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Reappraisal of hermit crab species (Crustacea: Anomura: Paguridea) reported by Camill Heller in 1861, 1862 and 1865

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Abstract

Redescriptions based on the type material are presented for 11 species of hermit crabs described as new by Camill Heller (HELLER 1861a, c, 1862, 1865): *Coenobita violascens* HELLER, 1862, *Diogenes avarus* HELLER, 1865 - for which a lectotype is designated, *Diogenes senex* HELLER, 1865, *Pagurus varipes* HELLER, 1861 [= *Dardanus tinctor* (FORSKÅL, 1775)], *Pagurus depressus* HELLER, 1861 [= *Dardanus lagopodos* (FORSKÅL, 1775)], *Calcinus rosaceus* HELLER, 1861, *Calcinus nitidus* HELLER, 1865, *Clibanarius carnifex* HELLER, 1861, *Clibanarius signatus* HELLER, 1861, *Paguristes barbatus* (HELLER, 1862) and *Paguristes ciliatus* HELLER, 1862. For 7 of those, detailed figures are provided. In addition, the material from the Red Sea along with the hermit crabs obtained during the circumnavigation of the earth by the frigate 'Novara' and identified by him have been reevaluated and necessary corrections made.

Keywords: Crustacea, Anomura, Paguridea, Camill Heller, Novara, lectotype designation

Zusammenfassung

Elf Arten von Einsiedlerkrebsen, die Camill Heller als neue Arten beschrieb (HELLER 1861a, c, 1862, 1865), werden hier anhand des Typenmaterials wiederbeschrieben: *Coenobita violascens* HELLER, 1862, *Diogenes avarus* HELLER, 1865 - für die ein Lectotypus designiert wird, *Diogenes senex* HELLER, 1865, *Pagurus varipes* HELLER, 1861 [= *Dardanus tinctor* (FORSKÅL, 1775)], *Pagurus depressus* HELLER, 1861 [= *Dardanus lagopodos* (FORSKÅL, 1775)], *Calcinus rosaceus* HELLER, 1861, *Calcinus nitidus* HELLER, 1865, *Clibanarius carnifex* HELLER, 1861, *Clibanarius signatus* HELLER, 1861, *Paguristes barbatus* (HELLER, 1862) und *Paguristes ciliatus* HELLER, 1862. Zu sieben Arten davon werden detailierte Zeichnungen präsentiert. Das übrige Material an Einsiedlerkrebsen aus dem Roten Meer und gesammelt während der Erdumseglung mit der Fregatte 'Novara', das Heller bestimmte, wurde nachuntersucht; die Bestimmungen korrigiert und kommentiert.

Introduction

Among the type material deposited in the Natural History Museum in Vienna (NHMW) those species described by Camill Heller (*26 September 1823, † 25 February 1917) constitute a very important part, especially of the Crustacea Collection. Within this group, he described several species of amphipods, isopods, copepods, cirripeds, branchiurans, tanaidaceans, stomatopods, cumaceans and numerous decapods. Some of the material he based the descriptions on was collected by himself in the Adriatic Sea or by travellers of the 18th century (e.g. Theodor Kotschy, Ida Pfeiffer, Georg Frauenfeld) in the Red Sea, the Arabian Gulf and the Indo-Pacific, but most stem from the circumnavigation of the earth by the frigate 'Novara' between 1857 and 1859.

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Camill (sometimes also spelled as Kamill) Heller was born near Teplitz in northern Bohemia (Teplice, now Czech Republic). He started to study philosophy in Prague, then changed to medical studies in Vienna, where he received his doctorate in 1849. He served in the army as a doctor up to 1854 in Dalmatia (now Croatia), then as Assistant of Natural History in Vienna at the "Josephsakademie". In 1858, he became Professor of Zoology and Comparative Anatomy at the University of Krakau (Cracow, Poland). In 1863, he moved in the same function to the University of Innsbruck (Austria), where he taught until his retirement in 1894. Heller was already interested in the fauna of the Adriatic Sea while working at the Academy. Later, he studied mainly the material deposited in the then "Naturalienkabinet", publishing on the crustaceans of the Red Sea (HELLER 1861a, b, c) and the monograph "Die Crustaceen des südlichen Europas" (HELLER 1863). Besides crustaceans, he also worked on echinoderms, tunicates, bryozoans and pycnogonids. His results of the investigation of the 'Novara' material were published in two preliminary papers (HELLER 1861d, 1862) and one paper in the volume of the 'Novara' series (HELLER 1865). Heller also studied the crustaceans, tunicates and pycnogonids collected during the Austrian-Hungarian "Nordpol-Expedition" with the vessel 'Tegetthoff' (HELLER 1875a,b). Later, he mainly worked on the fauna of the alps. He was 94 when he died in 1917 [biographical data based on an obituary by HEIDER (1917)].

The circumnavigation by the frigate 'Novara' was an initiative of Archduke Ferdinand Max (who later became Emperor Max of Mexico) and was under the patronage of Alexander von Humboldt. In addition to the scientific purpose, the voyage was also meant to serve improving international trading relations and as a nautical exercise.

The 'Novara' was the vessel chosen. She was launched in 1850 and acted as a sail-training vessel and ship of the line between 1851 and 1857. In order to prepare for the circumnavigation, the 'Novara' was refitted at the Pola naval yards in early 1857. The ventilation of the lower decks was improved and the number of cabins increased. The gun room was converted into a reading room and provided with a library and various charts and maps for use by the officers and scientists. The store rooms for the sail and tackle were enlarged so as to take double the normal quantity. A distilling apparatus was installed on the gun deck, and shower-bath facilities were improved.

The ship stood under the overall command of Commodore Bernhard von Wüllerstorf-Urbair. In addition to the crew, she had on board a 'scientific commission' that was appointed to observe, document and collect in the fields of geology, botany, zoology and anthropology during the 'Novara's world-wide quest. The scientific members, and their respective fields of interest, comprised: 1) Bernhard von Wüllerstorf-Urbair - oceanography, hydrography, meteorology and geophysics - 2) Karl Scherzer - topographical geography, ethnology, economics and official historiographer of the expedition- 3) Ferdinand von Hochstetter - mineralogy, geology and palaeontology - 4) Georg Frauenfeld - zoology, preservation of specimens - 5) Johannes Zelebor - preservation of zoological specimens - 6) Eduard Schwarz - botany - 7) Anton Jellinek - botanist, gardener - 8) Joseph Selleny - artist - and 9) Lieutenant Robert Müller - meteorological observer, linguist, and aid to Karl Scherzer.

The itinerary of the voyage was as follows: 30 April 1857 - departs Trieste; 8-17 June-Madeira; 5-31 August - Rio de Janeiro; 2-26 October - Cape of Good Hope, South

Africa; 9 November - Islands of St Paul and Amsterdam; 7 December - departs Amsterdam Island, southern Indian Ocean; 8-16 January 1858 - Ceylon; 31 January - Madras; 10 February - leaves Madras; 23 February - Nicobar Islands; 26 March - departs Nicobar Islands; 15-21 April - Singapore; 5-29 May - Java; 15-25 June - Manila; 5-18 July - Hong Kong; 25 July - Shanghai; 11 August - leaves Shanghai; 17 September - Island of Puynipet; 17 October - Sikyana Island; 5 November - Sydney; 7 December - departs Sydney; 21 December - New Zealand; 2 January 1859 - departs New Zealand; 2-23 February - Tahiti; 24 April - Valparaiso; 3 May - Santiago, Chile; 1 August - Gibraltar; 26 August - arrives at Trieste.

During the course of the expedition the 'Novara' covered 51,686 miles, and spent 551 days at sea and 298 at anchor or in port. Some 23,700 individual natural history specimens were collected. They comprised: 440 minerals, 300 reptiles, 1500 birds, 1400 amphibians, 1330 fish, 9000 insects, 8900 molluscs and crustaceans, 300 birds' eggs and nests, numerous skeletons, and 550 ethnographic objects.

The expedition's findings were published as an illustrated twenty-one volume scientific account in Vienna between 1861 and 1877. The three-volume narrative "Reise der Österreichischen Fregatte Novara um die Erde in den Jahren 1857, 1858 und 1859" by Karl Scherzer (Scherzer 1861a,b, 1862) became a bestseller, was much translated and republished (Treffer 1973).

Unfortunately, some samples were mislabelled based on clearly incorrect sampling localities [e.g. *Thelphusa chilensis*, *Thelphusa corrugata*; see also Pretzmann (1964); *Porcellana digitalis*; see Lewinsohn (1976)].

Heller described several species on a preliminary basis (1861d, 1862) and often indicated them again as new species in the 1865 publication. In some cases, he came to the conclusion that his earlier "new species" were identical with already described ones; others were described as new under a different name. In no case was reference given to his earlier papers. In addition, all lots which were acquired under 1866.I. were labelled with the names of the 1865 publication. These misleading labels, the lack of special labels for types and the poor accessibility of the collection due to space restrictions were responsible for the fact that they often could not be located upon request (Pretzmann in lit., Anker & Dworschak 2001). Types of the species described by Heller were therefore considered no longer extant by some researchers (Clark & Galil 1993, Forest & McLaughlin 2000: 59), which also gave rise to an invalid neotype designation (McLaughlin & Haig 1996).

The aim of the present paper is the redescription of the type material on which Heller based his descriptions of species of Paguridea. In addition, the material collected during the 'Novara'-Expedition and identified by him is reevaluated. The systematic presentation follows the generic sequence and spelling used by Heller (1865) in his full account of the Crustacea of the 'Novara'-Expedition. Restricted synonymies are presented for Heller's species together with material examined and explanatory remarks, as needed, for all the taxa he recorded. Institutional abbreviations include NHMW (Naturhistorisches Museum in Wien) and ZMB (Naturhistorisches Forschungsinstitut, Museum für Naturkunde zu Berlin). Abbreviations used in the material examined include sl (shield length), as measured from the midpoint of the rostrum or rostral lobe to the midpoint of the posterior margin of the shield, and ovig. (ovigerous).

Systematic account

Superfamily Coenobitoidea

Family Coenobitidae

Coenobita Latreille, 1829

Cenobita clypeata (Herbst) - Heller (1865: 82)

In part = *Coenobita brevimanus* Dana, 1852

Nicobar Islands: 6 males (sl = 9.8-20.8 mm), 3 females (sl = 15.4-19.0 mm), 1 ovig. female (sl = 17.4 mm), NHMW 19439.

Tahiti: 1 male (sl = 17.8 mm), NHMW 19437; 1 male (sl = 13..1 mm), NHMW 19438.

In part = *Paguristes pusillus pusillus* Henderson, 1896

Nicobar Islands: 1 male (sl = 8.8 mm), NHMW 19454.

Remarks: As have many carcinologists, Heller (1865) incorrectly attributed authorship of *Coenobita clypeatus* to Herbst (1791). Heller also followed H. Milne Edwards' (1836) and Dana's (1852b) interpretation of Fabricius' (1787) species, which was subsequently shown by Rathbun (1910) to actually represent Dana's (1852b) *Coenobita brevimanus*.

That Heller (1865) confounded a specimen of *Paguristes pusillus pusillus* with specimens of *Coenobita* is surprising. Henderson's (1896) species was described from an 'Investigator' station off the east coast of Ceylon (Sri Lanka), at a depth of 51 meters; an illustration was included by Alcock & Anderson (1897) in their "Illustrations of the Zoology" of the cruises. Although *Paguristes pusillus* was reported again from Ceylon by Southwell (1906), the only other records are from Japanese waters (Balss 1913, Yokoya 1933, Miyake 1978) and may, in fact, be referable to *Paguristes pusillus zhejiangensis* Wang & Tung, 1982 from the East China Sea. Miyake (1978) repeated Alcock's (1905) description, based on the same five specimens from 'Investigator' station 175, but indicated that he had no personal knowledge of the species. Neither Balss (1913), nor Yokoya (1933) gave a diagnosis for the specimens they attributed to *P. pusillus*, thus it is puzzling that some of the characters cited by Miyake (1978: 26) in his key do not apply to that species. Heller's (1865) specimen is much larger than any of the syntypes, which probably accounts for the differences seen in the present specimen. In this specimen, the left chela is noticeably larger than the right and the antennal flagella are considerably longer than the ocular peduncles. In all other respects, Heller's specimen agrees with Henderson's (1896) and Alcock's (1905) descriptions.

Cenobita olivieri Owen - Heller (1865: 82)

In part = *Coenobita perlatus* H. Milne Edwards, 1837.

Nicobar Islands: 1 male (sl = 22.3 mm), NHMW 19441; 2 females (sl = 17.7 mm, 19.1 mm), 4 ovig. females (sl = 19.6-23.8 mm), 4 not removed from shells, NHMW 19442; 1 male (6.9 mm), 5 small, not removed from shells, NHMW 19444.

In part = *Coenobita violascens* Heller, 1862.

Madras: 1 male (sl = 6.3 mm), NHMW 19440.

Remarks: *Coenobita olivieri* was described by Owen (1839) for the species Olivier (1811) misinterpreted as *Coenobita clypeatus* (Fabricius, 1787). Owen's (1839) description, based on a single male specimen collected in the Sandwich (Hawaiian) Islands, was not accompanied by an illustration. It would appear that Heller (1865) based the majority of his identifications on Owen's (1839) or Dana's (1852b) descriptions rather than on Olivier's (Latreille, 1818, pl. 311, fig.1) illustration. However, Heller (1865) was inconsistent in his identifications, mistakenly assigning a small specimen from Madras to *C. olivieri* that has, upon reexamination, proven to represent his own *C. violascens*.

