

A WORLDWIDE REVISION OF THE
RECENT AND FOSSIL SAND CRABS OF
THE ALBUNEIDAE STIMPSON AND
BLEPHARIPODIDAE, NEW FAMILY
(CRUSTACEA: DECAPODA:
ANOMURA: HIPPOIDEA)

CHRISTOPHER B. BOYKO

Research Associate

Division of Invertebrate Zoology

American Museum of Natural History

e-mail: cboyko@amnh.org

BULLETIN OF THE AMERICAN MUSEUM OF NATURAL HISTORY

CENTRAL PARK WEST AT 79TH STREET, NEW YORK, NY 10024

Number 272, 396 pp., 116 figures

Issued October 24, 2002

CONTENTS

Abstract	4
Introduction	4
Abbreviations	6
Morphological Characters and Terminology	7
Methods	10
Superfamily Hippoidea Latreille	10
Key to Families	10
Family Blepharipodidae, new family	10
Key to Genera	11
<i>Lophomastix</i> Benedict	11
Key to Species	12
<i>L. japonica</i> (Duruflé)	12
<i>L. antiqua</i> Schweitzer and Boyko	18
<i>L. diomedea</i> Benedict	20
<i>Blepharipoda</i> Randall	26
Key to Species	27
<i>B. occidentalis</i> Randall	27
<i>B. liberata</i> Shen	35
<i>B. doelloi</i> Schmitt	42
<i>B. spinosa</i> (H. Milne Edwards and Lucas)	48
Family Albuneidae Stimpson	54
Key to Subfamilies	56
Subfamily Lepidopinae, new subfamily	56
Key to Genera	57
<i>Austrolepidopa</i> Efford and Haig	57
Key to Species	57
<i>A. schmitti</i> Efford and Haig	57
<i>A. caledonia</i> Boyko and Harvey	63
<i>A. trigonops</i> Efford and Haig	68
<i>Leucolepidopa</i> Efford	74
<i>L. sunda</i> Efford	74
<i>Paraleucolepidopa</i> Calado	79
Key to Species	80
<i>P. myops</i> (Stimpson), new combination	80
<i>P. distincta</i> (Gomes Corrêa), new combination	86
<i>Lepidopa</i> Stimpson	92
Key to Species	93
<i>L. luciae</i> , new species	93
<i>L. mexicana</i> Efford	100
<i>L. wollebaeki</i> Sivertsen	106
<i>L. esposa</i> Efford	110
<i>L. websteri</i> Benedict	115
<i>L. venusta</i> Stimpson	122
<i>L. dexterae</i> Abele and Efford	128
<i>L. chilensis</i> Lenz	134
<i>L. californica</i> Efford	140
<i>L. haigae</i> Efford	146
<i>L. richmondi</i> Benedict	151
<i>L. mearnsi</i> Benedict	159
<i>L. deamae</i> Benedict	165
<i>L. benedicti</i> Schmitt	172

Subfamily Albuneinae Stimpson	180
Key to Genera	180
<i>Paralbunea</i> Serène	180
Key to Species	181
<i>P. intermedia</i> (Balss)	181
<i>P. manihinei</i> Serène	187
<i>P. paradoxa</i> (Gordon)	192
<i>P. dayriti</i> (Serène and Umali)	197
<i>Zygopa</i> Holthuis	203
Key to Species	204
<i>Z. michaelis</i> Holthuis	204
<i>Z. nortoni</i> Serène and Umali	210
<i>Squillalbunea</i> , new genus	214
<i>S. mariellae</i> (Serène), new combination	215
<i>Italialbunea</i> , new genus	221
<i>I. lutetiana</i> (Beschlin and De Angeli), new combination	221
<i>Stemonopa</i> Efford and Haig	222
<i>S. insignis</i> Efford and Haig	223
<i>Albunea</i> Weber	228
Key to Species	230
<i>A. speciosa</i> Dana	230
<i>A. hahnae</i> Blow and Manning	238
<i>A. cuisiana</i> Beschlin and De Angeli	238
<i>A. galapagensis</i> , new species	240
<i>A. microps</i> Miers	246
<i>A. elioti</i> Benedict	254
<i>A. bulla</i> , new species	260
<i>A. carabus</i> (Linnaeus)	266
<i>A. asymmetrica</i> (P. Müller)	274
<i>A. danai</i> Boyko	276
<i>A. marquisiana</i> Boyko	282
<i>A. holthuisi</i> Boyko and Harvey	290
<i>A. groeningi</i> , new species	296
<i>A. symmysta</i> (Linnaeus)	303
<i>A. occultus</i> , new species	313
<i>A. elegans</i> A. Milne Edwards and Bouvier	320
<i>A. paretii</i> Guérin Méneville	327
<i>A. lucasia</i> de Saussure	336
<i>A. catherinae</i> , new species	343
<i>A. steinitzi</i> Holthuis	352
<i>A. gibbesii</i> Stimpson	359
<i>A. thurstoni</i> Henderson	367
Acknowledgments	373
References	374
Appendix 1: Indeterminate Literature Records	393
Appendix 2: Excluded Taxa	394

ABSTRACT

The anomuran sand crab family Albuneidae *sensu stricto* was previously known worldwide from 41 validly described Recent species in eight genera and four fossil taxa of the genus *Albunea*. A worldwide revision is presented based on a comprehensive survey of the literature and examination of more than 1700 specimens representing all known species. The state of taxonomic knowledge regarding the Albuneidae is summarized; the family is divided into two new subfamilies; two new genera and six new species of albuneids are described; and new information on species' ranges and biology is presented. Additionally, the genera *Blepharipoda* Randall and *Lophomastix* Benedict are removed from the Albuneidae and placed in a new family, based in part on characters of the gill formula and morphology. This new family contains six Recent species and one fossil taxon. Although there is some doubt about its hippoid affinities, it is retained in the Hippoidea as the most basal taxon, pending further cladistic phylogenetic analyses.

Here and there are people with eyes which can see, minds which can correlate. They say to themselves: "If the science of the day before yesterday is rejected by the people of yesterday, and that of yesterday by us of today, is it not possible that what we call science now will be rejected by the men of tomorrow?" And the bravest of them answer, "It is possible."

Wassily Kandinsky, 1911, Concerning the Spiritual in Art

INTRODUCTION

Crustaceans in the anomuran superfamily Hippoidea Latreille, 1825 are specialized burrowing crabs that live in sandy habitats in shallow waters, predominantly in the tropics. The first described genus was *Albunea* Weber, 1795, a heterogeneous assemblage that included an albuneid (fig. 1C, although the species was *Cancer symmysta* Linnaeus rather than *C. carabus* Linnaeus) and two raninids (fig. 1D, E). Later authors also included thiid (fig. 1A) and corystid (fig. 1B) brachyurans in the Albuneidae, due to the convergently evolved sand-burrowing morphology of these taxa as well as to misinterpretations of early species descriptions. Most nonalbuneid taxa have long since been removed from this family (see under Blepharipodidae, n. fam., and appendix 2), but little work has been done in the Albuneidae at the alpha-taxonomic level or in elucidating the phylogenetic relationships of the species and higher taxa both within the family and within the Anomura and Decapoda. Historically, there has been little systematic work in either previously recognized hippoid family (i.e., the Albuneidae and the Hippidae) on a regional or worldwide basis. Prior to 1938, publications exclusively on albuneids were limited to those of Miers (1878) and Ortmann (1896), in which both authors listed the

known taxa but were unable to examine specimens of many taxa firsthand. Later, Gordon (1938) presented the first modern compilation of albuneid taxa, based mainly on material in the British Museum of Natural History and the Smithsonian Institution, and discussed the relationships among the known genera.

Subsequent to Gordon (1938), the few publications on albuneids were mostly of a regional nature (e.g., Serène and Umali, 1965 for Philippine albuneids; Boyko, 1999 for Hawaiian albuneids; Boyko, 2000a for Marques hippoids). These papers were necessarily limited to a descriptive capacity and added only a little to our understanding of the relationships among species and higher taxa in the family. In the Albuneidae *sensu lato*, there was no comprehensive worldwide study of any genus outside of Schmitt's (1942) review of *Blepharipoda* Randall, 1840, and Efford's (1971) revision of *Lepidopa* Stimpson, 1858. Although Efford's (1971) species concepts were perhaps too narrow, as he described several species that are synonymized herein, his work contained taxonomic keys as well as a discussion of morphological characters useful for the identification of species. Serène's (1977, 1979) review and description of *Paralbunea* Serène was by his own admission incomplete, as he

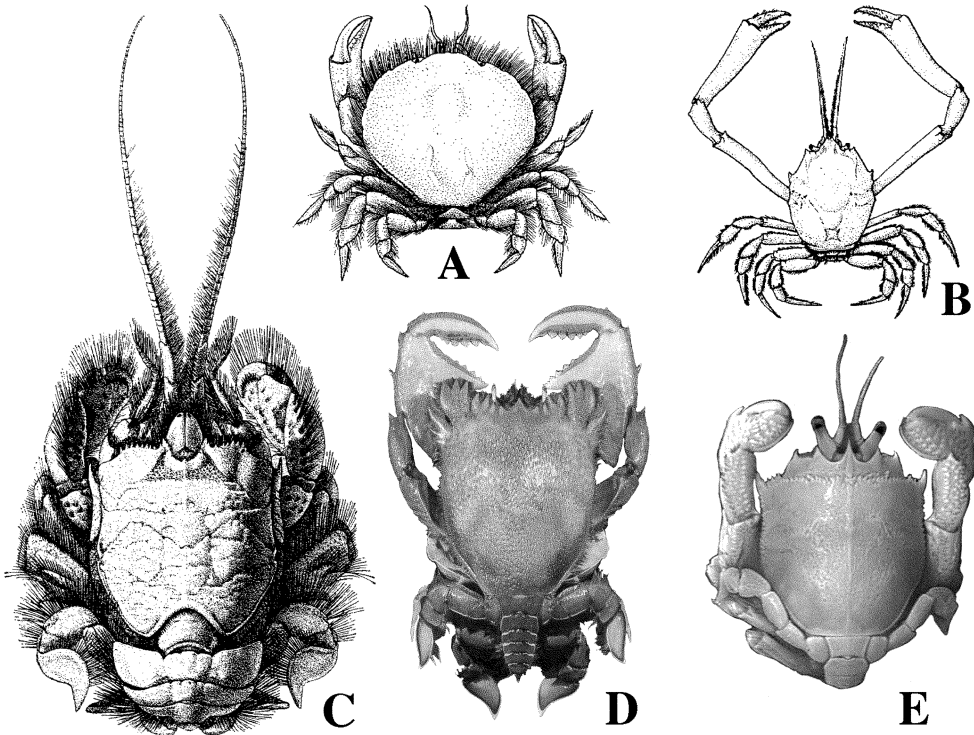


Fig. 1. Convergent crabs: **A.** *Thia scutellata* (Fabricius, 1793). **B.** *Corystes cassivelaunus* (Pennant, 1777). **C.** *Albunea carabus* (Linnaeus, 1758). **D.** *Ranina ranina* (Linnaeus, 1758). **E.** *Notopus dorsipes* (Fabricius, 1787). A, B, after Hayward et al. (1995), C, after Zariquiey Alvarez (1968), D, after Tinker (1965), E, specimen from Madagascar (MNHN). Figures not given to scale.

did not examine specimens of all relevant taxa.

Although Calado (1995) purported to review the taxonomy of all worldwide Albuneidae and Hippidae in her doctoral dissertation, this work is unsatisfactory for several reasons apart from its general unavailability. She examined only single specimens of most non-Brazilian taxa and based her redescriptions on these specimens alone. Additionally, she apparently accepted the identifications on all museum labels as correct, when in fact many specimens were wrongly identified. This led to several situations where an incorrectly identified specimen was used as the basis for the redescription and illustration of species (e.g., a specimen of *Lepidopa mexicana* was described by her as *L. mearnsi*, and her descriptions of *L. californica* and *L. myops* were both based on specimens of *L. californica*). In addition, Calado (1995) saw no material of nine albuneid species and

merely repeated the original descriptions of those taxa (translated into Portuguese) and introduced several misspellings of taxon names. The net result is that Calado's (1995) keys are misleading and serve no practical use for identifying albuneids. These shortcomings also prevent her work from being used for obtaining characters for phylogenetic analyses.

Most recently, Boyko and Harvey (1999) compiled a species list of all the tropical Indo-Pacific hippoids. They gave a key for their identification, described two new species of albuneids, and resolved several occurrences of confusion between similar taxa.

As little as has been written about the hippoid crabs in the realm of alpha-taxonomy, even less is known about the phylogenetic relationships among the species and genera in this superfamily. Efford (1969) proposed a phylogeny for the albuneid genera and later (Efford, 1971) presented a preliminary tree

for the genus *Lepidopa*, but these were based on relatively few morphological characters. To generate a comprehensive phylogeny for the Hippoidea, a better understanding of the taxonomy for the species involved is required. This comprehensive worldwide revision of the Albuneidae sensu lato is the first step toward understanding the relationships not only among the species and genera in this group, but between albuneids and the other hippoids and anomurans (Boyko and Harvey, in prep.).

The Albuneidae sensu stricto was previously known worldwide from 41 valid Recent species in eight genera and four fossil taxa of the genus *Albunea*. In the present work, I have made a comprehensive survey of the literature and examined 1052 cataloged lots (more than 1750 specimens) of albuneids from museums worldwide. Based on these data, I summarize the current state of taxonomic knowledge regarding the Albuneidae, divide the family into two new subfamilies, describe two new genera and six new species of albuneids, and present new information on species ranges and biology. Additionally, I remove the genera *Blepharipoda* Randall and *Lophomastix* Benedict from the Albuneidae and place them in their own new family, the Blepharipodidae, based primarily on characters from gill number and morphology. This new family contains six Recent species and one fossil taxon. Although there is some doubt about the hippoid affinities of the Blepharipodidae, it is retained in the Hippoidea, albeit basal to the Albuneidae and Hippidae, pending further cladistic phylogenetic analyses (Boyko and Harvey, in prep.).

ABBREVIATIONS

AHF	Allan Hancock Foundation (now in LACM)	BPBM	Bernice P. Bishop Museum, Honolulu, Hawaii
AM	Australian Museum, Sydney	CASIZ	California Academy of Sciences, Invertebrate Zoology, San Francisco
A&M	Texas A&M University, College Park,	CBB	Christopher B. Boyko collection
ANSP	Academy of Natural Sciences of Philadelphia, Pennsylvania	CBM-ZC	Chiba Museum (Zoology, Crustacea), Chiba, Japan
AMNH	American Museum of Natural History	GSU	Georgia Southern University, Statesboro, United States of America
BMNH	British Museum (Natural History) (now the Natural History Museum), London	HBOM	Harbor Branch Oceanographic Museum, Fort Pierce, Florida
		HNHM	Hungarian Natural History Museum, Budapest
		ICZN	International Commission on Zoological Nomenclature
		LACM	Natural History Museum of Los Angeles County, California
		MACN	Museo Argentino de Ciencias Naturales "Bernardino Rivadavia," Buenos Aires
		MCZ	Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts
		MNB	Museum für Naturkunde, Berlin
		MNHN	Muséum National d'Histoire Naturelle, Paris
		MNRJ	Museu Nacional, Rio de Janeiro
		MOV	Museum of Victoria, Abbotsford, Australia
		MRAC	Musée Royal de l'Afrique Centrale, Tervuren, Belgium
		NMCR	Philippine National Museum, Manila
		NTOU	National Taiwan Ocean University
		QM	Queensland Museum, South Brisbane, Australia
		RMNH	Rijksmuseum van Natuurlijke Historie (now Nationaal Natuurhistorisch Museum), Leiden, The Netherlands
		TU	Tulane University, Belle Chasse, Louisiana
		UFES	Coleção Zoológica do Departamento de Biologia, Universidade Federal do Espírito Santo, Vitória, Brazil
		UMZC	University Museum of Zoology, Cambridge, England
		UPRC	University of Panama Reference Collection
		URI	University of Rhode Island, Kingston
		USLZ	University of Louisiana at Lafayette
		USNM	National Museum of Natural History, Smithsonian Institution, Washington, D.C.
		WAM	Western Australian Museum, Perth

YPM	Yale Peabody Museum, New Haven, Connecticut
ZLKU	Zoological Laboratory, Kyushu University, Kita-Kyushu, Japan
ZMH	Zoologisches Institut und Zoologisches Museum der Universität, Hamburg, Germany
ZMO	Zoologisk Museum, Oslo
ZMTAU	Zoological Museum, Tel-Aviv University
ZMUC	Zoological Museum, University of Copenhagen
ZRC	Zoological Reference Collection, National University of Singapore

MORPHOLOGICAL CHARACTERS AND TERMINOLOGY

During this study, several important diagnostic morphological features were encountered that have not been described previously for albuneids or blepharipodids (see also Boyko and Harvey, 1999).

The setal field is a broad mat of very short, dense, simple setae (Boyko and Harvey, 1999) on the front of the carapace of albuneids and blepharipodids. The setal field varies in shape and extent across genera and species, but it appears to be relatively invariant within species. The carapace also possesses numerous transverse, setose grooves. Although carapace grooves (CG) have been scarcely mentioned by previous authors, I have identified 11 major grooves (numbered 1–11, fig. 2A) that can be recognized across albuneid and blepharipodid genera. Variability in the presence and the degree of fragmentation of grooves, in the anterior-posterior displacement of individual fragments, and in the texture of the grooves (e.g., smooth, crenulate) tends to be conservative within species, and thus carapace grooves are useful in recognizing species.

The median element of CG1 forms the posterior margin of the setal field and also of the frontal area. In some genera and species, the curved lateral elements of CG1 are often displaced posteriorly (as in fig. 2A). The metagastric region contains the short, anterior CG2 and the longer, posterior CG3. CG4 spans the width of the carapace and marks the border of the metagastric and mesogastric regions. CG5 is a fairly short groove that occurs medially in the mesogastric region. CG6 corresponds to the cervical groove in other

Anomura. CG7 is usually divided into two well-separated lateral fragments, but in some genera (e.g., *Austrolepidopa* Efford and Haig, 1968 and *Lepidopa*) CG7 merges medially with CG6. CG8–11 are relatively short medial grooves arranged anteriorly to posteriorly in the cardiac region.

The gill type and number are very different in the two families. All blepharipodids possess filamentous trichobranch gills (fig. 2B), two arthrobranchs on the second maxilliped, and one pleurobranch on pereopods II–IV. They also lack an epipod on the third maxilliped and an arthrobranch on the fifth pereopod. These gills are similar to those found on some other anomurans, such as aeglids, but are not the biserial or quadriserial phyllobranch gills as found in paguroids that have been misinterpreted as trichobranch (see McLaughlin and de Saint Laurent, 1998). In contrast, all albuneids have lamellar phyllobranch gills (fig. 2C), one arthrobranch on the second maxilliped, an arthrobranch on the fifth pereopod, an epipod on the third maxilliped, and lack pleurobranchs on pereopods II–IV.

The ocular peduncles of albuneids and blepharipodids are composed of three segments (fig. 2D; cf. Powar, 1969; terminology herein slightly modified from Boyko and Harvey, 1999, to better conform to Powar's usage). The proximal segments are fused to form the ocular plate, which is the name used herein for this structure. The median peduncular segments are either a pair of small free calcified elements or are fused to the ocular plate. The distal peduncular segments contain the corneas, where those structures have not been lost. The apparent division of the distal peduncular segment in *Blepharipoda* is not a true segmentation, but is only a weak calcification separating the segment into two pseudosegments. The presence in albuneids of ocular acicles has been controversial (e.g., McLaughlin, 1983; Martin and Abele, 1986). However, Boyko and Harvey (1999) conclusively showed that albuneids have no ocular acicles, only a calcified ocular plate and median peduncular segments; this is also true of blepharipodids.

As observed by previous workers, the third maxilliped (fig. 2E) contains a number of morphological characters useful for distin-

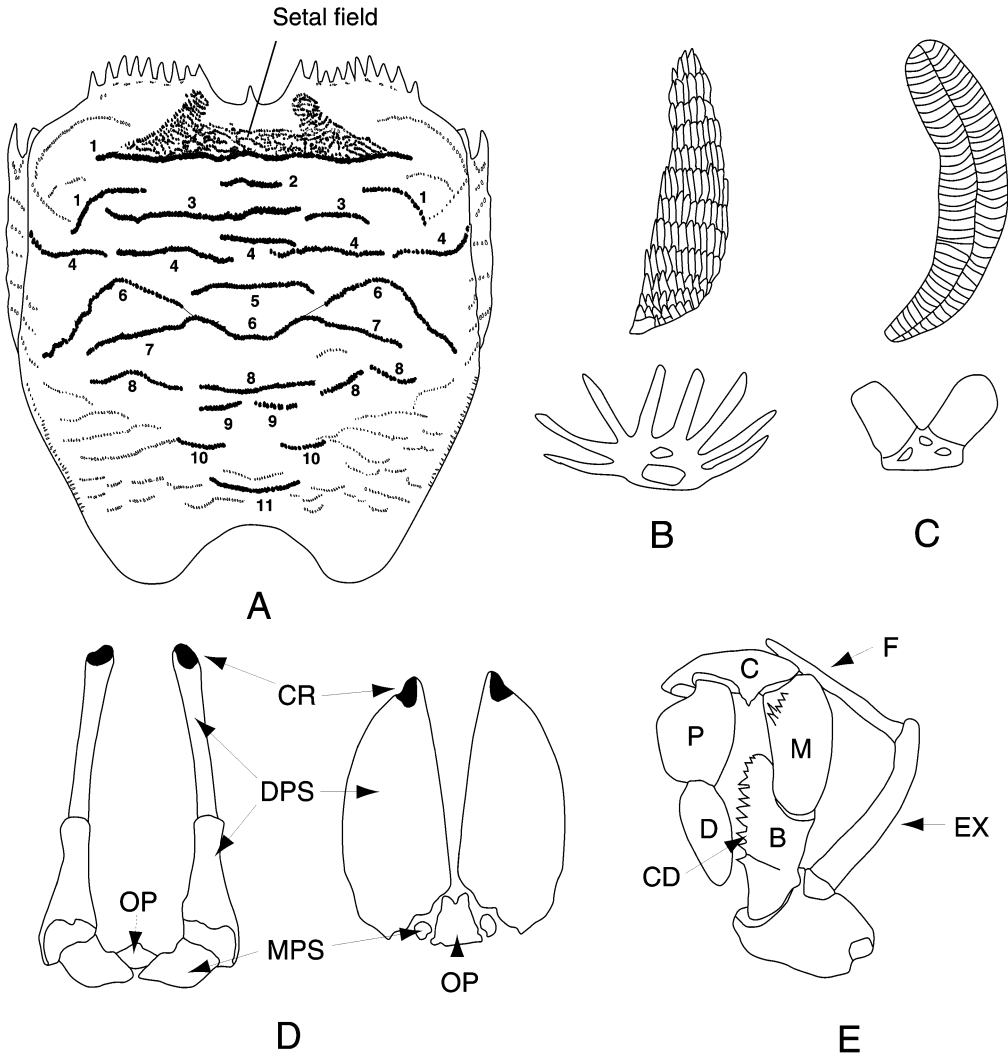


Fig. 2. **A.** Diagrammatic albuneid carapace based on *Albunea microps* Miers, 1878, showing setal field and setose carapace grooves (CG1–11) discussed in text. **B.** Diagrammatic trichobranch gill, whole (upper) and cross-section (lower) (after McLaughlin, 1980). **C.** Diagrammatic phyllobranch gill, whole (upper) and cross-section (lower) (after McLaughlin, 1980). **D.** Ocular peduncles of *Blepharipoda liberata* Shen, 1949 (left) and *A. symmysta* (Linnaeus, 1758) (right). **E.** Maxilliped III of *B. liberata*. Abbreviations: B, basis/ischium; C, carpus; CD, crista dentata; CR, cornea; D, dactylus; DPS, distal peduncular segment; EX, exopod; F, flagellum; M, merus; MPS, medial peduncular segment; OP, ocular plate; P, propodus.

guishing among hippoid genera and species. In most anomurans, the ischium bears a medial row of teeth, termed the crista dentata. Among the hippoids, only the blepharipodids are thought to possess a crista dentata (Martin and Abele, 1986; McLaughlin and Lemaitre, 1997). However, I have observed a

very reduced crista dentata on several species of *Albunea*.

The shape of the dactylus of the pereopod, particularly the third pereopod, has been used to distinguish among species of albuneids. To facilitate the description of the complex shape of this segment, several terms are used

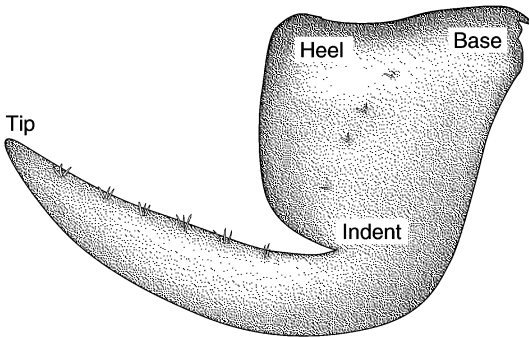


Fig. 3. Pereopod II dactyl of *Albunea* sp., lateral view, showing terms used in species accounts for landmarks on pereopod dactyli.

to refer to important landmarks (fig. 3; see also Boyko and Harvey, 1999). The “base” of the dactylus is the ventroproximal angle; the “heel” corresponds to the dorsoproximal angle, which is often strongly produced. The dorsal margin is almost always concave, sometimes smoothly so; in most species, however, the dorsal margin has a distinct angle, the apex of which is referred to as an “indent”. The dactylus terminates in a “tip”, which is somewhat rounded and lacks a corneous nail. As with all anomurans, the fifth pereopods are reduced. The morphology of the fifth pereopods varies little among species and, consequently, it is not included in the species descriptions.

In some species of albuneids and blepharipodids, certain segments of the pereopods bear a large transparent, decalcified area, hereafter called the “window,” that has only recently been reported in this family (Boyko and Harvey, 1999). This area, when present, is most prominent on the lateral surface of the merus (e.g., see fig. 27C), where it is comparable to the “leg membranes” of porcelain crabs (Porcellanidae) discussed in detail by Stillman and Somero (1996). If these windows are homologous with those of the porcelain crabs, they most likely function as respiratory structures. Similar structures, called “gas windows”, with a demonstrable respiratory effect, have been reported from the pereopods of certain ocypodid crabs (Brachyura: Ocypodidae) (Maitland, 1986), but these are almost certainly analogous, convergently evolved structures to the ones found on anomurans, rather than being ho-

mologous ones. These windows can also be found to a lesser degree on other pereopod segments of albuneids and blepharipodids, both laterally and mesially.

As in all decapod crustaceans, albuneid females have gonopores on the coxae of the third pereopods, whereas males have gonopores on the coxae of the fifth pereopods. However, in some albuneid genera and species (e.g., *Lepidopa*), males also have a small pore on the coxa of the third pereopod in a position analogous to that of the female gonopore. The precise nature and function of this pore are unknown. Male blepharipodid crabs never possess a pore on the third pereopod coxae.

In albuneids, females have well-developed uniramous pleopods on abdominal somites II–V. Male albuneids have traditionally been considered to lack pleopods (Efford and Haig, 1968). However, I have found rudimentary to small pleopods on abdominal somites II–V of male specimens with well-developed gonopores on the fifth pereopods in species of several albuneid genera (e.g., *Lepidopa*). In some *Albunea* species (e.g., *A. microps*, *A. speciosa*), specimens with large pores on the fifth pereopods, and with small pores on the coxae of the third pereopods, show no signs of pleopod development. In those species in which the third pereopod pore occurs in the male, it is always smaller than gonopores of same-sized females; likewise, the pleopods of females are always much more developed than those of males. Males are most reliably recognized by the presence of a gonopore on the fifth pereopod and by the rudimentary degree of development of the pleopods or lack thereof. In small specimens, however, the presence or absence of the male fifth pereopod gonopore is a more reliable indicator of sex than is pleopod development because both males and females may have small pleopod buds as juveniles. Male blepharipodid crabs have no trace of pleopod development. Male sand crabs and spiny sand crabs are typically subequal in size to, or slightly smaller than, females, except in *Blepharipoda occidentalis* where males are significantly larger (Boyko and Mikkelsen, 2002). There is no evidence of any species of albuneid or blepharipodid with dwarf or neotenous males, as found in

some species of *Emerita* Scopoli (Efford, 1967).

An additional secondary sexual character useful in distinguishing between species within genera is the shape of the male telson. Blepharipodids and lepidopines have little to no sexual dimorphism in the shape of the telson, but most of the Albuneinae exhibit highly differentiated male telson morphologies coupled with relatively invariant female telson shape within each genus. Male telson shape in the Albuneinae is also a good predictor of relationships within the species groups.

METHODS

Carapace length (CL), as measured from the midpoint of the anterior margin (including rostrum, if any) to the midpoint of the posterior concavity, is provided as an indicator of specimen size in most cases. If measurements are given as length vs. width, this is so noted in the text. Females with eggs are referred to as ovigers. In the list of synonyms, asterisks refer to publications citing material that I was able to examine during the present study. Absence of an asterisk in a specific entry does not imply that the identifications therein are in doubt, but only that I was unable to examine the material cited in that publication. Taxa are listed within this publication in rough approximation of their phylogenetic relationships to each other, starting with the most basal taxa, pending a detailed phylogenetic analysis (Boyko and Harvey, in prep.). The number of specimens examined for certain discrete morphological characters is listed in the text (e.g., "n = 3").

An extensive effort was made to incorporate nonsystematic references into the synonymy lists, including physiological literature, field guides, and popular works. It is hoped that the majority of such works that cite sand crabs have been included, but undoubtedly some omissions were made. Dissertations are cited only when they contain data not made available in other publications by the same author; data from my own dissertation (Boyko, 2000c) is therefore not included in this work, as that paper was in an essentially identical format to this monograph, excepting new species names and type

designations. Literature records that cannot be identified to species are given in appendix 1. Taxa excluded from the Albuneidae by various authors are listed in appendix 2. Station data for R/V "Coriolis" cruises were taken from Moosa (1984). Publication dates for publications based on the works of Cuvier follow Smith (1993), while authorship of family-level and higher taxa follows Martin and Davis (2001).

Illustrations were created using computer-assisted illustration techniques. Specimen images were first captured on a Macintosh computer with a digital camera connected to a Wild M8 dissecting microscope. These images were then prepared using the programs Adobe Photoshop and Adobe Illustrator. I attempted to record the position and size of setae in these drawings accurately, except that for clarity of presentation, I did not draw the plumules of plumose setae.

HIPPOIDEA LATREILLE, 1825

KEY TO FAMILIES

- 1 Pereopod I dactylus subchelate 2
- Pereopod I dactylus simple Hippidae
- 2 Gills trichobranch
- Blepharipodidae, new family
- Gills phyllobranch Albuneidae

BLEPHARIPODIDAE, NEW FAMILY

DIAGNOSIS: Carapace longer than wide, broadly keeled axially, front narrow; outer-ocular spines long, spinose; one or two hepatic anterolateral spines present; epibranchial spine present; branchiostegite weakly spinose. Rostrum triangular, spinose. Gills trichobranch; gill formula given below. Distal peduncular segment cylindrical, corneas large. Antennular segment I unarmed; dorsal flagellum with 18–85 articles, ventral flagellum with 6–21 articles. Antennal segment I unarmed dorsally; acicle short; flagellum with 8–44 articles. Proximal and distal maxillar endites subequal in width. Maxilliped I with epipod. Maxilliped II exopod with multiarticulated flagellum. Maxilliped III carpal projection short; merus armed; strong crista dentata present; exopod slender, with flagellum. Pereopod I dactylus subchelate; disto-dorsal carpal spine present; cutting edge spi-

nose. Pereopods II–IV dactyli laterally compressed and dorsoventrally expanded; dorsal margins of carpi spinose. Pereopod V reduced, chelate. Abdomen with pleura on somites II–V. Females with uniramous, paired pleopods on somites II–V; males without pleopods. Uropods present. Telson entire, ovate, laterally expanded. Telson sexual dimorphism weak to absent.

Gill formula (podobranch/arthrobranch/pleurobranch): maxilliped I, 0/0/0; maxilliped II, 0/0/0; maxilliped III, 0/0/1+1 rudimentary; pereopod I, 0/2/0; pereopod II, 0/2/1; pereopod III, 0/2/1; pereopod IV, 0/2/1; pereopod V, 0/0/0.

DISTRIBUTION: Eastern and western Pacific Ocean, also southwestern Atlantic Ocean. Exclusively antitropical.

TYPE GENUS: *Blepharipoda* Randall, 1840.

INCLUDED GENERA: *Blepharipoda* Randall, 1840; *Lophomastix* Benedict, 1904.

REMARKS: These two genera form a monophyletic unit that is either basal to the Hippidae and Albuneidae within the Hippoidea, or is one of the basal families of the Galatheaidea. Current evidence is equivocal as to the correct placement of this group at the superfamily level, and it is retained in the Hippoidea pending further study (Boyko and Harvey, in prep.). There is no doubt, however, that the retention of these two genera in the Albuneidae results in that family being paraphyletic, and so this new family is erected to contain them. The suggested common name for this family is “spiny sand crabs.”

KEY TO GENERA

- 1 Carapace with two hepatic lateral spines, distal segment of ocular peduncle subdivided into two pseudosegments . . . *Blepharipoda*
 – Carapace with one hepatic lateral spine, distal segment of ocular peduncle entire
 *Lophomastix*

LOPHOMASTIX BENEDICT, 1904

Blepharopoda [sic]: Duruflé, 1889: 92–95 (part).—Bouvier, 1898a: 566.—Bouvier, 1898b: 337 (part) (not *Blepharipoda* Randall, 1840).

Blephacopoda [sic]: Duruflé, 1889: unnumbered fig. (not *Blepharipoda* Randall, 1840).

Lophomastix Benedict, 1904: 621. – Balss, 1927: 1011. – Shen, 1949: 160–162. – Balss, 1957:

1599. – Miyake, 1978: 157. – Wicksten, 1980: 209 (list). – Coêlho and Calado, 1987: 41. – Calado, 1995: 225. – Sun and Wang, 1996: 35–36. – Boyko and Harvey, 1999: 383. – Schweitzer and Boyko, 2000: 631–632.

Blepharipoda: Balss, 1914: 92 (part). – Makarov, 1938: 110–111 (not *Blepharipoda* Randall, 1840).

Lophomastrix [sic]: Urita, 1934: 149, 153.

Lophopmastrix [sic]: Sun and Wang, 1996: 36.

Lophmastix [sic]: Sun and Wang, 1996: fig. 6.

DIAGNOSIS: Hepatic anterolateral spine present; anterior gastric spine absent; branchios-tegite weakly to moderately spinose. Distal segment of ocular peduncle entire. Dorsal flagellum with 18–54 articles, ventral flagellum with 6–13 articles. Antennal flagellum with 8–12 articles. Pereopod I dactylus dorsal margin smooth. Pereopods II–IV dactyli with produced, rounded heels.

DISTRIBUTION: Known from Russia; Japan; China; Korea; Baja California, Mexico; and California, USA (Recent); also from Washington, USA (fossil).

TYPE SPECIES: *Lophomastix diomedea* Benedict, 1904, by monotypy.

INCLUDED SPECIES: *L. japonica* (Duruflé, 1889); *L. diomedea* Benedict, 1904; *L. antiqua* Schweitzer and Boyko, 2000.

REMARKS: Bouvier (1898a) remarked on the primitive nature of the gill formula of *Blepharipoda fauriana*, a synonym of *Lophomastix japonica*. He also noted that the gill type (trichobranch) resembled that of other primitive anomurans such as the paguroids *Pylocheles* A. Milne Edwards and *Mixtopagurus* A. Milne Edwards, and the freshwater galatheid *Aegla* Leach. In this, Bouvier was not entirely correct, as McLaughlin and de Saint Laurent (1998) subsequently showed that the gill type of paguroids is actually biserial or quadriserial, rather than trichobranch. However, those of the aeglids and the blepharipodids are truly trichobranch. Subsequent authors took little notice of Bouvier’s (1898a) statements and continued to place *Lophomastix*, and its sister taxon *Blepharipoda*, within the Albuneidae. *Lophomastix* and *Blepharipoda* share trichobranch gill structure and identical gill formulas, as well as similar overall carapace, abdomen, and pereopod morphology. Both genera are antitropical in distribution (i.e.,

occurring both to the north and south of tropical waters).

KEY TO SPECIES

- 1 Spine on anterior margin lateral to ocular sinus needlelike *L. antiqua*
- Spine on anterior margin lateral to ocular sinus broad 2
- 2 Rostrum and lateral spines subequal in length, merus of pereopods II–IV spinose on lower margin, pereopod III dactylus with single heel lobe *L. diomedea*
- Rostrum approximately half the length of lateral spines, merus of pereopods II–IV smooth on lower margin, pereopod III dactylus with bifurcated heel lobe *L. japonica*

Lophomastix japonica (Duruflé, 1889)

Figures 4, 5

- Blepharopoda* [sic] *japonica* Duruflé, 1889: 93–95.
- Blephacopoda* [sic] *japonica*: Duruflé, 1889: unnumbered fig.
- Blepharopoda* [sic] *fauriana* Bouvier, 1898a: 566–567. – Bouvier, 1898b: 337–342, figs. 1–5.
- Blepharipoda japonica*: Balss, 1914: 92 (list). – Makarov, 1938: 111–113, fig. 41. – Kobyakova, 1955: 153, pl. 38, fig. 2 (1966: 208, pl. 38, fig. 2).
- Lophomastrix* [sic] *brevirostris* Urita, 1934: 149–154, figs. 1, 2. – Nishimura, 1939: 383, unnumbered fig. – Urita, 1942: 53–54. – Kamita, 1957: 91–94, figs. 37, 38.
- Lophomastix tchangsi* Yü, 1935: 51.
- Lophomastix japonica*: Shen, 1949: 162–165, pls. 16, 17. – Miyake, 1960: 89, pl. 44, fig. 2. – Kim, 1964: 8 (list), 11–12. – Miyake, 1965: 652, fig. 1112*. – Miyake, 1978: 157–158, fig. 62*. – Yang and Sun, 1979: 203. – Konishi, 1987: 123–138, figs. 2–9. – Wang, 1989: 39 (list). – Miyake, 1991: 158, pl. 53, fig. 3. – Asakura, 1995: 376, pl. 100, fig. 6. – Calado, 1995: 233–236, pl. 76, fig. a, pl. 77, figs. a–j. – Sun and Wang, 1996: 36. – Boyko and Mikelsen, 2002: 155.
- Lophomastix brevisrostris*: Yamaguti and Yamada, 1955: 133 (list). – Miyake, 1957: 91*. – Kamita, 1958: 70 (list). – Kim, 1963: 308 (list). – Kim, 1970: 6 (list). – Kim, 1973: 196–197, 563, 568, 595, pl. 3, fig. 17, text fig. 33. – Kim, 1977: 203.
- Blepharipoda fauriana*: Miyake, 1957: 91.
- Blepharipoda liberata*: Kurata, 1964: 13–14, figs. 22–31 (not *Blepharipoda liberata* Shen, 1949).

Lophomastix fauriana: Coêlho and Calado, 1987: table 1.

Lophomastrix [sic] *japonica*: Sun and Wang, 1996: 36.

Lophomastix [sic] *japonica*: Sun and Wang, 1996: fig. 6.

not *Blepharipoda fauriana*: Kurata, 1964: 11–13, figs. 1–21 (= *Blepharipoda liberata* Shen, 1949).

not *Lophomastix japonica*: Igarashi, 1970: 3, pl. 7, fig. 23 (= *Blepharipoda liberata* Shen, 1949).

MATERIAL EXAMINED: Russia: Saghalien (now Sakhalin), Nov. 27, 1926, coll. T. Urita: 1 ♀, 32.2 mm cl (USNM 104659); Saghalien, coll. T. Urita: 1 ♂, 21.2 mm cl (USNM 260864); Korsakov (= Odomari), Saghalien, Sept. 1943, coll. T. Urita: 1 ♂, 23.6 mm cl (ZLKU 3302), 1 oviger, 32.9 mm cl (ZLKU 3303).

Japan: Off Aomori, Oct. 1943, coll. Tanabe: 1 fragmented specimen (label indicates ♀), unmeasurable (ZLKU 3304); off Oshoro, Hokkaido, 50 m, July 6, 1954, coll. M. Yamada: 1 fragmented specimen, unmeasurable (ZLKU 3846); Oshoro, Hokkaido, coll. M. Sasaki: 1 ♀, 31.9 mm cl (USNM 54544); Cap Ainin-Kanmuri, Attukeshi, Hokkaido, May 30, 1962, coll. F. Iwata: 1 ♀, 29.8 mm cl (ZLKU 8864).

DIAGNOSIS: Outer-ocular spines triangular; rostrum not produced anteriorly as far as anterolateral spines; branchiostegite weakly spinose. Dorsal flagellum of antennule with 39–54 articles, ventral flagellum with 10–13 articles. Antennal flagellum with 8–12 articles. Pereopod II dactylus with tapered rounded heel. Pereopod III dactylus with bifurcated heel. Pereopod IV dactylus with produced acute heel.

DESCRIPTION: Carapace (fig. 4A) approximately 1.2 times longer than wide; gently keeled medially. Anterior margin with proximally broad and distally narrowing rugose outer-ocular spines on either side of ocular sinus, concave medially, becoming convex, then concave laterally; large spines and margin all armed with numerous small spinules. Rostrum large, rugose, dentate, triangular carapace extension, extending anteriorly approximately one-half length of outer-ocular spines; medial line depressed. Ocular sinus smoothly concave and armed with numerous

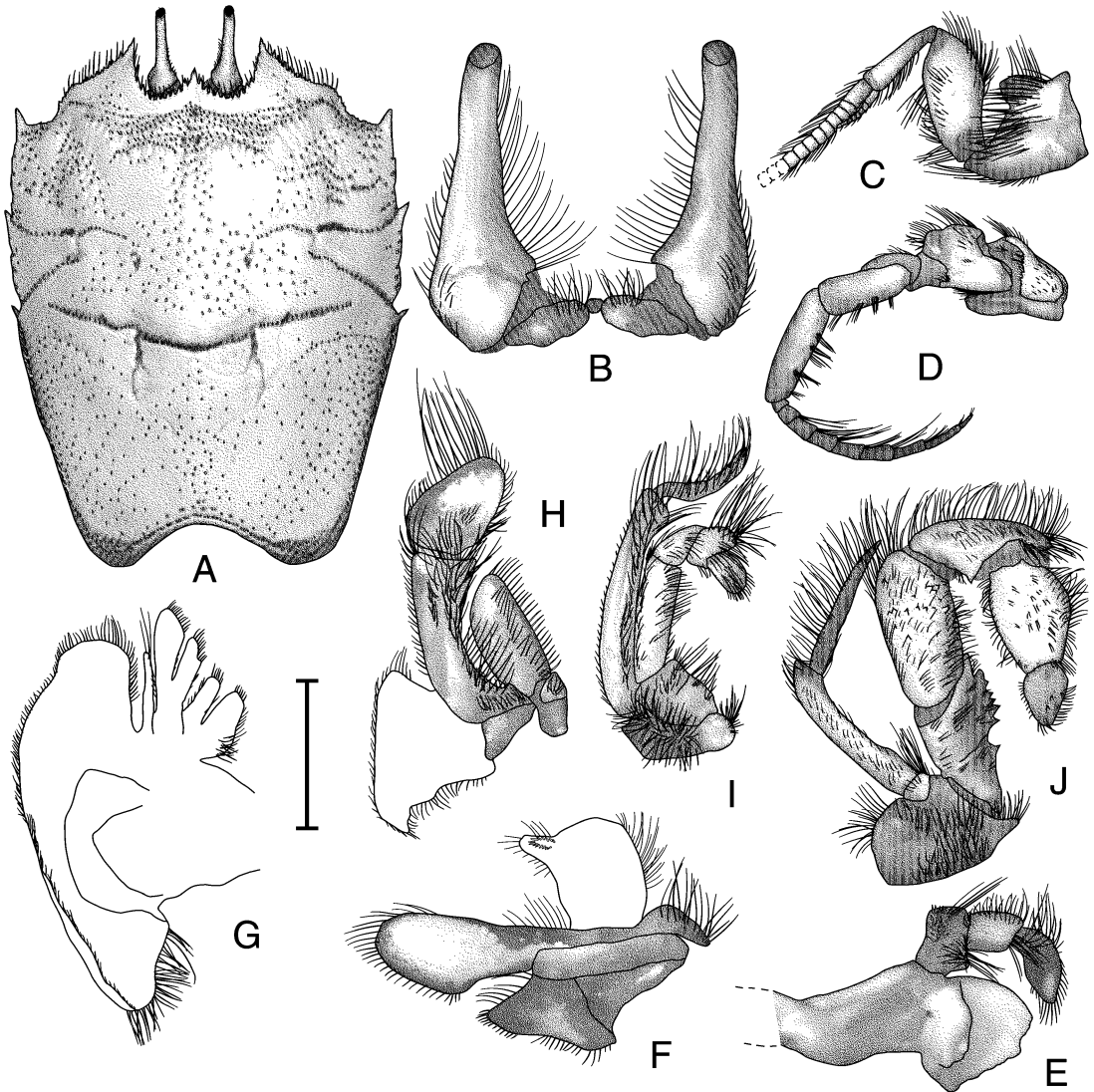


Fig. 4. *Lophomastix japonica* (Duroufflé, 1889): A, ♀, 31.9 mm cl, USNM 54544; B–J, oviger, 32.9 mm cl, ZLKU 3303. A. Carapace and ocular peduncles, dorsal view. B. Ocular peduncles, dorsal view. C. Left antennule, lateral view. D. Left antenna, lateral view. E. Left mandible, mesial view. F. Left maxillule, lateral view. G. Right maxilla, lateral view. H. Right maxilliped I, lateral view. I. Right maxilliped II, lateral view. J. Right maxilliped III, lateral view. Scale = 3.0 mm (B), 3.3 mm (F), 4.4 mm (E), 5.9 mm (C, H–J), 6.7 mm (D), 8.9 mm (G), and 10.6 mm (A).

small spines. Frontal region smooth medially with few setose rugose lines laterally behind outer-ocular spines; setal field wide, slightly curved, band anterior to CG1, without lateral elements. CG1 parallel to anterior margin of carapace, convex and produced dorsally, indented medially, armed with numerous small, rounded, corneous teeth along length;

no anterogastric median spine present. Mesogastric region smooth laterally with medial triangle of jagged, setose, corneous grooves; CG2 absent; CG3 absent; CG4 with two sinuous, crenulate lateral elements each approximately one-third carapace width, armed with rounded corneous teeth. Hepatic region with scattered, transverse, corneous lines, few

oblique grooves on lateral margin, and one anterolateral strong, anteriorly directed, corneous-tipped spine, spine surface with corneous grooves. Epibranchial region roughly triangular, smooth, with four to six corneous grooves mediolaterally, armed with one strong anterolateral spine approximately three-fourths length of hepatic spine. Metagastric region strongly carinate, covered in short corneous grooves; CG5 absent. CG6 sinuous and strongly crenulate, with corneous rounded teeth, oblique lateral elements separate from posteromedial and deeply indented concave element. CG7 absent. Cardiac region smooth laterally, with triangle of setose punctae medially; CG8 faint, paralleling medial portion of CG6 but extending more laterally. CG9–11 absent. Branchial region covered with numerous setose punctae; anterolateral margin with one short spine distally, numerous very small, acute spines proximally along margin. Posterior margin deeply and evenly convex; submarginal groove entire across posterior margin of carapace, setose. Branchiostegite without large spine; anterior region rugose and with numerous small spinules and many short rows of setae, sparsely covered with long plumose setae ventrally; posterior region membranous, with numerous irregular fragments and sparsely covered with long plumose setae.

Ocular plate (fig. 4B) small, ovate, ventromedial to median ocular segments, subsumed under anterior carapace margin. Median peduncular segments oblong, joined ventromedially by ocular plate; dorsomedial margin with short plumose setae. Distal peduncular segments elongate, entire, cylindrical, proximally inflated, distally tapering, somewhat laterally compressed with distinct ocular pore on medioventral surface just distal to base of segment; mesial margins widely separated along length; plumose setae along proximal half of lateral margins, in small proximolateral area, and on proximal four-fifths of mesial margins; long plumose setae on proximal three-fourths of ventromedial margins; distinct rounded cornea covering distolateral end of segment.

Antennule (fig. 4C) with segment III narrow proximally, expanding distally to 1.5 times proximal width; simple setae on dorsal margin, plumose setae on ventral margin;

dorsal exopodal flagellum with 39–54 articles ($n = 4$), long plumose setae on dorsal and ventral margins; ventral endopodal flagellum with 10–13 articles ($n = 4$), plumose setae on dorsal and ventral margins. Segment II slightly medially inflated from dorsal view, almost cylindrical, plumose setae on dorsal and ventral margins and scattered on ventrolateral third of surface. Segment I longer than wide, unarmed; distolateral surface with scattered long plumose setae; long plumose setae on dorsal and ventral margins.

Antenna (fig. 4D) with segment V approximately three times longer than wide, with seven short transverse lines of long simple setae on either side of ventral medial line, two tufts of setae on ventral midline; flagellum with 8–12 articles ($n = 5$), long simple setae at ventrodistal margin of each article. Segment IV subcylindrical, approximately 2.5 times longer than wide; four transverse rows of short simple setae on ventral margin either side of medial line. Segment III decalcified and produced mesiodistally. Segment II short, subcylindrical; antennal acicle short, rounded, rugose with few scattered setae. Segment I dorsally rounded, ventrally rectangular; few scattered setae on serrate distal margin and rugose surface; segment with ventromesial antennal gland pore.

Mandible (fig. 4E) incisor process with two teeth; cutting edge with one tooth. Palp three-segmented, with plumose setae on margins and long, thick, simple setae arising from bend in second segment.

Maxillule (fig. 4F) distal endite proximally narrow, widening to inflated distal end, with thick simple setae on distal margin, thin setae on dorsal margin. Proximal endite with thick simple setae on distal margin and decalcified dorsoventral lobe between calcified regions. Endopodal external lobe rounded distally and curled under; internal lobe produced distally with approximately 18 thick setae at distolateral margin; entire endopod subrectangular with mesiodistal narrow lobe (“mitten-shaped” where the mesiodistal lobe is the “thumb”).

Maxilla (fig. 4G) exopod evenly rounded and narrow, with plumose setae along distal margin. Scaphognathite bluntly angled on posterior lobe, with plumose setae.

Maxilliped I (fig. 4H) epipod short, sub-

triangular, with plumose setae on margins. Endite tapered distally and approximately three-fourths as long as first exopodal segment. Exopod with two segments; proximal segment narrow, margins parallel with plumose setae; distal segment spatulate, longer than wide, broadest medially, margins and proximal mesiodorsal surface with long plumose setae. Endopod flattened and elongate, reaching to distal end of proximal exopodal segment; plumose setae on margins.

Maxilliped II (fig. 4I) dactylus evenly rounded, length equal to width, with long simple setae on lateral surface; distal margin with thick simple setae. Propodus 2.5 times wider than long, plumose setae on distal margin and long simple setae at dorsodistal margin. Carpus not produced dorsodistally, approximately two times longer than wide; long simple setae on distal margin and scattered on lateral surface. Merus approximately 3.5 times longer than wide, margins parallel; with long plumose setae on lateral and mesial margins and scattered on mesiodorsal surface. Basis-ischium incompletely fused with deep suture, plumose setae on margins and on surface. Exopod one-half longer than merus, produced proximolaterally, lateral and mesial margins with short plumose setae; flagellum with six articles and long plumose setae.

Maxilliped III (fig. 4J) dactylus longer than wide, tip rounded; thick simple setae on distal margin, few thin simple setae on dorsal surface. Propodus dorsomedially inflated; scattered plumose setae on lateral surface; dorsal and ventral margins with plumose setae. Carpus slightly produced onto propodus, with small spine at distoventral margin; lateral surface with scattered plumose setae; plumose setae on dorsal and ventral margins. Merus with few strong corneous spines and numerous small spinules on distolateral third of surface; mediobasal margin unarmed; plumose setae on dorsal and ventral margins and scattered on lateral surface. Basis-ischium incompletely fused with deep suture, subequal to merus in length, produced mesiodistally; strong crista dentata of 9 or 10 large and small corneous teeth; ventral surface with one small acute tooth at distolateral margin. Exopod two-segmented: proximal segment small; second segment styliiform, slightly

longer than merus; plumose setae on margins and surface; flagellum with one elongate article and long plumose setae.

Pereopod I (fig. 5A) dactylus curved and tapering; lateral and mesial surfaces smooth; dorsal margin with numerous low, rounded teeth in proximal half, with long plumose setae; ventral margin unarmed, with submarginal tufts of short plumose setae. Propodal lateral surface with numerous short, raised, corneous lines, some with short setae; dorsal margin unarmed, with long plumose setae; ventral margin distally produced into acute spine, with long plumose setae; cutting edge with five to seven subequal corneous teeth, lined with long plumose setae; lateral surface of propodus unarmed; mesial surface rugose, with scattered long and short plumose setae. Carpus increasingly rugose dorsodistally, dorsodistal angle produced into strong corneous-tipped spine with small spinules on dorsal and ventral margins; distal margin with numerous spines; distoventral margin with strong spines and one or two small spines behind; dorsal and distal margins with long plumose setae; mesial surface rugose, with few scattered rows of short simple setae. Merus with short spine at distodorsal angle, distal submarginal crest of small corneous spines and large corneous spine at ventrodorsal margin; long plumose setae along subdistal crest on dorsal margin, scattered on dorsal half of lateral surface, and behind distoventral spine; mesial surface with few short rows of setae. Basis-ischium incompletely fused, unarmed. Coxa with small spine at proximal anterior margin.

Pereopod II (fig. 5B) dactylus smooth; base to heel proximally convex, becoming distally concave, heel smoothly rounded and produced, heel to tip with broad, subacute indent, tip subacute, tip to base broadly convex distally, becoming concave proximally; lateral surface smooth, with several small punctations in roughly straight line across medioproximal surface; mesial surface smooth, ventral margin with long plumose setae, dorsal margin with short simple setae. Propodal dorsal surface smooth, with ventral margin inflated and rounded; long plumose setae on ventral margin and scattered on surface; dorsolateral surface as narrow, oblique, flattened shelf, with short setae on dorsal

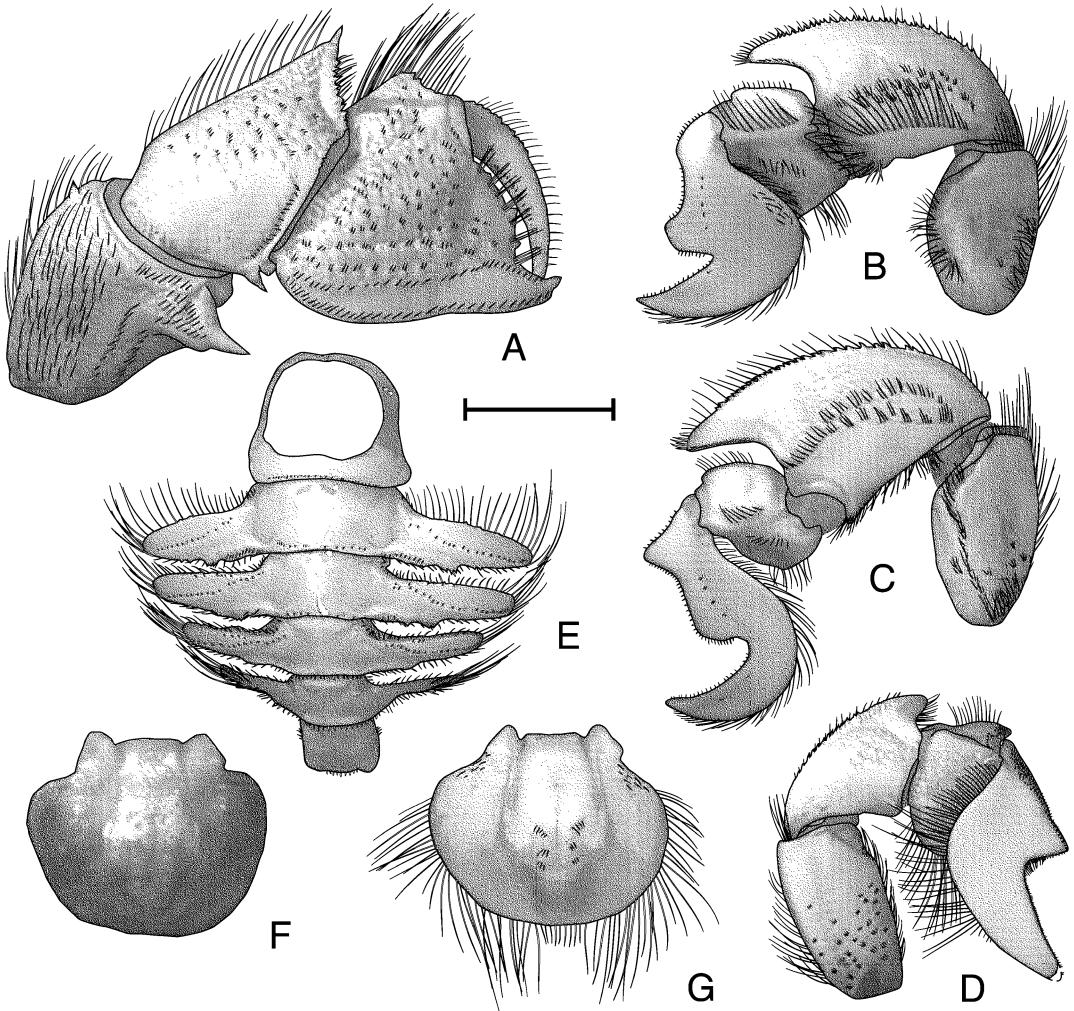


Fig. 5. *Lophomastix japonica* (Duroufflé, 1889): A, D, oviger, 32.9 mm cl, ZLKU 3303; B, C, G, ♀, 31.9 mm cl, USNM 54544; E, ♀, 32.2 mm cl, USNM 104659; F, ♂, 23.6 mm cl, ZLKU 3302. A. Right pereopod I, lateral view. B. Left pereopod II, lateral view. C. Left pereopod III, lateral view. D. Right pereopod IV, lateral view. E. Abdominal somites I–VI, dorsal view. F. Telson of ♂, dorsal view. G. Telson of ♀, dorsal view. Scale = 3.3 mm (F), 4.4 mm (G), and 9.5 mm (A–E).

margin and long plumose setae on ventral margin; mesial surface with elevated, curved setose ridge extending from ventral junction with dactylus almost to ventral proximal junction with carpus. Carpus strongly produced and subacute dorsodistally, dorsal margin serrated along distal four-fifths; lateral surface smooth, with triangular patch of rugae on distoventral third of surface extending into dorsomedial two-thirds of surface; submarginal elevated ridge ventrally, with long plumose setae; dorsal, ventral, and dis-

tal margins with short plumose setae; mesial surface smooth, dorsal, ventral, and distal margins with short simple setae; transverse line of short simple setae across surface. Merus with large median decalcified window covering nearly all of lateral surface, long plumose setae on dorsodistal and ventral margins; small acute spine at dorsodistal margin, ventral margin unarmed; mesial surface with few scattered patches of long plumose setae on surface and along dorsal and ventral margins. Basis-ischium incompletely

fused and unarmed. Coxa with two small spines on anterior margin.

Pereopod III (fig. 5C) dactylus with base to heel slightly concave, heel produced and rounded, heel to tip concave, with strong medial, rounded, produced lobe, tip subacute, tip to base smoothly convex; lateral surface smooth, row of small setose punctae proximal to medial lobe between heel and tip, dorsal margin with tufts of short setae; ventral margin with long plumose setae; mesial surface smooth, with plumose setae proximally at junction with propodus. Propodus not much inflated dorsoventrally; lateral surface smooth, simple setae on dorsal margin and in oblique row on surface; dorsolateral surface narrow, oblique, flattened with ventral row of long setae; ventral margin with long plumose setae; mesial surface with scattered long setae on and near ventral margin. Carpus strongly produced dorsodistally, reaching proximal margin of dactylus, tip subacute; distal four-fifths of dorsal margin with small corneous teeth; lateral surface rugose in medial third, with two distally merging medial transverse rows of short setae; mesial surface smooth, with row of long plumose setae on medial distal margin; dorsal and ventral margins with long plumose setae. Merus smooth, with large decalcified window covering nearly all of lateral surface; distodorsal margin with small spine; ventromedial margin unarmed; ventral and dorsodistal margins with long plumose setae; mesial surface smooth. Basis-ischium incompletely fused and unarmed. Coxa with medially directed anterior spine in males and females. Female with large gonopore on posterior mesial margin of coxa (not opposing the other coxa), without setae; male without pore.

Pereopod IV (fig. 5D) dactylus with base to heel straight, heel pointed and subacute, heel to tip wide and broadly rounded, tip subacute, tip to base broadly convex; lateral surface smooth, ventral margin with long plumose setae, dorsal margin with short simple setae; mesial surface smooth, small patch of plumose setae between heel and articulation with propodus. Propodus expanded dorsoventrally; ventral expansion almost reaching ventral margin of dactylus, ventral margin with long plumose setae; dorsal expansion with long plumose setae; lateral and

mesial surfaces smooth; mesial section of dorsal expansion incompletely fused to surrounding surface. Carpus produced dorsodistally; medial two-thirds of dorsal margin serrate; medial third of lateral surface with few setose rugae; long plumose setae on dorsal margin; mesial surface smooth with long simple and plumose setae on distal margin. Merus unarmed; dorsal and ventral margins with long plumose setae; few short setae scattered on proximoventral surface. Basis-ischium incompletely fused and unarmed. Coxa with small tubercle or spine at anterior margin.

Abdomen (fig. 5E) somite I wider than long, widest posteriorly; dorsal surface with anterior margin convex; posterior margin convex, with submarginal row of setose punctae; medial surface decalcified, with two short transverse calcified lines. Somite II anterior margin with punctations either side of midline, midline weakly produced, posterior margin concave, with incomplete setose punctate line along margin, lobular swellings on posterolateral corners; pleura expanded and directed posterolaterally; anterior margin with few, small, medial spines and long plumose setae; incomplete short line of simple setae running from anteromesial to posterolateral margins; posterior margin with two low spinose lobes, margin lateral to lobes with few short spines and short simple setae, mesial to lobes with short simple setae. Somite III similar to somite II, but narrower, shorter; pleura thinner and shorter than on somite II, directed laterally, anterior margin with few low spines, posterior margin with two low spinose lobes; posterior margin with short simple setae. Somite IV similar to somite III, but thinner and shorter, anterolateral lobular swellings smaller, posterior margin with row of short simple setae; pleura shorter than on somite III, directed anterolaterally; anterior margin with few, low, medial spines, posterior margin smooth with one low smooth lobe medially; margins with long plumose setae. Somite V subequal to somite IV, little to no lobular swelling anterolaterally, posterior margin with row of short simple setae; pleura approximately three-fourths length of somite IV pleura and directed anterolaterally; margins smooth, surface of pleura and margins with long plumose setae,

especially at distal tip. Somite VI subequal to somite V; anterolateral margin with short plumose setae; posteromedial margin with row of short simple setae; pleura absent.

Telson of male (fig. 5F; specimen illustrated damaged and without setae) subcircular, approximately as long as wide, with smoothly rounded distal tip; medial third heavily calcified, dorsally inflated, and tapering distally, lateral third weakly calcified; demarcation of calcified and uncalcified regions marked by low ridge; median longitudinal groove on distal two-thirds of calcified area, three to five short transverse rows of short simple setae on either side of median groove. Margins with long simple setae. Telson of female (fig. 5G) nearly identical to male, but slightly wider.

DISTRIBUTION: Known from Russia, Japan, China, and Korea, to 50 m depth.

MAXIMUM SIZE: Males: 23.6 mm cl; females: 32.9 mm cl.

TYPE SPECIMENS: The three syntypes of *Blepharopoda* [sic] *japonica* Duruflé, 1889 are not present in MNHN (Boyko, personal obs.) and are likely lost. *Blepharopoda* [sic] *fauriana* Bouvier, 1898a was based on the same three specimens (see below), and they are therefore lost as well. An unknown number of syntypes of *Lophomastix* [sic] *brevirostris* Urita, 1934 are not present in Tokyo Imperial University (K. Sakai, personal commun.) and are likely lost. The repository of the type (or types) of *Lophomastix tchangsii* Yü, 1935 is unknown.

TYPE LOCALITIES: Hakodate, Japan (*B. japonica* and *B. fauriana*); Enoura, Nagahama, Aniwa Bay, Japan; Tôbusi, Honto, Japan; Rakuma, Randomari, Japan; west coast of Saghalien (now Sakhalin), Japan (now Russia) (*L. brevisrostris*); Cheefoo, China (*L. tchangsii*).

REMARKS: Because both species were based on the same number of specimens from the same locality, donated by the same person, it is almost certain that the descriptions of *Blepharopoda* [sic] *japonica* and *Blepharopoda* [sic] *fauriana* were based on the same three specimens from Hakodate, Japan, donated to the MNHN by the Abbot Faurie in 1887. The specimens must have been left unlabeled by Duruflé and, when later examined by Bouvier, were thought to be

undescribed. The two taxa are therefore objective synonyms. It is remarkable that this could have occurred when both men worked in the same museum and published these descriptions less than 10 years apart. Balss (1914) was the first to recognize this species as a *Lophomastix*.

Although Urita (1934) repeatedly indicated that he had only a single specimen, he gave four different localities for the species, indicating that more than one specimen was known to him. The Japanese name for this species was “Urita-Kudahigegani” (Miyake, 1957), based on the belief that Urita’s *L. brevisrostris* was the correct name for this taxon. This species is now called “Kita-Kudahigegani” (Urita, 1942; Asakura, personal commun.).

Shen (1949) examined a large series of specimens from Chefoo, China, and concluded that *L. tchangsii* was synonymous with *L. japonica*. I was unable to obtain a copy of Yü’s (1935) abstract, but Shen (1949) was clearly correct in his conclusion, based on his comparison of Yu’s (1935) description with that of Duruflé (1889). Shen (1949) also synonymized *L. brevisrostris* with *L. japonica*. The text and illustrations of Shen (1949) served as the basis for the redescription of Calado (1995), who saw no material of this species.

