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REVIEW OF THE SUBFAMILY DALDORFIINAE NG & RODRÍGUEZ, 1986 (CRUSTACEA: DECAPODA: BRACHYURA: PARTHENOPIDAE)

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ABSTRACT. **–** The genus *Daldorfia* Rathbun, 1904, is revised with 12 species, two of which are described as new. The Daldorfiinae is rediagnosed and consists of four genera, *Daldorfia*, *Thyrolambrus* Rathbun, 1894, and two new monotypic genera, *Olenorfia*, and *Niobafia*. *Thyrolambrus* is reviewed and contains three species. Two poorly known species, *Parthenopoides cariei* Bouvier, 1914, and *Lambrus* (*Parthenopoides*) *erosus* Miers, 1879, do not belong in *Parthenopoides* Miers, 1879, or *Pseudolambrus* Paulson, 1875, respectively, where they are now classified. The two species are here transferred to *Olenorfia*, new genus, and *Niobafia*, new genus, respectively.

KEY WORDS. **–** Daldrofiinae, revision, taxonomy, new genus, new species, *Daldorfia*, *Thyrolambrus*, *Olenorfia*, *Niobafia*.

INTRODUCTION

The establishment of the family Daldorfiidae by Ng & Rodríguez (1986) had its roots in the dismantling of the Oxyrhyncha by Guinot (1978a). She proposed the recognition of the superfamily Parthenopoidea and recognized four informal groups. Ng & Rodríguez (1986) referred to these four groups as the Daldorfiidae, Parthenopidae sensu stricto, Dairidae and Aethridae, respectively, and in defining them as well, effectively established the Daldorfiidae and Dairidae as available names. Ng & Clark (2000) regarded the Daldorfiidae as a subfamily of Parthenopidae but made few comments. Ng et al. (2001), in their treatment of the Taiwanese brachyuaran fauna, followed Ng & Clark (2000) in using the Daldorfiinae. They also briefly addressed the subfamilial system of the Parthenopidae but again, with little elaboration. Martin & Davis (2002), however, retained Daldorfiidae as a family rather than reducing it to subfamilial level.

As part of a study on the Parthenopidae of the Indo-West Pacific region, it has become clear that while members of the Daldorfiidae have several distinctive features (e.g., interruption pattern of the sternal sutures, male gonopod structure, and the presence of the press button in mature females), their affinities are within the Parthenopidae (see Tan & Ng, 2007 in this supplement). The Daldorfiidae is here regarded as a subfamily of the Parthenopidae and is distinguished from all other subfamilies in the Parthenopidae by the comparatively larger size of antennal article 2 relative to antennular article 1; the comparatively smaller size of the antennal article 3 relative to the antennal article 2; and a unique arrangement of teeth on the upper margins of the meri of the ambulatory legs. A detailed discussion of the phylogenetic position of Daldorfiinae within the Parthenopidae is deferred until a more detailed analysis of the whole family has been completed.

MATERIALS AND METHODS

Terminology used in this study is illustrated in Figs. 1, 2 and 3. Carapace dimensions are given as carapace width (CW) and carapace length (CL), in millimetres, measured between the tips of the lateral teeth, and along the mid-line, respectively. Many species of the genus *Daldorfia* have a bifurcated lateral tooth and the CW is measured at the anterior fork, which is usually the maximum width of the specimen. Description of species generally follows that of Flipse (1930) with the following modifications.

The protrusions on the dorsal surfaces of parthenopids exist in several forms. If the surface of a protrusion is more or less smooth, it is termed a **tubercle**. A tubercle that is covered with numerous smaller round protrusions is described as **granulate**. Some protrusions may be supporting a plate-like structure at the summit, thus resembling a paxilla. This type of tubercle is described as **paxilliform**. A paxilliform tubercle with small spines extending from the edges of the plate-like structure is described as **stellate**.

Almost all parthenopids have a produced frontal region, which is called the rostrum. The rostrum of most parthenopids is well formed and distinctive and is typically triangular. In the Daldorfiinae, the rostrums are usually short, blunt, and sometimes deflexed (*D. investigatoris*). In others, it is lobate (*D. glasselli*), bilobate (*D. calconopia*), or even bifid (*D. triangularis*).

The region behind the rostrum and between the orbital is the **interorbital region**. Sometimes, there is a circular depression on the interorbital region in the Daldorfiinae, and it is referred to here as the **interorbital depression**. The region adjacent to the interorbital region that forms the dorsal periphery of the orbits is the **supraorbital region**. Sutures are sometimes found on the supraorbital region of brachyurans, which Ihle (1918) labeled as the mediodorsal (a) suture (innermost suture that is directly above the eyes) and the laterodorsal (b) suture (lateral to the mediodorsal suture). In the Parthenopidae, only one suture is present and it is not certain to which of Ihle's (1918) sutures it corresponds. Therefore, rather than attempting to use Ihle's terminology, we simply use the term, **supra-orbital suture**. The gastric region is divided into three regions: **protogastric**, **mesogastric** and **metagastric**. In the Daldorfiinae, the protogastric region is usually the largest, and usually more inflated than the **mesogastric region**. The **metagastric region** is usually lower than the mesogastric region in the Daldorfiinae. On the lateral side of the proto- and mesogastric regions is the **hepatic region**. The protogastric and branchial regions are sometimes so inflated as to form a ridge above the hepatic region, termed the **dorsal hepatic ridge**. The **cardiac region** is usually more inflated than the metagastric region. The **intestinal region** is narrow and usually depressed. On the lateral sides of the carapace are the strongly inflated branchial regions, which are divided into three regions: **epibranchial**, **mesobranchial** and **metabranchial**. The epibranchial region is typically the same size as both meso- and metabranchial regions combined and also more strongly inflated. In most species of the Daldorfiinae, the mesobranchial region is only slightly inflated, whereas the metabranchial is usually not inflated or even depressed.

The carapace edge immediately lateral and posterior to the orbits is termed the **exorbital angle**. The **hepatic margin** is considered to be distinct from the epibranchial margin and may bear one tooth or several teeth. Margins traditionally referred to as the anterolateral and posterolateral margins are re-interpreted. The anterolateral margin is usually defined as the carapace edge that is the combination of the hepatic and epibranchial margins (see Ng 1998: 1046). In this study, the hepatic margin is described separately, and the term anterolateral margin cannot be used. Instead, the carapace edge behind the hepatic margin is referred to as the **epibranchial margin**. The posterolateral margin is considered to be separated into three portions: 1) the posterior one-third of the epibranchial margin; 2) the **mesobranchial margin**; 3) the **metabranchial margin**. In the Parthenopidae, the proportional differences in the length of these three regions are important in generic diagnosis. Therefore, the terms anterolateral and posterolateral margins are abandoned and are described as the epibranchial, mesobranchial and metabranchial margins. Near the posterior two-thirds of the epibranchial margin, there is usually an acute angle, which is also the widest transverse width of the carapace. The position and shape of this angle on the epibranchial margin is potentially useful taxonomically and is referred to as the **lateral angle**. The lateral angle usually bears one or more teeth. The margin between the posterior ends of both metabranchial margins is the **posterior margin**, above which a granulated ridge may or may not be present.

The nomenclature of carapace grooves has seldom been emphasized in the taxonomy of the Parthenopidae, but owing to its utility, the following terminology is used. The notch separating the exorbital margin from the hepatic margin is termed the **hepato-orbital notch**. This notch also marks the start of the **hepato-orbital groove**, which separates the gastric (usually the protogastric) region from the hepatic region. The notch separating the hepatic margin from the epibranchial margin is termed the **hepatobranchial notch**. This notch also marks the start of the **hepatobranchial groove**, which separates the hepatic region from the branchial (usually the epibranchial) region. If a dorsal hepatic ridge is present, both the hepato-orbital and the hepatobranchial grooves are usually absent or reduced. The **gastro-orbital groove** is a short groove that separates the supraorbital region from the gastric region. The groove separating the branchial region from the gastric region is termed the **gastrobranchial groove**. The branchial region is separated from the cardiac region by the **cardiobranchial groove**. In the Daldorfiinae, the gastrobranchial and the cardiobranchial grooves are sometimes separated by a thin ridge that connects the median portion of the metabranchial region to the beginning of the cardiac region. This ridge is referred to as the **cardiobranchial ridge**. Note that Flipse (1930) referred to the gastrobranchial and the cardiobranchial grooves combined as the "*sulcus semilunaris*". We do not use this term because it is taxonomically important to distinguish the gastrobranchial from the cardiobranchial grooves.

Appendages are described from front to rear. For the antennule, the first antennular article, referred to as antennular article 1, is the most prominent article and comparisons of its size with the antennal articles are taxonomically important. The antenna consists of four articles and a flagellum. The article bearing the opening of the urinal gland, also known as the green gland, is designated as antennal article 1. The next article, which is also the largest of the antennal articles in the Daldorfiinae, and often called the "basal segment", is referred to here as antennal article 2. Antennal article 3 is

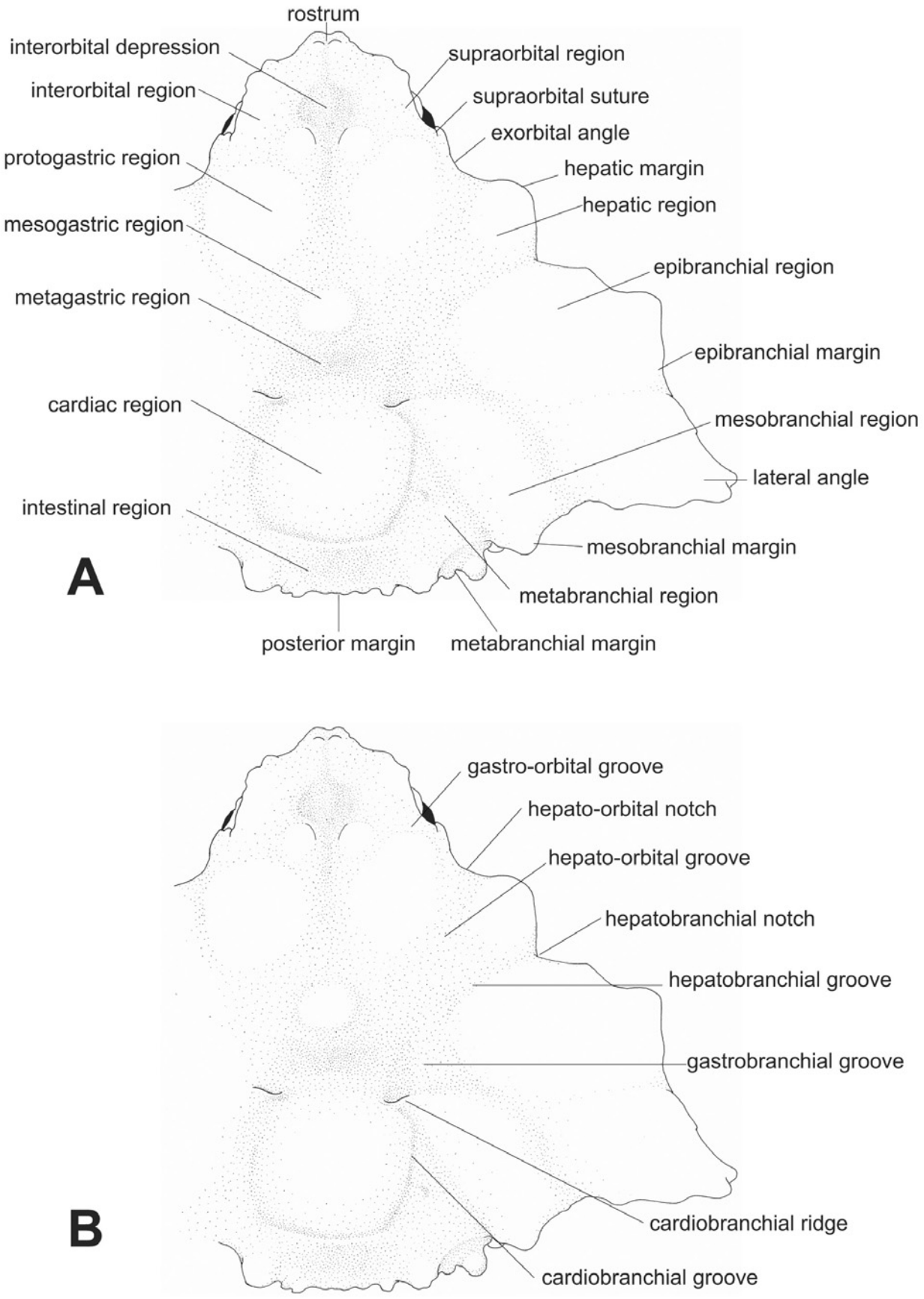

Fig. 1. Terminology used to describe the dorsal surface of the carapace based on *Daldorfia rathbunae* (De Man, 1902): A, carapace regions and margins; B, carapace grooves.

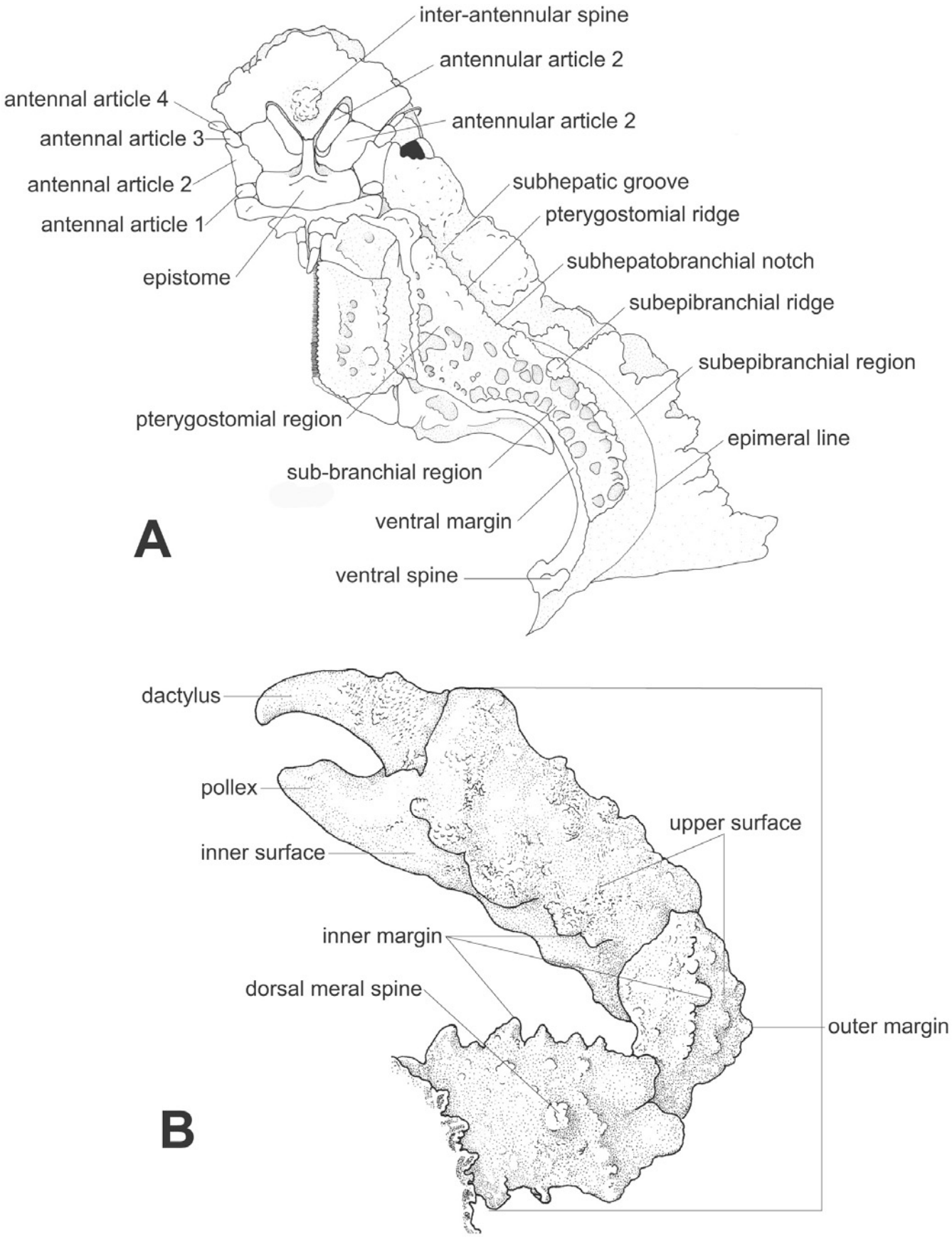

Fig. 2. Terminology used to describe: A, ventral aspects of the carapace based on *Daldorfia horrida* (Linnaeus, 1758); B, cheliped based on *D. bouveri* (A. Milne-Edwards, 1869) after Monod, 1956.

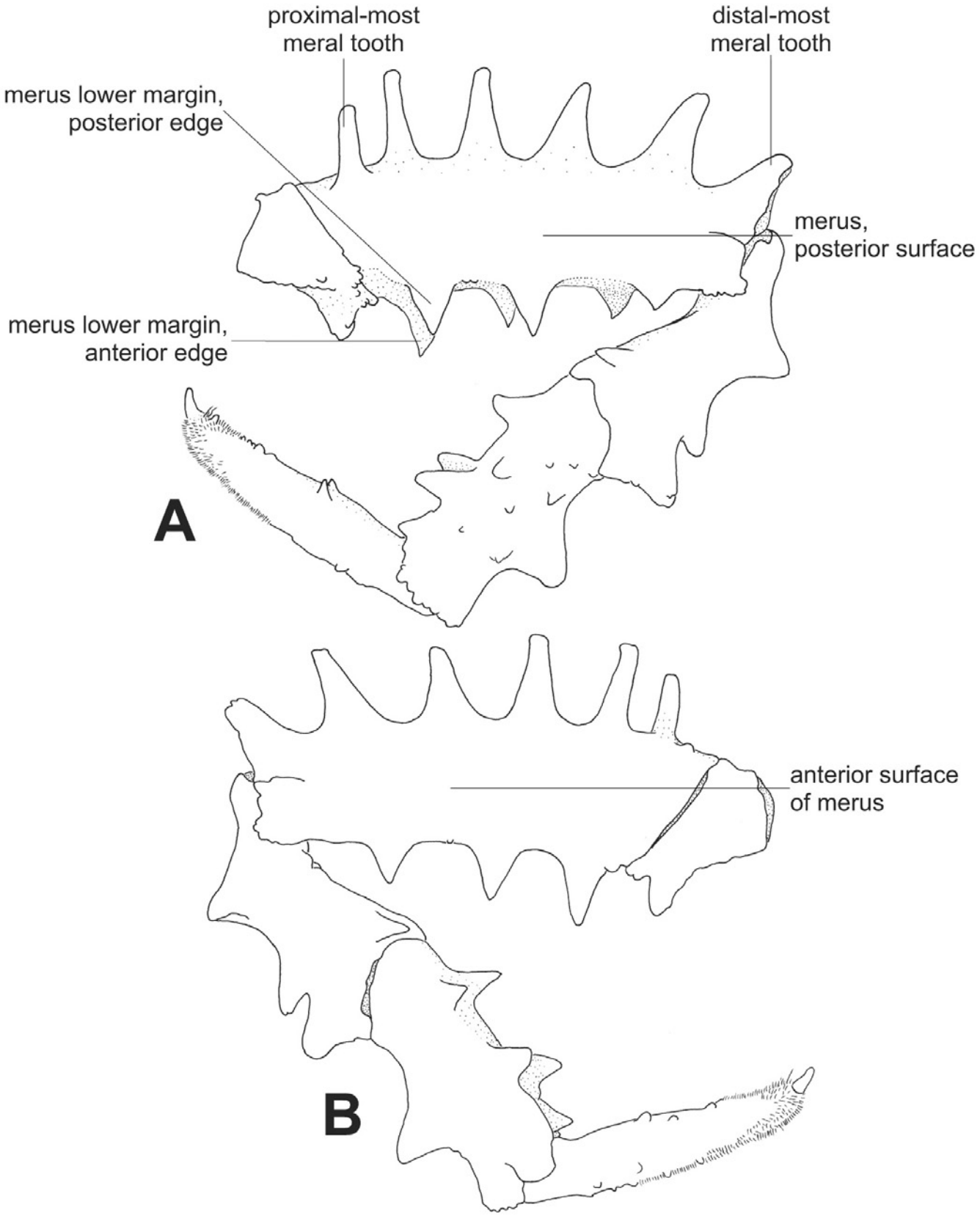

Fig. 3. Terminology used to describe the ambulatory legs based on the right first ambulatory leg (P2) of *Daldorfia horrida* (Linnaeus, 1758): A, posterior view; B, anterior view. Note that distal-most tooth is always slightly posterior to the other teeth on the upper margin of the merus in the Daldorfiinae. This meral teeth arrangement is called the daldorfiine arrangement.

typically smaller than antennal article 2 in the Daldorfiinae. The last article before the flagellum is antennal article 4.

The ventral subfrontal region is of some taxonomic value. On the inter-antennular septum, there is usually a spine, a tubercle or sometimes a ridge. This structure is referred to as the **inter-antennular spine**. In some species, the inter-antennular spine extends beyond the frontal margin. On the pterygostomial region, there is a ridge just beneath the moult line, it is here called the epimeral line sensu Warner (1977) [but referred to as pleural suture by Flipse (1930)] (Fig. 2A). This ridge, which may be smooth or granulated, begins at the anterior lateral corner of the buccal cavern and terminates near the lateral side of the cheliped coxa on the sub-branchial region. This ridge, the **pterygostomial ridge**, is found in all daldorfiines. This ridge is delimited posteriorly by a notch that demarcates the posterior border of the hepatic region on ventral side, and is termed the **subhepatobranchial notch**. Above the pterygostomial ridge is a groove, which may be shallow or deep, and terminates at the same location where the pterygostomial ridge ends. This groove is referred to as the **subhepatic groove**. Tubercles or granules may sometimes be present in the groove. After the sub-hepatobranchial notch, a ridge may be present on the **subepibranchial region**. This ridge, the **subepibranchial ridge**, is usually dentate and usually terminates near the base of the cheliped coxa. There is no groove above the subepibranchial ridge. Flipse (1930) referred to the the pterygostomial and subepibranchial ridges combined as the ventral comb, a term we do not use here because it does not define the regions which both ridges delimit. For example, the pterygostominal ridge is absent in some parthenopids (e.g., *Cryptopodia fornicata*). Therefore, a separate terminology for the ridges will facilitate future discussions with regard to the Parthenopidae.

In the middle of the fourth sternal segment, all male daldorfiines have a distinct **sternal pit**, which may be deep and well defined in some species. The floor of the pit may be tuberculate or there may be a ridge or two. This sternal pit is also present in juvenile females, but with maturity, it becomes continuous with the abdominal cavity. The shape of this sternal pit is useful in the species diagnosis and to a certain extent can even be used to identify juvenile females. This is because the sternal pit is not continuous with the abdominal cavity in juveniles and the shape and structure is identical with that of males of the same species.

Parthenopids generally have very long chelipeds, but are much less flexible than those of the Majidae (Rathbun, 1925; Ng, 1998). The inflexibility of the chelipeds of the parthenopids owes in part to the presence of one or more **ventral spines** located on the **sub-branchial region**, near the base of the cheliped coxa. The sub-branchial region is defined as the region below the subepibranchial ridge. In daldorfiines, the ventral spines are not well developed and often limited to one or a few tubercles on the edge of the sub-branchial region immediately adjacent to the cheliped coxa. These are the same spines referred by Flipse (1930) as the transverse comb and by Ng & Rodríguez (1986: 93, Fig. 1) as ventral spines. These spines are not emphasized in this study, being of limited taxonomic value in the Daldorfiinae. The ischiobasis of the cheliped is slightly subtriangular in cross-section, with a row of teeth only on the inner margin. The inner margin of the coxa and basis usually do not possess any teeth. There is usually a spine on the upper surface of the cheliped merus. This spine is referred to as the **dorsal meral spine** and it restricts the posterior movement of the cheliped mainly by engaging with the epibranchial teeth. The manus is usually not triangular in cross-section although there is a row of teeth on its inner surface. This row of teeth is referred to as the **inner margin**. In some species, this row of teeth might become turned upwards if the manus were triangular in cross-section. In members of the Parthenopinae with manus that is triangular in cross-section (e.g., *Cryptopodia*), this margin is dorsal in orientation, but corresponds to the inner margin in the Daldorfiinae. The accurate description of the margins on the manus is important, because the shape, number and position of the teeth are taxonomically useful. On the **outer surface** of the manus, there is usually no distinct row of teeth. A row of teeth is usually found on the **lower margin** of the manus.

The ambulatory legs (pereiopods 2–5) are described based on their orientation in living specimens. All ambulatory legs possess an **upper margin** and a **lower margin**. The side that is visible from the front of the crab is termed the **anterior surface** and the other side, the **posterior surface**. The anterior and posterior surfaces may be smooth or heavily tuberculate. The upper margins of all the ambulatory leg merus, carpus and propodus usually have a row of teeth, with the tooth shape ranging from spines to tubercles, to short subcylindrical prominences. On the upper margin of the ambulatory leg merus, the proximal-most tooth is in line with, and always posterior to the remaining teeth. This arrangement of teeth on the upper margin of the ambulatory leg merus, here termed the '**daldorfiine arrangement**', is unique to the Daldorfiinae. The lower margin of the all the ambulatory meri is usually divided into two edges, the **anterior edge** and **posterior edge**. The lower margin of the carpus is not clearly differentiated into two edges, but that of the propodus is slightly more distinct. Differences in the lower margin of both articles are not treated here in detail owing to a lack of useful taxonomic characters.

The following abbreviations are used in this study: G1 (male first pleopod or male first gonopod); G2 (male second pleopod or male second pleopod); P1 (cheliped); P2 (first ambulatory leg); P3 (second ambulatory leg); P4 (third ambulatory leg); P5 (fourth ambulatory leg); *C.* (*Cancer*); *D.* (*Daldorfia*); *Niobafia* (*N.*); *Ochtholambrus* (*Och.*); *Olenorfia* (*Ole.*); *Parthenope* (*P.*); and *T.* (*Thyrolambrus*). The term cheliped is used interchangably with P1 in this study.

Most of the material examined was from the MUSORSTOM expeditions, a collaborative venture between the Institut de Recherche pour le Développement (IRD, formerly ORSTOM) and the Muséum national d'Histoire naturelle, Paris. The specimens from the numerous expeditions are deposited in the Muséum national d'Histoire naturelle, Paris. Material from the TYRO Seychelles Expedition (Nationaal Natuurhistorisch

Museum, Leiden), Dr. Th. Mortenson's Danish Pacific Expedition (Zoologisk Museum, Copenhagen), the SIBOGA Expedition (Instituut voor Taxonomische Zoologie, Zoologisch Museum, Amsterdam), and the ALBATROSS expeditions (U.S. Fish Commission) also form part of the material examined. Other material examined is deposited in the following museums and institutions: Beijing Natural History Museum, Beijing (BNHM); Bernice P. Bishop Museum, Honolulu (BPBM); Florida Museum of Natural History, Florida (FMNH); Institute of Oceanology, Chinese Academy of Sciences, Qingdao (IOCAS); Los Angeles County Natural History Museum, California (LACM); Muséum National d'Histoire Naturelle, Paris (MNHN); Natural History Museum, London (NHM); National Science Museum, Tokyo (NSMT); National Taiwan Ocean University, Keelung, Taiwan (NTOU); Nationaal Natuurhistorisch Museum, Leiden (formerly Rijksmuseum van Natuurlijke Historie) (RMNH); South Australian Museum, Adelaide (SAM); Department of Biology, San Carlos University, Cebu, the Philippines (SCU); Natur-Museum und Forschung Institut Senckenberg, Frankfurt (SMF); National Museum of Natural History, Smithsonian Institution, Washington D. C. (USNM); Centro de Ciências Biológicas, Departamento de Biologia Animal, Univeridade Santa Ursula, Rio de Janeiro (USU); Western Australian Museum, Perth (WAM); Staatliches Museum für Naturkunde, Stuttgart (ZI); Instituut voor Taxonomische Zoologie (Zoologisch Museum), Amsterdam (ZMA); Museum für Naturkunde, Humboldt-Universität zu Berlin (ZMB); Zoologisk Museum, University of Copenhagen (ZMUC); Zoological Survey of India, Calcutta (ZSI); and Zoological Reference Collection, Raffles Museum of Biodiversity Research, National University of Singapore (ZRC).

SYSTEMATIC ACCOUNT

DALDORFIINAE Ng & Rodríguez, 1986

Daldorfidae [sic] Ng & Rodríguez, 1986: 90.
Daldorfiidae – Guinot & Bouchard, 1998: 657; Hendrickx, 1999: 256; Martin & Davis, 2001: 74.
Daldorfiinae – Ng & Clark, 2000: 238; Ng et al., 2001: 15.
Daldorphiinae [sic] – Davie, 2002: 385.

***Diagnosis.* –** Carapace broader than long, subtriangular to subpentagonal; regions usually well defined, usually inflated; dorsal surface rugose, tuberculate or granulated. Epibranchial margin slightly to strongly arcuate; slightly expanded, covering at least the meri of the P2 and P3, meri usually exposed when P4 and P5 are fully extended. Cheliped merus dorsal tooth well developed. Antennular article 1 either completely or incompletely excluded from orbital hiatus by antennal article two. Antennal article 2 large, about same size or larger than antennule article one; reaching orbital hiatus; antennal article three about one-third to one-quarter size of antennal article 2. Ambulatory legs meri upper margin with 6 teeth, teeth may be tuberculate, granulate or spinate; distalmost 5 teeth in same line, proximal-most tooth always posterior to other teeth. Mature female with functional press-button. Male abdominal segments 3–5 fused, though sutures visible; median sternal pit deep.

***Discussion.* –** Guinot (1978a) defined this group (the first of four that she characterized) as "...comprenant les genres à sternum thoracique don't les suture 4/5 et 5/6 sont seules interrompues et au système endophragmal au niveau IIIB." She mentioned that this group consist of the "genre *Daldorfia* Rathbun et ses alliés." The endophragmal system used by Guinot is not explored further because it is not unique to the Daldorfiinae, being also present in the Bellioidea (*Corystoides* Lucas, 1844, and *Acanthocyclus* Lucas, 1844) (Guinot, 1979: 259). Furthermore, specimens of daldorfiines are generally scarce, so endophragmal preparations were not performed. The endophragmal system will probably prove useful in higher-level systematics. The sternal suture interruption pattern was also shown not to be unique. The difficulties of using only these two characters to characterize the Daldorfiidae highlights the need to reappraise the characters used at the subfamilial level for the Parthenopidae.

The Parthenopidae is poorly defined, but one of the most important features uniting the family appears to be that adult male abdomen segments 3–5 are always immovable. This condition, however, is not unique to parthenopids because the Portunidae, Panopeidae and Xanthidae, for example, also have the same abdominal segments fused. The suture lines on abdominal segments 3–5, however, are visible in all adult male daldorfiines and may even appear to be free on superficial inspection (see Ng & Chia, 1994). In the Parthenopinae, the suture lines are often not visible. A recently recognized character for the Parthenopidae is that mature females retain a functional press-button, which is non-functional only when females are ovigerous. Guinot & Bouchard (1998) recognized the Daldorfiidae, but refrained from making further comments owing to the imprecise relationship with the Parthenopidae, and considered the press-buttons as "typical". The male pleopods of some daldorfiines approach that of the parthenopiine, *Garthambrus*. Whether the male pleopod similarities between daldorfiines and *Garthambrus* indicate a close phylogenetic relationship is unclear because the morphology of male pleopods in the Parthenopinae exhibits great diversity.

This begs the question on whether the Parthenopidae is a monophyletic family, and whether the subfamilies within it deserve the taxonomic ranking as currently proposed. In view of these uncertainties and in the absence of phylogenetic analyses of the Parthenopidae, it is here proposed to provisionally recognise the family Parthenopidae sensu lato with two subfamilies, viz. Parthenopinae and Daldorfiinae.

Three main characters differentiate the Daldorfiinae from the Parthenopinae. In the Daldorfiinae, antennal article 2 is about the same size or larger than antennular article 1. In the Parthenopinae, antennal article 2 is only about half the size of antennular article 1, and as such, usually does not reach the orbital hiatus. In the Daldorfiinae, antennal article 2 always reaches the orbital hiatus. The second character is the size of antennal article 3, which is about one-third to one-

quarter the size of article 2 in the Daldorfiinae. In the Parthenopinae, antennal article 3 is usually the same size or slightly smaller than antennal article 2. The third character is the unique arrangement of teeth on the meri of the ambulatory legs. The proximal-most meral tooth is not in the same line as the rest of the teeth and is positioned slightly posterior to the rest (Fig. 3). This 'daldorfiine arrangement' is seen in all daldorfiines but not in parthenopines.