As seen above, Heller (1865) confused *C. olivieri* with *C. perlatus* and *C. violascens*. *Coenobita olivieri* also was included in the synonymy of *C. spinosus* H. Milne Edwards, 1837 as a variety by Ortmann (1892), but was described by that author as having the dactyl of the left third pereopod smooth and flattened. McCulloch (1909), after referring to the original description and illustration of Olivier (1811), concluded that Owen's (1839) species could not have had a smooth and flattened left third dactyl. Consequently, McCulloch (1909) placed *C. olivieri* sensu Owen in synonymy with *C. spinosus* and proposed the name *C. variabilis* (as a varietal name) for Ortmann's (1892) variety with the flattened left third dactyl.

Although Owen reported that the Crustacea from the 'Blossom' voyages were deposited in the Museum of the Royal College of Surgeons of England and in the Museum of the Zoological Society of London, none of these specimens were ever acquired by the Natural History Museum, London (Ingle, 1991). The College of Surgeons was bombed in May of 1941, and presumably any remaining specimens from the 'Blossom' voyages were destroyed (Crane 1975). Consequently, the true identity of *Coenobita olivieri* will probably never be known; however, McLaughlin & Holthuis (in press) have suggested that it may infact be *C. violascens* Heller, 1862.

Cenobita rugosa H. Milne Edwards - Heller (1861a: 24, c: 254)

= *Coenobita scaevola* (Forskål, 1775)

Red Sea: 3 males (sl =14.2-16.8 mm); 3 females (sl = 11.6-14.1 mm), NHMW 19443.

Cenobita rugosa H. Milne Edwards - Heller (1865: 82)

In part = *Coenobita rugosus* H. Milne Edwards, 1837.

Ceylon: 1 male (sl = 12.9 mm), NHMW 19450;

Nicobar Islands: 2 females (sl = 6.3, 7.3 mm), 3 specimens not removed from shells, NHMW 1511; 4 females (sl = 6.2-8.8), 1 specimen not removed from shell, NHMW 19445; 15 males (sl = 3.4-13.6 mm), 22 females (sl = 3.0-14.3 mm), 3 ovig. females (sl = 5.7-12.9 mm), + 1 not sexed or measured, NHMW 19446; 7 males (sl = 3.1-5.2 mm), 7 females (sl = 3.1-6.6 mm), 2 ovig. females (sl = 7.2, 7.8 mm), + 26 not sexed or measured, NHMW 19447.

Madras: 2 males (sl = 4.1, 7.2 mm), 1 female (sl = 5.0 mm), NHMW 19452.

Tahiti: 2 males (sl = 7.3, 10.7 mm), 2 females (sl = 3.8, 4.2 mm), NHMW 19448; 2 males (sl = 3.7, 4.7 mm), 2 females (sl = 4.5, 5.7 mm), NHMW 19449.

In part = *Coenobita variabilis* McCulloch, 1909.

Sydney: 2 females (sl = 2.3, 12.1 mm), NHMW 19451.

Remarks: LEWINSOHN (1969) first called attention to HELLER's (1861a, c) misidentifications of specimens of the Red Sea as *C. rugosus*.

HESS (1865) described *Birgus hirsutus* from Sydney, a taxon that MCCULLOCH (1909) also put into synonymy with *C. spinosus*. However, McCulloch was of the impression that HESS' (1865) locality data had to be wrong because he (McCulloch) believed that the genus did not occur further south than north Queensland. Similarly, he stated that HELLER's (1865) record of *C. rugosus* from Sydney was incorrect. Although there admittedly were labeling errors in the 'Novara' collections, MCLAUGHLIN & HAIG (1996) demonstrated the geographic accuracy of another species, *Diogenes senex* HELLER, 1862, whose type locality of Sydney also had been disputed (LEWINSOHN 1969). That the 'Novara's previous port of call had been Sikyana Island in the Solomon Islands gives credence to the skepticism of HELLER's (1865) record of Sydney for "*C. rugosa*". However, MCCULLOCH (1909) distinguished his *C. spinosus* var. *variabilis* by the presence of a stridulating ridge on the left chela and the flattened lateral surfaces of the dactyl and propodus of the left third pereopod. HELLER's (1865) specimens agree with that definition of *C. variabilis*, and with recent comparative material from other parts of Australia.

Cenobita violascens HELLER, 1862

Figs 1-8

= *Coenobita violascens* HELLER, 1862

Cancer clypeatus: HERBST, 1791: 22, in part, pl. 23, fig. A, not pl. 23, fig B. Not *Pagurus clypeatus* FABRICIUS, 1787 (see remarks).

Cenobita violascens HELLER, 1862: 524; 1865: 82, pl. 7, fig. 1.

Coenobita violascens: HILGENDORF, 1869: 99 (in part), ? not pl. 6, fig. 3b; 1879: 825 (see remarks). – DE MAN, 1888a: 255. – NOBILI, 1903: 447. – NAKASONE, 1988: 172, fig. 7. – MCLAUGHLIN, 1997: 218, unnumbered figure.

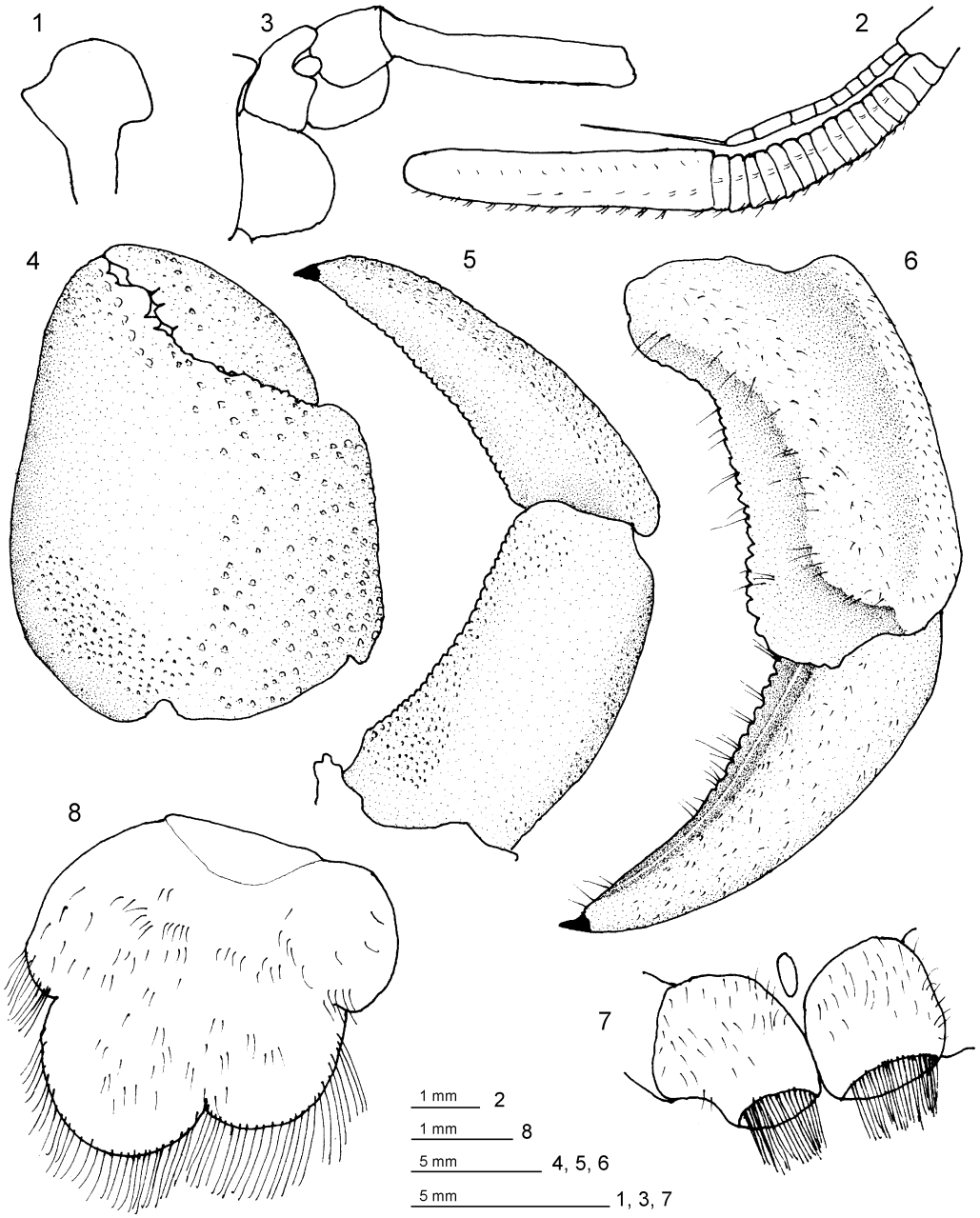
Coenobita cavipes: STEBBING, 1917: 24. – YAP-CHIONGCO, 1938: 211 – BARNARD, 1950: 470 – NAIYANETR, 1980: 23 (list); 1998: 46 (list) – NATEEWATHANA & al., 1981: 51 (list). Not *Coenobita cavipes* STIMPSON, 1858.

Syntypes: 3 males (sl = 11.5-16.7 mm), type locality Nicobar Islands, NHMW 19422.

Diagnosis: Dorsal surface of shield with scattered granules and punctations, lateral projections produced and each with terminal spinule; rostrum broadly triangular, not produced beyond level of lateral projections. Ocular peduncles compressed, reaching almost to mid-length of ultimate antennal peduncular segment; dorsal surfaces with numerous short setae; ocular acicles narrowly triangular, approximate. Antennular peduncles extremely long; basal peduncular segment (Fig. 1) with broad, roundly subrectangular dorsal lobe; lower ramus of flagellum (Fig. 2) approximately half length of upper. Antennal acicle (Fig. 3) fused with second peduncular segment.

Each chela with tuft of dense setae on upper inner margin. Left cheliped without stridulating ridge on upper outer surface of palm (Fig. 4), but with numerous scattered granules on upper half of outer face, fewer on lower half and lower central region nearly smooth; lower margin of palm straight or slightly concave, lower proximal angle produced into lobe-like projection.

Left third pereopod with lateral surface of propodus (Fig. 5) nearly smooth, separated from dorsal surface by well-marked longitudinal crest in anterior half, dorsomesial mar-



Figs 1-8: *Coenobita violascens* Heller, 1862. 1: dorsal lobe of proximal segment of antennular peduncle of syntype (sl = 11.5 mm) (lateral view); 2: antennular flagellum of syntype (sl = 11.5 mm) (lateral view); 3: antennal peduncle and fused acicle of syntype (sl = 11.5 mm) (lateral view); 4: left chela of syntype (sl = 11.5 mm) (outer face); 5: dactyl and propodus of left third pereopod of syntype (sl = 11.5 mm) (lateral view); 6: dactyl and propodus of left third pereopod of syntype (sl = 11.5 mm) (mesial view); 7: coxae of fifth pereopods of syntype (sl = 16.7 mm) (inner surface); 8: telson of syntype (sl = 11.5 mm) (dorsal view).

gin (Fig. 6) prominently projecting inward, upper half of mesial surface concave, median portion convex and with low ridge delineating concave ventromesial surface; dactyl broad, short, with dorsolateral margin (Fig. 5) distinctly angular, lateral face weakly convex, mesial surface (Fig. 6) with concave lower portion marked by distinct longitudinal ridge.

Coxae of males (Fig. 7) subequal, approximate, both thick and short, each with dense tuft of setae; no sexual tubes developed; sternal protuberance relatively small.

Telson (Fig. 8) with distinct incision separating anterior and posterior portions; terminal margins unarmed but with long dense setae over entire length.

Color: Entire body violet purple, but varying from light lavender to dark violet; dark patch of brown on outer lower surface of palm of left cheliped (NAKASONE 1988).

Habitat: Supralittoral; juveniles frequent mangrove forests; adults frequently found on beaches (MCLAUGHLIN 1997).

Distribution: Nicobar Islands; Phuket, Thailand; Cebu Island, Philippines; several Japanese Islands; Tanzania and Zanzibar.

Remarks: MCLAUGHLIN & HOLTHUIS (2001) have shown that one of HERBST's (1791) specimens of *Cancer clypeatus* (= *Pagurus clypeatus* FABRICIUS, 1787) (ZMB 2002) actually is *C. violascens*.

HILGENDORF (1869) identified specimens from Mombasa, Kenya, and Zanzibar as *C. violascens*. The male specimen from Mombasa (sl = 16.8 mm), ZMB 2866, after reexamination by one of the authors (PMcL) has been shown to actually represent *C. cavipes* STIMPSON, 1858. Hilgendorf did not identify his illustrated specimen, but the convexity of the lower margin of the left chela (HILGENDORF, 1869: pl. 6, fig. 3b) suggests that it was the specimen of *C. cavipes* and not *C. violascens* that was depicted.

Heller's taxon has been considered a synonym of *Coenobita compressus* H. MILNE EDWARDS, 1837 (e.g., MIERS 1880, ORTMANN 1892) or of *Coenobita cavipes* (e.g., DE MAN 1902, ALCOCK 1905, FIZE & SERÈNE 1955); however, NAKASONE (1988) has clearly interpreted HELLER's (1862) species correctly and demonstrated its distinctiveness.

Family Diogenidae

Diogenes DANA, 1851

Diogenes miles (FABRICIUS) - HELLER (1865: 83)

In part = *Diogenes alias* MCLAUGHLIN & HOLTHUIS, 2001.

Nicobar Islands: 1 male (sl = 10.3 mm), NHMW 19402.

Madras: 1 male (sl = 6.1 mm), NHMW 19403.

In part = *Diogenes custos* (FABRICIUS, 1798).

Nicobar Islands: 1 female (sl = 6.5 mm), NHMW 19404.