Kurata (1964) described the stage I and II zoeae of this species (erroneously as *Blepharipoda liberata*) from the Japanese plankton. Konishi (1987) described the complete larval development (from ovigerous females) of three zoeal stages and one megalopal stage lasting 30–35 days at 18°C and 30‰ salinity.

Based on the color illustration of Miyake (1991) and the color photograph of Asakura (1995), this species is a uniform chestnut-brown with light tan highlights on the carapace margins and grooves. The setae are tan.

This species is closest to *L. antiqua*, which also has narrow outer-ocular spines and punctae, rather than short transverse lines, on the branchial region of the carapace.

Lophomastix antiqua Schweitzer and Boyko, 2000

Figure 6

Lophomastix antiqua Schweitzer and Boyko, 2000: 632–633, figs. 3, 4*.

MATERIAL EXAMINED: USA: Washington: Late Eocene (Refugian) Quimper Sandstone at RB40, located in the SE¼ NE¼ sec. 18, T29N, R7E, Nordland Quadrangle, 7.5' series, East Jefferson Co., along the west shore of Oak Bay on the Quimper Peninsula, south of Port Townsend, coll. R. E. and M. Berglund: 1 specimen, 38.2 mm cl, holotype (USNM 501834), 1 specimen, not measured, paratype (USNM 501835).

DIAGNOSIS: Carapace longer than wide; rostrum triangular, broad proximally, needle-like distally, approximately as long as wide; triangular and distally needlelike extra-ocular spines; ocular sinuses concavely rounded; frontal region of carapace with lateral margins nearly perpendicular to anterior margin; carapace with numerous, deeply incised grooves; CG1, CG4, CG6 ornamented with scabrous granules; CG8 deeply incised, transverse, parallel to CG6 posterolaterally; branchiostegite with spines and coarse granules.

DESCRIPTION: Carapace (fig. 6) longer than wide, strongly vaulted transversely and weakly vaulted longitudinally; broadly keeled axially; carapace smooth axially, becoming increasingly granular toward lateral margins. Anterior margin weakly convex, rostrum as triangular spine ornamented with small spines, broad proximally, narrowing distally; ocular sinuses convexly rounded, armed with small spines; outer angles of ocular sinuses armed with proximally broad and triangularly serrate lobes tapering distally to long, attenuated, smooth, sharp spines; spines almost as long as rostrum; remainder of anterior margin not well known, appearing to be straight. Frontal region with two grooves; first groove deeply incised, transverse, parallel to anterior margin, groove more weakly developed at base of rostrum, corresponding to anterior margin of setal field in Recent species; second groove (CG1) sinuous, composed of three segments, two lateral segments convex-forward arcs, central segment a weakly convex arc with central concavity, ornamented with scabrous granules. Mesogastric region smooth, broadly keeled axially, CG2 absent, CG3 absent. CG4 with two sinuous lateral elements each approximately one-third carapace width; oblique groove sinuous, extending obliquely

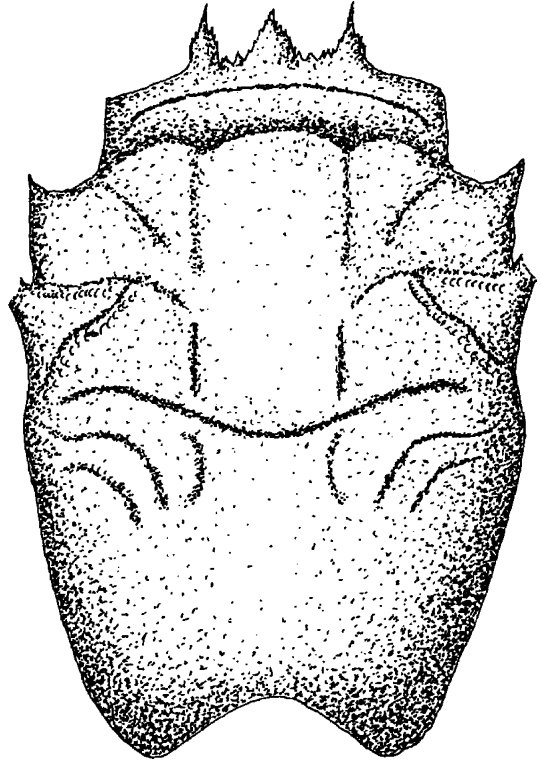


Fig. 6. *Lophomastix antiqua* Schweitzer and Boyko, 2000. 38.2 mm cl specimen, USNM 501834, holotype.

from base of first anterolateral spine posteriorly and toward axis of carapace. Anterolateral margin weakly convex, ornamented with two large spines; first hepatic lateral spine, broadly triangular, sharp, directed anterolaterally; second epibranchial lateral spine, not well known, appearing to be small, sharply triangular, directed weakly anterolaterally, located just posterior to intersection of CG4 with lateral margin of carapace. Posterolateral margin nearly straight, convergent posteriorly. Posterior margin strongly concave centrally, with broad, bluntly rounded projections at posterolateral corners. Epibranchial region triangular, granular, ornamented with second anterolateral spine, bounded anteriorly by CG4 and posteriorly by CG6. CG6 sinuous, lateral elements sharply oblique, medial element posteriorly displaced and sinuous, elements not continuous across carapace, ornamented with scabrous granules. CG7 fused with CG6. CG8

deeply incised, sinuous, curved anteriorly from lateral margins, concave centrally, incomplete medially, ornamented with scabrous granules. Cardiac region weakly granular, especially along lateral margins; CG9–11 absent. Branchiostegite with two sharp, narrow submarginal spines anterodorsally, coarsely granular posteriorly.

Propodus and carpus of right first pereopod (not illustrated) present, oriented anterolaterally to outer-ocular spine. Segments damaged, but appear typical of genus. Carpus of right second pereopod present, well preserved and with typical shape and serrate upper margin as for genus.

Abdominal somites (not illustrated) strongly vaulted transversely; first somite posterior margin straight, with submarginal row of punctae; remainder of segment obscured by carapace. Second somite with convexly rounded lateral margins; pleura broken, partially present on right side, upper and lower margins nearly straight, narrowing distally, distal margin nearly straight. Third somite broken, apex directed posteriorly; pleura missing. Fourth through sixth somites and telson missing.

DISTRIBUTION: Known only from the type locality.

TYPE SPECIMENS: USNM 501834 (holotype), USNM 501835 (paratype).

TYPE LOCALITY: Late Eocene (Refugian) Quimper Sandstone at RB40, located in the SE¼ NE¼ sec. 18, T29N, R7E, Nordland Quadrangle, 7.5' series, East Jefferson Co., along the west shore of Oak Bay on the Quimper Peninsula, south of Port Townsend, Washington, USA.

REMARKS: This fossil species differs in several features from the two Recent species of *Lophomastix*. The frontal region of *L. antiqua* has lateral edges that extend posteriorly almost perpendicular to the anterior margin. The lateral edges of the frontal region in the Recent species are much more gently rounded and extend at an oblique angle of approximately 45° to the anterior margin of the carapace in *L. japonica* and approximately 75° in *L. diomedae*. The rostrum of *L. antiqua* is narrowly triangular and the anterolateral spines are distally narrow and needlelike; the rostrum and those spines are shorter and more broadly triangular in the two Recent

species. Both the rostrum and outer-ocular spines are proportionally much longer than in Recent species. The fossil species displays a moderately deeply incised groove extending obliquely posteriorly from the base of the hepatic anterolateral spine; this groove is much more weakly developed in the Recent species. The cardiac region of the Recent species is better developed than that of the fossil. Finally, the dorsodistal region of the branchiostegite bears at least two strong acute submarginal spines in *L. antiqua*; this region is weakly spinose in Recent species. Characters of the pereopods and abdominal somites of *L. antiqua* are limited, due to the poor condition of the material examined, and cannot now be used to separate the species from the others in the genus.

Lophomastix antiqua appears closest to *L. japonica* in both the narrow shape of the outer-ocular spines and the presence of punctae, rather than short transverse lines, on the branchial region of the carapace. Discovery of pereopod material for *L. antiqua* would allow a clearer understanding of its relationships within the genus.

Lophomastix diomedae Benedict, 1904

Figures 7, 8

Lophomastix diomedae Benedict, 1904: 621–623, fig. 1*. – Haig and Wicksten, 1975: 100–101. – Luke, 1977: 31. – Wicksten, 1980: 209 (list). – Coêlho and Calado, 1987: table 1. – Williams et al., 1989: 35. – Calado, 1995: 226–230, pl. 74, figs. a–e, pl. 75, figs. a–d*. – Boyko and Mikkelsen, 2002: 155, 158.

MATERIAL EXAMINED: USA: California: AHF Sta. 1120–40, off San Nicholas Island, 29–33 fms (= 53.0–60.4 m), April 11, 1940, coll. R/V “Velero III”: 2 ♂, 15.3–16.0 mm cl, 1 ♀, 19.3 mm cl (LACM-AHF 15188); AHF Sta. 1120–40, off San Nicholas Island, 30 fms (= 54.9 m), April 11, 1940, coll. R/V “Velero III”: 1 ♂, 12.4 mm cl, 1 ♀, 21.4 mm cl, 1 ♀, unmeasurable (LACM-AHF 1122–40); 0.5 mi off Castle Rock, San Clemente Island, 22–37 fms (= 4.02–67.7 m), June 8, 1941, coll. R/V “Velero III”: 1 ♀, 21.0 mm cl (LACM-AHF 1327–41).

Mexico: Sta. 2913, Cortez Banks, Baja California Norte, 26 fms (= 47.6 m), Jan. 1889, coll. “Albatross”: 1 ♀, 7.7 mm cl, lec-

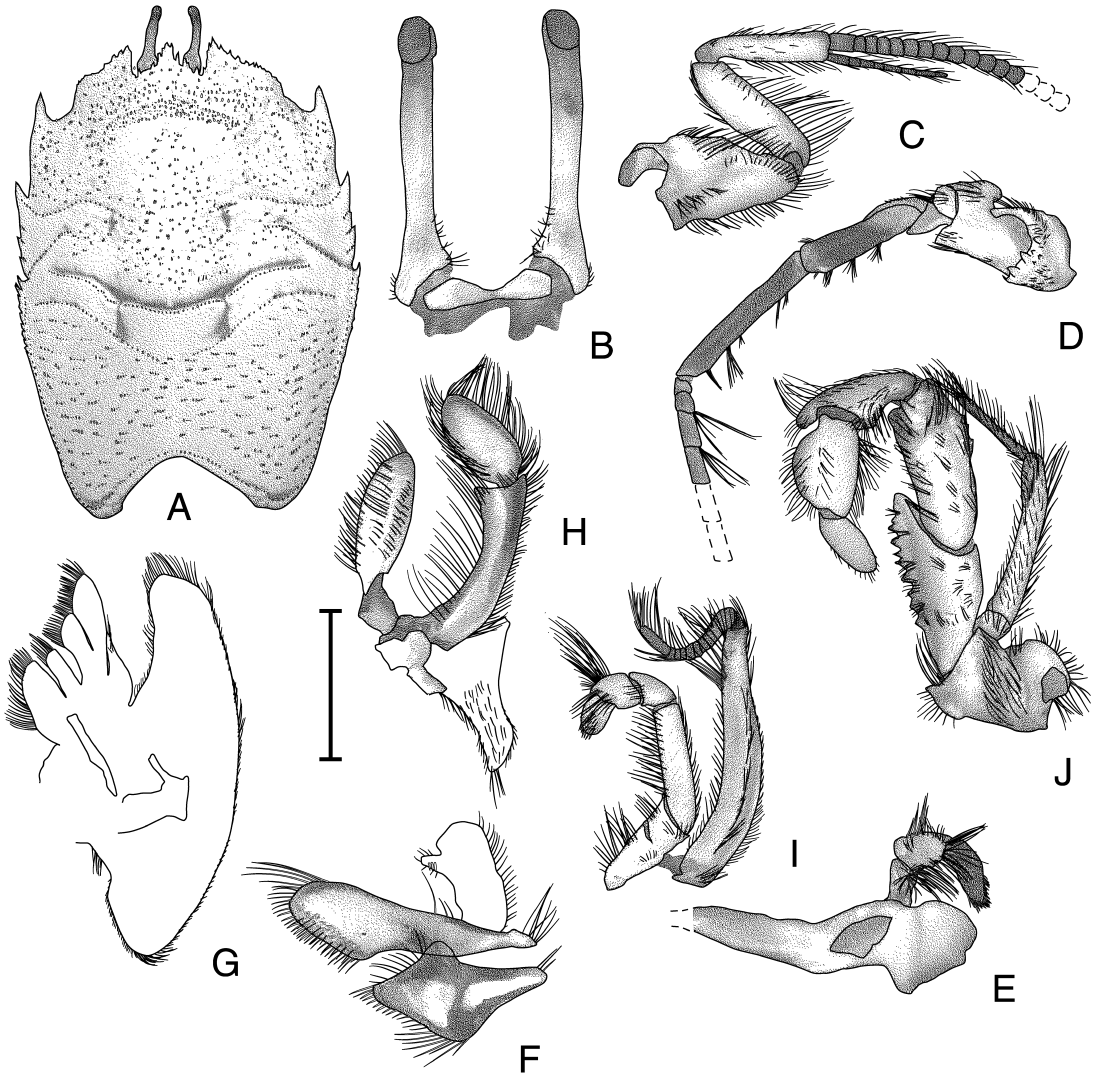


Fig. 7. *Lophomastix diomedeeae* Benedict, 1904: A, C–J, ♂, 16.0 mm cl, LACM-AHF 15188; B, ♀, 21.4 mm cl, LACM-AHF 1122–40. **A.** Carapace and ocular peduncles, dorsal view. **B.** Ocular peduncles, dorsal view. **C.** Right antennule, lateral view. **D.** Left antenna, lateral view. **E.** Left mandible, mesial view. **F.** Left maxillule, lateral view. **G.** Left maxilla, lateral view. **H.** Left maxilliped I, lateral view. **I.** Left maxilliped II, lateral view. **J.** Left maxilliped III, lateral view. Scale = 1.6 mm (B), 2.2 mm (F), 3.0 mm (C), 3.3 mm (D, E, G–J), and 5.8 mm (A).

totype (USNM 28771), 1 ♀, 5.5 mm cl, 1 broken and unsexable specimen, 14.0 mm cl, paralectotypes (USNM 310380).

DIAGNOSIS: Outer-ocular spines triangular; rostrum produced anteriorly as far as antero-lateral spines; branchiostegite weakly spinose. Dorsal flagellum with 18–30 articles, ventral flagellum with 6–8 articles. Antennal flagellum with 8–10 articles. Pereopod II

dactylus with low rounded heel. Pereopod III dactylus with single low rounded heel. Pereopod IV dactylus with produced rounded heel.

DESCRIPTION: Carapace (fig. 7A) approximately 1.2 times longer than wide; gently keeled medially. Anterior margin with large rugose spine on either side of ocular sinus; concave medially becoming convex laterally;

large spines and margin all armed with numerous small spinules. Rostrum as large rugose dentate triangular carapace extension, extending anteriorly as lateral anterior spines; medial line depressed. Ocular sinus acutely concave and armed with numerous small spines. Frontal region covered with numerous transverse, raised zigzag lines, anterior margins of raised lines corneous, lines with small simple setae; setal field a wide, slightly curved band anterior to CG1, without lateral elements. CG1 parallel to anterior margin of carapace, convex and produced dorsally, armed with numerous small rounded corneous teeth along length; no antero-gastric median spine present. Mesogastric region smooth laterally with medial triangle of jagged setose corneous grooves; CG2 absent; CG3 absent; CG4 with two sinuous crenulate lateral elements each approximately one-third carapace width, armed with rounded corneous teeth. Hepatic region with scattered transverse corneous lines and one anterolateral strong anteriorly directed corneous-tipped spine; spine surface with corneous grooves. Epibranchial region roughly triangular, smooth with three corneous grooves mediolaterally, armed with one strong anterolateral spine approximately one-half length of hepatic spine; two small lateral spinules behind large spine. Metagastric region covered in short corneous grooves; CG5 absent. CG6 sinuous and strongly crenulate with corneous rounded teeth, oblique lateral elements separate from medial and deeply indented concave element. CG7 absent. Cardiac region smooth; CG8 paralleling medial portion of CG6 but extending more laterally. CG9–11 absent. Branchial region covered with numerous transverse corneous-tipped setose grooves; anterolateral margin with numerous very small acute spines. Posterior margin deeply and irregularly convex; submarginal groove entire across posterior margin of carapace, setose. Branchiostegite without large spine; anterior region rugose and with numerous small spinules and many short rows of setae, sparsely covered with long plumose setae ventrally; posterior region membranous with numerous irregular fragments and sparsely covered with long plumose setae.

Ocular plate (fig. 7B) subsumed under an-

terior carapace margin. Median ocular segments oblong; dorsal margin with short plumose setae. Distal peduncular segments elongate, entire, cylindrical, somewhat laterally compressed with distinct ocular pore on medioventral surface just distal to base of segment; mesial margins widely separated along length; plumose setae along proximal quarter of ventrolateral margins and in small proximolateral area; long plumose setae on proximal three-fourths of ventral margins; rounded cornea distinct and covering distolateral end of segment.

Antennule (fig. 7C) with segment III narrow proximally, expanding distally to 1.5 times proximal width; simple setae on dorsal margin, plumose setae on ventral margin and sparsely scattered on lateral surface; dorsal exopodal flagellum with 18–30 articles ($n = 6$), long plumose setae on dorsal and ventral margins; ventral endopodal flagellum with six to eight articles ($n = 4$), plumose setae on dorsal and ventral margins. Segment II slightly medially inflated in dorsal view, almost cylindrical, plumose setae on dorsal and ventral margins and scattered on ventrolateral fourth of surface. Segment I longer than wide, unarmed; lateral surface with scattered long plumose setae; long plumose setae on dorsal and ventral margins.

Antenna (fig. 7D) with segment V approximately 7.5 times longer than wide, with four short transverse lines of long simple setae on either side of ventral medial line; flagellum with 8–10 articles ($n = 6$), long simple setae at ventrodistal margin of each article. Segment IV subcylindrical, approximately 4.5 times longer than wide; tuft of setae at dorsodistal margin; two transverse rows of short simple setae on ventral margin either side of medial line. Segment III decalcified and produced mesiodistally. Segment II short, subcylindrical; antennal acicle short, rounded, rugose, with few scattered setae. Segment I dorsally rounded, ventrally rectangular; few scattered setae on distal margins and surface; segment with ventromesial antennal gland pore.

Mandible (fig. 7E) incisor process with two teeth; cutting edge with one tooth. Palp three-segmented, with plumose setae on margins and long, thick, simple setae arising from bend in second segment.

Maxillule (fig. 7F) distal endite proximally narrow, widening to inflated distal end, with thick simple setae on distal margin. Proximal endite with thick simple setae on distal margin and decalcified dorsoventral lobe between calcified regions. Endopodal external lobe rounded distally and curled under; internal lobe produced distally, with three thick setae at distolateral margin; entire endopod "mitten-shaped."

Maxilla (fig. 7G) exopod evenly rounded and narrow with plumose setae along distal margin. Scaphognathite bluntly angled on posterior lobe, with plumose setae.

Maxilliped I (fig. 7H) epipod with plumose setae on margins, distolateral surface, and mesial surface. Endite tapered distally and approximately three-fourths as long as first exopodal segment. Exopod with two segments; proximal segment narrow, margins parallel, margins with plumose setae; distal segment spatulate, longer than wide, broadest medially, margins and proximal mesiodorsal margin with long plumose setae. Endopod flattened and elongate, reaching to distal end of proximal exopodal segment; plumose setae on margins.

Maxilliped II (fig. 7I) dactylus evenly rounded, length equal to width, with long simple setae on lateral surface; distal margin with thick simple setae. Propodus 1.5 times wider than long, plumose setae on distal margin and long simple setae at dorsodistal margin. Carpus not produced dorsodistally, approximately two times longer than wide; long simple setae on distal margin. Merus approximately four times longer than wide, margins parallel; with long plumose setae on lateral and mesial margins. Basis-ischium incompletely fused with deep suture, plumose setae on margins and on surface. Exopod one-third longer than merus, produced proximolaterally, flagellum with six articles; lateral and mesial margins with short plumose setae, submarginal dorsolateral ridge with short setae, flagellum with long plumose setae.

Maxilliped III (fig. 7J) dactylus longer than wide, tip rounded; thick simple setae on distal margin. Propodus dorsodistally inflated, with longitudinal median row of plumose setae on lateral surface; dorsal and ventral margins with plumose setae. Carpus slightly

produced onto propodus with small spine at distoventral margin; lateral surface with row of plumose setae ventromedially; plumose setae on dorsal and ventral margins. Merus with few strong corneous spines and numerous small spinules on distolateral third of surface; one large spine on mediolateral margin; plumose setae on dorsal and ventral margins and scattered on lateral surface. Basis-ischium incompletely fused with deep suture and subequal to merus in length, produced mesiodistally; strong crista dentata of 9 or 10 large and small corneous teeth; ventral surface with one small, acute tooth at distolateral margin. Exopod two-segmented: proximal segment small; second segment styli-form, approximately as long as merus; plumose setae on margins and surface; flagellum with one article and long plumose setae.

Pereopod I (fig. 8A) dactylus curved and tapering; lateral and mesial surfaces smooth; dorsal margin with numerous, low, rounded teeth, with long plumose setae; ventral margin unarmed, with row of short plumose setae. Propodal lateral surface with numerous short, raised, corneous lines, some with short setae; dorsal margin unarmed, with long plumose setae; ventral margin distally produced into acute spine, with long plumose setae; cutting edge with six subequal corneous teeth, and lined with long plumose setae; lateral surface of propodus unarmed. Carpus increasingly rugose dorsodistally, dorsodistal angle produced into strong corneous-tipped spine, with small teeth on dorsal surface of spine; dorsal and ventral margins of spine armed with numerous small spinules; dorsal margin with long plumose setae; mesial surface with few scattered rows of short simple setae. Merus with distal submarginal crest of corneous spines and large corneous spine at ventrodorsal margin; long plumose setae along subdistal crest, in sinuous line one-third from proximal margin of segment, and scattered on mesio-proximal third; mesial surface with few short rows of setae. Basis-ischium incompletely fused, unarmed. Coxa with small spine/tubercle at proximal anterior margin.

Pereopod II (fig. 8B) dactylus smooth; base to heel proximally convex becoming distally straight, heel smoothly rounded and low, heel to tip with narrow, rounded indent,

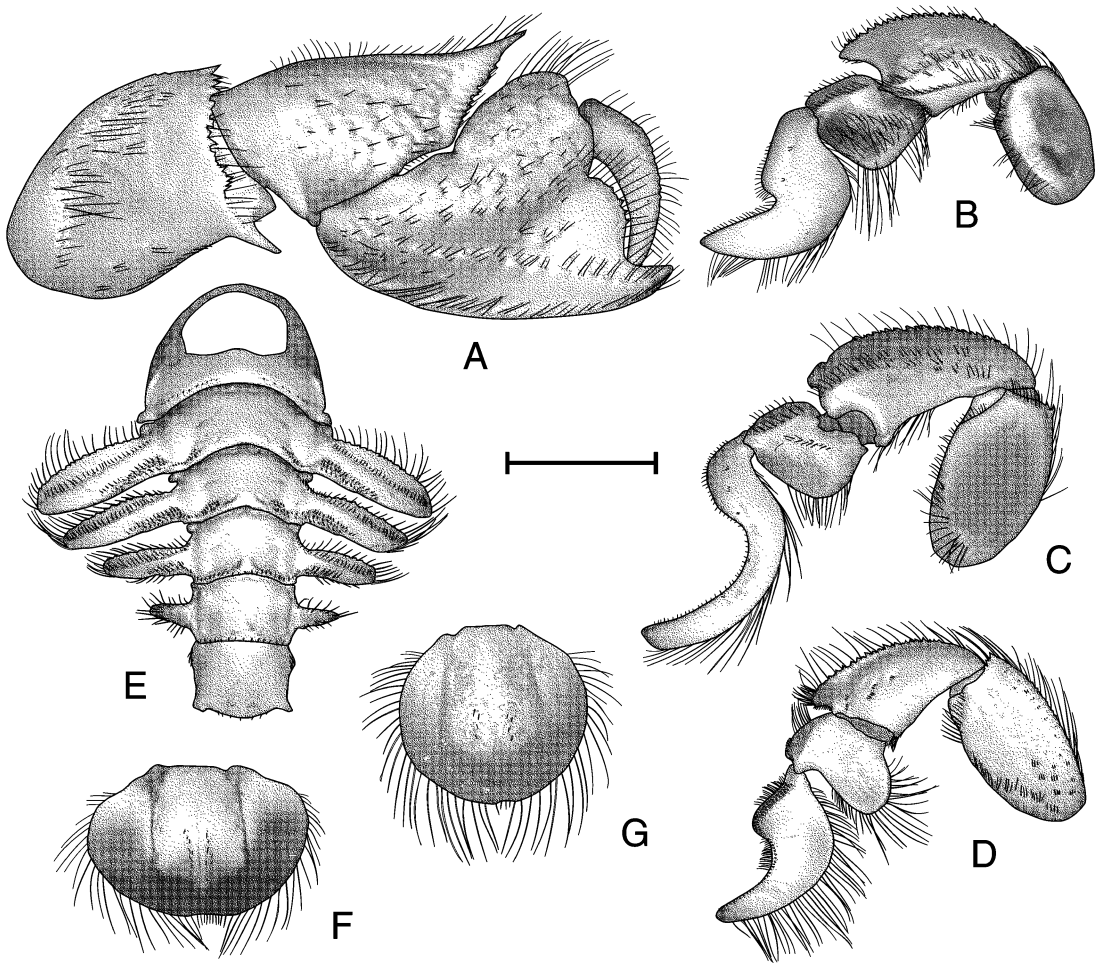


Fig. 8. *Lophomastix diomedeeae* Benedict, 1904: A, B, D-F, ♂, 16.0 mm cl, LACM-AHF 15188; C, G, ♀, 21.4 mm cl, LACM-AHF 1122-40. A. Right pereopod I, lateral view. B. Left pereopod II, lateral view. C. Left pereopod III, lateral view. D. Left pereopod IV, lateral view. E. Abdominal somites I-VI, dorsal view. F. Telson of ♂, dorsal view. G. Telson of ♀, dorsal view. Scale = 2.2 mm (G), 3.3 mm (A, F), 4.4 mm (E), 5.9 mm (C, D), and 6.7 mm (B).

tip subacute, tip to base broadly convex distally becoming concave proximally; lateral surface smooth, with several small punctations in roughly straight line across medio-proximal surface; mesial surface smooth, ventral margin with long plumose setae, dorsal margin with short simple setae. Propodal dorsal surface smooth, with ventral margin inflated and rounded; long plumose setae on ventral margin and scattered on surface; dorsolateral surface as narrow, oblique, flattened shelf, with short setae on dorsal margin and long plumose setae on ventral margin; mesial

surface with elevated, curved setose ridge from ventral junction with dactylus almost to ventral proximal junction with carpus. Carpus strongly produced and subacute dorso-distally, dorsal margin serrated along distal four-fifths; lateral surface smooth, with triangular patch of rugae on distoventral third of surface extending into dorsomedial two-thirds of surface; submarginal elevated ridge ventrally, with long plumose setae; dorsal, ventral, and distal margins with short plumose setae; mesial surface smooth, dorsal, ventral, and distal margins with short simple

setae; transverse line of short simple setae across surface. Merus with large median decalcified window covering nearly all of lateral surface, long plumose setae on dorsodistal and ventral margins; small acute spine at dorsodistal margin, one large and none to three small acute spines medially on ventral margin; mesial surface with few scattered patches of long plumose setae on surface on along dorsal and ventral margins. Basis-ischium incompletely fused and unarmed. Coxa with two small spines on anterior margin.

Pereopod III (fig. 8C) dactylus with base to heel straight, heel broadly rounded and low, heel to tip with broadly concave indent, tip subacute, tip to base smoothly convex; lateral surface smooth, dorsodistal margin with tufts of short setae; ventral margin with long plumose setae; mesial surface smooth, with plumose setae proximally at junction with propodus. Propodus not inflated dorsoventrally; lateral surface smooth, simple setae on dorsal margin and in oblique row on surface; dorsolateral surface narrow, oblique, flattened with ventral row of long setae; ventral margin with long plumose setae; mesial surface with scattered long setae on and near ventral margin. Carpus slightly produced dorsodistally, exceeding proximal margin of propodus by approximately one-fourth length of propodus, rounded; proximal four-fifths of dorsal margin with small corneous teeth; lateral surface rugose in medial third, with short setae and row of setae ventrally; mesial surface smooth, with row of long plumose setae on medial distal margin; dorsal and distal margins with long simple plumose setae. Merus smooth, with large decalcified window covering nearly all of lateral surface; distodorsal margin with small spine; ventromedial margin with one to three large and one or two small spines; ventral and dorsodistal margins with long plumose setae; mesial surface smooth. Basis-ischium incompletely fused and unarmed. Coxa with medially directed anterior spine in males and females. Female with large gonopore on posterior mesial margin of coxa (not opposing the other coxa), without setae; male without pore.

Pereopod IV (fig. 8D) dactylus with base to heel slightly concave, heel low and round-

ed, heel to tip wide and broadly rounded, tip subacute, tip to base broadly convex; lateral surface smooth, ventral margin with long plumose setae, dorsal margin with short simple setae; mesial surface smooth, small patch of plumose setae between heel and articulation with propodus. Propodus expanded dorsoventrally; ventral expansion almost reaching ventral margin of dactylus, ventral margin with long plumose setae; dorsal expansion with long plumose setae; lateral and mesial surfaces smooth; mesial section of dorsal expansion incompletely fused to surrounding surface. Carpus slightly produced dorsodistally; distal two-thirds of dorsal margin serrate; medial third of lateral surface with few setose rugae; long plumose setae on dorsal margin; mesial surface smooth, with long simple and plumose setae on distal margin. Merus with one large and one to three small spines at distolateral margin; dorsal and ventral margins with long plumose setae; few short setae scattered on proximoventral surface. Basis-ischium incompletely fused and unarmed. Coxa with small tubercle or spine on anterior margin.

Abdomen (fig. 8E) somite I wider than long, widest posteriorly; dorsal surface with anterior margin convex; posterior margin convex, with submarginal row of setose punctae; medial surface decalcified, with two short transverse calcified lines. Somite II anterior margin with punctations on either side of midline, midline weakly produced, posterior margin concave, with incomplete setose punctate line along margin, lobular swellings on posterolateral corners; pleura expanded and directed posterolaterally; anterior margin serrate, with long plumose setae; incomplete short line of simple setae running from anteromesial to posterolateral margins; posterior margin with two low smooth lobes, margin lateral to lobes smooth, mesial from lobes with short simple setae. Somite III similar to somite II, but narrower, shorter; pleura thinner and shorter than on somite II, anterior margin with low spines, posterior margin without well-defined lobes; posteromesial margin with short simple setae. Somite IV similar to somite III, but thinner and shorter, anterolateral lobular swellings smaller; pleura shorter than on somite III, directed laterally; anterior margin with

few low spines, posterior margin smooth with one low lobe mesially; margins with long plumose setae. Somite V subequal to somite IV, little to no lobular swelling anterolaterally; pleura approximately half length of somite IV pleura and directed laterally; margins smooth, surface of pleura with long plumose setae, especially at distal tip. Somite VI subequal to somite V; anterolateral margin with long plumose setae; posterior margin with row of short setae; pleura absent.

Telson of male (fig. 8F) subcircular, approximately as long as wide, with slight notch at distal tip; medial third heavily calcified, dorsally inflated, and tapering distally, lateral third weakly calcified; demarcation of calcified and uncalcified regions marked by low ridge; median longitudinal groove on distal two-thirds of calcified area, three to five short transverse rows of short simple setae on either side of median groove. Margins with long simple setae. Telson of female (fig. 8G) similar to male, with narrower uncalcified regions.

DISTRIBUTION: Known only from southern California, USA, and Baja California Norte, Mexico, in 40.2–67.7 m depth.

MAXIMUM SIZE: Males: 16.0 mm cl; females: 21.0 mm cl.

TYPE SPECIMENS: USNM 28774 (lectotype, designated herein), USNM 310380 (2 paratypes).

TYPE LOCALITY: "Albatross" Sta. 2913, off Cortes Bank, [Baja] California [Norte], [Mexico], in 26 fms [47.6 m] depth.

REMARKS: Calado (1995) selected the intact ♀ syntype as the lectotype in her dissertation, which is not considered a publication under the ICZN. No formal designation of this specimen as lectotype has subsequently been published, nor is any planned by Calado (de Melo, personal commun.) Therefore, the same ♀ specimen is herein selected as the lectotype to avoid confusion regarding the type status of this specimen.

BLEPHARIPODA RANDALL, 1840

Blepharipoda Randall, 1840: 130–131. – Ortmann, 1892: 535. – Ortmann, 1896: 222. – Holmes, 1900: 103. – Ortmann, 1901: 1153, 1271. – Balss, 1914: 92 (part). – Porter, 1915a:

78. – Porter, 1915b: 13. – Porter, 1916: 280. – Schmitt, 1921: 172. – Rathbun, 1926: 126 (part). – Balss, 1927: 1011. – Schmitt, 1942: 1. – Fesquet, 1942: 111. – Garcia Mendes, 1945: 118. – Shen, 1949: 154–155. – Snodgrass, 1952: 31. – Haig, 1955: 9. – Balss, 1957: 1599. – Castro, 1967: 1. – Glaessner, 1969: R483. – Epelde-Aguirre and Lopez, 1975: 165. – Miyake, 1978: 155. – Wicksten, 1980: 209 (list). – Boschi, 1981: 714, 739. – Calado, 1987: 86–87. – Coêlho and Calado, 1987: 41. – Manning, 1988: 626 (list). – Seridji, 1988: 1298–1299. – Calado et al., 1990: 747. – Calado, 1995: 98–99. – Sun and Wang, 1996: 33.

Albunhippa H. Milne Edwards and Lucas, 1841: 474–477. – Dana, 1852: 404. – Dana, 1853: 1429. – Boas, 1880: 134–136.

Albunhippe [sic]: Agassiz, 1845b: 1.

Abrote Philippi, 1857: 124.

Blepharopoda [sic]: Stimpson, 1858: 230. – Miers, 1878: 333–334. – Cano, 1889b: 263. – Duruflé, 1889: 92–95 (part). – Bouvier, 1898b: 337 (part). – Berg, 1900: 225.

Albunhippa (*Abrote*): Ortmann, 1901: 862–863, 1112.

Blefaripoda [sic]: Porter, 1936a: 153.

"*Lepidopa*": Kamita, 1957: 94–96 (not *Lepidopa* Stimpson, 1858).

Blepharipoda [sic]: Turner and Sexsmith, 1964: 50.

Albunhipa [sic]: Calado, 1987: 85. – Calado, 1995: 19.

not *Blepharopoda* [sic]: Duruflé, 1889: 92–95 (part). – Bouvier, 1898a: 566. – Bouvier, 1898b: 337 (part) (= *Lophomastix* Benedict, 1904).

not *Blephacopoda* [sic]: Duruflé, 1889: unnumbered fig. (= *Lophomastix* Benedict, 1904).

not *Blepharipoda* Brauer and Bergenstamm, 1889: 96. – Sabrosky and Arnaud, 1965: 1083 (Diptera: Tachinidae) (nom. preocc.) (= *Blepharipa* Rondani, 1856 fide Sabrosky and Arnaud, 1965).

not *Blepharipoda*: Balss, 1914: 92 (part). – Makarov, 1938: 110–111 (= *Lophomastix* Benedict, 1904).

not *Blepharipoda*: Rathbun, 1926: 126 (part) (= *Pagurus* Fabricius, 1775, *sensu lato*).

DIAGNOSIS: Outer-ocular spines triangular; two hepatic anterolateral spines present; anterior gastric spine present (except in *B. liberata*). Distal peduncular segments appearing two-segmented (pseudosegments). Antennular dorsal flagellum with 28–85 articles, ventral flagellum with 10–21 articles. Antennal flagellum with 11–44 articles. Pereopod I dactylus dorsal margin spinose; distodorsal

carpal spine present; cutting edge spinose. Pereopods II–IV dactyli with produced, rounded heels.

DISTRIBUTION: Known from Russia; China; Japan; Korea; central California, USA, south to Baja California, Mexico; Peru to Chile; and southern Brazil to Argentina.

TYPE SPECIES: *Blepharipoda*: *Blepharipoda occidentalis* J. W. Randall, 1840, by monotypy. *Albunhippa*: *Albunhippa spinosa* H. Milne Edwards and Lucas, 1841, by monotypy. *Abrote*: *Abrote spinimana* Philippi, 1857, by monotypy.

INCLUDED SPECIES: *B. occidentalis* J. W. Randall, 1840; *B. spinosa* (H. Milne Edwards and Lucas, 1841); *B. doelloi* Schmitt, 1942; *B. liberata* Shen, 1949.

REMARKS: *Blepharipoda* is an apparently difficult genus name to spell correctly (see above synonymy list). The precedence of *Blepharipoda* over *Albunhippa* has been a matter of some debate (e.g., Dana, 1852). The date of publication for volume 8(1) of the Proceedings of the Academy of Natural Sciences of Philadelphia, which contained Randall's description of *Blepharipoda*, is not known with certainty, but it was presented to the Academy at a meeting on May 5, 1840 (see Fox, 1913). Although the date is generally accepted to be 1840, whether this volume was published in 1839 or 1840 is irrelevant as far as priority of this genus name is concerned, as H. Milne Edwards and Lucas' paper describing the new genus *Albunhippa* was not published until sometime in 1841 (A. Crosnier, personal commun.), contrary to the statement of Dana (1852). *Blepharipoda* Randall is therefore the senior synonym and correct name for this genus. Randall (1840) considered this genus as the missing link between *Ranina* and *Albunea*, but these genera are in different decapod suborders and share only convergently evolved characters.

There is a junior homonym for this genus name in the Diptera (Insecta), but that name has long been synonymized, regardless of occasional recent citations as valid in the entomological literature (Sabrosky and Arnaud, 1965).

Blepharipoda and *Lophomastix* share trichobranch gill structure, the same gill formula, and similar overall carapace, abdomen, and pereopod morphology. Both are also an-

titropical in distribution. The apparent segmentation of the distal peduncular segments in *Blepharipoda* is, as in the hippid *Emerita*, the result of nonsclerotization of the membranous area, not true segmentation (see Pöw, 1969, for "*Hippa*" = *Emerita*).

The sole fossil species formerly placed in *Blepharipoda*, *B. brucei* Rathbun, 1926, was based on claw fragments and has recently been removed to the Paguridae (Schweitzer and Boyko, 2000).

KEY TO SPECIES

- 1 Basis-ischium of pereopod I with spine(s), meri of pereopods II–IV not all armed with small spine on distodorsal margin 2
- Basis-ischium of pereopod I without spine(s), meri of pereopods II–IV all armed with small spine on distodorsal margin 3
- 2 Anterior gastric spine present, posterior margin of abdominal somite II pleura toothed *B. occidentalis*
- Anterior gastric spine absent, posterior margin of abdominal somite II pleura smooth *B. liberata*
- 3 Coxae of pereopod II with one spine, distal margin of telson with notch *B. spinosa*
- Coxae of pereopod II with two spines, distal margin of telson smoothly rounded *B. doelloi*

Blepharipoda occidentalis Randall, 1840

Figures 9–11

Blepharipoda occidentalis Randall, 1840: 131–132, pl. 6*. – Gibbes, 1850a: 24, 27*. – Gibbes, 1850b: 187*. – Ortmann, 1896: 222 (part). – Holmes, 1900: 104–105. – Rathbun, 1904: 14 (list), 167. – Rathbun, 1911: 594 (list) (part). – Baker, 1912: 102. – Balss, 1914: 92 (list). – Porter, 1915a: 78–82 (part). – Porter, 1915b: 14–17 (part). – Porter, 1916: 280–282 (part). – Caldwell, 1918: 71. – Schmitt, 1921: 172, pl. 31, fig. 6. – Johnson and Snook, 1927: 346–349, fig. 295. – Porter, 1936b: 254–255 (part). – MacGinitie, 1938: 474. – Porter, 1940a: 312 (part). – Porter, 1940b: 146 (part). – Porter, 1941: 460 (part). – Schmitt, 1942: 2–9, pl. 1, figs. 4–6*. – Fesquet, 1942: 111–113. – Johnson and Lewis, 1942: 82–86, pls. 3, 4. – MacGinitie and MacGinitie, 1949: 304–305. – Snodgrass, 1952: 31–32, fig. 11b, c. – Smith et al., 1954: 186 (list). – Schuster-Dieterichs, 1956: 51 (list) (part). – Carlisle et al., 1960: 49. – Hedgpeth, 1961: 21, fig. 40. – Seilacher, 1961: 263–264, figs. 5–8. – Turner and Se-

- xsmith, 1964: 48. – Knight, 1968a: 337–367, figs. 1–61*. – Knight, 1968b: 63–93, figs. 1–61*. – Fonseca, 1970: 35 (part), fig. 71. – Carlton and Kuris, 1975: 410 (list). – Turner and Sexsmith, 1975: 46, 48, unnumbered fig. – Luke, 1977: 31. – Haig and Abbott, 1980: 582, fig. 24.5. – Wicksten, 1980: 209 (list). – Paul, 1981a: 159–168, figs. 1–3. – Paul, 1981b: 169–187, figs. 1d–f, 2a, 3, 4, 5b–d, 6b, c, 7, 8b, d, 10, 11d, f, g. – Coêlho and Calado, 1987: 42, table 1. – Williams et al., 1989: 35. – Faulkes et al., 1991: 1245. – Faulkes and Paul, 1993: 1600. – Calado, 1995: 113–116, pl. 34, figs. a–b, pl. 35, figs. a–d*. – Faulkes and Paul, 1997a: 162, 165–175. – Faulkes and Paul, 1997b: 793–804. – Faulkes and Paul, 1997c: 161–168. – Faulkes and Paul, 1997d: ii. – Dugan et al., 2000: 230–244. – Boyko and Mikkelsen 2002: 149–150, 152–153, 155, 158, fig. 1a.
- Blepharopoda* [sic] *occidentalis*: Stimpson, 1857: 486*. – Stimpson, 1858: 230. – Miers, 1878: 334–335. – Duruflé, 1889: 93, 95. – Bouvier, 1898b: 342.
- Blepharipoda* [sic] *occidentalis*: Turner and Sexsmith, 1964: 50, unnumbered fig.
- not *Blepharipoda occidentalis*: Ortmann, 1896: 222 (part). – Lenz, 1902: 749. – Rathbun, 1911: 594 (list) (part). – Porter, 1915a: 78–82 (part), fig. 10. – Porter, 1915b: 14–17 (part), fig. 3. – Porter, 1916: 280–282 (part), unnumbered fig. – Porter, 1936b: 254–255 (part). – Porter, 1936c: 338 (list). – Porter, 1940a: 312 (part). – Porter, 1940b: 146 (part). – Porter, 1941: 460 (part). – Schuster-Dieterichs, 1956: 52. – Fonseca, 1970: 35 (part) (= *Blepharipoda spinosa* (H. Milne Edwards and Lucas, 1841)).
- not *Blepharopoda* [sic] *occidentalis*: Berg, 1900: 225–227 (= *Blepharipoda doelloi* Schmitt, 1942).
- not *Blepharipoda occidentalis*: Porter, 1911: 17. – Porter, 1915a: 78–82 (part). – Porter, 1915b: 14–17 (part). – Porter, 1916: 280–282 (part). – Porter, 1936b: 254–255 (part). – Porter, 1940a: 312 (part). – Porter, 1940b: 146 (part). – Porter, 1941: 460 (part). – Barattini, 1957: 63–65, fig. 1. – Zolessi and Philippi, 1995: 10 (list). – Boschi, 1997: 224 (= *Blepharipoda doelloi* Schmitt, 1942).
- not *Blefaripoda* [sic] *occidentalis*: Porter, 1936a: 153 (= *Blepharipoda spinosa* (H. Milne Edwards and Lucas, 1841)).
- not *Blepharipoda occidentalis*: Schuster-Dieterichs, 1956: 52.– 29, 34, 36–37, 40, 45, 47–48, 51 (list, part) (= sp. indet.).
- not *Blepharipoda occidentalis*: Schram, 1986: 293, fig. 24–3 (= *Emerita* sp. [Hippidae]).
- “Southern California,” coll. C. A. Whiting: 2 ♂, 43.2–47.9 mm cl (USNM 24813); “West coast of America,” coll. unknown: 2 ♂, 60.6–66.1 mm cl (MCZ 19653); *San Francisco Co.*: Ocean Beach, San Francisco, March 1962, coll. C. Daiss: 1 ♂, 42.6 mm cl (CASIZ 109335); San Francisco, 1880, coll. D. S. Jordan: 1 ♂, 22 mm cl, 1 ♀, 47.8 mm cl (USNM 3091); near end of Lincoln Ave., Ocean Beach, San Francisco, March 7, 1984, coll. D. Alexander: 1 ♂, 56.4 mm cl (CASIZ 50641); *Monterey Co.*: Pacific Grove, Monterey, coll. unknown: 1 ♂, 58.8 mm cl (CASIZ 109239); Pacific Grove, Monterey, coll. H. Heath: 1 oviger, 49.8 mm cl (ANSP 566); Monterey Bay, 15 fms (= 27.4 m), coll. unknown: 1 ♂, 69.1 mm cl (CASIZ 109334); off Del Monte, Monterey Bay, 8 fms (= 14.6 m), Aug. 7, 1931, coll. G. E. MacGinitie: 1 megalopa, 3.4 mm cl; *San Luis Obispo Co.*: Cayucos, coll. H. F. F. Merrill: 2 ♂, 40.0–44.4 mm cl (CASIZ 109333); beach near Morrow Bay, coll. C. L. Hubbs: 3 ♂, 48.7–69.9 mm cl (CASIZ 109249); sand bar, Morro Bay, Aug. 1938, coll. T. and J. Q. Burch: 1 ♂, 58.2 mm cl, 1 oviger, 46.3 mm cl (AMNH 9048); coll. E. Deichmann: 1 ♂, 49.3 mm cl, 1 oviger, 57.5 mm cl (MCZ 9419); *Santa Barbara Co.*: Jalama Beach, north of Point Concepcion, June 3, 1999, coll. J. Diehl: 4 ♂, 36.9–47.8 mm cl, 2 ♀, 38.1–41.8 mm cl, 1 oviger, 32.6 mm cl (AMNH 18076); near Carpinteria, June 2, 1916, coll. C. L. Hubbs: 1 ♀, 26.1 mm cl (CASIZ 109244); Santa Barbara, coll. D. S. Jordan: 1 ♂, 37.0 mm cl (USNM 3047); from beach near East Point, Santa Rosa Island, Channel Islands, California, Feb. 4, 1954, coll. unknown: 1 oviger, 43.2 mm cl (CASIZ 3755); *Los Angeles Co.*: San Pedro, March 3, 1898, coll. “Albatross”: 1 ♂, 33.2 mm cl (USNM 21813); San Pedro, 1901, coll. T.D.A. Cockerell: 2 ♂, 35.2–52.5 mm cl (USNM 42201); caught on baited line, Manhattan Beach, Aug. 5, 1933, coll. V. Williams: 4 ♂, 48.2–50.7 mm cl (USNM 267780); Venice, coll. Venice Marine Biological Station: 1 ♂, 39.7 mm cl (USNM 43345); Hyperion, Oct. 25, 1921, coll. E. J. Brown: 1 ♂, 53.5 mm cl (USNM 56389); Long Beach, coll. H. N. Lowe: 4 ♂, 34.5–42.6 mm cl, 2 ♀, 38.9–44.8 mm cl, 3 ovigers, 38.0–44.3 mm cl (USNM 42102), 1 ♂,

MATERIAL EXAMINED: USA: California:

39.1 mm cl (BMNH 1937.6.1.6 ex USNM 42102), 1 ♂ 29.9 mm cl, 1 oviger, 36.2 mm cl (USNM 79389 ex USNM 42102); Long Beach, coll. H. N. Lowe: 1 oviger, 42.7 mm cl (USNM 42202); Long Beach, June 1905, coll. J. E. Benedict: 2 ♂, 45.2–46.6 mm cl, 3 ♀, 35.3–40.9 mm cl, 2 ovigers 35.4–38.3 mm cl (USNM 42203), 2 ♂, 45.2–50.0 mm cl (BMNH 1976.288 ex USNM 42203); Long Beach, coll. H. N. Lowe: 1 ♂, 51.8 mm cl (USNM 23057); *Orange Co.*: Corona del Mar, July 10, 1937, coll. G. E. and N. MacGinitie: 2 ♂, 33.4–34.9 mm cl, 1 ♀, 39.4 mm cl, 1 oviger, 36.6 mm cl (USNM 267781), 1 ♂ 40.5 mm cl, 1 ♀, 38.5 mm cl (RMNH 14644 ex USNM 267781), 6 ♂, 37.5–46.0 mm cl, 2 ♀, 38.1–43.1 mm cl, 2 ovigers, 32.6–37.4 mm cl (USNM 89482); Corona del Mar beach, July 1946, coll. G. E. and N. MacGinitie: 1 ♂, 52.6 mm cl (USNM 89496); Seal Beach, Spring 1919, coll. E. P. Chace: 1 ♀, 39.9 mm cl (USNM 54050); *San Diego Co.*: San Diego, coll. T. Nuttall and J. K. Townsend: 1 ♀, 49.5 mm cl, holotype (ANSP 3656); La Jolla, coll. Scripps Institute of Oceanography: 1 ♂, 38.0 mm cl, 1 ♀, 43.0 mm cl (BMNH 1959.8.5.65–66); La Jolla, 1927, coll. W. R. Coe: 1 ♀, 34.3 mm cl (YPM 21131); La Jolla, July 13, 1916, coll. unknown: 2 ♂, 33.8–46.9 mm cl, 1 ♀, 39.6 mm cl (AMNH 6157); La Jolla, 2 ♂, 44.5–57.7 mm cl (AMNH 9666); La Jolla, coll. unknown, 1 ♂, 10.0 mm cl (USNM uncataloged); San Diego, Jan. 17, 1905, coll. Davis: 1 ♂, 46.7 mm cl (USNM 104652); Mission Bay, Jun. 5, 1946, coll. unknown: 2 ♂, 46.7–48.2 mm cl, 1 oviger, 43.4 mm cl (CASIZ 109336); Coronado, Sept. 7, 1901, coll. H. E. Stockwell: 1 ♂, 56.8 mm cl (USNM 29021).

Mexico: Baja California Norte: Rosalia Bay, coll. A. W. Anthony: 1 ♂, 42.8 mm cl (USNM 19526); “Lower” [= Baja] California, Mexico, coll. T. H. Streets: 1 ♂, 45.3 mm cl (USNM 2298); San Pedro, coll. University of California Department of Biology: 1 oviger, 42.7 mm cl (USNM 267782).

No data/limited data: 1 ♂, 41.6 mm cl, 1 ♀, 42.2 mm cl (USNM 104651); “on the beach, cast up during reign of peridinium,” July 22, 1901, coll. unknown: 1 ♂, 44.3 mm cl, 1 ♀, 50.1 mm cl, 3 ovigers, 49.7–55.6 mm cl (USNM acc. 207824); Aug. 29, 1933,

coll. unknown: 1 ♂, 58.4 mm cl (USNM acc. 207834); 1 ♀, 17.5 mm cl (USNM 42200); [no data]: 1 ♂, 33.7 mm cl (USNM 5228); 1 ♂, 53.4 mm cl (USNM uncataloged).

Incorrect locality data: “Australia”, coll. H. A. Ward: 1 ♂, 44.4 mm cl (USNM 21743).

DIAGNOSIS: Carapace with anterior gastric spine. Antennular dorsal flagellum with 65–85 articles, ventral flagellum with 15–21 articles. Antennal flagellum with 24–44 articles. Pereopod I dactylus with two or three large spines on dorsal margin; carpus with one to three large spines proximal to dorso-distal spine; basis-ischium with spine(s). Pereopod II coxa with one spine (or one spine plus small tubercle). Abdominal somite II pleura spinose.

DESCRIPTION: Carapace (fig. 9A) approximately 1.3 times longer than wide; strongly keeled medially. Anterior margin with large rugose spine on either side of ocular sinus, convex laterally; large spines and margin all armed with numerous small spinules; large spine armed with strong low tooth on mesio-distal margin. Rostrum as large acute spine, extending nearly one-half length of proximal pseudosegment of distal peduncular segments. Ocular sinus acutely concave and armed with numerous small spines. Frontal region smooth; setal field as thin transverse line with anteriorly produced lateral elements. CG1 parallel to anterior margin of carapace, convex and produced dorsally, armed with numerous small rounded teeth along length and large anterogastric median spine. Mesogastric region smooth laterally, with row of medial punctae; CG2 absent; CG3 absent; CG4 with two long crenulate lateral elements approximately one-third carapace width. Hepatic region smooth, with scattered small punctae and two strong, slightly curved, anteriorly directed spines; anteriormost spine approximately one-half larger than posterior. Epibranchial region roughly triangular, smooth, armed with one strong spine subequal in length to posterior hepatic spine; three short setose grooves mediolaterally. Metagastric region smooth, with medial and posterior punctae; CG5 absent. CG6 strongly crenulate, with oblique anterolateral elements separate from medial concave element. CG7 absent. Cardiac region

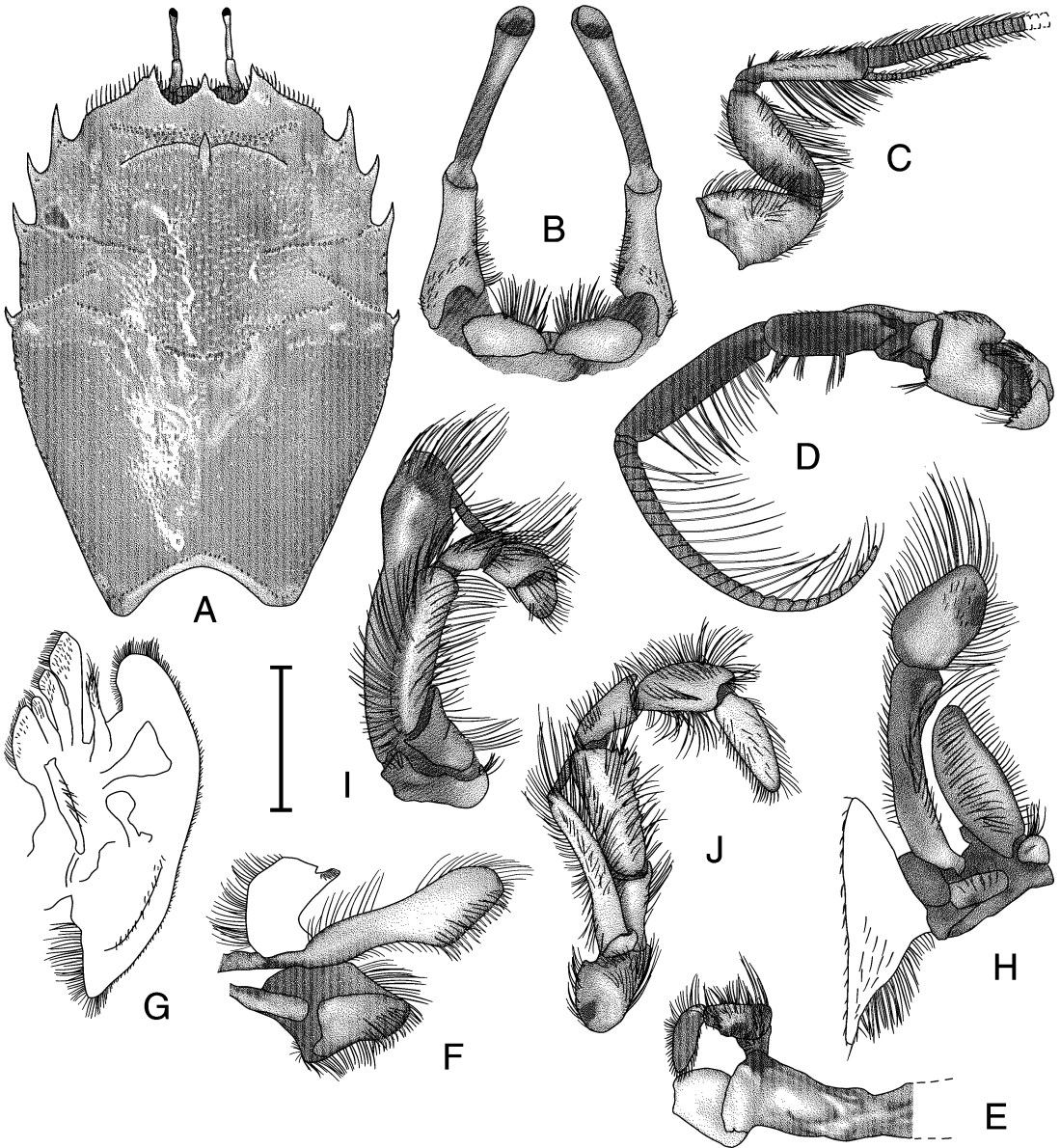


Fig. 9. *Blepharipoda occidentalis* J. W. Randall, 1840: A, ♂, 58.2 mm cl, AMNH 9048; B–J, ♂, 33.8 mm cl, AMNH 6157. A. Carapace and ocular peduncles, dorsal view. B. Ocular peduncles, dorsal view. C. Right antennule, lateral view. D. Left antenna, lateral view. E. Right mandible, mesial view. F. Right maxillule, lateral view. G. Left maxilla, lateral view. H. Right maxilliped I, lateral view. I. Right maxilliped II, lateral view. J. Right maxilliped III, lateral view. Scale = 3.3 mm (B, F), 4.4 mm (E, H, I), 5.9 mm (C, D, G), 6.7 mm (J), and 17.2 mm (A).

smooth, with few scattered punctae; CG8–11 absent. Branchial region smooth, with numerous scattered punctae and small spine on anterolateral margin; anterolateral margins spinose. Posterior margin deeply and evenly

convex; submarginal groove unbroken. Branchiostegite unarmed; anterior region with many short rows of setae and sparsely covered with long plumose setae ventrally; posterior region membranous, with numerous ir-

regular fragments and sparsely covered with long plumose setae.

Ocular plate (fig. 9B) subovate, located between median peduncular segments. Median peduncular segments oblong; dorsal margin with long plumose setae. Distal peduncular segments elongate, subdivided into proximal and distal pseudosegments; proximal pseudosegment tapering to distal end, with spiral band of plumose setae along mesial margin and ocular pore on ventromesial surface; distal pseudosegment cylindrical with distal rounded cornea; mesial margins widely separated along length.

Antennule (fig. 9C) segment III narrow proximally, expanding distally to twice proximal width; simple and plumose setae on dorsal margin, plumose setae on ventral margin and sparsely scattered on mediolateral surface; dorsal exopodal flagellum with 6585 articles ($n = 7$) [42 in megalopa], long plumose setae on dorsal and ventral margins; ventral endopodal flagellum with 15–21 articles ($n = 7$) [3 in megalopa], plumose setae on dorsal and ventral margins. Segment II medially inflated in dorsal view, with plumose setae on dorsal and ventral margins and scattered on ventrolateral half of surface. Segment I width subequal to length, unarmed; dorsolateral surface with long plumose setae; long plumose setae on dorsal and distoventral margins.

Antenna (fig. 9D) segment V approximately three times longer than wide, with 10 or 11 short transverse lines of long simple setae on either side of ventral medial line; flagellum with 24–44 articles ($n = 7$) [10 in megalopa], long simple setae at ventrodial margin of each article. Segment IV subcylindrical, approximately three times longer than wide; tuft of setae at dorodistal margin; two transverse rows of short simple setae on ventral margin either side of medial line. Segment III decalcified and produced mesiodistally. Segment II short, subcylindrical; antennal acicle short, rounded, with low spines on distal margin and few scattered setae. Segment I dorsally rounded, ventrally rectangular with distolaterally produced toothed lobe; few scattered setae on distal margins and surface; segment with ventromesial antennal gland pore.

Mandible (fig. 9E) incisor process with

two teeth; cutting edge lacking tooth or with one tooth. Palp three-segmented, with plumose setae on margins and long, thick, simple setae arising from bend in second segment.

Maxillule (fig. 9F) distal endite proximally narrow, widening to inflated distal end, with thick simple setae on distal margin and thin plumose setae on dorsal margin. Proximal endite with thick simple setae on distal margin and decalcified dorsoventral lobe between calcified regions. Endopod external lobe rounded distally and curled under; internal lobe produced distally with nine thick setae at distolateral margin; entire endopod "mitten-shaped."

Maxilla (fig. 9G) exopod evenly rounded with plumose setae along distal margin. Scaphognathite bluntly angled on posterior lobe, with plumose setae.

Maxilliped I (fig. 9H) epipod with plumose setae on margins, distolateral surface and mesial surface. Endite tapered distally and subequal to first segment of exopod. Exopod with two segments; proximal segment narrow, margins parallel, margins and surface with plumose setae; distal segment spatulate, longer than wide, broadest medially, margins with long plumose setae, few short setae scattered on mediolateral region. Endopod flattened and elongate, reaching to distal end of proximal exopodal segment; plumose setae on margins.

Maxilliped II (fig. 9I) dactylus evenly rounded, length equal to width, with long simple setae on lateral surface; distal margin with thick serrate setae. Propodus 1.5 times wider than long, slightly overreaching margin of dactylus, plumose setae on dorsal margin and long simple setae at dorsodistal margin. Carpus not produced dorsodistally, approximately two times longer than wide; long simple setae on dorsal and distal margins and scattered on surface. Merus approximately 4.5 times longer than wide, margins parallel; with long plumose setae on lateral and mesial margins and on mesial half of surface. Basis-ischium incompletely fused with deep suture and plumose setae on margins. Exopod one-third longer than merus, produced mesiodistally, flagellum with six articles.

Maxilliped III (fig. 9J) dactylus longer

than wide, tip rounded; long plumose setae on dorsal and ventral margins and scattered on surface; thick serrate setae on distal margin. Propodus with longitudinal median row of plumose setae on lateral surface; dorsal and ventral margins with plumose setae. Carpus slightly produced onto propodus, with small spine at distoventral margin; lateral surface with row of plumose setae ventromedially; plumose setae on dorsal and ventral margins. Merus with three or four strong corneous teeth and few small teeth on ventral surface, plumose setae on dorsal and ventral margins and scattered on lateral surface. Basis-ischium incompletely fused with deep suture, approximately one-half length of merus, with strong crista dentata of 11 large and small corneous teeth. Exopod two-segmented: proximal segment small; second segment styliform, tapering, approximately one-fourth longer than merus; plumose setae on margins and surface; flagellum with three indistinct subdivisions.

Pereopod I (fig. 10A) dactylus curved and tapering; lateral and mesial surfaces smooth; dorsal margin armed with two or three strong corneous spines ($n = 7$) and none to two small proximal spines ($n = 7$) (no spines on dactylus in megalopa), with long plumose and short simple setae; ventral margin unarmed with submarginal row of short simple setae. Propodal lateral surface with numerous short, transverse patches of rugae, some with short setae; dorsal margin with one or two small spines and long plumose setae; ventral margin distally produced into acute spine and with strong acute spine arising from midpoint of margin, with long plumose setae; cutting edge with four to six large corneous teeth ($n = 6$) increasing in size from junction with dactylus (no spines in megalopa), lined with long plumose setae; lateral surface of propodus with two large spines; distal spine just behind junction with dactylus approximately one-third down palm; proximal spine just anterior to junction with carpus at midpoint of propodus/carpus margin; mesial surface rugose with short and long plumose setae in rugose patches. Carpus with dorsodistal angle produced into strong corneous-tipped spine with small teeth on dorsal surface of spine; dorsal margin behind spine armed with one to three large spines and

none to two small spines ($n = 6$) and with small teeth on distal two-thirds of dorsal margin; dorsal margin with long plumose setae; lateral surface with few transverse setose rugae on medial surface; mesial surface with rugae and short simple setae, margins with long plumose setae. Merus with large spine at two-thirds length of ventral margin and large spine at dorsodistal angle; sinuous, submarginal raised, setose line running between two spines, lined with small spines; second sinuous line running parallel and proximal to first, but one-third from proximal margin; long plumose setae on distoventral angle, dorsal margin, and in oblique patch across surface; mesial surface with few short rows of setae. Basis-ischium incompletely fused, small spine (rarely two) in anterolateral margin. Coxa unarmed.

