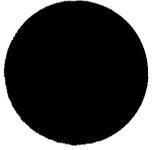


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Special Number 3

The Carcinological Society of Japan

1990



FRONTISPIECE

The battle of the Heike and the Genji at Dannoura in 1185.  
Colored print by Kuniyoshi.

RESEARCHES ON CRUSTACEA, SPECIAL NUMBER 3

**Crabs of the Subfamily Dorippinae MacLeay, 1838,  
from the Indo-West Pacific Region  
(Crustacea: Decapoda: Dorippidae)**

L. B. Holthuis and Raymond B. Manning

The Carcinological Society of Japan

Tokyo

June 1990

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**Crabs of the Subfamily Dorippinae MacLeay, 1838,  
from the Indo-West Pacific Region  
(Crustacea: Decapoda: Dorippidae)**

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**Introduction**

The Family Dorippidae comprises two subfamilies, the Dorippinae MacLeay, 1838, and the Ethusinae Guinot, 1977 (see Manning and Holthuis, 1981:29), differing in the position of the afferent branchial orifices and the structure of the last two pairs of legs. In the Dorippinae the afferent branchial openings are narrow and are situated ahead of the bases of the chelipeds, and the last two pereopods are subchelate, modified to allow the crab to carry something over its back. The Dorippinae are large, conspicuous, and rather common shallow water crabs, whereas the Ethusinae are smaller, much rarer, and usually live in deeper water.

The subfamily Dorippinae contains those species that before 1969 were all assigned to the genus *Dorippe* Weber, 1795. In 1969 Serène and Romimohtarto revised the Indo-Malayan species of *Dorippe*, dividing that genus into three genera and two subgenera: *Dorippe* Weber, 1795, comprising the nominotypical subgenus and the new subgenus *Dorippoides*; the new genus *Neodorippe*, including the nominotypical subgenus and the new subgenus *Nobilum*; and the new genus *Paradorippe*. They recognized 10 species within the Dorippinae, eight of which they considered to occur in the Indo-West Pacific region.

Subsequently, we (Manning and Holthuis, 1981:31, 35) added the new genera *Medorippe* and *Phyllodorippe*, from the eastern Atlantic, and raised all of the subgenera recognized by Serène and Romimohtarto (1969) to genera.

Meanwhile Chen (1980) described two new species of *Dorippe*, *D. sinica* and *D. tenuipes*, from China, and Serène (1981) described a species from Viet Nam, *D. miersi*, which proved to be a synonym of *D. tenuipes* Chen. In 1985 Chen described the new genus and species *Philippidorippe philippinensis*, and Manning and Holthuis (1986) gave preliminary accounts of four new species: *Dorippe irrorata*, *Dorippoides nudipes*, *Nobilum arachnoides*, and *Paradorippe cathayana*, and Chen (1987) described *Medorippe crosnieri* from Madagascar. Thus until now, 17 species of Dorippinae were known from the Indo-West Pacific. Here we recognize 17 species, one of which, *Dorippe quadridens* (Fabricius, 1793), is herein removed from the synonymy of *Dorippe frasco* (Herbst, 1785), and *Medorippe crosnieri* Chen, 1987 is considered to be a synonym of *M. lanata* (Linnaeus, 1767). We recognize nine genera in all, including one new genus, *Heikea*. Representatives of eight genera occur in the Indo-West Pacific, and members of seven genera are restricted to the Indo-West Pacific. *Phyllodorippe* Manning and Holthuis, 1981, occurs only in the eastern Atlantic, and *Medorippe* Manning and Holthuis, 1981, occurs in the eastern Atlantic, off southern Africa, and at Madagascar.

Although we adopt most of the taxa recognized by Serène and Romimohtarto (1969), whose work contributed considerably to a better understanding of the group, we do differ from their views in a few respects. Further, examination of some type specimens of older species in the museums at Copenhagen, Leiden, and London, revealed that some changes are needed in the nomenclature used by those authors. Those changes are incorporated here.

It was rather surprising to us that so little is known about a group that has attracted the attention of carcinologists for so long. Not counting misidentifications, no less than six names were applied to four Indo-West Pacific species before 1800, and, by 1850, 12 names had been applied to six species. Yet of the 17 species we recognize here, seven have been named since 1980. Further, other than relatively few observations on the biology of several species, we know very little about the biology and ecology of members of this group. Sadly, the most comprehensive observations on the biology of a single species, those by Pillai and Nair (1970, 1976) on a species from India, prove to be of little value because we cannot tell with certainty which species they studied.

