東邦大学審査学位論文(博士)

A Taxonomic Revision on the Family Rhynchocinetidae of the World (Crustacea: Decapoda: Caridea)

A Dissertation submitted to
the Graduate School of Science,
Toho University
for the Degree of Ph. D.

JUNJI OKUNO
Coastal Branch of Natural History Museum and Institute, Chiba
123 Yoshio, Katsuura, Chiba 299-5242, Japan

2013

Contents

1 INTRODUCTION

Caridean shrimps of the family Rhynchocinetidae currently comprise 24 species of 2 genera, *Cinetorhynchus* Holthuis, 1995 and *Rhynchocinetes* H. Milne Edwards, 1837, worldwide (De Grave and Fransen, 2011). Most species inhabit at shallow rocky reefs in tropical to temperate waters, and only four species of *Rhynchocinetes* occur in deepsea waters of the Indo-West Pacific. The shallow water rhynchocinetids inhabit the crevices and caves of rocky reefs by day, and actively forage for food on the surface of rocks at night (Manning, 1961; Okuno, 1993, 1994b). Some rhynchocinetids are economically important as to regional marine fisheries and the ornamental shrimp industry: *Rhynchocinetes typus* H. Milne Edwards, 1837 is a commercial species caught at coast of Chile (Holthuis, 1980); *R. durbanensis* Gordon, 1936 is commonly sold in the marine aquarium trade (Bauer, 2004; Calado, 2008); species inhabiting tropical coral reefs and temperate shallow rocky reefs have been frequently introduced to divers and naturalists in field guidebooks accompanied by their underwater photographs (e. g. Gosliner *et al*., 1994; Debelius, 1999; Kato and Okuno, 2001; Kawamoto and Okuno, 2003; Kuiter and Debelius, 2009; Humann and Deloach, 2010).

Current taxonomic studies based on morphology show that the Rhynchocinetidae is closely allied to the deepsea shrimp families, Eugonatonotidae Chace, 1936 and Nematocarcinidae Smith, 1884 (Chace, 1992; Holthuis, 1993; De Grave *et al*., 2009; De Grave and Fransen, 2011). As the result of relationship among caridean superfamilies by molecular analysis, Li *et al*. (2011) showed that Rhynchocinetidae is not included in the cluster containing the caridean shrimp families found at same habitat such as Hippolytidae Bate, 1888 and Palaemonidae Rafinesque, 1815, but rather in a group of deepsea shrimp families such as Alvinocarididae Christoffersen, 1986, Eugonatonotidae, Nematocarcinidae, and Oplophoridae Dana, 1852.

Up to now, Rhynchocinetidae is considered as a small taxon only involving 2 genera and 24 species, but the distributional range of rhynchocinetid species is cosmopolitan, with species around the world. Furthermore, the pattern of distribution differs between its two genera; *Cinetorhynchus* species show a pantropical distribution not only in the Indo-Pacific but also in Atlantic Ocean, while in *Rhynchocinetes*, the distribution is restricted to the Indo-Pacific, and 11 of 13 described species show an endemic distributional pattern in disjunctive temperate waters. Since the specific diversity of rhynchocinetids is not abundant, we can directly compare all previously described species composing a higher taxon on the familial level on the basis of examination of specific specimens (including the type material) deposited at museums around the world. For more than two decades, I have continued the taxonomic studies on rhynchocinetid shrimps, with establishment of 12 species as new to science: *Rhynchocinetes conspiciocellus* Okuno and Takeda, 1992; *R. brucei* Okuno, 1994; *Cinetorhynchus concolor* (Okuno, 1994); *R. rathbunae* Okuno, 1996; *C. manningi* Okuno, 1996; *R. enigma* Okuno, 1997; *R. holthuisi* Okuno, 1997; *C. erythrostictus* Okuno, 1997; *C. reticulatus* Okuno, 1997; *C. fasciatus* Okuno and Tachikawa, 1997; *C. hawaiiensis* Okuno and Hoover, 1998, and *C. brucei* Okuno, 2009 (Okuno and Takeda, 1992a, b; Okuno, 1993a, b, 1994a, b, 1995, 1996a, b, 1997a, b, c, 1998, 2009, Okuno and Tachikawa, 1997; Okuno and Hoover, 1998). Indeed, I was able to examine the type or other specimens of all of the described species of rhynchocinetids during the course of these studies for comparison with new species. Although it is simple and straight-forward taxonomic technique to

compare the external morphological features under the binocular microscope, there is no revisional study which focuses on all of the described species from around the world within a single family of decapod crustaceans. Furthermore, the fossil records of most caridean shrimps are unavailable, therefore, if the exact distributional patterns of the living species can be clearly analyzed, we can obtain evidence to clarify phylogenetic questions about rhynchocinetids such as the origin of the family and process for specific divergence.

The purposes of this doctoral dissertation are 1) to thoroughly revise the taxonomy of shrimps belonging to the family worldwide, 2) to assess the distinguishing morphological characters for genera and species, and 3) to provide a hypothesis on the divergence within the single family of caridean shrimp on the basis of the distributional pattern of the Recent species.

2 HISTORICAL BACKGROUND

Increasing number of described species

H. Milne Edwards (1837a) established the first species of rhynchocinetid shrimp, *Rhynchocinetes typus*, as the species of a monospecific caridean genus *Rhynchocinetes*. Later, taxonomic study on caridean shrimps dramatically progressed by numerous papers such as the United States Exploring Expedition (Dana, 1852), the scientific results of the Voyage of H. M. S. Challenger (Bate, 1888), and the monographs of several groups of carideans based on the collection of the Indian Museum (e. g., Kemp, 1914, 1916, 1922, 1925), and number of the described species in caridean shrimps was greatly increased. In 1936, the first taxonomic revision of Rhynchocinetidae was proposed by Gordon (1936), but only 1 genus and 6 species were recognized in that study although about 100 years had passed since the first species of rhynchocinetid shrimp was described by H. Milne Edwards (Fig. 1). This paucity of new species descriptions was probably due to the habitat and usually nocturnal activity of most species. These shrimps mainly inhabit crevices and caves of rocky reefs; thus, dredging or trawling poorly samples such species. Before the last two decades of the 20th century, only 10 species of rhynchocinetids were known, mainly from intertidal zone. As pointed out by Hayashi (2007), sampling using SCUBA equipment has increased the number of described rhynchocinetid species. Tiefenbacher (1983), Nomura and Hayashi (1992), Okuno (1994b, 1997c, 2009), Okuno and Tachikawa (1997) and Okuno and Hoover (1998) have described new species based on the specimens collected by that method.

The incorrect recognition of a number of rhynchocinetid species is due to the fact that two earlier described species, *R. typus* and *R. rugulosus* Stimpson, 1860 [= *R. serratus* (H. Milne Edwards, 1837)], were considered as widely distributed throughout the Indo-West Pacific (Holthuis, 1947). To date, as suggested by Okuno (1996a), the warm temperate and subtropical species of *Rhynchocinetes* are represented by endemics along the coasts of Peru and Chile (*R. typus*), southern coasts of Australia (*R. serratus*, *R. australis* Hale, 1941 and *R. kuiteri* Tiefenbacher, 1983), southern Pacific from Juan Fernandez to New Zealand (*R. balssi* Gordon, 1936), Japanese waters (*R. uritai* Kubo, 1942 and *R. conspiciocellus*) and Hawaii (*R. rathbunae*). Further endemic species of *Rhynchocinetes* were discovered some museum collections (Okuno, 1997a, b). Therefore, the identifications as *R. typus* and *R. rugulosus* on several papers are now corrected as follows: *R. rugulosus* sensu Rathbun (1906) from

Hawaii was newly described as *R. rathbunae*, *R. typus* sensu Stebbimg (1917) from South Africa as *R. durbanensis* Gordon, 1936, *R. typus* sensu Balss (1922) from Juan Fernandez as *R. balssi*, *R. rugulosus* sensu Hale (1927) from southern Australia as *R. australis*, *R. rugulosus* sensu Kubo (1936) from Japan as *R. uritai*, and *R. rugulosus* sensu Bruce (1991) from Hong Kong as *R. brucei* (Gordon, 1936; Hale, 1941; Kubo, 1942; Okuno, 1994a, 1996a). In spite of the higher diversity of antitropical species, the widely distributed species throughout the tropical regions of the Indo-West Pacific are poor. Only two species are known: *R. durbanensis* (= *Bus durbanensis*) and *R. brucei* (=*Bus brucei*).

These previous taxonomic studies on rhynchocinetids revealed that specific richness of the shrimps is found in shallow water habitats of tropical and temperate regions.

Genera included in Rhynchocinetidae

Earlier scientists regarded the genus *Rhynchocinetes* as a close ally of hippolytid shrimps (H. Milne Edwards, 1837a; Dana, 1852). Later, Ortmann (1890) proposed the family Rhynchocinetidae to the genus by having the particular morphological structure of the movable rostrum, which is articulated with carapace, and it has been considered as a monogeneric family of the carideans (e. g. Holthuis, 1955). Yaldwyn (1960) proposed, however, that Rhynchocinetidae not only includes *Rhynchocinetes* but also in other two genera, *Eugonatonotus* Schmitt, 1926 and *Lipkius* Yaldwyn, 1960. He did not recognize the movable rostrum as a diagnostic character of familial level, and the form of the first and second pereiopods are important characters which distinguish Rhynchocinetidae from other caridean families. Subsequent investigators did not accept this opinion, and regarded that the present family contained a single genus *Rhynchocinetes*, and thus moved *Eugonatonotus* to Eugonatonotidae and *Lipkius* to Nematocarcinidae (Thompson, 1966; Forest, 1977; Christoffersen, 1990; Chace, 1992; Holthuis, 1993; Martin and Davis, 2001; De Grave *et al*., 2009).

In the first revisional study on rhynchocinetids, Gordon (1936) pointed out that shrimps of *Rhynchocinetes* were subdivided into two species groups: one has two acute teeth at median carina of carapace behind the distinct rostral articulation and a supraorbital spine on the orbital region, and lacks the posterolateral teeth on the posterior margins of fourth and fifth abdominal somites; another group possesses three teeth at median carina of carapace behind the indistinct articulation and the posterolateral acute teeth at the posterior margin of fourth and fifth abdominal somites, and lacks supraorbital spine. Holthuis (1995) recognized that these differences justify to be divided into two subgenera, and established a new subgenus *Cinetorhynchus* to the later species group. Okuno (1997c) found meristic differences of the spines on the ischia and meri of the third to fifth pereiopods between two subgenera, and elevated *Cinetorhynchus* as the full generic rank. Furthermore, de Melo (2007) considered the position of the antennal spine on the anterior margin of carapace as a useful character in distinguishing *Cinetorhynchus* from *Rhynchocinetes*.

3 MATERIALS AND METHODS

The materials examined in this study were originated mainly from the museum collections deposited in the Australian Museum, Sydney, the Museum National d'Histoire Naturelle, Paris, the Museum of the Northern Territory, Darwin, Australia and the specimens collected from the shallow

water on the coast of southern Japan by me and deposited at the Coastal Branch of Natural History Museum and Institute, Chiba, and the National Museum of Nature and Sciences. They were listed in order of the northern to the southern localities in Material Examined of each species.

All drawings were made with the aid of a drawing tube mounted on a LEICA MZ 12 stereomicroscope with. The postorbital carapace length is abbreviated as CL in the text. The methods of measurements followed Okuno (1997c).

The institutional names are abbreviated as follows:

AHF— Allan Hancock Foundation,

AM— Australian Museum, Sydney

AMNH— American Museum of Natural History, New York.

ASIZ— Institute of Zoology, Academia Sinica, Taipei.

BPBM— Bernice Pauahi Bishop Museum, Honolulu.

CBM— Natural History Museum and Institute, Chiba.

CDMS— Charles Darwin Marine Station, Galapagos.

CMNH— Coastal Branch of Natural History Museum and Institute, Chiba.

KMNH— Kitakyushu Museum of Natural History, Kitakyushu.

KUMB— Kagoshima University, Marine Biological Laboratory, Kagoshima.

MNHN— Museum National d'Histoire Naturelle, Paris.

MI— Mauritius Institute.

NIWA— National Institute of Water and Atmospheric Research.

NMNZ— Museum of New Zealand Te Papa Tongarewa

NSMT— National Science Museum, Tokyo.

NTOU— National Taiwan Ocean University, Keelung.

NTM— Museum of the Northern Territory, Darwin.

OUMNH— Oxford University Museum of Natural History, Oxford.

QM— Queensland Museum, Brisbane.

RMNH— Rijksmuseum van Natuurlijke Historie. Leiden.

RUMF— Ryukyu University Museum, Fujukan.

SAMA— South Australian Museum, Adelaide.

SAMC— South African Museum, Capetown.

SMF— Natur-Museum und Forshungs-Institut Senckenberg, Frankfurt-am-Main.

SUF— Shimonoseki University of Fisheries, Shimonoseki.

TM— Tasmanian Museum.

ULL— University of Louisiana, Lafayette.

UMZC— University Museum of Zoology, Cambridge.

USNM— National Museum of Natural History, Smithsonian Institution, Washington, D. C.

YCM— Yokosuka City Museum, Yokosuka.

ZRC— Zoological Reference Collection, Department of Biological Sciences, National University of Singapore.

New taxa consisting of one subfamily and three genera, and three new species were established in the present study. Because all nomenclatural acts will be disclaimed in this doctoral dissertation, a new

subfamily was tentatively treated as “Subfamily A”, three genera as “*Aus*”, “*Bus*” and “*Cus*”, and three species as “*Bus* spp.1–3” in the text following the Article 8 of the International Code Zoological Nomenclature (ICZN, 1999).

4 MORPHOLOGICAL FEATURES USED IN THIS STUDY

For distinguishing subfamilies, genera or species of Rhynchocinetidae, the following morphological features are used:

Carapace (Fig. 2A): Number of spines on dorsal median carina, presence or absence of supraorbital spine or nodule, and structure of antennal spine are considered as diagnostic characters for subfamilial and generic level. In Rhynchocinetinae, there are two spines on dorsal median carina, instead of three in subfamily A. *Rhynchocinetes* and *Bus* of Rhynchocinetinae have a supraorbital spine, *Cus* of the same subfamily has a supraorbital nodule, and *Cinetorhynchus* and *Aus* of Subfamily A show the unarmed cephalic region. In *Rhynchocinetes* and *Bus*, inferior orbital angle is separated from the carinate antennal spine, but *Cus* of Rhynchocinetinae and both genera included in Subfamily A have the inferior orbital angle terminating in the antennal spine.

Rostrum (Fig. 2A): Articulated with carapace; the articulation is distinct in Rhynchocinetinae, but rostrum and carapace is continued ventrally with lateral carina in Subfamily A.

Thoracic sternite: The fifth to seventh sternites are armed each with a pair of acute median processes in the Subfamily A and *Bus* of the Rhynchocinetinae. In *Rhynchocinetes* and *Cus*, the posterior margins of these sternites have the low and subquadrate plate, without acute process.

Abdominal somites (Fig. 2A): The posterior margin of the fifth abdominal somites is armed with an acute posterolateral tooth in Subfamily A instead of entire in Rhynchocinetinae.

Antennule (Fig. 2B): Relationship between distolateral tooth of antennular proximal segment and stylocerite is species-specific. Most species are armed with a single tooth on ventromesial margin of the antennular proximal segment, except for *Cinetorhynchus concolor*, which has 2–4 ventromesial teeth at that position.

Antenna: (Fig. 2C) The width of scaphocerite distinguish *Rhynchocinetes* and *Bus* from *Cus* and sunfamily A: In *Rhynchocinetes* and *Bus*, the basal part of terminal tooth of external margin of scaphocerite as wide as lamella, whereas this part is considerably narrower than the width of lamella in *Cus* and subfamily A. Most species represent that the ventral margin of the basicerite is bluntly angular, but only *B. australis* is armed with an acute tooth at the margin.

Mouthparts: In Rhynchocinetinae, most species show the strongly elongate third maxilliped by sexual dimorphism. But *Bus australis* and *B. uritai* mark the maxilliped as normal form. Indeed, mating behavior of *B. uritai* clearly differs from those of most congeneric species with the elongate maxilliped (Bauer and Thiel, 2011). Most species have the well-developed podobranch on the second maxilliped, but in *Cinetorhynchus erythrostictus, B. rathbunae* and *B.* sp. 1, the podobranch remains only shaft and its filaments are rudimentally.

Arthrobranch (Tab. 1, 2): Number of arthrobranch is useful to identify the species of rhynchocinetids. It varies from lacking on all of appendages (*B. enigma*) to the presence of it from third maxilliped until fourth pereiopod (*R. typus*).

First pereiopod (Fig. 2D): Three species of Subfamily A, *C. hawaiiensis*, *C. reticulatus* and *Aus hendersoni* represent the strongly elongate pereiopod with subchela as the sexual dimorphism of mature male. In A. hendersoni, coxa is armed with corneous reef-like projection, which is one of the diagnoses of the gnus *Aus*.

Ambulatory pereiopods (Fig. 2E): Armature of ischia and meri separates Subfamily A from Rhynchocinetinae: three genera of the latter subfamily show a single spine on ischia and a single row of spines on meri, instead of two spines on ischia and two rows of spines on meri in Subfamily A. The dactyli (Fig. 2F) of all rhynchocinetid species is biunguiculate, and flexor margin is armed with some accessory spines. The number of the spines is useful to identify specific level of rhynchocinetids.

First pleopod: In male of Rhynchocinetinae, the form of endopod is various. The genus *Rhynchocinetes* has a shoulder-like projection at dorsolateral margin, instead of lacking in other two genera. The presence or absence of distinct lobe on external margin is species-specific in *Bus*.

Second pleopod: The relationship of lengths of appendices interna and masclina in male of Rhynchocinetinae is available as diagnosis of genus: In *Rhynchocinetes*, appendix masclina is elongate and longer than appendix interna, whereas the appendix masclina of *Bus* and *Cus* is oval and shorter than appendx interna.

5 TAXONOMY

5-1 Family Rhynchocinetidae Ortmann, 1890

Rhynchocinetidae Ortmann, 1890: 459.– Gordon, 1936: 75.– Burkenroad, 1939: 313.– Holthuis, 1947: 77.– Barnard, 1950: 762.– Yaldwyn, 1960: 16 (in part).– Thompson, 1966: 130.– Chace, 1997: 26.– Okuno, 1997b: 33.– Davie, 2002: 371.– Bauer, 2004: 71.– Poore, 2004: 75.– Hayashi, 2007: 96.– de Melo, 2007: 57.

Type genus. *Rhynchocinetes* H. Milne Edwards, 1837.

Dianosis. Body subcylindrical. Rostrum well developed, dentate, articulated with carapace, movable or immovable. Carapace covered with fine striations, hepatic spine absent, antennal spine present, supraorbital spine present or absent, anterior part of dorsal median carina dentate. Fifth thoracic sternite ventrally with or without a pair of acute median processes. Abdomen covered with fine striations, dorsal median carina obsolete, sixth somite armed posteroventrally with acute pre-anal tooth; telson covered with fine transeverse striations, armed with three pairs of dorsolateral spines. Eye with large, pigmented cornea, accessory pigmented spot present or absent. Antennule with two separate flagella, upper flagellum without accessory branch, proximal segment of antennular peduncle armed ventrally with mesial spine(s), stylocerite well developed. Antenna with basicerite covered with fine striations, scaphocerite well developed. Epistome unarmed. Mandible with corpus robust; palp 3 segmented, distal segment oval, furnished with numerous sohort setae, intermediate segment distolaterally with long setae, obliquely articulated with proximal segment; incisor process truncate distally, cutting edge with somewhat irregular-sized acute teeth; molar process obliquely truncate distally, transversely ribbed. Maxillula with palp elongated, feebly bilobed distally, upper lobe broad,

lower lobe distally with long stout seta; proximal endite with mesial margin subquadrate, with numerous stout setae mesially; distal endite with mesial margin truncate, armed with row of small spines and row of short setae. Maxilla with palp tapering distally; proximal endite broad, furnished with long setae densely; distal endite bilobed; scaphognathite with anterior lobe much broader than posterior, marginally densely setose, posterior lobe elongated, tapering posteriorly, mesial margin furnished with long setae. Maxillipeds with epipods and exopodal flagella. First maxilliped with caridean lobe narrow. Second maxilliped with oval epipod. Third maxilliped with endopod pereiopod-like. First to fourth pereiopods with epipods. First pereiopod cheliped, stouter than second. Second pereiopod cheliped, with carpus entiter. Third to fifth pereiopods with meri, carpi and propodi armed with spines, dactyli biunguiculate, flexor margin armed with a few small accessory spines.

Distributional range. Widespread tropical and temperate waters of the world, but not recorded from the Mediterranian Sea (Figs. 56, 57), littoral to around 300 m.

Remarks. This family is morphologically characterized by a typically movable rostrum, fine transverse striae on the surfaces of the carapace and the abdominal somites, first two pairs of pereiopods robust, fingers bearing long lateral and terminal spines and second pereiopod with carpus entire, not subdivided (Chace, 1997). As the result of the comprehensive examination on the specimens of all the described species of Rhynchocinetidae, these morphlogical features were constant in the family but the combination of them does not occur any families of the carideans. Therefore, on the basis of the morphology, Rhynchocinetidae is considered as a natural group. The phylogenetic studies based on the mulecular analysis also show that Rhynchocinetidae documents an independent cluster considered as familial level in the carideans (Bracken *et al*., 2009; Li *et al*., 2011).

Chace (1992) classified caridean shrimps based on the morphological features mainly by the three anterior pairs of pereiopods and six pairs of mouthparts, and included Rhynchoicnetidae in the superfamily Nematocarcinoidea Smith, 1884. Holthuis (1993), De Grave *et al*. (2009) and De Grave and Fransen (2011) followed this classification. This superfamily composes Eugonatonotidae, Nematocarcinidae, Rhynchoicnetidae and Xiphocarididae Ortmann, 1895. In addition of the diagnostic features listed above, Rhynchocinetidae is readily distinguished from Eugonatonotidae by lacking of the lateral carinae on carapace and dorsal crest of median carina of third abdominal tergum, from Nematocarcinidae by the armature of telson (constant three pairs od dorsal spines in Rhynchocinetidae vs. more pairs or a single row of spines in Nematocarcinidae), and from Xiphocarididae by lacking functional exopod on the pereiopods.

The molecular phylogeneric analyses also represented that Rhynchocinetidae is included in the cluster composed by the genera of deepsea shrimps and concluded Nematocarcinoidea as being polyphyletic (Bracken *et al*., 2009; Li *et al*., 2011). From these previous studies on the caridean classification, Rhynchocinetidae is considered to close to the deepsea shrimp families rather than Palaemonidae and Hippolytidae, although the nich to inhabitat at shallow waters resembles among these three families.

As mentioned below, *Cinetorhynchus* is divided into two genera, and *Rhynchocinetes* into three genera in the present study. In other caridean families (e. g. Palaemonidae), some morphological features used to distinguish these groups such as the armature of thoracic sternites and form of inferior orbital margin are regarded as the diagnostic characters not as subgeneic but as full generic level. From

this opinion, the previously recognized differences between *Cinetorhynchus* sensu lato and *Rhynchocinetes* seusu lato should be re-evaluated as the distinguishing features for the higher taxon than full generic level. Rhynchocinetidae is considered to be monophyletic family, and thus, the definition should be regarded to accomodate the hierachy between family and genus. Therefore, the present study first establish a new classification within Rhynchocinrtidae to contain two subfamilies, Subfamily A, newly proposed here for *Cinetorhynchus* s. l. and Rhynchocinetinae for *Rhynchocinetes* s. l.

Key to subfamilies of Rhynchocinetidae

1. Median carina of carapace armed with three spines; supraorbital spine absent…….....Subfamily A

–. Median carina of carapace armed with two spines; supraorbital spine or nodle present……Rhynchocinetinae

5-1-1 Checklist of subfamilies, genera and species of Rhynchocinetidae

Subfamily A subfam.nov.

Cinetorhynchus Holthuis, 1995:

Cinetorhynchus brucei Okuno, 2009: 940, figs. 1–3.

Cinetorhynchus concolor (Okuno, 1994)

Rhynchocinetes concolor Okuno, 1994b: 36, figs. 1, 2, 3A, 4A–D.

Cinetorhynchus erythrostictus Okuno, 1997c: 36, pl. 1A, B, Figs. 2A, 3, 4A–C.

Cinetorhynchus fasciatus Okuno and Tachikawa, 1997: 16, figs. 1–4.

Cinetorhynchus hawaiiensis Okuno and Hoover, 1998: 33, figs. 1–3, 4A, B, 5A.

Cinetorhynchus hendersoni; See ***Kemprhynchus hendersoni***

Cinetorhynchus hiatti (Holthuis and Hayashi, 1967)

Rhynchocinetes hiatti Holthuis and Hayashi, 1967: 162, figs. 1–2.

Cinetorhynchus manningi Okuno, 1996b: 725, figs. 1 2.

Cinetorhynchus reticulatus Okuno, 1997c: 49, pl. 1G, H, figs. 10 11 12A–C.

Cinetorhynchus rigens (Gordon, 1936)

Rhynchocinetes rigens Gordon, 1936: 76, figs. 1–4, 5e.

Cinetorhynchus striatus (Nomura and Hayashi, 1992)

Rhynchocinetes striatus Nomura and Hayashi, 1992: 199, figs. 1–4.

***Aus* gen. nov.**

Aus hendersoni (Kemp, 1925) comb. nov.

Rhynchocinetes hendersoni Kemp, 1925: 265, figs. 3–5, 7.

Rhynchocinetes intermedius Edmondson, 1952: 72, fig. 3.

Rhynchocinetes marshallensis Edmondson, 1952: 75 figs. 4 5a, c–h, 6.

Rhynchocinetinae Ortmann, 1890

Rhynchocinetes H. Milne-Edwards, 1837:

Rhynchocinetes albatrossae; See ***Bus brucei***

Rhynchocinetes australis; See ***Bus australis***

Rhynchocinetes balssi; See ***Bus balssi***

Rhynchocinetes brucei; See ***Bus brucei***

Rhynchocinetes concolor; See ***Cinetorhynchus concolor***

Rhynchocinetes conspiciocellus; See ***Bus conspiciocellus***

Rhynchocinetes durbanensis; See ***Bus durbanensis***

Rhynchocinetes enigma; See ***Bus enigma***

Rhynchocinetes hiatti; See ***Cinetorhynchus hiatti***

Rhynchocinetes holthuisi; See ***Bus holthuisi***

Rhynchocinetes intermedius; See ***Aus hendersoni***

Rhynchocinetes ikatere; See ***Cus ikatere***

Rhynchocinetes kuiteri; See ***Bus kuiteri***

Rhynchocinetes marshallensis; See ***Aus hendersoni***

Rhynchocinetes rathbunae; See ***Bus rathbunae***

Rhynchocinetes rigens; See ***Cinetorhynchus rigens***

Rhynchocinetes rugulosus; See ***Bus serratus***

Rhynchocinetes serratus: See ***Bus serratus***

Rhynchocinetes striatus; See ***Cinetorhynchus striatus***

Rhynchocinetes typus H. Milne-Edwards, 1837a: 383.

Rhynchocinetes uritai; See ***Bus uritai***

***Bus* gen. nov.**

Bus austlaris (Hale, 1941) comb. nov.

Rhynchocinetes australis Hale, 1941: 270, figs. 8a-d.

Bus balssi (Gordon, 1936) comb. nov.

Rhynchocinetes balssi Gordon, 1936: 85, figs. 7a, b.

Bus brucei (Okuno, 1994) comb. nov.

Rhynchocinetes brucei Okuno, 1994a: 29, pl. 1, figs. 1–3, 4A, B.

Rhynchocinetes albatrossae Chace, 1997: 28, figs. 15, 16.

Bus conspiciocellus (Okuno and Takeda, 1992) comb. nov.

Rhynchocinetes conspiciocellus Okuno and Takeda, 1992: 64, pl. 1A, B, figs. 1–3, 4A–D.

Bus durbanensis (Gordon, 1936) comb. nov.

Rhynchocinetes durbanensis Gordon, 1936: 83, fig. 5b, c, 7c, d.

Bus enigma (Okuno, 1997) comb. nov.

Rhynchocinetes enigma Okuno, 1997a: 13, figs. 1–3.

Bus holthuisi (Okuno, 1997) comb. nov.

Rhynchocinetes holthuisi Okuno, 1997b: 43, figs. 1–3, 4a–e.

Bus kuiteri (Tiefenbacher, 1983) comb. nov.

Rhynchocinetes kuiteri Tiefenbacher, 1983: 121, figs. 1–3.

Bus rathbunae (Okuno, 1996) comb. nov.

Rhynchocinetes rathbunae Okuno, 1996a: 309, figs. 1–3.

Bus serratus (H. Milne-Edwards, 1837) comb. nov.

Hippolyte serratus H. Milne-Edwards, 1837a: 377.

Rhynchocinetes rugulosus Stimpson, 1860:

Bus uritai (Kubo, 1942) comb. nov.

Rhynchocinetes uritai Kubo, 1942: 30, figs. 1–3.

***Bus* sp. 1**

***Bus* sp. 2**

***Bus* sp. 3**

***Cus* gen. nov.**

Cus ikatere (Yaldwyn, 1971) comb. nov.

Rhynchocinetes ikatere Yaldwyn, 1971: 87.

5-2 Subfamily A subfam. nov.

Type genus. *Cinetorhynchus* Holthuis, 1995.

Dianosis. Carapace without supraorbital spine, armed with three spines on median carina, antennal spine situated at tip of inferior orbital margin, feebly carinate ventrally, pterygostomial spine present or absent. Rostrum articulated partially with carapace, immovable. Fifth abdominal somite with triangular posterolateral acute tooth. Ambulatory pereiopods with ischia armed usually with two spines, meri with two rows of spines on lateral and ventral surface. First pereiopod with normal cheliped or considerably elongated palm, subchelate, with coxa armed or unarmed with corneous reef-like projection. Coxa of third pereiopod with or without spine.

Distributional range. Widespread tropical to warm temperate shallow waters of the world, but not recorded from the Mediterranian Sea (Figs. 56).

Remarks. The present subfamily is distinguished from Rhynchocinetinae by the armature of carapace, abdominal somite and ambulatory pereiopods, and development of rostral articulation. In Cinetorhynchinae, the dorsal median carina of carapace is armed with three spines from just posterior to rostral articulation to anterior two fifths and there is no spraorbital spine or nodule; posterior margin of the fifth abdominal somite is armed with an acute lateral tooth arising at midpoint; the ischia and meri of third to fifth pereiopods have two rows of spines on lateral surface and ventral border respectively. In contrast, the carapcace of Rhynchocinetinae possesses two spines on the dorsal median carina and a supraorbital spine or nodule; there is no posterolateral tooth on the fifth abdominal somite; ischia and meri of ambulatory pereiopods have a single row of spines. These differences have been considered as the definition of generic level between *Cinetorhynchus* and *Rhynchocinetes* (see Okuno, 1997c). However, as mentioned “Remarks” section of the family, the present study re-assessed the gaps as the distinguishing morphological features of the subfamilial level.

Key to genera of Rhynchocinetidae subfam.

1. Coxae of first and third pereiopods with distinct corneous projections .....……*Aus* gen. nov.
–. Coxae of first and third pereiopods without corneous projection ……. *Cinetorhynchus*

5-2-1 Genus *Cinetorhynchus* Holthuis, 1995

Cinetorhynchus Holthuis, 1995: 145 (in part).— Okuno, 1997b: 33 (in part).— Hayashi, 2007: 98 (in part).

Type species. *Rhynchocinetes rigens* Gordon, 1936, by original designation. Gender: masculine.

Diagnosis. Carapace without supraorbital spine, armed with three spines on median carina, antennal spine situated at tip of inferior orbital margin, feebly carinate ventrally, pterygostomial spine present or absent. Rostrum articulated partially with carapace, immovable. Fifth abdominal somite with triangular posterolateral acute tooth. First pereiopod with normal cheliped or considerably elongated palm, subchelate, with unarmed coxa. Ambulatory pereiopods with coxae unarmed, ischia armed usually with two spines, and meri with two rows of spines on lateral and ventral surface.

Distributional range. See "Distributional range" of subfamily.

Ecology. The shrimps of *Cinetorhynchus* usually occur in shallow waters from warm temperate to tropical regions. As mentioned by Burkenroad (1939) and Okuno (1993, 1994b), they inhabit in the deeper crevices and the submarine caves of coral androcky reefs. They completely hide in these places during daytime, and actively move to feed on the surfaces of coral head and rock at night.

Remarks. *Cinetorhynchus* was originally established as a subgenus of *Rhynchocinetes* by Holthuis (1995), and elevated to full generic status by Okuno (1997c).

Since Okuno (1997c) provided a revision of the Indo-West Pacific species of *Cinetorhynchus* and recogmized 6 species, three additional *Cinetorhynchus* species from this region were described (Okuno and Tachikawa, 1997; Okuno and Hoover, 1998; Okuno, 2009). In the Atlantic Ocean, two species of the genus have been known (Okuno, 1996). In this study, *Cinetorhynchus hendersoni* is moved to other genus. To date, therefore, this genus consists of 10 species worldwide. Okuno and Tachikawa (1997) provided a key to species of *Cinetorhynchus*. Keys to Japanese species of *Cinetorhynchus* are given by Okuno (1998) and Hayashi (2007). Herein, a complete recent key is modified as follows.

Key to species of *Cinetorhynchus*

1. Second and third pereiopods without arthrobranch……..…….2
–. Second and third pereiopods with arthrobranch……3
2. Stylocerite reaching distal margin of proximal segment of antennular peduncle; lateral surface of meri of ambulatory pereopods armed with 1–2 spines……...……*C. brucei*
–. Sylocerite reaching distal margin of distal segment of antennular peduncle; lateral surface of meri of ambulatory pereopods armed with 3–5 spines…….……..*C. manningi*
3. Ambulatory dactyli armed with a single accessory spine posterior to subterminal unguis……...4
–. Ambulatory dactyli armed with two accessory spines posterior to subterminal unguis……7
4. Stylocerite far overreaching distal margin of antennular ultimate segment; posteroventral angle of fourth abdominal somite acutely pointed…….....*C. hiatti*
–. Stylocerite reaching or slightly overreaching distal margin of antennular ultimate egment; osteroventral angle of fourth abdominal somite rounded……..5
5. Ambulatory carpi armed usually with three spines. (Thickened part of upper antennular flagellum falling slightly short of series of dorsodistal rostral teeth; second maxilliped nearly always with a developed podobranch)……*C. erythrostictus*

–. Ambulatory carpi armed usually with single spine……....6
6. Second maxilliped usually with vestige of podobranch; third and fourth pereiopods with meri armed usually with 5 spines on outer surface……...*C. rigens*
–. Second maxilliped with small, but developed podobranch; third and fourth pereiopods with meri armed with 2-4 spines on outer surface……..*C. fasciatus*
7. Mesial margin of antennular proximal segment with 2-4 teeth ventrally; rostral ventral margin with distinct interval between 4-5 strong proximal teeth and 5-9 small, equidistant distal teeth. (Posteroventral angle of fourth abdominal somite acutely pointed)…….*C. concolor*
–. Mesial margin of antennular proximal segment with a single tooth ventrally; rostral ventral margin with equidistant teeth, decreasing regularly in size distally……8
8. Distolateral spine of scaphocerite falling short of level of tip of lamella; fifth pereiopod overreaching midlength of scaphocerite…….*C. striatus*
–. Distolateral spine of scaphocerite overreaching level of tip of lamella; fifth pereiopod falling short of midlength of scaphocerite……..9
9. Stylocerite reaching distal margin of distal segment of antennular peduncle.……..*C. hawaiiensis*
–. Stylocerite reaching proximal third of distal segment of antennular peduncle……*C. reticulatus*

5-2-1-1 *Cinetorhynchus brucei* Okuno, 2009

(Figs. 3A, 6, 7)

Cinetorhynchus brucei Okuno, 2009: 940, figs. 1–3.
Cinetorhynchus brucei– De Grave and Fransen, 2011: 300 (list).

Material examined: Japan. CMNH-ZC 02256, 1♂(holotype), CL 4.6 mm, Imazuni, Kume-jima Island, Ryukyu Islands, 26º21.8’N, 126º49.6’E, 18 m, 9 October 2001, coll. T. Kawamoto; CMNH-ZC 02222, 1♀(paratype), CL 3.1 mm, Shichu-gama, Kume-jima Island, Ryukyu Islands, 26º21.0’N, 126º51.8’E, 30 m, 25 October 2001, coll. T. Kawamoto.

Description. Carapace (Fig. 6A) almost glabrous, but covered with very feeble transverse striations; dorsal median carina with 3 teeth, anteriormost tooth just posterior to rostral articulation, largest, apex directed anteriorly, intermediate and posteriormost teeth feebly articulated with median carina, situated posterior to level of posterior margin of orbit; supraorbital spine absent: orbit feebly developed, inferior orbital margin obsolete, terminating in antennal spine; antennal spine rather flattened, feebly carinate ventrally; pterygostomial angle rounded.

Rostrum (Fig. 6B) partially articulated with carapace, overreaching level of anterior margin of scaphocerite by distal two fifths, 1.5 times as long as carapace, nearly horizontal proximally, anterior half sinuous dorsad, apex directed anteriorly; dorsal margin armed with two groups of teeth, proximal group consisting of 2 large teeth, proximal tooth situated slightly posterior to distal margin of cornea, distal tooth at proximal two fifths of the length, distal group comprised of 2 small subterminal teeth; ventral margin unarmed proximally, distal two thirds armed with 7 teeth, proximal 4 teeth placed close together, interspaced by short setae, distal 3 teeth widely interspaced, lacking interspaced setae.

Fifth thoracic sternite armed posteriorly with pair of median acute processes (Fig. 6C). Sixth somite armed posteriorly with pair of processes, smaller and situated more laterally than those of fifth somite (Fig. 6C).

Abdominal somites (Fig. 6D) almost glabrous, but covered with very feeble oblique striations. Pleura of first to third somites broadly rounded; that of fourth somite with rounded posteroventral angle terminating in a minute process. Fifth somite with acuminate posteroventral process, posterolateral margin with acute tooth directed obliquely ventrad. Sixth somite 0.7 times as long as carapace, midpoint of posterior margin acutely prominent posteriorly, with acute posteroventral process; ventral surface armed with strongly hooked preanal spine. Telson 0.8 times as long as carapace, 1.2 times as long as sixth somite, tapering posteriorly, posterior margin acuminate medially, with 3 pairs of dorsal spines on posterior half; posterior margin with 3 pairs of spines, intermediate pair longest.

Ophthalmic somite (Fig. 6E) with midline slightly carinate, dorsally with elongate lobe. Eye (Fig. 6A) with large, globular cornea, maximum diameter longer than distal margin of stalk, distinct dorsal accessory pigment spot present; stalk widened, shorter than cornea.

Antennular peduncle (Fig. 6F) reaching level of midlength of rostrum. Proximal segment longer than distal two segments combined, dorsal surface moderately concave, with acute anterolateral tooth falling slightly short of level of midlength of intermediate segment, ventral surface mesially armed with a single spine; stylocerite well developed, acute, reaching level of distal articulation of the proximal segment, armed proximolaterally with acute tooth; statocyst small, longitudinally oblong. Intermediate segment subcylindrical, furnished with dense setae laterally, mesial surface with a few long setae. Distal segment subcylindrical, obliquely articulated with intermediate segment, ventrally with setae. Dorsal flagellum with short aesthetascs at distal three fifths of thickened part.

Antenna with stout basicerite armed ventrolaterally with acute tooth directed obliquely ventrad. Scaphocerite well developed, reaching level of distal third of rostrum, 3.0 times as long as maximum width, lateral margin almost straight, terminating in acute tooth falling slightly short of distomesial angle of oblique lamella, mesial margin convex. Carpocerite stout, reaching level of midlength of scaphocerite.

Epistome unarmed.

Mouthparts typical of the family. Second maxilliped with suboval epipod; podobranch consisting of shaft only, filaments absent; dactylus narrow, with mesial margin nearly straight, densely furnished with long setae; propodus elongate, with anterior margin broadly rounded, with dense long setae; carpus subquadrate, anterolateral angle bluntly produced; mesial surface of merus, ischium, and anterior part of basis shallowly concave; coxa inflated mesially, anteromesial margin angular; exopod with well developed flagellum, basal part of lateral surface shallowly concave. Third maxilliped with endopod reaching level of distal fifth of scaphocerite; ultimate segment with transverse rows of dense setae, ventrally furnished with numerous setae, 1.2 times as long as penultimate segment, terminating in corneous spine, with 1 distolateral and 4 distomesial subterminal spines: penultimate segment fringed sparsely with short setae, dorsolateral surface shallowly concave; antepenultimate segment slightly widened distally, dorsal surface obliquely situated; ischium short, depressed; exopod with segmented flagellum overreaching level of distal margin of antepenultimate segment.

First pereiopod (Fig. 7B) robust, slightly compressed, reaching level of distal third of scaphocerite. Chela 1.3 times as long as carpus, palm distinctly longer than dactylus, ventral surface with 8 transverse rows of short setae with setules; dactylus without denticulation on cutting edge, terminating in set of ungues, distal margin of corpus densely furnished with long setae; fixed finger without denticulation on cutting border, tapering distally, proximal half of border elevated dorsally, with row of long submarginal setae, midpoint of lateral surface with obliquely longitudinal row of dense long setae, terminating in set of ungues obliquely articulated with corpus. Carpus with distal margin truncate, ventrolateral surface slightly oblique. Merus 1.4 times as long as carpus, obliquely articulated with ischium. Coxa unarmed.

Second pereiopod (Fig. 7C) slender, slightly compressed, reaching level of distal fourth of scaphocerite. Chela with palm 2.8 times as long as dactylus; dactylus slightly arched, without denticulation on cutting border, terminating in set of ungues, distal margin of corpus furnished with long setae; fixed finger without denticulation but densely furnished with long setae on cutting edge, distolaterally with row of long setae, terminating in set of ungues, longest unguis subequal to corpus in length. Carpus 1.3 times as long as chela, 1.1 times as long as merus, distal margin bluntly produced, with sparse setae. Merus obliquely articulated with ischium. Coxa unarmed.

Ambulatory pereiopods slender. Third pereopod (Fig. 7D) overreaching apex of scaphocerite by distal two thirds of propodus and dactylus. Coxa unarmed. Ischium armed with 1 lateral and 1 ventral spines. Merus 2.1 times as long as carpus, armed with 2 lateral spines (distal spine near distal margin) and 2 ventral spines. Carpus armed with 2 lateral spines, with dorsodistal angle produced anteriorly. Propodus 1.5 times as long as carpus, ventral surface armed with 7 small spines, dorsal surface sparsely furnished with long setae, a few distal plumose setae. Dactylus (Fig. 7E) biunguiculate, ungues distinctly demarcated from corpus, flexor margin armed with 2 small accessory spines, distal spine about twice as long as proximal spine. Fourth pereopod overreaching apex of scaphocerite by distal fourth of propodus and dactylus, similar to third pereopod in armature and proportion, but carpus armed with 3 lateral spines. Fifth pereopod reaching level of distal fourth of scaphocerite. Ischium unarmed. Merus 1.8 times as long as carpus, armed only with distolateral, submarginal spine. Armature of carpus, propodus and dactylus similar to those of anterior two ambulatory pereopods.

Endopod of male first pleopod (Fig. 7F) generally oval, laterally furnished with short sparse setae, distal margin entire, without setae; appendix interna well developed, tapering distally, with a few cincinnuli terminally.

Endopod of male second pleopod (Fig. 7G) with appendices masculina and interna arising from midlength of mesial margin; appendix masculina oval, furnished with long sparse setae, shorter than appendix interna; appendix interna elongate, with a few cincinnuli terminally.

Uropod with protopodite posterolaterally acute. Both exopod and endopod overreaching level of tip of telson; exopod with lateral margin straight, terminating in acute tooth, mesially with movable spine longer than the terminal tooth; endopod slender, tapering distally.

Color in life (Fig. 3A). Ground color generally whitish semi-transparent. Anterior four fifths of carapace with transverse dull red bands, interspaces of bands and posterior part with fine white spots. Anterior parts of abdominal somites and posterior region of sixth somites each with dull red transverse bands, posterior parts of third and fourth somites with fine white spots, anterior half of sixth somite

reddish. External margins of telson and uropods, and dorsal antennular flagellum reddish. Antennular peduncle, third maxilliped, and pereopods covered with fine white spots.

Distribution. Type locality: Kume-jima Island, Ryukyu Islands, Japan (Okuno, 2009). So far known from Kume-jima Island (Fig. 59).

Remarks. *Cinetorhynchus brucei* appears closest to *C. manningi* Okuno, 1996, known from the western Atlantic Ocean. Except for *C. brucei* and *C. manningi*, which lack the arthrobranch on the second and third pereopods (Fig. 7A), the previously described species of *Cinetorhynchus* possess arthrobranchs on the third maxilliped and first to third pereopods. In addition to the branchial formula, these two species share rostral ventral teeth with distinct proximal and distal groups, and two small spines on the flexor margin of the dactyli of the third to fifth pereopods (see Okuno, 1996b). *Cinetorhynchus brucei* is immediately distinguished from *C. manningi* based on the shorter stylocerite, which reaches the distal margin of the proximal segment of the antennular peduncle (Fig. 6F), the podobranch on the second maxilliped without filaments, and one or two spines on the lateral surface of the meri of the ambulatory pereopods (Fig. 7D). In contrast, *C. manningi* has the stylocerite reaching the level of the distal margin of the antennular peduncle (Fig. 17C), the podobranch with well developed filaments, and the lateral surface of the meri of ambulatory pereopods armed with four or five (on third and fourth) (Fig. 17C) and three (on fifth) spines.

In its colour pattern, *C. brucei* is similar to *C. fasciatus* Okuno and Tachikawa, 1997 and *C. striatus* (Nomura and Hayashi, 1992) by having red transverse bands on abdominal somites, but the presence of numerous white spots on the carapace clearly differentiates the new species from the two latter species (see Nomura and Hayashi, 1992; Okuno, 1997c; Okuno and Tachikawa, 1997).

5-2-1-2 *Cinetorhynchus concolor* (Okuno, 1994)

(Figs. 3B, C, 8)

Rhynchocinetes hiatti– Kamezaki *et al*, 1988: 71, unnumbered fig. Not *Rhynchocinetes hiatti* Holthuis and Hayashi, 1967.

Rhynchocinetes sp.– Steene, 1990: 76, unnumbered fig.

Rhynchocinetes hiatti– Allen and Steene, 1994: 148, unnumbered fig. Not *Rhynchoicnetes hiatti* Holthuis and Hayashi, 1967.

Rhynchocinetes concolor Okuno, 1994: 66, figs. 1–2, 3A, 4A–D (original description).

Rhynchocinetes hiatti– Colin and Arneson, 1995: 218, fig. 1034. Not *Rhynchocinetes hiatti* Holthuis and Hayashi, 1967.

Rhynchocinetes sp.– Colin and Arneson, 1995: 218, fig. 1033 in color.

Rhynchocinetes concolor– Okuno, 1995: 2, figs. 1–2 in color.

Rhynchocinetes concolor– Gosliner *et al*., 1996: 217, fig. 784 in color.

Cinetorhynchus concolor– Chace, 1997: 27 (in key).

Cinetorhynchus concolor– Okuno, 1997: 43–45, pl. 1D, fig. 6.

Cinetorhynchus concolor– Okuno and Tachikawa, 1997: 24 (in key).

Cinetorhynchus concolor– Okuno and Hoover, 1998: 40.

Cinetorhynchus concolor– Okuno, 1998: 7, fig. 11.

Cinetorhynchus concolor– Hoover, 1998: 235, unnumbered fig in color.

Cinetorhynchus concolor– Hayashi, 1999a: 145, figs. 367a, 369a, 370a, f.

Cinetorhynchus concolor– Debelius, 1999: 170, unnumbered figs. in color.

Cinetorhynchus concolor– Eldredge, 1999: 75.

Cinetorhynchus concolor– Minemizu, 2000: 34, unnumbered fig. in color.

Cinetorhynchus concolor– Kato and Okuno, 2001: 15, unnumbered figs. in color.

Cinetorhynchus concolor– Davie, 2002: 372 (list).

Cinetorhynchus concolor– Kawamoto and Okuno, 2003: 19, unnumbered fig. in color.

Cinetorhynchus concolor– Paulay *et al*., 2003: 486 (list).

Cinetorhynchus concolor– Laboute and Richer de Forges, 2004: 379, unnumbered fig. in color.

Cinetorhynchus concolor– Hayashi, 2007: 99, figs. 42a, 43a, 44a, f.

Cinetorhynchus concolor– Poupin, 2009: 52, unnumbered fig. in color.

Cinetorhynchus concolor– Poupin and Juncker, 2010: 206, fig. a in color.

Cinetorhynchus concolor– Humann and DeLoach, 2010: 140, unnumbered fig. in color.

Cinetorhynchus concolor– De Grave and Fransen, 2011: 300 (list).

Material Examined: Japan. Izu Islands. Hachijo-jima Island. NSMT-Cr 3315, 1 juv., CL 4.3 mm, NSMT-Cr 3316, 1 juv. CL 3.2 mm, Occho-ga-hama, 15 m, submarine cave, 5 September 1994, coll. J. Okuno; CMNH-ZC 00716, 1♂, CL 10.0 mm, Sokodo, 5 m, 3 September 2000, coll. J. Okuno.— Ryukyu Islands. YCM-CM 975, 1♂, CL 12.9 mm (paratype of *Rhynchocinetes concolor*), Hamasaki, Kakeroma-jima Island, Amami Group, 28º11.0'N, 129º11.0'E, 7 m, 30 August 1993, coll. K. Hagiwara; YCM-CM 976, 1♂, CL 14.4 mm (paratype of *R. concolor*), Nishikomi, Amami-ohshima Island, Amami Group, 28º13.9'N, 129º10.1'E, 15 m, 31 August 1993, coll. K. Hagiwara; NSMT-Cr 2166, 1♀, CL 7.4 mm (holotype of *R. conoclor*), Hizushi-hama, Aka-jima Islet, Kerama Group, Ryukyu Islands, 26º11.2'N, 127º16.8'E, 3 m, 20 May 1993, coll. T. Hayashibara; NSMT-Cr 2222, 1♀, CL 16.0 mm (paratype of *R. concolor*), off Hiyajo, Kume-jima Island, Ryukyu Islands, 26º23.2'N, 126º47.7'E, 5 m, 23 November 1992, coll. K. Nomura; CMNH-ZC 00747, 1♂, CL 14.0 mm, "Pre-aquarium", Kume-jima Island, 20 m, 30 October 2001, coll. T. Kawamoto; SUF 530-2-1679, 1♂, CL 15.7 mm (paratype of *R. concolor*), Unari-zaki, Iriomote-jima Island, Yaeyama Group, Ryukyu Islands, 24º25.8'N, 123º45.9'E, 10 m, 5 September 1982.

Hawaii. CBM-ZC 3695, 1♀, CL 11.1 mm, BPBM S11358, 1 ovig.♀, CL 9.9 mm, Makaha, O'ahu, 5 m, 21 June 1997, coll. D. Dickay and J. P. Hoover.

Papua New Guinea. NTM Cr. 009511, 2 ovig.♀♀, CL 14.8, 15.6 mm (paratypes of *R. concolor*), Pik Island, Madang, 5º8.5'S, 145º49.7'E, 12–17 m, 31 October 1991, coll. G. Allen.

Australia. NTM Cr. 010307, 1♂, 2 ovig.♀♀, 1♀, CL 10.8–13.7 mm (paratypes of *R. concolor*), east side of Boot Reef, Queensland, 9º58.8'S, 144º42.3'E, 28 January 1993, coll. FNQ team; AM P84956, 1♀, CL 6.0 mm, Lizard Island, Queensland, 14º40'S, 145º28'E, 10 m, 21 November 1975, coll. N. Coleman; QM W17528, 1♂, CL 9.4 mm (paratype of *R. concolor*), Cartier Reef, Western Australia, 12º18'S, 123º17'E.

Solomon Islands. AM P20001, 1♂, CL 13.6 mm, outside south entrance to Sandfly Passage, Florida Islands, 9ºS, 160ºE, 18 m, 29 July 1973, coll. B. Goldman and J. Randall.

Vanuatu. AM P19454, 1♀, CL 10.6 mm, Pula Iwa, 25 June 1973, coll. G. Allen.

Chesterfield Islands. MNHN-Na12940, 1♂, CL 8.3 mm, Récif dans le lagon, 4 m, 24 August 1988.

New Caledonia. MNHN-Na 12942, 2♀♀, CL 8.2, 9.1 mm, MNHN-Na 12943, 1♂, 1♀, CL 5.7, 8.3 mm, Caverne du Récif externe de Taenia, 8 m, 25 March 1990; MNHN-Na 12963, 2♂♂, CL 11.7, 13.7 mm, Côte est, Récif Ana, Plongée de nuit, 3–10 m, 11 September 1989, coll. Menou; MNHM-Na 12941, 1♂, CL 11.6 mm, Baie de Kanala, 10–20 m, 9 January 1979, coll. R. V. "Vanban".— Île des Pins. MNHN, 1♂, CL 15.4 mm, stn 460, 20 m, coll. J. L. Menou.

Loyalty Islands. Uvea Island. MNHN-Na 12959, 2♂♂, CL 12.7, 14.4 mm, Passe de la Maurthe, 6–10 m, 16 November 1991, coll. J. P. Menou; MNHN-Na 12960, 1♀, CL 11.4 mm, MNHN-Na 12961, 1 ovig.♀, CL 10.9 mm, MNHN-Na 12962, 1 ovig.♀, CL 11.8 mm, Ilôt Bagat, st. 491, 9–11 m, 18 November 1991, coll. J. P. Menou; MNHN-Na 12944, 3♂♂, 1 ovig.♀, 1 juv. CL 4.4–14.4 mm, 7 m, 16 November 1991, coll. J. L. Menou.

Description. Carapace (Fig. 8A) almost glabrous, but covered with very feeble transverse striations; dorsal median carina with 3 teeth, anteriormost tooth just posterior to rostral articulation, largest, apex directed anteriorly, intermediate and posteriormost teeth feebly articulated with median carina, situated posterior to level of posterior margin of orbit; supraorbital spine absent: orbit feebly developed, inferior orbital margin obsolete, terminating in antennal spine; antennal spine rather flattened, feebly carinate ventrally; without pterygostomial spine.

Rostrum (Fig. 8B) distinctly upturned distally, 1.3–1.8 times as long as carapace, armed dorsally with 2 large teeth proximally, 2 small subterminal teeth, armed ventrally with 9–13 (usually 11) teeth, proximal 4 (rarely 5) teeth acutely pointed, directed anteriorly, separated by the distinct interval from proximal tooth of distal series, distal 5–9 (usually 7) teeth small, equidistant, ultimate tooth subterminally.

Fifth thoracic sternite armed posteriorly with a pair of acute, long median processes. Sixth somite armed posteriorly with a pair of processes, shorter and situated more laterally than those of fifth somite.

Abdominal somites (Fig. 8C) almost glabrous, but covered with very feeble oblique striations. Pleura of first to third somites broadly rounded; that of fourth somite with rounded posteroventral angle terminating in a minute process. Fifth somite with acuminate posteroventral process; posterolateral margin of fourth and fifth somites armed with acute tooth directed obliquely ventrad. Telson tapering posteriorly, posterior margin acuminate medially, with 3 pairs of dorsal spines on posterior half; posterior margin with 3 pairs of spines, intermediate pair longest.

Ophthalmic somite with midline slightly carinate, dorsally with elongate lobe. Eye (Fig. 8A) with large, globular cornea, maximum diameter longer than distal margin of stalk, distinct dorsal accessory pigment spot present; stalk widened, shorter than cornea.

Antennular peduncle (Fig. 8D) reaching proximal third of rostrum. Proximal segment longer than distal two segments combined, dorsal surface moderately concave, with acute anterolateral tooth slightly overreaching level of midlength of intermediate segment, ventral surface mesially armed with 2–4 (usually 2) acute teeth; stylocerite overreaching distal end of ultimate segment; upper flagellum

not reaching distal series of rostral dorsal teeth.

Scaphocerite reaching midlength of rostrum, 0.7–0.9 times as long as carapace, 2.6–3.9 times as long as width, with distolateral spine overreaching tip of lamella; basicerite armed with an acute spine anteriorly; carpocerite reaching level of proximal two fifths of scaphocerite.

Mouthparts typical of the family. Third maxilliped with endopod overreaching level of midlength of scaphocerite; ultimate segment with transverse rows of dense setae, ventrally furnished with numerous setae, 1.3–2.5 times as long as penultimate segment, terminating in corneous spine, with 2 distolateral and 4 distomesial subterminal spines, penultimate segment fringed sparsely with short setae, dorsolateral surface shallowly concave; antepenultimate segment slightly widened distally, dorsal surface obliquely situated; ischium short, depressed; exopod with segmented flagellum overreaching level of distal margin of antepenultimate segment.

Branchial formula as shown in Table 1.

First pereiopod robust, slightly compressed, reaching level of proximal third of scaphocerite. Chela 1.3–1.8 times as long as carpus, palm 2.3–2.7 times as long as dactylus, ventral surface with transverse rows of short setae with setules; dactylus without denticulation on cutting edge, terminating in set of ungues, distal margin of corpus densely furnished with long setae; fixed finger without denticulation on cutting border, tapering distally, proximal half of border elevated dorsally, with row of long submarginal setae, midpoint of lateral surface with obliquely longitudinal row of dense long setae, terminating in set of ungues obliquely articulated with corpus. Carpus with distal margin truncate, ventrolateral surface slightly oblique. Merus 1.1–1.2 times as long as carpus, obliquely articulated with ischium. Coxa unarmed.

Second pereiopod slender, slightly compressed, reaching level of distal fourth of scaphocerite. Chela with palm 3.4–4.8 times as long as dactylus; dactylus slightly arched, without denticulation on cutting border, terminating in set of ungues, distal margin of corpus furnished with long setae; fixed finger without denticulation but densely furnished with long setae on cutting edge, distolaterally with row of long setae, terminating in set of ungues, longest unguis subequal to corpus in length. Carpus 1.6–2.0 times as long as chela, 1.4–1.6 times as long as merus, distal margin bluntly produced, with sparse setae. Merus obliquely articulated with ischium. Coxa unarmed.

Ambulatory pereiopods considerably slender, with coxae with indistinctive spines, external margin rounded; dactyli (Fig. 8F) with 3 small claws posterior to terminal claw. Third pereiopod (Fig. 8E) overreaching tip of scaphocerite; merus with 4–8 (usually 5) spines on outer surface, 2–4 (usually 2) spines on ventral margin; carpus with 1–4 (usually 2) spines on outer surface. Fourth pereiopod reaching distal third of scaphocerite; merus with 3–6 (usually 5) spines on outer surface, 1–3 (usually 2) spines on ventral margin; carpus with 2 (rarely 3) spines on outer surface. Fifth pereiopod reaching midlength of scaphocerite; merus with 3–4 (rarely 5) spines on outer surface, 1–2 (rarely 3) spines on ventral margin; carpus with 2 (rarely1) spines on outer surface.

Endopod of male first pleopod generally oval, laterally furnished with short sparse setae, distal margin entire, without setae; appendix interna well developed, tapering distally, with a few cincinnuli terminally.

Endopod of male second pleopod with appendices masculina and interna arising from midlength of mesial margin; appendix masculina oblong, furnished with long sparse setae, subequal to appendix

interna in length; appendix interna elongate, with a few cincinnuli terminally.

Uropod with protopodite posterolaterally acute. Both exopod and endopod overreaching level of tip of telson; exopod with lateral margin straight, terminating in acute tooth, mesially with movable spine longer than the terminal tooth; endopod slender, tapering distally.

Coloration (Fig 3B, C). Ground color generally brilliant orange-red. Carapace with two pale oblique bands on dorsolateral and lateral surface, the dorsolateral band extending to the first abdominal somite. Rostrum orange-red, apex white. Abdomen with two pale oblique bands bordering by red lines, anterior band on anterior part of third somite, forming transverse in dorsal view, posterior band running from posterior part of third tergum to posteroventral margin of fifth somite, forming inverse V–shaped in dorsal view, sixth somite laterally with longitudinal pale band; posterolateral margin of fourth and fifth somites each with inconspicuous red spot. Telson orange–red, with white lateral margin. Third maxilliped and pereiopods generally orange, dorsal surface whitish. For color photographs see: Kamesaki *et al*, (1988); Steene (1990); Allen and Steene (1994); Colin and Arneson (1995); Okuno (1995); Gosliner *et al*. (1996); Okuno (1997); Okuno, (1998); Hoover (1998); Debelius (1999); Kato and Okuno (2001); Kawamoto and Okuno (2003); Laboute and Richer de Forges (2004).

Distribution. Type locality: Hizushi-hama, Aka-jima Islet, Kerama Group, Ryukyu Islands, southern Japan (Okuno, 1994b). Also known from various localities of the Indo-West Pacific (Fig. 59): **Austlaria:** Western Australia. Cartier Reef (Okuno, 1994; Davie, 2002); Queensland. Boot Reef (Okuno, 1994b; Davie, 2002); Lizard Island (present study); **Japan:** Izu Islands (Okuno, 1997; Kato and Okuno, 2001); Ryukyu Islands (Okuno, 1994b; Minemizu, 2000; Kawamoto and Okuno, 2003); **Mariana Islands:** Guam (Paulay *et al*., 2003); **Papua New Guinea:** Madang (Okuno, 1994b); **Solomon Islands:** Debelius (1999b), Florida Islands (present study); **Chesterfield Islands:** Okuno (1997); **Loyalty Islands:** Uvea Island (Okuno, 1997); **New Caledonia:** Récif Taenia, Récif Ana, Baie de Canala (Okuno, 1997); **Vanuatu:** Pula Iwa (present study), and **Hawaii:** Oahu (Okuno and Hoover, 1998), Hawaii (Hoover, 1998),

Remarks. Morphologically, *Cinetorhynchus concolor* is readily distinguished from other congeneric species by the presence of 2–4 teeth on mesial margin of ventral surface of the proximal segment of anyennular peduncle (Fig. 8D). In other congeners, a single tooth is present on the position. Furthermore, the combination of the length of stylocerite and armature of rostral ventral teeth are valuable to discriminate *C. concolor* from other related species: *Cinetorhynchus concolor* has the stylocerite overreaches distal margin of antennular peduncle (Fig. 8D), whereas it falls short of the margin in other congeneric species except for *C. hiatti*; the ventral margin of rostrum in *C. concolor* is armed with 4 (rarely 5) proximal strong teeth widely interspaced from equidistant distal series of small teeth (Fig. 8B), instead of the rostral ventral teeth decreasing regularly in size distally in other congeners except for *C. brucei*.

The present species is not uncommon in shallow rocky reef in the Indo-West Pacific, thus, its underwater photographs are reported several field guidebooks for divers and naturalists (e. g. Hoover, 1998; Debelius, 1999; Minemizu, 2000; Kuiter and Debelius, 2009). Although the exact specimens of *C. concolor* have not been collected from the Western Indian Ocean and French Polynesia, its underwater photographs revealed that the shrimp occurs in these areas (Poupin, 2009; Poupin and Juncker, 2010).

5-2-1-3 *Cinetorhynchus erythrostictus* Okuno, 1997

(Figs. 3D, 9)

Rhynchocinetes rigens– Fujino, 1975: 297, figs. 1–2. Not *Rhynchocinetes rigens* Gordon, 1936.

Rhynchocinetes rigens– Tiefenbacher, 1976: 317 (in part). Not *Rhynchocinetes rigens* Gordon, 1936.

Rhynchocinetes rigens– Bruce, 1980: 351 (in part). Not *Rhynchocinetes rigens* Gordon, 1936.

Rhynchocinetes rigens– Hirata *et al*., 1988: 59, unnumbered fig. Not *Rhynchocinetes rigens* Gordon, 1936.

Rhynchocinetes rigens– Kamesaki *et al*., 1988: 72, unnumbered fig. Not *Rhynchocinetes rigens* Gordon, 1936.

Rhynchocinetes rigens– Nomura and Matsukubo, 1992: 22, figs. 1, 3. Not *Rhynchocinetes rigens* Gordon, 1936.

Rhynchocinetes rigens– Okuno, 1994b: 69 (in part), figs. 3D, 4H. Not *Rhynchocinetes rigens* Gordon, 1936.

Cinetorhynchus erythrostictus Okuno, 1997: 36–40, pl. 1A, B, figs. 2A, 3, 4A–C.

Cinetorhynchus erythrostictus– Okuno and Tachikawa, 1997: 24 (in key).

Cinetorhynchus erythrostictus– Okuno, 1998: 4, figs. 3–5 in color.

Cinetorhynchus erythrostictus– Hayashi, 1999a: 146, figs. 367a, 368, 369b, 370b, g.

Cinetorhynchus erythrostictus– Minemizu, 2000: 33, unnumbered fig. in color.

Cinetorhynchus erythrostictus– Kato and Okuno, 2001: 16, unnumbered figs. in color.

Cinetorhynchus erythrostictus– Laboute and Recher de Forges, 2004: 379, unnumbered fig. in color.

Cinetorhynchus erythrostictus– Hayashi, 2007: 102, figs. 41, 42b, 43b, 44b, g.

Cinetorhynchus erythrostictus– De Grave and Fransen, 2011: 301 (list).

Material Examined: WESTERN PACIFIC. **Japan.** Honshu. NSMT-Cr 2586, 1♂(paratype) CL 9.1 mm, NSMT-Cr 2584, 1♂(paratype), CL 11.4 mm, 33º28.3'N, 135º47.0'E, Sabiura, Kushimoto, southern point of Kii Peninsula, 1–2 m, 8 January 1993; NSMT-Cr 2585, 1♂(paratype), CL 10.8 mm, same locality as NSMT-Cr 2586, 5 February 1993.— Izu Islands. CBM-ZC 1981, 1♂(paratype), CL 11.3 mm, 2 ovig.♀♀(paratypes), CL 14.0, 15.2 mm, 33º07.3'N, 139º49.2'E, Sokodo, Hachijo-jima Island, 15 m, 2 August 1995; NSMT-Cr 2620, 1♂(paratype), CL 11.4 mm, NSMT-Cr 2621, 1♂(paratype), CL 11.4 mm, 33º03.5'N, 139º47.9'E, submarine cave at Occho-ga-hama, Hachijo-jima Island, 10 m, 17 June 1993.— Ohsumi Islands. KMNH, 1♀(paratype), CL 15.0 mm, 30º19.0'N, 130º39.9'E, Anbo, Yaku-shimaIsland, 26 February 1965.— Ryukyu Islands. SUF 530-2-489, 2♂♂(paratypes), CL 11.4, 15.2 mm, 26º16.9'N, 129º59.1'E, tidepool on Keraji, Kikai-shima Island, Amami Group, 28 March 1979; NSMT-Cr 1421, 1♂(paratype), CL 7.3 mm, 26º42.9'N,127º50.1'E, submarine cave at Ie-shima Island, 25 m, 17 June 1990; NSMT-Cr 2071, 1♂(paratype), CL 12.2 mm, CBM-ZC 1980, 1♂(paratype), CL 17.3 mm, 26º14.2'N, 127º40.2'E, Naha Harbor, Okinawa Island, 1 m, 23 May 1993, coll. S. Ohashi and J. Okuno; NSMT-Cr 2155, 1♀(holotype), CL 16.0 mm, Aka Harbor, Aka-jima Islet, Kerama Group, Ryukyu Islands, 26º11.2'N, 127º17.1'E, 3 m, 17 May 1993; NSMT-Cr 2156, 1 ovig.♀(paratype), CL 13.0 mm, same data as NSMT-Cr 2155; NSMT-Cr 2146, 1♂(paratype), CL 10.7 mm, NSMT-Cr 2158, 1♂(paratype), CL 10.3 mm, NSMT-Cr 2165, 1♂(paratype), CL 9.4 mm, 26º11.2'N, 127º16.8'E, Hizushi-hama, Aka-jima Islet, Kerama Group, 3 m, 20 May 1993; NSMT-Cr 2572, 1♀(paratype), CL 13.7 mm, 26º23.2'N, 126º47.7'E, Hiyajo, Kume-jima Island, 5 m, 23 November 1992; NSMT-Cr 2573, 1♂(paratype), CL 10.9 mm, NSMT-Cr 2574, 1♂(paratype), CL

11.0 mm, 26º17.6’N, 126º47.8’E, Kuroishi, Kume-jima Island, 5 m, 24 November 1992.

Taiwan. Pingtung County. NTOU-M00690, 1♂, CL 17.9 mm, 1 ovig.♀, CL 16.1 mm, Fanchuanshih, Kending, no date, coll. H.-C. Liou; NTOU-M00691, 1♂, CL 11.0 mm, Artificul reef, Haikou Port, Kending, 22 March 2005, coll. C. W. Lin; NTOU-M00903, 1♂, CL 14.0 mm, 2♀♀. CL 8.3, 13.0 mm, Hongchaikeng, 9 September 2005.— Taitung County. NTOU-M00689, 2♂♂, CL 7.3, 11.0 mm, Wukongdong, Lanyu , 8 July 1997, coll. Y.-J. Liao.

Tonga. CMNH, 1♀, CL 10.8 mm, Swallows Cave, SW of Falevai Island, Vava’u Group, 18º40.926’S, 174º02.865’W, 17–18 m, 2 November 1996, coll. S. Ohashi, S. Kinjo and T. Kase.

New Caledonia. MNHN-Na 12939, 2♂♂(paratypes), CL 9.8, 10.0 mm, 1♀(paratype), CL 10.5 mm, 20º00.4’S, 163º56.3’E, Récif externe de Taenia, 8 m, 25 March 1990; MNHN-Na 12946, 1♀(paratype), CL 15.4 mm, 2 ovig.♀♀(paratypes), CL 14.6, 15.1 mm, 21º22.2’S, 165º56.4’E, Côte est. Recif Ana, 3–10 m, 11 September 1989; MNHN-Na 12937, 2♂♂(paratypes), CL 8.4, 8.6 mm, 1 ovig. ♀(paratype), CL 12.0 mm, 22º05.1’S, 165º58.0’E, Passe de Saint Vincent, 5 m, 21 March 1990.

Loyalty Islands. Uvea Island. MNHN-Na 12938, 4♂♂(paratypes), CL 9.7–11.5 mm, 1 ovig.♀(paratype), CL 13.3 mm, 20º29.2’S, 166º14.4’E, Haute Islet, 11 m, 19 November 1991; MNHN-Na 12947, 1 ovig.♀(paratype), CL 13.0 mm, 22º36.5’S, 166º16.8’E, Passe de la Meurthe, 6–10 m, 16 November 1991.

INDIAN OCEAN. **Mascarene Islands**. MI, 1♀, CL 17.8 mm, Mauritious, February, 1971.

Description. Carapace (Fig. 9A) almost glabrous, but covered with very feeble transverse striations; dorsal median carina with 3 teeth, anteriormost tooth just posterior to rostral articulation, largest, apex directed anteriorly, intermediate and posteriormost teeth feebly articulated with median carina, situated posterior to level of posterior margin of orbit; supraorbital spine absent: orbit feebly developed, inferior orbital margin obsolete, terminating in antennal spine; antennal spine rather flattened, feebly carinate ventrally; pterygostomial angle rounded.

Rostrum (Fig. 9B) partially articulated with carapace, overreaching level of anterior margin of scaphocerite by distal two fifths, 1.2–2.0 times as long as carapace, nearly horizontal proximally, anterior half sinuous dorsad, apex directed dorsally; dorsal margin armed with two groups of teeth, proximal group consisting of 2 large teeth, proximal tooth situated slightly anterior to distal margin of cornea, distal tooth at proximal third of the length, distal group comprised of 2 (rarely 1) small subterminal teeth; ventral margin unarmed proximal fifth, remaining part armed with 10–12 (rarely 9) teeth, decreasing in size distally.

Fifth thoracic sternite armed posteriorly with pair of median acute processes. Sixth somite armed posteriorly with pair of processes, smaller and situated more laterally than those of fifth somite.

Abdominal somites (Fig. 9C) almost glabrous, but covered with very feeble oblique striations. Pleura of first to third somites broadly rounded; that of fourth somite with rounded posteroventral angle terminating in a minute process. Fifth somite with acuminate posteroventral process, posterolateral margin with acute tooth directed obliquely ventrad. Sixth somite 0.5–0.7 times as long as carapace, midpoint of posterior margin acutely prominent posteriorly, with acute posteroventral process; ventral surface armed with strongly hooked preanal spine. Telson 0.6–0.7 times as long as carapace, 1.0–1.2 times as long as sixth somite, tapering posteriorly, posterior margin acuminate

medially, with 3 pairs of dorsal spines on posterior half; posterior margin with 3 pairs of spines, intermediate pair longest.

Ophthalmic somite with midline slightly carinate, dorsally with elongate lobe. Eye (Fig. 9A) with large, globular cornea, maximum diameter longer than distal margin of stalk, distinct dorsal accessory pigment spot present; stalk widened, shorter than cornea.

Antennular peduncle (Fig. 9D) reaching proximal quartor of rostrum, inner margin of proximal segment armed ventrally with an acute tooth; stylocerite strongly acute, subequal to, or slightly overreaching distal end of ultimate segment; thickend part of upper flagellum not reaching series of rostral teeth distodorsally.

Scaphocerite falling slightly short of level of midlength of rostrum, 0.6–0.9 times as long as carapace, 2.8–4.0 times as long as its maximum width, distolateral spine exceeding slightly beyond tip of lamella.

Mouthparts typical of the family. Second maxilliped with a small podobranch at proximal upper margin of epipod. Third maxilliped reaching proximal two thirds of scaphocerite, exceeding slightly beyond distal margin of antennular terminal segment; ultimate segment 0.4–0.5 times as long as carapace, 1.2–1.5 times as long as penultimate segment, with 7–8 dark spines distally.

Branchial formula as shown in Table 1.

First pereiopod reaching proximal third of scaphocerite, chela 0.3–0.4 times–as long as carapace, 1.5-1.9 times as long as carpus.

Second pereiopod reaching midlength of scaphocerite, chela 0.3 times as long as carapace, carpus 0.4 timesas long as carapace, 1.3–1.5 times as long as chela.

Ambulatory pereiopods slender, each dactylus biunguiculate, with a small, single accessory claw posterior to preterminal unguis (Fig. 9F). Third pereiopod (Fig. 9E) exceeding slightly beyond tip of scaphocerite; ischium with each articulated spine on outer surface and ventral margin; merus 0.7–0.8 times as long as carapace, 2.2–2.5 times as long as carpus, with 4–8 (usually 5) articulated spines on outer surface, 2–6 (usually 2–4) similar spines on ventral margin; carpus 0.3 times as long as carapace, with 2–4 (usually 3) articulated spines on outer surface; propodus 0.5–0.6 timesas long as carapace, 1.8–1.9 times as long as carpus. Fourth pereiopod reaching proximal two thirds of scaphocerite; spination of ischium agrees with that of third pereiopod; merus 0.6–0.7 times as long ascarapace, 2.0–2.3 times as long as carpus, with 4–7 (usually 5–6) articulated spines on outer surface, 2–5 (usually 2–3) similar spines on ventral margin; proportion of carpus resembling that of third pereiopod, with 2–3 (usually 3) articulated spines on outer surface; propodus 0.5–0.6 times as long as carapace, 1.8–2.0 times as long as carpus. Fifth pereiopod reaching midlength of scaphocerite; merus 0.5–0.6 times as long as carapace, 1.6–2.0 times as long as carpus, with 3–6 (usually 4–5) articulated spines on outer surface, 1–3 similar spines on ventral margin; proportion of carpus resembling above two pereiopods, with 1–3 (usually 2–3) articulated spines on outer surface; proportion of propodus similar to that of fourth pereiopod.

Endopod of male first pleopod with distal end slightly truncated; appendix interna well developed, median partexpanded mesially, rounded, distal part narrow, with a few cincinnuli terminally.

Endopod of male second pleopod with appendices masculina and interna arising from midlength of mesial margin; appendix masculina oblong, furnished with long sparse setae, shorter than appendix

interna; appendix interna elongate, with a few cincinnuli terminally.

Color in life (Fig. 3D). Ground color pinkish white. Carapace dorsally covered with red small spots densely, posterolaterally with large red spots, widely spaced, antennal and hepatic regions without spots, entire. Rostrum pinkish white, apex white, subapical part brilliant red. Abdominal somites covered with various sized red spots, lateral spots larger dorsal ones, third abdominal tergum with large brilliant red patch with posterior margin deeply concave in dorsal view. Telson and uropod with transverse red bands. Third maxilliped with antepenultimate segment reddish, penultimate and ultimate segments pinkish white. First pereiopod marbled with red. Ambulatory pereiopods with ischia and meri with red bands, carpi and propodi pinkish white.

Distribution. Type locality: Aka Harbor, Aka-jima Islet, Kerama Group, Ryukyu Islands, Japan. Also known from widespread tropical shallow waters of the Indo-West Pacific (Fig. 59): **Mauritious** (present study); **Taiwan** (De Grave *et al*., in prep); **New Caledonia** (Okuno, 1997c), and **Tonga** (present study).

Remarks. The present species was first reported by Fujino (1975) on the basis of three specimens from the Ryukyu Islands as large range extention of an Atlantic cpecies, *Rhynhcocinetes rigens* (= *Cinetorhynchus rigens*). Fujino (1975) concluded that there was no evidence to deal with the specimens from the isolated localities as each subspecies by his direct comparison. Okuno (1997c), however, considered that the western Pacific individuals are distinguishable from those from the Atlantic Ocean at the specific rank by the following characters: 1) The thickened part of the upper antennular flagellum is falling distinctly short of the distal series of the rostral dorsal teeth in *C. erythrostictus*, whereas it reaches the distal series of the teeth in *C. rigens*; 2) *Cinetorhynchus erythrostictus* has a podobranch with developed elements on the epipod of the second maxilliped; *C. rigens* has the rudimental podobranch at the maxilliped typically, and possesses only shaft, without elements, except two specimens from Madeira, which has an indistinct podobranch on the tip of the accessory lobe; 3) *Cinetorhynchus erythrostictus* nearly always possesses three spines on the carpi of the third and fourth pereiopods, whereas the normal complement for *C. rigens* appears to be a single spine (Fig. 20E); 4) In alive, *C. erythrostictus* is not covered with the red spots at the carapace anterolaterally, coloring pale white uniformly (Fig. 3D), whereas *C. rigens* is uniformly covered with the numerous red spots and patches on the whole surface of the carapace; 5) In alive, the sixth abdominal somite is covered with the red spots in *C. erythrostictus* (Fig. 3D), while in *C. rigens*, the somite has a longitudinal red and white bands. These characters of 1) and 5) are originally indicated by Fujino (1975), and 3) has been previously suggested by Tiefenbacher (1976). The present comparisons revealed that the other distinctions proposed by Fujino (1975) were unavailable to determine, because they were strongly variable within each species.

The present paper revealed the occurrence of *C. erythrostictus* from the western Indian Ocean.

5-2-1-4 *Cinetorhynchus fasciatus* Okuno and Tachikawa, 1997

(Figs. 10)

Cinetorhynchus fasciatus Okuno and Tachikawa, 1997: 16–23, figs. 1–4.

Cinetorhynchus fasciatus– Okuno, 1998: 2, fig. 1 in color.

Cinetorhynchus fasciatus– Hoover, 1998: 236, unnumbered fig. in color.
Cinetorhynchus fasciatus– Hayashi, 1999a: 147, figs. 367c, 369c, 370c, h.
Cinetorhynchus fasciatus– Debelius, 1999b: 168, unnumbered fig. in color.
Cinetorhynchus fasciatus– Hayashi, 2007: 103, figs. 42c, 43c, 44c, h.
Cinetorhynchus fasciatus– De Grave and Fransen, 2011: 301 (list).

Material examined: Japan. CBM-ZC 3629, 1♂(holotype), CL 6.5 mm, Tenno-ura beach, Chichi-jima Island, Ogasawara Islands, 27º02.2'N, 142º13.0'E, 5 m, 17 February 1996, coll. H. Tachikawa. CBM-ZC 3630, 1♂(paratypes), CL 4.8 mm, same data as holotype.

Hawaii. BPBM S11318, 1♂(paratype), CL 9.3 mm, Lanui Lookout, Oahu, 20º50.0'N, 156º55.0'W, 5 m, 25 January 1997, coll. J. P. Hoover; CMNH-ZC 01444, 2 ovig.♀♀, CL 11.5, 11.6 mm, Ala Moana Beach park, Oahu, 1 m, May 1999, coll. D. Takaoka.

Description. Carapace (Fig. 10A) covered with fine transverse striae, armed with three acute spines on dorsal median carina, anterior spine largest, just behind rostral articulation, two posterior spines feebly articulated with carapace; supraorbital spine absent; antennal spine acute, directed anteriorly; pterygostomian angle rounded, without spine.

Rostrum (Fig. 10B) incompletely articulated with carapace, distal half sinuous upwards, 1.4 times as long as carapace; dorsal margin armed with two teeth in the basal half of rostrum, and with two small teeth subterminally; ventral margin armed with 9–10 distinct spines, decreasing in size distally; lateral carina distinct, reaching along proximal two fifths of rostral length, continuous with upper orbital margin.

Abdominal somites (Fig. 10C) covered with fine striae; first three somites with the pleura marginally rounded; posteroventral angle of pleuron of fourth somite rounded, without protrusion; fifth somite with distinct posteroventral protrusion; in larger paratype, posterolateral margin of fourth and fifth somites with acute spine directed posteriorly, holotype and smaller paratype with no posterolateral spine on the fourth somite; sixth somite 0.6 times as long as carapace, with acute posteroventral spine, with strongly hooked anal spine between bases of uropods. Telson 0.7 times as long as carapace, 1.1–1.2 times as long as sixth abdominal somite, armed dorsally with three pairs of spines; midpoint of posterior margin triangular protruded, with three pairs of spines on each side of the protrusion, intermediate pair largest.

Eye (Fig. 10A) well developed, with large, globular cornea; stalk much more slender than cornea.

Antennular peduncle (Fig. 10D) reaching level of end of proximal third of rostral length; stylocerite acute, developed, reaching midlength of distal segment in holotype and smaller paratype, reaching distal margin of the segment in larger paratype; proximal segment armed with distolateral spine reaching level of end of proximal third of intermediate segment, ventrally with acute spine at mesial margin; thickened part of upper flagellum falling slightly short of rostral apex.

Antenna with scaphocerite 0.7–0.8 times as long as carapace, 2.8–2.9 times as long as maximum width, with distolateral spine acute, distinctly overreaching end of lamella; antennal carpocerite slightly overreaching level of midlength of scaphocerite; basicerite with acute ventrolateral spine and with rounded protrusion just above the spine.

Mouthparts typical of the family. Second maxilliped with oval epipod with small, but distinct podobranch; distal margin of dactylar segment almost straight, with dense long setae; propodal segment with distal margin broadly rounded, with sparse long setae; carpal segment with feeble protrusion distolaterally; exopod with tapering flagellum, with numerous setae distally. Third maxilliped reaching level of distal third of scaphocerite; exopod tapering; ultimate segment covered uniformly with dense short setae, 0.4 times as long as carapace, 1.2–1.4 times as long as penultimate segment, terminally with 6–7 dark spines; penultimate segment 0.3 times as long as carapace; antepenultimate segment armed with dorsodistal and distolateral spines, the former longer than the latter.

Branchial formula as shown in Table 1.

First pereiopod chelate, moderately robust, overreaching level of distal margin of antennal basicerite by length of dactylus; chela 0.3 times as long as carapace, 1.6–1.9 times as long as carpus, tips of both fingers with fine, dark terminal claws; carpus 0.2 times as long as carapace, distal margin truncate, fringed with sparse fine setae.

Second pereiopod chelate, more slender than first pereiopod, reaching level of end of proximal fourth of scaphocerite; chela 0.3 times as long as carapace, tips of both fingers with fine, dark terminal claws; carpus entire, 0.3–0.4 times as long as carapace, 1.2–1.7 times as long as chela.

Ambulatory pereiopods more or less stout. Third pereiopod (Fig. 10E) reaching level of base of distolateral spine of scaphocerite; ischium unarmed or armed with a single spine at lateral surface, and armed ventrally with a single spine; merus armed laterally with 2–4 equidistant spines, ventrally with two spines, 0.6–0.7 times as long as carapace, 2.1–2.4 times as long as carpus; carpus armed with a single spine, 0.3 times as long as carapace; propodus with mesial margin armed with sparse equidistant short spinules, 0.52–0.54 times as long as carapace, 1.8–1.9 times as long as carpus; dactylus (Fig. 10F) biunguiculate, armed with a single accessory claw posterior to preterminal unguis. Fourth pereiopod slightly overreaching level of midlength of scaphocerite; ischium armed each with single spine at lateral surface and ventral margin; merus armed laterally with 3–4 spines, ventrally with 1–2 spines, 0.6 times as long as carapace, 2.0–2.3 times as long as carpus; carpus 0.3 times as long as carapace, spinulation resembling that of third pereiopod; propodus 0.5–0.6 times as long as carapace, 1.8–2.1 times as long as carpus, spinulation resembling that of third pereiopod; dactylus similar to that of third pereiopod. Fifth pereiopod reaching level of proximal fifth of scaphocerite; spinulation of ischium, carpus, propodus and dactylus resembling those of fourth pereiopod; merus armed laterally with three equidistant spines, with ventral margin unarmed or armed with single spine, 0.4–0.5 times as long as carapace, 1.7–2.0 times as long as carpus; carpus 0.2–0.3 times as long as carapace; propodus 0.5 times as long as carapace, 1.7–2.3 times as long as carpus.

Endopod of male first pleopod rounded distally; appendix interna well developed, broadened basally, distal end with dense cincinnuli.

Endopod of male second pleopod with appendices masculina and interna at midlength of mesial margin; appendix masculina oblong, distal end fringed with dense setae; appendix interna slightly longer than appendix masculina, distal end with dense cincinnuli.

Uropod with protopodite with acute posterolateral tooth; exopod broad, exceeding tip of telson, with lateral margin straight, with acute articulated spine mesial to distolateral spine; endopod subequal

to exopod.

Color in life. Ground color transparent pinkish. Carapace with longitudinal band on midlength of dorsal carina, elongated each lateral side, directed posteriorly; base of dorsal teeth reddish; posterolateral carapace with red oblong blotch running obliquely. Rostral apex pinkish white, with deep red part just behind white apex. Posterior margin of first to fifth abdominal somites each with transverse orange band bordering by red lines; sixth somite pale orange, with two transverse red bands, anterior band at midlength of the somite, posterior band along distal margin. Telson and uropods with three transverse red bands, anterior band running proximally, second band at midlength of appendices, posteriormost band along distal margin. Ambulatory coxae and ischia red; meri red distally, with red band at distal fourth of length.

Distribution. Type locality: Chichi-jima Island, Ogasawara Islands, Japan (Okuno and Tachikawa, 1997). Also known only from the Hawaiian Islands (Okuno and Tachikawa, 1997; Hoover, 1998) (Fig. 59).

Remarks. *Cinetorhynchus fasciatus*, the Pacific species, *C. hiatti*, and the Atlantic species, *C. rigens* share the ambulatory carpi armed usually with a spine and dactyli armed with a single accessory claw posterior to preterminal unguis. *Cinetorhynchus fasciatusis* is clearly distinguished from *C. hiatti* in having the pleuron of the fourth abdominal somite with posteroventral angle rounded, without protrusion, the stylocerite reaching the midlength of the antennular distal segment, and the posterolateral angle of the antennal basicerite armed with a single acute spine. *Cinetorhynchus hiatti* has an acutely pointed protrusion on the posteroventral angle of the fourth abdominal somite, the stylocerite distinctly overreaching the level of the distal margin of the antennular distal segment, and the distal margin of the antennal basicerite armed usually with two acute spines. There is close similarity in the banded live coloration of both species, but they are easily distinguished from each other by consistent differences in the color patterns. *Cinetorhynchus hiatti* has distinct oblique bands on the carapace posterolaterally, and deeply orange ambulatory pereiopods (Okuno, 1995, 1997c), whereas these color patterns are lacking in *C. fasciatus*. *Cinetorhynchus fasciatus* differs from *C. rigens* in having a distinct podobranch on the epipod of the second maxilliped and third and fourth pereiopods with meri armed with 2–4 spines on the outer surface. In C. rigens, the podobranch of the maxilliped is vestigial, and the meri armed usually with five spines on the outer surface (Okuno, 1997c). Color pattern is adequate to distinguish *C. fasciatus* from *C. rigens* which has many red spots on the carapace and abdominal somites (Gordon, 1936; Wirtz, 1995).

The coloration of brilliant, broad reddish bands on the abdominal somites in life links *C. fasciatus* to *C. striatus* Nomura and Hayashi, 1992 (Nomura and Hayashi, 1992; Okuno, 1995, 1997c). However, the details of the pattern, and the oblique red oblong blotch on the lateral side of carapace, separate *C. fasciatus* from *C. striatus* in life. In morphology, these two species are clearly distinguished from each other in the length of distolateral spine of the scaphocerite, and the number of dactylar accessory claws and carpal spinulation of the ambulatory pereiopods.

Resembling the habitat of the congeners (Burkenroad, 1939; Okuno, 1993, 1994b), *C. fasciatus* inhabits submarine caves in shallow rocky reefs.

5-2-1-5 *Cinetorhynchus hawaiiensis* Okuno and Hoover, 1998

(Figs. 11–13, 14A)

Cinetorhynchus hawaiiensis Okuno and Hoover, 1998: 32, figs. 1–4, 5A, 6.
Cinetorhynchus hawaiiensis– Hoover, 1998: 236, unnumbered fig. in color.
Cinetorhynchus hawaiiensis– Debelius, 1999b: 169, unnumbered fig. in color.
Cinetorhynchus hawaiiensis– Coleman, 2000: 198, unnumbered fig. in color.
Cinetorhynchus hawaiiensis– Paulay *et al*., 2003: 486 (list).
Cinetorhynchus hawaiiensis– De Grave and Fransen, 2011: 301 (list).

Material examined: Hawaii. BPBM S 11356, 1♂(holotype), CL 6.6 mm, 19º39.0'N, 156º 00.0'W, Kailua Harbor, Hawai'i, 8 m, 10 July 1995, coll. J. P. Hoover; CBM-ZC 3693, 1♂(paratype), CL 6.1 mm, BPBM S 113571, 1ovig.♀(paratype), CL 5.4 mm, 21º28.0'N, 158º13.0'W, Makaha, O'ahu, 22 June 1995, 4 m, coll. J. P. Hoover and J. Earle; CBM-ZC 3694, 1♀(paratype), CL 4.3 mm, same locality as other paratypes, 21 June 1997, 5 m, coll. D. Dickey and J. P. Hoover.

Description. Carapace (Fig. 11A) with numerous fine transverse striae. Three acute teeth on dorsal carina behind rostral articulation, anterior tooth largest, the posterior two teeth appear to be articulated. Antennal spine acutely pointed, exceeding anterior margin of carapace; pterygostomian angle unarmed or armed with a small spine.

Rostrum (Fig. 11B) well developed, more or less sinuous upwards, articulated with carapace, slightly upturned distally, length 1.6–1.7 times as long as carapace; lateral carina distinct, continuous with upper orbital margin; dorsal margin armed with two large teeth proximally, two small teeth subterminally; ventral margin armed with 9–10 teeth decreasing regularly in size distally.

Abdominal somites (Fig. 11C) also with numerous fine transverse striae; pleura of first three somites rounded; posteroventral angle of fourth somite armed with distinct protrusion; fifth somite with acute protrusion posteroventrally; fourth and fifth somites posterolaterally acute; sixth somite slightly compressed, 0.5–0.6 times as long as carapace, with sharply pointed spine posteroventrally, with anal spine between uropodal basicerites. Telson (Fig. 11D) 0.6–0.8 times as long as carapace, 1.2–1.3 times as long as sixth abdominal somite, slightly convex dorsally; dorsal surface with three pairs of small spines; midpoint of posterior margin distinctly produced posteriorly, with three pairs of posterior spines.

Eye (Fig. 11A) with cornea pigmented, much broader than eyestalk.

Antennular peduncle (Fig. 14A) falling slightly short of level of midlength of rostrum; surface proximal segment concave, armed ventrally with an acute tooth at mesial margin, distolateral spine pointed terminally; stylocerite reaching level of base of upper flagellum, tapering, with pointed distal end; statocyst oval, longitudinal; thickened part of upper flagellum falling slightly short of level of rostral distal dorsal tooth.

Antenna with scaphocerite (Fig. 11E) well developed, reaching level of distal third of rostrum, 1.0–1.1 times as long as carapace, 3.1–3.2 times as long as maximum width, distolateral spine acutely pointed, overreaching distal margin of lamella; basicerite with fine transverse striae, armed marginally with a strongly pointed tooth and rounded lobe just above spine; carpocerite reaching level of proximal

third of scaphocerite.

Branchial formula as shown in Table 1..

Mouthparts (Fig. 12) typical of the family. Second maxilliped (Fig. 12E) with small, feebly developed oval epipod having well developed podobranch; distal margin of dactylus almost straight, with long dense setae; propodus with distal margin rounded, inner margin feebly expanded. Third maxilliped (Fig. 12F) reaching distal third of scaphocerite; antepenultimate segment with acute spine distolaterally; penultimate segment 0.4 times as long as carapace, with sparse setae on outer surface; ultimate segment 0.6–0.8 times as long as carapace, 1.6–2.0 times as long as penultimate segment, with 6–8 dark cornified spines at apex, covered uniformly with dense setae except distal fourth.