Pereopod II (fig. 10B) dactylus smooth; base to heel slightly concave, heel smoothly rounded and produced, heel to tip with narrow, subacute indent, tip subacute, tip to base broadly convex; lateral surface smooth, with several small punctations in roughly straight line across medioproximal surface; mesial surface smooth, ventral margin with long plumose setae, dorsal margin with short simple setae. Propodal dorsal surface smooth, ventral margin inflated and rounded; oblique row of long plumose setae from dorsal junction with dactylus to ventral junction with carpus, distal and ventral margins with long plumose setae; dorsolateral surface as narrow, oblique, flattened shelf, with short setae on dorsal margin and long plumose setae on ventral margin; mesial surface with elevated, curved setose ridge from ventral junction with dactylus almost to ventral proximal junction with carpus. Carpus strongly produced and subacute dorsodistally, almost reaching distal margin of propodus, dorsal margin serrated along distal four-fifths; lateral surface with patches of rugae and submarginal elevated ridge ventrally, rugae and ridge with long plumose setae; dorsal margin with short plumose setae; mesial surface smooth with long plumose setae in scattered patches on dorsal half of surface and on margins. Merus with small medial decalcified window ventral to median line, unarmed, with long plumose setae on proximal surface and margins; mesial surface nearly smooth

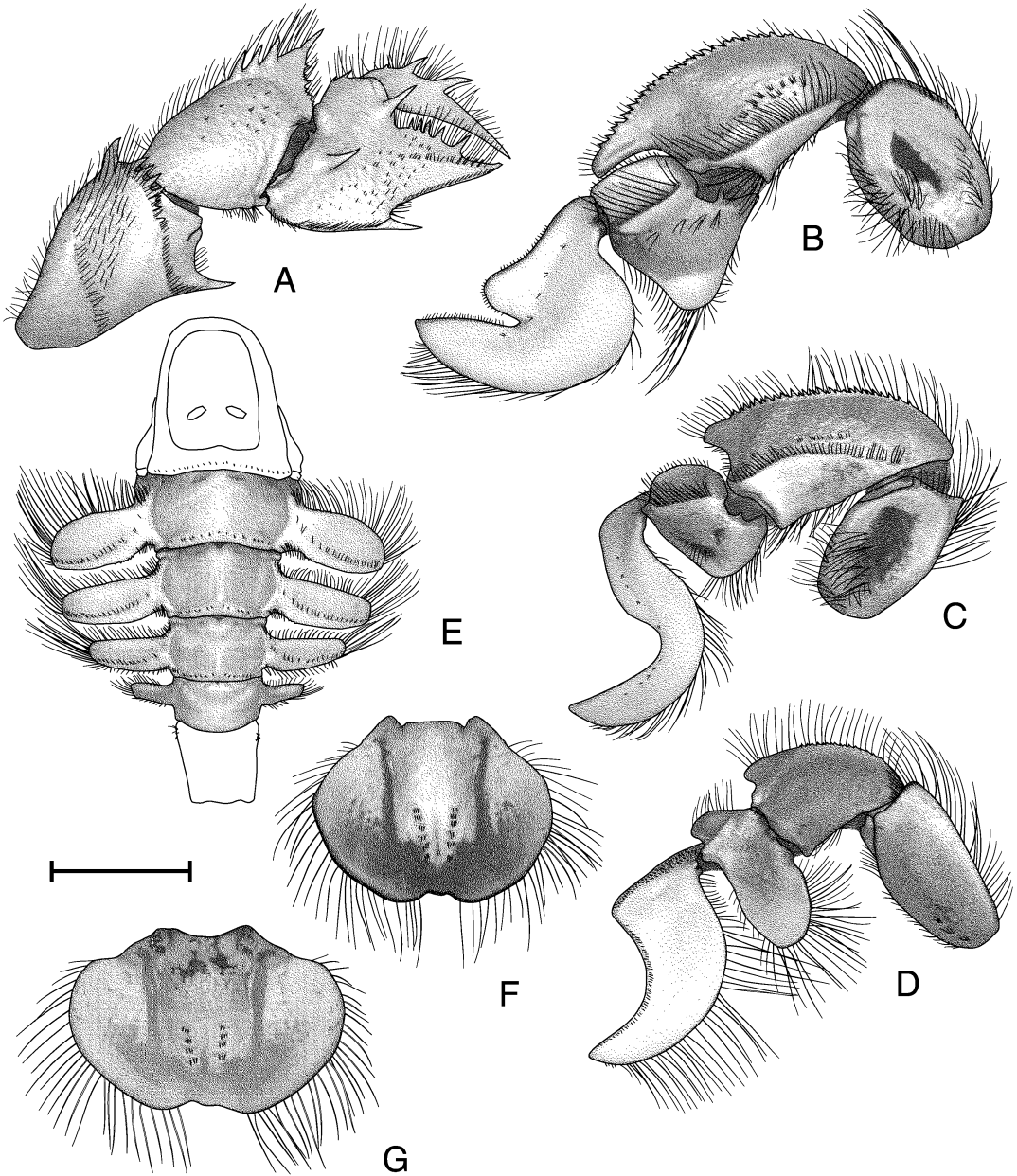


Fig. 10. *Blepharipoda occidentalis* J. W. Randall, 1840: A–F, ♂, 33.8 mm cl, AMNH 6157; G, ♀, 39.6 mm cl, AMNH 6157. A. Right pereopod I, lateral view. B. Left pereopod II, lateral view. C. Left pereopod III, lateral view. D. Left pereopod IV, lateral view. E. Abdominal somites I–VI, dorsal view. F. Telson of ♂, dorsal view. G. Telson of ♀, dorsal view. Scale = 4.4 mm (F, G), 6.7 mm (E), and 8.9 mm (A–D).

with few setae. Basis-ischium incompletely fused and unarmed. Coxa with one small spine or small spine plus a tubercle on anterior margin.

Pereopod III (fig. 10C) dactylus with base to heel straight, heel subquadrate, broad and low, heel to tip with broadly concave indent, tip subacute, tip to base smoothly convex;

lateral surface smooth, sinuous row of short setose punctations from median of heel to approximately one-half distance along distal blade; ventral margin with long plumose setae; mesial surface smooth with plumose setae proximally at junction with propodus. Propodus inflated dorsoventrally; lateral surface smooth, long plumose setae on ventral margin and in oblique submarginal row distally; dorsolateral surface narrow, oblique, flattened with ventral row of long plumose setae and dorsal row of short simple setae; mesial surface with scattered long setae on and near ventral margin. Carpus produced dorsodistally, exceeding proximal margin of propodus by approximately one-third length of propodus, rounded; medial three-fourths of dorsal margin spinose; lateral surface rugose in medial third, with short scattered setae and long row of setae ventral to rugose region; mesial surface smooth, with row of long plumose setae on distal margin. Merus smooth, with large decalcified window covering nearly all of lateral surface; unarmed; proximolateral margin and dorsodistal margin with long plumose setae, long plumose setae scattered on medioproximal surface; mesial surface smooth. Basis-ischium incompletely fused and unarmed. Coxa with medially directed spine, tubercle, or spine plus tubercle in males and females on anterior margin. Female with large gonopore on posterior mesial margin of coxa, not opposing or obscured by other coxa, without setae; male without pore.

Pereopod IV (fig. 10D) dactylus with base to heel straight, heel low and subacute, heel to tip broadly rounded in smooth arc, tip subacute, tip to base broadly convex; lateral surface smooth, ventral margin with long plumose setae, dorsal margin with short simple setae; mesial surface smooth, small patch of plumose setae between heel and articulation with propodus. Propodus expanded dorsally and ventrally; ventral expansion not reaching ventral margin of dactylus, ventral margin with long plumose setae; dorsal expansion with long plumose setae dorsally; lateral and mesial surfaces smooth. Carpus slightly produced dorsodistally; proximal two-thirds of dorsal margin serrate; medial third of lateral surface with rugae. Merus unarmed; dorsal and ventral margins with long plumose setae;

few short setae scattered on proximoventral surface. Basis-ischium incompletely fused and unarmed. Coxa with curved spine or tubercle at anterior margin.

Abdomen (fig. 10E) somite I longer than wide, widest posteriorly; dorsal surface with anterior margin convex; posterior margin straight with submarginal row of setose punctae; medial surface decalcified with two short transverse calcified lines on either side of midline. Somite II dorsal surface with strong medial keel; anterior margin straight, posterior margin concave; anterior margin with short decalcified areas either side of midline, posterior margin with submarginal row of short setae; pleura expanded and directed posterolaterally, anterolateral angle rounded, posterolateral angle more acute, posterior margin with row of low teeth; margins with long plumose setae; patch of setae at posterior junction with somite; row of short setose punctae running along surface from posterolateral margin of pleura to anteromesial margin. Somite III similar to somite II, but narrower, shorter, strongly convex medially; pleura thinner and shorter than on somite II, directed less posterolaterally, with setae as in somite II, posterior margin with short row of low teeth. Somite IV similar to somite III, but thinner and shorter; pleura shorter than on somite III, directed laterally; posterior margin smooth, margins with long plumose setae. Somite V subequal to somite IV; pleura approximately one-half length of somite IV pleura and directed laterally; margins and surface of pleura with long plumose setae. Somite VI subequal to somite V in width but longer; anterolateral margin with short plumose setae; posterior margin with few short setae; pleura absent.

Telson of male (fig. 10F) ovate, laterally expanded, wider than long, notch at distal tip with small medial rounded projection; medial third heavily calcified, dorsally inflated, and tapering distally, lateral third weakly calcified; demarcation of calcified and uncalcified regions marked by low ridge; median longitudinal groove on distal half of calcified area, six short transverse rows of short simple setae on either side of median groove. Margins with long simple setae. Telson of female (fig. 10G) nearly identical to male, but with

broader notch at tip and more laterally expanded uncalcified lobes.

DISTRIBUTION: San Francisco, California, USA, south to Baja California Norte, Mexico, lower intertidal to 27.4 m depth.

MAXIMUM SIZE: Males: 69.9 mm cl; females: 57.5 mm cl.

TYPE SPECIMEN: ANSP 3656 (holotype).

TYPE LOCALITY: San Diego, California, USA.

REMARKS: Color notes were made by the author on live animals (AMNH 18076): carapace bluish-brown, browner posteriorly, bluer anteriorly, spines white with hint of salmon; proximal pseudosegment of distal peduncular segments bluish, distal pseudosegment salmon proximally, white distally; antennular flagellum with alternating bands of light and dark articles (more than one article per band); antennal articles bluish-gray-brown with salmon highlights at joints; pereopod I dactylus salmon medially, white on edges, propodus brown proximally, salmon distally; pereopods II–IV bluish-brown, dactyli of pereopods II and III salmon in median, white on edges, dactyli of pereopod IV salmon-brown; abdominal somites bluish-brown with bluish pleural tips; uropods salmon; tip of telson salmon, remainder bluish-white; setae golden-yellow; eggs bright red.

Blepharipoda occidentalis is the only species of spiny sand crab that occurs in high densities and whose biology is fairly well known. It is common enough to be collected and used as a bait fish in California (Turner and Sexsmith, 1964), and is a known prey item of the black seabass, *Stereolepis gigas* Ayres (Luke, 1977), and the barred surfperch, *Amphistichus argenteus* Agassiz (Carlisle et al., 1960). According to MacGinitie and MacGinitie (1949), these animals are scavengers and do not eat live animals (e.g., *Emerita*, polychaetes). Ovigerous females are typically found from April to August (with exceptions, e.g., CASIZ 3755), with almost 100% of females being ovigerous in late June to early July (MacGinitie and MacGinitie, 1949). The duration of egg-carrying appears to be between 6 and 8 weeks (MacGinitie and MacGinitie, 1949). The complete larval development of this species (from ovigerous females) was described by Knight (1968a, 1968b) with five or six zoal

stages and one megalopal stage reached in 34–52 days at 16–18°C and 32.9–33.7‰ salinity.

Extensive observations on the tail-flipping locomotory technique of this species, as well as the tailfan neuromusculature, were made by Paul (1981a, 1981b). The digging behavior in this species has also been studied in detail (Faulkes and Paul, 1993; 1997b; 1997c).

A commensal clam of the genus *Mysella* (Bivalvia: Lasaeidae), most frequently identified as *M. pedroana* Dall, 1889 (Turgeon et al., 1998), is often found attached by byssal threads in the branchial chambers of *B. occidentalis* (fig. 11). Approximately two-thirds of the specimens of *B. occidentalis* examined were infested with this clam, typically with 1 or 2 clams per branchial chamber, but some specimens contained up to 22 clams in a single branchial chamber (Boyko and Mikkelsen, 1999; 2002). Gill clams are almost always found at the anterior end of the branchial chambers, primarily on the first pereopod arthrobranchs. No clams were found in any of the other three species of *Blepharipoda* or in species of *Lophomastix*.

Schram's (1986) photograph of a "*Blepharipoda occidentalis*" is not only actually a specimen of an *Emerita* sp., but is also cited in the text (Schram, 1986: 294) as an example of a brachyuran endoskeleton!

This species is most closely related to *B. liberata* from the northwest Pacific Ocean.

Blepharipoda liberata Shen, 1949

Figures 12, 13

Blepharipoda liberata Shen, 1949: 156–160, pls. 14, 15. – Kamita, 1958: 70 (list). – Miyake, 1960: 89, pl. 44, fig. 3. – Miyake, 1961: 12*. – Miyake et al., 1962: 125. – Kim, 1963: 295, 308 (list), fig. 11. – Kim, 1964: 8 (list), 11–12. – Miyake, 1965: 652, fig. 1113*. – Kim, 1970: 5–6 (list). – Suzuki, 1971: 97, pl. 34, fig. 8. – Kim, 1973: 194–196, 563, 568, 594, pl. 3, fig. 16, text-fig. 32. – Kim, 1977: 203. – Kikuchi and Miyake, 1978: 31 (list). – Miyake, 1978: 155–157, fig. 61*. – Yang and Sun, 1979: 203. – Coelho and Calado, 1987: 42, table 1. – Wang, 1989: 39 (list). – Miyake, 1991: 158. – Asakura, 1995: 376, fig. 21–286. – Calado, 1995: 107–110, pl. 32, fig. a, pl. 33, figs. a–j. – Sun and Wang, 1996: 33–35. – Boyko and Mikkelsen, 2002: 155.



Fig. 11. Lateral view of the left branchial chamber of a 44.9 mm cl ♂ *Blepharipoda occidentalis*, showing the placement of a 6.9 mm specimen of *Mysella pedroana* (and a smaller clam located to the upper left of the larger specimen). The lateral carapace wall has been removed from the host. Note the matting of the gill filaments caused by the clam.

“*Lepidopa* sp.” Kamita, 1957: 94–96, figs. 40, 41.

Blepharipoda fauriana: Kurata, 1964: 11–13, figs. 1–21 (not *Blepharipoda fauriana* Bouvier, 1898 = *Lophomastix japonica* (Duroufflé, 1889)).

Lophomastix japonica: Igarashi, 1970: 3, pl. 7, fig. 23 (not *Lophomastix japonica* (Duroufflé, 1889)).

Blepharipoda libeata [sic]: Sun and Wang, 1996: fig. 5.

not *Blepharipoda liberata*: Kurata, 1964: 13–14, figs. 22–31 (= *Lophomastix japonica* (Duroufflé, 1889)).

MATERIAL EXAMINED: **Japan:** Beach, Tomioka-3 Chome Higata, Amakusa Island, Kumamoto Prefecture, Kyusu Island, Aug. 1948, coll. S. Miyake: 1 ♂, 17.3 mm cl (ZLKU 3301); “Japan,” Oct. 1943, coll. I. Kubo: 1 oviger, 23.7 mm cl (ZLKU 3306); Karo Harbor, Tottori-city, Sea of Japan, July 31, 1950, coll. T. Kishida: 1 ♀, 30.4 mm cl (ZLKU 3335); Noda, Kii Prefecture, May 1938, coll. K. Okamoto: 1 ♂, 20.8 mm cl (ZLKU 3336); Oshima-Konominato, Fukuoka Prefecture, Kyushu Island, March 1959, coll. Motomatu: 1 ♂, 23.3 mm cl, 1 ♀, 28.9 mm cl (ZLKU 7247–7248); Yoichi-city, Hokkaido, Feb. 13, 1952, coll. H. Kurata: 1 ♀, 34.7 mm cl (ZLKU 8688).

DIAGNOSIS: Carapace without anterior gastric spine. Antennular dorsal flagellum with 37–40 articles, ventral flagellum with 10–12 articles. Antennal flagellum with 11–13 articles. Pereopod I dactylus dorsal margin with one or two large spines; carpus with none to three large spines proximal to dorsodistal spine; basis-ischium with spine(s). Pereopod II coxa with two spines. Abdominal somite II pleura smooth.

DESCRIPTION: Carapace (fig. 12A) approximately 1.3 times longer than wide; strongly keeled medially. Anterior margin with large rugose spine on either side of ocular sinus; convex laterally; large spines and margin all armed with numerous small spinules; large spines armed with produced rounded tooth on mesiodistal margin. Rostrum as large smooth acute spine, extending nearly one-half length of proximal pseudosegment of distal peduncular segments, three-fourths size of outer-ocular spines. Ocular sinus concave, sharply angled laterally and armed with numerous small spines. Frontal region smooth with few low teeth posterior to rostrum; setal field as thin, concave, transverse line, broadest medially, with posteriorly produced lateral elements widely separated from

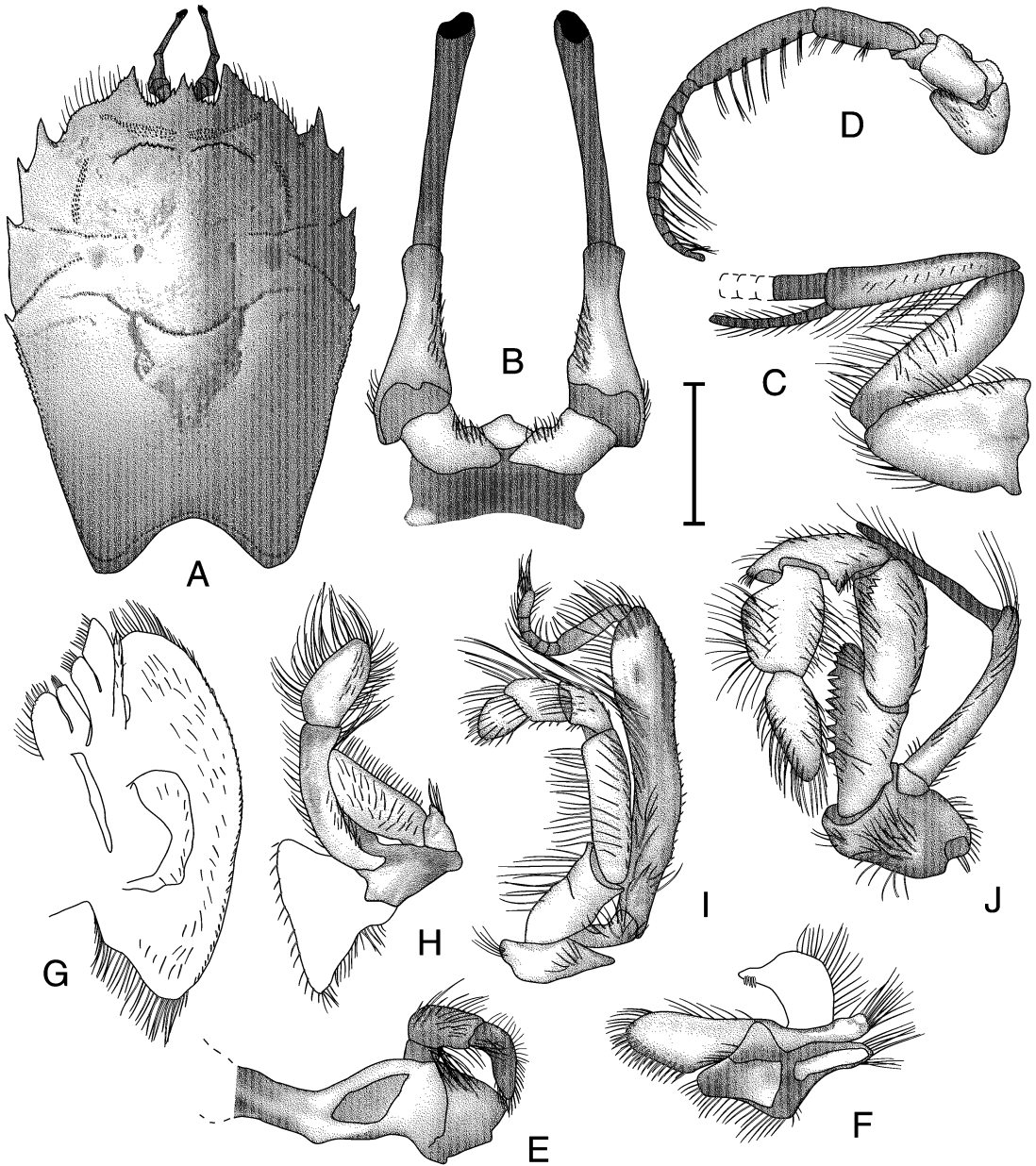


Fig. 12. *Blepharipoda liberata* Shen, 1949: A, ♀, 34.7 mm cl, ZLKU 8688; B–J, ♀, 28.9 mm cl, ZLKU 7247. A. Carapace and ocular peduncles, dorsal view. B. Ocular peduncles, dorsal view. C. Left antennule, lateral view. D. Left antenna, lateral view. E. Left mandible, mesial view. F. Left maxillule, lateral view. G. Left maxilla, lateral view. H. Right maxilliped I, lateral view. I. Left maxilliped II, lateral view. J. Left maxilliped III, lateral view. Scale = 2.2 mm (B), 3.0 mm (C, F), 3.3 mm (E, I), 4.4 mm (G, H, J), 6.7 mm (D), and 11.2 mm (A).

anterior element. CG1 parallel to anterior margin of carapace, convex and produced dorsally, armed with numerous small rounded teeth along length, smooth area at midline with at most a small tubercle (no strong anterogastric median spine). Mesogastric region smooth laterally, with row of medial punctae; CG2 absent; CG3 absent; CG4 with two long crenulate lateral elements approximately one-third carapace width, faintly setose. Hepatic region smooth, with scattered small punctae and two strong, slightly curved, anteriorly directed spines; anterior-most spine approximately two times larger than posterior. Epibranchial region roughly triangular, smooth, armed with one strong spine subequal in length to posterior hepatic spine. Metagastric region smooth, carinate, with medial and posterolateral punctae; CG5 absent. CG6 strongly crenulate, with oblique setose anterolateral elements separate from medial concave element that is setose only in median third. CG7 absent. Cardiac region carinate, smooth with few scattered punctae; CG8–11 absent. Branchial region smooth, with numerous scattered punctae and strong spine on distolateral margin; anterolateral margins spinose. Posterior margin deeply and evenly convex; submarginal groove unbroken. Branchiostegite unarmed; anterior region finely toothed, with many short rows of setae and sparsely covered with long plumose setae ventrally; posterior region membranous, with numerous irregular fragments and sparsely covered with long plumose setae.

Ocular plate (fig. 12B) subovate, located between medial peduncular segments. Median peduncular segments oblong; dorsal margin with long plumose setae. Distal peduncular segments elongate, subdivided into proximal and distal pseudosegments; proximal pseudosegment tapering to distal end with spiral band of plumose setae along mesial margin and ocular pore on ventromesial surface; distal pseudosegment cylindrical with distal rounded cornea; mesial margins widely separated along length.

Antennule (fig. 12C) segment III narrow proximally, expanding distally to twice proximal width; short simple setae on dorsal margin, plumose setae on ventral margin and sparsely scattered on mediolateral surface;

dorsal exopodal flagellum with 37–40 articles ($n = 3$), long plumose setae on dorsal and ventral margins; ventral endopodal flagellum with 10–12 articles ($n = 3$), plumose setae on dorsal and ventral margins. Segment II medially inflated in dorsal view, with plumose setae on dorsal and ventral margins and scattered on ventrolateral half of surface. Segment I width subequal to length, unarmed; dorsolateral surface with long plumose setae; long plumose setae on dorsal and distoventral margins.

Antenna (fig. 12D) segment V approximately 4.5 times longer than wide, with 11 short transverse lines of long simple setae on either side of ventral medial line; flagellum with 11–13 articles ($n = 6$), long simple setae at ventrodiscal margin of each article. Segment IV subcylindrical, approximately 3.5 times longer than wide; two transverse rows of short simple setae on ventral margin either side of medial line. Segment III decalcified and produced mesiodisally. Segment II short, subcylindrical; antennal acicle short, rounded, with low spines on distal margin and few scattered setae. Segment I dorsally rounded, ventrally rectangular with distolaterally produced toothed lobe; few scattered setae on distal margins and surface; segment with ventromesial antennal gland pore.

Mandible (fig. 12E) incisor process with two teeth; cutting edge with one tooth. Palp three-segmented, with plumose setae on margins and long, thick, simple setae arising from bend in second segment.

Maxillule (fig. 12F) distal endite proximally narrow, widening to inflated distal end, with thick simple setae on distal margin and thin plumose setae on dorsal margin. Proximal endite with thick simple setae on distal margin and decalcified dorsoventral lobe between calcified regions. Endopod external lobe rounded distally and curled under; internal lobe produced distally, with five thick setae at distolateral margin; entire endopod “mitten-shaped.”

Maxilla (fig. 12G) exopod evenly rounded with plumose setae along distal margin. Scaphognathite bluntly angled on posterior lobe, with medial indentation; plumose setae on margins and scattered on surface.

Maxilliped I (fig. 12H) epipod with short

plumose setae on margins, distolateral surface, and mesial surface. Endite tapered distally and subequal to first segment of exopod. Exopod with two segments; proximal segment narrow, margins parallel, margins and surface with plumose setae; distal segment spatulate, longer than wide, broadest medially, margins with long plumose setae, few short setae scattered on mediodistal region. Endopod flattened and elongate, reaching to distal end of proximal exopodal segment; plumose setae on margins.

Maxilliped II (fig. 12I) dactylus evenly rounded, length equal to width, with long simple setae on lateral surface; distal margin with thick serrate setae. Propodus length and width subequal, slightly overreaching margin of dactylus, plumose setae on dorsal margin and long simple setae at dorsodistal margin. Carpus not produced dorsodistally, length and width subequal; long simple setae on dorsal and distal margins and scattered on surface. Merus approximately three times longer than wide, margins parallel; long plumose setae on lateral and mesial margins and medially on surface. Basis-ischium incompletely fused, with deep suture with plumose setae on margins. Exopod over two times longer than merus, produced mesiodistally, flagellum with six articles and long plumose setae.

Maxilliped III (fig. 12J) dactylus longer than wide, tip rounded; long plumose setae on dorsal and ventral margins and scattered on surface; thick serrate setae on distal margin. Propodus inflated dorsodistally with longitudinal median row of plumose setae on lateral surface; dorsal and ventral margins with plumose setae. Carpus slightly produced onto propodus with small spine at distoventral margin; lateral surface with row of plumose setae ventromedially; plumose setae on dorsal and ventral margins. Merus with four or five strong corneous teeth and few small teeth on distoventral surface, plumose setae on dorsal and ventral margins and scattered on lateral surface. Basis-ischium incompletely fused with deep suture, subequal in length to of merus, with strong crista dentata of 10 or 11 large and small corneous teeth. Exopod two-segmented: proximal segment small; second segment styliform, tapering, approximately one-fourth longer than merus; plu-

mose setae on margins and surface; flagellum with two indistinct subdivisions.

Pereopod I (fig. 13A) dactylus curved and tapering; lateral and mesial surfaces smooth; dorsal margin armed with one or two strong corneous spines ($n = 6$), none to four small proximal spines ($n = 6$); with long plumose and short simple setae; ventral margin unarmed, with submarginal row of short simple setae. Propodus lateral surface with numerous short, transverse patches of rugae, some with short setae; dorsal margin with none to two small spines ($n = 6$), with long plumose setae; ventral margin distally produced into acute spine and with strong acute spine arising from midpoint of margin, with long plumose setae; cutting edge with three or four large and one or two small corneous teeth ($n = 6$) increasing in size from junction with dactylus, lined with long plumose setae; lateral surface of propodus with one or two large spines; distal spine just behind junction with dactylus approximately one-third down palm (this spine not always present); proximal spine just anterior to junction with carpus at midpoint of propodus/carpus margin; mesial surface rugose with short and long plumose setae in rugose patches. Carpus with dorsodistal angle produced into strong smooth corneous-tipped spine; dorsal margin behind spine armed with none to three large spines and none to two small spines ($n = 6$) and with small teeth on distal two-thirds of dorsal margin; dorsal margin with long plumose setae; lateral surface with few transverse setose rugae on medial surface; mesial surface with rugae and short simple setae, margins with long plumose setae. Merus with large spine at two-thirds length of ventral margin and large spine at dorsodistal angle; sinuous submarginal raised setose line running between two spines, lined with strong spines dorsodistally becoming smaller proximally; second sinuous line running parallel and proximal to first, but one-third from proximal margin, not spinose; long plumose setae on distoventral angle, dorsal margin, and in oblique patch across surface; mesial surface with few short rows of setae. Basis-ischium incompletely fused, one or two spines on distomesial margin ($n = 5$). Coxa unarmed.

Pereopod II (fig. 13B) dactylus smooth;

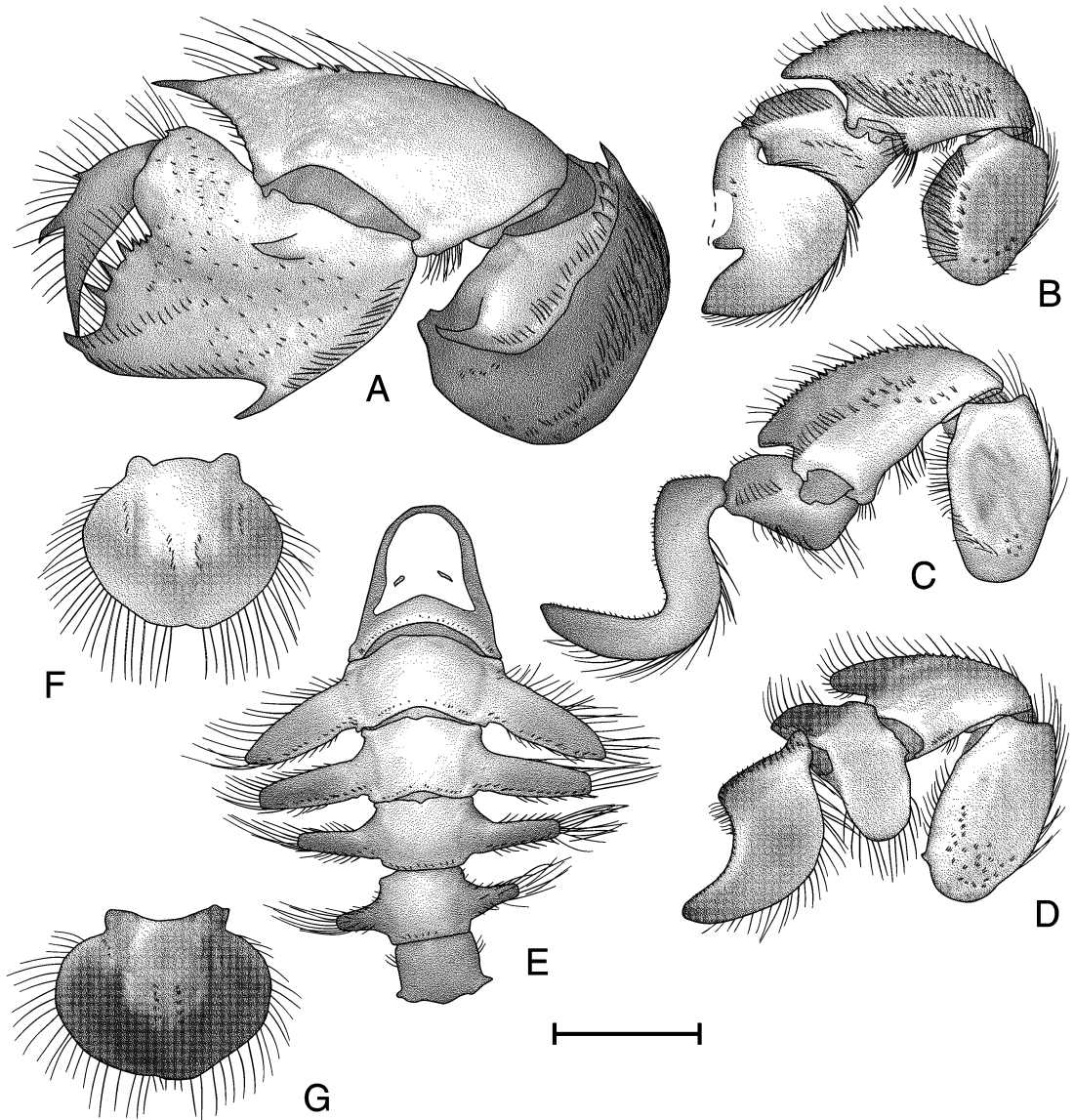


Fig. 13. *Blepharipoda liberata* Shen, 1949: A–E, G, ♀, 28.9 mm cl, ZLKU 7247; F, ♂, 17.3 mm cl, ZLKU 3301. A. Left pereopod I, lateral view. B. Left pereopod II, lateral view. C. Left pereopod III, lateral view. D. Left pereopod IV, lateral view. E. Abdominal somites I–VI, dorsal view. F. Telson of ♂, dorsal view. G. Telson of ♀, dorsal view. Scale = 3.0 mm (F), 4.4 mm (A, G), 5.9 mm (E), and 6.7 mm (B–D).

base to heel slightly concave, heel smoothly rounded and produced, heel to tip with narrow, subacute indent, tip subacute, tip to base broadly convex; lateral surface smooth, with several small punctations in roughly straight line across medioproximal surface; mesial surface smooth, ventral margin with long

plumose setae, dorsal margin with short simple setae. Propodal dorsal surface smooth, ventral margin inflated and rounded; distal and ventral margins with long plumose setae; dorsolateral surface as narrow, oblique, flattened shelf, with short setae on dorsal margin and long plumose setae on ventral margin;

mesial surface with elevated, curved setose ridge from ventral junction with dactylus almost to ventral proximal junction with carpus. Carpus strongly produced and subacute dorsodistally, reaching one-half length of propodus, dorsal margin serrated along distal four-fifths; lateral surface with patches of rugae and submarginal elevated ridge ventrally, rugae and ridge with long plumose setae; dorsal margin with long plumose setae; mesial surface smooth with long plumose setae on ventral margin, short simple setae on dorsal and distal margins. Merus with medial decalcified window; mesiodistal margin unarmed; long plumose setae on margins; mesial surface nearly smooth, with few setae. Basis-ischium incompletely fused and unarmed. Coxa with two small spines on anterior margin.

Pereopod III (fig. 13C) dactylus with base to heel almost straight, heel subquadrate, broad and low, heel to tip with broadly concave indent, tip subacute, tip to base smoothly convex; lateral surface smooth, sinuous row of short setose punctations from median of heel to approximately one-half distance along distal blade; ventral margin with long plumose setae, dorsal margin with short simple setae; mesial surface smooth with plumose setae proximally at junction with propodus. Propodus inflated dorsoventrally; lateral surface smooth, long plumose setae on ventral and distal margins; dorsolateral surface narrow, oblique, flattened with ventral row of long plumose setae and dorsal row of short simple setae; mesial surface with scattered long setae on and near ventral margin. Carpus produced dorsodistally, exceeding proximal margin of propodus by approximately one-half length of propodus, rounded; distal four-fifths of dorsal margin spinose; lateral surface rugose in medial third, with short scattered setae and long row of setae ventral to rugose region; mesial surface smooth, with row of long plumose setae on distal and dorsal margins. Merus smooth, with large decalcified window covering nearly all of lateral surface; dorsodistal margin unarmed; proximolateral margin and dorsodistal margin with long plumose setae, long plumose setae scattered on medioproximal surface; mesial surface smooth. Basis-ischium incompletely fused and unarmed. Coxa

with medially directed spine (rarely two), tubercle, or spine plus tubercle on anterior margin. Female with large gonopore on posterior mesial margin of coxa, not opposing or obscured by other coxa, without setae; male without pore.

Pereopod IV (fig. 13D) dactylus with base to heel straight, heel low and rounded, heel to tip broadly rounded in smooth arc, tip rounded, tip to base broadly convex; lateral surface smooth, ventral margin with long plumose setae, dorsal margin with short simple setae; mesial surface smooth, small patch of plumose setae between heel and articulation with propodus. Propodus expanded dorsally and ventrally; ventral expansion reaching ventral margin of dactylus, ventral margin with long plumose setae; dorsal expansion with long plumose setae dorsally; lateral and mesial surfaces smooth. Carpus produced dorsodistally; dorsal margin spinose in medial third; medial third of lateral surface with rugae. Merus distodorsal margin unarmed; dorsal and ventral margins with long plumose setae; few short setae scattered on proximoventral surface. Basis-ischium incompletely fused and unarmed. Coxa with curved spine at anterior margin.

Abdomen (fig. 13E) somite I as long as wide, widest posteriorly; dorsal surface with anterior margin convex; posterior margin irregularly concave with submarginal row of setose punctae; medial surface decalcified with two short transverse calcified lines on either side of midline. Somite II dorsal surface with strong medial keel; anterior margin irregularly convex, posterior margin irregularly concave; anterior margin with short decalcified areas either side of midline, posterior margin with submarginal row of short setae; pleura expanded and directed posterolaterally, anterolateral and posterolateral angles rounded, anterior and posterior margins smooth; anterior margins with long plumose setae, posterior margins with short simple setae; patch of setae at posterior junction with somite; row of short setose punctae on lateral surface running parallel to posterior margin. Somite III similar to somite II, but narrower, shorter, strongly convex medially; pleura thinner and slightly shorter than on somite II, directed laterally, with setae as in somite II, margins smooth. Somite IV similar to somite

III, but thinner and shorter; pleura shorter than on somite III, directed slightly anterolaterally; margins smooth, margins with long plumose setae. Somite V subequal to somite IV; pleura approximately one-half length of somite IV pleura and directed laterally; margins and surface of pleura with long plumose setae. Somite VI subequal to somite V in width but longer; mediolateral margin with short plumose setae; posterior margin without setae; pleura absent.

Telson of male (fig. 13F) ovate, laterally expanded, wider than long, distal tip with small medial indentation; medial third heavily calcified, dorsally inflated, and tapering distally, lateral third weakly calcified; demarcation of calcified and uncalcified regions marked by low ridge along length and short row of setae proximally; median longitudinal groove on distal half of calcified area, five or six short transverse rows of short simple setae on either side of median groove. Margins with long simple setae; no setae on proximalateral corners. Telson of female (fig. 13G) nearly identical to male, but with less indented distal margin tip and more inflated proximalateral lobes.

DISTRIBUTION: Known from Japan, China, and Korea; depth range unknown.

MAXIMUM SIZE: Males: 23.3 mm cl; females: 34.7 mm.

TYPE SPECIMENS: The repository of the two syntypes cited by Shen (1949) is unknown.

TYPE LOCALITY: Tungshan, Cheefoo, China.

REMARKS: This species was named "to commemorate the glorious and victorious liberalization of Chinese people by the People's Liberal Army under the direction of the Communist Party of China" (Shen, 1949). The Japanese name for this species is "Fushime-Kudahigegani" (Asakura, personal commun.). Kurata (1964) described zoal stages I, II and V of this species (erroneously identified as *B. fauriana*) from the Japanese plankton.

This species is most closely related to *B. occidentalis* from the eastern Pacific.

Blepharipoda doelloi Schmitt, 1942

Figures 14, 15

Blepharopoda [sic] *occidentalis*: Berg, 1900: 225–227 (not *Blepharipoda occidentalis* Randall, 1840).

Blepharipoda occidentalis: Porter, 1911: 17. – Porter, 1915a: 78–82 (part). – Porter, 1915b: 14–17 (part). – Porter, 1916: 280–282 (part). – Porter, 1936b: 254–255 (part). – Porter, 1940a: 312 (part). – Porter, 1940b: 146 (part). – Porter, 1941: 460 (part). – Barattini, 1957: 63–65, fig. 1. – Zolessi and Philippi, 1995: 10 (list). – Boschi, 1997: 224 (not *Blepharipoda occidentalis* Randall, 1840).

Blepharipoda doelloi Schmitt, 1942: 2–8, pl. 1, figs. 1–3. – Fesquet, 1942: 111–113. – Castro, 1967: 2, figs. 1–12*. – Boschi et al., 1968: 293–305, figs. 1–16. – Coêlho and Ramos, 1972: 176 (list). – Boschi, 1979: 137. – Boschi, 1981: 714, 739, fig. 241–69, 241–70, 241–71. – Calado, 1987: 88–94, pls. 1–5*. – Coêlho and Calado, 1987: 43, table 1. – Manning, 1988: 626–627 (list). – Calado et al., 1990: 747, fig. 1*. – Boschi et al., 1992: 18 (list), 56–57, fig. 59. – Calado, 1995: 102–105, pl. 1, figs. a–e, pl. 2, figs. a–m, pl. 3, fig. a, pl. 30, figs. a–d, pl. 31, figs. a, b. – Zolessi and Philippi, 1995: 10 (list). – Spivak, 1997: 74, 79, 81. – Boschi, 1997: 224. – Calado, 1998: 407. – Tablado and Venerus, 2000: 225 (types listed). – Boyko and Mikkelsen, 2002: 155.

MATERIAL EXAMINED: **Brazil:** Cabo São Tomé, Rio de Janeiro, Feb. 11, 1969, coll. Navio Oceanográfico "Prof. Besnard": 1 ♂, 7.6 mm cl (UFES 1165), 1 ♂, 9.0 mm cl, 1 ♀, 5.7 mm cl, 1 unsexable specimen, 9.7 mm cl, 2 unsexable and unmeasurable specimens (MNRJ 3853); Ilha do Pai, Rio de Janeiro, 30 m, March 24, 1962, coll. B. Tursch: 3 ♂, 9.3–11.7 mm cl (MNRJ 1555).

Argentina: Mar del Plata, Buenos Aires, Feb. 1924, coll. Franceschi and Leloir: 1 ♂, 22.0 mm cl, 1 ♀, 30.5 mm cl (MACN 14303); Playa Bristol, Mar del Plata, Feb. 2, 1962, coll. E. E. Boschi: 1 ♀, 23.1 mm cl, 1 oviger, 26.7 mm cl (AMNH 17527); Punta Hogotes, Mar del Plata, 1967, coll. E. E. Boschi: 1 ♀, 24.2 mm cl (AMNH 17528); Mar del Plata, Buenos Aires, coll. J. B. Llanos: 1 ♂, 23.9 mm cl (MACN 5081); Quequén Harbor, Buenos Aires, Jan. 1926, coll. G. Haedo: 1 ♀, 25.5 mm cl (MACN 16329); Quequén Harbor, Buenos Aires, Feb. 1, 1962, coll. unknown: 1 ♀, 28.3 mm cl (MACN 33636); Tres Arroyos, Balneario Reta, Dec. 9, 1963, coll. Daguerre: 1 ♀, 23.4 mm cl (USNM 260863); Necochea, 1926, coll. G. Haedo: 2 ♀, 24.7–28.6 mm cl (USNM 267783); Bahía Blanca, 1911, coll.

C. Porter: 1 ♂, 22.0 mm cl (MNHN-Hi 170); Sta. V-17-72, off Bahía Blanca, 39°21'S, 61°08'W, 15 m, May 19, 1961, coll. R/V "Vema": 2 juveniles, 5.3–5.3 mm cl (AMNH 15188).

DIAGNOSIS: Carapace with anterior gastric spine. Antennular dorsal flagellum with 28–42 articles, ventral flagellum with 11–14 articles. Antennal flagellum with 13–20 articles. Pereopod I dactylus dorsal margin with two large spines; carpus with one large spine proximal to dorsodistal spine; basis-ischium without spines. Pereopod II coxa with two spines. Pereopod IV coxa with one spine. Distal margin of telson smoothly rounded.

DESCRIPTION: Carapace (fig. 14A) approximately 1.3 times longer than wide; strongly keeled medially. Anterior margin with large rugose spine on either side of ocular sinus; convex laterally; large spines and margin all armed with numerous small spinules; large spine armed with produced, rounded tooth on mesiodistal margin. Rostrum as large smooth acute spine, extending nearly one-half length of proximal pseudosegment of distal peduncular segments; one-half to three-fourths size of outer-ocular spines. Ocular sinus evenly concave and armed with numerous small spines. Frontal region smooth; setal field as thin transverse line with posteriorly produced lateral elements widely separated from anterior element. CG1 parallel to anterior margin of carapace, convex and produced dorsally, armed with numerous small rounded teeth along length and large smooth anterogastric median spine. Mesogastric region smooth laterally, with row of medial punctae; CG2 absent; CG3 absent; CG4 with two long crenulate lateral elements each approximately one-third carapace width, not setose. Hepatic region smooth, with scattered small punctae and two strong, slightly curved, anteriorly directed spines; anteriormost spine approximately one-half larger than posterior. Epibranchial region roughly triangular, smooth, armed with one strong spine subequal in length to posterior hepatic spine. Metagastric region smooth, carinate, with medial and posterolateral punctae; CG5 absent. CG6 strongly crenulate, with oblique setose anterolateral elements separate from medial setae-free concave element. CG7 absent. Cardiac region carinate, smooth, with

few scattered punctae; CG8–11 absent. Branchial region smooth, with numerous scattered punctae and strong spine on anterolateral margin; anterolateral margins spinose. Posterior margin deeply and evenly convex; submarginal groove unbroken. Branchiostegite unarmed; anterior region finely toothed, with many short rows of setae and sparsely covered with long plumose setae ventrally; posterior region membranous, with numerous irregular fragments and sparsely covered with long plumose setae.

Ocular plate (fig. 14B) subovate, located between median peduncular segments. Median peduncular segments oblong; dorsal margin with long plumose setae. Distal peduncular segments elongate, subdivided into proximal and distal pseudosegments; proximal pseudosegment tapering to distal end with spiral band of plumose setae along mesial margin and ocular pore on ventromesial surface; distal pseudosegment cylindrical with distal rounded cornea; mesial margins widely separated along length.

Antennule (fig. 14C) segment III narrow proximally, expanding distally to twice proximal width; simple and plumose setae on dorsal margin, plumose setae on ventral margin and sparsely scattered on mediolateral surface; dorsal exopodal flagellum with 28–42 articles ($n = 7$) [17 in megalopa; 21 in juvenile], long plumose setae on dorsal and ventral margins; ventral endopodal flagellum with 11–14 articles ($n = 7$) [4 in megalopa; 7 in juvenile], plumose setae on dorsal and ventral margins. Segment II medially inflated from dorsal view, with plumose setae on dorsal and ventral margins and scattered on ventrolateral half of surface. Segment I width subequal to length, unarmed; dorsolateral surface with long plumose setae; long plumose setae on dorsal and distoventral margins.

Antenna (fig. 14D) segment V approximately 3.5 times longer than wide, with 10 or 11 short transverse lines of long simple setae on either side of ventral medial line; flagellum with 13–20 articles ($n = 7$) [12 in megalopa], long simple setae at ventrodistal margin of each article. Segment IV subcylindrical, approximately 3.5 times longer than wide; tuft of setae at dorsodistal margin; two transverse rows of short simple setae on

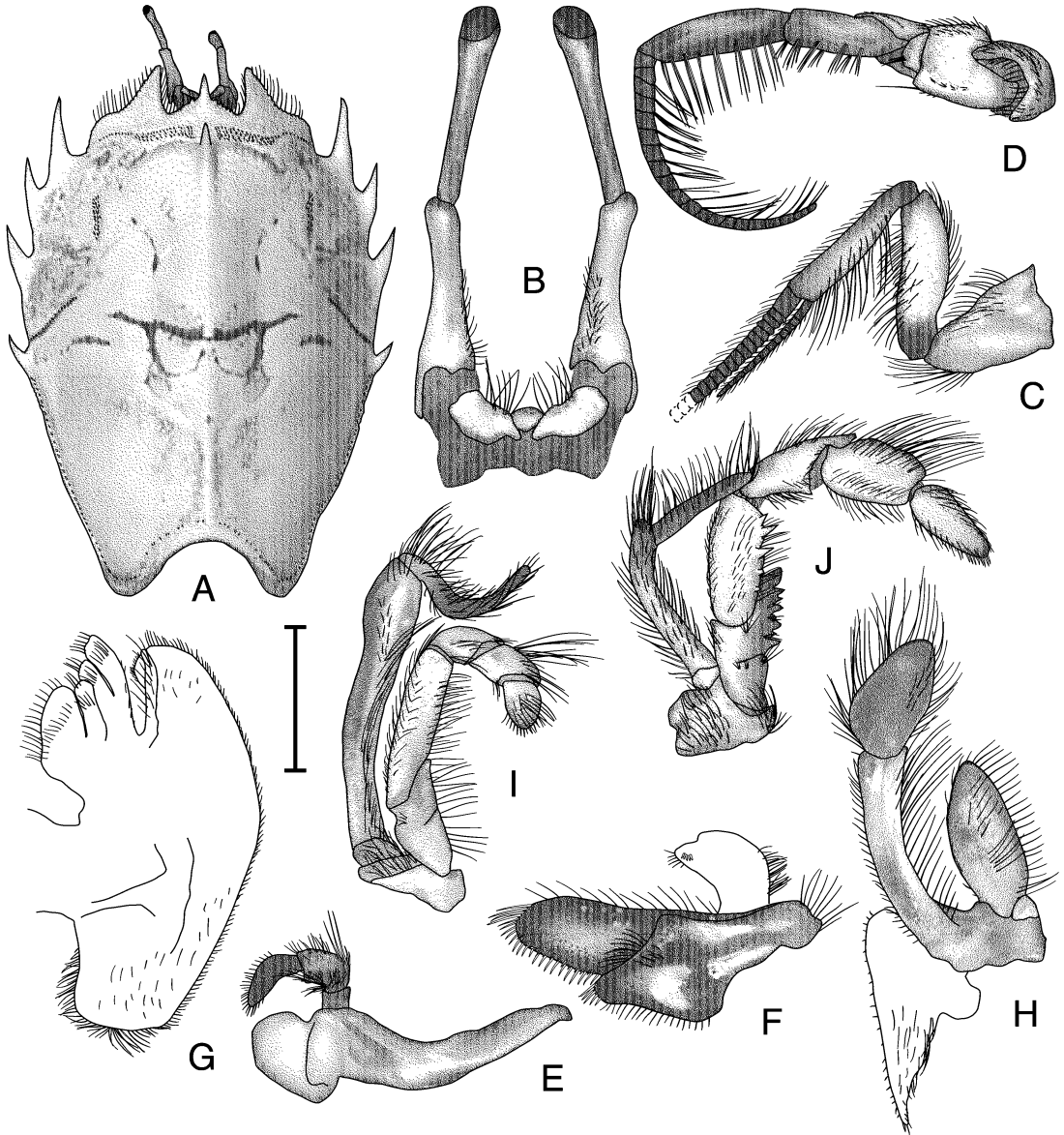


Fig. 14. *Blepharipoda doelloi* Schmitt, 1942: A, ♀, 28.6 mm cl, USNM 267783; B–J, ♀, 23.1 mm cl, AMNH 17527. A. Carapace and ocular peduncles, dorsal view. B. Ocular peduncles, dorsal view. C. Left antennule, lateral view. D. Left antenna, lateral view. E. Right mandible, mesial view. F. Left maxillule, lateral view. G. Left maxilla, lateral view. H. Right maxilliped I, lateral view. I. Right maxilliped II, lateral view. J. Right maxilliped III, lateral view. Scale = 2.2 mm (B, F), 3.0 mm (H, I), 3.3 mm (C, E, G), 4.4 mm (D, J), and 9.0 mm (A).

ventral margin either side of medial line. Segment III decalcified and produced mesio-distally. Segment II short, subcylindrical; antennal acicle short, rounded, with low spines on distal margin and few scattered setae.

Segment I dorsally rounded, ventrally rectangular with distolaterally produced toothed lobe; few scattered setae on distal margins and surface; segment with ventromesial antennal gland pore.

Mandible (fig. 14E) incisor process with two teeth; cutting edge smooth. Palp three-segmented, with plumose setae on margins and long, thick, simple setae arising from bend in second segment.

Maxillule (fig. 14F) distal endite proximally narrow, widening to inflated distal end, with thick simple setae on distal margin and thin plumose setae on dorsal margin. Proximal endite with thick simple setae on distal margin and decalcified dorsoventral lobe between calcified regions. Endopod external lobe rounded distally and curled under; internal lobe produced distally, with five thick setae at distolateral margin; entire endopod "mitten-shaped."

Maxilla (fig. 14G) exopod evenly rounded with plumose setae along distal margin. Scaphognathite bluntly angled on posterior lobe, with plumose setae.

Maxilliped I (fig. 14H) epipod with short plumose setae on margins, distolateral surface, and mesial surface. Endite tapered distally and subequal to first segment of exopod. Exopod with two segments; proximal segment narrow, margins parallel, margins and surface with plumose setae; distal segment spatulate, longer than wide, broadest medially, margins with long plumose setae, few short setae scattered on mediobasal region. Endopod flattened and elongate, reaching to distal end of proximal exopodal segment; plumose setae on margins.

Maxilliped II (fig. 14I) dactylus evenly rounded, length equal to width, with long simple setae on lateral surface; distal margin with thick serrate setae. Propodus two times wider than long, slightly overreaching margin of dactylus, plumose setae on dorsal margin and long simple setae at dorsodistal margin. Carpus not produced dorsodistally, approximately 1.5 times longer than wide; long simple setae on dorsal and distal margins and scattered on surface. Merus approximately 3.5 times longer than wide, margins parallel; with long plumose setae on lateral and mesial margins and on mesial half of surface. Basis-ischium incompletely fused with deep suture with plumose setae on margins. Exopod almost two times longer than merus, produced mesiodistally, flagellum with six articles and long plumose setae.

Maxilliped III (fig. 14J) dactylus longer

than wide, tip rounded; long plumose setae on dorsal and ventral margins and scattered on surface; thick serrate setae on distal margin. Propodus with longitudinal median row of plumose setae on lateral surface; dorsal and ventral margins with plumose setae. Carpus slightly produced onto propodus, with small spine at distoventral margin; lateral surface with row of plumose setae ventromedially; plumose setae on dorsal and ventral margins. Merus with two or three strong corneous teeth and few small teeth on ventral surface, plumose setae on dorsal and ventral margins and scattered on lateral surface. Basis-ischium incompletely fused with deep suture, subequal in length to merus, with strong crista dentata of 8–11 large and small corneous teeth. Exopod two-segmented; proximal segment small; second segment styliform, tapering, approximately one-fourth longer than merus; plumose setae on margins and surface; flagellum with three indistinct subdivisions.

Pereopod I (fig. 15A) dactylus curved and tapering; lateral and mesial surfaces smooth; dorsal margin armed with two strong corneous spines ($n = 7$), smooth proximally (two spines on dactylus of megalopa and juvenile); with long plumose and short simple setae; ventral margin unarmed, with submarginal row of short simple setae. Propodal lateral surface with numerous short, transverse patches of rugae, some with short setae; dorsal margin unarmed, with long plumose setae; ventral margin distally produced into acute spine and with strong acute spine arising from midpoint of margin, with long plumose setae; cutting edge with three large and one or two small corneous teeth ($n = 7$) increasing in size from junction with dactylus (no spines in megalopa or juvenile), lined with long plumose setae; lateral surface of propodus with two large spines; distal spine just behind junction with dactylus approximately one-third down palm; proximal spine just anterior to junction with carpus at midpoint of propodus/carpus margin; mesial surface rugose, with short and long plumose setae in rugose patches. Carpus with dorsodistal angle produced into strong smooth corneous-tipped spine; dorsal margin behind spine armed with one large spine and no small spines ($n = 7$) and with small teeth on

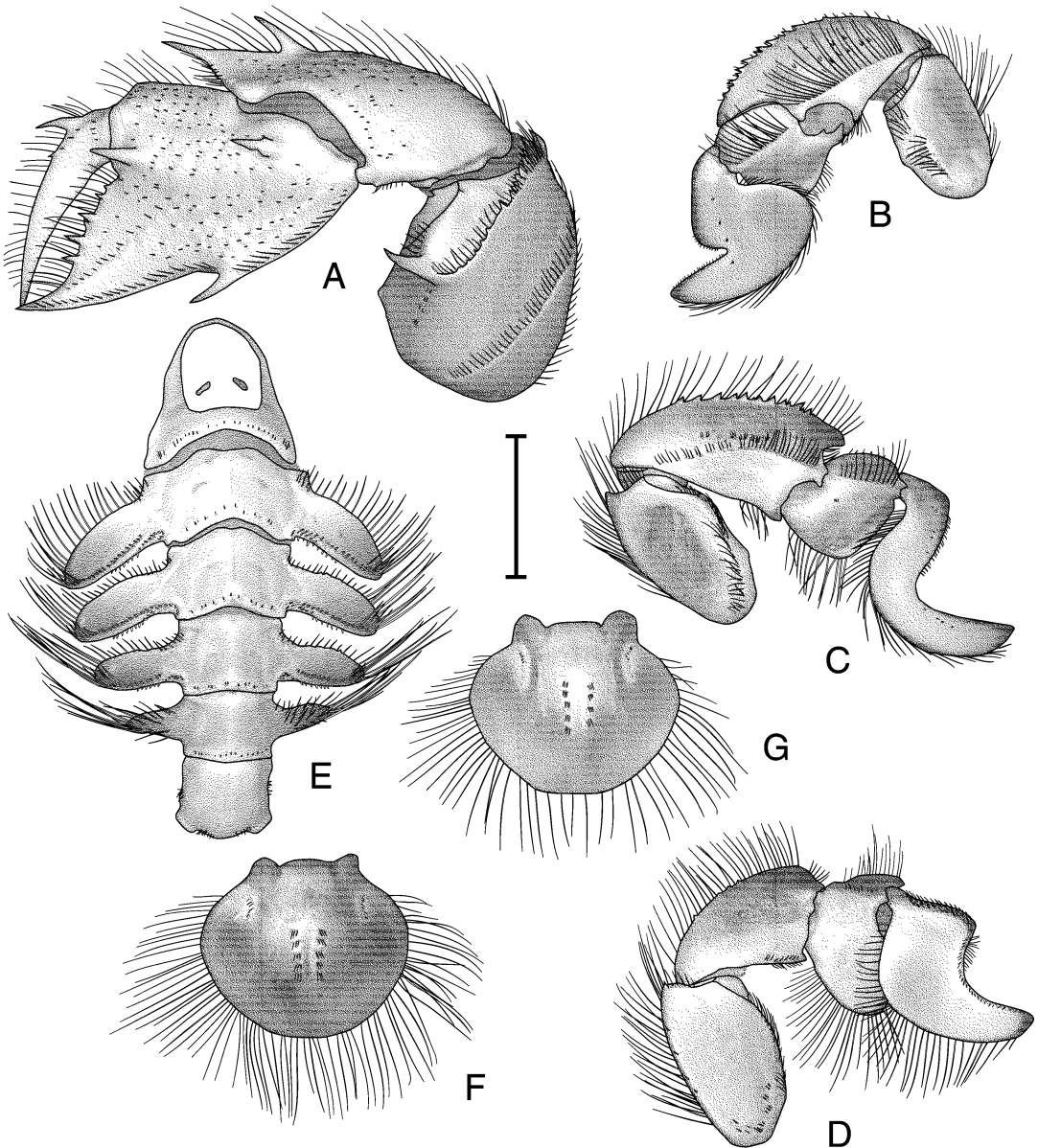


Fig. 15. *Blepharipoda doelloi* Schmitt, 1942: A-E, ♀, 23.1 mm cl, AMNH 17527; F, ♂, 22.0 mm cl, MACN 14303; G, ♀, 28.6 mm cl, USNM 267783. A. Left pereopod I, lateral view. B. Left pereopod II, lateral view. C. Right pereopod III, lateral view. D. Right pereopod IV, lateral view. E. Abdominal somites I-VI, dorsal view. F. Telson of ♂, dorsal view. G. Telson of ♀, dorsal view. Scale = 3.3 mm (F), 4.4 mm (A, E, G), and 5.9 mm (B-D).

distal two-thirds of dorsal margin; dorsal margin with long plumose setae; lateral surface with few transverse, setose rugae on medial surface; mesial surface with rugae and short simple setae, margins with long plu-

mose setae. Merus with large spine at two-thirds length of ventral margin and large spine at dorsodistal angle; sinuous submarginal raised setose line running between two spines, lined with strong spines dorsodistally

becoming smaller proximoventrally; second sinuous line running parallel and proximal to first, but one-third from proximal margin, not spinose; long plumose setae on distoventral angle, dorsal margin, and in oblique patch across surface; mesial surface with few short rows of setae. Basis-ischium incompletely fused, unarmed. Coxa unarmed.

Pereopod II (fig. 15B) dactylus smooth; base to heel straight, heel smoothly rounded and produced, heel to tip with narrow, rounded indent, tip subacute, tip to base broadly convex; lateral surface smooth, with several small punctations in roughly straight line across medioproximal surface; mesial surface smooth, ventral margin with long plumose setae, dorsal margin with short simple setae. Propodal dorsal surface smooth, ventral margin inflated and rounded; distal and ventral margins with long plumose setae; dorsolateral surface as narrow, oblique, flattened shelf, with short setae on dorsal margin and long plumose setae on ventral margin; mesial surface with elevated, curved setose ridge from ventral junction with dactylus almost to ventral proximal junction with carpus. Carpus strongly produced and subacute dorsodistally, almost reaching distal margin of propodus, dorsal margin serrated along distal two-thirds; lateral surface with patches of rugae and submarginal elevated ridge ventrally, rugae and ridge with long plumose setae; dorsal margin with short plumose setae; mesial surface smooth with long plumose setae on ventral margin, short simple setae on dorsal and distal margins. Merus with medial decalcified window; small spine at mesiodistal margin; long plumose setae on margins; mesial surface nearly smooth with few setae. Basis-ischium incompletely fused and unarmed. Coxa with two small spines on anterior margin.

Pereopod III (fig. 15C) dactylus with base to heel slightly convex, heel subquadrate, broad and low, heel to tip with broadly concave indent, tip subacute, tip to base smoothly convex; lateral surface smooth, sinuous row of short setose punctations from median of heel to approximately one-half distance along distal blade; ventral margin with long plumose setae, dorsal margin with short simple setae; mesial surface smooth with plumose setae proximally at junction with pro-

podus. Propodus inflated dorsoventrally; lateral surface smooth, long plumose setae on ventral margin; dorsolateral surface narrow, oblique, flattened, with ventral row of long plumose setae and dorsal row of short simple setae; mesial surface with scattered long setae on and near ventral margin. Carpus produced dorsodistally, exceeding proximal margin of propodus by approximately one-third length of propodus, rounded; medial three-quarters of dorsal margin spinose; lateral surface rugose in medial third, with short scattered setae and long row of setae ventral to rugose region; mesial surface smooth, with row of long plumose setae on distal and dorsal margins. Merus smooth, with large decalcified window covering nearly all of lateral surface; small spine at dorsodistal margin; proximolateral margin and dorsodistal margin with long plumose setae, long plumose setae scattered on medioproximal surface; mesial surface smooth. Basis-ischium incompletely fused and unarmed. Coxa with two (males) or one (females) medially directed spine on anterior margin. Female with large gonopore on posterior mesial margin of coxa, not opposing or obscured by other coxa, without setae; male without pore.

Pereopod IV (fig. 15D) dactylus with base to heel straight, heel low and rounded, heel to tip broadly rounded in smooth arc, tip rounded, tip to base broadly convex; lateral surface smooth, ventral margin with long plumose setae, dorsal margin with short simple setae; mesial surface smooth, small patch of plumose setae between heel and articulation with propodus. Propodus expanded dorsally and ventrally; ventral expansion reaching ventral margin of dactylus, ventral margin with long plumose setae; dorsal expansion with long plumose setae dorsally; lateral and mesial surfaces smooth. Carpus slightly produced dorsodistally; dorsal margin with few small medial teeth but almost smooth; medial third of lateral surface with rugae. Merus with small spine on distodorsal margin; dorsal and ventral margins with long plumose setae; few short setae scattered on proximoventral surface. Basis-ischium incompletely fused and unarmed. Coxa with curved spine at anterior margin.

Abdomen (fig. 15E) somite I as long as wide, widest posteriorly; dorsal surface with

anterior margin convex; posterior margin irregularly concave, with submarginal row of setose punctae; medial surface decalcified, with two short, transverse, calcified lines on either side of midline. Somite II dorsal surface with strong medial keel; anterior margin irregularly convex, posterior margin irregularly concave; anterior margin with short decalcified areas either side of midline, posterior margin with submarginal row of short setae; pleura expanded and directed posterolaterally, anterolateral and posterolateral angles rounded, anterior and posterior margins smooth; anterior margins with long plumose setae, posterior margins with short simple setae; patch of setae at posterior junction with somite; row of short setose punctae on lateral surface running parallel to posterior margin. Somite III similar to somite II, but narrower, shorter, strongly convex medially; pleura thinner and slightly shorter than on somite II, directed less posterolaterally, with setae as in somite II, anterior margin with few low teeth medially, posterior margin smooth. Somite IV similar to somite III, but thinner and shorter; pleura shorter than on somite III, directed laterally; anterior margin with few low teeth, posterior margin smooth, margins with long plumose setae. Somite V subequal to somite IV; pleura approximately one-half length of somite IV pleura and directed laterally; margins and surface of pleura with long plumose setae. Somite VI subequal to somite V in width but longer; mediolateral margin with short plumose setae; posterior margin row of few short setae either side of midline; pleura absent.

Telson of male (fig. 15F) ovate, laterally expanded, wider than long, distal tip smoothly rounded; medial third heavily calcified, dorsally inflated and tapering distally, lateral third weakly calcified; demarcation of calcified and uncalcified regions marked by low ridge; median longitudinal groove on distal half of calcified area, five short transverse rows of short simple setae on either side of median groove. Margins with long simple setae; few short setae on proximolateral corners. Telson of female (fig. 15G) nearly identical to male, but with blunter tip and more inflated proximolateral lobes.

DISTRIBUTION: Known from Rio de Janeiro,

Brazil, to Argentina, intertidal to 30 m depth.

MAXIMUM SIZE: Males: 23.9 mm cl; females: 30.5 mm cl. The largest specimens occur in the southern part of the range.

TYPE SPECIMENS: MACN 14303 (holotype, ♀, 21.8 mm cl), MACN 14189 (allotype, ♂, 15.0 mm cl), MACN 13946 (paratype, ♀, 18.8 mm cl).

TYPE LOCALITY: Mar del Plata, Buenos Aires, Argentina.

REMARKS: Although the types of this species were not available for direct examination, I was able to obtain color photographs of all three specimens. An additional two specimens (MACN 14303; see under Material Examined) were cited by Tablado and Venerus (2000) as paratypes, but they are not among the material cited by Schmitt (1942) and cannot be considered part of the type series despite their sharing of identical data with the holotype.

The complete larval development of this species (from ovigerous females) was described by Boschi et al. (1968). There are five zoeal stages and one megalopal stage obtained in 42–79 days at 20°C and 33.9–34.09‰ salinity (Boschi et al., 1968).

Calado (1987: figs. 1, 2a) made several errors in her illustrations of this species. The gastric spine was omitted (fig. 1), the carapace grooves were presented incorrectly and inconsistently (figs. 1, 2a), the flagellum of the exopod of maxilliped III was given as having two articles, and the mandibular palp was given as four-segmented.