In our study we encountered several features that are helpful in differentiating taxa but the function of which is unknown. For example, members of *Dorippe* have a swollen, sausage-like callosity dorsally on the coxa of the second walking leg (P3); females of *Dorippoides* also have this callosity and also have a spur-like process on the ischium of the second walking leg (P3) that is absent in members of *Dorippe*. Females of members of three genera, *Heikea*, *Neodorippe*, and *Nobilum*, have an erect median ventral spine on the sternite of the fourth leg; this sternal spine is also present on females of the West African *Phyllodorippe armata*, but is completely absent in females of the other genera.

In members of five genera, *Dorippoides*, *Medorippe*, *Paradorippe*, *Philippidorippe*, and *Phyllodorippe*, the opening of the exhalent canal is clearly visible dorsally between the rostral teeth. The canal is not visible dorsally in members of *Dorippe*, *Heikea*, *Neodorippe*, and *Nobilum*.

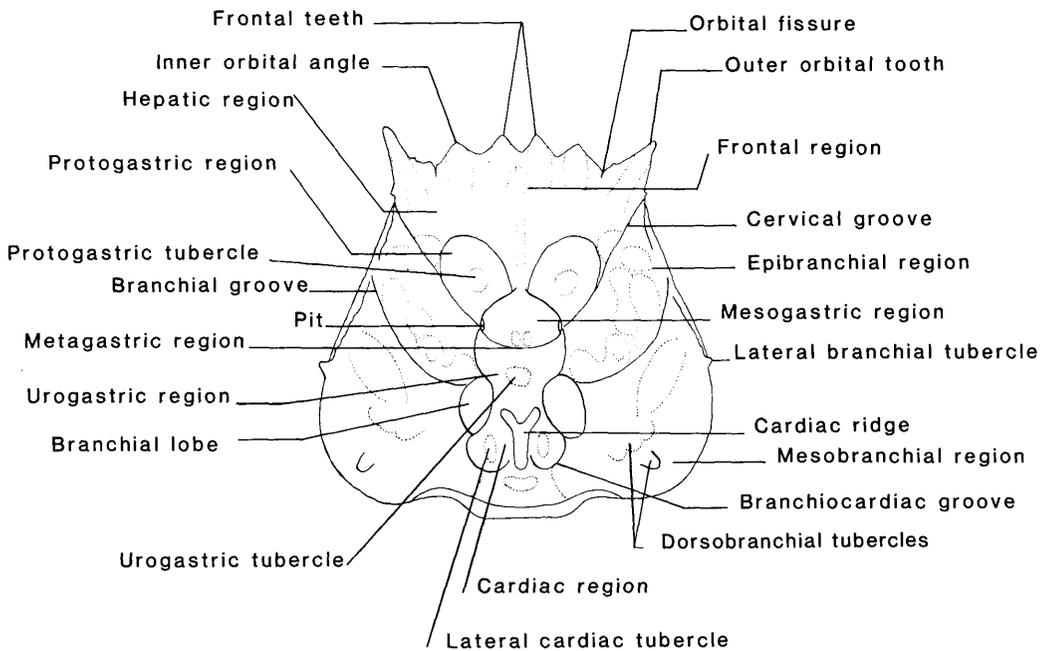


Figure 1. - Terms used in the descriptive accounts.

The right cheliped often is enlarged in adult males; in young males and in females the chelipeds are smaller than the adult male right cheliped and are subequal.

### Methods

The following abbreviations are used throughout the text: cb, carapace breadth; cl, carapace length; fm, fathom(s); ft, feet or foot; m, meter(s); mm, millimeter(s). We use P1-P5 interchangeably with first to fifth pereopods. The chelipeds or first pereopods may also be referred to as P1, the last or fifth pair of pereopods may be referred to as the fourth walking legs or P5. The walking legs are P2 to P5. We use gonopod and first male pleopod interchangeably.

Terminology of grooves and elevations on the carapace, used in the descriptions, is shown in Figure 1.