Remarks: It is unclear from his author citations, exactly who Heller was crediting with authorship of *Diogenes miles*. He listed FABRICIUS (1793) first, followed by HERBST

(1791). Like carcinologists before him (i.e., H. Milne Edwards 1836, 1837, Krauss 1843, Dana 1851, 1852a, b, Stimpson 1858), Heller (1865) was confused about the identity of Fabricius' (1787) *Diogenes miles* (as *Pagurus*). Even Fabricius (1798) himself, as well as Herbst (1804), became confused over the identity of this species that originally was based on Herbst's (1791: pl. 22, fig. 7), at the time, unpublished figure (cf. McLaughlin & Holthuis, 2001).

Diogenes custos Fabricius - Heller (1865: 259)

= *Diogenes dubius* (Herbst, 1804).

Java: 1 female (sl = 8.8 mm), NHMW 19405.

Remarks: Heller (1865) did not include the specimen he identified as *Diogenes custos* Fabricius, 1798 in his account of the genus from the 'Novara' Expedition, nor in his list of species collected in Java. However, in his table of species and their geographic distributions, "*Diogenes custos* Fabr." appears in the list of *Diogenes* species, with the collection locality of Java indicated. Reexamination has shown that this specimen correctly should be assigned to *D. dubius* Herbst, 1804.

Diogenes avarus Heller, 1865
Figs 9-12

Diogenes avarus Heller, 1865: 83, pl. 7, fig. 2. – Alcock, 1905: 68, pl. 6, figs. 6, 6a. – Forest, 1956b: 524, figs. 1-4. – Lewinsohn, 1969: 37, fig. 4; 1982: 49. – Tirmizi & Siddiqui, 1981: fig. 16; 1982: 54, fig. 29. – Ajmal Khan & Natarajan, 1984: 18, fig. 15. – Thomas, 1989: 74, figs. 2 m-o. – McLaughlin & Clark, 1997: 39, figs 3b, 8b, 9b-d, 11b. – McLaughlin, in press: 000, figs 3A-C.

"Pagurus claviger" Heller, unpublished; see remarks.

Diogenes rectimanus: Lanchester, 1902: 366 (in part). Not *Diogenes rectimanus* Miers, 1884.

Diogenes pugilator: Bouvier, 1892: 55. – Nobili, 1903a: 16; 1906a: 76; 1906b: 119. – Balss, 1915: 9. Not *Diogenes pugilator* Roux, 1829.

Diogenes pugilator var. *avarus*: Nobili, 1906b: 119.

Clibanarius padavensis: Nateewathana & al., 1981: 51 (in part) (list). Not *Clibanarius padavensis* de Man, 1888 (see remarks).

Lectotype herein selected: ovig. female (sl = 2.5 mm), type locality, Nicobar Islands, NHMW 19393.

Paralectotypes: Nicobar Islands: 3 males (sl = 2.5-2.7 mm), 1 female (sl = 2.4 mm); 3 specimens not removed from shells, NHMW 19393.

Ceylon: 2 males (sl =2.5, 2.8 mm), NHMW 19418, as "Pagurus claviger"

Diagnosis (based on lectotype; paralectotype variations shown in parentheses): shield (Fig. 9) longer than broad, with few short, transverse, spinulose ridges and long setae on dorsal surface [not shown in figure]; rostrum (obsolete or) broadly rounded. Dorsal margins of branchiostegites with 6 minute spinules (5-8 small spines). Ocular peduncles short and moderately stout; overreached by both antennular and antennal peduncles. Ocular acicles broad, with 2 (1-3) strong spines and few (several) minute spinules on terminal margin, not extending entire length. Intercalary rostriform process slender, reaching beyond proximal half of acicle but not beyond tip of inner-most acicular spines.

Antennal peduncles slightly shorter to nearly equal length of antennular peduncles. Antennal acicle not reaching to distal apex of fourth peduncular segment, with simple or bifid terminal spine, lateral margins unarmed (usually 1 or 2 spines distally), mesial margins with 4 (3-7) small spines. Antennal flagellum (with paired long setae ventrally; flagella missing in lectotype but long setae present in some paralectotypes).

Left cheliped with 2 rows of tubercles (3 rows of spines) on upper surface of dactyl. Lower margin of fixed finger and palm straight in female lectotype (Fig. 10), (sinuous in male paralectotypes (Fig. 11) with elongate chelae with irregular rows of small tubercles or subacute spines); palm with convex outer surface armed with moderately to closely-spaced tubercles, subacute or acute spines or spinules, and with weak crest of stronger tubercles or spines proximally near midpoint of proximal margin but not continued to articulation with dactyl, upper margin with irregular single to double row of small spinose tubercles (spines). Broad upper surface of carpus with 2 (3) rows of small acute or subacute spines, stronger on slightly produced distal angle, outer face angularly convex (with tuberculate or spinose weak or moderately prominent protuberance at median distal margin), surface armed with blunt or spinulose tubercles (and small spines). Dorsal margin of merus with 1 or more rows of small, simple or bifid spines, mesiodistal margin with row of small, subacute spines, (ventromesial distal angle with 3 or 4 prominent spines), ventrolateral margin with 3 (2-5 much smaller) spines distally. Right cheliped with noticeable hiatus between dactyl and fixed finger; upper margins of dactyl, palm and carpus each with (1-3 rows of small spines partially obscured by long plumose setae) row of low tubercles or protuberances.

Ambulatory legs with carpi missing in lectotype except for second right and detached left probably second, former with 3 spines at or near dorsodistal margin, latter with row of very small spines; (dorsal margins of carpi each with double row of small spines on dorsal surface of second, usually only single row of smaller spinules on third); propodi with irregular row of small (spines or) spinules, (always on second, frequently on third;) (mesial faces of dactyls each with 2 rows of rather widely-spaced moderately short setae).

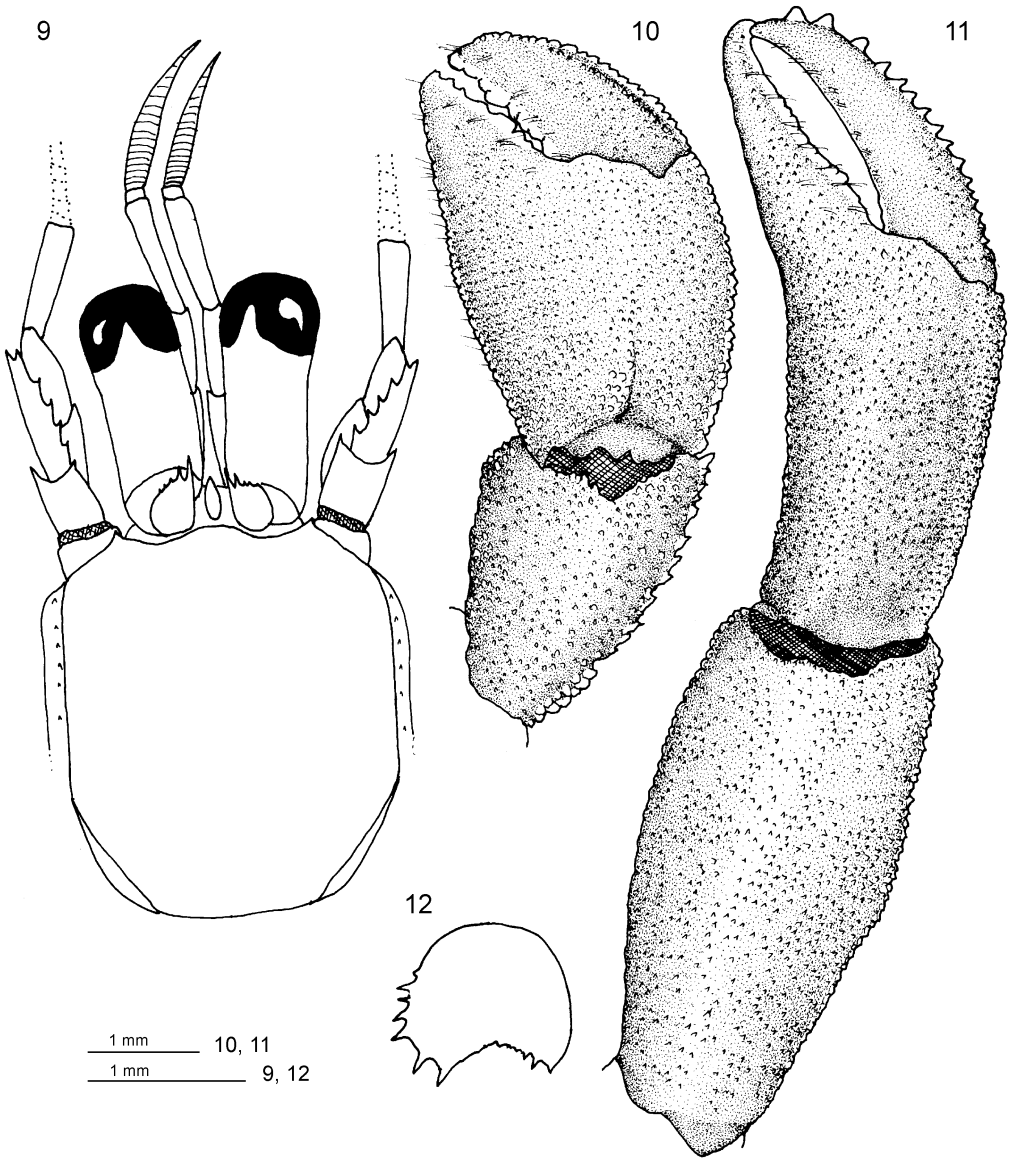
Telson (Fig. 12) without median cleft in lectotype, but with weak median cleft in at least one paralectotype (most telsons missing) (with median cleft); terminal margin of left lobe with (3) 6 large spines extending onto lateral margin (and several very small spinules medianly,) right terminal margin with 3 (4-6) smaller spines.

Color: Shield pale gray and cream, sometimes with blue tinges. Ocular peduncles cream, sometimes with blue-green flecks basally; corneas black. Antennular peduncles cream, sometimes with green-blue spot on dorsal surface of penultimate segment near articulation with ultimate segment, and spots proximally and distally on ultimate segment; flagella cream. Antennal peduncles cream; flagella cream with narrow blue-green bands on approximately every fourth article. Chelipeds cream with variable areas of brown especially ventrally on propodi. Ambulatory legs cream with some brown on propodi near mid-length, and scattered brown areas on carpus and merus (MORGAN 1987).

Habitat: Littoral and shallow sublittoral.

Distribution: East Africa and Red Sea; across Indian Ocean to Malaysia; northern Arabian Sea; Philippines; Indonesia; northern and northwestern Australia (MORGAN 1987)

Remarks: Lectotype designation has been made to ensure the name's proper and consistent application.



Figs 9-12: *Diogenes avarus* Heller, 1862. 9: shield and cephalic appendages of lectotype (setae and aesthetascs omitted); 10: chela and carpus of lectotype (outer faces); 11: chela and carpus of male paralectotype (outer faces); 12: telson of lectotype (dorsal view).

Among Heller's material from the 'Novara'-Expedition is one lot with an identification label that reads "Pagurus claviger, Novara, Ceylon". There is no mention of these specimens or this name in the expedition reports of 1862 or 1865. Reexamination of these specimens has shown that they represent *Diogenes avarus*.

In a review of the reference collection of the Phuket Marine Biological Center, McLaughlin (in press) determined that the samples identified by Nateewathana & al. (1981) as *Clibanarius padavensis*, actually contained *Clibanarius demani* Buitendijk, 1937, *Diogenes avarus*, and *Diogenes klaasi* Rahayu & Forest, 1995.

Diogenes senex Heller, 1865

Figs 13-15

Diogenes senex Heller, 1865: 85, pl. 7, fig. 3. – Haswell, 1882: 158. – Whitelegge, 1889: 232. – Alcock, 1905: 166 (in part) (lit). – Barnard, 1950: 446 (in part). – McLaughlin & Haig, 1996: 116, figs 1-3.

? *Diogenes gardineri*: Morgan, 1987: 175; ? not *Diogenes gardineri* Alcock, 1905.

? Not *Pagurus* (*Diogenes*) *senex*: Hilgendorf, 1879: 824.