The present study shows that the Daldorfiinae, should not only include *Daldorfia*, but also *Thyrolambrus* Rathbun, 1894, and two species, *Parthenopoides cariei* Bouvier, 1914, and *Lambrus* (*Parthenopoides*) *erosus* Miers, 1879 (see also Tan, 2004). *Parthenopoides cariei* has long been placed in the Parthenopidae but its relationship to other members has been unclear. It is here recognised as a member of the Daldorfiinae. The overall morphology of *Parthenopoides cariei* is very different from the other daldorfiines so a monotypic genus is established for it below. The poorly known species, *Lambrus* (*Parthenopoides*) *erosus* is also a daldorfiine owing to the large antennal article 2, comparatively smaller antennal article 3, presence of a dorsal meral spine, and the 'daldorfiine arrangement' of the ambulatory meral teeth. The highly eroded carapace is reminiscent of the carapace pattern seen on *Dairoides* (see Ng & Tan 1999). The mature female telson shape and very short male second pleopod of *Lambrus* (*Parthenopoides*) *erosus* differ markedly from the condition seen in all other daldorfiines; it is placed in a new monotypic genus.

Ng & Rodríguez (1986) spelt the family as Daldorfidae with a single 'i', which is incorrect. The correct spelling is Daldorfiidae since the name is derived from *Daldorfia*. This was corrected in later studies (Ng & Clark, 2000; Ng et al., 2001). Hendrickx (1999) incorrectly attributed the authorship of the Daldorfiidae to Rathbun (1904).

The subfamily Daldorfiinae as presently recognised, consists of four genera with 17 species, listed under the respective generic accounts.

Key to the genera of the Daldorfiinae

1. Posterior half of antennal article 2 enlarged, about twice width of the anterior half (Fig. 4c). G2 about half length of G1. Female telson length about twice that of width (Fig. 5c) ..... ***Niobafia***, new genus
– Posterior half of antennal article 2 not enlarged (Fig. 4 a, b, d). G1 longer than half length of G2. Female telson length about the same as width (Fig. 5 a, b, d) **2**
2. Manus slender to very slender, about half size of cheliped merus. Dorsal meral spine reduced to a granule or granules; not overlapping with epibranchial teeth ..... ***Thyrolambrus*** Rathbun, 1894
– Manus about the same size or larger than cheliped merus. Dorsal meral spine strong, distinct, not reduced; always overlapping with epibranchial teeth **3**
3. Carapace transversely ovate. Anterior lateral margin of antennal article 2 without a tooth (Fig. 4d). Female telson subtriangular, lateral margins of tip strongly constricted distally (Fig. 5d) ..... ***Olenorfia***, new genus
– Carapace triangular to subpentagonal. Anterior lateral margin of antennal article 2 with a tooth (Fig. 4a), tooth less than half length of antennal article 3. Female telson semicircular, tip blunt, not constricted (Fig. 5a) ..... ***Daldorfia*** Rathbun, 1904

DALDORFIA Rathbun, 1904

Cancer – Fabricius, 1775: 400; Herbst, 1788: 222 (part); Weber, 1795: viii.

Parthenope – Fabricius, 1798: 352 (part); Leach, 1814: 431; Latreille, 1817: 23 (part); Lamarck, 1818: 428 (part); Desmarest, 1825: 142; 1830: 279 (part); H. Milne Edwards, 1834: 359; Lucas, 1840: 425 (part); H. Milne Edwards in Cuvier, 1840: 81 (part); Miers, 1879a: 668; Alcock, 1895a: 279 (part); Stebbing, 1905: 27; 1910: 292; Bouvier, 1915: 227, 230, 231; Maki & Tsuchiya, 1923: 129 (part); Flipse, 1930: 57; Sakai, 1938: 328; Barnard, 1950: 64; Monod, 1956: 595; T. Sakai, 1965: 97 [non *Parthenope* Weber, 1795].

Parthenope (*Parthenope*) – De Haan, 1839: 81 [non *Parthenope* Weber, 1795].

Maja – Latreille, 1802: 26 (part); Bosc, 1802: 245 (part); Latreille, 1803: 87 (part); 1806: 37 (part); 1810: 97, 422 (part); Leach, 1814: 394 [non *Maja* Lamarck, 1801].

Daldorfia Rathbun, 1904: 170; 1906: 23; 1911: 259; Ward, 1942: 76; Garth, 1946: 412; 1958: 455; Takeda, 1973: 116; Sakai, 1976: 282; Dai & Yang, 1991: 173; Hendrickx, 1999: 256; Davie, 2002: 385.

Diagnosis. – Carapace subtriangular or subpentagonal; dorsal surface rugose, spinose, tuberculate or granulate; regions clearly demarcated; protogastric, mesogastric, cardiac, mesobranchial and metabranchial regions inflated; metagastric and intestinal regions depressed. Cardiobranchial groove continuous with intestical depression, forming U-shaped depression, may be deep or shallow. Antennular article 1 anteriorlateral corner forming part of orbital hiatus. Antennal article 2 anterior lateral margin with a tooth. Cheliped dorsal meral spine overlapping epibranchial teeth. G1 tubular, distal portion straight, bent or bulbous. G2 length subequal to or slightly longer than G1, distal segment about one-third as long as basal segment.

Type species. – *Cancer horridus* Linnaeus, 1758, by monotypy (Rathbun, 1904). Gender feminine.

Other species. – *Daldorfia bouvieri* (A. Milne-Edwards, 1869), *D. calconopia*, new species, *D. dimorpha*, new species, *D. excavata* (Baker, 1905), *D. glasselli* (Garth, 1958), *D. investigatoris* (Alcock, 1895), *D. leprosa* (Nobili, 1905), *D. rathbunae* (De Man, 1902), *D. spinosissima* (A. Milne-Edwards, 1862), *D. triangularis* Sakai, 1974, and *D. trigona* (A. Milne-Edwards, 1869).

Discussion. – *Daldorfia* had been confused with *Parthenope* Weber, 1795. Weber (1795) in establishing the genus Parthenope, included six species: *Cancer fornicata* Fabricius, 1781 (= *Cryptopodia fornicata*), *C. longimanus* Linnaeus, 1758, *P. giraffa*, *P. regina*, *P. lar*, and *P. dubia*, of which the last four were nomina nuda. He did not designate a type species and did not include *C. horridus* in *Parthenope*, but instead regarded it as a nomen dubium in the introduction to his text. Subsequently, Fabricius (1798) gave the first diagnosis of *Parthenope* and included *C. horridus*. Lamarck (1801) united *Inachus* Weber, 1795, and *Parthenope* into a new genus, *Maja*, and Latreille (1802) placed *C. horridus* in *Maja*, which was followed by Bosc (1802) and Latreille

(1803, 1806, 1810). Leach (1814: 431) divided *Maja* into two genera, *Parthenope* and *Maja*, and mentioned only *C. horridus* in *Parthenope*. Leach (1815) proposed a new genus, *Lambrus*, to accommodate *C. longimanus*, which he considered to be generically distinct from *C. horridus*, although he did not specifically say so. Inexplicably, however, Leach (1815) did not mention *Parthenope* despite commenting on it at length in an earlier work (Leach 1814).

Latreille (1817) transferred *C. horridus* back into *Parthenope*, a decision followed by Lamarck (1818). Desmarest (1825), probably following Leach (1815), placed *C. horridus* in *Parthenope*, and at the same time, separated all the other parthenopids into *Lambrus*. Later, Desmarest (1830) transferred all parthenopid species into *Parthenope*, a decision followed by H. Milne Edwards (1834). However, Lucas (1840), Miers (1879a, b) and Alcock (1895a), separated *Parthenope* from *Lambrus* sensu Leach (1815). Rathbun (1904), who was convinced that *C. horridus* and *C. longimanus* were not congeneric, pointed out that the designation of the type of *Parthenope* had already occurred when Lamarck (1801), in relegating *Parthenope* into *Maja*, listed only *C. longimanus* in *Parthenope*. All the species originally placed in *Lambrus* should be transferred to *Parthenope*, leaving *C. horridus* orphaned. As a result, Rathbun (1904) proposed the name *Daldorfia* to accommodate *Cancer horridus*. The International Commission on Zoological Nomenclature (ICZN, 1956: Direction 32), however, noted that "nothing in this work (Lamarck, 1801) is to be treated as constituting the designation of type species for the genera discussed therein". This problem was rectified by Opinion 696 (ICZN, 1964), which considered Rathbun (1904) as having designated *C. longimanus* Linnaeus, 1758, as the type species of *Parthenope*. Since the type species of *Lambrus* is also *C. longimanus*, *Lambrus* Leach, 1815, is a junior objective synonym of *Parthenope* Weber, 1795.

Several authors, however, retained the generic system proposed by Leach (1815) (e.g., Bouvier, 1915; Maki & Tsuchiya, 1923; Flipse, 1930; Sakai, 1938, 1965; Barnard, 1950; Monod, 1956). Flipse (1930) even proposed that since the name *Daldorfia* was rarely used, the rules of priority should be set aside and the genus ignored in order to avoid nomenclatural confusion. Holthuis (1962), citing infrequent usage, proposed to suppress *Parthenope* Weber, 1795, and *Daldorfia* Rathbun, 1904, and place *Lambrus* Leach, 1815, and *Parthenope* Fabricius, 1798, on the Official List of Generic Names in Zoology. This proposal, however, was rejected and the generic names *Parthenope* Weber, 1795 and *Daldorfia* Rathbun, 1904, are now conserved. *Parthenope* Fabricius, 1798, and *Lambrus* Leach, 1815, were placed on the Official Index of Rejected and Invalid Generic names of Zoology (ICZN, 1964: Opinion 696).

In any case, *Daldorfia* is relatively easy to recognise due to its rough and strongly inflated carapace, especially in the protogastric region. Most importantly, the anterior lateral corner of the antennular article 1 forms part of the orbital hiatus. In the other genera of the Daldorfiinae, the large antennal article 2 totally excludes the anterior lateral corner of the antennular article 1 from the orbital hiatus. The presence of a tooth on the anterior lateral margin of the antennal article 2 also differentiates *Daldorfia* from other daldorfiine genera. The abdominal segments 3–5 are fused and immovable in all mature males, but the sutures between these three segments are visible. This contrasts with that of most parthenopines, in which the sutures between the three abdominal segments are so completely fused as to not be visible.

Daldorfia has a wide distribution with its centre of diversity in the Indo-Pacific region. *Thyrolambrus leprosus* Nobili, 1905, and *Thyrolambrus excavatus* Baker, 1905, are both transferred to *Daldorfia*. *Parthenope acuta* Klunzinger, 1906, and *Parthenope semicircularis* Flipse, 1930, were found to be synonymous with *Thy. leprosus*. Specimens previously identified as *Parthenope spinosissima* A. Milne-Edward, 1862, from the Philippines and Ambon are recognized as *D. triangularis* (Sakai, 1974). A new species, very similar to *D. excavatus*, is recognized from Western Australia. Another new species, *D. dimorpha*, is described from Hawaii. Two species, *D. trigona* and *D. glasselli*, are known from the Eastern Pacific. *Daldorfia garthi* is a junior synonym of the very poorly known *Parthenope trigona*. Only one species is reported from the eastern Atlantic, *D. bouvieri*.

Key to the species of *Daldorfia*

1. Carapace, ambulatory legs and chelipeds densely covered with acuminate spines. Hepatic margin with a long spine. Meso- and metabranchial margins with teeth spinate **2**
– Carapace, ambulatory legs and chelipeds rugose; spines if present, relatively short and not densely distributed. Hepatic margin usually with 1 or 2 lobate tubercles, without long spine. Meso- and metabranchial margins with one to many teeth, teeth not spinate **3**
2. Spines on cheliped long, slender. Fingers on cheliped long, slender ..... ***Daldorfia triangularis*** (Sakai, 1974)
– Spines on cheliped short. Fingers on cheliped short .... ***Daldorfia spinosissima*** (A. Milne-Edwards, 1862)
3. Teeth on upper margin of ambulatory meri broad, with tips and lateral margins usually fused with adjacent teeth, sometimes appearing cristate. Male sternal pit deep, edges of pit entire; bottom of pit smooth **4**
– Upper margin of ambulatory meri with well separated spines or granules that may fused at tips but never on lateral margins, never cristate. Male sternal pit shallow or deep, edges usually laciniate; bottom of pit smooth or with ridges 5
4. Carapace not strongly rugose, meso- and metabranchial regions sparsely pitted. Subhepatic groove with a row of large tubercles, tubercles placed almost adjcent to each other .... ***Daldorfia trigona*** (A. Milne-Edwards, 1869)
– Carapace strongly rugose, meso- and metabranchial regions heavily pitted. Subhepatic groove with a row of small tubercles, tubercles well spaced from each other .... ***Daldorfia bouvieri*** (A. Milne-Edwards, 1869)
5. Teeth on upper margin of ambulatory leg meri well-defined, forming spines that may or may not be r-shaped **6**
– Teeth on margin of ambulatory leg meri ill-defined, usually forming irregular tubercles **10**
6. Epibranchial region strongly inflated. Tips of teeth on upper margin of ambulatory meri knobbed, not sharp .... ***Daldorfia glasselli*** (Garth, 1958)

– Epibranchial region inflated. Tips of teeth on upper margin of ambulatory meri sharp or truncated, not knobbed **7**

7. Cheliped manus subequal, not heterochelous. Protogastric region more inflated than epibranchial region .... ***Daldorfia investigatoris*** (Alcock, 1895)

– Cheliped manus heterochelous. Protogastric region not more inflated than epibranchial region **8**

8. Meso- and metabranchial margins lined with teeth, teeth tips extended laterally, continuous with tips of adjacent teeth. Male sternal pit not divided into 3 lobes. Base of teeth on upper margin of ambulatory meri broad .... ***Daldorfia dimorpha***, new species

– Mesobranchial margin usually with only one tooth, mesobranchial margin usually without teeth; tips of teeth, if present, not extended laterally. Male sternal pit divided into three lobes, with small anterior and the 2 large lateral lobes. Base of teeth on upper margin of ambulatory meri narrow **9**

9. Carapace generally smooth, branchial regions not pitted. Teeth on upper margin of ambulatory meri r-shaped except distalmost tooth; distalmost tooth tip recurved inwards, touching r-shape tip of second distalmost tooth .... ***Daldorfia rathbunae*** (De Man, 1902)

– Carapace generally tuberculated, branchial regions pitted. Teeth on upper margin of ambulatory meri not r-shaped, tips of all teeth slightly bent outwards .... ***Daldorfia horrida*** (Linnaeus, 1758)

10. Frontal margin trilobate, lateral lobes about half size of median lobe. Male sternal pit deep, bottom of pit with reticulate pattern. G1 tip not bulbous ..... ***Daldorfia leprosa*** (Nobili, 1905)

– Frontal margin bilobate. Male sternal pit shallow, bottom of pit either smooth or with Y-shape ridge. G1 tip bulbous to slightly bulbous **11**

11. Upper margins of ambulatory meribearing paxilliform tubercles. Male sternal pit bottom with Y-shaped ridge .... ***Daldorfia calconopia***, new species

– Upper margins of ambulatory meri bearing low, short, subcylindrical processes, opening distally. Male sternal pit bottom smooth, without any ridges .... ***Daldorfia excavata*** (Baker, 1905)

Daldorfia horrida (Linnaeus, 1758)
(Figs. 2, 3, 4A, 5A, 6, 7)

Cancer horridus Linnaeus, 1758: 629; 1767: 1047; Fabricius, 1775: 409; Herbst, 1788: 222, Pl. 14 Fig. 88; Olivier, 1791: 175.

Parthenope horrida – Fabricius, 1798: 353; Leach, 1815: 107; Lamarck, 1818: 238, 429; Latreille, 1818: Pl. 280; Desmarest, 1825: 143, Pl. 20 Fig. 1; 1830: 279; Henschel, 1833: 203; H. Milne Edwards, 1834: 360; H. Milne Edwards, in Cuvier 1836: Pl. 26 Fig. 2; Lucas, 1840: 425; H. Milne Edwards, in Cuvier, 1840: 81; Guérin-Méneville, 1831-1834: Pl. 7 Fig. 1; Bleeker, 1856: 5, 6; A. Milne-Edwards, 1873: 255; Nauck 1880: 44; Müller 1887: 473 (list); Ortmann, 1893: 417 (part); Alcock, 1895a: 279; De Man, 1902: 103; Stebbing, 1905: 27; Klunzinger, 1906: 54; Nobili, 1906: 179; 1907: 382; Stebbing, 1910: 292; Pesta, 1913: 39; Bouvier, 1915: 230, Fig. 49; Laurie, 1915: 434; Maki & Tsuchiya, 1923: 130, Pl. 15 Fig. 2; Balss, 1924: 1; Flipse, 1930: 58; 1931: 96; Sakai, 1934: 299; 1938: 340, Pl. 39 Fig. 3; Barnard, 1950: 64; Forest & Guinot, 1961: 26, Fig. 14; Sankarankutty, 1961: 134, Fig. 2 F; Michel, 1964: 9; Crosnier, 1976: 242; Debelius, 1999: 259.

Maja horrida – Bosc, 1802: 251; Latreille, 1803: 106; 1806: 37; Leach, 1814: 394.

Daldorfia horrida – Rathbun, 1904: 171; 1906: 39, Pl. 14 Fig. 5; 1911: 259; Laurie, 1915: 434; Sendler, 1923: 41; Urita, 1926: 29; Estampador, 1937: 557; Buitendijk, 1939: 266; Ward, 1942: 76; Tweedie, 1950: 107; Holthuis, 1959: 110; Takeda, 1973: 116, Fig. 5A–B; Sakai, 1976: 283, Pl. 96 Fig. 2, text-fig. 157; Garth & Alcalá, 1977: 648; Dai et al., 1986: 157, text-fig. 89; Garth et al., 1987: 242, 255; Ng et al., 1990: 112, Figs. 13, 14; Dai & Yang, 1991: 173, text-fig. 89; Cai et al., 1994: 583; Poupin, 1996: 28; Davie, 1998: 214; Muraoka, 1998: 30, Pl. 6; Tan et al. 1999: 199, Fig. 13c; Ng & Rahayu 2000: 782; Ng et al., 2001: 15; McLay et al., 2001: 966; Davie, 2002: 385 (list).

Daldorfia sp. – Kato & Okuno, 2001: 116.

Types. **–** Neotype, male, 127.2 × 91.7 mm (ZRC 1999.1028), Taiwan, Ilan County, Longtong Jetty, coll. S.-H. Wu, May 1999.

Material examined. **– Madagascar.** Nosy Bé. Intertidal zone, 360 m, A. Crosnier coll., Sep.1958: 1 male 52.8 × 39.5 mm (MNHN); Autafianambitry, intertidal zone, A. Crosnier coll., 3 Oct.1971: 1 female 85.6 × 62.1 mm (MNHN).

Nosy Iranja. Northwest Coast, intertidal zone, A. Crosnier coll., Apr.1959: 1 male 67.0 × 48.4 mm (MNHN). **Îles Glorieuses**. Lovee detritavy, intertidal, A. Crosnier coll., 29 Jan.1971: 1 male 63.3 × 47.2 mm (MNHN). **Réunion**. La Saline-les-Bains, Rifflagune, dead coral with algae, 0.5–1.0 m, H. G. Müller coll., 21–22 Jan.1989: 1 female 64.9 × 47.8 mm (SMF 17993); St. Paul, 50–90 m, 10 Jun.1973: 1 male 97.3 × 71.0 mm. **Seychelles**. TYRO Seychelles Expedition 1992/3: Platte Island atoll, 5º49'S 55º21'E, lagoon of inner atoll, 12 m, SCUBA diving, 7 Jan.1993: 1 male 47.0 × 33.9 mm (RMNH D 42927). REVES 2: Mahe Port Glaud, 1 m, 11 Sep.1980: 1 female 84.7 × 62.4 mm (MNHN). **Red Sea**. Rüppell coll., no date: 1 male 34.1 × 25.9 mm, 1 female 66.7 × 48.2 mm (SMF 2902). **Djibouti**. Récifs du Singouin et du Météore, dredge, 20 m, Mission Ch. Gravier, 1904 coll., 11 Mar.1904: 1 ovig. female 52.9 × 37.2 mm (MNHN). **Thailand**. Phuket, Ao Tang Khaen, sandy, rocky & mangrove shore, P. K. L. Ng, P. Clark, K. L. Yeo & T. H. T. Tan coll., 3–6 May 2000: 1 male 29.1 × 21.4 mm (ZRC). **Peninsular Malaysia**. Pulau Sembilan, off Bagar atoll, 24 Dec.1968: 1 female 84.4 × 59.8 mm. (ZRC 1996. 2091); Tioman Island, littoral rocky area, Jun.1988: 1 female 93.4 × 6.6 mm. (ZRC Y560). **Singapore**. Dry specimen from fish market, 1 Dec.1926: 1 male 139.8 × 99.7 mm (ZRC); Southern Islands, L. W. H. Tan coll., no date: 1 female 96.3 × 69.0 mm (ZRC). **Indonesia**. Pulau Pari, Seribu Island, 21 Nov.1973: 1 female 31.6 × 24.9 mm. (ZRC 1999.1459). **Cocos-Keeling Islands**. C. A. Gibson-Hill coll., 1941: 1 female 120.1 × 85.9 mm. (ZRC 1965.10.19.76). **Vietnam**. Nha Trang Bay, epibiote of *Halimeda*, R. Serène coll., 1958: 1 male 5.4 × 5.0 mm (ZRC 1970.8.4.18). **Taiwan**. Taipei County, Guihou (Yeliu), about 10 m, hook and line, rocky reefs, Chen Zhi coll., no date: 1 female 31.7 × 23.9 mm (NTOU); Taitung County, Lanyu, 4–5 m, night dive, S. H. Wu coll., 10 Jul.1997: 1 juv. ex. (NTOU); Ilan County, Gengfang, K. X. Lee coll., 2000: 3 males 103.6 × 73.3 – 107.9 × 75.9 mm, 2 females 96.2 × 69.9 – 102.7 × 73.1 mm (ZRC); Ilan County, Longtong Jetty, S.-H. Wu coll., May 1999: 1 female 112.5 × 81.7 mm (ZRC 1999.1028). K. X. Lee coll., 2000: 1 female 91.1 × 62.8 mm (ZRC). **Japan**. Ryukyu Island, Nakagusuku Bay, 15–20 m, gill net, M. Aizawa coll., 8 Sep.1991: 1 male 73.1 × 50.7 mm (NSMT-Cr. 11214); No other data: 1 female 75.2 × 58.2 mm (SMF ex. Sakai) (dried); No other data: 1 male 132.0 × 91.0 mm (ZMB 8505). **Philippines**. Mindanao, Zamboanga, V. Marten coll., no date: 1 male 24.9 × 18.6 mm (ZMB 16133); V. Mollendorf coll., no date: 1 female 57.3 × 42.0 mm (ZMB 12886). **Guam**. Neye Island, 2–4 ft (0.6–1.2 m), under rock, H. T. Conley coll., 28 Jun.1996: 1 male 18.0 × 13.6 mm (ZRC); Agat Bay, north of Alutom Island, fore-reef, in deep coral rubble, ca. 5 m depth, H. T. Conley coll., 10 Jan.2001: 1 male 18.0 × 13.0 mm (FMNH 36). **Papua New Guinea**. Samarai Reef, Feb.1933: 1 female 67.8 × 51.5 mm (ZRC 1965.10.19.77). **New Caledonia**. M. Aubry Le Comte coll., no date: 1 male 87.3 × 64.2 mm (MNHN-B638 S); Platier de Ouano, 1 m,

Richer De Forges coll., 2 Jun.1966: 1 male 99.6 × 72.4 mm, 1 female 77.6 × 54.7 mm (MNHN); Orstom-Noumea, Cafuer, Flat internal, South Lagoon, 130 m, May.1985: 1 female 110.7 × 80.1 mm (MNHN); Lagon Est, collected by diver, Aug.1986: 1 female 86.7 × 62.6 mm (MNHN); Toombo Reef, pente externe, collected during night dive, 18 m, 17 Nov.1987: 1 female 120.9 × 86.3 mm (MNHN); Exterior of Grand Récif, collected during night dive, 10–40 m, no date: 1 male 144.9 × 103.5 mm. **Vanuatu**. MUSORSTOM 8: stn DW1021, 17º42.70'S 168º37.00'E, 124–130 m, 28 Sep.1994: 1 male 49.0 × 35.6 mm (MNHN). **Samoa**. Purchased from Museum Godeffroi: 1 female 62.9 × 47.8 mm (SMF 2901). Tutuila Island, Fagaulu Reef, reef flat in coral rubble, L. Madrigal coll., 1 Feb.1998: 1 male 71.4 × 49.8 mm (BPBM). **French Polynesia**. Tahiti. G. Ranson coll., 1952: 1 female 99.4 × 73.0 mm (MNHN). **Tuamotu Archipelago**. Tikehau Atoll, wharf substructure, 1–5 m, G. Paulay coll., 10 Jan.2001: 1 female 40.8 × 29.7 mm (FMNH 1445). **No locality data**: 1 male 103.3 × 78.7 mm (SMF 10789); 1 male 111.6 × 83.9 mm (SMF 10788); 1 male 117.4 × 87.8 mm (MNHN-B4595 S); Donated by Mme. Pruvot: 1 male 130.3 × 95.4 mm (MNHN - Entrée No. 11-1928); Jaluit, Steinbach coll., no date: 1 female 123.3 × 93.0 mm (ZMB 9134).

***Diagnosis.* –** Carapace triangular to pentagonal, dorsal surface rugose, branchial region pitted, sometimes forming reticulate pattern. Frontal projection short, bilobate. Inter-antennular spine granulate, not continuous with rostrum tip. Maxilliped 3 propodus and dactylus not hidden behind merus and ischium; diagonal notch at junction of merus and carpus, distinct. Chelipeds heterochelous. Ambulatory meri upper margin dentate, usually with 6 teeth, lower margin dentate, 2 rows, each with 3 teeth. Male sternal pit superficially divided into 3 lobes, anterior one small, oval-shaped, lateral

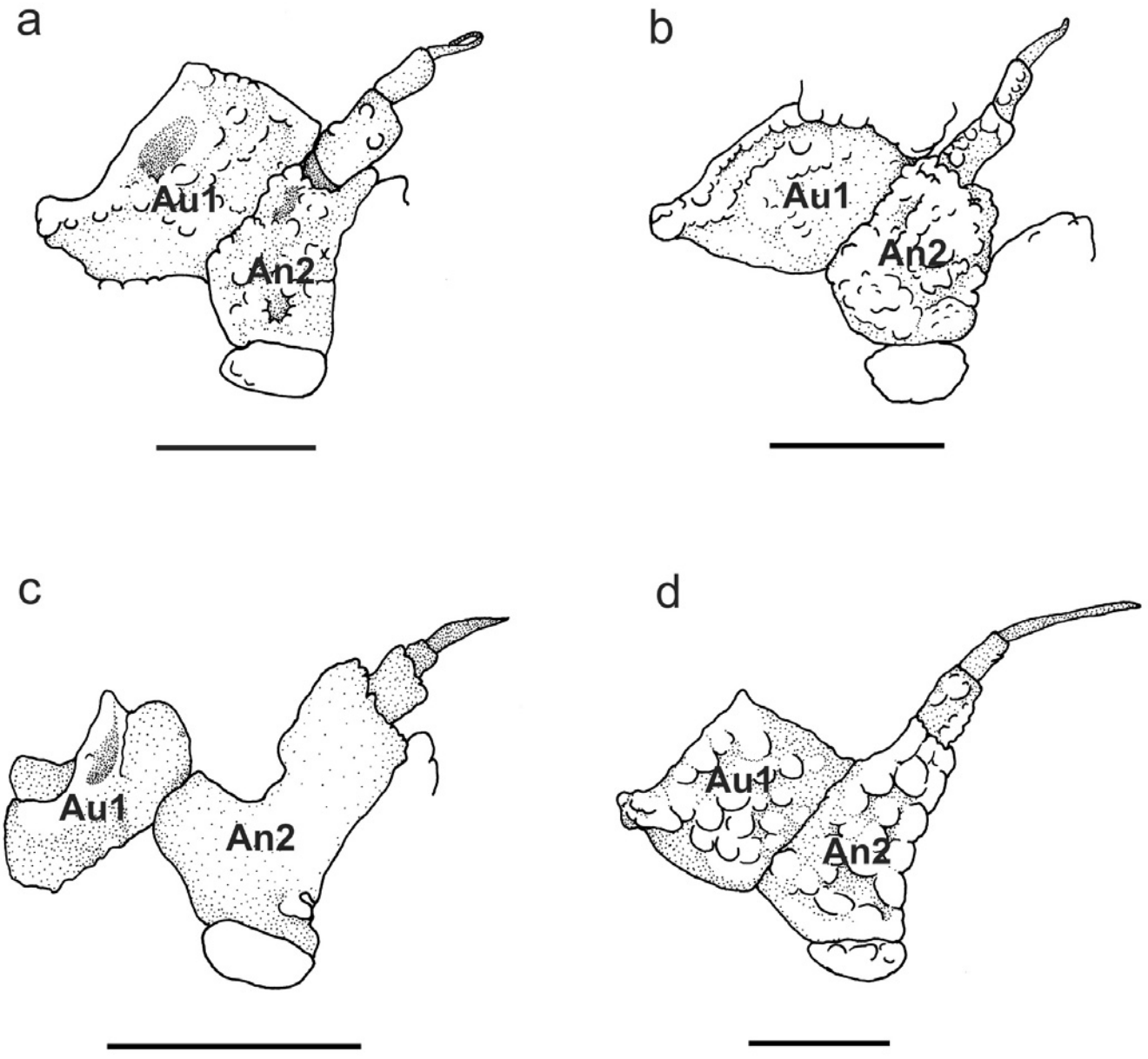

Fig. 4. Relative sizes of antennular article 1 and antennal article 2 of the four genera in Daldorfiinae: a, *Daldorfia horrida*, female, 91.1 × 62.8 mm (ZRC), Taiwan, C. McLay coll., 2000; b, *Thyrolambrus astroides*, male, 24.2 × 15.9 mm (USU 1087), Brazil, southeastern coast, RV LESTE II, no date; c, *Niobafia erosa*, female, 14.9 × 12.0 mm (ZRC), Hawaiian islands, north of Oahu, J. Park coll., Jan.2000; d, *Olenorfia cariei*, female, 27.8 × 20.8 mm (USNM), Guam, Tumon Bay, near Gun Beach, 55 ft. (17 m), under rock, V. Tyndzik coll., 2 Mar.1984. Abbreviations: Au 1, antennular article 1; An 2, antennal article 2. Scale bar = 1 mm.

ones large, kidney-shaped; bottom of pit with V-shaped ridge. G1 tubular, lateral margins straight, tip not bulbous. G2 slightly longer than G1, distal segment about 0.7 times length of basal segment.

***Description.* –** Carapace triangular to pentagonal, wider than long; dorsal surface rugose, tuberculate, branchial regions pitted; lateral angle acute; protogastric, mesogastric, metagastric, hepatic, epibranchial, mesobranchial, metabranchial, cardiac and intestinal regions distinct; all regions inflated except metagastric and metabranchial regions, which is depressed; protogastric and epibranchial regions more inflated than other regions; intestinal region slightly inflated medially in large specimens; epibranchial region divided into 2 portions by shallow transverse groove, anterior portion about twice the size of posterior portion. Gastrobranchial and cardiobranchial grooves deep; hepato-orbital and hepato-branchial grooves less deep; other grooves shallow. Frontal projection short, tip blunt, gently bilobate, edges tuberculate. Inter-orbital region with an oval depression. Supra-orbital region with 1 suture. Hepatic region lower than protogastric and epibranchial regions. Hepatic margin with distinct, pointed tooth. Epibranchial margin arcuate, usually with 9 teeth including lateral tooth, increasing in size posteriorly; larger teeth usually with a small, narrow dorsal ridge; lateral tooth bifurcated or trifurcated. Mesobranchial margins slightly convex, usually with large tooth. Metabranchial margin convex, without tooth. Posterior margin straight, tuberculate, usually divided into 3 lobes.

Inter-antennular spine granulate, not continuous with rostrum tip. Pterygostomial region pitted, forming reticulate pattern. Pterygostomial ridge prominent, thick, with about 3 small granules; subhepatic groove generally smooth, sometimes with few small, very low tubercles; suborbital portion of subhepatic groove deep, becoming shallow at subhepatic region, terminating below hepatobranchial notch. Sub-branchial region pitted, forming reticulate pattern, especially adjacent to ambulatory legs. Subepibranchial ridge present, formed by a row of 6 large, irregular, granulate tubercles, tubercles not continuous, not forming cristae. Sub-epibranchial region pitted, pits sparse; with 2 ventral spines.