Abbreviations for repositories for the material examined appear as the last entry for each lot examined; they are as follows:

A, Zoological Museum, Amsterdam

BM, The Natural History Museum, London (formerly British Museum (Natural History))

C, Zoological Museum, Copenhagen

L, Nationaal Natuurhistorisch Museum, Leiden (formerly Rijksmuseum van Natuurlijke Historie)

P, Muséum National d'Histoire Naturelle, Paris

SAM, South African Museum, Cape Town

W, National Museum of Natural History, Smithsonian Institution, Washington  
(USNM used for catalogue numbers)

ZRC, Zoological Reference Collection, Department of Zoology, National University of  
Singapore

ZSI, Zoological Survey of India, Calcutta

Geographic names may be anglicized and are spelled in accordance with the names given in gazetteers of the United States Board on Geographic Names; spellings as used in the original source usually are given in parentheses. If coordinates were not available in specimen or literature records, we have added them using the same gazetteers as sources. In our sections on "Material" and "Previous Records," localities are arranged from west to east, except for species largely or completely restricted to Japan and China; there localities are arranged from north to south.

### Acknowledgments

Many individuals contributed to this study. First of all we would like to thank our colleagues at other museums who provided working space and access to their collections or who loaned material to us: Alain Crosnier and D. Guinot, Muséum National d'Histoire Naturelle, Paris; R.W. Ingle, British Museum (Natural History), London; Jean Just and Torben Wolff, Zoological Museum, Copenhagen; Jan Stock, Zoological Museum, Amsterdam; Peter Ng, National University of Singapore, who loaned us the type of *Neodorippe japonica* var. *taiwanensis* Serène and Romimohtarto, 1969; M. van der Merwe, South African Museum; and H.C. Ghosh, Zoological Survey of India, Calcutta. Dr. Wolff also provided us with photographs of type specimens held at Copenhagen, some of which are used here. We thank the late T. Sakai for his help with some of the more obscure Japanese literature. Peter Ng also provided us with some of his observations on members of this group and pointed out several references that we otherwise might have missed. He also took time to review a draft of the manuscript, for which we thank him (with appreciation for his keen eye). Brian Morton, University of Hong Kong, kindly provided us with a copy of the paper by Shen (1940a), which otherwise was unavailable to us. We thank Ms. Keiko Hiratsuka Moore, Systematics Laboratory, National Marine Fisheries Service, for help in translating titles from the Japanese. Ms. Carolyn Hahn, Smithsonian Libraries, was particularly helpful with references; she went out of her way to find a copy of the article by J.S. Huxley in *Life Magazine*. Reproduction of figures from the literature was made possible by a grant from the Atherton Seidell Fund of the Smithsonian Institution. Most of the illustrations were made by Lilly King Manning, and all of the figures were prepared for publication by her.

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**Systematic Account**

**Family Dorippidae MacLeay, 1838**

**Subfamily Dorippinae MacLeay, 1838**

- Dorypiens H. Milne Edwards, 1837:99 [vernacular (French) name].
- Dorippiens H. Milne Edwards, 1837:151, 153 [vernacular (French) name].
- Dorippina MacLeay, 1838:69.
- Dorippites Lucas, 1840:114.
- Dorippidea De Haan, 1841:119, 120.
- Dorippidae White, 1847:53.
- Dorippiana Gibbes, 1850:186.
- Dorippiani Targioni Tozzetti, 1872a:397.
- Dorippinea Ortmann, 1892:551, 552.
- Dorippinae Alcock, 1896:273, 274.
- Dorippidi Acloque, 1899:150.
- Dorippoidea Glaessner, 1969:R492.

**Key to Indo-West Pacific Genera of Dorippinae**

- 1. Dactyli of second and third legs lacking fringes, naked or nearly so ..... 2
- Dactyli of second and third legs with distinct fringes of hairs on upper and lower margins..... 6
- 2. Lateral margin of carapace with epibranchial tubercle or spine ..... 3
- Lateral margin of carapace lacking epibranchial tubercle or spine..... 4
- 3. Carapace broader than long, with some low elevations. Meri of P2 and P3 with dorsal row of spines. Abdomen of male and female lacking distinct teeth ..... *Medorippe*
- Carapace longer than broad, with distinct tubercles. Meri of P2 and P3 lacking dorsal spines or spinules. Abdomen of male and female with distinct teeth on third and fourth somites (also on second in male) ..... *Dorippe*
- 4. Inner suborbital tooth much smaller than exorbital tooth ..... *Paradorippe*
- Inner suborbital tooth strong, about as large as exorbital tooth ..... 5
- 5. Cardiac region with X-shaped granular ridge. Third somite of male abdomen with large tubercle on each side ..... *Philippidorippe*
- Cardiac region smooth. Third somite of male abdomen lacking high tubercles ..... *Dorippoides*
- 6. Carapace usually distinctly longer than broad. Front reaching well beyond exorbital teeth. Dactyli of P2 and P3 with fringe of long hairs along upper and lower margins ..... *Neodorippe*
- Carapace usually slightly wider than long. Front extending to or slightly beyond exorbital teeth. Dactyli of P2 and P3 with fringe of short hairs along upper and ..... 7