First pereiopod (Fig. 13A) sexually dimorphic. In largest male holotype, first pereiopod slightly overreaching distal margin of scaphocerite, subchelate; chela 0.8 times as long as carapace, 2.1 times as carpus. In paratypes, this pereiopod falling slightly short of level of midlength of scaphocerite; chela 0.4–0.5 times as long as carapace, 1.4–1.9 times as long as carpus.

Second pereiopod (Fig. 13B) slightly overreaching level of midlength of scaphocerite; chela 0.3–0.4 times as long as carapace, armed terminally with dark cornified spines slightly curved inferiorly; carpus 0.5–0.6 times as long as carapace, 1.6–1.7 times as long as chela.

Ambulatory pereiopods slender. Propodi with sparse spinules on ventral margin, dense short setae distally. Dactyli (Fig. 13D) biunguiculate, armed with two accessory claws posterior to preterminal unguis, decreasing regularly in size proximally. Third pereiopod (Fig. 13C) falling slightly short of tip of scaphocerite; ischium armed with spine on lateral surface and ventral margin; merus 0.7–0.9 times as long as carapace, 2.0–2.5 times as long as carpus, armed laterally with five spines, ventrally with three spines; carpus 0.3–0.4 times as long as carapace, armed with three spines; propodus 0.6–0.7 times as long as carapace, 1.7–2.1 times as long as carpus. Fourth pereiopod slightly overreaching level of midlength of scaphocerite; spinations of ischium, merus and carpus agreeing those of third pereiopod; merus 0.7 times as long as carapace, 2.0–2.3 times as long as carpus; proportion of carpus resembling that of third pereiopod; propodus 0.6–0.7 times as long as carapace, 1.8–2.1 times as long as carpus. Fifth pereiopod reaching level of proximal third of scaphocerite; ischium with or without spine on lateral surface and ventral margin; merus 0.6 times as long as carapace, 1.8–2.1 times as long as carpus, armed laterally with three spines, ventral margin with or without one to two spines; carpus 0.3–0.4 times as long as carapace, armed with two spines; propodus 0.6–0.7 times as long as carapace, 1.9–2.2 times as long as carpus.

Endopod of male first pleopod (Fig. 13E) rounded distally; appendix interna well developed, broadened basally, distal end with dense cincinnuli. The illustrated endopod has a distinct concavity at outer margin, but this appendage in the other male specimen forms entire margin, without concavity.

Endopod of male second pleopod (Fig. 13F) with appendices masculina and interna at midlength of mesial margin; appendix masculina oblong, distal end fringed with dense setae; appendix interna slightly longer than appendix masculina, distal end with dense cincinnuli.

Uropod (Fig. 11F) with protopodite with acute posterolateral tooth; exopod broad, exceeding tip of telson, with lateral margin straight, with acute articulated spine mesial to distolateral spine; endopod subequal to exopod.

Color in life. In fresh specimen, carapace and abdominal somites deep red to orange-yellow

covered with small, ocellated blue-white spots of various sizes and intensities; spots usually indistinct in dark red specimens; carapace often conspicuously lighter than abdomen, producing a bicolor appearance; a distinct dark spot always present on lateral junction between second and third abdominal somites; rostrum pinkish transparent, with three transverse red bands from apex to midlength. In liquid 50 % ethylene glycol, carapace pinkish white; abdominal somites and appendages pale orange; dark orange spot at lateral junction between second and third abdominal somites; rostrum transparent, three red bands remaining distinctly.

Distribution. Type locality: Kailua Harbor, Hawaii (Okuno and Hoover, 1998). Known only from Guam, Mariana Islands (Paulay *et al*., 2003) and Maldive Islands, Indian Ocean (Coleman, 2000) (Fig. 60).

Remarks. *Cinetorhynchus hawaiiensis* appears closest to *C. reticulatus*. Both species share the ambulatory dactyli armed with two cornified claws posterior to the preterminal unguis, an antennular peduncle armed ventrally with a single spine, and the distolateral spine of the scaphocerite overreaching the tip of the lamella. In morphology, two minor characters separate these two species. In *C. hawaiiensis*, the stylocerite reaches the distal margin of distal segment of the antennular peduncle (Fig. 14A), whereas in *C. reticulatus*, it reaches the level of the distal third of that segment (Figs. 14B, 18C). Also, the length of the scaphocerite is 0.95–1.05 times as long as the carapace in *C. hawaiiensis*, instead of 0.75–0.95 (usually 0.79–0.90) in *C. reticulatus*. It should be noted that although the posteroventral angle of the fourth abdominal somite is armed with a distinct protrusion in *C. hawaiiensis*, and this feature is absent in the figure of *C. reticulatus* presented in Okuno (1997c), subsequent examination has revealed an intraspecific variation in *C. reticulatus*: the fourth abdominal somite may be unarmed or armed with a very small protrusion. This character, therefore, is unavailable to separate *C. hawaiiensis* from *C. reticulatus*. Two color features easily distinguish one species from the other: *C. hawaiiensis* has a distinct dark spot on the lateral junction of the second and third abdominal somites (persisting in preserved specimens) (Fig. 11C) and it completely lacks the red and white reticulations present on the abdominal somites of *C. reticulatus* (Fig. 3F). Pattern of lines and spots in the rhynchocinetid shrimps has proved to be the most consistent and conspicuous diagnostic character (Okuno, 1997c). We consider, therefore, the Hawaiian species to be distinct from *C. reticulatus* as specific level. Because of their close similarity, *C. hawaiiensis* and *C. reticulatus* can be considered a cryptic species pair in decapod crustaceans, as discussed by Knowlton (1986).

As is the case with *Aus hendersoni* and *Cinetorhynchus reticulatus*, the mature male of *C. hawaiiensis* develops subchelate first pereiopods.

As mentioned following lines, Okuno and Hoover (1998) reported the field observation of *Cinetorhynchus hawaiiensis* ecology in detail: It is common in coral beds dominated by *Porites compressa* Dana, 1846 at Hanauma Bay and Makaha, O'ahu, and Honaunau Bay, Keauhou Bay and Kailua Bay on the west side of the island of Hawai'i; *Porites compressa*, one of Hawaii's most abundant corals, is a low, branching, finger-like species possibly endemic to the islands (see Maragos, 1977; Jokiel, 1987); it forms extensive beds in locations protected from wave action either by topography or depth (usually 10 m or more); *C. hawaiiensis* inhabits spaces in dead coral at the bases of the colonies; by rough visual estimate, it occurs on the O'ahu sites at a density of 2–3 individuals per square meter, along with the slightly more abundant hippolytid shrimp, *Saron marmoratus* (Olivier,

1811); at west Hawai'i sites *C. hawaiiensis* was the predominant shrimp in its habitat, with roughly estimated population densities of up to a dozen or more per square meter, density peaking at about depths of 15 m; habitat in west Hawai'i was usually shared with occasional specimens of *C. concolor* and *C. hendersoni*, as well as *S. marmoratus*, although none were as abundant as *C. hawaiiensis*; none of the shrimps in west Hawai'i approached *C. hawaiiensis* in abundance except in the following case; at Keahou Bay, Hawai'i, *C. hendersoni* was predominant at depths of approximately 5 meters or less in holes and crevices in massive moundlike heads of *Porites lobata* Dana, 1846, another common Hawaiian coral; at these depths, *P. compressa* was absent. As depth increased, *P. compressa* replaced *P. lobata* and *C. hawaiiensis* replaced *C. hendersoni*; sparse population of *C. hawaiiensis* were also observed in silty dead coral along the side of the side of the boat channel between the Ala Wai Yacht Basin and Ala Moana Beach Park, Honolulu; other protected locations in Hawai'i undoubtedly contain additional populations of this apparently common shrimp; *C. hawaiiensis* was never observed along exposed rocky coastlines where *C. hiatti* and *Bus rathbunae* predominate; like other members of its genus, *C. hawaiiensis* emerges only at night. It seldom strays far from cover and is typically observed perched motionless just inside openings in the coral.

5-2-1-6 *Cinetorhynchus hiatti* (Holthuis and Hayashi, 1967)

(Fig. 3E, 15)

Rhynchocinetes rigens– Hiatt, 1948: 78. Not Gordon, 1936.

Rhynchocinetes rigens–Hiatt, 1954: 25, pl. 5, fig. 5. Not Gordon, 1936.

Rhynchocinetes hiatti–Holthuis, 1953: 54 (*nomen nudum*).

Rhynchocinetes hiatti– Morrison, 1954: 18 (*nomen nudum*).

Rhynchocinetes hiatti Holthuis & Hayashi, 1967: 162, figs. 1-2

Not *Rhynchocinetes hiatti*– Monod, 1972: 15, figs. 27-64 [= *Aus hendersoni* (Kemp, 1925)]..

Not *Rhynchocinetes hiatti*– Miyake, 1975: 105, unnumbered fig. in color [= *Aus hendersoni* (Kemp, 1925)].

Rhynchocinetes hiatti– Tiefenbacher, 1976: 318 (in part).

Not *Rhynchocinetes hiatti*– Takeda, 1982: 35, unnumbered fig. in color [= *Aus hendersoni* (Kemp, 1925)]

Rhynchocinetes hiatti–Bruce, 1984: 209, fig. 1.

Not *Rhynchocinetes hiatti*– Kamesaki *et al*, 1988: 71, fig. unnumbered [= *Cinetorhynchus concolor* (Okuno, 1994)].

Not *Rhynchocinetes hiatti*– Coleman, 1991: 104, fig. unnumbered [= *Cinetorhynchus striatus* (Nomura and Hayashi, 1992)]

Rhynchocinetes hiatti–Okuno, 1993: 5, fig. 5.

Rhynchocinetes hiatti–Okuno, 1994b: 69 (in part), figs. 3C, 4G.

Rhynchocinetes hiatti–Okuno, 1995; 2, fig. 3. in color.

Rhynchocinetes hiatti– Gosliner *et al.*, 1996: 218, fig. 788 in color.

Rhynchocinetes hiatti– Chace, 1997: 28 (in key).

Cinetorhynchus hiatti– Okuno, 1997: 40–43, pl. 1C, fig. 5.

Cinetorhynchus hiatti– Okuno and Tachikawa, 1997: 23 (in key).

Cinetorhynchus hiatti– Okuno, 1998: 3, fig. 2 in color.

Cinetorhynchus hiatti– Poupin, 1998: 10 (list).

Cinetorhynchus hiatti– Hoover, 1998: 237, unnumbered fig. in color.

Cinetorhynchus hiatti– Hayashi, 1999a: 148, figs. 367e, 369e, f, 370e, j.

Cinetorhynchus hiatti– Hickman and Zimmerman, 2000: 22, unnumbered fig. in color.

Cinetorhynchus hiatti– Minemizu, 2000: 33, unnumbered fig. in color.

Cinetorhynchus hiatti– Paulay *et al*., 2003: 7486 (list).

Cinetorhynchus hiatti– Hayashi, 2007: 104, figs. 42e, 43e, f, 44e, j.

Cinetorhynchus hiatti– Poupin and Juncker, 2010: 206, fig. b in color.

Cinetorhynchus hiatti– De Grave and Fransen, 2011: 301 (list).

Material Examined: WESTERN PACIFIC. **Japan.** Izu Islands. CMNH-ZC 01500, 1♂, CL 12.7 mm, Yaene Port, Hachijo-jima Island, 7 m, 14 October 2003, coll. K. Tanaka.— Ogasawara Islands. NSMT-Cr 2133, 1♀, CL 7.8 mm, Giant Hole, tate-jima Islet, southern part of Chichi-jima Island, 2 m, 17 November 1993, coll. T. Kase; SUF 530-2-1681, 1♂, CL 10.0 mm, Higashi-jima Islet, cave, 14 May 1982.— Ryukyu Islands. SUF 530-2-1680, 1 ovig.♀, CL 12.0 mm, Unari-zaki, Iriomote-jima Island, Yaeyama Group, 16 m, 7 June 1982.

Taiwan. KMNH 1995Z20IvR97, 1♂(holotype of *Rhynchocinetes hiatti*), CL 13.3 mm, Siangjiaowan, Kending, Pingtung County, 3– 4 m, 20 August 1965, coll. G. Nishi.

Hawaii. Oahu Island. BPBM, 1♀, CL 13.6 mm, Pupukea, 3–5 m, 19 May 1978; NSMT-Cr 2419, 1♂, CL 17.1 mm, west side of Waimea Bay, 21.38ºN, 158.04ºW, 7–10 m, 29 November 1994, coll. J. Earle; ZRC, 2♂♂, CL 13.3, 15.1 mm, Magic Island, Ala Moana area, Waikiki, 22 January 2000, coll. P. K. L. Ng and S. H. Tan.

Mariana Islands. Guam Island. NSMT-Cr 1723, 1 ovig.♀, CL 10.6 mm, NSMT-Cr1756, 1♀, CL 12.7 mm, detailed collection site unknown, coll. aquarium trader.

Marshall Islands. Enewetok Atoll. MNHN-Na 2775, 1♂, 2 ovig.♀♀, CL 8.7–10.9 mm, Eniwetok Island, 11º20’52”N, 162º20’36”E, 10 October 1969, coll. C. A. Child.

Loyalty Islands. Uvea Island. MNHN-Na 12948, 1 ovig.♀, CL 14.2 mm, Passe de la Meurthe, 6–10 m, 16 November 1991, coll. J. P. Menou.

Marquesus Islands. Nuku Hiva. BPBM S11280, 2 ovig.♀♀, CL 11.0, 11.7 mm, west side of Seufinelle de l’Est, 37.5 m, 1 May 1971, coll. J. E. Randall.

EASTERN PACIFIC. **Galapagos Islands**. CDRS 00-38, 1♂, CL 10.6 mm, CDRS 00-40, 1♂, CL 18.3 mm, CDRS 00-50, 1♂, CL 13.8 mm, Wolf Island, 12–15 m, night dive, 6–8 February 2000, coll. C. Hickman, Jr.

Description. Carapace (Fig. 15A) almost glabrous, but covered with very feeble transverse striations; dorsal median carina with 3 teeth, anteriormost tooth just posterior to rostral articulation, largest, apex directed anteriorly, intermediate and posteriormost teeth feebly articulated with median carina, situated considerably posterior to level of posterior margin of orbit; supraorbital spine absent: orbit feebly developed, inferior orbital margin obsolete, terminating in antennal spine; antennal spine rather flattened, feebly carinate ventrally; pterygostomial angle usually with a blunt tooth, rarely without spine, rounded.

Rostrum (Fig. 15B) partially articulated with carapace, overreaching level of midlength of scaphocerite, 0.8–1.6 times as long as carapace, nearly horizontal proximally, anterior half sinuous dorsad, apex directed anteriorly; dorsal margin armed with two groups of teeth, proximal group consisting of 2 large teeth, proximal tooth situated slightly posterior to distal margin of cornea, distal tooth at proximal third of the length, distal group comprised of 2 (rarely 3) small subterminal teeth; ventral margin unarmed proximally, armed with 8–12 teeth decreazing in size distally.

Fifth thoracic sternite armed posteriorly with a pair of acute, long median processes. Sixth somite armed posteriorly with a pair of processes, shorter and situated more laterally than those of fifth somite.

Abdominal somites (Fig. 15C) almost glabrous, but covered with very feeble oblique striations. Pleura of first to third somites broadly rounded; fourth and fifth somites with posteroventral margins terminating in acuminate process, posterolateral margins armed each with acute tooth directed obliquely ventrad. Sixth somite 0.4–0.8 times as long as carapace, midpoint of posterior margin acutely prominent posteriorly, with acute posteroventral process furnished with short dense setae; ventral surface armed with strongly hooked preanal spine. Telson 0.5–0.8 times as long as carapace, 1.1–1.4 times as long as sixth somite, tapering posteriorly, posterior margin acuminate medially, with 3 pairs of dorsal spines on posterior half; posterior margin with 3 pairs of spines, intermediate pair longest.

Ophthalmic somite with midline slightly carinate, dorsally with elongate lobe. Eye (Fig. 15A) with large, globular cornea, maximum diameter longer than distal margin of stalk, distinct dorsal accessory pigment spot present; stalk widened, shorter than cornea.

Antennular peduncle (Fig. 15D) reaching, or slightly overreaching level of midlength of rostrum. Proximal segment slightly longer than distal two segments combined, dorsal surface moderately concave, with acute anterolateral tooth reaching level of midlength of intermediate segment, ventral surface mesially armed with an acute tooth; stylocerite considerably exceeding level of distal end of ultimate segment, furnished with dense setae laterally and mesially. Distal segment subcylindrical, ventrally with setae. Dorsal flagellum with short aesthetascs except for proximal fifth of thickened part.

Antenna with stout basicerite (Fig. 15A) typically with two acute spines, directed anteriorly, rarely with a single spine just below a rounded lobe anterodorsally. Scaphocerite (Fig. 15E) slightly overreaching midlength of rostrum, 0.5–0.8 times as long as carapace, 2.7–3.4 times as long as its maximum width, lateral margin almost straight, terminating in acute tooth slightly overreaching level of distomesial angle of oblique lamella, mesial margin convex. Carpocerite (Fig. 15A) falling slightly short of level of midlength of scaphocerite.

Epistome unarmed.

Mouthparts typical of the family. Second maxilliped with suboval epipod; podobranchwell developed; dactylus narrow, with mesial margin nearly straight, densely furnished with long setae; propodus elongate, with anterior margin broadly rounded, with dense long setae; carpus subquadrate, anterolateral angle bluntly produced; mesial surface of merus, ischium, and anterior part of basis shallowly concave; exopod with well developed flagellum, basal part of lateral surface shallowly concave. Third maxilliped with endopod reaching or slightly overreaching level of distal margin of

scaphocerite in normal male and female, overreaching, distal margin of scaphocerite by proximal sixth of ultimate segment in large male (CL over 17.0 mm); ultimate segment with transverse rows of dense setae, ventrally furnished with numerous setae, 1.6–3.7 times as long as penultimate segment in normal male and female, 4.2–4.4 times as long as penultimate segment in large male, terminating in corneous spine, with 2 distolateral and 3 distomesial spines: penultimate segment fringed sparsely with short setae, dorsolateral surface shallowly concave; antepenultimate segment slightly widened distally, dorsolateral surface obliquely situated; ischium short, depressed; exopod with segmented flagellum slightly overreaching level of distal margin of antepenultimate segment.

Branchial formula as shown in Table 1.

First pereiopod robust, slightly compressed, reaching level of distal margin of scaphocerite. Chela 1.6–2.0 times as long as carpus, palm 2.2 times as long as dactylus, ventral surface with rows of dense short grooming setae with setules; dactylus arched, without denticulation on cutting edge, terminating in set of ungues, distal margin of corpus densely furnished with long setae; fixed finger without denticulation on cutting border, tapering distally, proximal half of the border with row of long setae, midpoint of lateral surface with tuft of dense short setae, terminating in set of ungues distinctly demarcated from corpus. Carpus with distal margin truncate, ventrolateral surface slightly oblique. Merus 1.4–1.5 times as long as carpus, obliquely articulated with ischium. Coxa unarmed.

Second pereiopod slender, slightly compressed, midlength of scaphocerite. Chela with palm 4.2–4.6 times as long as dactylus; dactylus slightly arched, without denticulation on cutting border, terminating in set of ungues, distal surface of corpus with tuft of long dense setae; fixed finger without denticulation but densely furnished with long setae on cutting border, terminating in set of ungues, longest unguis subequal to corpus in length. Carpus 1.2–1.6 times as long as chela, 1.2–1.3 times as long as merus, distal margin bluntly produced distoventrally, with sparse setae. Merus obliquely articulated with ischium. Coxa with small, blunt spine anterolaterally.

Ambulatory pereiopods considerably stouter than those of the congeners, with carpi typically armed with a single spine on outer surface, situated at level ofthe midlength; dactyli (Fig. 15G) biunguiculate, armed with a single accessory claw posterior to preterminal unguis. Third pereiopod (Fig. 15F) reaching midlength of scaphocerite; merus with 2–4 (usually 4) spines on outer surface, 1–2 (usually 1) spines on ventral margin. Fourth pereiopod reaching midlength of scaphocerite; merus with 4 (rarely 2) spines on outer surface, 1–2 (usually 1) spines on ventral margin. Fifth pereiopod reaching level of basal part of scaphocerite; ischium usually without spine; merus with 1–4 (usually 3) spines on outer surface, usually with a single spine (rarely unarmed) on ventral margin.

Endopod of first pleopod generally oblong, tapering distally, laterally furnished with short dense setae, distal margin entire, without setae; appendix interna well developed, proximally broad, distal part almost perpendicular, demarcated from proximal part, with a few cincinnuli terminally.

Endopod of second pleopod with appendices masculina and interna arising from midlength of mesial margin; appendix masculina elongate, furnished with long marginal setae, shorter than appendix interna; appendix interna elongate, with a few cincinnuli terminally.

Uropod with protopodite posterolaterally acute. Both exopod and endopod reaching level of tip of telson; exopod with lateral margin straight, terminating in acute tooth, mesially with movable spine longer than the terminal tooth; endopod slender, slightly tapering distally.

Color in life (Fig. 3E). Ground color brilliant orange. Carapace posterolaterally with three pale oblique bands bordering by red lines, posterior band extending to the first abdominal somite. Rostrum orange, more or less translucent, apex white. Abdominal somites each with transverse pale band bordering by red lines, the band of the sixth somite rarely broken, forming two pale ocelli circumscribing with red circle. Posterior margin of telson and uropods yellow. Third maxilliped and pereiopods uniformly orange, except for whitish dorsal surface.

Distribution. Type locality: Siangjiaowan (= Kosho Bay), Kending, Pingtung County, Taiwan (Holthuis and Hayashi, 1967). Widely distributed from Indo-Pacific (Fig. 58): **Japan:** Ryukyu Islands (Holthuis and Hayahsi, 1967; Hayashi, 1999), Ogasawara Islands (Okuno, 1997c); **Mariana Islands:** Guam (Okuno, 1997c; Paulay *et al*., 2003); **Caroline Islands:** Ifalik Atall (Holthuis and Hayashi, 1967); **Kapingamarangi Atoll:** Tewawaeal (Holthuis and Hayashi, 1967); **Marshall Islands:** Eniwetok Atoll (Holthuis and Hayahsi, 1967; Bruce, 1984), Bikini Atoll (Holthuis and Hayahsi, 1967); **Loyalty Islands:** Uvea Island (Okuno, 1997c); **Gilbert Islands:** Onotoa Atoll (Holthuis and Hayashi, 1967); **Tuamotu Archipelago:** Raroia Atoll (Holthuis and Hayashi, 1967); **Marquesas Islands:** Nuku Hiva (Okuno, 1997c); **Hawaii:** Oahu (Okuno, 1997c), Hawaii (Hoover, 1998), and **Galapagos Islands:** Wolf Island and Darwin Island (Hickman and Zimmerman, 2000).

Remarks. The holotype of *hiatti*, a male specimen from Taiwan, is housed at the collection of KMNH on account of the transference from the Zoological Laboratory of Kyushu University.

Cinetorhynchus hiatti is morphologically characterized by the combination of the stylocerite distinctly overreaching the distal end of the antennular peduncle (Fig. 18D), the carpi of the ambulatory pereiopods nearly always armed with a single spine (Fig. 18F), the lower number of the spines on the meral ventral margin of the third and fourth pereiopods (Fig. 18F) and the dactyli bearing a single small claw posterior to the preterminal unguis in the ambulatory pereiopods (Fig. 18G). This species has the antennal basicerite typically armed with two acute spines (Holthuis and Hayashi, 1967). Although this character reveals the intraspecific variation noted in the above lines, it may be available to determine it from the other congeneric species having the basicerite constantly armed with a single spine distoventrally. Tiefenbacher (1976) compared the forms of the coxal spine of the first pereiopod between *C. hiatti* and *Aus hendersoni*. The indistinctive spine, as bearing in *C. hiatti*, is appearedin all the congeners except *C. hendersoni*, which possesses a lobate corneous projection on the coxa.

Hiatt (1948, 1954) recorded the Hawaiian specimens identified with *R. rigens*. I could not examine these specimens that were not designated as the type seriesof *hiatti*. Because the morphological features between *C. hiatti* and *C. rigens* closely resemble each other and *C. hiatti* is not uncommon in the Hawaiian waters, I regarded that Hiatt's specimens may belong to *C. hiatti*. In the popular publications with the color photographs were several records under the name of *Rhynchocinetes hiatti* (Miyake, 1975; Takeda, 1982; Kamezaki *et al*, 1988; Coleman, 1991). These individuals were not identical with *C. hiatti* but with the other related species (cf. synonymous list).

5-2-1-7 *Cinetorhynchus manningi* Okuno, 1996

Figs. 16, 17

Rhynchocinetes rigens.– Manning, 1961: 1 (in part). Not *Rhynchocinetes rigens* Gordon, 1936.

Cinetorhynchus manningi Okuno, 1996b: 725, figs. 1–2.

Cinetorhynchus manningi– Okuno and Tachikawa, 1997: 23 (in key).

Cinetorhynchus manningi– De Grave and Fransen, 2011: 301 (list).

Material examined: CARIBBEAN SEA: **Florida**. USNM 277773, 1 ovig.♀(paratype), CL 8.0 mm, off Elliot Key, Bache Shoals, 4.5 m, 4 May 1960, coll. C. R. Robins. **Virgin Islands.** USNM 277772, 1 ovig.♀(holotype), CL 8.5 mm, Eagle Shoal, 10.5 m, 1 Feb 1961.

Description. A rather robust rhynchocinetid shrimp of subcylindrical body form (Fig. 16).

Carapace (Fig. 16) with many fine transverse striae. Three acute teeth on dorsal carina behind rostral articulation, anterior tooth largest. Antennal spine sharply pointed, considerably exceeding anterior margin of carapace. Anterolateral angle of carapace rounded, without pterygostomian spine.

Rostrum (Fig. 17A) well developed, indistinctly articulated with carapace, distinctly overreaching apex of scaphocerite; length 1.7 times as long as carapace; lateral carina distinct, reaching end of proximal third of rostrum, continuous with upper orbital margin; dorsal margin with 2 large proximal teeth, 2 small teeth subterminally; ventral margin with 10 teeth, proximal 4 teeth strong, separated by distinct interval from proximal tooth of distal series, distal 6 teeth considerably smaller than proximal four teeth, decreasing in size distally.

Abdominal somites (Fig. 16) with fine transverse striae; pleura of first 3 somites rounded; fourth somite with small, distinct or indistinct protrusion posteroventrally; fifth somite with acute protrusion posteroventrally; posterolateral margin of fourth and fifth somites each with acutely pointed tooth directed posteriorly; sixth somite rather compressed, 0.6 times as long as carapace, 2.1 times as long as its width, with acutely pointed posteroventral spine directed obliquely backwards, with acute anal spine between uropodal basicerites. Telson (Fig. 17B) 0.6–0.7 times as long as carapace, 1.1–1.2 times as long as sixth abdominal somite, rather convex dorsally; spination of dorsal surface in holotype abnormal, with 2 small spines on right side and a single small spine at left side, paratype has normal spination, armed with 3 pairs of small spines; posterior margin prominent, bearing 3 pairs of spinules at each side, intermediate spinules longest.

Eye (Fig. 16) with pigmented, rounded cornea, eyestalk much slenderer than cornea.

Antennular peduncle (Fig. 17C) reaching end of proximal third of rostrum; thickened part of upper flagellum reaching to about rostral apex; proximal segment with distal margin acutely pointed, inner margin ventrally with acute spine, surface concave; stylocerite well developed, reaching distal margin of distal segment; statocyst longitudinally oval.

Scaphocerite (Fig. 17D) well developed, reaching midlength of rostrum, 0.8 times as long as carapace, 3.3–3.4 times as long as its maximum width; external distal spine acute, reaching level of distal margin of lamella; basicerite covered with fine transverse striae, with acute spine directed anteriorly and terminal rounded lobe just above spine; carpocerite reaching end of proximal third of scaphocerite.

Mouthparts typical of the family. Second maxilliped with oval epipod having well developed podobranch; distal margin of dactylus almost straight, with long dense setae; propodus with distal margin rounded, inner margin feebly expanded. Third maxilliped reaching distal third of scaphocerite;

antepenultimate segment with acute spine distolaterally; penultimate segment 0.3 times as long as carapace, with sparse setae on outer surface; ultimate segment 0.5 times as long as carapace, 1.5–1.6 times as long as penultimate segment, with 6–8 dark horny claws at apex, covered uniformly with dense setae except distal fourth.

Branchial formula as shown in Table 1.

First pereiopod (Fig. 17E) stout, reaching end of proximal third of scaphocerite; chela slightly compressed, 0.4 times as long as carapace, 1.6–1.7 times as long as carpus, palm with short dense setae on proximal ventral margin, both fingers slightly curved mesially, with dark claws terminally; carpus 0.2 times as long as carapace, distal margin truncate, with dense cluster of rather long setae.

Second pereiopod (Fig. 17F) slenderer than first pereiopod, falling short of midlength of scaphocerite; chela 0.3 times as long as carapace, both fingers slightly curved inside, with dark horny claws terminally; carpus long, 0.4–0.5 times as long as carapace, 0.5–0.6 times as long as chela.

Ambulatory pereiopods rather slender, similar; dactyli (Fig. 17H) biunguiculate, armed with two accessory claws posterior to preterminal unguis, decreasing in size proximally; propodi with slightly dense setae on upper margin, with sparse spinules at distal two fifths of lower margin, terminal spinule largest of all; ischia with 2 articulated spines on outer surface and lower margin. Third pereiopod (Fig. 17G) reaching level of distal end of scaphocerite; merus 0.6–0.7 times as long as carapace, 2.0 times as long as carpus, with 4–5 articulated spines on outer surface, proximal spines equidistant, distal spine subterminal, distinctly separated from proximal series, with 3 spines on lower margin, and sparse long setae dorsodistally; carpus 0.3 times as long as carapace, with 2–3 articulated spines on outer surface, with sparse long setae at upper margin preterminally; propodus 0.5–0.6 times as long as carapace, 1.7 times as long as carpus.Fourth pereiopod falling short of distal end of scaphocerite; merus 0.6 times as long as carapace, with 4-5 articulated spines on outer surface, 2–3 articulated spines on lower margin; carpus 0.3–0.4 times as long as carapace, with 2 articulated spines on outer surface, with sparse long setae at upper margin preterminally; propodus 0.6 times as long as carapace, 1.6–1.8 times as long as carpus. Fifth pereiopod reaching midlength of scaphocerite; merus 0.5–0.6 times as long as carapace, 1.5–1.6 times as long as carpus, with three articulated spines on outer surface, a single spine situated at distal third of lower margin; carpus 0.4 times as long as carapace, spination similar to that of fourth pereiopod; propodus 0.6 times as long as carapace, 1.6 times as long as carpus.

Uropodal exopod (Fig. 17B) with articulated and non-articulated spines at distal third of outer border.

Color in life. Unknown.

Distribution. Type locality: Eagle Shoal, Virgin Islands, Carribian Sea (Okuno, 1996b). Known only from the Virgin Islands and Florida (Fig. 61).

Remarks. The dorsal spination of the telson in the holotype of *Cinetorhnchus manningi* is an abnormal condition, and can be attributed to intraspecific variation. The paratype does exhibit the normal condition.

Cinetorhynchus manningi appears closest to the Indo-Pacific congeneric species, *C. brucei* in regard to the branchial formula. The definition of these two species is discussed in the “Remarks” section of *C. brucei*.

The holotype of *C. manningi* was included in the various specimens reported as *Rhynchocinetes*

rigens (= *C. rigens*) by Manning (1961). *Cinetorhynchus manningi* is distinguished from *C. rigens*, another congeneric species from the Atlantic Ocean, by having the ambulatory pereiopodal dactyli armed with two accessory spines posterior to subterminal unguis on the flexor margin, a small posteroventral protrusion on the fourth abdominal somite, a well developed podobranch on the second maxilliped and the distinct interval between the proximal four teeth and the distal smaller teeth on ventral margin of rostrum. *Cinetorhynchus rigens* possesses a single accessory spine on the dactyli of the ambulatory pereiopods, unarmed and rounded posteroventral angle of the fourth abdominal somite, podobranch on the second maxilliped consisting by shaft only, without filaments, and ventral teeth on the rostrum decrease regularly in size distally (Gordon 1936; Okuno, 1997c)

In his report, Manning (1961) mentioned that there are two patterns of colorations in the western Atlantic population of *C. rigens*. However, the type specimens of *C. manningi* had lost their color pattern when I examined them. In some publications, beautiful underwater photographs have been included of an unidentified Atlantic rhynchocinetid species, the coloration of which definitively disagrees with that of *C. rigens* (see Baensch and Debelius, 1992; Debelius, 1983, 1984; Humann, 1992). This unidentified species has the red ground color on the whole body surface covered with fine pale white spots on the carapace, and five pale white transverse bands on the abdominal somites. I have not seen any specimen having the coloration mentioned above. Although the coloration is diagnostic in *Cinetorhynchus* (Nomura and Hayashi, 1992; Okuno, 1994b, 1997c, 2009; Okuno and Tachikawa, 1997, Okuno and Hoover, 1998), that of *C. manningi* has not been determined yet.

5-2-1-8 *Cinetorhynchus reticulatus* Okuno, 1997

(Figs. 3F, 14B, 18)

Rhynchocinetes hendersoni– Armstrong, 1941: 12. Not *Rhynchocinetes hendersoni* Kemp, 1925.

Rhynchocinetes sp.– Debelius, 1984: 68, fig. unnumbered.

Rhynchocinetes sp.– Baensch and Debelius, 1992: 545, figs. unnumbered.

Rhynchocinetes sp.– Hayashi *et al*, 1994: 268.

Rhynchocinetes sp.– Gosliner *et al*., 1996: 219, fig. 792.

Cinetorhynchus reticulatus Okuno, 1997: 49–53, pl. 1G, H, figs. 10, 11, 12A-C.

Cinetorhynchus reticulatus– Okuno and Tachikawa, 1997: 24 (in key).

Cinetorhynchus reticulatus– Okuno and Hoover, 1998: 40.

Cinetorhynchus reticulatus– Okuno, 1998: 4, figs. 6–7 in color.

Cinetorhynchus reticulatus– Poupin, 1998: 10 (list).

Cinetorhynchus reticulatus– Hayashi, 1999b: 219, figs. 371a, 372a, 374a, b.

Cinetorhynchus reticulatus– Minemizu, 2000: 35, unnumbered figs. in color.

Cinetorhynchus reticulatus– Kato and Okuno, 2001: 17, unnumbered figs. in color.

Cinetorhynchus reticulatus– Davie, 2002: 372 (list).

Cinetorhynchus reticulatus– Paulay *et al*., 2003: 486 (list).

Cinetorhynchus reticulatus– Hayashi, 2007: 104, figs. 45a, 46a, 49a, b.

Cinetorhynchus reticulatus– Humann and DeLoach, 2010: 140, unnumbered fig. in color.

Cinetorhynchus reticulatus– De Grave and Fransen, 2011: 301 (list).

Material examined: WESTERN PACIFIC. **Japan.** Izu Islands. NSMT-Cr 2626, 2♂♂(paratypes), CL 4.7, 5.1 mm, Nazumado, Hachijo-jima Island, 33º08.5'N, 139º44.4'E, 13 m, 28 September 1993, coll. S. Kato and J. Okuno; NSMT-Cr 3317, 1♂, CL 7.0 mm, 1♀, CL 10.0 mm, same locality as NSMT-Cr 2626, 8 September 1994, coll. J. Okuno; NSMT-Cr 2625, 1 ovig.♀(paratype), CL 10.0 mm, Occho-ga-hama, Hachijo-jima Island, 33º03.5'N, 139º47.9'E, 15 m, submarine cave, 28 September 1993, coll. S. Kato; CMNH-ZC 00717, 1♂, CL 8.0 mm, Nakano-mama, Hachijo-jima Island, 15 m, 25 October 1999, coll. K. Tanaka.— Ryukyu Islands. YCM-CM 979, 1♂(paratype), CL 10.0 mm CL, Fukaura, Amami-Oshima Island, Amami Group, 28º13.8'N, 129º17.4'E, 20 m, 2 September 1993, coll. K. Hagiwara; YCM-CM978, 1♂(paratype), CL 5.3mm, Sakinome, Amami-Ohshima Island, Amami Group, 28º11.2'N, 129º16.0'E, 28m, 2 September 1993, coll. M. Hayashi; CMNH, 1♂, CL 4.9 mm, Cross Hole, Irabu-jima Island, Miyako Group, 24º51.6'N, 129º09.5'E, 20 m, 5 July 2006, coll. J. Okuno.

Taiwan. Pingtung County. OUMNH 2009-23-0007, 1♂, CL 6.6 mm, Houpihu Township, Kending, 26 July 2009, coll. S. De Grave.

Mariana Islands. CBM-ZC 1467, 1 ovig.♀(paratype), CL 7.6 mm, CBM-ZC 1468, 1♂(paratype), CL 6.0 mm, CBM-ZC 1469, 1 ovig.♀(paratype), CL 8.1 mm, Pagan Island, 18º04.8'N, 145º27.6'E, 4–10 m, 27 May 1992, coll. P. Schupp; CBM-ZC 1466, 1♂(paratype), CL 4.8 mm, Pagan Island, shore, 24 May 1992, coll. A. Asakura.

Indonesia. Sulawesi. RMNH D47803, 1♂, CL 8.4 mm, RMNH D47804, 1♀, CL 6.0 mm, Spermonde Archipelago, 15 m, 30 June 1994.

Papua New Guinea. Madang. NTM. Cr. 009895, 1♂(paratype), CL 8.6 mm, northren end of Kranket Island, 5º09.6'S, 145º49.7'E, 23 m depth, 27 October 1991, coll. R. Hanley; 1♂ 9.1 mm CL (NTM. Cr.010236), 5° 10.0′ S, 145° 50.0′ E, Rasch Passage, 22 m depth, October 26, 1991; NTM. Cr. 011320, 8♂♂(paratypes), CL 5.0–9.8 mm, 5♀♀(paratypes), CL 3.7–4.9 mm, 6 ovig.♀♀(paratypes), CL 6.7–8.6mm, Pik Island, 5º08.5'S, 145º49.7'E, 12–17 m, 31 October 1991, coll. G. Allen; NTM. Cr. 010236, 1♂, CL 9.1 mm, Rasch Passage, 5º10.0'S, 145º50.0'E, 22 m, 26 October 1991, coll. R. Hanley.

Australia. Queensland. NTM. Cr. 010300, 1♀(paratype), CL 8.9 mm, Ashmore Reef, Coral Sea, 10º13.2'S, 144º24.9'E, 20–30 m, 22 January 1993, coll. FNQ team; AM P25173, 5♀♀, CL 3.0–10.3 mm, Lizard Island, Queensland, 14º40'S, 145º28'E, 10 m, 21 November 1975, coll. N. Coleman.

Solomon Islands. AM P84950, 1 ovig.♀, CL 9.0 mm, outside south entrance to Sandfly Passage, Florida Islands, 9ºS, 160ºE, 18 m, 29 July 1973, coll. B. Goldman and J. Randall; AM P20002, 2♂♂, CL 6.5, 9.5 mm, south west side of Savo Island, north west of Guadalcanal Island, 9º10'S, 159º45'E, 10 m, 18 July 1973, coll. B. Goldman.

West Samoa. AMNH. 9312, 1♂(paratype), CL 4.7 mm, 1 ovig.♀(paratype), CL 4.6 mm, Eastern Reef, Savaii, 13º26.4'S, 177º10.8'W, 17 October 1936.

Vanuatu. CMNH, Taj Mahal, W Efate Island, 17º38.383'S, 168º08.734'E, 15–18 m, 27 October 1996, coll. S. Ohashi, S. Kinjo and T. Kase.

Loyalty Islands. Uvea Island. MNHN-Na 12957, 1♂(holotype), CL 8.0 mm, MNHN-Na 12945, 1♂(paratype), CL 6.8 mm, 1 ovig.♀(paratype), CL 8.9 mm, Banya Islet, 20º35.8'S, 166º16.7'E, 27 m,

18 November 1991, coll. J. L. Menou.

New Caledonia. MNHN-Na 12956, 1 ovig.♀(paratype). CL 10.3 mm, Grotte Merlet, stn 250, 22º42.4’S, 166º41.2’E, 30 m, 20 January 1993, coll. Menou.

Marquesus Islands. Nuku Hiva. BPBM S11281, 1 ovig.♀(paratype), CL 9.1 mm, BPBM S11282, 1♀(paratype), CL 11.1 mm, 8º33.6’S, 140º00.0’W, west side of Sentinelle de l'Ouest, 37 m, 1 May 1971, coll. J. E. Randall.

INDIAN OCEAN. **Timor Sea.** Western Australia. QM W17809, 2♂♂(paratypes), CL 5.4, 6.3 mm, Hibernia Reef, 12º00.0’S, 123º18.0’E; NTM. Cr. 006368, 1♀(paratype), CL 6.8 mm, east side of West Pass, Asmore Reef, 12º14.0’S, 123º10.0’E, 20–21 m, 26 September 1987.

RED SEA. **Israel.** RMNH D47806, 1♂, CL 7.3 mm, Eilat, Gulf of Aqaba, 2 m, 20 December 1968, coll. D. Popper; RMNH D47809, 1♂, CL 4.6 mm, same locality as RMNH D47809, 10 June 1964, coll. C. Lewinsohn.

Egypt. RMNH D47805, 1♂, CL 9.2 mm, RMNH D47811, 2♂♂, CL 5.7, 6.2 mm, 1♀, CL 3.4 mm, 1 ovig.♀, CL 6.4 mm, RMNH D47812, 1 ovig♀, CL 7.6 mm, Wesset, Sinai coast of Gulf of Aqaba, 6–8October 1968, coll. L. Fishelson; RMNH D47807, 1♂, CL 10.0 mm, Dahab, Sinai coast of Gulf of Aqaba, 3 m, 10 October 1968, coll. L. Fishelson; RMNH D47808, 1♀, CL 4.0 mm, Marsa-el-At, Sinai coast of Gulf of Aqaba, 10 October 1954, coll. C. Lewinsohn; RMNH D47810, 1♂, CL 9.0 mm, Ras Muhammad, south point of Sinai Peninsula, 26–28 September 1969.

Tanzania. NTM. Cr. 010749, 4♂♂(paratypes), Cl 8.1–11.8 mm, 1♀(paratype), CL 10.4 mm, 1 ovig.♀(paratype), CL 9.8 mm, Pange Reef, Zanzibar Island, 6º02.0’S, 39º24.0’E, 10 m, 6 June 1974, coll. B. Benbow.

Description. Carapace (Fig. 18A) with pterygostomial angle usually unarmed, rarely armedwith small blunt spine.

Rostrum (Fig. 18B) slightly upturned gradually, 1.3–1.8 times as long as carapace, armed dorsally with 2 large teeth proximally, 2 (rarely 3) small teeth subterminally, armed ventrally with 8–11 (usually 10–11) acute teeth decreasing in size distally; lateral carina continuous with supraorbital margin through the ventralmargin of rostrum proximally.

Fourth abdominal somite usually armed with a posterolateral spine directed posteriorly, rarely unarmed. Fifth somite constantly with a posterolateral protrution directed posteriorly.

Antennular peduncle (Figs. 14B, 18C) usually reaching midlength of rostrum, rarely reaching proximal third of rostrum, inner margin of proximal segment armed ventrally withan acute tooth; stylocerite falling slightly short of distal margin of ultimate segment; thickened part of upper flagellum usually reaching subterminal of rostrum.

Scaphocerite (Fig. 18D) slightly overreaching midlength of rostrum, 0.8–0.9 times as longas carapace, 2.9–3.8 times as long as its maximum width, with distolateral spinesubequal or slightly overreaching tip of lamella.

Mouthparts typical of the family. Second maxilliped with a distinct podobranch at proximal upper margin of epipod. In female and small male, third maxilliped reaching proximal two thirds of scaphocerite, ultimate segment 0.5 times aslong as carapace, 1.3–1.6 times as long as penultimate segment, with 7–8 dark spines at apex. In large male, third maxilliped reaching rostral apex; ultimate

segment distinctly elongated, 0.6–0.7 times as long as carapace, 1.6–1.8 times as long as penultimate segment.

Branchial formula as shown in Table 1.

In female and small male, first pereiopod usually reaching midlength of scaphocerite, chela 0.3–0.6 times as long as carapace, 1.3–1.8 times as long as carpus, carpus 0.2–0.3 times as long as carapace; in large male, first pereiopod developed and stout, forming subchela (Fig. 18E), overreaching rostral apex by carpopropodial articulation, chela with palm strongly compressed distally, covered with sparse tubercles at ventral margin, 1.7–2.4 times as long as carapace, 2.3–3.5 times aslong as carpus, dactylus strongly curved directed ventrally, carpus 0.6–0.7 times as long as carapace.

Second pereiopod usually reaching midlength of scaphocerite, chela 0.3–0.4 times as long as carapace, carpus 0.4–0.6 times as long as carapace, 1.4–2.0 times as long as chela.

Ambulatory pereiopods slender, each dactylus (Fig. 18I) biunguiculate, armed with two accessory claws posterior to preterminal unguis. Third pereiopod (Fig. 18G) reaching proximal two thirds of scaphocerite; merus 0.7–0.8 times as long as carapace, 2.0–2.8 times as long as carpus, with 3–6 (usually 4–5) spines on outer surface, 2–6 (usually 3) spines on ventral margin; carpus 0.3–0.4 times as long as carapace, with 3 (rarely 2 or 4) spines on outer surface; propodus 0.6–0.7 times as long as carapace, 1.8–2.5 times as long as carpus. Fourth pereiopod reaching midlength of scaphocerite; merus 0.6–0.8 times as long as carapace, 1.7–2.4 times as long as carpus, with 3–5 (usually 4) spines on outer surface, 2–4 (usually 3) spines on ventral margin; carpus 0.3–0.4 times as long as carapace, with 1–3 (usually 3) spines on outer surface; propodus 0.6–0.8 times as long as carapace, 1.7–2.3 times as long as carpus. Fifth pereiopod reaching proximal third of scaphocerite; merus 0.6–0.8 times as long as carapace, 1.6–2.3 times as long as carpus, with 2–5 (usually 3) spines on outer surface, 1-3 spines on ventral margin; proportion of carpus resembling that of two former pereiopods, with 0–3 (usually 2) spines on outer surface; proportion of propodus resembling that of fouth pereiopod.

Endopod of male first pleopod generally oblong, tapering distally, laterally furnished with short dense setae, distal margin entire, without setae; appendix interna well developed, proximally broad, distal part almost perpendicular, demarcated from proximal part, with a few cincinnuli terminally.

Endopod of second pleopod with appendices masculina and interna arising from midlength of mesial margin; appendix masculina elongate, furnished with long marginal setae, shorter than appendix interna; appendix interna elongate, with a few cincinnuli terminally.

Color in life (Fig. 3F). Ground color reddish-orange. Carapace and abdomen covered with pale spots, considerably smaller pale spots present on the dorsal surface of anterior three abdominal somites, posterior part of carapace and anterior part of third abdominal each with transverse pale band, telson and uropods pale, with red bands on proximal part, midlength, and posterior margin. Rostrum banded by red and white. Third maxilliped and pereiopods banded by red and white.

Distribution. Type locality: Banya Islet, Uvea Island, Loyalty Islands (Okuno, 1997c). Also known from numerous localities of the Indo-West Pacific (Fig. 60): **Red Sea:** Gulf of Aqaba (Okuno and Hoover, 1998); **Tanzania:** Zanzibar Island (Okuno, 1997c); **Taiwan:** Pingtung County (De Grave *et al*, in prep); **Indonesia:** Sulawesi (Okuno and Hoover, 1998); **Timor Sea:** Hibernia Reef (Okuno, 1997c); **Australia:** Queensland. Ashmore Reef (Okuno, 1997c), Lizard Island (present study); **Japan:** Izu Islands (Okuno, 1997c; Kato and Okuno, 2001), Ryukyu Islands (Okuno, 1997c, present study);

Mariana Islands: Pagan Island (Hayashi *et al*., 1994, as *Rhynchocinetes* sp.; Okuno, 1997c); **Papua New Guinea:** Madang (Okuno, 1997c); **Solomon Islands:** Florida Islands (present study); **New Caledonia:** Grotte Marlet (Okuno, 1997c); **Vanuatu:** Efate Island (present study); **Western Samoa:** Savaii (Armstrong, 1941, as *Rhynchocinetes hendersoni*; Okuno, 1997c), and **Marqueseas Islands:** Nuku Hiva (Okuno, 1997c).

Remarks. The general morphology and marbled color in life of both *Cinetorhynchus reticulatus* and *Aus hendersoni* show close similarity. Thus, it is difficult to distinguish these two species by only color phtograph such as reported on several field guidebooks without exact specimen examined. The habitat of *C. reticulatus*, however, may be deeper than that of *A. hendersoni*; *C. reticulatus* commonly inhabits at the depth of 15–30 m, instead of 1–15 m in *A. hendersoni*. This difference may be useful to identify by only photograph.

The first pereiopods of small male and female specimens are not distinctly elongated, thus, the external feature of them are closely related to that of *C. erythrostictus*. However, *C. reticulatus* is readily distinguished from the latter in having the dactyli of the ambulatory pereiopods armed with two accessory claws posterior to the preterminal unguis, whereas the dactyli of *C. erythrostictus* bear a single accessory claw posterior to the preterminal unguis.

It was represented that the specimens previously recorded from Savaii, West Samoa (Armstrong, 1941) and from Pagan Island, the northern Mariana Islands (Hayashi *et al*, 1994) were identified with *C. reticulatus* as the result of the re-examinations (Okuno, 1997c).

5-2-1-9 *Cinetorhynchus rigens* (Gordon, 1936)

(Figs. 19, 20)

Rhynchocinetes rigens Gordon, 1936: 76, figs. 1–4, 5e.

Rhynchocinetes rigens– Burkenroad, 1939: 310.

Rhynchocinetes rigens– Figueira, 1960: 1.

Rhynchocinetes rigens– Manning, 1961: 2, figs. 1, 2.

Rhynchocinetes rigens– Chace, 1972: 17.

Not *Rhynchocinetes rigens*– Fujino, 1975: 297, figs. 1–2. (= *Cinetorhynchus erythrostictus* Okuno, 1997).

Rhynchocinetes rigens– Tiefenbacher, 1976: 317 (in part).

Rhynchocinetes rigens– Bruce, 1980: 351 (in part).

Not *Rhynchocinetes rigens*– Hirata *et al*., 1988: 59, unnumbered fig. (= *Cinetorhynchus erythrostictus* Okuno, 1997).

Not *Rhynchocinetes rigens*– Kamezaki *et al*., 1988: 72, unnumbered fig. (= *Cinetorhynchus erythrostictus* Okuno, 1997).

Rhynchocinetes rigens– Wirtz *et al*., 1988: 170, fig. 3.

Rhynchocinetes rigens– Manning and Chace, 1990: 9.

Not *Rhynchocinetes rigens*– Nomura and Matsukubo, 1992: 22, figs. 1, 3. (= *Cinetorhynchus erythrostictus* Okuno, 1997).

Not *Rhynchocinetes rigens*– Okuno, 1994b: 69 (in part), figs. 3D, 4H. (= *Cinetorhynchus erythrostictus* Okuno, 1997).

Rhynchocinetes rigens– Gonzáles Pérez, 1995: 61, figs. 5, 6 in color.
Rhynchocinetes rigens– Wirtz, 1995: 98, unnumbered fig. in color.
Rhynchocinetes rigens– Chace, 1997: 28 (in key).
Cinetorhynchus rigens– Okuno, 1997c: 33, fig. 4D–F.
Cinetorhynchus rigens– Okuno and Tachikawa, 1997: 24 (in key).
Rhynchocinetes rigens– Ramos-Porto and Coelho, 1998: 328 (list).
Cinetorhynchus rigens– Udekem d'Acoz, 1999: 92.
Cinetorhynchus rigens– Debelius, 1999: 31, unnumbered figs. in color.
Cinetorhynchus rigens– de Melo, 2007: 58, figs. 1–10.
Cinetorhynchus rigens– Cardos and Young, 2007: 328, figs. 40–46.
Cinetorhynchus rigens– De Grave and Fransen, 2011: 301 (list).
Cinetorhynchus rigens– Wirtz, 2011: 8.

Material examined: EASTERN ATLANTIC: **Madeira.** USNM 156441, 3♂♂, CL 14.9–15.8 mm, detailed collection data unknown; MNHN-Na 1847, 1♂, CL 12.4 mm, 3 ovig.♀♀, CL 13.2–18.3 mm, Pontinha, Funchal, 12 September 1959, coll. A. Figueira.

CARIBBEAN SEA: **Florida.** USNM 104744, 1♂, CL 9.1 mm, Baehe Shoals, off Elliot Key, 4.5 m, 4 May 1960, coll. C. R. Robins. **Bahamas.** USNM 189007, 2♂♂, CL 14.0–14.4 mm, 1 ovig.♀, CL 16.4 mm, N of Green Cay; USNM189009, 6♂♂, CL 9.4–10.8 mm, Exuma, south end of Cave Cay, 1.8–2.4 m, 11 July 1959. **Virgin Islands.** USNM 189004, 3♂♂, CL 9.4–13.5 mm, Eagle Shoal, 10.5 m, 1 February 1961, coll. J. E. Randall.

Description. Carapace (Fig. 19A) almost glabrous, but covered with very feeble transverse striations; dorsal median carina with 3 teeth, anteriormost tooth just posterior to rostral articulation, largest, apex directed anteriorly, intermediate and posteriormost teeth feebly articulated with median carina, situated considerably posterior to level of posterior margin of orbit; supraorbital spine absent: orbit feebly developed, inferior orbital margin obsolete, terminating in antennal spine; antennal spine rather flattened, feebly carinate ventrally; pterygostomial angle rounded.

Rostrum (Fig. 19B) partially articulated with carapace, overreaching level of anterior margin of scaphocerite by distal third, 1.2–1.9 times as long as carapace, nearly horizontal proximally, anterior half sinuous dorsad, apex directed anteriorly; dorsal margin armed with two groups of teeth, proximal group consisting of 2 large teeth, proximal tooth situated slightly posterior to distal margin of cornea, distal tooth at proximal third of the length, distal group comprised of 2 (rarely 3) small subterminal teeth; ventral margin unarmed proximally, armed with 10–11 (rarely 9) teeth decreazing in size distally.

Fifth thoracic sternite armed posteriorly with a pair of acute, long median processes. Sixth somite armed posteriorly with a pair of processes, shorter and situated more laterally than those of fifth somite.

Abdominal somites (Fig. 19C) almost glabrous, but covered with very feeble oblique striations. Pleura of first to third somites broadly rounded; that of fourth somite with rounded posteroventral angle terminating in a minute process. Fifth somite with acuminate posteroventral process,

posterolateral margin of fourth and fifth somites armed with acute tooth directed obliquely ventrad. Sixth somite 0.5–0.7 times as long as carapace, midpoint of posterior margin acutely prominent posteriorly, with acute posteroventral process furnished with short dense setae; ventral surface armed with strongly hooked preanal spine. Telson (Fig. 19D) 0.6–0.7 times as long as carapace, 1.1–1.3 times as long as sixth somite, tapering posteriorly, posterior margin acuminate medially, with 3 pairs of dorsal spines on posterior half; posterior margin with 3 pairs of spines, intermediate pair longest (Fig. 19E).

Ophthalmic somite with midline slightly carinate, dorsally with elongate lobe. Eye (Fig. 19A) with large, globular cornea, maximum diameter longer than distal margin of stalk, distinct dorsal accessory pigment spot present; stalk widened, shorter than cornea.

Antennular peduncle (Fig. 19F) falling slightly short of level of midlength of rostrum. Proximal segment longer than distal two segments combined, dorsal surface moderately concave, with acute anterolateral tooth reaching level of midlength of intermediate segment, ventral surface mesially armed with a single spine; stylocerite well developed, acute, reaching level of distal articulation of the peduncle, armed proximolaterally with acute tooth; statocyst small, longitudinally oblong, with dense short setae. Intermediate segment subcylindrical, furnished with dense setae laterally and mesially. Distal segment subcylindrical, obliquely articulated with intermediate segment, ventrally with setae. Dorsal flagellum with short aesthetascs except for proximal fifth of thickened part.

Antenna with stout basicerite (Fig. 19G) armed ventrolaterally with acute tooth directed anteriorly. Scaphocerite (Fig. 19G) well developed, reaching level of distal third of rostrum, 2.6–3.2 times as long as maximum width, lateral margin almost straight, terminating in acute tooth reaching level of distomesial angle of oblique lamella, mesial margin convex. Carpocerite (Fig. 19A) stout, reaching level of midlength of scaphocerite.

Epistome unarmed.

Mouthparts typical of the family. Second maxilliped with suboval epipod; podobranch consisting of shaft only, filaments absent; dactylus narrow, with mesial margin nearly straight, densely furnished with long setae; propodus elongate, with anterior margin broadly rounded, with dense long setae; carpus subquadrate, anterolateral angle bluntly produced; mesial surface of merus, ischium, and anterior part of basis shallowly concave; exopod with well developed flagellum, basal part of lateral surface shallowly concave. Third maxilliped with endopod reaching or slightly overreaching level of distal margin of scaphocerite; ultimate segment with transverse rows of dense setae, ventrally furnished with numerous setae, 1.5–1.7 times as long as penultimate segment, terminating in corneous spine, with 1–2 distolateral and 4–6 distomesial spines: penultimate segment fringed sparsely with short setae, dorsolateral surface shallowly concave; antepenultimate segment slightly widened distally, dorsolateral surface obliquely situated; ischium short, depressed; exopod with segmented flagellum slightly overreaching level of distal margin of antepenultimate segment.

Branchial formula as shown in Table 1.

First pereiopod (Fig. 20A) robust, slightly compressed, reaching or falling slightly short of level of midlength of scaphocerite. Chela 1.3–1.9 times as long as carpus, palm 2.1 times as long as dactylus, ventral surface with rows of dense short grooming setae with setules; dactylus (Fig. 20B) arched, without denticulation on cutting edge, terminating in set of ungues, distal margin of corpus densely

furnished with long setae; fixed finger (Fig. 20B) without denticulation on cutting border, tapering distally, proximal half of the border with row of long setae, midpoint of lateral surface with tuft of dense short setae, terminating in set of ungues distinctly demarcated from corpus. Carpus with distal margin truncate, ventrolateral surface slightly oblique. Merus 1.2 times as long as carpus, obliquely articulated with ischium. Coxa unarmed.

Second pereiopod (Fig. 20C) slender, slightly compressed, reaching or slightly overreaching level of midlength of scaphocerite. Chela with palm 2.6–3.2 times as long as dactylus; dactylus (Fig. 20D) slightly arched, without denticulation on cutting border, terminating in set of ungues, distal surface of corpus with tuft of long dense setae; fixed finger (Fig. 20D) without denticulation but densely furnished with long setae on cutting border, terminating in set of ungues, longest unguis subequal to corpus in length. Carpus 1.2–1.6 times as long as chela, 1.3–1.4 times as long as merus, distal margin bluntly produced distoventrally, with sparse setae. Merus obliquely articulated with ischium. Coxa unarmed.

Ambulatory pereiopods slender. Third pereiopod (Fig. 20E) overreaching apex of scaphocerite by distal third of propodus and dactylus. Coxa unarmed. Ischium armed with 1 lateral and 1 ventral spines. Merus 2.0–2.5 times as long as carpus, armed with 4–5 (rarely 6) lateral spines (distal spine near distal margin) and 1–2 (rarely 3) ventral spines. Carpus armed with 1–3 (usually 1) lateral spines, with dorsodistal angle produced anteriorly. Propodus 1.6–2.0 times as long as carpus, ventral surface armed with row of small spines, dorsal surface densely furnished with short setae. Dactylus (Fig. 20F) biunguiculate, ungues distinctly demarcated from corpus, flexor margin armed with a single small accessory spine. Fourth pereopod slightly overreaching apex of scaphocerite by length of dactylus, similar to third pereopod in armature and proportion. Fifth pereiopod slightly overreaching level of midlength of scaphocerite. Ischium unarmed. Merus 1.3–1.8 times as long as carpus. Armature similar to those of anterior two ambulatory pereiopods.

Endopod of first pleopod (Fig. 20G) generally oblong, tapering distally, laterally furnished with short dense setae, distal margin entire, without setae; appendix interna well developed, proximally broad, distal part almost perpendicular, demarcated from proximal part, with a few cincinnuli terminally.

Endopod of second pleopod (Fig. 20H) with appendices masculina and interna arising from three sevenths of mesial margin; appendix masculina oblong, furnished with long marginal setae, shorter than appendix interna; appendix interna elongate, with a few cincinnuli terminally.

Uropod (Fig. 19D) with protopodite posterolaterally acute. Both exopod and endopod reaching level of tip of telson; exopod with lateral margin straight, terminating in acute tooth, mesially with movable spine longer than the terminal tooth; endopod slender, slightly tapering distally.

Color in life. Ground color pinkish white. Carapace and anterior part of first abdominal somite covered with red spots densely, those on posterolateral surface larger than other parts. Rostrum uniformely red except for white apex. First to fifth abdominal somites with transeverse somewhat undulate red bands on each posterior margin, band on second somite covered with narrow transeverse white midline, that of third somite becoming broad at tergum, forming large red patch in dorsal view. Telson and uropod with transverse red red band contonuing to sixth abdominal somite. Third maxilliped vermilion. First pereiopod uniformely red, with white patch on distal margin of carpus,

dactylus vermilion. Ambulatory pereiopods with meri with red, proximally with white bands, carpi and propodi vermilion.

Distribution. Type locality: Madeira, eastern Atlantic (Gordon, 1936). Also known from several localities from both eastern and western Atlantic (Fig. 61): **Bermuda** (Burkenroad, 1939); **Azores** (Figueira, 1960); **Florida** (Manning, 1961); **Bahama** (Manning, 1961); **Birgin Islands** (Manning, 1961); **Cozmel** (Tiefenbacher, 1976); **Canary Islands** (Tiefenbacher, 1976); **Ascension Island** (Manning and Chace, 1990); **Capo Verde Islands** (Wirtz *et al*., 1988); **Brazil** (Ramos-Porto and Coelho, 1998; de Melo, 2007; Cardos and Young, 2007), and **Senegal** (Wirtz, 2011).

Remarks. *Cinetorhynchus rigens* was originally described as *Rhynchocinetes rigens* by Gordon (1936) on the basis of the specimens from Madeira, eastern Atlantic. This type species of the genus *Cinetorhynchus* has been re-described in detail by de Melo (2007) and Cardos and Young (2007) based on the specimens from Brazil. The specimens examined here consist of the topotypic mateial from Madeira and those studied by Manning (1961). There is no significant difference between the present specimens and previous descriptions.

5-2-1-10 *Cinetorhynchus striatus* (Nomura and Hayashi, 1992)

(Fig. 3G, 21)

Rhynchocinetes sp.– Debelius, 1983: 68, fig. unnumbered.

Rhynchocinetes sp.– Debelius, 1984: 68, fig. unnumbered.

Rhynchocinetes sp.– Kamezaki *et al*, 1988: 74, fig. unnumbered.

Rhynchocinetes hiatti– Coleman, 1991: 104, fig. unnumbered. Not *Rhynchocinetes hiatti* Holthuis and Hayashi, 1967.

Rhynchocinetes striatus Nomura and Hayashi, 1992: 199, figs. 1-4.

Rhynchocinetes striatus– Okuno, 1994b: 69 (in part), figs. 3E, 4F.

Rhynchocinetes striatus– Okuno, 1995: 3, fig. 4. in color.

Rhynchocinetes striatus– Gosliner *et al*., 1996: 218, fig. 790 in color.

Rhynchocinetes striatus– Chace, 1997: 28 (in key).

Cinetorhynchus striatus– Okuno, 1997c: 46, pl. 1E in color.

Cinetorhynchus striatus– Okuno and Tachikawa, 1997: 24 (in key).

Cinetorhynchus striatus– Okuno, 1998: 5, fig. 8 in color.

Cinetorhynchus striatus– Hayashi, 1999b: 220, figs. 369g, i, 371b, 372b, 374c, d.

Cinetorhynchus striatus– Minemizu, 2000: 34, unnumbered fig. in color.

Cinetorhynchus striatus– Halstead, 2000: 280, unnumbered fig. in color.

Cinetorhynchus striatus– Debelius, 2001: 253, unnumbered fig. in color.

Cinetorhynchus striatus– Davie, 2002: 373 (list).

Cinetorhynchus striatus– Paulay *et al*., 2003: 486 (list).

Cinetorhynchus striatus– Laboute and Recher de Forges, 2004: 380, unnumbered fig. in color.

Cinetorhynchus striatus– Hayashi, 2007: 107, figs. 43g, i, 45b, 46b, 47, 49c, d.

Cinetorhynchus striatus– Humann and DeLoach, 2010: 140, unnumbered fig. in color.

Cinetorhynchus striatus– De Grave and Fransen, 2011: 301 (list).

Material Examined: Japan. Amami Islands. YCM-CM 977, 1♂, CL 8.7 mm, Nishikomi, Amami-Ohshima Island, 15 m, 31 August 1993, coll. J. Okuno.— Ryukyu Islands. NSMT-Cr 2170, 1 ♂, CL 16.9 mm, Shoudoukutsu, Ie-shima Island, 26º42.9'N, 127º50.1'E, 20 m, 26 May 1993, coll. J. Okuno; NSMT-Cr 2171, 1♀, 2 ovig.♀♀, CL 19.3–20.7 mm, same locality as NSMT-Cr 2170, 18 m, 26 May 1993, coll. J. Okuno; NSMT-Cr 2037, 1♂, CL 20.3 mm, Aja, Naha, Okinawa Island, 26º14.2'N, 137º40.2'E, 1 m, 3 March 1993, coll. S. Ohashi; NSMT-Cr 2192, 3 ovig.♀♀, CL 21.0–22.5 mm, same locality as NSMT-Cr 2037, 23 May 1993, coll. S. Ohashi and J. Okuno; NSMT-Cr 2159, 1 ovig.♀, CL 18.8 mm, Hizushi-hama, Aka-jima Islet, Kerama Group, 26º11.2'N, 137º16.8'E, 3 m, 18 May 1993, coll. T. Hayashibara; CMNH-ZC 00643, 1♂, CL 17.4 mm, "Deepkiss dropp", Kume-jima Island, 35 m, 21 December 2001, coll. J. Okuno and A. Shioiri; SUF 530-2-1360, 1♂(paratype of *Rhynchocinetes striatus*), CL 16.5 mm, SUF 530-2-1361, 1♀(paratype of *R. striatus*), CL 18.3 mm, CMNH-ZC 00097, 1♂(paratype of *R. striatus* former YMP-553), CL 9.9 mm, Hori Port, Kuro-shima Islet, Yaeyama Group, 28 June 1987, coll. K. Nomura; SUF 530-2-1362, 1♀(paratype of *R. striatus*), CL 13.2 mm, same locality as SUF 530-2-1360, 27 November 1987, coll. K. Nomura; SUF 530-2-1682, 2♂♂, CL 11.5, 13.2 mm, Unari-zaki, Iriomote-jima Island, Yaeyama Group, 10 m, 5 September 1982.

Philippines. Visaya Islands. BPBM S11283, 1 ovig.♀, CL 18.5 mm, west side of Sumilon Island, east side o southern end of Cebu Island, 25 m, cave, 3 June 1981, coll. J. Randall, K. E. Carpenter and M. J. Ganel.

Fiji. CMNH, 1♂, CL 10.5 mm, NW of Dravuni Island, Great Astrolabe Reef, 18º46.862'S, 178º27.852'W, 7 m, 27 November 1996, coll. S. Ohashi, S. Kinjo and T. Kase.

Australia. AM P21096, 1♂, CL 10.8 mm, One Three Island, Capricorn Group, Queensland, 23º30'S, 152º05'E, 14 m, 6 October 1971, coll. Talbot, Hoese, Moore and Hutchings.

New Caledonia. MNHN-Na 12955, 1♂, 4 ovig.♀♀, CL 10.8–19.4 mm, Côte est, Récif Ana, 21º22.2'S, 165º56.4'E, 3–10 m, 11 September 1989, coll. J. L. Menou.

Description. Carapace (Fig. 21A) almost glabrous, but covered with very feeble transverse striations; dorsal median carina with 3 teeth, anteriormost tooth just posterior to rostral articulation, largest, apex directed feebly obliqure dorsally, intermediate and posteriormost teeth feebly articulated with median carina, situated considerably posterior to level of posterior margin of orbit; supraorbital spine absent: orbit feebly developed, inferior orbital margin obsolete, terminating in antennal spine; antennal spine rather flattened, feebly carinate ventrally; pterygostomial angle rounded.

Rostrum (Fig. 21B) partially articulated with carapace, overreaching level of anterior margin of scaphocerite bymidlength, 1.5–2.4 times as long as carapace, nearly horizontal proximally, anterior half srongly sinuous dorsad, apex directed upward dorsally; dorsal margin armed with two groups of teeth, proximal group consisting of 2 large teeth, proximal tooth situated slightly posterior to distal margin of cornea, distal tooth at proximal fifth of the length, distal group comprised of 2 (rarely 3) small subterminal teeth; ventral margin unarmed proximally, armed 11–14 (usually 12–13) teeth decreasing in size distally.

Abdominal somites (Fig. 21C) almost glabrous, but covered with very feeble oblique striations.

Pleura of first to third somites broadly rounded; that of fourth somite with rounded posteroventral angle terminating in a minute process. Fifth somite with acuminate posteroventral process; posterolateral margin of fourth and fifth somites armed with acute tooth directed obliquely ventrad. Telson tapering posteriorly, posterior margin acuminate medially, with 3 pairs of dorsal spines on posterior half; posterior margin with 3 pairs of spines, intermediate pair longest.

Ophthalmic somite with midline slightly carinate, dorsally with elongate lobe. Eye (Fig. 21A) with large, globular cornea, maximum diameter longer than distal margin of stalk, distinct dorsal accessory pigment spot present; stalk widened, shorter than cornea.

Antennular peduncle (Fig. 21D) reaching level of proximal third of rostrum. Proximal segment longer than distal two segments combined, dorsal surface moderately concave, with acute anterolateral tooth reaching level of proximal third of intermediate segment, ventral surface mesially armed with a single spine; stylocerite well developed, acute, reaching level of distal end of ultimate segment, armed proximolaterally with acute tooth; statocyst small, longitudinally oblong, with dense short setae. Intermediate segment subcylindrical, furnished with dense setae laterally and mesially. Distal segment subcylindrical, obliquely articulated with intermediate segment, ventrolaterally with setae. Dorsal flagellum with short aesthetascs except for proximal third of thickened part.

Antenna with stout basicerite (Fig. 21A) armed ventrolaterally with acute tooth directed anteriorly. Scaphocerite (Fig. 21E) considerably broad, 0.7–0.8 times as long as carapace, 2.4–3.5 times as long as its maximum width, distolateral spine falling distinctly short of tip of lamella. Carpocerite (Fig. 21A) stout, falling slightly short of level of midlength of scaphocerite.

Mouthparts typical of the family. Second maxilliped with well-developed podobranch. Third maxilliped with endopod reaching distal third of scaphocerite; ultimate segment with transverse rows of dense setae, ventrally furnished with numerous setae, 1.2–1.4 times as long as penultimate segment, terminating in corneous spine, with 2 distolateral and 4–5 distomesial spines: penultimate segment fringed sparsely with short setae, dorsolateral surface shallowly concave; merus slightly widened distally, dorsal surface obliquely situated; ischium short, depressed; exopod with segmented flagellum reaching level of midlength of antepenultimate segment.

Branchial formula as shown in Table 1.

First pereiopod robust, slightly compressed, reaching or falling slightly short of level of midlength of scaphocerite. Chela 1.3–1.7 times as long as carpus, palm 2.0–2.1 times as long as dactylus, ventral surface with rows of dense short grooming setae with setules; dactylus arched, without denticulation on cutting edge, terminating in set of ungues, distal margin of corpus densely furnished with long setae; fixed finger without denticulation on cutting border, tapering distally, proximal half of the border with row of long setae, midpoint of lateral surface with tuft of dense short setae, terminating in set of ungues distinctly demarcated from corpus. Carpus with distal margin truncate, ventrolateral surface slightly oblique. Merus 1.0–1.2 times as long as carpus, obliquely articulated with ischium. Coxa unarmed.

Second pereiopod slender, slightly compressed, reaching level of midlength of scaphocerite. Chela with palm 2.0–3.0 times as long as dactylus; dactylus slightly arched, without denticulation on cutting border, terminating in set of ungues, distal surface of corpus with tuft of long dense setae; fixed finger without denticulation but densely furnished with long setae on cutting border, terminating in set

of ungues, longest unguis subequal to corpus in length. Carpus 1.5–1.8 times as long as chela, 1.5–1.6 times as long as merus, distal margin bluntly produced distoventrally, with sparse setae. Merus obliquely articulated with ischium. Coxa unarmed.

Ambulatory pereiopods considerably slender, with dactyli (Fig. 21G) biunguiculate, armed with two accessory claws posterior to preterminal unguis. Third pereiopod (Fig. 21F) overreaching tip of scaphocerite by distal third of propodus; merus with 5–8 (usually 5–6, rarely 11) spines on outer surface, 2–6 (usually 3-4) spines on ventral margin; carpus slender, with 2–4 (usually 2) spines on outer surface. Fourth pereiopod slightly beyond tip of scaphocerite; merus with 5–7 (usually 5–6) spines on outer surface, 1–4 (usually3) spines on ventral margin; carpus with 2-3 spines on outer surface. Fifth pereiopod subequal to tip of scaphocerite; merus with 4–6 (usually 5) spines on outer surface, 1–3 (usually 2) spines on ventral margin; carpus with 2–3 (usually2) spines on outer surface, rarely unarmed.

Uropod with protopodite posterolaterally acute. Both exopod and endopod reaching level of tip of telson; exopod with lateral margin straight, terminating in acute tooth, mesially with movable spine longer than the terminal tooth; endopod slender, slightly tapering distally.

Color in life (Fig. 3G). Ground color whitish translucent. Carapace with somewhat obliquely transverse red band posterolaterally. Abdomen with 8 transverse red bands, that on third somite broadest, sixth band on the sixth abdominal somite inconspicuous ventrally, telson and uropods red, proximal two thirds and pre-terminal part each with transverse white band. Rostrum with white apex, red-white bands in length. Third maxilliped and pereiopods marbled with red and white.

Distribution. Type locality: Kadena Port, Okinawa Island, Ryukyu Islands, Japan (Nomura and Hayashi, 1992). Presently also known from Visaya Islands, Philippines (Okuno, 1997c), Queensland, Australia (present study), Great Astrolabe Reef, Fiji (present study) and New Caledonia (Okuno, 1997c) (Fig. 60). Usually found at rocky reef of 1–20 m depth.

Remarks. The present species was first reported as *Rhynchocinetes* sp. on popular publication (Debelius, 1983). By the striking color pattern with red ground color and white transverse bands on the carapace abdominal somites, it could be readily recognized as an undescribed species. Later, on the basis of the specimens from the Ryukyu Islands, southern Japan, Nomura and Hayashi (1992) described this species as new to science under the name of *Rhynchocinetes striatus*.

Morphologically, *Cinetorhynchus striatus* is distinguishable from other congeneric species by the terminal acute tooth of external margin of scaphocerite falling short of distal margin of lamella. The records from Australia and Fiji based on the actual specimens are for the first time.

5-2-2 Genus *Aus* gen. nov.

Type species. *Rhynchocinetes hendersoni* Kemp, 1925, present designation.

Diagnosis. Carapace without supraorbital spine, armed with three spines on median carina, antennal spine situated at tip of inferior orbital margin, feebly carinate ventrally, pterygostomial spine present or absent. Rostrum articulated partially with carapace, immovable. Fifth abdominal somite with triangular posterolateral acute tooth. First pereiopod with considerably elongated palm, subchela in mature male, with coxa armed with a reef-like corneous projection. Ambulatory pereiopods

somewhat compressed, with coxa of third pereiopod armed with a single spine.

Distributional range. Widespread from Red Sea to Pacific coast of Colombia, north to Japan, south to Austral Islands.

Ecology. The type species, *Aus hendersoni* hides in rocky crevices and submarine caves by day and feeds actively on the surface of rocky reefs at night (Okuno, 1993).

Remarks. Monod (1972) recorded 3 males, 1 female and 2 ovigerous females from the New Caledonian waters as *Rhynchocinetes hiatti*. Tiefenbacher (1976) re-examined these specimens as well as the Fijian specimen recorded by Kemp (1925), and corrected Monod's (1972) identification as *R. hendersoni*. He first indicated the presence of a corneous projection on the coxa of the first pereiopod in the present taxon (Tiefenbacher, 1976). Okuno (1997C) additionally found a developed spine on the coxa of third pereiopod of *Cinetorhynchus hendersoni*. Through the family Rhynchocinetidae, the possessing the coxal projection and spine on the pereiopods is the unique structure. Therefore, in this study, these morphological features are re-evaluated as the diagnostic characters as generic rank.

At present, this genus contains a single species, *A. hendersoni*. However, it possibly shows the taxonomic complex, thus, it is required that the taxonomic relationship among *A. hendersoni*, *Rhynchocinetes intermedius* and *R. marshallensis* is reconfirmed (see"Remarks" section of *A. hendersoni*).

5-2-2-1 *Aus hendersoni* (Kemp, 1925) comb. nov.

(Figs.3H, 22)

Rhynchocinetes rugulosus– Henderson, 1893: 438. Not *Rhynchocinetes rugulosus* Stimpson, 1860.

Rhynchocinetes rugulosus– Thurston, 1895: 120. Not *Rhynchocinetes rugulosus* Stimpson, 1860.

Rhynchocinetes hendersoni Kemp, 1925: 265, figs. 3–5, 7.

? *Rhynchocinetes hendersoni*– Boone, 1935: 109, pls. 28–29.

Rhynchocinetes hendersoni– Gordon, 1936: 82.

Not *Rhynchocinetes hendersoni*– Armstrong, 1941: 12 (= *Cinetorhynchus reticulatus* Okuno, 1997).

Rhynchocinetes hendersoni– Holthuis, 1947: 80.

Rhynchocinetes intermedius Edmondson, 1952: 72, fig. 3.

Rhynchocinetes marshallensis Edmondson, 1952: 75, figs. 4–6.

Rhynchocinetes hendersoni– McNeill, 1968: 18.

Rhynchocinetes rugulosus– Fujino, 1975: 300. Not *Rhynchocinetes rugulosus* Stimpson, 1860.

Rhynchocinetes hiatti– Monod, 1972: 15, figs. 27–64. Not *Rhynchocinetes hiatti* Holthuis & Hayashi, 1967.

Rhynchocinetes hiatti– Miyake, 1975: 105, unnumbered fig. in color. Not *Rhynchocinetes hiatti* Holthuis and Hayashi, 1967.

Rhynchocinetes hendersoni– Bruce, 1976: 4.

Rhynchocinetes hendersoni– Tiefenbacher, 1976: 318 (in part).

Rhynchocinetes rigens– Tiefenbacher, 1976: 317. Not *Rhynchocinetes rigens* Gordon, 1936.

Rhynchocinetes hiatti– Takeda, 1982: 35, unnumbered fig. in color. Not *Rhynchocinetes hiatti* Holthuis and Hayashi, 1967.

Rhynchocinetes hendersoni– Debelius, 1983: 76, unnumbered fig. in color.

Rhynchocinetes sp.–Debelius, 1983: 68, unnumbered fig. in color.

Rhynchocinetes hendersoni– Debelius, 1984: 76, fig. unnumbered.

Rhynchocinetes hendersoni– Kamezaki *et al*, 1988: 70, fig. unnumbered.

Rhynchocinetes hendersoni– Suzuki, 1992: 25, fig. 1.

Rhynchocinetes hendersoni– Okuno, 1993: 4, figs. 1-4 in color.

Rhynchocinetes hendersoni– Okuno, 1994b: 69 (in part), figs. 3B, 4E.

Rhynchocinetes hendersoni– Hayashi, 1995: 302, pl. 85, fig. 2 in color.

Rhynchocinetes hendersoni– Gosliner *et al*., 1996: 217, fig. 787 in color.

Rhynchocinetes hendersoni– Chace, 1997: 27 (in key).

Cinetorhynchus hendersoni– Okuno, 1997c: 46–49, pl. 1F, figs. 9, 12D–F in color.

Cinetorhynchus hendersoni– Okuno and Tachikawa, 1997: 24 (in key).

Cinetorhynchus hendersoni– Okuno and Hoover, 1998: 40.

Cinetorhynchus hendersoni– Okuno, 1998: 6, figs. 9–10 in color.

Cinetorhynchus hendersoni– Poupin, 1998: 10 (list).

Cinetorhynchus hendersoni– Hoover, 1998: 237, unnumbered fig. in color.

Cinetorhynchus hendersoni– Hayashi, 1999a: 148, figs. 367d, 369d, h, 370d, i

Cinetorhynchus hendersoni– Minemizu, 2000: 35, unnumbered figs. in color.

Cinetorhynchus hendersoni– Davie, 2002: 372 (list).

Cinetorhynchus hendersoni– Paulay *et al*., 2003: 486 (list).

Cinetorhynchus hendersoni– Hayashi, 2007: 103, figs. 42d, 43d, h, 44d, i.

Cinetorhynchus hendersoni– Itaki, 2009: 302, fig. 2F in color.

Cinetorhynchus hendersoni– De Grave and Fransen, 2011: 301(list).

Cinetorhynchus hendersoni– Humann and DeLoach, 2010: 140, unnumbered fig. in color.

Cinetorhynchus hendersoni– Itaki, 2012: 232, figs. 1C, D in color.

Material Examined: WESTERN PACIFIC. **Japan.** Honshu. NSMT-Cr 1702, 3♂♂, CL 10.8–12.3 mm, Kawana Harbor, Ito, Izu Peninsula, 34º57.1’N, 139º08.3’N, 1 m, 29 July 1992, coll. H. Yamada; NSMT-Cr 1717, 2♂♂, CL 10.3, 12.4 mm, NSMT-Cr 1755, 1♂, CL 9.5 mm, NSMT-Cr 1812, 1♂, CL 10.9 mm, same locality as NSMT-Cr 1702, 17 August 1992, coll. H. Yagi; CL; SUF, 1♂, CL 12.1 mm, Enashi, Numazu, NW coast of Izu Peninsula, Suruga Bay, 7 m, 22 June 1983, coll. Y. Maihara; CMNH-ZC Osezaki, coll. R. Minemizu.— Kyushu. KUMBcr 1046–1052, 2♂♂, CL 11.2, 13.9 mm, 5 ♀♀, CL 9.9–14.0 mm, Kagoshima Bay, 14 June 1992.— Ryukyu Islands. NSMT-Cr 2191, 5♂♂, CL 6.8–13.1 mm, 2♀♀, CL 8.5, 9.9 mm, 2 ovig.♀♀, CL 10.4, 13.2 mm, 26º14.2’N, 127º40.2’E, Naha Harbor, Okinawa Island, 1 m, 23 May 1993, coll. S. Ohashi and J. Okuno; NSMT-Cr 2193, 1 ovig.♀, CL 10.5 mm, sama data as NSMT-Cr 2191; NSMT-Cr 1939, 1♀CL 6.2 mm, Kuro-shima Islet, Yayeama Group, 14 August 1993, coll. M. Osawa.

Taiwan. Keelung City. NTOU-M00680, 2 ovig.♀♀, CL 8.5, 10.3 mm, Badouzih, 28 May 1984, coll. T.-Y. Chan; NTOU-M00681, 1♂, CL 9.9 mm, NTOU-M00682, 1♂, CL 10.6 mm, same locality as NTOU-M00680, 24 May 1984, coll. T.Y. Chan; NTOU-M00898, 4♂♂, CL 8.9–10.7 mm, 9♀♀, CL 9.7–10.5 mm, Bachihmen, 7 June 1984; NTOU-M00684, 3♂♂, CL 7.7–9.5 mm, 3 ovig.♀♀, CL 8.0–10.4 mm, same locality as NTOU-M00898, Oct 1994, coll. C.-S. He; NTOU M00683, 2♂♂, CL

7.4, 10.1 mm, 2 ovig.♀♀, CL 8.8, 9.4 mm, same locality as NTOU-M00898, 9 December 1994, coll. C.-S. He; NTOU M00910, 1♂, CL 9.8 mm, 6♀♀, CL 6.9–9.9 mm, 2 damaged specimens, CL 9.2, 10.4 mm, same locality as NTOU-M00898; NTOU M00688, 2♂♂, CL 9.9, 11.8 mm, 2 ovig.♀♀, CL 8.3, 9.7 mm, same locality as NTOU-M00898, 28 June.— Pingtung County. NTOU M00897, 7♂♂, CL 7.2–11.4 mm), 3♀♀, CL 9.4–13.0 mm, 2 ovig.♀♀, CL 8.17, 11.02 mm, 7 juvs., CL 4.0–7.1 mm, Nanwan, 1994; OUMNH 2009-23-0006, 1♂, CL 8.3 mm, Houpihu Township, Kending, 25 July 2009, coll. S. De Grave.

Hawaii. Oahu Island. BPBM 5766, 1♂(syntype of *Rhynchocinetes intermedius*), CL 12.6 mm, southwest coast, fish trap, 5 April 1950, coll. S. W. Tinker; BPBM S5635, 1 ovig.♀(syntype of *R. intermedius*), CL 10.2 mm, same data as BPBM 5766.— Hawaii Island. ULL, 14♂♂, CL 6.2–7.5 mm, 1♀, CL 5.3 mm, Coconut Island, 19º43’46”N, 155º04’07”E, 2–5 m, 19–20 March 2010; ULL, 47♂♂,. CL 5.5–9.6 mm, 17♀♀, CL 5.6–9.4 mm, Coconut Island, 19º43’46”N, 155º04’07”E, 2–5 m, 19–20 March 2010.

Marshall Islands. Enewetok Atoll. BPBM 5637, 1♂(holotype of *Rhynchocinetes marshallensis*), CL 8.8 mm, detailed collection site unknown, 13 April 1949, coll. S. W. Tinker.

Gilbert Islands. AM P20000, 1♂, CL 8.7 mm, Abaiang Atoll, Teiro Island, 7 m, 6 November 1973, coll. B. Goldman.

Line Islands. BPBM S8481, 1♂, CL 5.0 mm, coral reef ner middle of lagoon, Fanning Island, 6–7.5 m, 29 October 1968, coll. J. Randall.

Singapore. SMF, 1♂, CL 11.3 mm, detailed site unknown, 8 August 1979.

Papua New Guinea. AM P17995, 1♂, CL 9.0 mm, Northwest Bay, Manubada Island, Port Moresby, 24 June 1970, coll. B. Goldman.

New Caledonia. MNHN-Na 12952, 1 ovig.♀, CL 8.8 mm, Récif Lareignère, 3–12 m, 4 September 1991, coll. J. L. Menou; MNHN-Na 12954, 1♂, CL 10.6 mm, Côte est, Récif Ana, 21º22.2’S, 165º56.4’E, 3–10 m, 11 September 1989, coll. J. J. Menou; MNHN-Na 12951, 2♂♂, 1 ovig.♀, CL 7.4-8.9 mm, same data as MNHN-Na 12954; MNHN-Na 12949, 1♂, CL 8.4 mm, N. O. “Alis”, Campagne Halipro 1, Baie Laugier, SCUBA, March 1994, coll. Danigo.

Loyalty Islands. Uvea Island. MNHN-Na 12950, 1♂, CL 9.6 mm, Pléiades du Nord, 4 m, 17 November 1991, coll. J. P. Menou; MNHN-Na 12953, 1 ovig.♀, CL 9.6 mm, Bagat Islet, 9–11 m, 18 November 1991, coll. J. P. Menou.

Australia. Queensland. NTM. Cr. 003619, 3♂♂, CL 7.0–7.7 mm, Heron Island, Capricorn Group, 23.25ºS, 151.55ºE, 23 October 1976, coll. A. J. Bruce; AM P18533, 3♂♂, CL 6.7–9.6 mm, One Three Island, Capricorn Group, 23º30’S, 152º05’E, 5 October 1971; AM P16205, 2♂♂, 3 ovig.♀♀, 1♀, CL 5.4–6.9 mm, Low Isles, off Port Douglass, 16º32’S, 145º29’E, coll. British Great Barrier Reef Expedition.

Tonga. NTM. Cr. 004252, 1ovig.♀, CL 12.3 mm, Nukualofa, Tongatapu Island, 0.5–1 m, 12 September 1986, coll. M. Richmond.

Austral Islands. Rapa Island. BPBM S8590, 2♂♂, CL 7.8, 8.5 mm, east side of Akamiro Bay, 4–7.5 m, 8 February 1971, coll. J. Randall and D. Connoy; MNHN-Na 12964, 1♂, CL 11.7 mm, detailed collection site unknown, 2 m, in 1995, coll. J. Poupin.

INDIAN OCEAN. **Tanzania.** NTM. Cr. 003621, 1♂, CL 8.9 mm, Pange Reef, Zanzibar Island, 6–8

m, 8 July 1976, coll. B. Benbow.

RED SEA. **Egypt.** RMNH D47814, 1♂, CL 11.0 mm, Et Tur, Sinai coast of Gulf of Suez, 9–12 September 1968; RMNH D47813, 3♂♂, 5 ovig. ♀♀, CL 5.0-8.6 mm, Manta Cliff between Landing Bay and Ras Papenfuss, 0-5 m, 7 April 1962.

EASTERN PACIFIC. **Colombia**. AHF, 1♂, CL 6.1 mm, Ensenada de Utria, 20 July 1981, coll. Heary von Praul.

Description. Carapace (Fig. 22A) usually with small pterygostomial spine, rarely absent. Rostrum (Fig. 22B) usually straight, slightly upward obliquely, 1.0–1.8 times as long as carapace, armed dorsally with 2 large teeth proximally, 1–2 (usually 2) samll teeth subterminally, armed ventrally with 7–11 (usually 8–9) acute teeth decreasing in size distally; lateral carina indistinct, reaching proximal quartor of rostrum, continuous with upper orbital margin through the level of the middepth of rostrum proximally.

Fourth abdominal somite with posterolateral margin armed with an acute tooth directed posteriorly, but rarely unarmed. Fifth somite armed constantly with an acute tooth posterolaterally, directed posteriorly.

Antennular peduncle (Fig. 22C) usually reaching midlength of rostrum, rarely proximal third of rostrum, inner margin of proximal segment armed ventrally with an acute tooth; stylocerite falling slightly short of distal end of intermediate segment.

Scaphocerite 0.7–0.9 times as long as carapace, 3.1–4.1 times as long as its maximum width, distolateral spine reaching or overreaching tip of lamella.

Mouthparts typical of the family. In female and small male, third maxilliped reaching proximal two thirds of scaphocerite; in large male, third maxilliped reaching rostral apex.

Branchial formula as shown in Table 1.

In female and small male, first pereiopod usually reaching midlength of scaphocerite, coxa with a corneous projection acutely pointed or bifid distally; in large male, first pereiopod distinctly elongated and stout (Fig. 22D), overreaching level of rostral apex by carpopropodial articulation, coxa with a lobate corneous projection (Fig. 22E), chela with palm more or less arched, strongly compressed distally, covered with fine glanules at lower margin, 2.1–2.3 times as long as carapace, dactylus strongly curved directed ventrally, forming subchela.

Second pereiopod usually reaching level of midlength of scaphocerite.

Ambulatory pereiopods more or less stout, meri slightly compressed, each dactylus (Fig. 22H) biunguiculate, armed with two accessory claws posterior to preterminal unguis. Third pereiopod (Fig. 22F) reaching proximaltwo thirds of scaphocerite; coxa with an acutely pointed spine distally (Fig. 22G); merus with 3–7 (usually 4–5) articulated spines on outer surface, 2–5 (usually 3) articulated spines on ventral margin; carpus with 2 (rarely 1) articulated spines on outer surface. Fourth pereiopod usually reaching midlength of scaphocerite; coxa without spine; merus with 3–6 (usually 4) articulated spines on outer surface, 1–4 (usually 3) articulated spines on ventral margin; carpus with 2–3 (rarely 0 or 1) articulated spines on outer surface. Fifth pereiopod reaching proximal third of scaphocerite; coxa without spine; merus with 2–5 (usually 3) articulated spines on outer surface, 1–3 (usually 2) articulated spines on ventral margin; carpus with 2 articulated spines on outer surface.

Color in life (Fig. 3H). Ground color gray, more or less translucent. Carapace mottled by pale brown to red markings. Rostrum banded by red and white, apex white. Abdominal somites generally with pale brown to red undulate lines, sixth somite without conspicuous marks. Telson with white transverse band at posterior third. Third maxilliped and pereiopods banded by red and white.