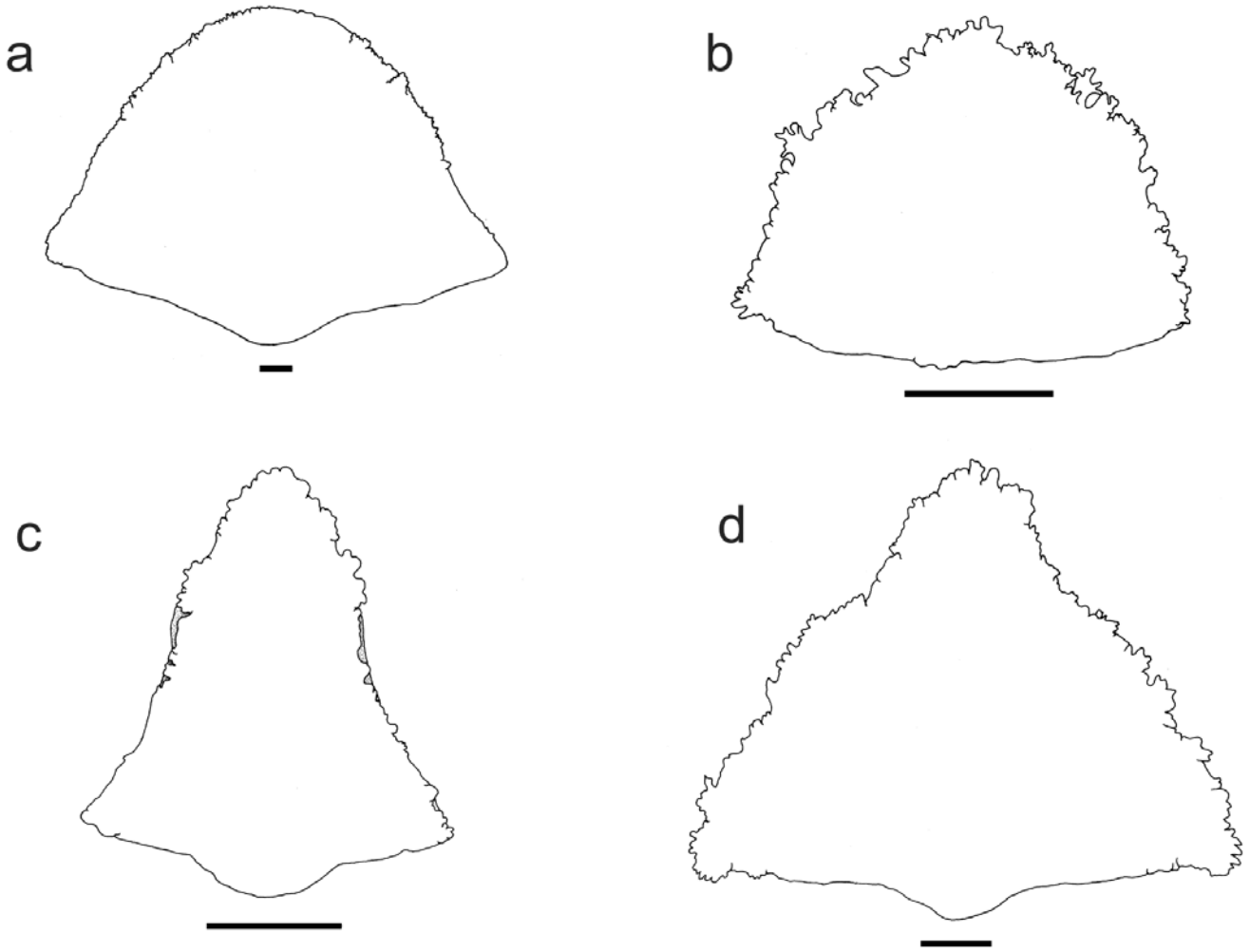

Fig. 5. Outlines of the mature female telsons of the four genera in Daldorfiinae: a, *Daldorfia horrida*, female, 91.1 × 62.8 mm (ZRC), Taiwan, C. McLay coll., 2000; b, *Thyrolambrus astroides*, female, 17.3 × 12.2 mm (USU 1087), Brazil, southeastern coast, RV LESTE II, no date; c, *Niobafia erosa*, female, 14.9 × 12.0 mm (ZRC), Hawaiian islands, north of Oahu, J. Park coll., Jan.2000; d, *Olenorfia cariei*, female, 27.8 × 20.8 mm (USNM), Guam, Tumon Bay, near Gun Beach, 55 ft (17 m), under rock, V. Tyndzik coll., 2 Mar.1984. Scale bar = 1 mm.

Antennules folded at around 45º; antennular article 1 pitted. Antennal article 2 immediately adjacent to antennular article 1, slightly shorter than antennular article 1, pitted, anterior margin reaching and filling orbital hiatus, anterior lateral margin with a well-developed tooth, mobile under pressure. Antennal article 3 small, about one half size of antennal article 2. Antennal article 4 very small, about half size of antennal article 3. Epistome wider than long, generally smooth, except for aggregation of tubercles below antennular article 1.

Maxilliped 3 outer surface tuberculate, tubercles generally rounded, larger ones granulate; diagonal notch present at junction of merus and carpus; propodus and dactylus not hidden behind ischium and merus when maxilliped 3 completely closed. Ischium subrectangular, divided into mesial and lateral portions by deep, broad, median groove, groove with about 5 pits arranged longitudinally, distalmost 2 pits usually further divided into 2 smaller subcircular pits; lateral portion with 2 large tubercles, posterior tubercle about twice as large as anterior tubercle; mesial margin with dense row of setae. Merus subquadrate, with oblique depression, anterior mesial portion deeper. Carpus dorsal surface tuberculate, with 1 or 2 small pits; upper margin dentate, teeth small, irregular; lower margin setose, setae long. Propodus distal margin with a tooth, lower margin setose, setae long. Dactylus upper margin dentate, teeth very small; lower margin setose, setae long. Exopod dorsal surface tuberculate, with a row of pits near lateral edge; about one half width of ischium; tapering slightly distally, distal tip partially hidden behind anterior lateral edge of merus; lateral edge dentate, usually with 5 teeth.

Thoracic sternites 1–2 completely fused, hidden behind sternite 3. Sternites 3–4 fused, suture line visible laterally; with deep pit in males and juvenile females, pit divided into 3 depressions by V-shaped ridge, 1 anterior, 2 lateral; anterior depression small, oval-shaped, lateral depressions much larger than anterior depression, kidney-shaped; bottom of pit with numerous smaller pits. Thoracic sternites 4-8 surfaces pitted; lateral margins dentate, teeth small; lateral margins tuberculate, tubercles small; sternites 4–7 each with an anterior and posterior pit, pit semicircular; posterior pit continuous with anterior pit of adjacent posterior sternite, forming a transversely oval pit. Sternite sutures 4/5 and 5/6 interrupted medially; sutures 6/7 and 7/8 not interrupted. Median suture absent on sternites 4–6; present only in posterior half of sternite 7; complete on sternite 8.

Chelipeds heterochelous in both sexes; major chela adapted for crushing, minor chela adapted for cutting. Coxa ventral surface tuberculate; with 3 deep oval depressions. Ischia-basis with suture line visible; ventral surface tuberculate; anterior portion of ischium slightly pitted, inner margin with 5 teeth. Merus subtriangular in cross-section; upper surface slightly tuberculate, distal two-fifths with distinct dorsal meral spine; inner margin with 4–6 teeth, median 2 teeth large and prominent, large teeth edges tuberculate, tubercles small, irregular; outer margin with 5 or 6 teeth, distalmost tooth

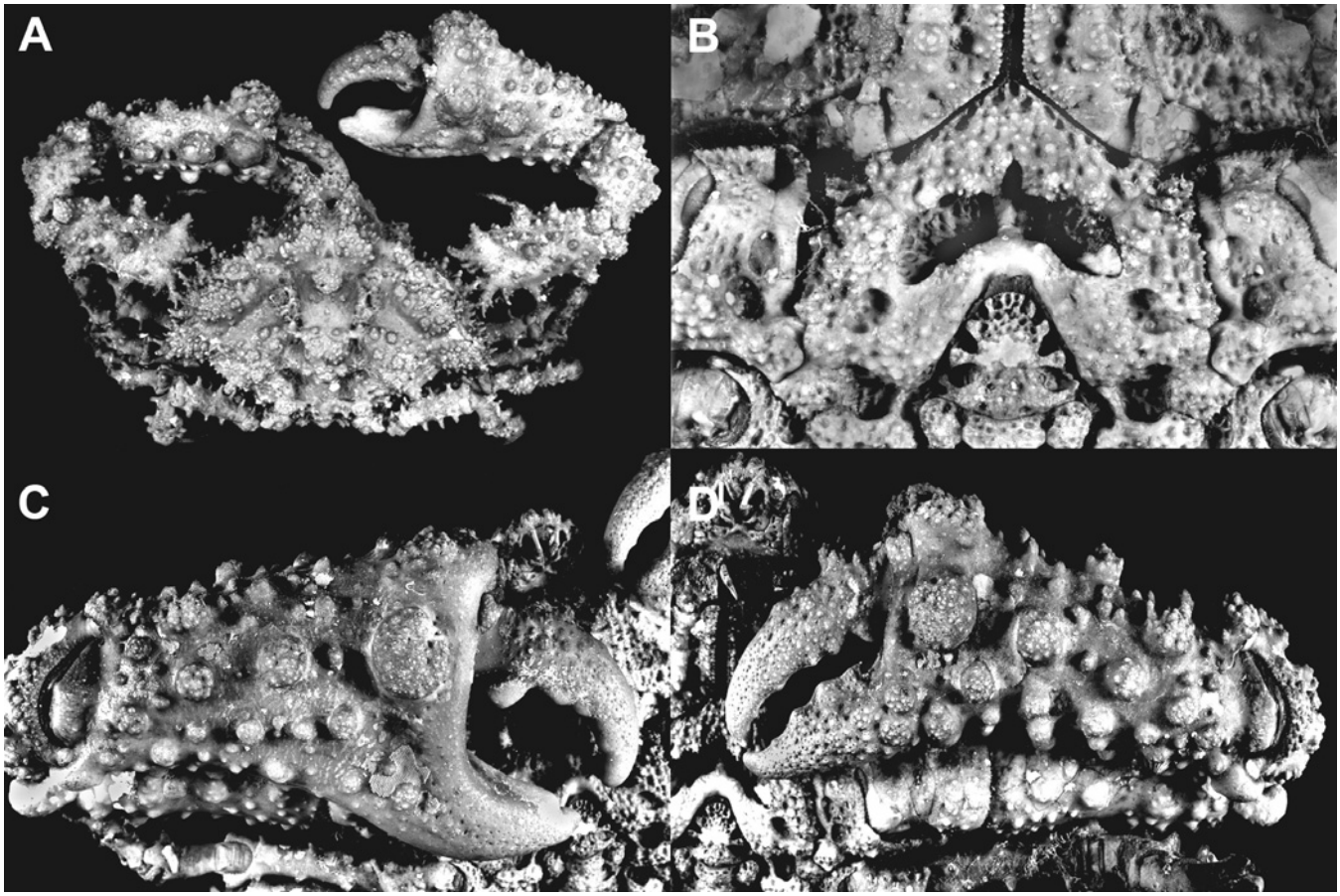

Fig. 6. *Daldorfia horrida* (Linnaeus, 1758): neotype, male, 127.2 × 91.7 mm (ZRC 1999.1028), Taiwan, Ilan County, Longtong Jetty: A, dorsal view; B, sternal pit; C, outer surface of right (major) cheliped; D, outer surface of left (minor) cheliped.

largest, separated from second distalmost tooth by wide notch; lower margin with 3 tubercles, tubercles round, low, granulate. Carpus margins surfaces tuberculate, tubercles paxilliform; margins not clearly demarcated. Manus subtriangular in cross-section; inner margin with a row of 3 large tubercles, bases of tubercles usually round in major chela, slightly flattened dorso-ventrally in minor chela; tubercle edges usually spinate; outer surface with variously sized round, low, granulate tubercles; median tubercles larger than outer tubercles. Fingers thick, relatively long, about 0.5 times length of manus. Major chelae dactylus strongly curved, forming a gap between cutting edges; dactylus cutting edge usually with 6 teeth, proximal-most tooth largest, decreasing in size distally; proximal-most tooth molariform, other teeth broad, low, blunt; pollex about same length as dactylus, cutting edge with a large, long, flat tooth, occupying almost entire length of pollex. Minor chelae dactylus and pollex not forming gap when fully closed; dactylus and pollex cutting edges each with 3 or 4 broad, short, triangular teeth; dactylus teeth shorter than pollex teeth.

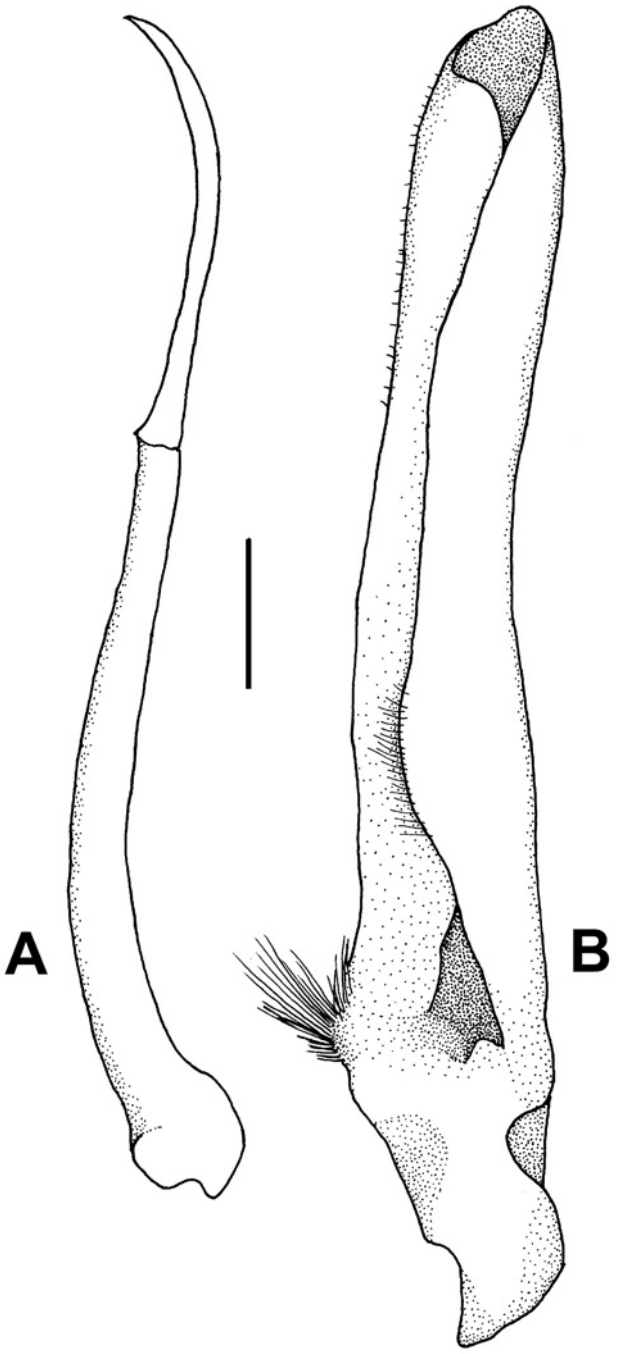

Fig. 7. *Daldorfia horrida* (Linnaeus, 1758): male, 47.0 × 33.9 mm (RMNH D 42927), Seychelles: A, left G2; B, left G1. Scale bar = 1 mm.

Ambulatory legs relatively stout, P2 longest. Each merus triangular in cross-section, surfaces smooth; upper margin with 6 teeth, teeth long, slender, slightly curving outwardly at tip; proximal-most tooth not in line with other teeth, placed slightly posteriorly; lower margin with 2 edges, each edge with 3 long, slender spines. Each carpus surface sometimes with 1–3 spine-like tubercles; about 0.5 times length of merus; upper margin usually with 2 spine-like teeth, distal tooth larger; lower surface not distinctly differentiated into anterior or posterior edges. Each propodus about 0.6 times length of merus; anterior and posterior surfaces smooth, sometimes with several short, blunt tubercles, less in P2 and P3, more in P4 and P5; lower surface differentiated into anterior and posterior edge; anterior edge with 2 short teeth; posterior edge with 2 or 3 short teeth. Each dactylus stout, slightly shorter than propodus; only upper and lower margin pubescent, forming distintive V-shaped pattern; anterior and posterior surface tuberculate, tubercles very small; tips clear, smooth, corneous.

Male abdomen segments 3–5 immovable in adults, movable in juveniles. Outer surface with 1 or 2 deep lateral depressions on each side. Segment 3 widest, segments 4–6 about same width. Segment 4 about same length as segment 3; segment 5 slightly longer than segment 4; segment 6 about 1.4 times longer than segment 5, about as long as wide. Telson triangular, slightly longer than wide, surface with 2 lateral depressions on each side and 1 central depression, apex rounded. Female all abdominal segments freely movable, surface with depressions similar to male abdomen. Female telson semicircular in mature specimens.

G1 tubular, straight, tip not tapering, blunt, not bulbous. G2 about 1.2 times length of G1, distal segment about 0.6 times length of basal segment.

Distribution. – *Daldorfia horrida* has been widely reported from the Indo-West Pacific, from the western Indian Ocean including Madagascar and the Red Sea to the Pacific as far east as Hao Atoll, French Polynesia (Nobili, 1907). *Daldorfia horrida* is yet to be reliably reported from Hawaii. To date all Hawaiian reports of *D. horrida* can be attributed to either *D. rathbunae* or *D. dimorpha*, new species (see discussion under each species).

Discussion. – Linnaeus (1758) did not explictly state whether he examined any specimens when he described this species. He, however, cited two illustrations, Rumphius (1705: Pl. 9) and Petiver (1713: Pl. 1 Fig. 7). Petiver's figure was essentially the same as that of Rumphius' Pl. 9 (see Holthuis, 1959: 73). Linnaeus (1767) later indicated that he had specimen(s) and gave a catalogue number (M.L.U. 442). The

letters M.L.U. refers to the Museum Ludovicae Ulricae, the collection of Queen Lovisa Ulrika (grandmother of King Gustav IV Adolf of Sweden), for which Linnaeus was "called there on several occasions to arrange the material" (Wallin 1997: 3). We enquired at the Swedish Museum of Natural History about the whereabouts of any specimen(s) that Linnaeus might have had in his possession. The first author also visited the Uppsala University Zoological Museum, current depository of Linnaeus' brachyuran specimens. Neither repository holds any specimens from the time of Linnaeus that correspond to *D. horrida*. Holm (1957) indicated that the specimen corresponding to *D. horrida* is 'saknas' (missing). Wallin (1997), in his catalogue of Linnaean type specimens, did not even list *D. horrida* or *C. horridus*. It appears that if Linnaeus ever had specimens, they are now lost. In any case, in the absence of a specimen, the illustration in Rumphius (1705: Pl. 9) hints at the identity of this species, which Holthuis (1959) confirmed as *D. horrida*. Holthuis (1959) also confirmed the conspeficity of *C. spinosus* of Rumphius (1705) with *C. horridus* and also noted that the former name, being pre-Linnaean, is invalid.

According to ICZN Article 72.4, the specimen illustrated by Rumphius (which he called *Cancer spinosus* or 'Rotskrabbe') can be considered to be the type (Rumphius, 1705: Pl. 9). However, the illustration appears more spinose than *D. horrida* as presently defined, vaguely resembling either *D. spinosissima* or an adult *D. triangularis* (see discusion under *D. triangularis*). On the other hand, on the basis of the shape of the teeth on the meri of the ambulatory legs, Rumphius' illustration is very likely to be *D. horrida* and not *D. triangularis*. However, the accuracy of some of Rumphius' illustrations cannot be determined, because he seldom provided figures for the crustaceans that he described. The publisher of his book, wanting to produce a more richly illustrated volume, added several new figures, many of which were based on specimens borrowed from various private collections in Holland. One of these figures is that of *D. horrida*, based on a specimen on loan from Henricus d'Acquet, Burgomaster of Delft (see Rumphius, 1705: 16 and Pl. 9; Holthuis, 1959: 66; Beekman, 1999: 39). To complicate matters, *D. triangularis* is also known from Ambon (Flipse, 1931) (as *D. spinosissima*; see discusion under *D. triangularis*). Therefore, if Rumphius' illustration is used as the basis for species identity, there is a strong possibility for taxonomic confusion. In addition, until the present study, specimens from some localities have been incorrectly identified with *D. horrida* (e.g. *D. dimorpha* from Hawaii). The superficial similarity of several species is a problem if a figure is selected as the iconotype of *D. horrida*. This is compounded by the fact that *C. horridus* is the type species of *Daldorfia*. The uncertainties and potential for confusion are thus clearly undesirable. In the interest of nomenclatural and taxonomic stability, a neotype for *C. horridus* is hereby selected. Linnaeus (1758) cited the type locality as "Asiatic Seas", so any good specimen from Asian waters is suitable. A male specimen, 127.2 × 91.7 mm (ZRC 1999.1028), from Taiwan is here selected as the neotype of *Cancer horrida* Linnaeus, 1758. The neotype would ideally be from Ambon, from where Rumphius (1705) originally described *D. horrida*, but we have been unable to locate a good specimen from there.

Daldorfia horrida resembles *D. rathbunae* except that the carapace of the former is considerably more rugose than the latter. Adults of both species could be readily differentiated by several characters, but most easily by the shape of the teeth on the ambulatory leg merus. In *D. horrida*, only the teeth tips are slightly bent outwards, whereas in *D. rathbunae*, about half the length of the teeth are bent outwards at an angle of 90º. This gives the ambulatory meral teeth of *D. rathbunae* a distinctive r-shaped appearance. In addition, the distal-most tooth of each ambulatory leg merus is recurved in *D. rathbunae*, but not in *D. horrida*.

The sternal pit is always present in *D. horrida* and is well defined in males and juvenile females. In adult females, the abdomen is expanded and the telson covers the sternal pit. The sternal pit is also continuous with the sternal depression covered by the abdomen and loses the characteristic sternal pit shape. The shape of the sternal pit has been found to be constant in mature, juvenile male and juvenile female specimens. This character can, therefore, be used to differentiate *D. horrida* and *D. rathbunae*, even for juveniles. In *D. horrida*, the sternal pit is divided into three depressions, with a small oval-shaped anterior depression and two large kidney-shaped lateral ones. Separating the three depressions is a V-shaped ridge at the bottom of the sternal pit. In *D. rathbunae*, the sternal pit also has a similar structure except that the anterior lobe is considerably smaller and the ridge is Y-shaped and not V-shaped.

Two photographs of the same specimen were identified by Kato & Okuno (2001) as *Daldorfia* species. In all likelihood, the specimen is a juvenile *Daldorfia horrida*, which, according to them, is only 2 cm CL. The carapace is triangular in the smaller of the two photographs in Kato & Okuno (2001). This is typical of the change in carapace shape in *D. horrida*, being triangular in juveniles, but becoming pentagonal in adults.

In what is perhaps the only study of the feeding behaviour of a *Daldorfia* species, Zipser & Vermeij (1978) observed that the large chela with the molariform tooth of *D. horrida* is used to crush snails and also the molluscan shells of hermit crabs. They observed *D. horrida* hunting by lowering its body over potential prey to trap it beneath the abdomen and legs. Prey is then manipulated with both chelae, the mouthparts, and P2 and/or P3. Gastropod prey that *D. horrida* was observed to feed on are *Cantharus fumosus*, *Cerithium columna*, *Columbella mercatoria*, *Conus* sp., *Cymatium nicobaricum*, *Cypraea moneta*, *Drupa morum*, *Drupa ricinus*, *Leucozonia leucozonalis*, *Morula granulata*, *Strombus gibberulus*, *Thais melonis*, *Trochus niloticus* and *Vasum turbinellus* (see Zipser & Vermeij, 1978). The second author has observed *D. horrida* feeding on *Turbo* and *Drupa* in a Taiwanese aquarium in the manner described by Zipser & Vermeij (1978). Their crushing of the gastropods can be heard even a few metres from the tank.

Garth & Alcalá (1977) reported *D. horrida* to be mildly toxic in the Philippines. Ng et al. (1990) also reported *D. horrida* as toxic in Singapore. Debelius (1999) reported a *D. horrida* that he photographed in Indonesia was consuming a small pufferfish. Toxicity of the flesh of *D. horrida* could be the result of accumulation of toxins acquired through its diet (see Ng, 1998), although to date, there have been no follow-up experiments to confirm the actual toxicity of the species.

Daldorfia bouvieri (A. Milne-Edwards, 1869) (Figs. 8, 9)

Parthenope bouvieri A. Milne-Edwards, 1869: 350; A. Milne-Edwards & Bouvier, 1900: 119, Pl. 18 Figs. 12–15; Bouvier, 1915: 53; Balss, 1921: 54; Bouvier, 1922: 77, Pl. 2 Fig. 4, Pl. 6 Figs. 9–11; Capart, 1951: 106; Monod, 1956: 595, Fig. 871; Forest & Guinot, 1966: 121; Crosnier, 1967: 340; Türkay, 1982: 99, 113.

Lambrus bouvieri – Miers, 1886: 93.

Types. **–** Holotype, male 48.8 × 34.2 mm (MNHN 636 S), Îles du Cape Vert, Cape St. Vincent, M. Bouvier coll., no date.

Material examined. **– Cape Verde Islands**. São Vicente, no other data: 1 male 34.9 × 25.7 mm, 1 female 28.4 × 20.6 mm (SMF 8952). **Sao Tome & Principe**. Gulf of Guinea, Rolas Island, Graeff coll., no date: 1 ovig. female 30.5 × 21.6 mm (ZMB 16134). **Congo**. Baie de Pointe Noire, 5–8 m. A Crosnier coll., 5 May 1965: 1 male 37.0 × 24.5 mm (MNHN); Baie de Pointe Noire, A. Crosnier coll., 21 Oct.1967: 1 male 66.6 × 43.7 mm (MNHN B 27537).

Diagnosis. **–** Carapace triangular to subtriangular, dorsal surface rugose, protogastric, mesogastric, hepatic and epibranchial regions heavily tuberculate, mesobranchial, metabranchial and cardiac region pitted. Frontal projection short, weakly bilobate. Inter-antennular spine granulate, not continuous with rostrum tip. Chelipeds heterochelous. Ambulatory leg meri upper margin dentate, usually with 6 or 7 teeth, margins of teeth fusing with adjacent teeth, upper margin appearing cristate; lower margins of ambulatory meri with 2 edges, edges dentate, teeth spade-like, closely-spaced. Male sternal pit not divided into lobes, bottom of pit smooth. Male G1 tubular, tip distal one-fifth bent inwards at about 90°. G2 about same length as G1, distal segment about 0.8 times length of basal segment.

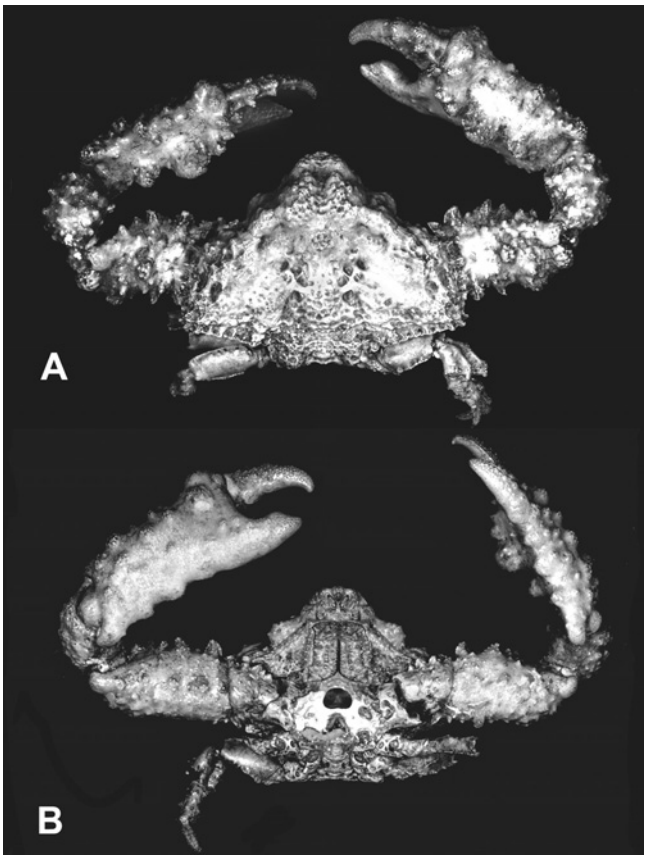

Fig. 8. *Daldorfia bouvieri* (A. Milne-Edwards, 1869): holotype, male, 48.8 × 34.2 mm (MNHN 636 S), Cape Verde Islands, Cape St. Vincent, M. Bouvier coll., no date: A, dorsal view; B, ventral view.

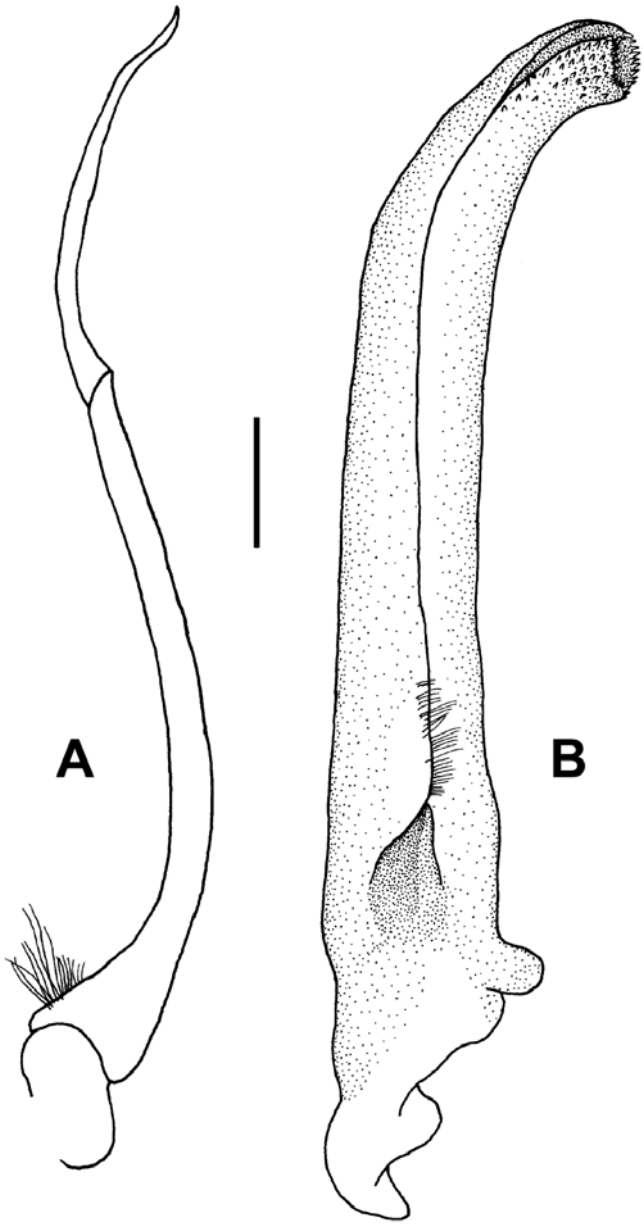

Fig. 9. *Daldorfia bouvieri* (A. Milne-Edwards, 1869): male, 37.0 × 24.5 mm (MNHN), Congo, Baie de Pointe Noire, 5–8 m, A. Crosnier coll., 5 May 1965: A, right G2; b, right G1. Scale bar = 1 mm.

Distribution. **–** Eastern coast of the Atlantic Ocean.

Discussion. **–** This is the only species of *Daldorfia* known from the eastern Atlantic. It can be differentiated from all Indo-West Pacific *Daldorfia* species by the shape of the teeth on the upper margins of the ambulatory legs meri, the shape of the male sternal pit and the G1. None of these characters, however, are presently considered significant enough to warrant placing *D. bouvieri* in a different genus.

The teeth on the upper margins of the ambulatory legs of this species are vaguely T-shaped and with the stems of the teeth being broad. These stems, especially the distal ones, are so broad that their margins are fused with adjacent teeth, forming a cristae-like structure on the distal portion of the merus. The degree of fusion varies between specimens. The teeth on P5 of a small male (37.0 × 24.5 mm, MNHN) have the distal-most four teeth completely fused but not the proximal three. On the P5 of a larger male (66.4 × 43.7 mm, MNHN B 27537), only the second and third distal-most teeth are fused. This arrangement is not seen in any Indo-West Pacific *Daldorfia* species.