This species is the Atlantic analogue of *B. spinosa*.

Blepharipoda spinosa

(H. Milne Edwards and Lucas, 1841)

Figures 16, 17

Albunea scabra: Molina, 1810: 187 (not *Hippa scabra* Fabricius, 1787 = *Ranina ranina* (Linnaeus, 1758)).

Albunhippa spinosa H. Milne Edwards and Lucas, 1841: 477, pl. 28, figs. 1–13. – Dana, 1852: 406. – Boas, 1880: 134–136. *Abrote spinimana* Philippi, 1857: 124–129, pl. 8 (NEW SYNONYMY).

Blepharopoda [sic] *spinosa*: Stimpson, 1858: 230. – Miers, 1878: 335–336. – Cano, 1889a: 100. – Cano, 1889b: 263.

- Blepharopoda* [sic] *spinimana*: Stimpson, 1858: 230. – Miers, 1878: 335. – Duruflé, 1889: 93, 95. – Bouvier, 1898b: 342.
- “*Dynomene?*” [sp.]: Cano, 1893: pl. 2, figs. 56–61 (not *Dynomene* Latreille in Desmarest, 1825).
- Blepharipoda occidentalis*: Ortmann, 1896: 222 (part). – Lenz, 1902: 749. – Rathbun, 1911: 594 (list) (part). – Porter, 1915a: 78–82 (part), fig. 10. – Porter, 1915b: 14–17 (part), fig. 3. – Porter, 1916: 280–282 (part), unnumbered fig. – Porter, 1936b: 254–255 (part). – Porter, 1936c: 338 (list). – Porter, 1940a: 312 (part). – Porter, 1940b: 146 (part). – Porter, 1941: 460 (part). – Schuster-Dieterichs, 1956: 52. – Fonseca, 1970: 35 (part) (not *Blepharipoda occidentalis* J. W. Randall, 1840).
- Blephaopoda* [sic] *speciosa*: Bouvier, 1898b: 342 (error for *Blepharipoda spinosa* (H. Milne Edwards and Lucas, 1841)).
- Blefaripoda* [sic] *occidentalis*: Porter, 1936a: 153 (not *Blepharipoda occidentalis* J. W. Randall, 1840).
- Blepharipoda spinosa*: Schmitt, 1942: 2.
- Blepharipoda spinimana*: Schmitt, 1942: 2–9, pl. 1, figs. 7, 8*. – Fesquet, 1942: 111–113. – Haig, 1955: 9–11, fig. 1*. – Knight, 1968a: 337–367, figs. 62–69*. – Knight, 1968b: 63–93, figs. 62–69*. – Fonseca, 1970: 35, fig. 70. – Del Solar et al., 1970: 23. – Epelde-Aguirre and Lopez, 1975: 165. – Coêlho and Calado, 1987: 43, table 1. – Carvacho and Saavedra, 1994: 174. – Calado, 1995: 119–121, pl. 36, figs. a–c, pl. 37, figs. a, b, pl. 38, figs. a–d*. – Boyko and Mikelsen, 2002: 155.
- Albuneidae: Báez, 1997: 173 (part). – Wehrmann and Báez, 1997: 269 (part).

MATERIAL EXAMINED: **Peru:** Barranca, Oct. 1949, coll. W. K. Weyrauch: 1 ♂, 23.5 mm cl (RMNH 6932); Ancon, 35 km north of Lima, coll. unknown: 1 ♀, 25.9 mm cl (BMNH 1913.12.10.127); Mollendo, Sept. 16, 1906, coll. R. Paessler: 1 ♂, 24.0 mm cl (ZMH K-5141).

Chile: Unknown [“Chili”], coll. unknown: 1 ♀, 25.8 mm cl, holotype of *B. spinosa* (MNHN-Hi 22); “Chili,” coll. unknown: 1 ♂, 27.9 mm cl (MNHN-Hi 194); Valparaiso, April 1930, coll. E. P. Reed: 1 ♀, 24.0 mm cl, 1 oviger, 32.8 mm cl (MACN 10811); Antofagasta, March 1940, coll. J. Herrera: 1 oviger, 29.0 mm cl, neotype of *B. spinimana* (USNM 79390); Bahia San Vicente, Concepcion, 6 m, May 3, 1960, coll. Jeldes: 1 ♀, 22.4 mm cl (ZMH K-27279).

DIAGNOSIS: Carapace with anterior gastric spine. Antennular dorsal flagellum with 56–64 articles, ventral flagellum with 12–14 articles. Antennal flagellum with 13–17 articles. Pereopod I dactylus dorsal margin with two or three large spines; carpus with none to three large spines proximal to dorsodistal spine; basis-ischium without spines. Pereopod II coxa with one spine. Pereopod IV coxa without spines. Distal margin of telson with notch.

DESCRIPTION: Carapace (fig. 16A) approximately 1.3 times longer than wide; strongly keeled medially. Anterior margin with large rugose spine on either side of ocular sinus, convex laterally; large spines and margin all armed with numerous small spinules; large spine armed with strong low tooth on mesio-distal margin. Rostrum as large acute tooth, extending nearly one-half length of proximal pseudosegment of distal peduncular segments. Ocular sinus acutely concave and armed with numerous small spines. Frontal region smooth; setal field as thin transverse line with anteriorly produced lateral elements. CG1 parallel to anterior margin of carapace, convex and produced dorsally, armed with numerous small, rounded teeth along length and large anterogastric median spine. Mesogastric region smooth laterally, with row of medial punctae; CG2 absent; CG3 absent; CG4 with two long crenulate lateral elements approximately one-fourth carapace width. Hepatic region smooth, with scattered small punctae and two strong, slightly curved, anteriorly directed spines; anteriormost spine approximately two times larger than posterior spine. Epibranchial region roughly triangular, smooth, armed with one strong spine subequal in length to posterior hepatic spine. Metagastric region smooth, with medial and posterior punctae; CG5 absent. CG6 strongly crenulate, with oblique lateral elements separate from medial concave element. CG7 absent. Cardiac region smooth, with few scattered punctae; CG8–11 absent. Branchial region smooth, with numerous scattered punctae and small spine on anterolateral margin. Posterior margin deeply and evenly convex; submarginal groove unbroken. Branchiostegite unarmed; anterior region with many short rows of setae and sparsely covered with long plumose se-

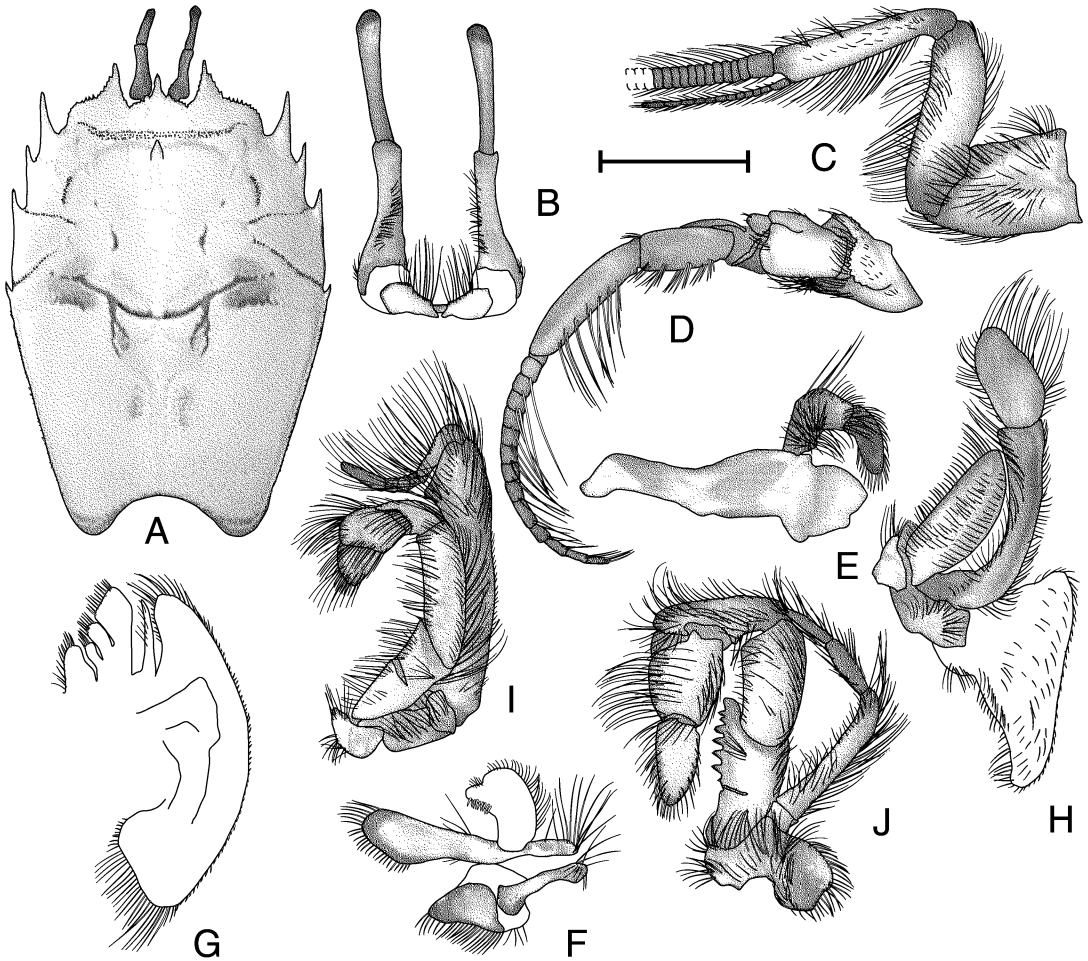


Fig. 16. *Blepharipoda spinosa* (H. Milne Edwards and Lucas, 1841): A, ♀, 22.4 mm cl, ZMH K-27279; B–J, ♀, 24.0 mm cl, MACN 10811. A. Carapace and ocular peduncles, dorsal view. B. Ocular peduncles, dorsal view. C. Left antennule, lateral view. D. Left antenna, lateral view. E. Left mandible, mesial view. F. Left maxillule, lateral view. G. Left maxilla, lateral view. H. Left maxilliped I, lateral view. I. Left maxilliped II, lateral view. J. Left maxilliped III, lateral view. Scale = 3.3 mm (B, C, E, F, H, I), 4.4 mm (D, G, J), and 8.0 mm (A).

tae ventrally; posterior region membranous, with numerous irregular fragments and sparsely covered with long plumose setae.

Ocular plate (fig. 16B) subovate, located between median peduncular segments. Median peduncular segments oblong; dorsal margin with long plumose setae. Distal peduncular segments elongate, subdivided into proximal and distal pseudosegments; proximal pseudosegment tapering to distal end with spiral band of plumose setae along mesial margin and ocular pore on ventromesial surface; distal pseudosegment cylindrical

with distal rounded cornea; mesial margins widely separated along length.

Antennule (fig. 16C) with segment III narrow proximally, expanding distally to twice proximal width; simple setae on dorsal margin, plumose setae on ventral margin and sparsely scattered on lateral surface; dorsal exopodal flagellum with 56–64 articles ($n = 4$), long plumose setae on dorsal and ventral margins; ventral endopodal flagellum with 12–14 articles ($n = 5$), plumose setae on dorsal and ventral margins. Segment II medially inflated from dorsal view, with plumose setae

on dorsal and ventral margins and scattered on ventrolateral half of surface. Segment I width subequal to length, unarmed; lateral surface with long plumose setae; long plumose setae on proximodorsal and distoventral margins.

Antenna (fig. 16D) with segment V approximately four times longer than wide, with four short transverse lines of long simple setae on either side of ventral medial line; flagellum with 13–17 articles ($n = 6$), long simple setae at ventrodorsal margin of each article. Segment IV subcylindrical, approximately 2.5 times longer than wide; tuft of setae at dorsodistal margin; two or three transverse rows of short simple setae on ventral margin either side of medial line. Segment III decalcified and produced mesiodistally. Segment II short, subcylindrical; antennal acicle short, rounded, with low spines on distal margin and few scattered setae. Segment I dorsally rounded, ventrally rectangular with distolaterally produced toothed lobe; few scattered setae on distal margins and surface; segment with ventromesial antennal gland pore.

Mandible (fig. 16E) incisor process with two teeth; cutting edge with one tooth. Palp three-segmented, with plumose setae on margins and long, thick, simple setae arising from bend in second segment.

Maxillule (fig. 16F) distal endite proximally narrow, widening to inflated distal end, with thick simple setae on distal margin. Proximal endite with thick simple setae on distal margin and decalcified dorsoventral lobe between calcified regions. Endopodal external lobe rounded distally and curled under; internal lobe produced distally with nine thick setae at distolateral margin; entire endopod “mitten-shaped.”

Maxilla (fig. 16G) exopod evenly rounded with plumose setae along distal margin. Sca-phognathite bluntly angled on posterior lobe, with plumose setae.

Maxilliped I (fig. 16H) epipod with plumose setae on margins, distolateral surface, and mesial surface. Endite tapered distally and subequal to first segment of exopod. Exopod with two segments; proximal segment narrow, margins parallel, margins and surface with plumose setae; distal segment spatulate, longer than wide, broadest medially,

margins with long plumose setae. Endopod flattened and elongate, reaching to distal end of proximal exopodal segment; plumose setae on margins.

Maxilliped II (fig. 16I) dactylus evenly rounded, length equal to width, with long simple setae on lateral surface; distal margin with thick serrate setae. Propodus 1.5 times wider than long, plumose setae on dorsal margin and long simple setae at dorsodistal margin. Carpus not produced dorsodistally, approximately two times longer than wide; long simple setae on dorsal and distal margins. Merus approximately 3.5 times longer than wide, margins parallel; with long plumose setae on lateral and mesial margins and on mesial third of surface. Basis-ischium incompletely fused with deep suture with plumose setae on margins and on surface. Exopod one-third longer than merus, produced mesiodistally, flagellum with five articles.

Maxilliped III (fig. 16J) dactylus longer than wide, tip rounded; long plumose setae on dorsal and ventral margins; thick serrate setae on distal margin. Propodus with longitudinal median row of plumose setae on lateral surface; dorsal and ventral margins with plumose setae. Carpus slightly produced onto propodus with small spine at distoventral margin; lateral surface with row of plumose setae ventromedially; plumose setae on dorsal and ventral margins. Merus with one or two strong corneous teeth and few small teeth on mesial surface, plumose setae on dorsal and ventral margins and scattered on lateral surface. Basis-ischium deeply incompletely fused and subequal to merus in length, with strong crista dentata of 10 large and small corneous teeth. Exopod two-segmented: proximal segment small; second segment styliform, tapering, approximately one-fourth longer than merus; plumose setae on margins and surface; flagellum with two articles.

Pereopod I (fig. 17A) dactylus curved and tapering; lateral and mesial surfaces smooth; dorsal margin armed with two or three strong, and no small, corneous spines ($n = 6$); with long plumose and short simple setae; ventral margin unarmed with submarginal row of short simple setae. Propodus lateral surface with numerous short patches of rugae, some with short setae; dorsal margin un-

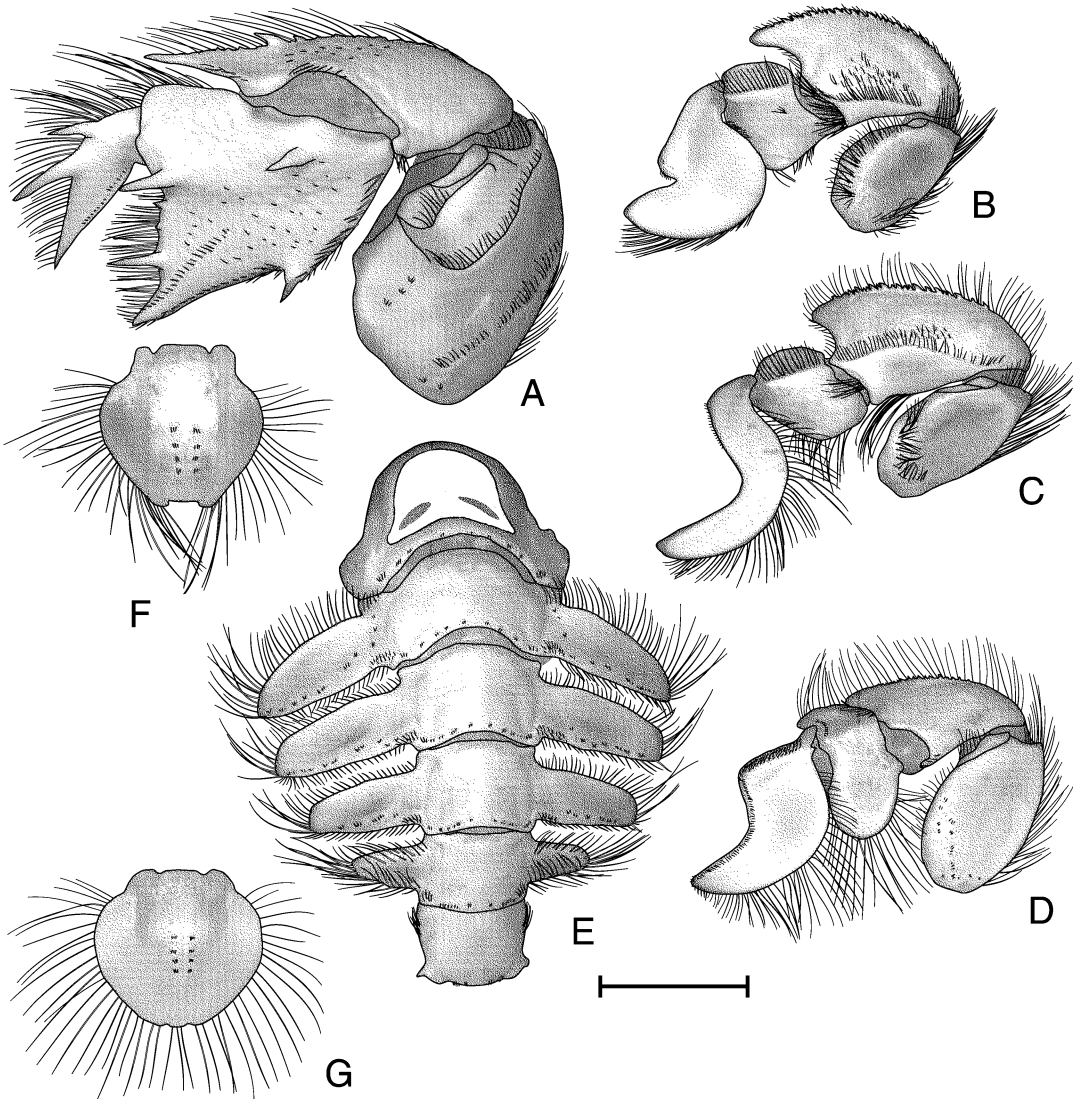


Fig. 17. *Blepharipoda spinosa* (H. Milne Edwards and Lucas, 1841): A-E, ♀, 24.0 mm cl, MACN 10811; F, ♂, 24.0 mm cl, ZMH K-5141; G, ♀, 22.4 mm cl, ZMH K-27279. A. Left pereopod I, lateral view. B. Left pereopod II, lateral view. C. Left pereopod III, lateral view. D. Left pereopod IV, lateral view. E. Abdominal somites I-VI, dorsal view. F. Telson of ♂, dorsal view. G. Telson of ♀, dorsal view. Scale = 4.4 mm (A, E-G) and 6.7 mm (B-D).

armed, with long plumose setae; ventral margin distally produced into acute spine and with strong acute spine arising from midpoint of margin, with long plumose setae; cutting edge with two or three large and two or three small corneous teeth ($n = 6$) increasing in size from junction with dactylus, lined with long plumose setae; lateral surface of propodus with two large spines; distal spine

just behind junction with dactylus at approximately one-third dorsal to ventral margin of palm; proximal spine just behind junction with carpus at midpoint of propodal/carpal margin. Carpus with dorsodistal angle produced into strong corneous-tipped spine with small teeth on dorsal surface of spine; dorsal margin behind spine armed with none to three smaller spines ($n = 6$) and with small

teeth on distal two-thirds of dorsal margin; dorsal margin with long plumose setae; lateral surface with few transverse, setose rugae on medial surface; mesial surface with rugae and short simple setae, margins with long plumose setae. Merus with two large spines; proximal spine at midpoint of mesial margin; distal spine at distomesial margin; sinuous raised setose line running between two spines, line with small spinules; second sinuous line running parallel and proximal to first; long plumose setae on distolateral angle, proximolateral margin, in oblique line across surface and scattered on surface; mesial surface with few short rows of setae. Basis-ischium incompletely fused, unarmed. Coxa unarmed.

Pereopod II (fig. 17B) dactylus smooth; base to heel straight, heel smoothly rounded, heel to tip with narrow, rounded indent, tip subacute, tip to base broadly convex; lateral surface smooth, with several small punctations in roughly straight line across medioproximal surface; mesial surface smooth, ventral margin with long plumose setae, dorsal margin with short simple setae. Propodal dorsal surface smooth, with ventral margin inflated and rounded; distal and ventral margins with long plumose setae; dorsolateral surface as narrow, oblique, flattened shelf, with short setae on dorsal margin and long plumose setae on ventral margin; mesial surface with elevated, curved, setose ridge from ventral junction with dactylus almost to ventral proximal junction with carpus. Carpus strongly produced and subacute dorsodistally, dorsal margin serrated along distal three-quarters; lateral surface smooth, with patches of rugae and submarginal elevated ridge ventrally, rugae and ridge with long plumose setae; dorsal margin with short plumose setae; mesial surface smooth with long plumose setae in scattered patches on dorsal half of surface and on margins. Merus with large median decalcified window covering nearly all of lateral surface, with long plumose setae on surface and margins; mesial surface nearly smooth with low tubercle or spine on distodorsal margin; few setae. Basis-ischium incompletely fused and unarmed. Coxa with one small spine on anterior margin.

Pereopod III (fig. 17C) dactylus with base to heel straight, heel broadly rounded and

low, heel to tip with broadly concave indent, tip subacute, tip to base smoothly convex; lateral surface smooth, dorsodistal margin with tufts of short setae; ventral margin with long plumose setae; mesial surface smooth, with plumose setae proximally at junction with propodus. Propodus not inflated dorsoventrally; lateral surface smooth, simple setae on dorsal margins; dorsolateral surface narrow, oblique, flattened, with ventral row of long setae; mesial surface with scattered long setae on and near ventral margin. Carpus produced dorsodistally, exceeding proximal margin of propodus by approximately one-fourth length of propodus, rounded; proximal two-thirds of dorsal margin spinose; lateral surface rugose in medial third, with short setae and row of setae ventrally; mesial surface smooth, with long plumose setae on distal margin. Merus smooth, with large decalcified window covering nearly all of lateral surface; distolateral margin with small spine; proximolateral margin and dorsodistal margin with long plumose setae; mesial surface smooth. Basis-ischium incompletely fused and unarmed. Coxa with medially directed spine in males and small tubercle in females on anterior margin. Female with large gonopore on posterior mesial margin of coxa, without setae; male without pore.

Pereopod IV (fig. 17D) dactylus with base to heel straight, heel low and rounded, heel to tip broadly rounded, tip subacute, tip to base broadly convex; lateral surface smooth, ventral margin with long plumose setae, dorsal margin with short simple setae; mesial surface smooth, small patch of plumose setae between heel and articulation with propodus. Propodus expanded dorsally and ventrally; ventral expansion reaching ventral margin of dactylus, ventral margin with long plumose setae; dorsal expansion with long plumose setae dorsally; lateral and mesial surfaces smooth. Carpus slightly produced dorsodistally; medial third of dorsal margin serrate; medial third of lateral surface with rugae. Merus with small spine at distolateral margin; dorsal and ventral margins with long plumose setae; few short setae scattered on proximoventral surface. Basis-ischium incompletely fused and unarmed. Coxa unarmed.

Abdomen (fig. 17E) with somite I approximately as long as wide, widest posteriorly; dorsal surface with anterior margin convex; posterior margin convex with submarginal row of setose punctae; medial surface decalcified, with two short transverse calcified lines. Somite II dorsal surface with medial keel; anterior margin convex, posterior margin concave; pleura expanded and directed posterolaterally, tapered laterally; margins with long plumose setae; patch of setae at posterior junction with somite; row of short setose punctae running from posterolateral margin of pleura to anteromesial margin. Somite III similar to somite II, but narrower, shorter; pleura subequal in width but shorter than on somite II, directed less posterolaterally, with setae as in somite II, except row of setose punctae running submarginally ventrally. Somite IV similar to somite III, but thinner and shorter; pleura shorter than on somite III, directed laterally; margins with long plumose setae. Somite V subequal to somite IV; pleura approximately two-thirds length of somite IV pleura and directed laterally; margins and surface of pleura with long plumose setae. Somite VI subequal to somite V; anterolateral margin with long plumose setae; posterior margin with two short rows of setae; pleura absent.

Telson of male (fig. 17F) subcircular, approximately as long as wide, with truncate notch at tip; medial third heavily calcified, dorsally inflated and tapering distally, lateral thirds weakly calcified; demarcation of calcified and uncalcified regions marked by low ridge; median longitudinal groove on distal two-thirds of calcified area, four short transverse rows of short simple setae on either side of median groove. Margins with long simple setae. Telson of female (fig. 17G) nearly identical to male, but with less prominent notch at tip and broader uncalcified regions.

DISTRIBUTION: Peru to Chile, intertidal to 6 m depth.

MAXIMUM SIZE: Males: 27.9 mm cl; females: 29.0 mm cl.

TYPE SPECIMENS: MNHN-Hi 22 (holotype of *Albunhippa spinosa*), USNM 79370 (neotype of *Abrote spinimana*, designated by Schmitt, 1942). The holotype of *Abrote spinimana* is lost (fide Schmitt, 1942).

TYPE LOCALITIES: Unknown (*Albunhippa spinosa*); Province of Antofagasta, Chile (*Abrote spinimana*).

REMARKS: Direct comparison of the type specimens of *Albunhippa spinosa* and *Abrote spinimana* shows that these two specimens are identical in all but size. The two species are herein considered subjective synonyms. This species is known in Peru as "mui-mui chino" (Del Solar et al., 1970) or "muy-muy chino" (Fonseca, 1970).

Cano (1893, as "*Dynomene?*") described a probable stage III zoea from the Chilean plankton. Knight (1968a, 1968b) described zoeal stages I–IV of this species from the Peruvian plankton, but the complete life history is still unknown.

Haig (1955) correctly concluded that Molina's (1810) record of *Albunea scabra* could not be identical with that Indian Ocean taxon. Unfortunately, Haig (1955) was not aware that *Hippa scabra* Fabricius is a junior synonym of *Ranina ranina* (Linnaeus) (Brachyura: Raninidae), which does indeed have an exclusively tropical Indo-Pacific distribution. Had she made this connection, she would surely have realized that *B. spinosa* is the only species of decapod in Chile large enough and strongly convergent enough with raninid morphology to be the source of Molina's (1810) record. No raninid species occur in Chile.

Although Calado (1995) included *Albunhippa spinosa* in synonymy with *Abrote spinimana*, she did not give any basis for this and continued to use the latter name for the species despite its junior synonym status. Calado (1995) also gave an incorrect type locality of "Tomé Bay de Talcahueno, Chile". Although aware of the correct name for this species, Boyko and Mikkelsen (2002) maintained the usage of *B. spinimana* as their work was not an appropriate venue for correcting the nomenclature.

This species is the Pacific analogue of *B. doelloi*.

ALBUNEIDAE STIMPSON, 1858

DIAGNOSIS: Carapace subquadrate; epibranchial spine absent. Gills phyllobranch; gill formula given below. Distal peduncular segments entire. Antennule with three seg-

ments; dorsal flagellum with 17–250 articles, ventral flagellum with 0–7 articles. Antenna five-segmented; acicle present; flagellum with one to nine articles. Proximal maxillar endites narrower than distal endites. Mandible with three-segmented palp. Maxilliped I with epipod. Maxilliped III with epipod; merus unarmed; crista dentata absent or weak; exopod slender or lamellar. Pereopod I subchelate; dactylus dorsal margin smooth or crenulate; propodus cutting edge smooth or with blunt teeth. Pereopods II–IV dactyli laterally compressed and dorsoventrally expanded; dorsal margins of carpi smooth (except *Albunea speciosa*). Pereopod V reduced, chelate. Abdomen with pleura on somites II–IV or II–V. Uropods present. Telson entire.

Gill Formula (podobranch/arthrobranch/pleurobranch): maxilliped I, 0/0/0; maxilliped II, 0/0/0; maxilliped III, 0/0/1; pereopod I, 0/2/0; pereopod II, 0/2/0; pereopod III, 0/2/0; pereopod IV, 0/2/0; pereopod V, 0/0/1.

DISTRIBUTION: Worldwide in tropical, subtropical, and temperate waters.

TYPE GENUS: *Albunea* Weber, 1795.

INCLUDED SUBFAMILIES: Albuneinae Weber, 1795; Lepidopinae, n. subfam.

REMARKS: The family name Albuneidae Stimpson, 1858 (a correction of Alburnidae) is no. 242 on the “Official list of family-group names in zoology” (ICZN, 1958). The family name Alburnidae Stimpson, 1858 (invalid original spelling for Albuneidae) is no. 276 on the “Official list of rejected and invalid family-group names in zoology” (ICZN, 1958). The “official” name for this family has been given as “mole crabs” and that of the Hippidae as “sand crabs” (Williams et al., 1989). Unofficially, both names have been used essentially interchangeably in the literature. However, species of Hippidae bear a much more striking resemblance to moles (Mammalia) in the shape of their carapaces than do albuneids. I suggest that the “official” common names of albuneids and hippids be switched and that the Albuneidae be furthermore known as “sand crabs.”

Although there has been much speculation about the use of the elongated antennules of albuneids as a feeding device (e.g., Williams, 1965), this seems unlikely. The antennules almost always have one long and one short flagellum (Snodgrass, 1952, incorrectly cites

a single long flagellum, which is only true of *Leucolepidopa*), and the two long flagellae possess interlocking mesially directed setae on the dorsal and ventral surfaces along their length. The primary function of the antennules is to form a respiratory tube through the sand by means of the interlocking setae (Snodgrass, 1952; Boyko, personal obs.). Water is taken in through the respiratory tube, but little material is transported along with it. This observation, combined with the fact that all albuneids have moderately well-developed mandibles, suggests that they are scavengers or predators, rather than any type of filter feeder. Observations of their burrowing behavior also support a detritivore lifestyle for these animals (Howard, 1968). Although Hill (1979) suggested that at least one albuneid, *Lepidopa websteri*, switches between filter feeding and deposit feeding, no experimental data were given by him to support this. Observations of food scraping from the antennules by the mouth parts (Pearse et al., 1942) were most likely antennule cleaning behaviors, not feeding. Benedict (1903) first hypothesized that the antennules are used in maintaining the flow of water to the branchial chambers, based on an “experiment” with a specimen of *Albunea gibbesii*. What is surprising about Benedict’s (1903) “experiment” is that it was done with a dead specimen in a beaker of sand and alcohol! Nevertheless, the idea of albuneids as filter feeders remains entrenched in the literature, especially nonsystematic works (e.g., Howard, 1968; Hill, 1979). The only record in the literature regarding stomach content in albuneids was given by Benedict (1903), who reported annelid setae, synaptid holothurian skin, and small crustacean flagellae in the stomach of a *Lepidopa benedicti* from Florida. It seems highly unlikely that the two specimens of *Albunea steinitzi* reported by Tirmizi (1978) would have survived 47 days in an aquarium if they were filter feeders.

Speculation on the reason for the apparent rarity of albuneids in suitable habitats dates back as far as Benedict (1903), who suggested that they might live in higher densities in deeper waters, or perhaps deeper in the sand. Nearly 100 years later, all available evidence still suggests that albuneids are rarely common in any sandy beach habitat.

Chace and Kensley (1992) doubted the homology of the shallow incision at the posterolateral angle of the albuneid carapace with the cardiac notch of alpheid shrimp (Caridea). Indeed, these are certainly not homologous features and are likely not even in analogous positions on the cardiac region. Williams (1984) included the character "third maxillipeds without epipodites" in his diagnosis of the Hippoidea, but all albuneids possess these structures.

Ortmann (1892) presented a somewhat crude tree indicating his opinion on the relationships among the hippoids and between them and the galatheoids and paguroids, but most of his conclusions are unsupported by morphological evidence. Ortmann (1892) presented *Blepharipoda* as an intermediate between galatheids and the other hippoids, but both galatheids and the "higher" albuneids have phyllobranch gills, while *Blepharipoda* has trichobranch gills. It is difficult to envision a scheme by which the gill type easily transitions back and forth between these two states. Ortmann (1892) also indicated that *Lepidopa* is more derived than *Albunea*, but current analysis suggests that the opposite may be true (Boyko and Harvey, in prep.). Hippoids have generally been considered primitive anomurans (e.g., Ortmann, 1892; Martin and Abele, 1986), and, indeed, the characteristics of the spermatophores of hippoids are somewhat intermediate between those found in macrurans and those found in the higher Anomura (e.g., hermit crabs) (Subramoniam, 1984; Tudge et al., 1999).

Digging behavior in hippoids has been postulated as a derived character uniting the Hippoidea (Faulkes and Paul, 1997b). However, it is equally possible that the similarities observed by Faulkes and Paul (1997b) in *Blepharipoda*, *Lepidopa*, and *Emerita* are due to convergence in morphology for a sand-dwelling lifestyle. Additional evidence showing that digging behavior is different in other sand-dwelling crabs (e.g., raninids) is needed to support any statement of this behavior as a synapomorphy for the Hippoidea.

Efford's (1969) tree of evolutionary relationships in the Albuneidae is not highly informative. Although his basic groupings of taxa were sound (e.g., *Albunea* with *Stemonopa*, *Lepidopa* with *Austrolepidopa*), his tree

was based on rough ideas of relationships and is not a cladogram. His tree lacked resolution at the level of "ancestral Albuneidae," and some of his suggestions are untenable given additional evidence. For example, Efford (1969) placed *Austrolepidopa* and *Leucolepidopa* in a more derived position than *Lepidopa*, apparently on the strength of a single character (number of articles on the antennal flagellum), which he assumed should be reduced in the derived state. This logic, when applied to this one character, is not flawed, but when other characters, such as presence of leg membranes and flagellum on the exopod of maxilliped III, are examined, the overall pattern is reversed. It is unfortunate that this is the only tree of albuneid relationships available to date, particularly because it has been cited as if it were a true cladogram (e.g., Faulkes and Paul, 1997a).

KEY TO SUBFAMILIES

- 1 Abdominal somite V with pleura; antennal acicle short (less than length of antennal segment III) . . . Lepidopinae, n. subfam.
- Abdominal somite V without pleura; antennal acicle long (greater than or equal to length of antennal segment III) Albuneinae

LEPIDOPINAE, new subfamily

TYPE GENUS: *Lepidopa* Stimpson, 1858, designated herein.

INCLUDED GENERA: *Lepidopa* Stimpson, 1858; *Austrolepidopa* Efford and Haig, 1968; *Leucolepidopa* Efford, 1969; *Paraleucolepidopa* Calado, 1996.

DIAGNOSIS: Carapace front broad, unarmed or weakly toothed; outer-ocular spines present (except in *Lepidopa haigae*); hepatic anterolateral spine present; branchiostegite unarmed. Rostrum present. Distal peduncular segment flattened; cornea absent. Antennule segment I unarmed; dorsal flagellum with 46–250 articles, ventral flagellum with 0–4 articles. Antenna acicle present, short; flagellum with three to nine articles. Maxilliped III carpal projection long; crista dentata absent. Pereopod I dactylus dorsal margin smooth; propodus cutting edge smooth; distodorsal carpal spine absent. Pereopod III male pore present (except in *Lepidopa cali-*

formica). Abdomen with pleura on somites II–V. Telson sexual dimorphism weak.

REMARKS: Although *Lepidopidae* Stammer (1936) (Crustacea: Mysidacea) is a senior family-level homonym of this new taxon, that name was placed on the “Official index of rejected and invalid family-group names in zoology” as name no. 398 (a family name based on a junior homonym of a genus) (ICZN, 1964).

The genera that comprise this new subfamily have always been considered to form a natural grouping within the Albuneidae (Efford and Haig, 1968; Efford, 1969), but that group was never formally named. The only genus that was questionably referred to this group was *Zygopa* (Holthuis, 1961), but as shown herein, that genus is allied to *Albunea* rather than to *Lepidopa*.

KEY TO GENERA

- 1 Antenna with three flagellar articles
 *Leucolepidopa*
- Antenna with more than three flagellar articles
 2
- 2 Pereopod IV merus with lateral surface calcified 3
- Pereopod IV merus with lateral surface decalcified *Lepidopa*
- 3 Rostral area with anterior margin rounded
 *Paraleucolepidopa*
- Rostral area with anterior margin truncated
 *Austrolepidopa*

AUSTROLEPIDOPA EFFORD AND HAIG, 1968

Austrolepidopa Efford and Haig, 1968: 898. – Haig, 1974: 449 (list). – Coêlho and Calado, 1987: 43, table 1. – Calado, 1995: 85–86. – Boyko and Harvey, 1999: 382, 401 (key).

DIAGNOSIS: Carapace approximately as wide as long, anterior margin armed with low spines. Rostrum produced and truncated. Distal peduncular segment flattened, tapering. Antennular dorsal flagellum with 46–90 articles, ventral flagellum with 2–4 articles. Antennal segment I unarmed; flagellum with seven or eight articles. Maxilliped II exopod with flagellum. Abdominal somite V pleura well calcified. Telson of male elongate ovate, evenly but weakly calcified.

DISTRIBUTION: Known only from Western

Australia, Queensland, Australia, and New Caledonia.

TYPE SPECIES: *Austrolepidopa schmitti* Efford and Haig, 1968, by original designation.

INCLUDED SPECIES: *A. schmitti* Efford and Haig, 1968; *A. trigonops* Efford and Haig, 1968; *A. caledonia* Boyko and Harvey, 1999.

REMARKS: As first pointed out by Boyko and Harvey (1999), Efford and Haig (1968) incorrectly identified males of this genus as females. Like all members of the Lepidopinae, the males of *Austrolepidopa* species possess pores on the coxae of pereopods III and V, and males of two of the three species also have small, budlike pleopods. Females have gonopores on the coxae of pereopods III and long pleopods. All three species of *Austrolepidopa* have a glossy, porcelainlike quality and are easily damaged if handled roughly.

The range of this genus would be extended to New South Wales, Australia, if cataloged specimens purported to belong to *Austrolepidopa* could be located in the AM (see under *A. schmitti*).

This genus is the sister taxon to all other genera in the Lepidopinae.

KEY TO SPECIES

- 1 Maxilliped III exopod with two segments 2
- Maxilliped III exopod with one segment
 *A. schmitti*
- 2 Setal field projecting almost to base of ocular sinus, CG8 entire *A. caledonia*
- Setal field projecting anteriorly on level with base of lateral carapace spine, CG8 broken
 *A. trigonops*

Austrolepidopa schmitti Efford and Haig, 1968

Figures 18, 19

Austrolepidopa schmitti Efford and Haig, 1968: 898–903, figs. 1–4*. – Coêlho and Calado, 1987: table 1. – Springthorpe and Lowry, 1994: 91 (list). – Calado, 1995: 86–89, pl. 26, figs. a, b, pl. 27, figs. a–f. – Fransen et al., 1997: 79 (list). – Boyko and Harvey, 1999: 400 (list), 401 (key).

MATERIAL EXAMINED: **Australia: Queensland:** Noosa Head, Aug. 8, 1922, coll. A. A. Livingstone: 1 ♂, 5.7 mm cl, 1 ♀, 7.3 mm

cl, paratypes (USNM 122072), 1 ♀, 7.5 mm cl, paratype (AM 15342), 1 ♂, 5.9 mm cl, 1 ♀, 6.4 mm cl, paratypes (BMNH 1967.9.2.1–2), 1 ♂, 5.7 mm cl, 1 ♀, 6.4 mm cl, paratypes (RMNH 23281), 1 ♂, 5.1 mm cl, 1 ♀, 5.8 mm cl, paratypes (LACM-AHF 221), 2 ♂, 6.7–7.8 mm cl, 10 ♀, 5.4–9.1 mm cl, paratypes (AM P6369); Middle Banks, Moreton Bay, Nov. 1983, coll. P. Saenger and S. Cook: 2 ♀, 3.4–4.5 mm cl, 2 juveniles, 1.9–2.0 mm cl (QM W12515); Bramble Bay, Moreton Bay, 65 ft (= 19.7 m), March 1976, Zoology Department, University of Queensland: 1 ♂, 5.0 mm cl (QM W8294); Middle Banks, Moreton Bay, 88 ft (= 26.7 m), March 1973, Zoology Department, University of Queensland: 1 ♀, 5.2 mm cl (QM W8327)

DIAGNOSIS: Carapace wider than long, covered with strongly setose grooves. Setal field with concave anterior margin and narrow lateral elements directed posteriorly. CG1 with contiguous posterior lateral elements; CG4 present as two long elements connected medially to anterior end of CG6; CG5 absent; CG6 merged with CG4 laterally and with CG7 medially to form two separate hybrid grooves; CG8 present as two short medial elements; CG11 absent. Anterior margin of carapace with finely toothed lobe lateral to ocular sinus. Rostral region truncate anteriorly, finely toothed. Ocular plate completely concealed dorsally by rostral region. Distal peduncular segments dorsoventrally flattened and ovate/triangular in shape, separated by slightly more than length of distal peduncular segments, lateral margin slightly convex, mesial margin slightly concave. Maxilliped III exopod without flagellum. Dactylus of pereopod II with heel produced, rounded. Dactylus of pereopod III with heel produced, subacute. Dactylus of pereopod IV deeply concave in indent, heel acute. Males without pleopods. Telson of male and female similar; flattened and ovate, medially with tufts of short, thin setae in paired longitudinal rows.

DESCRIPTION: Carapace (fig. 18A) slightly wider than long. Anterior margin dentate between ocular peduncles, with submarginal ventral row of long plumose setae. Rostrum absent, rostral area truncate, overreaching base of distal peduncular segments and exceeded by anterolateral lobes. Ocular sinus

sharply concave, dentate. Anterolateral lobe broadly triangular, dentate on margins, with mesial margin straight and lateral margin concave. Frontal region smooth, setal field with anterior margin narrow and reaching anterior margin of carapace, posterior margin broad, narrow lateral elements directed posteriorly, anterior margin concave. CG1 sinuous, slightly crenulate, bearing short setae, connected to posterior lateral elements. Mesogastric region smooth, CG2 absent; CG3 absent; CG4 present as two long elements connected medially to anterior end of CG6. Hepatic region smooth, with short rugose and setose lateral spine present on anterolateral margin; long row of setae parallel to anterior margin of carapace. Epibranchial region roughly triangular, smooth, posterior lateral margin with three short rows of setae. Metagastric region smooth; CG5 absent; CG6 slightly crenulate, median sinuous element separate from lateral elements, lateral fragments of CG6 connecting with median of CG4; CG7 absent. Cardiac region smooth; CG8 present as two short medial elements; CG9 absent; CG10 present as two slightly oblique elements almost meeting in median; CG11 absent. Branchial region with transverse rows of setae. Posterior margin deeply and evenly convex, with short lateral submarginal groove. Branchiostegite unarmed, covered with long plumose setae, anterior region with many short rows of setae, posterior region well calcified dorsally, membranous ventrally, with numerous irregular fragments.

Ocular plate and median peduncular segments completely concealed by front of carapace (fig. 18B). Distal peduncular segments elongate, ovate, triangular, broadly separated, margins with short plumose setae, ocular pigment visible at tip.

Antennule (fig. 18C) segment III narrow proximally, expanding distally to twice proximal width, produced distoventrally, simple setae on dorsal margin and scattered on face, few long plumose setae on distoventral margin; dorsal exopodal flagellum with 71–90 articles ($n = 6$), long plumose setae on dorsal and ventral margins, short simple setae on distolateral margins; ventral endopodal flagellum with two or three articles ($n = 6$), plumose setae on dorsal and ventral margins. Segment II with plumose setae on dorsal and

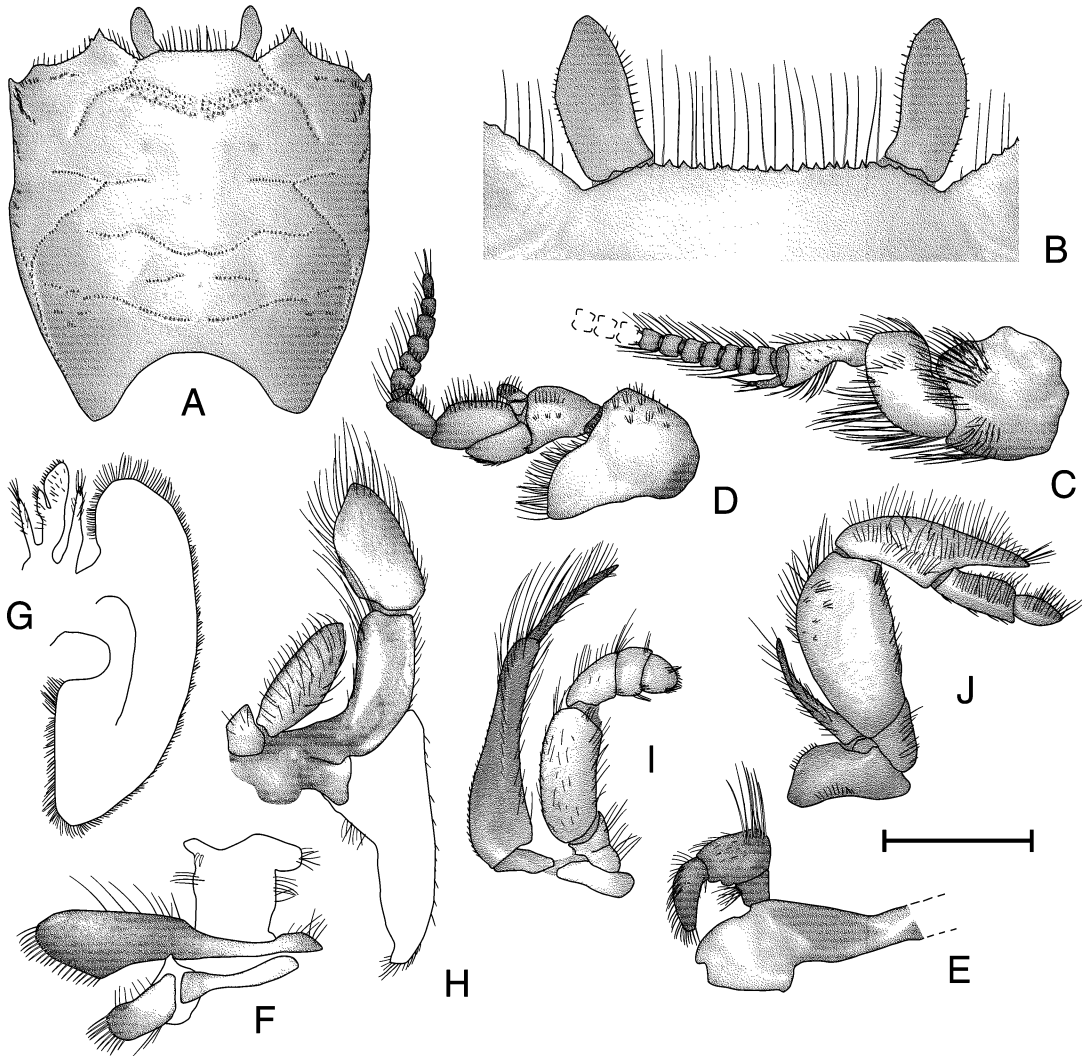


Fig. 18. *Austrolepidopa schmitti* Efford and Haig, 1968: A, B, ♂, 7.8 mm cl, AM P6369–6370, paratype; C–J, ♀, 7.5 mm cl, AM P15342, paratype. A. Carapace and ocular peduncles, dorsal view. B. Ocular peduncles, dorsal view. C. Left antennule, lateral view. D. Left antenna, lateral view. E. Right mandible, mesial view. F. Left maxillule, lateral view. G. Left maxilla, lateral view. H. Left maxilliped I, lateral view. I. Right maxilliped II, lateral view. J. Right maxilliped III, lateral view. Scale = 1.1 mm (B, G), 1.6 mm (E, I), 1.7 mm (H), 2.2 mm (C, D, F, J), and 3.3 mm (A).

ventral margins, and scattered on distolateral surface. Segment I wider than long, distolateral and distoventral surface and distal margin with long plumose setae.

Antenna (fig. 18D) with segment V approximately twice longer than wide, long plumose setae on dorsal margin; flagellum with seven articles ($n = 6$), long simple setae on dorsal, ventral, lateral, and distal margins.

Segment IV with long plumose setae on dorsal margin, and long simple setae on dorsolateral margin. Segment III with long plumose setae on ventral margin. Segment II short, widening distally, with long simple setae on dorsolateral margin and in short row ventromediolaterally; antennal acicle short, rounded, exceeding base of segment IV by approximately one-fourth length of segment

IV, long plumose setae on dorsal margin and long simple setae on lateral margin. Segment I rounded dorsally, with distoventral flattened plate, long plumose setae on ventrodistal margin, dorsolateral surface rugose and with long simple setae in short rows.

Mandible (fig. 18E) incisor process with two teeth; cutting edge with one tooth. Palp three-segmented, with plumose setae on margins and long, thick, simple setae arising from bend in second segment.

Maxillule (fig. 18F) distal endite proximally narrow, widening to inflated distal end, with thick simple setae on distal margin and thin plumose setae on dorsal margin. Proximal endite with thick simple setae on distal margin and thin plumose setae on dorsal margin. Endopod external lobe truncate distally and curled under, rounded proximally; internal lobe reduced with two thick setae at distolateral margin.

Maxilla (fig. 18G) exopod evenly rounded with plumose setae along distal margin. Scaphognathite bluntly angled on posterior lobe, with plumose setae.

Maxilliped I (fig. 18H) epipod with plumose setae on margins. Endite tapered distally and subequal to first segment of exopod. Exopod with two segments; proximal segment narrow, margins parallel, and with plumose setae; distal segment spatulate, approximately two times longer than wide, medial and proximal thirds of segment subequal in width, margins with long plumose setae, face of segment with few setae. Endopod flattened and elongate, reaching to distal end of proximal exopodal segment, with plumose setae on margins and surface.

Maxilliped II (fig. 18I) dactylus evenly rounded, length equal to width, with thick simple setae distally. Propodus twice as wide as long, not produced dorsodistally, with plumose setae on dorsal margin and short simple setae on distal margin. Carpus not produced dorsodistally, approximately two times longer than wide, with long simple setae on dorsal margin and few scattered on surface. Merus approximately 2.5 times longer than wide, margins nearly parallel but slightly inflated, with plumose setae on dorsolateral margin, ventral margin, and scattered on surface. Basis-ischium incompletely fused, with plumose setae on margins. Exopod one-third

longer than merus, flagellum with one elongate article, approximately one-half length of exopod.

Maxilliped III (fig. 18J) dactylus elongate with rounded tip, long simple setae on dorsal margin and in row on lateral surface. Propodus with longitudinal median row of simple setae, dorsal and ventral margins with simple setae. Carpus produced beyond distal end of propodus, overreaching dactylus by one-fourth dactylus length; lateral surface and dorsal margin with rows of plumose setae. Merus inflated, unarmed, with plumose setae on dorsodistal and ventrodistal margins. Basis incompletely fused with ischium, without crista dentata. Exopod two-segmented, proximal segment small, distal segment styliform, tapering, approximately one-half length of merus, plumose setae on margins and surface; flagellum absent.

Pereopod I (fig. 19A) dactylus curved and tapering; lateral and mesial surfaces smooth, dorsal margin with long plumose and short simple setae, ventral margin with short simple setae. Propodal lateral surface with numerous short, transverse rows of setose rugae, dorsal margin unarmed, ventral margin distally produced into acute spine, cutting edge lacking teeth, lined with long plumose setae; lateral, mesial, and ventral margins with long setae. Carpus unarmed, dorsal and distal margins with short plumose setae; lateral surface with few transverse rows of setae; mesial surface smooth, with scattered rows of long plumose setae, margins with long plumose setae. Merus unarmed; lateral surface with scattered transverse rows of short plumose setae, margins with short plumose setae; mesial side with few short rows of setae. Basis-ischium incompletely fused, unarmed. Coxa unarmed.

Pereopod II (fig. 19B) dactylus smooth, base to heel almost straight, heel smoothly rounded and low, heel to tip broadly indented and wide, tip rounded, tip to base broadly convex; lateral surface smooth, few setae along dorsal margin between heel and tip; mesial surface smooth, ventral margin with long plumose setae, dorsal margin with short plumose setae. Propodal dorsal surface smooth, ventral margin inflated and rounded, distal and ventral margins with long plumose setae; dorsolateral surface as narrow,

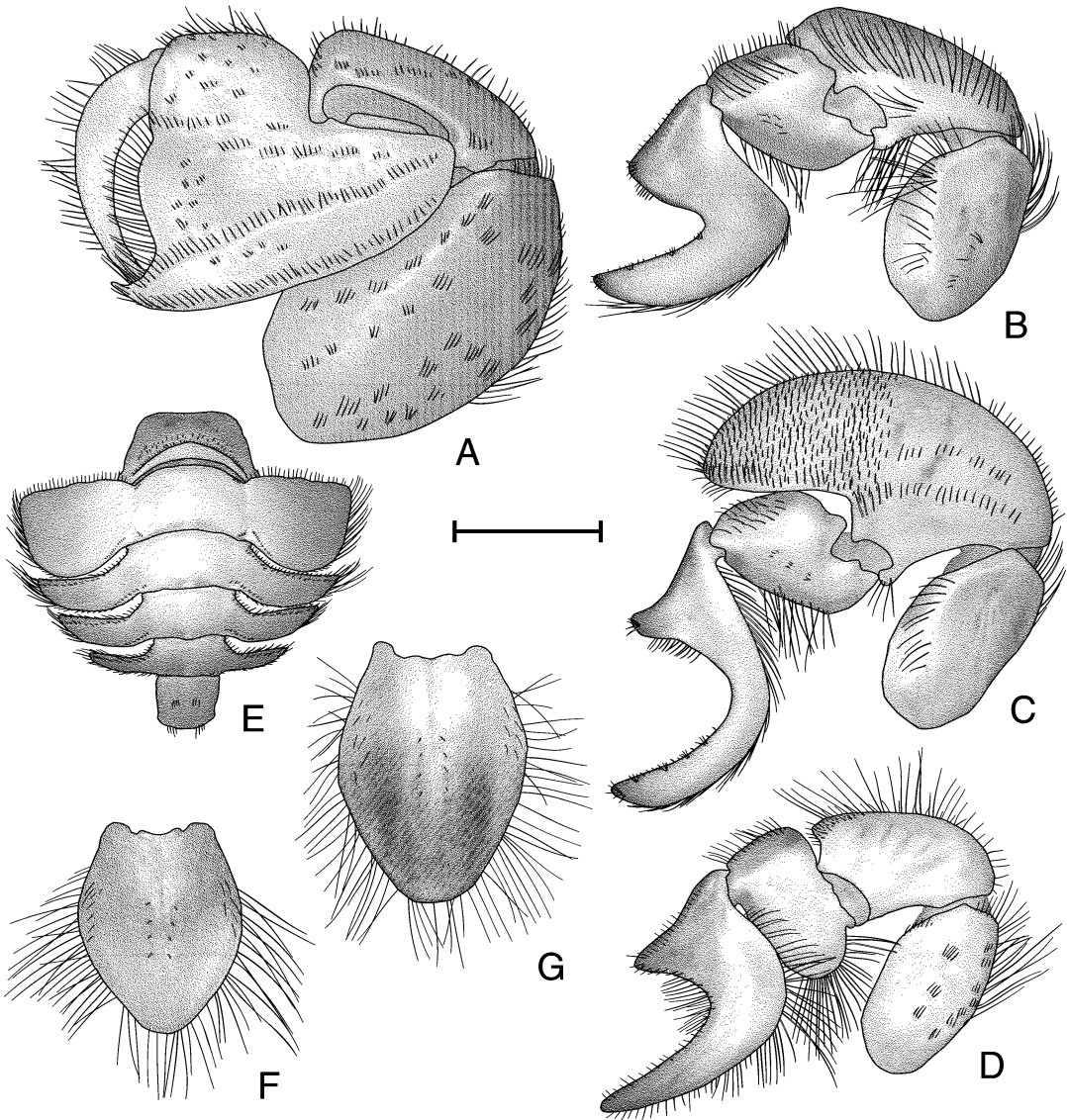


Fig. 19. *Austrolepidopa schmitti* Efford and Haig, 1968: A, F, ♂, 7.8 mm cl, AM P6369–6370, paratype; B–E, G, ♀, 7.5 mm cl, AM P15342, paratype. A. Left pereopod I, lateral view. B. Left pereopod II, lateral view. C. Left pereopod III, lateral view. D. Left pereopod IV, lateral view. E. Abdominal somites I–VI, dorsal view. F. Telson of ♂, dorsal view. G. Telson of ♀, dorsal view. Scale = 1.6 mm (F, G), 1.7 mm (A), 2.2 mm (B–D), and 3.3 mm (E).

oblique, flattened shelf, with short setae on dorsal margin and long plumose setae on ventral margin; mesial surface with curved row of simple setae from ventral junction with dactylus almost to ventral proximal junction with carpus. Carpus slightly inflated and produced, gently rounded; lateral surface nearly smooth, with irregular, broken row of

rugae and submarginal elevated ridge ventrally, rugae and ridge with long plumose setae, dorsal margin with long plumose setae; mesial surface smooth, submarginal and marginal rows of long plumose setae dorsally. Merus lateral surface decalcified, long plumose setae on margins and scattered on lateral surface; mesial surface with row of long

plumose setae ventral to dorsal margin and row of setal patches one-third from ventral margin. Basis-ischium incompletely fused and unarmed. Coxa unarmed.

Pereopod III (fig. 19C) dactylus with base to heel concave, heel produced and bluntly rounded, heel to tip broadly concave, tip rounded, tip to base smoothly convex; lateral surface smooth, dorsal margin with few tufts of setae; mesial surface smooth, with plumose setae proximally between heel and junction with propodus, ventral margin with long plumose setae, dorsal margin with short simple and plumose setae. Propodus not much inflated; lateral surface smooth, dorsolateral surface as narrow, oblique, flattened shelf with long plumose on surface, long plumose setae on ventral margin; mesial surface with scattered long setae on and near distal margin. Carpus produced, nearly reaching distal margin of propodus, broadly rounded and inflated distally, dorsolateral margin unarmed; distolateral surface covered with numerous rows of short, simple setae forming setal mat, increasingly prominent distally, proximolateral surface with two parallel rows of short simple setae; mesial surface smooth, with medial row of long plumose setae. Merus smooth, ovate, dorsal and ventral margins unarmed, dorsodistal and ventral margins with long plumose setae, lateral surface decalcified; mesial surface smooth. Basis-ischium incompletely fused and unarmed. Coxa of male with small tubercle; female coxa unarmed. Female with large gonopore on ventral surface of coxa, lacking setae; male with similar but smaller pore.

Pereopod IV (fig. 19D) dactylus base to heel concave, heel to tip broadly concave, tip subacute, tip to base evenly convex, heel of dactylus approximately one-half length of blade; lateral surface smooth, ventral margin with long plumose setae, dorsal margin with short simple setae; mesial surface smooth, plumose setae proximally. Propodus expanded ventrally; ventral expansion not reaching ventral dactylar margin; dorsal and ventral margins with long plumose setae; lateral and mesial surfaces smooth. Carpus slightly produced dorsodistally; lateral and mesial surfaces smooth, dorsal margin with short simple and long plumose setae, ventral margin with short plumose setae, small mat of short

simple setae on dorsodistal projection. Merus with scattered short transverse rows of setae on lateral surface, dorsal and ventrodial margins with long plumose setae, ventral surface fully calcified, smooth. Basis-ischium incompletely fused and unarmed. Coxa unarmed.

Abdomen (fig. 19E) with somite I approximately twice as wide as long, widest posteriorly, dorsal surface with anterior margin straight, small submarginal decalcified spots anteriorly, posterior margin slightly concave, submarginal row of short setae on elevated ridge, scattered short setae in region anterior to ridge. Somite II anterior margin straight but crenulate, with row of short setae at posterolateral angle; pleura expanded and directed laterally, lateral margins angled anteriorly and rounded posteriorly, anterior and lateral margins with long plumose setae, posterior margin with short setae, becoming submarginal posteromesially. Somite III similar to somite II, but shorter; pleura thinner and shorter than those of somite II, directed posteriorly in proximal half and laterally in distal half, with setae as in somite II, anterolateral angle acute, dorsal surface obliquely flattened anterolaterally with posterior marginal row of short setae. Somite IV similar to somite III, but thinner and shorter; pleura thinner and shorter than on somite III, directed and with setae as in somite III, dorsal surface obliquely flattened anterolaterally. Somite V narrower than somite IV; pleura approximately two-thirds as long as on somite IV, directed and with setae as in somite III, except with posterior row of setae terminating at posterolateral angle of somite. Somite VI subequal to somite V in width but longer, dorsal surface with two short oblique rows of setae laterad of midline posteriorly and medially; pleura absent.

Females with uniramous, paired pleopods on somites II–V, males without pleopods.

Telson of male (fig. 19F) ovate, longer than wide, smoothly rounded and tapered distally, dorsal surface with four short transverse rows of setae laterad of midline in median third, small area of submarginal setae in median third, margins with long plumose setae. Telson of female (fig. 19G) similar to that of male, distal margin more bluntly angled.

DISTRIBUTION: Known only from Queensland, Australia, in 19.7–26.7 m depth.

MAXIMUM SIZE: Males: 7.8 mm cl; females: 9.1 mm cl.

TYPE SPECIMENS: AM P15351 (holotype, lost), USNM 122072, AM 15342, BMNH 1967.9.2.1–2, RMNH 23281, LACM-AHF 221, AM P6369–6370 (22 paratypes), Efford Collection (1 paratype, current repository unknown).

TYPE LOCALITY: Noosa Head, Queensland, Australia.

REMARKS: The holotype and the 10 additional paratypes (AM P6370) cannot be located in AM and appear to be lost (Springthorpe and Lowry, 1994). The holotype, however, was recently described and illustrated by Calado (1995). Numerous additional cataloged specimens purported to be this taxon, but collected from New South Wales, Australia, are said to be in AM (Berents, personal commun.), but cannot be located. It is not unreasonable that this species ranges into New South Wales, but this remains to be verified.

This species is the sister taxon to the other two species in the genus.

Austrolepidopa caledonia
Boyko and Harvey, 1999

Figures 20, 21

Austrolepidopa caledonia Boyko and Harvey, 1999: 391–396, 400 (list), 401 (key), figs. 8, 9*.

MATERIAL EXAMINED: **Australia: Western Australia:** Sta. 05B10BT, northwest shelf, 19°05.0'S, 118°58.0'E, 82 m, Oct. 23, 1983, coll. CSIRO: 2 ♂, 7.2–8.2 mm cl, 1 oviger, 8.4 mm cl (QM W22312).

New Caledonia: Sta. DW 107, Grand Passage, 19°07.6'S, 163°30.2'E, 205 m, March 2, 1990, coll. MUSORSTOM Campagne SMIB 6: 1 ♂, 9.2 mm cl, holotype (MNHN-Hi 207), 1 ♀, 11.5 mm cl, allotype (MNHN-Hi 208); Sta. DW 109, 19°05.7'S, 163°29.7'E, 225 m, March 2, 1990, coll. MUSORSTOM Campagne SMIB 6: 1 ♀, 8 mm cl, paratype (MNHN-Hi 209); Sta. 502, 19°08'S, 163°30'W, lagoon nord, 190 m, March 4, 1985, coll. ORSTOM (B. Richer de Forges): 1 ♂, 8.7 mm cl (MNHN-Hi 255); Sta. 189, 19°7.5'S, 163°29'W, 210 m, Sept. 9, 1985,

coll. MUSORSTOM IV: 1 ♂, 8.7 mm cl (MNHN-Hi 256).

DIAGNOSIS: Carapace longer than wide, covered with strongly setose grooves. Setal field with straight anterior margin and narrow lateral elements directed posteriorly. CG1 with contiguous posterior lateral elements; CG4 nearly entire, with median section slightly displaced anteriorly; CG5 absent; CG6 merged with CG4 laterally and with CG7 medially to form two separate hybrid grooves; CG8 complete; CG11 absent. Anterior margin of carapace with finely toothed lobe lateral to ocular sinus. Rostral region truncate anteriorly, finely toothed. Ocular plate completely concealed dorsally by rostral region. Distal peduncular segments dorsoventrally flattened and triangular in shape, separated by slightly more than length of distal peduncular segments, lateral margins slightly convex, mesial margins slightly concave. Maxilliped III exopod with flagellum. Dactylus of pereopod II with heel slightly produced, low and rounded. Dactylus of pereopod III with heel slightly projecting, rounded. Dactylus of pereopod IV deeply concave in indent, heel produced and rounded. Males with small pleopods. Telson of male and female similar; flattened and ovate, medially with tufts of short, thin setae in paired longitudinal rows.