Distribution. Type locality: Pamban and Kilakarai, Gulf of Manaar, Indian Ocean (Kemp, 1922). Known from various localities from Indo-Pacific (Fig. 58): **Red Sea:** Gulf of Suez (Okuno and Hoover, 1998); **Tanzania:** Zanzibar Island (Okuno, 1997c); **Singapore:** Singapore (Okuno, 1997c); **Taiwan:** Keelung City (De Grave *et al*., in prep), Pingtung County (De Grave *et al*., in prep); **Australia:** Queensland. Port Douglass (McNeil1, 1968), Heron Island (Okuno, 1997c), One Three Island (present study); **Japan:** Honshu (Nomura and Hayashi, 1992; Okuno, 1993, 1997c), Kyushu (Okuno, 1997c), Ryukyu Islands (Okuno, 1997c); **Marshall Islands:** Eniwetok Atoll (Edmondson, 1952, as *Rhynchocinetes marshallensis*, Okuno, 1997c); **Papua New Guinea:** Poer Moresby (present study); **Loyalty Islands:** Maré (Monod, 1972, as *Rhynchocinetes hiatti*), Uvea Island (Okuno, 1997c); **New Caledonia:** Nouméa (Monod, 1972, as *Rhynchocinetes hiatti*), Récif Lareignere, Récif Ana, Baie Laugier (Okuno, 1997c); **Tonga:** Tongatapu Island (Okuno, 1997c); **Gilbert Islands:** Abaiang Atoll (present study); **Line Islands:** Funning Island (Okuno, 1997c); **Austral Islands**: Rapa Island (Okuno, 1997c); **Hawaii:** Oahu (Edmondson, 1952, as *Rhynchocinetes intermedius*, Okuno, 1997c), and **Colombia:** Ensenada de Utria (present study).

Remarks. This species was originally described by Kemp (1925) on the basis of a male and a female specimens from Pamban and Kilakarai of the Gulf of Mannar, central Indian Ocean. The present specimens can be identical with the Kepm's (1925) species by the combination of the shorter rostrum, the shorter stylocerite and the carpal spination of the third pereiopod. Although I could not confirm the presence or absence of corneous structure on the coxae of the first and third pereiopods in the type specimens, which have been deposited in the Zoological Survey of India (Boone, 1935), I regard these features as the distinguishing characters of *Aus hendersoni*. In this study, the western Pacific individuals was carefully compared with those from the coast of Colombia, the Eastern Pacific. But there is no significant differences between them, thus, the present species is regarded as a widely distirbuted species to ignore the Eastern Pacific Barrier.

The pterygostomial angle is typically armed with a small spine, but some specimens are lacking of it. The form of the posterolateral spine of the fourth abdominal somite is also variable, typically acute, but completely absent in some specimens. These differences were without reference to the sex, the development and the geographic form, and the sexual dimorphism appeared within the mature male specimens was represented by the distinctly elongated first pereiopod with subchela, described above. The specimens from the lower latitude form the dimorphism in smaller size than those from the higher latitude.

Through the courtesy of Dr. Raymond T. Bauer of the University of Louisiana, Lafayette, I was able to examine numerous specimens closely related to *Aus hendersoni* from the Hawaiian Islands. The specimens are divided into two forms; one has the elongate carpus of first pereiopod in the mature male (slender form), another has a shorter robust carpus in that pereiopod (stout form). The difference is supported by molecular analysis (Baeza *in litt*.). Careful examination of these two forms are also distinguishable the armature of fourth abdominal somite and length of anterolateral tooth of proximal

segment antennular peduncle: in the slender form, the posterior margin of the fourth somite is unarmed and the anterolateral tooth just reaches or falls slightly short of distal margin of intermediate segment of the peduncle. In contrast, the stout form has the fourth somite armed with a posterolateral tooth on posterior margin, and the distolateral tooth reaches midlength of distal segment of the peduncle. In the Hawaiian individuals, these two forms are considered as distinct species in morphological aspect. However, in the specimens collected from outside of Hawaii, the presence or absence of the posterolateral spine of the fourth abdominal somite is recognizable as intraspecific variation (Okuno, 1997c), and as in the case of the syntype of *Rhynchocinetes hendersoni*, the combination of these two features are opposed to those of the Hawaiian individuals: the posterolateral spine of the fourth somite is absent and the anterolateral tooth overreaches midlength of the distal segment of antennular peduncle (Kemp, 1925). Edmondson (1952) proposed two new species, *Rhynchocinetes intermedius* from off Oahu of Hawaii and *R. marshallensis* from Eniwetok Atoll of the Marshall Islands. Holthuis and Hayashi (1967) concluded the two species described by Edmondson (1952) as junior synonym of *R. hendersoni*. Okuno (1997c) re-examined the type specimens deposited at the Bernice P. Bishop Museum, Honolulu, and agreed quite with Holthuis and Hayashi's (1967) conclusion on account of the presence of the coxal projection and spine in the type specimens. However, from the finding the slender and stout species in Hawaii, the relationship of three nominal species should be re-assessed in morphology and nomenclature. Therefore, a taxonomic revision of *Aus* is required in near future although the present study is considered the genus as monospecific.

5-3 Subfamily Rhynchocinetinae Ortmann, 1890

Type genus. *Rhynchocinetes* H. Milne Edwards, 1837.

Diagnosis. Carapace with supraorbital spine acute or blunt, armed with two spines on median carina, antennal spine situated posterior and ventrad to tip of inferior orbital margin, supported by carina, or at tip of inferior orbital margin, feebly carinate ventrally, pterygostomial spine always present. Rostrum articulated completely with carapace, movable. Fifth abdominal somite without posterolateral tooth. Ambulatory pereiopods with ischia armed with a single spine (rarely unarmed), meri with one row of spines on ventral surface.

Distributional range.– Widespread tropical to warm temperate waters of the Indo-Pacific (Fig. 57), littoral to around 300 m.

Remarks. Most species of the subfamily represent the elongate third maxilliped and robust first pereiopod in male as sexual dimorphism. Correa *et al*. (2000) defined three ontogenetic male stages in *R. typus*: "typus male" has the first pereiopod without setae, with cutting boarder of fixed finger armed with 4 teeth, the ultimate segment of third maxilliped less 1.0 longer than postorbital carapace length, and the tip of the segment armed with 7 spines; "intermedius male" has the first pereiopod with dense setae, with cutting boarder of fixed finger armed with 4 teeth, the ultimate segment of third maxilliped 1.0–2.1 longer than postorbital carapace length, and the tip of the segment armed with 7 spines; "robustus male" has the first pereiopod with dense setae, with cutting boarder of fixed finger armed with 1 tooth, the ultimate segment of third maxilliped over 2.1 longer than postorbital carapace length, and the tip of the segment terminating in a single spine. The presence of dence setae on the first

pereiopod is characteristic in *R. typus*, thus, in this study, the three ontogenetic male stages are categorized as follows: “typus male” has the third maxilliped armed terminally with 7 spines and first pereiopod reaching level of the midlength of scaphocerite; “intermedius male” has the third maxilliped armed terminally with 7 spines and first pereiopod falling short of, to slightly overreaching level of the distal margin of scaphocerite; “robustus male” has the third maxilliped terminating in a single spines and first pereiopod obviously overreaching level of the distal margin of scaphocerite.

Shrimps of the subfamily occur in the Indo-Pacific region only, whereas the member of Cinetorhyncinae is distirbutied in both Indo-Pacific and Atlantic Ocean.

The genera of Rhynchocinetinae may be distinguished by the following key.

Key to genera of Rhynchocinetinae

1. Supraorbital spine present; antennal spine flanked by short carina ……..2
–. Supraorbital nodle present; anttenal spine not flanked by short carina .....….....*Cus* gen. nov.
2. Fifth thoracic sternite without a pair of acute ventral median processes; endopod of male first pleopod with shoulder-like projection dorsomesially; dactylus and palm of first pereiopod with tufts of dense setae dorsally …….....……*Rhynchocinetes*
–. Fifth thoracic sternite with a pair of acute ventral median processes; endopod of male first pleopod without shoulder-like projection dorsomesially; dactylus and palm of first pereiopod without tufts of setae …….....….....*Bus* gen. nov.

5-3-1 Genus *Rhynchocinetes* H. Milne-Edwards, 1837

Rhynchocinetes H. Milne Edwards, 1837: 382.– Kemp, 1925: 263 (in part).– Gordon, 1936: 75 (in part).– Hale, 1941: 269.– Holthuis, 1947: 77.– Barnard, 1950: 763.– Chace, 1997: 26 (in part).– Hayashi, 2007: 109 (in part).

Type species. *Rhynchocinetes typus* H. Milne-Edwards, 1837, by monotypy. Gender: masculine.

Diagnosis. Carapace with dorsal surface sparsely with short setae; a supraorbital spine acute, antennal spine situated posterior and ventrad to tip of inferior orbital margin, supported by carina, pterygostomial spine always present. Rostrum articulated completely with carapace, movable. Fifth abdominal somite without posterolateral tooth. Fifth thoracic sternite without acute median processes. First pereiopod with carpus armed distoventrally with 2–3 acute teeth, dorsal surface of palm and dactylus furnished with tuft of long dense setae. Male first pleopod with endopod with dorsomesial margin with shoulder-like projection. Male second pleopod with appendix masclina considerably elongate, distinctly longer than appendix interna.

Distributional range. Known only from coasts of Peru and Chile (Fig. 62).

Ecology. The well-developed male specimens of usual species of *Rhynchocinetes* have the considerably elongate third maxilliped and robust first pereiopod. Such sexual dimorphisms are available to guard and defend females during copulation (see Correa *et al*., 2000; Thiel *et al*., 2010).

Remarks. The present study recognizes that the genus is monotypic. *Rhynchocinetes* is

distinguished from other two genera belonging to the same subfamily on account of the following morphological features: 1) dorsal surface of carapace is furnished with sparse short setae in *Rhynchocinetes* (Fig. 24A), whereas there is no distinct setae on the carapace in other genera; 2) fifth thoracic sternite is armed posteriorly with pair of semiquadrate ridge, without median processes (Fig. 24C), instead of the presence of pair of acute median processes in other genera (Fig. 31C); 3) in mature male of *Rhynchocinetes*, the carpus of first pereiopod is armed distoventrally with 2–3 acute teeth (Fig. 25B), and dorsal surface of palm and dactylus possess the tufts of dense long setae (Fig. 25A, C), while the first pereiopod of other two genera has carpus with unarmed distal margin, and palm and dactylus without tufts of long setae; 4) endopod of male first pleopod has a shoulder-like protrusion on the dorsomesial margin in *Rhynchocinetes* (Fig. 25H), but there is no distinct protrusion on the endopod of other two genera; 5) in *Rhynchocinetes*, appendix masclina of male second pleopod is considerably slender and longer than appendix interna (Fig. 25I), in contrast, appendix masclina is moderately oval and shorter than appendix interna in other two genera.

5-3-1-1 *Rhynchocinetes typus* H. Milne-Edwards, 1837

(Figs. 23–25)

R [*hynchocinetes*]. *typus* H. Milne Edwards, 1837a: 383.
Rhynchocinetes typus– H. Milne Edwards, 1837b: 168, pl. 4C, figs. 1–8.
Rhynchocinetes typicus [sic.]– Dana, 1852: 568.
Rhynchocinetes typicus [sic.]– Dana, 1855: pl. 36, fig. 7a–d.
Rhynchocinetes typus– Heller, 1865: 120 (list).
Rhynchocinetes typus– Ortmann, 1890: 507, pl. 37, fig. 7d, f–i.
Rhinococynetes [sic.] *typus*– Sharp, 1893: 118 (list) (in part).
Not *Rhynchocinetes typus*– Lenz 1902: 734 (in part) [= *Bus balssi* (Gordon, 1936)].
Rhynchocinetes typus– Rathbun, 1911: 562, pl. 52, fig. 2.
Not *Rhynchocinetes typus*– Borradaile 1916: 85 [= *Bus balssi* (Gordon, 1936)].
Not *Rhynchocinetes typus*– Stebbing, 1917: 27, pl. 6 [= *Bus durbanensis* (Gordon, 1936)].
Not *Rhynchocinetes typus*– Balss 1922: 331 [= *Bus balssi* (Gordon, 1936)].
Rhynchocinetes typus– Gordon, 1936: 83, figs. 5a, d, 6a, b.
Rhynchocinetes typus– Holthuis, 1947: 78.
Rhynchocinetes typus– Holthuis, 1952: 66 (full synonymy).
Rhynchocinetes typus– Holthuis, 1980: 79.
Rhynchocinetes typus– Chace, 1997: 26 (in key).
Rhynchocinetes typus– Wicksten, 1991: 150 (list).
Rhynchocinetes typus– Hickman and Zimmerman, 2000: 21, unnumbered figs. in color.
Rhynchocinetes typus– de Melo, 2007: 58, figs. 11–20.
Rhynchocinetes typus– De Grave and Fransen, 2011: 302 (list).

Material examined: INDIAN OCEAN. MNHN-Na 1843, 1♂, CL 23.2 mm (syntype), detailed collection data unknown.

EASTERN PACIFIC. **Galápagos Islands.** RMNH, 1♂, CL 7.0 mm, Caleta Iguana, Isabela Island, 3 m, 14 April 1975, coll. G. M. Wellington.

Chile. CMNH, 1♂, CL 12.0 mm, CMNH, 1♂, CL 10.9 mm, 1 ovig.♀, CL 8.6 mm, Cta Chica, Arica, 27 January 1991, coll. Tokyo Sea Life Park.

Description. Carapace (Fig. 24A) almost glabrous, but covered with feeble transverse striations, dorsal surface furnished with sparse short setae; dorsal median carina with 2 teeth, anterior tooth just posterior to rostral articulation, less than posterior tooth in length, apex directed anteriorly, posterior tooth feebly articulated with median carina; supraorbital spine present; orbit feebly developed, inferior orbital margin feebly angular; antennal spine slightly longer than supraorbital spine, flanked by short carina; pterygostomial angle with blunt tooth.

Rostrum (Fig. 24B) articulated with carapace, 1.1–1.3 times as long as carapace, anterior half feebly upward, apex slightly directed downwards; dorsal margin armed with two large spaced teeth on proximal half, posterior-most tooth situated just above of cornea, proximal second tooth at midlength of rostrum, with 7 small subterminal teeth; ventral margin armed with 17 teeth, decreasing in size distally.

Fifth thoracic sternite armed posteriorly with pair of low, subquadrate ridge, without acute median processes (Fig. 24C). Sixth somite armed posteriorly with pair of triangular small median processes (Fig. 24C).

Abdominal somites (Fig. 24D) covered with feeble oblique striations. Pleura of first to third somites broadly rounded; that of fourth somite with rounded posteroventral angle. Fifth somite with posterolateral angle terminating in acuminate process. Sixth somite 0.4–0.5 times as long as carapace, midpoint of posterolateral margin acutely prominent posteriorly, posteroventral angle acutely pointed, fringed with dense short setae; ventral surface armed with strongly hooked preanal spine. Telson (Fig. 24E) 0.5–0.6 times as long as carapace, 1.2–1.3 times as long as sixth somite, tapering posteriorly, posterior margin acuminate medially, with 3 pairs of dorsal spines on posterior two thirds; posterior margin with 3 pairs of spines, intermediate pair longest, flexor margin with short setules, mesial-most pair plumose (Fig. 24F).

Ophthalmic somite with midline slightly carinate. Eye (Fig. 24A) with large, globular cornea, maximum diameter longer than distal margin of stalk, distinct dorsal accessory pigment spot pesent; stalk widened, shorter than cornea.

Antennular peduncle (Fig. 24G) reaching level of proximal third of rostrum. Proximal segment slightly longer than distal two segments combined, dorsal surface moderately concave, with acute anterolateral tooth reaching level of distal margin of distal segment, ventral surface mesially armed with a single spine; stylocerite well developed, acute, reaching level of distal margin of intermediate segment, armed proximolaterally with acute tooth; statocyst small, longitudinally oblong. Intermediate segment subcylindrical, furnished with dense setae laterally, mesial surface with long dense setae. Distal segment subcylindrical, shortest, ventrally with setae. Dorsal flagellum with short aesthetascs except for proximal fifth and distal fifth of thickened part.

Antenna with stout basicerite (Fig. 24A) armed ventrolaterally with acute tooth directed anteriorly; ventral margin angular, unarmed. Scaphocerite (Fig. 24H) well developed, falling slightly

short of level of tip of rostrum, 4.3 times as long as maximum width, lateral margin almost straight, terminating in acute tooth overreaching distal margin of lamella, proximal part of the tooth subequal to lamella in width, mesial margin convex. Carpocerite (Fig. 24A) stout, reaching level of proximal fourth of scaphocerite.

Epistome unarmed.

Mouthpartstypical of the family. Second maxilliped with suboval epipod; podobranch well developed; dactylus narrow, with mesial margin nearly straight, densely furnished with long setae; propodus elongate, with anterior margin broadly rounded, with dense long setae; carpus subquadrate, anterolateral angle bluntly produced; mesial surface of merus, ischium, and anterior part of basis shallowly concave; coxa inflated mesially, rounded; exopod with well developed flagellum, basal part of lateral surface shallowly concave. Third maxilliped with endopod overreaching level of distal margin of scaphocerite by whole length of ultimate segment in “robstus male”, by distal third of ultimate segment in “intermedius male”, slightly overreaching level of distal margin of scaphocerite in female; ultimate segment with transverse rows of dense setae, ventrally furnished with numerous setae, 5.9 times as long as penultimate segment, terminating in a single corneous spine in “robustus male”, 3.7–4.4 times as long as penultimate segment in “inrtermedius male”, 2.4 times as long as penultimate segment in female, terminating in a single corneous spine with 2 distolateral and 4–5 distomesial subterminal spines: penultimate segment fringed sparsely with short setae; antepenultimate segment with dorsal surface obliquely situated; ischium short, depressed; exopod with segmented flagellum reaching level of distal third of antepenultimate segment.

Branchial formula as shown in Table 2.

First pereiopod (Fig. 25A) stout, slightly compressed, overreaching level of distal margin of scaphocerite by length of dactylus in “robustus males”, reaching level of midlength of scaphocerite in “intermediate male”, reaching level of proximal third of scaphocerite in female. Chela 2.7–3.0 (“robustus and intermediate male”), 1.9 (female) times as long as carpus, palm 1.6–1.7 (“robustus and intermediate male”), 2.3 (female) times as long as dactylus, ventral surface with about 12 transverse rows of short setae with setules; dactylus (Fig. 25C) with cutting border furnished with long sparse setae, without denticulation, terminating in set of ungues, dorsolly furnished withtuft of dense setae in “intermediate and robust male”; fixed finger (Fig. 25C) with cutting border unarmed in female, armed with large, subquadrate tooth in “robustus male”, tapering distally, terminating in set of ungues obliquely articulated with corpus. Carpus (Fig. 25B) with distal margin truncate, dorsodistally terminating in acuminate tooth in “robustus and intermediate males”, ventrodistal margin armed with three short acute teeth. Merus 2.0–2.5 times as long as carpus, obliquely articulated with ischium. Coxa unarmed.

Second pereiopod (Fig. 25D) slender, slightly compressed, reaching level of distal two fifths of scaphocerite. Chela (Fig. 25D) with palm 4.0–4.2 times as long as dactylus; dactylus (Fig. 25E) slightly arched, without denticulation on cutting border, terminating in set of ungues, corpus furnished with tuft of long setae subterminally; fixed finger (Fig. 25E) without denticulation but densely furnished with long setae on cutting edge, terminating in set of ungues, longest unguis slightly shorter than corpus. Carpus 1.3–1.4 times as long as chela, 1.2–1.3 times as long as merus, distal margin truncated, with sparse setae. Merus obliquely articulated with ischium. Coxa unarmed.

Third pereiopod (Fig. 25F) overreaching level of distal margin of scaphocerite by length of dactylus. Coxa unarmed. Ischium armed with 1 lateral spine. Merus 1.9–2.1 times as long as carpus, armed with 4 lateral spines (distal spine near distal margin). Carpus armed with 2 lateral spines, with dorsodistal angle produced anteriorly. Propodus 1.5–1.6 times as long as carpus, ventral surface armed with about 10 small spines, dorsal surface sparsely furnished with short setae, distally with transverse rows of moderately long setae densely. Dactylus (Fig. 25G) biunguiculate, ungues distinctly demarcated from corpus, flexor margin armed with 2 small accessory claws posterior to subterminal unguis, decreasing in size proximally. Fourth pereiopod falling slightly short of distal margin of scaphocerite, similar to third pereopod in armature and proportion. Fifth pereiopod shortest of all the ambulatory pereiopods, slightly overreaching level of midlength of scaphocerite. Armature similar to those of two anterior ambulatory pereiopods, but merus armed with 3 lateral spines. Merus 1.6–1.7 times as long as carpus. Propodus 1.5–1.7 times as long as carpus.

Endopod of male first pleopod (Fig. 25H) oblong, subquadrate, external margin furnished with short sparse setae proximally, without distinct lobe, distal margin truncate, distomesially prominent, entire, without setae, mesial margin with shoulder-like protrusion dorsally; appendix interna well developed, tapering distally, with a few cincinnuli terminally.

Endopod of male second pleopod (Fig. 25I) with appendices masculina and interna arising from distal two fifths of mesial margin; appendix masculina considerably elongate, narrow, furnished with long sparse setae marfginally, distinctly longer than appendix interna; appendix interna elongate, with a few cincinnuli terminally.

Uropod (Fig. 24E) with protopodite posterolaterally acute. Both exopod and endopod reaching level of tip of telson; exopod with lateral margin straight, terminating in acute tooth, mesially with movable spine longer than the terminal tooth; endopod slender, rounded distally.

Color in life. Ground color pale white to pink. Carapace and first to fifth abdominal somites covered densely with reddish brown and white spots; some reddish brown spots on carapace continued with each other, forming short lines; dorsolateral surface of first to third abdominal somites also with white spots circled by reddish brown line, tergum of third somite with two white, short transeverse bands, anterior band V-shaped, posterior band almost straight, ground color between both bands darker than other parts, sixth somite with longitudinal dark red bands, interspaces yellow. Rostral tip yellow. Cephalic appendages red. First and second pereiopods reddish brown, with numerous white spots, tuft of setae on dactylus and palm of first pereiopod yellowish brown. Ambulatory pereiopods reddish brown, meri with white bands, junctions among each segment with yellowish white spots.

Distribution. Type locality: Indian Ocean (H. Milne Edwards, 1837a), but it is incorrect (Holthuis, 1952). True distribution of *R. typus* is restricted from cold temperate waters of the coasts of Peru and Chile and the Galápagos Islands (Holthuis, 1952; Wicksten, 1991; Okuno, 1996a): **Peru:** Lobos de Afera (Rathbun, 1910); **Chile:** Valparaiso (Dana, 1852, 1855; Ortmann, 1890); Iquique (Holthuis, 1952); Arica (present study); **Galápagos Islands:** Wicksten (1991); Hickman and Zimmerman (2000); Isabela Island (present study).

Remarks. One of the two syntypes examined in this study is considered as “typus male” in the ontogenetic stage.

In the present study, a single male specimen of *Rhynchocinetes typus* from the Galápagos Islands

was examined, and no significant morphological difference is found between the specimens from the Chilean coast and that of the islands. However, in the life coloration, the individuals of the Galápagos Islands is distinguishable from those of the coasts of Peru and Chile by having the distinctive white lines on the lateral surface of the carapace (Hickman and Zimmerman, 2000). The difference of the color pattern justifies to separate them as distinct species level. Because the present specimen from the Galápagos Islands is rather small, the further number of specimens including the mature males should be compared with those of the coasts of the Peru and Chile.

A single ovigerous female specimen referred to *R. typus* has been collected from the coast of Brazil, the Atlantic Ocean (de Melo, 2007). Since this shrimp is a commercially valuable species (Holthuis, 1980), the occurrence from Brazil seems to be not a natural range extension but an artificial invasion.

5-3-2 Genus *Bus* gen. nov.

Type species. *Rhynchocinetes conspiciocellus* Okuno and Takeda, 1992, by present designation.

Diagnosis. Medium sized rhynchocinetid shrimp with subcylindrical body. Carapace with dorsal surface without setae; a supraorbital spine present, acute or blunt, armed with two spines on median carina, antennal spine situated posterior and ventrad to tip of inferior orbital margin, supported by carina, pterygostomial spine always present. Rostrum well developed, dentate, completely articulated with carapace. Posterior margin of fifth abdominal somite unarmed with posterolateral tooth. Fifth thoracic sternite with a pair of acute median processes. First pereiopod with carpus with distal margin unarmed. Male first pleopod with endopod with dorsomedial margin not produced dorsally. Male second pleopod with appendix masclina shorter than appendix interna.

Distributional range. Widespread in the Indo-Pacific, but most species are disjunctive temperate area as endemic. Some species are distributed in tropical area.

Ecology. Forming rather large crowd of individuals on the intertidal to sublittoral crevices of rocky reef.

Remarks. De Grave and Frasen (2011) recognized 14 species belonging to *Rhynchocinetes*, but De Grave *et al*. (in prep) put *Rhynchocinetes albatrossae* into a junior synonym of *R. brucei*. Herein, 11 species of *Rhynchocinetes* sensu lato are moved to the present new genus in this study, and three undescribed species are considered as following lines. Therefore, total 14 species of the new genus are recognizable at present study.

Key to species of *Bus*

1. Basicerate of antenna armed ventrally with an acute tooth …….. *B. australis*
–. Basicerate of antenna ventrally unarmed……..……..2
2. Carpi of third and fourth pereiopods armed with a single spine; rostral dorsal margin armed with three spaced teeth at proximal two thirds ……..…… *B. durbanensis*
–. Carpi of third and fourth pereiopods armed with two spines; rostral dorsal margin armed with two spaced teeth at proximal two thirds……..…3

3. Third maxilliped and all pereiopods without arthrobranch ……. *B. enigma*
–. At least, third maxilliped and first pereiopod with arthrobranchs……4
4. Second and third pereiopods without arthrobranch……..5
–. Second pereiopod with arthrobranch……..……8
5. Stylocerite reaching distal margin of antennular peduncle…….6
–. Stylocerite falling short of distal margin of antennular peduncle……...…..7
6. Dactyli of ambulatory pereiopods armed with 4 accessory spoines posterior to subterminal unguis on flexor margin ……...…….. *B.* sp. 2
–. Dactyli of ambulatory pereiopods armed with 2 accessory spoines posterior to subterminal unguis on flexor margin ……..... *B.* sp. 3
7. Stylocerite reaching distal margin of intermediate segment of antennular peduncle; flexor margin of dactyli of ambulatory pereiopods armed with 2 accessory spoines posterior to subterminal unguis ……..... *B. balssi*
–. Stylocerite reaching midlength of intermediate segment of antennular peduncle; flexor margin of dactyli of ambulatory pereiopods armed with 3 accessory spoines posterior to subterminal unguis ……..... *B.* sp. 1
8. Third pereiopod without arthrobranch ……..9
–. Third pereiopod with arthrobranch ……..……..12
9. Stylocerite overreaching distal margin of antennular peduncle ……. B. *kuiteri*
–. Stylocerite falling short of distal margn of intermediate segment of antennular peduncle……10
10. Dactyli of amburatory pereiopods armed with 2 accessory spines on flexor margin posterior to pre-terminal unguis ……..….... *B. conspiciocellus*
–. Dactyli of amburatory pereiopods armed with 3 accessory spines on flexor margin posterior to pre-terminal unguis…….11
11. Merus of third pereiopod armed with four spaced spines; endopod of male first pleopod without distinct lobe at external margin …….....…….…….…..... *B. holthuisi*
–. Merus of third pereiopod armed with three spaced spines; endopod of male first pleopod with distinct lobe at external margin ……. *B. uritai*
12. Stylocerite falling short of distal margin of intermediate segment of anttenular peduncle ……..... *B. brucei*
–. Stylocerite at least overreaching distal margin of intermediate segment of anttenular peduncle ……..…….....……13
13. Stylocerite reaching distal margin of distal segment of antennular peduncle; filaments of podobranch on second maxilliped absent …….……..... *B. rathbunae*
–. Stylocerite reaching proximal third of distal segment of antennular peduncle; filaments of podobranch on second maxilliped present ……..……. *B. serratus*

5-3-2-1 *Bus australis* (Hale, 1941) comb. nov.

(Figs 26, 27, 39F)

Rhynchocinetes rugulosus– Hale, 1927: 55, fig, 49. Not *Rhynchocinetes rugulosus* Stimpson, 1860.

Rhynchocinetes australis Hale, 1941: 270–271, figs. 8a–d.

Rhynchocinetes australis– Debelius, 1983: 76, unnumbered fig. in color.

Rhynchocinetes australis– Debelius, 1984: 76, unnumbered fig. in color.

Rhynchocinetes australis– Chace, 1997: 27 (in key).

Rhynchocinetes australis– Okuno, 1997b: 49–50, fig. 4f.

Rhynchocinetes australis– Edger, 1997: 192, unnumbered fig. in color.

Rhynchocinetes australis– Debelius, 1999b: 166, unnumbered figs. in color.

Rhynchocinetes australis– Davie, 2002: 373 (list).

Rhynchocinetes australis– Poore, 2004: 76, fig. 18a, c.

Rhynchocinetes australis– Gowlett-Holmes, 2008: 211, unnumbered figs. in color.

Rhynchoicnetes australis– De Grave and Fransen, 2011: 301 (list).

Material examined.– **Australia.** Victoria. AM P11350, 1♂, 1♀(paratypes), CL 9.1, 8.3 mm, Port Philip Bay, 37º58'S, 144º54'E; NTM. Cr. 006932, 2♂♂, CL 8.3, 6.7 mm, Port Turton, Jetty, 34º10'S, 137º25'E, 12 December 1989, coll. C. Styan; NTM. Cr. 004933, 1♂, CL 8.5 mm, same locality as NTM. Cr. 006932, 4 m, 22 December 1989, coll. C. Styan; NTM. Cr. 006934, 1♂, 1 ovig. ♀, CL 9.1, 8.9 mm, Edithburgh, Jetty, 34º55'S, 137º45'E, 7 m, 10 December 1989, coll. C. Styan; NTM. Cr. 006935, 1 ovig.♀, CL 7.9 mm, NTM. Cr. 006936, 1♂, CL 6.4 mm, NTM. Cr. 00694,1 ovig. ♀, CL 7.1 mm, Second Valley, 34º30'S, 138º15'W, 16 December 1989, coll. C. Styan.— Tasmania. SAMA C5602, 2 ovig.♀♀, CL 13.8, 11.9 mm, Schoona Cave, off Forrester Point, Bathurst Channel, Port Davey, 3–18 m, 2 April 1993, coll. W. Zeidler, KL. Gowlett-Holmes and F. A. Barendam.

Description.– Carapace (Fig. 26A) almost glabrous, but covered with feeble transverse striations; dorsal median carina with 2 teeth, anterior tooth just posterior to rostral articulation, larger than posterior tooth, apex obliquely upward, posterior tooth feebly articulated with median carina; supraorbital spine present, long; orbit feebly developed, inferior orbital margin feebly angular; antennal spine considerably shorter than supraorbital spine, situated ventrad to inferior orbital margin, flanked by short carina; pterygostomial angle with blunt tooth.

Rostrum (Fig. 26C) articulated with carapace, overreaching level of anterior margin of scaphocerite by distal fourth, 1.0–1.1 times as long as carapace, anterior half feebly upward, apex directed anteriorly; dorsal margin armed with two large spaced teeth on proximal half, posterior-most tooth situated just above of cornea, proximal second tooth at midlength of rostrum, with 3–5 (usually 4) small subterminal teeth; ventral margin armed with 12–13 teeth, decreasing in size distally.

Fifth thoracic sternite armed posteriorly with pair of median acute, triangular processes. Sixth somite armed posteriorly with pair of processes, smaller and situated more laterally than those of fifth somite.

Abdominal somites (Fig. 26D) covered with feeble oblique striations. Pleura of first to third somites broadly rounded; that of fourth somite with rounded posteroventral angle terminating in a minute process. Fifth somite with acuminate posteroventral process. Sixth somite 0.4–0.5 times as long as carapace, midpoint of posterior margin acutely prominent posteriorly, posteroventral angle fringed with dense short setae; ventral surface armed with strongly hooked preanal spine. Telson (Fig.

26E) 0.4–0.6 times as long as carapace, 1.2–1.5 times as long as sixth somite, tapering posteriorly, posterior margin acuminate medially, with 3 pairs of dorsal spines on posterior half; posterior margin with 3 pairs of spines, intermediate pair longest.

Ophthalmic somite (Fig. 26C) with midline slightly carinate, dorsally with elongate lobe. Eye (Fig. 26B) with large, globular cornea, maximum diameter longer than distal margin of stalk, distinct dorsal accessory pigment spot present; stalk widened distally, shorter than cornea.

Antennular peduncle (Fig. 26F) reaching level of midlength of rostrum. Proximal segment longer than distal two segments combined, dorsal surface moderately concave, with acute anterolateral tooth reaching level of midlength of intermediate segment, ventral surface mesially armed with a single spine; stylocerite well developed, acute, overreaching level of midlength of distal segment, armed proximolaterally with acute tooth; statocyst small, longitudinally oblong. Intermediate segment subcylindrical, furnished with dense setae laterally, mesial surface with a few long setae. Distal segment subcylindrical, obliquely articulated with intermediate segment, ventrally with setae. Dorsal flagellum with short aesthetascs at distal three fifths of thickened part.

Antenna with stout basicerite (Fig. 26H, 39F) armed ventrolaterally with acute tooth directed anteriorly; ventral margin armed with acute (rarely bifid) tooth. Scaphocerite (Fig. 26G) well developed, falling slightly short of level of rostral apex, 3.1–4.0 times as long as maximum width, lateral margin almost straight, terminating in acute tooth overreaching distal margin of lamella, proximal part of the tooth subequal to lamella in width, mesial margin convex. Carpocerite (Fig. 26A) stout, reaching level of proximal two fifths of scaphocerite.

Epistome unarmed.

Mouthparts typical of the family. Second maxilliped with suboval epipod; podobranch well developed; dactylus narrow, with mesial margin nearly straight, densely furnished with long setae; propodus elongate, with anterior margin broadly rounded, with dense long setae; carpus subquadrate, anterolateral angle bluntly produced; mesial surface of merus, ischium, and anterior part of basis shallowly concave; coxa inflated mesially, anteromesial margin angular; exopod with well developed flagellum, basal part of lateral surface shallowly concave. Third maxilliped with endopod reaching or slightly overreaching level of distal margin of scaphocerite by length of distal fifth of ultimate segment; ultimate segment with transverse rows of dense setae, ventrally furnished with numerous setae, 1.6–2.9 times as long as penultimate segment, terminating in corneous spine, anteriorly with 6–8 (usually 7) subterminal spines: penultimate segment fringed sparsely with short setae, dorsolateral surface shallowly concave; antepenultimate segment slightly widened distally, dorsal surface obliquely situated; ischium short, depressed; exopod with segmented flagellum falling slightly short of level of distal margin of antepenultimate segment.

Branchial formula as shown in Table 2.

First pereiopod (Fig. 27A) stout, slightly compressed, reaching level of midlength of scaphocerite. Chela 1.5–2.2 times as long as carpus, palm distinctly longer than dactylus, ventral surface with transverse rows of short setae with setules; dactylus (Fig. 27B) without denticulation on cutting edge, terminating in set of ungues, distal margin of corpus densely furnished with long setae; fixed finger (Fig. 27B) without denticulation on cutting border, tapering distally, proximal half of border elevated dorsally, with row of long submarginal setae, terminating in set of ungues articulated with corpus.

Carpus with distal margin truncate, ventrolateral surface slightly oblique. Merus 1.5–1.6 times as long as carpus, obliquely articulated with ischium. Coxa unarmed.

Second pereiopod (Fig. 27C) slender, slightly compressed, reaching level of distal fifth of scaphocerite. Chela (Fig. 27D) with palm 3.0–4.6 times as long as dactylus; dactylus slightly arched, without denticulation on cutting border, terminating in set of ungues, distal margin of corpus furnished with long setae; fixed finger without denticulation but densely furnished with long setae on cutting edge, distolaterally with row of long setae, terminating in set of ungues, longest unguis subequal to corpus in length. Carpus 1.1–2.0 times as long as chela, 1.4–1.8 times as long as merus, distal margin bluntly produced, with sparse setae. Merus obliquely articulated with ischium. Coxa unarmed.

Third pereiopod (Fig. 27E) overreaching distal margin of scaphocerite by length of dactylus. Coxa unarmed. Ischium armed with 1 lateral spine. Merus 1.9–2.4 times as long as carpus, armed with 4–5 (rarely 6) lateral spines (distal spine near distal margin). Carpus armed with 2 lateral spines, with dorsodistal angle produced anteriorly. Propodus 1.6–1.9 times as long as carpus, ventral surface armed with about 10 small spines, dorsal surface sparsely furnished with long setae, a few distal plumose setae. Dactylus (Fig. 27F) biunguiculate, ungues distinctly demarcated from corpus, flexor margin armed with 3 small accessory claws, decreasing in size proximally. Fourth pereiopod reaching level of distal margin of scaphocerite, similar to third pereopod in armature and proportion of propodus. Merus 1.8–2.2 times as long as carpus. Fifth pereiopod reaching level of midlength of scaphocerite. Armature of carpus and dactylus similar to those of anterior two ambulatory pereopods. Ischium unarmed. Merus 1.5–1.8 times as long as carpus, armed with 3–5 (usually 3) lateral spines (distal spine near distal margin). Propodus 1.5–1.9 times as long as carpus.

Endopod of male first pleopod (Fig. 27G) generally oval, tapering distally, external margin proximally furnished with short dense setae, without lobe; appendix interna well developed, broad, with a few cincinnuli subterminally.

Endopod of second pleopod (Fig. 27H) with appendices masculina and interna arising from midlength of mesial margin; appendix masculina oval, furnished with long sparse setae, slightly shorter than appendix interna; appendix interna oval, broad, with a few cincinnuli terminally.

Uropod (Fig. 29E) with protopodite posterolaterally acute. Both exopod and endopod overreaching level of tip of telson; exopod with lateral margin straight, terminating in acute tooth, mesially with movable spine longer than the terminal tooth; endopod slender, tapering distally.

Color in life. Ground color pale whitish translucent. Carapace and abdominal somites with labyrinth dark lines, third abdominal somite with two dark lines running downwards from tergum to midpoint of lateral surfacei, interspaces of these lines yellowish, dorsal surfaces proximal to anterior line and distal to posterior line with pale white spots circled by dark lines; ground color of fourthand fifth somite darker than other parts, with yellow longtuidinal, dorsolateral lines continuing to posterior margin of telson. Rostrum yellow. Scaphocerite whitish translucent, with dark external margin. Third maxilliped and first and second pereiopods mottoled with white and dark red. Ambulatory pereiopods whitish translucent, with dark red external lines.

Distribution. Type locality: Edithburgh, St. Vincent Gulf, South Australia (Hale, 1941). Known only from coasts of South Australia, Tasmania and Victoria (Fig. 63).

Remarks. Hale (1941) described *R. australis* as new to science on the basis of the characteristics

having no arthrobranch on the third pereiopod and the endopod of male first pleopod with external margin entire, without lobe. In addition to the diagnosis established by Hale (1941), Okuno (1997b) pointed out that *R. australis* can be differentiated from the other congeneric species by the antennal basicerite being armed ventrally with an acute (rarely bifid) spine (Figs. 26H, 39F), and Dr. Wolfgang Zeidler (*in litt*.) kindly informed me the presence of this spine in the holotype of *R. australis* deposited at the South Australian Museum.

5-3-2-2 *Bus balssi* (Gordon, 1936) comb. nov.

(Figs. 28, 29)

? *Rhynchocinetes typus*– Miers, 1876: 77. Not *Rhynchocinetes typus* H. Milne Edwards, 1837.
Rhynchocinetes typus– Lenz, 1902: 734 (in part). Not *Rhynchocinetes typus* H. Milne Edwards, 1837.
Rhynchocinetes typus– Borradaile, 1916: 85. Not *Rhynchocinetes typus* H. Milne Edwards, 1837.
Rhynchocinetes typus– Balss, 1922: 331. Not *Rhynchocinetes typus* H. Milne Edwards, 1837.
Rhynchocinetes rugulosus– McCulloch, 1909: 310 (in part). Not *Rhynchocinetes rugulosus* Stimpson, 1860.
? *Rhynchocinetes rugulosus*– Chilton, 1911: 548. Not *Rhynchocinetes rugulosus* Stimpson, 1860.
Rhynchocinetes balssi Gordon, 1936: 85, fig. 7a, b.
Not *Rhynchocinetes balssi*– Hale, 1941: 270 (= *Bus* sp. 3).
Rhynchocinetes balssi– Holthuis, 1952: 67 (full synonymy).
Rhynchoicnetes balssi– Holthuis, 1972: 35.
Not *Rhynchoicnetes balssi*– Bruce, 1985: 124, fig. 1. (= *Bus* sp 3).
Rhynchocinetes balssi– Chace, 1997: 27 (in key).
Not *Rhynchoicnetes balssi*– Davie, 2002: 373 (list) (= *Bus* sp 3).
Rhynchocinetes balssi– Poupin, 2003: 21.
Rhynchocinetes balssi– Poore, 2004: 76.
Rhynchocinetes balssi– De Grave and Fransen, 2011: 302 (list).

Material examined: WESTERN PACIFIC: **New Zealand**. NIWA 46549, 1 ovig. ♀, CL 6.0 mm, stn. TAN 0205/65, 182–103 m, 30.0400833ºS, 178.717016ºE–30.0345500ºS, 178.7125167ºE, 22 April 2002, coll. National Institute of Water and Atmospheric Research.

Austral Islands. MNHN-071204-1, 1♂, CL 3.5 mm, Large du Cap Rukuaga, Rapa Island, stn 22, 18–22 m, 27º33.9'S, 144º21.7'W, 13 November. 2002; MNHN, 1 ovig. ♀, CL 7.1 mm, stn 20, blocs de coraux sur fond de sable, Rapa Island, 5 m, 27º35.4'N, 144º23.3'W, 12 November 2002..

EASTERN PACIFIC: **Juan Fernandez**. CMNH, 1♂, CL 5.2 mm, 1 ovig. ♀, CL 5.7 mm, El Pangal, Cumberland Bay, Robinson Crusoe Island, 10 m, January 2009, coll. F. Schneider.

Description. Carapace (Fig. 28A) almost glabrous, but covered with feeble transverse striations; dorsal median carina with 2 teeth, anterior tooth just posterior to rostral articulation, subequal to posterior tooth in size, apex obliquely directed upwards, posterior tooth feebly articulated with median carina; supraorbital spine present; orbit feebly developed, inferior orbital margin feebly angular; antennal spine as long as supraorbital spine, situated ventrad to inferior orbital margin, flanked by

short carina; pterygostomial angle with blunt tooth.

Rostrum (Fig. 28B) articulated with carapace, overreaching level of anterior margin of scaphocerite by subapical part, 1.3–1.5 times as long as carapace, anterior half feebly upward, apex slightly directed downwards; dorsal margin armed with two large spaced teeth on proximal half, posterior-most tooth situated just above of cornea, proximal second tooth at midlength of rostrum, with 5 small subterminal teeth; ventral margin armed with 12–14 teeth, decreasing in size distally.

Fifth thoracic sternite armed posteriorly with a pair of acute median processes. Sixth somite armed posteriorly with a pair of processes, shorter and situated more laterally than those of fifth somite.

Abdominal somites (Fig. 28C) covered with feeble oblique striations. Pleura of first to third somites broadly rounded; that of fourth somite with rounded posteroventral angle. Fifth somite with posterolateral angle terminating in acuminate process. Sixth somite 0.5–0.7 times as long as carapace, midpoint of posterolateral margin acutely prominent posteriorly, posteroventral angle acutely pointed, fringed with dense short setae; ventral surface armed with strongly hooked preanal spine. Telson (Fig. 28D) 0.7–0.8 times as long as carapace, 1.2–1.3 times as long as sixth somite, tapering posteriorly, posterior margin acuminate medially, with 3 pairs of dorsal spines on posterior two thirds; posterior margin with 3 pairs of spines, intermediate pair longest, flexor margin with sine setules, mesial-most pair plumose (Fig. 28E).

Ophthalmic somite with midline slightly carinate, dorsally with fooked lobe. Eye (Fig. 28A) with large, globular cornea, maximum diameter longer than distal margin of stalk, distinct dorsal accessory pigment spot present; stalk widened, shorter than cornea.

Antennular peduncle (Fig. 28F) reaching level of midlength of rostrum. Proximal segment slightly longer than distal two segments combined, dorsal surface moderately concave, with acute anterolateral tooth reaching level of proximal third of distal segment, ventral surface mesially armed with a single spine; stylocerite well developed, acute, reaching level of proximal third of distal segment, armed proximolaterally with acute tooth; statocyst small, longitudinally oblong. Intermediate segment subcylindrical, furnished with dense setae laterally, mesial surface with long dense setae. Distal segment subcylindrical, shortest, ventrally with setae. Dorsal flagellum with short aesthetascs at distal three fifths of thickened part.

Antenna with stout basicerite (Fig. 28A) armed ventrolaterally with acute tooth directed anteriorly; ventral margin unarmed. Scaphocerite (Fig. 28G) well developed, reaching level of subapical part of rostrum, 4.2–4.8 times as long as maximum width, lateral margin almost straight, terminating in acute tooth overreaching distal margin of lamella, proximal part of the tooth subequal to lamella in width, mesial margin convex. Carpocerite (Fig. 28A) stout, reaching level of proximal third of scaphocerite.

Epistome unarmed.

Mouthparts typical of the family. Second maxilliped (Fig. 29A) with suboval epipod; podobranch well developed; dactylus narrow, with mesial margin nearly straight, densely furnished with long setae; propodus elongate, with anterior margin broadly rounded, with dense long setae; carpus subquadrate, anterolateral angle bluntly produced; mesial surface of merus, ischium, and anterior part of basis shallowly concave; coxa inflated mesially, anteromesial margin angular; exopod with well

developed flagellum, basal part of lateral surface shallowly concave. Third maxilliped with endopod falling slightly short of level of distal margin of scaphocerite; ultimate segment with transverse rows of dense setae, ventrally furnished with numerous setae, 1.5–1.9 times as long as penultimate segment, terminating in a single corneous spine with 1 distolateral and 2 distolateral and 3–4 distomesial subterminal spines; penultimate segment fringed sparsely with short setae, dorsolateral surface shallowly concave; antepenultimate segment slightly widened distally, dorsal surface obliquely situated; ischium short, depressed; exopod with segmented flagellum reaching level of distal margin of antepenultimate segment.

Branchial formula as shown in Table 2.

First pereiopod (Fig. 29B) stout, slightly compressed, falling slightly short of level of midlength of scaphocerite. Chela 1.7–2.0 times as long as carpus, palm 1.9–2.7 times as long as dactylus, ventral surface with transverse rows of short grooming setae with setules; dactylus (Fig. 29C) with cutting border without denticulation, terminating in set of ungues, preterminally with tuft of short dense setae; fixed finger (Fig. 29C) with cutting border unarmed, proximally furnished with long dense setae, tapering distally, terminating in set of ungues obliquely articulated with corpus. Carpus with distal margin truncate, ventrolateral surface slightly oblique. Merus 1.0–1.7 times as long as carpus, obliquely articulated with ischium. Coxa unarmed.

Second pereiopod (Fig. 29D) slender, slightly compressed, slightly overreaching level of midlength of scaphocerite. Chela (Fig. 29E) with palm 3.2–4.5 times as long as dactylus; dactylus slightly arched, without denticulation on cutting border, terminating in set of ungues, corpus with tuft of long submarginal setae; fixed finger without denticulation but densely furnished with long setae on cutting edge, terminating in set of ungues, longest unguis about twice as long as corpus. Carpus 1.3–1.4 times as long as chela, 1.2–1.4 timea as long as merus, distal margin bluntly produced ventrolaterally, with sparse setae. Merus obliquely articulated with ischium. Coxa unarmed.

Third pereiopod (Fig. 29F) overreaching level of distal margin of scaphocerite by length of dactylus. Coxa unarmed. Ischium armed with 1 lateral spine. Merus 1.8–2.1 times as long as carpus, armed with 3 lateral spines (distal spine near distal margin). Carpus armed with 2 lateral spines, with dorsodistal angle produced anteriorly. Propodus 1.7 times as long as carpus, ventral surface armed with about 11 small spines, dorsal surface sparsely furnished with long setae, a few distal plumose setae. Dactylus (Fig. 29G) biunguiculate, ungues distinctly demarcated from corpus, flexor margin armed with 2 small accessory claws, decreasing in size proximally. Fourth pereiopod falling slightly short of distal margin of scaphocerite, similar to third pereopod in armature. Merus 1.8–1.9 times as long as carpus. Propodus 1.6–1.7 times as long as carpus. Fifth pereiopod reaching level of distal fourth of scaphocerite. Ischium unarmed. Merus 1–3 lateral spines, 1.6–1.8 times as long as carpus. Carpus 0–2 lateral spines. Propodus 1.6 times as long as carpus.

Endopod of male first pleopod (Fig. 29H) generally oval, tapering distally, external margin furnished with short sparse setae proximally, without lobe, distal part without setae; appendix interna well developed, slightly tapering distally, with a few cincinnuli terminally.

Endopod of second pleopod (Fig. 29I) with appendices masculina and interna arising from distal third of mesial margin; appendix masculina oblong, furnished with long sparse setae, considerably shorter than appendix interna; appendix interna elongate, with a few cincinnuli terminally.

Uropod (Fig. 28D) with protopodite posterolaterally acute. Both exopod and endopod falling slightly short of level of tip of telson; exopod with lateral margin straight, terminating in acute tooth, mesially with movable spine longer than the terminal tooth; endopod slender, tapering distally.

Color in life. Holthuis (1972) provided the color pattern of *R. balssi* based on the remaining on the preserved specimen from Easter Island. The detailed pattern mentioned by Holthuis (1972) is as follows:

A longitudinal broad red band extends over the movable part of the rostrum, leaving the basal dorsal tooth and the ventral part of the basal half untouched. On the carapace a narrow red line extends from the pterygostomian spine backward along the anterior part of lateral margin. A second line, above and parallel to it, reaches the lateral margin slightly behaind the posterior end of the first line. Four parallel oblique bands extend over the posterial branchial region, being placed almost perpendicular to the posterior part of the lateral margin of the carapace. The posterior two of these bands are connected at their ends closest to the margin. Two very indistinct parallel longitudinal lines mat be seen in the posterior part of the carapace just above the oblique lines of the branchial region. On the first three abdominal somites oblique lines of red colour can be seen, running about parallel to the oblique branchial lines. The postero-dorsal part of the third somite shows a large red spot. Over the last three abdominal somites some longitudinal red lines are seen, which continue onto the tailfan. The distal two segments of the third maxilliped are red. A few red chromatophores are also present on the palm of the first cheliped and more on the carpus; the merus of the cheliped shows two transverse red bands. The walking legs (pereiopods 3 to 5) have the propodus and carpus red, and the merus with three or four transverse bands.

Distribution. Type locality: Masatierra (= Robinson Crusoe Island), Juan Fernandez, Chile (Gordon, 1936; present study). Also known from Easter Island (Holthuis, 1972; Poupin, 2003), the Line Islands, French Polynesia (present study), Kermadec Islands (Chilton, 1911) and New Zealand (Gordon, 1936; present study) (Fig. 62).

Remarks. In this study, three additional undescribed species corresponding to *B. balssi* in gill formula are recognized. *Bus balssi* is distinguishable from other related species on account of the lacking of an accessory lobe on the external margin of endopod of the male first pleopod.

From the biogeographical aspect, records from New Zealand as *R. typus* by Miers (1876) and from Kermadec Islands as *R. rugulosus* by Chilton (1911) are referred to the present species. However, the specimens reported by Miers (1876) are armed with 7–8 teeth on apical part of upper rostral margin, instead of 5 in the present material. The armature does not correspond to that of other New Zealand species, *Cus ikatere*. Therefore, it is doubtful that there is a further species of rhynchocinetids in this area.

5-3-2-3 *Bus brucei* (Okuno, 1994) comb. nov.

(Figs. 4A, B, 30)

Rhynchocinetes typus– Borradaile, 1899: 415 . Not *Rhynchocinetes typus* H. Milne-Edwards, 1837.

Rhynchocinetes rugulosus– Debelius, 1983: 76, unnumbered fig. in color.

Rhynchocinetes rugulosus– Debelius, 1984: 76, unnumbered fig. in color.

Rhynchocinetes rugulosus– Bruce 1990: 612. Not *Rhynchocinetes rugulosus* Stimpson, 1860.

Rhynchocinetes brucei Okuno, 1994a: 29, pl. 1, figs.1-3, 4A, B.

Rhynchocientes rugulosa– Colin and Arneson 1995: 218, fig. 1035. Not *Rhynchocinetes rugulosus* Stimpson, 1860.

Rhynchocinetes brucei– Gosliner *et al*. 1996: 216, fig. 783 in color.

Rhynchocinetes brucei– Chace, 1997: 29.

Rhynchocinetes albatrossae Chace, 1997: 28, figs. 15, 16.

Rhynchocinetes brucei– Davie, 1998: 210, unnumbered fig. in color.

Rhynchocinetes brucei– Debelius 1999b: 166, unnumbered fig. in color.

Rhynchocinetes burucei [sic.]– Mimemizu 2000: 32, unnumbered fig.

Rhynchocinetes brucei– Davie 2002: 373 (list).

Rhynchocinetes brucei– Laboute and Recher de Forges, 2004: 380, unnumbered fig. in color.

Rhynchocinetes cf. *conspiciocellus*– Laboute and Recher de Forges, 2004: 381, unnumbered fig. in color.

Rhynchocinetes brucei– Poore *et al*., 2008: 90, unnumbered fig. in color.

Rhynchocinetes brucei– Humann and DeLoach, 2010: 141, unnumbered fig. in color.

Rhynchocinetes brucei– De Grave and Fransen, 2011: 302 (list).

Material examined: WESTERN PACIFIC. **Taiwan.** Taipei County. NTOU M00694, 1♂, CL 15.1 mm, 1 ovig.♀, CL 13.6 mm, Magang, Penghu, 29 March 1990, coll. P.-H. Ho.— NTOU M00901, 1♀, CL 13.5 mm, no specific locality.

Hong Kong. NTM Cr. 003618, 1♂, CL 10.0 mm (holotype), NTM Cr. 003618 (B, C), 2♂♂, CL 11.5, 14.5 mm (paratypes), Long Ke Wan, 8 m, 27 April 1980. NTM Cr. 003806, 1♂, CL 12.3 mm (paratype), Stn T/13, Mirs Bay, 22º31.5'N, 114º19.9'E, 18 m, 5 April 1986, coll. P. Shin; NTM Cr. 003812, 1♂, CL 15.4 mm, Stn. PH. HK-4, Kai Kun Tan, 4–6 m, 5 April 1986, coll. P. Hutchings; NTM Cr. 003951, 1 ovig.♀, CL 10.3 mm (paratype), Peng Chau, Mirs Bay, 15 April 1986. NTM Cr. 004002, 1♂, CL 10.8 mm (paratype), Gau Tau, Mirs Bay, 16–20 m, 18 April 1986, coll. divers.

Indonesia. Sulawesi. RMNH-D 49604, 1♂, CL 8.2 mm, RMNH-D 49605, 1♂, 1 ovig., 1 juv., CL ,1.1–6.5 mm, Bitung, Spermonde Archipelago, stn17, 20 m, 30. October 1994; RMNH-D 49606, 1 ♀, CL 4.3 mm, same locality as RMNH-D 49604, stn. 18, 31 m, 31 October 1994.

Australia. Queensland. NTM. Cr. 000678, 1♂, CL 9.3 mm (paratype), Lizard Island, coll. H. K. Larson. AM P20678, 1♂, CL 6.6 mm, Lizard Island, 14º40'S, 145º28'E, 4 m, 4 June 1975, coll. G. Anderson. AM P21886, 1♂, CL 6.2 mm, same locality as AM P20678, 17 November 1975, coll. N. Coleman. AM P 16328, 1♂, CL 5.0 mm, Heron Island, Capricorn Group, 23º27'S, 151º55'E, 36 m, October 1968, coll. K. Gillett. AM P18975, 1♂, 1♀, CL 8.8, 9.2 mm, One Three Island, Capricorn Group, 23º30'S, 152º05'E, December 1972, coll. A. Donne. AM P20142, 1♂, 1 ovig.♀, 8.5, 8.3 mm, same locality as AM P18975, 13 May 1974, coll. G. Anderson. AM P21095, 2♂♂, 1♀, 4.9–6.0 mm, same locality as AM P18975, 6 October 1971, coll. Talbot, Hoese, Moore and Hachings.— Western Australia. AM P80722, 1 ovig.♀, CL 11.1 mm, North West Shelf, Goodwin Oil Rig, 19º36'32"S, 115º56'8"E, 2008, coll. R. T. Springthorpe; AM P80721, 1♀, CL 11.0 mm, North West Shelf, Yodel Oil Rig, 19º43'4"S, 115º42'6"E, 2008, coll. R. T. Springthorpe.

New Caledonia. MNHN-Na 12984, 1 ovig.♀, CL 7.6 mm, Lagon nord, stn DW 1129, 19º29.2'S,

163º48.8’E, 40m, 26 October 1989, coll. B. Richer de Forges; MNHN-Na 12973, 1♂, CL 12.2 mm, Canal Woodin, De Vincent, stn 246, 18 August 1980, coll. P. Laboute; MNHN-Na 12977, 1♂, CL 11.3 mm Récif Lageinére, 3–12 m, 4 September 1991, coll. J. L. Menou; MNHN-Na 12976, 1 ovig.♀, CL 11.9 mm, Récif Lareignére, 3–12 m, 4 November 1991, coll. J. L. Menou; MNHN, 1♂, CL 5.6 mm, same locality as MNHN-Na 12976, 12–16 m, 3 May 1993; MNHN-Na 12974, 1♂, CL 10.7 mm, MNHN-Na 12975, 1♂, CL 10.7 mm, , MNHN, 1♂, CL 11.4 mm, Côte est, Récif Ana, 3–10 m, 11 September 1989, coll. Menou; MNHN-Na 12978, 1♂, CL 9.8 mm, Caverne du Récif externe de Taenia, 8 m, 25 March 1990, coll. Menou.— Lagon est. MNHN-Na 12991, 1♂, CL, 4.8 mm, stn 0707, 21º25.3’S, 166º04.1’E, 38–34 m, 10 August 1986, coll. B. Richer de Forges; MNHN-Na 12992, 1 ovig. ♀, CL 7.7 mm, stn 0668, 21º40.5’S, 166º29.1’E, 40 m, 8 August 1986, coll. B. Richer de Forges.— Île des Pins. MNHN-Na 12981, 1 ovig.♀, CL 5.9 mm, St 587, 22º32’S, 167º28’E, 35 m, 18 July 1985, coll. B. Richer de Forges; USNM, 1 ovig.♀, CL 7.2 mm, St 584, 22º43’S, 167º31’E, 25 m, 18 July 1985, coll. B. Richer de Forges.

Loyalty Islands. Lifu. UMZC, 1♀, CL 3.3 mm, 1896–1897, coll. Willey; MNHN-Na 12982, 1♂, CL 10.1 mm, Grand Récif Sud, stn 341, 22º51’S, 166º47’E, 19 m, coll. B. Richer de Forges; MNHN-Na 12983, 1 ovig.♀, CL 7.3 mm, Lagon Est, st 0619, 22º03.2’S, 166º54.2’E, 27–42 m, 6 August 1986, coll. B. Richer de Forges; MNHN-Na 12985, 1♂, CL 7.7 mm, Lagon Est, stn 0757, 21º15.3’S, 165º45.55’E, 44 m, 7 January 1987, coll. B. Richer de Forges; MNHN-Na 12986, 1 ovig.♀, CL 9.6 mm, Baie de Kanala, 10–20 m, 9 January 1979, coll. R. V. “Vauban”; MNHN-Na 12987, 1♂, CL 8.6 mm, Baie des Citrons, 10 m, 27 March 1987; MNHN-Na 12988, 1♂, CL 6.5 mm, Lagon est, stn 0671, 21º38.1’S, 166º25.5’E, 36–39 m, 8 August 1986, coll. B. Richer de Forges.

Chesterfield Islands. MNHN-Na 12990, 1♂, CL 8.6 mm, Iles Bellona, August 1988, coll. Corail 1; MNHN-Na 12979, 1♂, CL 7.1 mm, stn DW 105, 19º08.91’S, 158º39.19’E, 35 m, 27 August 1988, coll. B. Richer de Forges; MNHN-Na 12980, 1♂, CL 9.2 mm, St. CP 15, 21º24’90”S, 159º09’30”E, 60m, coll. Mer de Corail.

INDIAN OCEAN. **Madagascar.** MNHN, 1♀, CL 9.6 mm, Côte ouest, 17º58’S, 43º23’E, 90–110 m, 22 September 1973, coll. R. V. “FAO 26”. MNHN, 1 ovig.♀, CL 7.9 mm, Côte nord-ouest, 15º21.7’S, 46º12.6’E, 90–130 m, 8 Nobember 1972, coll. R. V. “Vauban”.

Description. Carapace (Fig. 30A) almost glabrous, but covered with feeble transverse striations; dorsal median carina with 2 teeth, anterior tooth just posterior to rostral articulation, subequal to posterior tooth in size, apex slightly directed upwards, posterior tooth feebly articulated with median carina; supraorbital spine present; orbit feebly developed, inferior orbital margin feebly angular; antennal spine somewhat longer than supraorbital spine, situated ventrad to inferior orbital margin, flanked by short carina; pterygostomial angle with blunt tooth.

Rostrum (Fig. 30B) articulated with carapace, overreaching level of anterior margin of scaphocerite by subapical part, 1.1–1.8 times as long as carapace, anterior half feebly upward, apex slightly directed downwards; dorsal margin armed with two large spaced teeth on proximal half, posterior-most tooth situated just above of cornea, proximal second tooth at proximal two fifths of rostrum, with 4–6 small subterminal teeth; ventral margin armed with 9–14 (usually 12–13) teeth, decreasing in size distally.

Fifth thoracic sternite armed posteriorly with pair of median acute processes. Sixth somite armed posteriorly with pair of processes, smaller and situated more laterally than those of fifth somite.

Abdominal somites covered with feeble oblique striations. Pleura of first to third somites broadly rounded; that of fourth somite with rounded posteroventral angle. Fifth somite with posterolateral angle terminating in acuminate process. Sixth somite 0.4–0.7 times as long as carapace, midpoint of posterolateral margin acutely prominent posteriorly, posteroventral angle acutely pointed, fringed with dense short setae; ventral surface armed with strongly hooked preanal spine. Telson 0.6–0.8 times as long as carapace, 1.1–1.5 times as long as sixth somite, tapering posteriorly, posterior margin acuminate medially, with 3 pairs of dorsal spines on posterior three fifths; posterior margin with 3 pairs of spines, intermediate pair longest, mesial-most pair plumose.

Ophthalmic somite with midline slightly carinate, dorsally with fooked lobe. Eye (Fig. 30A) with large, globular cornea, maximum diameter longer than distal margin of stalk, distinct dorsal accessory pigment spot present; stalk widened, shorter than cornea.

Antennular peduncle (Fig. 30C) reaching level of proximal two fifths of rostrum. Proximal segment subequal to distal two segments combined, dorsal surface moderately concave, with acute anterolateral tooth reaching level of distal third of intermediate segment, ventral surface mesially armed with a single spine; stylocerite well developed, acute, reaching level of midlength of intermediate segment, armed proximolaterally with acute tooth; statocyst small, longitudinally oblong. Intermediate segment subcylindrical, furnished with dense setae laterally, mesial surface with sparse short setae. Distal segment subcylindrical, shortest, ventrally with setae. Dorsal flagellum with short aesthetascs at distal two thirds of thickened part.

Antenna with stout basicerite (Fig. 30A) armed ventrolaterally with acute tooth directed anteriorly; ventral margin unarmed. Scaphocerite well developed, reaching level of subapical part of rostrum, 4.0–5.2 times as long as maximum width, lateral margin almost straight, terminating in acute tooth overreaching distal margin of lamella, proximal part of the tooth subequal to lamella in width, mesial margin convex. Carpocerite (Fig. 30A) stout, reaching level of proximal third of scaphocerite.

Epistome unarmed.

Mouthparts typical of the family. Second maxilliped with suboval epipod; podobranch well developed; dactylus narrow, with mesial margin nearly straight, densely furnished with long setae; propodus elongate, with anterior margin broadly rounded, with dense long setae; carpus subquadrate, anterolateral angle bluntly produced; mesial surface of merus, ischium, and anterior part of basis shallowly concave; coxa inflated mesially, anteromesial margin angular; exopod with well developed flagellum. Third maxilliped with endopod overreaching level of distal margin of scaphocerite by whole length of ultimate segment in “robstus male”, by distal third of ultimate segment in “intermedius male”, falling slightly short of level of distal margin of scaphocerite in “typus male” and female; ultimate segment with transverse rows of dense setae, ventrally furnished with numerous setae, 3.2–4.9 times as long as penultimate segment, terminating in a single corneous spine in “robustus male”, 2.0–2.9 times as long as penultimate segment in “intermedius male”, 1.9–2.2 times as long as penultimate segment in “typus male” and female, terminating in a single corneous spine with 2 distolateral and 4 distomesial subterminal spines: penultimate segment fringed sparsely with short setae, dorsolateral surface shallowly concave; antepenultimate segment slightly widened distally, dorsal surface obliquely

situated; ischium short, depressed; exopod with segmented flagellum reaching level of midlength of antepenultimate segment in “robustus male”, level of distal margin of antepenultimate segment in “typus male” and female.

Branchial formula as shown in Table 2.

First pereiopod stout, slightly compressed, overreaching level of distal margin of scaphocerite by length of distal half of dactylus in “robustus male”, falling slightly short of level of distal margin of scaphocerite in “typus male” and female. Chela 2.7–3.0 (“robustus male”), 2.0–2.4 (“intermedius male”), 1.8–1.9 (“typus male” and female) times as long as carpus, palm 1.3–1.9 times as long as dactylus, ventral surface with transverse rows of short setae with setules in “intermedius and typus males” and female, finely granlate, without setae in “robustus male”; dactylus with cutting border furnished with spiniform setae, without denticulation, terminating in set of ungues in “intermedius and typus males” and female, with sparse setae, armed with large, subtriangular tooth on proximal third of cutting border, terminating in a single unguis in “robustus male”, dorsolaterally armed with row of minute spines; fixed finger with cutting border unarmed in “intermedius and typus males” and female, armed with large, subtriangular tooth in “robustus male”, tapering distally, terminating in set of ungues obliquely articulated with corpus, ventrally armed with short spines in “intermedius and robustus males”. Carpus with distal margin truncate, dorsally strongly carinate, dorsodistally terminating in acuminate tooth reaching proximal fourth of palm in “robustus male”, ventrolateral surface slightly oblique. Merus 2.0–3.4 times as long as carpus, obliquely articulated with ischium. Coxa unarmed.

Second pereiopod slender, slightly compressed, falling short of level of distal margin of scaphocerite. Chela with palm 3.4 times as long as dactylus; dactylus slightly arched, without denticulation on cutting border, terminating in set of ungues, distal margin of corpus furnished with long setae; fixed finger without denticulation but densely furnished with long setae on cutting edge, distolaterally with row of long setae, terminating in set of ungues, longest unguis subequal to corpus in length. Carpus 1.3–1.6 times as long as chela, 1.6 times as long as merus, distal margin bluntly produced, with sparse setae. Merus obliquely articulated with ischium. Coxa unarmed.

Third pereiopod (Fig. 30D) overreaching level of distal margin of scaphocerite by lengths of distal fifth of propodus and dactylus. Coxa unarmed. Ischium armed with 1 lateral spine. Merus 2.1–2.4 times as long as carpus, armed with 3 (rarely 4) lateral spines (distal spine near distal margin). Carpus armed with 2 lateral spines, with dorsodistal angle produced anteriorly. Propodus 1.8–2.0 times as long as carpus, ventral surface armed with about 14 small spines, dorsal surface sparsely furnished with long setae, a few distal plumose setae. Dactylus (Fig. 30E) biunguiculate, ungues distinctly demarcated from corpus, flexor margin armed with 2 small accessory spines, decreasing in size proximally. Fourth pereiopod falling slightly short of distal margin of scaphocerite, similar to third pereopod in armature and proportion of propodus. Merus 2.0–2.2 times as long as carpus. Fifth pereiopod reaching level of midlength of scaphocerite. Armature similar to those of two anterior ambulatory pereiopods. Merus 1.7–1.9 times as long as carpus. Propodus 1.6–1.9 times as long as carpus.

Endopod of male first pleopod (Fig. 30F) broad, external margin with a small lobe at distal third, distal margin prominent, slightly fooked, without setae; appendix interna well developed, tapering distally, with a few cincinnuli terminally.

Endopod of male second pleopod with appendices masculina and interna arising from distal third of mesial margin; appendix masculina oval, furnished with long sparse setae, broader than appendix interna; appendix interna elongate, with a few cincinnuli terminally.

Uropod with protopodite posterolaterally acute. Both exopod and endopod slightly overreaching level of tip of telson; exopod with lateral margin straight, terminating in acute tooth, mesially with movable spine longer than the terminal tooth; endopod slender, tapering distally.

Color in life (Fig. 4A, B). Ground color pale, somewhat translucent. Carapace and abdominal somites covered with reddish-orange to reddish-brown complicated bands, interspaced with white spots circled with red and white lines. Rostrum generally reddish translucent, distodorsally yellow. Dorsal surface of third abdominal somite with a dark red median subquadrate spot. Third maxilliped red, with white narrow lateral line, first pereiopod red, with white dorsal line, ambulatory pereiopods with ischia and meri marbled with red and white, carpi and propodi red, with white longitudinal line.

Distribution. Type locality: Long Ke wan, Hong Kong (Okuno, 1994a). Widespread from the Indo-West Pacific (Fig. 64): **Madagascar:** Côte ouest, Côte nord-ouest (present study); **Taiwan:** Taipei County (De Grave *et al*., in prep); **Philippines:** Okuno (1994a); **Indonesia:** Sulawesi (present study); **Australia.** Queensland (present study), North West Shelf, WA (Poore *et al*., 2008; present study); **Chesterfield Islands:** present study; **Loyalty Islands:** Lifu (present study); **New Caledonia:** Récif Lageinére, Côte est, Récif Ana, Caverne du Récif externe de Taenia, Ile des Pins (present study).

Remarks. Borradaile (1899) reported a single specimen from Lifu, the Loyalty Islands as *Rhynchocinetes typus*. In the present study, the specimen deposited at the UMZC was re-examined, and it was confirmed to be identifiable with *Bus brucei*. This species has been known from Taiwan, Hong Kong, the Philippines and Great Barrier Reef and Western Australia of Australia based on the actual specimens (Okuno, 1994a; Poore *et al*., 2008; De Grave *et al*., in prep). The present report represents that *B. brucei* is recorded from Indonesia, New Caledonia, Chesterfield Islands, and Madagascar for the first time. Therefore, it will be regarded as a widely distibuted species resembling *B. durbanensis*.

5-3-2-4 *Bus conspiciocellus* (Okuno and Takeda, 1992) comb. nov.

(Figs. 4C, D, 31, 39G)

Rhynchocinetes uritai– Kubo, 1942: 30, figs. 1–3 (in part). Not *Rhynchocinetes uritai* Kuno, 1942.

Rhynchocinetes conspiciocellus Okuno and Takeda, 1992: 64, pl. 1A, B, figs. 1-3, 4A–D.

Rhynchocinetes conspiciocellus– Gosliner *et al*., 1996: 217, fig. 785 in color.

Rhynchocinetes conspiciocellus– Chace, 1997: 27 (in key).

Rhynchocinetes conspiciocellus– Hayashi, 1999b: 221, figs. 371c, 372c, 374e, f, k.

Rhynchocinetes conspiciocellus– Debelius, 1999b: 166, unnumbered fig. in color.

Rhynchocinetes conspiciocellus– Minemizu, 2000: 32, unnumbered fig. in color.

Rhynchocinetes conspiciocellus– Kato and Okuno, 2001: 18, unnumbered figs. in color.

Rhynchocinetes conspiciocellus– Kawamoto and Okuno, 2003: 20, unnumbered fig. in color.

Not *Rhynchocinetes* cf. *conspiciocellus*– Laboute and Recher de Forges, 2004: 381, unnumbered fig. in color. [= *Bus brucei* (Okuno, 1994)]

Rhynchocinetes conspiciocellus– Hayashi, 2007: 110, figs. 45c, 46c, 49e, f, k.

Rhynchocinetes conspiciocellus– De Grave and Fransen, 2011: 302 (list).

Material examined: Japan. Honshu. CMNH-ZC 00035, 1♂, CL 13.9 mm, Gotogaeri, Ubara Utopia, Katsuura, Boso Peninsula, intertidal zone, 26 February 1999, coll. M. Kurihara; CMNH-ZC 01458, 1♂, CL 12.0 mm, same locality as CMNH-ZC 00035, 30 July 1998, coll. M. Aizawa; CMNH-ZC 00277, 1♀, CL 10.0 mm, same locality as CMNH-ZC 00035, 18 April 2000, coll. M. Kurihara, K. Yanagi and J. Okuno; CMNH-ZC 01985, 1 ovig.♀, CL 11.5 mm, Asa-ne. Hasama, Tateyama, Boso Peninsula, 7 m, 22 September 2005, coll. M. Aizawa; NSMT-Cr 11103, 1 ovig.♀ (paratype), CL 11.0 mm, Shibazaki, Hayama, west coast of Miura Peninsula, Sagami Bay, 3 m, 35º15.8'N, 139º34.3'E, 3 August 1991, coll. J. Chiba; SUF-530-2-1407, 1♂(paratype), CL 9.2 mm, SUF-530-2-1408, 1♀(paratype), CL 7.8 mm, SUF-530-2-1406, 1♂(paratype), Enashi, Numazu, north-western coast of Izu Peninsula, Suruga Bay, 5–10 m, 35º09'N, 138º48.3'E, coll. Y. Maihara. Kushimoto, southern tip of Kii Peninsula, 33º28.3'N, 135º47'E, 17 February 1977.— Izu Islands. NSMT-Cr 11102, 1 ovig.♀(holotype), CL 11.9 mm, Sokodo, Hachijo-jima Island, 1 m, 33º07'N, 139º49'E, 5 September 1991, coll. J. Okuno; NSMT-Cr 1670, 1♂, CL 5.7 mm, same locality as holotype, 2 m, coll. J. Okuno; CBM-ZC 3134, 1♂, CL 5.6 mm, Hachijo-jima Island, 28 August 1996, coll. J. Okuno; CMNH, 1♂, CL 6.2 mm, Yaene Port, Hachijo-jima Island, 10 m, 6 September 1998, coll. J. Okuno.— Ogasawara Islands. NSMT-Cr 10960, 1♂(paratype), CL 4.8 mm, USNM252593, 1 ovig.♀(paratype), CL 6.2 mm, Kita Harbor, Haha-jima Island, 1 m, 24º42'N, 142º08'E, 15 June 1990, coll. J. Okuno.— Ohsumi Islands. CMNH-ZC 01442, 1♂, CL 12.3 mm, Omiya-shita, Yakushima, intertidal zone, 11 May 2003, coll. Y. Ikeda.— Ryukyu Islands. SUF, 1♂, CL 17.6 mm, Hayamachi Bay, Kikai-shima Island, Amami Group, tidepool, 6 April 1978, coll. H. Fujimoto; CMNH-ZC 02003, 1♂, CL 5.2 mm, Ankyaba, Amami-ohshima Island, Amami Group, tidepool, 12 July 2003, coll. M. Aizawa and Y. Ikeda; RUMF, 1♀, CL 5.1 mm, Oura Bay, Nago, Okinawa-jima Island, 20 June 2009, coll. D. Uyeno; NSMT-Cr 2190, 1♂, CL 11.7 mm, CMNH-ZC 00574, 1♂, CL 14.2 mm, Ajya, Naha, Okinawa-jima Island, 1 m, 23 May 1993, coll. S. Ohashi and J. Okuno; CMNH-ZC 00642, 1♂, CL 9.1 mm, "Shadow cave", Kume-jima Island, 15 m, 20 December 2001, coll. J. Okuno; CMNH, 1♂, CL 3.9 mm, Imgya Marine Garden, Miyako-jima Island, Miyako Islands, 5 m, 3 July 2006, coll. J. Okuno; RUMF-ZC 1521, 1♂, CL 4.7 mm, off Hoshizuna Beach, Iriomote-jima Island, Yaeyama Islands, 4 August 2009, coll. T. Naruse.

Taiwan. Keelung City. NTOU M00909, 2♀♀, CL 6.2, 6.4 mm, 1 ovig.♀, CL 6.3 mm, 1 juv., CL 3.8 mm, Badouzih, 9 November 2006; NTOU M00677, 1 ovig.♀, CL 10.6 mm, Bachihmen, 9 December 1994, coll. C.-S. He; NTOU M00667, 1♀, CL 9.4 mm, NTOU M00675, 1♀, CL 11.4 mm, 1 ovig.♀, CL 13.8 mm, Bachihmen, January 1995, coll. C.-S. He; NTOU M00673, 1♂, CL 9.0 mm, 1 ovig.♀, CL 14.4 mm, Bachihmen, 1995, coll. C.-S. He; NTOU M00670, 1 ovig.♀, CL 17.9 mm, Fishing port, Hepingdao, December 1993, coll. P.-H. Ho; NTOU M00668, 1 ovig.♀, CL 8.2 mm, Hepingdao, 10 m, 13 October 1993, coll. B.-F. Sie; NTOU M00676, 1♂, CL 13.8 mm, Hepingdao, 26 June 1997, coll. S.-H. Wu; NTOU M00904, 1♂, CL 15.9 mm, 3 ovig.♀♀, CL 12.4–13.9 mm, Hepingdao, 19 May 2006; NTOU M00906, 1♂, CL 6.5 mm, Hepingdao, 29 Jun 2006.—Taipei County. NTOU M00678, 2 ovig.♀♀, CL 13.8, 15.8 mm, 1♀, CL 14.3 mm, Longdong, May 1999,

coll. C.-W. Lin: NTOU M00674, 2♀♀, CL 4.7, 5.0 mm, 24 August 2005; NTOU M00669, 1 ovig.♀, CL 12.5 mm, Magang, Penghu, 29 March 1990.— Pingtung County. NTOU M00672, 1♂, CL 6.1 mm, Siaoliouciou, 10 m, 23 October 2003, coll. S. C. Jhuang; NTOU M00894, 1♀, CL 11.2 mm, Siaoliouciou, 11 February 2006.

Description. Carapace (Fig. 31A) almost glabrous, but covered with feeble transverse striations; dorsal median carina with 2 teeth, anterior tooth just posterior to rostral articulation, larger than posterior tooth, apex slightly directed upwards, posterior tooth feebly articulated with median carina; supraorbital spine present; orbit feebly developed, inferior orbital margin feebly angular; antennal spine narrower than supraorbital spine, situated ventrad to inferior orbital margin, flanked by short carina; pterygostomial angle with blunt tooth.

Rostrum (Fig. 31B) articulated with carapace, overreaching level of anterior margin of scaphocerite by subapical part, 1.0–1.4 times as long as carapace, anterior half feebly upward, apex directedanteriorly; dorsal margin armed with two large spaced teeth on proximal half, posterior-most tooth situated just above of cornea, proximal second tooth at about midlength of rostrum, with 5–7 small subterminal teeth; ventral margin armed with 13–15 (rarely 12) teeth, decreasing in size distally.

Fifth thoracic sternite armed posteriorly with a pair of acute median processes (Fig. 31C). Sixth somite armed posteriorly with a pair of triangular processes, shorter and situated more or less laterally than those of fifth somite (Fig. 31C).

Abdominal somites covered with feeble oblique striations. Pleura of first to third somites broadly rounded; that of fourth somite with rounded posteroventral angle. Fifth somite with posterolateral angle terminating in acuminate process. Sixth somite 0.4–0.6 times as long as carapace, midpoint of posterolateral margin acutely prominent posteriorly, posteroventral angle acutely pointed, fringed with dense short setae; ventral surface armed with strongly hooked preanal spine. Telson 0.6–0.7 times as long as carapace, 1.2–1.3 times as long as sixth somite, tapering posteriorly, posterior margin acuminate medially, with 3 pairs of dorsal spines on posterior two thirds; posterior margin with 3 pairs of spines, intermediate pair longest, mesial-most pair plumose.

Ophthalmic somite with midline slightly carinate, dorsally with fooked lobe. Eye (Fig. 31A) with large, globular cornea, maximum diameter longer than distal margin of stalk, distinct dorsal accessory pigment spot present; stalk widened, shorter than cornea.

Antennular peduncle (Fig. 31D) falling slightly short of level of midlength of rostrum. Proximal segment longer than distal two segments combined, dorsal surface moderately concave, with acute anterolateral tooth reaching or falling slightly short of level of distal margin of intermediate segment, ventral surface mesially armed with a single spine; stylocerite well developed, acute, reaching or slightly overreaching level of midlength of intermediate segment, armed proximolaterally with acute tooth; statocyst small, longitudinally oblong. Intermediate segment subcylindrical, furnished with dense setae laterally. Distal segment subcylindrical, shortest, ventrally with setae. Dorsal flagellum with short aesthetascs at distal five sixths of thickened part.

Antenna with stout basicerite (Fig. 31A) armed ventrolaterally with acute tooth directed anteriorly; ventral margin unarmed. Scaphocerite well developed, reaching level of subapical part of rostrum, 3.5–4.7 times as long as maximum width, lateral margin almost straight, terminating in acute

tooth overreaching distal margin of lamella, proximal part of the tooth subequal to lamella in width, mesial margin convex. Carpocerite (Fig. 31A) stout, reaching level of proximal two fifths of scaphocerite.

Epistome unarmed.

Mouthparts typical of the family. Second maxilliped with suboval epipod; podobranch well developed; dactylus narrow, with mesial margin nearly straight, densely furnished with long setae; propodus elongate, with anterior margin broadly rounded, with dense long setae; carpus subquadrate, anterolateral angle bluntly produced; mesial surface of merus, ischium, and anterior part of basis shallowly concave; coxa inflated mesially, anteromesial margin angular; exopod with well developed flagellum, basal part of lateral surface shallowly concave. Third maxilliped with endopod overreaching level of distal margin of scaphocerite by whole length of ultimate segment in “robustus and intermedius males”, by distal third of ultimate segment in “typus male”, reaching level of distal margin of scaphocerite in female; ultimate segment with transverse rows of dense setae, ventrally furnished with numerous setae, 3.4–3.9 (“robustus male”), 2.3 (“inrtermedius male”), 1.8–2.5 (“typus male” and female) times as long as penultimate segment, terminating in a single corneous spine in “robustus male”, with 0–4 distolateral and 2–4 distomesial subterminal spines in “intermedius and typus males” and female; penultimate segment fringed sparsely with short setae, dorsolateral surface shallowly concave; antepenultimate segment slightly widened distally, dorsal surface obliquely situated; ischium short, depressed; exopod with segmented flagellum overreaching level of distal margin of antepenultimate segment.

Branchial formula as shown in Table 2.

First pereiopod stout, slightly compressed, overreaching level of distal margin of scaphocerite by length of dactylus in “intermedius male”, reaching or falling slightly short of level of midlength of scaphocerite in “typus male” and female. Chela 2.9 (“robustus male”), 2.5 (“intermedius male”), 1.5–2.0 (“typus male” and female) times as long as carpus, palm distinctly longer than dactylus, ventral surface with 13 transverse rows of short setae with setules in “intermedius and typus males” and female, covered with minute spiniform setae dorsally and ventrally in “robustus male”; dactylus with cutting border furnished with spiniform setae, without denticulation in “intermedius and typus males” and female, armed proximally with large subtriangular tooth in “robustus male”, terminating in set of ungues; fixed finger with cutting border unarmed in “typus male” and female, armed with large, oblong corneous ridge, dorsoproximally and dorsodistally angles each with subtriangular tooth, proximal tooth oppose to between palmo-dactylar articulation and proximal tooth on dactylus in “robustus male”, tapering distally, terminating in set of ungues obliquely articulated with corpus. Carpus with distal margin truncate, dorsodistally terminating in acuminate tooth in “robustus and intermediate males”, ventrolateral surface slightly oblique. Merus 1.1–2.0 times as long as carpus, obliquely articulated with ischium. Coxa unarmed.

Second pereiopod slender, slightly compressed, reaching level of distal third of scaphocerite. Chela with palm 3.0–4.3 times as long as dactylus; dactylus slightly arched, without denticulation on cutting border, terminating in set of ungues, distal margin of corpus furnished with long setae; fixed finger without denticulation but densely furnished with long setae on cutting edge, distolaterally with row of long setae, terminating in set of ungues, longest unguis subequal to corpus in length. Carpus

1.3–1.9 times as long as chela, 1.3–1.6 times as long as merus, distal margin bluntly produced, with sparse setae. Merus obliquely articulated with ischium. Coxa unarmed.

Third pereiopod (Fig. 31E) falling slightly short of level of distal margin of scaphocerite. Coxa unarmed. Ischium armed with 1 lateral spine. Merus 2.1–2.2 times as long as carpus, armed with 3 lateral spines (distal spine near distal margin). Carpus armed with 2 lateral spines, with dorsodistal angle produced anteriorly. Propodus 1.7–1.8 times as long as carpus, ventral surface armed with about 15 small spines, dorsal surface sparsely furnished with long setae, a few distal plumose setae. Dactylus (Fig. 31F, 39G) biunguiculate, ungues distinctly demarcated from corpus, flexor margin armed with 2 small accessory spines posterior to preterminl unguis, decreasing in size proximally. Fourth pereiopod falling overreaching level of midlength of scaphocerite, similar to third pereopod in armature and proportion. Fifth pereiopod falling slightly short of level of midlength of scaphocerite, similar to those of two anterior ambulatory pereiopods in armature and proportion.

Endopod of male first pleopod (Fig. 31G) generally oval, external margin furnished with short sparse setae proximally, without distinct lobe at distal third of length, distal margin prominent, entire, without setae; appendix interna well developed, tapering distally, with a few cincinnuli terminally.

Endopod of male second pleopod with appendices masculina and interna arising from distal third of mesial margin; appendix masculina oval, furnished with long sparse setae, considerably broader than appendix interna; appendix interna elongate, with a few cincinnuli terminally.

Uropod with protopodite posterolaterally acute. Both exopod and endopod overreaching level of tip of telson; exopod with lateral margin straight, terminating in acute tooth, mesially with movable spine longer than the terminal tooth; endopod slender, tapering distally.

Color in life (Fig. 4C, D). Ground color pale, somewhat translucent. Carapace and abdominal somites covered with reddish–brown complicated bands, interspaced with white spots circled with red and white lines. Rostrum generally reddish translucent, distally yellow. Dorsal surface of third abdominal somite with a dark red median subquadrate spot. Third maxilliped red, with white narrow lateral line, first pereiopod red, with white dorsal line, ambulatory pereiopods with ischia and meri marbled with red and white, carpi and propodi red, with white longitudinal line.

Distribution. Type locality: Sokodo, Hachijo-jima Island, Izu Islands, Japan (Okuno and Takeda, 1992a). Also known from other localities of southern Japan, and Taiwan (De Grave *et al.*, in prep.; present study) (Fig. 65).

Remarks. This species was first reported as the sexual dimorphism of large female of *R. uritai* because a dark median spot on dorsal midline of the third abdomial tergum is present instead of lacking it in male and small female specimens (Kubo, 1942). Later, Okuno and Takeda (1992a) considered that the Japanese species with the dark median spot is a distinct species from *R. uritai* on account of the absence of a distinct lobe on the external margin of male first pleopod, and the relatively shorter scaphocerite. Furthermore, Okuno (1997b) pointed out that the armature on dactyli of the ambulatory pereiopods readily distinguishes *R. conspiciocellus* from *R. uritai*: In *R. conspiciocellus*, the flexor margin of the dactyli is armed with two accessory spines posterior to preterminal unguis (Fig. 31F, 39G), instead of three spines in *R. uritai* (Fig. 46E).

Bus conspiciocellus closely resembles *B. brucei* in color in life (Fig. 4A–D). However, the morphological features are readily distinguishable these two species: the third pereiopod lacks

arthrobranch in *B. conspiciocellus*, whereas the pereiopod of *B. brucei* possesses an arthrobranch; in *B. conspiciocellus*, the endopod of male first pleopod has a flexor margin without lobe in “typus” form (Fig. 31G) and with a very small lobe in “intermedius and robustus” forms, in contrast, a distinct lobe is constantly present in the endopod of *B. brucei* through the growth (Fig. 30F).

5-3-2-5 *Bus durbanensis* (Gordon, 1936) comb. nov.

(Fig. 4E–H, 32)

Rhynchocinetes typus– Stebbing, 1917: 27, pl. 6. Not *Rhynchocinetes typus* H. Milne-Edwards, 1837.

Rhynchocinetes durbanensis Gordon, 1936: 83, figs. 5b, c, 7c, d.

Rhynchocinetes durbanensis– Barnard, 1950: 763, fig. 145.

Rhynchocinetes durbanensis– Zarenkov, 1968: 58, fig. 1.

Rhynchocinetes durbanensis– Kensley, 1972: 34, fig. 15m.

Rhynchocinetes n. sp.– George and George. 1979: 79, pl. 67, fig. 7.

Rhynchocinetes durbanensis– Kensley, 1981: 23 (list).

Rhynchocinetes uritai– Debelius, 1983: 71, 77, unnumbered figs. in color. Not *Rhynchocinetes uritai* Kubo, 1942.

Rhynchocinetes rugulosus– Spies 1983: 88 . Not *Rhynchocinetes rugulosus* Stimpson, 1860.

Rhynchocinetes uritai– Debelius, 1984: 71, 77, unnumbered figs. in color. Not *Rhynchocinetes uritai* Kubo, 1942.

Rhynchocinetes sp.– Takeda 1986: 105, unnumbered fig.

Rhynchocinetes uritai– Baensch and Debelius, 1992: 542, unnumbered figs. Not *Rhynchocinetes uritai* Kubo, 1942.

Rhynchocinetes uritai– Lin, 1992: 103, unnumbered fig. Not *Rhynchocinetes uritai* Kubo, 1942.

Rhynchocinetes durbanensis– Okuno and Takeda, 1992b: 85, figs. 1, 2A–C, 4, 5 (right), 6–9.

Rhynchocinetes durbanensis– Okuno, 1993: 2, figs. 2–6.

Rhynchocinetes uritai– Baumeister, 1993: 242, unnumbered fig. Not *Rhynchocinetes uritai* Kubo, 1942.

Rhynchocinetes durbanensis– Debelius and Baench, 1994: 543, unnumbered figs.

Rhynchocinetes uritai– Allen and Steen 1994: 148, unnumbered fig. Not *Rhynchocinetes uritai* Kubo, 1942.

Rhynchocinetes uritai– Colin and Arneson 1995: 218, fig. 1036 . Not *Rhynchocinetes uritai* Kubo, 1942.

Rhynchocinetes durbanensis– Gosliner *et al*,1996: 217, fig. 786 in color.

Rhynchocinetes cf. *uritai*.– Schuhmacher and Hinterkircher, 1996: 130, unnumbered fig. Not *Rhynchocinetes uritai* Kubo, 1942.

Rhynchocinetes durbanensis– Chace, 1997: 30.

Rhynchocinetes durbanensis– Bruce, 1997: 208, unnumbered fig. in color.

Rhynchocinetes durbanensis– Debelius, 1998: 275, unnumbered figs. in color.

Rhynchocinetes durbanensis– Coleman, 1998: 35, unnumbered fig. in color.

Rhynchocinetes durbanensis– Masuda, 1999: 39, unnumbered fig. in color.

Rhynchocinetes durbanensis– Hayashi, 1999b: 222, figs. 371d, 372d, 374g, h.

Rhynchocinetes durbanensis– Debelius, 1999a: 254, innumbered figs. in color.

Rhynchocinetes durbanensis– Debelius, 1999b: 164, unnumbered figs. in color.

Rhynchocinetes durbanensis– Kobayashi, 2000: 176, unnumbered fig. in color.

Rhynchocinetes durbanensis– Halstead, 2000: 280, unnumbered fig. in color.

Rhynchocinetes durbanensis– Coleman, 2000: 197, unnumbered figs. in color.

Rhynchocinetes durbanensis– Minemizu, 2000: 30, unnumbered fig. in color.

Rhynchocinetes durbanensis– De Grave, 2001a: 49.

Rhynchocinetes durbanensis– Debelius, 2001: 253, unnumbered fig. in color.

Rhynchocinetes durbanensis– Davie, 2002: 373 (list).

Rhynchocinetes durbanensis– Kawamoto and Okuno, 2003: 21, unnumbered figs. in color.

Rhynchocinetes durbanensis– Laboute and Recher de Forges, 2004: 381, unnumbered fig. in color.

Rhynchocinetes durbanensis– Hayashi, 2007: 112, figs. 45d, 46d, 49g, h.

Rhynchocinetes durbanensis– Burukovsky, 2007: 5, fig. 3.

Rhynchocinetes durbanensis– Poupin, 2009: 52, unnumbered fig. in color.

Rhynchocinetes durbanensis– Humann and DeLoach, 2010: 141, unnumbered figs. in color.

Rhynchocinetes durbanensis– De Grave and Fransen, 2011: 302 (list).

Material examined: WESTERN PACIFIC. **Japan.** Izu Islands. CMNH-ZC 01111, 1♀, CL 3.0 mm, Nazumado, Hachijo-jima Island, 35 m, 27 August 2002, coll. K. Tanaka.— Ryulyu Islands. NSMT-Cr 2172, 1♂, CL 15.9 mm, NSMT-Cr 2173, 1♂, CL 15.0 mm, NSMT-Cr 2174, 1♂, CL 13.6 mm, NSMT-Cr 2167, 1 ovig.♀, CL 9.0 mm, Ie-shima Island, 26º42.0'N, 127º48.6'E, 20 m, 27 May 1993, coll. S. Ohashi; CMNH-ZC 00644, 1♂, CL 9.0 mm, off Hateno-hama, Kume-jima Island, 17 m, 19 October 2000, coll. J. Okuno.

