate longitudinally (condition sometimes very weak) 2
   Pleonite 3 not bidentate dorsally 3
2. Palms of gnathopods each with 2 defining spines, epimeron 3 deeply serrate posteriorly .... ***S. serrata***
   Palms of gnathopods each with one spine, epimeron 3 smooth posteriorly except for posteroventral tooth .... ***S. pacifica***
3. Pleonite 5 untoothed dorsally 4
   Pleonite 5 with dorsal tooth 5
4. Dorsal body carina and teeth commencing strongly on pereonite 5, epimeron 3 with medium-sized, acute posteroventral tooth .... ***S. sorpresa***
   Dorsal body carina and teeth commencing strongly on pereonite 6, epimeron 3 quadrate posteroventrally, with minute tooth .... ***S. tenella***
5. Epimeron 2 rounded posteroventrally, unarmed 6
   Epimeron 2 quadrate or bearing tooth posteroventrally 8
6. Epimeron 3 prolonged posteroventrally but lacking distinct tooth .... ***S. walkeri***
   Epimeron 3 with distinct but small posteroventral tooth 7
7. Dorsal body carina and teeth commencing strongly on pereonite 2 .... ***S. lorida***
   Dorsal body carina and teeth commencing strongly on pereonite 6 .... ***S. cohasseta***
8. Peduncle of uropods 1–2 lacking distolateral tooth or extension 9
   Peduncle of uropods 1–2 bearing distolateral tooth or extension 10
9. Telson cleft less than halfway .... ***S. redox***
   Telson cleft more than halfway .... ***Syrrhoites* species A and *S. terceris***
10. Epimeron 3 lacking posteroventral tooth .... ***S. trux***
    Epimeron 3 bearing posteroventral tooth 11

Key to the Species of *Syrrhoites*—Cont.

11. Tooth of epimeron 3 long and serrate ventrally .... ***S. anaticauda***
    Tooth of epimeron 3 short and smooth 12
12. Rostrum very long and deflexed .... ***Syrrhoites*** species A and ***S. pusilla***
    Rostrum of medium length and subhorizontally extended 13
13. Palms of gnathopods each with 2 defining spines 14
    Palms of gnathopods each with one defining spine 15
14. Serrations on epimeron 3 extremely large, article 2 of pereopod 5 evenly rounded posteroventrally and heavily serrate, distolateral process on peduncles of uropods 1–2 strong .... ***S. columbiae***
    Serrations on epimeron 3 small or absent, article 2 of pereopod 5 truncate posteroventrally, posterior serrations small, distolateral process on peduncles of uropods 1–2 weak .... ***S. pantasma***
15. Epimeron 2 with straight posterior margin and quadrate posteroventral corner .... ***S. cu***
    Epimeron 2 with sinuous posterior margin and tooth at posteroventral corner 16
16. Epimeron 3 with straight ventral margin and long posterior margin bearing 2 serrations, article 5 of pereopods 1–2 with few short posterior setae, article 5 of gnathopod 2 scarcely elongate .... ***S. silex***
    Epimeron 3 with beveled ventral margin and very short posterior margin lacking serrations, article 5 of pereopods 1–2 with numerous long posterior setae and spines, article 5 of gnathopod 2 elongate 17
17. Rostrum subhorizontally extended, telson cleft halfway, dorsal teeth on body small, article 2 of pereopod 5 widely expanded ventrally, uropods 1–2 with distolateral tooth on peduncle .... ***S. dulcis***
    Rostrum strongly deflexed, telson cleft more than halfway, dorsal teeth on body very large, article 2 of pereopod 5 narrowing ventrally, uropods 1–2 lacking distolateral tooth on peduncle (see couplets 9 and 12) .... ***Syrrhoites*** species A

Syrrhoites anaticauda K. H. Barnard

Syrrhoites anaticauda K. H. Barnard, 1930: 367–369, figure 37; 1932: 151–152, figure 89.

DIAGNOSIS.—Rostrum not deflexed; spines on gnathopods unknown, article 5 of gnathopod 2 unknown ("gnathopods like *S. serrata*"); article 5 of pereopods 1–2 unknown; article 2 of pereopod 5 expanded, rounded broadly and shallowly posteroventrally, with small bifid or blunt castellations on posteroventral margin; uropods 1–2 with distolateral processes on peduncles; dorsal teeth extending from pereonite 3 to pleonite 2, pleonite 3 with reverted tooth, 4 with large hump, 5 with sharp tooth, pereonites 4–7 and pleonites 1–3 with small lateral nodule; epimeron 1 lacking tooth, epimeron 2 with medium tooth, epimeron 3 with large tooth serrate ventrally, posterior margin convex; telson cleft slightly less than halfway.

Coxae 5–7 with small facial points. See K. H. Barnard (1932) for strong variant.

Antarctica, McMurdo; South Shetlands; 200–342 m.

Syrrhoites cohasseta J. L. Barnard

Syrrhoites cohasseta J. L. Barnard, 1967: 173–176, figure 85.

DIAGNOSIS.—Rostrum deflexed moderately to strongly; gnathopods with one defining spine, article 5 of gnathopod 2 very elongate; article 5 of pereopods 1–2 with long setae; article 2 of pereopod 5 expanded, subtruncate posteroventrally; uropods 1–2 with distolateral process of peduncle but weak on uropod 1; dorsal teeth extending from pereonite 6 to pleonite 3, latter tooth reverted, dorsoposterior margin of pleonite 4 sharply quadrate from lateral view, pleonite 5 with tooth; epimera 1–2 without tooth, 3 with small tooth, posterior margin nearly truncate; telson cleft about halfway.

Baja California, 1205–1720 m.

Syrrhoites columbiae, new species

FIGURES 32–34

DIAGNOSIS.—Rostrum not deflexed; gnathopods with 2 defining spines; article 5 of gnathopod 2 of

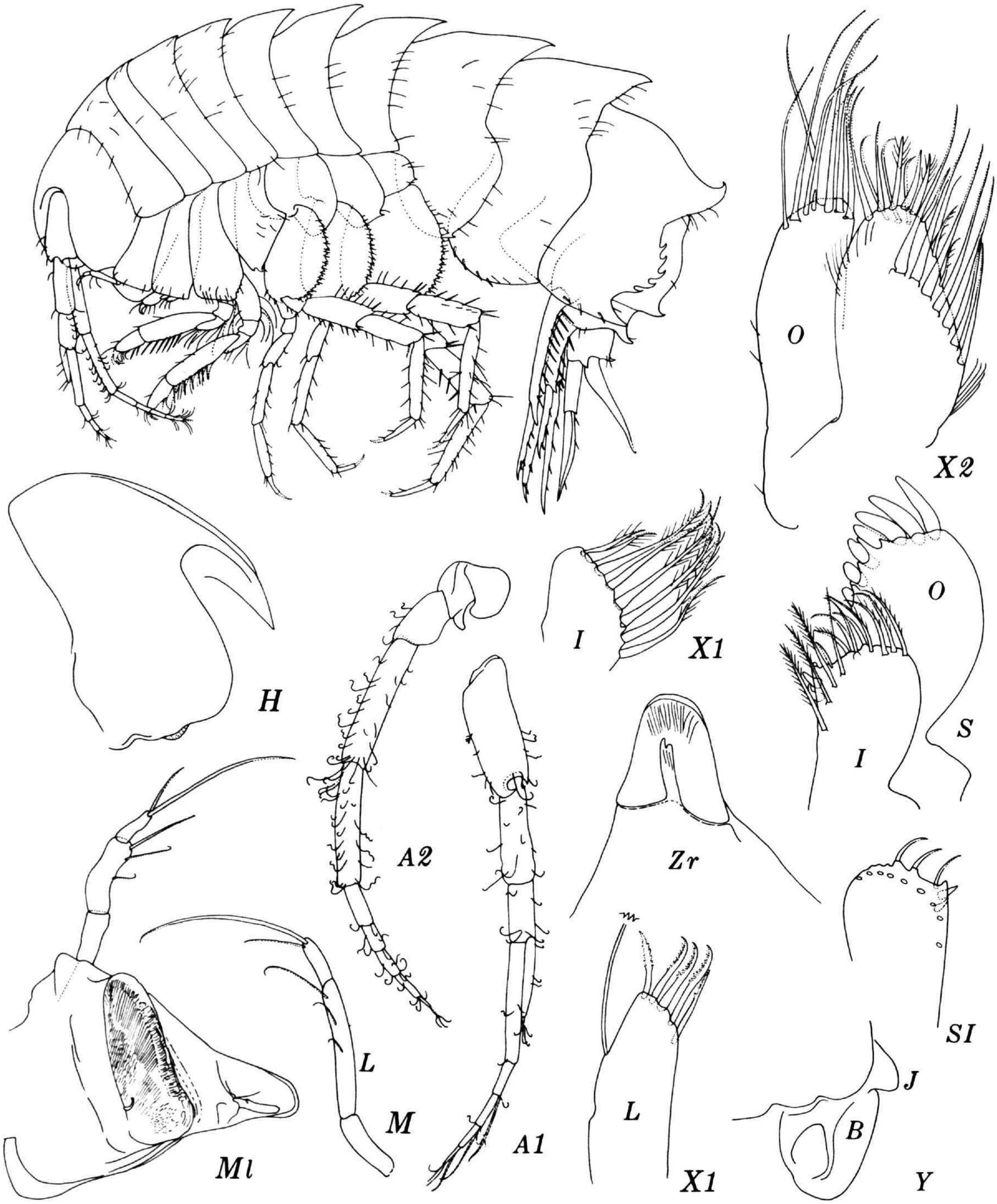

FIGURE 32.—*Syrrhoites columbiae*, new species, holotpye, male, 3.7 mm, Oregon 78; *J* = epistome.

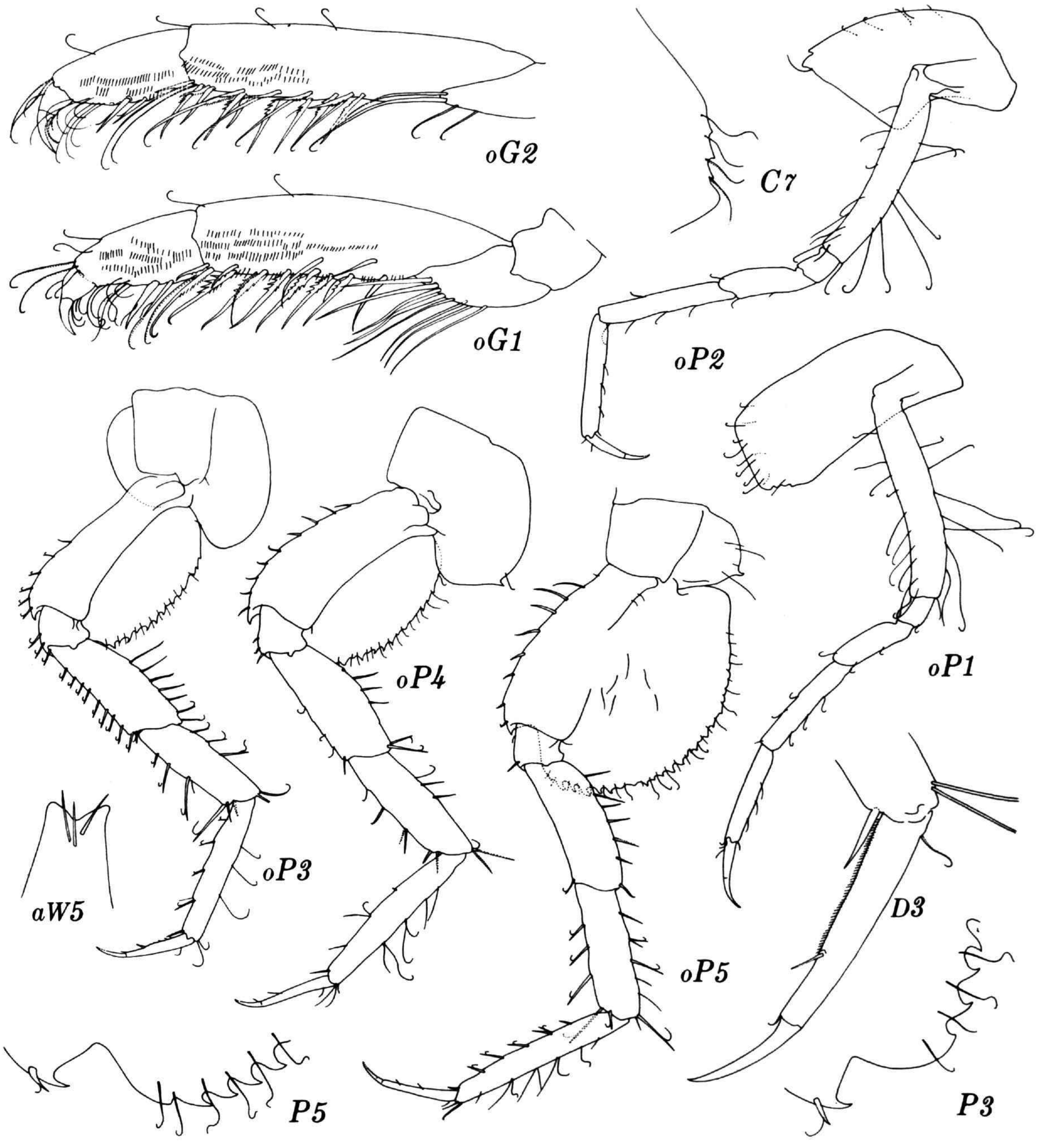

FIGURE 33.—*Syrrhoites columbiae,* new species, holotype, male, 3.7 mm, Oregon 78.