Males of *D. bouvieri* have well defined and smooth sternal pits (Fig. 8) unlike Indo-West Pacific *Daldorfia* species which always have some kind of ornamentation. The pit is also comparatively deeper in D. bouvieri than in Indo-West Pacific species.

The species most closely resembling *D. bouvieri* is *D. trigona* from the eastern Pacific Ocean. The anterolateral angle is more acute in *D. bouvieri* than *D. trigona*. In addition, the metabranchial margin of the carapace is continuous with the posterior margin at an angle, whereas in *D. trigona*, the metabranchial margin appears to be in the same line as the posterior margin. As such, the carapace shape of *D. bouvieri* appears less triangular than that of *D. trigona*. It is, however, difficult to distinguish both species apart, especially in small specimens, which are triangular in both species. The texture of the sternal pit in males also appears to be slightly different with that *D. bouvieri* being smooth, but lightly pitted in *D. trigona*. This character is also difficult to use because the pitting in *D. trigona* is not very obvious. The most useful character in differentiating between the two species is the subhepatic groove. There is a row of tubercles in both species, but the tubercles are considerably larger in *D. trigona* than *D. bouvieri*. This is true even when a small *D. trigona* (male 48.0 × 30.5 mm, LACM CR 193805818) is compared with a large *D. bouvieri* (male 66.6 × 43.7 mm, MNHN B 27537). The size of the tubercles in the subhepatic groove of the former is at least twice the size of the latter.

Daldorfia calconopia, new species
(Figs. 10a, b, 11)

Types. **–** Holotype, male 21.5 × 16.8 mm (WAM C 9930), Western Australia, west of Geraldton, stn 40, 28°14'00"S 113°28'00"E, at a depth of 60 fm (110 m), by beam trawl, from a bryozoan colony, collected by CSIRO, 4 Feb.1964; Paratype: 1 female 17.0 × 12.9 mm (WAM C 9930), same locality as holotype.

Material examined. **–** Australia, Western Australia. Off Cape Naturaliste, stn 134, 75–82 fm (137–150 m), CSIRO coll., 28 Aug.1963: 1 female 13.0 × 10.2 mm (WAM C 24923); North of Cape Leschenault, stn 217, 31°22'00"S 115°03'00"E, CSIRO coll., 11 Oct.1963: 1 male 11.8 × 9.3 mm (WAM C 9779); Northwest of Bluff Point, Geraldton, stn 131, 70 fm (128 m), sponge and bryozoan bottom, 27°40'00"S 113°03'00"E, CSIRO coll., 22 Aug.1963: 1 male 12.3 × 9.4 mm; 6 females 7.7 × 6.2 – 15.5 × 11.9 mm (WAM C 9753); West northwest of Rottnest Island, dredged on sponges, 95-96 fm (174-176 m), R. W. George coll., 14 Aug.1962: 2 females 18.9 × 14.7 mm, 21.3 × 16.2 mm (WAM C 24922).

Etymology. **–** The specific name is an arbitary combination of of the Latin words *calx*, meaning pebble, and *conopium* (feminine: *conopia*), meaning "mosquito-net". This alludes to the fine reticulate pattern on the dorsal surface of the carapace, which makes the crab looks like a pebble it is covered with a mosquito net.

Diagnosis. **–** Carapace subtriangular, dorsal surface tuberculate, tubercles paxilliform, coalescing at edges, forming reticulate pattern. Frontal projection relatively long, tip bifurcated. Inter-antennular spine well developed, elongate, continuous with rostrum tip. Maxilliped 3 propodus and dactylus hidden behind merus and ischium. Cheliped not heterochelous. Ambulatory leg meri upper margin tuberculate, tubercles small, irregular, paxilliform, slightly compressed laterally. Male sternal pit one lobe, bottom with Y-shaped ridge. G1 tubular, tip slightly bulbous. G2 1.2 times G1 length, distal segment about 0.6 times length of basal segment.

Description. **–** Carapace triangular to subtriangular, wider than long; dorsal surface heavily tuberculate, tubercles paxilliform, edges usually continuous with adjacent tubercles, forming reticulate pattern; lateral angle acute; protogastric, mesogastric, metagastric, hepatic, epibranchial, mesobranchial, metabranchial, cardiac and intestinal regions distinct, all regions inflated except metagastric, metabranchial and intestinal region which are depressed; protogastric and epibranchial regions more inflated than other regions; epibranchial region divided into 2 portions by shallow transverse groove, anterior portion about twice the size of posterior portion. Gastrobranchial and cardiobranchial grooves deep; hepato-orbital and hepatobranchial grooves less deep; other grooves shallow. Frontal projection relatively long, tip bifurcated, edges tuberculate. Interorbital region with an oval depression. Supraorbital region with one suture. Hepatic region lower than protogastric and epibranchial regions. Hepatic margin with distinct tooth, tip directed posteriorly. Epibranchial margin arcuate, usually with 9 or 10 teeth inclusive of lateral tooth, increasing in size posteriorly; larger teeth usually with a small, narrow dorsal ridge; lateral tooth bifurcated or trifurcated. Mesobranchial margins concave, with a large terminal tooth. Metabranchial margin convex, with no tooth. Posterior margin straight, tuberculate, usually divided into 3 lobes, outermost lobes larger than inner lobes, lobes densely tuberculate.

Inter-antennular spine well developed, elongate, continuous with rostrum tip. Pterygostomial region tuberculate, some tubercles slightly paxilliform, edges continuous with adjacent

tubercles, forming reticulate pattern. Pterygostomial ridge prominent, thick, not cristate, usually with 5 small, irregular tubercles; subhepatic groove tuberculate, tubercles stellate; suborbital portion of subhepatic groove deep, becoming shallow at subhepatic region, terminating below hepatobranchial notch. Sub-branchial region tuberculate, tubercles paxilliform, edges usually continuous with adjacent tubercles, forming reticulate pattern. Subepibranchial ridge present, formed by a row of 8 or 9 tubercles, tubercles continuous with adjacent tubercles, forming distinct cristae. Subepibranchial region pitted, pits sometimes with small round tubercles. Ventral spines very reduced.

Antennules folded at ca. 45º angle; antennular article 1 sparsely tuberculate. Antennal article 2 immediately adjacent to antennular article 1, slightly shorter than antennular article 1, tuberculate, anterior margin reaching and filling orbital hiatus, anterior lateral margin with well-developed tooth, mobile under pressure. Antennal article 3 small, about one-sixth size of antennal article 2. Antennal article 4 very small, about half size of antennal article 3. Epistome wider than long, surface generally smooth, except for cluster of tubercles below antennular article one.

Maxilliped 3 outer surface tuberculate, tubercles small, irregular; diagonal notch present at junction of merus and carpus; propodus and dactylus hidden behind ischium and merus when maxilliped 3 completely closed. Ischium subrectangular, divided into mesial and lateral portions by relatively shallow, broad groove; lateral portion usually with 4 irregular tubercles, second most proximal tubercle largest; mesial margin dentate, teeth small, with dense row of setae. Merus subquadrate, with oblique depression, anterior mesial portion deeper; anterior lateral portion auriculiform. Carpus dorsal surface slightly tuberculate; upper margin dentate, teeth small, irregular; lower margin setose, setae long. Propodus distal margin with a tooth, lower margin setose, setae long. Dactylus upper margin dentate, teeth very small; lower margin setose, setae long. Exopod dorsal surface tuberculate, tubercles small, irregular, less than half width of ischium, tapering slightly distally, tip partially hidden behind anterior lateral portion of merus; lateral edge dentate, teeth irregular, numerous.

Thoracic sternites 1–2 completely fused, hidden behind sternite 3. Sternites 3–4 fused; with a moderately deep pit, bottom with Y-shaped ridge. Thoracic sternites 4–8 surfaces eroded, lateral margins dentate, teeth small. Sternite sutures 4/5 and 5/6 interrupted medially; sutures 6/7 and 7/8 not interrupted. Median suture absent on sternite 4–7; complete on sternite 8.

Chelipeds not heterochelous, both adapted for cutting. Coxa ventral surface slightly tuberculate; with small round pit near

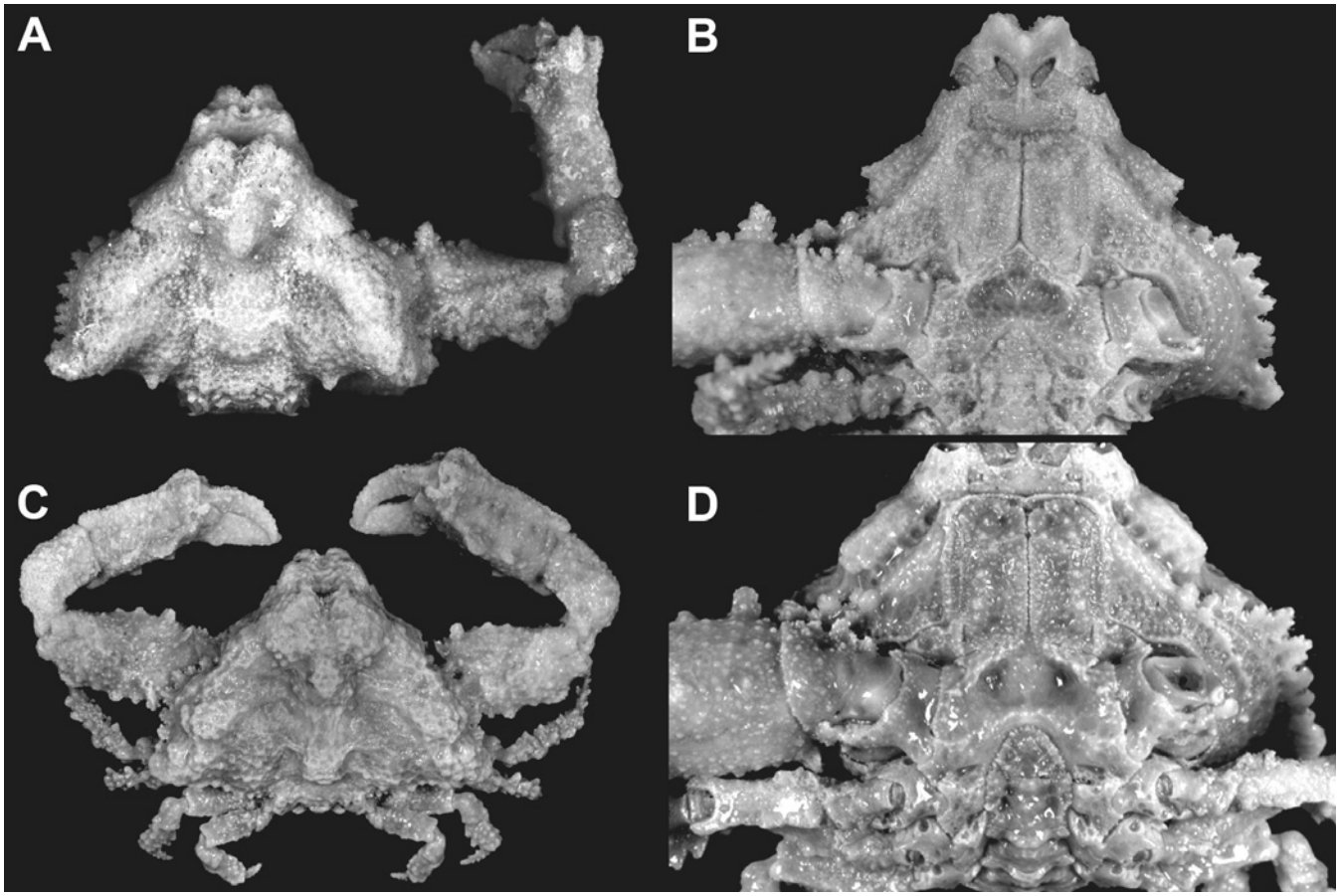

Fig. 10. *Daldorfia calconopia*, new species: A, B, holotype, male, 21.5 × 16.8 mm (WAM C 9930), Australia, Western Australia, west of Geraldton, stn 40, 28°14'00"S 113°28'00"E, at a depth of 60 fm (110 m), by beam trawl from a bryozoan colony, collected by CSIRO, 4 Feb.1964. *Daldorfia excavata* (Baker, 1905): C, D, lectotype, male, 26.3 × 19.8 mm (SAM C 1190), Australia, South Australia, Investigator Straits, dredged, 20–30 fm (37–55 m), J. C. Verco coll., no date. Dorsal view = A, C; Ventral view = B, D.

maxilliped 3 coxa. Basis-ischium fused, suture line visible. Basis ventral surface slightly tuberculate. Ischium surface tuberculate, inner margin with 5 or 6 irregular teeth. Merus subtriangular in cross-section; upper surface tuberculate, tubercles paxilliform; distal half length of merus with dorsal meral spine, granulate; inner margin with 3 or 4 teeth, second proximal tooth largest, teeth irregular, granulate; outer margin usually with 9 irregular teeth, median teeth larger, slightly spade-shaped; lower margin with 2 low teeth, distal tooth slightly larger. Carpus margins surfaces tuberculate, tubercles paxilliform; margins not clearly demarcated. Manus subtrigonal in cross-section; inner surface with a diagonal row of teeth, with 3 or 4 teeth, teeth slightly flattened dorso-ventrally, surface granulate; second distal-most tooth largest; outer surface tuberculate, with a diagonal row of relatively large but low tubercles, tubercles granulate; upper margin dentate, teeth small; lower margin lower margin with 2 large, sharp teeth. Fingers surfaces tuberculate, relatively long, about 0.5 times length of manus, relatively thick, slightly flatten. Dactylus slightly curved, sometimes forming a gap between cutting edges, cutting edge with 2 low teeth, proximal tooth about twice size of distal tooth. Pollex longer than dactylus, distal half of cutting edge with 2 teeth; tip slightly curving upwards.

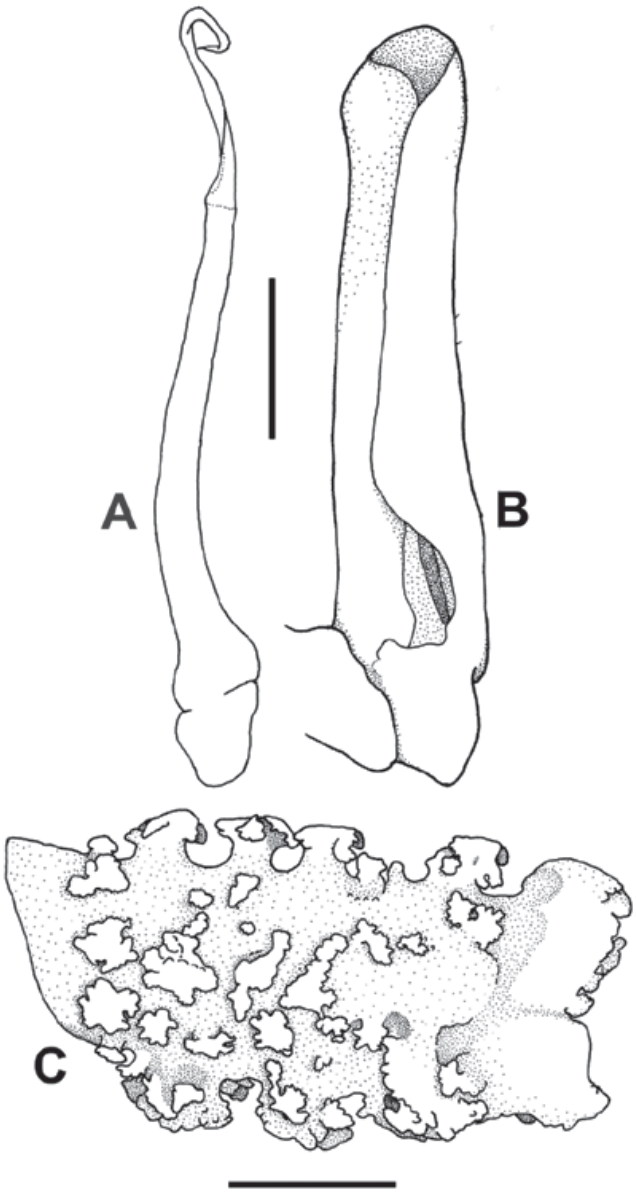

Fig. 11. *Daldorfia calconopia*, new species: holotype, male, 21.5 × 16.8 mm (WAM C 9930), Australia, Western Australia, west of Geraldton, stn 40, 28º14'00"S, 113º28'00"E, 60 fm (110 m), beam trawl from a bryozoan colony, CSIRO coll., 4 Feb.1964: A, left G2; B, left G1; C, posterior surface of P5 merus. Scale bar = 1 mm.

Ambulatory legs relatively stout, P2 longest. Each merus triangular in cross-section, surfaces heavily tuberculate, tubercles paxilliform; upper margin teeth tuberculate, tubercles paxilliform, irregular, proximal-most tubercle not in line with other tubercles, placed slightly posteriorly, distal most tubercle recurved inwards; lower margin with 2 edges, each edge with paxilliform tubercle, some slightly spade-shaped. Each carpus surfaces heavily tuberculate; length about 0.5 times merus length. Each propodus surfaces heavily tuberculate, tubercles large; length about 0.6 times merus length; lower surface differentiated into anterior and posterior edges; P2–4 posterior edge with 3 large teeth, proximal 2 teeth largest, distal tooth smallest; P5 propodus posterior edge teeth all lower than P2–4. Surface of each dactylus with long sharp teeth, usually glabrous; tip clear, smooth, corneous; P2 dactylus slender, slightly longer than propodus; P3–4 dactylus sub-equal to propodus; P5 dactylus shorter than propodus.

Male abdomen with segments 3–5 immovable in adults, T-shaped. Outer surface eroded, with 1 or 2 shallow lateral depressions on each side. Segment 3 widest, segment 4–6 about same width. Segments 3 and 4 about same length; segment 5 slightly longer than segment 4; segment 6 about 1.4 times longer than segment 5, about as long as wide. Segments 4–5 lateral margins tapering slightly towards segment 6; segment 6 lateral margins diverging outwards towards telson. Telson triangular, equilateral, apex rounded, surface tuberculate. Female abdominal segments all freely movable, surface eroded, tuberculate. Female telson broadly semicircular in mature specimens, lateral margins near tip slightly constricted.

G1 tubular, stout, proximal portion straight, tip slightly bulbous. G2 about 1.2 times length of G1, distal segment about 0.6 times length of basal segment.

Distribution. **–** This species is presently known only from Western Australia. Its closest congener is *D. excavata* that is presently known only from southern Australia.

Discussion. **–** This new species is very similar to *D. excavata* but can be differentiated by several characters. The most distinctive difference between the two species is the form of the teeth on the meri of the ambulatory legs. In *D. calconopia*, the teeth are tuberculate, paxilliform and slightly compressed laterally, while in *D. excavata*, the teeth are low, short and subcylindrical, opening distally. The dorsal surface of *D. calconopia* is more tuberculate than in *D. excavatus*. The tubercles of both species are structurally different, being small with many of them paxilliform in *D. calconopia*, but simple and larger in *D. excavata*. Both species have bilobed rostrums,

but that of *D. calconopia* is more projected and tuberculate than in *D. excavata*. Male *D. calconopia* has a Y-shaped ridge on the bottom of the sternal pit. In *D. excavata*, there is no ridge on the bottom of the sternal pit. In addition, the G1 tip in *D. calconopia* is less bulbous than that of *D. excavata*.

Daldorfia dimorpha, new species
(Figs. 12, 13)

Daldorfia horrida – Rathbun, 1906: 886, Pl. 14 Fig. 5 (part); Edmondson, 1925: 32; Hoover, 1998: 271, photo (a) [non *Cancer horridus* Linnaeus, 1758].

Parthenope horrida – Edmondson, 1946: 274, Fig. 170.

Types. **–** Holotype, male 31.0 × 22.1 mm (BPBM S 7002), the Hawaiian Islands, Molokai, Kawakillki, Capt. & Mrs. William Cowell coll., Oct.1964. Paratypes, all collected from the Hawaiian Islands. **Kauai**: 1 female 17.0 × 12.8 mm (BPBM S 6671), Hanumaula Bay, Pele Expedition, stn 004, 45-60 fm (14–18 m), 11 Sep.1959; 1 male 17.3 × 13.2 mm (BPBM S 6677), Port Allen, Pele Expedition, 35–85 ft (11–26 m), 12 Sept.1959; 2 males, 1 female (BPBM S 6668; dried), Port Allen, Pele Expedition, 12 Sept.1959; 1 juv. male (BPBM S 6676), Hanumaula Bay, Pele Expedition, stn 004, 45–60 ft (14–18 m), 29 Aug.1959. **Oahu**: 1 male 17.2 × 12.7 mm, 1 female 21.6 × 16.3 mm (BPBM S 487), Waikiki reef, Edmondson coll., Apr.1921; 1 female 24.1 × 18.2 mm (BPBM S 556), Waikiki reef, Edmondson coll., Jul.–Aug.1921; 2 males, 2 females (BPBM S 1572; dried), Waikiki, Edmondson coll., 1922–1923; 1 female 21.5 × 16.1 mm (BPBM S 2161), Waimanalo, T. T. Dranga coll., 1925; 1 male 15.4 × 11.4 (BPBM S 2199), exterior of Honolulu Horbour, T. T. Dranga coll., 21 Feb.1925; 1 juv. male 7.6 × 6.0 mm (BPBM S 2851), Waikiki Beach, Guberlet coll., 1926; 1 ex. (BPBM S 3191), Kahala, Edmondson coll., 1930; 1 female 20.7 × 15.1 mm (BPBM S 3202), Waikiki, Edmondson coll., Jan.1929; 1 female 20.9 × 15.4 mm (BPBM S 3403), Hanauma Bay, Edmondson coll., Jun.1931; 1 male 18.2 × 14.0 mm (BPBM S 3430), Kahala, Edmondson coll., May 1931; 1 ovig. female 19.6 × 14.4 mm (BPBM S 3612), Edmondson coll., 1932; 1 male 13.3 × 10.2 mm (BPBM S 3693), Black Point, Edmondson coll., Nov.1933; 1 male 23.9 × 17.5 mm (BPBM S 3762), Maile Point, Edmondson coll., 13 Jun.1934; 2 females 14.0 × 10.4–21.8 × 16.5 mm (BPBM S 4046), Kawela Bay, Edmondson coll., 15–17 Jul.1935; 1 male, 2 females (BPBM S 4252), Rabbit Island, 15 ft. (5 m), T. T. Dranga coll., 13 Nov.1936; 1 juv. ex. 6.4 × 4.8 mm (BPBM S 5101), Off Waikiki, 18 ft (5 m), H. Tuttle coll., 1 Jan.1945; 1 female 21.1 × 15.4 mm (BPBM S 6667), off Waikiki, Pele Expedition, 3-100 ft (1–31 m), 4 Aug.1959; 1 female 21.0 × 15.3 mm (BPBM S 6670), Pokui Bay, Pele Expedition, stn 189, 10–14 fm (27 m), 30 Jul.1959; 1 female 23.6 × 17.3 mm (BPBM S 8396), no other data; 1 female 26.3 × 19.7 mm (BPBM S 8476), Area No. 8, on E. R. Cross' shelling map in Hawaiian Shell News, Robert E. Ridgeway coll., 2 Feb.1965; 1 male 17.7 × 13.1 mm (BPBM S 10442), no other data; 1 female 24.8 × 18.4 mm (BPBM S 10443), no other data; 1 male 23.3 × 16.7 mm, Reef flat south of Kapapa Island, L. Zükeran coll., Jul.1964; 1 male 14.7 × 11.0; 1 ovig. female 22.2 × 16.8 mm (BPBM), Halona Blowhole, J. Park coll., 14 May 1999; 1 female 28.6 × 20.7 mm (BPBM), sandy beach, found under rocks in a tidepool during the day, J. Park coll., 16 Aug.1998; 2 males 20.9 × 15.7 mm, 21.5 × 15.9 mm (MNHN), Halona Cove, 15 m, rubble bottom, R. Holcom coll., 23 May 1999; 1 juv. male 10.1 × 7.3 mm (ZMUC), off Honolulu, Danish Pacific Expedition 1913–1916, dredging, 10–40 fms (18–73 m), 5 May 1915; 1 male 27.5 × 19.8 mm (ZRC), Diamond Head Reef, 1 m, J. Park coll., Jan.2000; 1 juv. 6.4 × 5.0 mm (ZRC), sandy Beach, 2 ft (0.6 m), in tide pool, 0100 hours, D. Takaoka coll., 25 Jan.2000; 1 male 19.1 × 14.8 mm (ZRC), Kahe Point, 10 ft (3 m), coral rubble, R. Holcom coll. Jan.2000; 2 females 23.9 × 17.1 mm, 21.1 × 15.4 mm (ZRC), R. Holcom coll., 2000. **Hawaii**: 1 male 27.0 × 19.3 mm (ZMUC), Hilo, Danish Pacific Expedition 1913-1916, west coast, shore collecting, 7 Apr.1915. **Northwestern Hawaii Islands**: 1 male 30.1 × 21.1 mm (BPBM S 1246), Laysan Island, Thaanum coll., 1923; 1 male 28.5 × 20.9 mm (BPBM S 1302), French Frigate Shoals, Thaanum coll., 1923; 1 male 20.1 × 15.0 mm (BPBM S 2714), Pearl and Hermes Reef, T. T. Dranga coll., Apr.1927.

Material examined. **–** See types.

Diagnosis. **–** Carapace subpentagonal, dorsal surface rugose, tuberculate. Frontal projection short, trilobate. Inter-antennular spine poorly developed, reduced to small, low tubercle; not continuous with rostrum margin. Maxilliped 3 propodus and dactylus not hidden behind merus and ischium; notch at junction of merus and carpus distinct. Cheliped heterochelous. Ambulatory meri upper margin dentate, with6 to 7 teeth, teeth r- to T-shaped. Male sternal pit subtriangular, not divided into smaller depressions, bottom of pit with 4 circular pits, anterior 2 pits smaller than posterior 2. G1 tubular, lateral margins sinuous; tip bent inwards, clefted. G2 about same length as G1; distal segment about 0.5 times basal segment length.

Description. **–** Carapace subpentagonal, wider than long; dorsal surface rugose to tuberculate; lateral angle acute; protogastric, mesogastric, metagastric, hepatic, epibranchial, mesobranchial, metabranchial, cardiac and intestinal regions

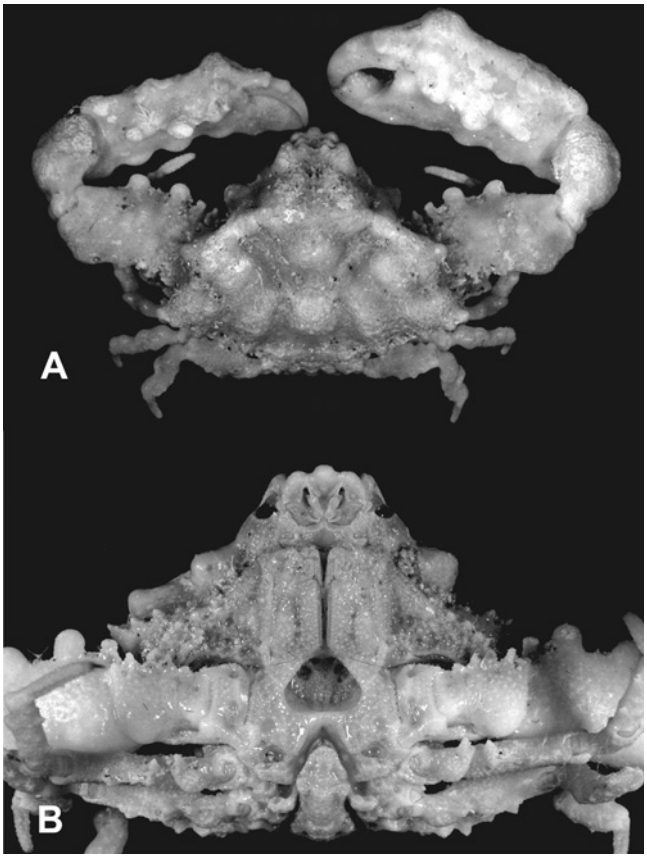

Fig. 12. *Daldorfia dimorpha*, new species: paratype, male, 27.5 × 19.8 mm (ZRC), Hawaiian islands, Oahu, Diamond Head reef, 1 m, J. Park coll., 01.2000: A, dorsal view; B, ventral view.

distinct, all regions inflated except metagastric, metabranchial and intestinal regions which are depressed; protogastric and mesobranchial regions more inflated than other regions; epibranchial region divided into 2 portions by shallow transverse groove, anterior portion about twice the size of posterior portion. Gastrobranchial groove posterior portion relatively deep, cardiobranchial groove less deep than gastrobranchial groove; hepatogastric and hepatobranchial grooves interrupted by dorsal hepatic ridge; other grooves shallow. Frontal projection short, tip blunt, trilobed, lobes small, median lobe larger than lateral lobes. Interorbital region with a circular pit. Supraorbital region with 1 suture. Hepatic region anterior portion slightly lower than protogastric and epibranchial regions; posterior portion inflated, forming dorsal hepatic ridge, continuous with protogastric and mesobranchial regions, demarcated from both protogastric and mesobranchial regions by thin sutures, sutures complete to incomplete. Hepatic margin unilobate, lobe large, distinct, edges usually entire. Epibranchial margin anterior two-thirds arcuate, usually with 9 teeth, increasing in size posteriorly; larger teeth usually with a small, narrow dorsal ridge. Mesobranchial margin straight, with 4 teeth, teeth T-shaped, each tooth with small, narrow dorsal ridge, tips usually continuous with adjacent teeth tips. Metabranchial margin concave, with 3 granulate tubercle-like teeth; tubercle adjacent to posterior largest. Posterior margin straight, tuberculate, tubercles granulate.

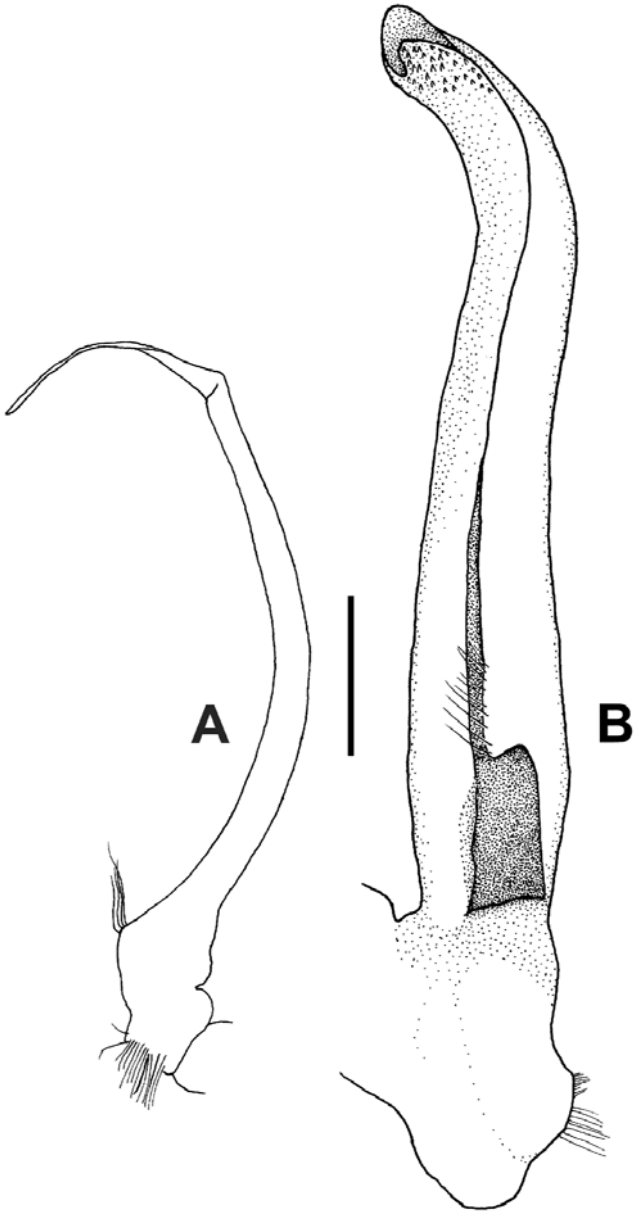

Fig. 13. *Daldorfia dimorpha*, new species: paratype, male, 27.5 × 19.8 mm, Hawaiian islands, Oahu, Diamond Head reef, 1 m, J. Park coll., Jan.2000 (ZRC): A, left G2; B, left G1. Scale bar = 1 mm.