Taiwan. Pingtung County. ASIZ 70050, 1♂, CL 13.4 mm, 1 ovig.♀, CL 8.5 mm, Shanhai Village, 10 May 1993, coll. M.-S. Jeng.

Indonesia. Sulawesi. RMNH-D 49616, 1♂, CL 5.5 mm, 1♀, CL 3.3 mm, Bitung, Spermonde Archipelago, stn 17, 20 m, 30 October 1994; RMNH-D 49609, 2♀♀, CL 2.7, 2.8 mm, Bitung, Spermonde Archipelago, stn 10, 20 m, 17 October 1994; RMNH-D 49608, 2♂♂, CL 5.9, 6.1 mm, 1 ♀, CL 3.7 mm, Bitung, Spermonde Archipelago, stn 17, 20 m, 30 October 1994; RMNH-D 49607, 1 ♂, CL 8.8 mm, 1 ovig.♀ CL 6.4 mm, Bitung, Spermonde Archipelago, stn 17, 20 m, 30 October 1994.— Ambon. RMNH-D 49610, 1 ovig.♀, CL 6.3 mm, Galghock, Rumphius Biohistorical Expedition 1990, stn 5, 12 m, SCUBA, 10 November 1990; RMNH-D 49612, 2♀♀, CL 3.3, 3.8 mm, Galghock, Rumphius Biohistorical Expedition 1990, stn 5, 12 m, SCUBA, 10 November 1990; RMNH-D49615, 1♂, CL 4.5 mm, 1♀, CL 3.1 mm, Galghock, Rumphius Biohistorical Expedition 1990, stn 5, 12 m, SCUBA, 10 November 1990; RMNH-D49611, 3♀♀, CL 3.0–3.3 mm, Galghock, Rumphius Biohistorical Expedition 1990, stn 5, 12 m, SCUBA, 10 November 1990; RMNH-D 49613, 1♀, CL 1.6 mm, Laha, Rumphius Biohistorical Expedition 1990, stn 18, 12 m, 19 November 1990; RMNH-D 49614, 3♂♂, CL 7.4–9.8 mm, 2 ovig.♀♀, CL 6.2, 7.8 mm, 4♀♀, CL 3.4–7.2 mm, Kaitetu (near Hila), Rumphius Biohistorical Expedition 1990, stn 23, 17 m, 22 Npvember 1990.

Australia. Western Australia. AM P80720, 1♂, CL 12.2 mm, AM P80723, 1♂, CL 13.7 mm, North West Shelf, Yodel Oil Rig, 19º43'4"S, 115º42'6"E, 2008, coll. R. T. Springthorpe; AM P80719, 1♂, CL 14.2 mm, North West Shelf, Wanaea Oil Rig, 19º35'34"S, 116º23'43"E, 2008, coll. R. T. Springthorpe.

New Caledonia. MNHN, 2♂♂, CL 6.6, 7.2 mm, CL N/O "Alis" campagne SURPRISES, stn CP1388, 18º23.8'S, 163º06.9'E, 40 m, 11 May 1999, coll. Richer-IRD; MNHN, 1♀, CL 4.2 mm, Lagon est, stn 0692, 21º32.0'S, 166º12.3'E, 44–48 m, 9 August 1986, coll. B. Richer de Forges; MNHN-Na 12995, 1 ovig.♀, CL 8.6 mm, Grand Récif Sud, stn 545, 22º52'S, 166º50'E, 37 m, 15 July 1985, coll. B. Richer de Forges; MNHN, 1♂, CL 11.6 mm, Ile aux Maîtres, 12 m, 26 March 1989, coll. P. Laboute.

Chesterfield Islands. MNHN, 1 ovig.♀, CL 8.6 mm, Corail 2, stn CP7, 20º51'97"S, 161º36'94"E, 63–64 m, 20 July 1988, coll. B. Richer de Forges.

Loyalty Islands. Uvea Island. MNHN CB 1051, 1 ovig.♀, CL 9.4 mm, MNHN CB 1050, 1♂, CL 10.5 mm, Bagat Islet, stn 491, 9–11 m, 18 November 1991, coll. J. P. Menou.

INDIAN OCEAN. **Sri Lanka**. ZRC, 6♂♂, CL 10.6–11.9 mm, Trincomalee, east coast of Ceylon, with SCUBA.

Kenya. Mombasa. NTM Cr. 010746, 1♀, CL 7.3 mm, Fort Jesus, old harnor, 35 m, 1 November 1973, coll. J. Wood.

Tanzania. NTM Cr. 010744, 1♂, CL 8.4 mm, Page, east coast of Zanzibar Island, 1 m, 12 January 1971, coll. B. Benbow; NTM Cr. 010747, 1♂, CL 14.9 mm, Pange Reef, west coast of Zanzibar Island, 17 December 1973, coll. B. Benbow.

Madagascar. MNHN, 1♂, CL 11.6 mm, Tany Kely, Nosy Be, 7 m, August 1971, coll. A. Crosnier; MNHN, 7♂♂, CL 8.6–11.4 mm, 1♀, CL 4.8 mm, 2 ovig.♀♀, 9.2, 10.3 mm, Tany Kely Nosy Be, 2 m, coll. J. Stevens.

Mascarene Islands. Mauritius. BPBM S 11279, 1 ovig.♀, CL 9.4 mm, Flic en Flac, west coast, 25 m, 10 July 1977, coll. J. E. Randall; BPBM, 1♂, CL 13.5 mm, detailed collection site unknown, coll. D. Pelicier.

South Africa. SAMC-A4351, 1♂, CL 16.0 mm, SAMC-A8432, 1♂, CL 13.4 mm, Darban, detailed collection data unknown.

Description. Carapace (Fig. 32A) almost glabrous, but covered with feeble transverse striations; dorsal median carina with 2 teeth, anterior tooth just posterior to rostral articulation, subequal to posterior tooth in size, apex slightly directed upwards, posterior tooth feebly articulated with median carina; supraorbital spine present; orbit feebly developed, inferior orbital margin feebly produced; antennal spine as long as supraorbital spine, situated ventrad to inferior orbital margin, flanked by short carina; pterygostomial angle with blunt tooth.

Rostrum (Fig. 32B) articulated with carapace, overreaching level of distal margin of scaphocerite by subapical part, 1.1–2.5 times as long as carapace, anterior half feebly upward, apex slightly directed downwards; dorsal margin armed with three large spaced teeth on proximal two thirds, posterior-most tooth situated just above of cornea, with 2–7 (usually 5–6) small subterminal teeth; ventral margin armed with 14–16 teeth, decreasing in size distally.

Fifth thoracic sternite armed posteriorly with a pair of acute median processes. Sixth somite armed posteriorly with a pair of processes, shorter and situated more laterally than those of fifth somite.

Abdominal somites covered with feeble oblique striations. Pleura of first to third somites broadly

rounded; that of fourth somite with feebly angular posteroventral margin. Third somite strongly humped dorsally. Fifth somite with posterolateral angle terminating in acuminate process. Sixth somite 0.4–0.5 times as long as carapace, midpoint of posterolateral margin acutely prominent posteriorly, posteroventral angle acutely pointed, fringed with short setae; ventral surface armed with strongly hooked preanal spine. Telson 0.6–0.7 times as long as carapace, 1.2–1.4 times as long as sixth somite, tapering posteriorly, posterior margin acuminate medially, with 3 pairs of dorsal spines on posterior three fifths; posterior margin with 3 pairs of spines, intermediate pair longest, mesial-most pair plumose.

Ophthalmic somite with midline slightly carinate, dorsally with fooked lobe. Eye (Fig. 32A) with large, globular cornea, maximum diameter longer than distal margin of stalk, distinct dorsal accessory pigment spot present; stalk widened, shorter than cornea.

Antennular peduncle (Fig. 32C) reaching level of midlength of rostrum. Proximal segment longer than distal two segments combined, dorsal surface moderately concave, with acute anterolateral tooth reaching level of distal third of intermediate segment, ventral surface mesially armed with a single spine; stylocerite well developed, acute, reaching level of proximal third of intermediate segment, armed proximolaterally with acute tooth; statocyst small, longitudinally oblong. Intermediate segment subcylindrical, furnished with dense setae laterally, mesial surface with long dense setae. Distal segment subcylindrical, obliquely articulated with intermediate segment, ventrally with setae. Dorsal flagellum with short aesthetascs at distal two thirds of thickened part.

Antenna with stout basicerite (Fig. 32A) armed ventrolaterally with acute tooth directed anteriorly; ventral margin unarmed. Scaphocerite well developed, reaching or falling slightly short of level of subapical part of rostrum, 3.5–4.5 times as long as maximum width, lateral margin almost straight, terminating in acute tooth overreaching distal margin of lamella, proximal part of the tooth subequal to lamella in width, mesial margin convex. Carpocerite (Fig. 32A) stout, reaching level of proximal third of scaphocerite.

Epistome unarmed.

Mouthparts typical of the family. Second maxilliped with suboval epipod; podobranch well developed; dactylus narrow, with mesial margin nearly straight, densely furnished with long setae; propodus elongate, with anterior margin broadly rounded, with dense long setae; carpus subquadrate, anterolateral angle bluntly produced; mesial surface of merus, ischium, and anterior part of basis shallowly concave; coxa inflated mesially, anteromesial margin angular; exopod with well developed flagellum, basal part of lateral surface shallowly concave. Third maxilliped with endopod overreaching level of distal margin of scaphocerite by length of distal third of ultimate segment in “intermedius male”, reaching or falling slightly short of level of distal margin of scaphocerite in female; ultimate segment with transverse rows of dense setae, ventrally furnished with numerous setae, 2.7–3.3 times as long as penultimate segment in “inrtermedius male”, 2.1–2.4 times as long as penultimate segment in “typus male” and female, terminating in a single corneous spine with 2 distolateral and 4 distomesial subterminal spines: penultimate segment fringed sparsely with short setae, dorsolateral surface shallowly concave; antepenultimate segment slightly widened distally, dorsal surface obliquely situated; ischium short, depressed; exopod with segmented flagellum reaching level of midlength of antepenultimate segment in “intermediate male”.

Branchial formula as shown in Table 2.

First pereiopod stout, slightly compressed, overreaching level of distal margin of scaphocerite by length of dactylus in “intermedius male”, reaching or slightly overreaching level of midlength of scaphocerite in “typus male” and female. Chela 2.8–4.0 (“intermedius male”), 1.4–2.2 (“typus male” and female) times as long as carpus, palm distinctly longer than dactylus, ventral surface with transverse rows of short setae with setules in in “typus male” and female, finely granulate in “intermediate male”; dactylus with cutting border furnished with spiniform setae, without denticulation, terminating in set of ungues, dorsolaterally armed with row of minute spines; fixed finger with cutting border unarmed in “typus male “ and female, armed with large, subquadrate tooth with dorsal margin slightly concave medially in “intermedius male”, tapering distally, terminating in set of ungues obliquely articulated with corpus, ventrally armed with short spines. Carpus with distal margin truncate in “typus male” and female, dorsodistally carinate, terminating in acuminate tooth in “intermediate males”, ventrolateral surface slightly oblique. Merus slightly longer than carpus, obliquely articulated with ischium. Coxa unarmed.

Second pereiopod slender, slightly compressed, reaching level of distal third of scaphocerite. Chela with palm 2.6 times as long as dactylus; dactylus slightly arched, without denticulation on cutting border, terminating in set of ungues, distal margin of corpus furnished with long setae; fixed finger without denticulation but densely furnished with long setae on cutting edge, distolaterally with row of long setae, terminating in set of ungues, longest unguis subequal to corpus in length. Carpus 1.3–1.7 times as long as chela, slightly longer than merus, distal margin bluntly produced, with sparse setae. Merus obliquely articulated with ischium. Coxa unarmed.

Third pereiopod (Fig. 32D) overreaching level of distal margin of scaphocerite by lengths of distal fifth of propodus and dactylus. Coxa unarmed. Ischium armed with 1 lateral spine. Merus 2.1–2.4 times as long as carpus, armed with 2–5 (usually 4) lateral spines (distal spine near distal margin). Carpus armed with a single lateral spine, with dorsodistal angle produced anteriorly. Propodus 1.8–2.1 times as long as carpus, ventral surface armed with about 14 small spines, dorsal surface sparsely furnished with long setae, a few distal plumose setae. Dactylus (Fig. 32E) biunguiculate, ungues distinctly demarcated from corpus, flexor margin armed with 3 small accessory spines, decreasing in size proximally. Fourth pereiopod reaching or slightly overreaching distal margin of scaphocerite by length of dactylus. Merus 1.8–2.1 times as long as carpus, armed with 3–4 lateral spines. Proportion of propodus and armature of dactylus similar to those of third pereiopod. Fifth pereiopod reaching level of distal fourth of scaphocerite. Merus 1.6–1.8 times as long as carpus, armed with 3–4 (rarely 1) lateral spines. Propodus 1.6–1.9 times as long as carpus. Armature of dactylus similar to those of two anterior ambulatory pereiopods.

Endopod of male first pleopod (Fig. 32F) generally oval, external margin with short sparse setae, without lobe, distal margin prominent, without setae; appendix interna well developed, tapering distally, with a few cincinnuli terminally.

Endopod of second pleopod with appendices masculina and interna arising from midlength of mesial margin; appendix masculina oval, furnished with long sparse setae, shorter than appendix interna; appendix interna elongate, with a few cincinnuli terminally.

Uropod with protopodite posterolaterally acute. Both exopod and endopod reaching level of tip of

telson; exopod with lateral margin straight, terminating in acute tooth, mesially with movable spine longer than the terminal tooth; endopod slender, tapering distally.

Color in life (Fig. 4E–H). Ground color pinkish white, somewhat translucent. Carapace and abdominal somites covered with brilliant red complicated bands, interspaced with white spots circled with red and white lines, dorsal surface of carapace with white Y-shaped mark on midline, both dorsolateral sides with white longitudinal lines running from posterior margin of orbit to posterior margin of carapace. Dorsal surface of third abdominal tergum with white V-shaped mark, white oblique line running downwards from tergum of third somite to anterolateral margin of second somite in lateral view, white longitudinal line running from anterior margin of fourth abdominal somite to posterior margin of telson. Rostrum dorsally yellow or white, ventrally brilliant red. Third maxilliped dorsally white, ventrally pinkish translucent, first pereiopod red, both fingers white, ambulatory pereiopods with ischia and meri marbled with red and white, carpi and propodi white.

Distribution. Type locality: Durban, South Africa (Gordon, 1936). Widespread from the Indo-West Pacific (Fig. 62): **Red Sea:** Zarenkov (1968); **Kenya:** Mombasa (present study); **Tanzania:** Zanzibar Island (present study); **Madagascar:** Nosy Be (present study); **Mascarene Islands:** Mauritius (present study); **Aden Bay:** Djibouti (Burukovsky, 2007); **Sri Lanka:** Trincomalee (present study); **Taiwan:** Pingtung County (De Grave *et al*., in prep); **Philippines:** Okuno and Takeda (1992b); **Indonesia:** Sulawesi, Ambon (present study); **Australia.** North West Shelf, WA (present study); **Japan:** Izu Islands (present study), Ryukyu Islands (Okuno, 1993b, Kawamoto and Okuno, 2003); **Papua New Guinea:** Hansa Bay (De Grave, 2001); **Chesterfield Islands:** present study; **Loyalty Islands:** Uvea Islands (present study); **New Caledonia:** Grand Récif Sud, Ile aux Maîtres (present study).

Remarks. Morphologically, *Bus durbanensis* is readily distinguished from other congeneric species on account of the rostral dorsal margin armed with widely spaced set of 3 teeth on proximal two thirds (Fig. 32B), and the carpi of ambulatory pereiopods armed with a single spine on midlenghth of lateral surface (Fig. 32D). Whereas in other congeners, the rostrum has 2 widely spaced teeth on proximal two thirds on the dorsal margin, and the carpi of third to fifth pereiopods are armed at least with 2 spines.

The present species was first reported as Rhynchocinetes typus from Durban, South Africa (Stebbing, 1917). Subsequently, in the first revision of rhynchocinetid shrimps, Gordon (1936) corrected the Stebbing's identification, and described the South African species as new to science under the name of *Rhynchocinetes durbanensis*. Since the original description was published, this species has been recorded only from South Africa (Baranard, 1955; Kensley, 1981) and Red Sea (Zarenkov, 1968) for a while. Although this species is now considered as very common in the tropical Indo-West Pacific, it had been confused with *R. uritai* when the appearance of several field guidebooks were began in the 1980's for divers and naturalists (e. g., Debelius, 1983, 1984). Okuno and Takeda (1992b) first indicated that this abundant species could be identified with *R. durbanensis*. After this report, *R. durbanensis* has been reported several publications, but the additional record based on the actual specimens have been restricted from Papua New Guinea (De Grave, 2001a), and Djibouti, Aden Bay (Burukovsky, 2007). In this paper, numerous specimens from various localities were examined as listed above, and no significant morphological differences are present between individuals from Indian

Ocean and Pacific Ocean.

5-3-2-6 *Bus enigma* (Okuno, 1997) comb. nov.

(Figs. 33–35)

Rhynchocinetes enigma Okuno, 1997a: 13–18, figs. 1–3.

Rhynchocinetes enigma– Davie, 2002: 373 (list).

Rhynchocinetes enigma– Poore, 2004: 76, fig. 18b.

Rhynchocinetes enigma– Poore *et al*., 2008: 90, unnumbered fig. in color.

Rhynchocinetes enigma– De Grave and Fransen, 2011: 302 (list).

Material Examined: Australia. Great Australian Bight. SAMA C5599, 1♂(holotype), CL 6.8 mm, approximately 15 km west-south-west of Pearson Islands, 34º17'N, 132º42'E, 140–160 m, 16 April 1989, coll. F.V. Comet; SAMA C5598, 1 ovig. ♀ (paratype), CL 9.0 mm, 250 km south-south-west of Ceduna, 33º12'S, 130º53'E, 113 m, 5 August 1981, coll. F.R.V. Soela; SAMA C5600, 1♂(paratype), CL 7.6 mm, approximately 115 km south-west of Eucla, 33º18'S, 127º38'E, 170 m, 17 January 1989, coll. F.V. Comet.— Western Australia. WAM 439-73, 1♂, CL 7.1 mm, NW of Cape Naturaliste, CSIRO stn 134, 33º40'S, 114º28'E, 27–28 August 1963.

Description. Carapace (Fig. 33, 34A) covered with fine transverse striae, armed with two acute teeth on dorsal median carina, anterior tooth just behind rostral articulation, posterior tooth feebly articulated with carapace; supraorbital spine acute, considerably longer than spines on dorsal median carina, directed anteriorly; antennal spine narrower than supraorbital spine, situated ventrad to inferior orbital margin, supported by a feeble carina, directed anteriorly; pterygostomial spine small, distinct.

Rostrum (Fig. 34A) articulated with carapace, 1.1–1.3 times as long as carapace; dorsal margin armed with two teeth in the basal half, and with three small teeth subterminally; ventral margin armed with eleven teeth, large proximally, elongate, decreasing distally.

Abdominal somites (Fig. 33) covered with fine striae; first three somites with the pleuron marginally rounded; pleura of fourth and fifth somites with distinct posteroventral tooth; sixth somite 0.48–0.50 times as long as carapace, with acute posteroventral spine, with strongly hooked anal spine between bases of uropods, directed posteriorly. Telson (Fig. 34B) 0.6 times as long as carapace, 1.2–1.3 times as long as sixth abdominal somite, armed dorsally with three pairs of spines; midpoint of posterior margin triangularly produced, with three pairs of spines, median pair longest.

Eye (Fig. 33) well developed, with large, globular cornea; stalk much more slender than cornea.

Antennular peduncle (Fig. 34C) reaching midlength of scaphocerite; stylocerite long, reaching or falling slightly short of level of distal margin of antennular distal segment; proximal segment with distolateral spine reaching distal margin of antennular median segment and small proximal lateral tooth, ventrally with acute spine at mesial margin; thickened part of upper antennular flagellum slightly overreaching rostral apex.

Antenna (Fig. 34D) with basicerite (Fig. 33) armed with acute ventrolateral spine and with rounded protrusion just above the spine; scaphocerite 0.9 times as long as carapace, 4.2 times as long

as maximum width, distolateral spine acute, distinctly overreaching end of lamella; carpocerite (Fig. 33) reaching proximal third of length of scaphocerite;.

Mouthparts (Fig. 35) typical of the family. Second maxilliped (Fig. 35E) with well developed podobranch; epipod slightly pointed distally; exopod well developed, tapering; dactylar segment with truncate distal margin; propodal segment with external margin rounded, mesial margin expanded; ischiomeral segment distinct. Third maxilliped (Fig. 35F) falling slightly short of tip of scaphocerite; exopod falling slightly short of distal margin of antepenultimate segment, tapering, with dense long setae; ultimate segment with six spines terminally, 0.6 times as long as carapace, 2.0–2.2 times as long as penultimate segment; penultimate segment 0.3 times as long as carapace.

Branchial formula as shown in Table 2.

First pereiopod (Fig. 34E) chelate, moderately robust, falling slightly short of midlength of scaphocerite; chela 0.4–0.5 times as long as carapace, 2.0–2.2 times as long as carpus, tips of both fingers with dark terminal claws; carpus 0.2–0.3 times as long as carapace, with acute spine at distal end of dorsal margin; merus distodorsally acute.

Second pereiopod (Fig. 34F) chelate, much more slender than first pereiopod, reaching distal sixth of length of scaphocerite; chela 0.4 times as long as carapace; carpus entire, 0.6–0.7 times as long as carapace, 1.5–2.0 times as long as chela.

Third pereiopod (Fig. 34G) reaching distal end of scaphocerite; ischium with single spine; merus 0.7–0.8 times as long as carapace, 1.5–2.0 times as long as carpus, with three almost equidistant spines; carpus 0.4 times as long as carapace, with two spines on outer surface; propodus 0.7 times as long as carapace, 1.7 times as long as carpus, with about six short spinules on flexor margin; dactylus (Fig. 34H) biunguiculate, armed with three accessory spines posterior to preterminal unguis, decreasing in size proximally. Fourth pereiopod reaching distal fifth of length of scaphocerite, spinulation resembling that of third pereiopod; merus 0.7 times as long as carapace, 1.9 times as long as carpus; carpus 0.3–0.4 times as long as carapace; propodus 0.7 times as long as carapace, 1.8 times as long as carpus. Fifth pereiopod falling slightly short of midlength of scaphocerite; spinulation resembling those of two anterior ambulatory pereiopods; merus 0.6 times as long as carapace, 1.6–1.7 times as long as carpus; carpus 0.3–0.4 times as long as carapace; propodus 0.6–0.7 times as long as carapace, 1.8 times as long as carpus.

Endopod of male first pleopod (Fig. 34I) with distal end rounded; well developed appendix interna at midlength of mesial margin, distal end of appendix with dense cincinnuli; distinct lobe at distal third of outer margin of endopod.

Endopod of male second pleopod (Fig. 34J) with appendices masculina and interna at distal two fifths of outer margin; appendix masculina broad, with distal margin rounded, fringed with dense setae; appendix interna considerably more slender and shorter than appendix masculina, with dense cincinnuli at distal end.

Uropodal exopod and endopod (Fig. 34K) slightly overreaching distal end of telson, exopod with a fixed and a movable spines at distal fifth of outer margin, the former considerably shorter than the latter.

Color in life. See Poore *et al*. (2008).

Distribution. Type locality: Approximately 15 km west-south-west of Pearson Islands, Great

Australian Bight, Australia. Also known only fromWestern Australia (Poore *et al*., 2008; present study) (Fig. 63).

Remarks. *Bus enigma* was originally described as *Rhynchocinetes enigma* on the basis of two male and one ovigerous female specimens collected by trawling from the Great Australian Bight at depths between 113 and 170 m. The present species differs distinctly from the other congeneric species by the absence of an arthrobranch on all the maxillipeds and pereiopods (Fig. 35G). The other species always have two small arthrobranchs on the third maxilliped and a developed arthrobranch on at least the first pereiopod.

The original description of the present species did not indicate its color pattern (Okuno, 1997a). Subsequently, Poore *et al*. (2008) showed the color photograph of the additional specimen of *B. enigma*. It is very unique, and readily distinguishable from the congeners on account of the numerous small red spots on the carapace.

5-3-2-7 *Bus holthuisi* (Okuno, 1997) comb. nov.

(Figs. 36–38, 39A–E)

Rhynchocinetes holthuisi Okuno, 1997b: 43–51, figs. 1–3, 4a–d.

Rhynchocinetes holthuisi– Burukovsky, 2007: 8, fig. 4.

Rhynchocinetes holthuisi– De Grave and Fransen, 2011: 302 (list).

Material examined: RED SEA. **Jordan.** RMNH D47456, 1 ovig.♀(holotype), CL 5.9 mm, Aqaba, Gulf of Aqaba, 11 April 1977.

Israel. RMNH D47460, 1 ovig.♀(paratype), CL 6.7 mm, Eilat, Gulf of Aqaba, 4–5 m, 20 September 1970, coll. D. Popper.

Egypt. RMNH D47457, 1♂(paratype), CL 9.6 mm, Dahab, Sinai coast of Gulf of Aqaba, 12 m, 13 October 1968, coll. L. Fishelson; CBM-ZC 3440, 1♂(paratype), CL 6.3 mm, Dahab, Sinai coast of Gulf of Aqaba, 3 m, 10 October 1968, coll. L. Fishelson; RMNH D47458, 1 ovig.♀(paratype), CL 6.1 mm, south of Marsa Murach, opposite Solar Lake, Sinai coast of Gulf of Aqaba, 15 July 1969; RMNH D47459, 1♂(paratype), CL 6.1 mm, El Hamira Bay, Sinai coast of northern Gulf of Aqaba, 21–23 July 1969; RMNH D47461, 2♂♂, 1♀(paratypes), CL 6.1–9.6 mm, Dahab, Sinai coast of Gulf of Aqaba, 3 m, 10 October 1968, coll. L. Fishelson.

Description. Carapace (Fig.36) covered with fine transverse striae, armed with two acute teeth on dorsal median carina, anterior tooth just behind rostral articulation, posterior tooth feebly articulated with carapace; supraorbital spine acute, considerably longer than spines on dorsal median carina, directed anteriorly; antennal spine considerably longer than supraorbital spine, situated ventrad to inferior orbital margin, supported by a feeble carina, directed anteriorly; pterygostomian spine small, distinct.

Rostrum (Fig.37A) articulated with carapace, 1.2–1.3 times as long as carapace; dorsal margin armed with two teeth on basal half of rostrum, and with 4–6 small teeth subterminally; ventral margin armed with 12–13 teeth.

Abdominal somites (Fig. 36) covered with fine striae; first three somites with pleuron marginally rounded; pleura of fourth and fifth somites with distinct posteroventral teeth; sixth somite 0.5–0.6 times as long as carapace, with acute posteroventral spine, with strongly hooked anal spine between bases of uropods. Telson (Fig. 37B) 0.6–0.7 times as long as carapace, 1.0–1.2 times as long as sixth abdominal somite, armed dorsally with three pairs of spines; midpoint of posterior margin triangularly produced, with three pairs of spines, median pair longest.

Eye (Fig. 36) well developed, with large, globular cornea; stalk much more slender than cornea.

Antennular peduncle (Fig. 39A) falling slightly short of midlength of rostrum; stylocerite long, reaching, or falling slightly short of level of midlength of antennular median segment; proximal segment with distolateral spine falling slightly short of distal margin of antennular median segment, ventrally with acute spine at mesial margin; thickened part of upper antennular flagellum overreaching rostral apex.

Antenna with scaphocerite (Fig. 37C) 0.8–0.9 times as long as carapace, 3.6–4.7 times as long as maximum width, distolateral spine acute, distinctly overreaching end of lamella; antennal carpocerite reaching proximal fourth of length of scaphocerite; basicerite (Fig. 36) with acute ventrolateral spine and with rounded protrusion just above spine, ventral margin entire.

Mouthparts typical of the family. Second maxilliped (Fig.38E) with developed podobranch; epipod rounded distally; exopod well developed, tapering; dactylar segment with truncate distal margin; propodal segment with external margin rounded, mesial margin expanded. Third maxilliped (Fig. 38F) falling slightly short of tip of scaphocerite; ultimate segment with 6–7 spines terminally, 0.6–0.8 times as long as carapace, 1.7–2.2 times as long as penultimate segment; penultimate segment 0.3–0.4 times as long as carapace; exopod reaching level of distal fourth of antepenultimate segment, tapering, with dense long setae.

Branchial formula as shown in Table 2.

First pereiopod (Fig. 37D) chelate, moderately robust, falling slightly short of midlength of scaphocerite; chela 0.4–0.5 times as long as carapace, 1.4–2.2 times as long as carpus, tips of both fingers with dark terminal claws; carpus 0.3 times as long as carapace, usually with acute spine at distal end of dorsal margin, but some males with bifid or tridentate spine (Fig. 37E).

Second pereiopod (Fig. 37F) chelate, more slender than first pereiopod, reaching distal third of length of scaphocerite; chela 0.4 times as long as carapace; carpus entire, 0.6–0.7 times as long as carapace, 1.6–1.7 times as long as chela.

Third pereiopod overreaching distal end of scaphocerite by lengths of distal fourth of propodus and dactylus; ischium with a spine; merus (Fig. 39C) 0.8–0.9 times as long as carapace, 2.1–2.3 times as long as carpus, with four (rarely five) almost equidistant spines; carpus 0.4 times as long as carapace, with two spines on outer surface; propodus 0.7–0.8 times as long as carapace, 1.8–2.1 times as long as carpus, with over ten short spinules on flexor margin; dactylus (Fig. 39D) biunguiculate, armed with three accessory claws posterior to preterminal unguis, decreasing in size proximally. Fourth pereiopod overreaching tip of scaphocerite by length of dactylus, spinulation resembling that of third pereiopod; merus 0.7–0.8 times as long as carapace, 1.9–2.1 times as long as carpus; carpus 0.4 times as long as carapace; propodus 0.7–0.8 times as long as carapace, 1.8–2.1 times as long as carpus. Fifth pereiopod reaching level of tip of scaphocerite; spinulation of ischium, carpus, propodus and dactylus

resembling those of third and fourth pereiopods; merus 0.6–0.8 times as long as carapace, 1.6–2.0 times as long as carpus, with 2-5 (usually 3) almost equidistant spines; carpus 0.3–0.4 times as long as carapace; propodus 0.7–0.8 times as long as carapace, 1.7–2.0 times as long as carpus.

Endopod of male first pleopod (Fig. 39E) with distal end pointed; appendix interna well developed, at midlength of mesial margin, distal end of appendix with dense cincinnuli; outer margin entire, without lobe.

Endopod of male second pleopod (Fig. 37G) with appendices masculina and interna at distal two fifths of outer margin; appendix masculina broad, with distal margin rounded, fringed with dense setae; appendix interna considerably more slender and shorter than appendix masculina, with dense cincinnuli at distal end.

Uropodal exopod and endopod (Fig. 37B) slightly overreaching distal end of telson, exopod with fixed and movable spines at distal fifth of outer margin, former considerably shorter than latter.

Color in life. Unknown.

Distribution. Type locality: Aqaba, Gulf of Aqaba, Jordan, northern Red Sea (Okuno, 1997b). Known only from the coasts of the Gulf of Aqaba, northern Red Sea, and Djibouti, Aden Bay (Okuno, 1997b; Burukovsky, 2007) (Fig. 66).

Remarks. *Bus holthuisi* is first described by Okuno (1997b) based on the specimens from the northern Red Sea. Subsequently, Burukovsky (2007) provided the second record of *B. holthuisi* from Djiouti, Aden Bay. Therefore, it is considered as endemic to the Red Sea to Percian Gulf region (Fig. 66).

The present species is closely related to *B. australis*, *B. conspiciocellus*, *B. kuiteri* and *B. uritai*. The morphological features shared by these five species are the presence of arthrobranchs on the third maxilliped and anterior two pereiopods. *Bus australis* differs from *B. holthuisi* in the presence of ventral tooth on the antennal basicerite (Figs. 26H, 39F) and the stylocerite reaching level of distal margin of antennular distal segment (Fig. 26F). *Bus conspiciocellus* differs from *B. holthuisi* in the ambulatory dactyli armed mesially with two accessory spines posterior to preterminal unguis (Figs. 31E, 39G). *Bus kuiteri* differs from *B. holthuisi* in the stylocerite overreaching distal end of the antennular distal segment (Figs. 39H, 40F) and the presence of a distinct or indistinct lobe at the midlength of external margin of male first pleopodal endopod (Fig. 41H). *Bus uritai* differs from *B. holthuisi* in the meral spinulation of the third and fourth pereiopods, armed usually with three equidistant spines (Figs. 39I, 46D) and the endopod of male first pleopod having a distinct lobe at the external margin (Figs. 39J, 46F). As pointed out in the previous rhynchocinetid papers, the coloration in life is one of the best diagnostic characters in this family. Unfortunately, the color pattern of *B. holthuisi* has not been clear.

One of the male paratypes (RMNH D47461, 9.6 mm CL) represents marked sexual dimorphism in the form of the third maxilliped and first pereiopod; the ultimate segment of the maxilliped is considerably elongated, the tip is armed only with single dark spine, and the length is 2.1 times as long as carapace and 5.5 times as long as penultimate segment; the first pereiopod overreaches tip of scaphocerite by the length of the dactylus. Three male paratypes (RMNH D 47457 and D 47461) have the carpus of the first pereiopod armed with the bifid or tridentate dorsodistal spine (Fig. 37E). This feature can be recognized as one of the sexual dimorphisms appearing only in the mature male.

5-3-2-8 *Bus kuiteri* (Tiefenbacher, 1983) comb. nov.

(Figs. 5A, B, 39H, 40, 41)

Rhynchocinetes kuiteri Tiefenbacher, 1983: 121–123, figs. 1–3.
Rhynchocinetes kuiteri– Debelius, 1983: 68, unnumbered fig. in color.
Rhynchocinetes kuiteri– Debelius, 1984: 68, unnumbered fig. in color.
Rhynchocinetes kuiteri– Chace, 1997: 27 (in key).
Rhynchocinetes kuiteri– Okuno, 1997b: 49, fig. 4h.
Rhynchocinetes kuiteri– Edger, 1997: 192, unnumbered fig. in color.
Rhynchocinetes kuiteri– Debelius, 1999b: 165, unnumbered figs. in color.
Rhynchocinetes kuiteri– Davie, 2002: 374 (list).
Rhynchocinetes kuiteri– Poore, 2004: 77.
Rhynchocinetes kuiteri– De Grave and Fransen, 2011: 302 (list).

Material examined: Australia. Tasmania. SAMA C5603, 1♂, CL 16.4 mm, Port Davey, Bathust Channel, Schooner Cove, 3–18 m, 2 April 1993, coll. W. Zeidler, K. L. Gowlett-Holmes and F. A. Barendam; SAMA TC 14264, 1♂, CL 18.2 mm, Tasman Peninsula, Fortescue Bay, Lanterns, 14–16 m, 12 July 1995, coll. K. L. Gowlett-Holmes. NSMT, 1♂, CL 12.7 mm, detailed data unknown, coll. aquarium trader.

Description. Carapace (Fig. 40A) almost glabrous, but covered with feeble transverse striations; dorsal median carina with 2 teeth, anterior tooth just posterior to rostral articulation, somewhat smaller than posterior tooth, apex directed anteriorly, posterior tooth feebly articulated with median carina; supraorbital spine present, strong; orbit feebly developed, inferior orbital margin feebly angular; antennal spine slightly narrower than supraorbital spine, situated ventrad to inferior orbital margin, flanked by short carina; pterygostomial angle with acute tooth.

Rostrum (Fig. 40B) articulated with carapace, overreaching level of anterior margin of scaphocerite by subapical part, 1.1 times as long as carapace, anterior half feebly upward, apex slightly directed downwards; dorsal margin armed with two large spaced teeth on proximal half, posterior-most tooth situated just above of cornea, proximal second tooth at midlength of rostrum, with 5–6 small subterminal teeth; ventral margin armed with 12 teeth, decreasing in size distally.

Fifth thoracic sternite armed posteriorly with a pair of acute median processes. Sixth somite armed posteriorly with a pair of processes, shorter and situated more laterally than those of fifth somite.

Abdominal somites (Fig. 40C) covered with feeble oblique striations. Pleura of first to third somites broadly rounded; those of fourth and fifth somites posterolaterally angular, terminating in acuminate small process. Sixth somite 0.5 times as long as carapace, midpoint of posterolateral margin acutely prominent posteriorly, posteroventral angle acutely pointed, fringed with dense short setae; ventral surface armed with strongly hooked preanal spine. Telson (Fig. 40D) 0.6 times as long as carapace, 1.2–1.3 times as long as sixth somite, tapering posteriorly, posterior margin acuminate

medially, with 3 pairs of dorsal spines on posterior two thirds; posterior margin with 3 pairs of spines, intermediate pair longest, mesial-most pair plumose (Fig. 40E).

Ophthalmic somite with midline slightly carinate, dorsally with fooked lobe. Eye (Fig. 40A) with large, globular cornea, maximum diameter longer than distal margin of stalk, distinct dorsal accessory pigment spot present; stalk widened, shorter than cornea.

Antennular peduncle (Fig. 39H, 40F) reaching level of midlength of rostrum. Proximal segment longer than distal two segments combined, dorsal surface moderately concave, with acute anterolateral tooth reaching level of distal third of intermediate segment, ventral surface mesially armed with a single spine; stylocerite well developed, acute, reaching or slightly overreaching level of distal margin of distal segment, armed proximolaterally with acute tooth; statocyst small, longitudinally oblong. Intermediate segment subcylindrical, furnished with dense setae laterally, mesial surface with long dense setae. Distal segment subcylindrical, shortest, ventrally with setae. Dorsal flagellum with short aesthetascs at distal two thirds of thickened part.

Antenna with stout basicerite (Fig. 40A) armed ventrolaterally with acute tooth directed anteriorly; ventral margin with angular projection at midlength. Scaphocerite (Fig. 40G) well developed, reaching level of subapical part of rostrum, 3.7–4.1 times as long as maximum width, lateral margin almost straight, terminating in acute tooth overreaching distal margin of lamella, proximal part of the tooth subequal to lamella in width, mesial margin convex. Carpocerite (Fig. 43A) stout, reaching level of proximal third of scaphocerite.

Epistome unarmed.

Mouthparts typical of the family. Second maxilliped (Fig. 40A) with suboval epipod; podobranch well developed; dactylus narrow, with mesial margin nearly straight, densely furnished with long setae; propodus elongate, with anterior margin broadly rounded, with dense long setae; carpus stout, anteromesial angle bluntly produced; mesial surface of merus, ischium, and anterior part of basis shallowly concave; coxa inflated mesially, anteromesial margin angular; exopod with well developed flagellum, median part of lateral surface shallowly concave. Third maxilliped with endopod overreaching level of distal margin of scaphocerite by distal third of ultimate segment in “typus male”; ultimate segment with transverse rows of dense setae, ventrally furnished with numerous setae, 1.7–2.4 times as long as penultimate segment in “typus male”, terminating in a single corneous spine with 1 distolateral and 6 distomesial subterminal spines: penultimate segment fringed sparsely with short setae, dorsolateral surface shallowly concave; antepenultimate segment slightly widened distally, dorsal surface obliquely situated; ischium short, depressed; exopod with segmented flagellum falling slightly short of level of midlength of antepenultimate segment.

Branchial formula as shown in Table 2.

First pereiopod (Fig. 41B) stout, slightly compressed, reaching level of midlength of scaphocerite. Chela 1.9–2.0 times as long as carpus in “typus male”, palm 1.9 times as long as dactylus, ventral surface with transverse rows of short grooming setae with setules; dactylus (Fig. 41C) arched, with cutting border without denticulation, terminating in set of ungues, preterminally with tuft of long setae; fixed finger (Fig. 41C) with cutting border unarmed, proximally furnished with dense long setae, tapering distally, terminating in set of ungues. Carpus with distal margin truncate, dorsodistally terminating in acuminate tooth, ventrolateral surface slightly oblique. Merus 1.6 times as long as

carpus, obliquely articulated with ischium. Coxa unarmed.

Second pereiopod (Fig. 41D) slender, slightly compressed, reaching level of distal third of scaphocerite. Chela (Fig. 41E) with palm 3.7 times as long as dactylus; dactylus slightly arched, without denticulation on cutting border, terminating in set of ungues, preterminally with tuft of long setae; fixed finger without denticulation but proximally furnished with dense long setae on cutting edge, terminating in set of ungues, longest unguis exactly longer than corpus. Carpus 1.6–1.7 times as long as chela, 1.4 times as long as merus, distal margin bluntly produced, with sparse setae. Merus obliquely articulated with ischium. Coxa unarmed.

Third pereiopod (Fig. 41F) reaching or slightly overreaching level of distal margin of scaphocerite. Coxa unarmed. Ischium armed with 1 lateral spine. Merus 1.9–2.0 times as long as carpus, armed with 3 lateral spines (distal spine near distal margin). Carpus armed with 2 lateral spines, with dorsodistal angle produced anteriorly. Propodus 1.5 times as long as carpus, ventral surface armed with about 11 small spines, dorsal surface sparsely furnished with long setae, a few distal plumose setae. Dactylus (Fig. 41G) biunguiculate, ungues distinctly demarcated from corpus, flexor margin armed with 3 small accessory spines, decreasing in size proximally. Fourth pereiopod falling slightly short of distal margin of scaphocerite, similar to third pereopod in armature and proportion. Fifth pereiopod reaching level of midlength of scaphocerite. Armature similar to those of two anterior ambulatory pereiopods except for ischium unarmed. Merus 1.5–1.6 times as long as carpus. Propodus 1.4–1.6 times as long as carpus.

Endopod of male first pleopod (Fig. 41H) generally oval, external margin furnished with short sparse setae proximally, with distinct lobe at distal third of length, distal margin rounded, entire, without setae; appendix interna well developed, distal part almost perpendicular, demarcated from proximal part, with a few cincinnuli terminally.

Endopod of second pleopod (Fig. 41I) with appendices masculina and interna arising from distal two fifths of mesial margin; appendix masculina widended distally, furnished with long sparse setae, slightly longer than appendix interna; appendix interna short, with a few cincinnuli terminally.

Uropod (Fig. 40D) with protopodite posterolaterally acute. Both exopod and endopod slightly overreaching level of tip of telson; exopod with lateral margin straight, terminating in acute tooth, mesially with movable spine longer than the terminal tooth; endopod slender, tapering distally.

Color in life (Fig. 5A, B). Tiefenbacher (1983) descrived the life-coloration of *R. kuiteri* in detail:

The ground is of pale gray-brown to dark yellow and not transparent. The rostrum, except the dark tip, shines light yellow. The carapace shows dark reddish-brown spots around the orbital region. The other parts are furnished with narrow more or less longitudinal reddish-brown stripes with brilliant white spots in between. One brilliant white spot we find at the distal part of the merus and carpus of the P1 as well as distally on the palm near the basis of the dactylus. The outsides of the merus, carpus and dactylus of the third, fourth and fifth legs are of a light rusty brown. The first abdominal segment shows in the middle vertically to the longitudinal a dark reddish-brown stripe, which is flanked by two narrow brilliant white ones. The second abdominal segment furnished with a stripe of the same kind on its caudal margin, but this one does not extend over the pleura. A lateral reddish-brown stripe with a narrow brilliant white stripe in its middle reaches from the fourth abdominal segment to the end of the telson on both sides. A stripe of the same kind runs dorsally over the total 4–6 abdominal segments and

ends with a small reddish-brown spot at the beginning of the telson.

Distribution. Type locality: Before Portsea at the mouth of Port Phillip Bay, Victoria, Australia (Tiefenbacher, 1983). Known only from Victoria and Tasmania, southeastern Australia (Fig. 63).

Remarks. The lacking the labyrinth red lines on abdominal somites in color in life appearently distinguishes *B. kuiteri* from the related species corresponding to the branchial formulae (Fig. 5A, B). Morpholigically, *B. kuiteri* appears closest to *B. australis*, the distributional range of which is overlapped with that of the former species in Victorian and Tasmanian coasts of southeastern Australia (Fig. 63). These two species share the long stylocerite reaching distal margin of antennular peduncle, and the lacking of arthrobranches on coxae of ambulatory pereiopods. *Bus kuiteri* is discriminated from *B. australis* by the unarmed ventral margin of antennal basicerite, and the absence of lobe on the external margin of male first pleopodal endopod.

5-3-2-9 *Bus rathbunae* (Okuno, 1996) comb. nov.

(Figs 5C, 42, 43)

Rhynchocinetes rugulosus– Rathbun, 1906, 911, fig. 64. Not *Rhynchocinetes rugulosus* Stimpson, 1860.

? *Rhynchocinetes rugulosus*– Edmondson, 1925: 6. Not *Rhynchocinetes rugulosus* Stimpson, 1860.

? *Rhynchocinetes rugulosus*– Hiatt, 1948: 79. Not *Rhynchocinetes rugulosus* Stimpson, 1860.

Rhynchocinetes rugulosus– Edmondson, 1952, 70 (in part), fig. 2. Not *Rhynchocinetes rugulosus* Stimpson, 1860.

Rhynchocinetes rathbunae Okuno, 1996: 309–316, figs. 1–3.

Rhynchocinetes rathbunae– Hoover, 1998: 238, unnumbered fig. in color.

Rhynchocinetes rathbunae– Debelius, 1999b: 167, unnumbered fig. in color.

Rhynchocinetes rathbunae– De Grave and Fransen, 2011: 302 (list).

Material examined: Hawaii. BPBM S11275, 1♂, CL 7.0 mm (holotype), Waimea Bay, O'ahu, 21º38.0'N, 158º04.0'W, 29 November 1994, coll. J. Hoover and J. Earle. BPBM S11276, 1♂, CL 11.6 mm (paratype) and BPBM S11277, 1 ovig.♀, CL 8.0 mm (paratype), Kahe Pt., O'ahu, 21º20.0'N, 158º11.0'W, 4 February 1977; NSMT-Cr 2420, 3♂♂, CL 11.3, 6.9, 6.3 mm, (paratypes), same data as BPBM S11275; CBM-ZC 1964, 1♀, CL 4.7 mm (paratype), Hanauma Bay, O'ahu, 21º16.3'N, 157º42.0'W, 25 June 1995, coll. J. Hoover; USNM 31008, 1 juv., CL 2.4 mm, (paratype), French Frigate Shoals, 17–17.5 fms (31–32 m) depth, coll. Steamer Albatross. NSMT-Cr 11104, 1♂, CL 8.6 mm, exact collection site unknown, coll. aquarium traders.

Description. Carapace (Fig. 42A) covered with fine transverse striae, armed with two acute spines on median carina, anterior spine just behind rostral articulation, posterior spine feebly articulated with carapace; supraorbital spine acute, directed anteriorly; antennal spine as long as supraorbital spine, situated ventrad to inferior orbital margin, supported by feeble carina, directed anteriorly; pterygostomial angle with a small acute spine.

Rostrum (Fig. 42B) articulated with carapace, 1.3–1.6 times as long as carapace; dorsal margin armed with two teeth proximally, five to six small teeth subterminally; ventral margin armed with

12–13 teeth.

Abdominal somites (Fig. 42C) covered with fine striae; first three somites with pleurae marginally rounded; sixth somite 0.5–0.7 times as long as carapace, 1.8–2.0 times as long as its distal depth, with an acute posteroventral spine; an acute anal spine between bases of uropods. Telson (Fig. 42D) 0.6–0.8 times as long as carapace, 1.2 times as long as sixth abdominal somite, armed dorsally with three pairs of spines, the first pair at proximal two-fifths and the third pair at distal fifth; midpoint of posterior margin prominent, with three pairs of spinules, median pair longest.

Eye well developed, with large, globular cornea; stalk much more slender than cornea.

Antennular peduncle (Fig. 42E) reaching about to midlength of scaphocerite; stylocerite long, reaching proximal third of distal segment; proximal segment with distolateral spine falling slightly short of distal margin of median segment, ventrally with an acute tooth at inner margin.

Scaphocerite (Fig. 42F) 0.8–1.0 times as long as carapace, 3.6–4.3 times as long as maximum width, outer margin slightly concave distally; distolateral spine acute, exceeding end of lamella; basicerite with an acute ventrodistal spine and with rounded lobe just above spine.

Mouthparts (Fig. 43) typical of the family. Second maxilliped (Fig. 43E) with podobranch consisting of shaft only, without filaments; epipod pointed distally, with the undivided, slightly triangular remains of a podobranch on upper margin proximally; dactylar segment with truncate distal margin; propodal segment broad, distomedial margin expanded; carpal segment with slightly convex distal end of outer margin. Third maxilliped (Fig. 43F) slightly overreaching tip of scaphocerite; ultimate segment 0.5–0.7 times as long as carapace, 1.7–1.9 times as long as penultimate segment, withsix dark corneous spines distally; penultimate segment 0.3–0.4 times as long as carapace; antepenultimate segment with a row of sparse setae laterally, with an acute distolateral tooth; exopod well developed, falling slightly short of distal margin of antepenultimate segment.

Branchial formula as shown in Table 2.

First pereiopod (Fig. 42G) chelate, moderately robust, falling slightly short of midlength of scaphocerite; chela 0.4–0.5 times as long as carapace, 1.6–2.0 times as long as carpus, tips of both fingers with dark claws; carpus 0.2–0.3 times as long ascarapace, with dorsal margin distally pointed; merus 1.6–1.8 times as long as carpus, with an acutely pointed spine at distal end of dorsal margin.

Second pereiopod (Fig. 42H) chelate, slenderer than first pereiopod, slightly overreaching midlength of scaphocerite; chela 0.3–0.4 times as long as carapace; carpus 0.4–0.5 times as long as carapace, 1.2–1.4 times as long as chela.

Third pereiopod (Fig. 42I) overreaching scaphocerite by propodal apex; ischium with an acute spine; merus 0.7–0.9 times as long as carapace, 2.2–2.5 times as long as carpus, with four to six almost equidistant acute spines; carpus 0.3–0.4 times as long as carapace, with two acute spines on outer surface; propodus 0.6-0.8 times as long as carapace, 1.9–2.0 times as long as carpus, with short equidistant spinules onflexor margin; dactylus (Fig. 42J) biunguiculate, armed with two accessory spines posterior to preterminal unguis, decreasing in size proximally Fourth pereiopod reaching distal third of scaphocerite,dentition resembling that of third pereiopod; merus 0.7–0.9 times as long as carapace,2.1–2.2 times as long as carpus; carpus 0.3–0.4 times as long as carapace; propodus 0.6–0.8 times as long as carapace, 1.7–2.0 times as long as carpus. Fifth pereiopod reaching proximal third of scaphocerite, dentitions of ischium and dactylus esembling those of third and fourth pereiopods; merus

0.6–0.7 times as long as carapace, 1.7–2.0 times as long as carpus, with four to five (rarely three) equidistant acute spines; dentition and proportion of carpus resembling those of fourth pereiopod; propodus 0.5–0.7 times as long as carapace, 1.6–1.9 times as long as carpus.

Endopod of male first pleopod (Fig. 42K) with distal end slightly pointed; developedappendix interna attaches midlength of inner margin, with numerous granules distally; small lobe at distal third of outer margin.

Endopod of male second pleopod (Fig. 42L) with appendices masculina and interna attached at distal two fifths of outer margin; appendix masculina broad, rounded, fringed with dense setae; appendix interna considerably more slender than appendix masculina, with numerous granules distally.

Uropodal endopod and exopod (Fig. 42M) overreaching tip of telson; exopod with an articulated spine and a non articulated spine at distal fourth of outer margin, the former much longer than the latter.

Color in life (Fig. 5C). Ground color of body generally translucent pink, carapace and first to fifth abdominal somites with labyrinth red lines, interspaced with white dots and lines. Rostral tip white. Third abdominal somite dorsally with a distinct, rounded (rarely oblong) median spot, sixth somite with longitudinal red lines extending to posterior margin of third somite. First and second pereiopods mottoled with red and white. Ambulatory pereiopods with meri with red bands and carpi and propodi with red lines at the margin.

Distribution. Type locality: Waimea Bay, Oahu, Hawaiian Islands (Okuno, 1996a). Known only from the Hawaiian Islands. It is usually found in the littoral zone (J. P. Hoover, *pers. comm*.).

Remarks. *Bus rathbunae* appears closest to *B. brucei* and *B. serratus* in the number of arthrobranchs and the presence of a lobe on the outer margin of the male first pleopod. The differences among these three species are summarized in Table 2 of Okuno (1996a). The most conspicuous diagnostic character of *B. rathbunae* is the podobranch on the epipod of the second maxilliped consisting of shaft only, without filaments (Fig. 43E); in the other two species, a small podobranch with developed filaments occurs on the maxilliped (Fig. 45A). The juvenile paratype was recorded as *Rhynchocinetes rugulosus* by Rathbun (1906). Its rostrum is armed dorsally with four teeth distally and ventrally with 10 teeth decreasing in size distally. Rathbun's illustration is incorrect because the proximal four teeth are distinctly smaller than the other teeth. The remarkable difference between the juvenile and the other specimens is the length of the stylocerite, which reaches the distal margin of the proximal antennular segment but not as far as the tip of the distolateral spine of the segment. The unusual length ofthe structure may represent the intraspecific variation during development.

One of the male paratypes (BPBM S11276, CL 11.6 mm) has the telson armed dorsally with four and two dorsal spines on the left and right sides, respectively, and its posterior margin is armed with three pairs of spinules and an extra spinule on the left side. The form of the telson in this specimen is probably abnormal; the other specimens are considered to represent the typical form of the genus.

The third maxilliped and the first pereiopod of the large male (CL 11.3 mm) are distinctly different from those features in the females. The third maxilliped overreaches the scaphocerite by one-half of the ultimate segment, which is distinctlylonger (1.1 times the length of the carapace and 3.3 times the length of the penultimate segment) than those of the other specimens. The first pereiopod reaches the distal fifth of the scaphocerite, and its chela is 0.6 times as long as the carapace and 2.3

times as long as the carpus.

Bus rathbunae is considered as endemic to the Hawaiian Islands, and its distributional range does not appear to overlap with those of the congeneric species.

Previous authors have recorded a rhynchocinetid species identified as *R. rugulosus* from several localities in the Hawaiian Islands: French Frigate Shoals (Rathbun 1906); Laysan Island (Edmondson 1925) and off O'ahu (Hiatt 1948, Edmondson 1952). The specimens recorded by Rathbun (1906) and Edmondson (1925) were reconfirmed. The specimen collected from Laysan Island (BPBM 1270, 3.7 mm CL) is dried and damaged, and the other specimens from the Hawaiian Islands have been lost. Although their taxonomic status was not determined morphologically, the distributional patterns suggest that the Hawaiian specimens previously recorded may be identical without hesitation with *B. rathbunae*, except for the specimen illustrated by Edmondson (1952; fig. 2), which without doubt can be referred to *B. rathbunae* because of the having five meral spines on the fourth pereiopod.

5-3-2-10 *Bus serratus* (H. Milne-Edwards, 1837) comb. nov.

(Figs. 44, 45)

H [*ippolyte*]. *serratus* H. Milne Edwards, 1837: 377.

Rhynchocinetes rugulosus Stimpson, 1860: 36.

Not *Rhynchocinetes rugulosus*– Rathbun, 1906, 911, fig. 64 [= *Bus rathbunae* (Okuno, 1996)].

Rhynchocinetes rugulosus– McCulloch, 1909: 310, pl. 89, figs. 1–8.

Not *Rhynchocinetes rugulosus* ?– Edmondson, 1925: 6 [= *Bus rathbunae* (Okuno, 1996)?].

Not *Rhynchocinetes rugulosus*– Hale, 1927: 55, fig, 49 [= *Bus australis* (Hale, 1941)].

Not *Rhynchocinetes rugulosus*– Kubo, 1936: 51, pl.. A–P, fig. 1. [= *Bus uritai* (Kubo, 1942)].

Rhynchocinetes rugulosus– Hale, 1941: 269, fig. 7.

Not *Rhynchocinetes rugulosus* ?– Hiatt, 1948: 79 [= *Bus rathbunae* (Okuno, 1996)?].

Not *Rhynchocinetes rugulosus*– Edmondson, 1952, 70 (in part), fig. 264 [= *Bus rathbunae* (Okuno, 1996)].

Rhynchocinetes rugulosus– Healy and Yaldwyn, 1970: 38, pl. 17 in color.

Not *Rhynchocinetes rugulosus*– Debelius, 1983: 76, unnumbered fig, in color [= *Bus brucei* (Okuno, 1994)].

Not *Rhynchocinetes rugulosus*– Debelius, 1984: 76, unnumbered fig, in color [= *Bus brucei* (Okuno, 1994)].

Not *Rhynchocinetes rugulosus*– Bruce 1990: 612[= *Bus brucei* (Okuno, 1994)].

Rhynchocinetes serratus– Holthuis, 1995: 144.

Rhynchocinetes rugulosus– Gosliner *et al*., 1996: 218, fig. 789 in color.

Rhynchocinetes rugulosus– Chace, 1997: 27 (in key).

Rhynchocinetes rugulosus– Edger, 1997: 191, unnumbered fig. in color.

Rhynchocinetes serratus– Debelius, 1999b: 165, unnumbered figs. in color.

Rhynchocinetes serratus– Davie, 2002: 374 (list).

Rhynchocinetes serratus– Poore, 2004: 77, pl. 7d in color, fig. 18d.

Rhynchocinetes serratus– De Grave and Fransen, 2011: 302 (list).

Material examined: Australia. New South Wales. AM P6486, 1 ovig.♀, CL 11.7 mm, Port Jackson, Sydney, 33º51’S, 151º16’E, 25 August 1923, coll. by H. O. Fletcher; AM P6615, 1 ovig.♀,

CL 10.3 mm, AM P9335, 1♂, CL 11.4 mm, 1 ovig.♀, CL 9.6 mm, Shellharbour, 34°35'S, 150°52'E, coll. by G. McAndrew; AM P12116, 1♂, CL 15.4 mm, Barmagui, 36°25'S, 150°04'E, coll. S. Perry; AM P16246, 2♂♂, CL 9.5, 9.8 mm, 1 ovig.♀, CL 7.3 mm, Long Reef, Collaroy, 33°45'S, 151°19'E, intertidal, 20 December 1964, coll. J. C. Yaldwyn; AM P20704, 1♂, CL 5.0 mm, off North Head, Sydney, 33°50'S, 151°18'E, 23 January 1973, coll. by Australian Museum Shelf Benthic Survey; AM P75252, 1♂, CL 3.4 mm, south of Batemans Bay, south side of Burrewarra Poi, 28 March 2004, coll. Australian Museum Party; AM P80924, 2♂♂, CL 3.8, 11.7 mm, 2 ovig.♀♀, CL 6.5, 7.3 mm, 1 juvenile, CL 2.2 mm, 1 km south of Tathra boat ramp, adjacent to rocky coast, 7 April 2008, coll. A. Hay, M. A. McGrouther, S. E. Reader and P. Berents; NTM. Cr. 003616, 1 ovig.♀, CL 12.0 mm, Manly, Sydney. SAM, 1♂, 1 ovig.♀, CL 6.2, 7.2 mm, approximately 8 miles NNE of Gabo Island, 37°28'S, 150°50'E, 54–65 m, 3 May 1996, coll. CSIRO.— Tasmania. SAM, 1♂, CL 13.3 mm, off Clydes Island, Pirates Bay, Tasman Peninsula, 8–10 m, 24 June 1995, coll. by K. L. Gowlett-Holmes.

Description. Carapace (Fig. 44A) almost glabrous, but covered with feeble transverse striations; dorsal median carina with 2 teeth, anterior tooth just posterior to rostral articulation, subequal to posterior tooth in size, apex slightly directed upwards, posterior tooth feebly articulated with median carina; supraorbital spine present; orbit feebly developed, inferior orbital margin feebly angular; antennal spine slightly shorter than supraorbital spine, situated ventrad to inferior orbital margin, flanked by short carina; pterygostomial angle with blunt tooth.

Rostrum (Fig. 44B) articulated with carapace, overreaching level of anterior margin of scaphocerite by subapical part, 1.0–1.3 times as long as carapace, anterior half feebly upward, apex feebly directed downwards; dorsal margin armed with two large spaced teeth on proximal half, posterior-most tooth situated just above of cornea, proximal second tooth at slightly proximal to midlength of rostrum, with 2–5 (usually 4) small subterminal teeth; ventral margin armed with 9–14 teeth, decreasing in size distally.

Fifth thoracic sternite armed posteriorly with a pair of acute median processes. Sixth somite armed posteriorly with a pair of processes, shorter and situated more laterally than those of fifth somite.

Abdominal somites (Fig. 44C) covered with feeble oblique striations. Pleura of first to third somites broadly rounded; that of fourth somite with rounded posteroventral angle. Fifth somite with posterolateral angle terminating in acuminate process. Sixth somite 0.4–0.5 times as long as carapace, midpoint of posterolateral margin acutely prominent posteriorly, posteroventral angle acutely pointed, fringed with dense short setae; ventral surface armed with strongly hooked preanal spine. Telson (Fig. 44D) 0.5–0.7 times as long as carapace, 1.2–1.6 times as long as sixth somite, tapering posteriorly, posterior margin acuminate medially, with 3 pairs of dorsal spines on posterior two thirds; posterior margin with 3 pairs of spines, intermediate pair longest, mesial-most pair plumose (Fig. 44E).

Ophthalmic somite with midline slightly carinate, dorsally with fooked lobe. Eye (Fig. 44A) with large, globular cornea, maximum diameter longer than distal margin of stalk, distinct dorsal accessory pigment spot present; stalk widened, shorter than cornea.

Antennular peduncle (Fig. 44F) reaching level of midlength of rostrum. Proximal segment longer than distal two segments combined, dorsal surface moderately concave, with acute anterolateral tooth

reaching or falling slightly short of level of distal margin of intermediate segment, ventral surface mesially armed with a single spine; stylocerite well developed, acute, overreaching level of midlength, or reaching level of distal margin of distal segment, armed proximolaterally with acute tooth; statocyst small, longitudinally oblong. Intermediate segment subcylindrical, furnished with dense setae laterally, mesial surface with long dense setae. Distal segment subcylindrical, shortest, ventrally with setae. Dorsal flagellum with short aesthetascs at distal two thirds of thickened part.

Antenna with stout basicerite (Fig. 44A) armed ventrolaterally with acute tooth directed anteriorly; ventral margin somewhat angular, unarmed; scaphocerite (Fig. 44G) well developed, reaching level of subapical part of rostrum, 3.7–4.0 times as long as maximum width, lateral margin almost straight, terminating in acute tooth overreaching distal margin of lamella, proximal part of the tooth subequal to lamella in width, mesial margin convex; carpocerite (Fig. 44A) stout, reaching level of proximal two fifths of scaphocerite.

Epistome unarmed.

Mouthparts typical of the family. Second maxilliped (Fig. 45A) with suboval epipod; podobranch well developed; dactylus narrow, with mesial margin nearly straight, densely furnished with long setae; propodus elongate, with anterior margin broadly rounded, with dense long setae; carpus subquadrate, anteromesial angle bluntly produced; mesial surface of merus, ischium, and anterior part of basis shallowly concave; coxa inflated mesially, anteromesial margin angular; exopod with well developed flagellum, lateral surface shallowly concave. Third maxilliped with endopod overreaching level of distal margin of scaphocerite by whole length of ultimate segment in “robstus male”, reaching level of distal margin of scaphocerite in “typus male” and female; ultimate segment with transverse rows of dense setae, ventrally furnished with numerous setae, 3.4–4.3 times as long as penultimate segment, terminating in a single corneous spine in “robustus male”, 2.1–2.7 times as long as penultimate segment in “typus male” and female, terminating in a single corneous spine with 2 distolateral and 4 distomesial subterminal spines: penultimate segment fringed sparsely with short setae, dorsolateral surface shallowly concave; antepenultimate segment slightly widened distally, dorsal surface obliquely situated; ischium short, depressed; exopod with segmented flagellum reaching level of midlength of antepenultimate segment in “robustus male”, falling slightly short of distal margin of the segment in female.

Branchial formula as shown in Table 2.

First pereiopod (Fig. 45B) stout, slightly compressed, reaching level of distal margin of scaphocerite in “intermedius and robustus males”, reaching or falling slightly short of level of midlength of scaphocerite in “typus male” and female. Chela 2.6–3.1 (“robustus male”), 2.0–2.4 (“typus male” and female) times as long as carpus, palm distinctly longer than dactylus, ventral surface with transverse rows of short setae with setules; dactylus (Fig. 45C) with cutting border furnished with short setae distally, without denticulation, terminating in set of ungues; fixed finger (Fig. 45C) with cutting border unarmed in “typus male “ and female, armed with large, subtriangular tooth in “robustus male”, tapering distally, terminating in set of ungues obliquely articulated with corpus, ventrally armed with short spines. Carpus with distal margin truncate, dorsodistally terminating in acuminate tooth in “robustus and intermediate males”, ventrolateral surface slightly oblique. Merus 2.0–2.1 times as long as carpus, obliquely articulated with ischium. Coxa unarmed.

Second pereiopod (Fig. 45D) slender, slightly compressed, falling short of level of distal margin of scaphocerite. Chela (Fig. 45E) with palm 3.3–3.9 times as long as dactylus; dactylus slightly arched, without denticulation on cutting border, terminating in set of ungues, distal margin of corpus furnished with long setae; fixed finger without denticulation but densely furnished with long setae on cutting edge, distolaterally with row of long setae, terminating in set of ungues, longest unguis subequal to corpus in length. Carpus 1.3–1.6 times as long as chela, 1.3 times as long as merus, distal margin bluntly produced, with sparse setae. Merus obliquely articulated with ischium. Coxa unarmed.

Third pereiopod (Fig. 45F) overreaching level of distal margin of scaphocerite by lengths of distal fifth of propodus and dactylus. Coxa unarmed. Ischium armed with 1 lateral spine. Merus 2.1–2.4 times as long as carpus, armed with 3 lateral spines (distal spine near distal margin). Carpus armed with 2 lateral spines, with dorsodistal angle produced anteriorly. Propodus 1.1–2.0 times as long as carpus, ventral surface armed with about 13 small spines, dorsal surface sparsely furnished with long setae, a few distal plumose setae. Dactylus (Fig. 45G) biunguiculate, ungues distinctly demarcated from corpus, flexor margin armed with 2 small accessory claws, decreasing in size proximally. Fourth pereiopod falling slightly short of distal margin of scaphocerite, similar to third pereopod in armature Merus 1.9–2.1 times as long as carpus. Propodus 1.7–1.9 times as long as carpus. Fifth pereiopod reaching level of distal fifth of scaphocerite. Armature similar to those of two anterior ambulatory pereiopods. Merus 1.5–1.7 times as long as carpus. Propodus 1.5–1.8 times as long as carpus.

Endopod of male first pleopod (Fig. 45H) generally oval, external margin furnished with short dense setae proximally, with distinct, more or less acute lobe at distal third, distal margin prominent, entire, without setae; appendix interna well developed, tapering distally, with a few cincinnuli terminally.

Endopod of male second pleopod (Fig. 45I) with appendices masculina and interna arising from midlength of mesial margin; appendix masculina oval, furnished with long sparse setae, considerably broader than appendix interna; appendix interna slender, elongate, with a few cincinnuli terminally.

Uropod (Fig. 44D) with protopodite posterolaterally acute. Both exopod and endopod slightly overreaching level of tip of telson; exopod with lateral margin straight, terminating in acute tooth, mesially with movable spine longer than the terminal tooth; endopod slender, tapering distally.

Color in life. Ground color pale, somewhat translucent. Carapace and abdominal somites covered with reddish-brown complicated bands, interspaced with blueish-white spots circled with lines of same color as bands. Rostrum generally reddish translucent, distally yellow. Dorsal surface of third abdominal somite covered with numerous blueish-white spots circled with reddish–brown lines, forming meshwork, without median spot; fifth and sixth somite dorsally with blueish-white longitudinal median band. Third maxilliped red, with white narrow lateral line, first pereiopod red, with white dorsal line, ambulatory pereiopods with ischia and meri with red and white bands, carpi and propodi red, with white longitudinal line.

Distribution. Type locality: Jervis Bay, New South Wales, Australia (H. Milne Edwards, 1837). Known only from southeastern coast of Australia from New South Wales to Tasmania (Fig. 63).

Remarks. Stimpson (1860) described *Rhynchocinetes rugulosus* as a new species based on the specimen from Port Jackson, Sydney, southeastern coast of Australia, the material of which was captured during the North Pacific Exploring Expedition, 1853–1856. The description is very short

without any illustration, and the most of type specimens collected by the expedition were destroyed in the Great Chicago Fire of 1871 (Manning, 1993). Subsequently, McCulloch (1909) redescibed *R. rugulosus* in detail based on the topotypic specimens accompanied with the description of its characteristic color pattern. Thus, this scientific name has been used to the shrimp taxon for a long time, and coloration in life was provided several popular publications (e. g. Hearly and Yaldwyn, 1970; Gosliner *et al*., 1996). Holthuis (1995) considered that *Hippolyte serratus* described by H. Milne Edwards (1837) from Sydney is a senior synonym of *R. rugulosus* on account of the rostral armature and biogeographical aspect. To date, available name of this shrimp has, therefore, been regarded as *Rhynchocinetes serratus*.

As mentioned in “Remarks” section of *Bus rathbunae*, *B. brucei*, *B. rathbunae* and *B. serratus* are closely related in the gill formula and presence of a distinct lobe on external margin of endopod of male first pleopod. In the coloration in life, *B. serratus* is clearly discriminated from two other related species by lacking the median spot on the dorsal carina of third abdominal somite. Morphologically, the longer stylocerite distinguishes *B. serratus* from both *B. brucei* and *B. rathbunae*; in *B. serratus*, stylocerite reaches level of distal margin of antennular peduncle (Fig. 44F), whereas those of the two later species reach or fall short of level of distal margin of the intermediate segment of the peduncle (Figs. 30C, 42E).

Bus serratus is an endimic species of shallow water of southeastern coast of Australia from New South Wales to Tasmania (Fig. 63). In this area, this shrimp species is abundant in crevices on rocky reef (Edger, 1997).

5-3-2-11 *Bus uritai* (Kubo, 1942) comb. nov.

Figs. 5D–F, 39I, J, 46

Rhynchocinetes rugulosus– Kubo, 1936: 51, pl.. A–P, fig. 1. Not *Rhynchocinetes rugulosus* Stimpson, 1860.

Rhynchocinetes uritai Kubo, 1942: 30, figs. 1–3 (in part).

Rhymchocinetes uritai– Suzuki, 1979: 291, fig. 32 (in color).

Rhymchocinetes uritai– Miyake, 1982: 25, pl. 9, fig. 3 (in color).

Rhymchocinetes uritai– Takeda, 1982: 35. fig. 103 (in color).

Not *Rhynchocinetes uritai*– Debelius, 1983: 71, 77, unnumbered figs. in color. [= *Bus durbanensis* (Gordon, 1936)].

Not *Rhynchocinetes uritai*– Debelius, 1984: 71, 77, unnumbered figs. in color. [= *Bus durbanensis* (Gordon, 1936)].

Not *Rhynchocinetes uritai*– Baensch and Debelius, 1992: 542, unnumbered figs. [= *Bus durbanensis* (Gordon, 1936)].

Not *Rhynchocinetes uritai*– Lin, 1992: 103, unnumbered fig. [= *Bus durbanensis* (Gordon, 1936)].

Not *Rhynchocinetes uritai*– Baumeister, 1993: 242, unnumbered fig. [= *Bus durbanensis* (Gordon, 1936)].

Not *Rhynchocinetes uritai*– Allen and Steen 1994: 148, unnumbered fig. [= *Bus durbanensis* (Gordon, 1936)].

Rhynchocinetes uritai– Kim, 1985: 66.

Not *Rhynchocinetes uritai*– Colin and Arneson 1995: 218, fig. 1036 [= *Bus durbanensis* (Gordon, 1936)].

Not *Rhynchocinetes* cf. *uritai*– Schuhmacher and Hinterkircher, 1996: 130, unnumbered fig. [= *Bus durbanensis*

(Gordon, 1936)].

Rhynchocinetes uritai– Okuno and Takeda, 1992a: 71, fig.4e, pl. 1C;

Rhynchocinetes uritai– Okuno and Takeda, 1992b: 85, figs. 2, 3D-F, 5 (left).

Rhynchocinetes uritai– Hayahsi, 1995: 302, pl. 85, fig. 1 in color.

Rhynchocinetes uritai– Gosliner et al., 1996: 218, fig. 791 in color.

Rhynchocinetes uritai– Chace, 1997: 27 (in ley).

Rhynchocinetes uritai– Okuno, 1997a: 50, fig. 4i, j.

Rhynchocinete s uritai– Hayashi, 1999b: 223, figs. 371e, 372e, 373, 374i, j, l.

Rhynchocinete s uritai– Debelius, 1999b: 165, unmunbered figs. in color.

Rhymchocinetes uritai– Minemizu, 2000: 30, unnumbered fig. (in color).

Rhymchocinetes uritai– Kato and Okuno, 2001: 18, unnumbered fig. in color.

Rhymchocinetes uritai– Cha *et al*., 2001: 124, unnumbered fig. (in color).

Rhynchocinetes uritai– Hayashi, 2007: 112, figs. 4i, 45e, 46e, 48, 49i, j, l.

Rhynchocinetes uritai– Motoh, 2008: 17 (list).

Rhynchocinetes uritai– Motoh *et al*., 2009: 279, fig. 3 in color.

Rhynchocinetes uritai– Itaki, 2009: 301, fig. 2E in color.

Rhynchocinetes uritai– Itaki, 2010: 280, fig. 2S in color.

Rhynchocinetes uritai– De Grave and Fransen, 2011: 302 (list).

Material examined: Japan. Honshu. CBM-ZC 3133, 2♂♂, 1 ovig.♀, CL 7.4–9.6 mm, Katsuura, Boso Peninsula, 15 July 1996; CMNH-ZC 00662, 1♂, CL 6.9 mm, Ubara-jima Islet, Ubara, Katsuura, Boso Peninsula, 24 October 2001, coll. H. Tachikawa *et al*.; NSMT-Cr 1484, 1♂(lectotype), CL 7.8 mm, Kominato, Boso Peninsula, 35º07.3’N, 140º11.6’E, 13 April 1941, coll. I. Kubo; NSMT-Cr 10297, 1 ovig.♀, CL 13.2 mm, Futo-harai Fishing Port, Ito, E coast of Izu Peninsula, Sagami Sea, 34º53’N, 139º08’E, 1 August 1990, coll. J. Okuno; NSMT-Cr 1681, 1♂, CL 10.6 mm, Kuzura, Numazu, NW coast of Izu Peninsula, Suruga Bay, 35º09’N, 138º52.4’E, 1 m, coll. J. Okuno; NSMT-Cr 10961, 1♂, 1♀, CL 6.4, 8.5 mm, same locality as NSMT-Cr 1681, 31 December 1990, coll. J. Okuno and H. Yagi.— Izu Islands. CMNH-ZC 01569, 1 ovig.♀, CL 10.6 mm, Kobo-hama, Izu-ohshima Island, intertidal, 18 April 2003, coll. H. Tachikawa and J. Takayama; NSMT-Cr 11106, 1 ♀, CL 8.6 mm, NSMT-Cr 11101, 3♂♂, CL 4.6–5.1 mm, Sokodo, Hachijo-jima Island, 33º07’N, 139º49’E, 1 m, 5 September 1991, coll. J. Okuno.— Awaji-shima Island. CMNH-ZC 2342, 1♀, CL 7.0 mm, Yura Fishing Port, Sumoto, 22 October 2008, coll. K. Hanano *et al*.— Shikoku. SUF530-2-496, 1♂, CL 9.3 mm, Shiwaki Port, Yuki, Tokushima, 12 July 1978, coll. T. Hamano.— Kyushu. CMNH-ZC 01805, 1♀, CL 4.1 mm, Tatsunokuchi, Nagasaki, 10 m, 23 October 2004, coll. J. Okuno.

Taiwan. Keelung City. NTOU M00902, 17♂♂, CL 4.9–7.8 mm, 1 ovig.♀, CL 6.8 mm, 14♀♀, CL 5.0–9.0 mm, 2 juvs., CL 1.9, 2.4 mm, Badouzih, 9 Nov 2006; NTOU M00893, 1♂, CL 9.0 mm, Bachihmen, 1995; NTOU M00900, 1♀, CL 13.6 mm, Hepingdao, 29 Jun 2006.—Taipei County. NTOU M00679, 1♂, CL 5.4 mm, Longdong, 24 Aug 2005.

Description. Carapace (Fig. 46A) almost glabrous, but covered with feeble transverse striations;

dorsal median carina with 2 teeth, anterior tooth just posterior to rostral articulation, slightly larger than posterior tooth, apex slightly directed anteriorly, posterior tooth feebly articulated with median carina; supraorbital spine present; orbit feebly developed, inferior orbital margin feebly angular; antennal spine as long as supraorbital spine, situated ventrad to inferior orbital margin, flanked by short carina; pterygostomial angle with blunt tooth.

Rostrum (Fig. 46B) articulated with carapace, overreaching level of anterior margin of scaphocerite by subapical part, 1.1–1.5 times as long as carapace, anterior half feebly upward, apex directed anteriorly; dorsal margin armed with two large spaced teeth on proximal half, posterior-most tooth situated just above of cornea, proximal second tooth at midlength of rostrum, with 5 (rarely 6) small subterminal teeth; ventral margin armed with 13–15 teeth, decreasing in size distally.

Fifth thoracic sternite armed posteriorly with a pair of acute median processes. Sixth somite armed posteriorly with a pair of processes, shorter and situated more laterally than those of fifth somite.

Abdominal somites covered with feeble oblique striations. Pleura of first to third somites broadly rounded; that of fourth somite with rounded posteroventral angle. Fifth somite with posterolateral angle terminating in acuminate process. Sixth somite 0.5–0.6 times as long as carapace, midpoint of posterolateral margin acutely prominent posteriorly, posteroventral angle acutely pointed, fringed with dense short setae; ventral surface armed with strongly hooked preanal spine. Telson 0.6–0.7 times as long as carapace, 1.2–1.5 times as long as sixth somite, tapering posteriorly, posterior margin acuminate medially, with 3 pairs of dorsal spines on posterior three fourths; posterior margin with 3 pairs of spines, intermediate pair longest, mesial-most pair plumose.

Ophthalmic somite with midline slightly carinate, dorsally with fooked lobe. Eye (Fig. 46A) with large, globular cornea, maximum diameter longer than distal margin of stalk, distinct dorsal accessory pigment spot present; stalk widened, shorter than cornea.

Antennular peduncle (Fig. 46C) falling slightly short of level of midlength of rostrum. Proximal segment longer than distal two segments combined, dorsal surface moderately concave, with acute anterolateral tooth reaching level of midlength of intermediate segment, ventral surface mesially armed with a single spine; stylocerite well developed, acute, reaching level of midlength of intermediate segment, armed proximolaterally with acute tooth; statocyst small, longitudinally oblong. Intermediate segment subcylindrical, furnished with dense setae laterally, mesial surface with long dense setae. Distal segment subcylindrical, shortest, ventrally with setae. Dorsal flagellum with short aesthetascs at distal three fourths of thickened part.

Antenna with stout basicerite (Fig. 46A) armed ventrolaterally with acute tooth directed anteriorly; ventral margin angular, unarmed; scaphocerite well developed, reaching level of posterior-most tooth of subapical part of rostrum, 3.9–4.6 times as long as maximum width, lateral margin almost straight, terminating in acute tooth overreaching distal margin of lamella, proximal part of the tooth subequal to lamella in width, mesial margin convex; carpocerite (Fig. 46A) stout, reaching level of proximal third of scaphocerite.

Epistome unarmed.

Mouthparts typical of the family. Second maxilliped with suboval epipod; podobranch well developed; dactylus narrow, with mesial margin nearly straight, densely furnished with long setae;

propodus elongate, with anterior margin broadly rounded, with dense long setae; carpus subquadrate, anterolateral angle bluntly produced; mesial surface of merus, ischium, and anterior part of basis shallowly concave; coxa feebly inflated mesially, anteromesial margin angular; exopod with well developed flagellum, basal part of lateral surface shallowly concave. Third maxilliped with endopod reaching level of distal three fourths of scaphocerite; ultimate segment with transverse rows of dense setae, ventrally furnished with numerous setae, 1.7–2.1 times as long as penultimate segment, terminating in a single corneous spine with 1–2 distolateral and 4 distomesial subterminal spines: penultimate segment fringed sparsely with short setae, dorsolateral surface shallowly concave; antepenultimate segment slightly widened distally, dorsal surface obliquely situated; ischium short, depressed; exopod with segmented flagellum overreaching level of distal margin of antepenultimate segment.

Branchial formula as shown in Table 2.

First pereiopod stout, slightly compressed, falling short of level of midlength of scaphocerite. Chela 1.5–1.8 times as long as carpus, palm distinctly longer than dactylus, ventral surface with # transverse rows of short setae with setules; dactylus with cutting border furnished with spiniform setae, without denticulation, terminating in set of ungues; fixed finger with cutting border unarmed, tapering distally, terminating in set of ungues obliquely articulated with corpus. Carpus with distal margin truncate, ventrolateral surface slightly oblique. Merus 1.2–1.3 times as long as carpus, obliquely articulated with ischium. Coxa unarmed.

Second pereiopod slender, slightly compressed, reaching level of distal third of scaphocerite. Chela with palm 3.5–4.8 times as long as dactylus; dactylus slightly arched, without denticulation on cutting border, terminating in set of ungues, distal margin of corpus furnished with long setae; fixed finger without denticulation but densely furnished with long setae on cutting edge, distolaterally with row of long setae, terminating in set of ungues, longest unguis subequal to corpus in length. Carpus 1.4–1.8 times as long as chela, 1.4 times as long as merus, distal margin bluntly produced, with sparse setae. Merus obliquely articulated with ischium. Coxa unarmed.

Third pereiopod (Fig. 46D) reaching level of distal margin of scaphocerite. Coxa unarmed. Ischium armed with 1 lateral spine. Merus 1.4–2.5 times as long as carpus, armed with 2–3 (rarely 1) lateral spines (distal spine near distal margin). Carpus armed with 2 lateral spines, with dorsodistal angle produced anteriorly. Propodus (Fig. 39I) 1.7–2.1 times as long as carpus, ventral surface armed with about 16 small spines, dorsal surface sparsely furnished with long setae, a few distal plumose setae. Dactylus (Fig. 46E) biunguiculate, ungues distinctly demarcated from corpus, flexor margin armed with 3 small accessory claws, decreasing in size proximally. Fourth pereiopod falling slightly short of distal margin of scaphocerite, similar to third pereopod in armature and proportion. Fifth pereiopod reaching level of distal third of scaphocerite. Armature similar to those of two anterior ambulatory pereiopods. Merus 1.6–1.9 times as long as carpus. Propodus 1.6–1.9 times as long as carpus.

Endopod of male first pleopod (Fig. 39J, 46F) generally oval, external margin furnished with short sparse setae proximally, with distinct lobe at midlength, distal margin prominent, entire, without setae; appendix interna well developed, slightly tapering distally, with a few cincinnuli terminally.

Endopod of male second pleopod with appendices masculina and interna arising from distal two

fifths of mesial margin; appendix masculina oval, furnished with long sparse setae, somewhat broader than appendix interna; appendix interna elongate, with a few cincinnuli terminally.

Uropod with protopodite posterolaterally acute. Both exopod and endopod slightly overreaching level of tip of telson; exopod with lateral margin straight, terminating in acute tooth, mesially with movable spine longer than the terminal tooth; endopod slender, tapering distally.

Color in life (Fig. 5D–F). Ground color pale, somewhat translucent. Carapace and abdominal somites covered with reddish-brown to purplish-red oblique bands, strongly curved on carapace, interspaced with white spots circled with same color as bands. Rostrum generally whitish yellow. Dorsal surface of third abdominal somite without a median spot. Third maxilliped red, proximally translucent, first pereiopod with chela gray, other segments with red lateral lines, ambulatory pereiopods whitish translucent, with red longitudinal line.

Distribution. Type locality: Kominato, Kamogawa, Boso Peninsula, Honshu, Japan (Kubo, 1942; Okuno and Takeda, 1992a). Known from several localities on Japanese waters (Fig. 65): Shimoda, Izu Peninsula (Bauer and Thiel, 2011); Kushimoto, Kii Peninsila (Miyake, 1982); Hachijo-jima Island, Izu Islands (Kato and Okuno, 2001; present study); Tobi-shima Islet, Akita, Sea of Japan (Suzuki, 1979); Wakasa Bay, Fukui, Sea of Japan (Motoh *et al*., 2009); Matsue, Shimane, Sea of Japan (Itaki, 2009, 2010); Also known from southern Korea (Cha *et al*., 2001) and northern Taiwan (De Grave *et al*., in prep).

Remarks. Morphologically, *Bus uritai* apperars closest to *B. kuiteri* from southeastern Australia in shareing with the lacking arthrobranches on ambulatory pereiopois, meri of ambulatory pereiopods armed with 3 lateral spines, dactyli of the pereiopods armed with 3 accessory claws posterior to subterminal unguis on flexor margin, endopod of male first pleopod with a lobe on mesial margin. However, B. uritai is readily discriminated from *B. kuiteri* by the shorter stylocerite of antennular peduncle falling short of distal margin of intermediate segment (Fig. 46C), instead of overreaching distal margin of antennular peduncle in *B. kuiteri* (Fig. 39H, 40F). In coloration in life, both species distinctly differs from each other (Fig. 5A, B, D–F). Morphological similarities also show among *B. uritai*, *B. conspiciocellus* and *B. holthuisi*, and these distinguishing features are mentioned “Remarks” sections of the latter two species.

This species does not show the elongated third maxilliped and robust first pereiopod in male as sexual dimorphism. Bauer and Thiel (2011) indicated that protandrous sequential hermaphroditism is recognized in *R. uritai*.

5-3-2-12 *Bus* sp. 1

(Figs. 5G, H, 47, 48)

Rhynchocinetes sp.– Minemizu, 2000: 32, unnumbered fig. in color.

Material examined: WESTERN PACIFIC. **Japan**. CMNH, 1♂, CL 8.4 mm, CMNH, 1♂, CL 5.4 mm, Hyotan-jima Islet, Chichi-jima Island, Ogasawara (Bonin) Islands, 30 m, January 1997, coll. Y. Morita.

Loyalty Island. MNHN CB 1065, 1♂, CL 8.4 mm, MNHN CB 1066, 1 ovig.♀, CL 7.0 mm,

MNHN, 1♂, CL 8.7 mm, Banya Islet, Uvea Island, 20º35.8'S, 166º 16.7'E, 27 m, 18 September 1991, coll. J. P. Menou.

INDIAN OCEAN. **Mascarene Islands**. BPBM S11278, 1♂, CL 8.1 mm, 1 ovig.♀, CL 8.2 mm, Cave at base of reef front near Flic en Flac, west coast of Mauritius, 25 m, 10 July 1977, coll. J. E. Randall.

Description. Carapace (Fig. 47A) almost glabrous, but covered with feeble transverse striations; dorsal median carina with 2 teeth, anterior tooth just posterior to rostral articulation, larger than posterior tooth, apex slightly directed upwards, posterior tooth feebly articulated with median carina; supraorbital spine present; orbit feebly developed, inferior orbital margin feebly angular; antennal spine narrower than supraorbital spine, situated ventrad to inferior orbital margin, flanked by short carina; pterygostomial angle with blunt tooth.

Rostrum (Fig. 47C) articulated with carapace, overreaching level of anterior margin of scaphocerite by subapical part, 1.3–1.5 times as long as carapace, anterior half feebly upward, apex slightly directed downwards; dorsal margin armed with two large spaced teeth on proximal half, posterior-most tooth situated just above of cornea, proximal second tooth at midlength of rostrum, with 5–7 small subterminal teeth; ventral margin armed with 13–15 teeth, decreasing in size distally.

Fifth thoracic sternite armed posteriorly with a pair of acute median processes. Sixth somite armed posteriorly with a pair of processes, shorter and situated more laterally than those of fifth somite.

Abdominal somites (Fig. 47E) covered with feeble oblique striations. Pleura of first to third somites broadly rounded; that of fourth somite with rounded posteroventral angle. Fifth somite with posterolateral angle terminating in acuminate process. Sixth somite 0.5 times as long as carapace, midpoint of posterolateral margin acutely prominent posteriorly, posteroventral angle acutely pointed, fringed with dense short setae; ventral surface armed with strongly hooked preanal spine (Fig. 47F). Telson (Fig. 47G) 0.5–0.7 times as long as carapace, 1.1–1.3 times as long as sixth somite, tapering posteriorly, posterior margin acuminate medially, with 3 pairs of dorsal spines on posterior two thirds; posterior margin with 3 pairs of spines, intermediate pair longest, proximal half of flexor margin with setules, mesial-most pair plumose (Fig. 47H).

Ophthalmic somite (Fig. 47D) with midline slightly carinate, dorsally with fooked lobe. Eye (Fig. 47B) with large, globular cornea, maximum diameter longer than distal margin of stalk, distinct dorsal accessory pigment spot present; stalk widened, shorter than cornea.

Antennular peduncle (Fig. 47I) reaching level of midlength of rostrum. Proximal segment longer than distal two segments combined, dorsal surface moderately concave, with acute anterolateral tooth reaching level of distal third of intermediate segment, ventral surface mesially armed with a single spine; stylocerite well developed, acute, reaching level of midlength of intermediate segment, armed proximolaterally with acute tooth; statocyst small, longitudinally oblong. Intermediate segment subcylindrical, furnished with dense setae laterally, mesial surface with long dense setae. Distal segment subcylindrical, shortest, ventrally with setae. Dorsal flagellum with short aesthetascs at distal three fifths of thickened part.

Antenna with stout basicerite (Fig. 47A) armed ventrolaterally with acute tooth directed

anteriorly; ventral margin unarmed; scaphocerite (Fig. 47J) well developed, reaching level of subapical part of rostrum, 4.2–5.4 times as long as maximum width, lateral margin almost straight, terminating in acute tooth overreaching distal margin of lamella, proximal part of the tooth subequal to lamella in width, mesial margin convex; carpocerite (Fig. 47A) stout, reaching level of proximal two fifths of scaphocerite.

Epistome unarmed.

Mouthparts typical of the family. Second maxilliped with suboval epipod; podobranch consisting of shaft only, filaments absent; dactylus narrow, with mesial margin nearly straight, densely furnished with long setae; propodus elongate, with anterior margin broadly rounded, with dense long setae; carpus subquadrate, anterolateral angle bluntly produced; mesial surface of merus, ischium, and anterior part of basis shallowly concave; coxa inflated mesially, anteromesial margin angular; exopod with well developed flagellum, basal part of lateral surface shallowly concave. Third maxilliped with endopod overreaching level of distal margin of scaphocerite by whole length of ultimate segment in “robstus male”, by distal three fifths of ultimate segment in “intermedius male”, reaching level of distal margin of scaphocerite in “typus male” and female; ultimate segment with transverse rows of dense setae, ventrally furnished with numerous setae, 4.9 times as long as penultimate segment, terminating in a single corneous spine in “robustus male”, 2.8 times as long as penultimate segment in “inrtermedius male”, 1.6–2.5 times as long as penultimate segment in “typus male” and female, terminating in a single corneous spine with 2 distolateral and 4 distomesial subterminal spines; penultimate segment fringed sparsely with short setae, dorsolateral surface shallowly concave; antepenultimate segment slightly widened distally, dorsal surface obliquely situated; ischium short, depressed; exopod with segmented flagellum reaching level of midlength of antepenultimate segment in “robstus and intermedius males”, reaching level of distal margin of antepenultimate segment in “typus male” and female.

Branchial formula as shown in Table 2.

First pereiopod (Fig. 48A) stout, slightly compressed, overreaching level of distal margin of scaphocerite by length of dactylus in “intermedius and robustus males”, reaching level of midlength of scaphocerite in “typus male” and female. Chela 2.5 (“robustus male”), 2.3–2.4 (“intermedius male”), 1.5–2.0 (“typus male” and female) times as long as carpus, palm distinctly longer than dactylus, ventral surface with transverse rows of short setae with setules; dactylus (Fig. 48B) with cutting border furnished with spiniform setae, dorsolaterally armed with row of minute spines, without denticulation, terminating in set of ungues in “typus male” and female, armed proximally with subquadrate broad tooth, terminating in single unguis in “robustus and intermedius males”; fixed finger (Fig. 48B) with cutting border unarmed, tapering distally, terminating in set of ungues obliquely articulated with corpus in “typus male “ and female, armed with large, subquadrate tooth, terminating in single unguis in “robustus and intermedius males”, ventrally armed with short spines. Carpus with distal margin truncate, dorsodistally terminating in acuminate tooth in “robustus and intermediate males”, ventrolateral surface slightly oblique. Merus 1.4–1.7 times as long as carpus, obliquely articulated with ischium. Coxa unarmed.

Second pereiopod (Fig. 48C) slender, slightly compressed, falling slightly short of level of distal margin of scaphocerite. Chela (Fig. 48D) with palm 2.7–3.6 times as long as dactylus; dactylus slightly

arched, without denticulation on cutting border, terminating in set of ungues, corpus furnished distolaterally with long dense setae; fixed finger without denticulation but densely furnished with long setae on cutting edge, terminating in set of ungues, longest unguis slightly shorter than corpus in length. Carpus 1.2–1.6 times as long as chela, 1.2–1.7 times as long as merus, distal margin bluntly produced, with sparse setae. Merus obliquely articulated with ischium. Coxa unarmed.