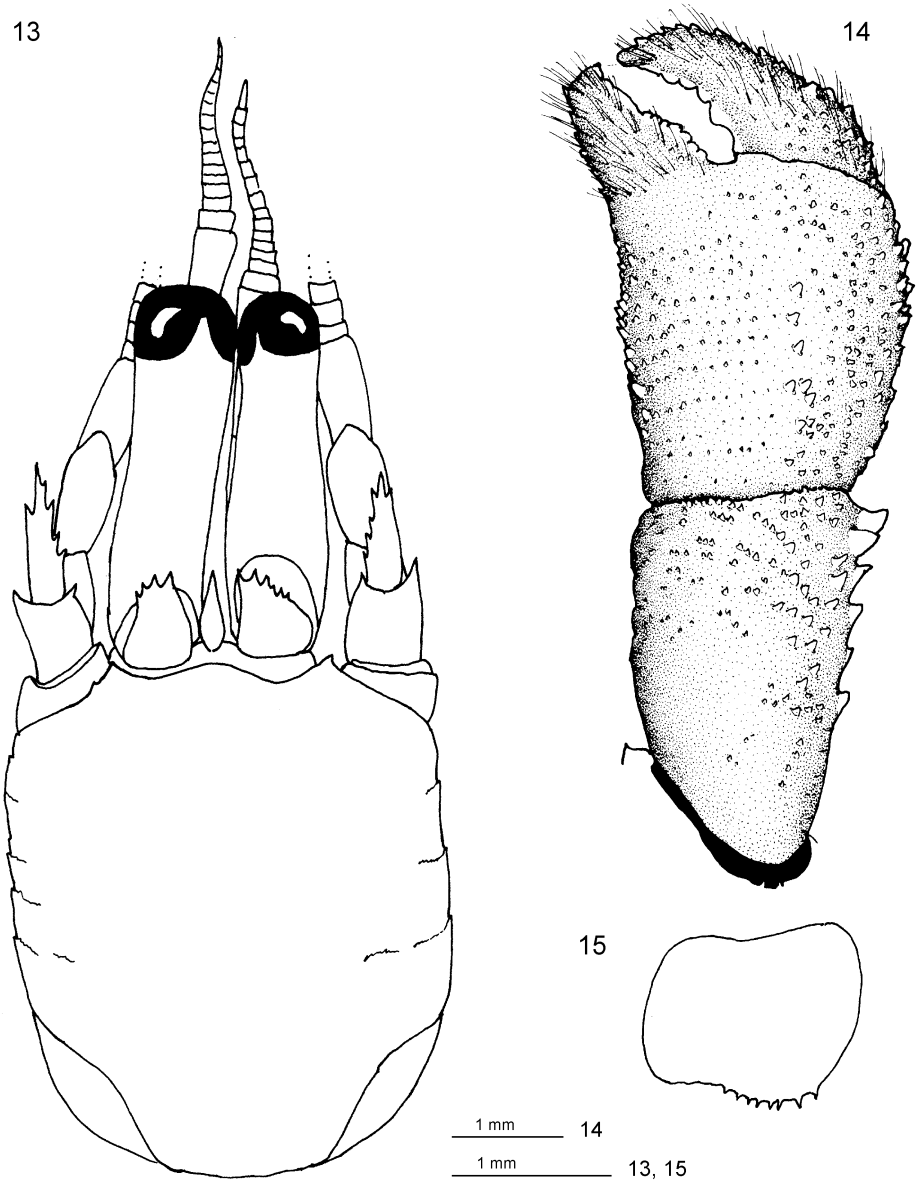
Not *Diogenes senex*: Bouvier, 1892: 55. – Nobili, 1903: 16; 1906a: 78; 1906b: 118. – -Balss, 1927: 224. – Forest, 1956b: 531. – Nakasone, 1975: 1, fig. 1 . – Miyake & Imafuku, 1980: 3. – Morgan, 1987: 176.

Not *Diogenes senex*: Lanchester, 1902: 366. (= *Diogenes stenops* Morgan & Forest, 1991).

Holotype [replaces neotype of McLaughlin & Haig (1996)]: male (sl = 3.1 mm), NHMW 19395; type locality, Sydney, Australia.

Diagnosis based on holotype [parentheses contain variations noted by McLaughlin & Haig (1996)]. Shield (Fig. 13) longer than broad; dorsal surface with sparse tufts of long setae, scattered spines and transverse spinulose ridges laterally on each side, lateral margins sometimes also with few small spines and long setae. Branchiostegal dorsal margin with row of (4-8 small) 8 or 9 very small spinules and few long setae, 1 additional small spine, practically obscured by dense setae, on distal margin of branchiostegite dorsally. Rostrum (obsolete to) broadly rounded. Rostriform process slender, acute, (usually not reaching distal margin of inner-most spine of ocular acicles, occasionally) equaling (or slightly exceeding) length of acicular spines. No ventral process or spine, but often few setae. Ocular peduncles (0.75) 0.80 length of shield, distal margin of cornea usually reaching distal 0.25 (0.33-0.50) of ultimate segment of antennular peduncle; antennal peduncle reaching only to base of cornea. Ocular acicles roundly triangular (or subrectangular), distal margin with (usually) 1 (or 2) moderately strong and (2-) 4 much smaller spines, not extending beyond 0.50 of lateral margin, (occasionally with only 4 or 5 small spines). Antennular peduncles with 1 (-3) moderately long setae on dorsal margin of ultimate segment. Antennal acicle not bifurcate, not reaching (rarely reaching) to proximal margin of ultimate peduncular segment; with simple (or bifid) tip, mesial margin with 3 or 4 (2-4) spines and several long setae, lateral margin with 0 (-2) spines. Antennal flagellum quite short, slightly overreaching (barely reaching) distal margin of carpus of left cheliped; ventral margin of each article with pair of long setae provided with auxiliary setules. (Maxillule with 1 long stiff bristle on weakly developed internal endopodal lobe, external lobe absent.)

Left cheliped with row of (acute spines or) small spinulose tubercles on upper surface of dactyl, supplemental 1 (or 2 similar) row(s) of (spines or) tubercles and additional scattered spinules or tubercles on upper outer surface; entire outer face with rather long, moderately dense setae. Lower margin of palm (Fig. 14) and fixed finger rounded, nearly straight (to noticeably sinuous), with irregular (single or) nearly double row of moderately small (spines or) spinulose tubercles, outer surface of fixed finger with scattered



Figs 13-15: *Diogenes senex* Heller, 1865, holotype. 13: shield and cephalic appendages (setae and aesthetascs omitted); 14: chela and carpus (outer faces; setation shown only for dactyl and fixed finger); 15: telson.

spinules or small tuberculate spines and long setae; outer surface of palm strongly convex, with very distinctly produced midline providing triangular appearance, upper margin somewhat flattened (or rounded) and with (1 to several) irregular almost triple row of small (spines or) spinulose tubercles, upper outer surface usually (with 1 longitudinal row of spines or) spinules and occasionally also additional scattered spinules or granu-

les, prominently produced midline armed with irregular single to double (triple) row of small spines (or spinulose tubercles) extending more than (at least) half length of palm, (and sometimes to articulation of dactyl and fixed finger) strongest in proximal 0.35, lower outer surface with numerous scattered, small (spines or) spinulose tubercles and long setae. Carpus with outer face convex; upper margin with (slightly raised) row of spines proximally, upper outer surface spinose or tuberculate, frequently with distinct longitudinal row of spines, distal margin with 3 (-5 acute) spines, lower outer surface and lower margin spinose or tuberculate. Merus with row of tubercles on upper margin. Right cheliped usually with distinct hiatus between dactyl and fixed finger; long setae on outer, upper and lower surfaces often virtually obscuring all armature. Dactyl with row of small spines or spinules on upper margin and outer face; fixed finger with few spinules. Outer face and lower margin of palm with scattered spines, spinules or small tubercles, upper margin rounded, unarmed or weakly spinulose. Carpus with long setae on all surfaces; upper surface somewhat flattened, usually with row of small spines, spinules, or small spinulose tubercles on both inner and outer margins, and commonly 1 stronger spine at each distal angle, outer face usually with scattered spinules or tubercles.

Ambulatory legs with dactyls approximately 0.20 (0.33) longer than propodi, with numerous long stiff setae on all surfaces. Propodi 1.25 (1.50 to twice) length of carpi, all surfaces with long setae. Carpi usually with 1 strong spine at dorsodistal margins of 2nd pereopods (and 1-5 small spines usually in proximal half to 0.65); third with dorsodistal spine (and usually 1 spine in proximal 0.50, infrequently unarmed). Sternite of third pereopods with anterior lobe (subsemicircular to) roundly rectangular (often obscured by long setae).

Telson (Fig. 15) with slightly asymmetrical posterior lobes, median cleft (usually indistinct or) absent; left terminal margin with 2 relatively large and few small spinules, right damaged (with row of very small spines or spinules, becoming appreciably larger on left and extending at least half length of left lateral margin, occasionally 1 or 2 spines also extending onto right lateral margin.)

Color: Not reported.

Habitat: Intertidal and shallow subtidal.

Distribution: East coast of Australia from south of Sydney to Port Essington, Northern Australia (McLaughlin & Haig 1996).

Remarks: The recognition of the existence of Heller's (1865) holotype of *D. senex* invalidates the neotype designated by McLaughlin & Haig (1996). As discussed by these authors, it is quite possible that Morgan's (1987) *D. gardineri* is actually *D. senex*. It is equally unlikely that Hilgendorf's (1879) record of *D. senex* from Moçambique is accurate, but until his material can be reexamined, the true identity of his taxon cannot be determined.

Petrochirus Stimpson, 1858

Petrochirus granulatus (Olivier) - Heller (1865: 85)

= *Petrochirus diogenes* (Linnaeus, 1758).

Rio de Janeiro: 1 male (sl = 11.6 mm), NHMW 1514; 1 male (sl = 11.7 mm), NHMW 19426.

Remarks: Heller's (1865) identification was correct in that the Linnean species, *Cancer diogenes* Linnaeus, 1758, at that time represented a composite taxon. Holthuis (1959), selected as the lectotype of Linnaeus' taxon, the specimen illustrated by Catesby (1754), thus fixing the identity of *Petrochirus diogenes. Pagurus granulatus* became a junior subjective synonym (Holthuis 1959).

Dardanus Paul'son, 1875

Pagurus varipes Heller, 1861

= *Dardanus tinctor* (Forskål, 1775)

Cancer tinctor Forskål, 1775: 93, 94. – Herbst, 1796: 30.

Pagurus varipes Heller, 1861a: 244, pl. 1, fig. 1, pl. 2, figs. 2, 3; 1861b: 22. – Alcock, 1905: 90, pl. 9, fig. 7. – Fize & Serène, 213, text fig. 33C, D.

Pagurus pedunculatus Ortmann, 1894: 31. – Barnard, 1950: 429, text fig. 79a. Not *Dardanus pedunculatus* (Herbst, 1804).

Pagurus brevipes Bonnier & Perez, 1902: 117.

Dardanus tinctor: Lewinsohn, 1969: 26, pl. 1, figs 1, 2. – Hogarth, 1988: 1099.

Not *Pagurus varipes*: de Man, 1888b: 436. – Henderson, 1893: 420 [= *Dardanus pedunculatus* (Herbst, 1804)].

Not *Dardanus varipes*: Boone, 1938 [= *Dardanus gemmatus* (H. Milne Edwards, 1848)].

Not *Dardanus tinctor*: Sakai, 1973, unnumbered fig. – Miyake, 1978: 55 (key) [= *Dardanus gemmatus* (H. Milne Edwards, 1848)].

Syntypes: 1 male (sl = 14.5 mm), NHMW 19398 [specimen figured by Heller (1861a)]; 1 male (sl = 20.2 mm) NHMW 19399; type locality, Red Sea.

Diagnosis based on male syntype (sl = 14.5 mm), NHMW 19398: Shield slightly longer than broad. Ocular peduncles short, stout, slightly broadened distally, corneas slightly less than 0.50 length of ocular peduncles; ocular acicles multispinose. Antennular peduncles overreaching distal margins of corneas by approximately half length of ultimate segment. Antennal peduncles reaching to or not quite to distal margins of corneas.

Left cheliped massive; upper margin of dactyl with several longitudinal rows of rounded tubercles, but not forming crest; outer surface with similar irregular rows of tubercles. Upper margin of palm with irregular, almost double row of blunt spines or tubercles, lower half glabrous, outer face with numerous subparallel rows of small tubercles in upper 0.65; straight lower margin with row of closely-spaced small tubercles extending length of fixed finger, fixed finger with row of slightly larger tubercles adjacent to cutting edge.

Dactyl and propodus of left 3rd pereopod considerably broader than right; dactyl slightly longer than propodus, lateral surface concave dorsally, with prominent longitudinal, somewhat rugose carina near ventral margin not extending to tip, dorsolateral and ventrolateral margins each with prominent crest, spinose dorsally, crenulate ventrally. Propodus with unarmed lateral face concave dorsally and ventrally and convex medianly, dorsolateral and ventrolateral margins each with crenulate or bluntly spinose, outwardly directed crest.

Color: Not reported.

Habitat: Commonly associated with anemones; often found on coral reefs; 0-85 m.

Distribution: Red Sea, Gulf of Aden and Persian Gulf; East Africa (Lewinsohn 1982).

Pagurus depressus HELLER, 1861

= *Dardanus lagopodes* (FORSKÅL, 1775)

Cancer lagopodes FORSKÅL, 1775: 93. – HERBST, 1796: 29.
Pagurus sanguinolentus QUOY & GAIMARD, 1824: 532, pl. 79, fig 2. – FOREST, 1953c: 559, figs 12-14; 1956b: 1064. – FIZE & SERÈNE, 1955: 166, text fig. 25A, B, C, pl. 4a, figs 4, 5.
Pagurus affinis H. MILNE EDWARDS, 1836: 274; 1837: 224; 1848: 62.
Pagurus euopsis DANA, 1852: 452, 1855: 10, pl. 28, fig. 6. – DE MAN, 1888b: 429. – Alcock, 1905: 86, pl. 9, fig. 2. – YAP-CHIONGCO, 1938: 200, pl. 1, fig. 7.
Pagurus depressus HELLER, 1861a: 22; 1861c: 248. – HILGENDORF, 1879: 814. – DE MAN, 1888b: 431.
Dardanus Hellerii PAUL'SON, 1875: 90, 91, pl. 12, fig. 4, 4a-c.
Dardanus lagopodes: LEWINSOHN, 1969: 32, pl. 2, figs. 1, 2; 1982: 47. – MIYAKE, 1978: 55, text fig. 19; 1982:110, pl. 37, fig. 4. – ASAKURA, 1995: 357, pl. 95, fig. 6. – TUDGE, 1995: 25, fig. 10, pl. 3, fig. f.

Syntypes: 2 females (sl =12.5, 15.0 mm), NHMW 19396; type locality, Red Sea.

Diagnosis based on Heller's syntypes: Carapace depressed. Ocular peduncles subcylindrical, longer than antennular peduncles; somewhat broadened distally; cornea occupying no more than 0.20 of peduncle; interocular lobes prominent; ocular acicles trifid . Antennular peduncles reaching to bases of corneas. Antennal peduncles reaching distal 0.20 of ocular peduncles but not reaching to bases of corneas; antennal acicles overreaching distal margins of fourth peduncular segments, terminally bifid.