Inter-antennular spine absent or reduced to a small, low tubercle; not continuous with rostrum margin. Pterygostomial region pitted, forming reticulate pattern. Pterygostomial ridge prominent, thick, not cristate, lined with small tubercles. Subhepatic groove usually with a row of 7 small, irregular tubercles; suborbital portion deep, becoming shallow at subhepatic region; terminating below hepatobranchial notch. Sub-branchial region pitted, forming reticulate pattern. Subepibranchial ridge dentate, not cristate, teeth subtriangular, edges irregular, proximal-most 3 teeth largest, other teeth smaller by half. Subepibranchial region pitted, pits relatively large, shallow. Ventral spines reduced to 2 tubercles, tubercles irregular, outer tubercle larger.

Antennules folded at about 60º; antennular article 1 tuberculate. Antennal article 2 immediately adjacent to and slightly shorter than antennular article 1, tuberculate; anterior margin reaching and filling orbital hiatus; anterior lateral margin with well-developed tooth; mobile under pressure. Antennal article 3 small, about one half size of antennal article 2. Antennal article 4 very small, about half size of antennal article 3. Epistome wider than long, surface generally smooth; anterior margin lined with round tubercles; posterior margin median portion with small triangular, various sized teeth.

Maxilliped 3 outer surface tuberculate, tubercles of various sizes, irregular; V-shaped notch present at junction of merus and carpus; propodus and dactylus not hidden behind ischium and merus when maxilliped 3 completely closed. Ischium subrectangular, divided into mesial and lateral portions by deep, broad, median groove; groove with a row of 5 or 6 subcircular pits; lateral portion proximal region with cluster of tubercles, tubercles granulate; mesial margin dentate, teeth very small, with dense row of setae. Merus subquadrate, with diagonal row of tubercles, tubercles irregular, proximal-most tubercle slightly larger than others, both sides of tubercle row pitted, pits shallow; anterior lateral portion slightly auriculiform. Carpus dorsal surface slightly tuberculate; upper margin dentate, teeth very small, irregular; lower margin setose, setae long. Propodus dorsal surface slightly tuberculate; upper margin dentate, teeth very small, irregular; lower margin setose, setae long. Dactylus upper margin dentate, teeth very small; lower margin setose, setae long. Exopod dorsal surface tuberculate, tubercles small, irregular; about one half ischium width; tapering slightly distally, distal tip partially hidden behind anterior lateral portion of merus; lateral margin dentate, teeth irregular of various sizes.

Thoracic sternites surface tuberculate. Thoracic sternites 1–2 completely fused, hidden behind sternite 3. Sternites 3–4

fused, suture line visible laterally; with deep, pit in males and juvenile females; sternal pit broadly triangular, apex rounded, bottom of pit periphery pitted, median portion with 2 circular depressions, anterior portion with 2 smaller depressions. Thoracic sternites 4–8 lateral margins tuberculate, tubercles small, distributed unevenly. Sternite sutures 4/5, 5/6 interrupted medially, sutures 6/7, 7/8 not interrupted. Median suture present on sternites 4, 6, 7, 8, absent on sternite 5. Male sternites 4–6 surfaces not hidden by abdomen, sternites 7–8 partially hidden. Male sternite 4 median lateral portion with a small oval depression near cheliped coxa, posterior lateral margin with a semicircular depression; sternites 5–7 anterior portion each with a large tubercle, tubercle irregular, posterior lateral portion each with a semicircular depression; sternite 8 anterior portion with small tubercle, posterior portion hidden behind abdomen. Adult female thoracic sternum completely hidden behind abdomen.

Chelipeds heterochelous, surfaces tuberculate to slightly tuberculate. Coxa ventral surface anterior portion with an oval depression, deep; posterior portion with 2 oval depressions, shallow. Basis-ischium fused, suture line visible. Basis ventral surface tuberculate, anterior portion with a small circular depression. Ischium ventral surface tuberculate; inner margin with 5 triangular teeth. Merus subtriangular in cross-section, surfaces tuberculate; upper surface distal one third region with short, blunt dorsal meral spine; inner margin proximal half with 3 blunt, lobiform teeth, distal half without teeth; outer margin proximal half with 4 teeth, proximal-most 3 teeth irregular, fourth tooth lobiform; outer margin distal half with large, lobiform tooth; lower margin usually with a row of 3 low tubercles. Carpus surfaces tuberculate; margins not clearly demarcated; inner margin with short, blunt tooth. Manus subtriangular in cross-section, surfaces sparsely to moderately tuberculate; inner margin dentate, with 3 or 4 teeth, teeth lobate and blunt in males, lamelliform, sharp and cristate in females; outer margin with 3 or 4 low, broad tubercles, distal-most tubercle largest, blunt; lower margin proximal portion with 2 small teeth, blunt and broad in males, sharp in females. Major chela dactylus strongly curved, forming a gap between cutting edges; cutting edge with 2 or 3 teeth, teeth low, broad. Major chela pollex longer than dactylus, cutting edge with a large, long, molariform tooth; tip blunt, curving slightly upwards. Minor chela dactylus and pollex not forming gap when fully closed; dactylus and pollex cutting edges dentate, with short teeth of various sizes.

Ambulatory legs relatively stout; first pair longest. Ischia ventral surface of P2, P3 each with a long, sharp spine; P4, P5 each with a short and blunt spine. Each merus triangular in cross-section, surfaces tuberculate, tubercles small, low; upper margin dentate, teeth usually T-shaped except proximal- and distal-most teeth; proximal-most tooth r-shaped, not in line with the rest, placed slightly posteriorly; distal-most teeth reverse r-shaped; P2, P3 and P4 meri lower margin with 1 posterior edge, edge usually with 3 subtriangular teeth, proximal 2 teeth immediately adjacent to each other; P5 lower margin with 2 edges, edges low, indistinct, lined with small irregular teeth. Each carpus about 0.5 times merus length, surfaces generally smooth. Each propodus about 0.6 times merus length, surfaces irregular, lower portion slightly tuberculate. Each dactylus stout, slightly shorter than propodus; surface spinulate, setose, setae short, stout; tips clear, smooth, corneous.

Male abdomen with segments 3–5 immovable in adults; T-shaped. Outer surface eroded, with 2 lateral depressions on each side. Segment 3 widest; segment 4–6 about same width, all narrower than segment 3. Segments 3 and 4 about same length; segment 5 slightly longer than segment 4; segment 6 about 1.5 times segment 5. Segments 4–5 lateral margins tapering slightly towards segment 6; segment 6 lateral margins slightly concaved medially, distal portion diverging outwards towards telson. Telson triangular, slightly longer than wide, apex rounded, surface eroded. Female abdominal segments all freely movable, surface eroded and tuberculate. Female telson broadly semicircular in mature specimens, lateral margins near tip slightly constricted.

G1 tubular, slender, sinuous; tip curving inwards, ventral surface with a distal notch. G2 about 0.7 times length of G1, distal segment about 0.3 times length of basal segment.

Etymology. **–** This species exhibits sexual dimorphism with respect to the shape of the teeth on the inner margin of the cheliped meri. The specific name is derived from the Greek word *dimorphe*, meaning two forms, and is used as a noun in apposition.

Distribution. **–** Apparently endemic to the Hawaiian Islands.

Discussion. **–** This species exhibits sexual dimorphism. In males, the teeth on the inner margin of the cheliped meri are generally lobed and smooth, but lamelliform, sharp and continuous at their base in females. The teeth pattern in females also resembles that of *D. leprosa*. No sexual dimorphism, however, is observed in *D. leprosa*, with both males and females having lamelliform teeth on the inner margin of the cheliped meri. *Daldorfia dimorpha* can be distinguished from *D. leprosa* by having well formed r- or T-shaped teeth on the upper margin of the ambulatory leg meri. In *D. leprosa*, the teeth are typically tuberculate, low and granulate.

Rathbun (1906) reported *D. horrida* from the Hawaiian Islands, but did not state how many specimens she had examined. The photograph provided by Rathbun (1906: Pl. 19 Fig. 5) from station 3874, however, represents *D. rathbunae* instead of *D. horrida*. As for the male specimen from Hilo, it can be confidently referred to *D. dimorpha*. This is because Rathbun mentioned that the teeth on the ambulatory legs "...have two points in opposite directions...", i.e., T-shaped as clearly shown in her illustration (Rathbun, 1906: Fig. 39).

The records by Edmondson (1925, 1946) and Hoover (1998) of *D. horrida* must be referred to *D. rathbunae* as well. Edmondson (1925) reported three specimens collected from the French Frigate Shoals, Laysan and Ocean islands (= Kure

Atoll) by the Tanager Expedition. We have examined the specimens (both males) from both the French Frigate Shoals and Laysan Islands and they are clearly not *D. horrida*. The carapace dorsal surface is tuberculated and not rugose. The inner margin of the cheliped merus has about two or three spines that are not as sharp as those in *D. horrida*. The inner surface of the manus also bears several somewhat rounded spines, as opposed to the strong spines found in *D. horrida*. Although we were unable to locate and examine the specimen from Ocean Island in BPBM, it is probably also referable to *D. dimorpha*.

Edmondson (1946) reported that this species "occurs about the shores and also at moderate depths", and is seen frequently. Specimens of this species can be obtained by beach-combing at depths as shallow as one metre (pers. comm., J. Park).

Some specimens obtained had dense growth of pink and other colored coralline algae growing on the carapace. Hoover (1998) photographed a living individual with pink coralline algae covering the entire specimen, but that specimen was not preserved.

We examined a freshly preserved specimen of this *D. dimorpha*, and, although it was in alcohol for a day, the colour of the carapace was still olive-green. This, we believe, is quite close to the live colouration of this species.

Daldorfia excavata (Baker, 1905), new combination
(Figs. 10 c, d, 14)

Thyrolambrus excavatus Baker, 1905: 129, Pl. 24 Fig. 7; Hale, 1927a: 142, Fig. 144; 1927b: 311; Davie, 2002: 385 (list).

Types. – Lectotype, male 26.3 × 19.8 mm, Australia, South Australia, Investigator Straits, dredged, 20–30 fm (37–55 m), J. C. Verco coll., no date (SAM C 1190). Paralectotypes: 1 male 18.4 × 14.5 mm, 1 female 24.3 × 18.5 mm (SAM C 1190), same data as lectotype. Baker (1905) in his description of this species did not designate any holotypes or paratypes but referred to the specimens that he had as "types" without indicating how many he had. As such, all the specimens he had are syntypes. The syntypes consists of two males and one female. The larger male (26.3 × 19.8 mm) is hereby designated as the lectotype. The smaller male (18.4 × 14.5 mm) and the female (24.3 × 18.5 mm) are paralectotypes.

Material examined. – See types.

Diagnosis. – Carapace subtriangular, dorsal surface rugose. Subfrontal region and epistomal region slightly concave. Inter-antennular spine well developed, elongate, anterior portion continuous with frontal margin, forming ridge. Maxilliped 3 exopod, propodus and dactylus almost totally hidden behind merus and ischium; notch at junction of merus and carpus absent. Cheliped heterochelous. Ambulatory leg meri upper margin tuberculate, tubercles low, short, subcylindrical, open distally. Male sternal pit divided into 3 lobes, anterior lobe small, 2 lateral lobes large, anterior lobe separated from lateral lobes by thin ridge at bottom of sternal pit. G1 tubular, tip bulbous. G2 slightly longer than G1; distal segment about same length as basal segment.

Distribution. – Presently known only from South Australia.

Discussion. – This species was originally described as a species of *Thyrolambrus* but is now excluded because it lacks the typical thigh-shaped cheliped merus. In addition, the rostrum is considerably more produced than that of *Thyrolambrus* species. Furthermore, there is a tooth on the anterior outer corner of the antennal article 2 (absent in *Thyrolambrus*).

The G1 of *D. excavata* and *D. calconopia* is tubular like most of the other species of *Daldorfia*, except that the tip is bulbous. The male sternal pits of both species are the shallowest and the most poorly defined amongst all *Daldorfia* species. The inter-antennular spines of both species are placed more anteriorly when compared to most *Daldorfia* species, and they sometimes appear as a median lobe on the rostrum. A gradual

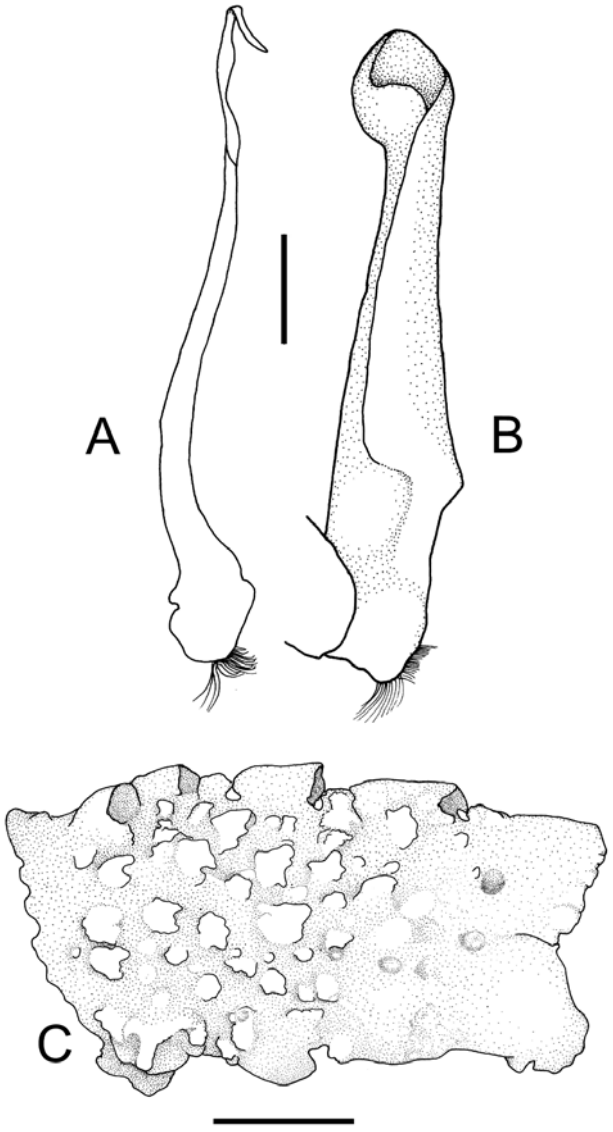

Fig. 14. *Daldorfia excavata* (Baker, 1905): lectotype, male, 26.3 × 19.8 mm (SAM C 1190), Australia, Southern Australia, Investigator Straits, dredged, 20–30 fm (37–55 m), J. C. Verco coll., no date: A, left G2; B, left G1. Paralectotype, female, 24.3 × 18.5 mm (SAM C 1190), same data as lectotype: C, merus of right P5. Scale bar = 1 mm.

change in the characters discussed above can be observed, however, so both species are regarded as congeneric and in *Daldorfia*.

Daldorfia excavata and *D. calconopia* bear some resemblance to *D. investigatoris* in having a well-developed inter-antennular spine that is placed more anteriorly than other *Daldorfia* species. Often, the anterior portion of the inter-antennular spine is continuous with the anterior margin of the rostrum. In other species of *Daldorfia*, the inter-antennular spine is often placed posteriorly, and is not continuous with the anterior margin of the rostrum. Differences between *D. excavata* and *D. calconopia* are discussed under the account of the latter species.

Daldorfia excavata should not to be confused with *Lambrus excavatus* Stimpson, 1871 (see Stimpson, 1871b), which was placed in the subgenus *Pseudolambrus* by Garth (1958) and *Parthenope* by Hendrickx (1999). Although *L. excavatus* was placed in *Pseudolambrus* by Garth (1958), our ongoing studies suggest that *Pseudolambrus* should be restricted to Indo-Pacific species (type species: *Parthenope calappoides* Adams & White, 1849; type locality: the Philippines). Likewise, *L. excavatus* does not belong *Parthenope* sensu stricto (type species: *Cancer longimanus* Linnaeus, 1758) because species of *Parthenope* sensu stricto have considerably longer chelipeds (vs. short) and a circular (vs. triangular) carapace. As such, a new genus, *Ochtholambrus*, has been erected and diagnosed by Tan & Ng (2007) for *Lambrus excavatus* Stimpson, 1871, for which it is the type species of this new genus. *Ochtholambrus excavatus* superficially resembles *Daldorfia* but is not a daldorfiine. The antennal article 2 of *Och. excavatus* is not larger than antennal article 3 and the teeth on the ambulatory leg meri do not have the daldorfiine arrangement.

Daldorfia glasselli (Garth, 1958), new combination
Fig. 15

Thyrolambrus erosus Rathbun, 1898: 579, Pl. 42 Fig. 1; 1925: 533, Pl. 197, Pl. 281 Fig. 2; Bouvier, 1914: 703; Garth, 1948: 31.

Thyrolambrus rathbunae Balss, 1935: 128 [replacement name for *Thyrolambrus erosus* Rathbun, 1898][non *Thyrolambrus rathbuni* De Man, 1903 = *Daldorfia rathbunae* (De Man, 1903)].

Thyrolambrus glasselli Garth, 1958: 452, Pl. Z2, Fig. 8, 8a, Pl. 51 Fig. 1 [replacment name for *Thyrolambrus rathbunae* Balss, 1935]; 1960: 115; 1992: 3; Von Prahl et al.,1990: 27; Lemaitre & Alvarez León, 1992: 54; Morán & Dittel, 1993: 614 (list); Hendrickx, 1993: 312; 1995: 133; 1999: 242, Pl. 10 Fig. D; Aguilera, 2002: 314 (list).

Types. – Holotype, 1 female 25.0 × 18.4 mm (USNM 21577), Mexico, off Cape St. Lucas, U.S. Fish Comission Steamer ALBATROSS, stn 2829, 22°52'00"N 109°55'00"W, 31 fm (57 m), 1 May 1888 (not examined).

Material examined. – Mexico. Gulf of California, U.S. Fish Comission Steamer ALBATROSS, stn 2824, 24°22'30"N 110°19'30"W, 8 fm (15 m), 30 Apr.1888: 1 female 23.5 × 17.3 mm (MNHN B 27536; ex. USNM 21964); Gulf of California, north of San Francisco Island, RV VELERO III, stn 647–37, 22 fm (40 m), 8 Mar.1937: 3 females 12.1 × 9.6 – 15.2 × 12.2 mm (LACM).

Diagnosis. – Carapace pentagonal, dorsal surface irregular, pitted, pits irregular, with large tubercles on protograstric, mesogastric, hepatic, and mesobranchial regions. Frontal margin deflexed, usually lobate. Sub-frontal region and epistomal region slightly concave. Inter-antennular spine well developed, elongate, anterior portion just under frontal lobe. Maxilliped 3 exopod propodus and dactylus hidden behind merus and ischium; notch at junction of merus and carpus absent. Cheliped slightly heterochelous. Ambulatory leg meri upper margin tuberculate, tubercles tall, slightly irregular. Male sternal pit fan shape. G1 tubular, distal quarter strongly bent, tip tapering, tip margin flared, clefted. G2 0.7 times G1, distal segment very short, about 0.2 times length of basal segment.

Distribution. – Tropical eastern Pacific.

Discussion. – *Thyrolambrus erosus* Rathbun, 1898, was first described from Mexico, but some 19 years prior, Miers (1879b) described another unrelated species, *Lambrus* (*Parthenopoides*) *erosus*. There would not be a problem of homonomy, however, if both species remained in their original genera. Balss (1935) regarded the subgenus *Parthenopoides* Miers, 1879, as a junior synonym of *Pseudolambrus* Paulson, 1875, and transferred *Lambrus* (*Parthenopoides*) *erosus* into the genus *Thyrolambrus*. As a result, *T. erosus* Rathbun, 1898, became a secondary homonym of *Lambrus* (*Parthenopoides*) *erosus* Miers, 1879. Balss (1935) suggested that since

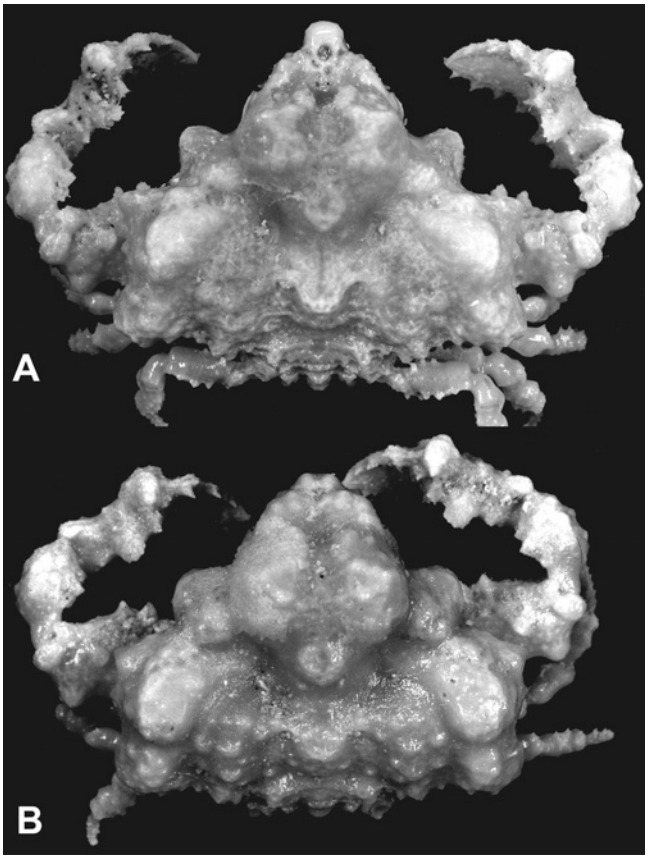

Fig. 15. *Daldorfia glasselli* (Garth, 1958), Gulf of California, north of San Francisco Island, 22 fm (40 m), stn 647–37, RV VELERO III coll., 8 Mar.1937: A, female, 14.8 × 11.6 mm (LACM); B, female, 15.2 × 12.2 mm (LACM).

Lambrus (*Parthenopoides*) *erosus*, had priority over *T. erosus*, it should be conserved and proposed to replace *T. erosus* Rathbun, 1898, with *T. rathbunae*. He was, however, unaware of two important events. Firstly, Flipse (1930) had already removed *Thyrolambrus erosus* Rathbun, 1898, into the genus *Parthenope* (= *Daldorfia*) five years earlier. Secondly, the new name proposed by Balss (1935) was already pre-occupied by *Thyrolambrus rathbuni* De Man, 1902. Although the spelling of this replacement species name is different, it was clear that De Man (1902) intended to name this species after Mary Rathbun because he noted: "Diese niedliche, kleine Krabbe, welche ich mir erlaube der eifrigen, amerikanschen Carcinologin Miss Mary Rathbun in Washington zu widmen". If De Man he had not explained the origin of the name, the original spelling rathbuni would be valid and there would be two valid species names, *D. rathbuni* (De Man, 1902) and *D. rathbunae* (Balss 1935). Fortunately, however, De Man's intention to name the species after a lady was obvious. Therefore, the name *rathbuni* of De Man must be corrected to *rathbunae* and becomes a senior homonym of *T. rathbunae* Balss, 1935. Garth (1958) pointed out this error and subsequently replaced the secondary homonym (*T. rathbunae*) with a new name, *T. glasselli*, which is now the valid name for Balss's species.

It is not clear why Rathbun (1898) placed *D. glasselli* (as *T. erosa*) in *Thyrolambrus* when she had already commented that this species: "...although possessing a strong resemblance to *T. astroides*, differs noticeably in the shape of the carapace and the character of the surface." The most distinctive difference between *D. glasselli* and all *Thyrolambrus* species is the ratio of the cheliped merus length to the carapace width. In *Thyrolambrus*, the cheliped merus is about 0.6 times that of the carapace width, but only 0.3 times in *D. glasselli*. This ratio is even smaller than that of most *Daldorfia* species, which is in the range of 0.4–0.5 times the carapace width. The cheliped manus is not as narrow and thin as those of *Thyrolambrus* species. The maxilliped 3 propodus and dactylus, like that of *D. calconopia* and *D. excavata*, are hidden behind the merus and ischium. The specimens of *D. glasselli* that we have examined (MNHN B 327536) have large tubercles on the protogastric, mesogastric, cardiac, hepatic and epibranchial regions, and superficially resemble *Pseudolambrus hepatoconus* (Flipse 1930) in the Parthenopinae.

Daldorfia investigatoris (Alcock, 1895)
(Figs. 16, 17)

Parthenope investigatoris Alcock, 1895b: 296; Alcock & Anderson, 1896: Pl. 23 Fig. 1; Flipse, 1930: 85 (key); Sakai, 1965: 98, Pl. 45 Fig. 1.

Daldorfia investigatoris – Rathbun, 1911: 259; Sakai, 1976: 285, Pl. 96 Fig. 1; Muraoka, 1998: 30; Morgan, 2001: 120 (list).

Types. **–** The types consist of two female syntypes collected from the Pedro Shoal, Laccadive Islands, currently in the ZSI. We have not examined the types but D. Yeo, who examined and photographed them at our request, noted that they match the original description well and both belong to the same species. The larger syntype, 60.7 × 45.5 mm, is hereby designated as the lectotype. The smaller female (carapace not measure) is the paralectotype. Two catalogue numbers accompanied the types (ZSI 8895/6; ZSI 618/10) but it is not clear which of the labels refers to which specimen (D. Yeo, pers. comm.).

Material examined. **–** Seychelles. REVES 2: stn 21, 55–60 m, 6 Sep.1980: 1 female 29.5 × 22.0 mm (MNHN). **South China Sea**. Macclesfield Bank (Zhongsha Qundao), 30–40 fm (55–73 m), HMS EGERIA, no date: 1 female 20.1 × 15.5 mm (NHM 1893.11.3.234). The Philippines. Visayas, Bohol, Panglao, Balicasag Island, 200–300 m, local fishermen coll., Jun.2002: 2 females 40.0 × 29.3 mm, 20.9 × 22.7 mm (ZRC). **Japan**. Wagu, Mie Prefecture, (34º4'N

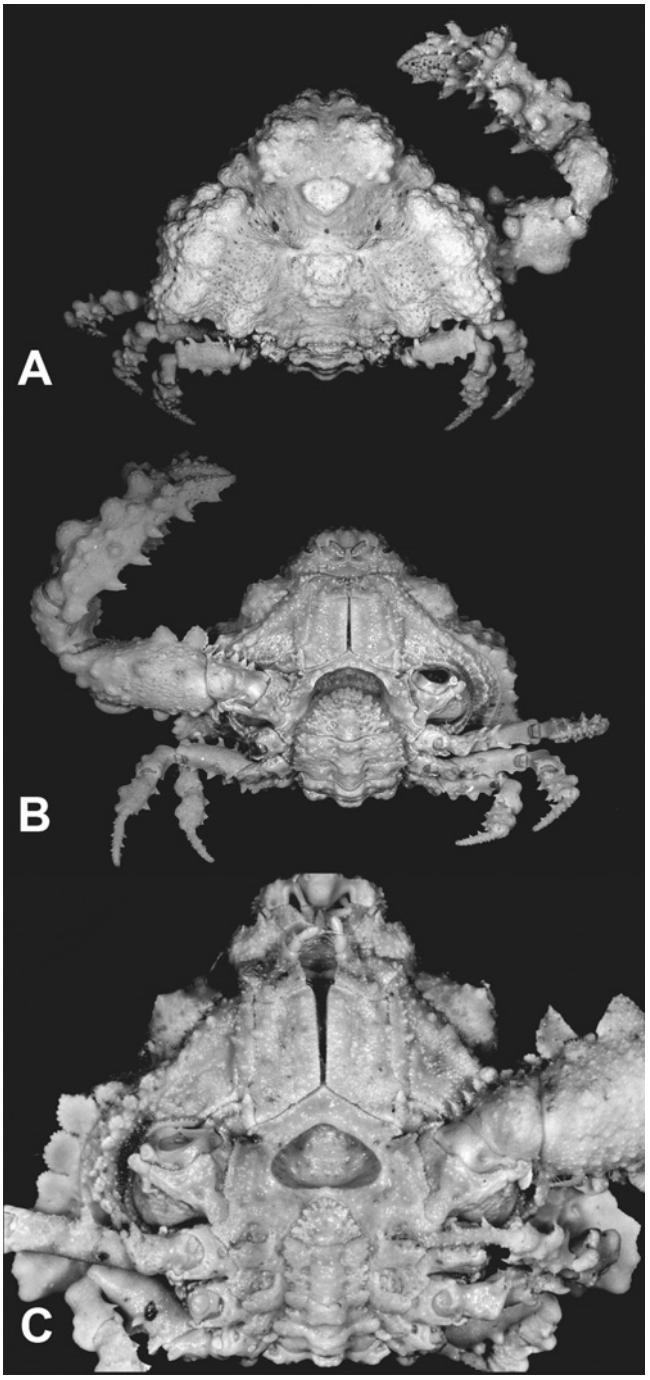

Fig. 16. *Daldorfia investigatoris* (Alcock, 1895): lectotype, female, 60.7 × 45.5 mm (ZSI 8895/6; ZSI 618/10), Laccadive islands, Pedro Shoal: A, dorsal view; B, ventral view. Male, 45.8 × 33.2 mm (SMF 25261), Japan, Honshu, probably Sagami Bay, no date: C, sternal pit of male.

136º51.3'E), in spiny lobster trap, 40–50 m depth, Yamashita coll., no date: 1 female 53.7 × 39.5 mm (SMF 11068); Sagami Bay: 1 male 45.8 × 34.0 mm (SMF 25161, ex coll. T. Sakai); Honshu, probably Sagami Bay, no date: 1 male 45.8 × 33.2 mm (SMF 25261 ex. coll. T. Sakai); No other data: 1 male 44.7 × 33.2 mm (SMF ex coll. T. Sakai); No other data: 1 female 43.2 × 33.0 mm (SMF ex. coll. T. Sakai) (dried); Wagu, Kii Peninsula, Mie Prefecture, N. Yamashita coll. 1978–1979: 1 female 54.2 × 39.3 mm (RMNH D 32066). **Vanuatu**. MUSORSTOM 8: stn DW1021, 17º42.75'S 168º37.00'E, 124–130 m, 28 Sep.1994: 1 male 49.6 × 35.3 mm (MNHN). **New Caledonia**. CHALCAL 1984: Chesterfield, Bellona, stn CP16, 21º41.67'S 159º21.92'E: 1 female 18.0 × 14.0 mm (MNHN). Landsdowne, Fairway Banks, stn D6, 20º57.00'S 161º43.00'E, 45 m: 1 male 18.2 × 14.1 mm (MNHN).

Diagnosis. – Carapace subpentagonal, dorsal surface granulate; protogastric region more inflated than the other regions. Frontal projection strongly deflexed. Subfrontal region and epistomal region flat. Inter-antennular spine well developed, elongate, continuous with anterior margin of rostrum. Maxilliped 3 exopod propodus and dactylus not hidden behind merus and ischium; notch at junction of merus and carpus distinct. Cheliped not heterochelous, both cutters. Ambulatory leg meri upper margin tuberculate, tubercles irregular. Male sternal pit subtriangular. G1 tubular, distal 0.2 bent inwards. Male G2 about same length as G1. G2 distal segment about 0.3 times basal segment length.

Distribution. – The Seychelles, Amirante Islands (Rathbun, 1911); India, Laccadive Islands, Pedro Shoals (Alcock, 1895); Japan (Sakai, 1965); and Christmas Island from the eastern Indian Ocean (Morgan, 2001); reported for the first time from the South-China Sea, New Caledonia and Vanuatu.

Discussion. – *Daldorfia investigatoris* is a very distinctive species as a result of the greatly inflated protogastric region and strongly deflexed rostrum. It is also one of the few species of *Daldorfia* in which the chelipeds are not heterochelous and are both cutters. Of the four or five broad teeth on the inner margin of the manus, the second distal-most tooth is the largest, somewhat flattened, and curving towards the fingers. This character appears to be unique to *D. investigatoris*.