Third pereiopod (Fig. 48E) overreaching level of distal margin of scaphocerite by lengths of distal fifth of propodus and dactylus. Coxa unarmed. Ischium armed with 1 lateral spine. Merus 1.8–2.3 times as long as carpus, armed with 3 lateral spines (distal spine near distal margin). Carpus armed with 2 lateral spines, with dorsodistal angle produced anteriorly. Propodus 1.7–1.9 times as long as carpus, ventral surface armed with about 15 small spines, dorsal surface sparsely furnished with long setae, a few distal plumose setae. Dactylus (Fig. 48F) biunguiculate, ungues distinctly demarcated from corpus, flexor margin armed with 3 small accessory claws, decreasing in size proximally. Fourth pereiopod falling slightly short of distal margin of scaphocerite, similar to third pereopod in armature and proportion. Fifth pereiopod reaching level of distal third of scaphocerite. Armature similar to those of two anterior ambulatory pereiopods. Merus 1.6–1.7 times as long as carpus. Propodus 1.6–1.8 times as long as carpus.

Endopod of male first pleopod (Fig. 48G) generally oval, external margin furnished with short sparse setae proximally, with distinct lobe at distal third of length, distal margin prominent, entire, without setae; appendix interna well developed, tapering distally, with a few cincinnuli terminally.

Endopod of male second pleopod (Fig. 48H) with appendices masculina and interna arising from distal two fifths of mesial margin; appendix masculina oval, furnished with long sparse setae, considerably broader than appendix interna; appendix interna elongate, with a few cincinnuli terminally.

Uropod (Fig. 47G) with protopodite posterolaterally acute. Both exopod and endopod slightly overreaching level of tip of telson; exopod with lateral margin straight, terminating in acute tooth, mesially with movable spine longer than the terminal tooth; endopod slender, tapering distally.

Color in life (Fig. 5G, H). Ground color pinkish translucent. Carapace and abdominal somites covered with brilliant red oblique bands, strongly curved on carapace, interspaced with white spots, whitish yellow line laterally running from sixth abdominal somite to telson. Rostrum generally whitish yellow. Dorsal surface of third abdominal somite without a median spot. Third maxilliped translucent, ultimate and penultimate segments with dorsal and ventral borders red, antepenultimate segment with red transverse bands. First pereiopod whitish translucent with dorsal and ventral borders red, dactylus white, merus and ischium with red transverse bands. Second pereiopod whitish translucent, merus and ischium with red transverse bands. Ambulatory pereiopods with propodi and carpi reddish translucent, with meri and ischia with red transverse bands.

Distribution. Known from the Ogasawara Islands and Loyalty Islands, the western Pacific, and Mauritius, the western Indian Ocean (Fig. 64).

Remarks. The number of the arthrobranch on the pereiopods links *Bus* sp. 1 to *B. balssi* and B. spp. 2 and 3. The former differs from the latter on account of the following morphological features: 1) the stylocerite is falling slightly short of tip of the distolateral spine of the antennular proximal segment in *B*. sp. 1 (Fig. 47I), whereas the stylocerite of other three species reaches or overreaches

level of tip of the anterodistal spine (Figs. 28F, 49G, 51G); 2) in *B*. sp. 1, the podobranch on the second maxilliped possesses the slightly triangular efferent vessel without filaments. The podobranch of other related species have the efferent vessel furnished with developed filaments (Fig. 29A); 3) the dactyli of the ambulatory pereiopods are armed with 3 accessory claws posterior to preterminal unguis in *B*. sp. 1 (Fig. 48F). In contrast, *B. balssi* and *B*. sp. 3 have the dactyli armed with 2 accessory claws (Figs. 29G, 52F), *B*. sp. 2 with 4 accessory claws (Fig. 50F); 4) *Bus* sp. 1 has a distinct lobe at distal third of the external margin of the endopod of male first pleopod (Fig. 48G), while *B. balssi* and *B*. sp. 2 have the endopod with the entire external margin (Figs. 29H, 50G).

In coloration in life, *Bus* sp. 1 is closely related to *B. uritai* on account of the red labyrinthine stripes running on the carapace and abdominal somites, and lacking a dark median spot on the dorsal carina of third abdominal somite (Fig. 5D–H). The banded penultimate segment of third maxilliped and meri of pereiopods readily distinguish *B*. sp. 1 from *B. uritai* (Fig. 5G, H).

Minemizu (2000) recorded the present species as *Rhynchocinetes* sp. The specimens from the Ogasawara Islands were collected from same diving site of Minemizu's photograph.

5-3-2-13 *Bus* sp. 2

(Figs. 49, 50)

Rhynchocinetes australis– Hale, 1941: 270 (in part). Not *Rhynchocinetes australis* Hale, 1941.

Material examined: Australia. New South Wales. AM P19530, 1♀, CL 12.4 mm, 1 ovig.♀, CL 13.4 mm, off Ulladulla, 120.8 m, Challenge trawl, 1959 (detailed date unknown), coll. A. A. Racek.— Victoria. AM P9447, 1 ovig.♀, CL 12.0 mm (paratype of *Rhynchocinetes australis*), WSW of Gabo Island, 37º34'S, 149º55'E, December 1929, coll. H. H. Hale; TM G 3644, 1♂, CL 8.4 mm, SSE of Gabo Island, SS5–94, stn 199, 37º 44.0'S, 149º 58.0'E, 108–115 m, benthic sled, 17 September 1994, coll. CSIRO; TM G 3711 (ex TM G 3708), 1♂, CL 10.6 mm, SS6–96, stn 212, 37º 45.2'S, 150º 00.3'E, 108 m, benthic sled, 12 December 1996; TM G 3680, 1♂, CL 7.8 mm, TM, 1♂, CL 9.0 mm, 2♀♀, CL 8.8, 10.6 mm, SS6–96, stn 171, 37º 43.4'S, 150º 06.6'E, 140–142 m, benthic sled, 8 December 1996, coll. FRV Southern Surveyor; TM G 3629, 1♂, CL 6.5 mm, SS5–94, stn 88, 37º 36.7'S, 149º 55.0'E, 90–93 m, 30 August 1994, from fish stomach contents; TM G 3647, 3♂♂, CL 5.0–9.0 mm, 6♀♀, CL 5.4–10.0 mm, SAMA, 1♀, CL 8.5 mm, 1 ovig.♀, CL 9.0 mm, SS2–96, stn 185, 37º 21.8'S, 150º 05.9'E, 90–94 m, 6 May 1996, benthic sled.

Description. Carapace (Figs 49A) almost glabrous, but covered with feeble transverse striations; dorsal median carina with 2 teeth, anterior tooth just posterior to rostral articulation, smaller than posterior tooth, apex directed anteriorly, posterior tooth feebly articulated with median carina; supraorbital spine present, large; orbit feebly developed, inferior orbital margin feebly angular; antennal spine as long as supraorbital spine, situated ventrad to inferior orbital margin, flanked by short carina; pterygostomial angle with small acute tooth.

Rostrum (Figs 49C) articulated with carapace, overreaching level of anterior margin of scaphocerite by subapical part, 1.1–1.4 times as long as carapace, anterior half feebly upward, apex

slightly directed downwards; dorsal margin armed with two large spaced teeth on proximal half, posterior-most tooth situated just above of cornea, proximal second tooth at midlength of rostrum, with 5 small subterminal teeth; ventral margin armed with 11–13 (rarely 17) teeth, decreasing in size distally.

Fifth thoracic sternite armed posteriorly with a pair of acute median processes. Sixth somite armed posteriorly with a pair of processes, shorter and situated more laterally than those of fifth somite.

Abdominal somites (Fig. 49D) covered with feeble oblique striations. Pleura of first to third somites broadly rounded; Fourth and fifth somites with posterolateral angle terminating in acuminate process. Sixth somite 0.5 times as long as carapace, midpoint of posterolateral margin acutely prominent posteriorly, posteroventral angle acutely pointed, fringed with dense short setae; ventral surface armed with strongly hooked preanal spine. Telson (Fig. 49E) 0.6–0.7 times as long as carapace, 1.2–1.3 times as long as sixth somite, tapering posteriorly, posterior margin acuminate medially, dorsal surface furnished with row of sparse long setae at midline, armed with 3 pairs of spines on posterior two thirds; posterior margin with 3 pairs of spines, intermediate pair longest, proximal two thirds of flexor margin with setules, mesial-most pair plumose (Fig. 49F).

Ophthalmic somite with midline slightly carinate, dorsally with fooked lobe. Eye (Fig. 49B) with large, globular cornea, maximum diameter longer than distal margin of stalk, distinct dorsal accessory pigment spot present; stalk widened, shorter than cornea.

Antennular peduncle (Fig. 49G) falling slightly short of level of midlength of rostrum. Proximal segment longer than distal two segments combined, dorsal surface moderately concave, with acute anterolateral tooth falling slightly short of level of distal margin of intermediate segment, ventral surface mesially armed with a single spine; stylocerite well developed, acute, reaching level of distal margin of peduncle, armed proximolaterally with acute tooth; statocyst small, longitudinally oblong, furnished with short seate. Intermediate segment subcylindrical, furnished with dense setae laterally, mesial surface with long dense setae. Distal segment subcylindrical, shortest, ventrally with setae. Dorsal flagellum with short aesthetascs at distal three fifths of thickened part.

Antenna with stout basicerite (Fig. 49A) armed ventrolaterally with acute tooth directed anteriorly; ventral margin somewhat angular, unarmed; scaphocerite (Fig. 49H) well developed, reaching level of subapical part of rostrum, 4.0–4.4 times as long as maximum width, lateral margin feebly concave, terminating in acute tooth overreaching distal margin of lamella, proximal part of the tooth slightly narrower than lamella in width, mesial margin convex proximally; carpocerite (Fig. 49A) stout, reaching level of proximal third of scaphocerite.

Mouthparts typical of the family. Second maxilliped with suboval epipod; podobranch consisting of shaft only, filaments absent; dactylus narrow, with mesial margin nearly straight, densely furnished with long setae; propodus elongate, with anterior margin broadly rounded, with dense long setae; carpus subquadrate, anterolateral angle bluntly produced; mesial surface of merus, ischium, and anterior part of basis shallowly concave; coxa inflated mesially, anteromesial margin angular; exopod with well developed flagellum, basal part of lateral surface shallowly concave. Third maxilliped with endopod overreaching level of distal margin of scaphocerite by almost whole length of ultimate segment in “intermedius male”, reaching or slightly overreaching levelo of distal margin of

scaphocerite in “typus male”; ultimate segment with transverse rows of dense setae, ventrally furnished with numerous setae, 2.7 times as long as penultimate segment in “intermedius male”, 2.4–2.5 times as long as penultimate segment in “typus male”, terminating in a single corneous spine with 1–2 distolateral and 3–4 distomesial subterminal spines: penultimate segment fringed sparsely with short setae, dorsolateral surface shallowly concave; antepenultimate segment slightly widened distally, dorsal surface obliquely situated; ischium short, depressed; exopod with segmented flagellum overreaching level of distal margin of antepenultimate segment.

First pereiopod (Fig. 50A) stout, slightly compressed, reaching level of distal seventh of scaphocerite in “intermedius male”, falling slightly short of level of midlength of scaphocerite in “typus male”. Chela 2.2–2.7 (“intermedius male”), 1.6–2.0 (“typus male”) times as long as carpus, palm distinctly longer than dactylus, ventral surface with transverse rows of short setae with setules; dactylus (Fig. 50B) with cutting border furnished with spiniform setae, without denticulation, terminating in set of ungues; fixed finger (Fig. 50B) with cutting border unarmed, tapering distally, terminating in set of ungues obliquely articulated with corpus, ventrally armed with short spines. Carpus with distal margin truncate, dorsodistally terminating in acuminate tooth, ventrolateral surface slightly oblique. Merus 1.4–1.8 times as long as carpus, obliquely articulated with ischium. Coxa unarmed.

Second pereiopod (Fig. 50C) slender, slightly compressed, falling slightly short of level of distal margin of scaphocerite. Chela (Fig. 50D) with palm 3.2–4.8 times as long as dactylus; dactylus slightly arched, without denticulation on cutting border, terminating in set of ungues, corpus furnished distolaterally with long dense setae; fixed finger without denticulation but densely furnished with long setae on cutting edge, terminating in set of ungues, longest unguis slightly shorter than corpus in length. Carpus 1.4–1.6 times as long as chela, 1.3–1.5 times as long as merus, distal margin truncate, with sparse short setae. Merus obliquely articulated with ischium. Coxa unarmed.

Third pereiopod (Fig. 50E) overreaching level of distal margin of scaphocerite by lengths of distal fourth of propodus and dactylus. Coxa unarmed. Ischium armed with 1 lateral spine. Merus 1.5–2.0 times as long as carpus, armed with 3 lateral spines (distal spine near distal margin). Carpus armed with 2 lateral spines, with dorsodistal angle produced anteriorly. Propodus 1.5–1.7 times as long as carpus, ventral surface armed with about 17 small spines, dorsal surface sparsely furnished with short setae. Dactylus (Fig. 50F) biunguiculate, ungues distinctly demarcated from corpus, flexor margin armed with 4 small accessory claws posterior to preterminal unguis, decreasing in size proximally. Fourth pereiopod reaching level of distal margin of scaphocerite, similar to third pereopod in armature and proportion. Fifth pereiopod most slender in ambulatory pereiopods, reaching level of distal fourth of scaphocerite. Armature similar to those of two anterior ambulatory pereiopods. Merus 1.5–1.7 times as long as carpus. Propodus 1.6–1.7 times as long as carpus.

Endopod of male first pleopod (Fig. 50G) generally subquadrate, external margin furnished with short sparse setae proximally, without lobe, distal margin truncate, with midpoint feely prominent, without setae; mesial margin with additional folded free lobule, appendix interna well developed, feebly tapering distally, with a few cincinnuli terminally.

Endopod of male second pleopod (Fig. 50H) with appendices masculina and interna arising from distal two fifths of mesial margin; appendix masculina oval, furnished with long sparse setae,

considerably broader than appendix interna; appendix interna elongate, with a few cincinnuli terminally.

Uropod (Fig. 49E) with protopodite posterolaterally subquadrate. Both exopod and endopod reaching level of tip of telson; exopod with lateral margin straight, terminating in acute tooth, mesially with movable spine considerably longer than the terminal tooth; endopod slender, tapering distally.

Color in life. Fresh specimens pigmented with marked transverse red lines on tergum of first 2 abdominal somites, anterior one of which lines extending to ventral margin of pleuron, and sharp whitish line bordering by slender red lines extending laterally along posterior three abdominal somites and telson. Carapace with several reddish spots on anterolateral part and semi-circular red line on posterolateral part. Lateral surface of ambulatory pereiopods with longitudinal red line, at least on merus. Hence, color pattern showing a closest similarity to *Bus kuiteri* shown by Tiefenbacher (1983) and present study.

Distribution. This species is collected in southeastern Australian waters (Fig. 63), at the depths of 90–142 m.

Remarks. The re-examination of the paratypes of *Rhynchocinetes australis* deposited at the Australian Museum, Sydney, represented that one of them (AM P9447) correnspondsto *B*. sp. 2 by the lacking an arthrobranch on the second pereiopod, the length of stylocerite, and the armature of dactyli of the ambulatory pereiopods.

Bus sp. 2 has no arthrobranch on the posterior four pereopods, and this remarkable gill formula is common with *B. balssi* and *B.* spp. 1 and 3 (Tab. 2). However, *B*. sp. 2 is consistently different from these three related species by the armature of dactyli of the ambulatory pereiopods. In *B*. sp. 2, the flexor margin of the dactyli is armed with 4 accessory claws posterior to preterminal unguis (Fig. 50F), instead of 2 claws in *B. balssi* and *B*. sp. 3 (Figs. 29G, 52F), and 3 claws in *B*. sp. 1 (Fig. 48F). Furthermore, the stylocerite of *B*. sp. 2 reaches level of distal margin of antennular peduncle (Fig. 49G), whereas the stylocerite does not reach the margin in *B. balssi* and *B*. sp. 1 (Figs. 28F, 47I). The lacking a lateral lobe on the mesial margin of the endopod of the male first pleopod distinguishes *B. balssi* and *B*. sp. 2 (Figs. 29H, 50G) from *B*. spp. 1 and 3 with a distinct lobe (Figs. 48G, 52G).

These four species are readily distinguished by the coloration in life. In the color pattern, *B*. sp. 2 is closest to *Bus kuiteri* rather than *B. balssi* and *B*. spp. 1 and 3, therefore, these two species cannot be differentiated each other without examination on exact specimens. So far noticed from available data, *B*. sp. 2 has a relatively smaller numbers of red spots scattering on the carapace as comapared with those in *B. kuiteri* (about 10 or slightly more in *B*. sp. 2 vs approximately 20 in *B. kuiteri:* see also Tiefenbacher, 1983; figs 1, 3), though it is not confident this color pattern could be considered to be a specific difference. Hence, some doubts remained unsolved whether the two species are actually mimic in color or the photographed specimens and those examined by Tiefenbacher (1983; figs 1, 3) belong to distinct species. Reconfirmation of the natural color of *B. kuiteri* is required in future.

5-3-2-14 *Bus* sp. 3

(Figs. 51, 52)

Rhynchocinetes rugulosus– McCulloch, 1909: 310 (in part). Not *Rhynchoicnetes rugulosus* Stimpson, 1860.

Rhynchoicnetes balssi– Hale, 1941: 270. Not *Rhynchocinetes balssi* Gordon, 1936.

Rhynchoicnetes balssi– Bruce 1985: 124, fig. 1. Not *Rhynchocinetes balssi* Gordon, 1936.

Rhynchoicnetes balssi– Davie, 2002: 373 (list). Not *Rhynchocinetes balssi* Gordon, 1936.

Rhynchocinetes ballsi (sic.)– Coleman, 2002: 50, unnumbered fig. in color. Not *Rhynchocinetes balssi* Gordon, 1936.

Material examind: Australia. Norfolk Island. NTM-Cr 001675, 1 ovig.♀, CL 6.4 mm, Cascade, 29°01.5'S, 167°58.0'E, 17 April 1984, coll. H. K. Larson.— Load Howe Island. AM G2419, 1♂, 1♀、1ovig.♀, CL 7.0–8.3 mm, 31º33'S, 159º05'E, coll. Mrs. Nicholls; AM P1053, 2 ovig.♀♀, CL 5.3, 7.1 mm; AM P84944, 3♂♂, 1 ovig.♀, CL 6.3–9.6 mm, coll. T. R. Icely; AM P73338, 1 ovig.♀, CL 7.1 mm, Neds Beach reef flat, 31º51.7'S, 159º06.8'E, 15 November 2004, coll. G. Kelly; AM P54951, 4♂♂, 1♀, 1 ovig.♀, CL 7.1–10.0 mm, south end of lagoon, 31º33'S, 159º05'E, 18 September 1962; NTM-Cr 000545, 1♂, CL 4.0 mm, Erscott's Hole, 4 m, 13 December 1979, coll. N. Coleman.

Description. Carapace (Fig. 51A) almost glabrous, but covered with feeble transverse striations; dorsal median carina with 2 teeth, anterior tooth just posterior to rostral articulation, smaller than posterior tooth, apex directed anteriorly, posterior tooth feebly articulated with median carina; supraorbital spine present; orbit feebly developed, inferior orbital margin somewhat triangular; antennal spine narrower than supraorbital spine, situated ventrad to inferior orbital margin, flanked by short carina; pterygostomial angle with small acute tooth.

Rostrum (Fig. 51C) articulated with carapace, overreaching level of anterior margin of scaphocerite by subapical part, 1.1–1.5 times as long as carapace, anterior half feebly upward, apex slightly directed downwards; dorsal margin armed with two large spaced teeth on proximal half, posterior-most tooth situated just above of cornea, proximal second tooth falling short of level of midlength of rostrum, with 4–6 small subterminal teeth; ventral margin armed with 10–12 (rarely 9) teeth, decreasing in size distally.

Fifth thoracic sternite armed posteriorly with a pair of acute median processes. Sixth somite armed posteriorly with a pair of processes, shorter and situated more laterally than those of fifth somite.

Abdominal somites (Fig. 51D) covered with feeble oblique striations. Pleura of first to third somites broadly rounded; that of fourth somite with feebly angular posteroventral margin. Fifth somite with posterolateral angle terminating in acuminate process. Sixth somite 0.4–0.6 times as long as carapace, midpoint of posterolateral margin acutely prominent posteriorly, posteroventral angle acutely pointed, fringed with dense short setae; ventral surface armed with strongly hooked preanal spine. Telson (Fig. 51E) 0.6–0.8 times as long as carapace, 1.1–1.3 times as long as sixth somite, tapering posteriorly, posterior margin acuminate medially, with 3 pairs of dorsal spines on posterior two thirds; posterior margin with 3 pairs of spines, intermediate pair longest, with setules, mesial-most pair plumose (Fig. 51F).

Ophthalmic somite with midline slightly carinate, dorsally with fooked lobe. Eye (Fig. 51B) with large, globular cornea, maximum diameter longer than distal margin of stalk, distinct dorsal accessory pigment spot present; stalk widened distally, subequal to cornea in length.

Antennular peduncle (Fig. 51G) reaching level of midlength of rostrum. Proximal segment longer than distal two segments combined, dorsal surface moderately concave, with acute anterolateral tooth falling slightly short of level of midlength of distal segment, ventral surface mesially armed with a single spine; stylocerite well developed, acute, reaching od falling slightly short of level of distal margin of peduncle, armed proximolaterally with acute tooth; statocyst small, longitudinally oblong. Intermediate segment subcylindrical, furnished with dense setae laterally, mesial surface with long dense setae. Distal segment subcylindrical, subequal to intermediate segment in length, ventrally with setae. Dorsal flagellum with short aesthetascs except for proximal sixth of thickened part.

Antenna with stout basicerite (Fig. 51A) armed ventrolaterally with acute tooth directed anteriorly; ventral margin unarmed. Scaphocerite (Fig. 51H) well developed, reaching level of subapical part of rostrum, 3.3–4.2 times as long as maximum width, lateral margin almost straight, terminating in acute tooth overreaching distal margin of lamella, proximal part of the tooth broader than lamella, mesial margin convex proximally. Carpocerite (Fig. 51A) stout, falling slightly short of level of midlength of scaphocerite.

Epistome unarmed.

Mouthparts typical of the family. Second maxilliped with suboval epipod; podobranch well developed; dactylus narrow, with mesial margin nearly straight, densely furnished with long setae; propodus elongate, with anterior margin broadly rounded, with dense long setae; carpus subquadrate, anterolateral angle bluntly produced; mesial surface of merus, ischium, and anterior part of basis shallowly concave; coxa inflated mesially, anteromesial margin angular; exopod with well developed flagellum, basal part of lateral surface shallowly concave. Third maxilliped with endopod overreaching level of distal margin of scaphocerite by whole length of ultimate segment in “robstus male”, by distal third of ultimate segment in “intermedius male”, overreaching level of distal margin of scaphocerite by distal fifth of ultimate segment in “typus male” and female; ultimate segment with transverse rows of dense setae, ventrally furnished with numerous setae, 2.8 times as long as penultimate segment, terminating in a single corneous spine in “robustus male”, 2.3 times as long as penultimate segment in “inrtermedius male”, 1.6–1.8 times as long as penultimate segment in “typus male” and female, terminating in a single corneous spine with 2 distolateral and 4 distomesial subterminal spines: penultimate segment fringed sparsely with short setae, dorsolateral surface shallowly concave; antepenultimate segment slightly widened distally, dorsal surface obliquely situated; ischium short, depressed; exopod with segmented flagellum overreaching level of distal margin of antepenultimate segment.

First pereiopod (Fig. 52A) stout, slightly compressed, overreaching level of distal margin of scaphocerite by length of distal half of dactylus in “robustus male”, reaching level of midlength of scaphocerite in “typus male” and female. Chela 2.4 (“robustus male”), 2.2–2.3 (“intermedius male”), 1.7–1.8 (“typus male” and female) times as long as carpus, palm distinctly longer than dactylus, ventral surface with transverse rows of short setae with setules; dactylus (Fig. 52B) with cutting border furnished with spiniform setae, without denticulation, terminating in set of ungues; fixed finger (Fig. 52B) with cutting border unarmed, tapering distally, terminating in set of ungues obliquely articulated with corpus, ventrally armed with short spines. Carpus with distal margin truncate, dorsodistally terminating in acuminate tooth in “robustus and intermediate males”, ventrolateral surface slightly

oblique. Merus 1.4–1.9 times as long as carpus, obliquely articulated with ischium. Coxa unarmed.

Second pereiopod (Fig. 52C) slender, slightly compressed, falling slightly short of level of distal margin of scaphocerite. Chela (Fig. 52D) with palm 3.2–4.8 times as long as dactylus; dactylus slightly arched, without denticulation on cutting border, terminating in set of ungues, distolateral surface of corpus furnished with long setae; fixed finger without denticulation but densely furnished with long setae on cutting edge, terminating in set of ungues, longest unguis. Carpus 1.2–1.4 times as long as chela, 1.2–1.3 times as long as merus, distal margintruncate, with sparse setae. Merus obliquely articulated with ischium. Coxa unarmed.

Third pereiopod (Fig. 52E) overreaching level of distal margin of scaphocerite by lengths of distal third of propodus and dactylus. Coxa unarmed. Ischium armed with 1 lateral spine. Merus 1.8–2.4 times as long as carpus, armed with 2–3 lateral spines (distal spine near distal margin). Carpus armed with 2 lateral spines, with dorsodistal angle produced anteriorly. Propodus 1.7–2.0 times as long as carpus, ventral surface armed with about 14 small spines, dorsal surface sparsely furnished with short setae, a few distal plumose setae. Dactylus (Fig. 52F) biunguiculate, ungues distinctly demarcated from corpus, flexor margin armed with 2 small accessory claws posterior to subterminal unguis, decreasing in size proximally. Fourth pereiopod reaching level of distal margin of scaphocerite, similar to third pereopod in armature and proportion. Fifth pereiopod reaching level of midlength of scaphocerite. Armature similar to those of two anterior ambulatory pereiopods, but ischium rarely unarmed. Merus 1.6–2.1 times as long as carpus. Propodus 1.7–2.1 times as long as carpus.

Endopod of male first pleopod (Fig. 52G) generally oval, external margin furnished with short sparse setae proximally, with distinct lobe at distal third of length, considerably tapering distally, without setae; appendix interna well developed, feebly tapering distally, with a few cincinnuli terminally.

Endopod of male second pleopod (Fig. 52H) with appendices masculina and interna arising from distal two fifths of mesial margin; appendix masculina oval, furnished with long sparse setae; appendix interna elongate, distinctly longer than appendix masclina, with a few cincinnuli terminally.

Uropod (Fig. 51E) with protopodite posterolaterally acute. Both exopod and endopod slightly overreaching level of tip of telson; exopod with lateral margin straight, terminating in acute tooth, mesially with movable spine longer than the terminal tooth; endopod slender, tapering distally.

Color in life. Ground color of body generally translucent pink, carapace and first to fifth abdominal somites with oblique red lines, interspaced with white dots. Rostral tip white. Sixth abdominal somite with longitudinal red lines extending to posterior margin of telson. First and second pereiopods mottoled with red and yellow. Ambulatory pereiopods with meri with red and yellow bands and carpi and propodi white.

Distribution. Known only from Load Howe Island and Norfalk Island, southeastern Australia.

Remarks. *Bus* sp. 3 appears closest to *B. balssi* on account of the presence of arthrobranch on the third maxilliped and first pereiopod only and the armature of the ambulatory pereiopods. The present undescribed species is immediately distinguished from *B. balssi* by the following differences: The stylocerite of *B.* sp. 3 overreaches level of midlength of the antennular peduncle (Fig. 52G), but the stylocerite reaches level of distal margin of intermediate segment of the peduncle in *B. balssi* (Fig. 28F). The external margin of endopod of the male first pleopod has a distinct lobe in *B.* sp. 3 (Fig.

52G), instead of the lacking the lobe in *B. balssi* (Fig. 29H).

The present undescribed species was first reported as *Rhynchocinetes rugulosus* from Load Howe Island by McCulloch (1909). Subaequently, Hale (1941) re-examined the specimens reported by McCulloch (1909) deposited at the Australian Museum, and indicated that the specimens from Load Howe Island were referred to *R. balssi*. During short stay at the Australian Museum, I investigated several additional specimens from the island as well as those examined by Hale (1941). Careful comparison with the topotypic specimens of *B. balssi* revealed that the specimens from Load Howe Island are differentiated from *B. balssi* by the morphological features disccussed above. Furthermore, an ovigerous specimen from Norfalk Island was conspecific with the undescribed species. Therefore, *B.* sp. 3 will be considered an endemic species in the subtropical area of southeastern Australian waters.

5-3-1 Genus *Cus* gen. nov.

Type species. *Rhynchocinetes ikatere* Yaldwyn, 1971, by present designation.

Diagnosis. Medium sized rhynchocinetid shrimp with subcylindrical body. Carapace with dorsal surface without setae; a supraorbital nodule present, inferior orbital angle terminating in antennal spine not carinate; two teeth on median carina, anterior tooth fixed, posterior tooth articulated with carapace. Rostrum well developed, dentate, completely articulated with carapace. Posterior margin of fifth abdominal somite unarmed with posterolateral tooth. Fifth thoracic sternite without acute median processes. Distal margin of carpus of first pereiopod unarmed. Male first pleopod with endopod with dorsomedial margin not produced dorsally. Male second pleopod with appendix masclina shorter than appendix interna.

Distributional range. So far known from Great Australian Bight, southern Australia and New Zealand.

Ecology. The single species belonging to the genus, *C. ikatere*, occurs from deep waters of New Zealand and Great Australian Bight at the depths of 170–294 m.

Remarks. The present genus is closely related to *Rhynchocinetes* in sharing with the carapace segmented with rostrum by complete articulation, the dorsal carina of carapace is armed with two teeth just posterior to rostral articulation, the lacking of the posterolateral tooth of fourth and fifth abdominal somites, and the single row of spines on the lateral surface of meri and ischia of third to fifth pereiopods. However, following morphological features readily distinguish the present new genus from *Rhynchocinetes* and *Bus*: 1) In *Cus*, the carapace possesses a supraorbital nodule instead of a supraorbital spine in *Rhynchocinetes*. 2) The inferior orbital margin of carapace of *Cus* is continuous with an antennal spine, which is not carinate, while in other two genera of Rhynchocinetinae, the antennal spine is distinctly carinate, and situated on lower level to the protruded anterior angle of the inferior orbital margin. 3) *Cus* has the lamella of scaphocerite is distinctly wider than the width of base of distolateral tooth of lateral margin of scaphocerite. In contrast, the width of lamella of *Rhynchocinetes* and *Bus* is considerably narrow, being subequal to base of distolateral tooth in width.

5-3-3-1 *Cus ikatere* (Yaldwyn, 1971) comb. nov.

(Figs. 53–55)

Rhynchocinetes n. sp.– Richardson and Yaldwyn, 1958: 29, fig. 25.

Rhynchocinetes ikatere Yaldwyn, 1971: 87.

Rhynchocinetes ikatere– Chace, 1997: 26 (in key).

Rhynchocinetes ikatere– Yaldwyn and Webber, 2011: 189 (list).

Rhynchocinetes ikatere– De Grave and Fransen, 2011: 302 (list).

Material examined: Australia. SAMA-C 5601, 1♂, CL 9.9 mm, approximately 100 M SSW of Eucla, Great Australian Bight, Western Australia, 33º17'S, 128º16'E, 170 m, 15 January 1959, coll. W. Zeidler and K. Gowlett-Holmes.

New Zealand. NMNZ Cr. 1871, 1♀(holotype of *Rhynchocinetes ikatere*), CL 11.0 mm, NMNZ Cr. 2183, 1♀(paratype of *R. ikatere*), CL 11.0 mm, Bay of Plenty, North Island; NIWA 13695, 1♀, CL 10.7 mm, 37º27.69'S, 176º54.81'E–37º27.87'S, 176º54.85'E, station TAN0413/170, 294–247 m, 16 November 2004, coll. National Institute of Water & Atmospheric Research.

Description. Carapace (Fig. 54A) almost glabrous, but covered with feeble transverse striations; dorsal median carina with 2 teeth, anterior tooth just posterior to rostral articulation, larger than posterior tooth, apex directed anteriorly, posterior tooth feebly articulated with median carina; supraorbital nodule present (Fig. 54D); orbit feebly developed (Fig. 54E), inferior orbital margin obsolete, terminating in antennal spine (Fig. 54D); antennal spine rather flattened, without lateral carina (Fig. 54D); pterygostomial angle with blunt tooth.

Rostrum (Fig. 54C) articulated with carapace, overreaching level of anterior margin of scaphocerite by subapical part, 1.0–1.2 times as long as carapace, anterior half feebly upward, apex directed anteriorly; dorsal margin armed with two large spaced teeth on proximal half, posterior-most tooth situated just above of cornea, proximal second tooth at midlength of rostrum, with 3–4 small subterminal teeth; ventral margin armed with 9–10 teeth, decreasing in size distally

Fifth thoracic sternite armed posteriorly with pair of row, subquadrate ridge, without acute median processes. Sixth somite armed posteriorly with pair of triangular small median processes.

Abdominal somites (Fig. 54F) covered with feeble oblique striations. Pleura of first to third somites broadly rounded. Fifth somite with posteroventral margin terminating in acuminate process. Sixth somite 0.5–0.7 times as long as carapace, midpoint of posterior margin acutely prominent posteriorly, with acute posteroventral process; ventral surface armed with strongly hooked preanal spine. Telson (Fig. 54G) 0.6–0.7 times as long as carapace, 1.0–1.2 times as long as sixth somite, tapering posteriorly, posterior margin acuminate medially, with 3 pairs of dorsal spines on posterior half; posterior margin with 3 pairs of spines, intermediate pair longest (Fig. 54H).

Ophthalmic somite (Fig. 54E) with midline slightly carinate, dorsally with elongate lobe. Eye (Fig. 54B) with large, globular cornea, maximum diameter longer than distal margin of stalk, distinct dorsal accessory pigment spot present; stalk widened distally, shorter than cornea.

Antennular peduncle (Fig. 54I) slightly overreaching level of midlength of rostrum. Proximal segment longer than distal two segments combined, dorsal surface moderately concave, with acute anterolateral tooth reaching level of proximal two thirds of intermediate segment, ventral surface

mesially armed with a single spine; stylocerite well developed, acute, falling slightly short of level of distal margin of the terminal segment, armed proximolaterally with acute tooth; statocyst small, longitudinally oblong. Intermediate segment subcylindrical, furnished with dense setae laterally, mesial surface with a few long setae. Distal segment subcylindrical, obliquely articulated with intermediate segment, ventrally with setae. Dorsal flagellum with short aesthetascs at distal 29 segments of thickened part.

Antenna with stout basicerite (Fig. 54A) armed ventrolaterally with acute tooth slightly upwards dsitally. Scaphocerite (Fig. 54J) well developed, overreaching level of distal margin of antennular peduncle by distal third of length, 3.3–3.8 times as long as maximum width, lateral margin almost straight, terminating in acute tooth overreaching level of distal margin of lamella, proximal part of the tooth about half as long as lamella in width, mesial margin convex. Carpocerite (Fig. 54A) stout, reaching level of proximal two fifths of scaphocerite.

Epistome unarmed.

Mouthparts typical of the family. Second maxilliped with suboval epipod; podobranch well developed. Third maxilliped with endopod falling slightly short of level of distal margin of scaphocerite; ultimate segment with transverse rows of dense setae, ventrally furnished with numerous setae, 1.5–1.9 times as long as penultimate segment, terminating in corneous spine, with 2 distolateral and 4 distomesial subterminal spines; penultimate segment fringed sparsely with short setae, dorsolateral surface shallowly concave; antepenultimate segment slightly widened distally, dorsal surface obliquely situated; ischium short, depressed; exopod with segmented flagellum slightly overreaching level of distal margin of antepenultimate segment.

First pereiopod (Fig. 55A) robust, slightly compressed, reaching level of midlength of scaphocerite. Chela 1.4–1.7 times as long as carpus, palm about twice as long as dactylus, ventral surface with transverse rows of short setae with setules; dactylus (Fig. 55C) without denticulation on cutting edge, terminating in set of ungues, distal margin of corpus densely furnished with long setae; fixed finger (Fig. 55B) without denticulation on cutting border, tapering distally, with row of long marginal setae, terminating in set of ungues. Carpus with distal margin truncate, ventrolateral surface slightly oblique. Merus 1.2–1.3 times as long as carpus, obliquely articulated with ischium. Coxa unarmed.

Second pereiopod (Fig. 55C) slender, slightly compressed, overreaching level of distal margin of scaphocerite by length distal halh of dactylus. Chela (Fig. 55D) with palm 2.8–3.0 times as long as dactylus; dactylus slightly arched, without denticulation on cutting border, terminating in set of ungues, distalolateral surface of corpus furnished with long setae; fixed finger without denticulation but densely furnished with long setae on cutting edge, distolaterally with row of long setae, terminating in set of ungues, slightly shorter than corpus in length. Carpus 1.6–1.8 times as long as chela, 1.5–1.6 times as long as merus, distal margin bluntly produced, with sparse setae. Merus obliquely articulated with ischium. Coxa unarmed.

Ambulatory pereiopods considerably slender (Fig. 53), with dactyli (Fig. 55F) biunguiculate, ungues distinctly demarcated from corpus, flexor margin armed with 5 small accessory spines posterior to subterminal unguis, decreasing in size proximally. Third pereiopod overreaching apex of scaphocerite by proximal three fifths of propodus and dactylus. Coxa unarmed. Ischium armed with 1

lateral spine. Merus 1.6–1.8 times as long as carpus, armed with 3–4 lateral spines (distal spine near distal margin). Carpus armed with 2 lateral spines, with dorsodistal angle produced anteriorly. Propodus 1.4–1.6 times as long as carpus, ventral surface armed with small spines, dorsal surface sparsely furnished with long setae, a few distal plumose setae. Fourth pereiopod overreaching level of distal margin of scaphocerite by lengths of distal fourth of propodus and dactylus, similar to third pereopod in armature and proportion. Fifth pereiopod (Fig. 55E) overreaching level of distal margin of scaphocerite by length of dactylus. Ischium unarmed. Merus 1.2–1.3 times as long as carpus. Armature of carpus, propodus and dactylus, proportion of propodus similar to those of anterior two ambulatory pereopods.

Endopod of male first pleopod (Fig. 55G) generally oval, laterally furnished with short sparse setae proximally, considerably tapering distally, without setae; appendix interna well developed, stout, tapering distally, with a few cincinnuli terminally.

Endopod of male second pleopod (Fig. 55H) with appendices masculina and interna arising from midlength of mesial margin; appendix masculina oblong, furnished with long sparse setae, shorter than appendix interna; appendix interna elongate, with a few cincinnuli terminally.

Uropod (Fig. 54G) with protopodite posterolaterally acute. Both exopod and endopod overreaching level of tip of telson; exopod with lateral margin straight, terminating in acute tooth, mesially with movable spine longer than the terminal tooth; endopod slender, tapering distally.

Color in life. Yaldwyn (1971) mentioned as “Distinctive colour pattern in life of symmetorically placed white bands on right red carapace and abdomen”.

Distribution. Type locality: Off Mayor Island, Bay of Plenty, 37°15’S, 176°12’E. Also known only from Great Australian Bight, southern Australia (present study).

Remarks. The present specimen from the Great Australian Bight compared with the paratype and topotypic specimens, and represents that no significant differences among the individuals from two rather isolated localities. Yaldwyn (1971) did not describe some distinguishing morphological features used to identification with rhyncocinetids. Therefore, the detailed re-description of *Cus ikattere* is provided herewith and I regarded the following features as the diagnoses of the species: The stylocerite reaches the level of midlength of distal segment of antennular peduncle (Fig. 54I), and the dactyli of ambulatory pereiopods are armed with 5 accessory spines posterior to subterminal unguis, decreasing in size proximally (Fig. 55F).

6 BIOGEOGRAPHICAL NOTES

6-1 A review on distributional range of the Recent species

In the present study, the family Rhynchocinetidae is considered to be composed of two subfamilies, Subfamily A and Rhynchocinetinae, for the first time because of several morphological differences mentioned in the “Taxonomy” part of this dissertation. In addition to the morphological aspect, the distributional pattern of Subfamily A does not agree with that of Rhynchocinetinae: Shrimps of Subfamily A are distributed not only in the Indo-Pacific but also in the Atlantic, and all the species occur in shallow waters of the tropical region. In contrast, the members of the Rhynchocinetinae are only from the Indo-Pacific, and 13 of 16 species documents the endemic to the

disjunctive temperate area. Because the fossil record of any rhynchocinetid is unavailable, the detailed and comprehensive review of the distributional pattern of all of the Recent species will be valuable in to resolving the phylogenetic evolution within the family.

Species of Subfamily A occur throughout pantropical waters of the world oceans except for Mediterranean, viz., Indo-Western and Eastern Pacific Oceans, and both the Western and Eastern Atlantic Oceans (Paulay, 1997) (Fig. 56). The distributional range of Subfamily A to date is disjunctive, since 9 species from the Indo-Pacific and 2 from the Atlantic Ocean are recognized in the present study. As mentioned in the taxonomic part of this dissertation, the classification in subfamily concluded that the Indo-Pacific species, *Aus hendersoni*, is morphologically distinguished from other species of Subfamily A at the generic level in regard to having the corneous projection on the coxae of the first and third pereiopods. However, two Atlantic species, *Cinetorhynchus manningi* and *C. rigens*, do not show such as significant morphological structure to distinguish them from the Indo-Pacific *Cinetorhynchus* species as a separate genus.

In the Indo-Pacific, the vast tropical area from Red Sea to the islands of French Polynesia is known as the Indo-West Pacific, and distributional ranges of numerous caridean shrimps are widespread throughout this region (Bruce, 1980). Most of shallow-water species can be distributed along the Eurasia continental shelf because the larval stage of carideans as well as other taxa of animals may readily develop in plankton-rich waters. As in numerous cases of tropical shallow water carideans, several *Cinetorhynchus* species are mainly recorded from the Indo-West Pacific, and each species shows a rather wide distribution: *C. concolor* and *C. reticulatus* throughout the Indian Ocean to French Polynesia (Figs. 59, 60); *C. erythrostictus* from the Indian Ocean to New Caledonia (Fig. 59), and *C. striatus* from several localities of the western Pacific (Fig. 60). Other Indo-West Pacific *Cinetorhynchus* species are restricted in their distributional range, but these are from the tropical waters: *C. brucei* from the Ryukyu Islands (Fig. 59); *C. fasciatus* from Ogasawara and Hawaiian Islands (Fig. 59); *C. hawaiiensis* from the Maldive, Mariana and Hawaiian Islands (Fig. 60). A few Indo-West Pacific carideans have expanded into the Eastern Pacific by crossing into the East Pacific Barrier (Bruce, 1980; De Grave, 2001b), which is a wide expanse of deep water lying between French Polynesia and America, which separates the Indo-West Pacific biota from that of the Eastern Pacific (Briggs, 1995; Paulay, 1997). In the Rhynchocinetidae, two Indo-West Pacific species of Subfamily A, *Aus hendersoni* and *Cinetorhynchus hiatti*, are also distributed in the Eastern Pacific (Fig. 58).

Two Atlantic species show differences of their distributional pattern: *C. rigens* occurs from both West and East Atlantic, but *C. manningi* is restricted in Caribbean Sea (Fig. 61).

Conversely, shrimps included in the Rhynchocinetinae spread only into the Indo-Pacific region (Fig. 57). Furthermore, the horizontal distributional range of most species is restricted from the temperate waters or area shown the high degree of endemism in the Indo-Pacific. Below, these species and their distributional range are briefly reviewed:

Rhynchocinetes typus and *Bus balssi* are included in the Chilean decapod fauna, but with different distributional patterns (Fig. 62). *Rhynchocinetes typus* is known only from the coast of Peru and Chile, and Galápagos Island (Holthuis 1980; Wicksten, 1991). The considerably long coast of South American Continent is divided into the Peruvian Province from Guayaquil, Ecuador to Chiloé Island of Chile, and Magellanic Province, southward to the island (Rathbun, 1911; Haig, 1955; Boschi, 2000).

The division of these provinces is reflected as the separation of the warm- and cold temperate faunas. The range of distribution in *R. typus* corresponds to the warm temperate region, which is strongly influenced by the Peru Coastal Current. The caridean shrimp fauna of the Galápagos Islands is similar to that of the tropical Eastern Pacific such as the western coast of Mexico and the coasts of Colombia, Ecuador and northern Peru (Wicksten, 1991). The faunal affinities between the Galápagos Islands and the Pervian Province is recognized so small because the Peru Countercurrent separates the Peru Coastal Current from the Peru Oceanic Current becoming around the Galápagos Islands as the South Equatrial Current (Finet, 1991). This biogeographical aspect is doubtful that these two populations of R. typus are possibly differentiated as the specific level. Therefore, as indicated in "Remarks" section of *R. typus*, the individuals from the coast of Peru and Chile should be carefully compared with those from the Galápagos Islands morphologically. In Chilean waters, *Bus balssi* is only recorded from Juan Fernandez and Easter Island, not from the mainland. This species is also known from the Austral Islands, southern part of French Polynesia and New Zealand (Gordon, 1936; present study). The marine fauna of Juan Fernandez represents a high degree of endemism (Briggs, 1974), but Haig (1955) pointed out the decapod anomuran fauna of Juan Fernandez is similar to that of New Zealand. Therefore, the distributional range of *B. balssi* represents the islands situated south of the faunal boundary line of the southeastern Pacific indicated by Poupin (2008).

Bus australis, *B. enigma*, *B. kuiteri*, *B. serratus* and *B.* sp. 2 represent the endemic species of the temperate waters of southern Australian coastline (Fig. 63). High degree of endemic species is regarded in several taxa of marine organisms in this area, and the coastline is subdivided into five subregions (O'Hara and Poore, 2000). The five species are known in the subregions categorized by them: *B. australis* and *B. kuiteri* are in the coast from South Australian Gulf to central Victoria including Tasmania; *B. enigma* is from the south-west coast of Perth to the South Australian Gulf, and *B. serratus* and *B.* sp. 2 are in the coast from Wilson's Promontory to Sydney. *Bus* sp. 3 is also an Australian endemic species, but is distributed only in Load Howe Island and Norfolk Island (Fig. 64).

Bus conspiciocellus and *B. uritai* occur in the northwestern Pacific, including central to southern Japanese waters, southern Korea and Taiwan (Fig. 65). Distributional pattern of these two species are somewhat differentiated from each other. *Bus conspiciocellus* ranges from temperate waters on the Pacific coast of southern Japan to subtropical areas such as the Ryukyu Islands, southward to southern part of Taiwan. While *B. uritai* occurs from the Sea of Japan coast of Akita Prefecture to the western coast of Kyushu and disjunctive waters of Cheju Island of southern Korea and northwestern coast of Taiwan, but it does not occur in the Ryukyu Islands. This biogeographical difference suggested that *B. uritai* is adapted cooler environment than *B. conspiciocellus*. As in the case of *B. uritai*, a number of warm temperate marine animals of the north-western Pacific show a similar distributional pattern by inhabiting the mainland of Japan and northern part of Taiwan but not in the Ryukyu Islands. For instance, some shore fishes commonly found the temperate Japanese waters such as the bullhead shark, *Heterodontus japonicus* Maclay and Macleay, 1884 (Heterodontiformes: Heterodontidae) and the moray eel, *Gymnothorax kidako* (Temminck and Schlegel, 1847) (Anguilliformes: Muraenidae) show this particular distributional pattern (Nakabo, 2013). Possibly these animals disperse along the coast of Eurasia Continent. The main stream of the warm Kuroshio Current running north along the Ryukyu Islands seems to impede the dispersal of these temperate animals southward throughout the islands.

Bus holthuisi is recorded only from the northern Red Sea and Gulf of Aden (Fig. 66). Numerous marine biologists have noted the high percentage of endemic species in the Red Sea, but indeed, the endemic shore fishes of Red Sea are also distributed in Gulf of Aden and Persian Gulf (Por, 1989). Thus, *B. holthuisi* is regarded as an endemic species of this rather wide area.

Bus rathbunae has been recorded only from the Hawaiian Islands (Fig. 64). The isolation of the Hawaiian Archipelago and the high rate of endemism of its fauna are characteristic (Briggs, 1974; Kay and Palumbi, 1987). However, several decapod crustaceans distributed in Hawaii are also found in other places of the Indo-West Pacific. Among them, *B. rathbunae* and the xanthid crab, *Lybia edmondsoni* Takeda and Miyake, 1968 are regarded as true endemic species of Hawaii but I don't understand the significance of the last part of this sentence.

There are three completely tropical species: *Bus durbanensis* is widely distributed in the Indo-West Pacific from the eastern coast of Africa, northward to the Ryukyu Islands (Fig. 62); *B. brucei* is known from the tropical western Pacific and western Indian Ocean but they have not been recorded from the oceanic islands of the central Pacific (Fig. 64), and *B.* sp. 1 has been known only from three disjunctive localities. However, the distribution of the species is considered as a wide range from the tropical Indo-West Pacific from the localities (Fig. 64). Especially, *B. durbanensis* is very common species through tropical Indo-West Pacific, but is not recorded from oceanic islands of central Pacific, which are situated on the Pacific plate.

The distributional range different rhynchocinetid species may be related to the period of its dispersive planktonic larval stage. The studies on larval development of Rhynchocinetidae have been done by *Cinetorhynchus rigens* by Gurney (1941), *C. striatus* by Maihara and Kyoya (2001b), *C. reticulatus* by Maihara (2004), *Aus hendersoni* by Maihara and Kyoya (2001a), *Bus conspiciocellus* by Matoba and Shokita (1998), and *B. uritai* by Maihara (2002). Except for Gurney (1941), these were studied under laboratory condition. As mentioned by Maihara (2002), *A. hendersoni* and *B. uritai* are distinctly differentiated in their distributional range, the planktonic zoeal period are similar to each other: 11 zoeal stages during 23–42 days in *A. hendersoni*, and 10 stages during 23–38 days in *B. uritai*. *Cinetorhynchus reticulatus*, which is a widespread species in the tropical Indo-Pacific, had 10 zoeal stages during larval development of 33–53 days (Maihara, 2004). Matoba and Shokita (1998) reported that *B. conspiciocellus* shows 11 zoeal stages, with development with an extremely long period, 75–120 days although it is endemic to the northwestern Pacific region from Japan to Taiwan. From these previous studies on the larval development of rhynchocietids, unfortunately, the relationship between distributional range and planktonic stages is unclear.

Sea surface temperatures influence the disjunctive distributional pattern of endemic species. The southern coast of Australia occupied the most abundant endemic species with temperatures of 15.5–25 ^{o}C in summer and 11.5–20 ^{o}C in winter (O'Hara and Poore, 2000). In the temperate region of Japanese waters, the year average of sea surface temperature ranges 14–26 ^{o}C. The monthly average of seawater temperature in Chilean coast is between 17 and 20 ^{o}C (Briggs, 1974). If the adult of temperate species are physiologically adapted to these temperatures (around 20 ^{o}C), the larval development will be not successful in cooler or warmer environments, restricting their distributional range. Thus, more physiological studies of each temperate species to the water temperature are required.

6-2 Hypothesis on formation of distributional pattern of the Recent species

Although rhynchocinetids are mainly composed by shallow water species, Rhynchocinetidae have been considered close to some deepsea shrimp families on the basis of morphological and molecular phylogenetic analyses (Chace, 1992; Li *et al*., 2011). In particular, Li *et al*. (2011) documented that Rhynchocinetidae is included in the clade contained Alvinocarididae, Campylonotidae Sollaud, 1913, Eugonatonotidae, Nematocarcinidae, Oplophoridae and Pasiphaeidae Dana, 1852. These families nearly always inhabit the deep sea. Inhabiting the same shallow water niches as rhynchocinetids are a cluster of families such as Alpheidae Rafinesque, 1815, Barbouridae Christffersen, 1987, Hippolytidae and Palaemonidae (Li *et al*., 2011). However, the distributional pattern of the living species of Rhynchocinetidae mentioned above strongly suggests that the origin of the family seems to have occurred in shallow waters of the Tethys Sea: it came into the epoch during the Pangean supercontinental formation was completed (256.0 Ma) and narrowed by the grows of the Atlantic Ocean and the drift of the continent of India (15.0 Ma) (Stow, 2010). Renema *et al*. (2008) recognized it as hotspot of the tropical shallow water diversity of the living organisms.

Shrimps included in Subfamily A consist of the tropical species over the world except for Mediterranean Sea (Fig. 56), whereas those of Rhynchocinetinae possess both antitropical and tropical species but restrict in the Indo-Pacific (Fig. 57). Since the distribution of the species of Subfamily A ranges in pantropical region of the world, the common ancestor of both subfamilies arose in which geological time period or epoch Tethys Sea (Fig. 67), and thus Subfamily A seems to be a relict of the Tethys Sea. This sea served as the passage for biotic migration between Indo-West Pacific and Atlantic Ocean in middle Eocene (45.0 Ma), and as a species diversification hotspot at Western Tethyan region, viz., southwest Europe, northwest Africa, and along the eastern shore of the Arabian Peninsula, Pakistan, and West India around this period (Renema *et al*., 2008). Subsequently, the continental collision of India with Asia and development of the Sunda islands narrowed the Tethys Sea from the northeastern Atlantic to the northwestern Indian Ocean in middle Miocene (15.0 Ma) (Stow, 2010). The Isthmus of Panama is considered as the most recent biogeographic barrier to separate the tropical shallow-water marine biota between Indo-Pacific and Atlantic in 3.0 Ma (Briggs, 1970; Zachos *et al*., 2001). The formation of Isthmus of Panama is considered as one of the geological events involved in the closure of Tethys Sea. Shrimps of Subfamily A hide in cave environments considering as physiochemically similar to deep waters on account of the presence of aphotic zone and lacking influence by wind and wave (Ohtsuka *et al*., 1999). Thus, members of Subfamily A may be regarded as the relicts of deepsea taxa, some of which became extinct in the Mediterranean region by the influence of the Messian salinity crisis during 5.6–5.3 Ma (Garcia-Castellanos *et al*., 2009). The relationship of the geological period of divergence, time scale and two oceans is summarized as in Fig. 67. The geographical separation of rhynchocinetids by both Indo-Pacific and Atlantic is not reflected by their major phylogenetic clades.

On the other hand, the distributional pattern of the living species of the subfamily Rhynchocinetinae indicates that divergence at the species level arose after the migration of tropical shallow-water species between the Eastern Pacific and Western Atlantic was completely blocked by formination of the Isthmus of Panama. As mentioned previously, distributional ranges of most species in the Rhynchocinetinae are restricted in several areas of higher (temperate) latitude, and only two

species (*B. brucei* and *B. durbanensis*) are distributed in the East Indies Triangle, which is an area including the Philippines, Malay Peninsula and Papua New Guinea, and is the location of the highest diversity (= the greatest species richness) in the marine world (Briggs, 1992, 1995, 1999). There is a hypothesis that the distributional process of numerous marine organisms in the Indo-Pacific extends outward from the East Indies, their center of origin. This is the center of origin hypothesis by Briggs (1992, 1995, 1999). The Rhynchocinetinae has a small number of species in the East Indies Triangle, and over half of species recognized in this study occur in warm and cool temperate areas of the southern hemisphere (Figs. 62–65). According to Briggs (1999), this pattern generally corresponds to his hypothesis: the range of disjunctive related species occurs in peripheral areas after dispersal from the center of origin, with subsequent extinctions outwards from the East Indies. Against, Renema *et al*. (2008) indicated that the specific diversity has already began at least 50 Ma in the Tethys sea. In the present study, the East Indies Triangle is not considered as the center of origin in Rhynchocinetinae as mentioned below.

The highest species diversity of Rhynchocinetinae with 6 of 16 known species (38 %) is shown in the southern coast of Australia (Figs. 63, 64). Moreover, the highest disparity of morphologoical features and color pattern is found among the species occurring in this area: For example, some morphological distinguishing features of *Cus ikatere* are considered herein as generic diagnoses; the presence of a ventral tooth of antennal basicerite appears only in *Bus australis*; the number of arthrobranches is variable in the endemic species from lacking on all the appendages in *Bus enigma* arthrobranches present on the coxal membrane of third maxilliped and first to third pereiopods in *B. serratus*. Almost all species of Rhynchocinetinae have the labyrinthine red lines in color in life (Figs. 4, 5), but *B. enigma* and *B. kuiteri* do not have such lines on the abdominal somites (Fig. 5A, B; Tiefenbacher, 1983; Poore *et al*., 2008). Southern Australia has an east-west coastline ranging 5500 km into the temperate zone, and contains the high percentage of endemic species of marine animals (O'Hara and Poore, 2000). The five of 6 species of Rhynchocinetinae in this area are endemic. The western Australian coastline began to form in the late Cretaceous since Australia started moving north from Antarctica (Short and Woodroffe, 2009). Subsequently, tropical species invaded and speciated in this area as indicated by O'Hara and Poore (2000). Possibly, a common ancestor(s) of the two rhynchocinetid subfamilies invaded from the Tethys Sea along the coast of the African Continent and adapted from tropical to temperate environments. Shrimps of Rhynchocinetinae do not show the highly cryptic behavior found in species of Subfamily A. They form more or less large crowds of individuals on the intertidal to sublittoral crevices of rocky reef, and readily visible by day. The reason for the rhynchocinetine dispersal southward might have been as an escape from abundant predators in tropical highest diversity area; or, alternatively a reversion to the lower temperature tolerances of their hypothesized deepsea ancestors. In any case, the diversity and disparity of Rhynchocinetinae species in the southern coast Australia are considered herein to be reflected the center of origin of the subfamily. High latitude regions of the southern hemisphere have been recognized as centers of origin in several taxa (Briggs, 1992). Feldmann (1986) concluded that two taxa of decapod crustaceans, the family Aeglidae Dana, 1852 and *Lyreidus* De Haan, 1841 of the family Raninidae De Haan, 1839, have their center of origin in the high latitude region of the southern hemisphere. In antitropical shore wrasses of the genus *Pseudolabrus* Bleeker, 1862, Mabuchi *et al*. (2004) indicated that it originated in

the southern hemisphere. Because species of Rhynchocinetinae are distributed only in the Indo-Pacific, the specific divergence must have begun after Tethys Sea was closed. A possible scenario for endemism in temperate waters is as follows: After formation of the Isthmus of Panama, numerous glacial-interglacial cycles have been taken place during the Pleistocene period, and most lower sea-level periods with glaciations showed a –140 m difference from the present sea level (Schopf, 1980). During the lower sea-level periods, the temperate rhynchocinetid species would have been able to cross the areas of lower latitude because of cooler temperatures, and then concentrically disperse from the center of origin (Fig. 68): Species occurring in the north-western Pacific such as Japan, Korea and northern Taiwan then expanded along the eastern coast of Sunda Land; the endemic species of Red Sea, Gulf of Aden and Persian Gulf are proposed to have migrated along the western coast of Sunda Land and Eurasia continental shelf; rhynchocinetids possibly extended to the Hawaiian Islands by the route of the Eastern Pacific and North Equatorial Currents as indicated by Newman (1986). Species inhabited the Peru-Chilean coast including Juan Fernandez Islands probably dispersed along the Kermadec Islands, the southern part of Austral Islands, Easter Island and seamounts of the Sala y Gómez and Nazca ridge as a series of stepping-stones. The distributional pattern of a living species, *Bus balssi*, suggests the possibility of dispersal in the southern Pacific region. Furthermore, it is thought that some deepwater species of rhynchocinetids such as *Cus ikatere* and *Bus* sp. 3 apparently remained in those depths after sea level became high as today. On the other hand, only 3 of 16 species (*Bus brucei*, *B. durbanensis* and *B.* sp. 1) are widespread in the tropical Indo-West Pacific (Figs. 62, 64). These species may be expanded after the Sunda Land had disappeared. Nishimura (1982) pointed out that the great environmental changes such as eustatic sea level changes or emergence of land bridges may have facilitate expansion by this new dispersal route.

It is noteworthy that no species of Rhynchocinetinae have ever been recorded from the oceanic islands of Micronesia and lower latitudes of French Polynesia (Fig. 57). Paulay *et al* (2003) recognized total 138 caridean shrimp species from the Mariana Islands from compilations of literature and examination of collections. Caridean shrimps from other areas of Micronesia are reported from various publications: Kusaie (=Kosrae) and Truk (=Chuuk), the Caroline Islands (Kubo, 1940); the Marshall Islands (Edmondson, 1952; Chace, 1955; Holthuis, 1981; Bruce, 1983, 1984; Bruce and Zmarzly, 1983); the Palau Islands (Miyake and Hayashi, 1966; Miyake and Fujino, 1968; Hayashi, 1975; Bruce, 1977); Kapingamarangi Atoll (Holthuis and Hayashi, 1967; Hayashi, 1975; Holthuis, 1981), and the Gilbert Islands (Hayashi, 1986). The specimens of Rhynchocinetinae from Micronesia were not confirmed in the present study as well as the publications listed above. Total 167 carideans were reported from French Polynesia at that time (Poupin, 1998). The present study records *Bus balssi* from Rapa Island, in the southern part of Austral Islands, but this locality is situated in a temperate area of South Pacific rather than tropical French Polynesia. The absence of rhynchocinetids the latter tropical oceanic islands might be explained by the vast distances from the center of origin, as the open-ocean waters show a low plankton productivity inadequate for rhynchocinetid larval development and dispersal. To validate the hypothesis of rhynchocinetine absence in Micronesia and most of French Polynesia, the detailed field observations with SCUBA equipment will be necessary.

7 ACKNOWLEDGEMENT

I would like to thank Dr. Teruaki Nishikawa (Toho University) for his valuable suggestions to improve the present work for doctoral dissertation. My cordial thanks due to Dr. Masatune Takeda (NSMT) for his helpful guidance and suggestions during my career as a carcinologist.

Grateful acknowledgements are extended to Dr. Raymond T. Bauer of the University of Louisiana, Lafayette, for his help and warmest hospitality during my stay in his laboratory as well as his home at Lafayette. He also kindly reviewed the early draft of the dissertation and gave me valuable comments improving it.

I am deeply indebted to Dr. Tin-Yam Chan (NTOU), Dr. Lucius G. Eldredge of Pacific Science Association, Dr. Ken-ichi Hayashi (SUF), Dr. Stephen Keable (AM), Dr. Tohru Naruse (RUMF) Dr. Peter K. L. Ng (ZRC) and Dr. Michitaka Shimomura (KMNH) for their kind supports during my stay at their laboratories to investigate the specimens deposited at their collection. I also thank Mr. Keiichi Nomura of Kushimoto Marine Park Center and the staffs of the Tokyo Sea Life Park, Tokyo, for donating me the valuable materials examined in this study. I wish to express my sincere gratitude to Dr. Alain Crosnier (MNHN) for sending me on loan the various specimens collected by MUSORSTOM cruise and giving me the good opportunity to report on the collections and publish the result in the present publication, and also the helpful comments on the early draft of the manuscript. My thanks go to Dr. Alexander J. Bruce (QM) for sending me on loan several specimens deposited at the collection of NTM and QM, and the late Dr. John C. Yaldwyn (NMNZ) for the re-examination on the holotype of *Rhynchocinetes ikatere* by himself. I am grateful to Dr. Sammy De Grave (OUMNH), Dr. Charles H. J. M. Fransen and the late Dr. Lipke B. Holthuis (RMNH), Dr. Karen Gowlett-Holmes (SAMA), Drs. A. W. Harvey and A. A. Lwin (AMNH), Dr. Yukio Hanamura of the National Research Institute of Fisheries Science, Yokohama, Dr. Ming-Shiou Jeng (ASIZ), Dr. Tomoyuki Komai (CBM), Dr. Hiroshi Suzuki (KUMB), Dr. R. A. Symonds (UMZC), Dr. Martin Thiel of the Universidad Católica del Norte, Coquimbo, Chile, Dr. Michael Türkay (SMF), Dr. W. Richard Webber (NMNZ) and Dr. Mary K. Wicksten of the Texas A & M University for kind arranging my examination on their materials.

Sincere indebtedness is due to the late Dr. Fenner A. Chace, Jr. (USNM) for sending me on loan the materials under his care and translating Tiefenbacher's paper of 1976 from the German to the English.

I would also like to thank the following persons who made the present study possible: Mr. J. L. Menou of the ORSTOM Research Center of Noumea, New Caledonia, took the photograph in color of New Caledonian materials. Mr. John P. Hoover and the late Mr. Darrell Takaoka of Honolulu, Hawaii, kindly donated me the specimens collected at Oahu Island. The specimens of *C. reticulatus* from Pagan Island, the northern Mariana Islands were collected in cooperation with the Division of Fish and Wildlife, Department of Natural Resources (Commonwealth of the Northern Mariana Islands). Messrs. Kiyoshi Hagiwara and Masayoshi Hayashi (YCM), Shoichi Kato of Hachijo-jima Island, Tsuyoshi Kawamoto of Kume-jima Island, Yasuhiro Morita of the Ogasawara Islands, Shuichi Ohashi of Naha City, Okinawa Prefecture, and Kotaro Tanaka of Hachijo-jima Island for their kindness to capture the materials in the coast of southern Japan with SCUBA diving.

8 REFERENCES

Allen, G. R. and R. Steene, 1994. Indo-Pacific coral reef field guide. 378 pp. Tropical Reef Research, Singapore.

Armstrong, J. C., 1941. The Caridea and Stomatopoda of the Second Templeton Crocker-American Museum Expedition to the Pacific Ocean. American Museum Novitates, (1137): 1–14, 4 figs.

Baensch, H. and H. Debelius. 1992. Meerwasser Atlas. Mergus, Melle, 1216 pp.

Balss, H. 1922. Decapoden von Juan Fernandez. In: Skottsberg, C. (ed.), The Natural History of Juan Fernandez and Easter Island, vol. 3. Zoology, pp. 329–340. Uppsala.

Bate, C. S., 1888. Report on the Crustacea Macrura collected by the Challenger during the years 1873–1876. Report on the Scientific Results of the Voyage of H. M. S. Challenger during the years 1873–76. **24**: 1–942, pls. 1–157.

Bauer, R. T., 2004. Remarkable shrimps: adaptations and natural history of the carideans. 282 pp. University of Oklahoma Press, Norman.

Bauer, R. T. and M. Thiel, 2011. First description of a pure-search mating system and protandry in the shrimp *Rhynchocinetes uritai* (Decapoda: Caridea). Journal of Crustacean Biology, **31**(2): 286–295.

Boone, L., 1935. Crustacea and Echinodermata. Scientific results of the world cruise of the yacht "Alva", 1931, William K. Vanderbilt, Commanding. Bulletin of the Vanderbilt Marine Museum, **6**: 1–263, pls. 1–96.

Borradaile, L. A., 1899. On the Stomatopoda and Macrura brought by Dr. Willey from south seas. In: Willey, A. (ed.), Zoological Results based on material from New Britain, New Guinea, Loyalty Islands and elsewhere, collected during the years 1895, 1896 and 1897, pp. 395–428, pls. 36–39.

Borradaile, L. A., 1916. Crustacea, Part 1.– Decapoda. In: British Antarctic ("Terra Nova") Expedition 1910. Natural History Report, Zoology, **3**(2): 75–110.

Boschi, E. E., 2000. Biodiversity of marine decapod brachyurans of the Americas. Journal of Crustacean Biology, 20(spec. no 2): 337–342.

Bracken, H. D., S. De Grave and D. Felder, 2009. Phylogeny of the infraorder Caridea based on mitochondrial and nuclear genes (Crustacea: Decapoda). In: Martin, J. W., K. A. Crandall and D. L. Felder (eds), Decapod crustacean phylogenetics, pp. 281–305. CRC Press, Boca Raton.

Briggs, J. C., 1970. Tropical shelf zoogeography. Proceedings of the California Academy of Sciences, 4th series, **38**(7): 131–137.

Briggs, J. C., 1974. Marine zoogeography. 475 pp. McGraw-Hill, New York.

Briggs, J. C., 1992. The marine East Indies: centre of origin? Global Ecology and Biogeography Letters, **2**: 149–156.

Briggs, J. C., 1995. Global Biogeography. 452 pp. Elsevier, Amsterdum.

Briggs, J. C., 1999. Extinction and replacement in the Indo-West Pacific Ocean. Journal of Biogeography, **26**: 777–783.

Bruce, A. J., 1976. A report on a small collection of shrimps from the Kenya National Marine Parks at Malindi, with notes on selected species. Zoologische Verhandelingen, (145): 1–72, 23 figs.

Bruce, A. J., 1977. *Periclimenes kororensis* sp. nov., an unusual shrimp associate of the fungiid coral

Heliofungia actiniformis. Micronesica, **13**(1): 33–43.

Bruce, A. J., 1980. The evolution and zoogeography of shallow-water tropical shrimps. In: Proceedings of the International Symposium Marine Biogeography and Evolution in the Southern Hemisphare, Auckland, 1978. N. Z. DSIR information series, **137**: 337–355.

Bruce, A. J., 1983. *Miropandalus hardingi*, new genus, new species, a bizzare commensal pandalid shrimp from the Marshall Islands. Journal of Crustacean Biology, **3**(3): 482–490.

Bruce, A. J., 1984. A notes on some specimens of *Rhynchocinetes* (Decapoda, Rhynchocinetidae) from Enewetak Atoll, Marshall Islands. Crustaceana, **46**(2): 209–211, 1 fig.

Bruce, A. J. 1985. Caridean shrimps from Lord Howe Island. Beagle, Occasional Papers of the Northern Territory Museum of Arts and Sciences, **1**: 123–130.

Bruce, A. J. 1990. Recent additions to the pontoniine shrimp fauna of Australia. The Beagle, Records of the Northern Territory Museum of Arts and Sciences, **7**(2): 9–20.

Bruce, A. J., 1997. Infraorder Caridea. Shrimps. In: Richmond, M. D. (ed.), A guide to the seashores of eastern Africa and the Western Indian Ocean islands. 204–211 pp., Sida/Department for Research Cooperation, Sarec.

Bruce, A. J. and D. L. Zmarzly, 1983. *Periclimenes pilipes*, new species, a crinoid associate from Enewetak Atoll, Marshall Islands (Crustacea: Decapoda: Pontoniinae). Journal of Crustacean Biology, **3**(4): 644–654.

Burkenroad, M. D., 1939. Some remarks upon non-peneid Crustacea Decapoda. The Annals and Magazine of Natural History, series 11, **3**: 310–318.

Burukovsky R. N. 2007. On some new and rare shrimps from the Indo-Western Pacific. *Zoologicheskii Zhurnal* **86**(12): 1–8 (In Russian with Engulish abstract.)

Calado, R., 2008. Marine Ornamental Shrimp: Biology, Aquaculture and Conservation. 263 pp. Wiley-Blackwell, Oxford.

Cardoso, I. A. and P. S. Young, 2007. Caridea (Crustacea, Decapoda: Disciadidae, Palaemonidae, Processidae, Rhynchocinetidae) from Rocas Atoll including two new species of *Periclimenaeus* Borradaile, 1951 [sic]. Arquivos do Museu Nacional, Rio de Janeiro, **65**(3): 277–337.

Cha, H. K., J. U. Lee, C. H. Park, C. I. Baik, S. Y. Hong, J. H. Park, D. W. Lee, Y. M. Choi, K. Hwang, Z. G. Kim, K. H. Choi, H. Sohn, M. H. Sohn, D. H. Kim and J. H. Choi, 2001. Shrimps of the Korean Waters. 188 pp. National Fisheries Research and Development Institute, Pusan.

Chace, F. A., Jr., 1955. Notes on shrimps from the Marshall Islands. Proceedings of the United States National Museum, **105**(3349): 1–22.

Chace, F. A., Jr., 1972. The shrimps of the Smithsonian-Bredin Caribbean Expeditions with a summary of the West Indian shallow-water species (Crustacea: Decapoda: Natantia). Smithsonian Contributions to Zoology, **98**: i–x+1–179.

Chace, F. A. Jr., 1992. On the classification of the Caridea (Decapoda). Crustaceana, **63**(1): 70–80.

Chace F. A. Jr., 1997. The caridean shrimps (Crustacea: Decapoda) of the Albatross Philippine Expedition, 1907-1910, Part 7: Families Atyidae, Eugonatonotidae, Rhynchocinetidae, Bathypalaemonellidae, Processidae, and Hippolytidae. Smithsonian Contributions to Zoology, **587**: i-iv+1–106.

Chilton, C., 1911. The Crustacea of the Kermadec Islands. Transactions and Proceedings of the New

Zealand Institute, **43**: 544–573.

Christoffersen, M. L., 1990. A new superfamily classification of the Caridea (Crustacea: Pleocyemata) based on phylogenetic pattern. Zeitschrift für Zoologische Systematik und Evolutionsforschung, **28**: 94–106.

Coleman, N., 1991. Encyclopedia of marine animals. 324 pp. Blandford, London.

Coleman, N., 1998. Discover Loloata Island: Marine life guide to Papua New Guinea. 70 pp. Nevil Coleman's Underwater Geographic, Springwood.

Coleman, N., 2000. Marine Life of he Maldives. 328 pp. Atoll Editions, Victoria.

Coleman, N., 2002. Lord Howe Island Marine Park. 95 pp.Neville Coleman’s Underwater Geographic, Springwood.

Colin, P. L. and C. Arneson, 1995. Tropical Pacific invertebrates: A field guide to the marine invertebrates occurring on tropical Pacific coral reefs, seagrass beds and mangroves. 296 pp. Coral Reef Press, Beverly Hills.

Correa, C., J. A. Baeza, E. Dupré, I. A. Hinojosa and M. Thiel, 2000. Mating behavier and fertilization success of three ontogenetic stages of male rock shrimp *Rhynchocinetes typus* (Decapoda: Caridea). Journal of Crustacean Biology, **20**(4): 628–640.

Dana, J. D., 1852. Crustacea, Part 1. In: United States Exploring Expedition during the years 1838, 1839, 1840, 1841, 1842, under the Command of Charles Wilkes, volume 13. 685 pp. Philadelphia.

Dana, J. D., 1855. Atlas, Crustacea. United States Exploring Expedition during the years 1838, 1839, 1840, 1841, 1842, under the Command of Charles Wilkes, U. S. N. Pls. 1–96. Philadelphia.

Davie, P. J. F., 1998. Wild guide to Moreton Bay. 408 pp. Queensland Museum, South Brisbane.

Davie, P. J. F., 2002. Crustacea: Malacostraca: Phyllocarida, Hoplocarida, Encarida (part 1). In: Wells, A. and Houston, W. W. K. (eds.), Zoological Catalogue of Australia. Vol. 19.3A. xii + 551 pp. CSIRO Publishing, Collingwood.

De Grave S., 2001a. Caridean shrimps (Crustacea, Decapoda) from Hansa Bay, Papua New Guinea: Bresiliidae, Hippolytidae, Pandalidae, Pasiphaeidae, Processidae, Rhynchocinetidae, Stylodactylidae and Thalassocarcinidae. Bulletin de l’Institut Royal des Sciences Naturelles de Belgique, Biologie, **71**: 45–52.

De Grave, S., 2001b. Biogeography of Indo-Pacific Pontoniinae (Crustacea, Decapoda): a PAE analysis. Journal of Biogeography, **28**: 1239–1253.

De Grave, S. and C. H. J. M. Fransen, 2011. Carideorum catalogus: The Recent species of the Dendrobranchiate, stenopodidean, procarididean and caridean shrimps (Crustacea: Decapoda). Zoologische Mededelingen, Leiden, **85**(9): 195− 589.

De Grave, S., N. D. Pentcheff, S. T. Ahyong, T.-Y. Chan, K. A. Crandall, P. C. Dworschak, D. L. Felder, R. M. Feldmann, C. H. J. M. Fransen, L. Y. D. Goulding, R. Lemaitre, M. E. Y. Low, J. M. Martin, P. K. L. Ng , C. E. Schweitzer, S. H. Tan, D. Tshudy, R. Wetzer, 2009. A classification of living and fossil genera of decapod crustaceans. The Raffles Bulletin of Zoology, Supplement, **21**: 1− 109.

De Grave, S., J. Okuno and T.-Y. Chan, in prep. Crustacea fauna of Taiwan: caridean families predominately shallow water. National Taiwan Ocean University, Keelung.

Debelius, H., 1983. Gepanzerte Meerestritter. 120 pp. Kernen Verlag, Essen.

Debelius, H., 1984. Armored knights of the sea. 120 pp. Kernen Verlag, Essen.

Debelius, H., 1999a. Indian Ocean reef guide. 321 pp. Ikan-Unterwasserarchiv, Frankfurt.

Debelius, H., 1999b. Crustacea guide of the world. 321 pp. Ikan-Unterwasserarchiv, Frankfurt.

Debelius, H., 2001. Asia Pacific reef guide. 321 pp. Ikan-Unterwasserarchiv, Frankfurt.

Edgar, G. J., 1997. Australian Marine Life: the Plants and Animals of Temperate Waters. 544 pp. Reed, Kew.

Edmondson, C. H., 1925. Crustacea of tropical central Pacific. Marine Zoology of tropical central Pacific. (Tanagar Expedition Publication No. 1). Bulletin of the Bernice P. Bishop Museum, **27**: 3–26.

Edmondson, C. H., 1952. Additional central Pacific crustaceans. Occational Papers of Bernice P. Bishop Museum, **21**(6): 67–86.

Eldredge, L. G., 1999. Numberes of Hawaiian species: supplement 4. Bishop Museum Occasional Paper, (58): 72–78.

Feldmann, R. M., 1986. Paleobiogeography of two decapod crustacean taxa in the southern hemisphere: global conclusions with sparse data. In: Gore, R. H. and K. L. Heck (eds.), Crustacean Biogeography, pp. 5–19. A. A. Balkema, Rotterdam.

Figueira, A. J. G., 1960. On a small collection of decapod crustaceans from the Azores. Bocagiana, **6**: 1–13.

Finet, Y., 1991. The marine mollusks of the Galápagos Islands. In: James, M. J. (ed.), Galápagos Marine Invertebrates: Taxonomy, Biogeography, and Evolution in Darwin's Islands, pp. 253–280. Plenum Press, New York.

Forest, J., 1977. Un groupement injustifie: la superfamille des Bresilioida. Remarques critiques sur le statut des familles reunies sous ce nom (Crustacea Decapoda Caridea). Bulletin du Muséum National d'Histoire Naturelle, (3)(475): 869–888, 14 figs.

Fujino, T., 1975. Occurrence of *Rhynchocinetes rigens* Gordon, 1936 (Crustacea, Decapoda, Rhynchocinetidae) in the Indo-Pacific region. Publication of the Seto Marine Biological Laboratory, **22**(5): 297–302, 2 figs.

Garcia-Castellanos, D., F. Estrada, I. Jiménez-Munt, C. Gorini, M. Fernàndez, J. Vergés and R. De Vicente, 2009. Catastrophic flood of the Mediterranean after the Messinian salinity crisis. Nature, **462**: 778–781.

González Pérez, J. A., 1995. Catálogo de los Crustáceos Decápodos de las Islas Canarias. 282 pp. Turquesa, Santa Cruz de Tenerife.

Gordon, I., 1936. On the macruran genus *Rhynchocinetes*, with the description of a new species. Proceedings of the Zoological Society of London, **1936**: 75–88.

Gosliner, T. M., D. W. Behrens and G. C. Williams, 1996. Coral reef animals of the Indo-Pacific. 314 pp. Sea Challengers, Monterey.

Gowlett-Holmes, K., 2008. A Field Guide to the Marine Invertebrates of South Australia. 333 pp. Notomares, Sandy Bay.

Gurney, R., 1941. On the larvae of certain Crustacea Macrura, mainly from Bermuda. 3. The larval stage of *Rhynchocinetes rigens* Gordon. Journal of the Linnean Society, London, **41**: 113–124.

Haig, J., 1955. The Crustacea Anomura of Chile. Reports of the Lund University Chile Expedition 1948–49, (20): 1–68.

Hale, H. H. 1927. The crustaceans of South Australia. Part 1. 201 pp. South Australian Government Pinter, Adelede.

Hale, H. H. 1941. Decapod Crustacea. B. A. N. Z. Antarctic Research Expedition Reports, Series B, **4**(9):257–285, pl. 3.

Halstead, B. 1999. Coral Sea reef guide. 321 pp. Ikan- Unterwasserarchiv, Frankfurt.

Hayashi, K.-I., 1975. The Indo-West Pacific Processidae (Crustacea, Decapoda, Caridea). Journal of the Shimonoseki University of Fisheries, **24**(1): 47–145.

Hayashi, K.-I., 1986. An annotated list of shrimps (Alpheidae and Palaemonidae excluded) collected from the Gilbert and Solomon Islands. Proceedings of the Japanese Society of Systematic Zoology, (32): 17–29.

Hayashi, K.-I., 1995. Infraorder Caridea (Alpheidae excepted). In: Nishimura, S. (ed.), Guide to Seashore Animals of Japan with Color Pictures and Keys, vol. II, pp. 296–314, 330–336, pls. 85–86, 90. Hoikusha, Osaka. (In Japanese.)

Hayashi, K.-I., 1999a. Shrimps and lobsters from Japan (105). Family Rhynchocinetidae, genus *Cinetorhynchus*, 1. Aquabiology (Kaiyo to Seibutsu), **21**(2): 144–149. (In Japanese.)

Hayashi, K.-I., 1999b. Shrimps and lobsters from Japan (106). Family Rhynchocinetidae, genera *Cinetorhynchus*, 2 and *Rhynchocinetes*. Aquabiology (Kaiyo to Seibutsu), **21**(3): 219–223. (In Japanese.)

Hayashi, K.-I., 2007. Caridean shrimps (Crustacea: Decapoda: Pleocyemata) from Japanese waters, part 1. Oplophoroidea, Nematocarcinoidea, Atyoidea, Stylodactyloidea, Pasiphaeoidea and Psalidopodoidea. 292 pp. Seibutsukenkyusha, Tokyo. (In Japanese.)

Hayashi, K.-I., T. Komai and A. Asakura, 1994. Macrura (Crustacea: Decapoda: Stenopodidea, Caridea and Palinulidea) collected from the Northern Mariana Islands, Micronesia. In: Asakura, A. and T. Furuki (eds.), Biological Expedition to the Northern Mariana Islands, Micronesia. Natural History Research, Special Issue, (1): 267–273.

Healy, A. and J. Yaldwyn, 1970. Australian Crustaceans in Colour. 112 pp. Reed, Sydney.

Heller, C., 1865. Crustaceen. Reize der Österreichischen Fregatte Novara um die Erde in den Jahren 1857, 1858, 1859 unter den Befehlen des Commodors B. von Wüllerstorf-Urbair. Zoologischer Theil. **2**(3): 1–280, pls. 1–25.

Henderson, J. R., 1893. A contribution to Indian carcinology. Transactions of the Linnean Society of London, Zoology, (2)**5**: 325–458, pls. 36–40.

Hiatt, R. W., 1948. Records of rare Hawaiian decapod crustacea. Pacific Science, **2** (2): 78–80.

Hiatt, R. W., 1954. Hawaiian marine invertebrates: A guide to their Identification. University of Hawaii, Honolulu, i-viii + 1–140 pp.

Hickman, C., Jr. and T. L. Zimmerman, 2000. A Field Guide to Crustaceans of Galápagos. 156 pp. Suger Spring Press, Lexington.

Hirata, Y., Y. Nakasone and S. Shokita, 1988. Okinawan decapods and shells in color. Revised ed. Fudokisha, Okinawa. 1–144 pp., many unnumbered photos (In Japanese.).

Holthuis, L. B., 1947. The Decapoda of the Siboga Expedition part IX. The Hippolytidae and Rhynchocinetidae collected by the Siboga and Snellius Expeditions with remarks on other species. Siboga Exped. Monographs, **39**a(10): 1–100, 15 figs.

Holthuis, L. B., 1952. The Crustacea Decapoda Macrura of Chile. Reports of the Lund University Chile Expedition 1948–49, (5): 1–110.

Holthuis, L. B., 1953. Enumaration of the decapod and stomatopod Crustacea from Pacific coral islands. Atoll Research Bulletin, (24): 1–66, 2 maps.

Holthuis, L. B., 1972. The Crustacea Decapoda Macrura (the Alpheidae excepted) of Easter Island. Zoologische Mededelingen, Leiden, **46**: 29–54, 2 pls.

Holthuis, L. B., 1980. FAO species catalogue. Vol. 1, Shrimps and prawns of the world. An annoted catalogue of species of interest to fisheries. FAO Fisheries Synopsis, (125): 1–271.

Holthuis, L. B., 1981. Description of three new species of shrimps (Crustacea: Decapoda: Caridea) from Pacific islands. Proceedings of the Biological Society of Washington, **94**(3): 787–800.

Holthuis, L. B., 1993. The recent genera of the caridean and stenopodidean shrimps (Crustacea, Decapoda) with an appendix on the order Amphionidacea. Nationaal Natuurhistorisch Museum, Leiden. 1–328 pp., 312 figs.

Holthuis, L. B., 1995. Notes on Indo-Pacific Crustacea Decapoda III to IX. Zoologische Mededelingen, Leiden, **69**: 139–151.

Holthuis, L. B. and K.- I. Hayashi, 1967. A new species of shrimp, *Rhynchocinetes hiatti* (Crustacea, Decapoda). Annotationes Zoologicae Japonenses, **40**(3): 161–170.

Hoover, J. P., 1998. Hawaii's sea creatures: A guide to Hawaii's marine invertebrates. 366 pp. Mutual Publishing, Honolulu.

Humann, P. 1992. Reef creature identification: Florida Caribbean Bahamas. 320 pp. New World Publications, Jacksonville, Florida.

Humann, P. and N. DeLoach, 2010. Reef creature identification: Tropical Pacific. 497 pp. New World Publications, Jacksonville, Florida.

International Commission on Zoological Nomenclature, 1999. International Code of Zoological Nomenclature. 306 pp. International Trust for Zoological Nomenclature, London.

Itaki, T., 2009. Distribution of shrimps in east Shimane. Bulletin of the Hoshizaki Green Foundation, (12): 299–307. (In Japanese with English abstract.)

Itaki, T., 2010. Distribution of shrimps in east Shimane, part 2. Bulletin of the Hoshizaki Green Foundation, (13): 279–288. (In Japanese with English abstract.)

Itaki, T., 2012. Two species of shrimps from Shimane, Sea of Japan. Bulletin of the Hoshizaki Green Foundation, (15): 231–233. (In Japanese with English abstract.)

Jokiel, P. L., 1987. Ecology, biogeography and evolution of corals in Hawaii. Trends for Ecology and Evolution, **2**(7): 179-182.

Kamezaki, N., K. Nomura, T. Hamano and H. Misaki, 1988. Crustacea. In: Marine Park Center (ed.). Illustrated marine organisms in Okinawa Islands, 8. Southern Press, Okinawa, 1–232 pp., (in Japanese).

Kato, S. and J. Okuno, 2001. Shrimps and crabs of Hachijo Island. 157 pp. TBS-Britannica, Tokyo. (In Japanese.)

Kawamoto, T. and J. Okuno, 2003. Shrimps and crabs of Kume Island, Okinawa. 173 pp. Hankyu Communications, Tokyo. (In Japanese.)

Kay, E. A. and S. R. Palumbi, 1987. Endemism and evolution in Hawaiian marine invertebrates.

Trends for Ecology and Evolution, **2**(7): 183–186.

Kemp, S., 1914. Notes on Crustacea Decapoda in the Indian Museum V. Hippolytidae. Records of the Indian Museum, **10**(2): 81–129, pls. 1–7.

Kemp, S., 1916. Notes on Crustacea Decapoda in the Indian Museum VI. Indian Crangonidae. Records of the Indian Museum, **16**(8): 355–384, pl. 8.

Kemp, S., 1922. Notes on Crustacea Decapoda in the Indian Museum XV. Pontoniinae. Records of the Indian Museum, **24**(2): 113–288, pls. 3–9.

Kemp, S., 1925. Notes on Crustacea Decapoda in the Indian Museum XVII. On various Caridea. Records of the Indian Museum, **27**(4): 249–343.

Kensley, B., 1972. Shrimps & prawns of South Africa. 65 pp. Trustees of South African Museum, Cape Town.

Kensley, B., 1981. On the zoogeography of southern African decapod crustacea, with a distributional checklist of the species. Smithsonian Contributions to Zoology, **338**: 1–64.

Kim, H. S., 1985. Systematic studies on crustaceans of Korea, 1. Decapods. Proceedings of the College of Natural Sciences, Seoul National University, **10**(1): 63–94.

Knowlton, N., 1986. Cryptic and sibling species among the decapod Crustacea. Journal of Crustacean Biology, **6**(3): 356-363.

Kubo, I., 1936. Some notes on *Rhynchocinetes rugulosus* Stimpson. Botany and Zoology (Syokubutu oyobi Dobutu), **4**(11): 51–56. (In Japanese.)

Kubo, I., 1940. On some shrimps collected from Micronesia. Journal of the Imperial Fisheries Institute, **34**(1): 77–99.

Kubo, I., 1942. On two new species of Decapoda Macrura. Annotationes Zoologicae Japonenses, **21**(1): 30–38.

Kuiter, R. H. and H. Debelius, 2009. World atlas of marine fauna. 725 pp. Ikan-Unterwasserarchiv, Frankfult.

Laboute, P. and B. Richer de Forges, 2004. Lagons et rédifs de Nouvelle-Calédonie. 520 pp. Editions Catherine Ledru, Nouméa.

Lenz, H., 1902. Die Crustaceen der Sammlung Plate (Decapoda und Stomatopoda). Zoologische Jahrbucher, Supplement, **5**: 731–772, pl. 23.

Li, C. P., S. De Grave, T.-Y. Chan, H. C. Lei and K. H. Chu, 2011. Molecular systematics of caridean shrimps based on five nuclear genes: Implications for superfamily classification. Zoologischer Anzeiger, **250**: 270–279.

Lin, H. S., 1992. Coral Reefs of Malaysia. 196 pp. Tropical Press, Kuala Lumpur.

Mabuchi, K., T. Nakabo and M. Nishida, 2004. Molecular phylogeny of the antitropical genus *Pseudolabrus* (Perciformies: Labridae): evidence for a southern hemisphere origin. Molecular Phylogenetics and Evolution, **32**: 375–382.

Maihara, Y., 2002. Larval stages of the rhynchocinetid shrimp, *Rhynchocinetes uritai* Kubo, 1942 (Decapoda, Caridea, Rhynchocinetidae) reared under laboratory conditions. Science Reports of the Museum, Tokai University, **4**: 59–77. (In Japanese with English abstract.)

Maihara, Y., 2004. Larval stages of the rhynchocinetid shrimp species, *Cinetorhynchus reticulatus* Okuno, 1997 (Decapoda, Caridea, Rhynchocinetidae) reared under laboratory conditions. Science

Reports of the Museum, Tokai University, **6**: 15–33. (In Japanese with English abstract.)

Maihata, Y. and N. Kyoya, 2001a. Larval stages of the rhynchocinetid shrimp, *Cinetorhynchus hendersoni* (Kemp, 1925) (Decapoda, Caridea, Rhynchocinetidae) reared under laboratory conditions. Bulletin of Institute of Oceanic Research and Development, Tokai University, **22**: 75–91. (In Japanese with English abstract.)

Maihata, Y. and N. Kyoya, 2001b. Larval stages of the rhynchocinetid shrimp, *Cinetorhynchus striatus* (Nomura & Hayashi, 1992) (Decapoda, Caridea, Rhynchocinetidae) reared in the laboratory. Science Reports of the Museum, Tokai University, **3**: 43–62. (In Japanese with English abstract.)

Manning, R. B., 1961. Notes on the caridean shrimp, *Rhynchocinetes rigens* Gordon (Crustacea, Decapoda), in the western Atlantic. Notulae Naturae, (348): 1–7.

Manning, L. B., 1993. The scientific contributions of William Stimpson, an early American naturalist and taxonomist. In: Truesdale, F. (ed.), History of carcinology, pp. 109–117. Balkema, Rotterdam.

Manning, R. B. and Chace, F. A. Jr., 1990. Decapod and stomatopod Crustacea from Ascention Island, South Atlantic Ocean. Smithsonian Contributions to Zoology, **503**: 1–91.

Maragos, J. E. 1977. Order Scleractinia: stony corals. In: Devaney, D. M. and L. G. Eldredge (eds.), Reef and shore fauna of Hawaii. B. P. Bishop Museum Press, Honolulu, 158–241.

Martin, J. W. and G. E. Davis, 2001. An updated classification of the Recent Crustacea. National History Museum of the Los Angeles County, California.

Masuda, H., 1999. Guide Book to Marine Life. 404 pp. Tokaidaigaku Shuppankai, Tokyo. (In Japanese.)

Matoba, H. and S. Shokita, 1998. Larval development of the rhynchocinetid shrimp, *Rhynchocinetes conspiciocellus* Okuno & Takeda (Decapoda: Caridea: Rhynchocinetidae) reared under laboratory conditions. Crustacean Research, (27): 40–69.

McCulloch, A. R., 1909. Studies in Australian Crustacea. No. 2. Records of the Australian Museum, **7**: 305–314, pls. 88–89.

McNeill, F. A., 1968. Crustacea, Decapoda & Stomatopoda. Great Barrier Reef Expedition 1928–29 Scientific Reports, **7**(2): 1–98, pls. 1–2.

Melo, G. A. S., de, 2007. The family Rhynchocinetidae Ortmann (Crustacea, Decapoda, Caridea) on the Brazilian coast. Revista Brasileira de Zoologia, 24(1): 57–63.