Left cheliped broad, but not massive, and not much longer than right; upper margin and outer surface of palm with rows of acute, corneous-tipped spines, not obscured by long setae. Carpus with 3 spines on upper margin, outer face with few spines in lower half and 1 or 2 below upper margin. Right cheliped with double row of spines on upper margin of palm; outer face of dactyl and palm each with rows of moderately strong, corneous-tipped spines. Carpus with 3 spines on upper margin, outer face with 2 spines in upper half and row of spines on distal margin and 2 in lower half.

Dactyl of left third pereopod appreciably longer than propodus, not laterally compressed, lateral face with weak longitudinal sulcus, flanked dorsally and ventrally by irregularly set small corneous spines and long stiff setae; propodus with dorsal surface armed laterally with almost double row of corneous-tipped small spines, curving laterally in distal half leaving anterior dorsal margin practically glabrous; lateral face concave in dorsal half, smooth and with only single row of widely-spaced tufts of setae, median elevated broad ridge, somewhat depressed lower outer face and ventral margin each with 2 or more rows of corneous spines and tufts of long stiff setae.

Telson strongly asymmetrical; left posterior lobe largest, terminal margin with 6 spines extending onto lateral margin, right with 2 spines (smaller female).

Color: "rubescens" (HELLER 1861a).

Habitat: Frequently associated with coral reefs. Often with actinians on shells (LEWINSOHN 1969).

Distribution: Red Sea, Indian Ocean, Western and Central Pacific (LEWINSOHN 1969).

Remarks: FOREST (1953c) and FIZE & SERÈNE (1955) reported on the morphological variability of this species, which has a very broad geographic distribution. Similarly, these authors and others have observed different color morphs. These variations un-

doubtedly account for the numerous names that have been given to this species. Heller's (1861a, b) specimens from the Red Sea correspond with the type area from which Forskål's (1775) species was first described.

Pagurus Lar Heller, 1862

This species was not mentioned again in the 'Novara' complete report, and no specimen so labeled has been found in the Naturhistorisches Museum in Wien. It is probable that before Heller completed the final (Heller 1865) 'Novara' report he had realized that the species he had described as "*Pagurus Lar*" was an already described species. His description is insufficiant to ascertain to what taxon he may have been referring. It does not appear to have been any of the species of *Dardanus* collected during the expedition.

Pagurus difformis H. Milne Edwards - Heller (1865: 86)

= *Dardanus deformis* (H. Milne Edwards, 1836).

Tahiti: 1 male (sl = 10.1 mm), NHMW 19414.

Remarks: Although Heller referenced only H. Milne Edwards' (1836) original description, he used the spelling that Dana (1852b) had used. Heller cited Milne Edwards' figure as plate 13, figure 14. Milne Edwards himself (1836: 272) incorrectly cited his figure of this species as pl. 14, fig. 2, and this error was repeated by both Alcock (1905) and Lewinsohn (1969). Morgan (1990) accurately cited the plate and figure number; however, he made no comment about the earlier errors. H. Milne Edwards' (1836) plate 14, fig. 2 depicts his interpretation of *Diogenes miles*, but is actually *Diogenes merguiensis* de Man, 1888 (McLaughlin & Holthuis 2001). The correct citation for the figures of "*Pagurus*" *deformis* is plate 13, figures 4, 4a.

Pagurus punctulatus Olivier - Heller (1865: 87)

= *Dardanus megistos* (Herbst, 1804)

Nicobar Islands: 1 male (sl = 11.0 mm), NHMW 19415.

Tahiti: 1 male (sl = 14.4 mm), NHMW 19416.

Aniculus Dana, 1852

Aniculus typicus (Fabricius) - Heller (1865: 87)

= *Coenobita perlatus* H. Milne Edwards, 1837

Auckland: 1 male (sl = 21.1 mm), NHMW 19421.

[= *Aniculus aniculus* (Fabricius, 1787) (see remarks)]

Tahiti: 1 female (sl = 17.3 mm), NHMW 19424; 1 female (sl = 21.8 mm), NHMW 19423.

Remarks: The only entry in the 'Novara' report of "*Aniculus typicus*" gives the collection site as Auckland, New Zealand. Forest & McLaughlin (2000), believing at that

time that HELLER's (1865) specimens were no longer extant, placed Heller's *Aniculus typicus* in synonymy with *Dardanus arrosor* (HERBST, 1796). FOREST & MCLAUGHLIN (2000) reasoned that although MIERS (1876), FILHOL (1885) and THOMSON (1899) followed HELLER (1865) in listing this species as "*Aniculus typicus*", HUTTON (1882) was correct in believing that this tropical species should be excluded from the New Zealand fauna since it had never been seen since Heller's original report. CHILTON (1911), however, reported a specimen he attributed to *Aniculus aniculus* from east of Stewart Island. Subsequently, FOREST (1952) reexamined Chilton's specimen, in the interim having been renamed *Aniculus chiltoni* THOMPSON, 1930, and determined that it actually was a specimen of *Dardanus arrosor*. FOREST & MCLAUGHLIN (2000) consequently assumed that like Chilton, Heller had mistaken a specimen of *Dardanus arrosor* for *Aniculus aniculus*. Reexamination of Heller's specimen, presumably from Auckland, has shown that it is neither *Aniculus aniculus* nor *Dardanus arrosor*, but *Coenobita perlatus*. It would appear that in this case, the locality is incorrect, as *Coenobita* species are not known on the main Islands of New Zealand (cf. FOREST & MCLAUGHLIN 2000). Heller did correctly identify two specimens of *Aniculus aniculus* from Tahiti (as *Aniculus typicus*), but these were not included in the 'Novara' account.

Calcinus DANA 1851

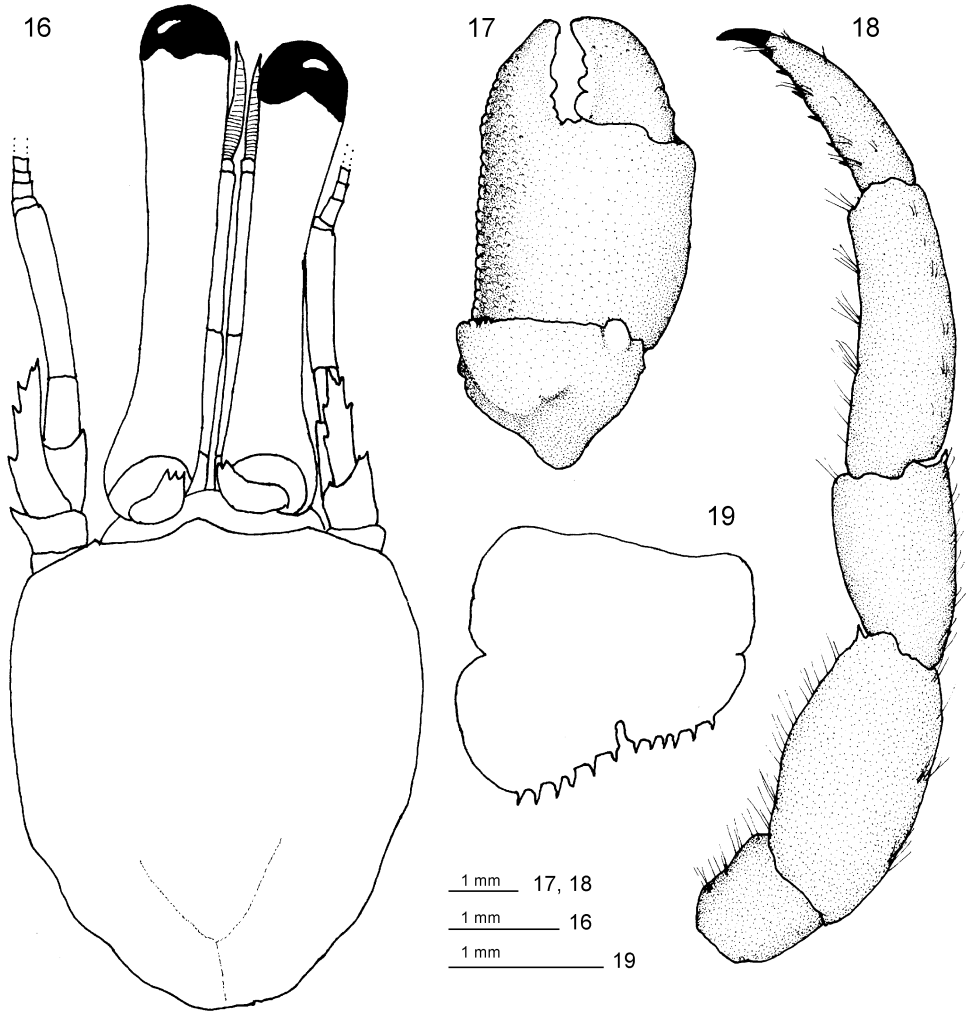
Calcinus rosaceus HELLER, 1861
Figs 16-19

Calcinus rosaceus HELLER, 1861a: 23; 1861c: 253. – HILGENDORF, 1869: 111. – DE MAN, 1881a: 102. – ALCOCK, 1905: 163. – NOBILI, 1906a: 84, pl. 5, fig. 6. – FOREST, 1956a: 222, figs 5-9. – LEWINSOHN, 1969: 50. – MORGAN, 1991: 908.
Calcinus nitidus var. *australiensis* BOUVIER, 1915: 30, figs 12, 13.

Holotype: male (sl = 4.5 mm), NHMW 19400; type locality, Red Sea.

Diagnosis based on holotype with reported variations noted in parentheses. Shield (Fig. 16) appreciably longer than broad. Rostrum obtusely triangular, reaching well beyond level of weak lateral projections. Ocular peduncles asymmetrical in length, left longest, slightly longer than shield (shorter than shield); ocular acicles bi- or trifid (simple or bifid). Antennular peduncles reaching distal 0.75 of longer ocular peduncle. Antennal peduncles reaching to mid-length of longer ocular peduncle; fourth segment with dorsodistal spine; third segment with prominent ventrodistal spine; second segment with dorsolateral distal angle somewhat produced, terminally blunt or with bifid spine. Antennal acicle slightly overreaching proximal margin of ultimate peduncular segment, with simple terminal spine, mesial and lateral faces each with 0-4 acute spines.

Left cheliped with a prominent hiatus between dactyl and fixed finger; dorsal surface of dactyl with two small spiniform tubercles proximally, minutely tuberculate distally. Palm (Fig. 17) without (or with) row of conical tubercles on upper margin; outer face smooth in upper 0.75 (or covered with granules.) faintly tuberculate in lower 0.25. Carpus with small spine on dorsodistal margin. Right cheliped with row of small spines on dorsal margin of dactyl, decreasing in size distally. Palm with 6 (5) spines on upper margin, outer face with 3 blunt spines on distal margin, lower 0.20 weakly tuberculate. Carpus with dorsodistal spine and 2 smaller spines on dorsal margin.



Figs 16-19: *Calcinus rosaceus* Heller, 1861, holotype. 16: shield and cephalic appendages (setae and aesthetascs omitted); 17: chela and carpus (outer faces); 18: left third pereopod (lateral view); 19: telson (dorsal view).

Dactyl (Fig. 18) of left third pereopod distinctly shorter than propodus; no brush of dense setae on ventral margins of dactyl and propodus; ventral margin of dactyl with 6 small corneous spines; carpus with dorsodistal spine; merus with slender spine at ventrolateral distal angle.

Telson (Fig. 19) with prominent incision on lateral margins separating anterior and posterior lobes; asymmetrical posterior lobes separated by moderately shallow median cleft, left lobe considerably larger, terminal margin with 6 corneous-tipped spines, not extending onto lateral; right terminal margin also with 6 spines, not extending onto lateral margin.

Color: Overall color of bright black-violet, fading in preservative to red or rose.

Habitat: Coral reefs among living coral; 1-2 m.

Distribution: Red Sea; East Africa (MORGAN 1991); Mauritius (LEWINSOHN 1969).

Calcinus cristimanus (H. MILNE EDWARDS) - HELLER (1861a: 23, c: 254)

= *Calcinus latens* (RANDALL, 1840)

Red Sea: 1 male (sl = 7.2 mm), NHMW 19419.

Calcinus tibicen (HERBST) - HELLER (1865: 87)

In part = *Calcinus laevimanus* (RANDALL, 1840)

Nicobar Islands: 9 males (sl = 4.3-7.7 mm), 2 females (sl = 2.7, 3.6 mm), 11 not removed from shells, NMHW 19433; 1 female (sl = 5.4 mm), 3 not removed from shells, NHMW 19432.

Tahiti: 1 male (sl = 5.5 mm), 1 (sl = 4.9 mm), 1 ovig. female (sl = 5.0 mm), 3 not removed from shells, NHMW 19434; 4 males (3.3-7.1 mm), 1 female (sl = 3.7 mm), 7 ovig. females (sl = 3.6-4.0 mm), 56 not removed from shells, NHMW 19435.

Sydney: 5 males (sl = 1.37-2.36 mm), 3 females (sl = 1.31-1.52 mm), 16 juveniles (0.92-1.22 mm), 7 juveniles not removed from shells, NHMW 19436.

In part = *Calcinus* sp. (possibly C. *sirius* MORGAN, 1991)

Sydney: 1 juvenile (sl = 0.92 mm), NHMW 19588.

In part = *Clibanarius* sp.

Sydney: juveniles (sl = 0.61-0.95 mm), NHMW 19587.

Remarks: Among the numerous, very small, mostly juvenile specimens from Sydney, was one specimen of *Calcinus*, that clearly was not *C. laevimanus*. The spinose upper margin of the palm of the left cheliped suggests that it possibly could be *C. sirius*, another species also occurring in the area. However, the specimen's immaturity and lack of color make a confident identification impossible. Additionally there were several juvenile specimens of a species of *Clibanarius*, also lacking all color that could not be identified to specific level.