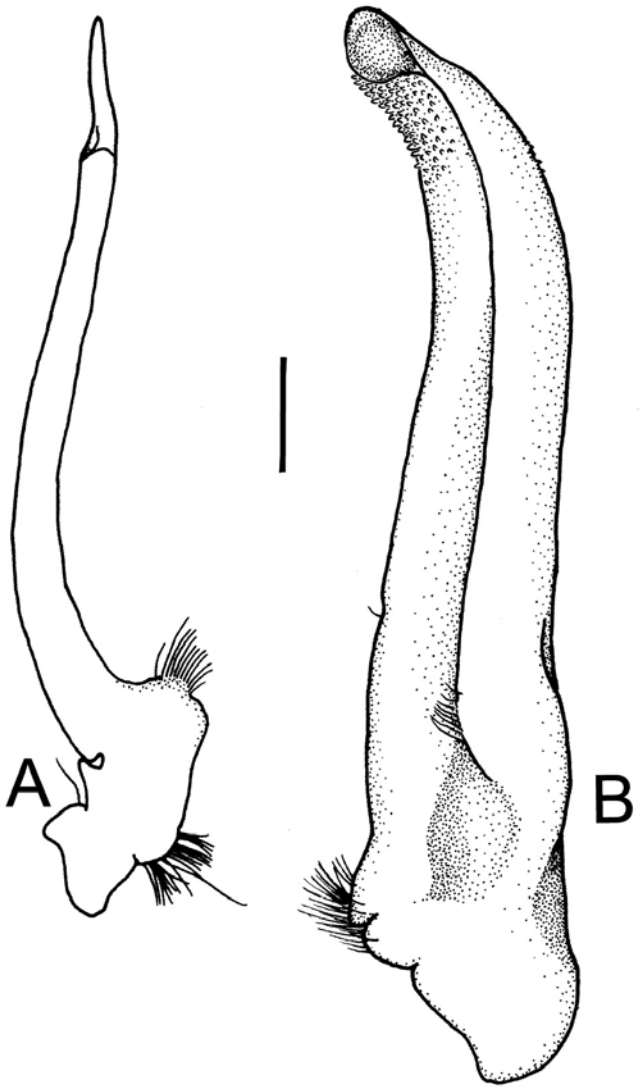

Fig. 17. *Daldorfia investigatoris* (Alcock, 1895): male, 45.8 × 33.2 mm (SMF 25261), Japan, Honshu, probably Sagami Bay, no date: A, left G2; B, left G1. Scale bar = 1 mm.

Daldorfia leprosa (Nobili, 1905)
(Figs. 18, 19)

Lambrus (*Thyrolambrus*) *leprosus* Nobili, 1905: 399; 1906: 179, Pl. 9 Fig. 7.
Parthenope acuta Klunzinger, 1906: 55, Pl. 2 Fig. 10a–e; Laurie, 1915: 408, 411; Flipse, 1930: 57 (key).
Daldorfia acuta – Serène, 1968: 61; Chen & Xu, 1991: 79, Fig. 24.
Parthenope semicircularis Flipse, 1930: 58, 60, Figs. 40a–b.
Daldorfia semicircularis – Buitendijk, 1939: 266; Sakai, 1976: 285, text-fig. 159.

Types. – The male holotype, collected from the Red Sea, reported to measure 28.5 × 21.5 mm in carapace dimensions, is apparently deposited in Museo di Torino. The holotype, however, could not be located in the Turin Museum in 1999 (O. Chia, pers. comm.). Although the type could not be examined, the excellent published description and photograph of the specimen (Nobili, 1905: 179, Pl. 9 Fig. 7) is sufficient to establish its identity.

Material examined. – **Red Sea**. "Am Klippenabhang bei Koseir": 1 male (CL 1 cm) (Staatliches Museum für Naturkunde, Stuttgart, ZIa 3360) (holotype of *Parthenope acuta* Klunzinger, 1906; studied from photographs courtesy of curator, Hans-Jörg Niederhöfer). CALYPSO coll. 1952: 1 male 19.3 × 14.0 mm (MNHN B 27-106). **Aldabra Islands**. No other data: 1 female 22.8 × 16.5 mm (MNHN B 27104). **Indonesia**. Kepulauan Tukangbesi, west coast of Binongko island (ca. 5º58'S 124º00'E), SIBOGA Expedition, stn 220, 55 m, coral sand substratum, 1–3 Nov.1899: 1 male 25.4 × 18.1 mm (ZMA) (holotype of *Parthenope semicircularis* Flipse, 1930); Kera, near Timor, SNELLIUS Expedition coll., 11–13 Nov.1929: 2 males 8.4 × 6.2 mm, 23.8 × 18.0 mm (RMNH D 4465); RUMPHIUS 2, Seram, west of Seram, Pulau Marsegu (ca. 3º00'S 128º03'E), stn MARS 3, on coral, Monod & Serène coll., 18 Jan.1975: 1 male 18.0 × 13.0 mm (MNHN B 9922). **Guam**. Agana Bay, fore-reef, in deep coral rubble, 27 m depth, H. T. Conley coll., 6 Jun.2000: 1 male 27.9 × 20.6 mm (UF6). **Society Islands**. Moorea, east of Passe Taotoi, outer reef slope, under rocks, 12–25 m, G. Paulay coll., 22 Oct.2001: 1 ovig. female 23.2 × 17.2 mm (FMNH 1508). **Tuamotu Archipelago**. Rangiroa Atoll, ca. one km south of northwest point atoll off Motu Maeherehouae, outer reef slope, under

rock, 6–12 m, 14.93ºS 147.86ºW, G. Paulay coll., 10 Nov.2001: 1 female 23.3 × 17.1 mm (FMNH 1504).

Diagnosis. **–** Carapace subpentagonal, dorsal surface tuberculate, tubercles small, fairly evenly spread out. Frontal projection deflexed, subfrontal region and epistomal region slightly concave. Inter-antennular spine not well developed, reduced to 1 or 2 low tubercles. Maxilliped 3 exopod propodus and dactylus not hidden behind merus and ischium; notch at junction of merus and carpus distinct. Cheliped heterochelous. P2–P4 upper margin meral teeth spade-shaped; P5 meri upper margin teeth short, tubercles irregular. Male sternal pit bottom with reticulate pattern, covered with small evenly distributed tubercles. G1 tubular, slender, tip curving inwards. G2 about 0.8 times G1 length; distal segment about 0.5 times basal segment length.

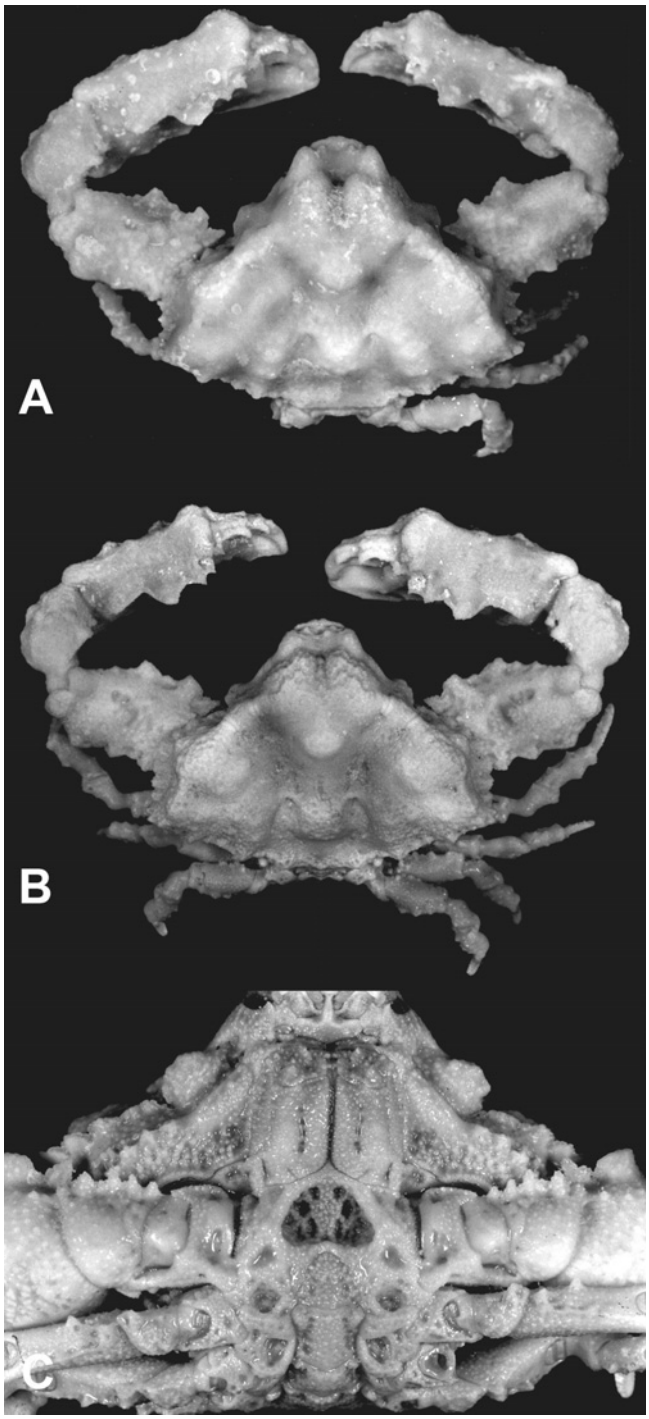

Fig. 18. *Daldorfia leprosa* (Nobili, 1905): male, 19.3 × 14.2 mm (MNHN B 27-106), Red Sea, *Calypso* coll., no date: A, dorsal view. *Parthenope semicircularis* Flipse, 1930 (= *D. leprosa*): holotype, male, 25.4 × 18.1 mm (ZMA), Indonesia, Kepulauan Tukangbesi, west coast of Binongko (ca. 5º58'S 124º00'E), SIBOGA Expedition, stn 220, 55 m, coral sand substratum, 1–3 Nov.1899: B, dorsal view; C, ventral view.

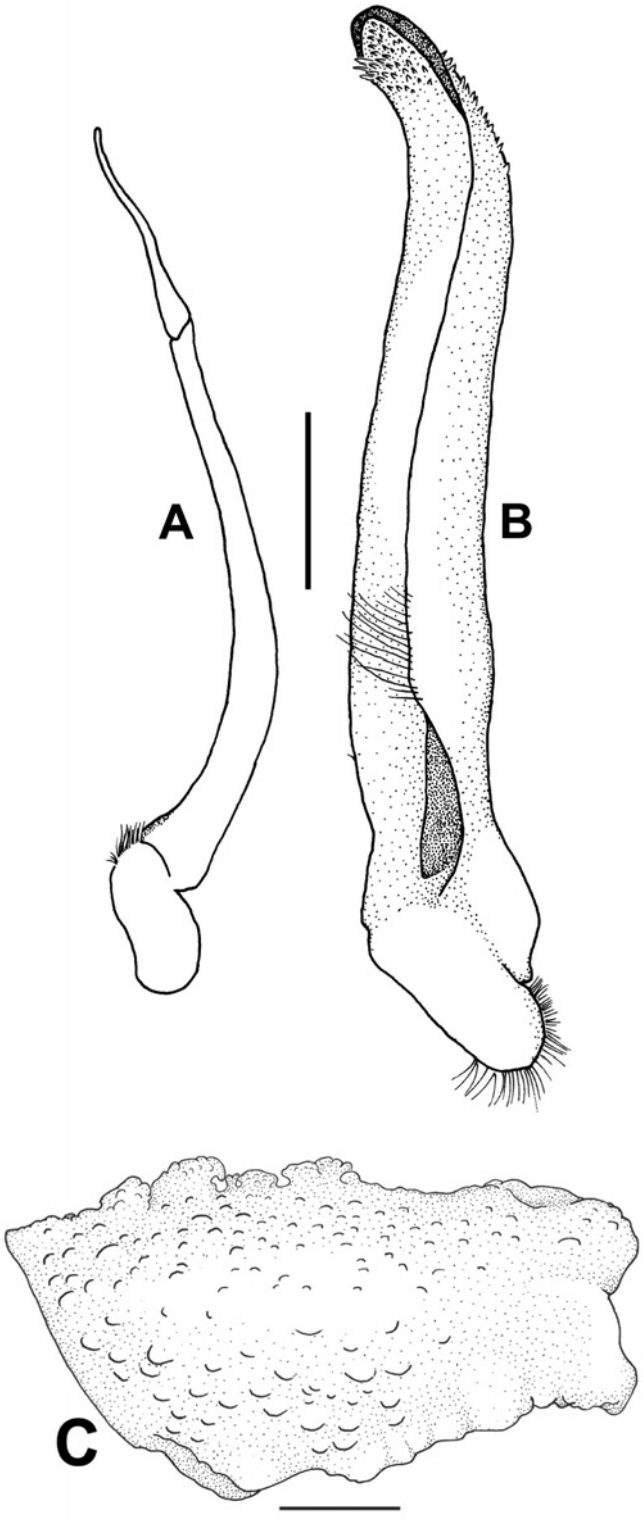

Fig. 19. *Daldorfia leprosa* (Nobili, 1905): male, 23.8 × 18.0 mm (RMNH D 4465), Indonesia, Kera, near Timor, SNELLIUS Expedition coll., 11–13 Nov.1929: A, left G2; B, left G1; C, right P5 merus. Scale bar = 1 mm.

***Etymology.* –** The name has been changed from *leprosus* to *leprosa* to reflect the feminine gender of the genus *Daldorfia*. The word '*leprosus*' is Latin for scaly or scabby.

***Distribution.* –** Reported from the Red Sea (Nobili 1905, 1906; Klunzinger, 1906; Laurie, 1915); Japan (Sakai, 1976); South China Sea, Nansha Islands (Chen & Xu, 1991); and Indonesia (Flipse, 1930; Buitendijk, 1939). This species is a new record for Guam, the Society Islands, and Tuamotu Archipelago.

***Discussion.* –** The teeth on the ambulatory meri are quite distinctive, especially those on P5. Nobili (1906: 182) commented that: "Les pattes ambulatoires sont plutòt courtes; tous les articles sont régulièrement granulés et noduleux; leurs méropodites offrent quelques saillies dentiformes très irrégulières, mais pas les dents caractéristiques disposées en forme de filet grec de *Th. Rathbuni*." The meral teeth of the P2 are larger than on other pereopods, being relatively prominent and spade-shaped. The meral teeth become progressively smaller in P3 to P5, being reduced to low granulate tubercles in P5. Adults have the shortest ambulatory meral teeth on the P5 amongst all *Daldorfia* species, and this character is useful for identification purposes.

The holotype of *D. semicircularis* was examined and is identical with the specimens from the Red Sea (MNHN B 27–106). The morphology of the G1 of the holotype of *D. semicircularis* and *D. leprosa* from the Red Sea is very similar, as are their external morphologies, and most notably, the thin continuous ridge on the protogastric and epibranchial regions, semicircular sternal pit in male specimens, similar teeth shape on P2 to P5, and shape of the teeth on the inner margins of both chelipeds.

Daldorfia leprosa superficially resembles *D. dimorpha* because of the similarly-shaped carapace and the presence of a dorsal hepatic ridge. In male and female *D. leprosa*, the inner margin of each cheliped manus has a row of four or five relatively large teeth, which are slightly flattened and the bases of which are continuous with adjacent teeth. This particular arrangement can only be found only in females of *D. dimorpha* but not males. The best features distinguishing *D. leprosa* from *D. dimorpha* are the spade-shaped meral teeth on the upper margins of P2–P4, and short and stubby meral teeth on P5. In *D. dimorpha*, the meral teeth are either r- or T-shaped. Most importantly, the distal-most ambulatory meral tooth in *D. leprosa* is a rounded, smooth tubercle, but is a recurved r-shape in *D. dimorpha*.

Daldorfia rathbunae (De Man, 1902)
Fig. 20, 21

Parthenope horrida – Latreille, 1818: Pl. 279; Tinker, 1965: 90. [Non *Cancer horridus* Linnaeus, 1758]

Thyrolambrus rathbuni De Man, 1902: 677, Pl. 22, Fig. 35; Bouvier, 1915: 229, 232; Flipse, 1930: 89 (list); Sakai, 1972: 32.

Daldorfia horrida – Rathbun, 1906: 886, Pl. 14 Fig. 5. [Non *Cancer horridus* Linnaeus, 1758]

Daldorfia rathbuni – Sakai, 1976: 284, text-fig. 158; Davie, 2002: 385 (list).

***Types.* –** Holotype, 1 juv. female 13.6 × 10.6 mm (SMF 10787), Indonesia, Ternate, W. Kükenthal coll., 1894.

***Material examined.* – Madagascar**. Nosy Be, no other data: 1 male 20.3 × 15.7 mm (MNHN). **Seychelles**. REVES 2: stn 4, 32 m, 2 Sep.1980: 1 female 10.0 × 7.7 mm; Stn 23, 45 m, 7 Sep.1980: 1 male 24.4 × 18.6 mm; Stn 24, 35 m, 8 Sep.1980: 1 male 20.0 × 15.2 mm (MNHN); Stn 38, 44 m, 13 Sep.1980: 1 male 27.7 × 20.5 mm (MNHN). TYRO Seychelles Expedition 1992/3: stn 776, North of Foivre Island, 5º42'S 53º18'E, calcareous gravel, Halimeda deposit and small rhodolites, 42–45 m, 2.4 Agassiz trawl, 31 Dec.1992: 2 ex. 6.3 × 5.1 mm, 8.3 × 6.7 mm (RMNH D 42929). **Japan**. Yoron Yamada coll., Mar.1967: 1 juv. female 10.3 × 8.0 mm (SMF ex coll. T. Sakai). **Australia**. RGSQ Herald Cay Expedition: stn 7, Queensland, Coral Sea, Coringa-Herald Nature Reserve, northwest end, northeast Herald Cay, 16º56'S 149º11'E, 15 m, marine, reef lagoon, bommie, under dead coral, P. Davie & M. Preker coll., 20 Jun.1997: 1 female 24.8 × 18.8 mm (QM W22465). **Papua New Guinea**. H. Schoede coll., no date: 1 female 26.5 × 20.7 mm (ZMB 13796). **New Caledonia**. LAGON 8: stn 487, 18º55'S 163º31'E, 37 m, 2 Mar.1985: 1 ex. 8.5 × 6.6 mm (MNHN); LAGON 10: stn 661, 21º45.90'S 166º31.40'E, 32 m, 8 Aug.1986: 1 female 43.3 × 31.8 mm (MNHN). **Chesterfield Islands**. CORAIL 2: stn DW84, 19º12.00'S 158º56.80'E, 16–26 m, 25 Aug.1988: 1 male 20.9 × 16.1 mm (MNHN); Stn DW136, 19º31.20'S 158º16.00'E, 37 m, 30 Aug.1988: 1 male 19.0 × 14.3 mm (MNHN); Stn DW156, 19º48.95'S 158º21.03'E, 42 m, 1 Sep.1988: 1 female 20.4 × 15.3 mm (MNHN). **No locality data**. 1 ovig. female 30.5 × 20.7 mm (ZMB 16134); 1 male 10.2 × 8.2 mm (ZMA De 100.713).

***Diagnosis.* –** Carapace subpentagonal, dorsal surface slightly rugose. Subfrontal region and epistomal region flat. Inter-antennular spine granulate, elongate, isolated, not continuous with frontal margin. Maxilliped 3 propodus and dactylus not hidden behind merus and ischium; notch at junction of merus and carpus distinct. Cheliped heterochelous. Ambulatory leg meri upper margin dentate, with 6 teeth, teeth r-shaped; lower margin with 2 edges, edges dentate, anterior edge with 2 teeth, posterior edge with 3 spines. Male sternal pit superficially divided into 3 depressions, 1 smaller anterior, 2 larger lateral, anterior depression much smaller than lateral, bottom of sternal pit with median Y-shaped ridge. G1 tubular, lateral margins straight. G2 slightly longer than G1; distal segment about 0.7 times length of basal segment.

***Distribution.* –** Originally described from Ternate, Indonesia (De Man, 1902), and also from Japan (Sakai 1972, 1976). Some specimens reported by Rathbun (1906), as *D. horrida*, from Hawaii are actually *D. rathbunae*. This species is reported for the first time from Madagascar, Seychelles, Australia, Papua New Guinea, New Caledonia and the Chesterfield Islands.

***Discussion.* –** *Daldorfia rathbunae* resembles *D. horrida* but can be differentiated by its distinctively smoother carapace. The shape of the teeth on the ambulatory legs is also different with that of *D. rathbunae* being r-shaped, in contrast to the thinner and longer teeth of *D. horrida*. The sternal pit is also similar in both species but can be distinguished by the fine details of the pit structure. The sternal pit is generally divided

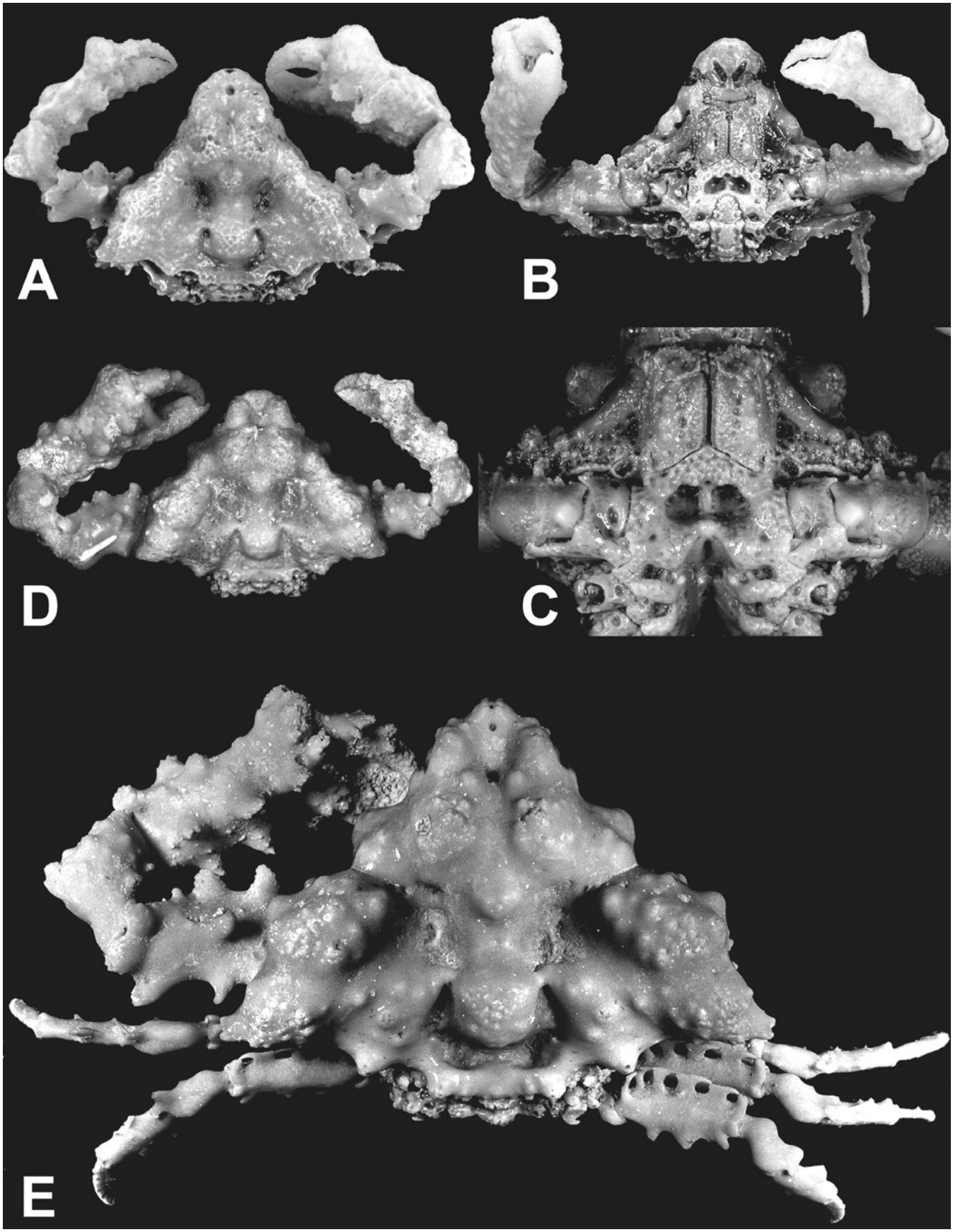

Fig. 20. *Daldorfia rathbunae* (De Man, 1902): holotype, 1 juv. female, 13.6 × 10.6 mm (SMF 10787), Indonesia, Moluccas, Ternate, W. Kükenthal coll., 1894: A, dorsal view; B, ventral view. Male, 27.7 × 20.5 mm (MNHN), Seychelles, stn 38, 44 m, 13 Sep.1980: C, dorsal view, D, male sternal pit. Female, 43.3 × 31.8 mm (MNHN), New Caledonia, Lagoon East, stn 661, 21º45.90'S 166º31.40'E, 32 m, 8 Aug.1986: e, dorsal view.

into three ovate depressions in both species, with a small anterior depression and 2 lateral ones. In *D. rathbunae*, the anterior depression is separated from the lateral depressions by a low median ridge at the bottom of the pit. In *D. horrida*, the anterior depression is comparatively larger than *D. rathbunae*, and the separation of the three depressions is very distinct with a Y-shaped ridge at the base of the sternal pit.

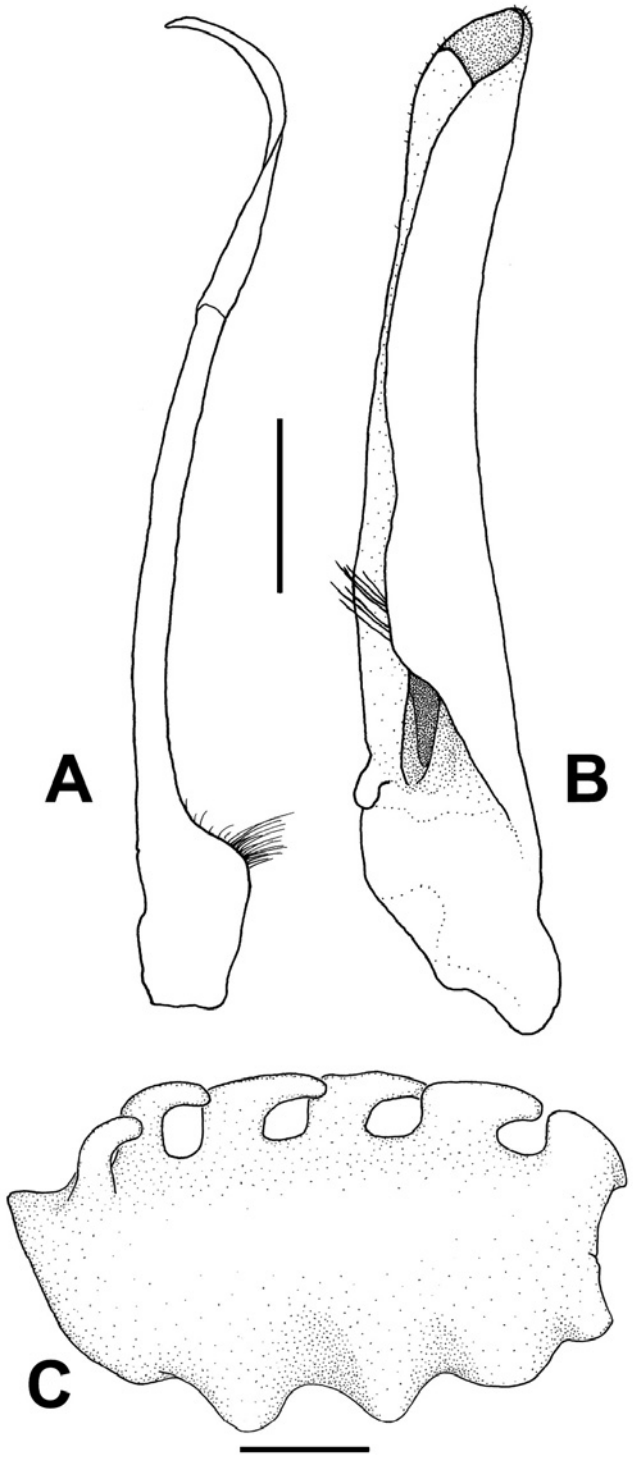

Fig. 21. *Daldorfia rathbunae* (De Man, 1902): male, 27.7 × 20.5 mm (MNHN), Seychelles, stn 38, 44 m, 13 Sep.1980: A, left G2; B, left G1. Male, 24.5 × 18.7 mm (MNHN), Seychelles, stn 23, 45 m: c, right P5 merus. Scale bar = 1 mm.

Reports of *D. horrida* by Rathbun (1906) from the Hawaiian Islands are referrable to either *D. dimorpha* or *D. rathbunae*. The specimen from Hilo is clearly *D. dimorpha* as discussed previously (see discussion under *D. dimorpha*). The photograph in her report (Rathbun, 1906: Pl. 14 Fig. 5) depicts *D. rathbunae* based on the distinctively r-shaped teeth, which she referred to as 'scythe-shaped', on the upper margin of the ambulatory leg meri. We did not examine Rathbuns's other Hawaiian specimens, so we are unable to determine their identities.

It is clear from the picture provided by Tinker (1965) that his specimen is not *D. horrida* but *D. rathbunae* based on the relatively smooth carapace and the shape of the male sternal pit. In addition, the sternal pit is divided into three depressions by a median and not Y-shaped ridge.

Sakai (1976) transferred *D. rathbunae* from *Thyrolambrus* into *Daldorfia* on account of the crusher-claw of the cheliped, but retained the original spelling of De Man (1902). As discussed earlier, however, De Man (1902) stated that it was named after Mary Rathbun, and as such, the correct specific name should be *D. rathbunae* and not *D. rathbuni*.

Daldorfia spinosissima (A. Milne-Edwards, 1862) (Figs. 22, 23)

Parthenope spinosissima A. Milne-Edwards, 1862: F8, Pl. 18, Fig. 1, 1a, 1b; Alcock, 1895a: 280; 1895b: 297 (key); A. Milne-Edwards & Bouvier, 1900: 120; Bouvier, 1915: 230, 232; Flipse, 1930: 85 (key); Michel,1964: 9.
Parthenope horrida var. spinosissima – Ortmann, 1893: 417 (in part).

Types. **–** Holotype, Ile Bourbon (La Réunion), female 165.9 × 100.7 mm (MNHN B 4596 S).

Material examined. **– Yemen**. Gulf of Aden, Socotra Island, outflow of the Gulf of Aden, washed on shore, M. Apel coll., Mar.1999: 1 male 151.3 × 99.1 mm (SMF). **La Réunion**. Baie de la Possession, Gueze coll., no date: 1 male 167.2 × 105.1 mm (MNHN).

Diagnosis. **–** Carapace subtriangular, protogastric and mesobranchial regions greatly inflated, spinate, other regions less inflated, spinate. Frontal projection produced, tip not bifid. Subfrontal region and epistomal region flat. Inter-antennular spine well developed, spinate. Maxilliped 3 exopod, propodus and dactylus not hidden behind merus and ischium; notch at junction of merus and carpus distinct. Cheliped slightly heterochelous. Ambulatory leg meri upper margin dentate, teeth large, broad at base. Male sternal pit semicircular. G1 tubular, distal 0.3 bent ca. 90º inwards. G2 about 0.8 length of G1; distal segment about 0.3 length of basal segment.

Distribution. **–** The specimen from Yemen represents a new record for the species and extends its distribution westwards from La Réunion (Ile Bourbon). Records of this species reported from Japan (Sakai 1976), the Philippines (Serène & Umali, 1972) and Ambon, Indonesia (Flipse 1931) were found to be *D. triangularis*.

***Discussion.* –** There appears to be a slight sexual dimorphism in *D. spinosissima*, with males appearing to have longer chelipeds than females. The smaller male from Yemen has comparatively longer chelipeds than those of the female holotype (see Fig. 21a, b). The rostrum is also more blunt in the male than the female. The rostrum of the female holotype appears to be divided into two portions at the tip resembling the closely related *D. triangularis*. The division of the rostrum tip, however, is not distinctly bifurcated in *D. spinosissima* as seen in *D. triangularis*.

Fig. 22. *Daldorfia spinosissima* (A. Milne-Edward, 1862): holotype, female, 165.9 × 100.7 mm (MNHN B 4596 S), Île Bourbon (Réunion).

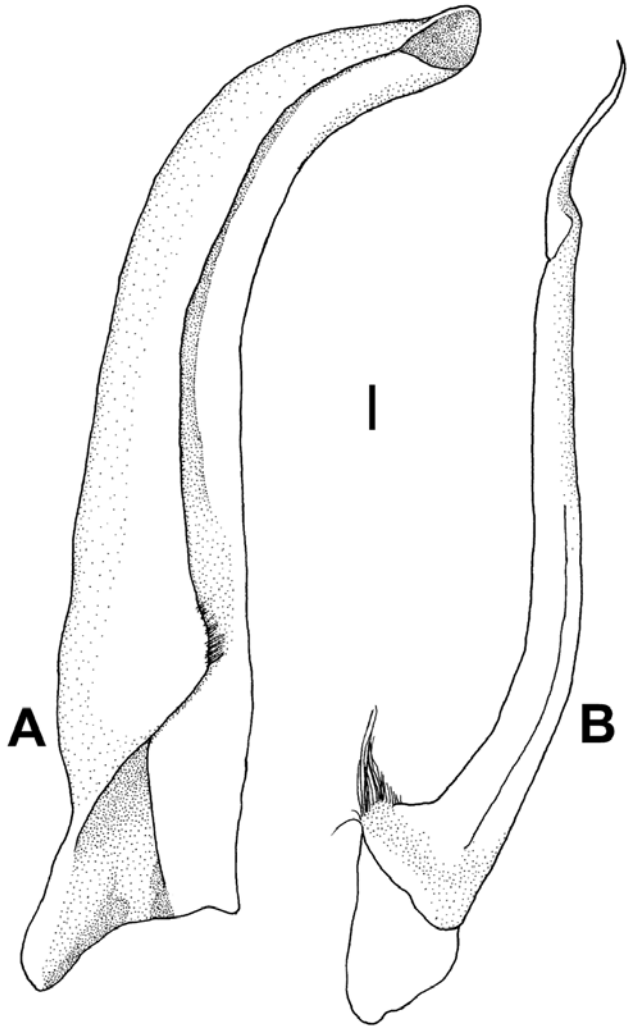

Fig. 23. *Daldorfia spinosissima* (A. Milne-Edward, 1862): male, 151.3 × 99.1 mm (SMF), Yemen, Gulf of Aden, Socotra Island, outflow of the Gulf of Aden, washed on shore, M. Apel coll., Mar.1999: A, right G1; B, right G2. Scale bar = 1 mm.