DESCRIPTION: Carapace (fig. 20A) approximately as wide as long. Anterior margin dentate between ocular peduncles, submarginal ventral row of long plumose setae. Rostrum absent, rostral area truncate, overreaching base of distal peduncular segments and exceeded by anterolateral lobes. Ocular sinus concave, dentate. Anterolateral lobe broadly triangular, dentate on margin, with mesial margin convex and lateral margin concave. Frontal region smooth, setal field with anterior and posterior margins subequal in length, narrow lateral elements directed posteriorly, straight anterior margin. CG1 sinuous, slightly crenulate, bearing short setae, connected to posterior lateral elements. Mesogastric region smooth, CG2 absent; CG3 present only as short lateral grooves; CG4 nearly entire, median element slightly displaced anteriorly. Hepatic region rugose anteriorly and anteromesially, otherwise smooth, with short rugose and setose lateral spine present on an-

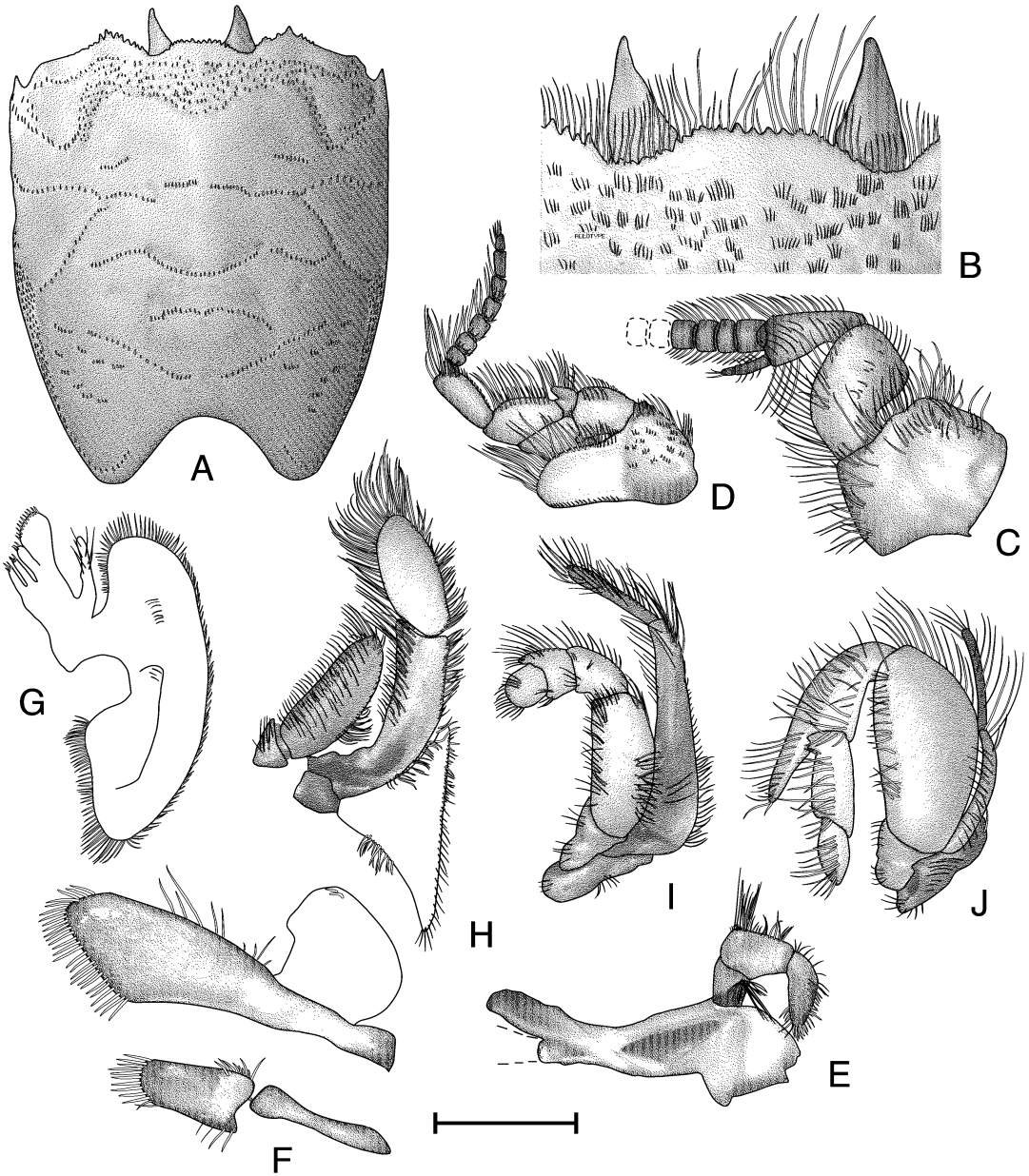


Fig. 20. *Austrolepidopa caledonia* Boyko and Harvey, 1999: A, B, ♀, 11.5 mm cl, MNHN Hi-208, allotype; C–J, ♀, 8.0 mm cl, MNHN Hi-209, paratype. A. Carapace and ocular peduncles, dorsal view. B. Ocular peduncles, dorsal view. C. Left antennule, lateral view. D. Left antenna, lateral view. E. Left mandible, mesial view. F. Left maxillule, lateral view. G. Left maxilla, lateral view. H. Left maxilliped I, lateral view. I. Left maxilliped II, lateral view. J. Left maxilliped III, lateral view. Scale = 0.8 mm (F), 1.6 mm (B, C, E, H, I), 2.2 mm (D, G, J), and 4.4 mm (A).

terolateral margin. Epibranchial region roughly triangular, smooth, posterior lateral margin with short row of setae. Metagastric region smooth; CG5 absent; CG6 slightly crenulate, median concave element merging with CG7 to form hybrid groove, lateral fragment of CG6 connecting with CG4; CG7 transverse, merging with median third of CG6. Cardiac region smooth; CG8 uninterrupted; CG9 absent; CG10 present as oblique grooves almost meeting in median; CG11 absent. Branchial region with eight to nine short, transverse rows of setae. Posterior margin deeply and evenly convex, with short lateral submarginal groove. Branchiostegite unarmed, covered with long golden plumose setae, anterior region with many short rows of setae, posterior region well calcified dorsally, membranous ventrally, with numerous irregular fragments.

Ocular plate and median peduncular segments completely concealed by front of carapace (fig. 20B). Distal peduncular segments triangular (almost ovate in smallest specimen), broadly separated, margins without setae, ocular pigment visible in mesiodistal area.

Antennule (fig. 20C) with segment III narrow proximally, expanding distally to twice proximal width, produced distoventrally, simple setae on dorsal margin and few long plumose setae on distoventral margin; dorsal exopodal flagellum with 67 articles (only one specimen with intact flagella), long plumose setae on dorsal and ventral margins; ventral endopodal flagellum short, usually of three articles (proximal pair sometimes fused), plumose setae on dorsal and ventral margins. Segment II with plumose setae on dorsal and ventral margins, and scattered on lateral surface. Segment I wider than long, small tubercle on proximoventral margin, lateral surface with long plumose setae dorsally and ventrally, and on dorsal, ventral, and distal margins.

Antenna (fig. 20D) with segment V approximately two times longer than wide, long plumose setae on dorsomesial margin, and long simple setae on dorsolateral margin; flagellum with seven or eight articles, long simple setae on dorsal, ventral, lateral and distal margins. Segment IV with long plumose setae on dorsomesial margin, and long simple

setae on dorsolateral margin. Segment III with long plumose setae on ventral margin, and scattered long simple setae on proximodorsal margin. Segment II short, widening distally, with long simple setae on dorsolateral margin; antennal acicle short, rounded, exceeding base of segment IV by approximately one-fourth length of segment IV, long plumose setae on dorsal margin and long simple setae on lateral margin. Segment I rounded dorsally, flattened ventrally, long plumose setae on margins, lateral surface rugose and with long setae dorsally, produced ventrally into oblong flattened plate.

Mandible (fig. 20E) incisor process with two teeth; cutting edge with one tooth. Palp three-segmented, with plumose setae on margins and long, thick, simple setae arising from bend in second segment.

Maxillule (fig. 20F) distal endite proximally narrow, widening to inflated distal end, with thick simple setae on distal margin. Proximal endite with thick simple setae on distal margin. Endopodal external lobe truncate distally and curled under, rounded proximally; internal lobe reduced with two thick setae at distolateral margin.

Maxilla (fig. 20G) exopod evenly rounded with plumose setae along distal margin. Sca-phognathite bluntly angled on posterior lobe with plumose setae.

Maxilliped I (fig. 20H) epipod with plumose setae on distal margin and on distolateral surface. Endite tapered distally and subequal to first segment of exopod. Exopod with two segments; proximal segment narrow, margins parallel, margins with plumose setae; distal segment spatulate, approximately two times longer than wide, broadest medially, margins with long plumose setae. Endopod flattened and elongate, reaching to distal end of proximal exopodal segment, with plumose setae on margins.

Maxilliped II (fig. 20I) dactylus evenly rounded, length equal to width, with thick simple setae distally. Propodus 1.5 times wider than long, slightly produced dorsodistally, with plumose setae on dorsal margin and long simple setae on distal margin. Carpus not strongly produced dorsodistally, approximately two times longer than wide, with long simple setae on dorsal margin. Merus approximately two times longer than wide,

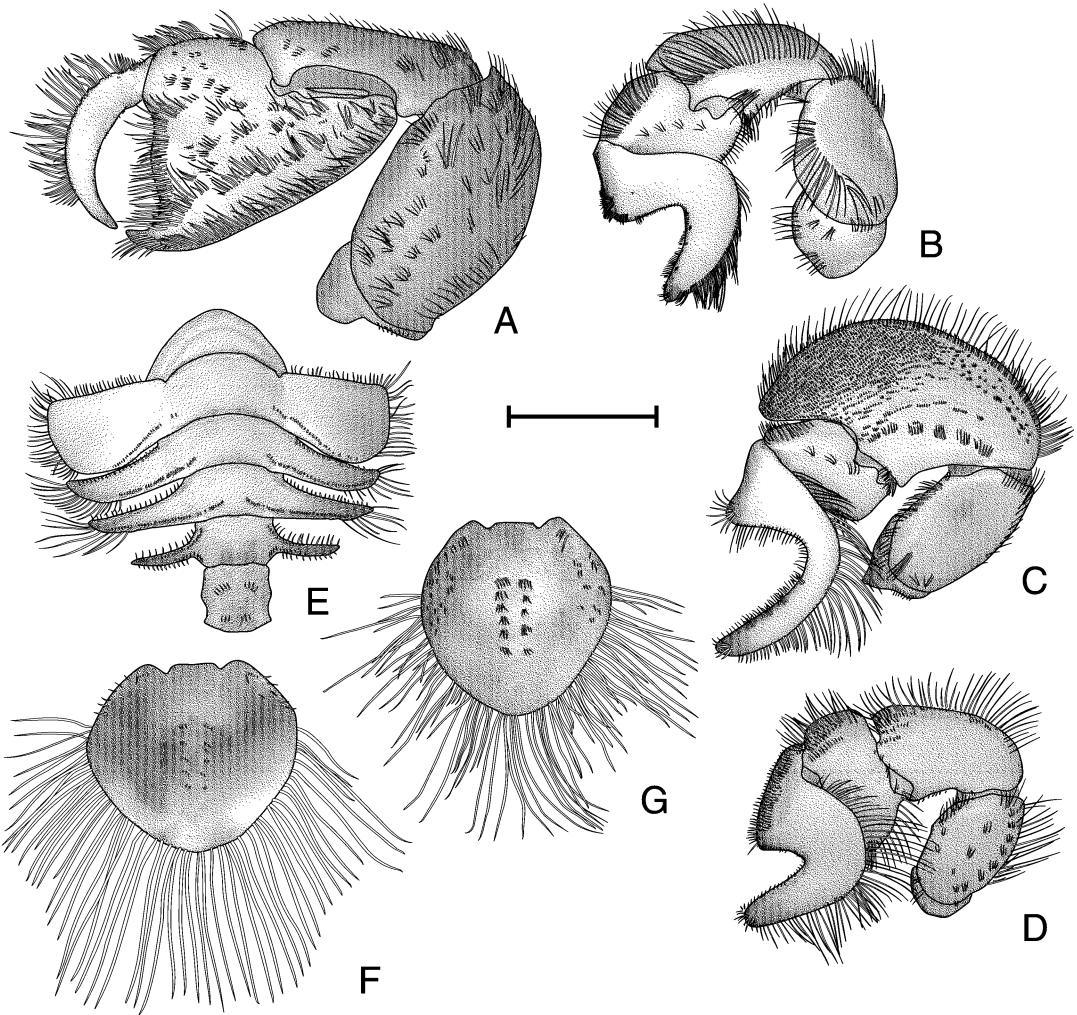


Fig. 21. *Austrolepidopa caledonia* Boyko and Harvey, 1999: A–E, G, ♀, 11.5 mm cl, MNHN Hi-208, allotype; F, ♂, 9.2 mm cl, MNHN Hi-207, holotype. A. Left pereopod I, lateral view. B. Left pereopod II, lateral view. C. Left pereopod III, lateral view. D. Left pereopod IV, lateral view. E. Abdominal somites I–VI, dorsal view. F. Telson of ♂, dorsal view. G. Telson of ♀, dorsal view. Scale = 2.2 mm (F), 3.0 mm (G), 3.3 mm (A), and 4.4 mm (B–E).

margins nearly parallel but slightly inflated, with simple setae on ventrolateral margin and plumose setae on dorsolateral margin. Basis-ischium incompletely fused, with plumose setae on margins. Exopod one-third longer than merus, flagellum with one article.

Maxilliped III (fig. 20J) dactylus with rounded tip, long simple setae on margins and lateral surface. Propodus with longitudinal median row of simple setae, margins with simple setae. Carpus produced nearly to distal end of propodus; lateral surface and

margins with plumose setae. Merus inflated, unarmed, with plumose setae on margins. Basis incompletely fused with ischium, without crista dentata. Exopod two-segmented, proximal segment small, distal segment styliform, tapering, approximately one-half length of merus, plumose setae on margins; flagellum with one article, almost reaching distal end of merus.

Pereopod I (fig. 21A) dactylus curved and tapering; lateral and mesial surfaces smooth, dorsal margin with long plumose and short

simple setae, ventral margin with short simple setae. Propodal lateral surface with numerous short, transverse rows of setose rugae, dorsal margin unarmed, ventral margin distally produced into acute spine, cutting edge lacking teeth, lined with long plumose setae; lateral, mesial, and ventral margins with long setae. Carpus unarmed, dorsal and distal margins with long plumose setae; lateral surface with few transverse rows of setae; mesial surface smooth, with scattered rows of long plumose setae, margins with long plumose setae. Merus unarmed; lateral surface with scattered transverse rows of long plumose setae, margins with long plumose setae; mesial side with few short rows of setae. Basis-ischium incompletely fused, unarmed. Coxa unarmed.

Pereopod II (fig. 21B) dactylus smooth, base to heel slightly concave, heel with smoothly rounded low spur, heel to tip broadly indented and wide, tip rounded, tip to base broadly convex; lateral surface smooth, few setae along dorsal margin between heel and tip; mesial surface smooth, ventral margin with long plumose setae, dorsal margin with short plumose setae and patch of long plumose setae between heel and base (not illustrated). Propodal dorsal surface smooth, ventral margin inflated and rounded, oblique open row of long plumose setae on lateral surface, distal and ventral margins with long plumose setae; dorsolateral surface a narrow, oblique, flattened shelf, short setae on dorsal margin and long plumose setae on ventral margin; mesial surface with curved row of simple setae from ventral junction with dactylus almost to ventral proximal junction with carpus. Carpus slightly inflated and produced, gently rounded; lateral surface nearly smooth, with irregular, broken row of rugae and submarginal elevated ridge ventrally, rugae and ridge with long plumose setae, margins with long plumose setae; mesial surface smooth, submarginal and marginal rows of long plumose setae dorsally. Merus with lateral surface fully calcified, long plumose setae on margins; mesial surface with row of long plumose setae below dorsal margin and row of setal patches one-third from ventral margin. Basis-ischium incompletely fused and unarmed. Coxa unarmed.

Pereopod III (fig. 21C) dactylus with base to heel slightly concave, heel low and rounded, heel to tip broadly concave, tip rounded, tip to base smoothly convex; lateral surface smooth, dorsal margin with few tufts of setae; mesial surface smooth, with plumose setae proximally between heel and junction with propodus, ventral margin with long plumose setae, dorsal margin with short simple and plumose setae. Propodus not much inflated; lateral surface smooth, dorsolateral surface as narrow, oblique, flattened shelf, long plumose setae distally, simple setae on margins, long plumose setae on ventral margin; mesial surface with scattered long setae on and near distal margin. Carpus produced, nearly reaching distal margin of propodus, broadly rounded and inflated distally, dorsolateral margin unarmed; lateral surface covered with numerous rows of short, simple setae forming a setal mat, increasingly prominent distally; mesial surface smooth, long plumose setae on margins. Merus smooth, ovate, dorsal and ventral margins unarmed, with long plumose setae, laterodistal margin with long plumose setae, lateral surface fully calcified; mesial surface smooth. Basis-ischium incompletely fused and unarmed. Coxa unarmed. Female with large gonopore on ventral surface of coxa, lacking setae, male with similar but smaller pore.

Pereopod IV (fig. 21D) dactylus with base to heel straight, heel to tip broadly concave, tip rounded, tip to base evenly convex, heel and blade of dactylus subequal in length; lateral surface smooth, ventral margin with long plumose setae, dorsal margin with short simple setae; mesial surface smooth, plumose setae proximally. Propodus expanded dorsally and ventrally; ventral expansion equals ventral dactylar margin, numerous short simple setae at margins; dorsal expansion with row of long plumose setae; lateral and mesial surfaces smooth. Carpus not produced dorsodistally; lateral and mesial surfaces smooth, dorsal margin with short simple and long plumose setae, ventral margin with short plumose setae. Merus with scattered short transverse rows of setae on lateral surface, dorsal and ventrodiscal margins with long plumose setae, ventrodiscal angle slightly expanded, ventral surface fully calcified,

smooth. Basis-ischium incompletely fused and unarmed. Coxa unarmed.

Abdomen (fig. 21E) with somite I approximately as wide as long, widest posteriorly, dorsal surface with anterior margin straight, small submarginal decalcified spots anteriorly, posterior margin slightly concave, submarginal row of short setae on elevated ridge, open row of setae anterior to ridge. Somite II anterior margin straight, with tuft of setae at posterolateral angle; pleura expanded and directed slightly anteriorly, lateral margins angled anteriorly and rounded posteriorly, anterior and lateral margins with long plumose setae, posterior margin with row of short setae, becoming submarginal posteromesially. Somite III similar to somite II, but shorter; pleura thinner and shorter than those of somite II, directed anteriorly, with setae as in somite II, anterolateral angle acute, dorsal surface obliquely flattened anterolaterally. Somite IV similar to somite III, but thinner and shorter; with posterior row of setae interrupted in median of posterior margin; pleura thinner and shorter than on somite III, directed laterally and slightly anteriorly, dorsal surface obliquely flattened anterolaterally, margins with long plumose setae. Somite V narrower than somite IV; pleura approximately two-thirds as long as on somite IV, directed posteriorly and laterally, with setae as in somite IV, except with posterior row setae terminating at posterolateral angle of somite. Somite VI subequal to somite V in width but longer, dorsal surface with short oblique rows of setae laterad of midline posteriorly and medially, anterolateral margins with scattered plumose setae; pleura absent.

Females with uniramous, paired pleopods on somites II–V, males with small pleopod buds on somites II–V.

Telson of male (fig. 21F) ovate, slightly wider than long, smoothly rounded posteriorly, dorsal surface with six short transverse rows of setae laterad of midline in median third, rugose near anterolateral angle, with short setae, margins with long plumose setae. Telson of female (fig. 21G) similar to that of male, with larger rugose areas anterolaterally.

DISTRIBUTION: Known from the vicinity of New Caledonia, in 190–225 m depth. Possibly from Western Australia (see below).

MAXIMUM SIZE: Males: 9.2 mm cl; females: 11.5 mm cl.

TYPE SPECIMENS: MNHN-Hi 207 (holotype), MNHN-Hi 208 (allotype), MNHN-Hi 209 (paratype).

TYPE LOCALITY: Grand Passage, New Caledonia, 19°07.6'S, 163°30.2'E, 205 m.

REMARKS: The record from 225 m is the greatest depth reported for any species in the Albuneidae, considerably exceeding the next deepest record, 151.5 m for a specimen of *Albunea symmysta* (Linnaeus, 1758) from the Philippines (USNM 68613). *Austrolepidopa caledonia* appears to live in a habitat at least partially composed of pteropod ooze, as evidenced by the small *Limacina*-type pteropods (Mollusca) found adhered to the holotype (P. Mikkelsen, personal commun.).

The specimens from Western Australia, including the only known ovigerous *Austrolepidopa*, are tentatively referred to this species. They are clearly not *A. trigonops*, but they show some differences in the shape of the setal field and carapace CGs from the prior known specimens of *A. caledonia*. It is possible that these specimens represent an undescribed species in the genus, close to *A. caledonia*.

Austrolepidopa caledonia is most closely related to *A. trigonops*, from which it differs in having smaller anterolateral spines, shallower ocular sinuses, and a more anteriorly projected setal field. The carapace grooves also differ between the two species; for example, in *A. trigonops*, the median section of CG4 in the metagastric region is broken into four short elements, and CG8 is interrupted medially and is less produced laterally. Both species possess a two-segmented exopod on maxilliped III, while *A. schmitti* has only a one-segmented exopod.

Austrolepidopa trigonops

Efford and Haig, 1968

Figures 22, 23

Austrolepidopa trigonops Efford and Haig, 1968: 904–907, figs. 5–7*. – Haig, 1974: 447 (list). – Coêlho and Calado, 1987: 41. – Jones and Morgan, 1993: 150 (list). – Calado, 1995: 92–95, pl. 28, figs. a–d, pl. 29, figs. a–d*. – Boyko and Harvey, 1999: 382, 395–396, 400 (list), 401 (key)*.

MATERIAL EXAMINED: **Australia: Western Australia:** North of east end of Rottnest Island, 19.5 fms (= 35.7 m), May 7, 1960, coll. R. W. George on "Davena": 1 ♂, damaged, unmeasurable (9.8 mm cl cited by Eford and Haig, 1968), holotype (WAM 7949); near bar on south passage, Shark's Bay, 6 fms (= 11 m), May 14, 1960, R. W. George on "Davena": 1 ♀, 13.4 mm cl, paratype (WAM 7959); about 7 mi west of City Beach, Perth, 16 fms (= 29.3 m), Aug. 15, 1962, coll. R. W. George on "Bluefin": 1 ♀, 10.2 mm cl (WAM 23397); Sta. Bone-NW Shelf-36, off Kimberley, 18°38.16'S, 120°06.94'E, 93 m, July 1, 1999, coll. Y. Bone: 1 ♂, 5.1 mm cl (MOV J47315); Sta. Bone-NW Shelf-09, off Kimberley, 15°59.89'S, 121°50.109'E, 30 m, June 26, 1999, coll. Y. Bone: 1 ♀, 7.8 mm cl (MOV J47314).

DIAGNOSIS: Carapace as long as wide, covered with strongly setose grooves. Setal field with concave anterior margin and narrow lateral elements directed posteriorly. CG1 with contiguous posterior lateral elements; CG4 with four short median elements displaced anteriorly and posteriorly from long lateral portions of CG4; CG5 absent; CG6 merged with CG4 laterally and with CG7 medially to form two separate hybrid grooves; CG8 broken into three or four short elements; CG11 absent. Anterior margin of carapace with finely toothed lobe lateral to ocular sinus. Rostral region truncate anteriorly, finely toothed. Ocular plate completely concealed dorsally by rostral region. Distal peduncular segments dorsoventrally flattened and triangular in shape, separated by slightly more than length of distal peduncular segments, lateral margins sinuous, mesial margins slightly concave. Maxilliped III exopod with flagellum. Dactylus of pereopod II with heel slightly produced, low and rounded. Dactylus of pereopod III with heel slightly projecting, rounded. Dactylus of pereopod IV deeply concave in indent, heel produced and rounded. Males with small pleopods. Telson of male and female similar; flattened and ovate, medially with tufts of short, thin setae in paired longitudinal rows.

DESCRIPTION: Carapace (fig. 22A) approximately as wide as long. Anterior margin dentate between ocular peduncles, with sub-

marginal ventral row of long plumose setae. Rostrum absent, rostral area truncate, overreaching base of distal peduncular segments and exceeded by anterolateral lobes. Ocular sinus concave, dentate. Anterolateral lobe broadly triangular, dentate on margin, with mesial margin convex and lateral margin concave. Frontal region smooth, setal field with anterior and posterior margins subequal in length, not reaching to anterior margin of carapace, narrow lateral elements directed posteriorly, anterior margin concave. CG1 sinuous, strongly crenulate, bearing short setae, connected to posterior lateral elements. Mesogastric region smooth, CG2 absent; CG3 present only as short lateral grooves; CG4 with four short median elements displaced anteriorly and posteriorly from long lateral portions of CG4. Hepatic region rugose anteriorly and anteromesially, otherwise smooth, with short rugose and setose lateral spine present on anterolateral margin. Epi-branchial region roughly triangular, smooth, posterior lateral margin with short row of setae. Metagastric region smooth; CG5 absent; CG6 slightly crenulate, median concave element merging with CG7 to form hybrid groove, lateral fragment of CG6 connecting with CG4; CG7 transverse, merging with median third of CG6. Cardiac region smooth; CG8 broken into three or four short elements; CG9 absent; CG10 present as oblique elements almost meeting in median; CG11 absent. Branchial region with short, transverse rows of setae. Posterior margin deeply and evenly convex, with submarginal groove reaching approximately halfway up posterior concavity. Branchiostegite unarmed, covered with long plumose setae, anterior region with many short rows of setae, posterior region well calcified dorsally, membranous ventrally, with numerous irregular fragments.

Ocular plate and median peduncular segments completely concealed by front of carapace (fig. 22B). Distal peduncular segments triangular, broadly separated, margins without setae, ocular pigment visible in mesio-distal area.

Antennule (fig. 22C) with segment III narrow proximally, expanding distally to twice proximal width, produced distoventrally, simple setae on dorsal margin and few long plumose setae on distoventral margin; dorsal

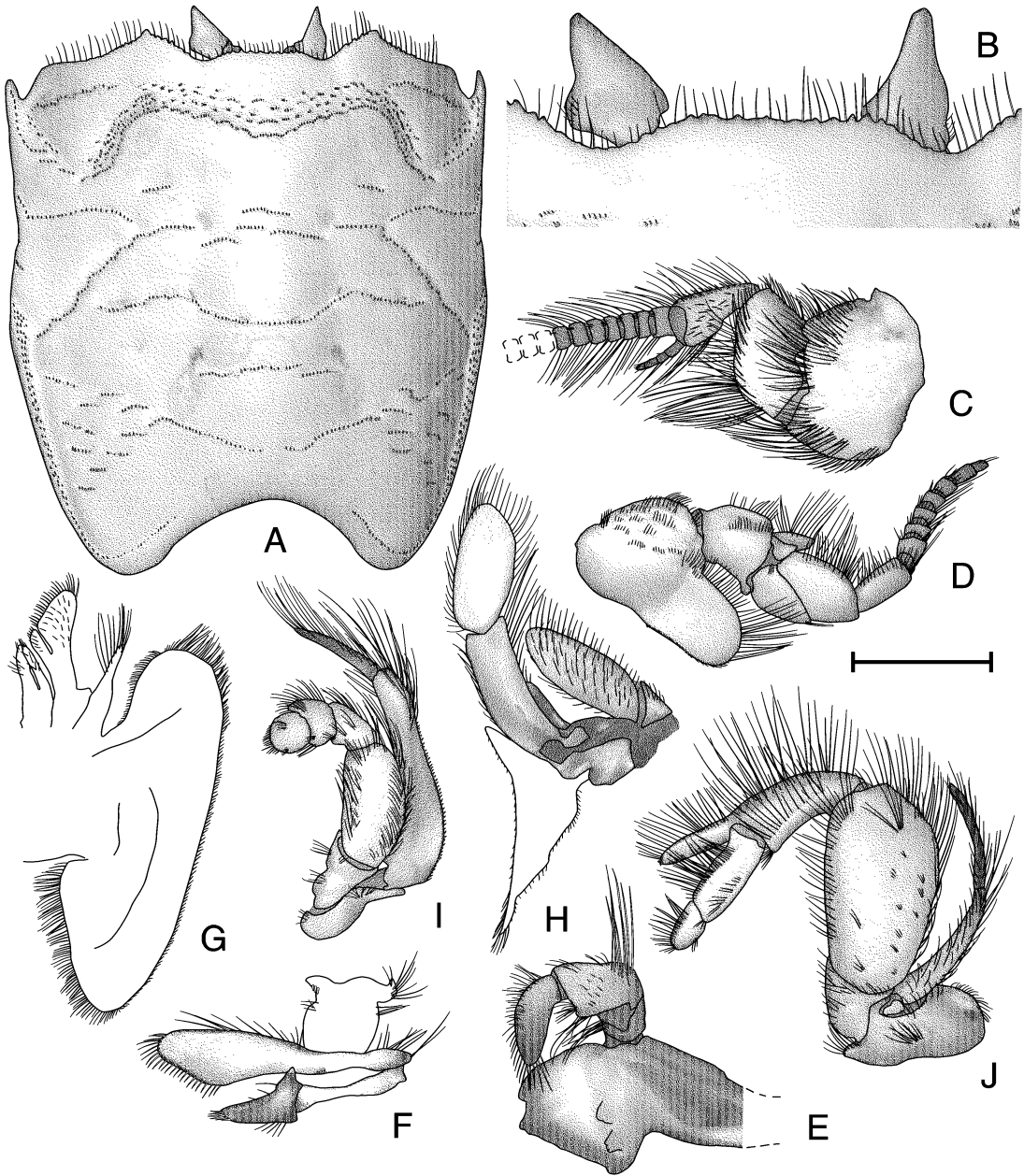


Fig. 22. *Austrolepidopa trigonops* Efford and Haig, 1968: A–J, ♀, 13.4 mm cl, WAM 7959, paratype. **A.** Carapace and ocular peduncles, dorsal view. **B.** Ocular peduncles, dorsal view. **C.** Left antennule, lateral view. **D.** Right antenna, lateral view. **E.** Right mandible, mesial view. **F.** Left maxillule, lateral view. **G.** Left maxilla, lateral view. **H.** Right maxilliped I, lateral view. **I.** Left maxilliped II, lateral view. **J.** Left maxilliped III, lateral view. Scale = 1.7 mm (B), 2.1 mm (E), 2.2 mm (F), 3.0 mm (C, H, D), 3.3 mm (D, G, J), and 4.4 mm (A).

exopodal flagellum with 46–59 articles ($n = 2$), long plumose setae on dorsal and ventral margins; ventral endopodal flagellum with three or four articles ($n = 2$), plumose setae on dorsal and ventral margins. Segment II with plumose setae on dorsal and ventral margins, and scattered on lateral surface. Segment I wider than long, distodorsal third of surface rugose, lateral surface with long plumose setae on dorsolateral and ventrolateral surface, and on dorsal, ventral, and distal margins.

Antenna (fig. 22D) with segment V approximately two times longer than wide, long plumose setae on dorsomesial margin, and long simple setae on dorsolateral margin; flagellum with eight articles ($n = 2$), long simple setae on dorsal, ventral, lateral, and distal margins. Segment IV with long plumose setae on dorsomesial margin, and long simple setae on dorsolateral margin. Segment III with long plumose setae on ventral margin, and scattered long simple setae on proximodorsal margin. Segment II short, widening distally, with long simple setae on dorsolateral margin and in row on lateral surface; antennal acicle short, rounded, exceeding base of segment IV by approximately one-fourth length of segment IV, long plumose setae on dorsal and lateral margins. Segment I rounded dorsally, flattened ventrally, long plumose setae on margins, dorsolateral surface rugose with short setae, ventral margin produced into oblong flattened plate.

Mandible (fig. 22E) incisor process with two teeth; cutting edge with one tooth. Palp three-segmented, with plumose setae on margins and long, thick, simple setae arising from bend in second segment.

Maxillule (fig. 22F) distal endite proximally narrow, widening to inflated distal end, with thick simple setae on distal margin and thin setae along dorsal margin. Proximal endite with thick simple setae on distal margin. Endopodal external lobe truncate distally and curled under, rounded proximally; internal lobe reduced with three thick setae at distolateral margin.

Maxilla (fig. 22G) exopod evenly rounded, with plumose setae along distal margin. Scaphognathite bluntly angled on posterior lobe, with plumose setae.

Maxilliped I (fig. 22H) epipod with plu-

mose setae on margins. Endite tapered distally and subequal to first segment of exopod. Exopod with two segments; proximal segment narrow, margins parallel, margins with plumose setae; distal segment spatulate, approximately two times longer than wide, broadest medially, margins with long plumose setae. Endopod flattened and elongate, reaching to distal end of proximal exopodal segment, with plumose setae on margins.

Maxilliped II (fig. 22I) dactylus evenly rounded, length equal to width, with thick simple setae distally. Propodus 1.5 times wider than long, slightly produced dorsodistally, with plumose setae on dorsal margin and long simple setae on distal margin. Carpus not strongly produced dorsodistally, approximately two times longer than wide, with long simple setae on dorsal margin. Merus approximately two times longer than wide, margins nearly parallel but slightly inflated, with simple setae on ventrolateral margin and plumose setae on dorsolateral margin. Basis-ischium incompletely fused, with plumose setae on margins. Exopod one-third longer than merus, flagellum with one article.

Maxilliped III (fig. 22J) dactylus with rounded tip, long simple setae on margins and lateral surface. Propodus with longitudinal median row of simple setae, margins with simple setae. Carpus produced slightly beyond distal end of propodus; lateral surface and margins with long plumose setae. Merus inflated, unarmed, with plumose setae on margins, short simple and long plumose setae scattered on lateral surface. Basis incompletely fused with ischium, without crista dentata. Exopod two-segmented, proximal segment small, distal segment styliform, tapering, approximately one-half length of merus, plumose setae on margins; flagellum with one article, almost reaching distal end of merus.

Pereopod I (fig. 23A) dactylus curved and tapering; lateral and mesial surfaces smooth, dorsal margin with long plumose and short simple setae, ventral margin with short simple setae. Propodal lateral surface with numerous short, transverse rows of setose rugae, dorsal margin unarmed but rugose, ventral margin distally produced into acute spine, cutting edge lacking teeth, lined with long plumose setae; lateral, mesial, and ven-

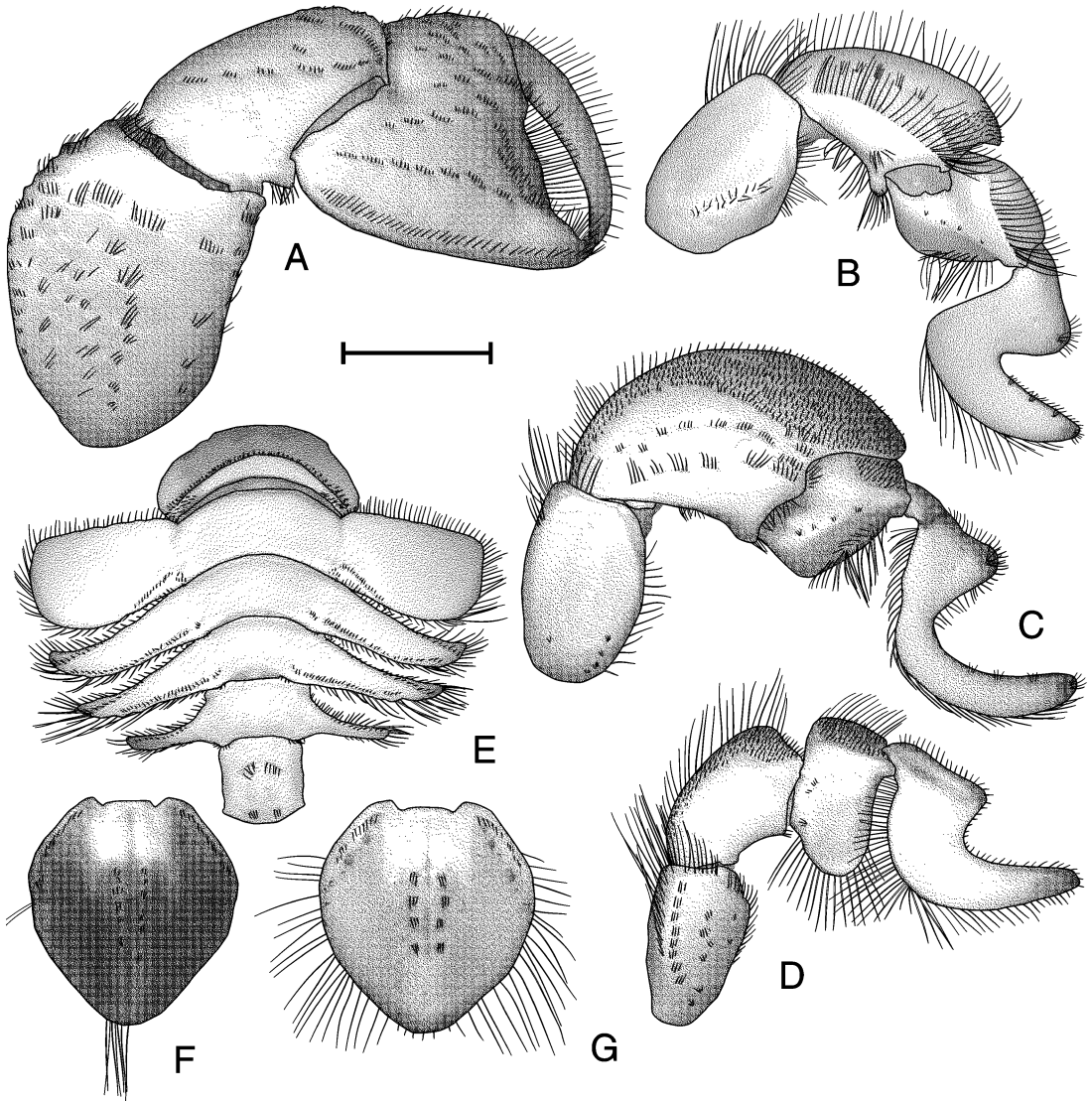


Fig. 23. *Austrolepidopa trigonops* Efford and Haig, 1968: A-E, G, ♀, 13.4 mm cl, WAM 7959, paratype; F, ♂, 9.8 mm cl, WAM 7949, holotype. A. Right pereopod I, lateral view. B. Right pereopod II, lateral view. C. Right pereopod III, lateral view. D. Right pereopod IV, lateral view. E. Abdominal somites I-VI, dorsal view. F. Telson of ♂, dorsal view. G. Telson of ♀, dorsal view. Scale = 2.2 mm (F), 3.3 mm (A, G), and 4.4 mm (B-E).

tral margins with long setae. Carpus unarmed, dorsal margin distally rugose; lateral surface with few transverse rows of setae; mesial surface smooth, with scattered rows of long plumose setae, margins with long plumose setae. Merus unarmed; lateral surface with scattered transverse rows of long plumose setae, margins with short plumose

setae; mesial side with few short rows of setae. Basis-ischium incompletely fused, unarmed. Coxa unarmed.

Pereopod II (fig. 23B) dactylus smooth, base to heel slightly concave, heel with smoothly rounded low spur, heel to tip broadly indented and wide, tip rounded, tip to base broadly convex; lateral surface

smooth, few setae along dorsal margin between heel and tip; mesial surface smooth, ventral margin with long plumose setae, dorsal margin with short plumose setae and a patch of long plumose setae between heel and base. Propodal dorsal surface smooth, ventral margin inflated and rounded, oblique row of long plumose setae on lateral surface, distoventral margin with long plumose setae; dorsolateral surface as narrow, oblique, flattened shelf, short setae on dorsal margin and long plumose setae on ventral margin; mesial surface with curved row of simple setae from ventral junction with dactylus almost to ventral proximal junction with carpus. Carpus slightly inflated and produced, gently rounded with subacute tip; lateral surface nearly smooth, with irregular, broken row of rugae and submarginal elevated ridge ventrally, rugae and ridge with long plumose setae, margins with long plumose setae; mesial surface smooth, submarginal and marginal rows of long plumose setae dorsally. Merus with lateral surface fully calcified, long plumose setae on margins; mesial surface with row of long plumose setae below dorsal margin and row of setal patches one-third from ventral margin. Basis-ischium incompletely fused and unarmed. Coxa unarmed.

Pereopod III (fig. 23C) dactylus with base to heel slightly concave, heel low and rounded, heel to tip broadly concave, tip rounded, tip to base smoothly convex distally and crenulate proximally; lateral surface smooth, dorsal margin with few tufts of setae; mesial surface smooth, plumose setae proximally between heel and junction with propodus, ventral margin with long plumose setae, dorsal margin with short simple and plumose setae. Propodus not much inflated; lateral surface smooth, dorsolateral surface as narrow, oblique, flattened shelf with mat of short setae, simple setae on margins, long plumose setae on ventral margin; mesial surface with scattered long setae on and near distal margin. Carpus produced, nearly reaching distal margin of propodus, broadly rounded and inflated distally, dorsolateral margin unarmed; lateral surface covered with numerous rows of short, simple setae forming setal mat, increasingly prominent distally, two broken rows of long simple setae ventral to setal mat; mesial surface smooth, long plumose

setae on margins and in medial transverse row. Merus smooth, ovate, dorsal and ventral margins unarmed, with long plumose setae, laterodistal margin with long plumose setae, lateral surface fully calcified; mesial surface smooth. Basis-ischium incompletely fused and unarmed. Coxa unarmed. Female with large gonopore on ventral surface of coxa, lacking setae, male with similar but smaller pore.

Pereopod IV (fig. 23D) dactylus with base to heel slightly concave, heel to tip broadly concave, tip rounded, tip to base evenly convex, heel approximately one-fourth length of blade of dactylus; lateral surface smooth, ventral margin with long plumose setae, dorsal margin with short simple setae; mesial surface smooth, row of plumose setae dorsally and scattered on surface. Propodus expanded dorsally and ventrally; ventral expansion approximately equal to ventral dactylus margin, long plumose setae at ventral margin; dorsal expansion with row of long plumose setae and mat of short simple setae; lateral and mesial surfaces smooth. Carpus slightly produced dorsodistally; lateral and mesial surfaces smooth, dorsal margin with short simple and long plumose setae and mat of short setae on distal quarter, ventral margin with short plumose setae. Merus with scattered short transverse rows of setae on lateral surface, dorsal and ventrodiscal margins with long plumose setae, ventrodiscal angle slightly expanded, ventral surface fully calcified, smooth. Basis-ischium incompletely fused and unarmed. Coxa unarmed.

Abdomen (fig. 23E) with somite I wider than long, widest posteriorly, dorsal surface with anterior margin slightly convex, small submarginal decalcified spots anteriorly, posterior margin slightly concave, submarginal row of short setae on elevated ridge, row of setae anterior to ridge, and area of setae at posterolateral corners. Somite II anterior margin convex, with tuft of setae at posterolateral angle; pleura expanded and directed posterolaterally, anterior margin crenulate, lateral margins angled anteriorly and rounded posteriorly, anterior and lateral margins with long plumose setae, posterior margin with row of short setae, becoming submarginal posteromesially. Somite III similar to somite II, but shorter; pleura thinner and shorter

than those of somite II, directed posterolaterally, with setae as in somite II, anterolateral angle subacute, dorsal surface obliquely flattened anterolaterally. Somite IV similar to somite III, but thinner and shorter; with posterior row of setae interrupted in median of posterior margin; pleura thinner and shorter than on somite III, directed posterolaterally, posterior margin crenulate, dorsal surface obliquely flattened anterolaterally, margins with long plumose setae. Somite V narrower than somite IV; pleura approximately two-thirds as long as on somite IV, directed laterally, with setae as in somite IV, except with posterior row setae terminating at posterolateral angle of somite and not submarginal. Somite VI subequal to somite V in width but longer, dorsal surface with short oblique rows of setae laterad of midline posteriorly and medially, anterolateral margins with scattered plumose setae; pleura absent.

Females with uniramous, paired pleopods on somites II–V, males with small pleopod buds on somites II–V.

Telson of male (fig. 23F) ovate, tapering distally, slightly longer than wide, smoothly rounded distally, dorsal surface with six short transverse rows of setae laterad of midline in median third, row of short submarginal setae along anterior third of margin, margins with long plumose setae (inferred from broken setae). Telson of female (fig. 23G) similar to that of male, with four short transverse rows of setae laterad of midline.

DISTRIBUTION: Known only from Western Australia and Queensland, Australia, in 11–93 m depth.

MAXIMUM SIZE: Males: 9.8 mm cl; females: 13.4 mm cl.

TYPE SPECIMENS: WAM 7949 (holotype, formerly no. 62–62), WAM 7959 (paratype, formerly no. 72–62), WAM 316–62 (paratype, lost).

TYPE LOCALITY: 5 mi north of east end of Rottneest Island, Western Australia, 19.5 fms (= 35.7 m).

REMARKS: Although Efford and Haig (1968) referred to the holotype as a female, it possesses reduced pleopods and is therefore actually a male of this species. However, it is in a pulverized and virtually unidentifiable condition. The paratype from Beagle Is-

land was lost in the mail en route to Brazil (Hewitt, personal commun.).

This species is the sister taxon to *A. caledonia*.

LEUCOLEPIDOPA EFFORD, 1969

Leucolepidopa Efford, 1969: 1–2. – Coêlho and Calado, 1987: 42. – Calado, 1995: 217.

DIAGNOSIS: Carapace as wide as long, anterior margin weakly toothed. Rostrum produced and rounded. Distal peduncular segment flattened, ovate; setae on dorsal surface. Antennular dorsal flagellum with 23+ articles, ventral flagellum absent. Antennal segment I unarmed; flagellum with three articles. Maxilliped II exopod without flagellum. Maxilliped III exopod without flagellum. Abdominal somite V pleura well calcified. Males with pleopods. Telson of male ovate, evenly but weakly calcified.

DISTRIBUTION: Known from Sunda Strait between Sumatra and Java, Indonesia, and from Western Australia, Australia.

TYPE SPECIES: *Leucolepidopa sunda* Efford, 1969, by monotypy.

REMARKS: This genus is monotypic and intermediate between *Austrolepidopa* and *Paraleucolepidopa*.

Leucolepidopa sunda Efford, 1969

Figures 24, 25

Leucolepidopa sunda Efford, 1969: 2–4, pl. 1, figs. 1–7, pl. 2, figs. 1–8*. – Coêlho and Calado, 1987: table 1. – Calado, 1995: 217–221, pl. 71, figs. a–d, pl. 72, figs. a, b, pl. 73, figs. a–d*. – Boyko and Harvey, 1999: 400 (list), 401 (key).

MATERIAL EXAMINED: **Indonesia:** Sta. 75, Sunda Strait, between Sumatra and Java, 06°10'S, 105°44'E, 40 m, July 29, 1922, coll. Danish Kei Island Expedition: 1 ♂, 7.2 mm cl, holotype (ZMUC 168).

Australia: Sta. Bone-NW Shelf-37, off Kimberley, 18°46.97'S, 120°14.48'E, Western Australia, 76 m, July 1, 1999, coll. Y. Bone: 1 ♂, 5.5 mm cl (MOV J47316).

DIAGNOSIS: As for genus.

DESCRIPTION: Carapace (fig. 24A) approximately as wide as long. Anterior margin smooth between ocular peduncles. Rostrum absent, rostral area convex, overreaching

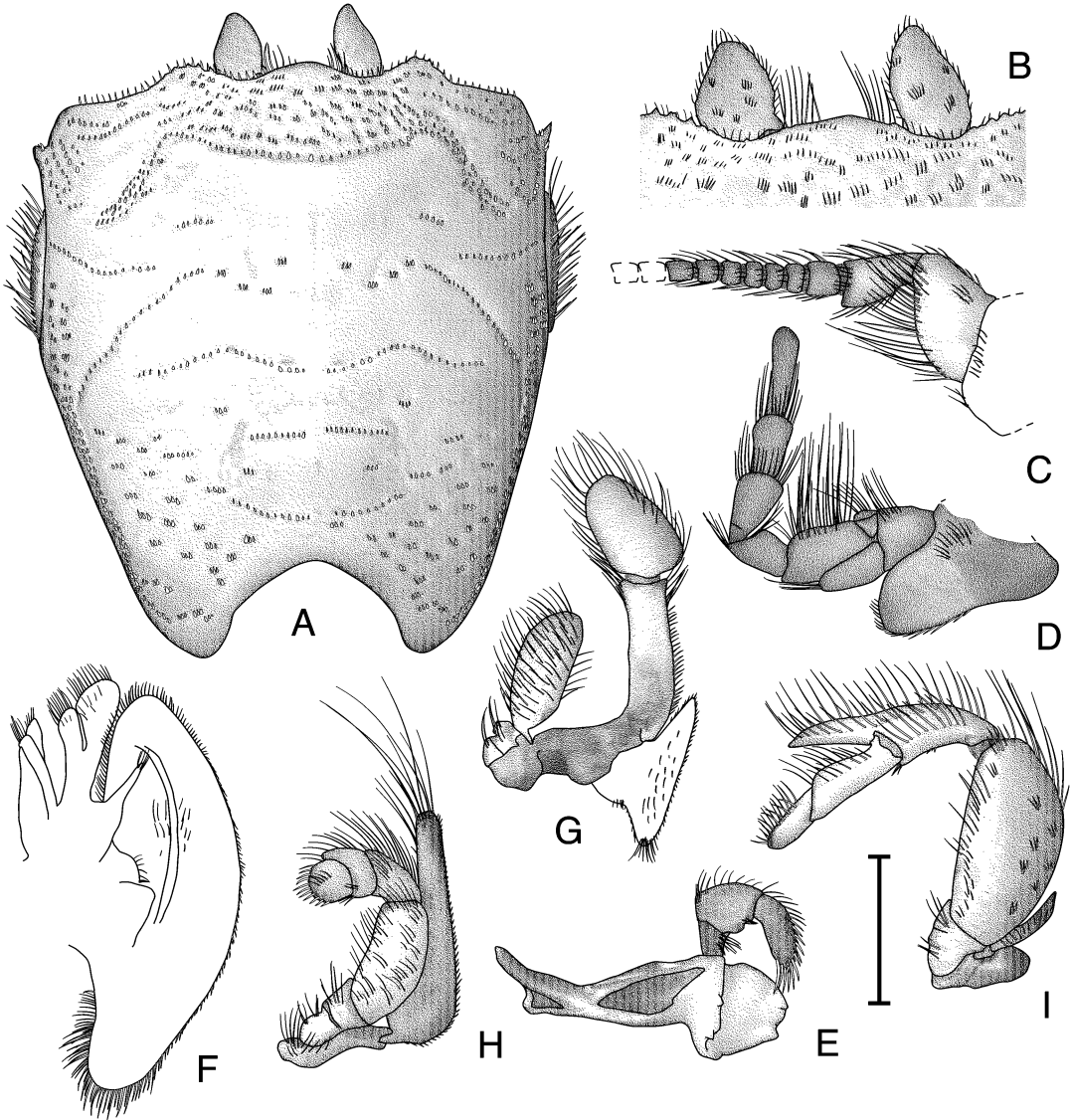


Fig. 24. *Leucolepidopa sunnda* Efford, 1969: A–I, ♂, 7.2 mm cl, ZMUC 168, holotype. A. Carapace, branchiostegite, and ocular peduncles, dorsal view. B. Ocular peduncles, dorsal view. C. Left antennule, lateral view. D. Left antenna, lateral view. E. Left mandible, mesial view. F. Left maxilla, lateral view. G. Left maxilliped I, lateral view. H. Left maxilliped II, lateral view. I. Left maxilliped III, lateral view. Scale = 1.4 mm (B), 1.6 mm (C–H), and 2.2 mm (A, I).

base of distal peduncular segments and exceeded by anterolateral lobes. Ocular sinus concave, with few low teeth. Anterolateral lobe broadly triangular, dentate on margin, with margins convex. Frontal region smooth, setal field broadest anteriorly, reaching to anterior margin of carapace, narrow lateral elements directed posteriorly, anterior margin

sinuous. CG1 concave, strongly crenulate, bearing short setae, connected to posterior lateral elements. Mesogastric region smooth, CG2 absent; CG3 present only as short lateral grooves; CG4 with eight short median elements: median two in line with two longer lateral elements, submedian six oblique and displaced posteriorly toward midline. Hepat-

ic region rugose anteriorly and anteromesially, otherwise smooth, with short rugose and setose lateral spine present on anterolateral margin. Epibranchial region roughly triangular, smooth, posterior lateral margin with numerous short setae. Metagastric region smooth; CG5 absent; CG6 slightly crenulate, median concave element merging with CG7 to form hybrid groove, lateral fragment of CG6 inserted between long lateral elements and short oblique elements of CG4; CG7 oblique, merging with median third of CG6. Cardiac region smooth; CG8 broken into two long transverse elements; CG9 present as two very short lateral elements; CG10 present as two oblique elements almost meeting in median; CG11 absent. Branchial region with short, transverse rows of setae. Posterior margin deeply and evenly convex, with submarginal groove reaching posterior margin of posterior concavity. Branchiostegite unarmed, covered with long plumose setae, anterior region with many short rows of setae, posterior region well calcified dorsally, membranous ventrally, with numerous irregular fragments.

Ocular plate and median peduncular segments completely concealed by front of carapace (fig. 24B). Distal peduncular segments oblong, rounded distally, broadly separated, margins and dorsal surface with short setae.

Antennule (fig. 24C) with segment III narrow proximally, expanding distally to twice proximal width, produced distoventrally, long plumose setae on dorsal, ventral, and distal margins; dorsal exopodal flagellum with 123 articles ($n = 1$), long plumose setae on dorsal, ventral and distal margins; ventral endopodal flagellum absent ($n = 1$). Segment II with plumose setae on dorsal and ventral margins, and scattered on lateral surface. Segment I damaged in only specimen.

Antenna (fig. 24D) with segment V approximately two times longer than wide, long plumose setae on distal margin; flagellum with three articles ($n = 1$), long thick simple setae on dorsal, ventral, lateral, and distal margins. Segment IV with long plumose setae on dorsomesial margin, and long simple setae on dorsolateral margin. Segment III with long plumose setae on distoventral margin. Segment II short, widening distally, with long simple setae on dorsolateral margin; an-

tennal acicle short, rounded, not reaching base of segment IV, long plumose setae on dorsal and lateral margins. Segment I rounded dorsally, flattened ventrally, long plumose setae on margins, dorsolateral surface rugose and with short setae, ventral margin produced into oblong flattened plate.

Mandible (fig. 24E) incisor process with two teeth; cutting edge with one tooth. Palp three-segmented, with plumose setae on margins and long, thick, simple setae arising from bend in second segment.

Maxillule unknown.

Maxilla (fig. 24F) exopod evenly rounded, with plumose setae along distal margin. Scaphognathite rounded on posterior lobe, with plumose setae. Endopod and endites without useful characters.

Maxilliped I (fig. 24G) epipod reduced, with plumose setae on margins and surface. Endite tapered distally and subequal to first segment of exopod. Exopod with two segments; proximal segment narrow, margins parallel, margins with plumose setae; distal segment spatulate, approximately 1.5 times longer than wide, broadest proximally, margins with long plumose setae. Endopod flattened and elongate, reaching to distal end of proximal exopodal segment, with plumose setae on margins.

Maxilliped II (fig. 24H) dactylus evenly rounded, length equal to width, with thick simple setae distally and in transverse medial row. Propodus two times wider than long, slightly produced dorsodistally, with plumose setae on dorsal and distoventral margins. Carpus not strongly produced dorsodistally, approximately two times longer than wide, with long simple setae on dorsal margin and scattered on distolateral surface. Merus approximately two times longer than wide, margins nearly parallel but slightly inflated, with plumose setae on margins and scattered on lateral surface. Basis-ischium incompletely fused, with plumose setae on margins. Exopod two times longer than merus, without flagellum, with long simple setae at distal tip.

Maxilliped III (fig. 24I) dactylus with rounded tip, long simple setae on margins and lateral surface. Propodus with longitudinal, median row of simple setae, margins with simple setae. Carpus produced to distal

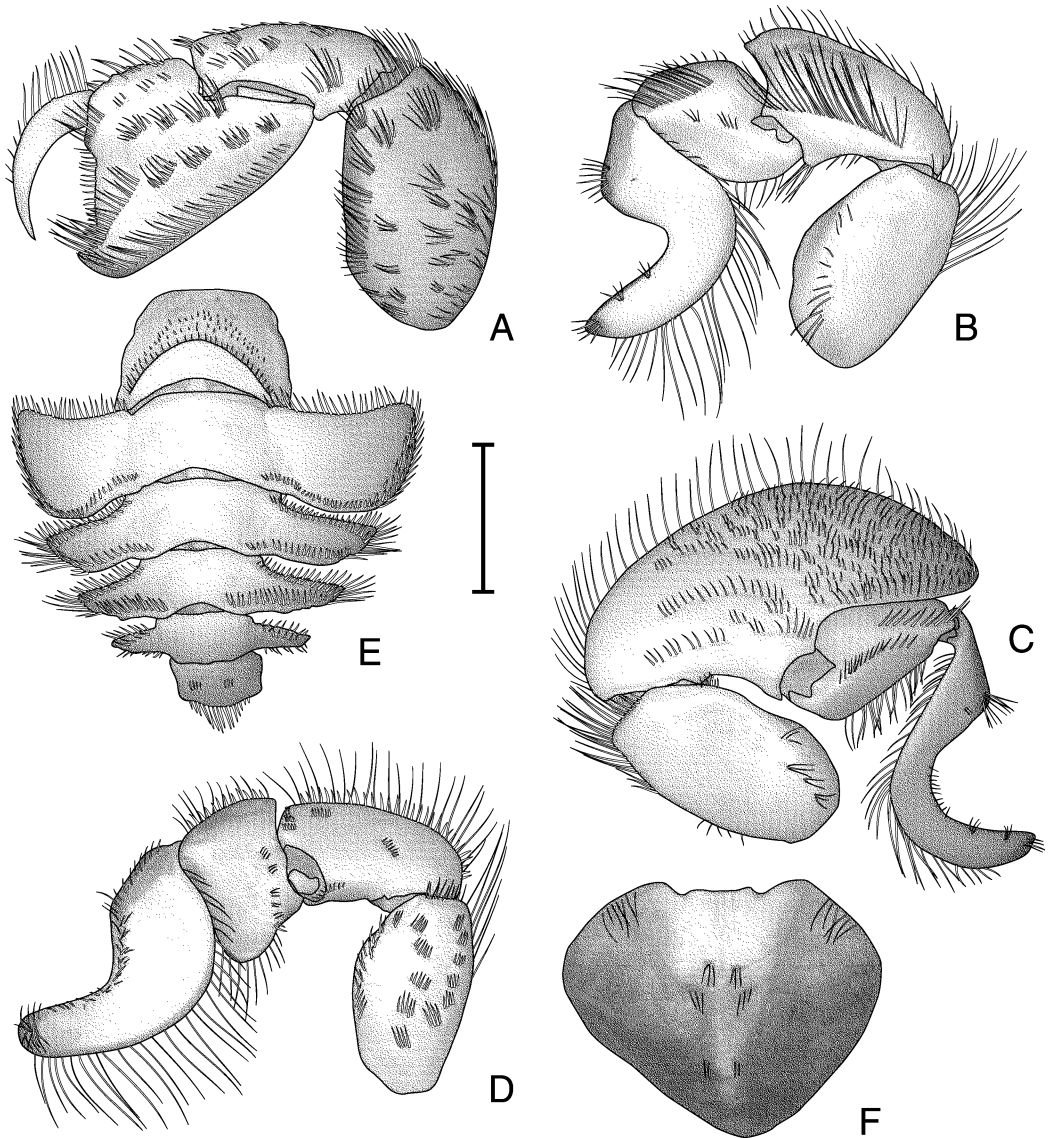


Fig. 25. *Leucolepidopa sunda* Efford, 1969: A–F, ♂, 7.2 mm cl, ZMUC 168, holotype. **A.** Left pereopod I, lateral view. **B.** Left pereopod II, lateral view. **C.** Right pereopod III, lateral view. **D.** Left pereopod IV, lateral view. **E.** Abdominal somites I–VI, dorsal view. **F.** Telson of ♂, dorsal view. Scale = 2.1 mm (F) and 2.2 mm (A–E).

end of propodus; lateral surface and margins with long plumose setae. Merus inflated, unarmed, with plumose setae on margins, short simple and long plumose setae scattered on lateral surface. Basis incompletely fused with ischium, without crista dentata. Exopod two-segmented, proximal segment small, distal segment styliform, tapering, approximately

one-half length of merus, plumose setae on margins; flagellum absent.

Pereopod I (fig. 25A) dactylus curved and tapering; lateral and mesial surfaces smooth, dorsal margin with long plumose and short simple setae, ventral margin with short simple setae. Propodus lateral surface with numerous short, transverse rows of setose ru-

gae, dorsal margin unarmed but rugose, ventral margin distally produced into acute spine, cutting edge lacking teeth, lined with short blunt and long plumose setae; lateral, mesial, and ventral margins with long setae. Carpus unarmed, dorsal margin distally rugose; lateral surface with few transverse rows of setae; mesial surface smooth, with scattered rows of long plumose setae, margins with long plumose setae. Merus unarmed; margins and lateral surface with scattered transverse rows of long plumose setae; mesial surface with few short rows of setae. Basis-ischium incompletely fused, unarmed. Coxa unarmed.

Pereopod II (fig. 25B) dactylus smooth, base to heel slightly concave, heel with smoothly rounded low spur, heel to tip broadly indented and wide, tip rounded, tip to base broadly convex; lateral surface smooth, few setae along dorsal margin between heel and tip; mesial surface smooth, ventral margin with long plumose setae, dorsal margin with short plumose setae and a patch of long plumose setae between heel and base. Propodal dorsal surface smooth, ventral margin inflated and rounded, oblique row of long plumose setae on lateral surface, distoventral margin with long plumose setae; dorsolateral surface as narrow, oblique, flattened shelf, short setae on dorsal margin and long plumose setae on ventral margin; mesial surface with curved row of simple setae from ventral junction with dactylus almost to ventral proximal junction with carpus. Carpus inflated and produced dorsodistally, gently rounded with subacute tip; lateral surface nearly smooth, with irregular, broken row of rugae and submarginal elevated ridge ventrally, rugae and ridge with long plumose setae, margins with long plumose setae; mesial surface smooth, submarginal and marginal rows of long plumose setae dorsally. Merus with lateral surface fully calcified, long plumose setae on dorsodistal margin, short plumose setae on ventral margin; mesial surface with row of long plumose setae below dorsal margin and row of setal patches one-third from ventral margin. Basis-ischium incompletely fused and unarmed. Coxa unarmed.

Pereopod III (fig. 25C) dactylus with base to heel straight, heel low and rounded, heel to tip broadly concave, tip rounded, tip to

base smoothly convex distally; lateral surface smooth, heel and dorsodistal margin with tufts of long simple setae; mesial surface smooth, plumose setae proximally between heel and junction with propodus, ventral margin with long plumose setae, dorsal margin with short simple and plumose setae. Propodus not much inflated; lateral surface smooth, dorsolateral surface as narrow, oblique, flattened shelf with mat of short setae, simple setae on margins, long plumose setae on ventral margin; mesial surface with scattered long setae on and near distal margin. Carpus produced, overreaching distal margin of propodus, broadly rounded and inflated distally, dorsolateral margin unarmed; lateral surface covered with numerous rows of short, simple setae forming setal mat, increasingly prominent distally, two broken rows of long simple setae ventral to setal mat; mesial surface smooth, long plumose setae on margins and in medial transverse row. Merus smooth, ovate, dorsal and ventral margins unarmed, dorsodistal and proximoventral margins with long plumose setae, lateral surface fully calcified; mesial surface smooth. Basis-ischium incompletely fused and unarmed. Coxa unarmed. Female with presumed large gonopore on ventral surface of coxa, lacking setae, male with similar but smaller pore.

Pereopod IV (fig. 25D) dactylus with base to heel convex, heel to tip broadly concave, tip rounded, tip to base evenly convex; lateral surface smooth, ventral margin with long plumose setae, dorsal margin with short simple setae; mesial surface smooth, row of plumose setae dorsally and scattered on surface. Propodus expanded dorsally and ventrally; ventral expansion not reaching ventral dactylus margin, long plumose setae at ventral margin; dorsal expansion with row of long plumose and short simple setae; lateral surface with transverse row of short plumose setae; lateral and mesial surfaces smooth; mesial surface with distal row of long plumose setae. Carpus slightly produced dorsodistally; lateral surface smooth, with few short rows of short simple setae; mesial surfaces smooth; dorsal margin with short simple and long plumose setae, ventral margin with short plumose setae. Merus with scattered, short, transverse rows of setae on lat-

eral surface, dorsodistal margin with long plumose setae, ventrodistal margin slightly expanded, ventral surface fully calcified, smooth. Basis-ischium incompletely fused and unarmed. Coxa unarmed.

Abdomen (fig. 25E) with somite I wider than long, widest posteriorly, dorsal surface with anterior margin straight, small submarginal decalcified spots anteriorly, posterior margin slightly concave, submarginal row of short setae on elevated ridge, numerous scattered short setae anterior to ridge. Somite II anterior margin convex; without setae; pleura expanded and directed anterolaterally, anterior margin smooth, lateral margins angled anteriorly and rounded posteriorly, anterior and lateral margins with long plumose setae, lateral and posterior margins with submarginal row of short setae. Somite III similar to somite II, but shorter with anterior and posterior margins sinuous; pleura thinner and shorter than those of somite II, directed posterolaterally, with setae as in somite II and additional submarginal row of setae anteriorly, anterolateral angle subacute, dorsal surface obliquely flattened anterolaterally; posterior margins crenulate. Somite IV similar to somite III, but thinner and shorter; with posterior row of pleural setae continuing onto lateral margins; pleura thinner and shorter than on somite III, directed laterally, anterior and posterior margins crenulate, dorsal surface obliquely flattened anterolaterally, margins with long plumose setae. Somite V narrower than somite IV; pleura approximately two-thirds as long as on somite IV, crenulate, directed laterally, with setae as in somite IV. Somite VI subequal to somite V in width but longer, dorsal surface with short oblique rows of setae laterad of midline medially, anterolateral margins with scattered plumose setae, posterior margin with row of long simple setae; pleura absent.

Females unknown, males with small pleopod buds on somites II–V.

Telson of male (fig. 25F) spade-shaped, tapering distally, slightly wider than long, smoothly rounded distally, dorsal surface with three short transverse rows of setae laterad of midline in median third, row of short submarginal setae in anterolateral corners, margins with long plumose setae (inferred

from broken setae). Telson of female unknown.

DISTRIBUTION: Known only from the type locality and Western Australia, Australia.

MAXIMUM SIZE: Males: 7.2 mm cl; females unknown.

TYPE SPECIMEN: ZMUC 168 (holotype).

TYPE LOCALITY: Sunda Strait, between Sumatra and Java, Indonesia, 06°10'S, 105°44'E, 40 m depth.