Calcinus gaimardii (H. MILNE EDWARDS) - HELLER (1865: 87)

In part = *Calcinus gaimardii* (H. MILNE EDWARDS, 1848).

Nicobar Islands: 2 males (sl = 7.1, 7.2 mm), 3 females (sl = 3.4-7.2 mm), NHMW 19427.

In part = *Calcinus morgani* RAHAYU & FOREST, 1999.

Nicobar Islands: 2 males (sl = 7.1, 7.8 mm), 1 ovig. female (sl = 6.5mm), NHMW 19428.

Nicobar Islands: 1 male (sl = 7.4 mm), NHMW 1942.

Remarks: RAHAYU & FOREST (1999) divided *C. gaimardii* into two distinct species, principally upon the color patterns of the shield. *Calcinus gaimardii*, sensu stricto, was characterized by having the shield partially to entirely reddish brown, whereas the shield

of *C. morgani* Rahayu & Forest, 1999 was predominently light greenish-blue or creamy white. Of course there is only the faintest hint of color on a few of Heller's specimen, and this restricted primarily to the left chelipeds; however, the weak differences in morphology indicated by Rahayu & Forest (1999) suggest that Heller's (1865) Nicobar specimens of NHMW 19427 represent the true *C. gaimardii,* while those of NHMW 19428 and 19429 seem to represent *C. morgani*. The distributional map provided by Rahayu & Forest (1999) shows both species occurring in the general area of the Nicobar Islands. McLaughlin (2001) reported only *C. gaimardii* from the Andaman Sea, based on observed color.

Calcinus elegans (H. Milne Edwards) - Heller (1865: 88)

= *Calcinus elegans* (H. Milne Edwards, 1837).

Tahiti: 2 males (sl = 6.4, 7.2 mm), 2 females (sl = 4.5, 6.5 mm), 1 ovig. female (sl = 4.6 mm), 1 not removed from shell, NHMW 19417.

Calcinus latens (Randall) - Heller (1865: 88)

In part = *Calcinus* cf. *sirius* Morgan 1991 (see remarks).

Sydney: 2 females (sl = 1.8, 2.1 mm), 1 ovig. female (sl = 3.2 mm), 2, missing most appendages, not removed from shells, NHMW 19434.

In part = *Calcinus* cf. *spicatus* Forest, 1951 (see remarks).

Tahiti: 4 ovig. females (sl = 2.5-3.5 mm), NHMW 19431.

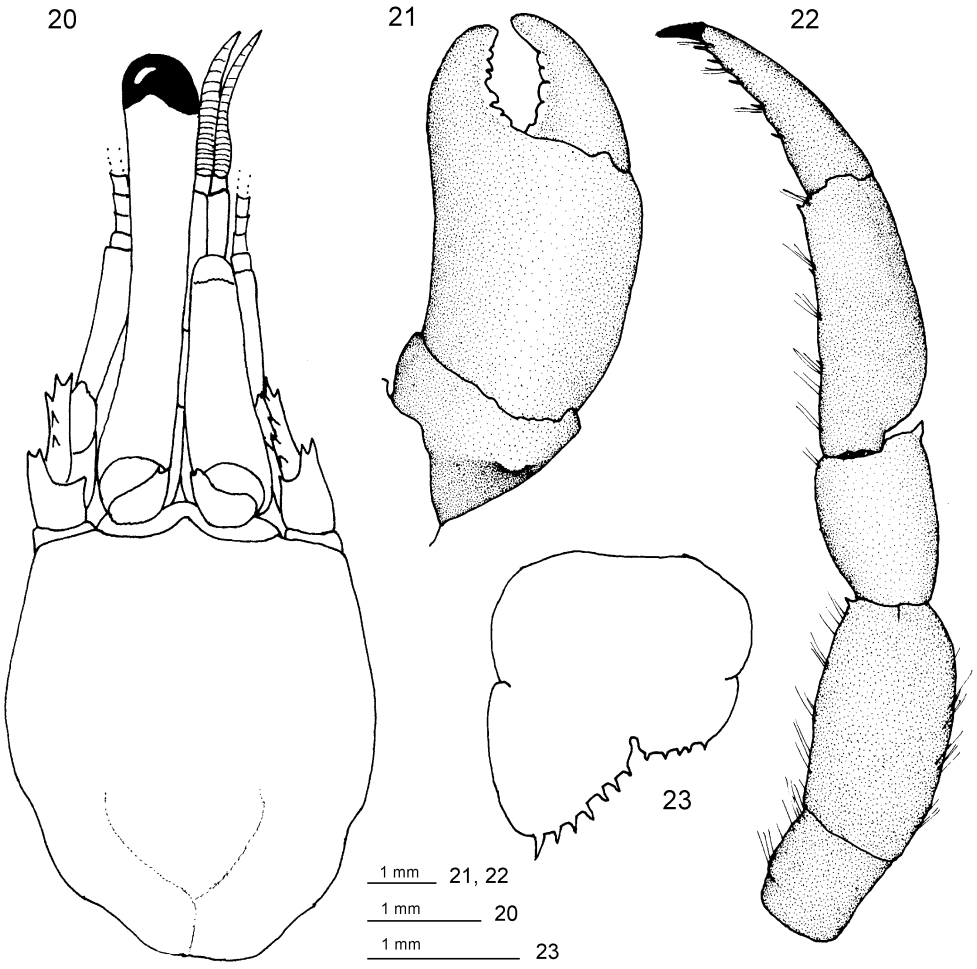
Remarks: The specimens from Sydney do not appear to represent *C. latens* as Heller (1865) believed. All are quite small, and partially decalcified, as well as lacking any indication of color. However, in having a single spine on the left posterior lobe of the telson, a moderate number of tufts of setae on the ventral margins of the dactyl and propodus of the third pereopod, tuberculate outer surface and spinose upper margin of the palm of the left cheliped, and spinose upper margin of right, these specimens most closely agree with the description of small females provided by Morgan (1991) for *C. sirus*.

The specimens from Tahiti similarly do not appear to represent *C. latens*. As with most species of *Calcinus* where identifications are principally based on color, the present identification is not positive. These specimens are attributed to *C.* cf. *spicatus* because of the spinose and tuberculate armature of the left chela, the moderately dense tufts of setae on the dactyl and propodus of the third left pereopod, and the presence of three or four spines on the margin of the right lobe of the telson.

Calcinus nitidus Heller, 1865
Figs 20-23

Calcinus nitidus Heller, 1865: 89, pl. 7, fig. 4. – de Man, 1890: 111. – Ortmann, 1892: 293. – Forest, 1956b: 218, figs 1-4. – Poupin, 1994: 18 (in part), fig. 14; 1997: 706, fig. 6B.

Holotype: male (sl = 4.5 mm), NHMW 19397; type locality, Tahiti.



Figs 20-23: *Calcinus nitidus* HELLER, 1865, holotype. 20: shield and cephalic appendages (setae and aesthetascs omitted); 21: left chela and carpus (outer faces); 22: left third pereopod (lateral view); 23: telson (dorsal view).

Diagnosis based on holotype, with reported variations in parentheses. Shield (Fig. 20) longer than broad. Rostrum broadly triangular, slightly exceeding level of weak lateral projections. Ocular peduncles – left long and slender, right regenerating, left approximately equal to length of shield; ocular acicles distinctly or faintly bifid. Antennular peduncles when fully extended reaching only to distal 0.20 of left ocular peduncle. Antennal peduncles reaching slightly beyond mid-length of left ocular peduncle; fourth segment with small dorsodistal spine; third segment with ventrodistal spinule; second segment with dorsodistal angle produced into distinctly bifid spine. Antennal acicle reaching to or slightly beyond proximal margin of ultimate peduncular segment, with simple or bifid terminal spine and 2-4 acute spines on dorsomesial surface, 1 distal spine on lateral margin.

Left cheliped with prominent hiatus between dactyl and fixed finger; dactyl with upper surface microscopically crenulate. Palm (Fig. 21) convex, slightly damaged outer surface and upper margin smooth. Carpus with low tubercle on outer face, otherwise smooth. Right cheliped with prominent hiatus between dactyl and fixed finger; dactyl with 2 prominent tubercles and double row of minute, corneous-tipped granules; 6 (7) broad, corneous-tipped spines on upper margin of palm. Carpus with strong dorsodistal spine and 2 (3 small spines) spinulose protuberances on dorsal surface.

Dactyl of left third pereopod (Fig. 22) approximately equal to length of propodus (distinctly shorter than propodus); no brush of setae on ventral margins of dactyl and propodus; ventral margins of dactyls each with 5 corneous spines; carpi each with dorsodistal spine.

Telson (Fig. 23) with distinct lateral indentations separating anterior and posterior sections; strongly asymmetrical posterior lobes separated by moderately shallow median cleft; left terminal margin with 7 corneous-tipped spines, not extending onto lateral margin, right terminal margin with 5 spines, also not extending onto lateral margins.

Color in life: Shield white with large median orange patch. Ocular peduncles pale orange; corneas black. Antennular peduncle blue-black except distal part of last segment orange; flagella brown-orange. Antennal peduncles and flagella orange. Chelipeds white with large patches of orange on outer and inner surfaces of chelae, dorsal margins of carpi, mesial, ventral and lateral surfaces of meri. Ambulatory legs vivid orange, somewhat more intense on propodi and dactyls (Poupin 1997).

Habitat: Among branches of living coral; to depths of 5 m (Poupin 1997).

Distribution: French Polynesia.

Clibanarius Dana, 1852

Clibanarius carnifex Heller, 1861

Clibanarius carnifex Heller, 1861a: 23; 1861c: 250. – Buitendijk, 1937: 267 (key). – Fize and Serène, 1955: 76 (key). – Lewinsohn, 1969: 23, fig. 3.

Holotype: male (sl = 10.0 mm), NHMW 19391; type locality, Red Sea.

Diagnosis (based on holotype): Shield distinctly longer than broad; rostrum triangular, short, but projecting well beyond level anterior margin and obsolete lateral projections. Ocular peduncles long and slender, 0.80 length of shield; ocular acicles acutely triangular, marginally multidenticulate Antennular peduncles when fully extended reaching slightly beyond bases of corneas, but not overreaching distal corneal margins. Antennal peduncles shorter, reaching only to distal 0.80 of ocular peduncles and approximately 0.85 of ultimate segment of antennular peduncles; supernumerary segment quite distinct; fourth segment with dorsodistal spine; third segment with small ventrodistal spine; second segment with dorsolateral distal angle developed as long slender spine, dorsomesial distal angle completely unarmed; first segment with small spine on ventrolateral distal margin; antennal acicle reaching well beyond proximal margin of ultimate peduncular segment, with bifid terminal spine and 1 slender spine on lateral margin practically obscured by long setae.

Chelipeds similar, but left slightly stouter; right slightly longer. Dactyls each with row of corneous-tipped spines on dorsomesial margin and irregular double row of corneous-tipped spines on dorsal surface accompanied by long stiff setae. Palms each with row of 4 or 5 strong corneous-tipped spines on elevated dorsomesial margin, 1 more prominent conical tubercle on adjacent proximal margin, dorsal surfaces with corneous-tipped small spines, most numerous distally on palm and on fixed finger, dorsolateral portion of palms primarily with low protuberances and tufts of setae; lateral faces with few corneous spinules and tufts of setae; mesial faces nearly glabrous; ventral surfaces of palms, and carpi each with prominent median articulation. Carpi each with forwardly directed dorsodistal spine; dorsal margins and lateral faces each with numerous short transverse protuberant ridges and short to moderately long setae. Meri each with short transverse rows of setae on dorsal margins; lateral faces each with transverse rows of setae, few small spines or spinules on ventrolateral margins distally; ventromesial margins each with row of small spines in proximal 0.75.

Ambulatory legs with dactyls of third pereopods slightly longer than propodi - but, according to LEWINSOHN (1969) in young specimens shorter. Dactyl and propodus of third left dissimilar. Dactyls of second and third right subcylindrical, surfaces all with irregular rows of tufts of short and moderately short setae, ventral surfaces also each with row of 14 or 15 corneous spinules, decreasing in size posteriorly. Propodi each irregular rows of tufts of setae. Third left pereopod with lateral surface of dactyl somewhat flattened and with faint longitudinal sulcus proximally; surfaces all with irregular rows of short and moderately short setae; ventral margin with row of 15 corneous spinules, decreasing in size proximally; propodus with lateral face distinctly flattened, broadened, centrally concave, and separated from upper surface by with distinct ridge of stiff bristles often obscuring margin, small spine on laterodistal margin ventrally, and double row of protuberances and tufts of stiff setae ventrally below concavity, mesial face with few rows of sparse setae and 1 small spine on distal margin ventrally. Carpi all with dorsodistal spine and low protuberances on dorsal surfaces; lateral faces each with few rows of low protuberances and setae, best developed on third left. Meri each with low protuberances and short setae on all surfaces, ventrolateral margins each with 2 or 3 small spines at distal angle.

Telson with distinct lateral incisions; incipient, asymmetrical posterior lobes not delineated by distinct median cleft; terminal margin with 7 small, corneous, ventrally directed spines on left lobe, extending onto lateral margin, 3 on right.

Color: Ocular peduncles with white band at base of cornea, most of peduncle whitish color with variable network of red. Tubercles of chelipeds white and ground color reddish. Ambulatory legs with red network (reticulation) detectable on a bright background. This is particularly easy to see on the dactyl and propodus. The numerous setae on the appendages are yellowish [after LEWINSOHN (1969)].

Habitat: Intertidal.

Distribution: Red Sea; Aden (LEWINSOHN 1969).

Clibanarius signatus HELLER, 1861

Clibanarius signatus HELLER, 1861a: 23; 1861c: 252. – CHOPRA & DAS, 1940: 150, figs 3, 4. – LEWINSOHN, 1969: 20, fig. 2. – TIRMIZI & SIDDIQUI, 1982: 73, figs 38, 39.