7. Gastric region with 5 separate prominences. Orbital margin, lateral to fissure, with erect spine ..... *Nobilum*  
 - Gastric region with less than 5 separate prominences. Orbital margin unarmed ..... *Heikea*, new genus

### Key to Genera of Dorippinae, Based on Male First Pleopods

1. Gonopod short and broad, usually not more than 4 times as long as wide at base; often with basal lobe. [Apex simple, or with 2 rounded lobes, or with 4 or more short, irregular processes] ..... 2  
 - Gonopod slender, strongly curved, C- or S-shaped, more than 5 times as long as wide at base; without basal lobe. [Apex ending in 3 to 5 rounded or pointed lobes] ..... 6
2. Gonopod straight, tip simple, blunt or pointed. Basal lobe present ..... 3  
 - Gonopod strongly curved, tip with 2, 4, or more lobes ..... 5
3. Distal part of gonopod widening distally, tip acute, turned abruptly, often twisted ..... 4  
 - Distal part of gonopod a narrow, often tongue-shaped chitinous process with a bluntly rounded tip, sometimes with small lateral denticle ..... *Dorippe*
4. Distal part of gonopod triangular, tip directed sideways, not twisted, distal margin broad ..... *Medorippe*  
 - Distal part of gonopod ending in slender point, twisted inward and upward or backward ..... *Dorippoides*
5. Basal lobe present. Gonopod regularly curved. Tip of gonopod ending in 2 auricular lobes ..... *Philippidorippe*  
 - Basal lobe absent. Gonopod angularly bent in middle. Tip of gonopod with 4 or more irregular processes, 1 of which may be hook- or hammer-shaped ..... *Paradorippe*
6. Gonopod S-shaped, with large, inverse, triangular subdistal lobe and recurved subdistal spine ..... *Phyllodorippe*  
 [Not represented in Indo-West Pacific region.]  
 - Gonopod forming simple curve (C-shaped), subdistal lobe, if present, narrow and slender, without recurved subdistal spine ..... 7
7. Gonopod ending in rounded tip overreached by 1 shorter and 1 longer, sharply pointed, tooth-like processes ..... *Neodorippe*  
 - Gonopod ending in blunt lobes, without spiniform processes ..... 8
8. Gonopod ending in 3 short, broad, rounded lobes. No subdistal lobe present ..... *Nobilum*  
 - Gonopod ending in 2 elongate, blunt lobes, with slender, narrow, subdistal lobe on convex margin and shorter lobe on concave margin ..... *Heikea*, new genus

Remarks. - In addition to the records of fossils of *Dorippe quadridens* (Fabricius), *Heikea japonica* (Von Siebold), and *Paradorippe granulata* (De Haan) cited below under "Fossil Record" in the accounts of those species, the following species of Dorippinae are known as fossils:

***Dorippe carpathica* Förster, 1979**

*Dorippe? carpathica* Förster, 1979:91, fig. 3, pl. 2: fig. 3. - Müller, 1984:66. - Sakai, 1985:333, 336. [Middle Miocene of southern Poland.]

***Dorippe fankhauseri* Studer, 1892**

*Dorippe fankhauseri* Studer, 1892:6, pl. 1: figs. 1-4. - Glaessner, 1929:137 [as *D. Frankhauseri*]. - Bachmayer and Rutsch, 1962:677, pl. 2: fig. 1. [Miocene of Switzerland.]

***Dorippe margaretha* Lörenthey and Beurlen, 1929**

*Dorippe margaretha* Lörenthey, 1911:528 [nomen nudum]; 1913:326 [nomen nudum]. - Lörenthey and Beurlen, 1929:135, pl. 6: fig. 1. - Glaessner, 1929:137; 1969:R492, fig. 304.8. - Müller, 1979:279, 287, pl. 13: fig. 4; 1984:66, pl. 34: figs. 1-5. - Sakai, 1985:333, 336, fig. 8. [Tertiary of Hungary.]  
? *Dorippe* aff. *lanata*. - Veiga Ferreira, 1965:10, pl. 1: figs. 5, 6 [Tertiary of ?Portugal].