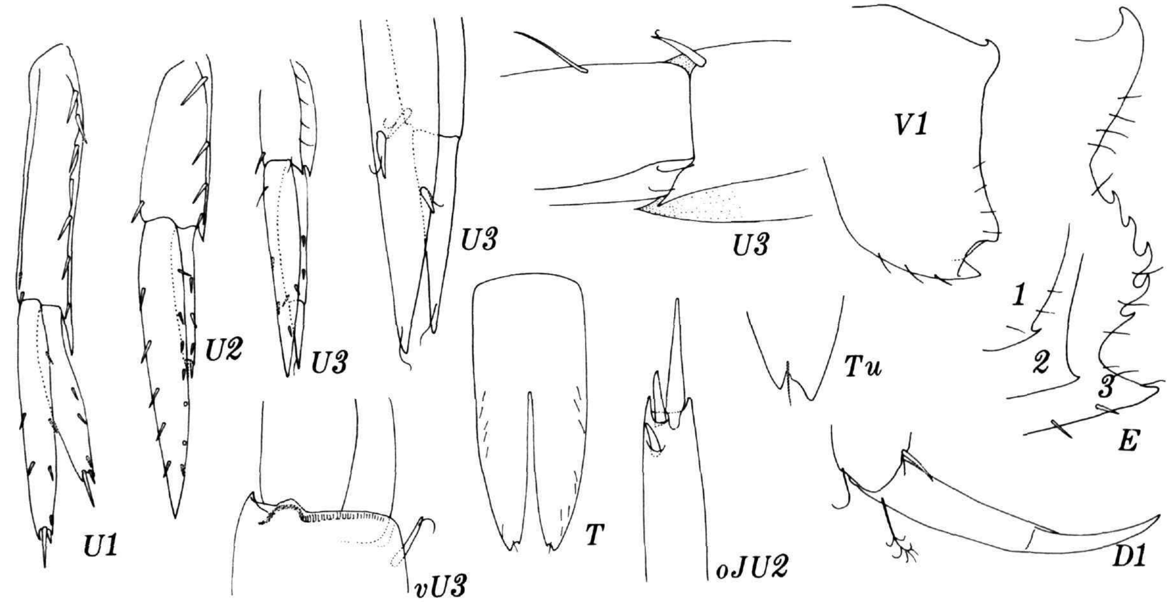

FIGURE 34.—*Syrrhoites columbiae*, new species, holotype, male, 3.7 mm, Oregon 78; *J*=ramus.

medium elongation; article 5 of pereopods 1–2 poorly setose (setae sparse and short); article 2 of pereopod 5 expanded, ovate, rounded posteroventrally, with medium-sized serrations posteroventrally; uropods 1–2 with distolateral process on peduncles; dorsal teeth extending from pereonite 4 to pleonite 2, pleonites 3–5 with reverted tooth; epimera 1–2 with small tooth, 3 with large tooth and posterior bulge with large serrations; telson cleft slightly more than halfway.

DESCRIPTION OF ?YOUNG MALE.—Rostrum of medium length, turned downwards slightly, lateral lobes broadly rounded, convex and scarcely truncate anteriorly (depending on view); body strongly carinate dorsally, carinae separated into teeth commencing with pereonite 4 and increasing in size to pleonite 2, tooth of pleonite 3 slightly smaller and reverted, teeth of pleonites 4–5 small and reverted, pleonite 6 with very small reverted dorsal tooth; tooth of pleonite 5 weakly bifid apically in plane from side to side; tooth of pleonite 4 above insertion of uropod 1 obsolescent; pleonal epimeron 1 with broadly rounded posterior margin and small posteroventral tooth, epimeron 2 with sinuous posterior margin and small posteroventral tooth, epimeron 3 regularly quadratiform, with convex posterior margin deeply serrate, posteroventral sharp tooth large; article 1 of antenna 1 with one strong reverted distomedial cusp; gnathopods slender, almost indistinguishable from each other, but gnathopod 2 slightly the longer, each palm with 2 spines, fifth articles of gnathopods strongly spinose their full lengths; second articles of pereopods 3–5 of medium breadth, densely and deeply serrate, posteroventral corners evenly rounded; outer rami of uropods 1–2 apically spinose; article 2 of outer ramus of uropod 3 of medium length; telson cleft about 60 percent of its length; outer plate of maxilliped with one strong cusp produced between 2 spine-teeth; coxa 3 with serrations on distoposterior margin, coxa 4 with 2 serrations forming anteroventral corner, coxae 6 and 7 each with small posterior cusps.

HOLOTYPE.—USNM 127134, male, 3.7 mm. Unique.

TYPE-LOCALITY.—Oregon 78, off mouth of Columbia River, Oregon, 44°40.1'N, 125°06.7'W, 800 m, 18 June 1964.

RELATIONSHIP.—This species has close affinities with *Syrrhoites serrata* (Sars) (see Sars 1895, pl. 137). The 2 species are grossly similar in dorsal ornamentation except that *S. serrata* has double teeth on some pleonites, the bidentation occurring axially. *Syrrhoites columbiae* has a weakly bidentate tooth of pleonite 5 that occurs in the lateral plane and which presumably does not occur on *S. serrata.* The serrations of coxae 3–4 and the cusps of coxae 6–7 characterize *S. columbiae.* The outer plate of the maxilliped has a fixed cusp not occurring in *S. serrata.*

Oregon, 800 m.

Syrrhoites cu, new species

FIGURES 35–37

DIAGNOSIS.—Rostrum not deflexed; gnathopods with one defining spine, article 5 of gnathopod 2 elongate; article 5 of pereopods 1–2 with about 3 long posterior setae; article 2 of pereopod 5 expanded, ovate, rounded posteroventrally, serrations small; uropods 1–2 with distolateral process on peduncles; dorsal teeth extending from pereonites 5–6 to pleonite 4, tooth on pleonite 5 large, female with weak dorsal serrations on pleonite 3; epimera 1–2 lacking teeth or softly quadrate posteroventrally, epimeron 3 with weak tooth in female, quadrate in male, posterior margin straight, very short, posteriorly serrate in female, epimeron beveled below main tooth; telson cleft slightly more than halfway.

DESCRIPTION OF FEMALE.—Rostrum of medium length, turned downwards slightly, lateral cephalic lobes broadly adz-shaped and convex anteriorly, head short, with ventral notch strongly anteriad; body weakly carinate dorsally, posterodorsal teeth commencing on pereonite 5 and increasing in size to pleonite 3, latter tooth formed as squared-off, serrate carina, tooth of pleonite 4 weak, that of pleonite 5 long; pleonite 4 with weak posterolateral tooth above insertion of uropod 1; pleonal epimeron 1 broadly subquadrate posteroventrally, epimeron 2 with straight posterior margin and quadrate posteroventral corner, epimeron 3 of medium depth, posterior margin straight and minutely serrate, posteroventral corner with small tooth; article 1 of antenna 1 with one strong distal cusp; gnathopods with one major palmar spine, palms essentially indistinct, article 5 of gnathopod 2 strongly setose and not abnormally elongate; article 2 of pereopods 3–5 of medium breadth, posteroventral margins sloping and not distinctly quadrate or produced; outer ramus of uropod 1 with distal spines, of uropod 2 with subdistal constriction and small spine; article 2 of outer ramus of uropod 3 not distinguished clearly; telson cleft about 60 percent of its length.

Maxillae 1–2 are like those figured herein for *Syrrhoites pantasma,* new species. The mandibular palp is also like that of *S. pantasma* except the midmarginal seta (of 5) on article 2 is large and elongate.

MALE.—Differing from female in stronger ventral extension of pleonal epimeron 3 with relatively shorter posterior margin, in dorsad thickening of pleonites 4–5, thinner tooth of pleonite 5 and stronger and more erect dorsal hump of pleonite 6; article 2 of pereopods 3–5 relatively narrower than in female; article 3 of antenna 1 shorter, article 5 of antenna 2 longer, and bases of flagella on antenna 1 conjoint; short article 2 on outer ramus of uropod 3 more clearly distinct in male than in female; apices of telson shown to be bifid because of better preservation in male; rostrum slightly sharper than in female; coxa 6 with rounded, not subquadrate posterior lobe.

HOLOTYPE.—AMNH 14,395, female, 3.2 mm.

TYPE-LOCALITY.—*Vema* 15–38, off Pacific Colombia, 05°00′N, 79°04′W, 3023–3251 m, 15 November 1958.

MATERIAL.—Male and female from the type-locality.

RELATIONSHIP.—This species resembles *Syrrhoites walkeri* Bonnier (1896) in most of its major qualitative characters but differs by several quantitative characters and a few of qualitative significance. The dorsal teeth are generally much larger in *S. walkeri* than in *S. cu,* except for the tooth of pleonite 5. Pleonal epimeron 3 of *S. walkeri* lacks posterior serrations (a possible sexual characteristic) but has a larger epimeral tooth than does *S. cu;* the posterior lobe of coxa 4 is sharper in *S. walkeri* and the major spines on the outer plate of the maxilliped smaller in *S. walkeri* than in *S. cu.*

Syrrhoites tenellus K. H. Barnard (1925) lacks a tooth and serrations on pleonal epimeron 3 and apparently has distinct palms on gnathopods 1–2.

There is a strong resemblance between *S. cu* and *S. trux* J. L. Barnard (1967) but *S. trux* has a distinct but minute tooth on pleonal epimeron 1, a sinuous posterior margin of epimeron 2, a vertically shortened epimeron 3 with the shape of a hatchet and coxa 4 has sharp corners.

Syrrhoites cohasseta J. L. Barnard (1967) differs

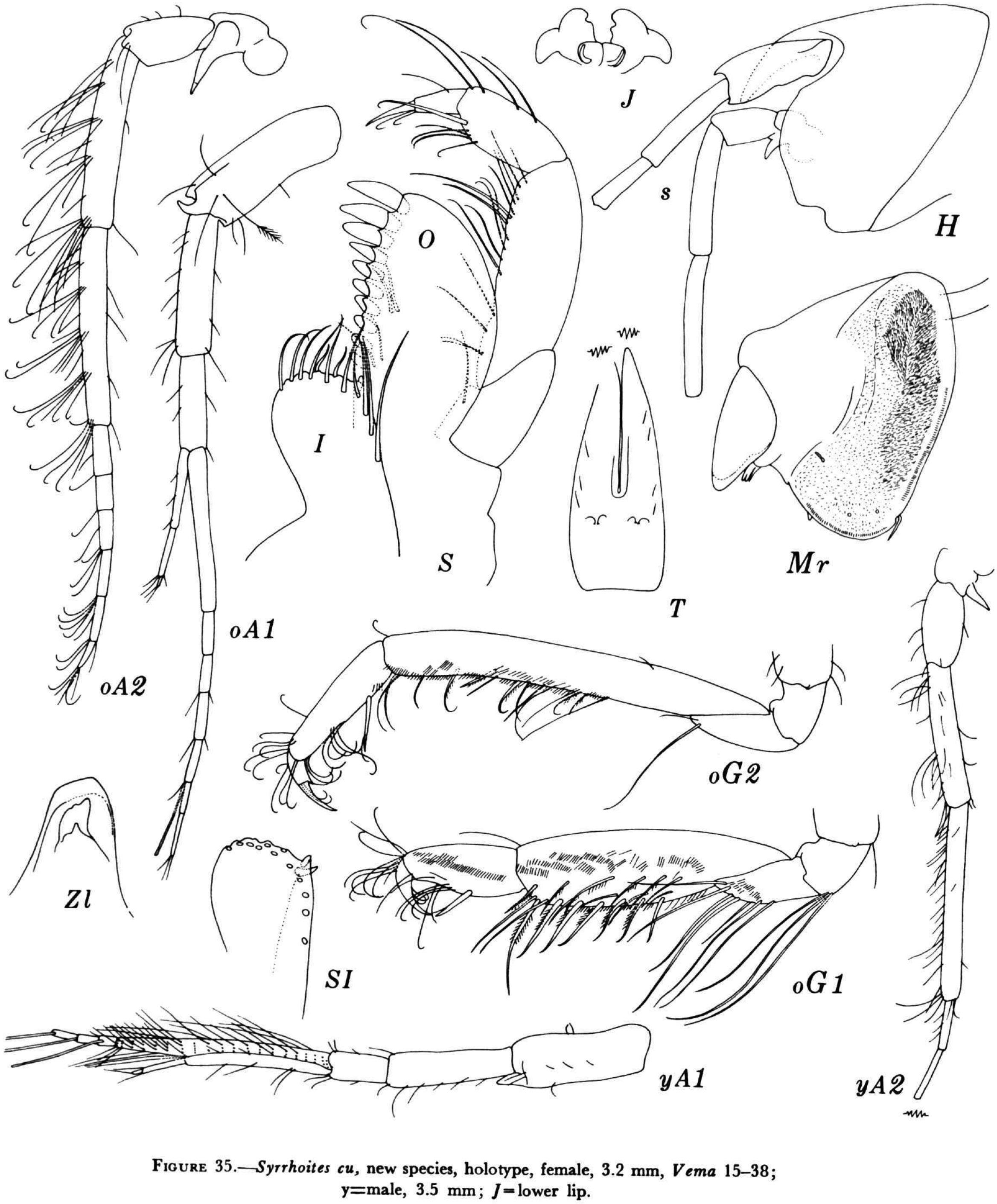

FIGURE 35.—*Syrrhoites cu*, new species, holotype, female, 3.2 mm, *Vema* 15-38; y=male, 3.5 mm; *J*=lower lip.