Miers, E. J., 1876. Catalogue of the stalk-and sessile-eyed Crustacea of New Zealand. 136 pp., 3 pls. Colonial Museum and Geological Survey Department, London.

Milne-Edwards, H., 1837a. Histoire naturelle des Crustaces, comprenant l'anatomie, la physiologie et la classification de ces animaux, Librairie encyclopedique de Rorent, Paris, 2: 1–532, atlas, pls. 1–42.

Milne-Edwards, H., 1837b. Note sur le Rhynchocinète, nouveau genre de Crustacè, décapode. Annales des Sciences Naturelles, seconde série, **7**: 165–168, pl. 4.

Minemizu, R., 2000. Marine decapod and stomatopod crustaceans mainly from Japan. 344 pp. Bun-ichi Sogo Shuppan, Tokyo. (In Japanese.)

Miyake, S., 1975. Macrura and Anomura. In: The aquatic lower animals of Japan. Gakushu-kenkyusha, Tokyo: 98–119, unnumbered photos in color. (In Japanese.)

Miyake, S., 1982. Japanese crustacean decapods and stomatopods in color, 1. 261 pp., 56 pls.

Hoikusha, Osaka (In Japanese.).

Miyake, S. and T. Fujino, 1968. Pontoniid shrimps from the Palau Islands (Crustacea, Decapoda, Palaemonidae). Journal of the Faculty of Agriculture, Kyushu University, **14**(3): 399–431.

Miyake, S. and K.-I. Hayashi, 1966. Some hippolytid shrimps living in coral reefs of the West Pacific. Journal of the Faculty of Agriculture, Kyushu University, **14**(1): 143–160.

Monod, T., 1972. Sur quatre crevettes du Pacifique Sud. Cahiers du Pacifique, (16): 7–29, 87 figs.

Morrison, J. P. E., 1954. Animal ecology of Raroia Atoll, Tuamotus. Part 1. Ecological notes on the mollusks and other animals of Raroia. Atoll Research Bulletin, (34): 1–20.

Motoh, H., 2008. Macruran decapods from the Sea of Japan-1. A checklist based on literature. Report of the Noto Marine Center, (14): 13–27. (In Japanese with English Abstract.)

Motoh, H., G. Tabinuki and C. Osawa, 2009. On the babded boxer shrimp *Stenopus hispidus* and spotted hinge-beak shrimp *Rhynchocinetes uritai* from Wakasa Bay, the Sea of Japan. Bulletin of the Hoshizaki Green Foundation, (12): 277–280. (In Japanese with English abstract.)

Nakabo, T., 2013. Biogeography of East Asian fishes. In: Nakabo, T. (ed.), Fishes of Japan with pictorial keys to the species. Third Edition, pp. 2289–2338. Yokai University Press, Tokyo.

Newman, W. A., 1986. Origin of the Hawaiian marine fauna: dispersal and vicariance as indicated by barnacles and other organisms. In: Gore, R. H. and K. L. Heck (eds.), Crustacean Biogeography, pp. 21–49. A. A. Balkema, Rotterdam.

Nishimura, S., 1982. Where did the ancestor arise? An alternative theory to locate the center of origin. Contributions from the Biological Laboratory, Kyoto University, **26**(2): 189–207.

Nomura, K. and K.- I. Hayashi, 1992. *Rhynchocinetes striatus*, a new species (Decapoda, Caridea, Rhynchocinetidae) from southern Japan. Zoological Science, **9**(1): 199–206.

Nomura, K. and K. Matsukubo, 1992. *Rhynchocinetes rigens* Gordon from Susami, Wakayama Prefecture, central Japan. Nanki Seibutsu **34**(1): 22–24, 3 figs. (In Japanese with English summary).

O'Hara, T. D. and G. C. B. Poore, 2000. Patterns of distribution for southern Australian marine echinoderms and decapods. Journal of Biogeography, 27: 1321–1335.

Ohtsuka, S., M. J. Grygier and K. Torigoe, 1999. The phylogeny, zoogeography, and ecology of marine cavernicolous crustaceans. Taxa, (6): 3–13 (in Jpapanese with English abstract).

Okuno, J., 1993a. New record of a hinge-beak shrimp, *Rhynchocinetes hendersoni* from eastern coast of Izu Peninsula, Japan. Izu Oceanic Park Diving News, **4**(3): 4–5. (In Japanese.)

Okuno, J., 1993b. First record of a hinge-beak shrimp, *Rhynchocinetes durbanensis* Gordon, 1936 from Japan. I. O. P. Diving News, (43): 2–5. (In Japanese with English abstract.)

Okuno, J., 1994a. A new species of hinge-beak shrimp from the western Pacific (Crustacea, Decapoda, Rhynchocinetidae). The Beagle, Records of the Museum and Art Galleries of the Northern Territory, **11**: 29–37.

Okuno, J., 1994b. *Rhynchocinetes concolor*, a new shrimp (Caridea: Rhynchocinetidae) from the Indo-West Pacific. Proceedings of the Japanese Society of Systematic Zoology, (52): 65–74.

Okuno, J., 1995. Notes on three rhynchocinetid shrimps, *Rhynchocinetes concolor* Okuno, 1994, *R. hiatti* Holthuis et Hayashi, 1967 and *R. striatus* Nomura et Hayashi, 1992. I. O. P. Diving News, **6**(8): 2–3. (In Japanese.)

Okuno, J., 1996a. *Rhynchocinetes rathbunae*, a new shrimp from the Hawaiian Islands (Crustacea: Decapoda: Rhynchocinetidae). Pacific Science, **50**(3): 309–316.

Okuno, J., 1996b. *Cinetorhynchus manningi*, a new shrimp (Crustacea: Decapoda: Caridea: Rhynchocinetidae) from the western Atlantic. Proceedings of the Biological Society of Washington, **109**(4): 725–730.

Okuno, J., 1997a. A new shrimp of the genus *Rhynchocinetes* from the Great Australian Bight (Crustacea: Decapoda: Rhynchocinetidae). Records of the South Australian Museum, **30**(1): 13–18.

Okuno, J. 1997b. *Rhynchocinetes holthuisi*, a new shrimp from the Gulf of Aqaba, northern Red Sea (Crustacea: Decapoda: Rhynchocinetidae). Zoologische Mededelingen, Leiden, **71**(6): 43–51.

Okuno, J., 1997c. Review on the genus *Cinetorhynchus* Holthuis, 1995 from the Indo-West Pacific (Caridea: Rhynchocinetidae). *In* B. Richer de Forges (ed.), Les Fonds Meubles des Lagons de Nouvelle-Caledonie (Sedimentlogie, Benthos). Etudes et Theses, 3. Paris, ORSRTOM, 31–58, 1 pl.

Okuno, J., 1998. A revision of the genus *Cinetorhynchus* Holthuis, 1995 (Crustacea: Decapoda: Rhynchocinetidae), from Japan. I. O. P. Diving News, **9**(8): 2–7. (In Japanese with English abstract.)

Okuno, J., 2009. *Cinetorhynchus brucei*, a new species of shrimp (Decapoda, Caridea, Rhynchocinetidae) from the Ryukyu Islands, Japan. Crustaceana, **82**(7): 939–949.

Okuno, J. and J. P. Hoover, 1998. *Cinetorhynchus hawaiiensis*, a new shrimp forming a cryptic species pair with *C. reticulatus* Okuno, 1997, and new records of three congeneric species (Decapoda: Caridea: Rhynchocinetidae). Natural History Research, **5**(1): 31–42.

Okuno, J. and H. Tachikawa, 1997. *Cinetorhynchus fasciatus*, a new shrimp from the western and central Pacific (Decapoda: Caridea: Rhynchocinetidae). Crustacean Research, (26): 16–25.

Okuno, J. and M. Takeda, 1992a. Description of a new hinge-beak shrimp, *Rhynchocinetes conspiciocellus*, from southern Japan, with designation of the lectotype of *R. uritai* Kubo, 1942. Bulletin of the National Science Museum series A (Zoology), **18**(2): 63–72, pl.1.

Okuno, J. and M. Takeda, 1992b. Distinction between two hinge-beak shrimps, *Rhynchocinetes durbanensis* Gordon and *R. uritai* Kubo (Family Rhynchocinetidae). Revue françcaise d'Aquariologie et Herpetologie, **19**(3): 85–90.

Ortmann, A., 1890. Die Decapoden-Krebse des Strassburger Museums, mit besunderer Berücksichtigung der von Herrn Dr. Döderlein bei Japan und bei Liu-kiu-Inslen gesammelten und z. Z. im strassburger Museum auf bewahrten Formen. Zoologische Jahrbücher, Abtheilung für Systematik, Geohraphie und Biologie der Thiere, **5**: 437–542, pls. 36–37.

Paulay, G., 1997. Diversity and distribution of reef organisms. In: Birkeland, C. (ed.), Life and death of coral reefs, pp. 298–353. Chapman & Hall, New York.

Paulay, G., R. Kropp, P. K. L. Ng and L. G. Eldledge, 2003. The crustaceans and pycnogonids of the Mariana Islands. Micronesica, **35**/**36**: 456–543.

Poore, G. C. B., 2004. Marine decapod Crustacea of Southern Australia: a Guide to Identification. 574 pp. 32 pls. CSIRO Publishing, Collingwood.

Poore, G. C. B., A. W. McCallum and J. Taylor, 2008. Decapod Crustacea of the continental margin of

southwestern and central Western Australia: preliminary identifications of 524 species from FRV Southern Surveyor voyage SS10-2005. Museum Victoria Science Report, (11): 1–106.

Por, F. D., 1989. The Legacy of Tethys: an Aquatic Biogeography of the Levant. 214 pp. Kluwer Academic Publishers, Dordrecht.

Poupin, J., 1998. Crustacea Decapoda and Stomatopoda of French Polynesia. Atoll Research Bulletin, (451): i–ii+1–62.

Poupin, J., 2003. Crustacea Decapoda and Stomatopoda of Easter Island and surrounding areas. A documented checklist with historical overview and biolgeographic comments. Atoll Research Bulletin, (500): i–vi+1–50.

Poupin, J., 2008. Biogeography of the decapod and stomatopod Crustacea of the tropical Pacific: Issues and prospects. Pacific Science, **62**(3): 377-383.

Poupin, J., 2009. Crustacés de la Réunion. Décapodes et stomatopodes. 139 pp. IRD Éditions, Marseille.

Poupin, J. and M. Juncker, 2010. A guide to the decapod crustaceans of the South Pacific. 317 pp. Pacific Community, Noumea.

Ramos-Porto, M. and P. A. Coelho, 1998. Malacostraca. Eucarida. Caridea (Alpheidea excluded). In: Young, P. S. (ed.), Catalogue of Crastacea of Brazil, pp. 325–350, Museu Nacional, Rio de Janeiro.

Rathbun, M. J., 1906. The brachyura and macrura of the Hawaiian Islands. Bulletin of the United States Fish Commission, **23**: 827–930, pls. 3–24.

Rathbun, M. J., 1911. The stalk-eyed Crustacea of Peru and the adjacent coast. Proceedings of the United States National Museum, **38**: 531–620, pls. 36–56.

Renema, W., D. R. Bellwood, J. C. Braga, K. Bromfield, R. Hall, K. G. Johnson, P. Lunt, C. P. Meyer, L. B. McMonagle, R. J. Morley, A. O'Dea, J. A. Todd, F. P. Wesselingh, M. E. J. Wilson and J. M. Pandolfi, 2008. Hopping hotspots: Global shifts in marine biodiversity. Science, **321**: 654–657.

Richardson, L. R. and J. C. Yaldwyn, 1958. A guide to the natant decapod crustacea (shrimps and prawns) of New Zealand. Tuatara, **7**(1): 17–41, 50 figs.

Schopf, T. J. M., 1980. Paleoceanography. 341 pp. Harvard University Press, Cambridge.

Schuhmacher H. and J. Hinterkircher. 1996. Niedere Meerestiere. Schwämme, Korallen, Krebse, Schnecken, Seesterne und andere. Rotes Meer, Indischer Ozean, Pazifik. 319 pp. BLV Verlagsgesellschaft mbH München, München.

Sharp, B., 1893. Catalogue of the crustaceans in the museum of the Academy of Natural Sciences of Philadelphia. Proceedings of the Academy of Natural Sciences of Philadelphia, **1893**: 104–127.

Short, A. D. and C. D. Woodroffe, 2009. The coast of Australia. 288 pp. Cambridge University Press, Melbourne.

Steene, R. 1990. Coral reefs: Nature's richest realm. 336 pp Crawford House Press, NSW.

Stimpson, W. 1860. Prodromus descriptionis animalium evertebratorum, quae in Expeditione ad Oceanum Pacificum Septentrionalem, a Republica Federata missa, Cadwaladaro Ringgold et Johanne Rodgers Ducibus, observavit et descripsit. Proceedings of the Academy of Natural Sciences of Philadelphia, **1860**: 22–47.

Sttebing T. R. R. 1917. The malacostraca of Natal. Annals of the Durban Museum **2**: 1–33, pls. 1–6.

Stow, D., 2010. Vanished Ocean: how Tethys reshaped the world. 300 pp. Oxford University Press.

Suzuki, H., 1992. Two rare species of shrimp and shell from western region of Sagami Bay. Reports of the Manazuru Marine Laboratory for Science Education, Faculty of Education, Yokohama National University, (8): 25–27. (In Japanese with Engulish summary.)

Suzuki, S., 1979. [Marine Invertebrates of Yamagata Prefecture]. 370 pp., 22 pls. Tamakibi-kai, Yamagata. (In Japanese.)

Takeda, M., 1982. Key to the Japanese and foreign crustaceans fully illustrated in colors. Hokuryukan, Tokyo. i-vi+1-284 pp., many unnumbered figs. (in Japanese).

Thompson, J. R., 1966. The caridean superfamily Bresilioidea (Decapoda Natantia). A revision and a discussion of its validity and affinities. Crustaceana, **11**(2): 129–140, 5 figs.

Thurston, E., 1895. Ramesvaram Island and fauna of the Gulf of Manaar. Madras Goverment Museum, Bulletin, (3): 79–138, pls. 4–7.

Tiefenbacher, L. 1976. Einige Bemerkungen zu *Rhynchocinetes rigens* Gordon, 1936, und Seiner Verbreitung (Decapoda). Crustaceana, **31**(3): 317–320.

Tiefenbacher, L. 1983. A new species of *Rhynchocinetes* from South-Australia (Crustacea, Decapoda, Rhynchocinetidae). Revue française d'Aquariologie et Herpetologie, **9**(4): 121–124.

Udekem d'Acoz, C. d', 1999. Inventaire et distribution des crustacés decapods de l'Atlantique nord-oriental, de la Méditerrannée et des eaux continentals adjacentes au nord de 25ºN. 383 pp. Museum National d'Histoire Naturelle, Paris.

Wicksten, M. K., 1991. Caridean and stenopodid shrimp of the Galápagos Islands. In: James, M. J. (ed.), Galápagos Marine Invertebrates: Taxonomy, Biogeography, and Evolution in Darwin's Islands, pp. 147–156. Plenum Press, New York.

Wirtz, P., 1995. Unterwasserfuhrer Madeira, Kanaren, Azoren. Niedere Tiere. 247 pp. Delius Klasing, Stuttgart.

Wirtz, P., 2011. New records of marine invertebrates from the coast of Senegal. Arquipelago, **28**: 7–9.

Wirtz, P., B. Müller and P. Nahke, 1988. The caribbian shrimp, *Turearіocaris neglecta* Chace, 1969 found in association with *Didiema antillarum* at Madeira, and two new records of decapod crustaceans from the Cape Verde Islands. Cour. Forsh.- Inst. Senckenberg, (105): 169–171, 3 figs.

Yaldwyn, J. C., 1960. Crustacea Decapoda Natantia from the Chatham Rise: A deep water bottom fauna from New Zealand. New Zealand Department of Scientific and Industrial Research Bulletin, (139): 13–53, 10 figs.

Yaldwyn, J. C. 1971. Preliminary descriptions of a new genus and twelve new species of natant decapod crustacea from New Zealand. Records of the Dominion Museum, **7**: 85–94.

Yaldwyn, J. C. and W. R. Webber, 2011. Annotated checklist of New Zealand Decapoda (Arthropoda: Crustacea). Tuhinga, **22**: 171–272.

Zachos, J., M. Pagani, L. Sloan, E. Thomas and K. Billups, 2001. Trends, rhythms, and aberrations in global climate 65 Ma to present. Science, **292**: 686–693.

Zarenkov, N. A., 1968. New data on rare shrimps (Thalassocarididae, Rhynchocinetidae, Stylodactylidae, Campylonotidae, Psalidopodidae). Byulleten Moskovskogo Obschchestva Ispytatelei Priody, Oldel Biologicheskii, 73(3): 57–62. (In Russian.)

Table 1. Branchial formulae of the Subfamily A.

	Pleurobranchs									Arthrobranchs										Podobranchs									
	Maxillipeds			Pereiopods						Maxillipeds			Pereiopods							Maxillipeds			Pereiopods						
Taxa	1	2	3	1	2	3	4	5		1	2	3	1	2	3	4	5			1	2	3	1	2	3	4	5		
C. brucei	–	–	–	1	1	1	1	1		–	–	2	1	–	–	–	–			–	r	–	–	–	–	–	–		
C. concolor	–	–	–	1	1	1	1	1		–	–	2	1	1	1	–	–			–	1	–	–	–	–	–	–		
C. erythrostictus	–	–	–	1	1	1	1	1		–	–	2	1	1	1	–	–			–	1	–	–	–	–	–	–		
C. fasciatus	–	–	–	1	1	1	1	1		–	–	2	1	1	1	–	–			–	1	–	–	–	–	–	–		
C. hawaiiensis	–	–	–	1	1	1	1	1		–	–	2	1	1	1	–	–			–	1	–	–	–	–	–	–		
C. hiatti	–	–	–	1	1	1	1	1		–	–	2	1	1	1	–	–			–	1	–	–	–	–	–	–		
C. manningi	–	–	–	1	1	1	1	1		–	–	2	1	–	–	–	–			–	1	–	–	–	–	–	–		
C. reticulatus	–	–	–	1	1	1	1	1		–	–	2	1	1	1	–	–			–	1	–	–	–	–	–	–		
C. rigens	–	–	–	1	1	1	1	1		–	–	2	1	1	1	–	–			–	r	–	–	–	–	–	–		
C. striatus	–	–	–	1	1	1	1	1		–	–	2	1	1	1	–	–			–	1	–	–	–	–	–	–		
A. hendersoni	–	–	–	1	1	1	1	1		–	–	2	1	1	1	–	–			–	1	–	–	–	–	–	–		

r=rudimentary.

Table 2. Branchial formulae of subfamily Rhynchocinetinae.

	Pleurobranchs									Arthrobranchs										Podobranchs									
	Maxillipeds			Pereiopods						Maxillipeds			Pereiopods							Maxillipeds			Pereiopods						
Taxa	1	2	3	1	2	3	4	5		1	2	3	1	2	3	4	5			1	2	3	1	2	3	4	5		
R. typus	–	–	–	1	1	1	1	1		–	–	2	1	1	1	1	–			–	1	–	–	–	–	–	–		
B. australis	–	–	–	1	1	1	1	1		–	–	2	1	1	–	–	–			–	1	–	–	–	–	–	–		
B. balssi	–	–	–	1	1	1	1	1		–	–	2	1	–	–	–	–			–	1	–	–	–	–	–	–		
B. brucei	–	–	–	1	1	1	1	1		–	–	2	1	1	1	–	–			–	1	–	–	–	–	–	–		
B. conspiciocellus	–	–	–	1	1	1	1	1		–	–	2	1	1	–	–	–			–	1	–	–	–	–	–	–		
B. durbanensis	–	–	–	1	1	1	1	1		–	–	2	1	1	1	–	–			–	1	–	–	–	–	–	–		
B. enigma	–	–	–	1	1	1	1	1		–	–	–	–	–	–	–	–			–	1	–	–	–	–	–	–		
B. holthuisi	–	–	–	1	1	1	1	1		–	–	2	1	1	–	–	–			–	1	–	–	–	–	–	–		
B. kuiteri	–	–	–	1	1	1	1	1		–	–	2	1	1	–	–	–			–	1	–	–	–	–	–	–		
B. rathbunae	–	–	–	1	1	1	1	1		–	–	2	1	1	1	–	–			–	r	–	–	–	–	–	–		
B. serratus	–	–	–	1	1	1	1	1		–	–	2	1	1	1	–	–			–	1	–	–	–	–	–	–		
B. uritai	–	–	–	1	1	1	1	1		–	–	2	1	1	–	–	–			–	1	–	–	–	–	–	–		
B. sp. 1	–	–	–	1	1	1	1	1		–	–	2	1	–	–	–	–			–	r	–	–	–	–	–	–		
B. sp. 2	–	–	–	1	1	1	1	1		–	–	2	1	–	–	–	–			–	1	–	–	–	–	–	–		
B. sp. 3	–	–	–	1	1	1	1	1		–	–	2	1	–	–	–	–			–	1	–	–	–	–	–	–		
C. ikatere	–	–	–	1	1	1	1	1		–	–	2	1	1	–	–	–			–	1	–	–	–	–	–	–		

r=rudimentary.

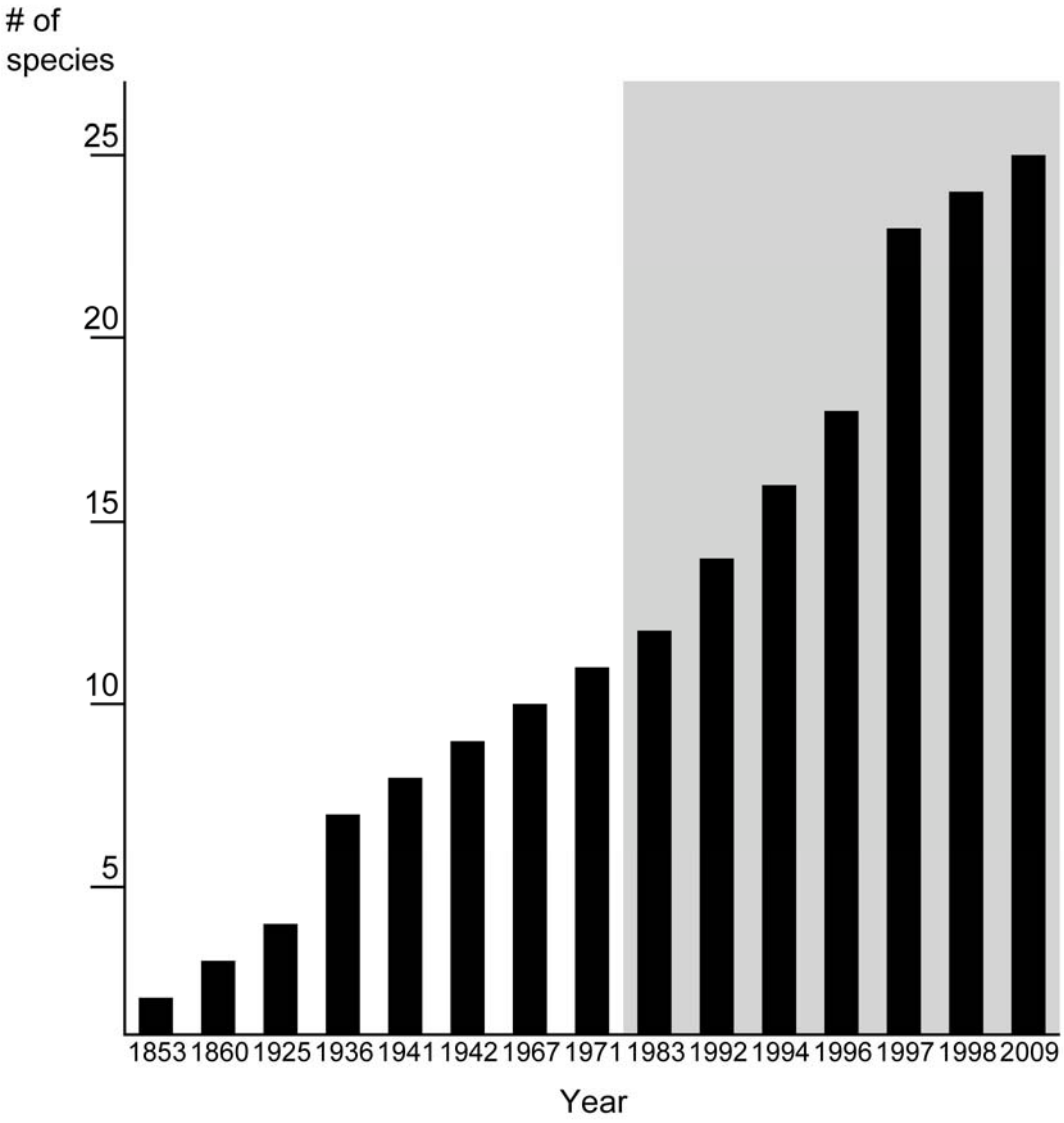

Fig. 1. Cumulative number of the described species of the family Rhynchocinetidae since 1857. Meshed part indicates the period that the SCUBA diving is available for sampling of rhynchocinetids.

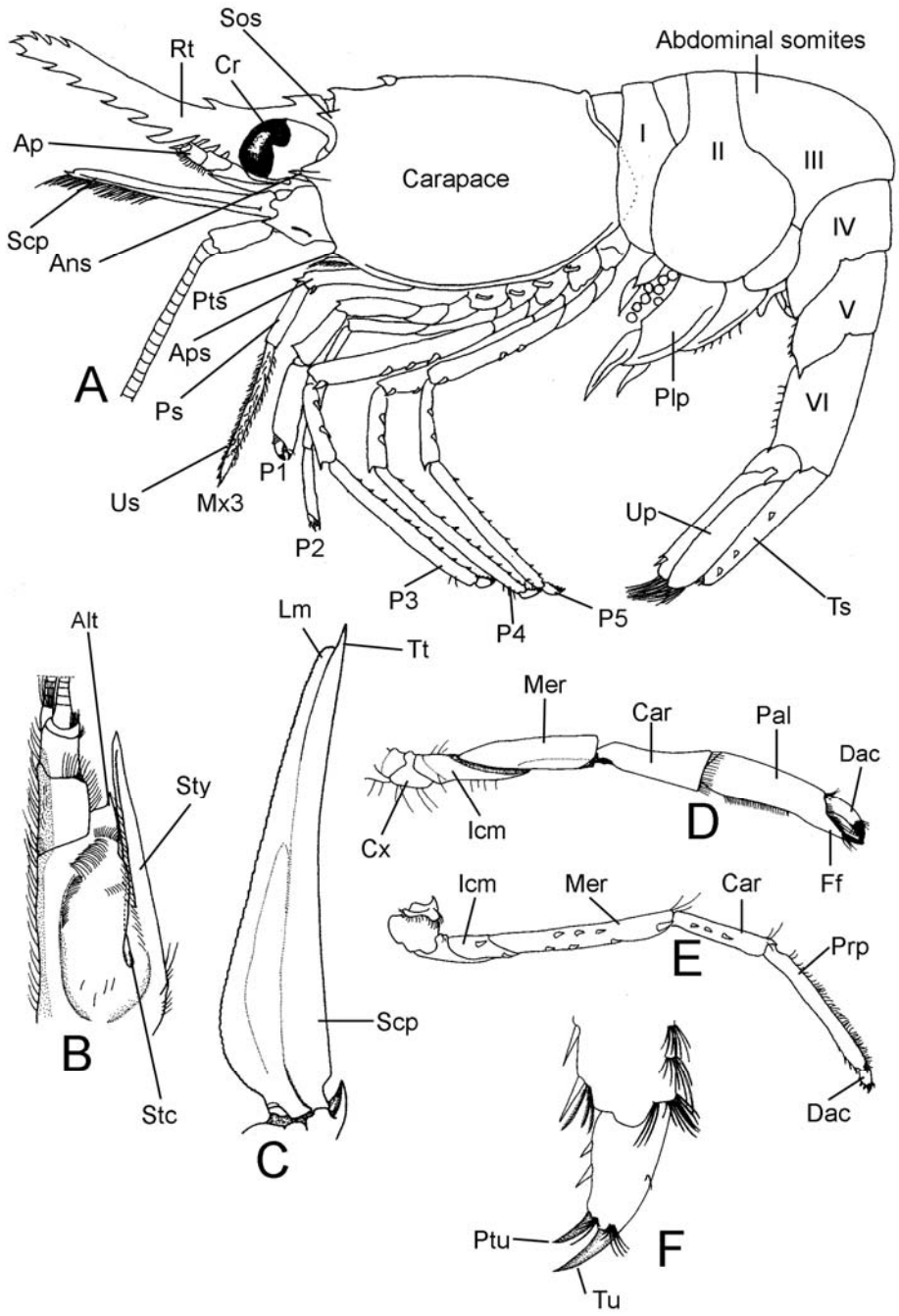

Fig. 2. Diagramatic rhynchocinetid shrimp drawing terms used in description. A, entire animal, lateral view. Ans, Antennal spine; Ap, antennular peduncle; Aps, antepenultimate segment; Cr, cornea; Mx3, third maxilliped; P1-P5, first to third pereiopod; Plp, pleopod; Ps, penultimate segment; Pts, pterygostomial spine; Rt, rostrum; Scp, scaphocerite; Sos, supraorbital spine; Ts, telson; Up, uropod; Us, ultimate segment. B, antennular peduncle, dorsal view. Alt, anterolateral tooth of proximal segment; Stc, statocyst; Sty, Stylocerite. C, antenna, dorsal view. Lm, lamella; Scp, scaphocerite; Tt, terminal tooth. D, first pereiopod, E, third pereiopod, lateral view. Car, carpus; Cx, coax; Dac, dactylus; Ff, fixed finger; Icm, Ischium; Mer, merus; Pal, palm; Prp, propodus. F, dactylus of ambulatory pereiopods. Ptu, preterminal unguis; tu, terminal unguis.

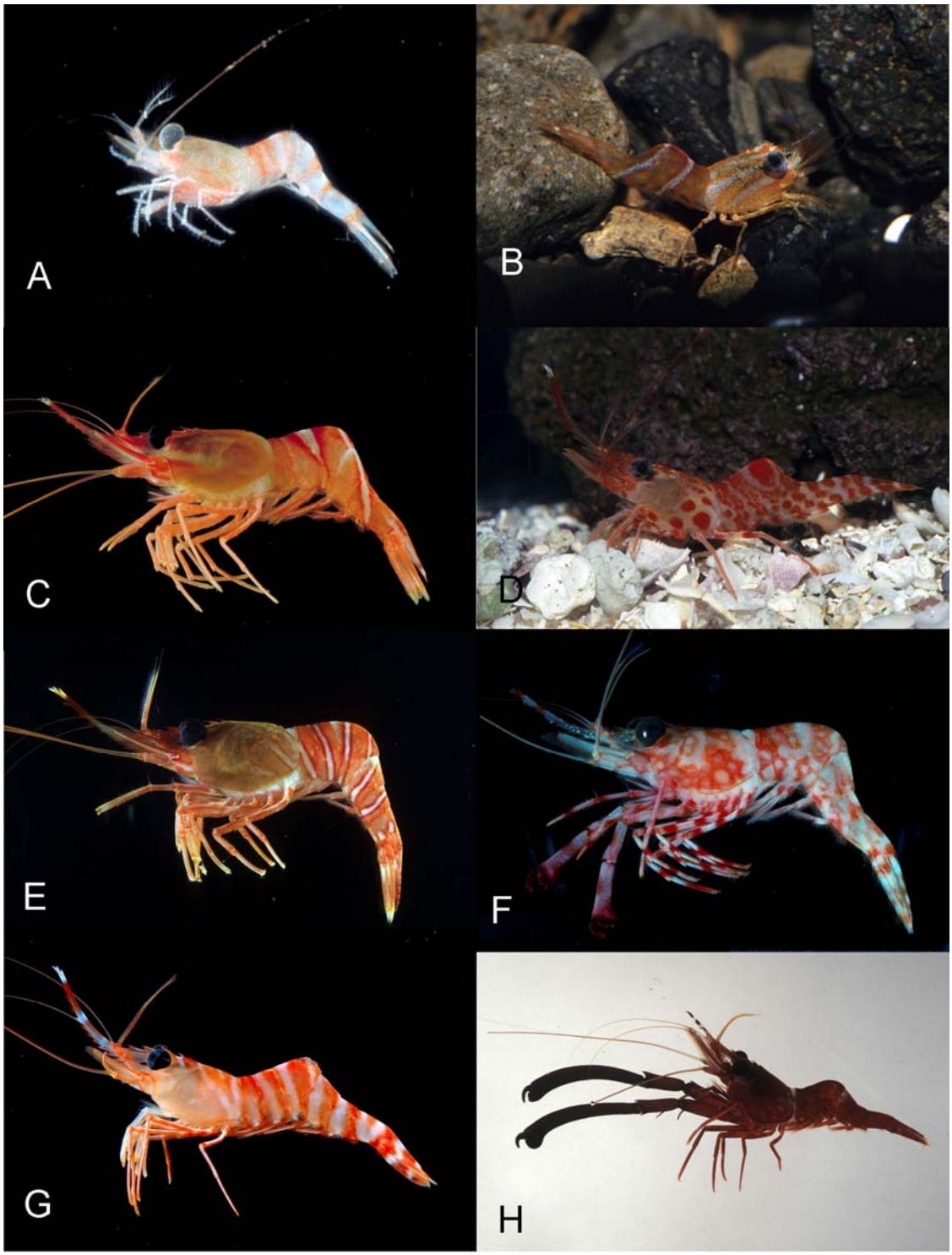

Fig. 3. Color pattern of Rhynchocinetidae subfam. A, *Cinetorhynchus brucei* Okuno, 2009, CMNH-ZC 02222, paratype ♀, CL 3.1 mm; B, *C. concolor* (Okuno, 1994), NSMT-Cr 3315, juv. CL 4.3 mm; C, same, CMNH-ZC 00747, ♂, CL 14.0 mm; D, *C. erythrostictus* Okuno, 1997, NSMT-Cr 2620, ♂, CL 11.4 mm; E, *C. hiatti* (Holthuis and Hayashi, 1967), CMNH-ZC 01500, ♂, 12.7 mm; F, *C. reticulates* Okuno, 1997, CMNH-ZC 00717, ♂, CL 8.0 mm; G, *C. striatus* (Nomura and Hayashi, 1992), CMNH-ZC 00643, ♂, CL 17.4 mm; H, *Aus hendersoni* (Kemp, 1925), NSMT-Cr 1812, ♂, CL 10.9 mm. Photos by J. Okuno.

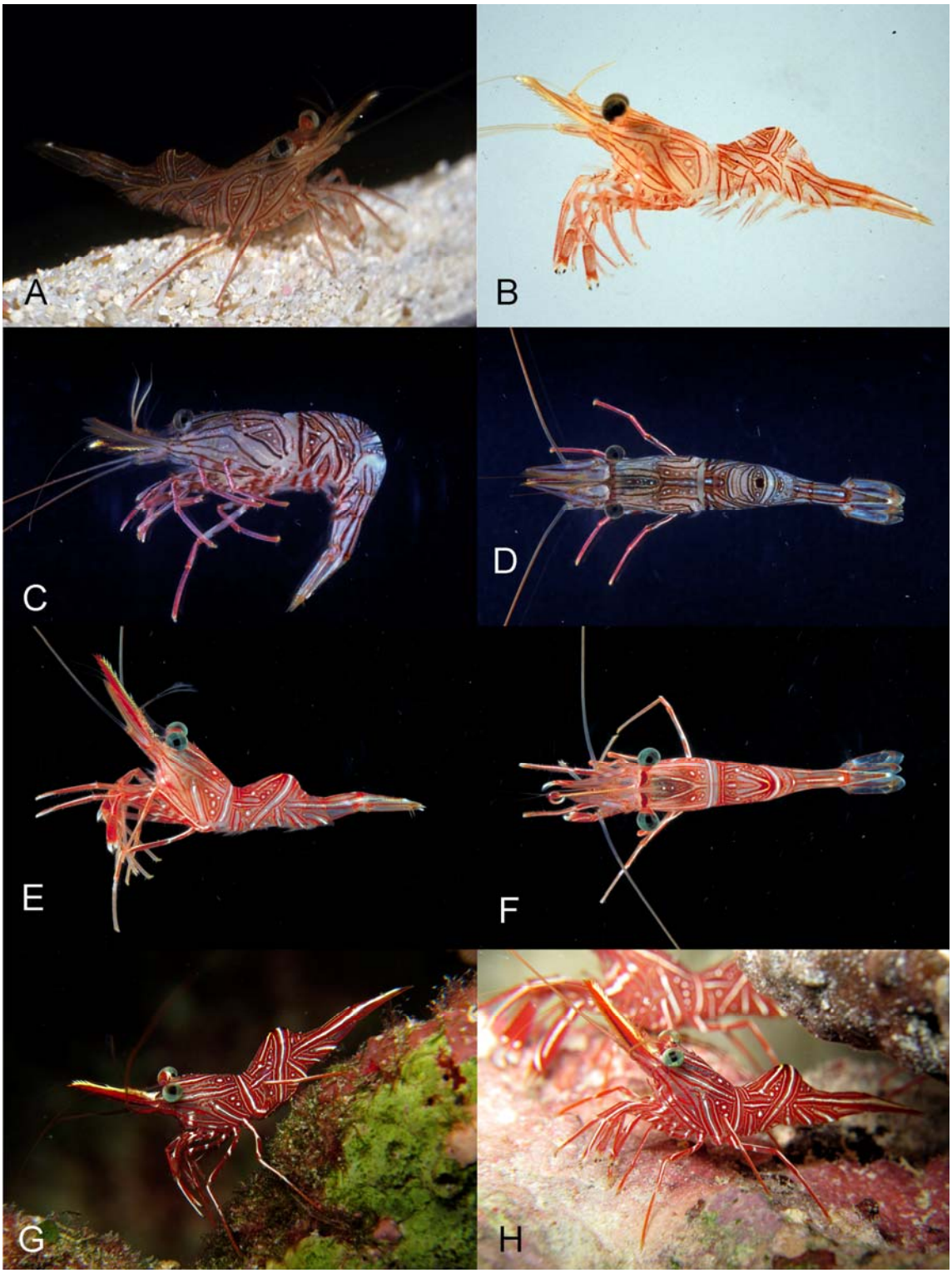

Fig. 4. Color pattern of Rhynchocinetinae. A, *Bus brucei* (Okuno, 1994), NSMT-Cr 1529, ♂, CL 6.4 mm, in aquarium; B, same specimen, lateral; C, *B. conspiciocellus* (Okuno and Takeda, 1992), CMNH-ZC 00277, ♀, CL 10.0 mm, lateral; D, same specimen, dorsal; E, *B. durbanensis* (Gordon, 1936), CMNH-ZC 00644, ♂, CL 9.0 mm, lateral; F, same specimen, dorsal; G, same, living individual at Ryukyu Islands; H, same, living individuals at Ryukyu Islands. Photos by J. Okuno.

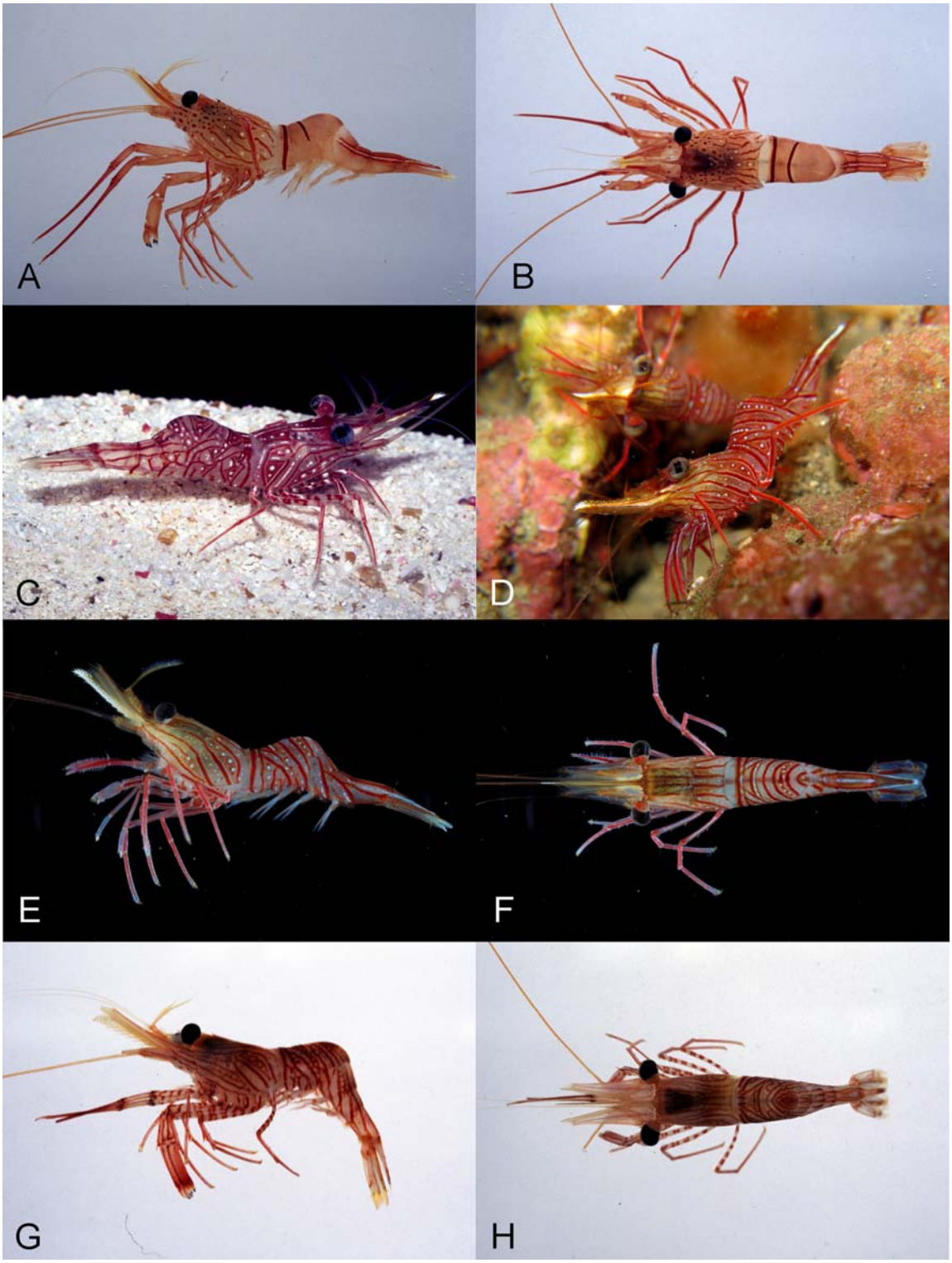

Fig. 5. Color patten of Rhynchocinetinae. A, *Bus kuiteri* (Tiefenbacher, 1983), NSMT, ♂, CL 12.7 mm, lateral; B, same specimen, dorsal; C, *B. rathbunae* (Okuno, 1996), NSMT-Cr 11104, ♂, CL 8.6 mm, in aquarium; D, *B. uritai* (Kubo, 1942), living individuals at Boso Peninsula, Japan; E, same, CMNH-ZC 00662, ♂, CL 6.9 mm, lateral; F, same specimen, dorsal; G, *B.* sp. 1, CMNH, ♂, CL 8.4 mm, lateral; H, same specimen, dorsal. Photos by J. Okuno.

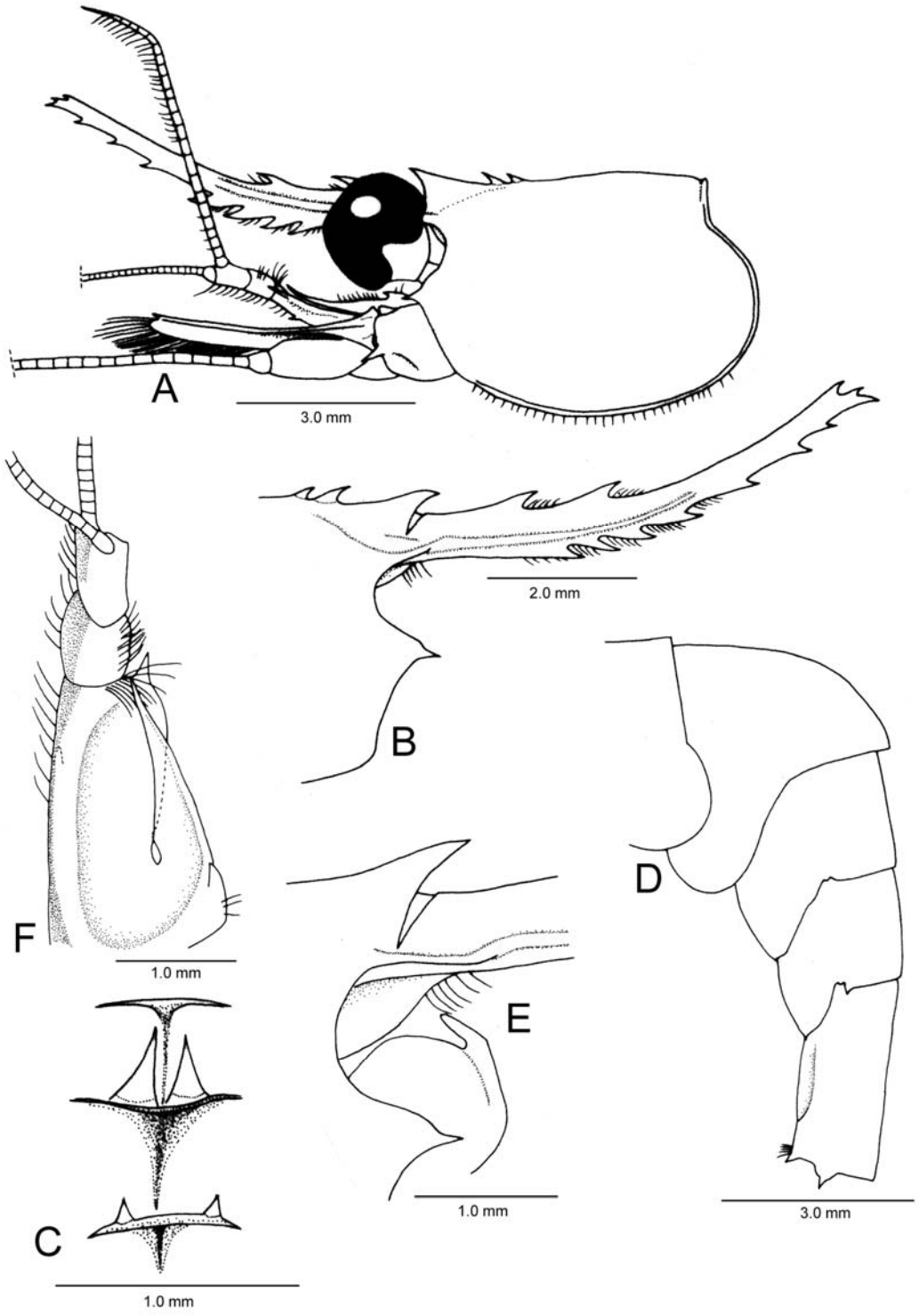

Fig. 6. *Cinetorhynchus brucei* Okuno, 2009. CMNH-ZC 02256, holotype ♂, CL 4.6 mm. A, carapace, rostrum and cephalic appendages, lateral; B, anterior part of carapace and rostrum, lateral; C, fifth and sixth thoracic sternites, ventral; D, second to sixth abdominal somites, lateral; E, ophthalmic somite, orbital region of carapace and proximal part of rostrum, lateral; F, right antennular peduncle, dorsal.

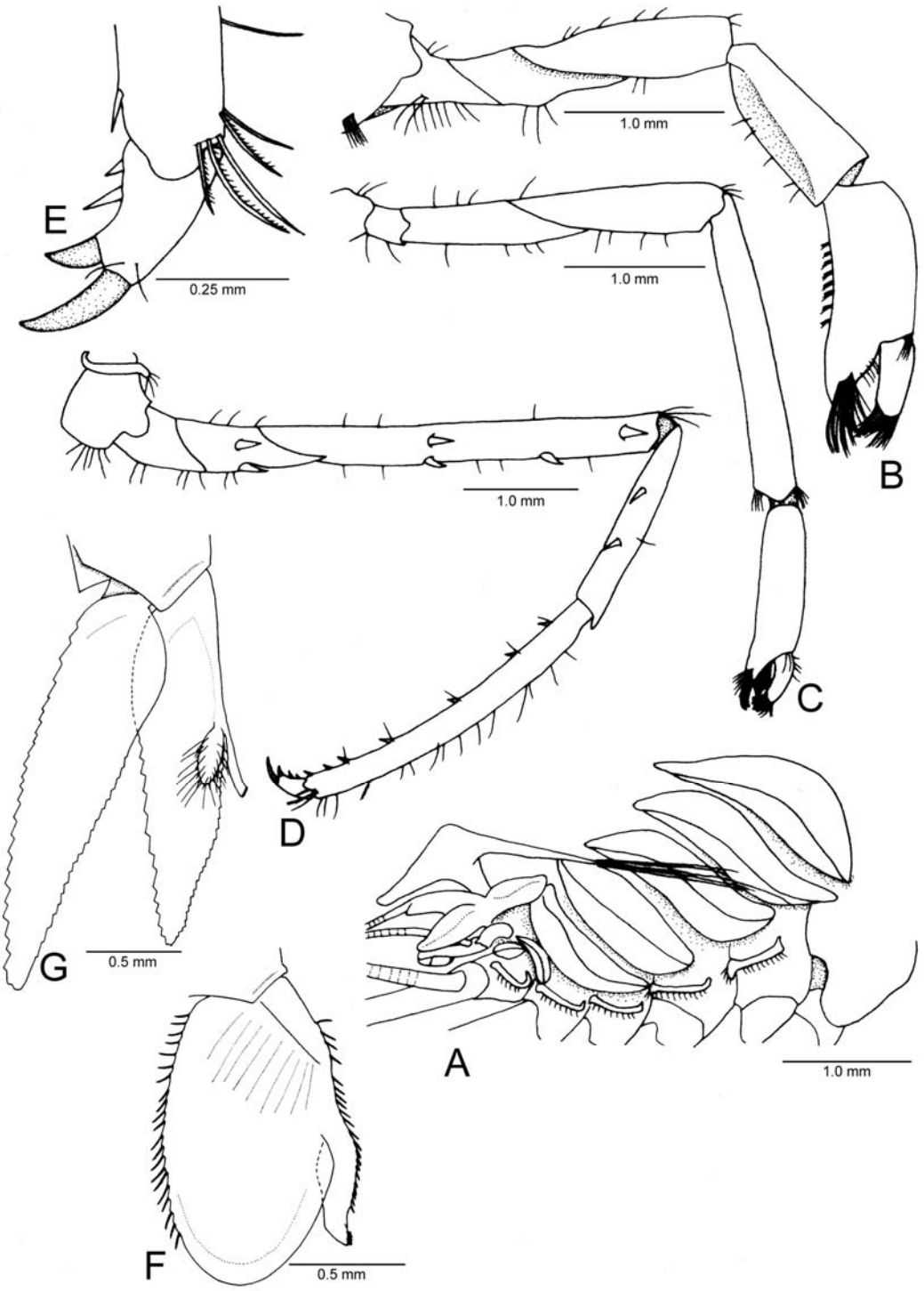

Fig. 7. *Cinetorhynchus brucei* Okuno, 2009. CMNH-ZC 02256, holotype ♂, CL 4.6 mm. A, left branchial chamber, lateral; B, right first pereiopod, lateral; C, right second pereiopod, lateral; D, right third pereiopod, lateral; E, same, dactylus, lateral; F, endopod of right first pleopod, external; G, right second pleopod (setae omitted), external.

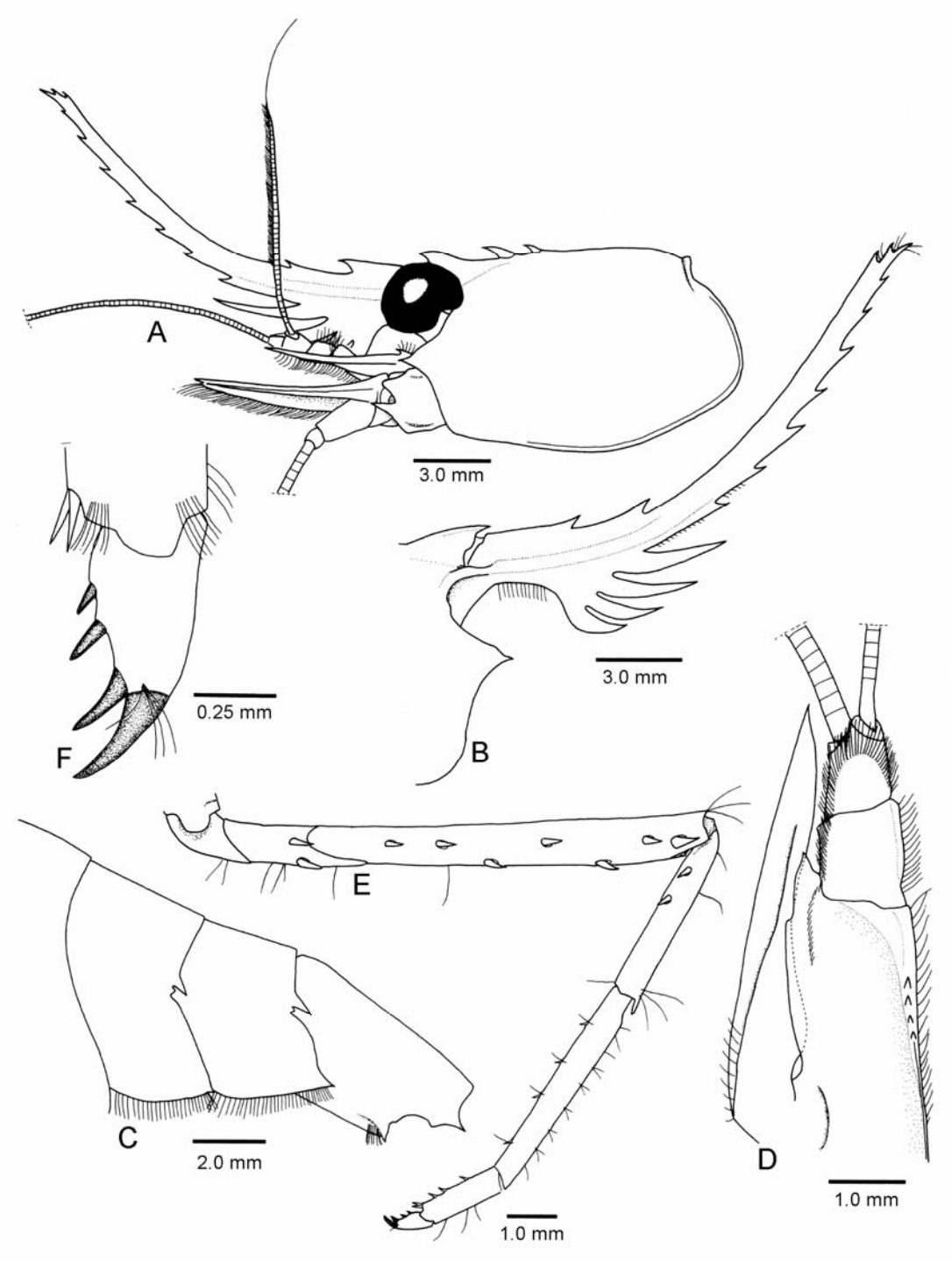

Fig. 8. *Cinetorhynchus concolor* (Okuno, 1994). CMNH-ZC 00716, ♂, CL 10.0 mm. A, carapace and cephalic appendages, lateral; B, rostrum, lateral; C, third to sixth abdominal somites, lateral; D, right antennular peduncle, ventral; E, right third pereiopod (propodus somewhat damaged), lateral; F, same, dactylus, lateral view.

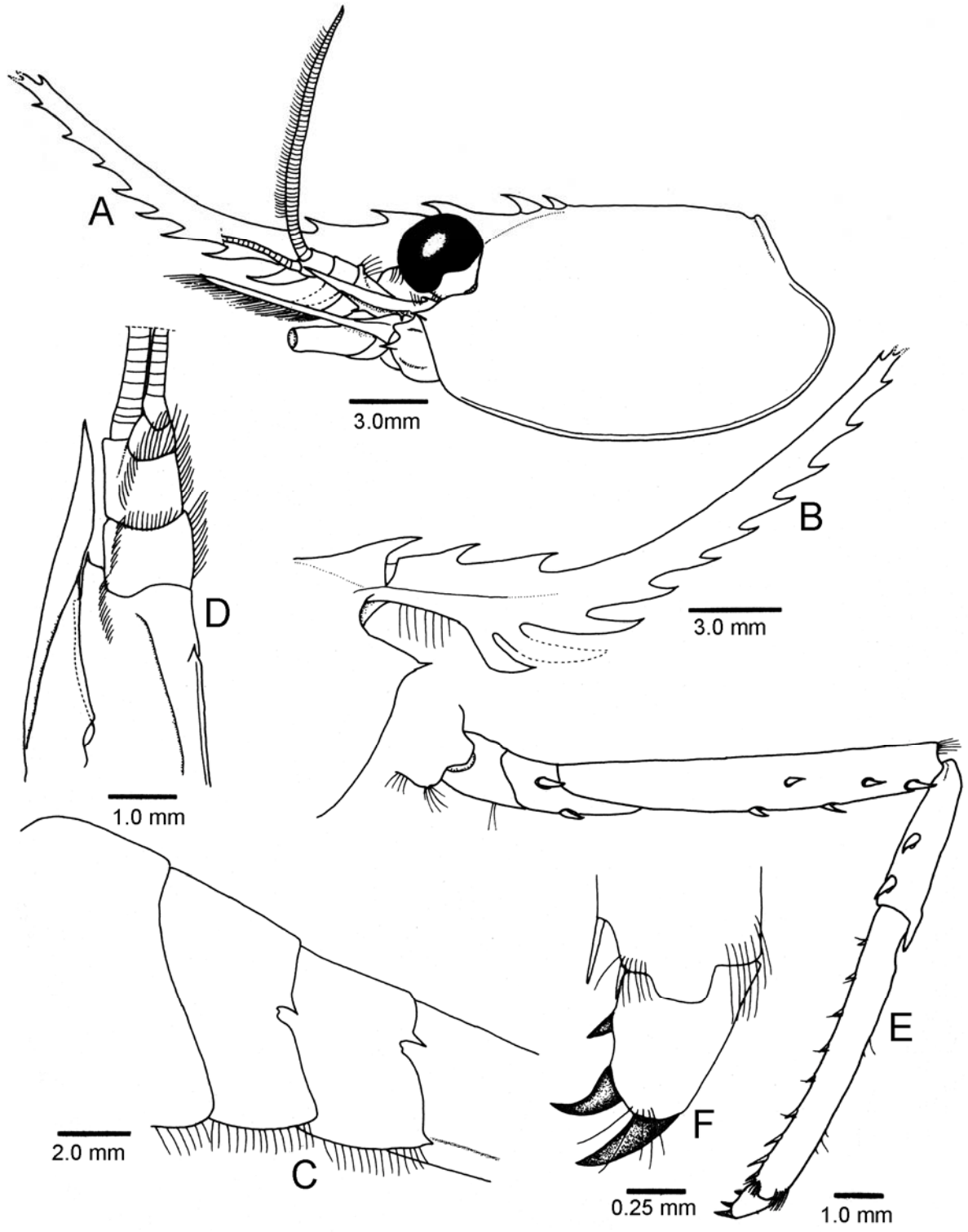

Fig. 9. *Cinetorhynchus erythrostictus* Okuno, 1997. NTOU-M00691, ♂, CL 11.0 mm. A, carapace and cephalic appendages, lateral; B, rostrum, lateral; C, third to sixth abdominal somites, lateral; D, right antennular peduncle, ventral; E, right third pereiopod (propodus somewhat damaged), lateral; F, same, dactylus, lateral.

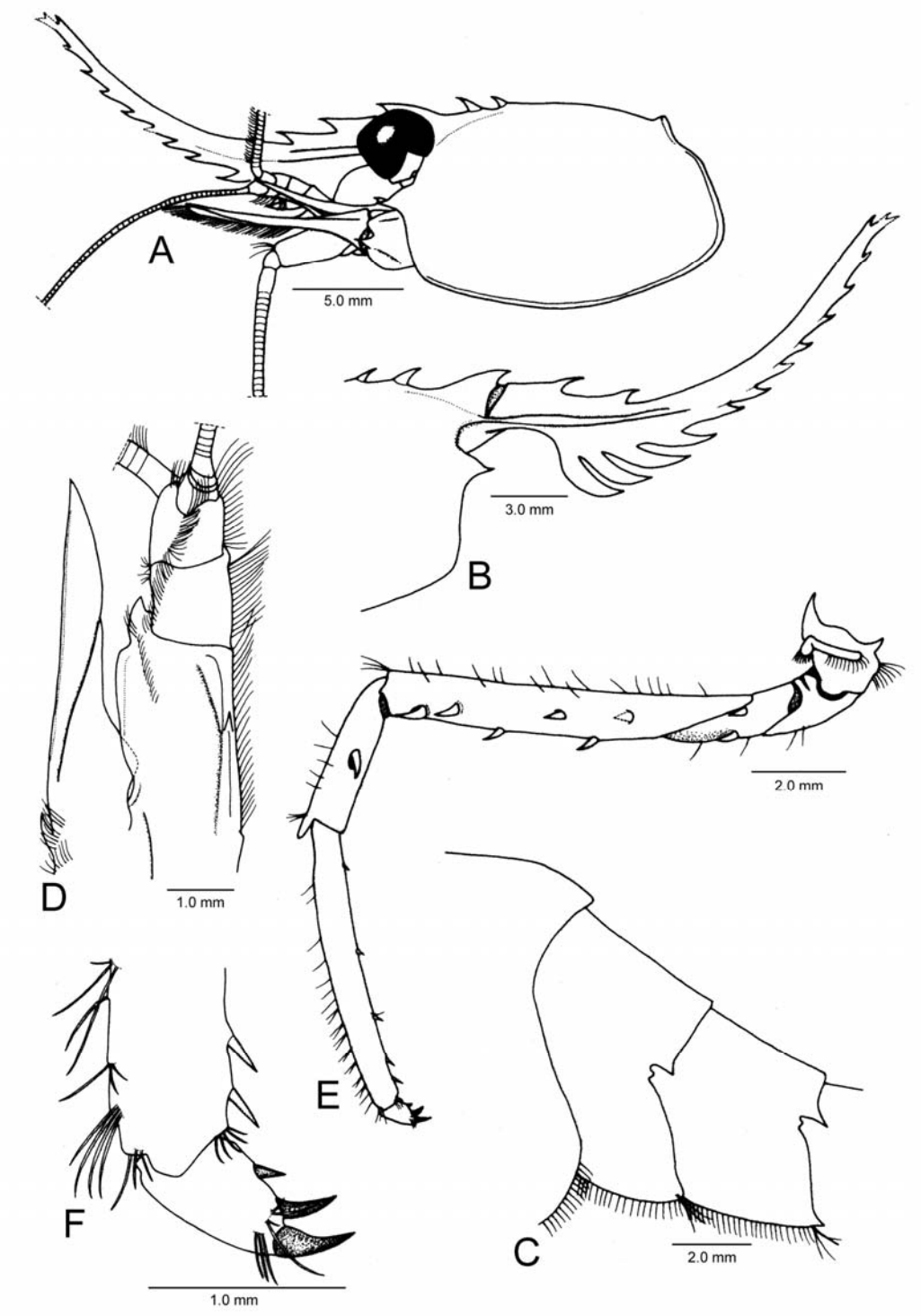

Fig. 10. *Cinetorhynchus fasciatus* Okuno and Tachikawa, 1997. CMNH-ZC 01444A, ovig.♀, CL 11.6 mm (A–D), CMNH-ZC 01444B, ovig.♀, CL 11.5 mm (E, F). A, carapace and cephalic appendages, lateral; B, anterior part of carapace with rostrum, lateral; C, fourth and fifth abdominal somites, lateral; D, right antennular peduncle, ventral; E, left third pereiopod, lateral; F, same, dactylus, lateral.

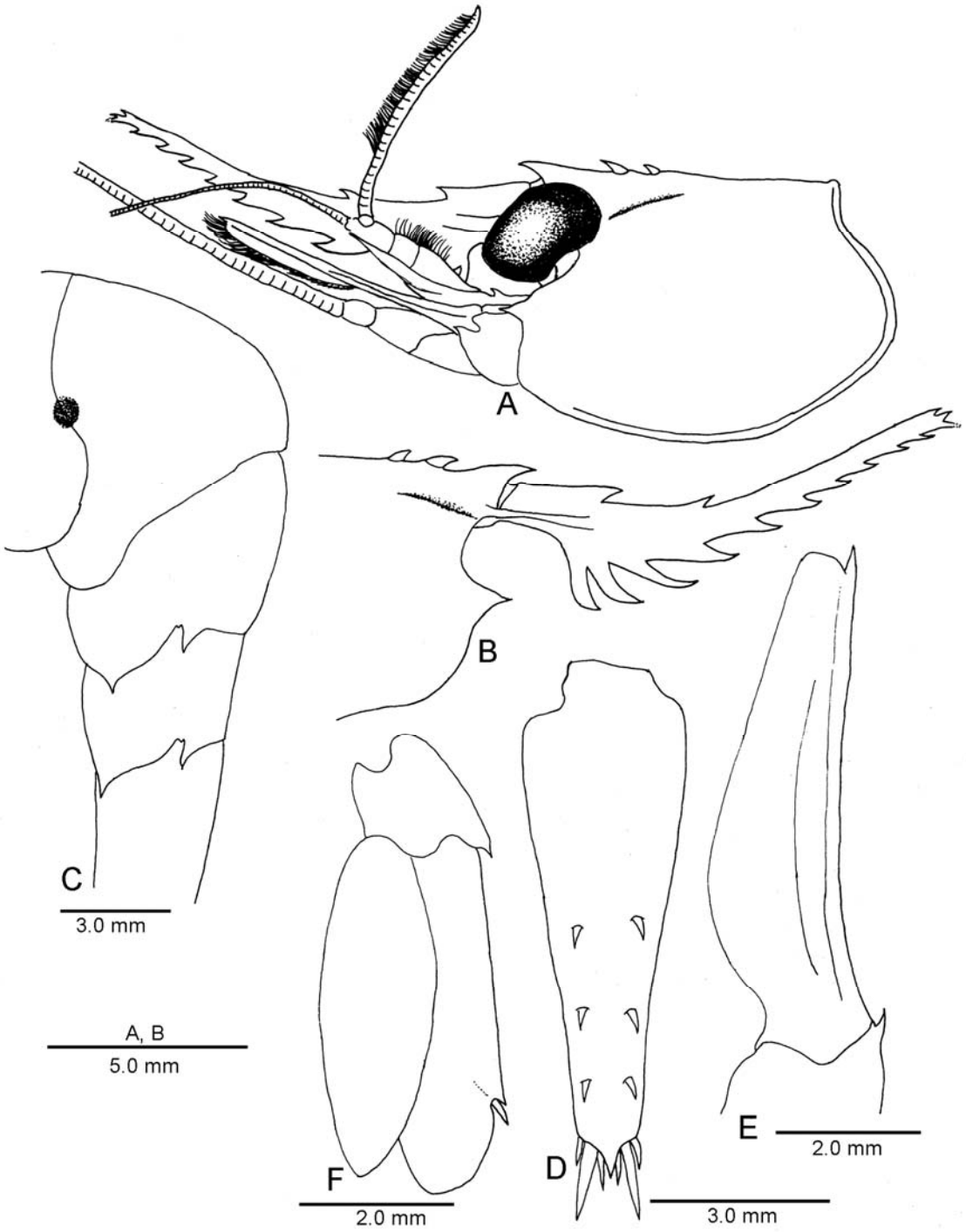

Fig. 11. *Cinetorhynchus hawaiiensis* Okuno and Hoover, 1998. BPBM S11356, holotype ♂, CL 6.6 mm. A, carapace and cephalic appendages, lateral; B, anterior part of carapace with rostrum, lateral; C, third to fifth abdominal somites, lateral; D, telson, dorsal; E, scaphocerite, dorsal; F, right uropod, dorsal. Modified Okuno and Hoover (1998).

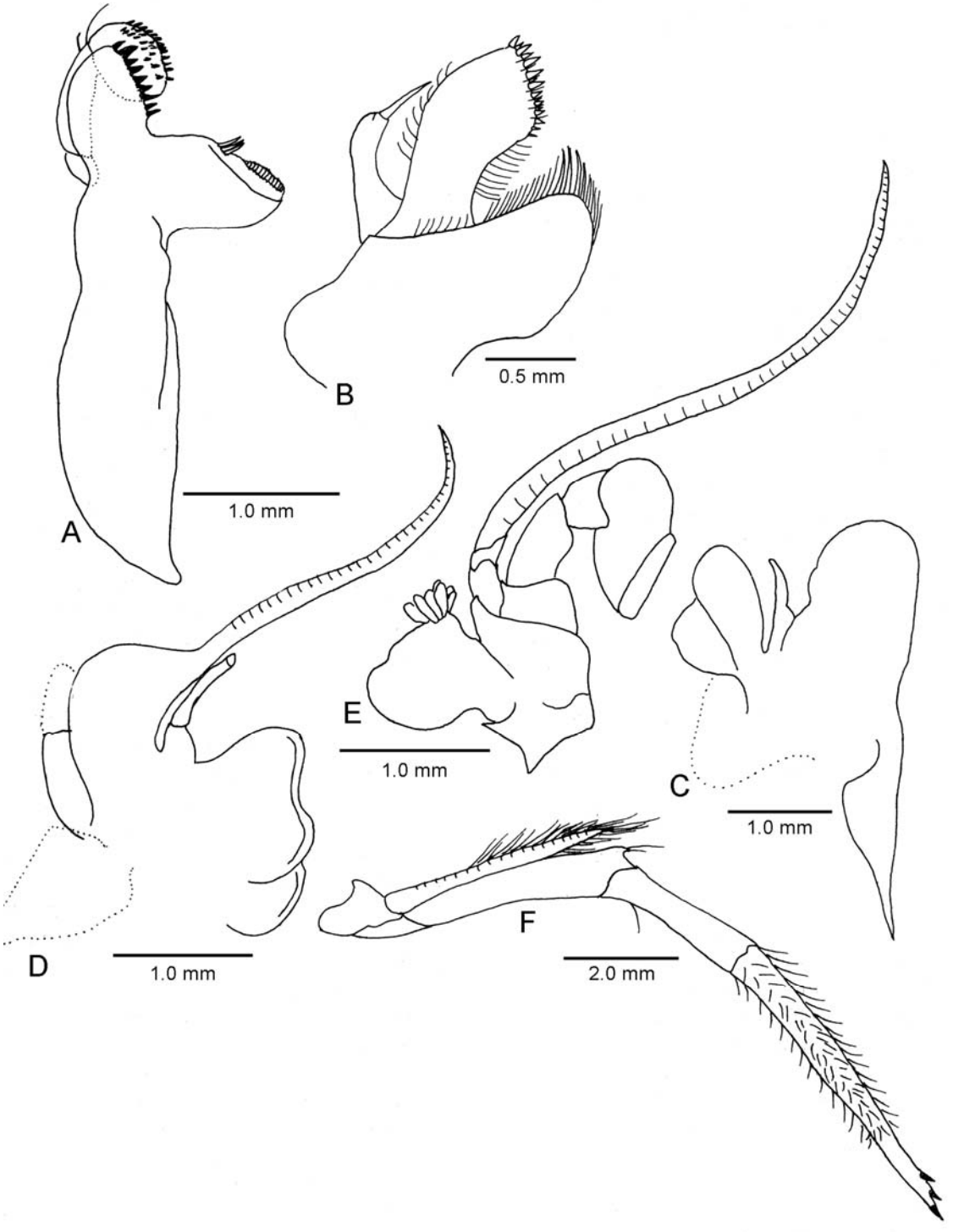

Fig. 12. *Cinetorhynchus hawaiiensis* Okuno and Hoover, 1998. BPBM S11356, holotype ♂, CL 6.6 mm. Right mouthparts. A, mandible, external; B, maxillula, external; C, maxilla, dorsal; D, first maxilliped, external; E, second maxilliped, external; F, third maxilliped, lateral. C–E, setae omitted. Modified Okuno and Hoover (1998).

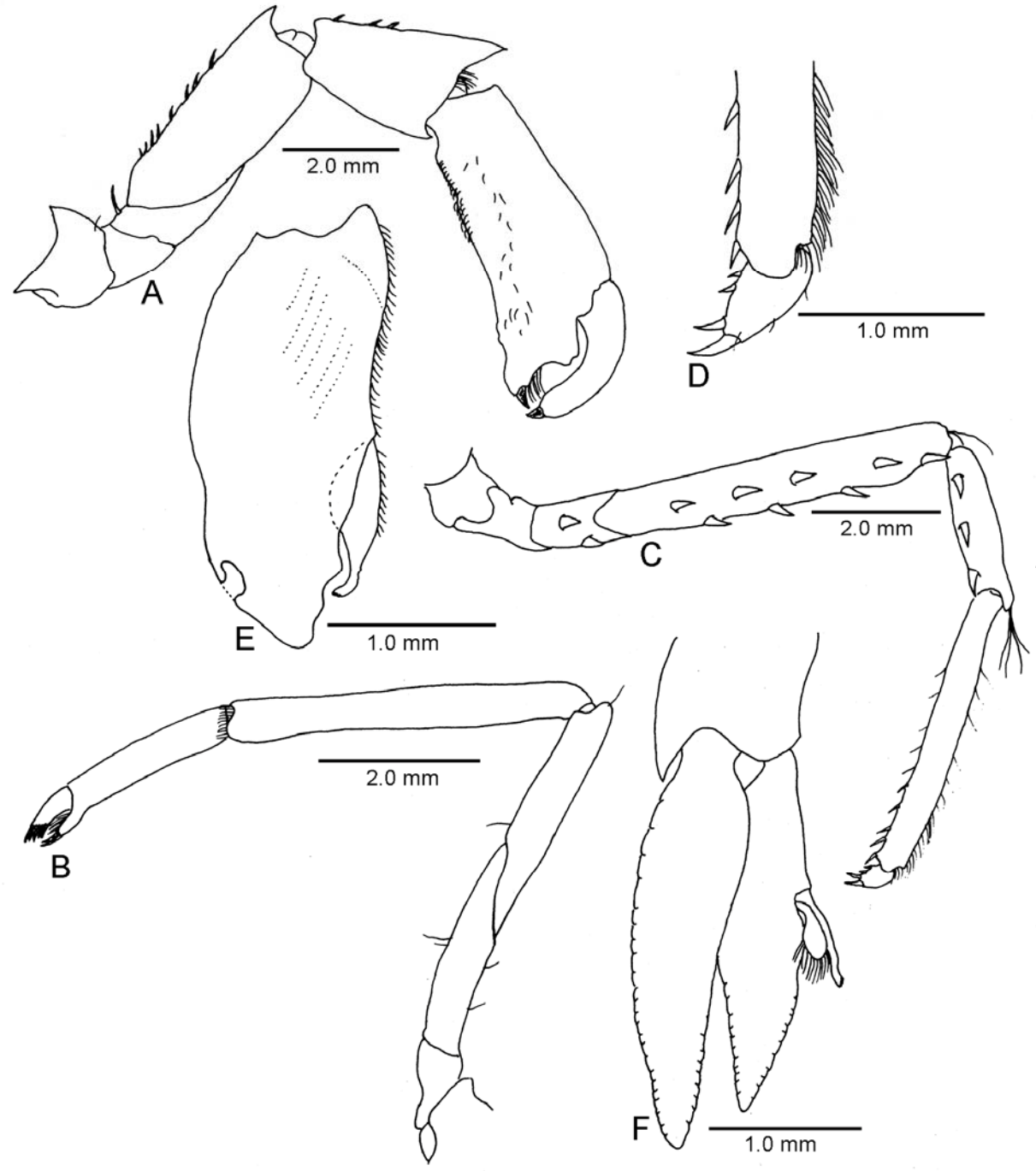

Fig. 13. *Cinetorhynchus hawaiiensis* Okuno and Hoover, 1998. BPBM S11356, holotype ♂, CL 6.6 mm. A, right first pereiopod, lateral; B, left second pereiopod, lateral; C, right third pereiopod, lateral; D, same, dactylus, lateral; E, endopod of right first pleopod, external; F, right second pleopod, external. Modified Okuno and Hoover (1998).

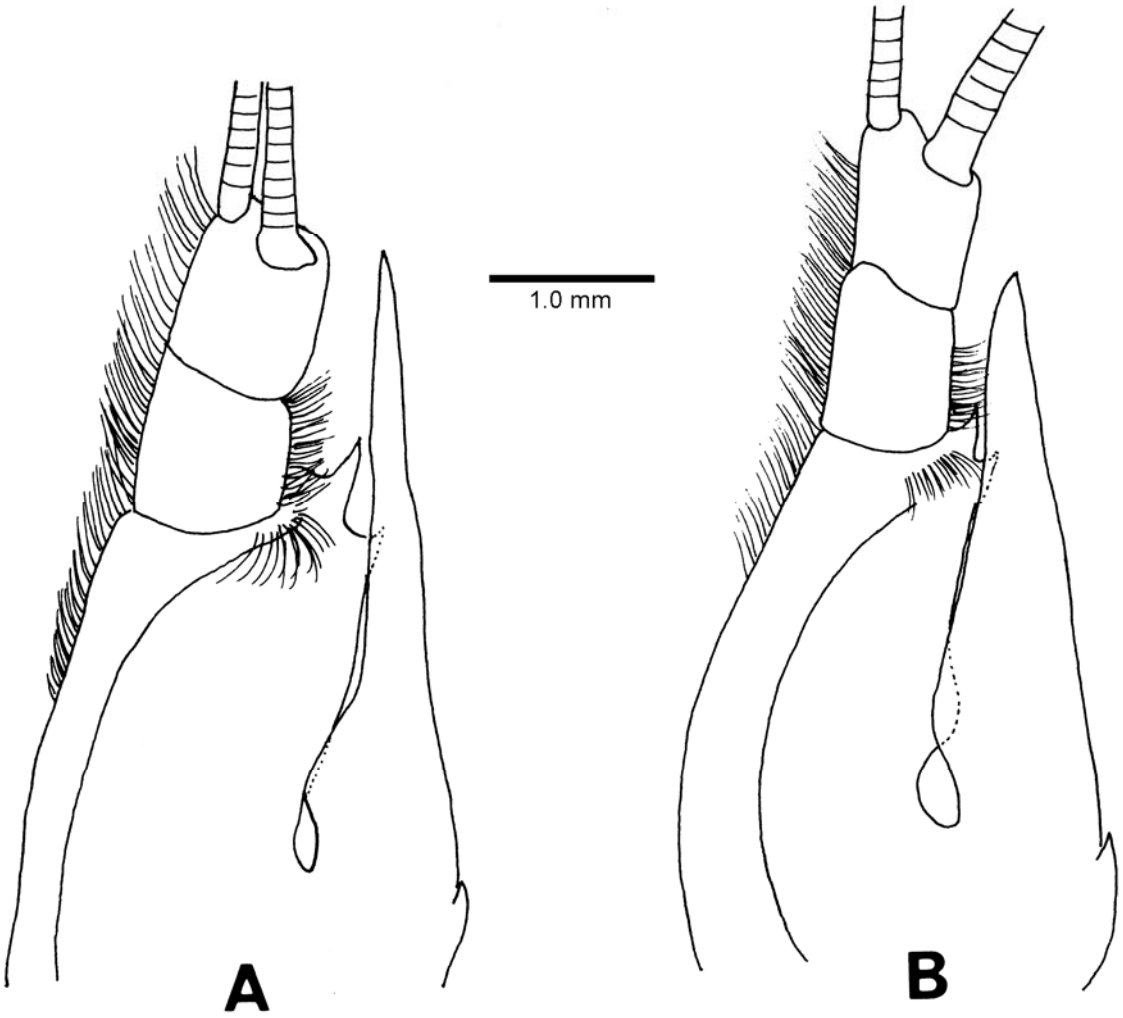

Fig. 14. Comparison of length of stylocerite. A, *Cinetorhynchus hawaiiensis* Okuno and Hoover, 1998, BPBM S11356, holotype ♂, CL 6.6 mm; B, *C. reticulatus* Okuno, 1997, RMNH D47806, ♂, CL 7.3 mm. Modified Okuno and Hoover (1998).

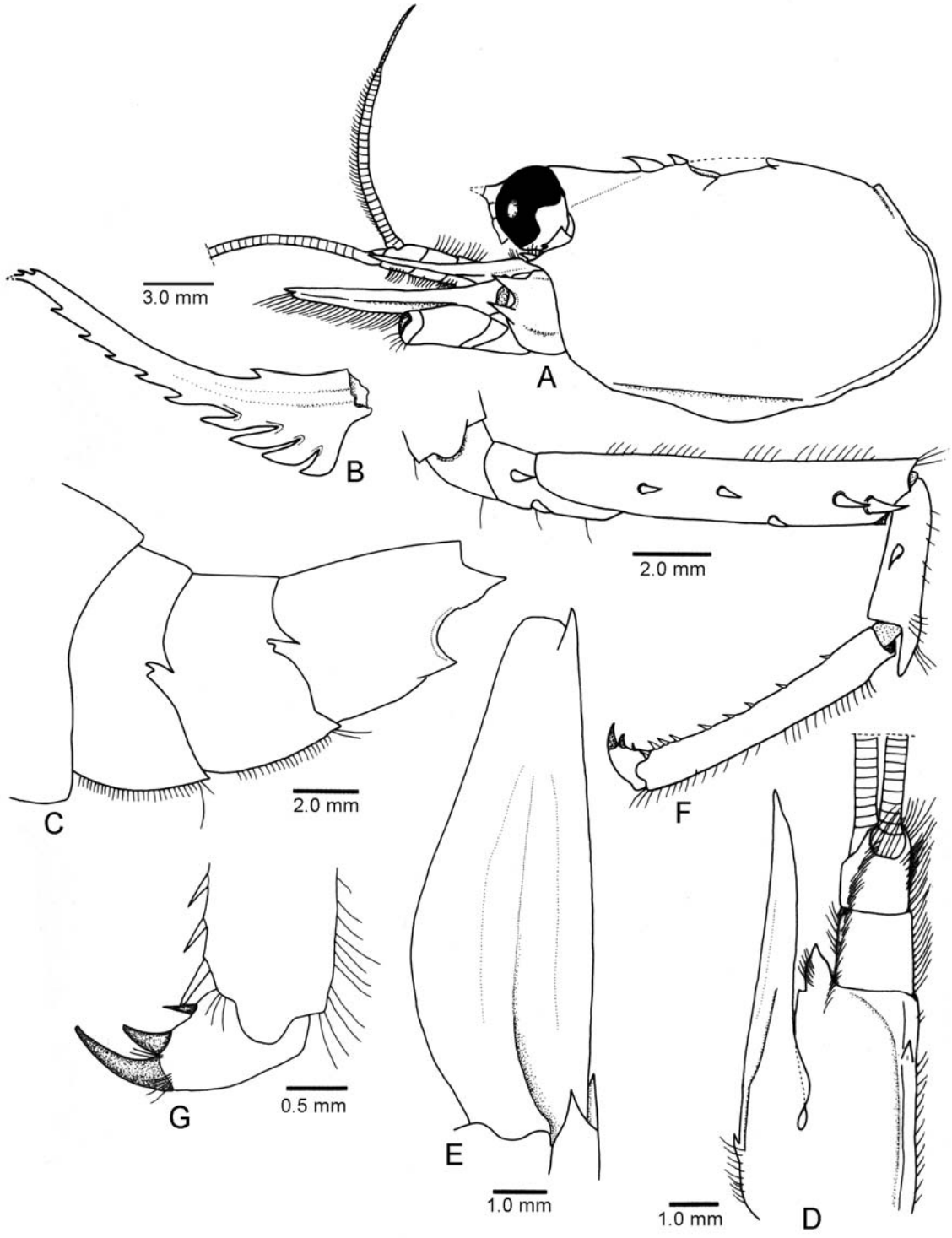

Fig. 15. *Cinetorhynchus hiatti* (Holthuis and Hayashi, 1967). KMNH 1995Z20IvR97, holotype ♂, CL 13.3 mm. A, carapace (somewhat damaged dorsally) and cephalic appendages, lateral; B, rostrum, lateral; C, third to sixth abdominal somites, lateral; D, right antennular peduncle, ventral; E, right scaphocerite, dorsal; F, right third pereiopod, lateral; G, same, dactylus, lateral.

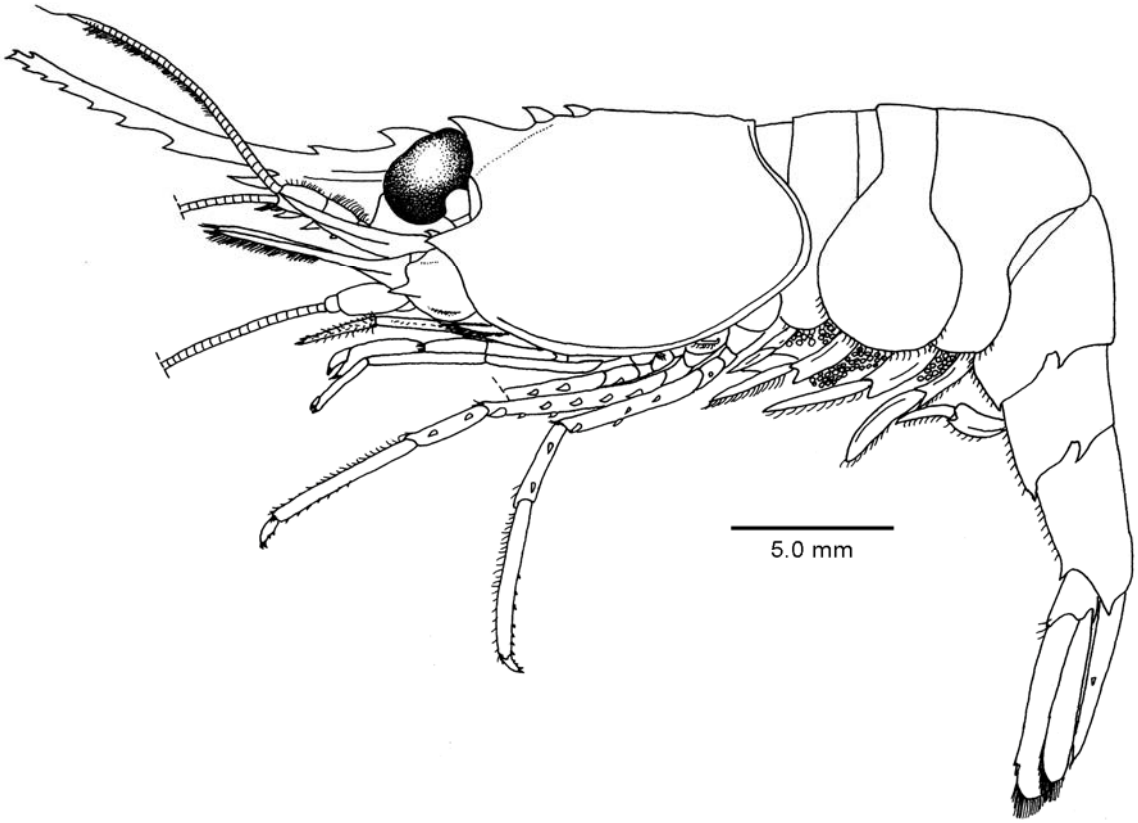

Fig. 16. *Cinetorhynchus manningi* Okuno, 1996. USNM 277772, holotype ovig. ♀, CL 8.5 mm. Entier animal, lateral. Scale: 5.0 mm. Modified Okuno (1996b).

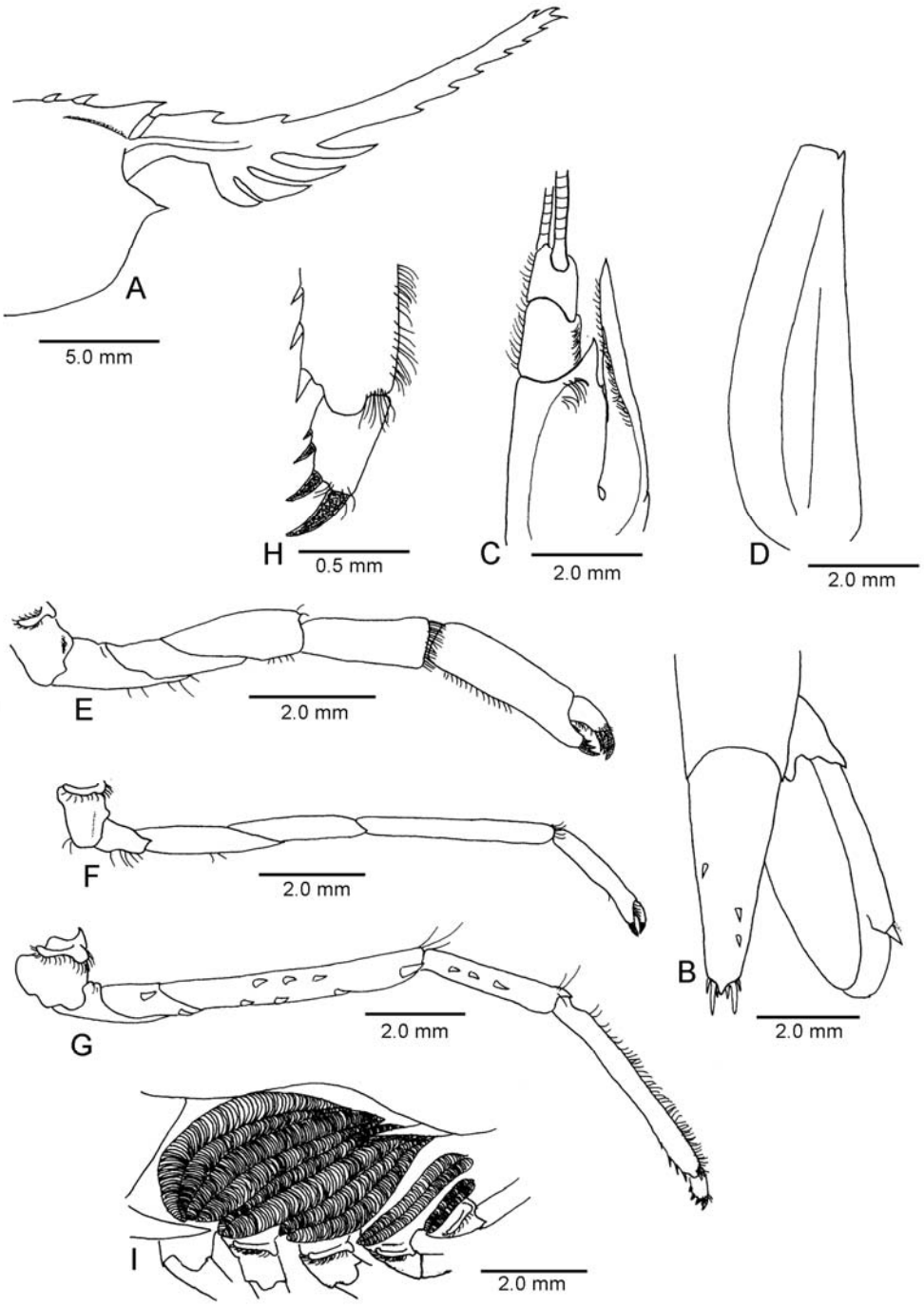

Fig. 17. *Cinetorhynchus manningi* Okuno, 1996. A–H, USNM 277772, holotype ovig. ♀, CL 8.5 mm; I, USNM 277773, paratype ovige. ♀, CL 8.0 mm. A, anterior part of carapace with rostrum, lateral; B, telson and right uropod, dorsal; C, antennular peduncle, dorsal; D, scaphocerite, dorsal; E, right forst pereiopod, lateral; F, right second pereiopod, lateral; G, right third pereiopod, lateral; H, same, dactylus, lateral; I, right branchial chamber, lateral. Modified Okuno (1996b).