Clibanarius aequabilis merguiensis: Balss, 1915: 9. Not *Clibanarius aequabilis merguiensis* de Man, 1888.

Syntypes: 7 males (sl = 3.9-6.5 mm), 2 females (sl = 3.3, 4.0 mm), NHMW 19392; type locality, Red Sea.

Diagnosis (based on type series): Shield longer than broad. Ocular peduncles approximately 0.80 length of shield; corneas not particularly dilated; ocular acicles roundly triangular, usually with 1 or 2 more prominent spines and 3 or 4 smaller spines. Antennular peduncles reaching beyond bases of corneas by not overreaching distal margins. Antennal peduncles varying from not quite reaching bases of corneas to nearly reaching distal margins; acicle reaching to or slightly beyond distal margin of penultimate segment, with terminal simple or weakly bifid spine.

Chelipeds subequal, right usually slightly larger, both shorter and stouter than ambulatory legs. Chelae with appreciable hiatus between dactyls and fixed fingers; dactyls each with 2, fixed fingers each with 3 rows of small, conical, corneous-tipped spines on dorsal surfaces; mesial faces of dactyls and lateral faces of fixed fingers similarly armed. Palms each with 5 or 6 rows of small, conical, corneous-tipped spines, strongest on dorsomesial margins; lateral faces similarly armed, spines all usually accompanied by 1-3 long setae; mesial and ventral surfaces with few sparse tufts of setae. Carpi rarely with 1, usually with 2 strong spines on dorsal margins; dorsal surfaces with few low, setose protuberances, dorsodistal margins each with 2 or 3 corneous-tipped spines. Meri with transverse, setose ridges on dorsal surfaces, ventromesial margins each with row of acute or subacute spines.

Ambulatory legs with dactyls shorter than propodi; ventral margins each with 5 or 6 small corneous spines. Propodi of second and third right subcylindrical; lateral face of propodus of third left flattened and with dorsolateral margin carinate, ventral margin with row of low, sometimes spinulose protuberances and sparse tufts of setae. Carpi each with dorsodistal spine.

Color: Background color of cephalothorax yellowish-white, with variable red markings, transverse streak of white always present directly posterior to anterior margin. Ocular peduncles with red longitudinal stripes. Chelipeds darker red and obscurely streaked with yellowish-white along some margins; prominent whitish area near ventrolateral margins of palms, extending almost to tips of fixed fingers; tubercles white; narrow white area just proximal to claws. Ambulatory legs yellowish-white with very prominent red longitudinal stripes (4 or 5) on all segments; no transverse rings of color on dactyls (Chopra & Das 1940).

Habitat: Not reported.

Distribution: Red and Arabian Seas (Tirmizi & Siddiqui 1982).

Clibanarius semistriatus Heller, 1862

This species was not included in the full 'Novara' report, and no specimen was found in the museum collections that corresponded with that specific name. As with Heller's "*Pagurus Lar*", it is probable that he realized that this was not a new taxon and simply omitted it from the major report. From his description and remarks on the color of the specimen, this may be the same species he had described earlier (Heller, 1861a) as *Clibanarius signatus*.

Clibanarius striolatus Dana - Heller (1865: 89)

In part = *Clibanarius striolatus* Dana, 1852.

Tahiti: 1 male (sl = 3.9 mm), NHMW 19407.

In part = *Clibanarius* cf. *demani* Buitendijk, 1937 (see remarks).

Nicobar Islands: 1 male (sl = 3.7 mm), 2 females (sl = 3.6, 3.9 mm), NHMW 19406.

In part = *Clibanarius longitarsus* (de Haan, 1849) (see remarks).

Nicobar Islands: 2 males (sl = 3.1, 5.2 mm), NHMW 19585.

In part = *Clibanarius* cf. *merguiensis* de Man, 1888 (see remarks).

Nicobar Islands: 1 female (sl = 4.2 mm), 1 ovig. female (sl =2.8 mm), NHMW 19586.

Remarks: Clearly Heller (1865) did not fully appreciate the species complexity existing in the genus *Clibanarius*, as his interpretation of *C. striolatus* demonstrates. His single specimen from Tahiti was correctly identified, whereas he confounded three additional species from the Nicobar Islands under that name.

The specimens herein identified as *Clibanarius* cf. *demani*, have a very faint indication of striping on the ambulatory legs that suggest their identity as Buitendijk's taxon. Additionally their morphology agrees with that described by Rahayu & Forest (1993) for this species. However, faint coloration remaining after many years in preservative can be misleading. Consequently we can only consider the identification tentative.

There is no trace of coloration in the two male specimens (NHMW 19585); however, their morphology clearly indicated that they do not represent *C. striolatus*. We have identified them, with reasonable confidence as *C. longitarsus*.

There are indications of striping on the ambulatory legs of the specimens we have tentatively assigned to *C. merguiensis*, that correspond well with those described for this species. Although the strength of the spination observed in the Nicobar specimens agrees well with that described by Fize & Serène (1955) for de Man's (1888a) species, we cannot completely be confident that the present specimens truly represent *C. merguiensis*.

Clibanarius corallinus (H. Milne Edwards) - Heller (1865: 89)

= *Clibanarius corallinus* (H. Milne Edwards, 1848).

Nicobar Islands: 1 male (sl = 12.8 mm), 1 female (sl = 5.0 mm), NHMW 19409.

Tahiti: 1 male (sl = 8.5 mm), NHMW 19408.

Clibanarius humilis (Dana) - Heller (1865: 90)

= *Clibanarius humilis* (Dana, 1852).

Nicobar Islands: 2 males (sl = 2.9, 3.0 mm), NHMW 19410.

Remarks: All color is lacking in Heller's specimens, and the spination of the chelipeds is somewhat stronger than seen in some specimens of this species. However, in the

structure of the anterior lobe of the sternite of the third pereopods, and in the symmetry and armature of the posterior lobes of the telson, there is agreement with comparative material. Unfortunately, most descriptions of *Clibanarius* species do not include these characters, so our identification can only be considered tentative.

Clibanarius virescens (Krauss) - Heller (1865: 90)

= *Clibanarius virescens* (Krauss, 1843).

Hong Kong: 1 male (sl = 5.7 mm), 19411.

Clibanarius longitarsis (de Haan) - Heller (1865: 90)

= *Clibanarius longitarsus* (de Haan, 1849).

Nicobar Islands: 3 males (sl = 7.1-11.1 mm), 2 females (sl = 7.8, 11.0 mm), 1 not removed from shell, NHMW 19412.

Madras: 1 male (sl = 6.2 mm), 1 female (sl = 5.3 mm), 1 ovig. female (sl = 5.9 mm), 3 not removed from shells, NHMW 19413.

Remarks: None of Heller's specimens has any trace of color. Our identification has been based on the general morphology of the chelipeds and shortness of the antennal acicles.

Clibanarius aequabilis (Dana) - Heller (1865: 91)

This clearly is a misidentification; however these specimens cannot be identified with certainty. They appear closest to *Clibanarius ransoni* Forest, 1953b.

Chile: 3 males (sl = 1.2-2.3 mm), 3 ovig. females (sl =1.8-2.0 mm), 3 not removed from shells, NHMW 19401.

Remarks: Forest (1953a) noted that Heller's (1865: 91) comments on the specimens he identified as *C. aequabilis* also agreed well with *C. albidigitus* Nobili, 1901. Consequently, Forest (1953a, 1955) excluded Heller's (1865) account from the distribution of Dana's species, although, he did not question the accuracy of Heller's locality. In contrast, Haig (1955) questionably included *C. aequabilis* in her report on the Chilean anomuran fauna. However, she commented that since many of Heller's records were known to be inaccurate, it was quite likely that his material came from some other locality.

Heller's specimens now lack any trace of color, and all are quite small, but the presence of ovigerous females confirms their maturity. The ocular peduncles of Heller's specimens are considerably shorter than were described and illustrated by either Dana (1852: 464, 1855: pl. 29, fig. 4a) or Forest (1853a: 439, fig. 1) for *C. aequabilis* or for *C. albidigitus* by Holthuis (1954). Although ocular peduncle length is often a function of animal size, it is very unlikely that size alone could account for this major difference. Heller's (1865) description of the coloration of the dactyl and propodus of the ambulatory legs lends support to our suggestion that these specimens may be conspecific with *C. ransoni*, and substantiates the probable inaccuracy of the locality data.

Paguristes DANA, 1851

Heller's *Clibanarius barbatus* is correctly assigned to *Paguristes*.

Paguristes barbatus (HELLER, 1862)

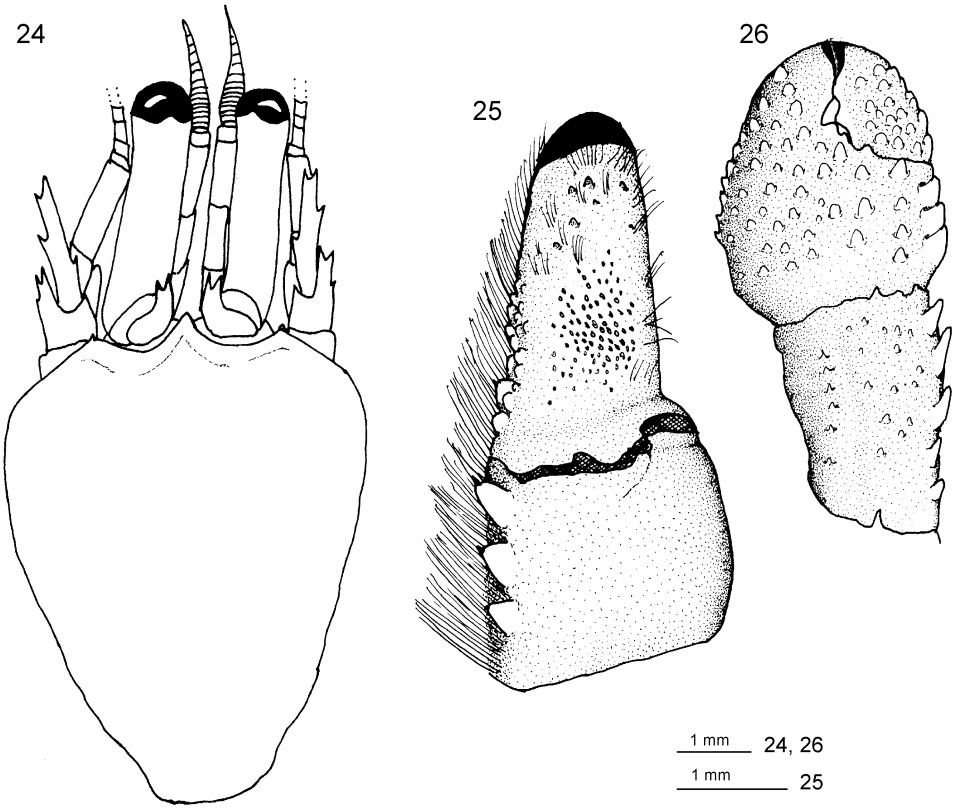
Figs 24-26

Clibanarius barbatus HELLER, 1862: 524; 1865: 90, pl. 7, fig. 5. – FILHOL, 1885: 425 (in part).
? *Clibanarius barbatus*: MIERS 1876: 67. – THOMSON 1899: 172 (see remarks).
Paguristes barbatus: MCCULLOCH 1913: 340. – FOREST & MCLAUGHLIN, 2000: 59, figs 16, 17.
Not *Clibanarius barbatus*: LUCAS 1886: 62 = *Paguristes sulcatus* BAKER, 1905.
Not *Paguristes barbatus*: ORTMANN 1892: 279, pl. 12, figs 7, 7p. – DOFLEIN 1902: 64. – BALSS 1913: 39. – TERAO 1913: 373. – YOKOYA 1933: 74; 1939: 278, figs 10A, B. – MIYAKE 1957: 86; 1960: 93, pl. 46, fig. 5. – MIYAKE et al. 1962: 125. – KIM 1963: 297, fig. 14; 1964: 8; 1970: 12; 1973: 210, 597, fig. 42, pl. 5, fig. 23 = *Paguristes ortmanni* MIYAKE, 1978.
Not *Paguristes barbatus*: STEAD 1898: 208. – WHITELEGGE 1889: 232 = *Paguristes squamosus* MCCULLOCH, 1913.
Not *Paguristes barbatus*: CHILTON 1911: 300. – ZARENKOV 1968: 194. – SCHEMBRI 1982: 865. – SCHEMBRI & MCLAY 1983: 28, fig. 4. – SCHEMBRI 1988: 95 = *Paguristes subpilosus* HENDERSON, 1888.

Holotype: male (sl = 2.3 mm), NHMW 19390; type locality, Auckland, New Zealand.

Redescription based on Heller's holotype [with variations noted by FOREST & MCLAUGHLIN (2000) in parentheses]: shield (Fig. 24) considerably longer than broad (approximately 0.60-0.80 total carapace length; maximum shield width 0.70-0.80 length;) surface with spiny tubercles laterally. Rostrum narrowly triangular, extending at least half own length beyond level of lateral projections, reaching to mid-length of ocular acicles, apex subacute. Ocular peduncles approximately 0.50 length of shield with minimum peduncular diameter practically equal to corneal diameter; ocular acicles terminally bifid (or with long slender terminal spine and small lateral additional tooth). Antennular peduncles reaching nearly to or slightly beyond distal margins of corneas; basal segment with small acute spine on dorsolateral margin of statocyst lobe. Antennal peduncles reaching distal 0.80 of ocular peduncles (sometimes reaching to or nearly to base of corneas); second segment with strongly produced dorsolateral distal angle, reaching to base of fifth segment, with bifid terminal spine and additional spine on lateral margin; mesial margin unarmed (with 2 spiniform tubercles, occasionally additional small tubercle on dorsal surface mesially); antennal acicle long, reaching nearly to distal margin of fifth peduncular segment, distally bifurcate and with 1 supplementary spine on lateral margin; 1 prominent spine in proximal third of mesial margin. Antennal flagellum shorter than shield, articles (usually) with 1-4 short stiff setae.