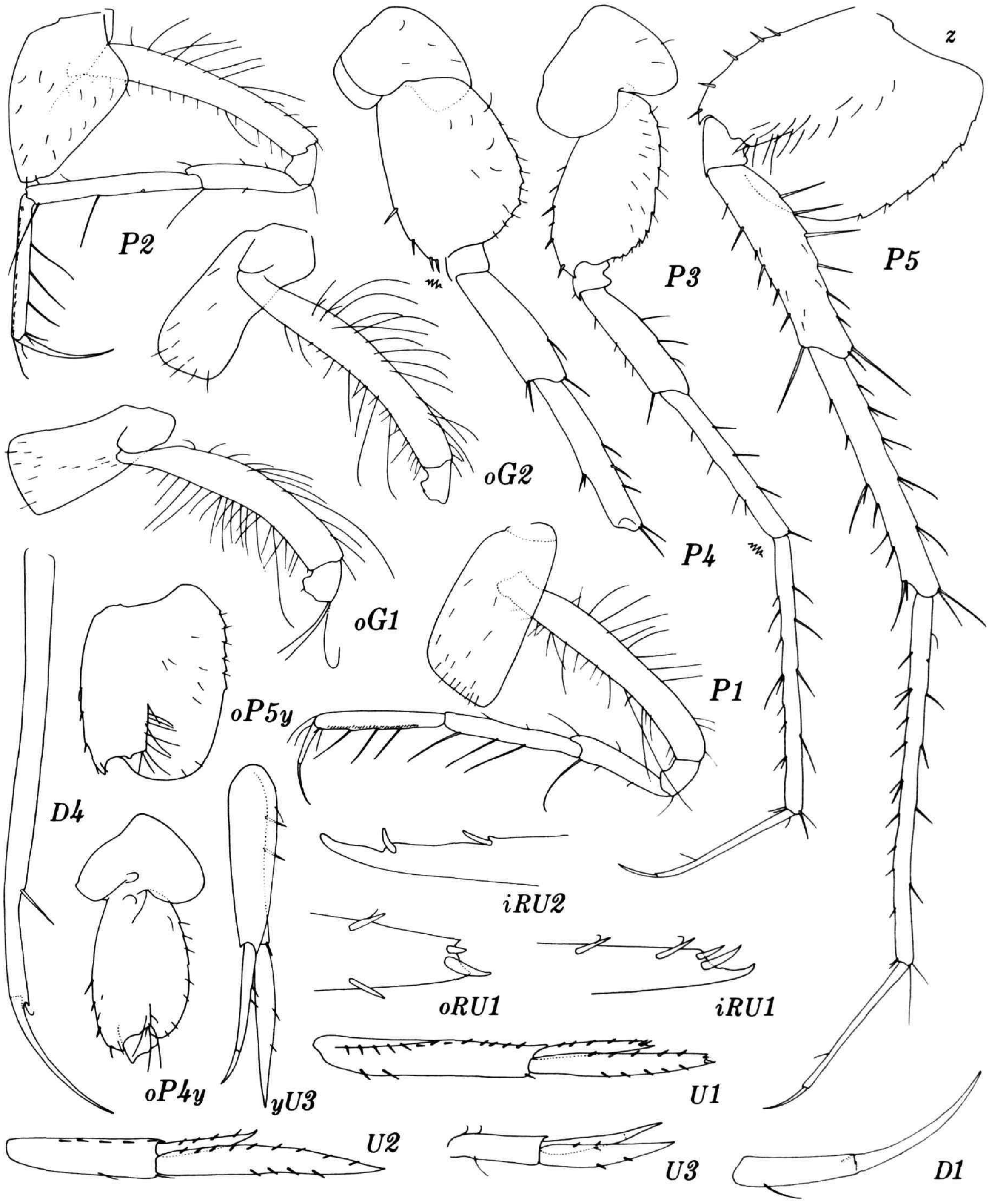

FIGURE 36.—*Syrrhoites cu*, new species, holotype, female, 3.2 mm, *Vema* 15–38; y=male, 3.5 mm; *R*=ramus.

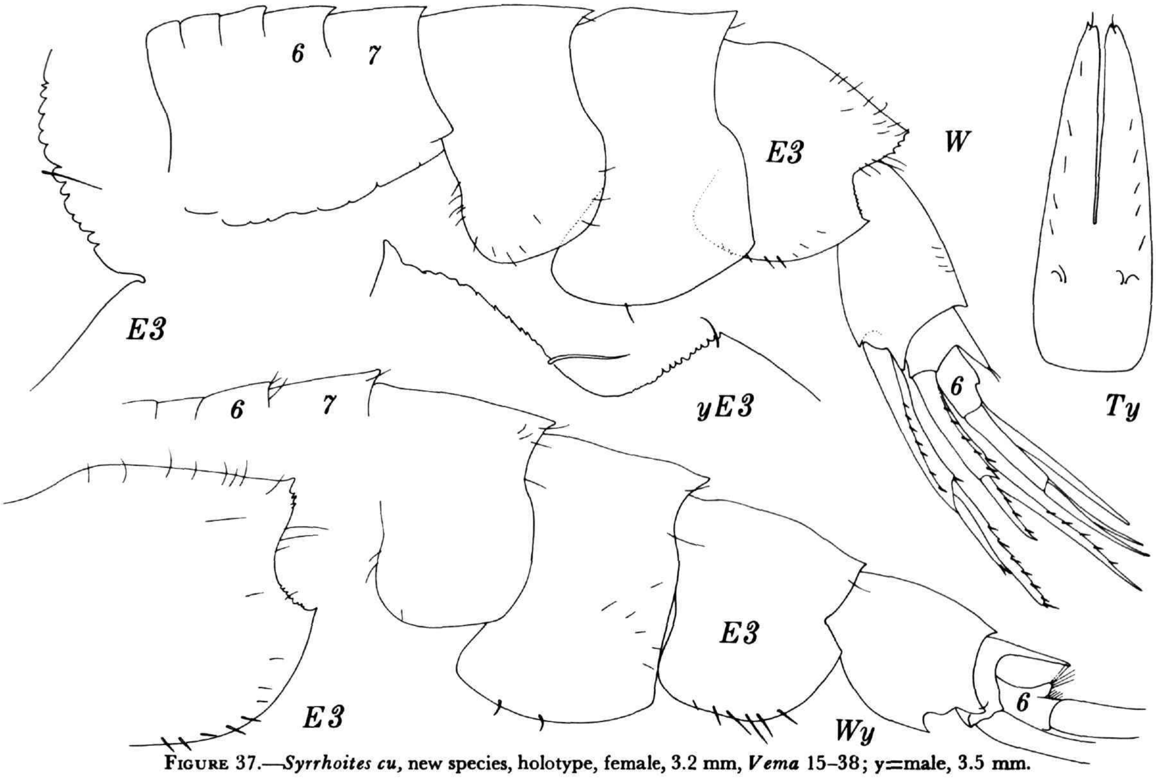

FIGURE 37.—*Syrrhoites cu*, new species, holotype, female, 3.2 mm, *Vema* 15–38; y=male, 3.5 mm.

from *S. cu* in the absence of distal spines on the outer ramus of uropod, 1, the very elongate article 5 of gnathopod 2 lacking posterior setae, the quadrate posteroventral corner of article 2 on pereopod 5 in the female.

Syrrhoites silex J. L. Barnard (1967) is very similar to the species at hand but differs primarily in the presence of a large posteroventral sinuosity and tooth on pleonal epimeron 2; *S. silex* also has distinctly articulate distal spines on the outer ramus of uropod 2 and a narrow article 5 of pereopod 5 with subconically produced posteroventral corner.

Pacific Colombia, 3023–3251 m.

Syrrhoites dulcis J. L. Barnard

Syrrhoites dulcis J. L. Barnard, 1967: 176–178, figure 86.

DIAGNOSIS.—Rostrum not deflexed; gnathopods with one defining spine, article 5 of gnathopod 2 elongate; article 5 of pereopods 1–2 with long spine-setae; article 2 of pereopod 5 expanded and ventrally truncate; uropods 1–2 with distolateral process on peduncles; dorsal teeth extending from pereonite 3 to pleonite 5, tooth of pleonite 3 slightly reverted; epimeron 1 lacking tooth, epimera 2–3 with small tooth, posterior margin of epimeron 3 short, nearly straight, epimeron below tooth beveled; telson cleft halfway.

Baja California, 1095–1205 m.

Syrrhoites lorida (J. L. Barnard)

Kindia lorida J. L. Barnard, 1962a: 57, figure 49.

DIAGNOSIS.—Rostrum deflexed; gnathopods with one defining spine; following parts unknown: gnathopod 2, pereopods 1–2, pereopod 5, uropods 1–2; dorsal teeth extending from pereonite 2 to pleonite 5 except tooth on pleonite 4 damaged and possibly very small; epimera 1–2 lacking tooth, 3 with medium sharp tooth and convex posterior margin; telson cleft about five-eighths its length.

South Africa, 3045 m.

Syrrhoites pacifica Nagata

Syrrhoites pacificus Nagata, 1965: 171–174, figure 16.

DIAGNOSIS.—Rostrum not deflexed; gnathopods with one defining spine, article 5 of gnathopod 2 elongate; article 5 of pereopods 1–2 with long setae; article 2 of pereopod 5 expanded and posteroventrally rounded; uropods 1–2 with distolateral process on peduncles, that on uropod 2 weak; dorsal teeth in female extending from pereonite 2 to pleonite 3, obsolescent on pleonites 4–5, in male from pereonite 7 to pleonite 5 but weak on pleonite 4, pleonite 3 in both sexes with tooth forming crest and on posterior segments generally dorsal configuration saddle-shaped, thus with hump in middle of segment dorsally; epimera 1–2 unknown, 3 with sharply extended acute posteroventral corner, and concave short posterior margin; telson cleft halfway.

Japan, 20–100 m.

Syrrhoites pantasma, new species

FIGURES 38, 39

DIAGNOSIS.—Rostrum especially small and moderately deflexed; gnathopods with 2 defining spines, article 5 of gnathopod 2 elongate; article 5 of pereopods 1–2 with posterior setae short to medium in length; article 2 of pereopod 5 widely expanded and ventrally truncate; uropods 1–2 with weak distolateral process on peduncles; dorsal teeth extending from pereonite 5 to pleonite 5; tooth on pleonite 3 slightly reverted, tooth on pleonites 4–5 of medium size; epimeron 1 lacking tooth, epimeron 2 with medium tooth, 3 with small tooth, posterior margin weak to strongly convex, serrate in male; telson cleft about five-eighths its length.

DESCRIPTION OF FEMALE.—Rostrum of medium length, lateral cephalic lobes narrowly truncate anteriorly; body strongly carinate dorsally, pereonites 5–7 and pleonites 1–6 all with strong posterodorsal teeth, teeth anterior to urosome largest, tooth of pleonite 3 slightly reverted; pleonite 4 with strong subacute lateral tooth above insertion of uropod 1; pleonal epimeron 1 broadly rounded posteroventrally, epimeron 2 with posterior margin swept into medium-sized tooth, epimeron 3 deep, with strongly convex posterior margin and minute posteroventral tooth; article 1 of antenna 1 with one strong distolateral cusp, a small distomedial cusp; article 2 of pereopods 3–5 very broad, articles 4–5 slender, highly elongate in comparison to *Syrrhoites sorpresa* (J. L. Barnard); outer rami of uropods 1–2 distally spinose; outer ramus of uropod 3 with article 2 almost 30 percent as long as article 1, telson cleft slightly more than halfway.

?MALE, 3.0 mm: Bearing spined penial processes on seventh pereonal sternite; differing from female in larger tooth of pleonal epimeron 3 with small serrations on posterior margin above tooth; all other parts figured and described for female similar, including antenna 1, but dorsal ornamentation of pleonites 5 and 6 damaged and not analyzed; head illustrated without need for restoration.

HOLOTYPE.—AMNH 14,399, female, 4.0 mm.

TYPE-LOCALITY.—*Vema* 15–62, off Ecuador, 01°30′ S, 82°19′W, 1363–1369 m, 3 December 1958.

MATERIAL.—*Vema* 15–59 (1 male), 15–62 (holotype).

RELATIONSHIP.—This species has approximately the same dorsal configuration as *Syrrhoites sorpresa* (J. L. Barnard, 1962a, as *Kindia sorpresa*) from Cape Basin, South Africa. The unique specimen of that species was badly damaged and several characters are unknown except for a specimen reported herein believed to be identical with *S. sorpresa:* the condition of the uropods, the shape of pleonal epimeron 2, the dorsal margins of urosomites 2 and 3. Like the specimen at hand and so many deep-sea synopiid specimens the rostrum is forced upward and damaged. The rostrum is restored in the drawings of *S. pantasma*, new species. Nevertheless, the specimen at hand is in good condition and differs from *S. sorpresa* in the following characters: (1) the deeper pleonal epimeron 3, with long, convex posterior margin and small, nearly obsolete posteroventral tooth (in *S. sorpresa* the posterior margin is short, concave, and the tooth is large and dominates the epimeron); (2) the presence of 2 palmar defining spines on gnathopods 1 and 2 (1 spine in *S. sorpresa*); (3) the much longer articles 5 and 6 of pereopods 3 and 4.

If the specimen of *S. sorpresa* reported herein is correctly identified then *S. pantasma* differs from *S. sorpresa* in the presence of a tooth on pleonal epimeron 2, a vestigial cusp on the peduncle of uropod 1, a cusp on coxa 3 and a strongly setose gnathopod 2 among other more minor characters.