REMARKS: Both known specimens possess small pleopods, but Efford (1969) made no mention of this character.

PARALEUCOLEPIDOPA CALADO, 1996

Lepidopa Ortmann, 1896: 225–226 (part). – Schmitt, 1921: 172 (part). – Gordon, 1938: 188–190 (part). – Garcia Mendes, 1945: 119 (part). – Efford, 1971: 60–61 (part). – Calado, 1987: 119–121 (part). – Coêlho and Calado, 1987: 41 (part). – Manning, 1988: 626–627 (part). – Calado, 1995: 125–126 (part) (not *Lepidopa* Stimpson, 1858).

Lepidops: Stimpson, 1860: 241. – Miers, 1878: 331–332 (part) (not *Lepidopa* Stimpson, 1858). *Paraleucopidopa* Calado, 1995: 264. – Calado, 1996: 47. – Calado, 1997b: 59–60.

DIAGNOSIS: Carapace wider than long, anterior margin weakly toothed. Rostrum produced and rounded. Distal peduncular segment flattened, ovate. Antennular dorsal flagellum with 56–67 articles, ventral flagellum with two articles. Antennal segment I unarmed; flagellum with six to eight articles. Maxilliped II exopod without flagellum. Maxilliped III exopod without flagellum. Abdominal somite V pleura well calcified. Males with pleopods. Telson of male diamond-shaped, evenly but weakly calcified.

DISTRIBUTION: Baja California, Mexico, to Panama; Dominican Republic to Brazil.

TYPE SPECIES: *Lepidopa myops* Stimpson, 1860, as the senior synonym of *L. panamaensis* Efford, 1971, the type species by monotypy.

INCLUDED SPECIES: *P. myops* (Stimpson, 1860); *P. distincta* (Gomes Côrrea, 1968).

REMARKS: Calado (1995) first introduced this generic name in her doctoral dissertation, but it must be considered unpublished from that source. It is unfortunate that she chose to subsequently publish the name in an abstract (Calado, 1996), but it is validly pub-

lished therein. A more complete redescription of the genus was given by Calado (1997b).

This genus was described with the type and sole species of *Lepidopa panamaensis* (Calado, 1996). Direct comparison of the type specimens of that taxon and numerous specimens of *L. myops* showed no important differences, and the two taxa are synonymous. *Lepidopa myops* is therefore the type of *Paraleucolepidopa* as the senior synonym of *L. panamaensis*. To complicate matters further, none of Calado's (1996; 1997b) defining characters for the genus *Paraleucolepidopa* are diagnostic for that taxon, which suggests that *Paraleucolepidopa* may be a synonym of *Lepidopa*. However, a cladistic phylogenetic analysis of the Albuneidae (Boyko and Harvey, in prep.) shows that the monophyletic clade containing *L. myops* and *L. distincta* is the sister taxon to *Lepidopa* and contains several synapomorphies (antennular dorsal flagellum with 56–67 articles, antennal segment I unarmed, maxilliped II exopod without flagellum, abdominal somite V pleura well calcified). As Calado's (1996) name is the earliest available for this clade, the name *Paraleucolepidopa* must stand but based on an entirely different suite of characters than that given by Calado (1996, 1997b).

This genus is intermediate between *Leucolepidopa* and *Lepidopa*.

KEY TO SPECIES

- 1 Rostrum extending forward between ocular peduncles *P. distincta*
 – Rostrum not extending between ocular peduncles *P. myops*

Paraleucolepidopa myops (Stimpson, 1860),
 new combination

Figures 26, 27

Lepidops myops Stimpson, 1860: 241–242*. – Miers, 1878: 333, pl. 5, fig. 16*. – Evans, 1967: 404 (list).

Lepidopa myops: Ortman, 1896: 226–227. – Faxon, 1895: 237 (list). – Holmes, 1900: 105 (part). – Rathbun, 1904: 14 (list) (part), 167 (list) (part). – Schmitt, 1921: 172 (part). – Gordon, 1938: 188 (part)*. – Garcia Mendes, 1945: 119 (list). – Haig et al., 1970: 25 (part). – Efford, 1971: 63–70, figs. 1e, p, 2f, 3j, 4d, u, 5q,

6a, d, 7e*. – Luke, 1977: 31. – Haig, 1980: 291, fig. 19.8. – Coêlho and Calado, 1987: table 1. – Lemaitre and Alvarez León, 1993: 50 (list). – Hendrickx, 1992: 7 (list). – Hendrickx and Harvey, 1999: 367 (list).

Lepidopa spp. Knight, 1970: 141 (part).

Lepidopa panamaensis Efford, 1971: 72–74, figs. 1g, n, 2g, 3l, 4f, v, 5n, 6b, g, q, 7d, m*. – Coêlho and Calado, 1987: table 1 (NEW SYNONYMY).

Lepidopa Myops: Seridji, 1988: 1298.

Paraleucolepidopa panamaensis: Calado, 1995: 264–268, pl. 85, figs. a–e, pl. 86, figs. a–d. – Calado, 1996: 47. – Calado, 1997b: 60–64, figs. 1, 2. – Hendrickx and Harvey, 1999: 367 (list).
 not *Lepidopa myops*: Holmes, 1900: 105 (part). – Benedict, 1903: 892–893, figs. 1, 4. – Rathbun, 1904: 14 (list) (part), 167 (list) (part). – Baker, 1912: 102. – Schmitt, 1921: 172 (part), pl. 31, fig. 4. – Johnson and Snook, 1927: 346, 348–349, figs. 296–297. – Gordon, 1938: 188 (part), figs. 1b, 2a, j*. – MacGinitie, 1938: 474. – Johnson and Lewis, 1942: 82, 86, pl. 5, figs. 1–8. – Ricketts and Calvin, 1948: 188, pl. 38, fig. 4. – MacGinitie and MacGinitie, 1949: 305, fig. 149. – Schuster-Dieterichs, 1956: 51 (list). – Turner and Sexsmith, 1964: 48. – Haig et al., 1970: 25 (part). – Knight, 1970: 127–136, figs. 1–59. – Sanchez and Aguilar, 1975: 10–11. – Turner and Sexsmith, 1975: 46. – Boschi, 1981: 715, fig. 241–54. – Calado, 1995: 185–188, pl. 39, fig. 1, pl. 40, fig. j, pl. 41, fig. j, pl. 60, figs. a–c, pl. 61, figs. a–d* (= *Lepidopa californica* Efford, 1971).

MATERIAL EXAMINED: **Mexico: Baja California Norte:** Gorda Point (Gulf side), 14 fms (= 25.6 m), April 24, 1937, coll. W. Williams: 1 oviger, 6.3 mm cl (USNM 267792); **Baja California Sur:** Cabo San Lucas, coll. J. Xantus: 1 oviger, 8.9 mm cl, lectotype of *L. myops* (MCZ 1386), 1 ♀, 9.2 mm cl, 1 oviger, 9.0 mm cl, paralectotypes of *L. myops* (BMNH 61.44), 1 ♀, 7.7 mm cl, paralectotype of *L. myops* (MNHN-Hi 83 ex USNM ex MCZ), 1 oviger, 9.0 mm cl, paralectotype of *L. myops* (ANSP 947 ex USNM); 5 mi northwest of Inocentes Ranch, near Cabo San Lucas, 15–30 fms (= 27.4–54.9 m), Jan. 29, 1939, coll. F. E. Lewis: 1 ♀, 6.8 mm cl (USNM 304313); **Nayarit:** Maria Magdalena Island, Tres Marias Islands, off Nayarit, 12 fms (= 21.9 m), Feb. 8, 1938, coll. S. A. Glassell: 1 ♀, 7.4 mm cl (USNM 304302); **Jalisco:** Banderas Bay, 25–40 fms (= 45.7–73.2 m), Feb. 13, 1938, coll. S. A. Glassell:

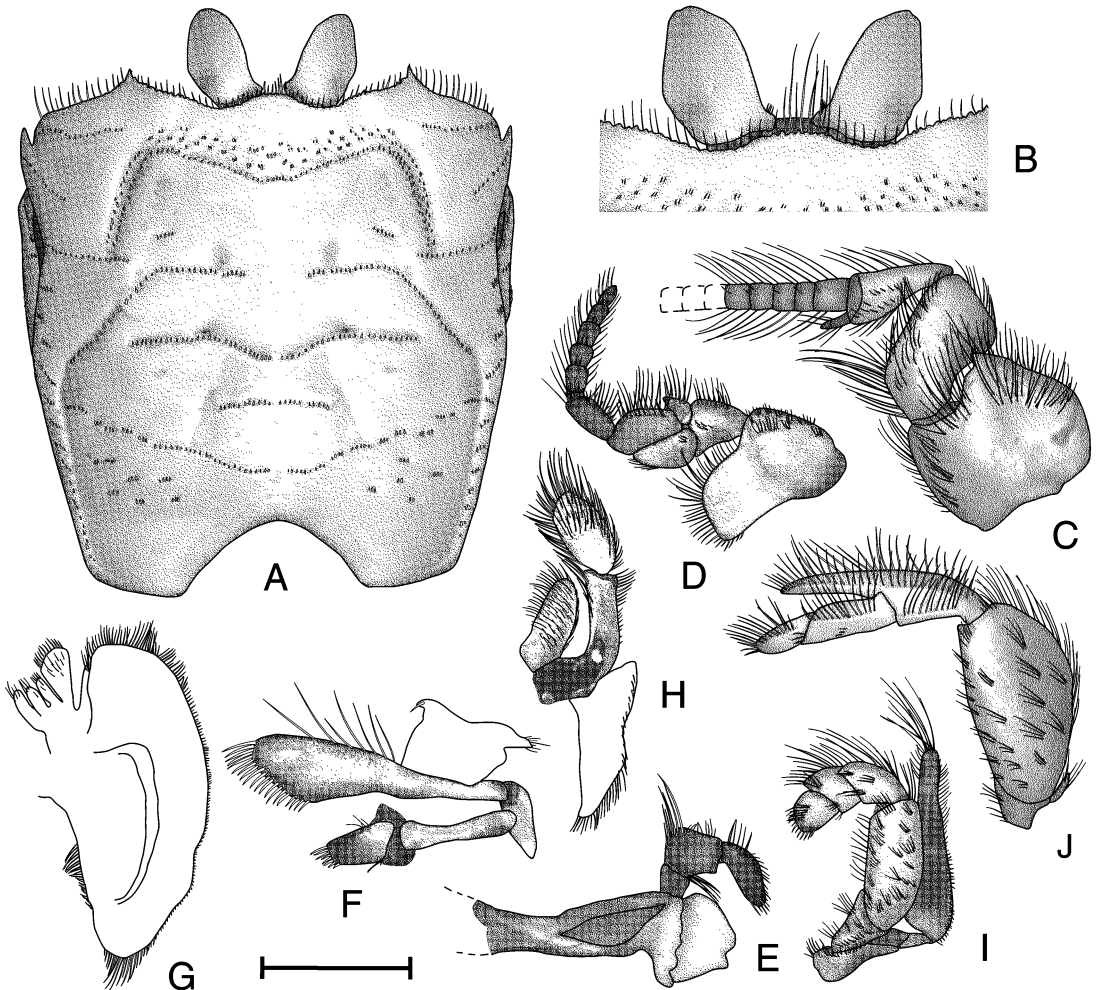


Fig. 26. *Paraleucolepidopa myops* (Stimpson, 1860), n. comb.: A, B, oviger, 8.9 mm cl, MCZ 1386, lectotype; C–J, ♀, 6.8 mm cl, USNM 304313. A. Carapace, branchiostegite, and ocular peduncles, dorsal view. B. Ocular peduncles, dorsal view. C. Left antennule, lateral view. D. Left antenna, lateral view. E. Left mandible, mesial view. F. Left maxillule, lateral view. G. Left maxilla, lateral view. H. Left maxilliped I, lateral view. I. Left maxilliped II, lateral view. J. Left maxilliped III, lateral view. Scale = 1.1 mm (F), 1.6 mm (C, E, I), 2.2 mm (B, D, G, H, J), and 3.3 mm (A).

1 ♀, 6.8 mm cl (USNM 260975); **Oaxaca:** Bay of Dulce, 20 fms (= 36.6 m), April 5, 1937, coll. W. Williams and F. E. Lewis on R/V "Stranger": 1 ♀, 8.6 mm cl (USNM 260976); Bay of Dulce, 20 fms (= 36.6 m), Sept. 5, 1937, coll. W. Williams and F. E. Lewis on R/V "Stranger": 1 unsexable and unmeasurable specimen (USNM 260977).

Panama: Taboganilla, Aug. 10, 1915, coll. T. Mortensen: 1 ♀, 8.5 mm cl, holotype of *L. panamaensis* (ZMUC 169); southwest point of Ray Islas Perlas, 15–25 m, Jan. 26,

1916, coll. T. Mortensen: 1 ♀, 7.8 mm cl, paratype of *L. panamaensis* (ZMUC 2636).

DIAGNOSIS: Rostrum not produced anteriorly as far as anterolateral spines. CG4 with short gap at median. Pereopod III carpal projection approximately as long as broad. Pereopod IV dactylus heel approximately one-third as long as blade.

DESCRIPTION: Carapace (fig. 26A) wider than long. Anterior margin convex on either side of ocular sinus, toothed, with basally broad, distally acute medial spine. Rostrum

a rounded, toothed projection reaching beyond median peduncular segments; unarmed. Ocular sinus smoothly concave, toothed; unarmed. Frontal region smooth; setal field a broad, sparsely setose, medially concave band paralleling CG1; extending posterolaterally almost to CG4. CG1 parallel to anterior margin of carapace, sinuous, slightly crenulate, medially concave, medial and lateral elements united. Mesogastric region smooth; CG2 absent; CG3 present as short oblique lateral elements; CG4 with two transverse long lateral elements. Hepatic region smooth with oblique lateral setose groove and short, subacute spine at median of lateral margin. Epibranchial region roughly triangular, smooth; posterolateral margin with four short rows of setae. Metagastric region smooth; CG5 absent. CG6 crenulate, with separate laterally oblique, medially straight, long lateral fragments and long sinuous median element united with CG7. CG7 straight relative to anterior margin of carapace and united with median fragment of CG6. Cardiac region smooth; CG8 present as two long medial elements. CG9 absent. CG10 present as two long oblique elements almost united in median. CG11 absent. Branchial region with few short, transverse rows of setae. Posterior margin deeply and smoothly concave medially and more or less straight laterally, with submarginal groove reaching halfway up posterior concavity, but lined with setae only to posterolateral corners of carapace. Branchiostegite without anterior submarginal spine; anterior region with anterodorsal transverse groove and granular surface; with many long plumose setae; posterior region membranous with numerous irregular fragments and sparsely covered with long plumose setae.

Ocular plate (fig. 26B) subquadrate, covered by carapace; median peduncular segments reduced to small rounded calcified areas anterior to ocular plate. Distal peduncular segments irregularly ovate, angled distolaterally, flattened with medially angled convex lateral and distally convex, proximally concave mesial margins, margins smooth; faint unpigmented notch in median of distal tip present; mesial margins separated along entire length; proximomesial margins with long simple setae.

Antennule (fig. 26C) segment III narrow proximally, expanding distally to two times proximal width; with plumose setae on dorsal and ventral margins and scattered on lateral surface; dorsal exopodal flagellum with 57–67 articles ($n = 4$), long plumose setae on dorsal and ventral margins, short simple setae on distal margins; ventral endopodal flagellum with two articles ($n = 5$), plumose setae on dorsal and ventral margins. Segment II medially inflated in dorsal view, with plumose setae on dorsal and ventral margins, and scattered on ventral third of lateral surface. Segment I wider than long, unarmed; lateral surface dorsodistal third rugose, with long plumose setae; scattered long plumose setae on distal and ventral lateral surfaces; long plumose setae on dorsal and ventral margins.

Antenna (fig. 26D) with segment V approximately two times longer than wide, with short plumose setae on dorsal and distal margins; flagellum with six or seven (rarely eight) articles ($n = 7$), long plumose setae on dorsal, ventral, and distal margins. Segment IV almost cylindrical, overreaching segment III by one-half of its length, with two rows of long plumose setae on dorsal margin. Segment III with long plumose setae on distoventral margin and short simple setae in small patch at proximodorsal angle. Segment II widening distally, with long plumose setae in subdorsal row and scattered in medial third of lateral surface; antennal acicle short, triangular, overreaching segment IV proximal margin by one-third of its length, with long plumose setae on dorsal margin. Segment I rounded proximally, flattened and truncated ventrolaterally, with long plumose setae on margins; lateral surface unarmed; scattered setae on dorsal third of lateral surface; segment with ventromesial antennal gland pore.

Mandible (fig. 26E) incisor process with two teeth; cutting edge with one tooth. Palp three-segmented, with plumose setae on margins and long, thick, simple setae arising from bend in second segment.

Maxillule (fig. 26F) distal endite proximally narrow, widening to inflated distal end, with thick simple setae on distal margin and long plumose setae on dorsal margin. Proximal endite with thick simple setae on distal margin. Endopodal external lobe truncate

distally and curled under, with wide proximal projection; internal lobe reduced, with one thick seta at distolateral margin.

Maxilla (fig. 26G) exopod rounded with plumose setae along distal margin. Scaphognathite gently rounded on posterior lobe, with plumose setae.

Maxilliped I (fig. 26H) epipod with plumose setae on margins. Endite tapered distally and subequal to first segment of exopod. Exopod with two segments; proximal segment narrow, margins parallel, margins with plumose setae; distal segment spatulate, longer than wide, curved mesially, broadest medially, margins and distolateral half of surface with long plumose setae. Endopod flattened and elongate, reaching to distal end of proximal exopodal segment, with plumose setae on margins.

Maxilliped II (fig. 26I) dactylus evenly rounded, length subequal to width, with thick simple setae distally and thin simple setae in short transverse row on lateral surface. Propodus slightly produced dorsodistally, two times wider than long, with plumose setae on dorsal margin and long simple setae on dorsodistal and ventrodistal margins. Carpus not strongly produced dorsodistally, approximately two times longer than wide, with long simple setae on dorsal margin and short simple setae on dorsodistal, ventrodistal, and medial lateral surface. Merus 2.5 times longer than wide, margins parallel but slightly inflated submedially, with simple setae on ventral margin and scattered on lateral surface, plumose setae on dorsolateral margin. Basis-ischium incompletely fused, with plumose setae on margins and lateral surface. Exopod one-third longer than merus, without flagellum.

Maxilliped III (fig. 26J) dactylus elongate and evenly rounded; long plumose setae on dorsal margin and lateral surface. Propodus with longitudinal median row of plumose setae on lateral surface; distoventral margins with short simple setae. Carpus strongly produced onto propodus, overreaching distal margin of propodus and extending one-half onto dactylus; lateral surface with medial transverse row of plumose setae; plumose setae on margins. Merus unarmed, broadly inflated distolaterally, with long plumose setae on dorsal margin and short simple setae scat-

tered in patches on lateral surface. Basis-ischium incompletely fused, without crista dentata. Exopod two-segmented: proximal segment small; distal segment styliform, tapering, approximately one-fifth length of merus, with plumose setae on margins; without flagellum.

Pereopod I (fig. 27A) dactylus curved and tapering; lateral and mesial surfaces smooth; dorsal margin with small rugose area proximally, smooth distally, long plumose setae along length; ventral margin with short simple setae. Propodal lateral surface with numerous short, transverse rows of setose rugae; dorsal margin with few small low ridges and spinules; ventral margin distally produced into subacute spine; cutting edge lacking teeth, lined with long plumose setae; dorsal margin with long plumose setae, ventral margin with short simple setae. Carpus with dorsodistal angle rounded, with numerous setose rugae, dorsal margin smooth, with long plumose setae; lateral surface with few transverse setose ridges; mesial surface smooth with medial transverse row of long plumose setae. Merus unarmed; lateral surface with scattered transverse rows of short plumose setae, margins with long plumose setae; mesial side with few short rows of setae; proximal third of mesial surface with decalcified window. Basis-ischium incompletely fused, unarmed. Coxa unarmed.

Pereopod II (fig. 27B) dactylus smooth; with base to heel faintly concave, heel produced and rounded, heel to tip with broad rounded indent, tip subacute, tip to base broadly convex; lateral surface smooth, with few small setose punctae proximal to heel; mesial surface smooth, ventral margin with long plumose setae, dorsal margin with short simple setae, with patch of long plumose setae at base reaching across median of heel. Propodus with dorsal surface smooth, ventral margin inflated and rounded; distal and ventral margin with long plumose setae; dorsolateral surface as narrow, oblique, flattened shelf, with long plumose setae on dorsal and ventral margins; short transverse row of long plumose setae on surface; mesial surface with subdistal row of long plumose setae. Carpus produced dorsodistally, narrowing to rounded tip, not overreaching propodus; lateral surface nearly smooth, with two irregu-

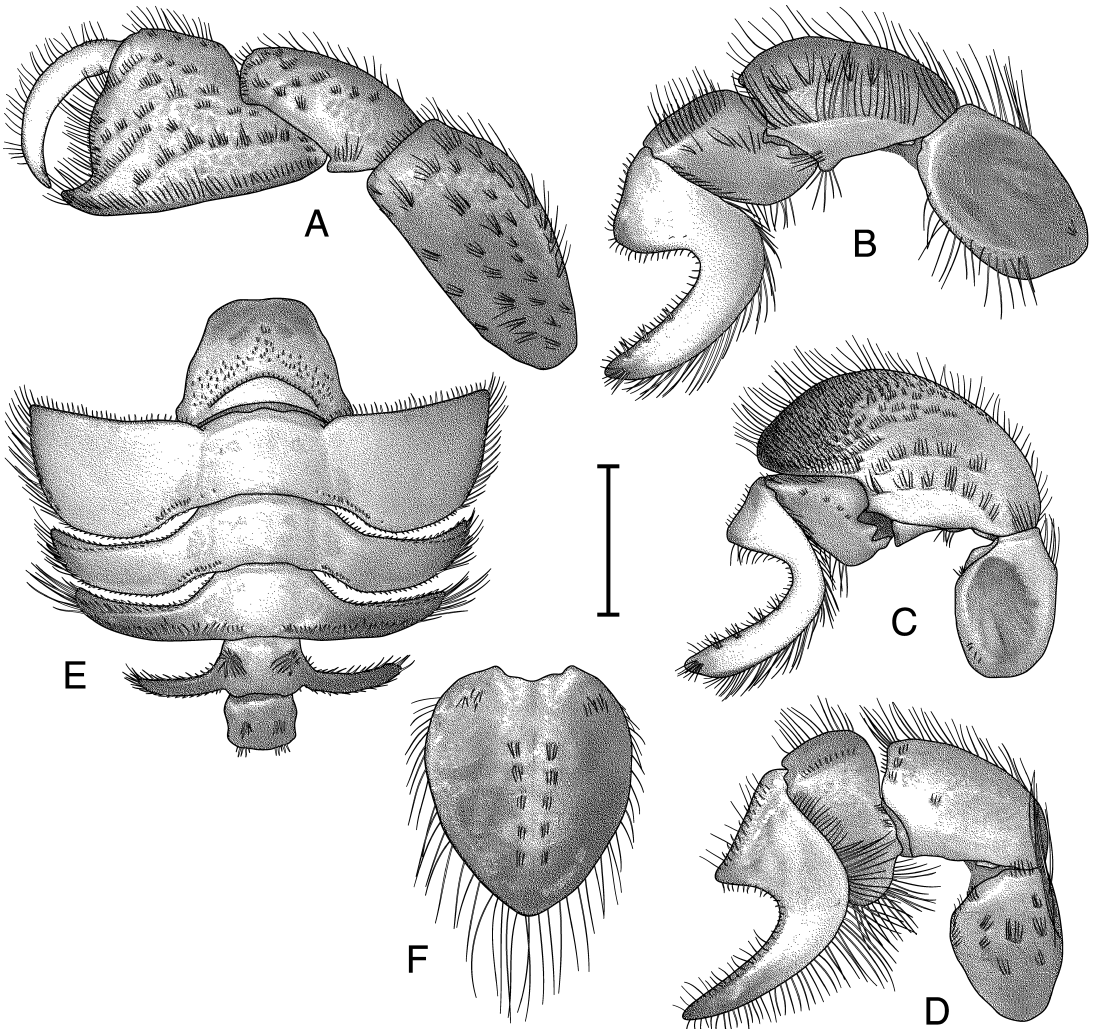


Fig. 27. *Paraleucolepidopa myops* (Stimpson, 1860), n. comb.: A, B, D-F, ♀, 6.8 mm cl, USNM 304313; C, oviger, 8.9 mm cl, MCZ 1386, lectotype. A. Left pereopod I, lateral view. B. Left pereopod II, lateral view. C. Left pereopod III, lateral view. D. Left pereopod IV, lateral view. E. Abdominal somites I-VI, dorsal view. F. Telson ♀, dorsal view. Scale = 1.4 mm (F), 2.2 mm (A, B, D), and 4.4 mm (C, E).

lar, broken rows of rugae and submarginal elevated ridge ventrally, rugae and ridge with long plumose setae; dorsal margin with long plumose setae; mesial surface smooth with medial transverse row of long plumose setae. Merus with lateral surface almost entirely decalcified, with long plumose setae on dorsodistal and ventral margins; mesial surface nearly smooth with oblique median ridge, long plumose setal patches dorsal to ridge

and in row ventrally. Basis-ischium incompletely fused and unarmed. Coxa unarmed.

Pereopod III (fig. 27C) dactylus base to heel slightly concave, heel low, rounded, and only slightly produced, heel to tip with broad, evenly rounded indent, tip subacute, tip to base smoothly convex; lateral surface smooth, with tuft of short simple setae at end of tip, dorsodistal margin with tufts of short setae; ventral margin with long plumose se-

tae, dorsal margin with short simple and plumose setae; mesial surface smooth with plumose setae proximally at junction with propodus and in row across base of heel. Propodus not inflated dorsoventrally; lateral surface smooth, with simple setae in oblique row subdorsally, and long plumose setae on ventral margin; dorsolateral surface narrow, oblique, flattened; mesial surface with scattered long setae on and near distoventral margin. Carpus strongly produced and inflated dorsodistally, reaching distal margin of propodus, broadly rounded; dorsolateral margin unarmed; lateral surface with mat of short setae on dorsodistal third of segment and two broken transverse rows of short plumose setae medially; dorsal margin with long plumose setae; mesial surface smooth, dorsomedial third decalcified, with long plumose setae on margins and in median transverse row ventral to decalcified area. Merus smooth, lateral surface almost entirely decalcified; dorsal and ventral margins unarmed, long plumose setae dorsodistally; mesial surface smooth. Basis-ischium incompletely fused and unarmed. Coxa unarmed. Female pereopod III with large mesioproximal gonopore (not opposing other gonopore); male unknown.

Pereopod IV (fig. 27D) dactylus with base to heel straight, heel acute and produced, heel to tip broadly rounded and concave, tip acute, tip to base convex; lateral surface smooth, ventral margin with long plumose setae, dorsal margin with short and long simple setae; mesial surface with dorsal decalcified region, demarcated ventrally by longitudinal elevated ridge across heel with row of short plumose setae. Propodus expanded dorsally and ventrally; ventral expansion reaching ventral margin of dactylus, ventral margin with long plumose setae; dorsal expansion with row of long plumose setae dorsally and short simple setae ventrally; lateral and mesial surfaces smooth. Carpus slightly produced dorsodistally; lateral and mesial surfaces smooth; dorsomedial two-thirds of mesial surface decalcified; dorsal margin with few scattered, short setae at dorsodistal angle; dorsal margin with long plumose setae, ventral margin with few short, simple setae. Merus lateral surface with short transverse rows of setae, dorsodistal margin with

long plumose setae; mesial surface with large decalcified window proximoventrally. Basis-ischium incompletely fused and unarmed. Coxa unarmed.

Abdomen (fig. 27E) somite I wider than long, widest posteriorly; dorsal surface with anterior margin medially slightly concave; posterior margin concave, with elevated submarginal curved row of short setae and broad field of short simple setae anterior to submarginal row; with small faint transverse decalcified windows laterad of segment median. Somite II anterior margin irregularly convex, posterior margin irregularly concave; pleura expanded and directed anterolaterally, angled anterolaterally, rounded posterolaterally, row of short simple setae at postero-mesial margin, extending onto posterolateral region of pleura; anterior and lateral margins with long plumose setae, posterior margin with short setae. Somite III similar to somite II, narrower and shorter; pleura thinner and shorter than on somite II, directed posterolaterally proximally and curving forward distally, with setae as in somite II; anterolateral angle subacute; dorsal surface slightly obliquely flattened anterolaterally, with submarginal row of short simple setae. Somite IV similar to somite III; pleura thinner and shorter than on somite III, directed anterolaterally; dorsal surface slightly obliquely flattened anterolaterally, with submarginal row of short simple setae; lateral margins with long plumose setae, short simple setae on anterior margin and in posterior submarginal row. Somite V wider than somite IV; anterolateral margins with submarginal tufts of long plumose setae; pleura indistinct from somite, shorter than in somite IV, thin, flattened, directed anterolaterally, and covered with short plumose setae. Somite VI subequal to somite V; dorsal surface with two short transverse rows of setae laterad of midline anteriorly, posterior margin with medially separated row of plumose setae; pleura absent.

Female with long uniramous pleopods on somites II–V; male unknown.

Telson of male unknown. Telson of female (fig. 27F) heart-shaped, lateral margins evenly convex and tapering to rounded distal tip; dorsal surface evenly calcified; median longitudinal groove with two parallel transverse

rows of short simple setae in medial two-thirds; margins with long simple setae.

DISTRIBUTION: Baja California Norte (Gulf side) south to Panama, in 15–73.2 m depth.

MAXIMUM SIZE: Males: unknown; females: 9.2 mm cl.

TYPE SPECIMENS: MCZ 1386 (lectotype of *L. myops*, selected by Efford, 1971), BMNH 61.44 (2 paralectotypes of *L. myops*), MNHN-Hi 83 (paralectotype of *L. myops*), ANSP 947 (paralectotype of *L. myops*), ZMUC 169 (holotype of *L. panamaensis*), ZMUC 2636 (paratype of *L. panamaensis*).

TYPE LOCALITIES: *P. myops*: Cabo San Lucas, Baja California Sur, Mexico; *P. panamaensis*: Taboganilla, Panama.

REMARKS: Type specimens of *P. myops* would be present in USNM had most of the Stimpson's Crustacea not been destroyed in the Great Chicago Fire of 1871. The paralectotype now in MNHN was sent from USNM by Stimpson in June 1858, while the BMNH specimens were also sent by Stimpson, but in January 1861 (Deiss and Manning, 1981). The Harvard specimen also came from USNM in 1861 (Deiss and Manning, 1981). It is unknown how the ANSP specimen came to be in that institution. USNM now has no types of this species in its collections.

The lack of an illustration accompanying the original description of this species (Stimpson, 1860) probably contributed to the long-standing confusion between it and *L. californica*. Stimpson (1860) did, however, clearly mention the anterior margin of the carapace as "armed with small teeth," which is not true of *L. californica* and should have served to distinguish the two taxa in spite of the brevity of Stimpson's (1860) description.

As noted by Efford (1971), Schmitt's (1921) citation of the measurements of a "type" specimen for *L. myops* was only a repetition of Stimpson's (1860) measurement, not a lectotype designation.

Direct comparison of the type specimens of *L. panamaensis* and numerous specimens of *P. myops* showed no important differences and the two taxa are synonymous. The differences cited between the two species by Efford (1971), such as number of anterior marginal teeth, broken anterolateral setal line, and number of antennal flagella, are variable

in the species. *Lepidopa myops* is therefore the type of *Paraleucolepidopa* as the senior synonym of *L. panamaensis*. Calado (1995) did not recognize the synonymy of *P. myops* and *P. panamaensis*, undoubtedly because her only specimens of *P. "myops"* (BMNH 1937.6.1.4–5) were actually *L. californica*.

There is little doubt that at least some of the larvae cited by Knight (1970) under "*Lepidopa* spp." represent this taxon. The identity of the other larval species is unclear (see appendix 1).

This species is the Pacific analogue of *P. distincta*.

Paraleucolepidopa distincta (Gomes Corrêa, 1968), new combination

Figures 28, 29

Lepidopa "que se encontra em estudo" Castro, 1967: 2.

Lepidopa distincta Gomes Corrêa, 1968: 77–84, figs. 1–16*. – Efford, 1971: 70–72 (part), figs. 3k, 5c, 7f*. – Coêlho and Ramos, 1972: 176. – Calado, 1987: 121–129, pls. 13–15. – Coêlho and Calado, 1987: table 1. – Manning, 1988: 626–627 (list). – Calado et al., 1990: 749, fig. 3c. – Calado, 1995: 159–162, pl. 39, fig. f, pl. 40, fig. f, pl. 41, fig. e, pl. 50, figs. a–e, pl. 51, figs. a–f. – Calado, 1998: 408.

?not *Lepidopa distincta*: Efford, 1971: 70–72 (part), fig. 7n* (= *Paraleucolepidopa*, sp. nov.?).

MATERIAL EXAMINED: **Dominican Republic**: Outside Yuncu Reef, off Point Trujillo, Aug. 18, 1932, coll. J. C. Armstrong: 1 ♀, 4.9 mm cl (AMNH 10362), 1 ♀, 8.3 mm cl (USNM 122635 ex AMNH 10362), 1 ♂, 4.3 mm cl (BMNH 1968.55 ex AMNH 10362), 1 ♂, 6.3 mm cl (RMNH 23986 ex AMNH 10362).

Brazil: Alagoas, 09°53'20"S, 35°51'20"W, 14 m, Sept. 6, 1965, coll. P. A. Coêlho: 1 ♂, 5.6 mm cl, 2 ♀, 7.5–7.7 mm cl, syntypes (MNRJ 6473); Alagoas, 10°05'20"S, 36°02'15"W, 10–20 m, Sept. 4, 1965, coll. P. A. Coêlho: 1 ♀, 6.4 mm, syntype (MNRJ 1552).

DIAGNOSIS: Rostrum produced anteriorly as far as anterolateral spines. CG4 with wide gap at median. Pereopod III carpal projection much longer than broad. Pereopod IV dactylus heel approximately half as long as blade.

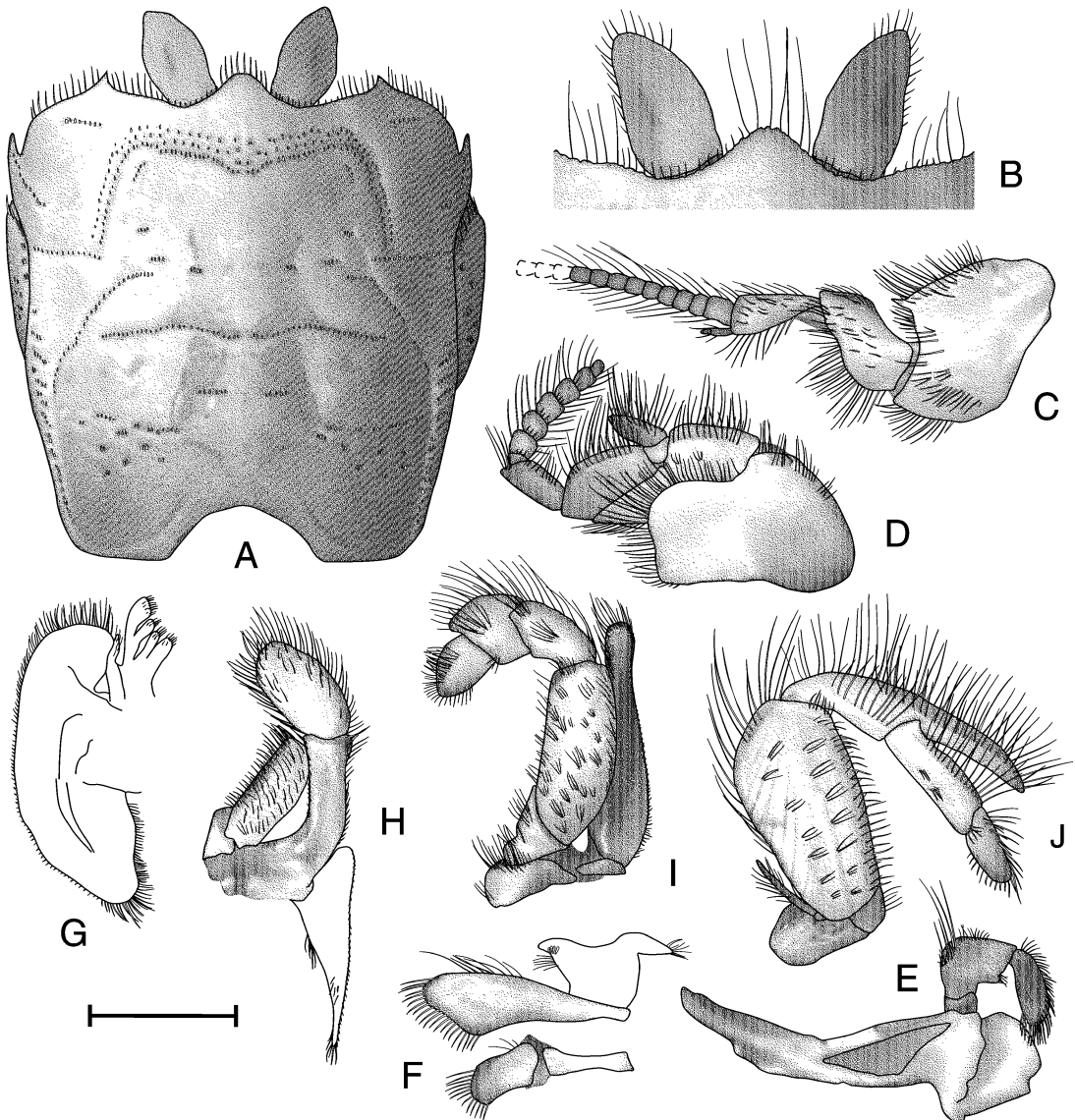


Fig. 28. *Paraleucolepidopa distincta* (Gomes Corrêa, 1968), n. comb.: A, B, J, ♀, 6.4 mm cl, MNRJ 1552, syntype; B–I, ♀, 8.3 mm cl, USNM 122635. A. Carapace, branchiostegite, and ocular peduncles, dorsal view. B. Ocular peduncles, dorsal view. C. Left antennule, lateral view. D. Left maxilliped I, lateral view. E. Left maxilliped II, lateral view. F. Right maxilliped III, lateral view. G. Left mandible, mesial view. H. Right maxilla, lateral view. I. Left maxilliped II, lateral view. J. Right maxilliped III, lateral view. Scale = 1.4 mm (B, F), 1.6 mm (E, I), 1.7 mm (J), 2.2 mm (C, D, G, H), and 5.0 mm (A).

DESCRIPTION: Carapace (fig. 28A) wider than long. Anterior margin slightly convex on either side of ocular sinus, finely toothed, with basally broad, distally acute medial spine. Rostrum as rounded, finely crenulate

projection reaching to proximal margin of distal peduncular segments; unarmed. Ocular sinus smoothly concave, finely toothed; unarmed. Frontal region smooth; setal field as broad, sparsely setose, medially concave

band paralleling CG1; extending posterolaterally almost to CG4. CG1 parallel to anterior margin of carapace, sinuous, slightly crenulate, medially concave, medial and lateral elements united. Mesogastric region smooth; CG2 absent; CG3 present as short transverse lateral elements; CG4 with two transverse, long lateral elements and two to four short, posteriorly displaced medial elements. Hepatic region smooth with oblique lateral, setose groove and short, subacute spine at midpoint of lateral margin. Epibranchial region generally triangular, smooth; posterolateral margin with four short rows of setae. Metagastric region smooth; CG5 absent. CG6 crenulate, with separate laterally oblique, medially straight, long lateral fragments and long sinuous median element united with CG7. CG7 straight relative to anterior margin of carapace and united with median fragment of CG6. Cardiac region smooth; CG8 present as two long medial elements. CGs 9–11 absent. Branchial region with few short, transverse rows of setae. Posterior margin deeply and evenly concave, with submarginal groove reaching three-fourths way up posterior concavity, but lined with setae only to posterolateral corners of carapace. Branchiostegite without anterior submarginal spine; anterior region with anterodorsal transverse groove and granular surface, with many long plumose setae; posterior region membranous, with numerous irregular fragments and sparsely covered with long plumose setae.

Ocular plate (fig. 28B) subquadrate, covered by carapace; median peduncular segments reduced to small rounded calcified areas anterior to ocular plate. Distal peduncular segments irregularly ovate, angled distolaterally, flattened with proximally convex and distally concave lateral margins and proximally concave, distally convex mesial margins, margins smooth; long longitudinal faintly pigmented streak slightly lateral to median line present; mesial margins separated along entire length; distal mesial and lateral margins with long simple setae.

Antennule (fig. 28C) segment III narrow proximally, expanding distally to three times proximal width; with plumose setae on dorsal and ventral margins and scattered on lateral surface; dorsal exopodal flagellum with

52–63 articles ($n = 4$), long plumose setae on dorsal and ventral margins, short simple setae on distal margins; ventral endopodal flagellum with two articles ($n = 5$), plumose setae on dorsal and ventral margins. Segment II medially inflated in dorsal view, with long plumose setae on dorsal and ventral margins, short plumose setae scattered on medial third of lateral surface. Segment I longer than wide, armed with acute small spine on dorsodistal margin; dorsodistal one-fifth of lateral surface rugose, with long plumose setae; scattered long plumose setae on distal and ventrolateral surfaces; long plumose setae on dorsal and ventral margins.

Antenna (fig. 28D) with segment V approximately two times longer than wide, with short plumose setae on dorsal and distal margins; flagellum with seven or eight articles ($n = 6$), long plumose setae on dorsal, ventral, and distal margins. Segment IV almost cylindrical, overreaching segment III by one-third of its length, with two rows of long plumose setae on dorsal margin. Segment III with long plumose setae on distoventral margin. Segment II widening distally, with long plumose setae in subdorsal row and scattered in medial third of lateral surface; antennal acicula short, triangular, overreaching segment IV proximal margin by one-third of its length, with long plumose setae on dorsal margin. Segment I rounded proximally, flattened and truncated ventrolaterally, with long plumose setae on margins; lateral surface with small acute spine on mediadorsal margin; scattered setae on dorsal fifth of lateral surface; segment with ventromesial antennal gland pore.

Mandible (fig. 28E) incisor process with two teeth; cutting edge with one tooth. Palp three-segmented, with plumose setae on margins and long, thick, simple setae arising from bend in second segment.

Maxillule (fig. 28F) distal endite proximally narrow, widening to inflated distal end, with thick simple setae on distal margin and long plumose setae on dorsal margin. Proximal endite with thick simple setae on distal margin. Endopodal external lobe truncate distally and curled under, with wide proximal projection; internal lobe reduced, with four thick setae at distolateral margin.

Maxilla (fig. 28G) exopod rounded, with

plumose setae along distal margin. Scaphognathite gently rounded on posterior lobe, with plumose setae.

Maxilliped I (fig. 28H) epipod with plumose setae on margins. Endite tapered distally and subequal to first segment of exopod. Exopod with two segments; proximal segment narrow, margins parallel, margins with plumose setae; distal segment spatulate, longer than wide, curved mesially, broadest medially, margins and distal half of surface with long plumose setae. Endopod flattened and elongate, reaching to distal end of proximal exopodal segment, with plumose setae on margins.

Maxilliped II (fig. 28I) dactylus evenly rounded, longer than wide, with thick simple setae on distal margins and thin simple setae in short transverse row on lateral surface. Propodus slightly produced dorsodistally, two times wider than long, with plumose setae on dorsal margin and long simple setae on dorsodistal and ventrodial margins. Carpus not strongly produced dorsodistally, approximately two times longer than wide, with long simple setae on dorsal margin and short simple setae on dorsodistal and mediolateral surfaces. Merus 2.5 times longer than wide, margins parallel but slightly inflated submedially, with simple setae on ventral margin and scattered in short rows on lateral surface, plumose setae on dorsolateral margin. Basis-ischium incompletely fused, with plumose setae on margins and lateral surface. Exopod one-third longer than merus, without flagellum.

Maxilliped III (fig. 28J) dactylus elongate and evenly rounded; long plumose setae on dorsal margin and in subdorsal row on lateral surface. Propodus with longitudinal median row of plumose setae on lateral surface; disventral margin with short simple setae. Carpus strongly produced onto propodus, overreaching distal margin of propodus and extending one-third onto dactylus; lateral surface with medial transverse row of long plumose setae; long plumose setae on margins. Merus unarmed, broadly inflated distolaterally, with long plumose setae on dorsal margin and short simple setae in short rows on lateral surface and ventral margin. Basis-ischium incompletely fused, without crista dentata. Exopod two-segmented; proximal

segment small; distal segment styliiform, tapering, approximately one-third length of merus, with plumose setae on margins; without flagellum.

Pereopod I (fig. 29A) dactylus curved and tapering; lateral surface smooth, with proximal submarginal setose groove, mesial surface smooth; dorsal margin with low rounded teeth on proximal three-fourths, smooth distally, long plumose setae along length; ventral margin with short simple setae. Propodal lateral surface with numerous short, transverse rows of setose rugae; dorsal margin with few small low ridges and distal spinules; ventral margin distally produced into subacute spine; cutting edge lacking teeth, lined with long plumose setae; dorsal margin with long plumose setae, ventral margin with short simple setae. Carpus with dorsodistal angle rounded, with several small rounded spines and numerous setose rugae, dorsal margin smooth, with long plumose setae; lateral surface with few transverse, setose ridges; mesial surface smooth, with medial transverse row of long plumose setae. Merus unarmed; lateral surface with scattered transverse rows of short plumose setae, dorsal margin with long plumose setae, ventral margin with short plumose setae; mesial surface with few scattered setae; proximal half of mesial surface with decalcified window. Basis-ischium incompletely fused, unarmed. Coxa unarmed.

Pereopod II (fig. 29B) dactylus smooth; base to heel straight, heel produced and rounded with lateral submarginal row of long plumose setae, heel to tip with broad rounded indent, tip subacute, tip to base broadly convex; lateral surface smooth; mesial surface smooth, ventral margin with long plumose setae, dorsal margin with short simple setae, with patch of long plumose setae at base reaching across median of heel. Propodus with dorsal surface smooth, ventral margin inflated and rounded; distal and ventral margin with long plumose setae; dorsolateral surface as narrow, oblique, flattened shelf, with long plumose setae on dorsal and ventral margins; short transverse row of long plumose setae on surface; mesial surface with subdistal row of long plumose setae. Carpus produced dorsodistally, narrowing to rounded tip, not overreaching propodus; lat-

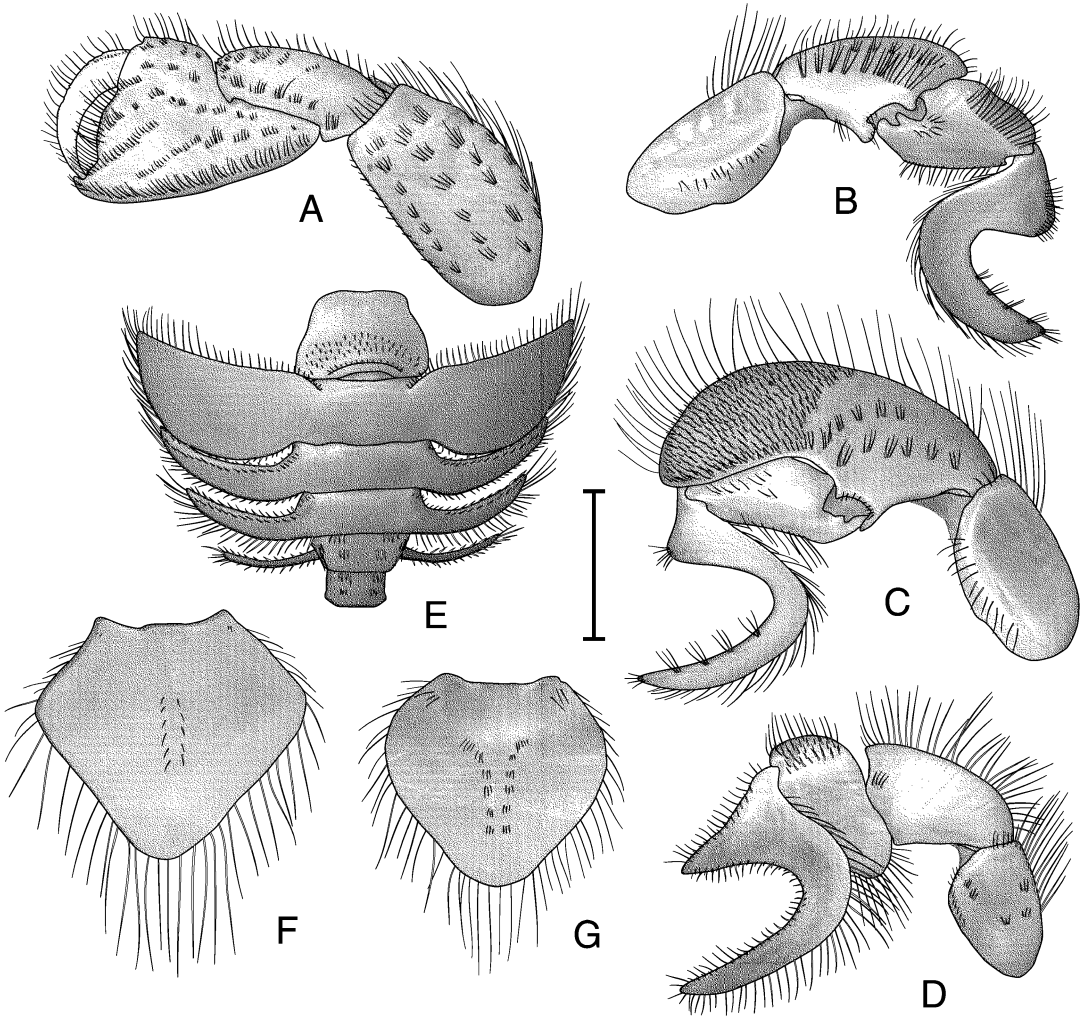


Fig. 29. *Paraleucolepidopa distincta* (Gomes Corrêa, 1968), n. comb.: A-D, G, ♀, 6.4 mm cl, MNRJ 1552, syntype; E, ♀, 8.3 mm cl, USNM 122635; F, ♂, 5.6 mm cl, MNRJ 6473, syntype. **A.** Left pereopod I, lateral view. **B.** Right pereopod II, lateral view. **C.** Left pereopod III, lateral view. **D.** Left pereopod IV, lateral view. **E.** Abdominal somites I-VI, dorsal view. **F.** Telson of ♂, dorsal view. **G.** Telson of ♀, dorsal view. Scale = 0.8 mm (F), 1.1 mm (G), 2.2 mm (A-D), and 3.3 mm (E).

eral surface nearly smooth, with two irregular, broken rows of rugae and submarginal elevated ridge ventrally, rugae and ridge with long plumose setae; dorsal margin with long plumose setae; mesial surface smooth with medial oblique and distal rows of long plumose setae. Merus with lateral surface almost entirely decalcified, with long plumose setae on dorsodistal margin and short plumose setae on ventral margin; mesial surface nearly smooth, with faint oblique median ridge,

long plumose setae in row ventrally. Basis-ischium incompletely fused and unarmed. Coxa unarmed.

Pereopod III (fig. 29C) dactylus base to heel slightly concave, heel low, rounded, and only slightly produced, heel to tip with broad, evenly rounded indent, tip subacute, tip to base smoothly convex; lateral surface smooth, with tuft of short simple setae at base of heel and end of tip, dorsodistal margin with tufts of short setae; ventral margin

with long plumose setae, dorsal margin with short simple and plumose setae; mesial surface smooth with plumose setae proximally at junction with propodus and in row across base of heel. Propodus not inflated dorsoventrally; lateral surface smooth, with simple setae in oblique row subdorsally, and long plumose setae on ventral margin; dorsolateral surface narrow, oblique, flattened; mesial surface with scattered long setae on and near distoventral margin. Carpus strongly produced and inflated dorsodistally, overreaching distal margin of propodus, broadly rounded; dorsolateral margin unarmed; lateral surface with mat of short setae on dorsodistal half of segment and two broken transverse rows of short plumose setae medially; dorsal margin with long plumose setae; mesial surface smooth, dorsomedial third decalcified, with long plumose setae on margins. Merus smooth, lateral surface almost entirely decalcified; dorsal and ventral margins unarmed, long plumose setae dorsodistally and ventrally; mesial surface smooth. Basis-ischium incompletely fused and unarmed. Coxa unarmed. Female pereopod III with large mesioproximal gonopore (not opposing other gonopore); male with similar but smaller pore.

Pereopod IV (fig. 29D) dactylus with base to heel slightly concave, heel acute and produced, heel to tip broadly rounded and concave, tip acute, tip to base convex; lateral surface smooth, ventral margin with long plumose setae, dorsal margin with short and long simple setae; mesial surface with dorsal decalcified region, demarcated ventrally by longitudinal elevated ridge across heel, with row of short plumose setae. Propodus expanded dorsally and ventrally; ventral expansion reaching ventral margin of dactylus, ventral margin with long plumose setae; dorsal expansion with row of long plumose setae dorsally and mat of short simple setae ventrally; lateral and mesial surfaces smooth. Carpus slightly produced dorsodistally; lateral and mesial surfaces smooth; dorsomedial two-thirds of mesial surface decalcified; dorsal margin with long plumose setae, ventral margin with few short simple setae. Merus lateral surface with few short transverse rows of setae, dorsodistal margin with long plumose setae; mesial surface with large decal-

cified window proximoventrally. Basis-ischium incompletely fused and unarmed. Coxa unarmed.

Abdomen (fig. 29E) somite I wider than long, widest posteriorly; dorsal surface with anterior margin medially slightly concave; posterior margin concave, with elevated submarginal curved row of short setae and broad field of short simple setae anterior to submarginal row; small faint transverse decalcified windows laterad of segment median. Somite II anterior margin irregularly convex, posterior margin irregularly concave; pleura expanded and directed anterolaterally, angled anterolaterally, rounded posterolaterally; anterior and lateral margins with long plumose setae, posterior margin with short setae. Somite III similar to somite II, narrower and shorter; pleura thinner and shorter than on somite II, directed anterolaterally, with setae as in somite II; anterolateral angle subacute; dorsal surface slightly obliquely flattened anterolaterally, with submarginal row of short simple setae. Somite IV similar to somite III, with short rows of simple setae on either side of medial posterior margin; pleura thinner and shorter than on somite III, directed anterolaterally; dorsal surface slightly obliquely flattened anterolaterally, with submarginal row of short simple setae; lateral margins with long plumose setae, short simple setae on anterior margin and in posterior submarginal row. Somite V wider than somite IV; anterolateral margins with submarginal tufts of long plumose setae, two short rows of simple setae medially on either side of median line and on posterior margin; pleura distinct from somite, shorter than in somite IV, thin, flattened, directed anterolaterally and covered with short plumose setae. Somite VI narrower than somite V; dorsal surface with two short transverse rows of setae laterad of midline anteriorly; pleura absent.

Female with long uniramous pleopods on somites II–V; male with tiny pleopods.

Telson of male (fig. 29F) diamond-shaped, weakly calcified; mediolateral margins produced and rounded, distal tip rounded; anterolateral corners with few short simple setae, lateral margins with long simple setae; median longitudinal groove with short rows of few short, simple setae in medial two-thirds. Telson of female (fig. 29G) similar to

male but with rounded mediolateral margins, dorsal surface evenly and weakly calcified; median longitudinal groove with two parallel transverse rows of short simple setae in medial two-thirds, curving laterally in proximal one-fourth of groove; anterolateral angles with few short, simple setae, margins with long simple setae.

DISTRIBUTION: Known only from the Dominican Republic, Pernambuco and Alagoas, Brazil (Calado, 1987), in 1.4–48.0 m depth (Calado, 1987).

MAXIMUM SIZE: Males: 6.3 mm cl; females: 7.7 mm cl.

TYPE SPECIMENS: MNRJ 6473 (3 syntypes), MNRJ 1552 (1 syntype), repository of one additional syntype unknown.

TYPE LOCALITIES: Alagoas, 09°53'20"S, 35°51'20"W, Brazil, 14 m; Alagoas, 10°05'20"S, 36°02'15"W, Brazil, 10–20 m; Ilha do Pai, Rio de Janeiro, Brazil.

REMARKS: Calado (1995, 1996, 1997b) did not recognize that this taxon was congeneric with her type species of *Paraleucolepidopa*, although she examined a large number of specimens of *P. distincta* from Brazil (Calado, 1987, 1995). The drawings of Calado (1987: figs. 13, 14c, d) contain errors in the placement of the carapace grooves, which are different in the two figures of the carapace (figs. 13, 14c), and in the incomplete suture between segments III and IV of the antenna (fig. 14d).

One specimen (AMNH 10363) cited by Efford (1971; AMNH 10361) as being this species is actually quite different in numerous aspects of the CGs, and it may represent an undescribed species of *Paraleucolepidopa*. Unfortunately, this specimen is badly damaged on the front of the carapace, and a description of this possible new species must wait until more material is available.

This species is the Atlantic analogue of *P. myops*.

LEPIDOPA STIMPSON, 1858

Albunea: H. Milne Edwards, 1837b: 202–203 (part). – Chenu and Desmarest, 1877: 32 (part) (not *Albunea* Weber, 1795).

Albunaea [sic]: Dana, 1852: 404 (part) (not *Albunea* Weber, 1795).

Lepidopa Stimpson, 1858: 230. – Ortmann, 1896:

225–226 (part). – Holmes, 1900: 105. – Ortmann, 1901: 1153, 1275. – Benedict, 1903: 891. – Porter, 1915b: 17. – Schmitt, 1921: 172 (part). – Balss, 1927: 1011. – Gordon, 1938: 188–190 (part). – Garcia Mendes, 1945: 119 (part). – Snodgrass, 1952: 31. – Haig, 1955: 11. – Balss, 1957: 1599. – Holthuis, 1961: 27–28. – Chace and Haig, 1962: 344. – Holthuis, 1962: 125–128. – Rodrigues da Costa, 1962: 7–9. – ICZN, 1964: 28–29. – Efford, 1971: 60–61 (part). – Epelde-Aguirre and Lopez, 1975: 165. – Rodriguez, 1980: 235. – Wicksten, 1980: 209 (list). – Kaestner, 1980: 335. – Boschi, 1981: 714, 739. – Williams, 1984: 250. – Calado, 1987: 119–121 (part). – Coêlho and Calado, 1987: 41 (part). – Melville and Smith, 1987: 114. – Manning, 1988: 626–627 (part). – Seridji, 1988: 1298–1299. – Rios et al., 1990: 27. – Calado, 1995: 125–126 (part). – Boyko and Harvey, 1999: 380, 382.

Lepidops: Miers, 1878: 331–332 (part). – Kingsley, 1880: 410. – Ortmann, 1892: 535. – Moreira, 1901: 30. – Holthuis, 1962: 127–128. – ICZN, 1964: 28–29 (unjustified emendation).

Ledopipa [sic]: Calado, 1987: 85.

not *Lepidopa* Ortmann, 1896: 225–226 (part). – Schmitt, 1921: 172 (part). – Gordon, 1938: 188–190 (part). – Garcia Mendes, 1945: 119 (part). – Efford, 1971: 60–61 (part). – Calado, 1987: 119–121 (part). – Coêlho and Calado, 1987: 41 (part). – Manning, 1988: 626–627 (part). – Calado, 1995: 125–126 (part)) (= *Paraleucolepidopa* Calado, 1996).

not *Lepidops* Stimpson, 1860: 241. – Miers, 1878: 331–332 (part) (= *Paraleucolepidopa* Calado, 1996).

not *Lepidops*: Miers, 1878: 331–332 (part) (= *Thia* Leach, 1815).

not *Lepidopa*: Gordon, 1938: 187–190 (part) (= *Thia* Leach, 1815).

not “?Lepidopa”: Kamita, 1957: 94–96 (= *Blepharipoda* Randall, 1840).

DIAGNOSIS: Carapace unarmed or weakly spinose. Rostrum narrow, rounded. Distal peduncular segment flattened. Antennule dorsal flagellum with 78–250 articles, ventral flagellum with two or three articles. Antenna flagellum with six to nine articles. Maxilliped II with flagellum. Maxilliped III exopod without flagellum. Abdominal somite V pleura weakly calcified. Males with small pleopods.

DISTRIBUTION: Central California, USA, south to Chile; Virginia, USA, south to Brazil.

TYPE SPECIES: *Lepidopa venusta* Stimpson,

1859, by designation of ICZN Opinion 693 (ICZN, 1964).

INCLUDED SPECIES: *L. venusta* Stimpson, 1859; *L. chilensis* Lenz, 1902; *L. deamae* Benedict, 1903; *L. mearnsi* Benedict, 1903; *L. richmondi* Benedict, 1903; *L. wollebaeki* Sivertsen, 1934; *L. benedicti* Schmitt, 1935; *L. californica* Efford, 1971; *L. esposa* Efford, 1971; *L. haigae* Efford, 1971; *L. mexicana* Efford, 1971; *L. dexteræ* Abele and Efford, 1972; *L. luciae*, n. sp.

REMARKS: This genus is no. 1575 on the "Official list of generic names in zoology," and is feminine (ICZN, 1964). The original type species of this genus was designated as *Hippa scutellata* Fabricius by Stimpson (1858). However, as shown by Holthuis (1962), that species is actually a third brachyuran, and Stimpson's concept of the species applied to the taxon now known as *Lepidopa richmondi* Benedict. Rather than relegate *Lepidopa* to synonymy with *Thia*, and introduce a new name for the genus previously known as *Lepidopa*, Holthuis (1962) recommended the designation of a new type species for *Lepidopa*. The ICZN concurred and selected *L. venusta* as the type species in 1964 (ICZN, 1964). This was, in retrospect, perhaps not the best choice for the type species, as it belongs to the "venusta-group" of *Lepidopa*, rather than to the "benedicti-group" to which *L. richmondi* belongs.

The names *Lepidops* Stimpson (no. 1674) and *Lepidops* Miers (no. 1675) are both placed on the "Official index of rejected and invalid generic names in zoology," as both are unjustified emendations of *Lepidopa* (ICZN, 1964).

Efford's (1971: fig. 12) "evolutionary tree" divided the genus into four major "groups" (listed here in Efford's order from most basal to most derived): the "californica-group," the "myops-group," the "benedicti-group," and the "venusta-group." The "myops-group" is now recognized as the genus *Paraleucolepidopa*, and is actually basal to *Lepidopa* sensu stricto. The "californica-group" (with only one species) is not basal, but rather is intermediate between the "venusta-" and "benedicti-" groups.

KEY TO SPECIES

- 1 Antennal segment I spine present; branchial setae = punctae ("benedicti-group") . . . 2
 - Antennal segment I spine absent; branchial setae = setose grooves 6
- 2 Anterolateral spines absent *L. haigae*
 - Anterolateral spines present 3
- 3 Ventrorostral spine present 4
 - Ventrorostral spine absent 5
- 4 Posterior submarginal groove entire
 - *L. richmondi*
 - Posterior submarginal groove broken in median *L. mearnsi*
- 5 Pereopod II dactylus indent narrow
 - *L. deamae*
 - Pereopod II dactylus indent broad
 - *L. benedicti*
- 6 Ventrorostral spine present ("venusta-group") 7
 - Ventrorostral spine absent . . . *L. californica*
- 7 Maxilliped III exopod less than half merus length 8
 - Maxilliped III exopod more than half merus length 10
- 8 CG10 present *L. luciae*, n. sp.
 - CG10 absent 9
- 9 Distal margins of distal peduncular segments tapered *L. wollebaeki*
 - Distal margins of distal peduncular segments rounded *L. mexicana*
- 10 Pereopod II dactylus heel rounded
 - *L. esposa*
 - Pereopod II dactylus heel tapered 11
- 11 Ocular peduncles subquadrate distally
 - *L. dexteræ*
 - Ocular peduncles ovate distally 12
- 12 CG9 and CG10 present *L. venusta*
 - CG9 and CG10 absent 13
- 13 Posterior submarginal groove extending up sides of medial indentation . . . *L. websteri*
 - Posterior submarginal groove not extending up sides of medial indentation
 - *L. chilensis*

Lepidopa luciae, new species

Figures 30, 31

Lepidopa venusta: Benedict, 1903: 892, fig. 2*. – Schmitt, 1935: 210, fig. 70*. – Gordon, 1938: 188*. – Efford, 1971: 87–89 (part), figs. 3p, 4l, t, 5c, k, 6h, 7b*. – Manning, 1988: 626–627, 630–631, fig. 4* (not *Lepidopa venusta* Stimpson, 1859).

MATERIAL EXAMINED: **Saint Lucia**: Saint Lucia, "Peru" [= West Indies], coll. Stolz-

man: 4 ♂, 5.5–8.8 mm cl, 1 ♀, 9.8 mm cl, paratypes (BMNH 1890.10.7.152–156).

Trinidad and Tobago: Nariva Swamp, beach side, Cocal, Nariva Co., Trinidad, July 13, 1979, coll. L. N. Sorkin: 1 ♀, 11.4 mm cl, holotype (AMNH 17533); Maracas Bay, Trinidad, Dec. 25, 1970, coll. J. M. Stohley: 1 ♂, 6.6 mm cl, 1 unsexable, unmeasurable specimen, paratypes (USNM 141353); Mayaro Beach, Trinidad, Aug. 1972, coll. V. Quesnel: 1 ♀, 12.1 mm cl, paratype (USNM 143381); Trinidad, coll. R. A. White: 1 ♂, 8.0 mm cl, paratype (BMNH 1950.12.28.6).

Costa Rica: Port Limon, coll. L. C. Gagno: 1 ♀, 10.9 mm cl, paratype (ZMH K-5146).

Colombia: Sabanilla, "New Grenada" [= Colombia], March 16–22, 1884, coll. R/V "Albatross": 2 ♀, 7.7–11.6 mm cl, 1 oviger, 10.0 mm cl, paratypes (USNM 7573).