We were unable to examine the specimens reported by Alcock (1895a) and it is difficult to confirm the identity his specimens (one male and one female) from the Bay of Bengal, 88 fm (161 m). His description was not specific enough to determine whether the specimens were *D. spinosissima* or *D. triangularis*. Nevertheless, his specimens are very probably *D. spinosissima* rather than *D. triangularis*, because the former species appears to be restricted to the Indian Ocean. *Daldorfia triangularis* is currently known only from the Pacific Ocean.

Almost nothing is known about the habits of *D. spinosissima* but it apparently does not inhabit very deep waters. Specimens recorded by Alcock (1895a) are from a depth of 88 fm (ca. 161 m) and the specimen from Yemen was apparently found dead on the shore (pers. comm., M. Türkay).

Daldorfia triangularis Sakai, 1974
(Fig. 24)

Cancer cristatus? Shaw & Nodder, 1802: Pl. 524 (incorrect identification).
Parthenope horrida var. *spinosissima* – Ortmann, 1893: 417 (part).
Parthenope spinosissima – Flipse, 1931: 95.
Daldorfia spinosissima – Serène & Umali, 1972: 58; Sakai, 1976: 286, text-fig. 160.
Daldorfia triangularis Sakai, 1974: 89; 1976: 287, text-fig. 161; Takeda & Manuel, 2000: 153, Fig. 3A.

***Types.* –** Neotype, female 160.7 × 104.4 mm (NSMT-Cr 13940), Japan, Okinawa-jima Island, off Itoman, 150 m, S. Tamaki coll., 15 Jul.1997.

***Material examined.* – The Philippines**. Visayas, Bohol, Panglao, Balicasag Island, T. Kase coll., 09.1998: 1 female 32.6 × 22.4 mm (NSMT-Cr 12995); Visayas, Bohol, Panglao, Balicasag Island, 50–500 m, in tangle-nets, local fishermen coll., 28 Nov.2001: 1 female 48.0 × 33.3 mm (ZRC); Visayas, Bohol, Panglao, Balicasag Island, 200–300 m, in tangle-nets, local fishermen coll., Jun.2001: 1 male 38.3 × 25.5 mm (ZRC); Canigao Straits between Leyte and Bohol, hook and line, 90 fm (ca. 165 m), 1 May 1974: 1 male 132 × 108 mm, dried (SCU); Zamboanga del norte, Aliguay, Apr.2002: 1 male 166.3 × 144.8 mm (ZRC 2003.0097). **Papua New Guinea**. Ralum, F. Dahl coll., 1896–1897: 1 male 153.0 × 96.5 mm (ZMB 18069).

***Diagnosis.* –** Carapace subtriangular, protogastric and mesobranchial regions with large broad spines, other regions lightly granulate. Frontal margin produced, rostrum bifid. Subfrontal region and epistomal region flat. Inter-antennular spine well developed, spinate. Maxilliped 3 exopod propodus and dactylus not hidden behind merus and ischium; notch at junction of merus and carpus distinct. Cheliped long, slender, not heterochelous. Ambulatory meri upper margin spinate,

spines large and broad at base. Male sternal pit semicircular. G1 unknown.

***Distribution.* –** Described from Japan (Sakai, 1976), it is now established that reports of *D. spinossima* from the Philippines (Serène & Umali, 1972) and Ambon (Flipse, 1931) are actually *D. triangularis*. This species is recorded for the first time from Papua New Guinea.

***Discussion.* –** *Daldorfia triangularis* was described based on a juvenile male (45 × 31.5 mm), collected off Tosa Shimizu, Japan (Sakai, 1974). We have been unable to trace the holotype in the known depositories of T. Sakai's specimens (SMF, NSMT-R, Kawanaga Prefecture Museum) so it is presumed lost. Considering that there are changes in the shape of the rostrum during different stages of growth (see below), there is also potential for confusion in the interpretation of characters. Furthermore, adult specimens of *D. triangularis* may be confused with *D. spinossisima*. Therefore, a neotype designation for *D.triangularis* is justified to clarify the identity of the species. The neotype selected here is a female specimen (160.7 × 104.4 mm, NSMT-Cr 13940), from Okinawa-jima Island, off Itoman, Japan.

We have on hand, an immature female (similar in size to the holotype) from Balicasag Island, the Philippines, and a much larger male specimen from Aliguay, the Philippines. The illustration of *D. triangularis* by Sakai (1974) clearly shows a spatulliform rostrum. In the female from Balicasag, which is only slightly larger, the rostrum is less spatuliform and slightly more bifurcated. In large specimens [neotype female 160.7 × 104.4 mm (NSMT-Cr 13940), Okinawa; male 132 × 108 mm, dried (SCU), Canigao Straits; male (ZRC), Aliguay], the rostrum is distinctly bifurcated. Apparently, the shape of the rostrum changes with increasing carapace size.

The number of teeth on the hepatic margin appears to be variable. The male holotype of *D. triangularis* has two teeth on the hepatic margin, whereas the smaller female from the Philippines (NSMT-Cr 12995) has only one. The slightly larger female from the Philippines (ZRC), however, has two teeth on the left hepatic margin, but three on the right. The illustration by Shaw & Nodder (1802) and the photographs by Serène & Umali (1972) seem to indicate that there are more than two teeth on the hepatic margins. The dimensions of the specimen illustrated by Shaw & Nodder (1802) are not known but the specimens of Serène & Umali (1972) and Sakai (1976) are all considerably larger than the original type specimen of *D. triangularis* and the two females from the Philippines. The specimen reported by Serène & Umali (1972) is a dried female (153 × 100 mm) whereas the specimen in Sakai (1976) is a male (111 × 74 mm). This seems to indicate that the number of teeth on the hepatic margin may increases with carapace size.

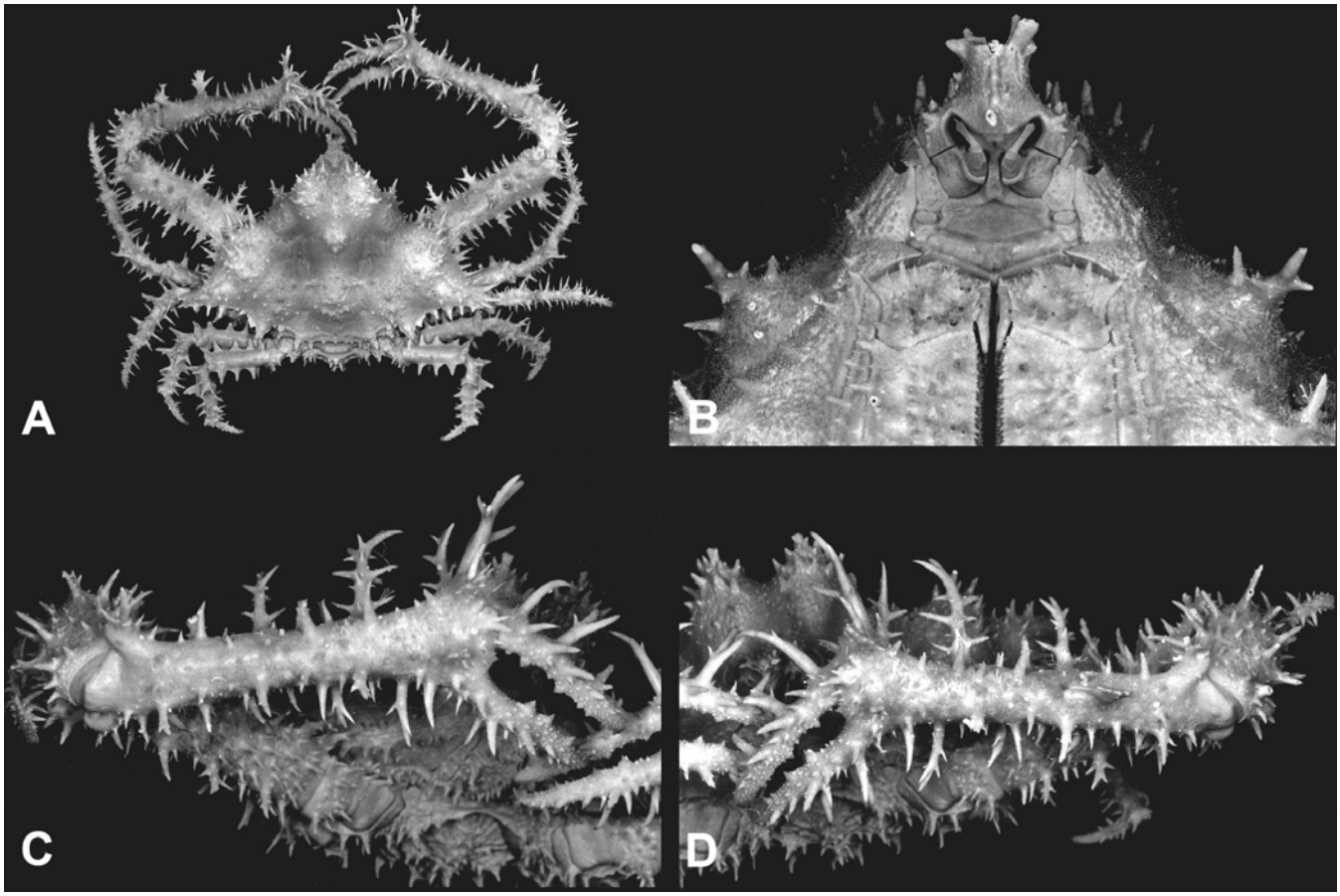

Fig. 24. *Daldorfia triangularis* Sakai, 1974: neotype, female, 160.7 × 104.4 mm (NSMT-Cr 13940), Japan, Okinawa-jima Island, off Itoman, 150 m, S. Tamaki coll., 15 Jul.1997: A, dorsal view; B, ventral view of head region; C, left cheliped, frontal view; D, right cheliped, frontal view.

Daldorfia triangularis is most likely to be confused with *D. spinosissima*. Both species have a spinose carapace. *Daldorfia triangularis* can most easily be differentiated from *D. spinosissima* by its bifid rostrum (versus rounded and blunt) and more slender chelipeds (versus stouter). The spines on the chelipeds of *D. cristata* are also longer and narrower than those on *D. spinossisima*. The geographical distributions of both species also appear to be different, with *D. triangularis* being found only in the Pacific Ocean, whereas all known records of *D. spinosissima* are from the Indian Ocean.

Shaw & Nodder (1802) briefly described a spinose crab, which they referred to as *C. cristatus*. They were probably unsure of the identity of this species because they added a question mark after *cristata*. In a footnote, they stated that "This highly singular species, says Seba, is the cancer [sic] *horridus* of Rumphius...", confirming their hesitancy. Seba's plates, however, show that there were actually two *Daldorfia* species involved. In Seba (1758) Pl. 19, Figs. 17 and 18, the illustrated crab is *D. horrida*, whereas the illustrated specimen in Pl. 22, Figs. 2 and 3, is very similar to that by Shaw & Nodder (1802). It is possible than that Shaw & Nodder (1802) were referring to Seba's figures in plate 22 rather than plate 19, as it is clear that both illustrations are of the same species. What is not clear is why Shaw & Nodder (1802) named their illustration as *C. cristatus*, when there are doubts about its identity. It is possible that Shaw & Nodder (1802) had actually confused another species, *C. cristatus* [= *Micippa cristata* (Linnaeus, 1758), Majidae], with the specimen that they illustrated (L. B. Holthuis, pers. comm.). In any case, the name *C. cristatus* is only a doubtful identification with *Micippa cristata*, and the name is thus unavailable for use with the present *Daldorfia* species.

Although the description of this species by Shaw & Nodder (1802) is short, it is clear that they were referring to *D. triangularis*. It is clearly not *D. horrida* as they commented that the upper part of the carapace is covered with groups of "sharp spines and hair-like prickles", a character not found in *D. horrida*. They also mentioned that: "the long and thick arms are covered along their whole outline with branching subdivisions which are visible even on the forcipes (= chelipeds) themselves." The chelipeds of *D. horrida* are thick but not as long as that of *D. triangularis* and certainly do not have strong spines on the periphery. Most importantly, they stated very clearly the diagnostic characters of this species, which are "... numerous ramified and fasciculated spines, and bifid crested snout." Their illustration also clearly shows a specimen with a very distinctive bifid rostrum. This confirms that they are not referring to *D. spinossisima*.

Daldorfia trigona (A. Milne-Edwards, 1869)
(Fig. 25)

Parthenope trigona A. Milne-Edwards, 1869: 351; A. Milne-Edwards & Bouvier, 1900: 121; Bouvier, 1915: 230.

Parthenope (*Pseudolambrus*) *excavata* – Boone, 1927: 173, Fig. 58. [Non *Lambrus excavatus* Stimpson, 1871].

Lambrus (*Pseudolambrus*) *trigonus* – Flipse, 1930: 96.

Daldorfia garthi Glassell, in Garth, 1940: 67, Pl. 17 Figs. 1–11; Garth, 1946: 412, Fig. 55 Figs. 1–11; Crane, 1947: 74; Garth,1958: 455–458, Pl. Z2 Figs. 7, 7a, Pl. 51 Fig. 2; von Prahl & Alberico, 1986: 103, 104 (tab.); Lemaitre & Alvarez León, 1992: 54 (list); Hendrickx, 1995: 133 (list); 1999: 256; Zimmerman & Martin, 1999: 656.

Parthenope bouvieri – Monod, 1956: 596, Fig. 872 (part).

Types. – Holotype, female 44.5 × 28.9 mm (MNHN B 643 S), no locality data.

Material examined. – Galápagos Islands, Sulivan Bay, James Island, 0º17'00"S 90º35'13"W, RV VELERO III, 21 Jan.1938: 1 male 48.0 × 30.5 mm (LACM CR 193805818) (holotype of *Daldorfia garthi* Glassell, in Garth, 1940); 1 ovig. female 45.0 × 28.9 mm (LACM CR 193805819), same data (paratype of *Daldorfia garthi* Glassell, in Garth, 1940).

Diagnosis. – Carapace subtriangular, dorsal surface rugose. Front weakly trilobate, deflexed. Subfrontal region and epistomal region slightly concave. Inter-antennular spine present, granulate, anterior portion not protruding beyond frontal margin. Maxilliped 3 exopod, propodus and dactylus not hidden behind merus and ischium; notch at junction of merus and carpus distinct. Cheliped heterochelous. Ambulatory leg meri upper margin with T-shaped teeth, teeth usually fusing at tips, sometimes at lateral edge. Lower margins of P2 to P5 with 2 dentate edges, teeth sides almost totally fused, edges appearing cristate, cristae with small holes. Male sternal pit bottom semicircular, bottom lightly pitted. G1 cylindrical, distal quarter sharply bent inwards. G2 slightly longer than G1; distal segment about 0.8 times length of basal segment.

Distribution. – Presently known only from the Eastern Pacific, from the Galápagos Islands (Glassell in Garth, 1940; Garth, 1958) and Costa Rica (Crane, 1947; Zimmerman & Martin, 1999).

Discussion. – The T-shaped teeth on the upper margins of all the ambulatory leg meri distinguish this species from Indo-West Pacific congeners. The teeth on both lower margin edges of the ambulatory leg meri are usually fused with adjacent teeth, and thus, the lower margin appears to have two rows of cristae. These two characters ally *D. trigona* with *D. bouvieri*. Both species, however, can be differentiated by the tubercle size in the sub-hepatic groove. The female holotype of *D. trigona* bears a row of large roundish tubercles in the sub-hepatic groove just above the pterygostomial ridge. Similarly sized tubercles are also present in the holotype and paratype of *D. garthi*. Of the specimens of *D. bouvieri* examined, both large and small, the tubercles in the sub-hepatic groove are considerably smaller than those of *D. trigona* – these we regard as the most reliable characters to distinguish *D. trigona* from *D. bouvieri*.

Daldorfia trigona was described from an unknown locality and the holotype is a large dried female (Fig. 23a, b). It is, without a doubt, a species of *Daldorfia* although Flipse (1930) placed it in *Pseudolambrus*. Whether he was aware of its real identity is questionable, because members of this genus are difficult to mistake for *Pseudolambrus* species.

Daldorfia garthi is here treated as junior subjective synonym of *D. trigona*. The following differences were observed and considered to be intra-specific variation: The dorsal surface of the carapace of the slightly smaller-sized *D. trigona* holotype is considerably more rugose and granulated than the holotype of *D. garthi*. The posterior region of *D. trigona* also has a distinctive lattice pattern, which is much more extensive than the *D. garthi* holotype. Comparison of the female paratype with the male holotype of *D. garthi* showed that the paratype is slightly more rugose than the holotype, being especially obvious on the epibranchial region. This suggests that there might be some slight sexual dimorphism.

Ochtholambrus excavatus (Stimpson, 1858) [(as *Parthenope* (*Pseudolambrus*) *excavata*] as reported and figured by Boone (1927: Fig. 58) is actually *D. trigona*.

Niobafia, new genus

Lambrus (*Parthenopoides*) – Miers, 1879b: 25 [non *Lambrus* (*Parthenopoides*) Miers, 1879a].

Lambrus (*Parthenolambrus*) – Miers, 1886: 99 [non *Parthenope* (*Parthenolambrus*) Alcock, 1895].

Thyrolambrus – Balss, 1935: 128 [non *Thyrolambrus* Rathbun, 1894].

Parthenope (*Pseudolambrus*) – Chen & Xu, 1991: 75 [non *Pseudolambrus* Paulson, 1875].

Type species. – *Lambrus* (*Parthenopoides*) *erosus* Miers, 1879, by present designation.

Diagnosis. – Carapace dorsal surface tuberculate, tubercules paxilliform or stellate, tips of paxilliform tubercles fusing with adjacent tubercles at edges, forming dense net-like pattern, except for gastrobranchial and U-shaped cardiobranchial grooves. Frontal projection short, blunt, unilobate, slightly deflexed, edges dentate, teeth short and irregular. Subfrontal and epistomal region deeply concave. Antennal article 2 larger than the antennal article 1, chevron-shaped, anterior margin extending beyond anterior lateral edge of first antennular article. Antennular article 1 not forming part of orbital margin, sunken into sub-frontal region. Epistomal region elevated above sub-frontal region. Epibranchial margin arcuate, dentate, teeth irregular. Lateral angle ca. 90º. Posterior margin almost in straight line with meso- and metabranchial margins. Cheliped subequal, both cutters; pollex tip slightly behind fixed finger when fully closed; all merus surfaces tuberculate, dorsal surface with 1 tooth. Manus lower margin dentate, teeth broad, low, irregular. Ambulatory leg merus upper margin with r-shaped teeth except for distal-most tooth, surfaces reticulate; carpus, propodus surfaces with irregular, angular tubercles; dactylus spinulate. G1 tubular, slightly sinuous, slender. G2 very short, less than half G1 length; distal segment about 0.2 times basal segment length. Mature female telson

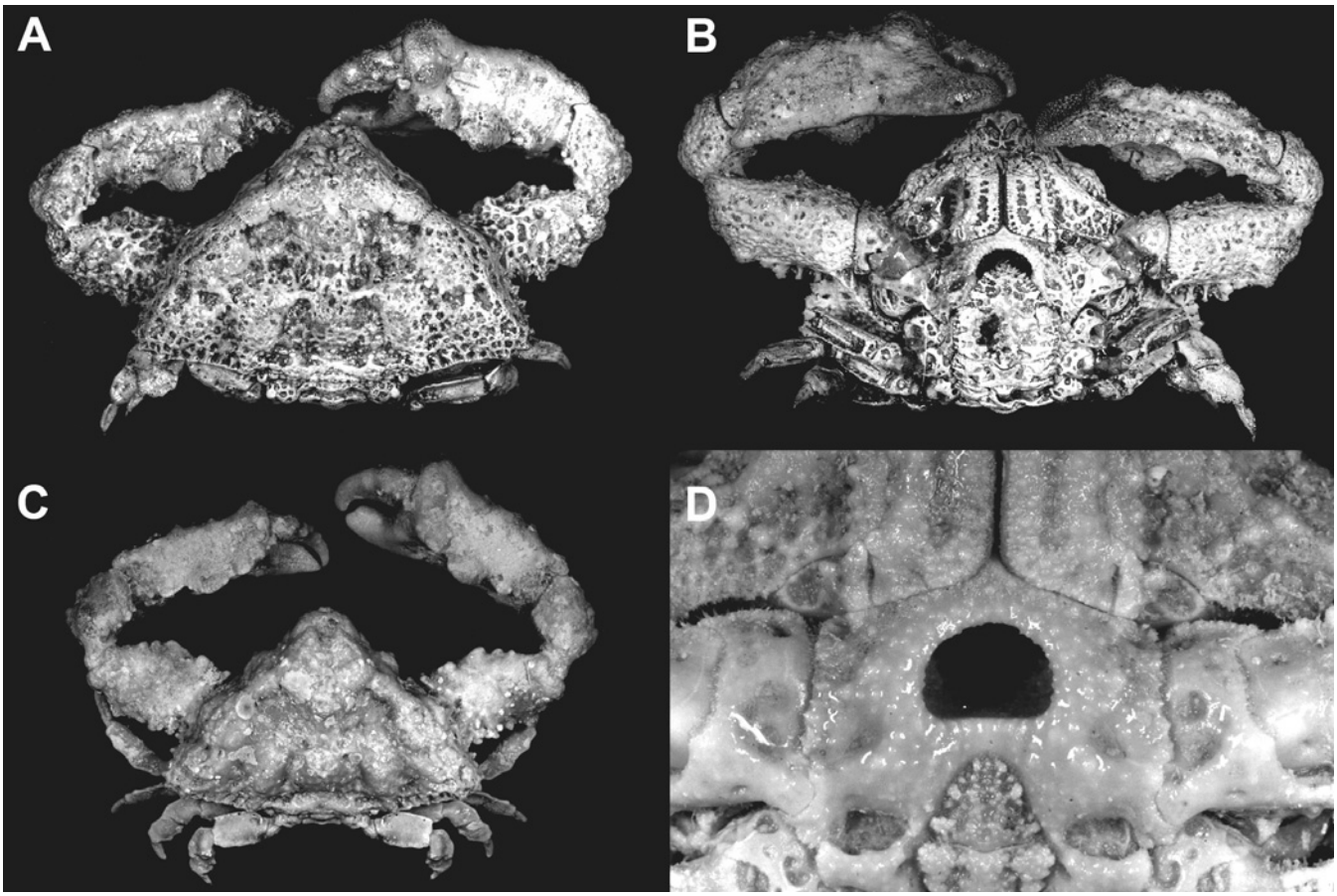

Fig. 25. *Daldorfia trigona* (A. Milne-Edwards, 1869): holotype, female, 44.5 × 28.9 mm (MNHN B 643 S), no locality data: A, dorsal view; B, ventral view. *Daldorfia garthi* Glassell, in Garth, 1940: holotype, male, 48.0 × 30.5 mm (LACM CR 193805818), Galápagos Islands, Sullivan Bay, James Island, 0º17'00"S 90º35'13"W, RV VELERO III, 21 Jan.1938: C, dorsal view; D, ventral view.

broadly triangular, length about twice width, lateral margins strongly concave.

Etymology. – The type species of *Niobafia* resembles an eroded pebble. The genus name is an arbitary combination of Nioba, the daughter of Tantalus in Greek mythology who was changed by Zeus into stone, and with the last three letters of the generic name, *Daldorfia*. Gender feminine.

Discussion. – The generic position of the *N. erosa* has been uncertain since its description. Miers (1879b: 25) placed it in the subgenus *Parthenopoides* and commented that it "... cannot be confounded with any other of the genus known to me." This species, however, cannot belong in the subgenus *Parthenopoides* (see Miers 1879a) because its type species, *Lambrus massena* Roux, 1830, clearly belongs in the Parthenopinae owing to the short antennal article 2 (unpublished data). Miers (1886) later placed *N. erosa* in the subgenus *Parthenolambrus* A. Milne-Edwards, 1878 (a junior synonym of *Pseudolambrus* sensu Flipse, 1930). *Pseudolambrus*, however, is also a parthenopine genus . Balss (1935) transferred *N. erosa* to *Thyrolambrus* and at the same time created a series of complicated nomenclatural problems (see discussion under *D. glasselli*). Chen & Xu (1991) returned the species to *Pseudolambrus*. The large antenal article 2 and the typical daldorfiine arrangement of the teeth on the upper margin of the ambulatory leg merus clearly shows that Lambrus erosus Miers, 1879, is not a member of *Parthenopoides*, *Pseudolambrus* or *Parthenolambrus* (= *Pseudolambrus*).

The large and chevron-shaped antennal article 2, triangular female telson and the very short male second pleopod distinguishes *Niobafia* from other genera in the Daldorfiinae. The antennal article 2 is large and completely excludes antennular article 1 from the orbital hiatus. In fully mature females, the telson is not semicircular like other daldorfiines. It is, instead, triangular with strongly concaved lateral margins. The G2 is also about half the length of the G1, which is the shortest amongst the known daldorfiines. The combination of these characters makes the genus distinctive.

Niobafia erosa (Miers, 1879), new combination
(Figs. 4C, 5C, 26, 27)

Lambrus (*Parthenopoides*) *erosus* Miers, 1879b: 25, Pl. 5 Fig. 8.
Lambrus (*Parthenolambrus*) *erosus* – Miers, 1886: 99.
Parthenope (*Pseudolambrus*) *erosa* – Rathbun, 1911: 258, Pl. 20 Fig. 11; Chen & Xu, 1991: 75, Fig. 21.
Parthenopoides erosus – Bouvier, 1915: 236, Fig. 21; Flipse, 1930: 85; Ward, 1942: 77; Michel, 1964: 9.
Thyrolambrus erosus – Balss, 1935: 128; Guinot, 1967: 836, Fig. 36a, b, 37; 1978b: 15, Fig. A, A1, B; Peyrot-Clausade & Serène, 1977: 1351, Pl. 2D.

Types. – Holotype, female 12.5 × 9.2 mm (NHM 1862.35), Eastern Seas, HMS HERALD coll.

Material examined. – **Kenya**. GALATHEA Expedition 1950–1952. Mombasa: stn 255, 4º05'S 39º41'E, coral reef, 22 Mar.1951: 1 male 9.6 × 8.3 mm (ZMUC). **Madagascar**. Récif de Tuléar, Stn 12–10-6, 22 m, Peyrot-Clausade coll, 1972: 1 female 13.9 × 11.1 mm (MNHN B 27105). **Mauritius**. Récifs du Grand Port, P. Carié coll., no date: 1 male 12.7 × 10.6 mm (MNHN B 27535). **Hawaiian Islands**. North of Oahu, J. Park coll., Jan.2000: 1 female 14.9 × 12.0 mm (ZRC). **Kiribati**. Whippowill Expedition, Line islands, Washington (= Teraina) Island, Aug.1924: 1 ex. 23.7 × 18.7 mm (BPBM S 1965).

Diagnosis. – Carapace subtriangular, dorsal surface tuberculate, tubercules paxilliform or stellate, tips of paxilliform tubercles fusing with adjacent tubercles at edges, forming dense net-like pattern, except for gastrobranchial and U-shaped cardiobranchial grooves; distinct U-shaped depression present around cardiac regions. Frontal projection broad, blunt, not produced, periphery thick, forming a semicircular ridge surrounding antennules. Hepatic region heavily tuberculate, with 2 ridges directly above post-cervical ridge, connecting the hepatic and mesobranchial regions, forming a small hole beneath both ridges. Antennules sunken in sub-frontal cavity, totally excluded from orbital hiatus. Epibranchial margin arcuate. Lateral angle ca. 90º with mesobranchial margin. Ambulatory legs merus surfaces heavily reticulate; dactyli tips long, pectinated. G1 tubular, sinuous, slender. G2 very short, less than half G1 length; distal segment about 0.2 times basal segment length. Mature female telson triangular, length ca. 2 times width, lateral margins strongly concave.

Distribution. – Eastern Africa to the Central Pacific: Madagascar (Peyrot-Clausade & Serène, 1977); Diego

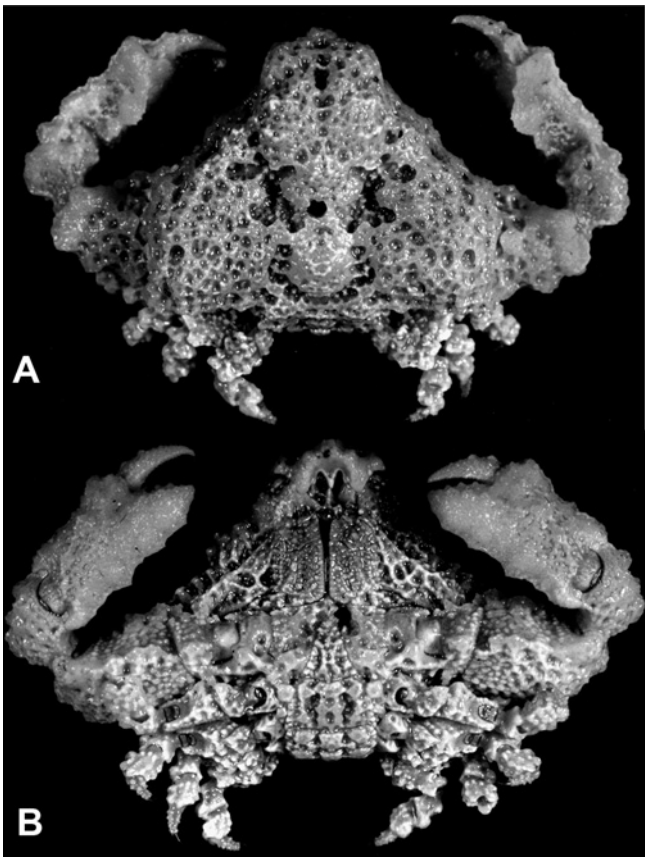

Fig. 26. *Niobafia erosa* (Miers, 1879): holotype, female, 12.5 × 9.2 mm (NHM 1862.35), Eastern Seas, HMS HERALD coll., no date: A, dorsal view; B, ventral view.

Garcia, Chagos Archipelago (Ward, 1942); the Nansha Islands (Chen & Xu, 1991); recorded for the first time from eastern Africa and the Hawaiian islands.