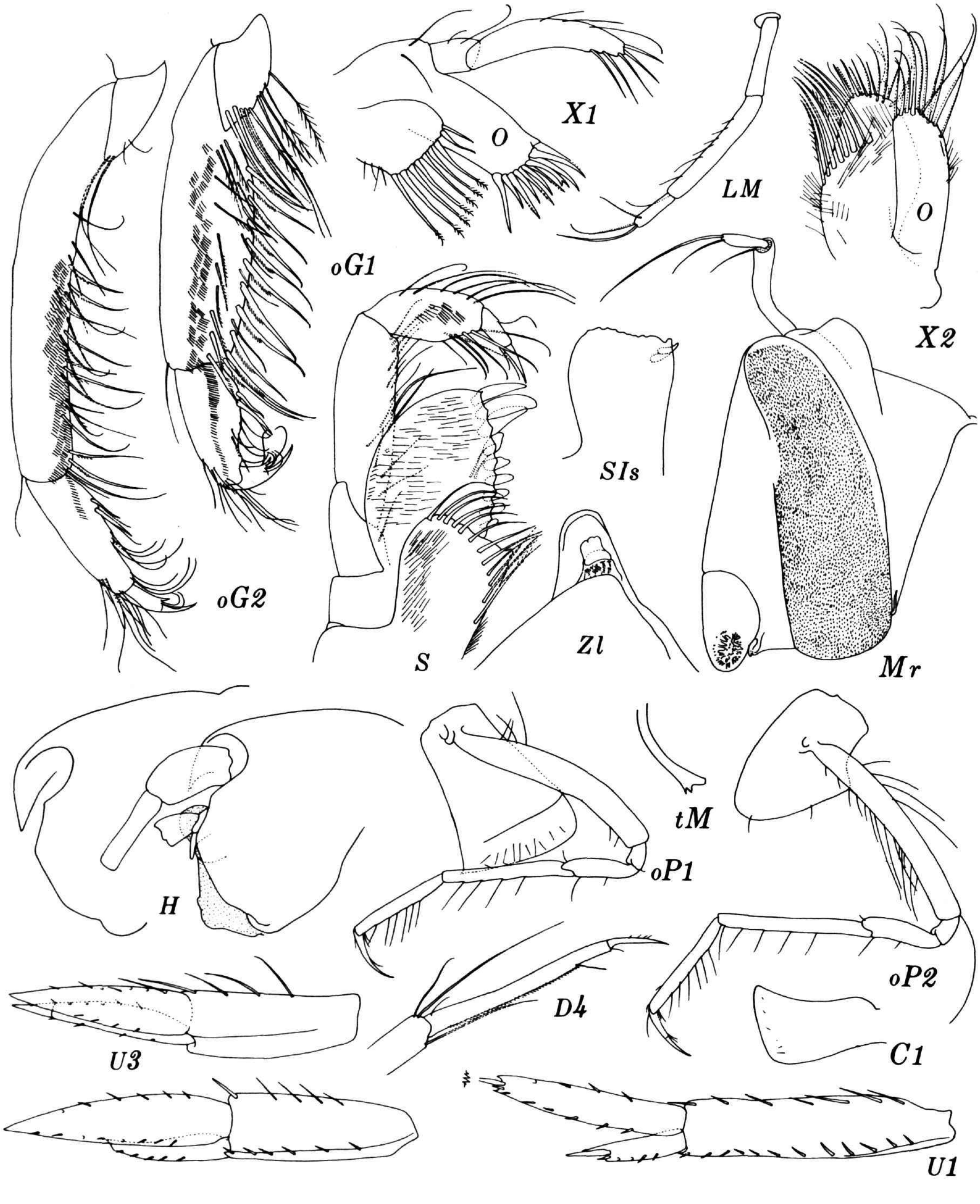

FIGURE 38.—*Syrrhoites pantasma,* new species, holotype, female, 4.0 mm, *Vema* 15–62.

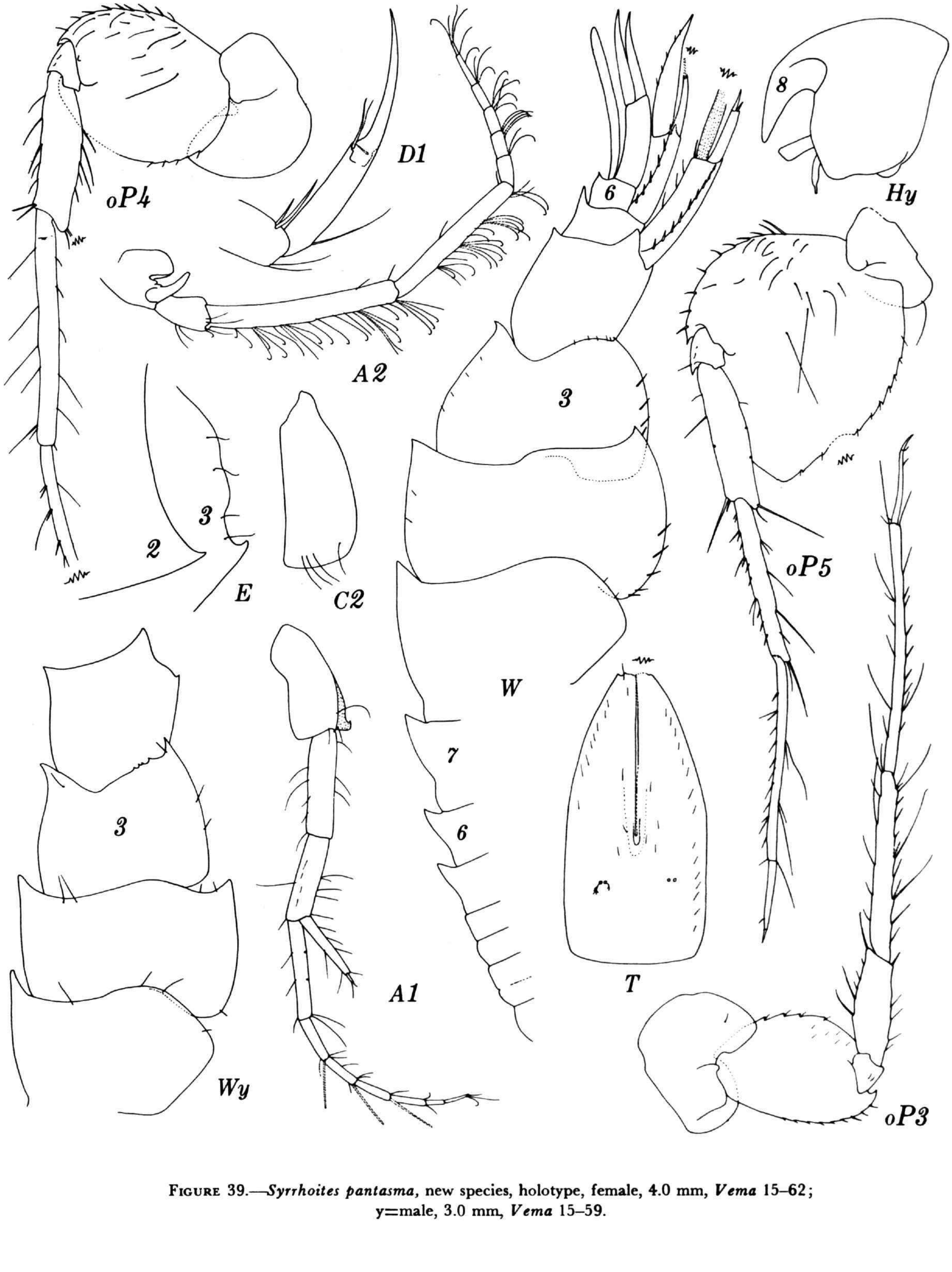

FIGURE 39.—*Syrrhoites pantasma*, new species, holotype, female, 4.0 mm, *Vema* 15–62; y=male, 3.0 mm, *Vema* 15–59.

Syrrhoites pantasma has a character which is unique, so far as is known, among members of *Syrrhoites.* The anteroventral corner of coxa 3 has a small cusp, typical of many members of *Austrosyrrhoe, Bruzelia* and *Latacunga.*

Syrrhoites pantasma resembles *S. silex* J. L. Barnard (1967) very strongly but differs in the presence of a cusp on coxa 3, a very enlarged article 2 of pereopod 5, a vestigial cusp on peduncle of uropod 1 and a relatively elongate inner ramus of uropod 1 among other more minor characters.

Off Pacific Panama and Ecuador, 1369–2853 m.

Syrrhoites pusilla Enequist

Syrrhoites pusillus Enequist, 1950: 338–340, figures 57–60.

DIAGNOSIS.—Rostrum deflexed; gnathopods with one defining spine, article 5 of gnathopod 2 elongate; article 5 of pereopods 1–2 with long spines; article 2 of pereopod 5 expanded and posteroventrally rounded; uropods 1–2 with weak distolateral process on peduncles; dorsal teeth extending from pereonite 5 to pleonite 5 but tooth on pereonite 4 obsolescent, large on pereonite 5, reverted on pereonite 3; epimeron 1 lacking tooth, epimeron 2 with small tooth, 3 with small, sharp upturned tooth, posterior margin short, slightly concave; telson cleft two-thirds its length.

Skagerrak.

Syrrhoites redox J. L. Barnard

Syrrhoites redox J. L. Barnard, 1967: 178–183, figures 87, 88.

DIAGNOSIS.—Rostrum not deflexed; gnathopods with one defining spine, article 5 of gnathopod 2 elongate; article 5 of pereopods 1–2 lacking long spines; article 2 of pereopod 5 expanded and ventrally truncate; uropods 1–2 with no peduncular processes; small dorsal teeth extending from pereonite 5 to pleonite 2, tooth of pleonites 3 and 5 large, tooth of pleonite 4 obsolescent; epimeron 1 lacking tooth, epimeron 2 with small tooth, epimeron 3 with sharp posteroventral corner, posterior margin short and convex; telson cleft about one-third its length.

Baja California, 1720–1748 m.

Syrrhoites serrata (Sars)

Bruzelia serrata Sars, 1879: 447.
Syrrhoites serratus.—Sars, 1895: 392–394, pl. 137.—Gurjanova, 1951: 593, figure 398.

DIAGNOSIS.—Rostrum slightly deflexed; gnathopods with 2 defining spines, article 5 of gnathopod 2 not elongate; article 5 of pereopods 1–2 with short setae; article 2 of pereopod 5 expanded and posteroventrally rounded; uropod 1 with strong peduncular process, uropod 2 with weak process; dorsal teeth extending from pereonite 5 to pleonite 5, teeth paired in tandem on each segment producing dorsal saddle crest especially on pleonites 1–4; epimeron 1 lacking tooth, epimeron 2 with small tooth, epimeron 3 with medium sharp tooth, posterior margin convex and heavily serrate; telson cleft about two-thirds its length.

Arctic boreal of North Atlantic, bathyal.

Syrrhoites silex J. L. Barnard

Syrrhoites silex J. L. Barnard, 1967: 183–185, figure 89.

DIAGNOSIS.—Rostrum not deflexed; gnathopods with one defining spine, article 5 of gnathopod 2 slightly elongate; article 5 of pereopods 1–2 with 3 setae of medium length; article 2 of pereopod 5 slightly expanded and ventrally truncate; uropods 1–2 with distolateral process on peduncles; dorsal teeth extending from pereonite 5 to pleonite 5, tooth on pleonite 3 slightly reverted; epimeron 1 lacking tooth, epimera 2 and 3 with small tooth, epimeron 3 with 2 serrations above main tooth; telson cleft two-thirds its length.

Baja California, 1095–1205 m.

Syrrhoites sorpresa (J. L. Barnard)

FIGURES 40, 41

Kindia sorpresa J. L. Barnard, 1962a: 57, figure 48.

DIAGNOSIS.—Rostrum not deflexed; gnathopods with one defining spine, article 5 of gnathopod 2 elongate; article 5 of pereopods 1–2 with long posterior setae; article 2 of pereopod 5 expanded and truncate ventrally; uropods 1–2 probably with peduncular processes; dorsal teeth extending from pereonite 5 to pleonite 3, tooth small on pleonite 4, probably also

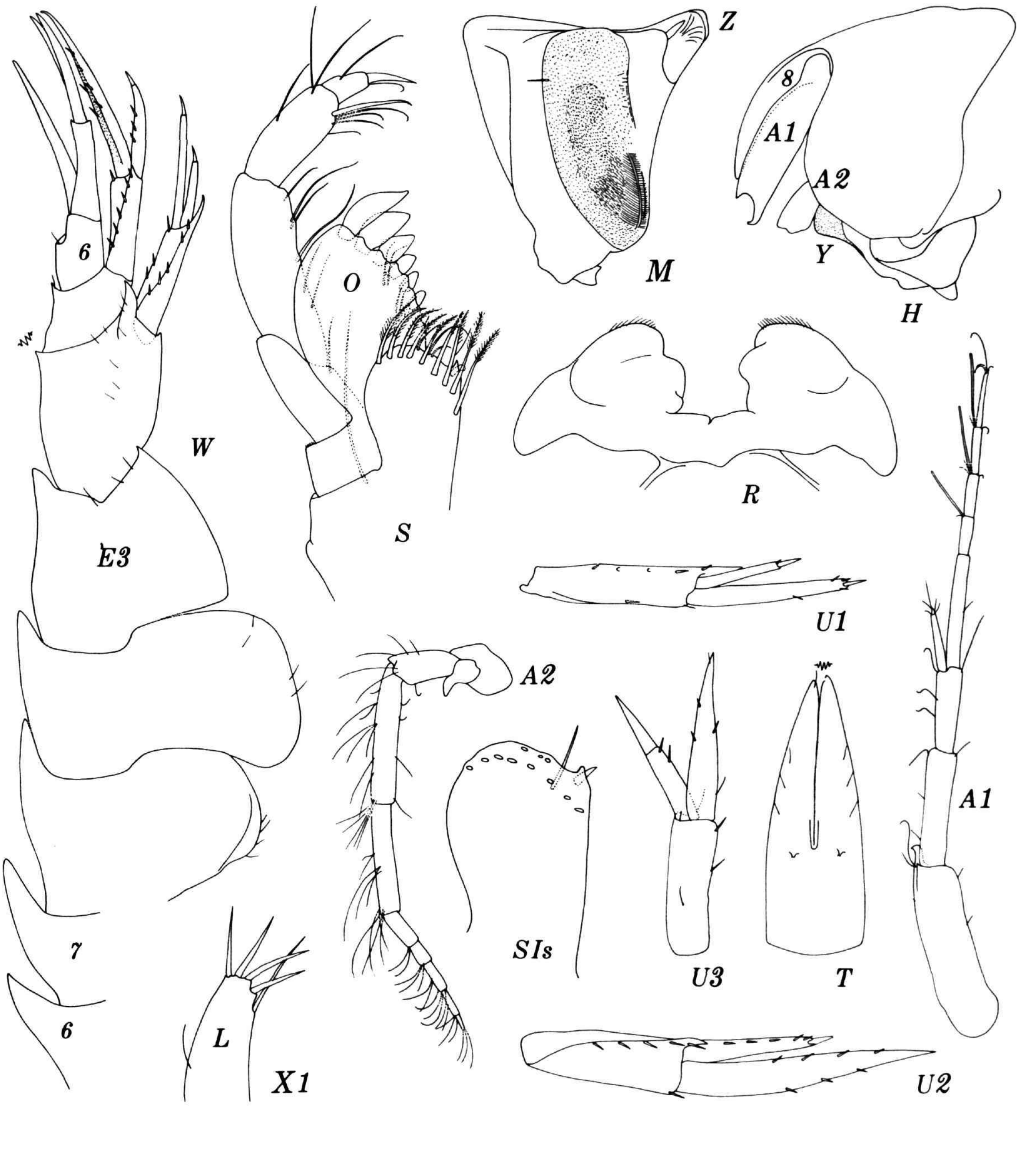

FIGURE 40.—*Syrrhoites sorpresa* (J. L. Barnard), male, 3.8 mm, *Eltanin* 257.