DIAGNOSIS: Carapace wider than long, with lightly setose grooves. Anterior margin with two large spines lateral to ocular sinus. CG5 absent; CG8 present as punctae; CG10 present as punctae; posterior submarginal groove reaching to posterior margin of posterior concavity. Rostrum present, rounded and armed with ventral acute spine. Distal peduncular segments dorsoventrally flattened, ovate, distal margin smooth. Cornea absent. Antennal segment I unarmed. Dactylus of pereopod II with heel produced and rounded. Dactylus of pereopod III with heel thin, projecting, acute. Dactylus of pereopod IV with produced acute heel and deep indent. Telson of male spatulate, proximal two-thirds laterally convex, distal third laterally concave with lateral expansions rounded, distal tip rounded; medioproximal third heavily calcified, lateral and distal regions decalcified.

DESCRIPTION: Carapace (fig. 30A) wider than long. Anterior margin convex on either side of ocular sinus, smooth. Rostrum as rounded projection reaching beyond median peduncular segments and with submarginal, terminal acute spine. Ocular sinus smoothly concave; unarmed. Frontal region smooth; setal field reduced to narrow band anterior and paralleling CG1, concave medially. CG1 parallel to anterior margin of carapace, sinuous, slightly crenulate, medially concave, medial and lateral elements united. Mesogastric region smooth; CG2 absent; CG3 absent;

CG4 with several (three to seven) anteriorly and posteriorly displaced very short elements and two long, oblique lateral elements connected to posterior margins of CG1 lateral elements. Hepatic region smooth with oblique lateral setose groove and very short, acute spine at median of lateral margin. Epibranchial region roughly triangular, smooth; posterolateral margin with two short rows of setae. Metagastric region smooth; CG5 absent. CG6 crenulate, with separate oblique long lateral fragments and short, concave, median element united with CG7. CG7 nearly straight relative to anterior margin of carapace and united with median fragment of CG6. Cardiac region smooth; CG8 present as eight minute setose punctae. CG9 absent. CG10 present as few minute setose punctae in short oblique rows. CG11 absent. Branchial region with few setose punctae but without short, transverse rows of setae. Posterior margin deeply and smoothly concave medially and more or less straight laterally, with submarginal groove reaching to posterior margin of posterior concavity. Branchiostegite without anterior submarginal spine; anterior region with anterodorsal transverse groove and granular surface; with many long plumose setae; posterior region membranous with numerous irregular fragments and sparsely covered with long plumose setae.

Ocular plate (fig. 30B) minute; median peduncular segments laterally elongate oblong segments, not covered by carapace anterolaterally ventral to ocular plate. Distal peduncular segments irregularly elongate-ovate, angled distolaterally, flattened, with convex lateral and mesial margins, shallow notch present laterally one-third from proximal margin, margins smooth; mesial margins separated along entire length; mesial, lateral and distal margins with long simple setae.

Antennule (fig. 30C) segment III narrow proximally, expanding distally to two times proximal width; with plumose setae on dorsal and ventral margins; dorsal exopodal flagellum with 85–123 articles ($n = 6$), long plumose setae on dorsal and ventral margins; ventral endopodal flagellum with two or three articles ($n = 6$), plumose setae on dorsal and ventral margins. Segment II medially inflated in dorsal view, with plumose setae

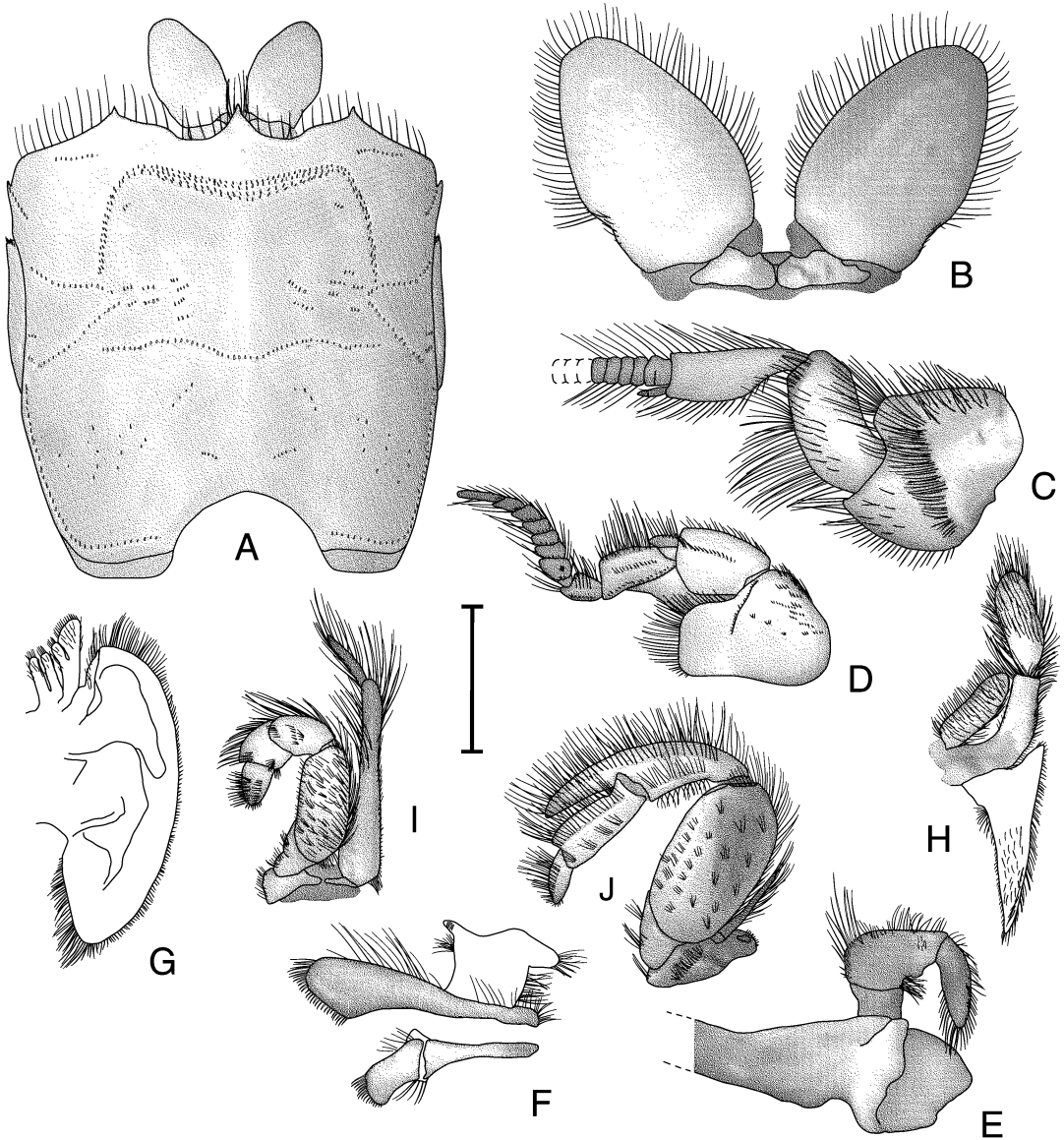


Fig. 30. *Lepidopa luciae*, n. sp.: A, ♀, 11.4 mm cl, AMNH 17533, holotype; B–J, ♀, 12.1 mm cl, USNM 143381, paratype. A. Carapace, branchiostegite, and ocular peduncles, dorsal view. B. Ocular peduncles, dorsal view. C. Left antennule, lateral view. D. Left antenna, lateral view. E. Left mandible, mesial view. F. Left maxillule, lateral view. G. Left maxilla, lateral view. H. Left maxilliped I, lateral view. I. Left maxilliped II, lateral view. J. Left maxilliped III, lateral view. Scale = 2.1 mm (E, F), 2.2 mm (B), 3.3 mm (C, I, J), and 4.4 mm (A, D, G, H).

on dorsal and ventral margins and scattered on distoventral third of lateral surface. Segment I width and length subequal, unarmed; lateral surface with submarginal dorsal row of long plumose setae and transverse band of long plumose setae across segment median;

long plumose setae on dorsal and ventral margins.

Antenna (fig. 30D) with segment V approximately 1.5 times longer than wide, with short plumose setae on dorsal margin and in submarginal ventral row, long plumose setae

on distoventral margin; flagellum with eight articles ($n = 6$), long plumose setae on dorsal, ventral, and distal margins. Segment IV almost cylindrical, overreaching segment III by two-fifths its length, with long plumose setae on dorsal and distal margins, and two rows of short setae on lateral surface, one medial and one ventrally submarginal. Segment III with long plumose setae on ventral margin and short simple setae on dorsal margin. Segment II widening distally, with one row of short plumose setae on lateral surface; antennal acicle short, triangular, overreaching segment IV proximal margin by one-third of its length, with long plumose setae on dorsal margin. Segment I rounded proximally, flattened and truncated ventrolaterally with long plumose setae on margins, short simple setae scattered on dorsal quarter of lateral surface and along transverse groove separating truncate lobe from proximal portion of segment; lateral margin unarmed; segment with ventromesial antennal gland pore.

Mandible (fig. 30E) incisor process with two teeth; cutting edge with one tooth. Palp three-segmented, with plumose setae on margins and long, thick, simple setae arising from bend in second segment.

Maxillule (fig. 30F) distal endite proximally narrow, widening to inflated distal end, with thick simple setae on distal margin and plumose setae on dorsal margin. Proximal endite with thick simple setae on distal margin. Endopodal external lobe truncate distally and curled under, with wide proximal projection; internal lobe reduced with four thick setae at distolateral margin.

Maxilla (fig. 30G) exopod rounded with plumose setae along distal margin. Scaphognathite bluntly angled on posterior lobe, with plumose setae.

Maxilliped I (fig. 30H) epipod with plumose setae on margins and on distolateral surface. Endite tapered distally and subequal to first segment of exopod. Exopod with two segments; proximal segment narrow, margins parallel, with plumose setae; distal segment spatulate, longer than wide, curved mesially, broadest medially, margins and distal three-fourths of lateral surface with long plumose setae. Endopod flattened and elongate, reaching to distal end of proximal exopodal segment, with plumose setae on margins.

Maxilliped II (fig. 30I) dactylus evenly rounded, longer than wide, with thick simple setae distally and thin simple setae in short row on lateral surface. Propodus slightly produced dorsodistally, one-half wider than long, with plumose setae on dorsal margin and long simple setae on dorsodistal and ventrodorsal margins. Carpus not produced dorsodistally, approximately two times longer than wide, with long simple setae on dorsal margin and scattered on lateral surface. Merus 1.5 times longer than wide, margins parallel but slightly inflated subproximally, with long simple setae on ventral margin and long plumose setae on dorsal margin and scattered on lateral surface. Basis-ischium incompletely fused, with plumose setae on margins. Exopod two times longer than merus, flagellum with one elongate article.

Maxilliped III (fig. 30J) dactylus elongate and evenly rounded; long plumose setae on margins and in medial transverse row on lateral surface. Propodus with longitudinal median row of plumose setae on lateral surface; submarginal interrupted ventral row of long simple setae; distodorsal tuft of long plumose setae; dorsal and ventral margins with short plumose setae. Carpus strongly produced onto propodus, overreaching four-fifths of propodus length; lateral surface with medial transverse row of long plumose setae; submarginal ventral row of long plumose setae; long plumose setae on margins. Merus unarmed, broadly inflated distolaterally, depressed and decalcified medially, with long plumose setae on dorsal margin and short plumose setae on medioventral margin and scattered on lateral surface. Basis-ischium incompletely fused, without crista dentata. Exopod two-segmented: proximal segment small; distal segment styliiform, tapering, approximately one-half length of merus, with plumose setae on margins; without flagellum.

Pereopod I (fig. 31A) dactylus curved and tapering; lateral and mesial surfaces smooth; dorsal margin with small rugose area proximally, smooth distally, with long plumose setae; ventral margin with short simple setae. Propodal lateral surface with numerous short, transverse rows of setose rugae; dorsal margin with few small, low ridges; ventral margin distally produced into acute spine; cutting edge lacking teeth, lined with long plu-

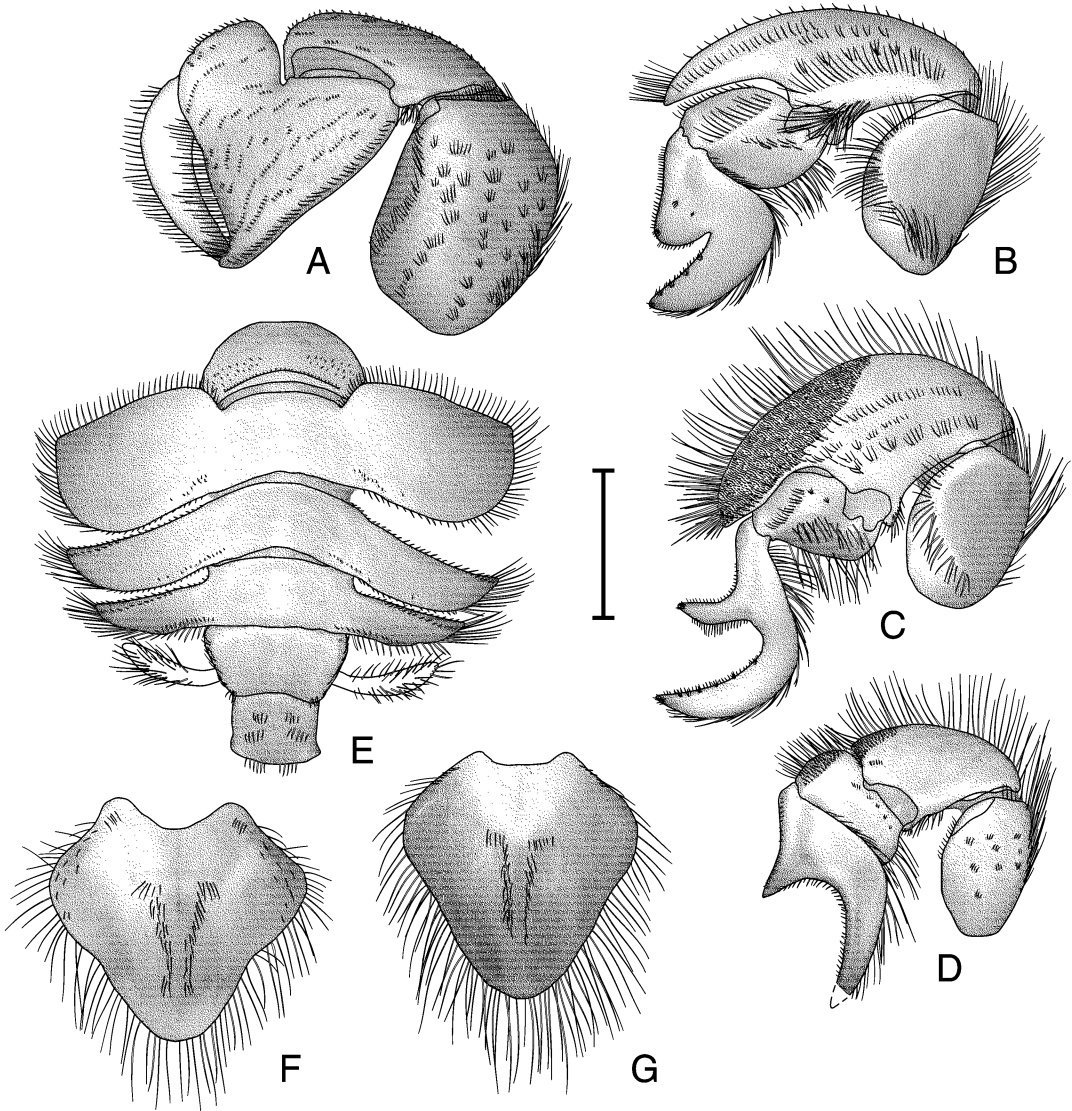


Fig. 31. *Lepidopa luciae*, n. sp.: A-E, G, ♀, 12.1 mm cl, USNM 143381, paratype; F, ♂, 8.8 mm cl, BMNH 1890.10.7.152-156, paratype. **A.** Left pereopod I, lateral view. **B.** Left pereopod II, lateral view. **C.** Left pereopod III, lateral view. **D.** Left pereopod IV, lateral view. **E.** Abdominal somites I-VI, dorsal view. **F.** Telson of ♂, dorsal view. **G.** Telson of ♀, dorsal view. Scale = 1.4 mm (F), 3.0 mm (G), and 4.4 mm (A-E).

mouse setae; dorsal margin with short plumose setae, ventral margin with short simple setae; mesial surface with few short transverse rows of setose rugae. Carpus with dorsodistal angle rounded and surface rugose with short simple setae, dorsal margin smooth, with short plumose setae; lateral surface with few scattered, transverse, setose

ridges; mesial surface smooth, with transverse row of long plumose setae halfway from dorsal margin and few scattered short plumose setae on surface. Merus unarmed; lateral surface with scattered transverse rows of short plumose setae, dorsal margin with long plumose setae; mesial side with few short rows of long plumose setae; proximal

third of mesial surface with decalcified window. Basis-ischium incompletely fused, unarmed. Coxa unarmed.

Pereopod II (fig. 31B) dactylus smooth; with base to heel slightly concave, heel produced and rounded, with apical tuft of short simple setae, heel to tip with narrow, subacute indent, tip subacute with apical tuft of short simple setae, tip to base broadly convex; lateral surface smooth; mesial surface smooth, ventral margin with long plumose setae, dorsal margin with short simple setae, with patch of long plumose setae at base reaching across median of heel. Propodus with dorsal surface smooth, ventral margin inflated and rounded; distal and ventral margins with long plumose setae; dorsolateral surface as narrow, oblique, flattened shelf, with long plumose setae on ventral margin; short transverse row of long plumose setae on surface; mesial surface with oblique row of long plumose setae, distal and ventral margins with dense row of long plumose setae. Carpus strongly produced dorsodistally, reaching distal margin of propodus; lateral surface nearly smooth, with four irregular, interrupted rows of rugae and submarginal elevated ridge ventrally, rugae and ridge with long plumose setae; dorsal margin with short plumose setae, distoventral and ventral margins with long plumose setae; mesial surface smooth with medial oblique and subdistal rows of long plumose setae, few scattered short plumose setae on surface. Merus lateral surface almost entirely decalcified, with long plumose setae on dorsal and ventral margins; mesial surface nearly smooth, with oblique median ridge, patches of long plumose setae dorsal to ridge and in row ventrally, with decalcified area on proximal third of area ventral to ridge. Basis-ischium incompletely fused and unarmed. Coxa unarmed.

Pereopod III (fig. 31C) dactylus base to heel broadly indented, heel acute, thin, and produced, heel to tip with broad, angled indent, tip acute, tip to base smoothly convex; lateral surface smooth, with apical tufts of short simple setae on heel and tip, lateral surface proximal to indent with few setose punctae; ventral margin with long plumose setae, dorsal margin with short simple and plumose setae; mesial surface smooth, with plumose setae proximally at junction with

propodus and in row across base of heel. Propodus not inflated dorsoventrally; lateral surface smooth, with simple setae subdorsally and long plumose setae on ventral margin; dorsolateral surface narrow, oblique, flattened; mesial surface with scattered long setae on and near distoventral margin. Carpus strongly produced dorsodistally and inflated, overreaching distal margin of propodus, rounded; dorsolateral margin unarmed; lateral surface with mat of short setae on dorsodistal third of segment and three long transverse rows of setae medially and scattered on proximal lateral surface; dorsal margin with long plumose setae; mesial surface smooth, with long plumose setae on margins and in median oblique row. Merus smooth, lateral surface almost entirely decalcified; dorsal and ventral margins unarmed, with long plumose setae; mesial surface smooth with patch of long plumose setae on proximomesial margin. Basis-ischium incompletely fused and unarmed. Coxa unarmed. Female pereopod III with large mesioproximal gonopore (not opposing other gonopore); male with slightly smaller pore.

Pereopod IV (fig. 31D) dactylus with base to heel concave, heel acute, with apical tuft of short simple setae, heel to tip broadly rounded and concave, tip acute with apical tuft of short simple setae, tip to base convex; lateral surface smooth, ventral margin with long plumose setae, dorsal margin with short simple setae; mesial surface with dorsal decalcified region, demarcated ventrally by longitudinal elevated ridge across heel with row of short plumose setae. Propodus expanded dorsally and ventrally; ventral expansion not reaching ventral margin of dactylus, margins with long plumose setae; dorsal expansion with row of long plumose setae medially and mat of short setae; lateral and mesial surfaces smooth. Carpus slightly produced dorsodistally; lateral and mesial surfaces smooth; dorsomedial half of lateral and mesial surfaces decalcified, with medial patch of long plumose setae subdistally and long plumose setae on distoventral margin of mesial surface; dorsal margin with small mat of short setae at dorsodistal angle; dorsal margin with long plumose setae, ventral margin with short simple setae. Merus with small median decalcified area on lateral surface, few short

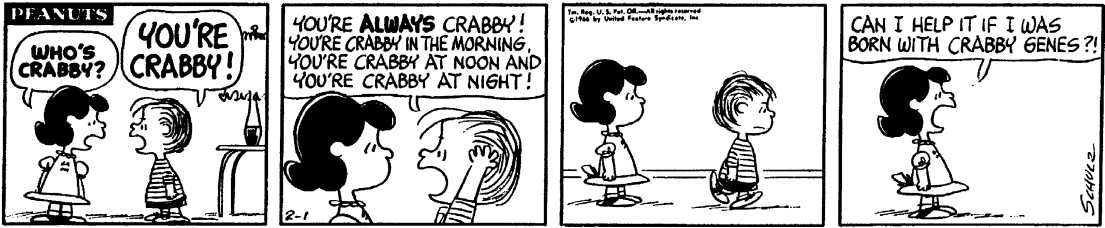


Fig. 31.1. Original 1966 “Peanuts” comic strip by Charles M. Schulz showing reason for the specific name of *Lepidopa luciae*, n. sp. (reproduced by permission).

transverse rows of setae, dorsal and distoventral margins with long plumose setae; mesial surface with small decalcified window proximoventrally. Basis-ischium incompletely fused and unarmed. Coxa unarmed.

Abdomen (fig. 31E) with somite I wider than long, widest posteriorly; dorsal surface with anterior margin straight; posterior margin concave, with elevated submarginal curved row of short setae and narrow field of short simple setae anterior to submarginal row; with small faint transverse decalcified window laterad of segment median. Somite II anterior margin convex, posterior margin irregularly concave; pleura expanded and directed posterolaterally, angled anterolaterally, rounded posterolaterally, small patch of short simple setae at posteromesial margin; anterior and lateral margins with long plumose setae, posterior margin with short setae. Somite III similar to somite II, narrower and shorter; pleura thinner and shorter than on somite II, directed posterolaterally, with setae as in somite II; anterolateral angle subacute; dorsal surface obliquely flattened anterolaterally, with posterior row of short simple setae. Somite IV similar to somite III; pleura thinner and shorter than on somite III, directed laterally; dorsal surface slightly obliquely flattened anterolaterally, with ventral row of short simple setae; margins with long plumose setae. Somite V wider than somite IV, narrowing posteriorly; anterolateral margins with plumose setae, two lateral rows of setae on posterior margin; pleura distinct from somite, shorter than in somite IV, thin, flattened, directed anterolaterally, and covered with plumose setae. Somite VI narrower than somite V; dorsal surface with four short transverse rows of setae laterad of midline

anteriorly, posterior margin with long plumose setae; pleura absent.

Female with long uniramous pleopods on somites II–V; male with small pleopods.

Telson of male (fig. 31F) spatulate, proximal two-thirds laterally convex, distal third laterally concave with lateral expansions rounded, distal tip rounded; medioproximal third heavily calcified, lateral and distal regions decalcified; median longitudinal groove running along calcified region; two parallel distally converging rows of short simple setae in medial third; margins with long simple setae. Telson of female (fig. 31G) similar to male, with less produced lateral expansions and more gently concave distolateral third.

DISTRIBUTION: Known from Saint Lucia, West Indies, south to Colombia; depth range unknown.

MAXIMUM SIZE: Males: 8.8 mm cl; females: 12.1 mm cl.

TYPE SPECIMENS: AMNH 17533 (holotype), BMNH 1890.10.7.152–156 (5 paratypes), BMNH 1950.12.28.6 (paratype), USNM 7573 (3 paratypes), USNM 141353 (2 paratypes), USNM 143381 (paratype), ZMH K-5146 (paratype).

TYPE LOCALITY: Nariva Swamp, Cocal, Nariva Co., Trinidad, Trinidad and Tobago.

ETYMOLOGY: This species is named in honor of Charles M. Schulz (1922–2000), creator of the beloved “Peanuts” comic strip that ran nearly 50 years, from October 2, 1950 until the very date of his death. The specific name “*luciae*” is given after the “Peanuts” character Lucy VanPelt, as suggested by Jean Schulz, in recognition of Lucy’s supremely “crabby” attitude (fig. 31.1).

REMARKS: Schmitt’s (1935) citation and

figure of "*Lepidopa venusta*" was based on the specimens discussed by Benedict (1903), which all belong to this new species. The erroneous "Peruvian" locality cited above was discussed in more detail by Holthuis (1961), who correctly identified it as a Caribbean locality.

Lepidopa luciae appears superficially similar to *L. venusta*, and is the sister species to all other members of the "venusta-group." It can be separated from *L. venusta* by the rounded dactylus heel of pereopod II, the shorter dactylus heel of pereopod III, and the sinuous lateral margin of the ocular sinus. *Lepidopa venusta* has an acute dactylus heel of pereopod II, a longer dactylus heel of pereopod III, and a smoothly concave lateral margin of the ocular sinus.

Lepidopa mexicana Efford, 1971

Figures 32, 33

Lepidopa mexicana Efford, 1971: 89–90, figs. 2k, 3s, 4o, 5f, i, 6f, m, 7c*. – Coêlho and Calado, 1987: table 1. – Rios et al., 1990: 30, figs. 1d, 4. – Lemaitre and Alvarez León, 1993: 50 (list). – Hendrickx, 1992: 8 (list). – Moran and Dittel, 1993: 612 (list). – Ramos and Rios, 1995: 104, fig. 6. – Hendrickx and Harvey, 1999: 367 (list).

not *Lepidopa mexicana*: Calado, 1995: 181–182, pl. 39, fig. j, pl. 40, fig. i, pl. 41, fig. i, pl. 58, fig. a, pl. 59, figs. a–c* (= *Lepidopa mearnsi* Benedict, 1903).

MATERIAL EXAMINED: Mexico: "Mexico," 1926, coll. Sec. Agricultura y Fomento: 1 oviger, 9.4 mm cl, holotype (USNM 62384); Teacapan, Sinaloa, 1926, coll. unknown: 2 ♀, 7.5–7.7 mm cl, paratypes (USNM 122634); Teacapan, Sinaloa, June 1926, coll. unknown: 1 ♂, 8.5 mm cl (USNM 62448); Zihuatenejo Bay, Guerrero, Feb. 7, 1963, coll. I. E. Efford: 1 ♀, 8.6 mm cl, paratype (LACM-AHF 638);

Costa Rica: Puntarenas, coll. S. Orsted: 1 ♀, 7.6 mm cl, paratype (ZMUC 2637).

Panama (Pacific): Sta. 235–3–7, Culebra Beach, June 3, 1977, coll. H. W. Kaufman: 1 juvenile, 2.9 mm cl (USNM 260936); Sta. 253–4–1, Culebra Beach, Feb. 7, 1978, coll. H. W. Kaufman: 1 juvenile, 2.4 mm cl (USNM 260937); Sta. 183–7, Scout Island Beach, March 10, 1974, coll. M. L. Jones and H. W. Kaufmann: 1 juvenile, 2.7 mm cl

(USNM 260938); south side, Perico Island, July 22, 1978, coll. M. L. Jones: 1 ♀, 7.5 mm cl (USNM 304312); Sta. 241–4–6, Culebra Beach, Dec. 10, 1977, coll. H. W. Kaufman: 1 oviger, 8.3 mm cl (USNM 304317).

DIAGNOSIS: Carapace wider than long, with lightly setose grooves. Anterior margin with two large spines lateral to ocular sinus. CG5 absent; CG8 absent; CG10 absent; posterior submarginal groove reaching to posterior margin of posterior concavity. Rostrum present, rounded and armed with ventral acute spine. Distal peduncular segments dorsoventrally flattened, ovate, distal margin smooth. Cornea absent. Antennal segment I unarmed. Dactylus of pereopod II with heel produced and rounded. Dactylus of pereopod III with heel thin, projecting, acute. Dactylus of pereopod IV with produced acute heel and deep indent. Telson of male spatulate, with broadly rounded and produced lateral lobes, proximal third laterally concave, medial third laterally convex, distal third laterally concave, distal tip rounded; medioproximal third heavily calcified, lateral and distal regions decalcified.

DESCRIPTION: Carapace (fig. 32A) wider than long. Anterior margin convex on either side of ocular sinus, smooth. Rostrum as rounded projection reaching beyond median peduncular segments and with a submarginal, terminal acute spine. Ocular sinus smoothly concave; unarmed. Frontal region smooth; setal field reduced to narrow band anterior to and paralleling CG1, concave medially. CG1 parallel to anterior margin of carapace, sinuous, slightly crenulate, medially concave, medial and lateral elements united. Mesogastric region smooth; CG2 absent; CG3 absent; CG4 with several (2–12) anteriorly and posteriorly displaced very short elements with wide gap in median and two long, oblique lateral elements connected to posterior margins of CG1 lateral elements. Hepatic region smooth, with oblique lateral setose groove and short, acute spine at median of lateral margin. Epibranchial region generally triangular, smooth; posterolateral margin with three or four short rows of setae. Metagastric region smooth; CG5 absent. CG6 crenulate, with separate oblique long lateral fragments and short, concave, median element united with CG7. CG7 slightly con-

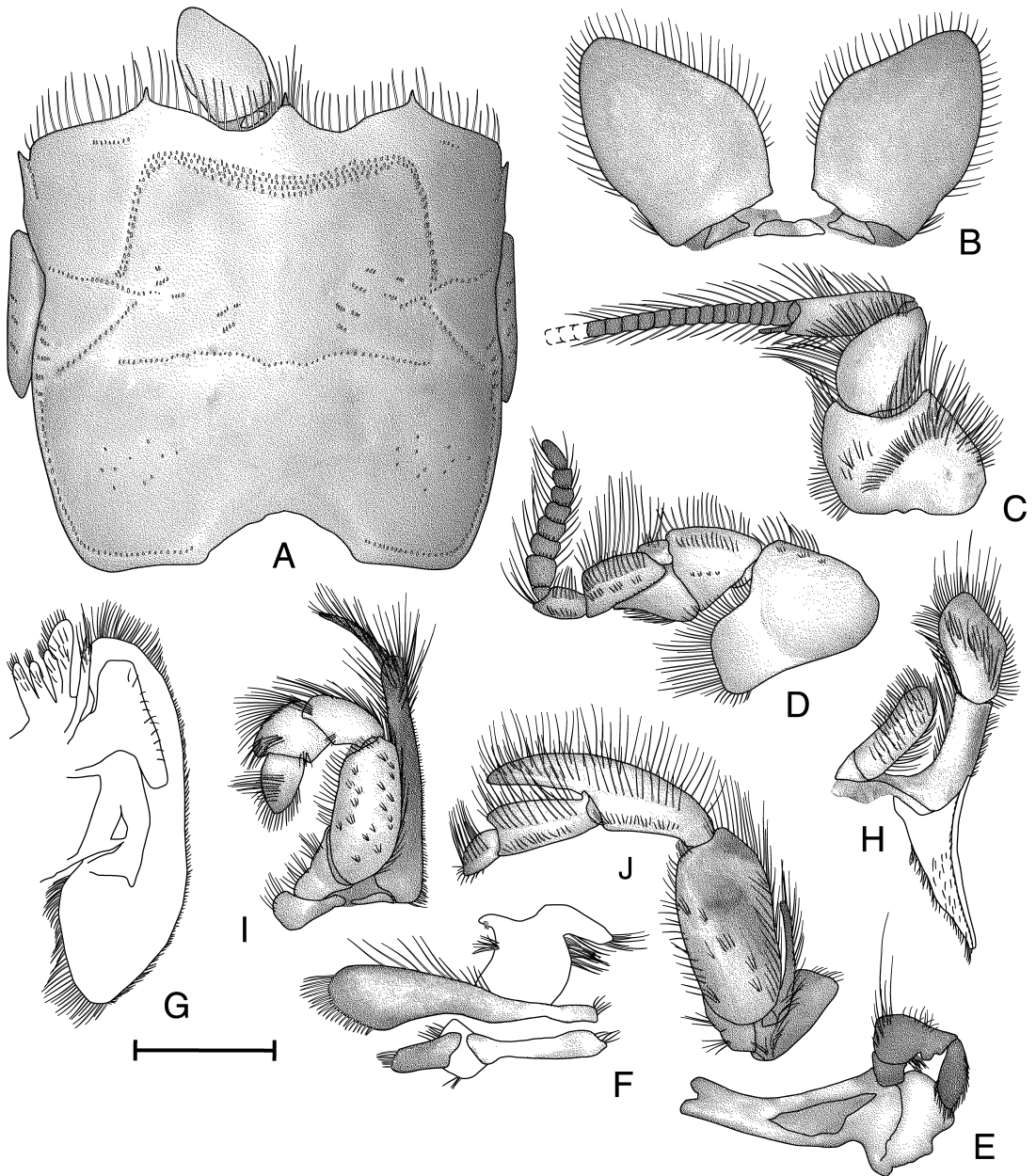


Fig. 32. *Lepidopa mexicana* Efford, 1971: A, oviger, 9.4 mm cl, USNM 62384, holotype; B–J, ♀, 7.5 mm cl, USNM 304312. A. Carapace, branchiostegite, and left ocular peduncle, dorsal view. B. Ocular peduncles, dorsal view. C. Left antennule, lateral view. D. Left antenna, lateral view. E. Left mandible, mesial view. F. Left maxillule, lateral view. G. Left maxilla, lateral view. H. Left maxilliped I, lateral view. I. Left maxilliped II, lateral view. J. Left maxilliped III, lateral view. Scale = 1.1 mm (F), 1.4 mm (B), 1.6 mm (E, I), 2.2 mm (C, D, G, H, J), and 3.3 mm (A).

vex relative to anterior margin of carapace and united with median fragment of CG6. Cardiac region smooth; CG8–11 absent. Branchial region with few setose punctae but without short, transverse rows of setae. Posterior margin deeply and irregularly concave medially and more or less straight laterally, with submarginal groove reaching to posterior margin of posterior concavity. Branchiostegite without anterior submarginal spine; anterior region with anterodorsal transverse groove and granular surface; with many long plumose setae; posterior region membranous, with numerous, irregular fragments, and sparsely covered with long plumose setae.

Ocular plate (fig. 32B) laterally elongate oblong segment; median peduncular segments reduced to small subquadrate calcified areas anterolaterally ventral to ocular plate, not covered by carapace. Distal peduncular segments irregularly elongate-ovate, angled distolaterally, flattened with convex lateral and mesial margins, shallow notch present on lateral margin one-third from proximal margin, margins smooth; mesial margins separated along entire length; mesial, lateral, and distal margins with long simple setae.

Antennule (fig. 32C) segment III narrow proximally, expanding distally to two times proximal width; with plumose setae on dorsal and ventral margins; dorsal exopodal flagellum with 98–108 articles ($n = 4$), long plumose setae on dorsal and ventral margins; ventral endopodal flagellum with two or three articles ($n = 6$), plumose setae on dorsal and ventral margins. Segment II medially inflated in dorsal view, with plumose setae on dorsal and ventral margins. Segment I wider than long, unarmed; lateral surface with submarginal dorsal row of long plumose setae and transverse band of long plumose setae across segment median; long plumose setae on dorsal and ventral margins.

Antenna (fig. 32D) with segment V approximately 1.5 times longer than wide, with long plumose setae on dorsal margin and short plumose setae in submarginal ventral row, long plumose setae on distoventral margin; flagellum with eight articles ($n = 5$), long plumose setae on dorsal, ventral, and distal margins. Segment IV almost cylindrical, overreaching segment III by one-third of

its length, with long plumose setae on dorsal and distal margins, and two interrupted rows of short setae on lateral surface, one medial and one ventrally submarginal. Segment III with long plumose setae on ventral margin and short simple setae on dorsal margin. Segment II widening distally, with one long row of short plumose setae on lateral surface; antennal acicle short, triangular, overreaching segment IV proximal margin by one-sixth own length, with long plumose setae on dorsal margin. Segment I rounded proximally, flattened and truncated ventrolaterally, with long plumose setae on margins, short simple setae scattered on dorsal one-eighth of lateral surface; lateral margin unarmed; segment with ventromesial antennal gland pore.

Mandible (fig. 32E) incisor process with two teeth; cutting edge with one tooth. Palp three-segmented, with plumose setae on margins and long, thick, simple setae arising from bend in second segment.

Maxillule (fig. 32F) distal endite proximally narrow, widening to inflated distal end, with thick simple setae on distal margin and plumose setae on dorsal margin. Proximal endite with thick simple setae on distal margin. Endopodal external lobe truncate distally and curled under, with wide proximal projection; internal lobe reduced, with two thick setae at distolateral margin.

Maxilla (fig. 32G) exopod rounded with plumose setae along distal margin. Scaphognathite bluntly angled on posterior lobe with plumose setae.

Maxilliped I (fig. 32H) epipod with plumose setae on margins and on distolateral surface. Endite tapered distally and subequal to first segment of exopod. Exopod with two segments; proximal segment narrow, margins parallel, margins with plumose setae; distal segment spatulate, longer than wide, curved mesially, broadest medially, margins and medial third of lateral surface with long plumose setae. Endopod flattened and elongate, reaching to distal end of proximal exopodal segment, with plumose setae on margins.

Maxilliped II (fig. 32I) dactylus evenly rounded, longer than wide, with thick simple setae distally and thin simple setae in short row on lateral surface. Propodus slightly produced dorsodistally, one-half wider than long, with plumose setae on dorsal margin

and long simple setae on dorsodistal and ventrodistal margins. Carpus not produced dorsodistally, approximately two times longer than wide, with long simple setae on dorsal margin and on dorsodistal and ventrodistal margins. Merus 2.5 times longer than wide, margins parallel but slightly inflated subproximally, with long simple setae on ventral margin and long plumose setae on dorsal margin and scattered on lateral surface. Basis-ischium incompletely fused, with plumose setae on margins. Exopod 1.5 times longer than merus, flagellum with one elongate article.

Maxilliped III (fig. 32J) dactylus elongate and evenly rounded; long plumose setae on margins and in medial transverse row on lateral surface. Propodus with longitudinal median row of plumose setae on lateral surface; submarginal interrupted ventral row of long simple setae; distodorsal tuft of long plumose setae; dorsal and ventral margins with short plumose setae. Carpus strongly produced onto propodus, overreaching nine-tenths of propodal length; lateral surface with medial transverse row of long plumose setae; submarginal ventral row of long plumose setae; long plumose setae on margins. Merus unarmed, weakly inflated distolaterally, depressed and decalcified medially, with long plumose setae on dorsal margin and short plumose setae on ventral margin and scattered on lateral surface. Basis-ischium incompletely fused, without crista dentata. Exopod two-segmented: proximal segment small; distal segment styliform, tapering, approximately three-fifths length of merus, with plumose setae on margins; without flagellum.

Pereopod I (fig. 33A) dactylus curved and tapering; lateral and mesial surfaces smooth; dorsal margin with small rugose area proximally, smooth distally, with long plumose setae; ventral margin with short simple setae. Propodal lateral surface with numerous short, transverse rows of setose rugae; dorsal margin with few small, low ridges; ventral margin distally produced into acute spine; cutting edge lacking teeth, lined with long plumose setae; dorsal margin with short plumose setae, ventral margin with short simple setae; mesial surface with few short transverse rows of setose rugae. Carpus with dor-

sodistal angle subquadrate and surface rugose, with short simple setae, dorsal margin smooth with short plumose setae; lateral surface with few scattered transverse, setose ridges; mesial surface smooth, with transverse row of long plumose setae halfway from dorsal margin and few scattered short plumose setae on surface. Merus unarmed; lateral surface with scattered transverse rows of short plumose setae, dorsal margin with long plumose setae; mesial side with few short rows of long plumose setae; proximal half of mesial surface with decalcified window. Basis-ischium incompletely fused, unarmed. Coxa unarmed.

Pereopod II (fig. 33B) dactylus smooth; with base to heel slightly concave, heel produced and rounded, heel to tip with wide, subacute indent, tip subacute with apical tuft of short simple setae, tip to base broadly convex; lateral surface smooth; mesial surface smooth, ventral margin with long plumose setae, dorsal margin with short simple setae, with patch of long plumose setae at base reaching across median of heel. Propodus with dorsal surface smooth, ventral margin inflated and rounded; distal and ventral margin with long plumose setae; dorsolateral surface as narrow, oblique, flattened shelf, with long plumose setae on ventral margin; short transverse row of long plumose setae on surface; mesial surface with oblique row of long plumose setae, distal and ventral margins with dense row of long plumose setae. Carpus strongly produced dorsodistally, extending three-fourths length of propodus; lateral surface nearly smooth, with irregular, interrupted row of rugae and submarginal elevated ridge ventrally, rugae and ridge with long plumose setae; dorsal margin with short plumose setae, distoventral and ventral margins with long plumose setae; mesial surface smooth, with medial oblique and subdistal rows of long plumose setae, few scattered short plumose setae on surface. Merus lateral surface almost entirely decalcified, with long plumose setae on dorsal and ventral margins; mesial surface nearly smooth, with oblique median ridge, long plumose setae patches dorsal to ridge and in row ventrally, with decalcified area on proximal third of area ventral to ridge. Basis-ischium incompletely fused and unarmed. Coxa unarmed.

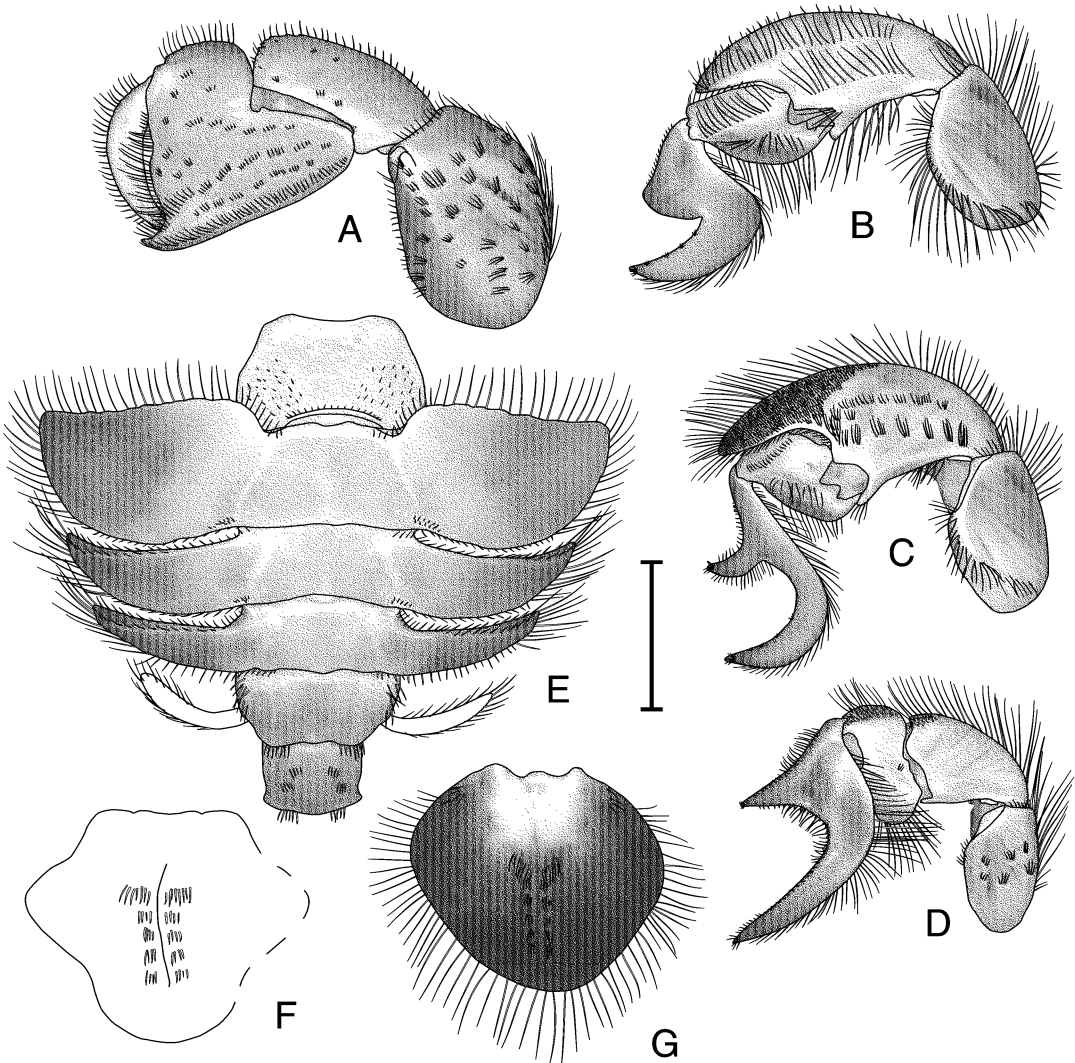


Fig. 33. *Lepidopa mexicana* Efford, 1971: A-E, G, ♀, 7.5 mm cl, USNM 304312; F, ♂, 8.5 mm cl, USNM 62448. **A.** Left pereopod I, lateral view. **B.** Left pereopod II, lateral view. **C.** Left pereopod III, lateral view. **D.** Left pereopod IV, lateral view. **E.** Abdominal somites I-VI, dorsal view. **F.** Telson of ♂, dorsal view. **G.** Telson of ♀, dorsal view. Scale = 1.6 mm (F, G), 2.2 mm (E), and 3.0 mm (A-D).

Pereopod III (fig. 33C) dactylus base to heel broadly indented, heel acute, thin, and produced, heel to tip with broad, angled indent, tip acute, tip to base smoothly convex; lateral surface smooth, with apical tufts of short simple setae on heel and tip, lateral surface proximal to indent with few setose punctae; ventral margin with long plumose setae, dorsal margin with short simple and plumose setae; mesial surface smooth, with

plumose setae proximally at junction with propodus and in row across base of heel. Propodus not inflated dorsoventrally; lateral surface smooth, with simple setae subdorsally, and long plumose setae on ventral margin; dorsolateral surface narrow, oblique, flattened; mesial surface with scattered long setae on and near distoventral margin. Carpus strongly produced dorsodistally and inflated, overreaching distal margin of propodus,

rounded; dorsolateral margin unarmed; lateral surface with mat of short setae on dorsodistal third of segment and two long and one short transverse rows of setae medially; dorsal margin with long plumose setae; mesial surface smooth, with small median decalcified area, long plumose setae on margins and in median oblique row. Merus smooth, lateral surface almost entirely decalcified; dorsal and ventral margins unarmed, dorsodistal and ventral margins with long plumose setae; mesial surface smooth, with patch of long plumose setae on proximomesial margin. Basis-ischium incompletely fused and unarmed. Coxa unarmed. Female pereopod III with large mesioproximal gonopore (not opposing other gonopore); male with slightly smaller pore.

Pereopod IV (fig. 33D) dactylus with base to heel concave, heel acute, with apical tuft of short simple setae, heel to tip broadly rounded and concave, tip acute with apical tuft of short simple setae, tip to base convex; lateral surface smooth, ventral margin with long plumose setae, dorsal margin with short simple setae; mesial surface with dorsal decalcified region, demarcated ventrally by longitudinal elevated ridge across heel, with row of short plumose setae. Propodus expanded dorsally and ventrally; ventral expansion reaching ventral margin of dactylus, margins with long plumose setae; dorsal expansion with row of long plumose setae medially and mat of short setae; lateral and mesial surfaces smooth. Carpus slightly produced dorsodistally; lateral and mesial surfaces smooth; dorsomedial half of lateral and mesial surfaces decalcified, with medial patch of long plumose setae subdistally and long plumose setae on distoventral margin of mesial surface; dorsal margin with small mat of short setae at dorsodistal angle; dorsal margin with long plumose setae, ventral margin with short simple setae. Merus lateral surface small median decalcified area, with few short transverse rows of setae, dorsal and distoventral margins with long plumose setae; mesial surface with small decalcified window proximoventrally. Basis-ischium incompletely fused and unarmed. Coxa unarmed.

Abdomen (fig. 33E) with somite I wider than long, widest posteriorly; dorsal surface with anterior margin concave; posterior mar-

gin concave, with elevated submarginal curved row of short setae and broad field of short simple setae anterior to submarginal row; with small faint transverse decalcified window laterad of segment median. Somite II anterior margin irregularly convex, posterior margin irregularly concave; pleura expanded and directed laterally, angled anterolaterally, rounded posterolaterally, anterior margin weakly crenulate, small patch of short simple setae at posteromesial margin; anterior and lateral margins with long plumose setae, posterior margin with short setae. Somite III similar to somite II, narrower and shorter; pleura thinner and shorter than on somite II, directed anterolaterally, with setae as in somite II; anterolateral angle subacute; dorsal surface obliquely flattened anterolaterally, with posterior row of short simple setae. Somite IV similar to somite III; pleura thinner and shorter than on somite III, directed anterolaterally; dorsal surface slightly obliquely flattened anterolaterally, with posterior row of short simple setae; margins with long plumose setae. Somite V wider than somite IV, narrowing posteriorly; anterolateral margins with plumose setae, two lateral rows of setae on posterior margin; pleura decalcified and distinct from somite, shorter than in somite IV, thin, flattened, directed anterolaterally, and covered with plumose setae. Somite VI narrower than somite V; dorsal surface with four short transverse rows of setae laterad of midline anteriorly, posterior margin with two rows of long plumose setae; pleura absent.

Female with long uniramous pleopods on somites II–V; male with small pleopods.

Telson of male (fig. 33F) spatulate, with broadly rounded and produced lateral lobes, proximal third laterally concave, medial third laterally convex, distal third laterally concave, distal tip rounded; medioproximal third heavily calcified, lateral and distal regions decalcified; median longitudinal groove running along calcified region; two parallel distally converging rows of short simple setae in medial third; margins with long simple setae. Telson of female (fig. 33G) similar to male, with less produced lateral expansions, lateral margins almost evenly convex.

DISTRIBUTION: From Sinaloa, Mexico, to

Panama and Colombia (Rios et al., 1990); depth range unknown.

MAXIMUM SIZE: Males: 8.5 mm cl; females: 9.4 mm cl.

TYPE SPECIMENS: USNM 62384 (holotype), USNM 122634 (2 paratypes), LACM-AHF 638 (paratype), ZMUC 2637 (paratype).

TYPE LOCALITY: "Mexico."

REMARKS: Calado (1995) examined only a single specimen labeled as *L. mexicana* (identified by D. Dexter), but which is a misidentified *L. mearnsi*. Calado (1995) saw no specimens of true *L. mexicana* and gave the type locality for this species incorrectly as "Teacapan, Sinoloa [sic], México."

Lepidopa mexicana is the sister species to *L. wollebaeki*, and differs from that species only in minor details of the arrangement of CG4 and CG5. Unfortunately, *L. wollebaeki* is only known from the holotype specimen, and intraspecific variation in that species is therefore unknown. Further Galápagos material may show that *L. wollebaeki* and *L. mexicana* are conspecific. If true, the species would have a range similar to that of *Alburnea galapagensis*, n. sp., which is known from both the Galápagos and the Gulf of California.

Lepidopa wollebaeki Sivertsen, 1934

Figures 34, 35

Lepidopa wollebaeki Sivertsen, 1934: 9, pl. 4, figs. 35–41*. – Efford, 1971: 96–98, figs. 1h, 4n, 8*. – Coêlho and Calado, 1987: table 1. – Calado, 1995: 213–215, pl. 39, fig. q, pl. 40, fig. p, pl. 41, fig. p, pl. 70, figs. a–f*.

Lepidopa wollebaecki [sic]: Gordon, 1938: 188.

Lepidopa wolleboecki [sic]: Garcia Mendes, 1945: 119 (list).

Lepidopa wollebaeki [sic]: Calado, 1987: 119 (list).

Lepidopa wolleboeki [sic]: Hendrickx and Harvey, 1999: 367.

MATERIAL EXAMINED: **Ecuador**: Floreana Island, Galápagos Islands, Aug. 24, 1925, coll. Galápagos Expedition: 1 ♀, 7.2 mm cl, holotype (ZMO F100).

DIAGNOSIS: Carapace wider than long, with lightly setose grooves. Anterior margin with two large spines lateral to ocular sinus. CG5 present; CG8 absent; CG10 absent; posterior submarginal groove reaching posterolateral

margin of posterior concavity. Rostrum present, rounded and armed with ventral acute spine. Distal peduncular segments dorsoventrally flattened, ovate, distal margin smooth. Cornea absent. Antennal segment I unarmed. Dactylus of pereopod II with heel produced and rounded. Dactylus of pereopod III with heel thin, projecting, acute. Dactylus of pereopod IV unknown. Telson of female appearing to be diamond-shaped and elongated, with strong narrow lateral projections.

DESCRIPTION: Carapace (fig. 34A) wider than long. Anterior margin concave on either side of ocular sinus, smooth. Rostrum as rounded projection reaching beyond median peduncular segments and with a submarginal, terminal acute spine. Ocular sinus smoothly concave; unarmed. Frontal region smooth; setal field reduced to narrow band anterior and paralleling CG1, concave medially. CG1 parallel to anterior margin of carapace, sinuous, slightly crenulate, medially concave, medial and lateral elements united. Mesogastric region smooth; CG2 absent; CG3 absent; CG4 with two long oblique lateral elements. Hepatic region smooth, with oblique lateral setose groove and very short, acute spine at median of lateral margin. Epi-branchial region generally triangular, smooth; posterolateral margin with three short rows of setae. Metagastric region smooth; CG5 present as two very short medial elements. CG6 crenulate, with separate oblique, long, lateral fragments and short sinuous median element united with CG7. CG7 straight relative to anterior margin of carapace and united with median fragment of CG6. Cardiac region smooth; CG8–11 absent. Branchial region with few punctae but without short, transverse rows of setae. Posterior margin deeply and irregularly concave medially and more or less straight laterally, with submarginal groove reaching posterolateral margin of posterior concavity. Branchiostegite without anterior submarginal spine; anterior region with anterodorsal transverse groove and granular surface; posterior region membranous, with numerous irregular fragments.

Ocular plate (fig. 34B) covered by carapace; median peduncular segments reduced to small oblong calcified areas anterolateral to ocular plate. Distal peduncular segments irregularly ovate, angled distolaterally, flat-

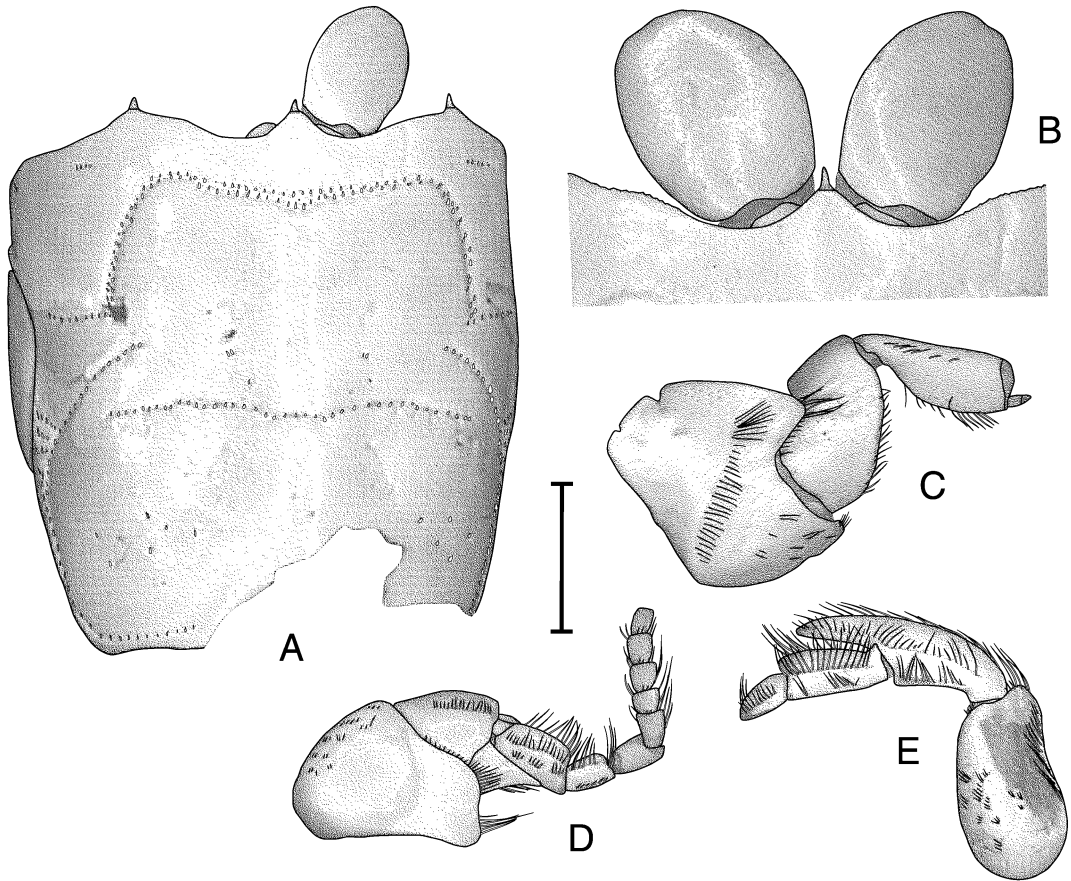


Fig. 34. *Lepidopa wollebaeki* Sivertsen, 1934: A–E, ♀, 7.2 mm cl, ZMO F100, holotype. **A.** Carapace, left branchiostegite, and right ocular peduncle, dorsal view. **B.** Ocular peduncles (reconstructed), dorsal view. **C.** Right antennule, lateral view. **D.** Right antenna, lateral view. **E.** Left maxilliped III, lateral view. Scale = 1.4 mm (B), 1.6 mm (C), 2.2 mm (D, E), and 2.3 mm (A).

tened with convex lateral and mesial margins and slightly indented distal margin, margins smooth; cornea absent; mesial margins separated along entire length.

Antennule (fig. 34C) segment III narrow proximally, expanding distally to two times proximal width; with plumose setae on ventral margin and scattered on dorsolateral surface; dorsal exopodal flagellum with unknown number of articles (76 in Sivertsen, 1934: fig. 37); ventral endopodal flagellum with two articles ($n = 1$), plumose setae on dorsal and ventral margins. Segment II medially inflated in dorsal view, with plumose setae on dorsal and ventral margins. Segment I longer than wide, unarmed; lateral surface dorsomedial third rugose; long plumose setae

on dorsal and ventral margins and in transverse row on mediolateral surface.

Antenna (fig. 34D) with segment V approximately 1.5 times longer than wide, with short plumose setae on dorsal and distal margins; flagellum with seven articles ($n = 1$), long plumose setae on dorsal, ventral, and distal margins. Segment IV almost cylindrical, overreaching segment III by one-third of its length, with long plumose setae on dorsal and distal margins, and two rows of setae on dorsolateral margin. Segment III with long plumose setae on ventral margin. Segment II widening distally, with plumose setae on dorsal margin and in short transverse mediolateral row; antennal acicle short, triangular, overreaching segment IV proximal margin

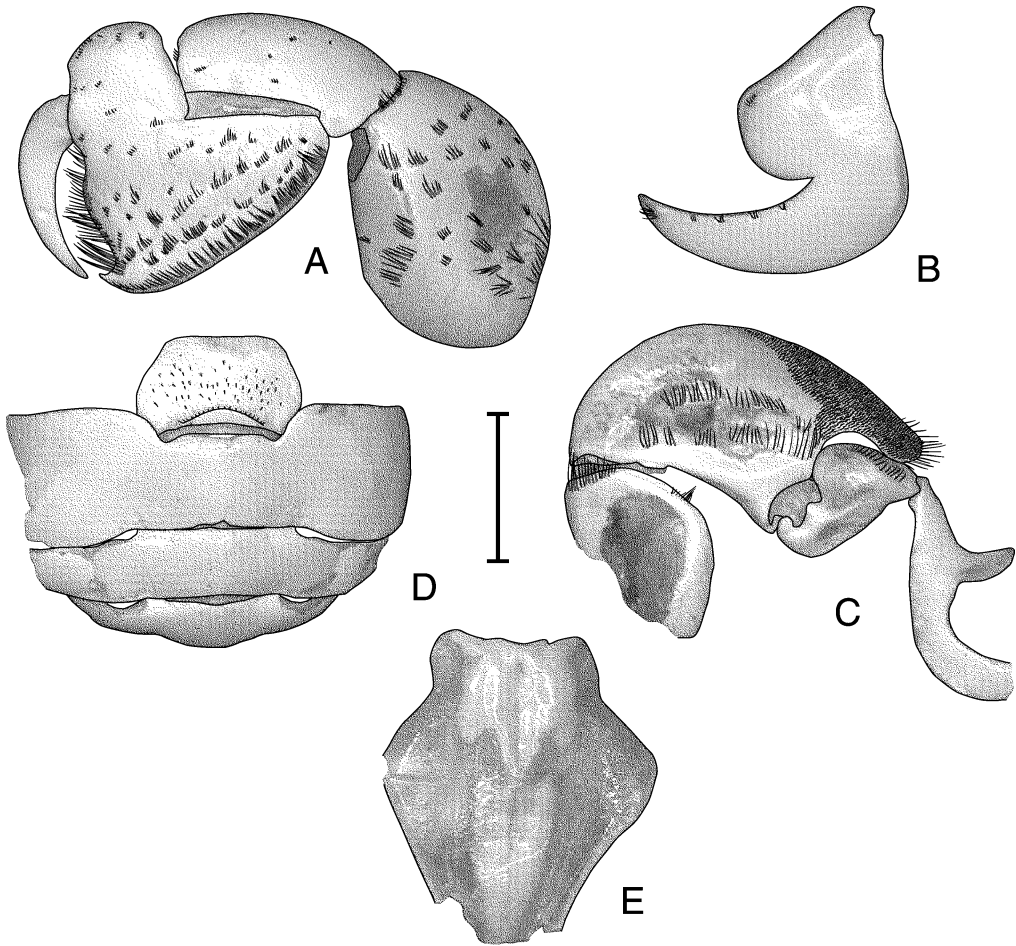


Fig. 35. *Lepidopa wollebaeki* Sivertsen, 1934: A–E, ♀, 7.2 mm cl, ZMO F100, holotype. **A.** Left pereopod I, lateral view. **B.** Left pereopod II dactylus, lateral view. **C.** Right pereopod III, lateral view. **D.** Abdominal somites I–IV, dorsal view. **F.** Telson of ♀, dorsal view. Scale = 1.1 mm (E), 1.6 mm (B), and 2.2 mm (A, C, D).

by one-fourth of its length, with long plumose setae on dorsal margin. Segment I rounded proximally, flattened and truncated ventrolaterally, with long plumose setae on margins; lateral margin unarmed; segment with ventromesial antennal gland pore.

Mandible, maxillule, maxilla, maxilliped I, maxilliped II unknown.

Maxilliped III (fig. 34E) dactylus elongate and evenly rounded; long plumose setae on margins and in transverse row on lateral surface. Propodus with longitudinal median row of long plumose setae on lateral surface; margins with plumose setae. Carpus strongly produced onto propodus, reaching three-

fourths length of propodus; lateral surface with medial transverse row of plumose setae; plumose setae on margins. Merus unarmed, broadly inflated distolaterally, with long plumose setae on distolateral margin and short plumose setae scattered on lateral surface. Basis-ischium unknown. Exopod unknown, but presumed similar to other species in the genus with proximal segment small; distal segment styliform, tapering, without flagellum.

Pereopod I (fig. 35A) dactylus curved and tapering; lateral and mesial surfaces smooth; dorsal margin with small rugose area proximally, smooth distally; ventral margin with

short simple setae. Propodus lateral surface with numerous short, transverse rows of setose rugae; dorsal margin with few small low ridges; ventral margin distally produced into acute spine; cutting edge lacking teeth, lined with long plumose setae; dorsal margin with short plumose setae, ventral margin with short simple setae. Carpus with dorsodistal angle rounded, dorsal margin smooth with short plumose setae; lateral surface with few transverse, setose ridges; mesial surface smooth. Merus unarmed; lateral surface with scattered transverse rows of short plumose setae, margins with long plumose setae. Basis-ischium and coxa unknown.

Pereopod II (fig. 35B) dactylus smooth; with base to heel slightly concave, heel produced and subquadrate, heel to tip with broad, acute indent, tip acute, tip to base broadly convex; lateral surface smooth with tufts of short simple setae at distal ends of heel and tip; mesial surface smooth, ventral margin with long plumose setae, dorsal margin with short simple setae, with patch of long plumose setae at base reaching across median of heel. Remainder of pereopod unknown.

Pereopod III (fig. 35C) dactylus base to heel broadly indented, heel acute, thin, and produced, heel to tip with broad, subquadrate indent, tip acute (from Sivertsen, 1934), tip to base smoothly convex; lateral surface smooth, with tufts of short setae at end of heel and tip, dorsodistal margin with tufts of short setae; ventral margin with long plumose setae, dorsal margin with short simple and plumose setae; mesial surface smooth. Propodus not inflated dorsoventrally; lateral surface smooth, with simple setae subdorsally, and long plumose setae on ventral margin; dorsolateral surface narrow, oblique, flattened; mesial surface with scattered long setae on and near distoventral margin. Carpus strongly produced dorsodistally and inflated, almost reaching distal margin of propodus, rounded; dorsolateral margin unarmed; lateral surface with mat of short setae on dorsodistal third of segment and long transverse row of setae medially and scattered on proximal lateral surface; dorsal margin with long plumose setae; mesial surface smooth, dorsomesial third decalcified. Merus smooth, lateral surface almost entirely decalcified;

dorsal and ventral margins unarmed, with long plumose setae; laterodistal margin with long plumose setae; mesial surface smooth. Basis-ischium and coxa unknown.

Pereopod IV unknown.