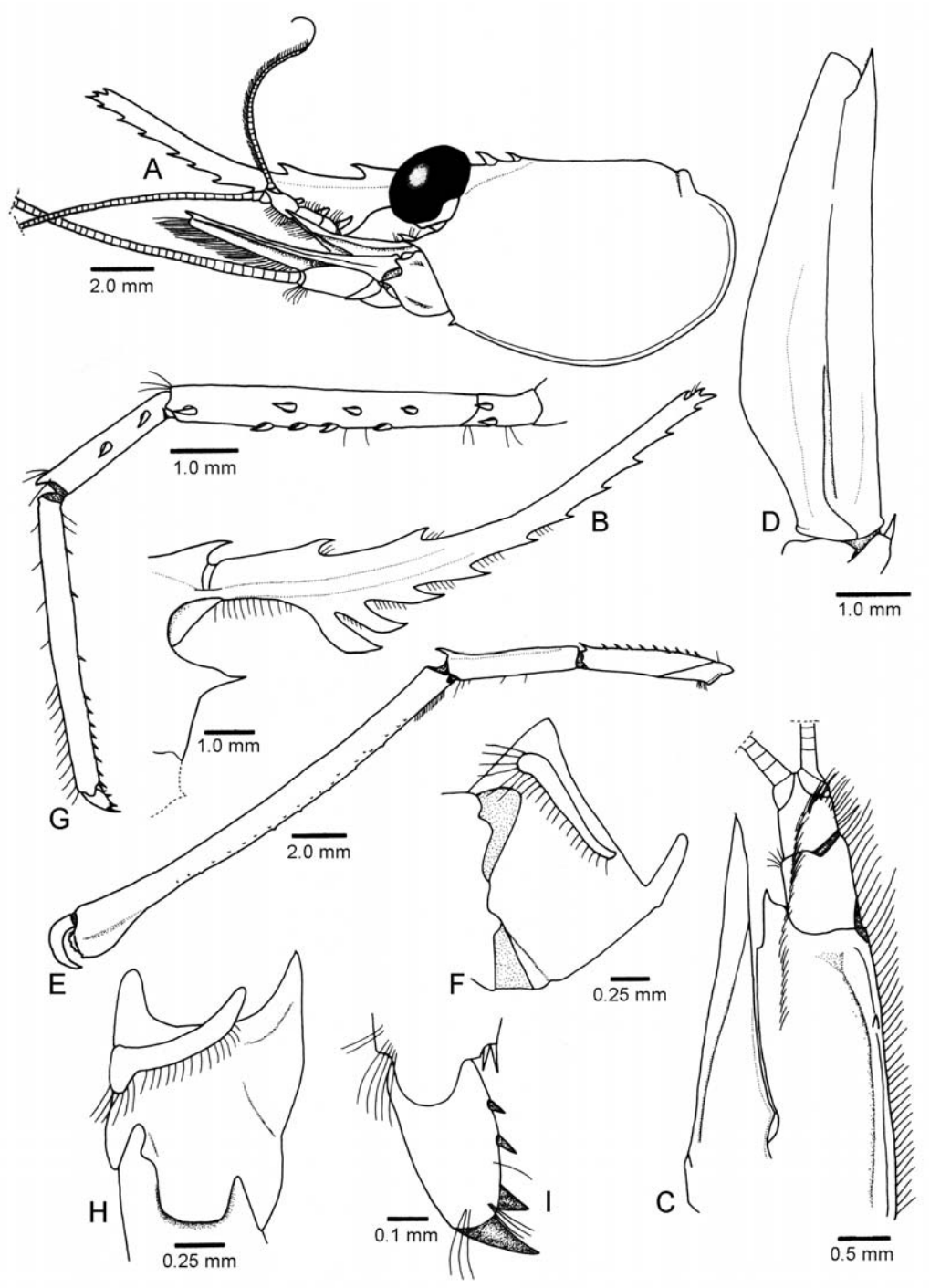

Fig. 18. *Cinetorhynchus reticulatus* Okuno, 1997. OUMNH 2009-23-0007, ♂, CL 6.6 mm. A, carapace and cephalic appendages, lateral; B, rostrum, lateral; C, right antennular peduncle, ventral; D, right scaphocerite, dorsal; E, left first pereiopod, lateral; F, same, coxa, lateral; G, left third pereiopod, lateral; H, same, coxa, lateral; I, same, dactylus, lateral.

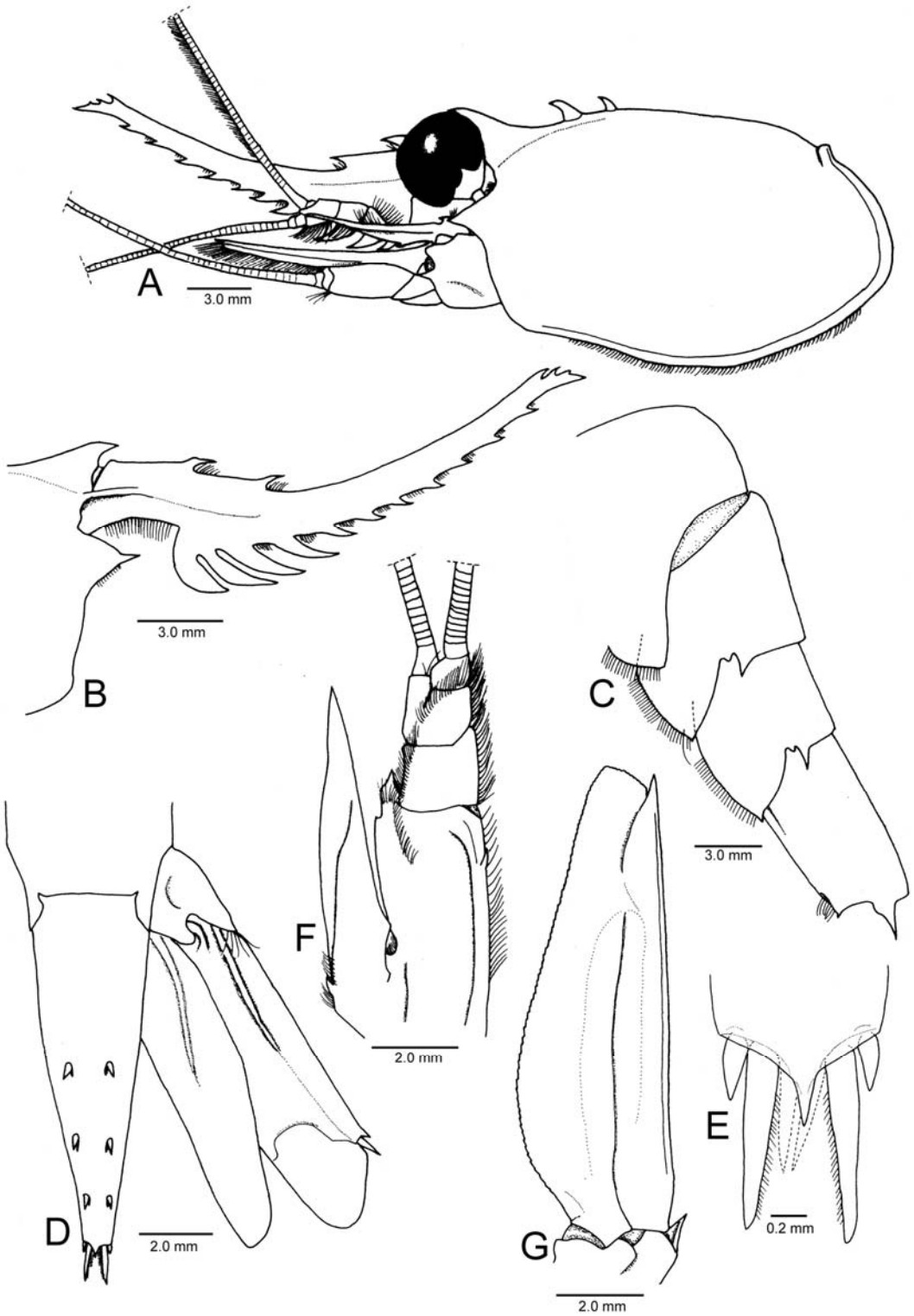

Fig. 19. *Cinetorhynchus rigens* (Gordon, 1936). USNM 156441A, ♂, CL 15.4 mm (A–C, F, G), USNM 156441B, ♂, CL 15.8 mm (D, E). A, carapace and and cephalic appendages, lateral; B, rostrum, lateral; C, fourth to sixth abdominal somites, lateral; D, telson and right uropod, dorsal; E, tip of telson, dorsal; F, right antennular peduncle, ventral; G, right scaphocerite, dorsal.

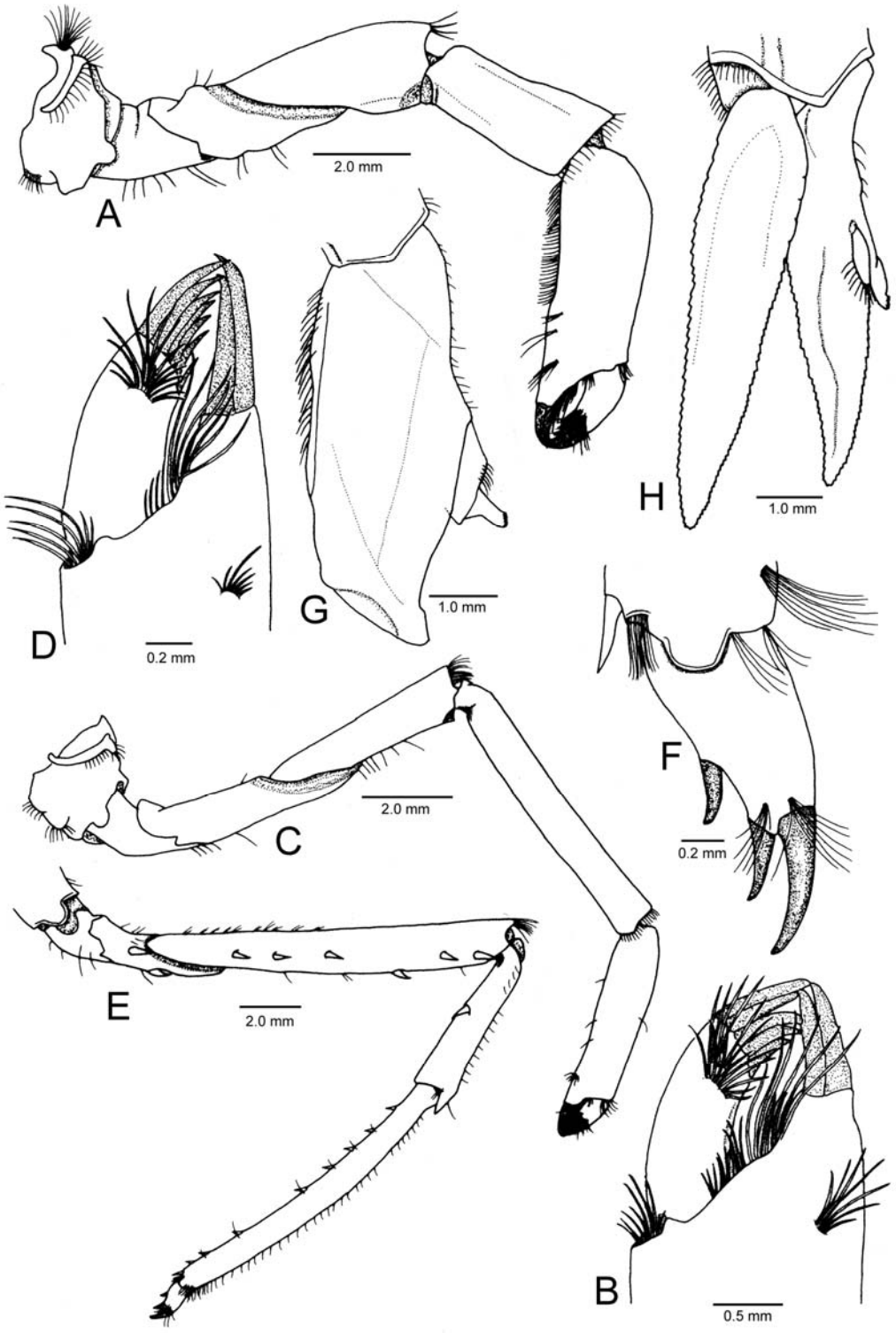

Fig. 20. *Cinetorhynchus rigens* (Gordon, 1936). USNM 156441A, ♂, CL 15.4 mm. A, right first pereiopod, lateral; B, same, dactylus and fixed finger, lateral; C, right second pereiopod, lateral; D, same, dactylus and fixed finger, lateral; E, right third pereiopod, lateral; F, same, dactylus, lateral; G, endopod of right first pleopod, external; H, right second pleopod, external.

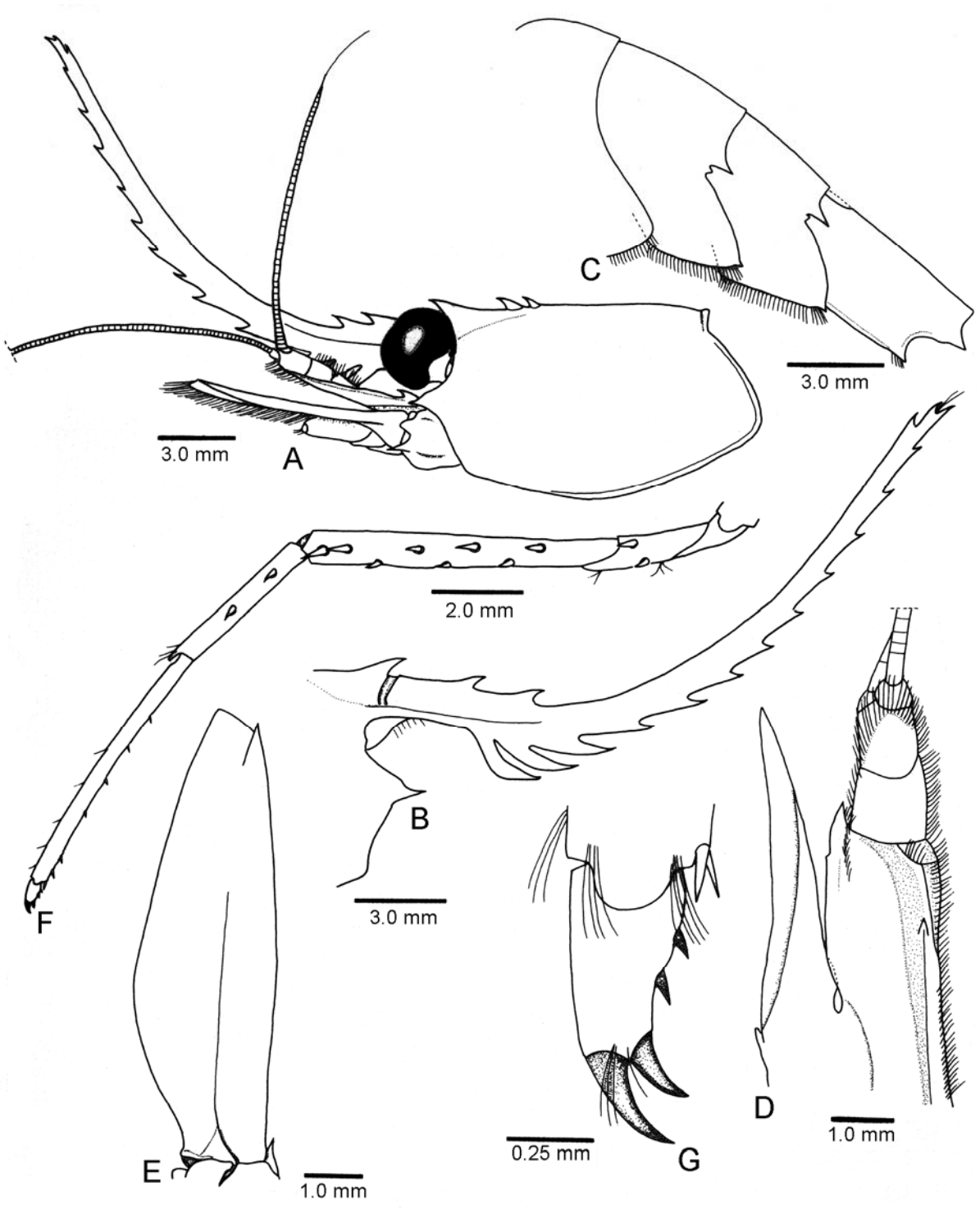

Fig. 21. *Cinetorhynchus striatus* (Nomura and Hayashi, 1992). CMNH-ZC 00097, paratype ♂, CL 9.9 mm. A, carapace and cephalic appendages, lateral; B, rostrum, lateral; C, third to sixth abdominal somites, lateral; D, right antennular peduncle, ventral; E, right scaphocerite, dorsal; F, left third pereiopod, lateral; G, same, dactylus, lateral.

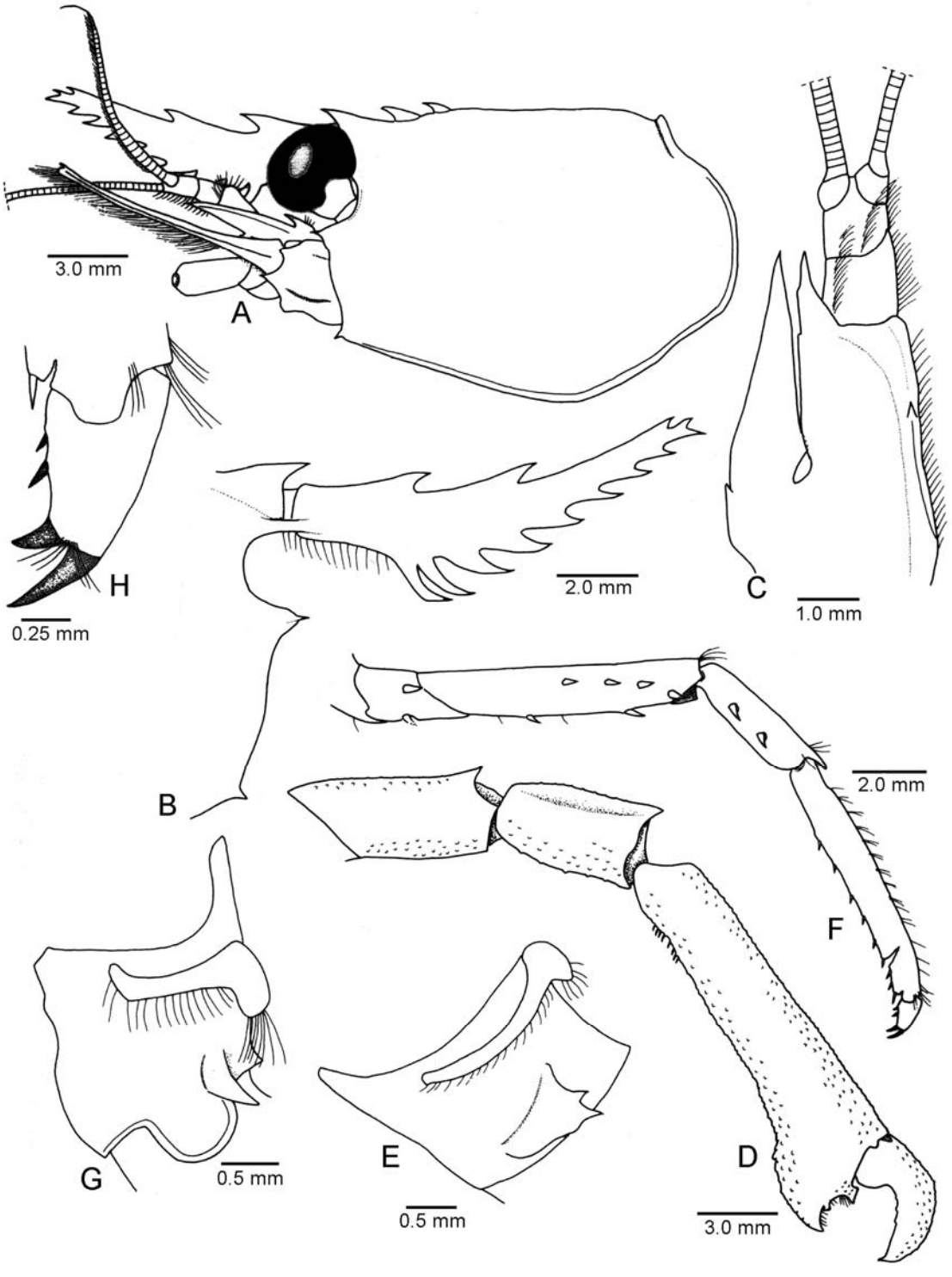

Fig. 22. *Aus hendersoni* (Kemp, 1925). NTOU-M00682, ♂, CL 10.6 mm. A, carapace and cephalic appendages, lateral; B, anterior part of carapace with rostrum, lateral; C, right antennular peduncle, ventral; D, right first pereiopod, lateral; E, same, coxa, lateral; F, right third pereiopod (propodus somewhat damaged), lateral; G, same, coxa, lateral; H, same, dactylus, lateral.

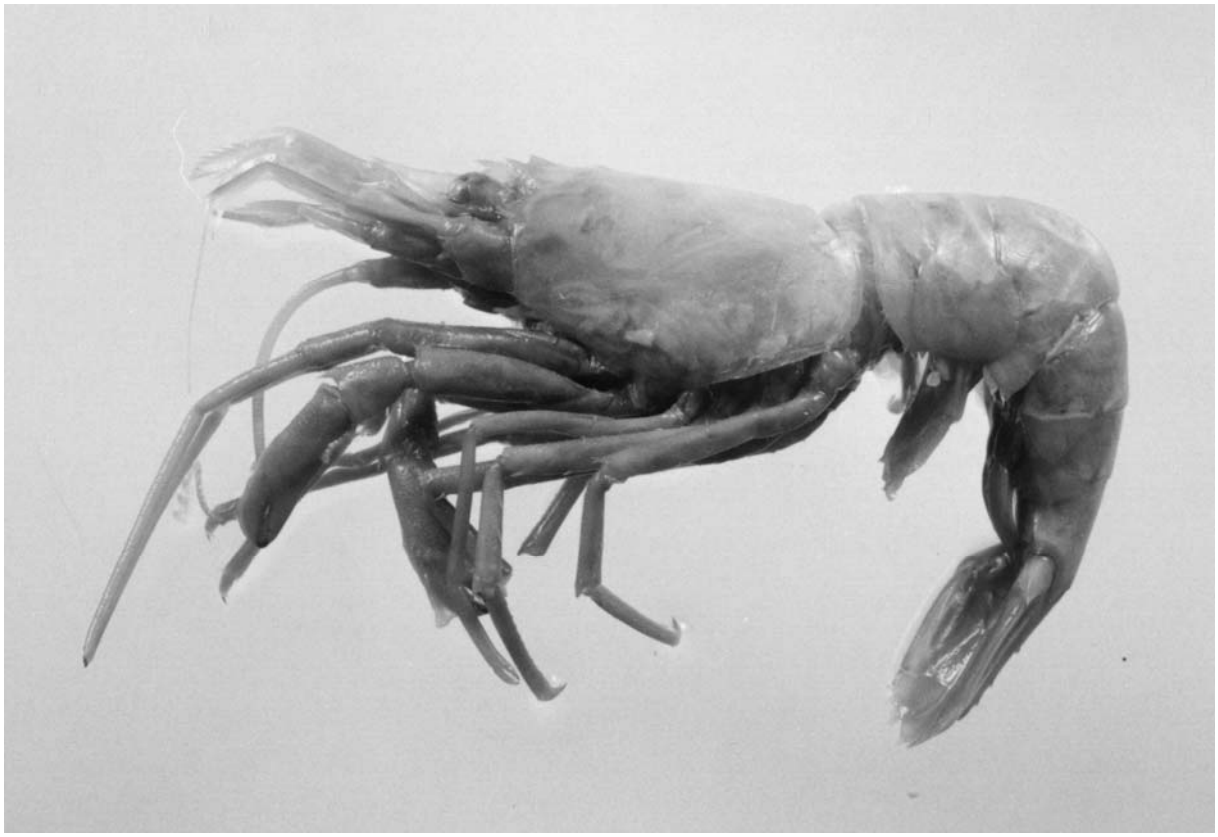

Fig. 23. *Rhynchocinetes typus* H. Milne Edwards, 1837. MNHN-Na 1843, syntype ♂, CL 23.2 mm. Photo by J. Okuno.

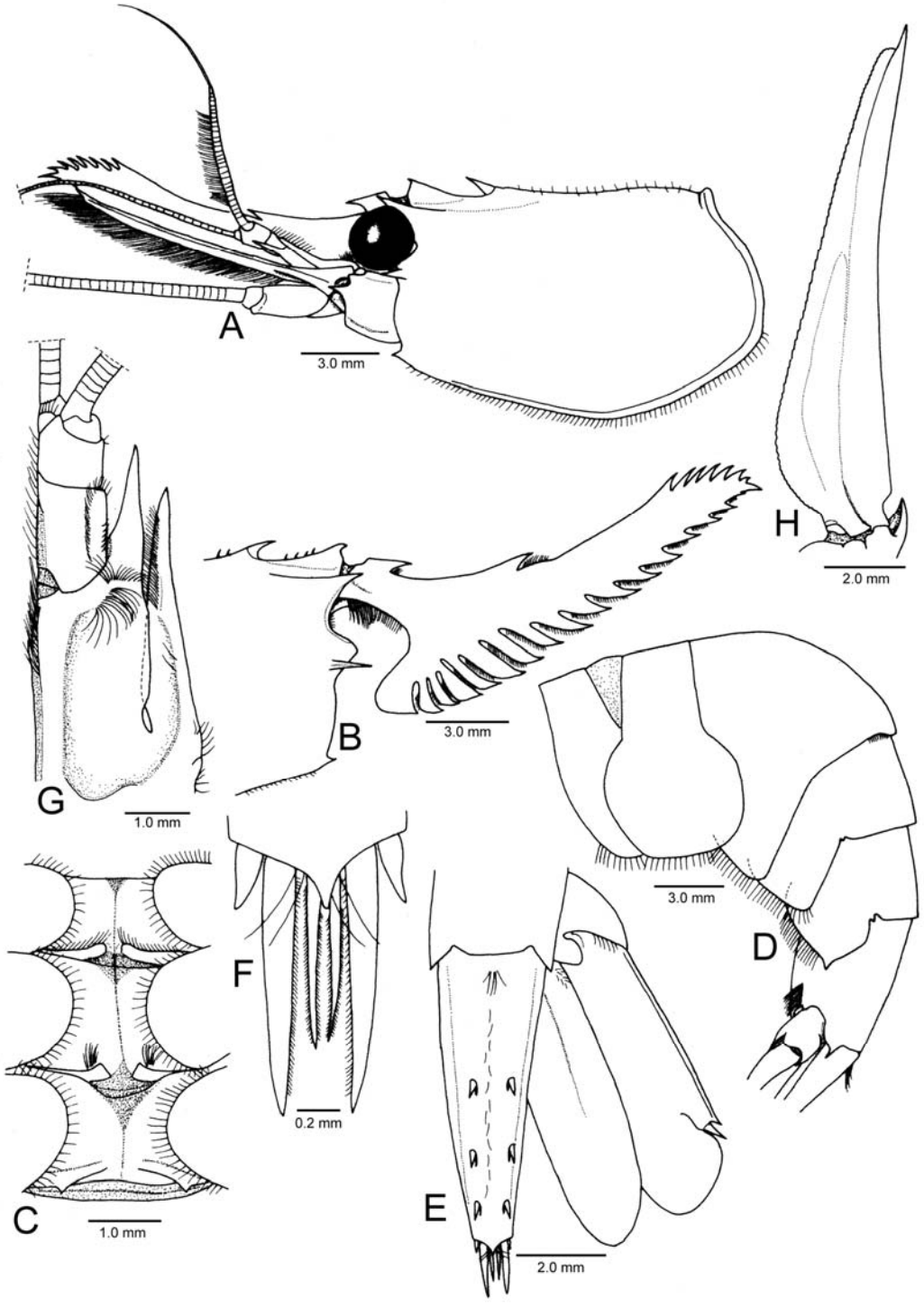

Fig. 24. *Rhynchocinetes typus* H. Milne Edwards, 1837. CMNH, ♂, CL 12.0 mm (A, B, D–H), CMNH, ♂, CL 10.9 mm (C). A, carapace and cephalic appendages, lateral; B, anterior part of carapace with rostrum, lateral; C, fifth to seventh thoracic sternites, ventral; D, abdominal somites, lateral; E, telson and right uropod, dorsal; F, tip of telson, dorsal; G, right antennular peduncle, dorsal; H, right scaphocerite, dorsal.

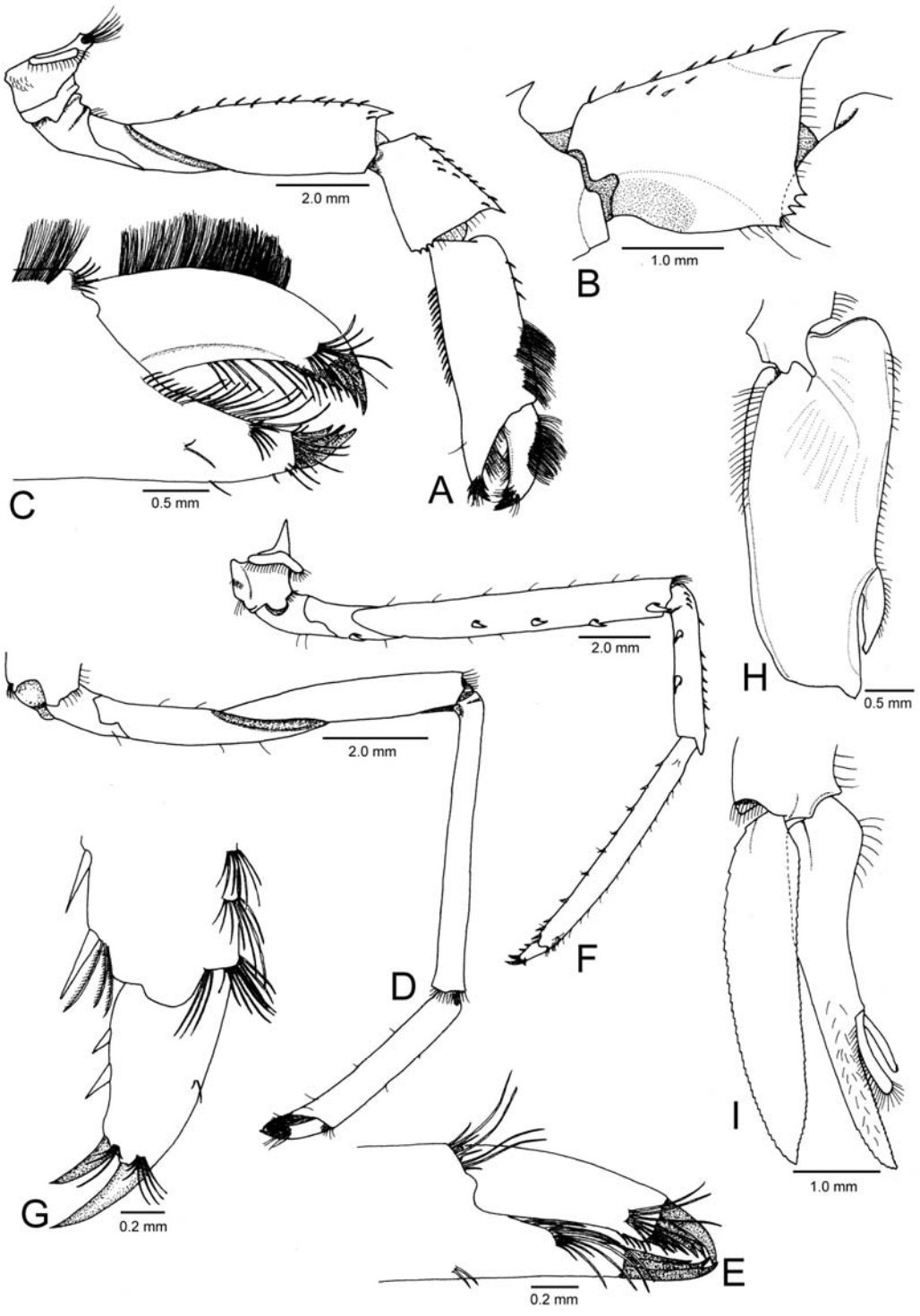

Fig. 25. *Rhynchocinetes typus* H. Milne Edwards, 1837. CMNH, ♂, CL 12.0 mm. A, right first pereiopod, lateral; B, same, carpus, lateral; C, same, dactylus and fixed finger, lateral; D, right second pereiopod, lateral; E, same, dactylus and fixed finger, lateral; F, right third pereiopod, lateral; G, same, dactylus, lateral; H, endopod of right first pleopod, external; I, right second pleopod, external.

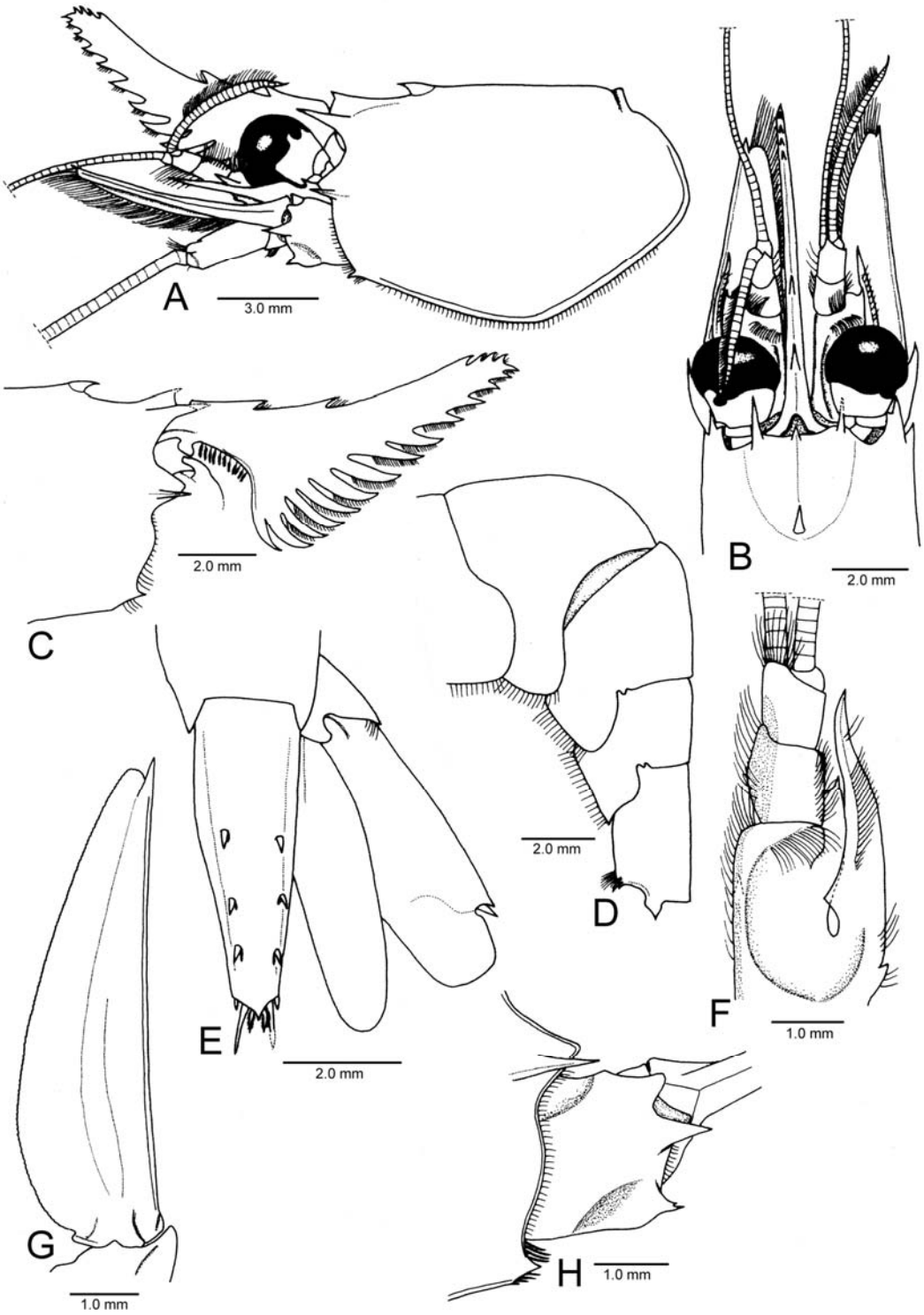

Fig. 26. *Bus australis* (Hale, 1941). NTM. Cr. 004933, ♂, CL 8.5 mm. A, carapace and cephalic appendages, lateral; B, anterior part of carapace and cephalic appendages, dorsal; C, anterior part of carapace with rostrum and interocular beak, lateral; D, third to sixth abdominal somites, lateral; E, telson and right uropod, dorsal; F, right antennular peduncle, dorsal; G, right scaphocerite, dorsal; H, right antennal basicerite, lateral.

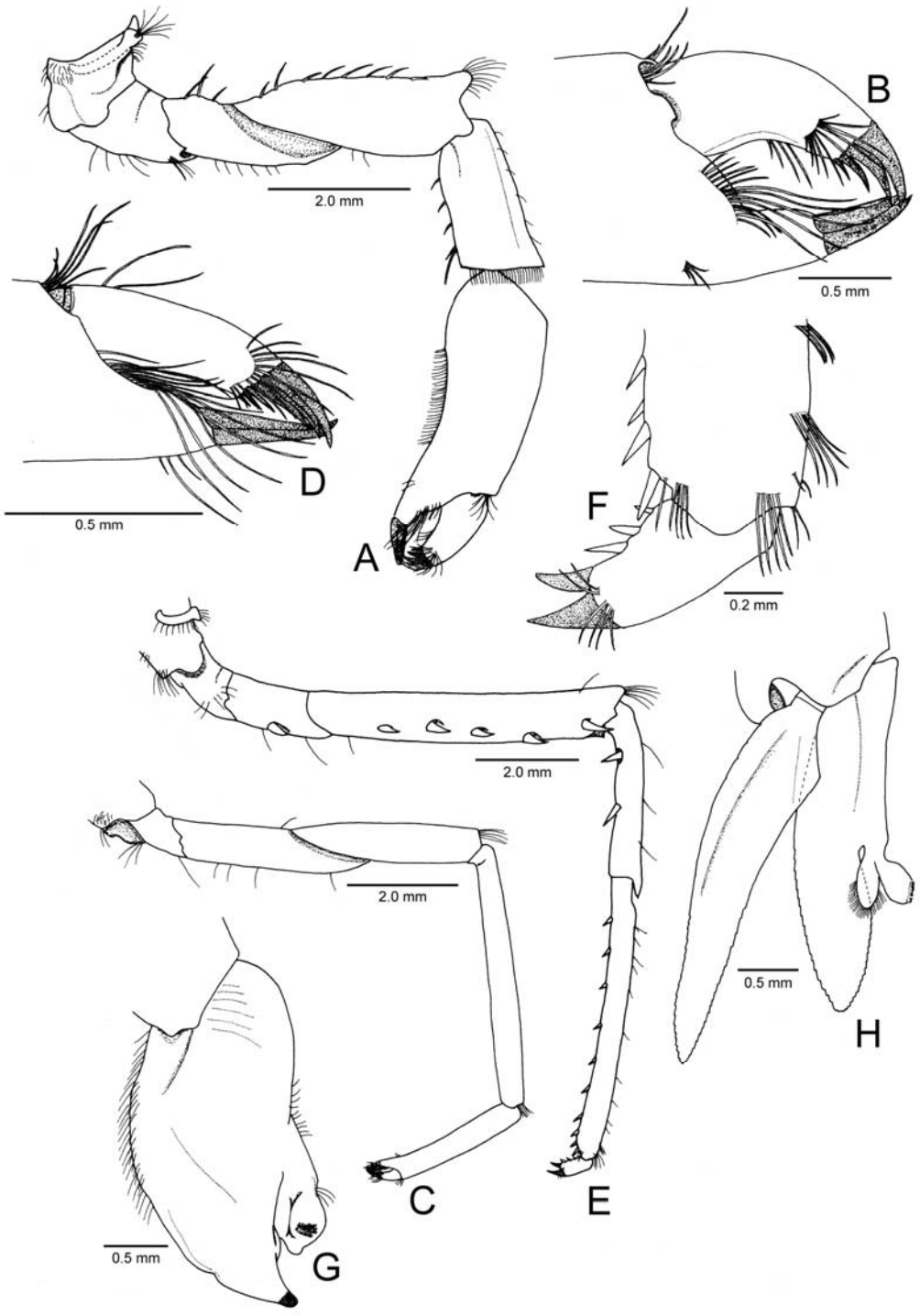

Fig. 27. *Bus australis* (Hale, 1941). NTM. Cr. 004933, ♂, CL 8.5 mm. A, right first pereiopod, lateral; B, same, dactylus and fixed finger, lateral; C, right second pereiopod, lateral; D, same, dactylus and fixed finger, lateral; E, right third pereiopod, lateral; F, same, dactylus, lateral; G, endopod of right first pleopod, external; H, right second pleopod, external.

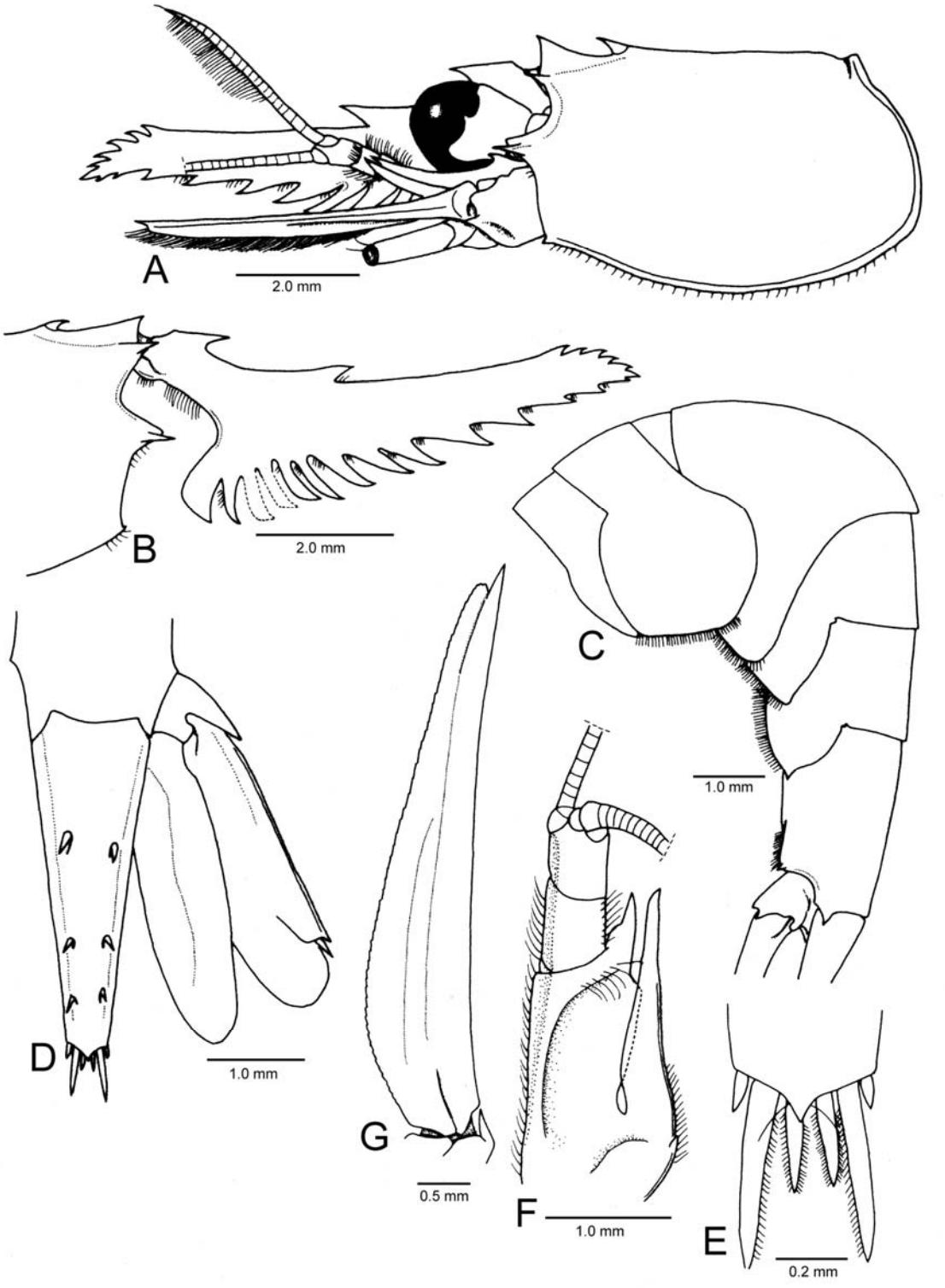

Fig. 28. *Bus balssi* (Gordon, 1936). CMNH, ♂, CL 5.2 mm. A, carapace and cephalic appendages, lateral; B, carapace with rostrum, lateral; C, abdominal somites, lateral; D, telson and right uropod, dorsal; E, tip of telson, dorsal; F, right antennular peduncle, dorsal; G, right scaphocerite, dorsal.

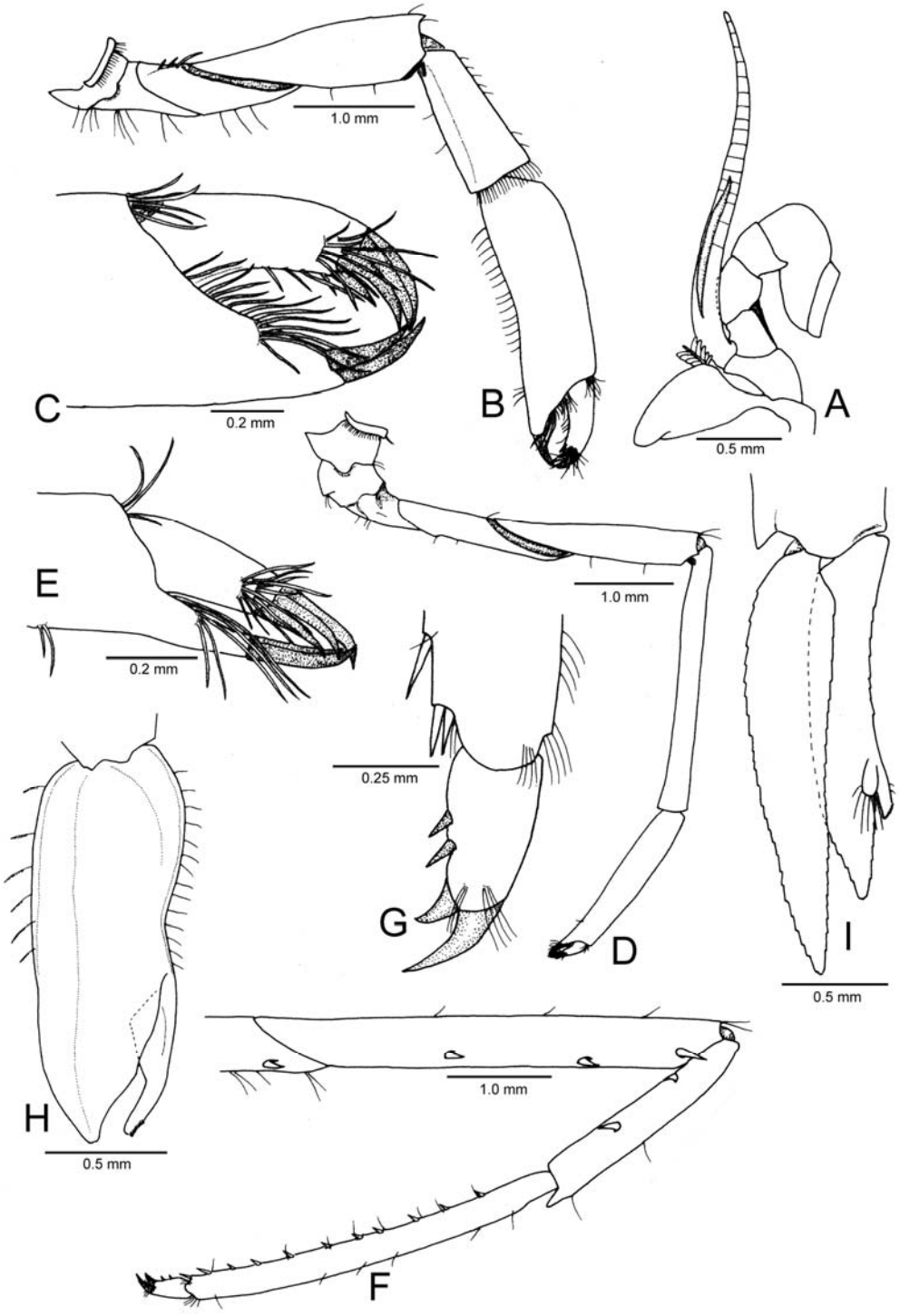

Fig. 29. *Bus balssi* (Gordon, 1936). CMNH, ♂, CL 5.2 mm. A, right second maxilliped, external; B, right first pereiopod, lateral; C, same, dactylus and fixed finger, lateral; D, right second pereiopod, lateral; E, same, dactylus and fixed finger, lateral; F, right third pereiopod, lateral; G, same, dactylus, lateral; H, endopod of right first pleopod, external; I, right second pleopod, external.

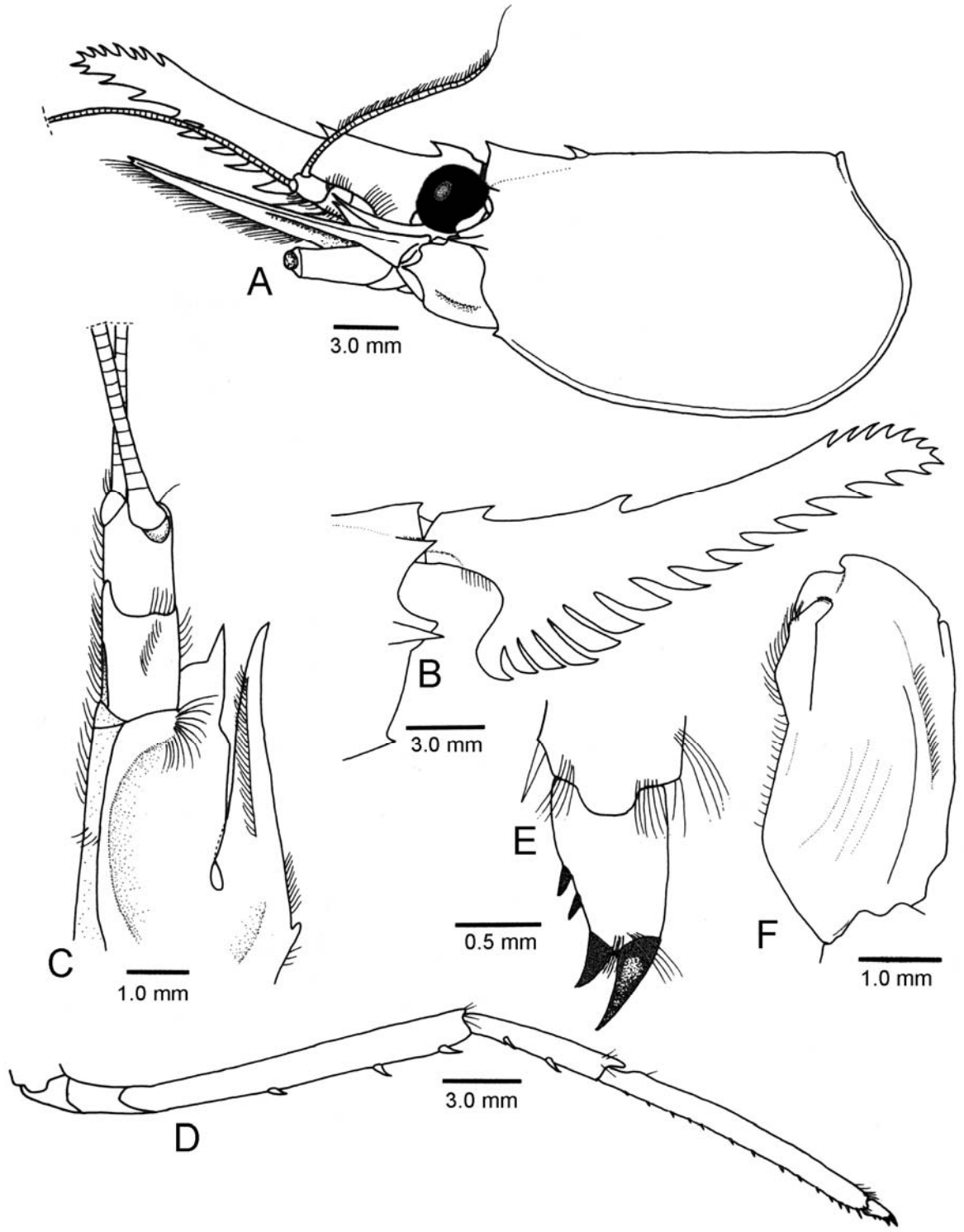

Fig. 30. *Bus brucei* (Okuno, 1994). NTOU-M00694, ♂, CL 15.1 mm. A, carapace and cephalic appendages, lateral; B, rostrum, lateral; C, right antennular peduncle, dorsal; D, right third pereiopod, lateral; E, same, dactylus, lateral; F, endopod of right pleopod, external.

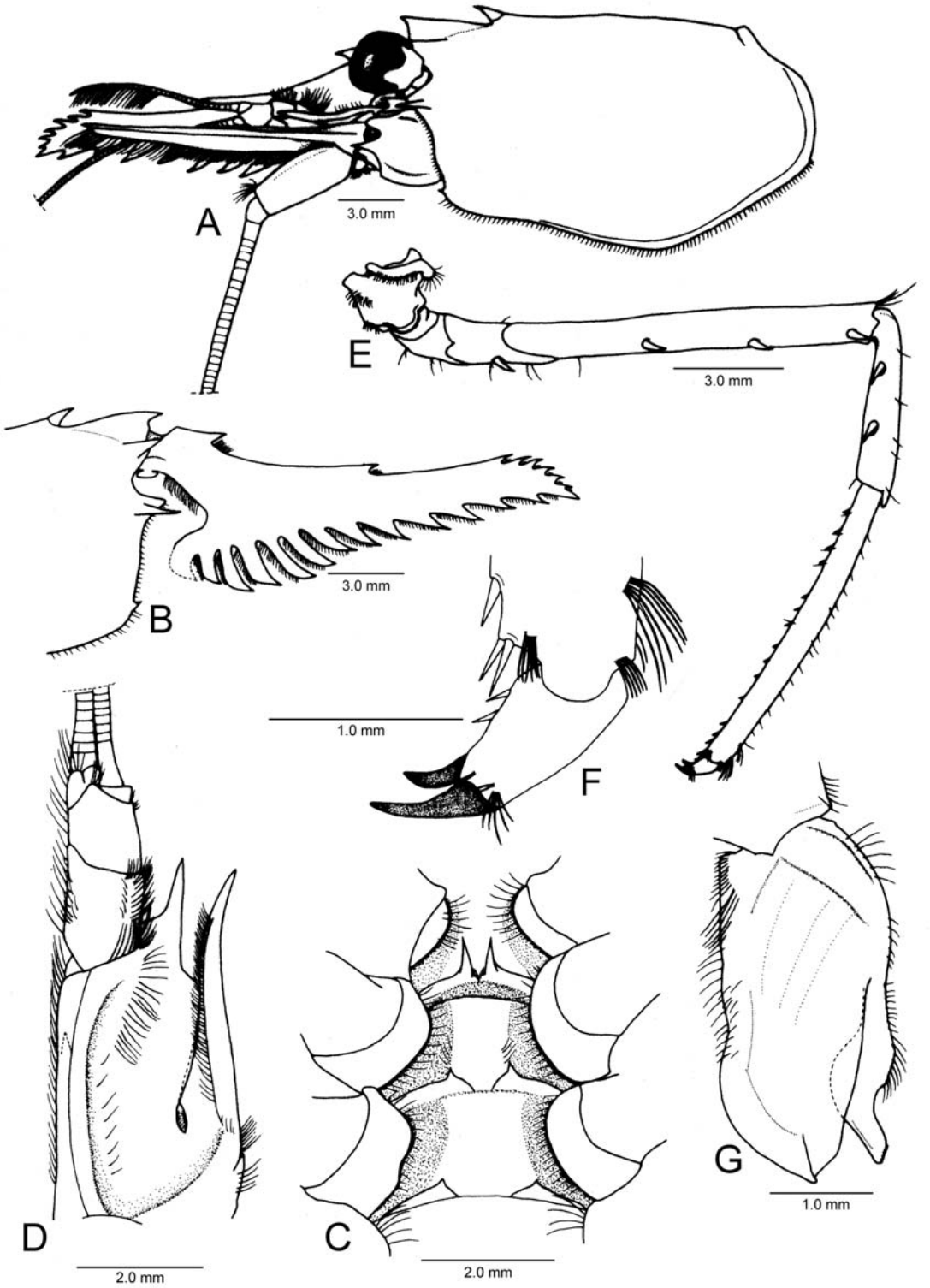

Fig. 31. *Bus conspiciocellus* (Okuno and Takeda, 1992).CMNH-ZC 00035, ♂, CL 13.9 mm. A, carapace and cephalic appendages, lateral; B, rostrum, lateral; C, fifth to seventh thoracic sternites, ventral; D, right antennular peduncle, dorsal; E, left third pereiopod, lateral; F, same, dactylus, lateral; G, endopod of right pleopod, external.

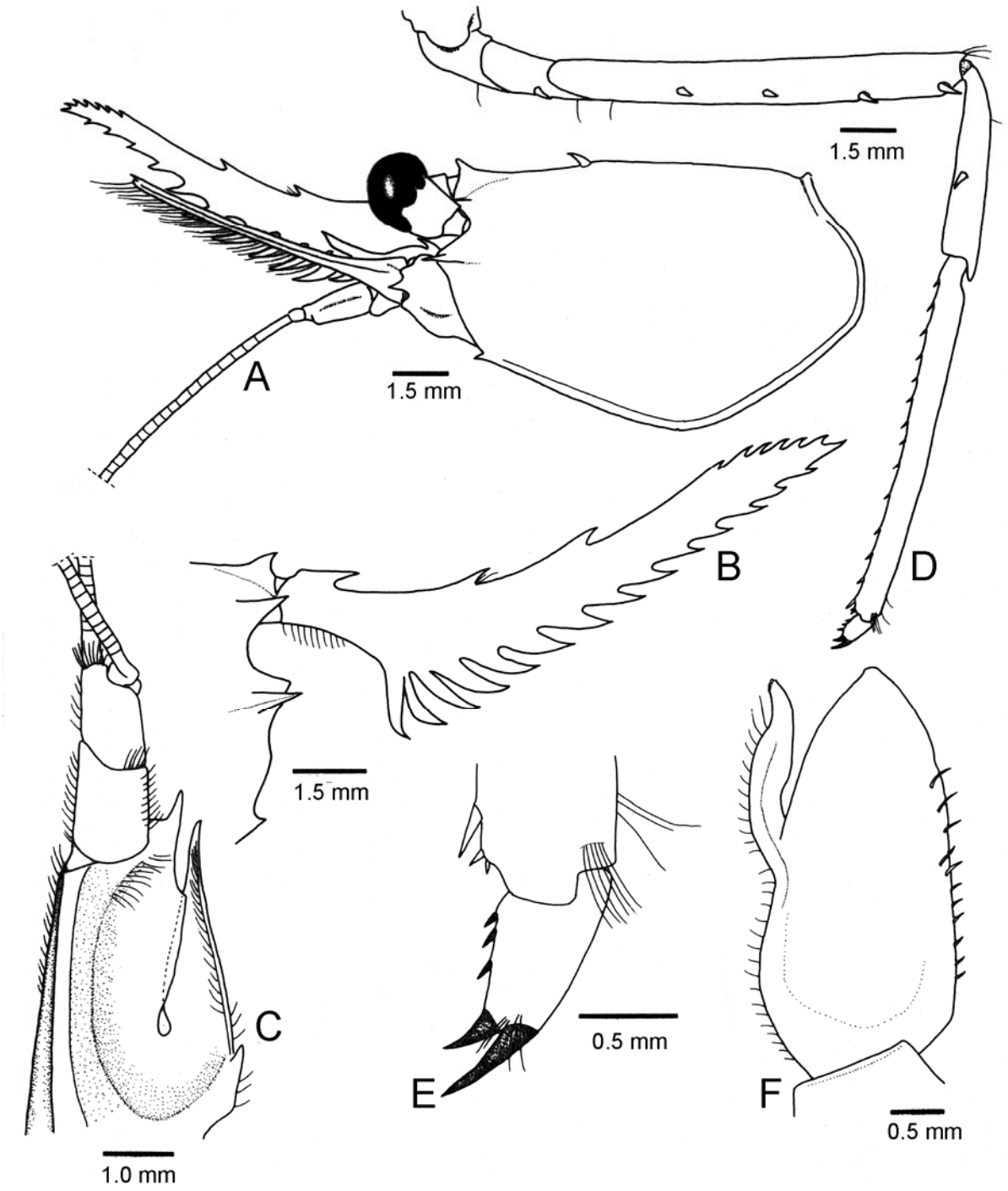

Fig. 32. *Bus durbanensis* (Gordon, 1936). ASIZ 70050, ovig.♀, CL 8.5 mm (A, B), ♂, CL 13.4 mm (C-F). A, carapace and cephalic appendages (left antennular peduncle damaged), lateral; B, rostrum, lateral; C, right antennular peduncle, dorsal; D, right third pereiopod, lateral; E, same, dactylus, lateral; F, endopod of right pleopod, external.

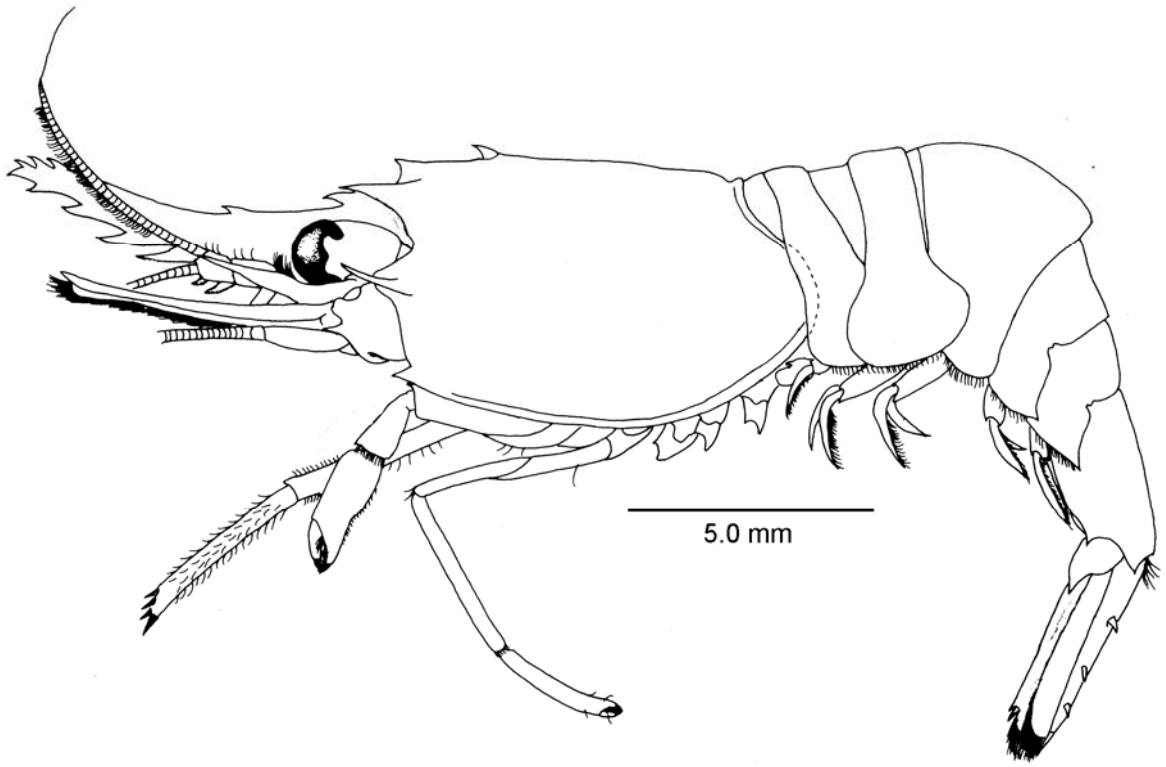

Fig. 33. *Bus enigma* (Okuno, 1997). SAMA C5599, holotype ♂, CL 6.8 mm. Entire animal, lateral. Modified Okuno (1997a).

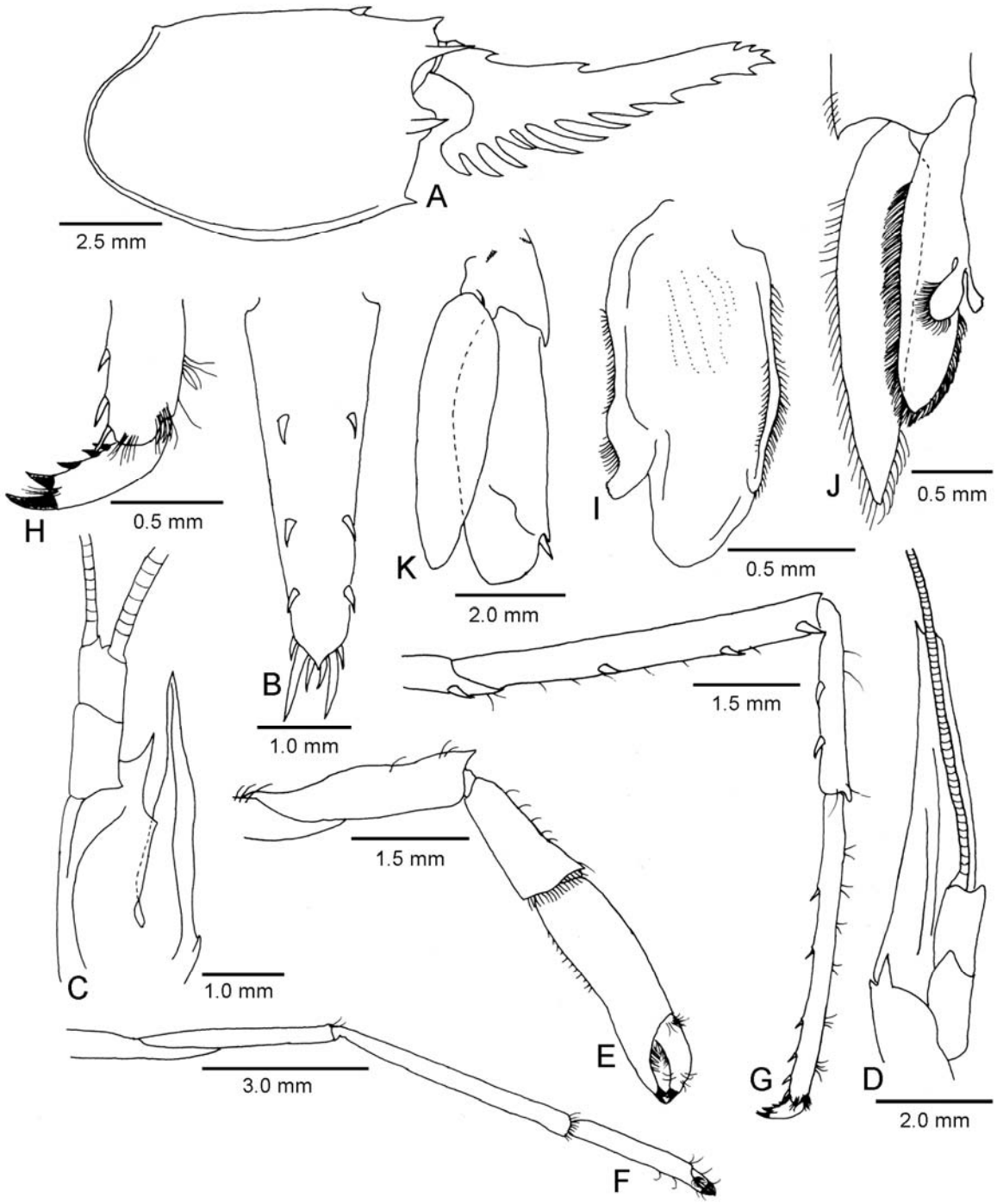

Fig. 34. *Bus enigma* (Okuno, 1997). SAMA C5599, holotype ♂, CL 6.8 mm. A, carapace with rostrum, lateral; B, telson, dorsal; C, right antennular peduncle, dorsal; D, right antenna, ventral; E, right first pereiopod, lateral; F, right second pereiopod, lateral; G, right third pereiopod, lateral; H, same, dactylus, lateral; I, endopod of right first pleopod, ventral; J, right second pleopod, external; K, right uropod, dorsal. Modified Okuno (1997a).

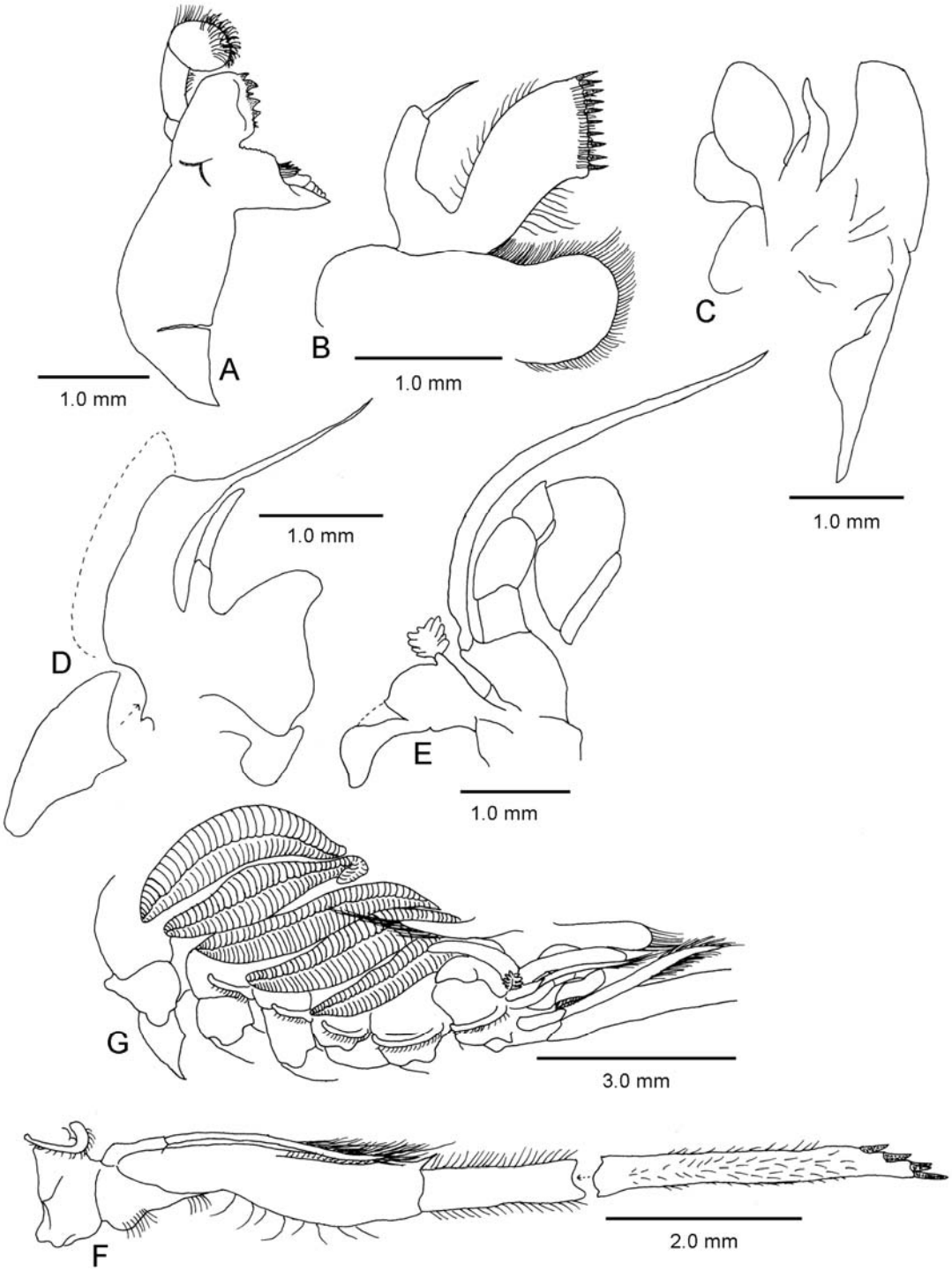

Fig. 35. *Bus enigma* (Okuno, 1997). SAMA C5600, paratype ♂, CL 7.6 mm. Right mouthparts. A, mandible, external; B, maxillula, external; C, maxilla, dorsal; D, first maxilliped (anterior lobe of epipod broken), external; E, second maxilliped, external; F, third maxilliped, lateral; G, right branchial chamber, lateral. Modified Okuno (1997a).

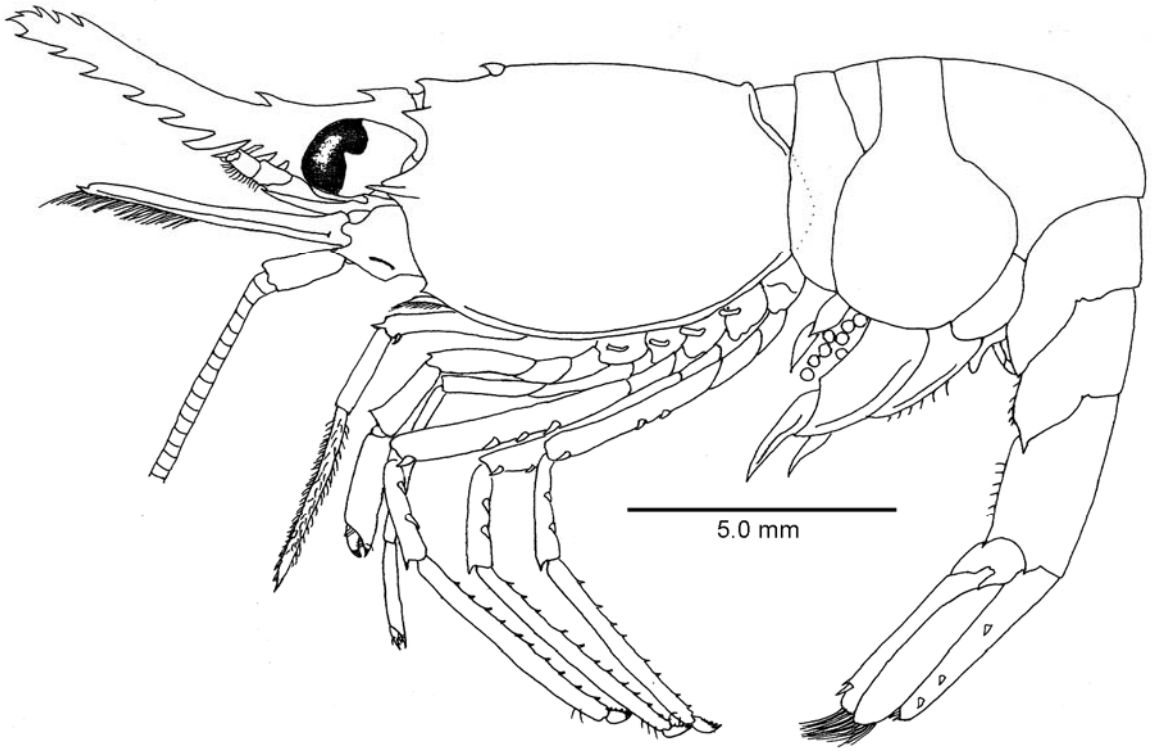

Fig. 36. *Bus holthuisi* (Okuno, 1997). RMNH D47456, holotype ovig.♀, CL 5.9 mm. Entire animal, lateral. Modified Okuno (1997b).

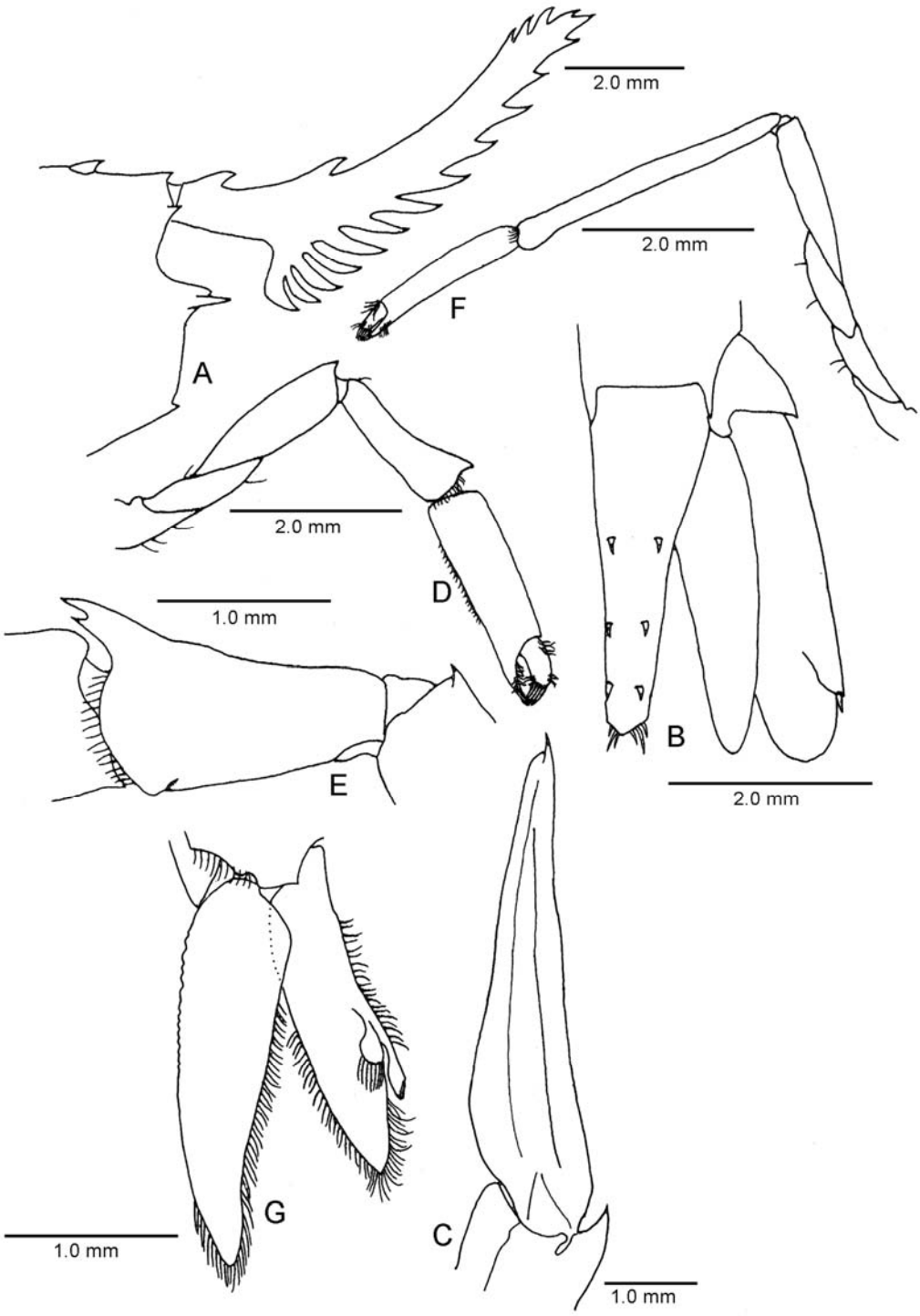

Fig. 37. *Bus holthuisi* (Okuno, 1997). RMNH D47456, holotype ovig.♀, CL 5.9 mm (A–D, F); RMNH D47457, paratype ♂, CL 9.6 mm (E, G). A, anterior part of carapace with rostrum, lateral; B, telson and risht uropod, dorsal; C, right scaphocerite, dorsal; D, right first pereiopod, lateral; E, carpus of left first pereiopod, lateral; F, left second pereiopod, lateral; G, right second pleopod, external. Modified Okuno (1997b).

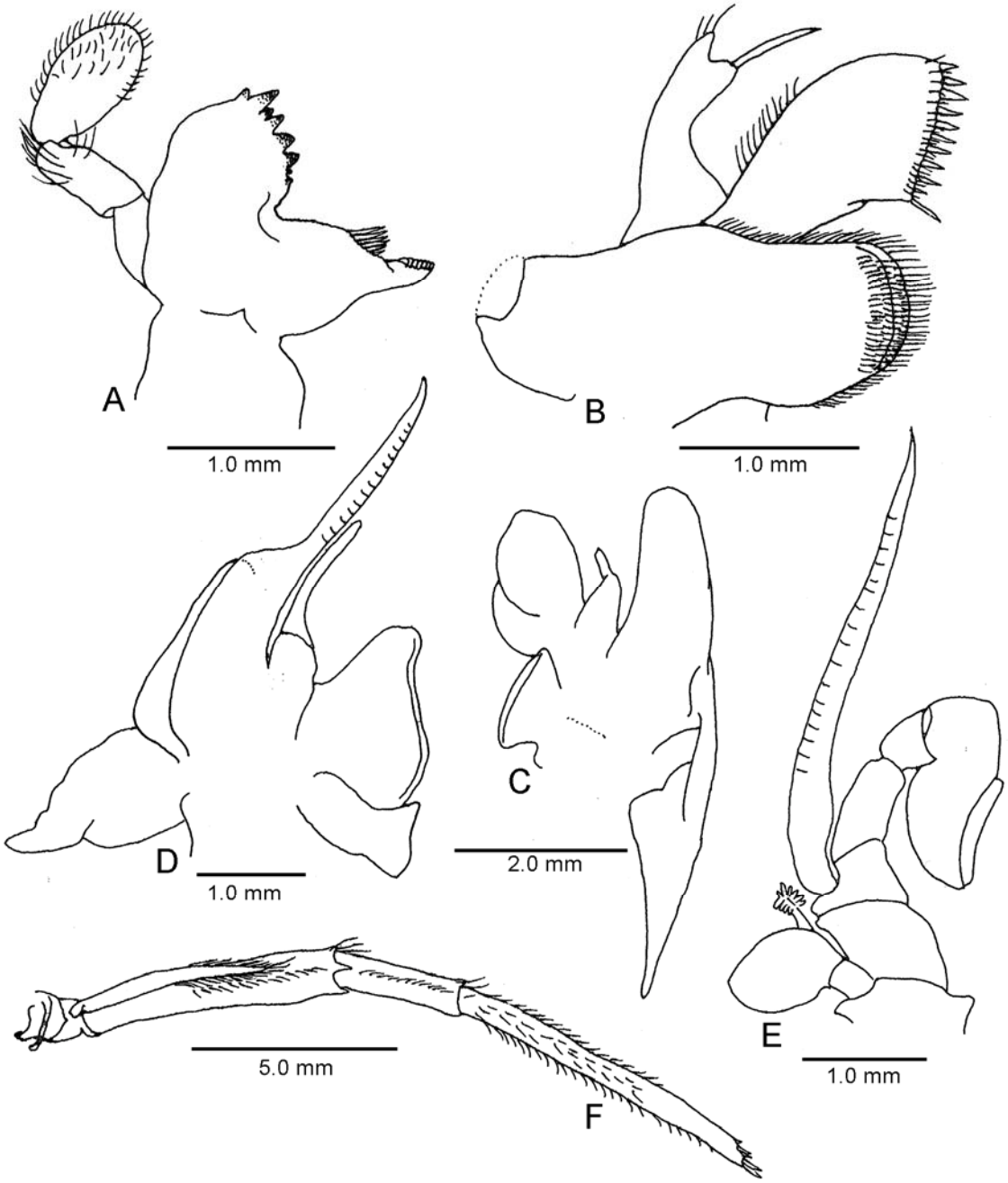

Fig. 38. *Bus holthuisi* (Okuno, 1997). RMNH D47457, paratype ♂, CL 9.6 mm. Right mouthparts. A, mandible, external; B, maxillula, external; C, maxilla, dorsal; D, first maxilliped, external; E, second maxilliped, external; F, third maxilliped, lateral. Modified Okuno (1997b).

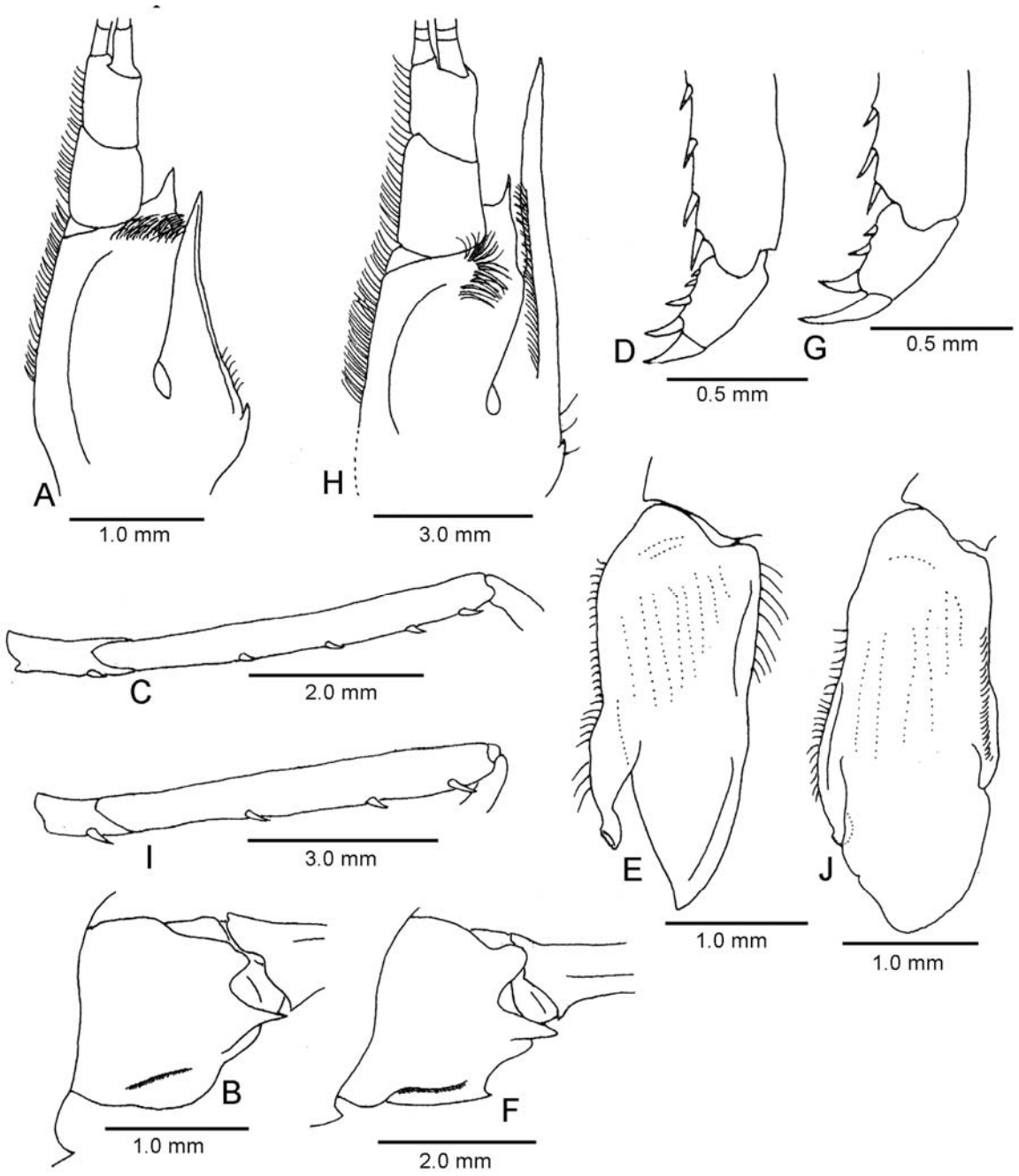

Fig. 39. Comparisons of distinguishing features. A–D, *Bus holthuisi* (Okuno, 1997), RMNH D47456, holotype ovig.♀, CL 5.9 mm; E, *B. holthuisi* (Okuno, 1997), RMNH D47457, paratype ♂, CL 9.6 mm; F, *B. australis* (Hale, 1941), NTM Cr. 006934, ♂, CL 9.1 mm; G, *B. conspiciocellus* (Okuno and Takeda, 1992), CBM-ZC 3134, ♂, CL 5.6 mm; H, *B. kuiteri* (Tiefenbacher, 1983), SAMA C5603, ♂, CL 16.4 mm; I, J, *B. uritai* Kubo, 1942, CBM-ZC 3133, ♂, CL 7.4 mm. A, H, right antennular peduncle, dorsal; B, F, right antennal basicerite, lateral; C, I, ischium and merus of right third pereiopod, lateral; D, G, dactylus of right third pereiopod, lateral; E, J, endopod of right first pleopod, ventral. Modified Okuno (1997b).

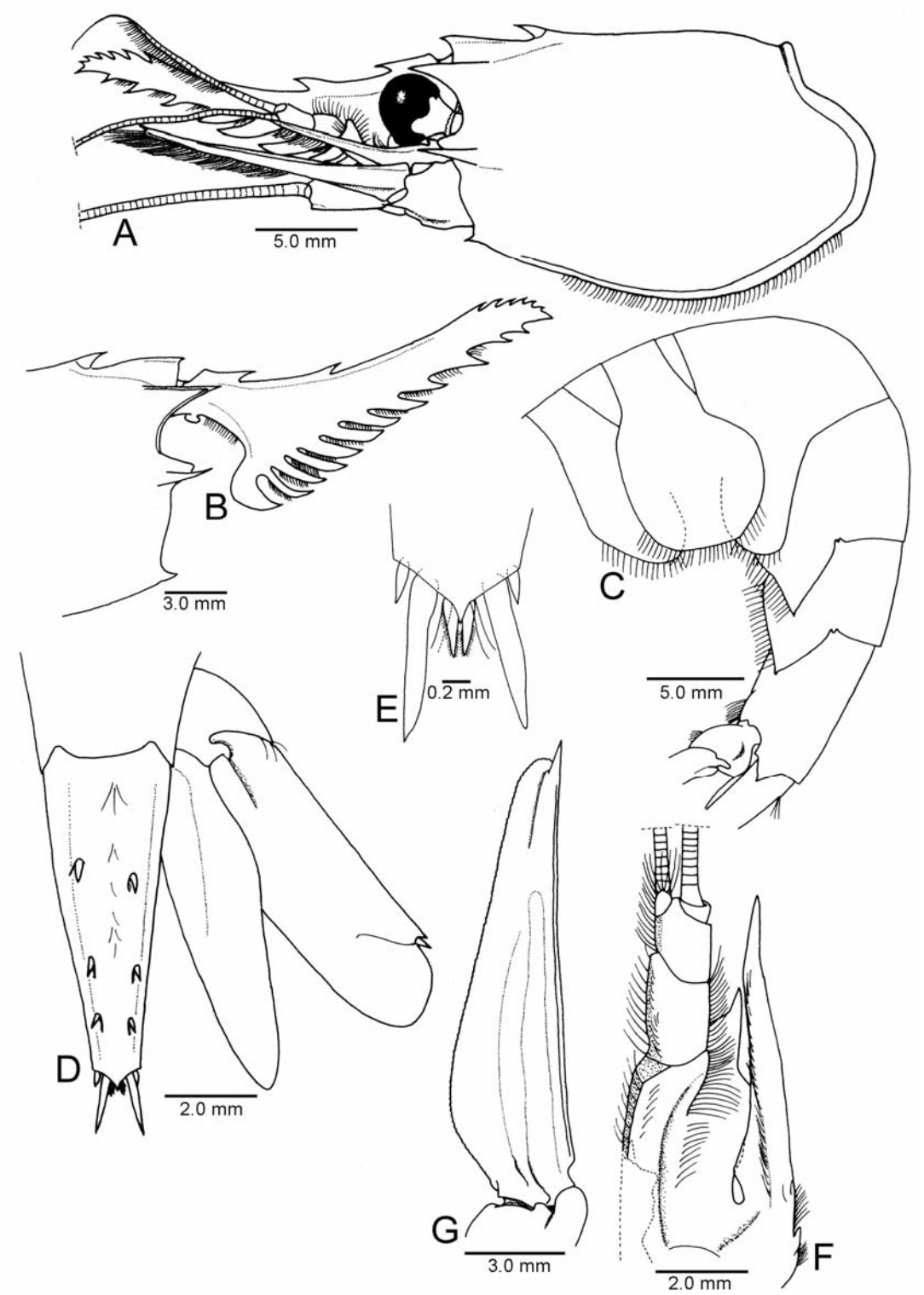

Fig. 40. *Bus kuiteri* (Tiefenbacher, 1983). SAMA C5603, ♂, CL 16.4 mm (A–C, F, G), NSMT, ♂, CL 12.7 mm (D, E). A, carapace and cephalic appendages, lateral; B, anterior part of carapace and cephalic appendages, dorsal; C, abdominal somites, lateral; D, telson and right uropod, dorsal; E, tip of telson, dorsal; F, right antennular peduncle, dorsal (proximomedial part broken); G, right scaphocerite, dorsal.