Chelipeds subequal, right slightly larger, similar in armature. Dactyl of left chela with dorsal surface nearly level, few corneous-tipped spines marginally and few piliferous tubercles, mesial face flat, glabrous, and covered with tiny, rounded, corneous granules (Fig. 25), apparently forming stridulating apparatus when rubbed together. Palm (Fig. 26) short, approximately 0.75 length of dactyl, with lateral surface broadly rounded, 3 prominent spines on dorsomesial margin, partially obscured by long setae. Carpus with row of short (often) corneous-tipped spines on dorsolateral margin, of almost completely concealed by dense long setae, dorsal surface with weak longitudinal groove laterad of



Figs 24-26: *Paguristes barbatus* (Heller, 1862), holotype. 24: shield and cephalic appendages (setae and aesthetascs omitted); 25: left chela (mesial faces); 26: carpus and chela of left cheliped (dorsal view, setae omitted).

midline (prominent median) and scattered small spinulose tubercles, dorsodistal margin with 1 (or 2) spines, dorsomesial margin with row of (5 or 6) 6 left, 7 right, strong, conical, corneous-tipped spines. Merus with small spines on ventromesial and ventrolateral margins, (ventrolateral margin sometimes also with 2 or 3 stronger distally); lateral face (sometimes) with scattered granules (very low protuberances) and somewhat concave ventral margin; dorsodistal margin with 1 prominent, corneous-tipped spine. Ischium with row of acute spines on ventromesial margin.

Second and third pereopods with dactyls subequal to propodi (lengths of upper margins in ratio of 0.88-1.1 dactyl to propodus). Mesial faces of dactyls of second pereopods with short, transverse, piliferous ridges (striations), each marginally armed with few corneous spinules and divided into 2 series by weak longitudinal groove, lateral faces each with few, very low, setiferous protuberances, ventral margins each with few (5 or 6) corneous spinules in distal half, concealed by dense setae. Row of spinulose protuberances dorsally on propodi, spines (setose protuberances) on carpi, both concealed by dense long setae; mesial and ventral surfaces with transverse protuberances (both segments with longitudinal dorsal row of corneous-tipped spines). Meri each with (row of

tiny spinules on dorsal margin of merus and) double row of spinules on ventral margin. Third pereopods lack dorsal row of sharp corneous-tipped spines on propodi and carpi but carpi each with strong dorsodistal spine.

First and second abdominal appendages paired and modified as gonopods. (Paired first pleopods of male each with inferior plate much longer than basal segment and enlarged in spatulate shape; distal margin armed with only few denticles; inner lobe rounded, weakly rolled, with long setae on the inner face and anterior margin; distal lobe slightly overreaching inferior plate; free margin of inferior plate with fringe of shorter setae. Paired second pleopods with short basal segment, elongate second segment and two partially fused segments, latter showing some torsion, with marginal and terminal setae; preceding segment with tuft without of setae. Pleopods 3 to 5 with exopods short, endopods vestigial or absent. Paired first pleopods of female equal, 2-segmented; pleopods 2 to 4 biramous, pleopod 5 uniramous. Brood pouch, formed by large fold of abdomen, very well developed and completely covering eggs attached to pleopods 2-4.)

Telson missing in holotype (with posterior lobes broad, left lobe slightly larger, terminal margins each with 2 or 3 strong, recurved corneous-tipped teeth, and few smaller teeth; 2 or 3 strong teeth on lateral margins.)

Color: In life, body and appendages brown; chelipeds and ambulatory legs tipped with black. Ocular peduncles, antennular and antennal peduncles blue. In alcohol, ocular peduncles generally retain reddish orange tinge; chelipeds and ambulatory legs mottled orange and cream (FOREST & MCLAUGHLIN 2000).

Habitat: Shallow water species, with maximum depth of 37 m reported (FOREST & MCLAUGHLIN 2000).

Distribution: Apparently endemic to New Zealand.

Remarks: FOREST & MCLAUGHLIN (2000) reported that HELLER's (1862) holotype had been deposited in the Natural History Museum, London, but could not currently be located. Their remark was based on the fact that MIERS (1876) presumably had redescribed HELLER's (1862) species, retaining it in the genus *Clibanarius* and indicating that the specimen was in the British collection. THOMSON (1899) had also had a similar interpretation of MIERS' (1876: 67) account. Although, the specimen described by Miers may have been "*Clibanarius*" *barbatus*, it obviously was not HELLER's (1862) specimen. Miers' description was so general that it could have applied to a number of species of *Clibanarius* or *Paguristes*. Until such time as Miers' actual specimen can be located, his and THOMSON's (1899) references to "*Clibanarius" barbatus* must be considered questionable.

FILHOL (1885 a, b) referred both the HELLER's (1865) and MIERS' (1876) accounts of *C. barbatus*; however, THOMSON (1899) clearly was basing his report only on Miers' redescription. MCCULLOCH (1913) pointed out the fact that HENDERSON (1888) had suggested that Heller's species should be assigned to *Paguristes*. MCCULLOCH (1913) also cast doubt on the accuracy of both HELLER's (1865) and MIERS' (1876) locality data, suggesting that *Paguristes barbatus* might not be a New Zealand species at all. That doubt was dispatched when FOREST & MCLAUGHLIN (2000) confirmed the species' occurrence in waters off the North Island.

Paguristes ciliatus Heller, 1862
Figs 27-30

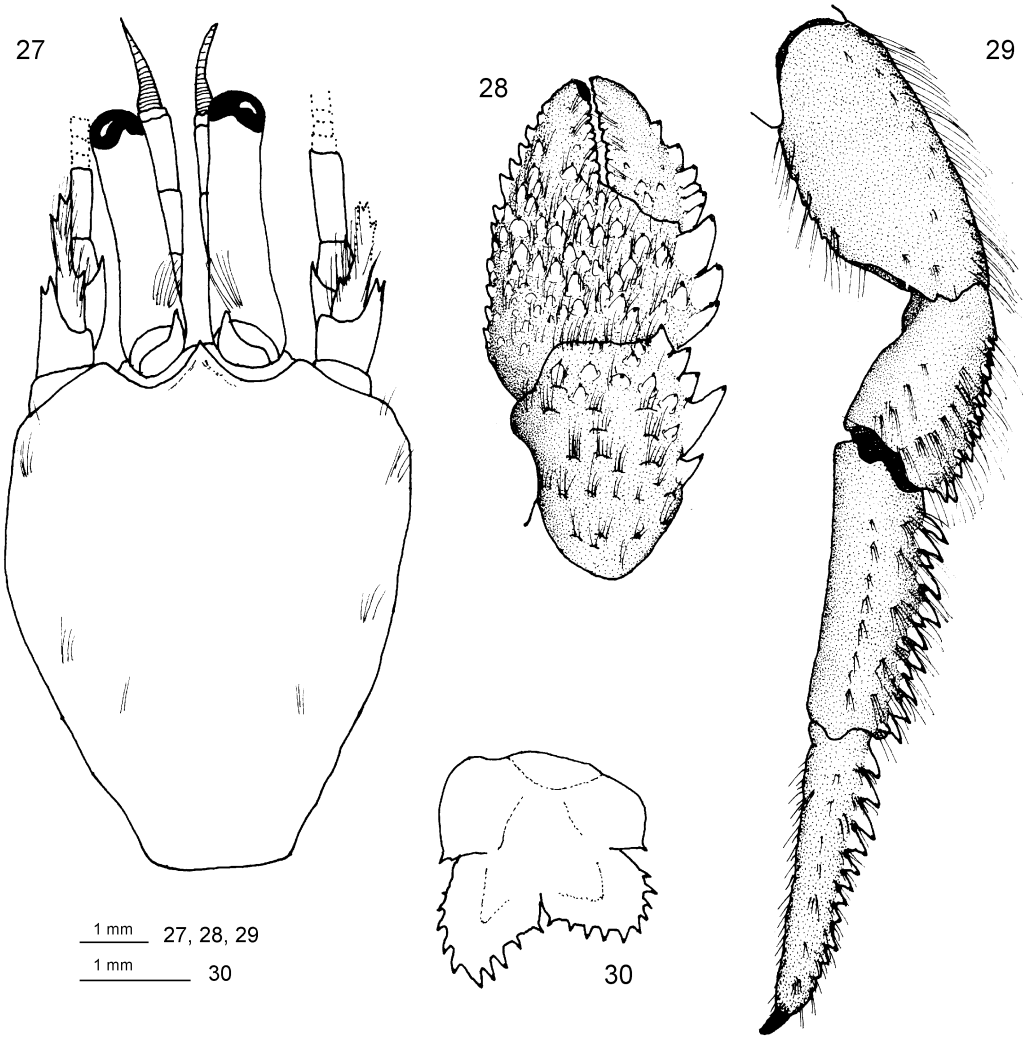
Paguristes ciliatus Heller, 1862: 525; 1865: 91, pl. 7, fig. 6.
Not *Paguristes* ? *ciliatus*: Alcock, 1905: 34.

Holotype: male (sl = 2.5 mm) , NHMW 19389; type locality, Nicobar Islands.

Diagnosis: Shield (Fig. 27) distinctly longer than broad, few tufts of setae laterally. Rostrum triangular, terminating in acute tip, considerably overreaching lateral projections and reaching approximately to middle of ocular acicles. Ocular peduncles long, moderately slender, each with tuft of setae proximally on dorsal surface; ocular acicles narrowly triangular, moderately short, terminating in acute tips, widely separated. Antennular peduncles reaching beyond bases of corneas but not beyond distal margins. Antennal peduncles shorter than antennular peduncles, reaching to distal third of ocular peduncles, but not to corneal bases; second segment with produced, bifid dorsolateral distal angle; antennal acicle reaching approximately to mid-length of fifth peduncular segment, with terminal bifid spine, setose but not completely concealing 1 or 2 marginal spines. Antennal flagellum broken, but probably at least as long as shield.

Chelipeds similar. Dactyls each with 3 or 4 conical, corneous-tipped spines on dorsomesial margin in proximal half, 1 or 2 smaller spines in distal half, few additional spines on dorsal surface in proximal third. Palms (Fig. 28) each with numerous conical, corneous-tipped spines on dorsal surface and dorsolateral margin, but not extending to tip of fixed finger, each accompanied by several moderately stiff bristles; lateral faces with similar but smaller tubercles and setae; mesial and ventral surfaces with only few tufts of setae. Carpi each with 2 or 3 prominent, corneous-tipped spines on dorsomesial margin, few somewhat smaller spines on dorsodistal margins, dorsal surface with several smaller spines distally, few mesially; proximal half adjacent to innermost spines smooth but with few tufts of setae, numerous smaller corneous-tipped spines or protuberances and tufts of setae laterally (in dorsal view). Meri each with row of conical spines on ventromesial margin accompanied by tufts of setae, ventrolateral margins only with setae.

Second (Fig. 29) and third pereopods with marginal setae; dactyls approximately 1.2 longer than propodi. Dactyls of second pereopods each with dorsal row of stout, conical, corneous-tipped spines accompanied by tufts of stiff setae; ventral margins each with 14 or 15 corneous spinules, flanked on either side by row of tufts of setae (not visible in lateral view); propodi each with irregular row of similar spines and tufts of setae on dorsal margins; carpi each with almost double row of corneous-tipped spines, outer row slightly smaller; meri each with row of small spines and long setae on ventral margins. Third pereopods each with irregular double row of corneous spinules and tufts of setae on dorsal surface of dactyl, mesial face with 2 rows of widely-spaced corneous spinules, ventral margin with row of 11 or 12 corneous spinules and tufts of setae; propodus with short transverse rows of setae on dorsal and ventral surfaces; carpus with dorsodistal spine and dorsal row of low, spinulose protuberances or small, corneous-tipped spines and tufts of setae, tufts of setae also laterally and ventrally; merus also with tufts of setae dorsally and ventrally.



Figs 27-30: *Paguristes ciliatus* HELLER, 1862, holotype. 27: shield and cephalic appendages (setae and aesthetascs omitted); 28: carpus and chela of left cheliped (dorsal view); 29: left third pereopod (lateral view); 30: telson (dorsal view).

Telson (Fig. 30) with very prominent incision dividing telson into anterior and posterior portions; anterior portion with 1 corneous-tipped spine at each posterior angle; posterior lobes asymmetrical, terminal margins each with row of generally equi-distantly-spaced, corneous-tipped spines, extending nearly full length of lateral margins.

Color: Not known.

Habitat: Not reported.

Distribution: Presently known only from the type locality.

Remarks: Alcock (1905) described a specimen in the collections of the Indian Museum as *Paguristes* ? *ciliatus*, relating it closely to his own new species *P. balanophilus* Alcock. That specimen had been collected in the Persian Gulf. The present redescription of Heller's (1862) holotype shows clearly that Alcock's specimen is not conspecific with Heller's species from the the Nicobar Islands. The identity of Alcock's (1905) *Paguristes* ? *ciliatus* is uncertain.

Family Paguridae

Pagurus Fabricius, 1775

Eupagurus novi-zelandiae Dana - Heller (1865: 92)

= *Pagurus novizealandiae* (Dana, 1852).

Auckland, 2 males (sl = 2.7, 2.8 mm), 1 female (sl = 3.6 mm), NHMW 19425.

Remarks: The change from *Eupagurus* to *Pagurus* has been discussed at length by McLaughlin (1974).

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