Abdomen (fig. 35D) with somite I wider than long, widest posteriorly; dorsal surface with anterior margin straight; posterior margin concave, with elevated submarginal curved row of short setae and broad field of short simple setae anterior to submarginal row; with small faint transverse decalcified window laterad of segment median. Somite II anterior margin convex, posterior margin irregularly concave; pleura expanded and directed laterally, angled anterolaterally, rounded posterolaterally, small patch of short simple setae at posteromesial margin; anterior and lateral margins with long plumose setae, posterior margin with short setae. Somite III similar to somite II, narrower and shorter; pleura thinner and shorter than on somite II, directed laterally, with setae as in somite II; anterolateral angle acute; dorsal surface slightly obliquely flattened anterolaterally. Somite IV similar to somite III; pleura thinner and shorter than on somite III, directed anterolaterally; dorsal surface slightly obliquely flattened anterolaterally; margin with long plumose setae. Somites V and VI unknown.

Female with long uniramous pleopods on somites II–V; male unknown.

Telson of male unknown. Telson of female (fig. 35E) extremely damaged but appearing to be diamond-shaped and elongated, with strong narrow lateral projections; tip unknown.

DISTRIBUTION: Known only from the unique holotype from the Galápagos Islands.

MAXIMUM SIZE: Males: unknown; females: 7.2 mm cl.

TYPE SPECIMEN: ZMO F100 (holotype).

TYPE LOCALITY: Floreana Island, Galápagos Islands, Ecuador.

REMARKS: Although it may seem surprising that this species has not been collected subsequent to the holotype, it should be noted that *Albunea galapagensis*, n. sp. was unknown from the Galápagos prior to this work. This indicates that, in spite of the recognized biogeographic importance of the Galápagos Islands, and the intensive collecting

that occurs there, many species from these islands are still poorly known.

Due to the poor condition of the dry holotype, only limited morphological details are known about this species. It is clearly a member of the “*venusta*-group” of species, and it appears to be the sister species to *L. mexicana* Efford. In fact, examination of the intact portions of the holotype shows this species to be almost identical to *L. mexicana* in many respects, such as the shape of the dactyli of pereopods II and III, and the shape of the telson. It differs from *L. mexicana* in the arrangement of CG4 and CG5. Further Galápagos material may show that this taxon and *L. mexicana* are conspecific. The range of this species would then be comparable with the only other Galápagos albuneid known, *Albunea galapagensis*, n. sp., which occurs both in the Galápagos and in the Gulf of California.

Lepidopa esposa Efford, 1971

Figures 36, 37

Lepidopa esposa Efford, 1971: 94–96, figs. 1o, 2i, 3q, 4c, 7g. – Haig, 1980: 290, fig. 19.7*. – Coelho and Calado, 1987: 42–43, table 1. – Hendrickx, 1992: 7 (list). – Calado, 1995: 165–166, pl. 39, fig. g, pl. 41, fig. f, pl. 52, figs. a–d. – Hendrickx and Harvey, 1999: 367 (list).

MATERIAL EXAMINED: **Mexico:** **Sonora:** Cholla Bay, Sept. 7, 1975, coll. J. R. Hendrickson: 2 ♂, 4.5–4.9 mm cl (LACM-AHF 75–108–1); Norse Beach near Cholla Bay, Nov. 13, 1975, coll. E. Snyder: 1 ♀, 10.0 mm cl (LACM-AHF 16801); **Baja California Sur:** Bahia La Paz, gulf side, 1905, coll. Digue: 1 ♂, 8.5 mm cl, holotype (MNHN-Hi 82).

DIAGNOSIS: Carapace wider than long, with lightly setose grooves. Anterior margin with two large spines lateral to ocular sinus. CG5 absent; CG8 present; CG10 absent; posterior submarginal groove reaching to lateral margin of posterior concavity. Rostrum present, rounded and armed with ventral acute spine. Distal peduncular segments dorsoventrally flattened, ovate, distal margin smooth. Cornea absent, but pigmented notch present. Antennal segment I unarmed. Dactylus of pereopod II with heel produced and rounded. Dactylus of pereopod III with heel thin, pro-

jecting, acute. Dactylus of pereopod IV with produced acute heel and deep indent. Telson of male spatulate, with length subequal to width, proximal half of lateral margins convex, distal half concave, produced into short rounded tip; weakly calcified except in proximal third.

DESCRIPTION: Carapace (fig. 36A) wider than long. Anterior margin concave and with one large spine on either side of ocular sinus. Rostrum as acute projection reaching beyond median peduncular segments, with submarginal and terminal acute spine. Ocular sinus smoothly concave to convex laterally; unarmed. Frontal region smooth; setal field reduced to narrow band anterior to CG1, broadest and concave in median. CG1 parallel to anterior margin of carapace, sinuous, slightly crenulate, with medial fragment and lateral elements united. Mesogastric region smooth; CG2 absent; CG3 absent; CG4 with eight very short submedial fragments scattered at mesial end of lateral long oblique elements. Hepatic region smooth, with setose groove and short, blunt spine at midpoint of lateral margin (holotype illustrated is damaged on right side). Epibranchial region generally triangular, smooth; posterolateral margin with three short rows of setae. Metagastric region smooth; CG5 absent. CG6 crenulate, with oblique long, lateral fragments and three very short elements scattered slightly posteriorly to mesial end of lateral fragments. CG7 straight relative to anterior margin of carapace and separate from CG6, short gap at median. Cardiac region smooth; CG8 with four very short elements parallel to CG7 in median of cardiac region. CG9 absent. CG10 absent. CG11 absent. Branchial region with few setose punctae. Posterior margin deeply convex medially and straight laterally, with submarginal groove reaching to lateral margin of posterior concavity. Branchiostegite without short anterior submarginal spine; anterior region with anterodorsal groove and granular surface; with many short setae; posterior region membranous with numerous irregular fragments and sparsely covered with long plumose setae.

Ocular plate (fig. 36B) covered by carapace; median peduncular segments reduced to small rounded calcified area anterolateral to ocular plate. Distal peduncular segments

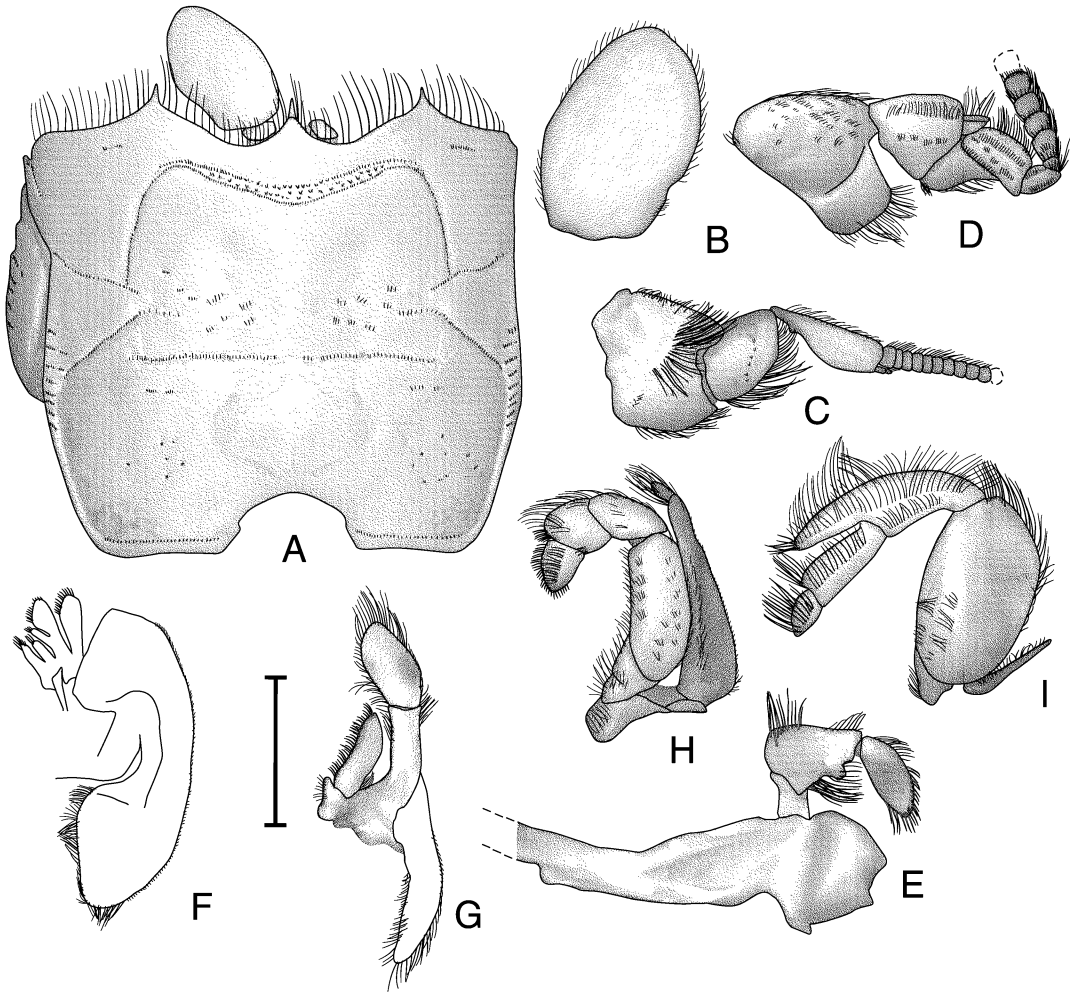


Fig. 36. *Lepidopa esposa* Efford, 1971: A–I, ♂, 8.5 mm cl, MNHN-Hi 82, holotype. **A.** Carapace, left branchiostegite, and left ocular peduncle, dorsal view. **B.** Right ocular peduncle, dorsal view. **C.** Right antennule, lateral view. **D.** Right antenna, lateral view. **E.** Left mandible, mesial view. **F.** Left maxilla, lateral view. **G.** Left maxilliped I, lateral view. **H.** Left maxilliped II, lateral view. **I.** Left maxilliped III, lateral view. Scale = 1.1 mm (H), 1.6 mm (E), 2.1 mm (B), and 3.3 mm (A, C, D, F, G, I).

elongate, smoothly rounded and flattened with convex lateral margins; notch present on lateral margin one-third from proximal margin; mesial margins separated along entire length; mesial and lateral margins with sparse row of short plumose setae.

Antennule (fig. 36C) with segment III with narrow proximally, expanding distally to twice proximal width; with plumose setae on dorsal margin; dorsal exopodal flagellum with 12+ articles (12 in only extant, broken

antennule of holotype), long plumose setae on dorsal margin; ventral endopodal flagellum short with two articles and plumose setae on dorsal margin. Segment II medially inflated in dorsal view, with plumose setae on ventral margin. Segment I wider than long, unarmed; lateral surface dorsodistal third rugose, with long plumose setae; long plumose setae on dorsal and ventral margins.

Antenna (fig. 36D) with segment V approximately as long as wide, with short plu-

mose setae on dorsal and ventral margins; flagellum with seven or more articles (holotype with five on one broken antenna, seven on other), long plumose setae on dorsal, ventral, and distal margins. Segment IV almost cylindrical, overreaching segment III by one-half of its length, with long plumose setae on dorsal, ventral, and distal margins and row of setae on dorsolateral margin. Segment III with long plumose setae on ventral margin. Segment II widening distally, with plumose setae on margins; antennal acicle short, triangular, overreaching segment IV proximal margin by one-fourth of its length, with long plumose setae on dorsal margin. Segment I rounded proximally, flattened and truncate ventrolaterally, with long plumose setae on margins; lateral surface without spine; segment with ventromesial antennal gland pore.

Mandible (fig. 36E) incisor process with one tooth; cutting edge with one tooth. Palp three-segmented, with plumose setae on margins and long, thick, simple setae arising from bend in second segment.

Maxillule unknown.

Maxilla (fig. 36F) exopod rounded, with plumose setae along distal margin. Scaphognathite bluntly angled on posterior lobe, with plumose setae.

Maxilliped I (fig. 36G) epipod with plumose setae on distal margin and on distolateral surface. Endite tapered distally and subequal to first segment of exopod. Exopod with two segments; proximal segment narrow, margins parallel, margins with plumose setae; distal segment spatulate, approximately as long as wide, broadest medially, margins with long plumose setae. Endopod flattened and elongate, reaching to distal end of proximal exopodal segment, with plumose setae on margins.

Maxilliped II (fig. 36H) dactylus evenly rounded, length equal to width, with thick simple setae distally. Propodus 1.5 times wider than long, with plumose setae on dorsal margin and long simple setae on distal margin. Carpus not strongly produced dorsodistally, approximately two times longer than wide, with long simple setae on dorsal margin. Merus more than two times longer than wide, margins parallel but slightly inflated basally, with simple setae on ventrolateral margin and plumose setae on dorso-

lateral margin. Basis-ischium incompletely fused, with plumose setae on margins. Exopod one-third longer than merus, flagellum with one short article.

Maxilliped III (fig. 36I) dactylus evenly rounded, with long plumose setae on margins and lateral surface. Propodus with longitudinal median row of plumose setae on lateral surface; margins with plumose setae. Carpus strongly produced onto propodus, overreaching propodus by three-fourths of its length; lateral surface with row of plumose setae ventromedially, plumose setae on margins. Merus unarmed, broadly inflated medially, with plumose setae on margins. Basis-ischium incompletely fused, without crista dentata. Exopod two-segmented; proximal segment small; distal segment styliiform, tapering, approximately one-third length of merus, with plumose setae on margins; without flagellum.

Pereopod I (fig. 37A) dactylus curved and tapering; lateral and mesial surfaces smooth; dorsal margin with long plumose and short simple setae; ventral margin with short simple setae. Propodal lateral surface with numerous short, transverse rows of setose rugae; dorsal margin with few small, low spines; ventral margin distally produced into acute spine; cutting edge lacking teeth, lined with long plumose setae; dorsal margin with short plumose setae, ventral margin with short simple setae. Carpus with dorsodistal angle rounded, dorsal margin smooth, with short plumose setae; lateral surface with few transverse, setose ridges; mesial surface smooth, with few scattered rows of long plumose setae, margins with short plumose setae. Merus unarmed; lateral surface with scattered transverse rows of long plumose setae, margins with long plumose setae; mesial surface with few short rows of setae; proximal third of mesial surface with decalcified window. Basis-ischium incompletely fused, unarmed. Coxa with small posteromesial tubercle.

Pereopod II (fig. 37B) dactylus smooth; with base to heel almost straight, heel smoothly rounded, heel to tip with narrow, acute indent, tip acute, tip to base broadly convex; lateral surface smooth, with one or two small tufts of short setae proximally, several widely spaced, submarginal tufts of

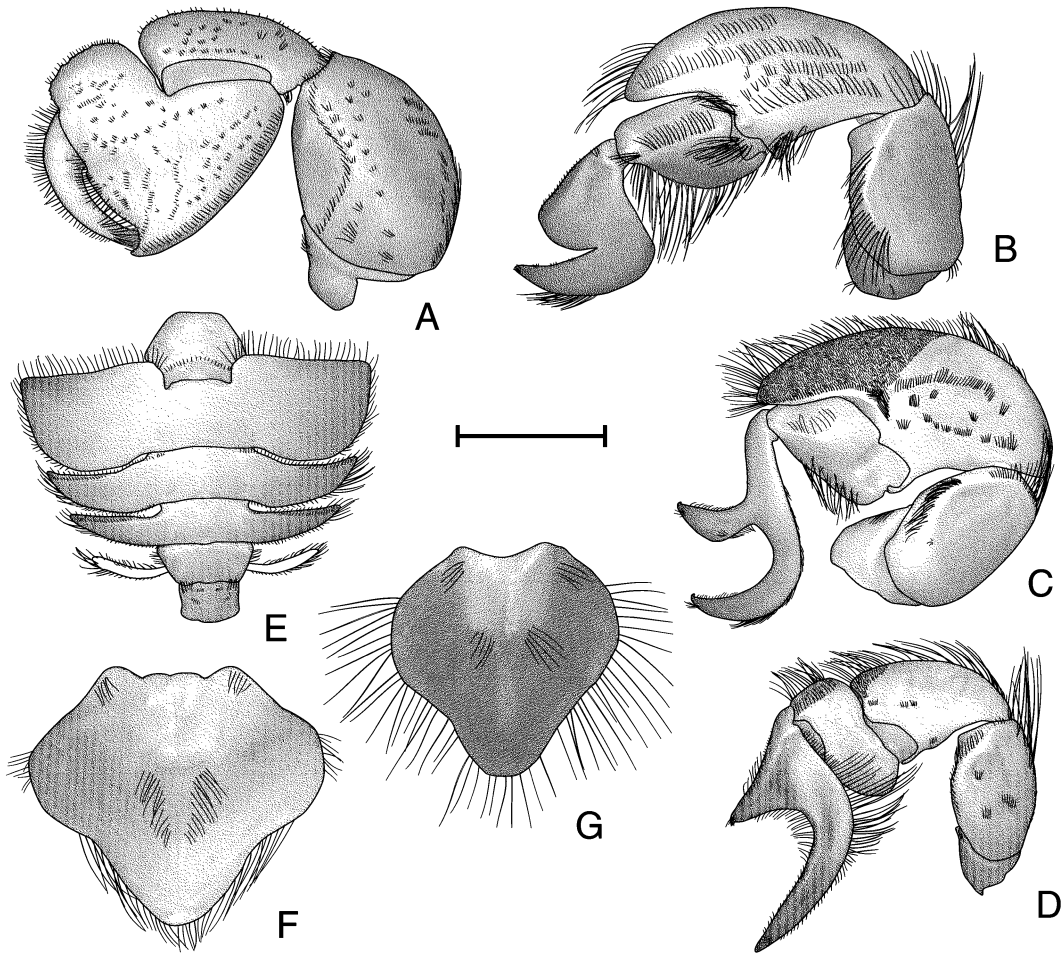


Fig. 37. *Lepidopa esposa* Efford, 1971: A–F, ♂, 8.5 mm cl, MNHN-Hi 82, holotype; G, ♀, 10.0 mm, LACM 168–01. A. Left pereopod I, lateral view. B. Left pereopod II, lateral view. C. Left pereopod III, lateral view. D. Left pereopod IV, lateral view. E. Abdominal somites I–VI, dorsal view. F. Telson of ♂, dorsal view. G. Telson of ♀, dorsal view. Scale = 1.6 mm (F), 2.2 mm (G), 3.3 mm (A–D), and 4.4 mm (E).

short setae dorsodistally; mesial surface smooth, ventral margin with long plumose setae, dorsal margin with short simple setae, with patch of long plumose setae at base. Propodus with dorsal surface smooth, ventral margin inflated and rounded; distal and ventral margins with long plumose setae; dorsolateral surface as narrow, oblique, flattened shelf, with long plumose setae on ventral margin; mesial surface with ventral row of setae. Carpus strongly produced dorsodistally; lateral surface nearly smooth, with irregular, interrupted row of rugae and submarginal elevated ridge ventrally, rugae and

ridge with long plumose setae; distal margins with long plumose setae; mesial surface smooth, with long plumose setae in scattered patches in line subdorsally and on margins. Merus lateral surface almost entirely decalcified, with few scattered setae on surface and margins; mesial surface nearly smooth, with oblique median ridge, long plumose setae patches dorsal to ridge and in row ventrally, with decalcified area on proximal half of area dorsal to ridge. Basis-ischium incompletely fused and unarmed. Coxa with small mesioproximal tubercle.

Pereopod III (fig. 37C) dactylus with base

to heel broadly indented, heel acute and produced, inflated medially, heel to tip with broad, evenly rounded indent, tip acute, tip to base smoothly convex; lateral surface smooth, with tufts of short setae at end of heel and tip and at inflated median of heel, dorsodistal margin with tufts of short setae; ventromesial margin with long plumose setae, dorsal margin with short simple and plumose setae; mesial surface smooth with plumose setae proximally at junction with propodus. Propodus not inflated dorsoventrally; lateral surface smooth, with simple setae on dorsal margins, and long plumose setae on ventral margin; dorsolateral surface narrow, oblique, flattened; mesial surface with scattered long setae on and near distal margin. Carpus strongly produced dorsodistally and inflated, reaching distal margin of propodus, pointed but not acute; dorsolateral margin unarmed; lateral surface with mat of short setae on distal third of segment and two longer rows of setae ventrally; mesial surface smooth, with long plumose setae on margins and in median transverse row. Merus smooth, lateral surface almost entirely decalcified; dorsal and ventral margins unarmed, with long plumose setae; laterodistal margin with long plumose setae; mesial surface smooth, with small decalcified window at junction with basis-ischium. Basis-ischium incompletely fused and unarmed. Coxa with small mesioproximal tubercle. Female pereopod III unknown; male with small pore.

Pereopod IV (fig. 37D) dactylus with base to heel slightly concave, heel acute, heel to tip broadly rounded and concave, tip acute, tip to base convex; lateral surface smooth, ventral margin with long plumose setae, dorsal margin with short simple setae; mesial surface with dorsal decalcified region, demarcated ventrally by longitudinal elevated ridge across heel with row of short setae. Propodus expanded dorsally and ventrally; ventral expansion not exceeding ventral margin of dactylus, margin with long plumose setae; dorsal expansion with row of long plumose setae medially; lateral and mesial surfaces smooth. Carpus not produced dorsodistally; lateral and mesial surfaces smooth; lateral surface with distal two-thirds decalcified; dorsal margin with small mat of short setae at dorsodistal angle, short simple and

long plumose setae on margin; ventral margin with short simple setae. Merus with lateral surface with scattered short transverse rows of setae, dorsal and ventrodorsal margins with long plumose setae; mesial surface with large decalcified window proximoven- trally. Basis-ischium incompletely fused and unarmed. Coxa unarmed.

Abdomen (fig. 37E) with somite I approximately as long as wide, widest posteriorly; dorsal surface with anterior margin straight; posterior margin straight, with elevated submarginal row of short setae; with small transverse decalcified windows laterad of segment median. Somite II dorsal surface with submarginal transverse ridge anteriorly; pleura expanded and directed laterally; dorsolateral margin angled, posterolateral margin rounded, anterior and lateral margins with long plumose setae, posterior margin with short setae. Somite III similar to somite II, but narrower, shorter, and lacking anterior submarginal ridge; small tuft of short thick setae on posterolateral angle; pleura thinner and shorter than on somite II, directed anterolaterally, with setae as in somite II, but reaching onto anterior margin of somite; anterolateral angle acute; dorsal surface obliquely flattened anterolaterally. Somite IV similar to somite III, but thinner and shorter; pleura thinner and shorter than on somite III, directed anterolaterally; dorsal surface obliquely flattened anterolaterally; margin with long plumose setae. Somite V wider than somite IV; lateral margins with plumose setae and two short rows of setae posterolaterally; pleura distinct from somite, shorter than in somite IV, thin, flattened and directed anteriorly. Somite VI narrower than somite V in width; dorsal surface with short transverse rows of setae laterad of midline anteriorly; pleura absent.

Female pleopods unknown; males with reduced pleopods.

Telson of male (fig. 37F) spatulate, with length subequal to width, proximal half of lateral margins convex, distal half concave, produced into short rounded tip; weakly calcified except in proximal third; median longitudinal groove short, not extending to distal end of calcified area, without setae; calcified plate not elevated medially; two oblique rows of setae just distal to calcified

region. Telson of female (fig. 37G) similar to male, with less produced lateral expansions.

DISTRIBUTION: Known only from Sonora and Baja California Sur, Mexico; depth range unknown.

MAXIMUM SIZE: Males: 8.5 mm cl; females: 10.0 mm cl.

TYPE SPECIMEN: MNHN-Hi 82 (holotype).

TYPE LOCALITY: Bahia La Paz, Baja California Sur (Gulf side), Mexico.

REMARKS: Calado (1995) saw no material of this species and redescribed it based on the description and illustrations of Efford (1971).

This species is a member of the “*venusta*-group” and it appears most closely related to *L. chilensis*.

Lepidopa websteri Benedict, 1903

Figures 38, 39

Albunea scutellata: Gibbes, 1850b: 187 (not *Thia scutellata* (Fabricius, 1793)).

Lepidops venusta: Kingsley, 1880: 410 (not *Lepidopa venusta* Stimpson, 1859).

Lepidopa venusta: Ortmann, 1896: 226 (part) (not *Lepidopa venusta* Stimpson, 1859).

Lepidopa scutellata: Ortmann, 1896: 227 (part) (not *Thia scutellata* (Fabricius, 1793)).

Lepidopa websteri Benedict, 1903: 892, fig. 3*. – Hay and Shore, 1918: 415, pl. 30, fig. 12. – Gordon, 1938: 188, figs. 1c, 2c*. – Pearse et al., 1942: 185, fig. 11*. – Garcia Mendes, 1945: 119 (list). – Williams, 1965: 138–139, fig. 114. – Howard, 1968: 256, fig. 4. – Kurata, 1970: 184–187, pls. 55, 56. – Efford, 1971: 91–92, figs. 1b, k, 2j, 3r, 4h, m, 5g, i, 6o*. – Van Engel and Sandifer, 1972: 158. – Young, 1978: 177. – Hill, 1979: 43–51, fig. 2. – Kaestner, 1980: 336. – Williams, 1984: 250–251, fig. 184. – Fox and Ruppert, 1985: 259 (list). – Coêlho and Calado, 1987: 42–43, table 1. – Manning, 1988: 626–627, 629–631, figs. 2, 3*. – Ruppert and Fox, 1988: 250, 404, fig. 227. – Williams et al., 1989: 35. – Calado, 1995: 209–211, pl. 39, fig. p, pl. 40, fig. o, pl. 41, fig. o, pl. 69, figs. a, b*.

Lepidopa “probably *L. websteri*”: Sandifer and Van Engel, 1972: 220–225, figs. 1–3.

Lepidopa cf. *L. websteri*: Sandifer, 1973: 244.

MATERIAL EXAMINED: **USA:** **North Carolina:** *Dare Co.:* On beach, Southern Shores, Outer Banks, Aug. 12, 1997, coll. C. B. Boyko: 1 carapace, 6.4 mm (CBB); *Carteret Co.:* Beaufort, coll. H. G. Webster: 1 ♀, 7.0 mm cl, holotype (USNM 42214 ex Union Col-

lege Collection); Fort Macon, Beaufort, Dec. 1871, coll. H. C. Yarrow: 1 ♀, 12.8 mm cl (YPM 21137); Macon Beach, Beaufort, July 5, 1939, coll. A. S. Pearse: 1 ♂, 7.9 mm cl (USNM 155242); Macon Beach, Beaufort, July 11, 1939, coll. A. S. Pearse: 2 ♂, 7.3–8.4 mm cl (USNM 155243); Macon Beach, Beaufort, 0.5 m, July 12, 1939, coll. A. S. Pearse: 1 ♂, 8.4 mm cl, 1 oviger, 10.9 mm cl (USNM 155244); Macon Beach, Beaufort, 0.5 m, July 14, 1939, coll. A. S. Pearse: 2 ♂, 7.8–8.2 mm cl, 1 oviger, 11.7 mm cl (USNM 155245); ocean beach, Fort Macon, above low tide line, coll. unknown: 1 ♀, 8.8 mm cl (USNM 267790); Fort Macon, Beaufort, June 1940, coll. O. Hartman: 1 ♂, 8.9 mm cl (USNM 267791); bathing beach, Bogue Bank, Beaufort, June 27, 1929, coll. A. Shaftsbury: 1 ♂, 6.2 mm cl, 1 ♀, 8.4 mm cl (USNM 62783); Bogue Banks, near Fort Macon, May 11, 1941, coll. K. D. McDougall: 1 ♂, 4.2 mm cl (USNM 81968); Beaufort, Aug. 1, 1941, coll. A. S. Pearse: 2 ♂, 8.9–9.1 mm cl, 1 unmeasurable juvenile (USNM 81969); Sta. 316, Fort Macon, Outside Beaufort, July 21, 1941, coll. A. S. Pearse: 1 first stage crab, 2.1 mm cl (USNM 81971); Bird Shoal, Beaufort, Aug. 16, 1941, coll. A. S. Pearse: 1 ♀, 8.9 mm cl (USNM 81972); Sta. 267, Bird Shoal, Beaufort, June 18, 1941, coll. A. S. Pearse: 1 ♂, 6.7 mm cl (USNM 81973); Sta. 299, Fort Macon Beach, outside Beaufort, July 10, 1941, coll. A. S. Pearse: 1 ♀, 7.2 mm cl, 1 oviger, 8.9 mm cl (USNM 81975); Sta. 303, Bird Shoal, Beaufort, July 12, 1941, coll. A. S. Pearse: 1 ♂, 7.6 mm cl, 1 unsexable specimen, 9.9 mm cl (USNM 81974), 1 ♂, 8.3 mm cl (RMNH 14630 ex USNM 81974); Sta. 331, outer beach, Cape Lookout, Aug. 9, 1941, coll. A. S. Pearse: 1 ♀, 4.8 mm cl, 8 juveniles, 2.6–4.4 mm cl (USNM 81970); Cape Lookout, Aug. 9, 1941, coll. A. S. Pearse: 1 ♂, 9.2 mm cl (USNM 82146); **South Carolina:** *Charleston Co.:* Edisto Beach at McMillan Cottage, April 14, 1979, coll. M. L. Jones: 1 ♂, 7.0 mm cl, 1 ♀, 5.8 mm cl (USNM 285389); Charleston, coll. unknown: 15 ♂, 5.4–7.8 mm cl, 7 ♀, 6.5–8.3 mm cl (MCZ 867); Sta. 2260, 32°51'N, 79°25'W”, 12 m, May 20, 1965, coll. National Marine Fisheries Service “*Asterias 65-1*”: 1 ♂, 4.7 mm cl (MCZ 19652); **Georgia:** *Liberty Co.:*

North Beach, St. Catherines Island, May 17, 1995, coll. C. B. Boyko: 2 ♂, 6.9–7.8 mm cl (AMNH 17183); Sta. M2, North Beach, St. Catherines Island, Oct. 17, 1997, coll. C. B. Boyko, J. Slapcinsky, and R. Moyle: 2 ♂, 5.1–7.8 mm cl (AMNH 17642); Sta. M2, North Beach, St. Catherines Island, Oct. 12, 1999, coll. C. B. Boyko, A. Carson, M. Spector, and J. Williams: 1 ♂, 8.9 mm cl (AMNH 18085); Sta. M5, sandbar offshore, North Beach, St. Catherines Island, May 16, 1998, coll. C. B. Boyko, J. Slapcinsky, A. and D. Harvey, and J. Williams: 1 ♂, 5.8 mm cl, 1 ♀, 7.6 mm cl (AMNH 17740); Sta. M5, sandbar offshore, North Beach, St. Catherines Island, May 20, 1998, coll. C. B. Boyko, J. Slapcinsky, A. and D. Harvey, and J. Williams: 1 ♂, 6.8 mm cl, 1 unsexable and unmeasurable molt (AMNH 17741); Sta. M5, sandbar offshore, North Beach, St. Catherines Island, May 20, 1998, coll. C. B. Boyko, J. Slapcinsky, A. and D. Harvey, and J. Williams: 1 left maxilliped III (rest eaten by unidentified shorebird) (AMNH 17739); Sta. M5, sandbar offshore, North Beach, St. Catherines Island, Oct. 29–Nov. 4, 1998, coll. C. B. Boyko, A. Harvey, M. Spector, J. and J. Slapcinsky, and J. Williams: 1 ♂, 6.8 mm cl (AMNH 17903); Sta. M5, sandbar offshore, North Beach, St. Catherines Island, Oct. 31, 1998, coll. C. B. Boyko, A. Harvey, M. Spector, J. and J. Slapcinsky, and J. Williams: 2 ♂, 7.0–7.5 mm cl (AMNH 17892); Sta. M5, sandbar offshore, North Beach, St. Catherines Island, Nov. 3, 1998, coll. C. B. Boyko, A. Harvey, M. Spector, J. and J. Slapcinsky, and J. Williams: 1 ♂, 5.5 mm cl, 1 ♀, 6.5 mm cl (AMNH 17896); Sta. M5, sandbar offshore, North Beach, St. Catherines Island, Oct. 13, 1999, coll. C. B. Boyko, A. Carson, M. Spector and J. Williams: 2 ♂, 4.9–8.2 mm cl, 3 ♀, 4.3–5.4 mm cl (AMNH 18084); Sta. M7, South Beach, St. Catherines Island, May 19, 1998, coll. C. B. Boyko, J. Slapcinsky, A. and D. Harvey, and J. Williams: 1 ♂, 5.8 mm cl (AMNH 17738); Sta. M21, between North Beach and Engineer's Point, St. Catherines Island, May 22, 1998, coll. C. B. Boyko, J. Slapcinsky, A. and D. Harvey, and J. Williams: 4 unsexable molts, 7.3–9.9 mm cl (AMNH 17742); Sta. M22, west of Engineer's Point, St. Catherines Island, Oct. 18, 1997, coll. C. B. Boyko, J.

Slapcinsky, and R. Moyle: 1 ♀, 10.5 mm cl (AMNH 17629); *McIntosh Co.*: Sapelo Island, intertidal, Feb. 24, 1963, coll. M. Gray: 2 ♂, 5.3–5.9 mm cl, 2 ♀, 6.1–7.2 mm cl (USNM 150673); off Georgia, 31°45'N, 80°28'W, 16 m, Feb. 24, 1977, coll. Texas Instruments: 1 ♂, 12.6 mm cl (USNM 174091); **Florida**: *Martin Co.*: ca. 1 mi north of St. Lucie Inlet, 27°10'54"N, 80°09'30"W, July 10, 1984, coll. R. B. Manning: 1 ♂, 8.7 mm cl (USNM 221780); ca. 1 mi north of St. Lucie Inlet, 27°10'54"N, 80°09'30"W, July 8, 1984, coll. R. B. Manning: 1 ♀, 4.2 mm cl (USNM 221781); ca. 1 mi north of St. Lucie Inlet, 27°10'54"N, 80°09'30"W, July 13, 1984, coll. R. B. Manning: 1 juvenile, 3.6 mm cl (USNM 221783); ca. 1 mi north of St. Lucie Inlet, 27°10.9'N, 80°09.5'W, July 16, 1984, coll. R. B. Manning: 1 ♂, 7.5 mm cl (HBOM 089:06395); *Pinellas Co.*: Tampa Bay, coll. unknown: 1 ♀, 4.9 mm cl (USNM 49117); **Mississippi**: *Jackson Co.*: south side, Petit Bois Island, Aug. 4, 1953, coll. S. L. Wallace: 1 ♀, 11.9 mm cl (USNM 95752); Horn Island, 1 m, May 29, 1985, coll. C. J. Field: 1 oviger, 10.6 mm cl (USNM 231290); *Harrison Co.*: Ship Island, north side near lighthouse, Aug. 21, 1951, coll. Allredge, Rosso, and Breland: 1 ♂, 6.5 mm cl (USNM 92432); **Louisiana**: *Jefferson Parish*: Grand Terre Island, Oct. 11, 1975, coll. D. Clark: 1 ♂, 6.3 mm cl (USLZ 437); Grande Terre Island, 0.5 mi east of Ft. Livingston, Oct. 11, 1975, coll. S. Williams: 1 ♂, 7.6 mm cl (USLZ 499); Grand Terre Island, Oct. 10, 1975, coll. R. Spinello: 3 ♂, 8.0–8.5 mm cl (USLZ 501); Elmer's Island, Cherniere Caminada, May 30, 1973, coll. D. L. Felder: 1 ♂, 7.8 mm cl, 1 ♀, 8.9 mm cl (USLZ 2017); **Texas**: *Nueces Co.*: Mustang Island, south end, approximately 10 mi south of Port Aransas, Oct. 31, 1975, coll. C. Dugas: 1 ♂, 6.9 mm cl (USLZ 528); Mustang Island, approximately 10 mi south of Port Aransas, Aug. 14, 1979, coll. D. L. Felder: 1 ♀, 7.3 mm cl (USLZ 2037).

No Data: 5 ♂, 5.0–8.3 mm cl, 6 ♀, 6.9–10.2 mm cl (MCZ 13225), 1 ♀, 10.5 mm cl (BMNH 1998.91 ex MCZ 13225).

DIAGNOSIS: Carapace wider than long, with lightly setose grooves. Anterior margin with two large spines lateral to ocular sinus. CG5 absent; CG8 absent; CG10 absent; posterior

submarginal groove reaching slightly beyond posterior margin of posterior concavity. Rostrum present, rounded and armed with ventral acute spine. Distal peduncular segments dorsoventrally flattened, ovate, distal margin smooth; pigmented notch present. Antennal segment I unarmed. Dactylus of pereopod II with heel produced, tapering, and subacute. Dactylus of pereopod III with heel thin, projecting, acute. Dactylus of pereopod IV with produced acute heel and deep indent. Telson of male spatulate, proximal two-thirds laterally convex, distal third laterally concave, lateral expansions rounded, distal tip rounded; medioproximal third heavily calcified, lateral and distal regions decalcified.

DESCRIPTION: Carapace (fig. 38A) wider than long. Anterior margin concave on either side of ocular sinus, smooth. Rostrum as subacute projection reaching beyond median peduncular segments and with a submarginal, terminal acute spine. Ocular sinus smoothly concave; unarmed. Frontal region smooth; setal field reduced to narrow band anterior and paralleling CG1, concave medially. CG1 parallel to anterior margin of carapace, sinuous, slightly crenulate, medially concave, medial and lateral elements united. Mesogastric region smooth; CG2 absent; CG3 absent; CG4 with three or four very short elements and two longer oblique lateral elements. Hepatic region smooth with oblique lateral, setose groove and short, acute spine at median of lateral margin. Epibranchial region generally triangular, smooth; posterolateral margin with four short rows of setae. Metagastric region smooth; CG5 absent. CG6 crenulate, with separate oblique, long lateral fragments and short, sinuous median element united with CG7. CG7 straight relative to anterior margin of carapace and united with median fragment of CG6. Cardiac region smooth; CG8–11 absent. Branchial region with few punctae but without short, transverse rows of setae. Posterior margin deeply and irregularly concave medially and more or less straight laterally, with submarginal groove reaching slightly beyond posterior margin of posterior concavity. Branchiostegite without anterior submarginal spine; anterior region with anterodorsal transverse groove and granular surface; with many long plumose setae; posterior region membranous with numerous, ir-

regular fragments and sparsely covered with long plumose setae.

Ocular plate covered by carapace; median peduncular segments (fig. 38A) reduced to small rounded calcified area anterolateral to ocular plate. Distal peduncular segments (fig. 38B) irregularly ovate, angled distolaterally, flattened with convex lateral and mesial margins, margins smooth; pigmented area at notch on lateral margin one-third from proximal margin present; mesial margins separated along entire length; mesial, lateral and distal margins with long simple setae.

Antennule (fig. 38C) segment III narrow proximally, expanding distally to two times proximal width; with plumose setae on ventral margin; dorsal exopodal flagellum with 150–170 articles ($n = 6$), long plumose setae on dorsal and ventral margins; ventral endopodal flagellum with two articles ($n = 6$), plumose setae on dorsal and ventral margins. Segment II medially inflated in dorsal view, with plumose setae on dorsal and ventral margins and in oblique row on mediiodistal surface. Segment I wider than long, unarmed; dorsomedial third of lateral surface rugose, with long plumose setae; long plumose setae on dorsal and ventral margins.

Antenna (fig. 38D) with segment V approximately 1.5 times longer than wide, with short plumose setae on dorsal and distal margins; flagellum with eight articles ($n = 6$), long plumose setae on dorsal, ventral, and distal margins. Segment IV almost cylindrical, overreaching segment III by one-third of its length, with long plumose setae on dorsal and distal margins, and row of setae on dorsolateral margin. Segment III with long plumose setae on ventral margin. Segment II widening distally, with plumose setae on dorsal margin and in short transverse mediiodistal row; antennal acicle short, triangular, overreaching segment IV proximal margin by one-fourth of its length, with long plumose setae on dorsal margin. Segment I rounded proximally, flattened and truncated ventrolaterally, with long plumose setae on margins; lateral margin unarmed; segment with ventromesial antennal gland pore.

Mandible (fig. 38E) incisor process with two teeth; cutting edge with one tooth. Palp three-segmented, with plumose setae on mar-

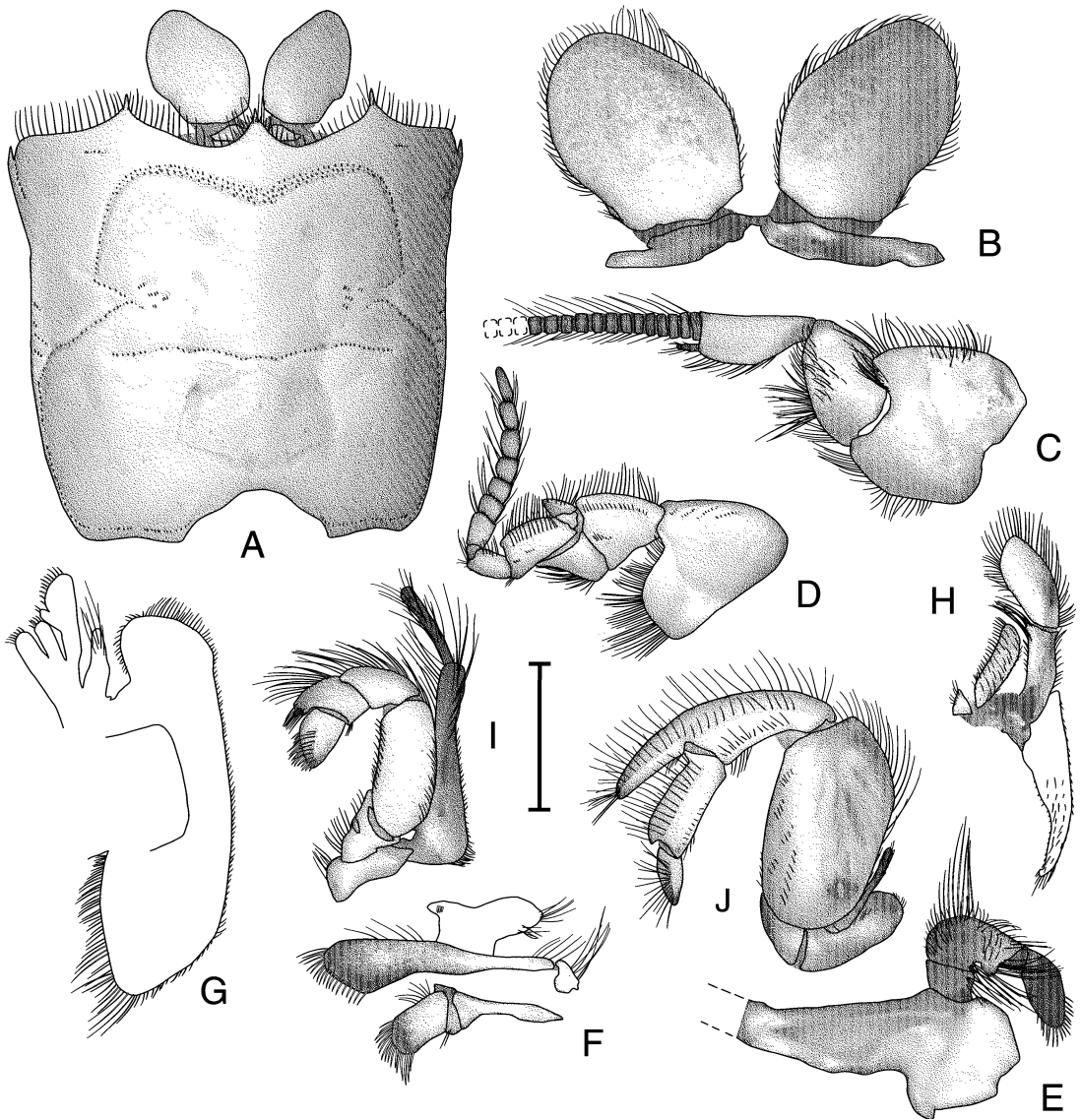


Fig. 38. *Lepidopa websteri* Benedict, 1903: A–J, ♂, 7.1 mm cl, MCZ 13225. **A.** Carapace and ocular peduncles, dorsal view. **B.** Ocular peduncles, dorsal view. **C.** Left antennule, lateral view. **D.** Left antenna, lateral view. **E.** Left mandible, mesial view. **F.** Left maxillule, lateral view. **G.** Left maxilla, lateral view. **H.** Left maxilliped I, lateral view. **I.** Left maxilliped II, lateral view. **J.** Left maxilliped III, lateral view. Scale = 1.4 mm (F), 1.6 mm (B, E), 2.2 mm (C, G, I), 3.0 mm (J), 3.3 mm (D, H), and 4.4 mm (A).

gins and long, thick, simple setae arising from bend in second segment.

Maxillule (fig. 38F) distal endite proximally narrow, widening to inflated distal end, with thick simple setae on distal margin and plumose setae on dorsal margin. Proximal

endite with thick simple setae on distal margin. Endopod external lobe truncate distally and curled under, with wide proximal projection; internal lobe reduced, with three thick setae at distolateral margin.

Maxilla (fig. 38G) exopod rounded with

plumose setae along distal margin. Scaphognathite bluntly angled on posterior lobe with plumose setae.

Maxilliped I (fig. 38H) epipod with plumose setae on margins and on distolateral surface. Endite tapered distally and subequal to first segment of exopod. Exopod with two segments; proximal segment narrow, margins parallel, margins with plumose setae; distal segment spatulate, longer than wide, curved mesially, broadest medially, margins with long plumose setae. Endopod flattened and elongate, reaching to distal end of proximal exopodal segment, with plumose setae on margins.

Maxilliped II (fig. 38I) dactylus evenly rounded, longer than wide, with thick simple setae distally and thin simple setae in short row on lateral surface. Propodus slightly produced dorsodistally, two times wider than long, with plumose setae on dorsal margin and long simple setae on dorsodistal margin. Carpus not strongly produced dorsodistally, approximately two times longer than wide, with long simple setae on dorsal margin. Merus two times longer than wide, margins parallel but slightly inflated submedially, with simple setae on ventrolateral margin and plumose setae on dorsolateral margin. Basis-ischium incompletely fused, with plumose setae on margins. Exopod one-third longer than merus, flagellum with one elongate article.

Maxilliped III (fig. 38J) dactylus elongate and evenly rounded; long plumose setae on margins and lateral surface. Propodus with longitudinal median row of plumose setae on lateral surface; margins with plumose setae. Carpus strongly produced onto propodus, almost reaching distal margin of propodus; lateral surface with medial transverse row of plumose setae; plumose setae on margins. Merus unarmed, broadly inflated distolaterally, with plumose setae on distolateral margin. Basis-ischium incompletely fused, without crista dentata. Exopod two-segmented: proximal segment small; distal segment styliform, tapering, approximately one-third length of merus, with plumose setae on margins; without flagellum.

Pereopod I (fig. 39A) dactylus curved and tapering; lateral and mesial surfaces smooth; dorsal margin with small rugose area proxi-

mally, smooth distally; ventral margin with short simple setae. Propodal lateral surface with numerous short, transverse rows of setose rugae; dorsal margin with few small low ridges; ventral margin distally produced into acute spine; cutting edge lacking teeth, lined with long plumose setae; dorsal margin with short plumose setae, ventral margin with short simple setae. Carpus with dorsodistal angle rounded, dorsal margin smooth, with short plumose setae; lateral surface with few transverse setose ridges; mesial surface smooth, with medial transverse row of long plumose setae. Merus unarmed; lateral surface with scattered transverse rows of short plumose setae, margins with long plumose setae; mesial surface with few short rows of setae; proximal third of mesial surface with decalcified window. Basis-ischium incompletely fused, unarmed. Coxa with small posteromesial tubercle.

Pereopod II (fig. 39B) dactylus smooth; with base to heel concave, heel produced and narrowing to subacute tip, heel to tip with narrow, acute indent, tip acute, tip to base broadly convex; lateral surface smooth; mesial surface smooth, ventral margin with long plumose setae, dorsal margin with short simple setae, with patch of long plumose setae at base reaching across median of heel. Propodus with dorsal surface smooth, ventral margin inflated and rounded; distal and ventral margin with long plumose setae; dorsolateral surface as narrow, oblique, flattened shelf, with long plumose setae on ventral margin; short transverse row of long plumose setae on surface; mesial surface with subdistal row of long plumose setae. Carpus strongly produced dorsodistally, reaching three-fourths length of propodus; lateral surface nearly smooth, with two irregular, interrupted rows of rugae and submarginal elevated ridge ventrally, rugae and ridge with long plumose setae; dorsal margin with long plumose setae; mesial surface smooth, with medial transverse row of long plumose setae. Merus lateral surface almost entirely decalcified, with long plumose setae on margins; mesial surface nearly smooth, with oblique median ridge, long plumose setae patches dorsal to ridge and in row ventrally, with decalcified area on proximal half of area dorsal

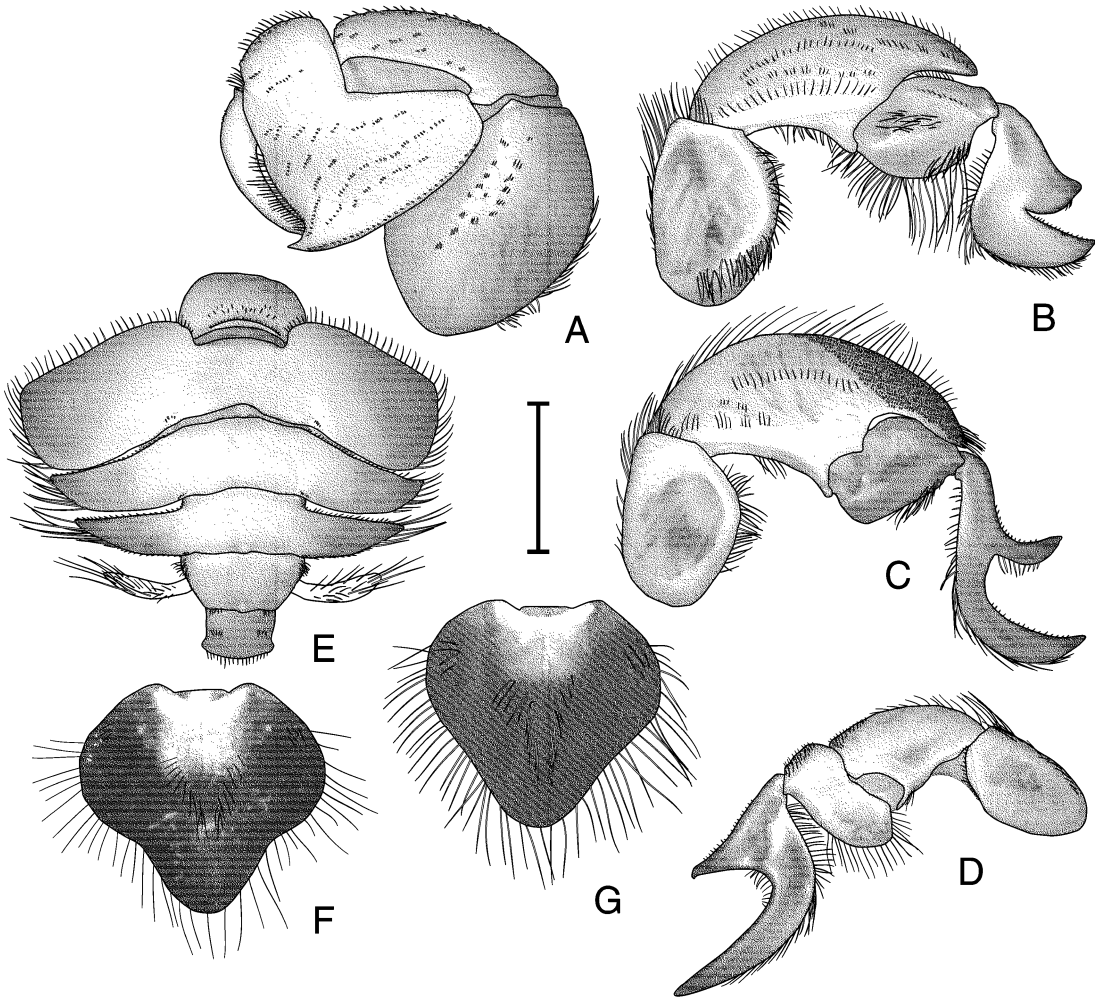


Fig. 39. *Lepidopa websteri* Benedict, 1903: A-F, ♂, 7.1 mm cl, MCZ 13225; G, ♀, 7.9 mm cl, MCZ 13225. A. Left pereopod I, lateral view. B. Right pereopod II, lateral view. C. Right pereopod III, lateral view. D. Left pereopod IV, lateral view. E. Abdominal somites I-VI, dorsal view. F. Telson of ♂, dorsal view. G. Telson of ♀, dorsal view. Scale = 1.6 mm (F), 1.7 mm (G), 3.3 mm (A-D), and 4.4 mm (E).

to ridge. Basis-ischium incompletely fused and unarmed. Coxa unarmed.

Pereopod III (fig. 39C) dactylus base to heel broadly indented, heel acute, thin, and produced, heel to tip with broad, evenly rounded indent, tip acute, tip to base smoothly convex; lateral surface smooth, with tufts of short setae at end of heel and tip, dorsodistal margin with tufts of short setae; ventral margin with long plumose setae, dorsal margin with short simple and plumose setae; mesial surface smooth, with plumose setae

proximally at junction with propodus and in row across base of heel. Propodus not inflated dorsoventrally; lateral surface smooth, with simple setae subdorsally and long plumose setae on ventral margin; dorsolateral surface narrow, oblique, flattened; mesial surface with scattered long setae on and near distoventral margin. Carpus strongly produced dorsodistally and inflated, reaching distal margin of propodus, pointed and almost acute; dorsolateral margin unarmed; lateral surface with mat of short setae on dor-

sodistal third of segment, long transverse row of setae medially and scattered on proximal lateral surface; dorsal margin with long plumose setae; mesial surface smooth, dorsomesial third decalcified, with long plumose setae on margins and in median transverse row ventral to decalcified area. Merus smooth, lateral surface almost entirely decalcified; dorsal and ventral margins unarmed, with long plumose setae; laterodistal margin with long plumose setae; mesial surface smooth. Basis-ischium incompletely fused and unarmed. Coxa unarmed. Female pereopod III with large mesioproximal gonopore (not opposing other gonopore); male with slightly smaller pore.

Pereopod IV (fig. 39D) dactylus with base to heel slightly concave, heel acute, heel to tip broadly rounded and concave, tip acute, tip to base convex; lateral surface smooth, ventral margin with long plumose setae, dorsal margin with short simple setae; mesial surface with dorsal decalcified region, demarcated ventrally by longitudinal elevated ridge across heel, with row of short plumose setae. Propodus expanded dorsally and ventrally; ventral expansion not reaching ventral margin of dactylus, margins with long plumose setae; dorsal expansion with row of long plumose setae medially and mat of short setae; lateral and mesial surfaces smooth. Carpus slightly produced dorsodistally; lateral and mesial surfaces smooth; dorsomedial two-thirds of lateral and mesial surfaces decalcified; dorsal margin with small mat of short setae at dorsodistal angle; ventral margin with short simple setae. Merus with large median decalcified area on lateral surface and few short transverse rows of setae, dorsal and ventrodistal margins with long plumose setae; mesial surface with large decalcified window proximoventrally. Basis-ischium incompletely fused and unarmed. Coxa unarmed.

Abdomen (fig. 39E) with somite I wider than long, widest posteriorly; dorsal surface with anterior margin straight; posterior margin concave, with elevated submarginal curved row of short setae and narrow field of short simple setae anterior to submarginal row; with small, faint, transverse decalcified window laterad of segment median. Somite II anterior margin convex, posterior margin

irregularly concave; pleura expanded and directed posterolaterally, angled anterolaterally, rounded posterolaterally, small patch of short simple setae at posteromesial margin; anterior and lateral margins with long plumose setae, posterior margin with short setae. Somite III similar to somite II, narrower and shorter; pleura thinner and shorter than on somite II, directed posterolaterally proximally and curving forward distally, with setae as in somite II; anterolateral angle acute; dorsal surface slightly obliquely flattened anterolaterally. Somite IV similar to somite III; pleura thinner and shorter than on somite III, directed laterally; dorsal surface slightly obliquely flattened anterolaterally; margin with long plumose setae. Somite V wider than somite IV, narrowing posteriorly; anterolateral margins with plumose setae, two rows of setae on posterior margin; pleura distinct from somite, shorter than in somite IV, thin, flattened, directed anterolaterally, and covered with plumose setae. Somite VI narrower than somite V; dorsal surface with two short transverse rows of setae laterad of midline anteriorly, posterior margin with long plumose setae; pleura absent.

Female with long uniramous pleopods on somites II–V; male with small pleopods.

Telson of male (fig. 39F) spatulate, proximal two-thirds laterally convex, distal third straight, tapering, lateral expansions rounded, distal tip rounded; medioproximal third heavily calcified, lateral and distal regions decalcified; median longitudinal groove running along calcified region; two distally converging rows of short simple setae in medial third; margin with long simple setae. Telson of female (fig. 39G) similar to male, with only slightly less tapering distolateral third.

DISTRIBUTION: From North Carolina south to Texas, USA, in up to 12 m depth. Larvae known from as far north as Virginia.

MAXIMUM SIZE: Males: 12.6 mm cl; females: 12.8 mm cl.

TYPE SPECIMEN: USNM 42214 (holotype).

TYPE LOCALITY: Fort Macon, North Carolina, USA.

REMARKS: The holotype was originally deposited in the collections of Union University in New York (Benedict, 1903) and was later transferred to USNM.

The U-shaped burrowing pattern of this

species was discussed by Howard (1968), who correctly suggested that this species was, at least in part, a detritus feeder. Hill (1979) indicated that this species was filter-feeding during the day and deposit-feeding at night, but he gave no data to support this. Hill's (1979) supposed observations of filter-feeding at night were likely observations of water circulation.

This species is an excellent example of the relative scarcity of albuneids. As of 1918, only two specimens (one being the holotype) were known. Hay and Shore (1918) noted "a vast amount of digging close to shore has failed to produce any living specimen, nor has dredging at distances from the shore varying from 200 yards to 20 miles". This species is most common exactly at the edge of the low tide line in areas of low wave action (Boyko, personal obs.), where it is assured of minimal turbulence and maximum coverage by water during the tidal cycle, but appears never to occur in high densities in any location along this zone.

Ovigerous females are known from North Carolina in July (Williams, 1984). Larvae of this species have been recorded off Virginia, as far as 36° north (Sandifer and Van Engel, 1972), and have been found in the North Carolina and Virginia plankton during July and August (Williams, 1984). Zoal stages I–III were recorded from the plankton off Virginia by Sandifer and Van Engel (1972). Kurata (1970) reported that this species had five or six zoal stages, and he described stage I from larvae obtained from an ovigerous female and stages II, IV, and "6" from the Georgia plankton. However, as pointed out by Stuck and Truesdale (1986), it is more likely that Kurata (1970: pl. 56, fig. e) had four sequential zoal stages, and that stage IV molted into the so-called megalopa. Kurata's "megalopa" was a curious hybrid of a zoal anterior half and a megalopal posterior half. Kurata (1970) was apparently unaware of the aberrant nature of this specimen and made no comment on its unusual appearance. This illustrates the difficulty of extrapolating "normal" larval development from a single specimen (see also Gore and Van Dover, 1981).

The color of *L. websteri* is white, iridescent, with pink tinting on the anterior portion

of carapace and blue along carapace grooves and branchiostegite and distal segments of pereopod V, abdominal somites pinkish, with blue-green margins (Boyko, personal obs., modified from Williams, 1984).

This species is a member of the "venusta-group" and is closest to *L. venusta* and *L. dexterae*.

Lepidopa venusta Stimpson, 1859

Figures 40, 41

- Lepidopa venusta* Stimpson, 1858: 230 (nomen nudum). – Stimpson, 1859: 79. – Ortmann, 1896: 226 (part). – Garcia Mendes, 1945: 119 (list). – Holthuis, 1962: 125–128. – ICZN, 1964: 28–29. – Gomes, 1965: 97–102, figs. 1–9*. – Castro, 1967: 2*. – Efford, 1971: 87–89 (part)*. – Coêlho and Ramos, 1972: 176 (list). – Rodriguez, 1980: 237–238, fig. 53. – Calado, 1987: 143–149, pl. 20*. – Coêlho and Calado, 1987: 43, table 1. – Melville and Smith, 1987: 307. – Calado et al., 1990: 749–750, fig. 3b*. – Rosini et al., 1994: 103–106. – Calado, 1995: 203–206, pl. 39, fig. o, pl. 40, fig. n, pl. 41, fig. n, pl. 67, figs. a–c, pl. 68, figs. a–e*. – Calado, 1998: 408. – Nucci et al., 2001: 479.
- Lepidops venusta*: Miers, 1878: 332–333 (unjustified emendation).
- Lepidopa* sp. Gordon, 1938: 188, fig. 1a*.
not *Lepidops venusta*: Kingsley, 1880: 410 (= *Lepidopa websteri* Benedict, 1903).
- not *Lepidopa venusta*: Ortmann, 1896: 226 (part) (= *Lepidopa websteri* Benedict, 1903).
- not *Lepidopa venusta*: Boone, 1930: 61–63, pl. 16, figs. a–c (= *Lepidopa benedicti* Schmitt, 1935).
- not *Lepidopa venusta*: Benedict, 1903: 892, fig. 2*. – Schmitt, 1935: 210, fig. 70*. – Gordon, 1938: 188, fig. 2b*. – Efford, 1971: 87–89 (part), figs. 3p, 4l, t, 5c, k, 6h, 7b*. – Manning, 1988: 626–627, 630–631, fig. 4* (= *Lepidopa luciae*, n. sp.).

MATERIAL EXAMINED: U.S. Virgin Islands: St. Thomas, coll. A. H. Riise: 1 ♀, 10.6 mm cl, neotype (ZMUC 8557).

Panama: La Venta, March 11, 1937, coll. S. F. Hildebrand: 1 ♂, 11.1 mm cl (USNM 304309).

Brazil: Ilha Do Pai, Rio de Janeiro, May 1, 1962, coll. B. Tursch: 1 ♂, 7.4 mm cl (MNRJ 1554); Praia De Baraquecaba, Rio de Janeiro, Nov. 10, 1966, coll. A. S. F. Ditadi: 1 ♀, 5.1 mm cl (MNRJ 3857); Praia de Domingo, Dominques, Ubatuba, São Paulo,

Aug. 27, 1958, coll. F. C. Müller: 1 ♂, 7.9 mm cl, 1 ♀, 8.4 mm cl (MNRJ 1553).

DIAGNOSIS: Carapace wider than long, with lightly setose grooves. Anterior margin with two large spines lateral to ocular sinus. CG5 absent; CG8 present as punctae; CG10 present as punctae; posterior submarginal groove reaching to posterior margin of posterior concavity. Rostrum present, rounded and armed with ventral acute spine. Distal peduncular segments dorsoventrally flattened, ovate, distal margin smooth. Cornea absent. Antennal segment I unarmed. Dactylus of pereopod II with heel produced, tapering, and subacute. Dactylus of pereopod III with heel thin, projecting, acute. Dactylus of pereopod IV with produced acute heel and deep indent. Telson of male spatulate, proximal two-thirds laterally convex, distal third laterally concave with lateral expansions rounded, distal tip rounded; medioproximal third heavily calcified, lateral and distal regions decalcified.

DESCRIPTION: Carapace (fig. 40A) wider than long. Anterior margin straight to slightly convex on either side of ocular sinus, smooth. Rostrum as rounded projection reaching beyond median peduncular segments and with a submarginal, terminal acute spine. Ocular sinus smoothly concave; unarmed. Frontal region smooth; setal field reduced to narrow band anterior and paralleling CG1, concave medially. CG1 parallel to anterior margin of carapace, sinuous, slightly crenulate, medially concave, medial and lateral elements united. Mesogastric region smooth; CG2 absent; CG3 absent; CG4 with numerous (ca. 12–20) anteriorly and posteriorly displaced very short elements and two short, broken, oblique lateral elements connected to posterior margins of CG1 lateral elements. Hepatic region smooth with oblique lateral setose groove and very short, thin, acute spine at median of lateral margin. Epibranchial region roughly triangular, smooth; posterolateral margin with four short rows of setae. Metagastric region smooth; CG5 absent. CG6 crenulate, with separate oblique curved long lateral fragments and short, nearly straight, median element united with CG7. CG7 nearly straight relative to anterior margin of carapace and united with median fragment of CG6. Cardiac region

smooth; CG8 present as four minute setose punctae. CG9 present as two minute setose punctae. CG10 present as few minute setose punctae in oblique rows. CG11 absent. Branchial region with few setose punctae but without short, transverse rows of setae. Posterior margin deeply and smoothly concave medially and more or less straight laterally, with submarginal groove reaching to posterior margin of posterior concavity. Branchiostegite without anterior submarginal spine; anterior region with anterodorsal transverse groove and granular surface; with many long plumose setae; posterior region membranous with numerous irregular fragments and sparsely covered with long plumose setae.

Ocular plate (fig. 40B) small, rounded; median peduncular segments laterally elongate, oblong, not covered by carapace, anterolaterally ventral to ocular plate. Distal peduncular segments irregularly ovate, angled distolaterally, flattened with convex lateral and mesial margins, margins smooth; mesial margins separated along entire length; mesial, lateral, and distal margins with long simple setae.

Antennule (fig. 40C) segment III narrow proximally, expanding distally to two times proximal width; with plumose setae on dorsal and ventral margins; dorsal exopodal flagellum with 139–150 articles ($n = 3$) on broken flagella, 250 articles ($n = 1$) on intact flagellum, long plumose setae on dorsal and ventral margins; ventral endopodal flagellum with 2 or 3 articles ($n = 5$), plumose setae on dorsal and ventral margins. Segment II medially inflated in dorsal view, with plumose setae on dorsal and ventral margins and scattered on distoventral third of lateral surface. Segment I width and length subequal, unarmed; lateral surface with submarginal dorsal row of long plumose setae and transverse rows of long plumose setae across segment median; long plumose setae on dorsal and ventral margins.

Antenna (fig. 40D) with segment V approximately one-fifth times longer than wide, with short plumose setae on dorsal margin and in submarginal ventral row, long plumose setae on distoventral margin; flagellum with eight articles ($n = 5$), long plumose setae on dorsal, ventral, and distal margins.