***Medorippe lanata* (Linnaeus, 1767)**

*Dorippe lanata*. - Gemmellaro, 1914:78, pl. 1: fig. 5. - Glaessner, 1929:137. [Pleistocene of Sicily.]

**Genus *Dorippe* Weber, 1795**

*Notogastropus* Vosmaer, 1763:635 [not binominal; name placed on the Official Index of Rejected and Invalid Generic Names in Zoology (International Commission, 1987b:132) in Opinion 688 (International Commission, 1964:17)].

*Noto-gastropus* Vosmaer, 1765:119 [not binominal].

*Dorippe* Weber, 1795:93 [type species *Cancer quadridens* Fabricius, 1793, by subsequent selection by Holthuis, 1962:54, 55; gender feminine; name placed on the Official List of Generic Names in Zoology (International Commission, 1987b:83) in Opinion 688 (International Commission, 1964:16)].

*Dorippe* Fabricius, 1798:361 [type species *Cancer quadridens* Fabricius, 1793, by subsequent selection by Latreille, 1810:96, 422; gender feminine].

*Doripe*. - Lamarck, 1801:151 [erroneous spelling of *Dorippe* Weber, 1795].

*Dorippus*. - Rafinesque, 1814:21 [erroneous spelling of *Dorippe* Weber, 1795].

*Doripus*. - Rafinesque, 1815:97 [erroneous spelling of *Dorippe* Weber, 1795].

*Dorippa*. - Lucas, 1840:115 [erroneous spelling of *Dorippe* Weber, 1795].

*Docippe*. - E. Desmarest, 1858:28 [erroneous spelling of *Dorippe* Weber, 1795].

*Dorripe*. - Alcock and Anderson, 1894:198 [erroneous spelling of *Dorippe* Weber, 1795].

*Doryppe*. - Dawydoff, 1952:139 [erroneous spelling of *Dorippe* Weber, 1795].

*Doripp*. - Kamita, 1963:21 [erroneous spelling of *Dorippe* Weber, 1795].

Definition. - Carapace as long as wide, or, in larger specimens, slightly wider than long, surface very rough and uneven, with deep grooves and distinct tubercles. Cervical groove distinct but wide; a short, precervical ridge placed before distal part of cervical groove, forming its anterior margin; indistinct groove branching forward

from cervical groove, just mediad of precervical ridge, turning inward and encircling protogastric region. Mesogastric region with 2 oblique, deep pits placed in or just mediad of cervical groove. Branchial groove very deep and sharply defined, anterior margin defined by rounded ridge. Branchiocardiac groove deep. Protogastric region with tubercle in each half. Mesogastric region with 2 closely placed submedian tubercles. Metagastric region low, with few, short, sharp, parallel, oblique grooves on each side extending posterolaterally. Urogastric region with single tubercle. Branchial lobes convex, sometimes with tubercle. Cardiac region with V- or Y-shaped median ridge, flanked at either side of posterior end by single tubercle; 1 median tubercle placed behind median ridge. Each epibranchial region with 1-4 tubercles and a ridge along anterior margin of branchial groove; inner 3 of these 4 tubercles often low, inconspicuous, or absent, fourth always distinct; oblique groove separating first from second tubercle. Mesobranchial area with 3 large distinct tubercles: 1 lateral branchial tubercle, on lateral margin, and 2 dorsobranchial tubercles, anteriormost placed more mesially than posterior.

Front with 2 triangular submedian teeth, exhalent canal not visible in dorsal view. Inner orbital teeth about as large as frontal, reaching less far forward. Dorsal surface of frontal teeth flat or convex; 2 tubercles present behind frontal teeth, anteriormost low, wide, round, posteriormost small, low, transversely oval. Posterior margin of orbit with fissure. Inner margin of exorbital tooth bulging inward at fissure, sometimes overlapping inner margin of fissure. Outer orbital tooth triangular, slender and pointed, reaching slightly beyond frontal teeth. Lower orbital margin with spines on outer margin of inner suborbital tooth, latter reaching farther forward than exorbital tooth. Eyes elongate and slender, pointed, cornea ventrolateral.