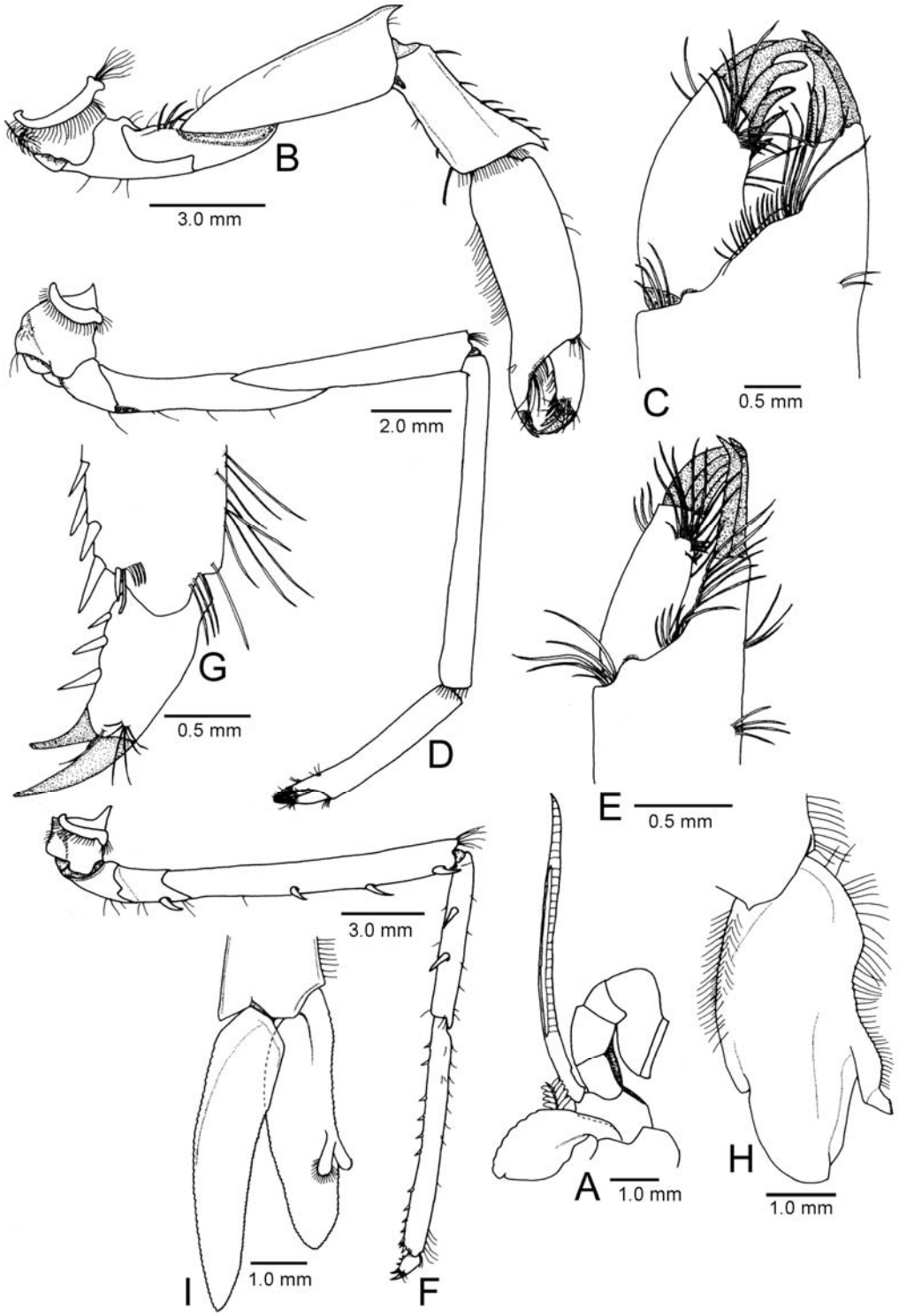

Fig. 41. *Bus kuiteri* (Tiefenbacher, 1983). SAMA C5603, ♂, CL 16.4 mm. A, right second maxilliped, external; B, right first pereiopod, lateral; C, same, dactylus and fixed finger, lateral; D, right second pereiopod, lateral; E, same, dactylus and fixed finger, lateral; F, right third pereiopod, lateral; G, same, dactylus, lateral; H, endopod of right first pleopod, external; I, right second pleopod, external.

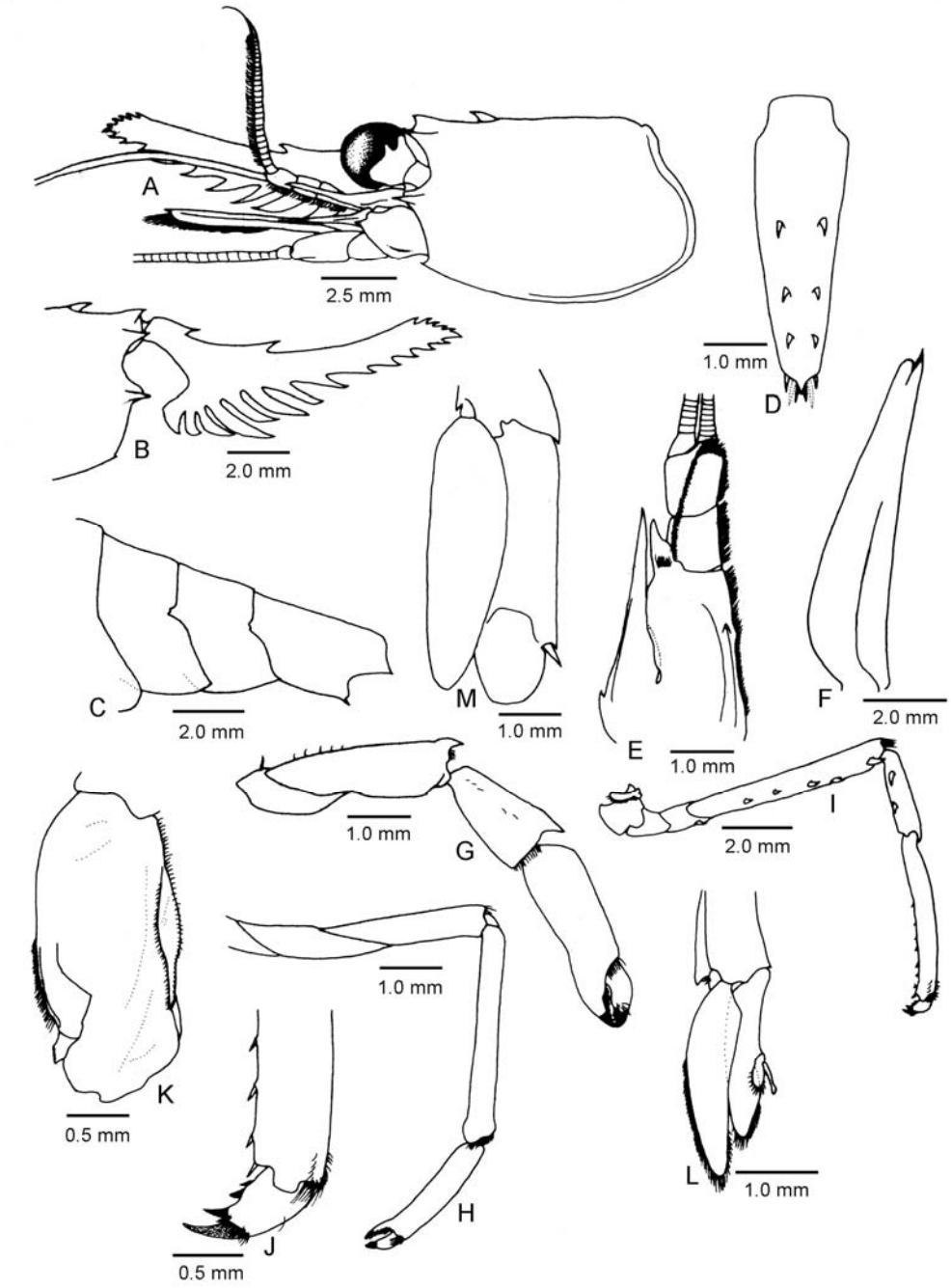

Fig. 42. *Bus rathbunae* (Okuno, 1996). BPBM S11275, holotype ♂, CL 7.0 mm. A, carapace and cephalic appendages, lateral; B, anterior part of carapace with rostrum, lateral; C, fourth to sixth abdominal somites, lateral; D, telson, dorsal; E, right antennular peduncle, ventral; F, right scaphocerite, dorsal; G, right first pereiopod, lateral; H, right second pereiopod, lateral; I, right third pereiopod, lateral; J, same, dactylus, lateral; K, endopod of right first pleopod, ventral; L, right second pleopod, external; M, right uropod, dorsal. Modified Okuno (1996a).

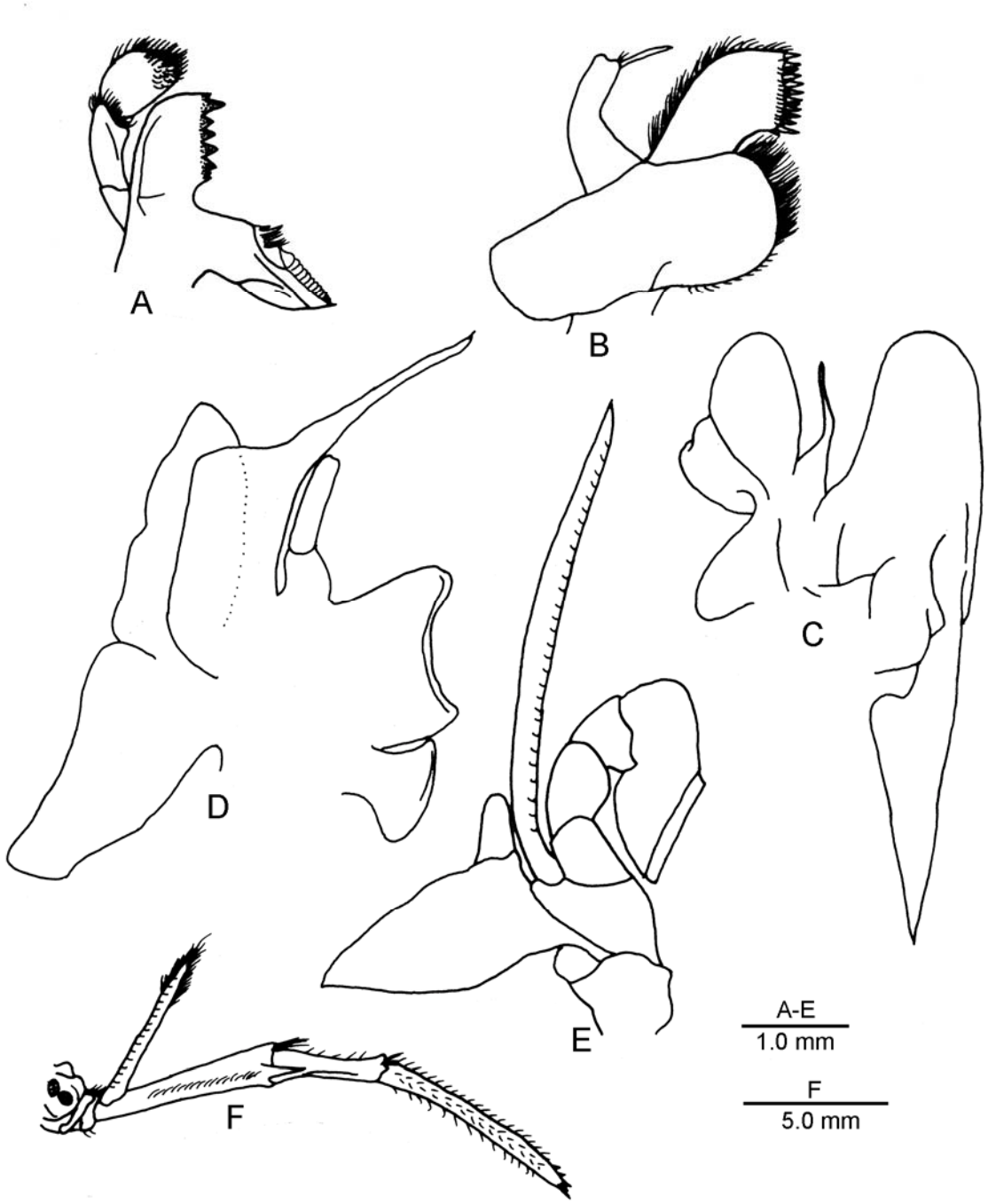

Fig. 43. *Bus rathbunae* (Okuno, 1996). BPBM S11276, paratype ♂, CL 11.6 mm. Right mouthparts. A, mandible, external; B, maxillula, external; C, maxilla, dorsal; D, first maxilliped, external; E, second maxilliped, external; F, third maxilliped, lateral. Modified Okuno (1996a).

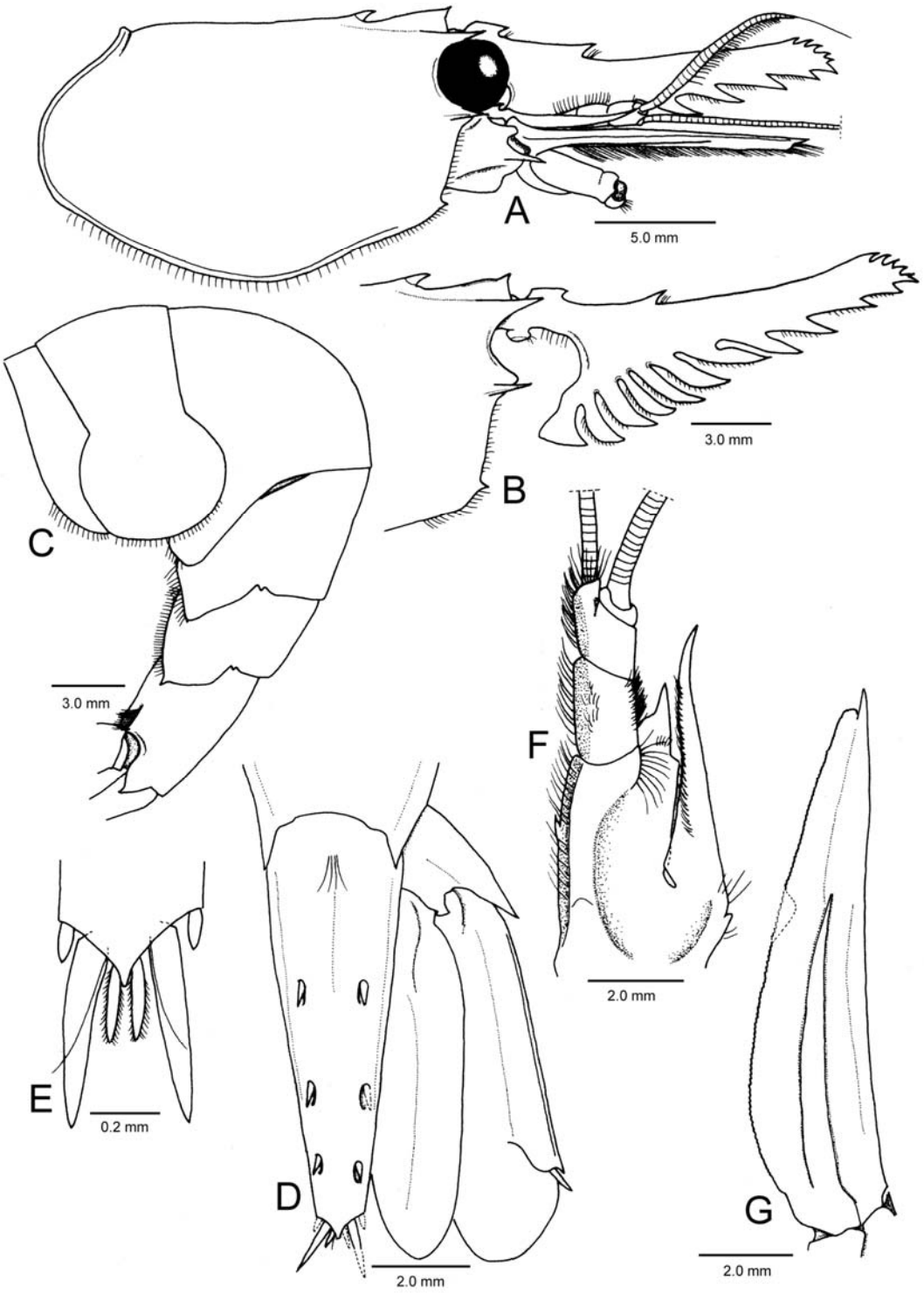

Fig. 44. *Bus serratus* (H. Milne Edwards, 1837). SAMA, ♂, CL 13.3 mm (A–D, F, G), NTM. Cr. 000343, ♂, CL 5.8 mm (E). A, carapace and cephalic appendages, lateral; B, anterior part of carapace and cephalic appendages, dorsal; C, abdominal somites, lateral; D, telson and right uropod, dorsal; E, tip of telson, dorsal; F, right antennular peduncle, dorsal; G, right scaphocerite, dorsal.

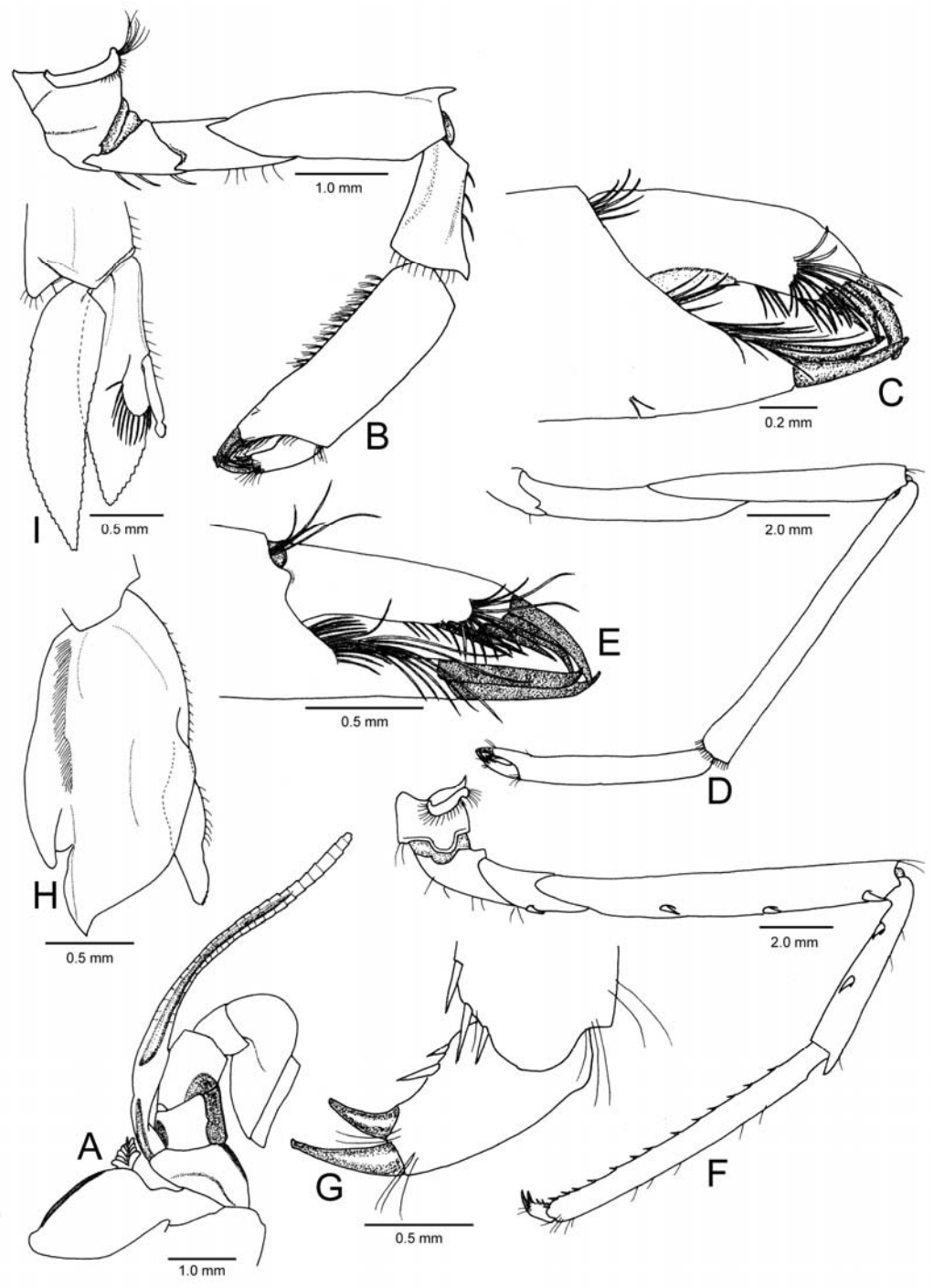

Fig. 45. *Bus serratus* (H. Milne Edwards, 1837). SAMA, ♂, CL 13.3 mm (A, D–H), NTM. Cr. 000343, ♂, CL 5.8 mm (B, C, I). A, right second maxilliped, external; B, right first pereiopod, lateral; C, same, dactylus and fixed finger, lateral; D, right second pereiopod, lateral; E, same, dactylus and fixed finger, lateral; F, right third pereiopod, lateral; G, same, dactylus, lateral; H, endopod of right first pleopod, external; I, right second pleopod, external.

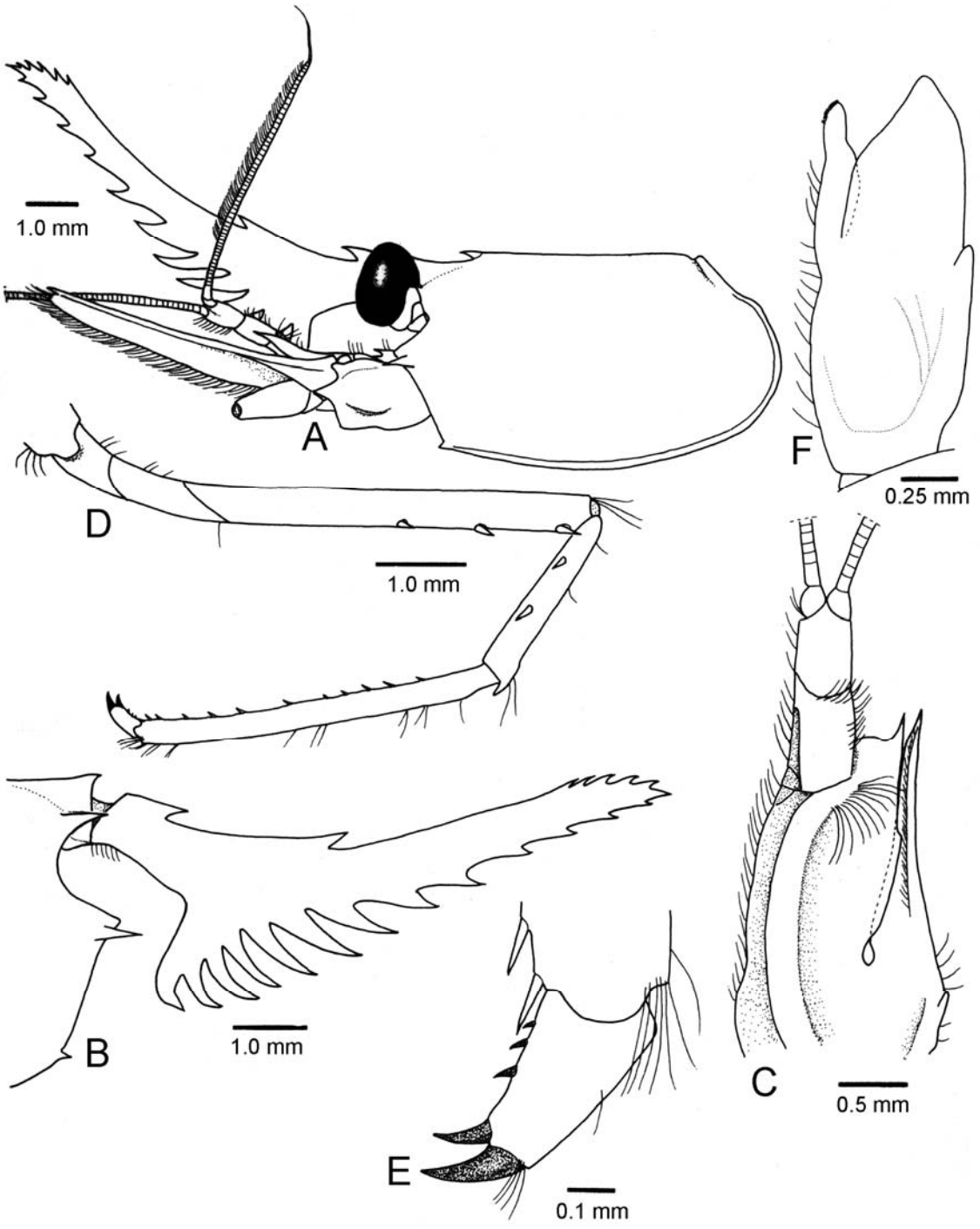

Fig. 46. *Bus uritai* (Kubo, 1942). NTOU-M00679, ♂, CL 5.4 mm. A, carapace and cephalic appendages, lateral; B, anterior part of carapace with rostrum, lateral; C, right antennular peduncle, dorsal; D, right third pereiopod, lateral; E, same, dactylus, lateral; F, endopod of right first pleopod, external.

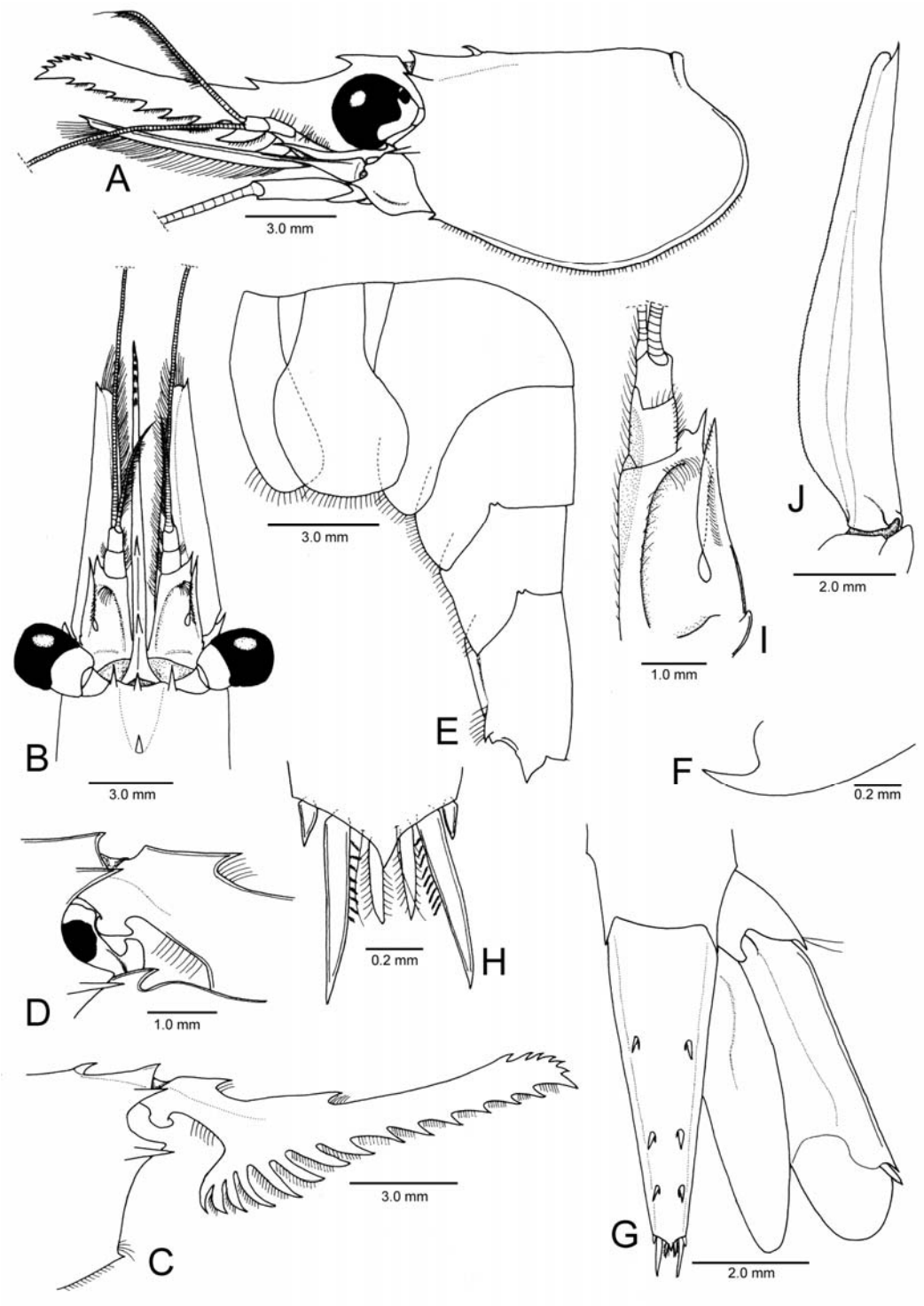

Fig. 47. *Bus* sp. 1. CMNH, ♂, CL 8.4 mm. A, carapace and cephalic appendages, lateral; B, anterior part of carapace and cephalic appendages, dorsal; C, anterior part of carapace with rostrum, lateral; D, orbital region of carapace, lateral; E, abdominal somites, lateral; F, anal spine, lateral; G, telson and right uropod, dorsal; H, tip of telson, dorsal; I, right antennular peduncle, dorsal; J, right scaphocerite, dorsal.

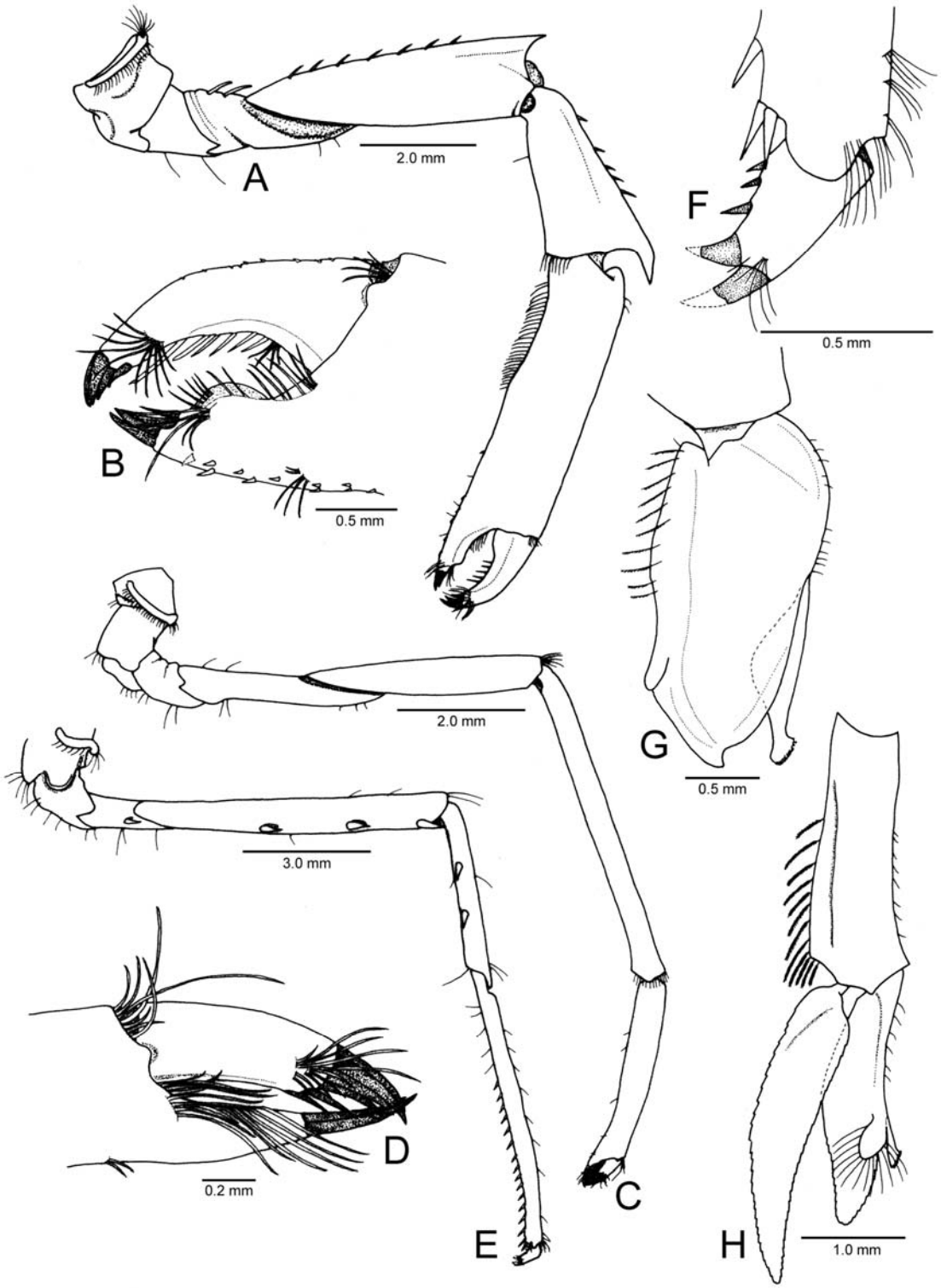

Fig. 48. *Bus* sp. 1. CMNH, ♂, CL 8.4 mm. A, right first pereiopod, lateral; B, same, dactylus and fixed finger, mesial; C, right second pereiopod, lateral; D, same, dactylus and fixed finger, lateral; E, right third pereiopod, lateral; F, same, dactylus, lateral (distal parts of ungues broken); G, endopod of right first pleopod, external; H, right second pleopod, external.

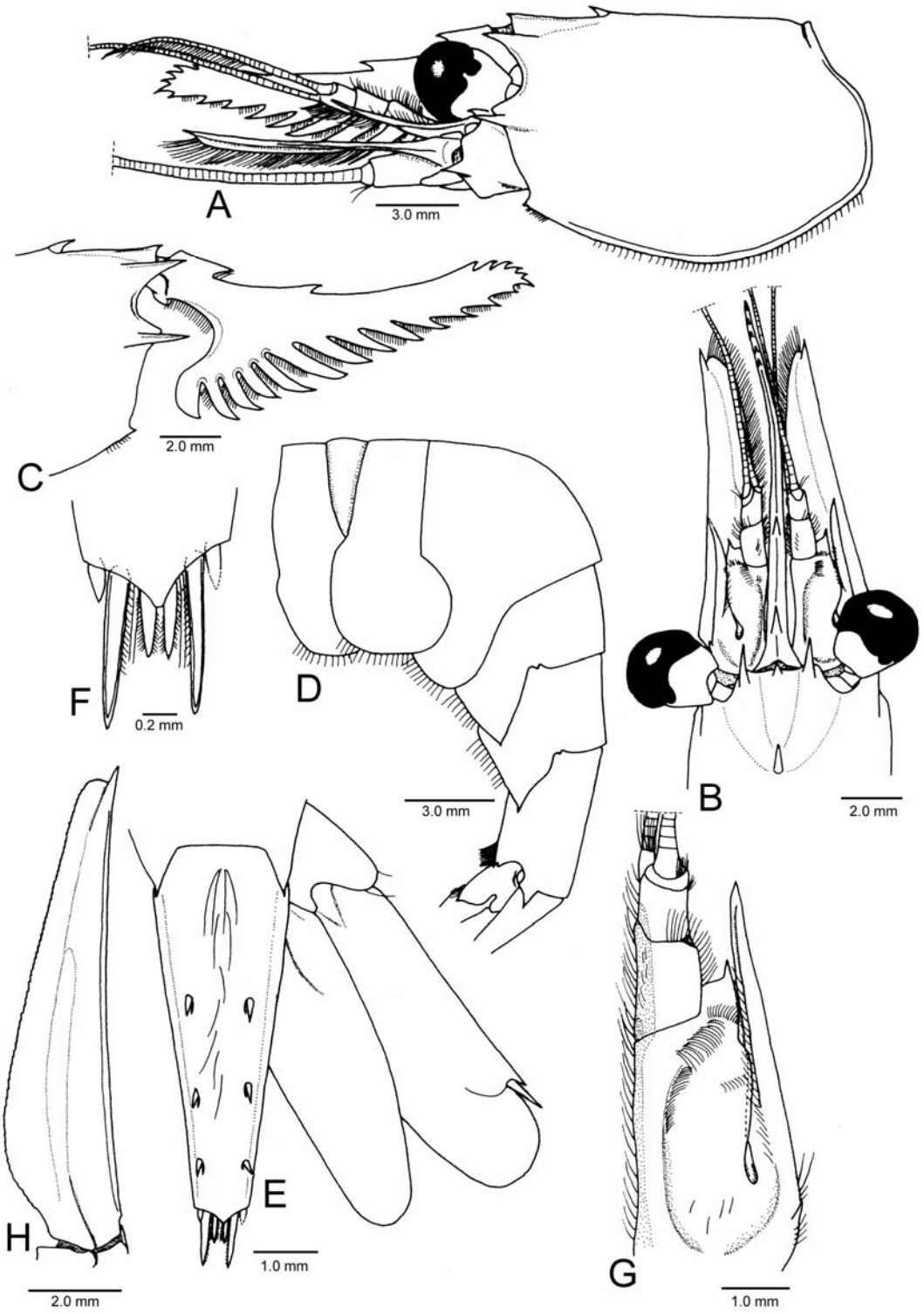

Fig. 49. *Bus* sp. 2. TM G 3711, ♂, CL 10.6 mm (A, C–H), TM, ♂, CL 9.0 mm (B). A, carapace and cephalic appendages, lateral; B, anterior part of carapace and cephalic appendages, dorsal; C, anterior part of carapace with rostrum, lateral; D, abdominal somites, lateral; E, telson and right uropod, dorsal; F, tip of telson, dorsal; G, right antennular peduncle, dorsal; H, right scaphocerite, dorsal.

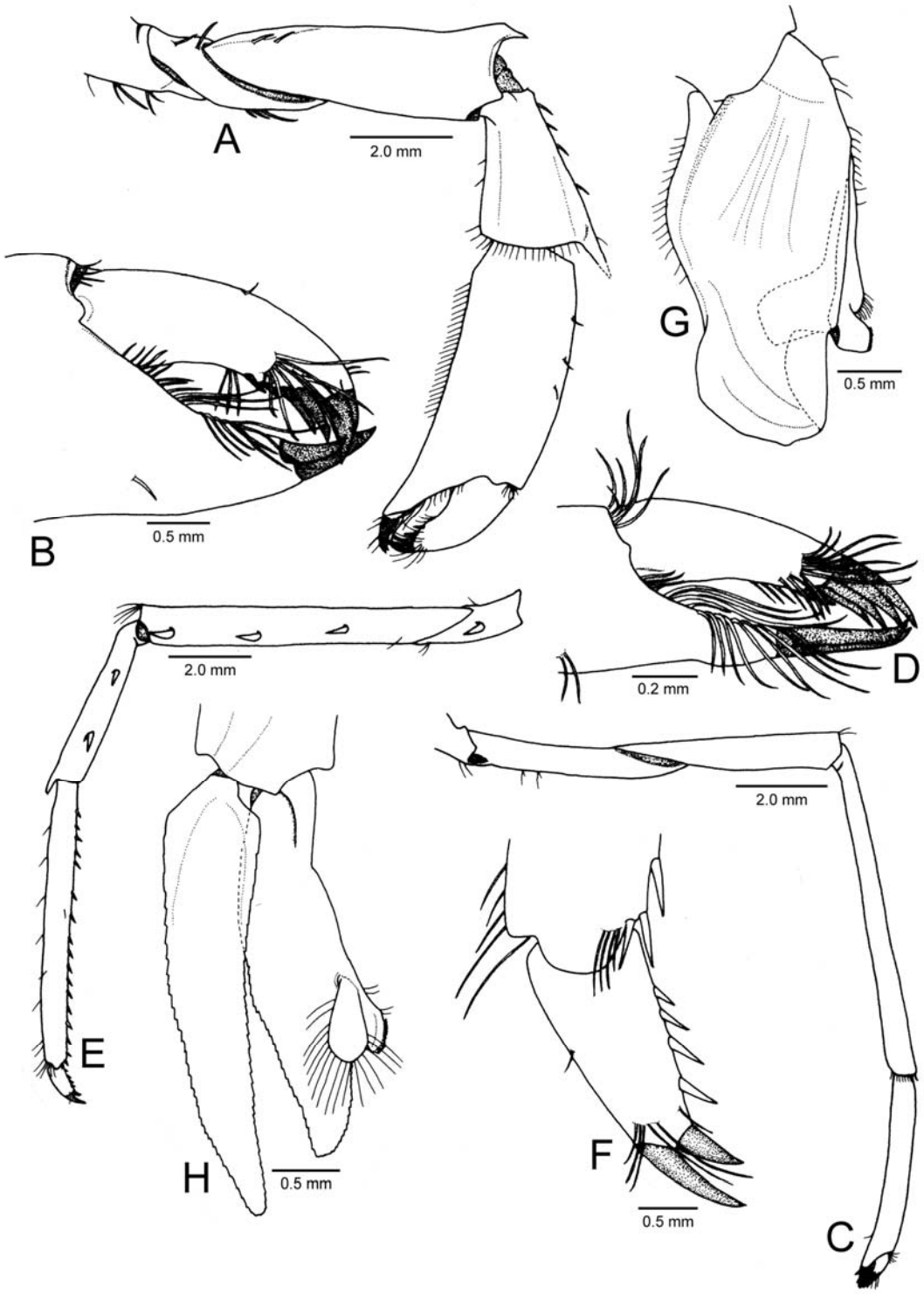

Fig. 50. *Bus* sp. 2. TM G 3711, ♂, CL 10.6 mm (A–G), TM, ♂, CL 9.0 mm. A, right first pereiopod, lateral; B, same, dactylus and fixed finger, lateral C, right second pereiopod, lateral; D, same, dactylus and fixed finger, lateral; E, left third pereiopod, lateral; F, same, dactylus, lateral; G, endopod of right first pleopod, external; H, right second pleopod, external.

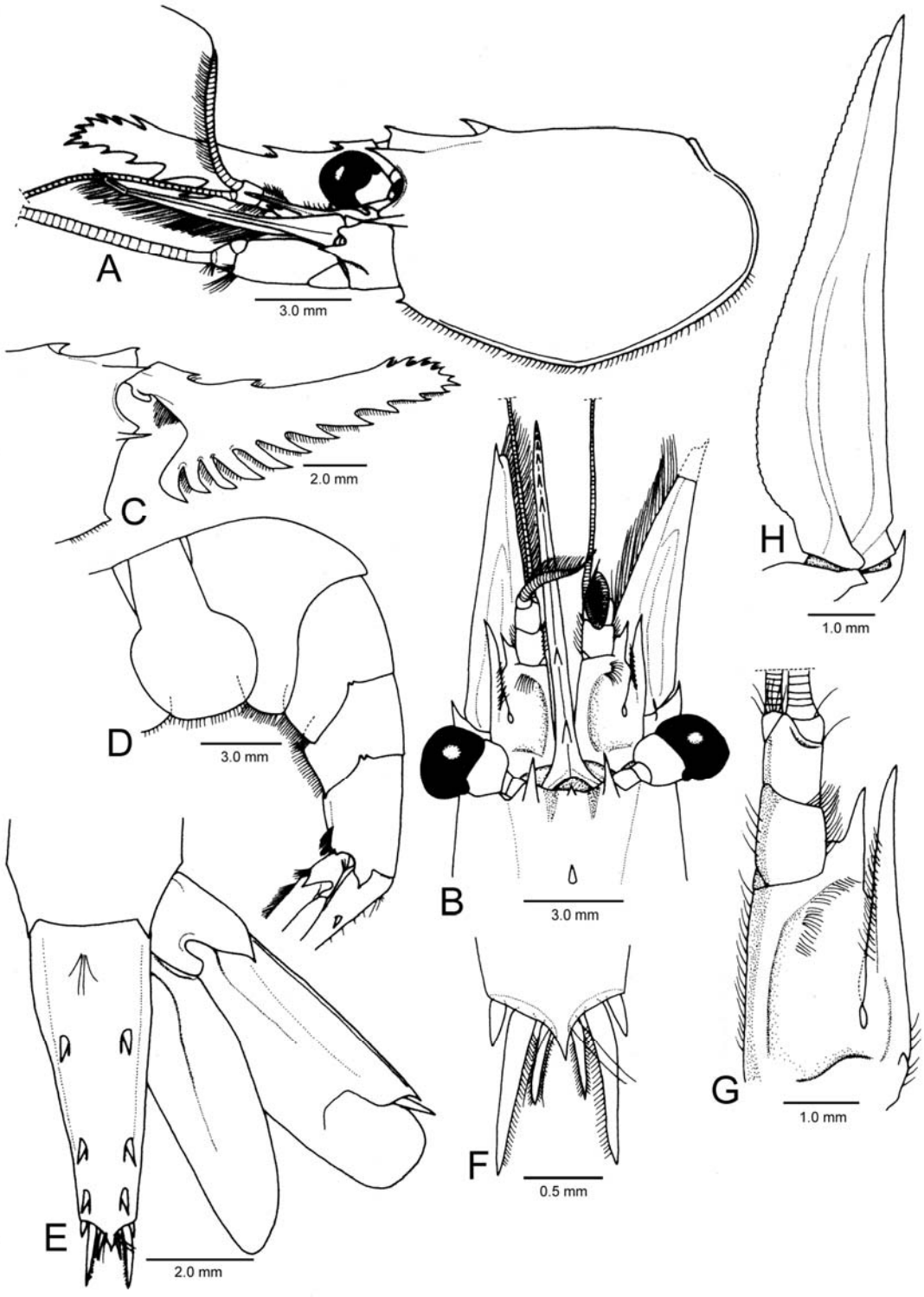

Fig. 51. *Bus* sp. 3. AM P85941A, ♂, CL 9.6 mm (A–G), AM P85941B, CL 9.2 mm (H). A, carapace and cephalic appendages, lateral; B, anterior part of carapace and cephalic appendages, dorsal; C, anterior part of carapace with rostrum, lateral; D, second to sixth abdominal somites, lateral; E, telson and right uropod, dorsal; F, tip of telson, dorsal; G, right antennular peduncle, dorsal; H, right scaphocerite, dorsal.

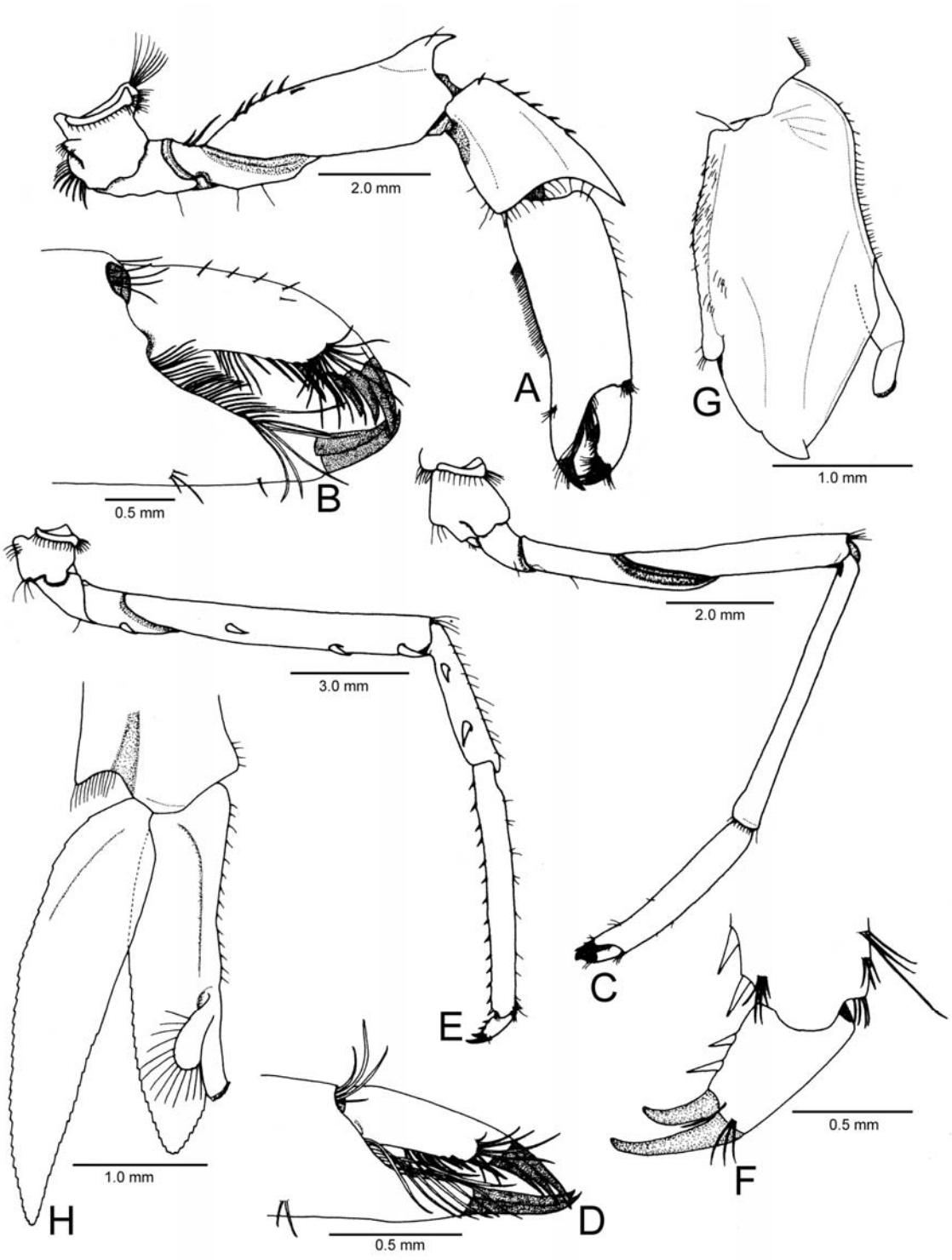

Fig. 52. *Bus* sp. 3. AM P85941A, ♂, CL 9.6 mm. A, right first pereiopod, lateral; B, same, dactylus and fixed finger, lateral C, right second pereiopod, lateral; D, same, dactylus and fixed finger, lateral; E, right third pereiopod, lateral; F, same, dactylus, lateral; G, endopod of right first pleopod, external; H, right second pleopod, external.

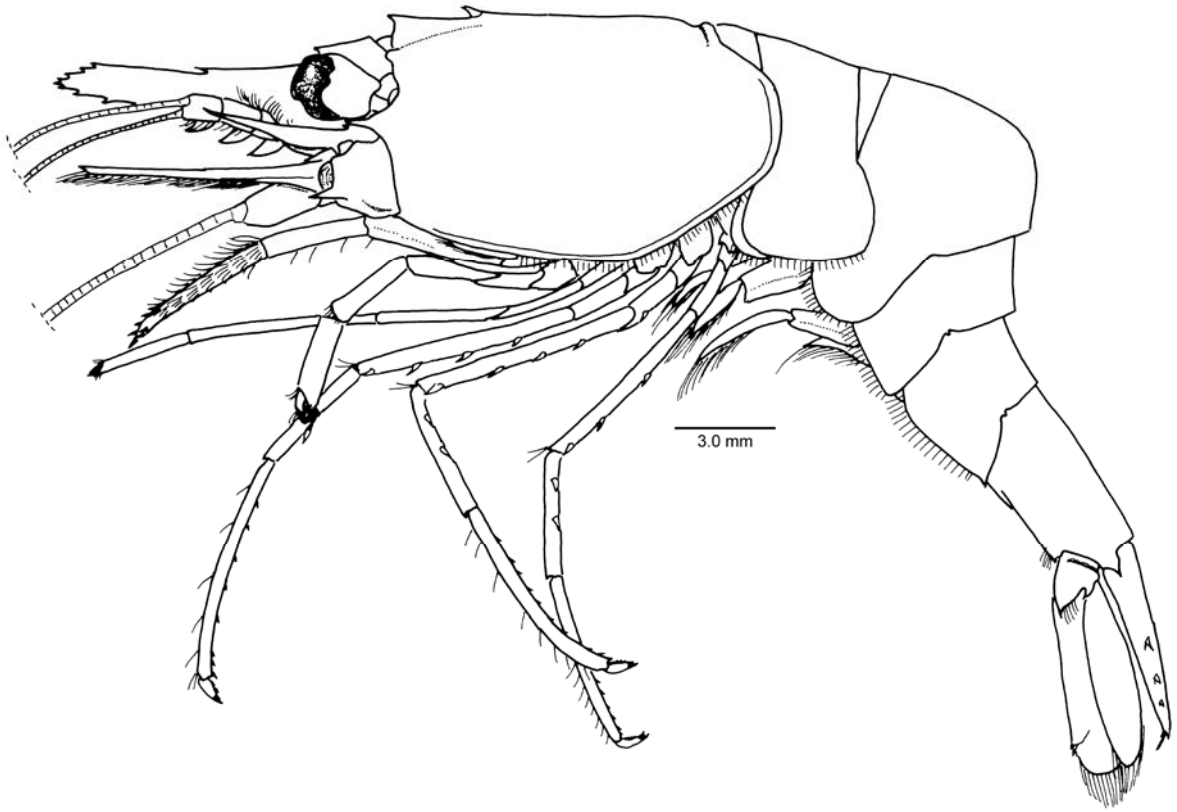

Fig. 53. *Cus ikatere* (Yaldwyn, 1971). SAMA-C 5601, ♂, CL 9.9 mm. Entire animal, lateral.

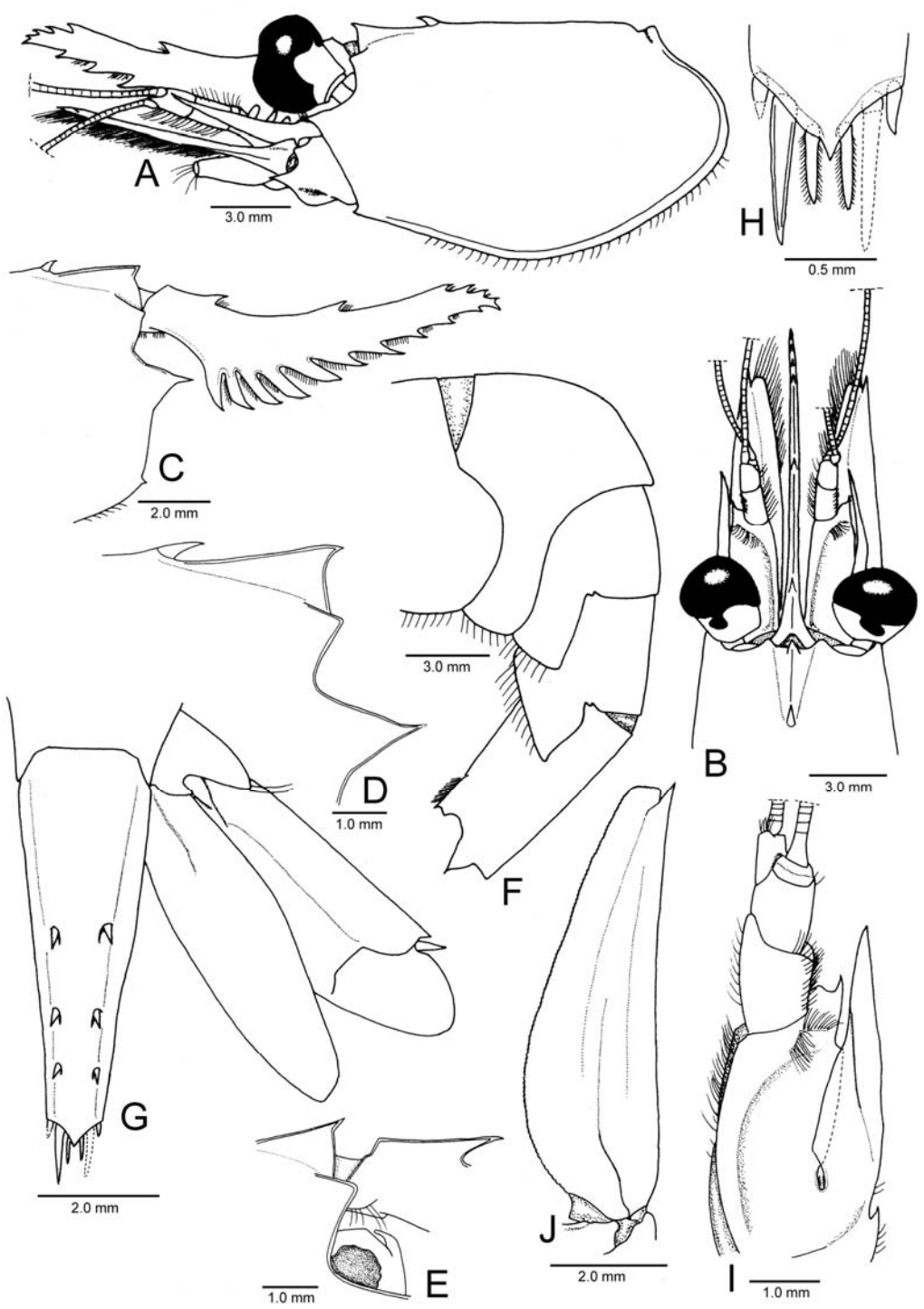

Fig. 54. *Cus ikatere* (Yaldwyn, 1971). NIWA 13695, ♀, CL 10.7 mm (A, B, D–F), SAMA-C 5601, ♂, CL 9.9 mm (C, G–J). A, carapace and cephalic appendages, lateral; B, anterior part of carapace and cephalic appendages, dorsal; C, anterior part of carapace with rostrum, lateral; D, orbital region of carapace, lateral; E, same, with interocular beak, lateral; F, third to sixth abdominal somites, lateral; G, telson and right uropod, dorsal; H, tip of telson, dorsal; I, right antennular peduncle, dorsal; J, right scaphocerite, dorsal.

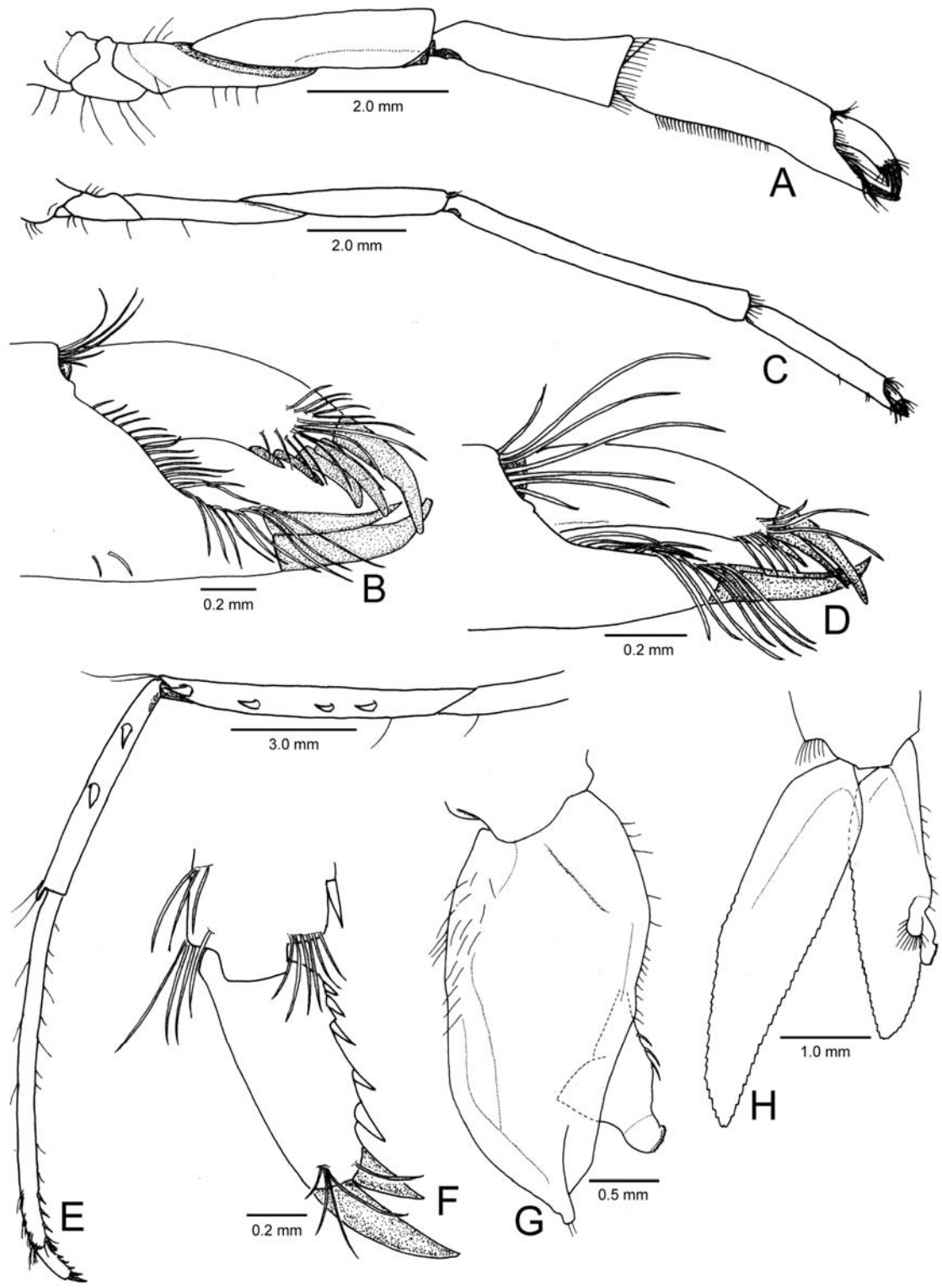

Fig. 55. *Cus ikatere* (Yaldwyn, 1971). SAMA-C 5601, ♂, CL 9.9 mm (A–C, G, H), NIWA 13695, ♀, CL 10.7 mm (E, F). A, right first pereiopod, lateral; B, same, dactylus and fixed finger, lateral C, right second pereiopod, lateral; D, same, dactylus and fixed finger, lateral; E, left fifth pereiopod, lateral; F, same, dactylus, lateral; G, endopod of right first pleopod, external; H, right second pleopod, external.

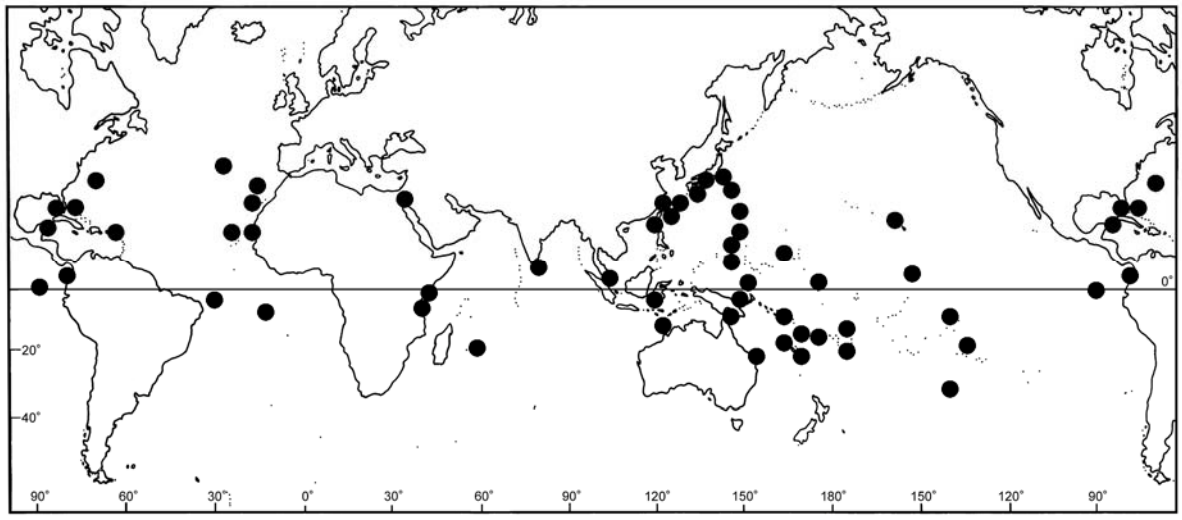

Fig. 56. Geographic distribution of Subfamily A.

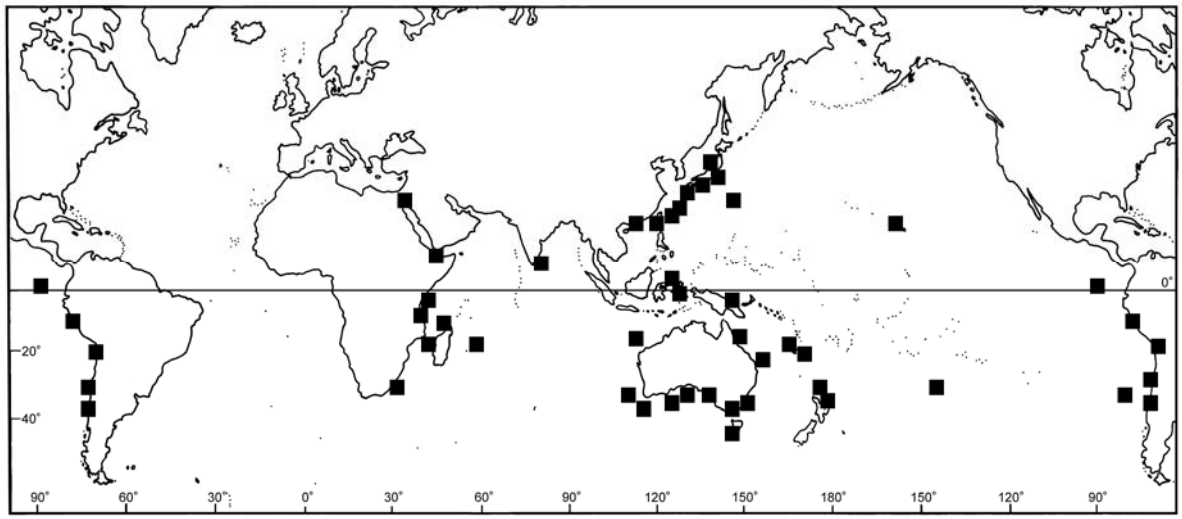

Fig. 57. Gengraphic distribution of Rhynchocinetinae.

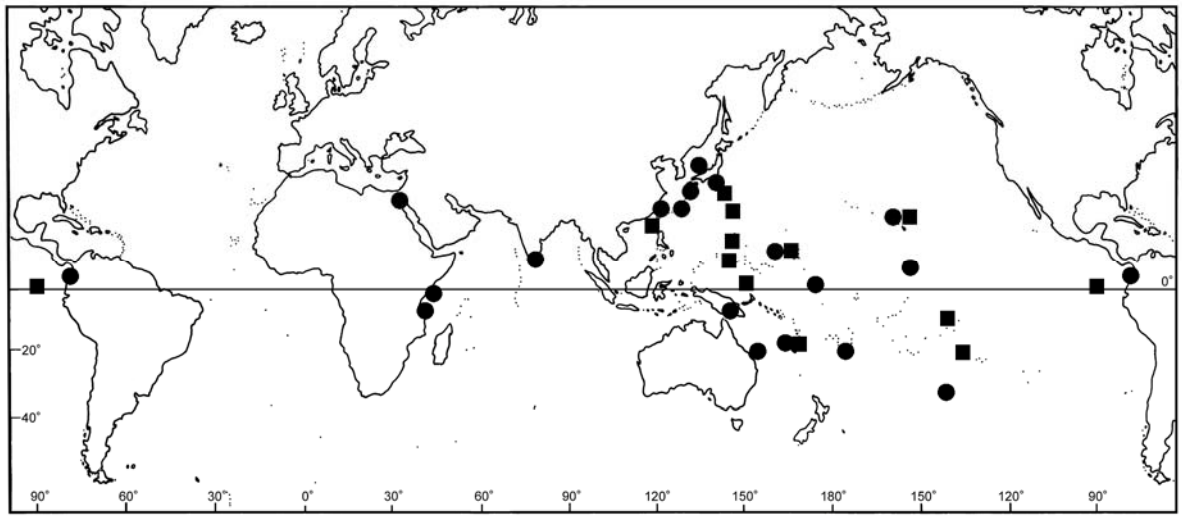

Fig. 58. Distributions of *Aus hendersoni* (circle) and *Cinetorhynchus hiatti* (square).

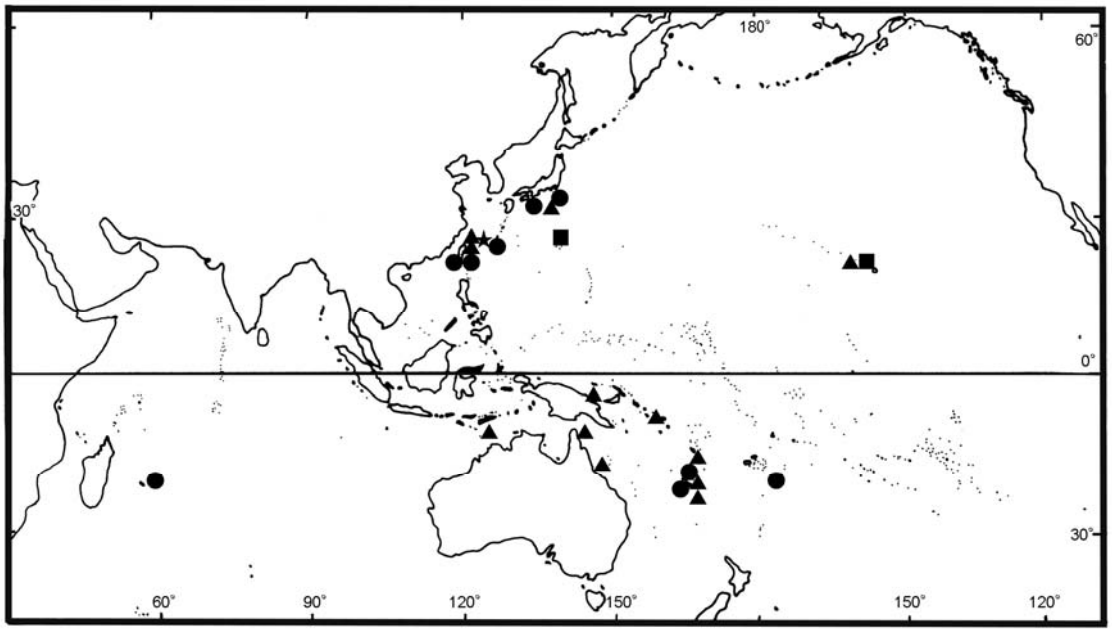

Fig. 59. Distributions of *Cinetorhynchus brucei* (ster), *C. concolor* (triangle), *C. erythrostictus* (circle) and *C.fasciatus* (square).

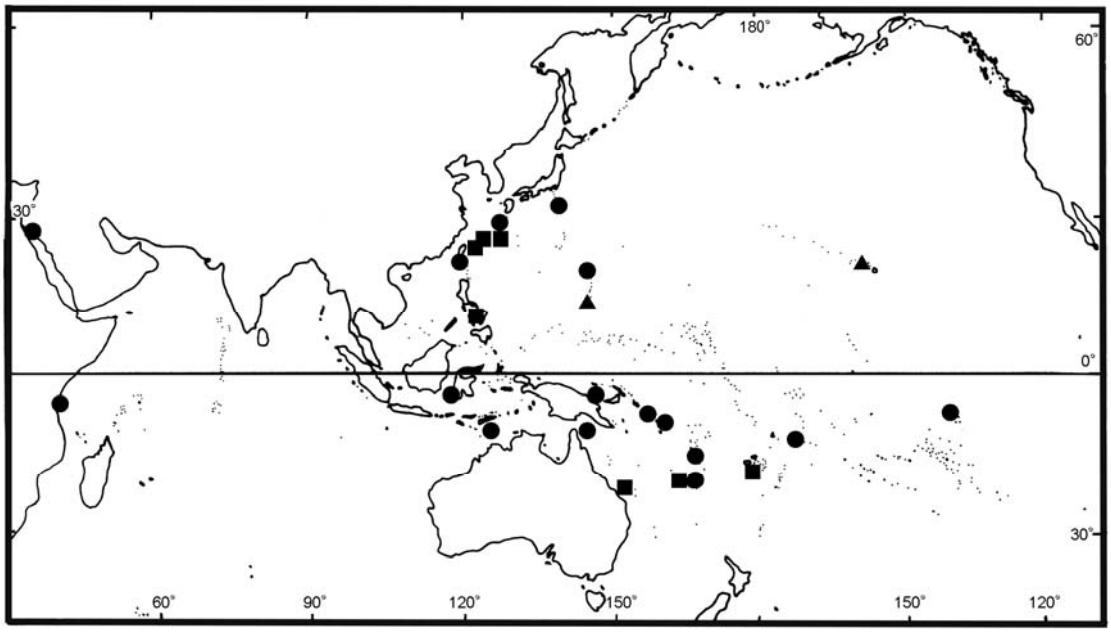

Fig. 60. Distributions of *Cinetorhynchus hawaiiensis* (triangle), *C. reticulates* (circle) and *C. striatus* (square).

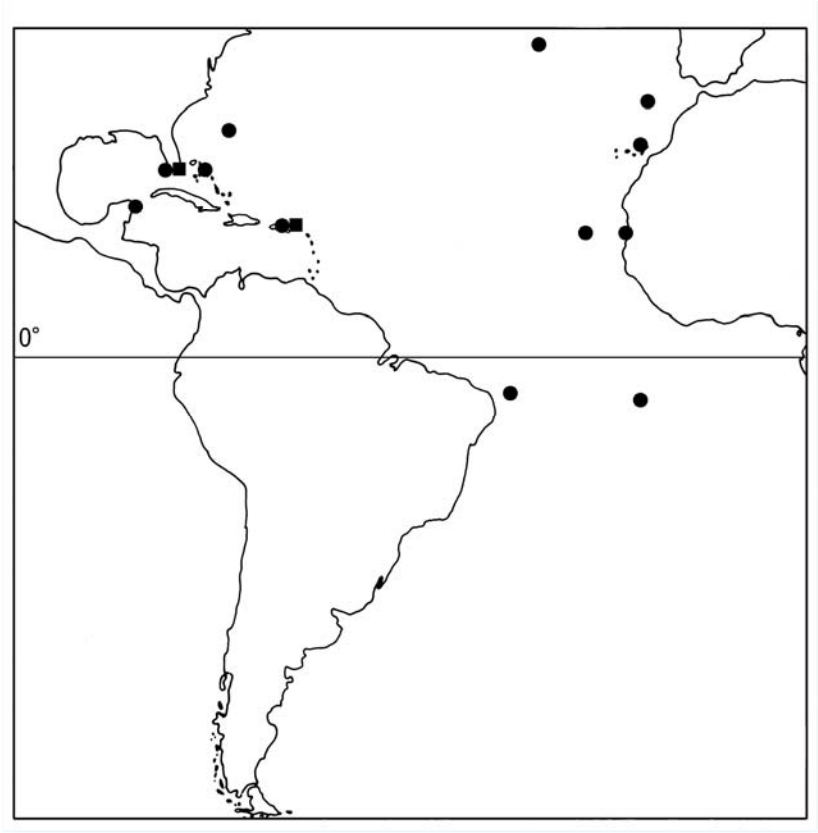

Fig. 61. Distributions of *Cinetorhynchus manningi* (square) and *C. rigens* (circle).

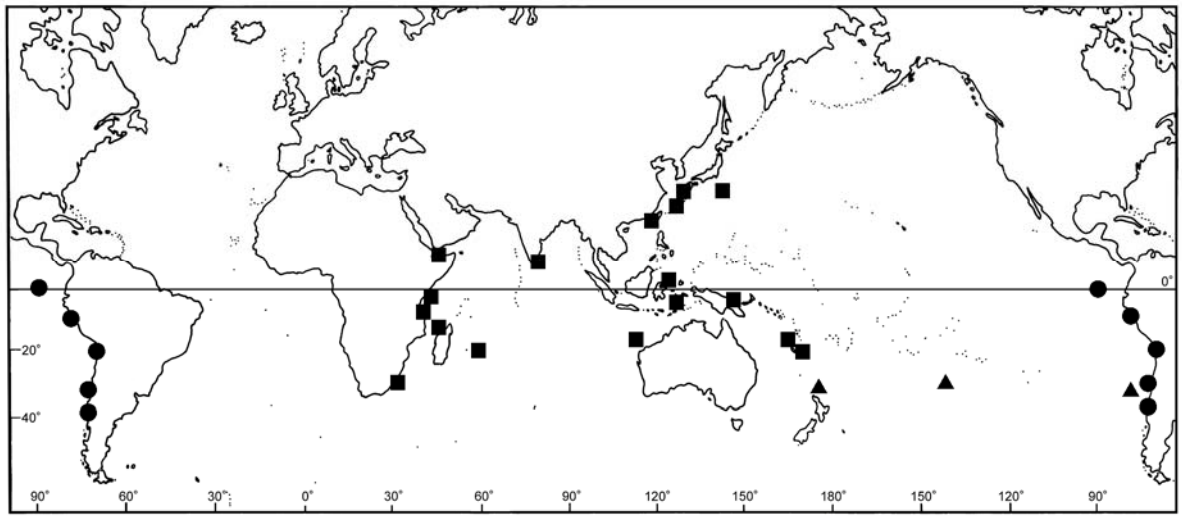

Fig. 62. Distributions of *Rhynchocinetes typus* (circle), *Bus balssi* (triangle) and *B. durbanensis* (square).

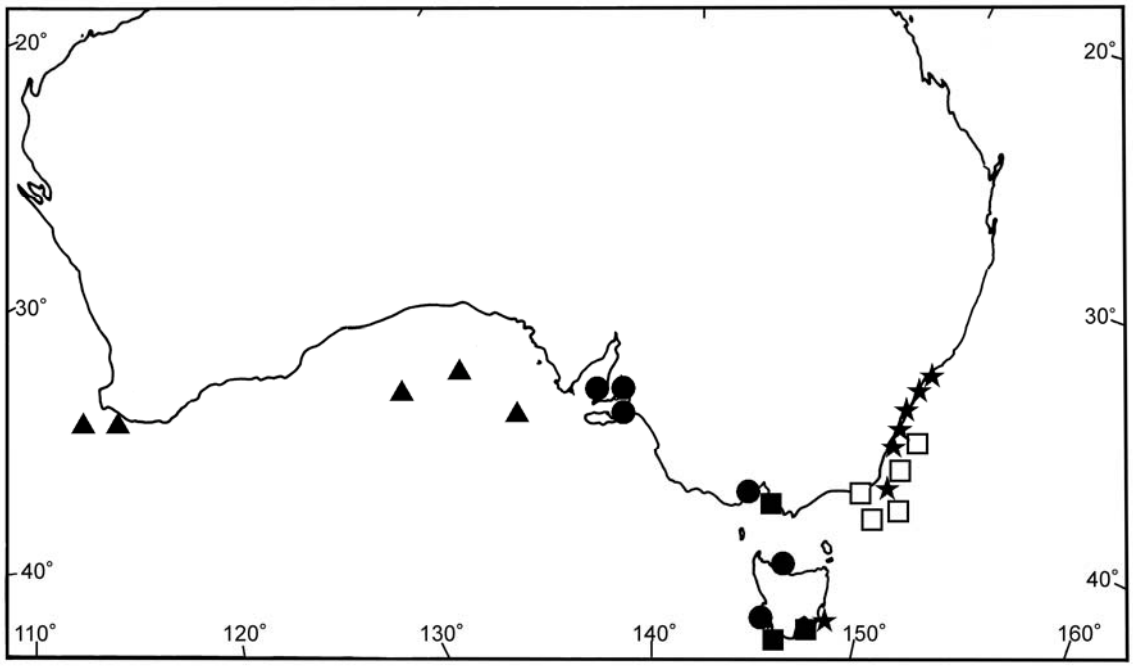

Fig. 63. Distributions of *Bus australis* (circle), *B. enigma* (triangle), *B. kuiteri* (solid square), *B. serratus* (ster) and *B.* sp. 2 (open square).

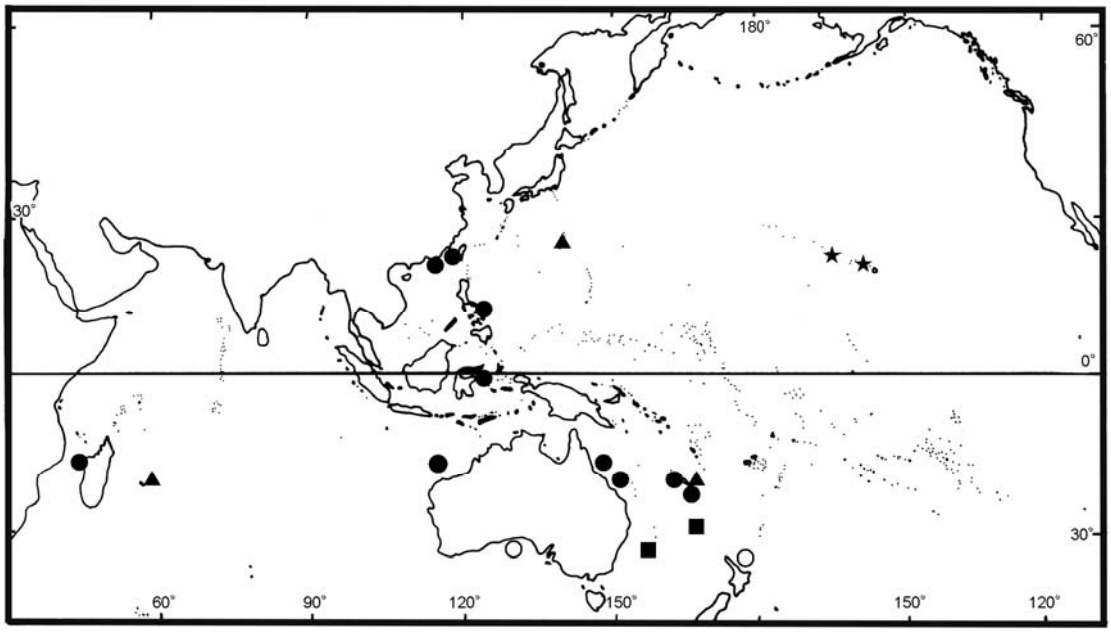

Fig. 64. Distributions of *Bus brucei* (solid circle), *B. rathbunae* (ster), *B.* sp. 1 (triangle), *B.* sp. 3 (square) and *Cus ikatere* (open circle).

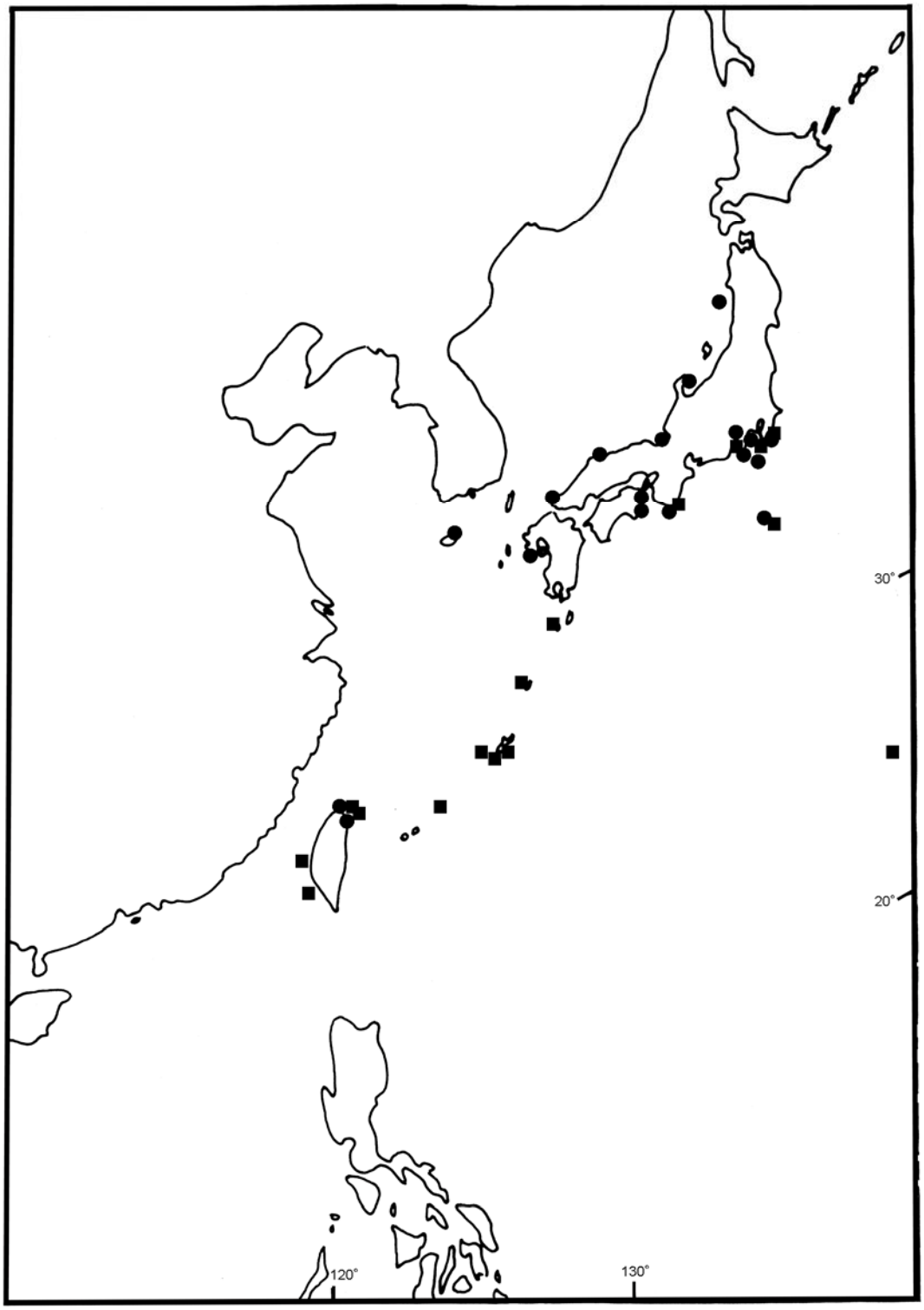

Fig. 65. Distributions of *Bus conspiciocellus* (square) and *B. uritai* (circle).

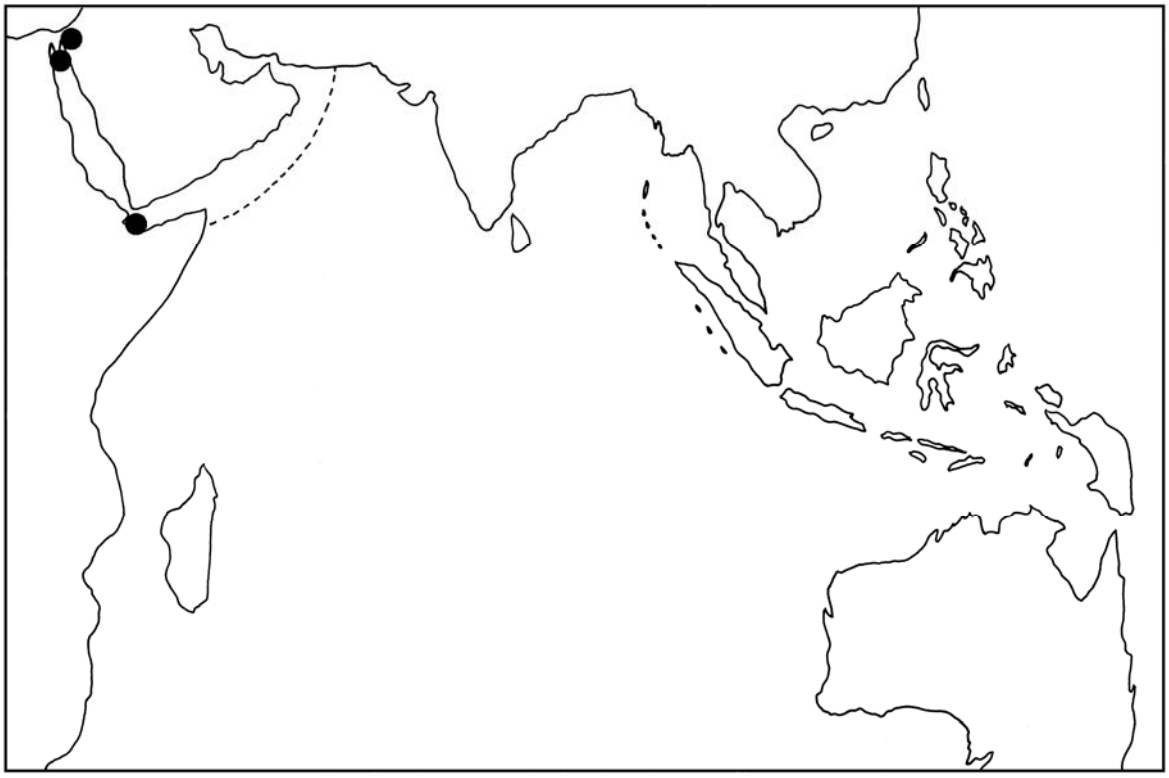

Fig. 66. Distributon of *Bus holthuisi* (circle). Broken line indicates the border between Red Sea-Persian Gulf endemic area and other regions of the Indian Ocean.

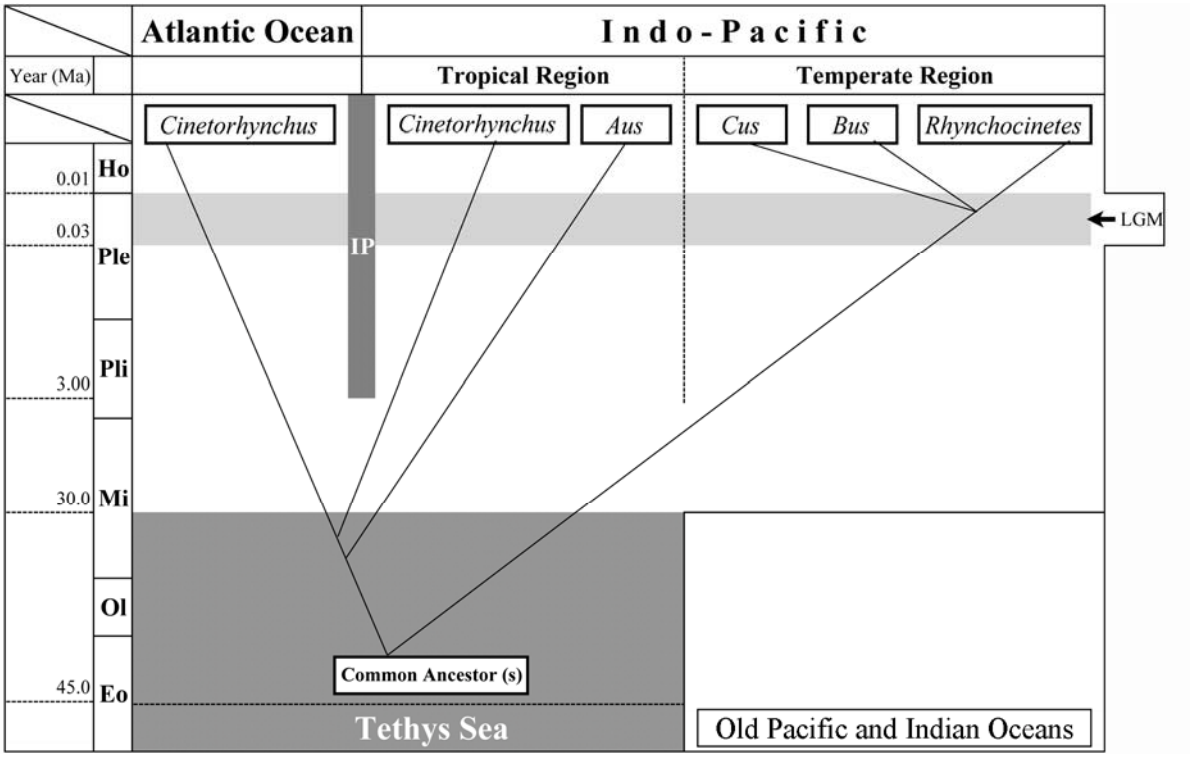

Fig. 67. Hypothesis on a morphology-based phylogeny of Rhynchocinetindae. Abbreviations: Eo, Eocene; Ho, Holocene; IP, Isthmus of Panama; LGM, Last Gracial Maximum; Mi, Miocene; l. Oligocene; Ple, Pleistocene; Pli. Pliocene.

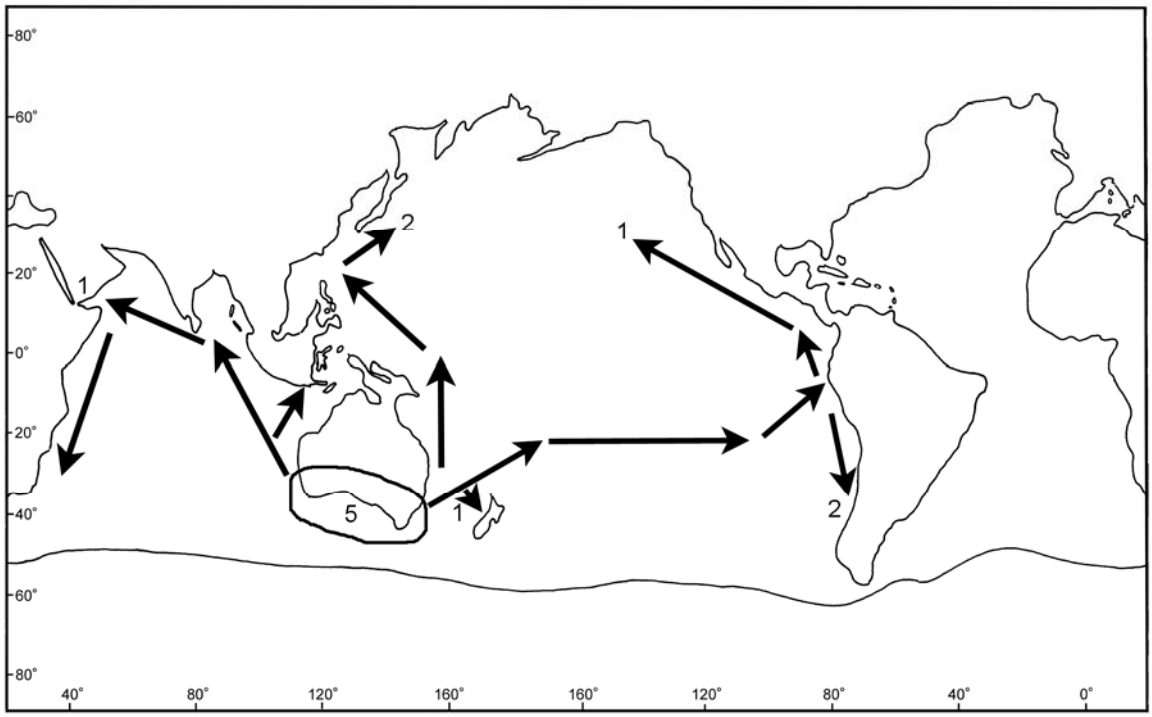

Fig. 68. Hypothesis on disporsal process of Rhynchocinetinae during lower sea-level period of the Gracial Age. Numbers indicate the Recent endemic species each disjunct temperate area.