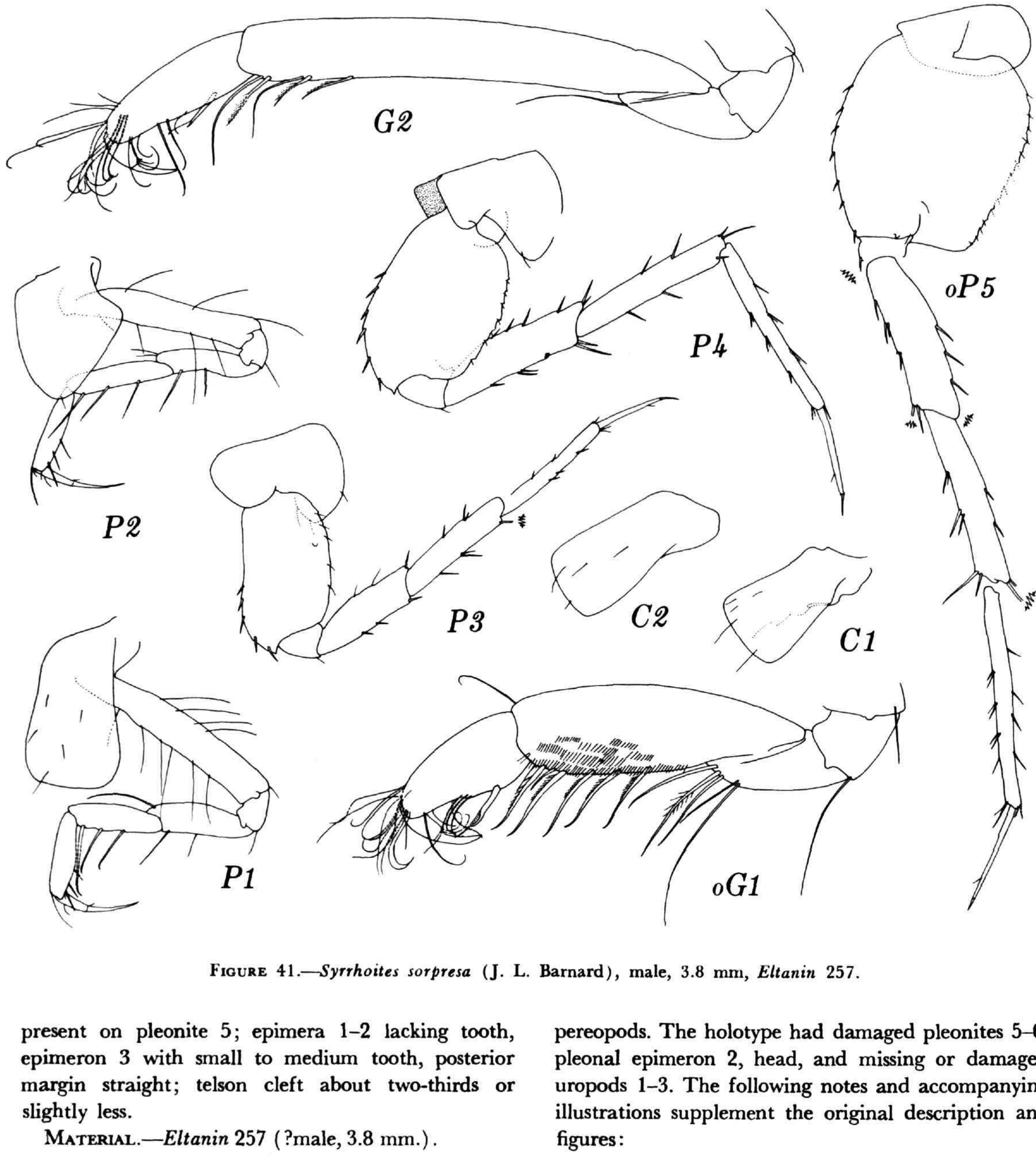

FIGURE 41.—*Syrrhoites sorpresa* (J. L. Barnard), male, 3.8 mm, *Eltanin* 257.

present on pleonite 5; epimera 1–2 lacking tooth, epimeron 3 with small to medium tooth, posterior margin straight; telson cleft about two-thirds or slightly less.

MATERIAL.—*Eltanin* 257 (?male, 3.8 mm.).

REMARKS.—The individual in this collection is in much better condition than was the holotype (the unique representative of the species at the time of its erection). The present identification is based on congruence in the dorsal teeth of pereonites and pleonites 1–4, pleonal epimera, coxae, head, gnathopods and pereopods. The holotype had damaged pleonites 5–6, pleonal epimeron 2, head, and missing or damaged uropods 1–3. The following notes and accompanying illustrations supplement the original description and figures:

Pleonite 5 with small dorsal tooth, pleonite 6 slightly elevated posterodorsally but untoothed (tooth of pleonite 4 dorsally damaged); pleonal epimeron 2 with evenly and slightly convex posterior margin and smoothly rounded posteroventral corner (tooth of epimeron 3 damaged); posterolateral, suprauropodal tooth of pleonite 4 very long and sharp; gnathopods essentially simple (thus resulting in description of now synonymous genus *Kindia*), each definitely bearing only one major posterior spine; coxa 3 definitely with rounded anteroventral corner; pereopods 1–2 with posterior setae but no comb on article 6; serrations on posterior margin of article 2 on pereopod 5 extending full length; peduncle of uropod 1 with long distolateral process, outer ramus slightly more than half as long as inner, apices of both rami and outer ramus of uropod 1 with large distal spine and subsidiary spines; outer ramus of uropod 2 slightly more than half as long as inner ramus, latter narrow, lanceolate, distally simple, peduncle with small distolateral process; outer ramus of uropod 3 biarticulate, article 2 more than two-thirds as long as article 1; left and right mandibles similar but right molar bearing marginal spine, absent on left molar. Other details of mouthparts and appendages shown in figures.

There may be subspecific differences in the two individuals of this species now known, but if so they must be confined to pleonites 5–6 and the uropods or on article 1 of antenna 1 (which perhaps was inadequately observed in the holotype).

Maxillae are not illustrated herein, except for the apex of the palp on maxilla 1; maxillae otherwise resemble those illustrated for *Syrrhoites pantasma*, new species.

Record.—Drake Passage, 3867–4086 m.

Drake Passage and Cape Basin, South Africa, 1861–3867 m.

Syrrhoites tenella K. H. Barnard

Syrrhoites tenellus K. H. Barnard, 1925: 353–354.

Diagnosis.—Rostrum slightly deflexed; gnathopods "like *serratus*," thus gnathopods probably with one defining spine, article 5 of gnathopod 2 not elongate; pereopods 1–2 "like *walkeri*," thus probably lacking long spines on article 5; pereopod 5 "like *walkeri*," thus article 2 probably expanded and posteroventrally rounded; uropods 1–2 "like *serratus*," thus probably with processes on peduncles but weak on uropod 2; dorsal carina extending from pereonites 6 or 7 to pleonite 4, not extended as teeth, posterodorsal corners of segments extended quadrately; epimeron 1 lacking tooth, epimera 2–3 quadrate and with slight point at posteroventral corner; telson cleft halfway.

South Africa, 700 fms.

Syrrhoites terceris J. L. Barnard

Syrrhoites terceris J. L. Barnard, 1964: 31–32, figure 25.

Diagnosis.—Rostrum not deflexed; gnathopods with one defining spine, article 5 of gnathopod 2 elongate; article 5 of pereopods 1–2 with setae of medium length; article 2 of pereopod 5 expanded, ventrally subtruncate; uropods 1–2 lacking peduncular processes; dorsal teeth extending from pereonite 5 to pleonite 2, teeth obsolescent on pleonites 3–4 and small on pleonite 5; epimeron 1 lacking tooth, epimeron 2 with medium tooth, epimeron 3 with sharply quadrate posteroventral corner, posterior margin finely serrate; telson cleft two-thirds its length.

East tropical Pacific, 1609–1746 m.

Syrrhoites trux J. L. Barnard

Syrrhoites trux J. L. Barnard, 1967: 185–188, figures 90, 91.

Diagnosis.—Rostrum not deflexed; gnathopods with one defining spine, article 5 of gnathopod 2 scarcely elongate; article 5 of pereopods 1–2 with numerous short setae; article 2 of pereopod 5 expanded and broadly rounded posteroventrally; uropods 1–2 with distolateral process on peduncles; pereonite 7 with weak tooth, pleonites 1–2 with quadrate posterodorsal elevations, pleonite 3 with sharp tooth, pleonites 4–5 with small tooth erect on pleonite 4; epimeron 1 with small tooth, epimera 2–3 with quadrate posteroventral corner, epimeron 3 with short and straight posterior margin; telson cleft halfway.

Baja California, 842–1095 m.

Syrrhoites walkeri Bonnier

Syrrhoites Walkeri Bonnier, 1896: 647–650, pl. 38, figure 4.

Diagnosis.—Rostrum not deflexed; gnathopods with one defining spine, article 5 of gnathopod 2 elongate; article 5 of pereopods 1–2 lacking long setae; article 2 of pereopod 5 expanded and posteroventrally rounded; uropod 1 with peducular process, uropod 2 apparently without; dorsal teeth extending from pereonite 6 to pleonite 5; epimera 1–2 lacking tooth, epimeron 3 extended as sharp posteroventral protusion, posterior margin slightly concave; telson cleft halfway.

Northeast Atlantic, 950 m.

Syrrhoites species A

FIGURES 42, 43

DIAGNOSIS.—Rostrum moderately deflexed; gnathopods with one defining spine, article 5 of gnathopod 2 elongate; article 5 of pereopods 1–2 with long spines; article 2 of pereopod 5 narrowly expanded and subtruncate posteroventrally; uropod 2 lacking peduncular process, uropod 1 unknown; dorsal teeth extending from pereonite 5 to pleonite 3, tooth absent on pleonite 4, small (female) to medium (male) tooth on pleonite 5; epimeron 1 lacking tooth, subquadrate posteroventrally, epimera 2–3 with medium tooth, posterior margin of epimeron 3 straight; telson cleft two-thirds its length.

MALE WITH SPECIAL CHARACTER.—Sternal teeth present on pereonites 4–6.

MATERIAL.—*Eltanin* 75 (2).

REMARKS.—These specimens, a male and a female, though obviously distinct from any species heretofore described, are not named because they are moderately damaged; they lack uropod 1, the distal spines on the outer ramus of uropod 2 and pereopods 3–5 are badly damaged in the male so that the posterior margins of the second articles are unclear; the setae and spines of many of the appendages, especially antennae and pereopods 3–5, are worn off as if they had been sandblasted. The most remarkable aspect of the male is the presence of 3 large sternal hooks on the pereon. Unfortunately this discovery came late in the current study and although previously analyzed specimens of other species were reexamined in search for these hooks, several specimens which might have had them were so damaged by dissection and analysis that they were not clearly useful. The sternites of the pereon are extremely weak and fragile in many deep-sea synopiids. These hooks may be an excellent specific character of some males of the group and should be noted when possible.

DESCRIPTION.—Rostrum very long, lateral cephalic lobes weakly rounded anteriorly; body strongly carinate, dorsal teeth occurring on pereonites 5–7, pleonites 1–3 and pleonite 4, teeth of pereonites 5–7 and pleonites 1–3 largest, tooth of pleonite 3 slightly reverted; pleonite 4 with strong subacute tooth (broken in male) above insertion of uropod 1; pleonal epimeron 1 broadly rounded posteroventrally, epimeron 2 with posterior margin swept into medium-sized tooth (presumed in male, *see* relationship), epimeron 3 of medium depth, with straight posterior margin and weak blunt (male) or sharp (female) posteroventral tooth ("sandblasted"); article 2 of pereopods 4–5 moderately broad, of pereopod 3 apparently moderately slender, articles 4 and 5 not especially elongate (where known, see figures); outer ramus of uropod 2 with sockets indicating presence of distal spine(s); outer ramus of uropod 3 with very elongate article 2, about equal in length to article 1; telson cleft about two-thirds of its length; male and female differing only in presence of sternal hooks in male and brood lamellae in female.

Mouthparts like those of *S. sorpresa* figured herein except as follows; both mandibles with spine on molar, right lacinia mobilis similar and simple, left lacinia mobilis with weakly developed bifid or trifid fused process adjacent to its base; lower lip not analyzed owing to damage; first maxillary palp with similar positions of distal setae; maxilliped similar but terminal spine of outer plate much more slender and inner plate with 2 medioventral coupling spines instead of one.