Left and right chelipeds of females and small males equal. In large males right cheliped stronger. In larger cheliped, fingers less than twice as long as upper margin of palm, directed slightly downward. Palm smooth, swollen, higher than long dorsally; lower margin lacking teeth or tubercles, convex, merging under gently concave curve with lower margin of fixed finger. Smaller cheliped with fingers 2 to 3 times longer than palm, both fingers with 2 grooves, separated by ridge, most distinct basally. Upper margin of dactylus ridge-like, lower margin of fixed finger with interrupted groove. Cutting edges with 12 to 16 subequal, triangular teeth, regularly distributed over edge. Palm with shallow, longitudinal groove in upper part of outer surface. Dorsal margin of palm and basal part of dorsal margin of dactylus with fringe of hairs. Lower surface of palm with double row of hairs, rest of lower margin of chela naked. Carpus smooth or tubercular, with groove, often indistinct. Merus with large, often acute, tubercles on lateral surface.

Second and third pereopods long, third leg longest of all legs. Merus flattened or almost cylindrical, usually evenly covered by short pubescence of rather stiff hairs; in some species hairs scarce and soft. No fringes of hairs present on any segment. Carpus granular on anterior margin, often with some hairs. Propodus and dactylus entirely naked. P3 of female without spur on ischium. Dorsal part of coxa of P3 in male and female swollen, sausage-shaped, often whitish, fused with posterolateral margin of carapacè.

Sternum finely or roughly granular. Sternite of P1 with granular, transverse ridge on each half, 2 ridges separated by narrow median groove or meeting medially. Sternites of following 2 segments also with transverse granular ridge in each half. In

male all 3 sternites exposed, in female only first 2. Ridge of sternite of P3 in female covered by abdomen; ridge ending at elevated rounded tubercle carrying female gonopore. No median spine present on any thoracic sternites of female.

Abdomen of male with first somite trapezoidal, widening posteriorly, posterior margin concave; upper surface with 2 longitudinal grooves, diverging posteriorly. Second somite shorter and wider than first, with 3 teeth or tubercles in transverse row. Third somite widest of all, with transverse row of 3 often large teeth or tubercles. Fourth somite narrower, narrowing posteriorly, with single median tooth or tubercle. Fifth somite widening posteriorly, with single median tubercle, sometimes indistinct or absent. Sixth somite also narrowing posteriorly, with 2 longitudinal grooves, converging posteriorly; posterolateral angles of sixth somite produced, enclosing base of telson. Telson triangular, with rounded apex.

Abdomen of adult female very wide. Transverse ridges on second to fifth somites, especially those on third to fifth somites, conspicuous. Ridges of third and fourth somites each with median and 2 lateral teeth or tubercles, occasionally with smaller denticle intervening. Telson somewhat longer than wide, apex rounded.

First pleopod of male short and straight, gradually tapering to single short, slender, blunt, corneous apex. Lobe present in basal part of outer margin of pleopod.

#### Key to Species of *Dorippe*

1. Carpus of cheliped smooth and naked, lacking granules on upper surface or anterior margin ..... *D. frascoe*
- Carpus of cheliped with distinct granules or tubercles and short hairs on upper surface ..... 2
2. Anterolateral margin of carapace, between base of exorbital tooth and cervical groove, smooth, without tubercles or denticles. Teeth on lower orbital margin in cluster. Merus of second and third pereopods almost cylindrical ..... *D. sinica*
- Anterolateral margin of carapace, between base of exorbital tooth and cervical groove, with few to many tubercles or denticles. Lower orbital margin with row of teeth. Merus of second and third pereopods compressed, distinctly higher than wide ..... 3
3. Merus of third pereopod more than 6 times as long as high ..... *D. tenuipes*  
Merus of third pereopod less than 6 times as long as high ..... 4
4. Palm of chela smooth, or granular only in extreme basal part. Meri of P2 and P3 covered with pubescence. Lower orbital margin with 5 or 6 spines, but without additional row of denticles. [Inner dorsal margin of exorbital tooth usually with 2 to 6 spinules] ..... *D. quadridens*
- Palm of chela with granules over greater part of surface. Meri of P2 and P3 naked. Lower orbital margin with 5 or 6 large teeth flanked ventrally by row of small denticles. [Inner dorsal margin of exorbital tooth smooth] ..... *D. irrorata*