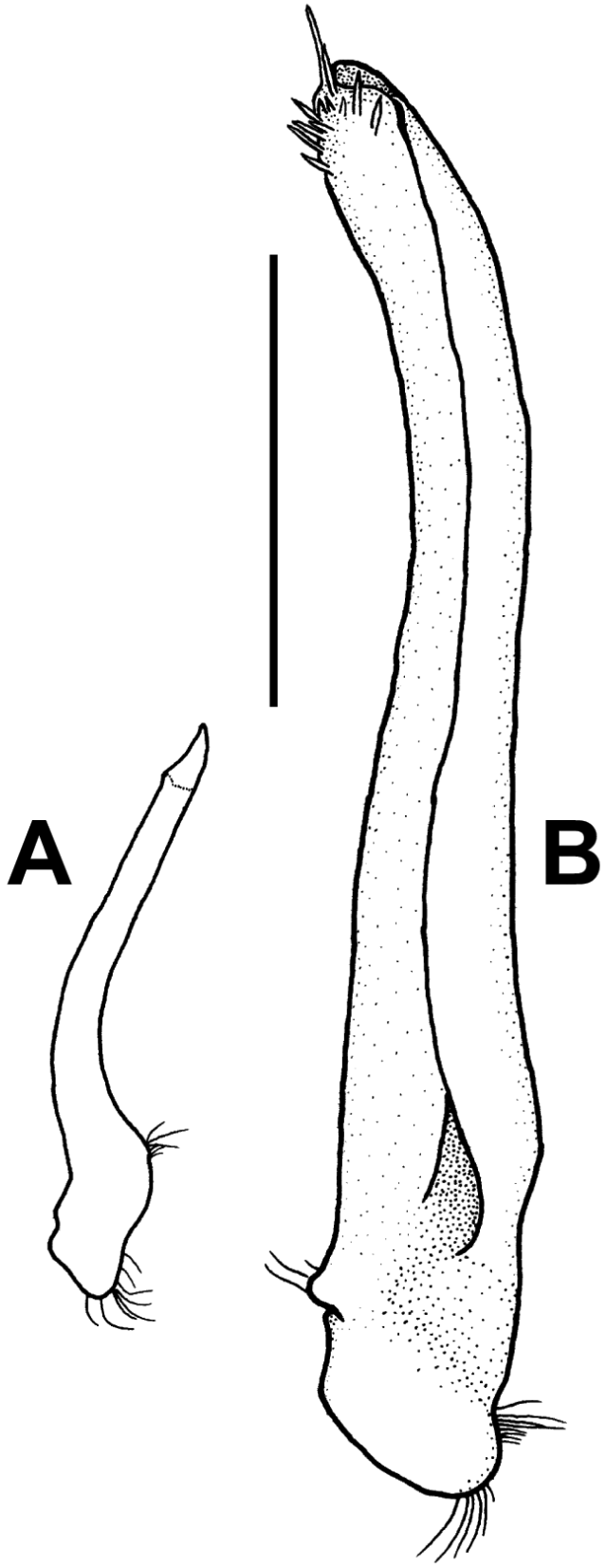

Fig. 27. *Niobafia erosa* (Miers, 1879): male, 9.6 × 8.3 mm (ZMUC), Kenya, Mombasa, Galathea Expedition 1950–52, stn 255, 4º05'S 39º41'E, coral reef, 22 Mar.1951: A, left G2; B, left G1. Scale bar = 1 mm.

***Discussion.* –** This species is easily differentiated from other species in the Daldorfiinae because of its very distinctive carapace shape and highly eroded carapace dorsal surface. Mature females have a triangular telson, which is about twice as long as wide, with strongly concave lateral margins. All other mature female daldorfiine species have a semicircular to triangular telson.

The sternal pits of male *N. erosa* are also characteristic, being trilobate is differentiated into an anterior and two lateral lobes. Each lobe is placed about 60º to each other. The sternal pit is also rather shallow and granulate.

Olenorfia, new genus

Thyrolambrus – Balss, 1935: 128 (part) [non *Thyrolambrus* Rathbun, 1894].

***Type species.* –** *Parthenopoides cariei* Bouvier, 1914, by present designation.

***Diagnosis.* –** Carapace transversely pentagonal. Regions on dorsal surface of carapace not inflated. Frontal projection slightly convex, short, margin usually with 5 short broad teeth. Subfrontal and epistomal region concave. Inter-antennular spine present as a row of low tubercles, not protruding beyond rostrum anterior margin. Antennular article 1 totally excluded from orbit. Antennal article 2 longer than first article of antennule; anterior margin forming part of the orbit. Maxilliped 3 exopod, propodus and dactylus partially hidden behind merus and ischium; notch at junction of merus and carpus absent. Mature female abdomen telson subtriangular, longer than broad, distal one-third lateral margins strongly constricted. G1 tubular, tip tapering on dorsal side. G2 about 0.7 times length of G1; distal segment about 0.5 times basal segment length.

***Etymology.* –** Derived from an arbitrary combination of Olenus, a man mentioned in Ovid's Metamorphoses, with the last three letters of the generic name, *Daldorfia*. Olenus' wife, Lethaea, claimed that her beauty surpassed that of any Greek goddess. As a result, both she and her husband were turned into stone at Mount Ida. Gender feminine.

***Discussion.* –** *Olenorfia* is here established for *Parthenopoides cariei* Bouvier, 1914. It is distinguished from other genera in the Daldorfiinae by the differently shaped antennal article 2, which is slightly larger than antennular article 1. The anterior margin of antennal article 2 extends way past the anterior lateral corner of the antennular article 1. In *Daldorfia* and *Thyrolambrus*, antennal article 2 is slightly smaller than that of antennular article 1 and the anterior margin never extends past the anterior lateral corner of antennular article 1. At the most, as seen in *T. astroides*, the anterior margin of antennal article 2 is on the same level as the anterior lateral corner of antennular article 1.

The carapace shape of *Olenorfia* also differs from all other daldorfiines, being relatively flat over the entire dorsal surface. This is because the inflation of the branchial and

gastric regions is not vertical but horizontal. As a result, the epibranchial region bulges laterally, thereby concealing the epibrancial margin below it. The lateral edges of the epibranchial region bear three large, equally spaced teeth, which should not be confused with the actual epibranchial teeth, hidden below.

The regions on the carapace, however, remain distinct from each other owing to shallow but distinct grooves. The dorsal surface of the carapace is densely tuberculate and the tubercles are generally of the same size. These tubercles are connected via numerous smooth ridges on the metagastric, branchial and cardiac regions, forming a reticulate pattern.

The male sternal pit is an inverted V-shape, which is very different from the generally semicircular shaped pits of *Thyrolambrus* and *Daldorfia*.

Olenorfia cariei (Bouvier, 1914)
(Figs. 4D, 5D, 28, 29)

Parthenopoides cariei Bouvier, 1914: 703; 1915: 232, Fig. 20, Pl. 7 Fig. 6; Flipse, 1930: 85; Michel, 1964: 9 (lit. cited); Guinot 1966: 751, Figs. 4, 10; 1967: 838; 1978b: 13, Fig. 2A.
Thyrolambrus careie [sic] – Balss, 1935: 128.

Types. – *Parthenopoides cariei* Bouvier, 1914: Mauritius, environs de Port Louis, P. Caríe coll., 1913: Lectotype, male 21.6 × 15.4 mm (MNHN B 27107). Paralectotype: male 23.0 × 16.5 mm (MNHN B 27713), same data as lectotype.

Bouvier (1914) gave little information when he described this species and did not indicate the number of specimens he examined. In a more detailed description, Bouvier (1915) indicated that there were two specimens, without designating a type. Both male specimens are syntypes, but in bad condition. The smaller male specimen (21.6 × 15.4 mm) is selected as the lectotype, being less damaged and has the carapace and sternum still intact.

Material examined. – **Guam**. Tumon Bay, near Gun Beach, 55 ft. (16.8 m), under rock, V. Tyndzik coll., 2 Mar.1984: 1 female 27.8 × 20.8 mm (USNM); Agat Bay, north of Alutom Island, fore-reef, in deep coral rubble, ca. 5 m depth, H. T. Conley coll., 18 Dec.2000: 1 male 30.3 × 21.6 mm (ZRC); Agat Bay, north of Alutom Island, fore-reef, in deep coral rubble, ca. 5 m depth, H. T. Conley coll., 10 Jan.2001: 1 female 25.6 × 19.5 mm (FMNH).

Diagnosis. – Carapace subpentagonal, broader than long, dorsal surface densely tuberculate, tubercle relatively large, reticulate pattern on metagastric, cardiac and branchial regions; regions distinct. Carapace periphery with almost continuous cristae, beginning at postorbital region, connecting the lateral portion of hepatic, epibranchial, meso- and metabranchial region on one side, continuous with a ridge just above the posterior margin, continuous on the other side, terminating at opposite postorbital region. Hepatic region with a lateral tooth. Epibranchial margin arcuate; epibranchial region lateral side with 2 large teeth. Last epibranchial tooth large, slightly curving anteriorly. Frontal projection short, blunt, deflexed, dentate, usually with 5 short teeth. Antennal article 2, larger than antennular article 1; anterior margin extending beyond anterior lateral corner of antennular article 1. Antennular article 1 outer margin not forming part of orbit. Cheliped subequal, monomorphic, both as cutters; pollex tip behind fixed finger when fully closed; merus surfaces tuberculate, dorsal surface with 3 spines, continuous at base with a ridge; manus lower margin with 6 spines, second distal-most spine bifurcated. Ambulatory legs heavily tuberculate on all articles, tubercles short, spine like; upper margin of merus with short spines, broad at base. G1 tubular, dorsal surface of tip tapering, pointed. G2 about 0.7 times G1 length; distal segment about 0.3 times basal segment length.

Distribution. – Mauritius, Palau (Balss, 1935), and for the first time from Guam.

Discussion. – Michel (1964) mentioned that the type locality of O. cariei is Mauritius and that two specimens were reported by Bouvier (1915) are from Port-Louis. It appears that Michel probably did not have specimens on hand, but merely cited Bouvier (1915). Evidently, Michel (1964) used a reprint of Bouvier (1915) judging from the page number cited, 55, rather than the journal page number, 232.

Thyrolambrus Rathbun, 1894

Thyrolambrus Rathbun, 1894: 83 [type species: *Thyrolambrus astroides* Rathbun, 1894, by monotypy]; Bouvier, 1915: 229, 230 (part); Rathbun, 1925: 531; Flipse, 1930: 89 (table); Balss, 1935: 128; Garth, 1958: 451.

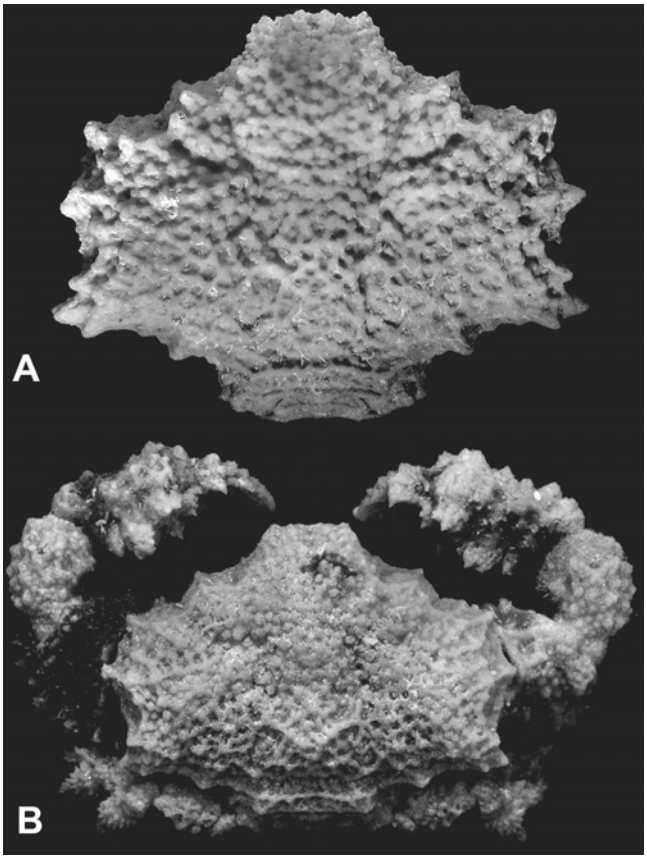

Fig. 28. *Olenorfia cariei* (Bouvier, 1914): A, lectotype, male, 21.6 × 15.4 mm (MNHN B 27107), Mauritius, environs de Port Louis, P. Carié coll., 1913; B, female, 27.8 × 20.8 mm (USNM), Guam, Tumon Bay, near Gun Beach, 55 ft (17 m) depth, under rock, V. Tyndzik coll., 2 Mar.1984.

Parthenope (*Parthenomerus*) Alcock, 1895a: 280 [type species: *Parthenope* (*Parthenomerus*) efflorescens Alcock, 1895, by monotypy].

Parthenopoides – Flipse, 1930: 85 (part). Not *Parthenopoides* Miers, 1879.

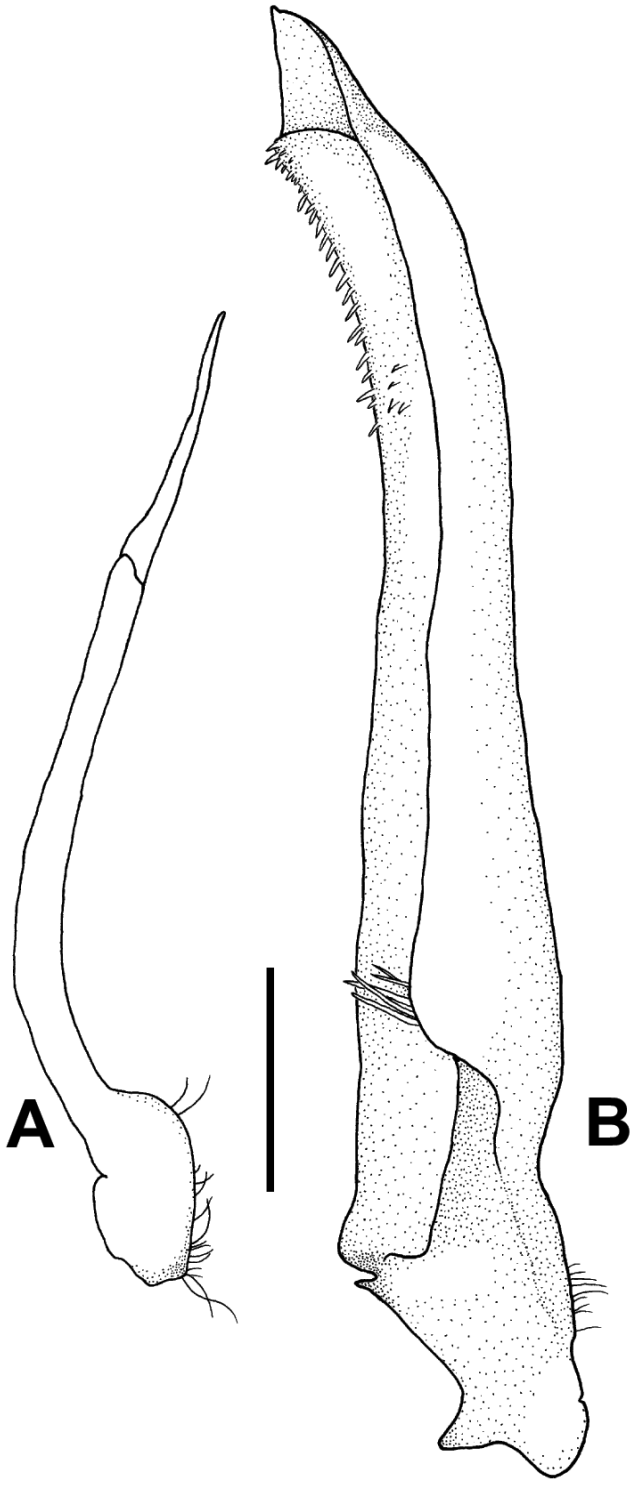

Fig. 29. *Olenorfia cariei* (Bouvier, 1914): lectotype, male, 21.6 × 15.4 mm (MNHN B 27107), Ile Maurice (Mauritius), environs de Port Louis, P. Carie coll., 1913: A, left G2; B, left G1. Scale bar = 1 mm.

Diagnosis. – Carapace subpentagonal, broader than long; protogastric region greatly inflated; mesogastric, cardiac, epibranchial regions inflated, mesobranchial region slightly inflated; metagastric and intestinal regions usually depressed; dorsal surface reticulate or paxillate; gastrobranchial deep; cardiobranchial groove continuous with intestinal depression, forming a U-shaped depression. Antennular article 1 not forming part of orbit hiatus, totally excluded by antennal article 2. Maxilliped 3 expod, propodus and dactylus completed hidden behind ishium and merus; carpus without notch at junction with merus. Chelipeds merus about twice size of manus; manus inner and lower margins each with a row of long, sharp, curved spines, spines slender to very slender; spines continuous on lower margin of pollex and upper margin of dactylus. G1 tubular, sometimes sinuous at tip. G2 about the same length or slightly longer than G1; distal segment about 0.3 times basal segment.

Included species. – *Thyrolambrus astroides* Rathbun, 1894, *Parthenope* (*Parthenomerus*) *efflorescens* Alcock, 1895; *Thyrolambrus verrucibrachium* Zimmerman & Martin, 1999.

Discussion. – Rathbun (1894) established *Thyrolambrus* for the Atlantic *T. astroides*. Alcock (1895a) established the subgenus, *Parthenope* (*Parthenomerus*) for a new species, *Parthenope* (*Parthenomerus*) *efflorescens*, from the Indian Ocean. Both species have a relatively thick cheliped merus in contrast to the very slender cheliped manus. *Parthenope* (*Parthenomerus*) *efflorescens* and *T. astroides* are readily separated by the very slender cheliped manus, but are otherwise indistinguishable at the generic level. Therefore, we regard the Atlantic and Indo-West Pacific species as congeneric, although the name *Parthenomerus* remains available. *Thyrolambrus verrucibrachium* Zimmerman & Martin, 1999, from the Eastern Pacific, is the third species in this genus.

Historically, the concept of *Thyrolambrus* has been fluid resulting in an unstable composition. The following species have been variously attributed to *Thyrolambrus*: *T. leprosus*, *T. excavatus*, *T. glasselli*, *T. rathbunae*, *T. cariei* (sensu Balss, 1935), and *T. erosus* Rathbun, 1898. The first four species are now placed in *Daldorfia*, whereas the last two are the type species of new monotypic genera. Bouvier (1915) was probably the first to list all the species placed in *Thyrolambrus* at that time, namely, *T. astroides*, *T. rathbuniae*, *T. erosus*, and *T. leprosus*. He chose, however, to place *T. efflorescens* in *Parthenope* (which was at that time, the genus that *Daldorfia* specieswere placed in; all other parthnopine were placed into the genus *Lambrus*) rather than *Thyrolambrus*. Balss (1935) attempted to resolve Bouvier's (1915) arguments for not placing *T. efflorescens* in *Thyrolambrus*, but in the process, generated further confusion. He first commented that *Parthenopoides* (type species: *Lambrus massena* Roux, 1830) is a junior synonym of *Pseudolambrus* Paulson, 1875. *Parthenopoides erosa* Miers, 1879, and *Parthenopoides cariei* Bouvier, 1915, however, cannot belong in *Parthenopoides* because Balss (1935) already considered it a synonym of *Pseudolambrus*. *Parthenopoides* sensu stricto, however, is distinct from *Pseudolambrus* (type species: *Lambrus*

calappoides Adams & White, 1848) and restricted to the Mediterranean and eastern Atlantic (unpub. data.). Neither *Parthenopoides erosa* Miers, 1879, nor *Parthenopoides cariei* Bouvier, 1914, belong to *Thyrolambrus*, *Parthenopoides* sensu stricto or *Pseudolambrus*. Flipse (1930) included the following species in *Thyrolambrus*: *T. astroides*, *T. excavatus*, *D. leprosa* and *D. rathbunae*; and placed *Parthenope* (*Parthenomerus*) *efflorescens* as a synonym of *T. asteroides*. He did not explain why these species were congeneric, especially when *T. excavatus*, *D. leprosa* and *D. rathbunae*, are closer in general form to the type species of *Daldorfia* than that of *Thyrolambrus*.

Nevertheless, *Thyrolambrus is* easily differentiated from other daldorfiines by having a thigh-shaped cheliped merus and a relatively thinner manus. In all other daldorfiines, the cheliped manus is either larger or subequal in size to the cheliped merus.

Key to the species of *Thyrolambrus*

1. Cheliped manus very slender; dactylus very thin, forceps-like, about as long as manus in juveniles to about 0.7 times length of manus in adults ..... ***Thyrolambrus efflorescens*** (Alcock, 1895)
– Cheliped manus not as slender; dactylus relatively broad, about 0.6 times length of manus in adults **2**
2. Hepatic region equally inflated as protogastric and epibranchial regions. Epibranchial margin without distinct teeth. Hepato-orbital notch shallow ..... ***Thyrolambrus verrucibrachium*** Zimmerman & Martin, 1999
– Hepatic region less inflated than protogastric and epibranchial regions. Epibranchial margin with distinct teeth. Hepato-orbital notch deep ..... ***Thyrolambrus astroides*** Rathbun, 1894

Thyrolambrus astroides Rathbun, 1894
(Figs. 4B, 5B, 30a)

Thyrolambrus astroides Rathbun, 1894: 83; Bouvier, 1915: 229, 230; Rathbun, 1925: 532, Pl. 280, Figs. 5, 6; Campos & Manjarres, 1990: 130, Fig. 2; Melo, 1996: 294.

Types. – *Thyrolambrus astroides* Rathbun, 1894: Lectotype, 1 male (20 × 14 mm) (USNM 9515), Cuba, off Havana, 23°10'40"N 82°20'15"W, 189 fm (346 m), U.S. Fish Commission Steamer ALBATROSS, stn 2338, coral substratum, 19 Jan.1885 (not examined). Paralectotypes: 2 females (USNM 9507), Cuba, off Havana, 23°10'42"N 82°18'24"W, 67 fm (123 m), U.S. Fish Commission Steamer ALBATROSS, stn 2334, white coral substratum, 19 Jan.1885 (not examined). Type specimen data after Rathbun (1894: 84). Rathbun (1894) did not designate any of the specimens that she had examined as the holotype, as such, the male specimen from station 2338 (USNM 9515) is here choosen as the lectotype.

Material examined. – **Cuba.** Off Havana, State University off Iowa Expedition, 200 fm (366 m), 26 May 1893: 1 male 22.5 × 15.2 mm (MNHN B 27534) (ex. USNM 69026). **Brazil**. Southeastern coast, RV LESTE II, no other data: 1 male 24.2 × 15.9 mm, 1 female 17.3 × 12.2 mm (USU 1087); 9º05'S 36º51'W, 54 m, RV AKAROA coll., no date: 1 female 12.3 × 8.8 mm (MNHN B 27531).

Diagnosis. – Carapace dorsal surface tuberculate, tubercles paxiiliform, forming reticulate pattern, frost-like. Lateral margins of sternum segments 4–6 with a broad tooth on each side. Chelipeds manus slender, inner and lower margins each with a row of sharp, curved spines, spines slender; fingers thin, not forceps-like. Male sternal pit bottom with several Y-shaped ridges. Ambulatory legs with well-spaced irregular paxilliform tubercles.

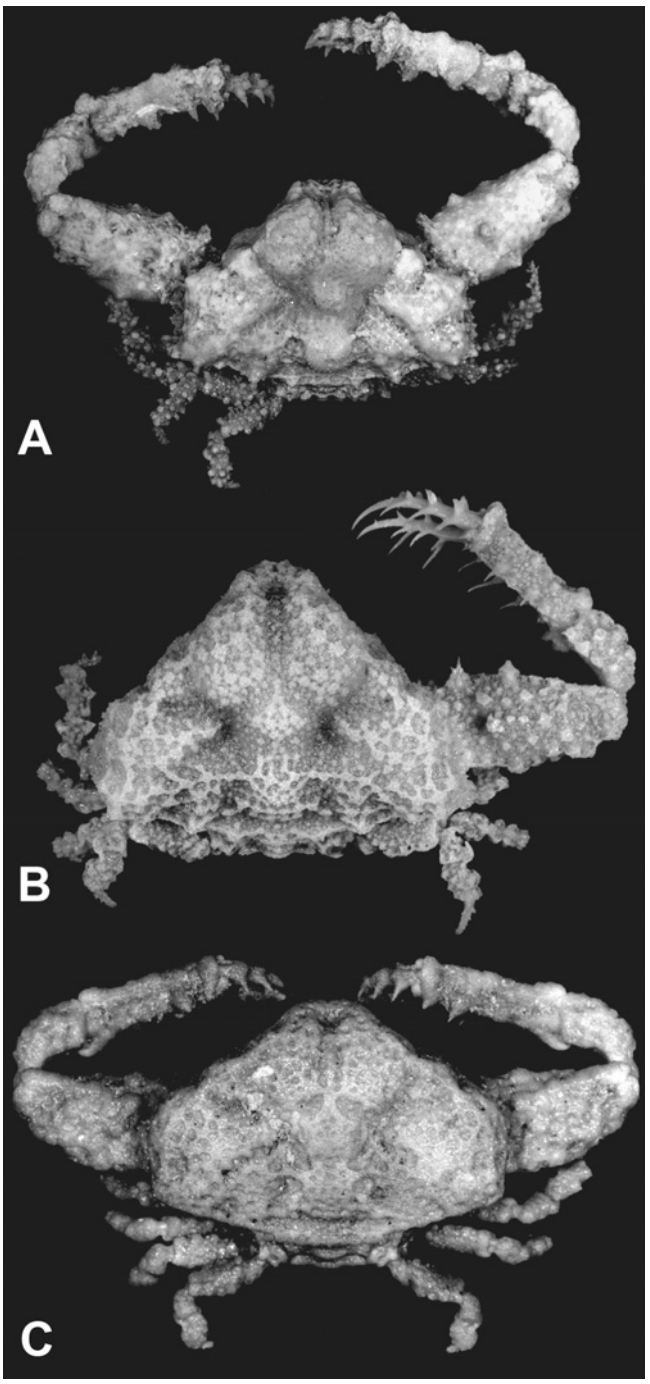

Fig. 30. *Thyrolambrus astroides* Rathbun, 1894: A, male, 24.2 × 15.9 mm (USU 1087), Brazil. *Thyrolambrus efflorescens* (Alcock, 1895): B, holotype, female, 26.6 × 19.5 mm (ZSI 8611/6), Andaman Sea, 36 fm (66 m). *Thyrolambrus verrucibrachium* Zimmerman & Martin, 1999: C, paratype, female, 22.0 × 15.2 mm (LACM CR 19891941), Costa Rica, Isla del Coco, lsla Manuelita (ca. 5º33'40"N 87º2'47"W), 21–24 m, under rocks, K. L. Kaiser coll., 22 Mar.1989.

Distribution. – Western Atlantic.

Discussion. – Comparisons of *T. astroides* with *T. verrucibrachium*, its closest congener, were dealt with in detail by Zimmerman & Martin (1999) who also examined the holotype of *T. asteroides*. *Thyrolambrus astroides* can easily be distinguished from *T. verrucibrachium* by the degree of inflation of the hepatic region when compared to the protgastric and epibranchial regions. In *T. astroides*, the hepatic region is less inflated than the protgastric and epibranchial regions, but about equal in *T. verrucibrachium*. As a result of the differences in the degree of inflation of the hepatic region, the hepatogastric and hepatobranchial grooves are more pronounced, with deeper intervening grooves, in *T. astroides* than in *T. verrucibrachium*.

Thyrolambrus efflorescens (Alcock, 1895)
(Fig. 30b)

Parthenope (*Parthenomerus*) *efflorescens* Alcock, 1895a: 281; 1895b: 298 (key); Alcock & Anderson, 1896: Pl. 22 Fig. 5, 5A.
Parthenope efflorescens – Bouvier, 1915: 230, 232, 235.
Thyrolambrus astroides – Michel, 1964: 10 (lit. cited). Not *Thyrolambrus astroides* Rathbun, 1904 (= *D. glasselli* Garth, 1958).
Parthenomerus efflorescens – Serène, 1980: 717, Pl. 2B, D.

Types. – *Parthenope* (*Parthenomerus*) *efflorescens* Alcock, 1895: Holotype, female 26.6 × 19.5 mm, Andaman Sea, 36 fm (66 m) (ZSI 8611/6). We were unable to examine the female holotype, currently in ZSI, but photographs taken by D. Yeo at our request, are here published for the first time. The specimen matches the original description very well, and as mentioned by Alcock (1895a), only one cheliped remains on the holotype. The characteristic slender manus is evident.

Material examined. – **Mauritius**. Presented by M. V. de Robilliard: 1 female 32.9 × 21.8 mm (NHM 1887.12). **The Philippines**. Visaya, Bohol, Panglao, Balicasag Island, T. Kase coll., Sep.1998: 1 ovig. female 26.8 × 18.8 mm (NSMT-Cr 13034); Visaya, Bohol, Panglao, Balicasag Island, 50–500 m, locali fishermen coll., 28 Nov.2001: 1 male CW 44.3 mm (ZRC). **Guam**. Apra Harbour, 8–11 m, under rocks, coll. H. T. Conley, Aug.1998: 1 female 17.2 × 11.6 mm (ZRC); Piti, 1–2 m, 1–1.5 m deep in rubble, coll. H. T. Conley, Sep.1998: 1 male 27.0 × 18.7 mm (ZRC). **Tuamotu Archipelago**. Rangion Atoll, Avatoru Motu, off second hoa to the east of airfield, outer reef slope, under rocks, 12–17 m, 14.90ºS 147.61ºW, G. Paulay coll., 10 Oct.2001: 1 female 23.6 × 17.2 mm (FMNH 1523).

Diagnosis. – Carapace dorsal surface tuberculate, tubercles paxilliform, tips intensely stellate, forming reticulate pattern. Lateral margins of sternum segments 4–6 with a long sharp spine on each side. Chelipeds manus slender, inner and lower margins each with a row of sharp, curved spines, spines very slender; fingers very thin, forceps-like. Male sternal pit bottom tuberculate, tubercles paxilliform. Ambulatory legs with well-spaced irregular paxilliform tubercles.

Distribution. – The type specimens was described from the Andaman Sea (Alcock 1895) and subsequently reported from Mauritius (Michel 1964). The specimens from the Philippines, Guam and Tuamotu Archipelago represent new records.

Discussion. – *Thyrolambrus efflorescens* is the only represensative of the genus in the Indo-West Pacific. It can easily be distinguished from the other two species by the unique shape of its cheliped manus. The manus of *T. efflorescens* is thinner than in the other two species, and has longer and thinner spines on the inner and lower margins. The form of the cheliped fingers is diagonostic of *T. efflorescens*, both of which are extremely thin, slender and forceps-like in contrast to the comparatively thicker, more robust fingers of *T. astroides* and *T. verrucibrachium*.

Thyrolambrus efflorescens most closely resembles *T. astroides* and was once considered a synonym of the latter species (Michel, 1964). The texture of the dorsal surface of the carapace of *T. efflorescens*, however, is more densely tuberculate than in *T. astroides*. The tubercles of *T. efflorescens* are also paxilliform with far more numerous tips than that of *T. astroides*. The teeth on chliped of *T. efflorescens* are long, slender and sharp, as opposed to those of *T. astroides*, which are short, blunt and broadly triangular (compare Figs. 30b and 30c).

Interestingly, Serène (1980) reported that L. Zehntner had correctly recognised this species as new about one year (ca. 1894) before the publication of *T. efflorescens* by Alcock (1895a). Apparently, Zehntner never published his new species (Serène 1980).

Zimmerman & Martin (1999) reported a specimen from Mauritius, which they tentatively identified as *T. astroides*. That specimen could well be *T. efflorescens* except for the fact that they did not mention the structure of the cheliped fingers. If the cheliped fingers were indeed very slender and forceps-like, it is very likely that that specimen is *T. efflorescens* rather than *T. astroides*.

Thyrolambrus verrucibrachium
Zimmerman & Martin, 1999
(Fig. 30c)

Thyrolambrus glasselli – Garth, 1958: 452 (part); Hertlein, 1963: 246. Not *T. glasselli* Garth, 1958.
Thyrolambrus astroides – Garth, 1992a: 1, Fig. 1; 1992b: 3, tab. 1, 5; Hendrickx, 1995: 133 (list). Not *T. astroides* Rathbun, 1894.
Thyrolambrus verrucibrachium Zimmerman & Martin, 1999: 652, Figs. 2–4; Hendrickx, 1999: 244, Pl. 11 A, B, C; Aguilera, 2002: 314 (list).

Types. – *Thyrolambrus verrucibrachium* Zimmerman & Martin, 1999: Holotype, male 31.7 × 21.1 mm (LACM CR 19891941), Mexico, Cape Henslow, Socorro Island, coll. P. L. Haaker coll., 26 Nov.1984; Paratype: 1 female 22.0 × 15.2 mm (LACM CR 19891941), Costa Rica, Isla del Coco, lsla Manuelita (ca. 5º33'40"N 87º2'47"W), 21–24 m, under rocks, K. L. Kaiser coll., 22 Mar.1989.

Material examined. – See types.

Diagnosis. – Carapace dorsal surface tuberculate, tubercles large, granulate. Sternum segments 4–6 lateral margin without a spine, reduced to an irregular ridge. Chelipeds manus slender, inner and lower margins each with a row of sharp,

curved spines, spines short; fingers thin, not forceps-like. Male sternal pit bottom with Y-shape ridges. Ambulatory legs with densely spaced granules.

***Distribution.* –** Eastern Pacific, from Mexico to Costa Rica.

***Discussion.* –** A comprehensive account of this species was given by Zimmerman & Martin (1999). Differences between *T. verrucibrachium* and *T. astroides*, its nearest congener, have been treated under the latter species. An addition character is with regards to the teeth on the lateral margins of the sternal segments four to six. The teeth are reduced to irregular ridges in *T. verrucibrachium*, whereas in *T. asteroides* and *T. efflorescens*, the teeth are distinct.

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