RELATIONSHIP.—This species has a remarkable resemblance to *S. sorpresa* (J. L. Barnard, 1962a, and see herein) but pleonal epimeron 2 (though damaged in male) has a distinct, medium-sized posteroventral tooth; the apex of the tooth is broken but the internal lines of the succeeding instar demonstrate its form in the male. It is well developed in the female. The lateral peduncular cusp of *Syrrhoites* species A is not as strong on uropod 2 as it is in *S. sorpresa,* coxa 4 is more elongate and coxae 5 and 6 have strongly truncate posteroventral lobes.

Apparently *Syrrhoites* species A differs from the following species in those characters stated: from *S. anaticauda* K. H. Barnard in the presence of only one strong spine on the gnathopodal palms, in the absence of serrations on pleonal epimeron 3 (possibly a sexually dimorphic character) and the absence of dorsal teeth on pereonites 3 and 4; from *S. redox* J. L. Barnard in the larger segmental teeth, the much deeper cleft of the telson, the poorly setose gnathopod 2; from its sympatriot *S. pantasma,* new species, in the presence of only one spine on the gnathopodal

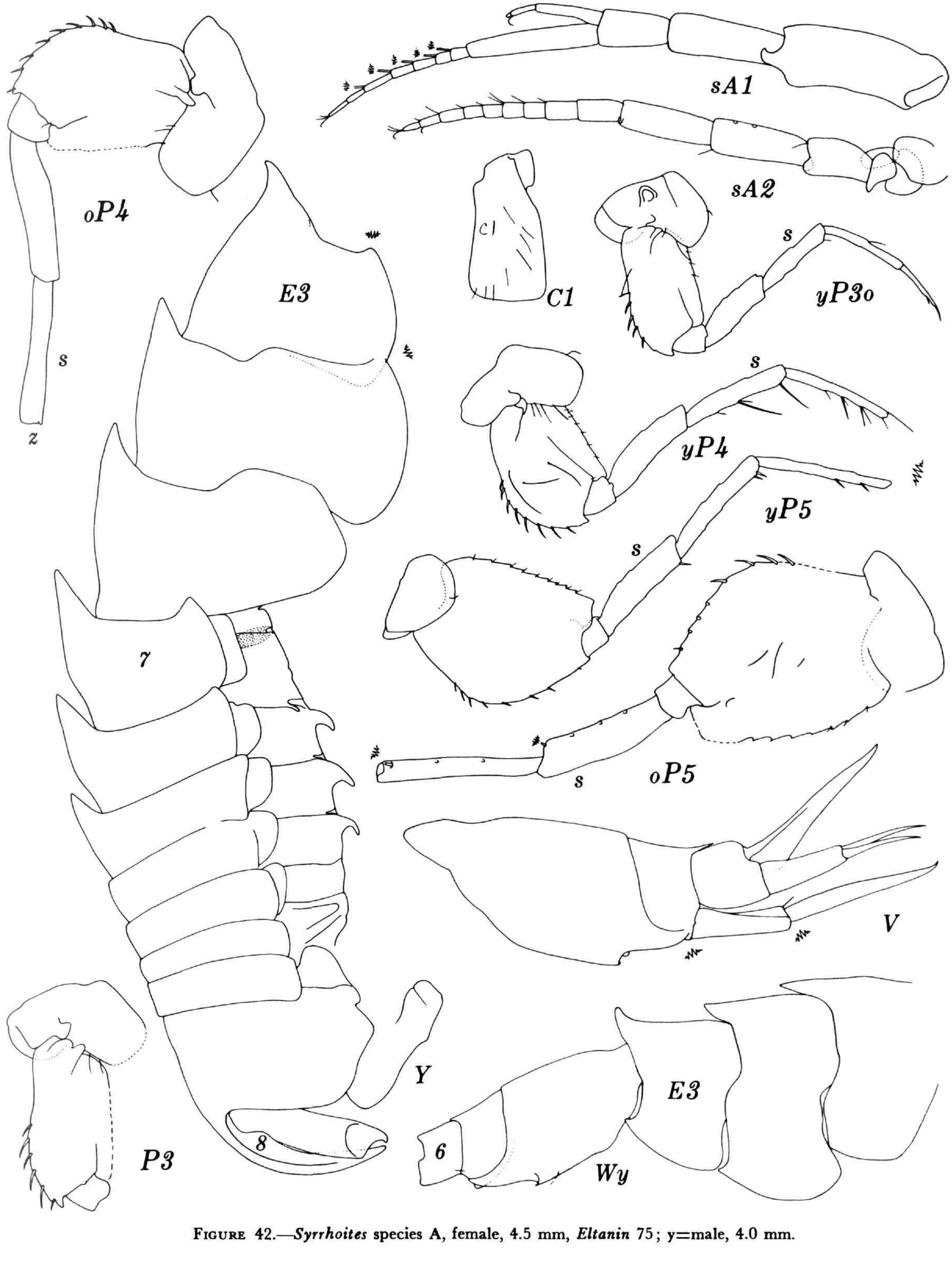

FIGURE 42.—*Syrrhoites* species A, female, 4.5 mm, *Eltanin* 75; y=male, 4.0 mm.

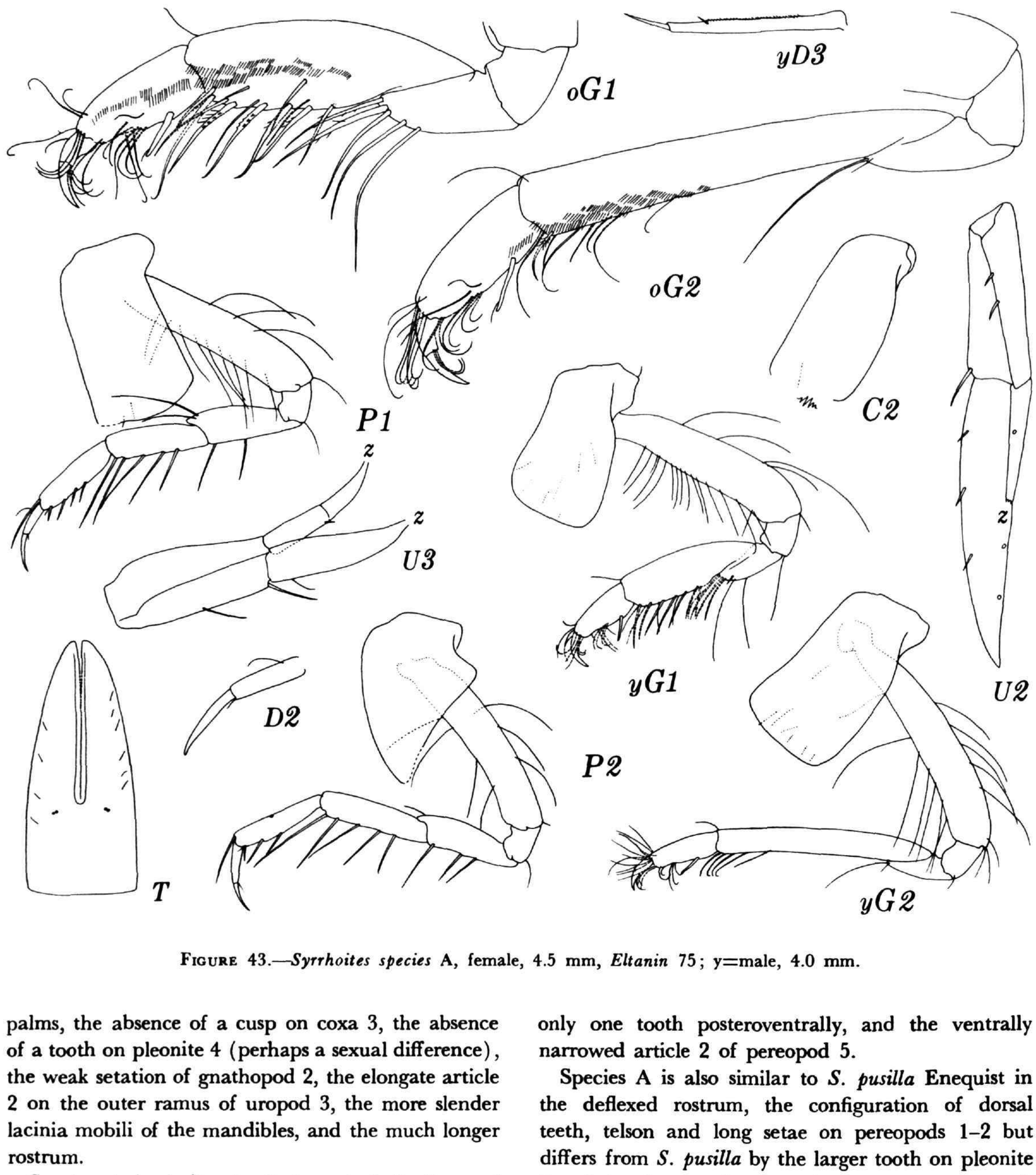

FIGURE 43.—*Syrrhoites species* A, female, 4.5 mm, *Eltanin* 75; y=male, 4.0 mm.

palms, the absence of a cusp on coxa 3, the absence of a tooth on pleonite 4 (perhaps a sexual difference), the weak setation of gnathopod 2, the elongate article 2 on the outer ramus of uropod 3, the more slender lacinia mobili of the mandibles, and the much longer rostrum.

Species A is similar to *S. terceris* J. L. Barnard in the deeply cleft telson and the absence of processes on the peduncles of uropods 1–2 but it differs from *S. terceris* in the much larger dorsal teeth on body segments, the posteriorly shortened epimeron 3 with only one tooth posteroventrally, and the ventrally narrowed article 2 of pereopod 5.

Species A is also similar to *S. pusilla* Enequist in the deflexed rostrum, the configuration of dorsal teeth, telson and long setae on pereopods 1–2 but differs from *S. pusilla* by the larger tooth on pleonite 3 and the absence of peduncular processes on uropods 1–2.

Species A resembles *S. dulcis* J. L. Barnard in the long spines on article 5 of pereopods 1–2 and in the elongate article 5 of gnathopod 2 but differs from

S. dulcis in the long downturned rostrum, the narrower and more deeply cleft telson, the much larger dorsal teeth, the ventrally narrowing article 2 of pereopod 5, the absence of peduncular teeth on uropods 1–2 and the absence of a dorsal tooth on pleonite 4.

Chile, 1834 m.

Tiron Liljeborg

Tiron Liljeborg, 1865: 19.—Stebbing, 1906: 275–276.
Tessarops Norman, 1868: 412 [homonym, Arachnida].

DIAGNOSIS.—Forehead protuberant or not (type-species), lateral cephalic lobe sharp; eyes present and accessory eyes usually present; mandible with palp, molar of medium size, strongly projecting, columnar and triturative; mouthparts basic; articles 1–2 of antenna 1 basic; coxa 1 ordinary, coxae 3–4 not pelagont or weakly so, coxa 3 softly rectangular, posterior margin almost parallel with anterior margin and not strongly excavate; coxa 4 variable, typically adz-shaped and almost as long as coxa 3, surface area of latter nearly equal to coxa 4, rarely coxa 4 distinctly shorter and smaller than 3 and weakly comma-shaped; gnathopods simple, hands elongate, linear, lacking distinct spines; dactyl of gnathopod 2 normal; pereopods 3–5 very short, dactyls typically very short, clawlike and bearing large inner wire-seta, but occasionally dactyls slightly elongate and poorly armed; article 2 of pereopod 5 posteroventrally rounded; pleonites 1–3 typically denticulate dorsally but apparently smooth in 3 species; uropod 3 greatly exceeding apices of uropods 1–2, (except in *T. brevidactylus*), peduncle short; telson elongate, deeply cleft.

Uropod 1 reaching apex of uropod 2 (see *Pseudotiron*).

TYPE-SPECIES.—*Lysianassa spinifera* Stimpson (1853) (·=*T. acanthurus* Liljeborg, 1865, *see* Sars, 1895).

REMARKS.—Apparently all species of *Tiron* have one or more small teeth on the dorsoposterior margin of pleonites 1–5, the teeth usually becoming enlarged on pleonites 4–5; on pleonites 1–3 the middle tooth is often very small and indistinguishable from a group of serrations running transversely across the segmental margin; these extra serrations are mentioned in the diagnoses of species, but little account is yet taken of the size of dorsal teeth generally until more is known of growth and sexual variables. Males usually have larger teeth than do females.

Accessory eyes have not been seen in all species.

In the following key *T. antarcticus* is omitted because several of its attributes are unknown and it otherwise is similar to *T. biocellata;* see the latter for minor distinctions known so far.

Dactyls of pereopods 1–5 are classed in 2 alternatives, either normally claw-shaped or stubby. The condition of stubby dactyls may be seen herein on *T. tropakis;* the dactyls are short, tumid and may bear one or more accessory processes or spines. Even if the spine extends as a point the dactyl is still regarded as stubby.

Tiron bombayensis Tembe-Deshpende (1964) is a nomen nudum.

Key to the Species of *Tiron*

(*T. antarcticus* omitted, see text)

1. Each lobe of telson with medial row of one or more large spines (all of pereopods 1–5 with stubby dactyls) 2
   Each lobe of telson lacking large medial spines in rows 5
2. Outer plate of maxilliped aberrant, apically incised and guarded by hooked wing on each side, large spines absent .... *T. thompsoni*
   Outer plate of maxilliped normal, ovate, bearing large spines on medial margin 3
3. Article 2 of pereopods 4–5 with posterior submarginal row of long plumose setae *T. intermedia*
   Article 2 of pereopods 4–5 lacking special row of setae 4
4. Accessory eye composed of 4 appressed ommatidia, mandibular palp present .... *T. australis*
   Accessory eye composed of 2 segregated ommatidia, mandibular palp absent .... *T. tropakis*
5. Dactyls of pereopods 1–5 stubby 6
   Dactyls of pereopods 1–5 ordinary 7

Key to the Species of *Tiron*—Cont.

6. Outer ramus of uropod 2 shortened, rami of uropod 3 obliquely truncate apically ..... *T. brevidactylus*
   Outer ramus of uropod 2 as long as inner, rami of uropod 3 pointed apically ..... *T. altifrons*
7. Posterior margin on article 2 of pereopod 5 smooth, accessory eye with 3 appressed ommatidia ..... *T. spiniferum*
   Posterior margin on article 2 of pereopod 5 crenulate and setulose, accessory eye with 2 segregated ommatidia ..... *T. biocellata*

Tiron altifrons Reid

Tiron altifrons Reid, 1951: 235–236, figure 31.

Diagnosis.—Accessory eye apparently composed of about 5 appressed ommatidia; mouthparts unknown; dactyls of pereopods 1–5 stubby but sharp; article 2 of pereopods 4–5 lacking special setal row, article 2 of pereopod 5 with 3 setulose crenulations posteriorly; pleonites 1–3 unknown; outer rami of uropods 1–2 not shortened; rami of uropod 3 apically pointed; each lobe of telson with 3 groups of dorsal bristles.

West Africa.

Tiron antarcticus K. H. Barnard

Tiron antarcticus K. H. Barnard, 1932: 148–149, figure 86.

Diagnosis.—Accessory eyes not seen; mouthparts not fully described; dactyls of pereopods 1–5 ordinary; article 2 of pereopods 4–5 without special row of setae, article 2 of pereopod 5 posteriorly crenulate and setulose; pleonites 1–3 not dorsally crenulate; rami of uropods not described; each lobe of telson with 4–5 dorsal setules.

South Shetlands and South Georgia, 135–200 m.

Tiron australis Stebbing

Tiron australis Stebbing, 1908: 79–81, pl. 38.

Diagnosis.—Accessory eye with 4 appressed ommatidia; inner plate of maxilla 1 fully setose but with smooth acclivital portion in middle; inner plate of maxilla 2 with medial submarginal row of setae; outer plate of maxilliped normal; dactyls of pereopods 1–5 stubby but apically sharp; article 2 of pereopods 4–5 without special row of setae, article 2 of pereopod 5 weakly and irregularly crenulate posteriorly but not setulose; pleonites 1–3 dorsally crenulate; outer ramus of uropod 1 not shortened, of uropod 2 shortened slightly; rami of uropod 3 apically pointed; each lobe of telson with medial row of large spines.

South Africa, 47 fms.

Tiron biocellata J. L. Barnard

Figure 44

Tiron biocellata J. L. Barnard, 1962b: 75, figure 2.

Diagnosis.—Accessory eye composed of 2 segregated ommatidia; inner plate of maxilla 1 fully setose; inner plate of maxilla 2 with medial row of submarginal setae; outer plate of maxilliped normal; dactyls of pereopod 5 ordinary; article 2 of pereopods 4–5 without special row of setae, article 2 of pereopod 5 crenulate and setulose posteriorly; pleonites 1–3 weakly crenulate dorsally; outer rami of uropods 1–2 significantly shortened; rami of uropod 3 apically pointed; telson with weak dorsal setae.

Distinguished from *T. antarcticus* K. H. Barnard also in the narrow and more elongate article 4 of pereopod 5.

Remarks.—Mouthparts of this species and *T. tropakis*, new species, have many similarities, especially the maxillipeds and maxilla 2 which are similar in all essentials, but the outer plate of maxilla 1 in *T. biocellata* has 10 spines, that of *T. tropakis* 7 spines, the inner plate of *T. biocellata* has only a small gap between the terminal and medial setae whereas a large gap occurs in *T. tropakis*. The latter has no mandibular palp. The telson of *T. biocellata* has almost no dorsal spines, occasionally one subterminal spine occurring on each lobe.

Material.—*Velero* 4718 (1), 4719 (1), 4721 (4), 4759 (1), 4787 (8), 4822 (1), 4836 (2), 4840 (1), 4842 (1), 4843 (1), 4861 (2), 4869 (3), 4870 (2), 4871 (1), 4885 (5), 4886 (2), 5042 (1), 5109 (1), 5134 (6), 5167 (1), 5172 (4), 5256 (2), 5346 (1), 5373 (1), 5507 (1), 5557 (1), 5564 (4), 5631 (2),

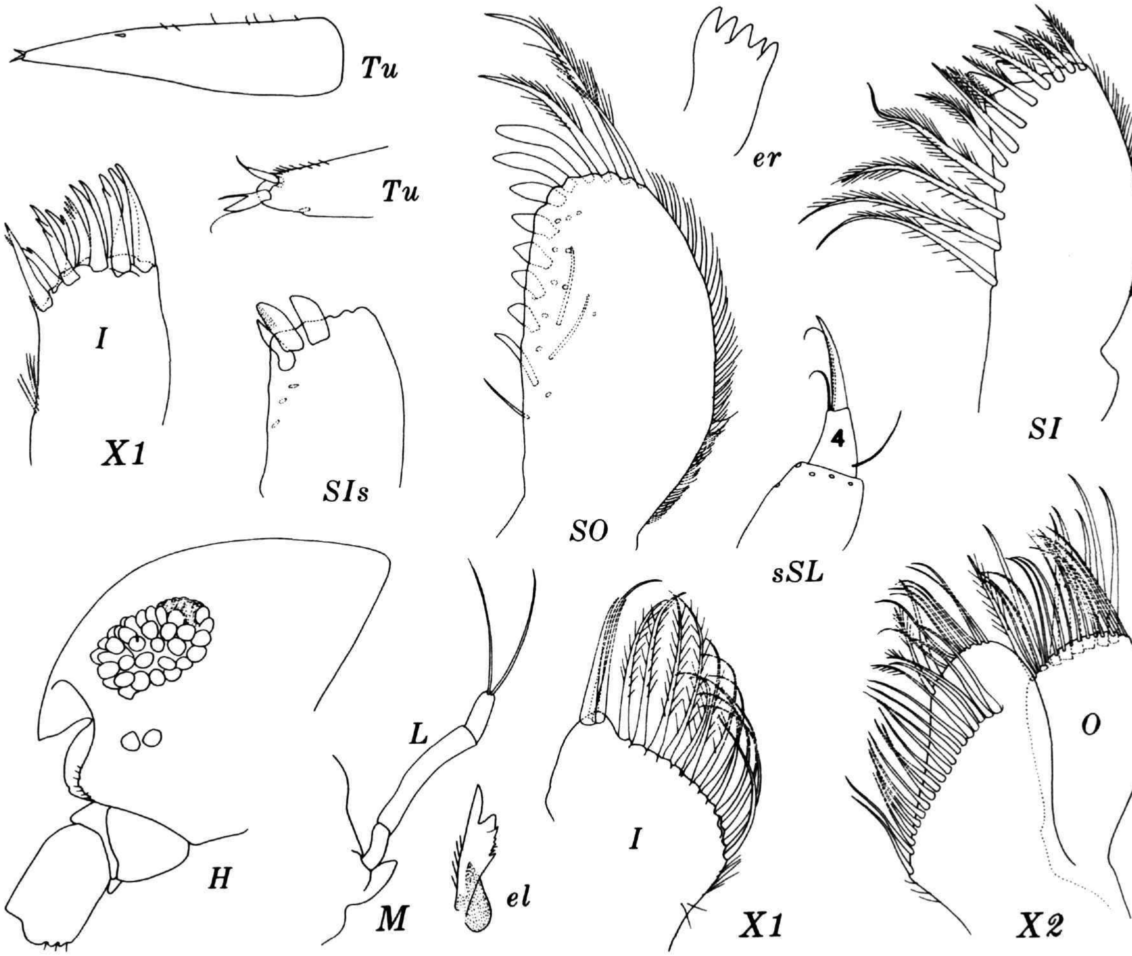

FIGURE 44.—*Tiron biocellata* J. L. Barnard, female, 4.6 mm, *Velero* 5631; *e*=lacinia mobilis.

5654 (1), 5709 (2), 5740 (1), 5741 (1), 5765 (1), 5838 (1), 5965 (2), 5968 (1), 5972 (1), 5973 (1), 6100 (1), 6102 (2), 6103 (1), 6393 (1), 6694 (1) (from the Allan Hancock Foundation).

California and Baja California, 9–180 m.

Tiron brevidactylus (Pillai)

Pseudotiron brevidactylus Pillai, 1957: 43–46, figure 7.

DIAGNOSIS.—Accessory eyes not described; inner plate of maxilla 1 small and naked; inner plate of maxilla 2 lacking medial setae; outer plate of maxilliped normal; dactyls of pereopods 1–5 stubby; article 2 of pereopods 4–5 lacking special setal row, article 2 of pereopod 5 crenulate and setulose posteriorly; serrations on pleonites 1–3 not mentioned; outer ramus of uropod 1 as long as inner, but shortened on uropod 2; rami of uropod 3 with oblique truncate apices; telson with several scattered dorsal setae.

Mandibular palp absent (special character, see *T. tropakis*, new species).

Travancore.

Tiron intermedia Reid

Tiron intermedia Reid, 1951: 233–235, figure 30.

DIAGNOSIS.—Accessory eyes present but composition unknown; mouthparts unknown; dactyls of pereopods 1–5 stubby; article 2 of pereopods 4–5 with posterior submarginal row of long plumose setae, article 2 of pereopod 5 with posterodorsal ala bearing 3 crenulations, no setules; pleonites 1–3 dorsally crenulate; rami of uropods 1–2 unknown; rami of uropod 3 apically pointed; each lobe of telson with row of ?medial spines.

West Africa.

Tiron spiniferum (Stimpson)

Lysianassa spinifera Stimpson, 1853: 49.
Tiron acanthurus Liljeborg, 1865: 19.—Sars, 1895: 399–401, pl. 140.—Shoemaker, 1930: 291–292.—Stephensen, 1938: 231; 1944: 76.—Gurjanova, 1951: 591, figure 397.
Tiron spiniferum Shoemaker, 1955: 38–39.

Diagnosis.—Accessory eye composed of 3 appressed ommatidia; inner plate of maxilla 1 fully setose; inner plate of maxilla 2 with medial submarginal row of setae; outer plate of maxilliped normal; dactyls of pereopods 1–5 ordinary; article 2 of pereopods 4–5 lacking special row of setae, article 2 of pereopod 5 smooth posteriorly; pleonites 1–3 dorsally crenulate; outer rami of uropods 1–2 shortened; rami of uropod 3 apically pointed; telson lacking large spines or setae dorsally.

Circumboreal, south to Bay of Fundy, Skagerrak, Sea of Japan, generally 30–200 m, rarely to 682 m.

Tiron thompsoni Walker

Tiron thompsoni Walker, 1904: 263–264, pl. 4, figure 21.

Diagnosis.—Eyes not known; maxillae unknown; outer plate of maxilliped with apical excavation guarded by falcate wings, large spines absent; dactyls of pereopods 1–5 stubby but apically sharp; article 2 of pereopods 4–5 apparently without special setal row, posterior margin on article 2 of pereopod 5 unknown; dorsal serrations on pleonites 1–3 not mentioned; outer ramus of uropod 1 as long as inner, but shortened on uropod 2; rami of uropod 3 with truncate apices; telson with at least one large spine on dorsomedial margin of each lobe, perhaps full row overlooked.

Ceylon.

Tiron tropakis, new species

Figures 45, 46

Diagnosis.—Accessory eye composed of 2 segregated ommatidia; inner plate of maxilla 1 fully setose but margin broken by smooth acclivity; inner plate of maxilla 1 fully setose but margin broken by smooth acclivity; inner plate of maxilla 2 with row of submarginal setae; outer plate of maxilliped normal; dactyls of pereopods 1–5 stubby; article 2 of pereopods 4–5 without special setal row, article 2 of pereopod 5 weakly crenulate and setulose posteriorly; pleonites 1–3 dorsally crenulate; outer ramus of uropod 1 as long as inner, but shortened on uropod 2; rami of uropod 3 apically pointed; each lobe of telson with medial row of large spines.

Mandibular palp absent (see *T. brevidactylus*).

Description of female.—Dorsoanterior margin of head curving evenly to rostrum without forming extended forehead, rostrum pointing obliquely anteroventrally, accessory eye formed of 2 slightly separated ommatidia; mandible without palp; inner plates of maxilla 1 large, terminally setose and medially with long gap between setal groups, outer plates with 7 spines, inner lobe of maxilla 2 with dense mediosubmarginal setal row; inner and outer plates of maxillipeds typical of genus (type-species); gnathopodal dactyls of medium stoutness and bearing medium-sized inner tooth; coxae unusually short for genus, coxa 2 with slight anteroproximal wing, coxa 3 posteriorly excavate, distally expanded and lobate posteriorly in resemblance of coxa 4; coxa 4 especially short and broad, comma-shaped, posteriorly excavate; posterior lobes of coxae 5–6 very large; pereopods 1–5 with short and broad sixth articles, distally appearing as prehensile because of relative breadth and presence of large distal spine and peculiar dactyls; dactyls of pereopods 1–2 formed of a basal subspherical disc imbedded in end of article 6, disc with hook tooth, long seta matching curve of hook and accessory small spine at base of hook; article 6 with large distal spine; dactyls of pereopods 3–5 similar but hook-spine only hooked distally, seta similar, basal portion of dactyl not discoid, article 2 of pereopods 3–4 evenly ovate, of medium breadth, article 2 of pereopod 5 proximally broad, evenly tapering distally, posterior margin evenly convex; pleonal epimera 1–3 with small posteroventral points, each with one or a few posterior notches, evenly convex margins; pleonites 1–3 dorsally and laterally with small notches becoming increasingly contiguous to form dorsal serrations but no distinct dorsal teeth present; pleonites 4–5

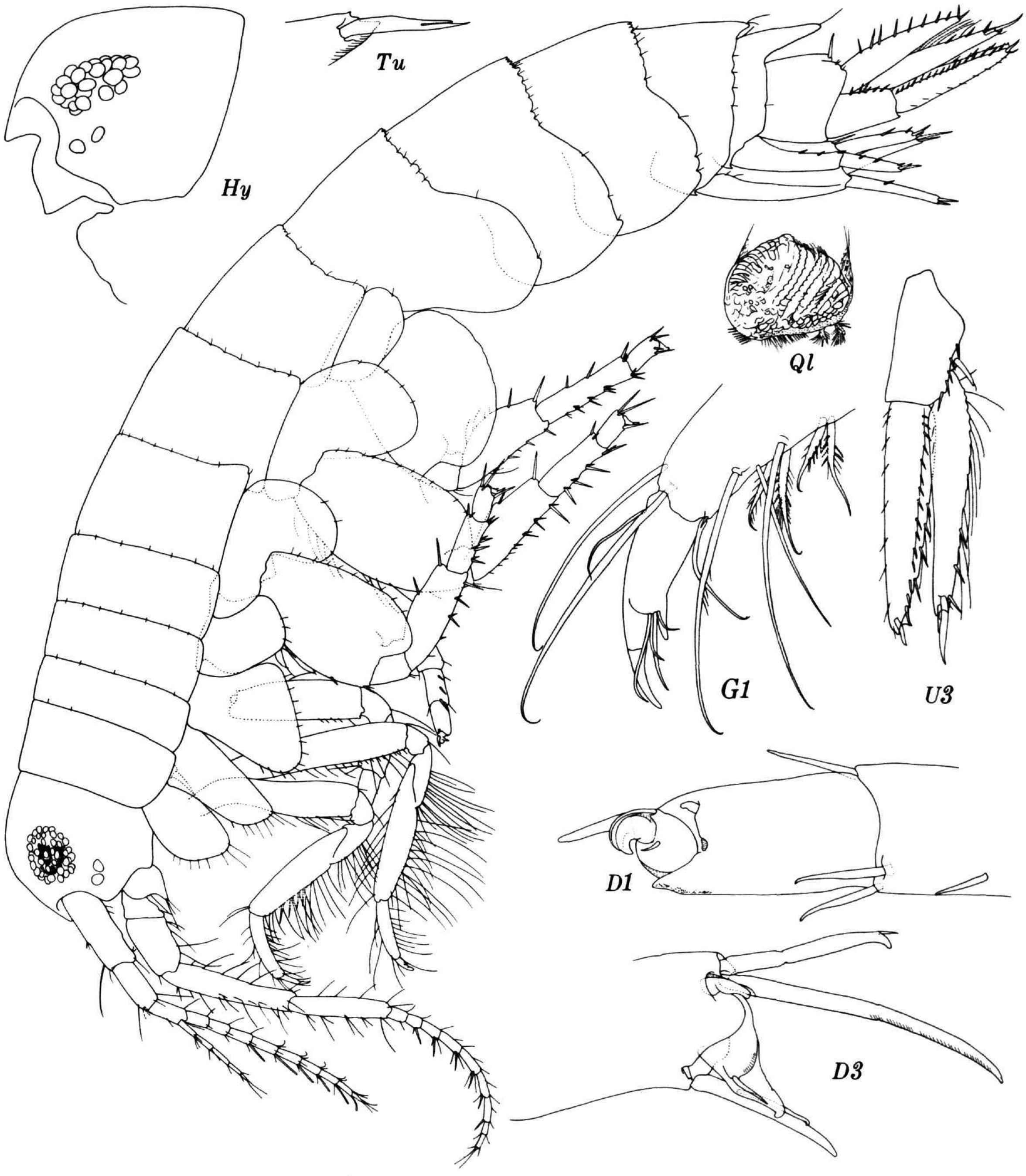

FIGURE 45.—*Tiron tropakis*, new species, holotype, female, 4.9 mm, *Velero* 6688; *y*=male, 4.5 mm, *Velero* 5828; in toto view with pleopeds removed.

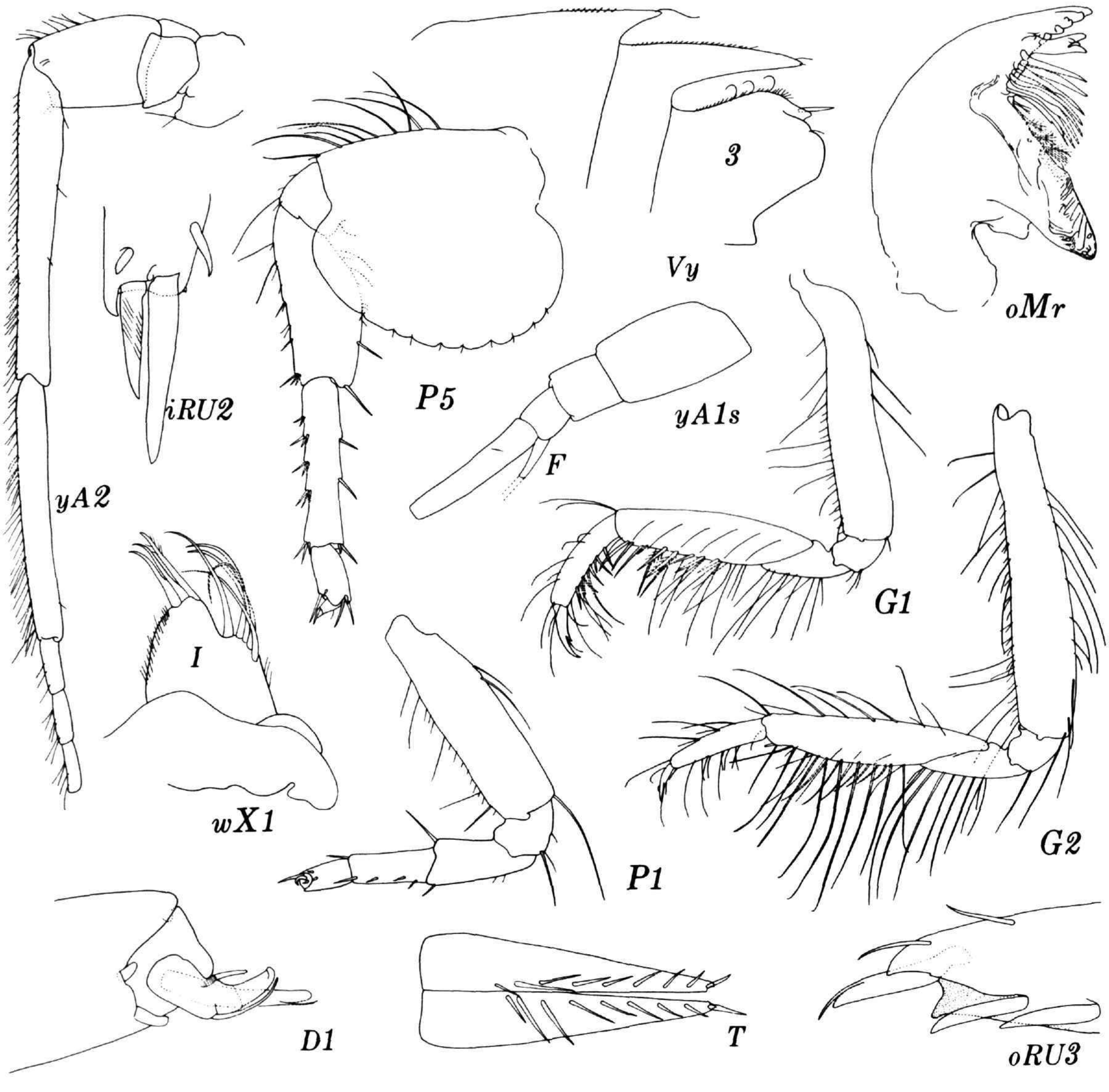

FIGURE 46.—*Tiron tropakis,* new species, holotype, female, 4.9 mm, *Velero* 6688; *y*=male, 4.5 mm, *Velero* 5828; *w*=female, 3.9 mm, *Velero* 5775; *R*=ramus.

with medium and large dorsal teeth, pleonite 6 with posterodorsal spine, no tooth; uropods 1–2 weakly spinose, uropod 3 with normally elongate, lanceolate rami; telson with numerous dorsal spines arranged in medial row on each lobe.

Male.—Pleonites 4–5 higher than in female, teeth slightly better developed, pleonite 6 with weak dorsal hump; antennae elongate, base of primary flagellum on antenna 1 conjoint; telson with only 2 subapical spines on each lobe.

HOLOTYPE.—AHF 663, female, 4.9 mm.

TYPE-LOCALITY.—*Velero* 6688, California, 34°24′00″N, 119°50′45″W, 9 m, 3 December 1959.

RELATIONSHIP.—This species resembles *T. biocellata* in its general appearance except for the terminal ends of the pereopods which have shortened sixth articles with prehensoid condition. In this respect *T. tropakis* resembles *T. australis* Stebbing (1908) but differs from that species in the absence of a mandibular palp, the presence of 2 discrete lateral accessory ommatidia instead of a small bundle of several, and apparently the structure of articles 6 and 7 of the pereopods differs but Stebbing does not clearly draw the condition. *Tiron brevidactylus* (Pillai, 1957) also lacks a mandibular palp and has relatively stout and shortened pereopod apices but not as strongly modified as in *T. tropakis.* No accessory eyes are mentioned for *T. brevidactylus,* apparently the inner lobe of maxilla 1 is small and without setae, the inner lobe of maxilla 2 has no medial setae, the posterior lobes of coxae 5–6 are small, article 2 of pereopod 4 is pear-shaped and pleonites 1–3 have a distinctly marked middorsal point almost developed into a tooth.

Tiron thompsoni Walker (1904) has peculiar outer plates of the maxillipeds, a supernumerary dactylus on the pereopods, a stout hook-tooth on dactyls of the gnathopods, less strongly prehensile pereopods and dorsal points on pleonites 1–3.

Apparently both *T. altifrons* Reid (1951) and *T. intermedia* Reid (1951) have the accessory eye small and formed of several ommatidia closely compacted, and article 2 of pereopod 5 is either fully hemispherical (*altifrons*) or bears a posterodorsal extended wing marked below by a sinuation (*intermedia*).

Adults between 5–6 mm lose serrations and points on pleonal epimera. The holotype has exceptionally large accessory ommatidia; generally they are as small as on *T. biocellata.*

MATERIAL.—Pacific Ocean, Peru: *Velero* 395 (200+); California: 4836 (1), 4861 (1), 5346 (2), 5614B (1), 5617 (1), 5631 (4), 5756 (1), 5768B (5), 5775 (6), 5828 (1), 5880 (7), 6205 (1), 6298 (2), 6300 (2), 6395 (1), 6409 (1), 6688 (1) (see Anonymous, 1965, for *Velero* data); USNM Acc. 125734, off Balboa, California, February–March 1933, 7–15 fms, G. E. MacGinitie (1); USNM 151/571–152/584, Laguna Beach, California, Hilton (1); Caribbean, Venezuela, *Velero* Atlantic samples, A27 (2), 28 (1), 32 (19), 42 (1); Tampa Bay, Florida, USNM (1) (no further data); North Carolina, Albatross III, Sta. 19–5, No. 8 amphipod, 24 May 1949, vertical haul from 10 fms, 34°05′N, 77°12′W, Don W. H. Sutcliffe, Jr. (1); USNM Acc. 183598, Fish Hawk Sta. 8895, Bottom Net, off Cape Henry, Virginia, Light Ship, 16.5 fms, 21 October 1920 (1); USNM D4–41 (1) (data unavailable).

California to Peru, Virginia to Venezuela, 3–157 m.

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Appendix

(Station List)

Samples collected by RV *Vema* and RV *Eltanin*. See Anonymous (1965) for data of samples collected by RV *Velero IV*. See J. L. Barnard (1971) for data of Oregon material collected by Dr. A. G. Carey, Jr.

Eltanin:

50, off southern Peru, 16°12'S, 74°41'W, 2599–2858 m, 15 June 1962.

75, off Chile, 31°10'S, 71°56'W, 1932-3142 m, 24 June 1962.

257, Drake Passage, 61°09'S, 67°51'W, 3867–4086 m.

350, east of Tierra del Fuego, 55°03'S, 58°57'W, 2452 m, 4 December 1962.

Vema:

14–58, west Mediterranean Sea, off Oran, 36°10'N, 01°35'W, 2070 m, 31 July 1958.

15–13, off Caribbean Columbia, 11°30'N, 75°50'W, 2875–2944 m, 8 November 1958.

15–20, off Caribbean Panama, 09°46.5'N, 79°37.5'W, 825–860 m, 10 November 1958.

15–38, off Pacific Colombia, 05°00'N, 79°04'W, 3023–3251 m, 15 November 1958.

15–46, off Pacific Costa Rica, 09°22'N, 89°33'W, 3517–3528 m, 20 November 1958.

15–49, off Pacific Costa Rica, 09°24'N, 89°27'W, 3563 m, 22 November 1958.

15–51, off Pacific Costa Rica, 09°15'N, 89°29'W, 3514–3554 m, 23 November 1958.

15–52, off Pacific Costa Rica, 09°20.5'N, 89°39'W, 3475–3497 m, 23 November 1958.

15–53, off Pacific Costa Rica, 09°23'N, 89°32'W, 3545 m, 23 November 1958.

15–55, off Pacific Nicaragua, 12°45'N, 88°38'W, 3777–3950 m, 11 November 1958.

15–58, off Pacific Nicaragua, 12°11'N, 89°34'W, 5680–5690 m, 27 November 1958.

15–59, off Pacific Panama, 07°05'N, 85°55'W, 2853–2855 m, 30 November 1958.

15–62, off Ecuador, 01°30'S, 82°19'W, 1363–1369 m, 3 December 1958.

15–131, east of Bahia Blanca, Argentina, 40°14.6'S, 55°24.7'W, 1475 m, 3 April 1959.

15–153, Bahamas Islands, 25°01.5'N, 77°47'W, 2357–2370 m, 21 June 1959.

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* U.S. GOVERNMENT PRINTING OFFICE: 1972 O—484-317/24

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