*Dorippe frascone* (Herbst, 1785)

## Figures 2-3

- Notogastropus* Vosmaer, 1763:635 [Ambon, Indonesia]. - A.-G. Desmarest, 1823:250; 1825:134. - De Haan, 1841:121. - Rathbun, 1897:163. - Holthuis, 1962:54, 56. - International Commission, 1964:17.
- Noto-gastropus* Vosmaer, 1765:119, pl. 64: figs. 1, 2 [Ambon, Indonesia]. - Holthuis, 1962:54,56. - International Commission, 1964:17.
- Cancer Frascone* Herbst, 1785:192, pl. 11: fig. 70 [type locality "an den ostindischen Ufern"; type originally in Zoological Museum, Berlin, but now lost; name placed on the Official List of Specific names in Zoology (see International Commission, 1987b:232) in Opinion 688 (International Commission, 1964:16)].
- Cancer nodulosus* Olivier, 1791:168 [type locality unknown ("Il se trouve..."); not *Cancer nodulosus* Fabricius, 1781].
- Doripe nodulosa*. - Lamarck, 1801:151. - Bosc, 1802:208, pl. 4: fig. 2. - A.-G. Desmarest, 1830:264, pl. 4: fig. 2.
- Cancer frascone*. - Herbst, 1803:12. - Holthuis, 1962:55, 56. - Glaessner, 1969:R492. - Manning and Holthuis, 1981:30.
- Dorippe Frascone*. - A.-G. Desmarest, 1822:120.
- Dorippe frascone*. - Holthuis, 1962:54, 55. - Serène, 1968:40.
- Dorippe (Dorippe) frascone*. - Serène and Romimohtarto, 1969:6 [p.p., not text-figs. 1, 5, 10, 15A,B, and not pl. 1: figs. A,B and pl. 3: figs. A-C].

Vernacular Name. - "Das Fratzengesicht" (monkey-face) (Herbst, 1785).

Material. - Indonesia: Ujung Pandang, Sulawesi (as Makassar, Celebes), 5°07'S, 119°24'E, D.M. Piller, 2 ♂, 1 ♀ (L; larger male, cl 26 mm, L Crust.D. 820, is neotype of *Cancer frascone* Herbst).

Philippines: Parang, eastern Illana Bay, southern Mindanao, 7°23'N, 124°16'E, beach in front of village, 20 ft (= 37 m), 150 ft seine, sand, 23 May 1908, *Albatross*, 1 ♂ (W). - Qunituay Reef, Catbalogan, western Samar, 11°46'N, 124°53'E, taken from jellyfish, 6 ft (= 2 m) deep, 150 ft seine, sand and coral, 16 Apr 1908, *Albatross*, 1 ♂ (W). - Canmahala Bay, Ragay Gulf, Luzon, 13°30'N, 122°45'E, 4-30 ft (= 1-10 m), coral and sand, collected with dynamite, 11 Mar 1909, *Albatross*, 1 ♂, 1 ♀ (W). - Jamelo Cove, southern Luzon, 10 ft (= 3 m), 150 ft seine, 13 Jul 1908, *Albatross*, 1 ♀ (W). - Mariveles, Luzon, 14°26'N, 120°29'E, 28 Jun 1913, A.M. Reese, 1 ♂ (W). - Port Binanga, Subig Bay, Luzon, 14°45'N, 120°15'E, probably 1-10 m deep, probably with 150 ft seine, 8 Jan 1908, *Albatross*, 2 ♂, 1 ♀ (W). - Olongapo, Luzon, 14°50'N, 120°16'E, beach, 20 ft (= 7 m) deep, 250 ft seine, sand, 7 Jan 1908, *Albatross*, 1 ♂ (W).

Description. - Carapace strongly sculptured, but usually less so than in *D. quadridens* and *D. sinica*. Tubercles in females low and broad, in males higher and more wart-like. Protogastric and mesogastric tubercles usually divided in two. Urogastric and inner 2 tubercles of epibranchial region distinct, but inner of 2 large epibranchial tubercles lower and less conspicuous than second; 2 outer epibranchial tubercles obsolete. Branchial lobes visible as elevated tubercles. Median ridge of cardiac region V-shaped, followed by depressed area, all 3 cardiac tubercles distinct in male, posteriormost small in female; lateral cardiac tubercles showing depression at top.

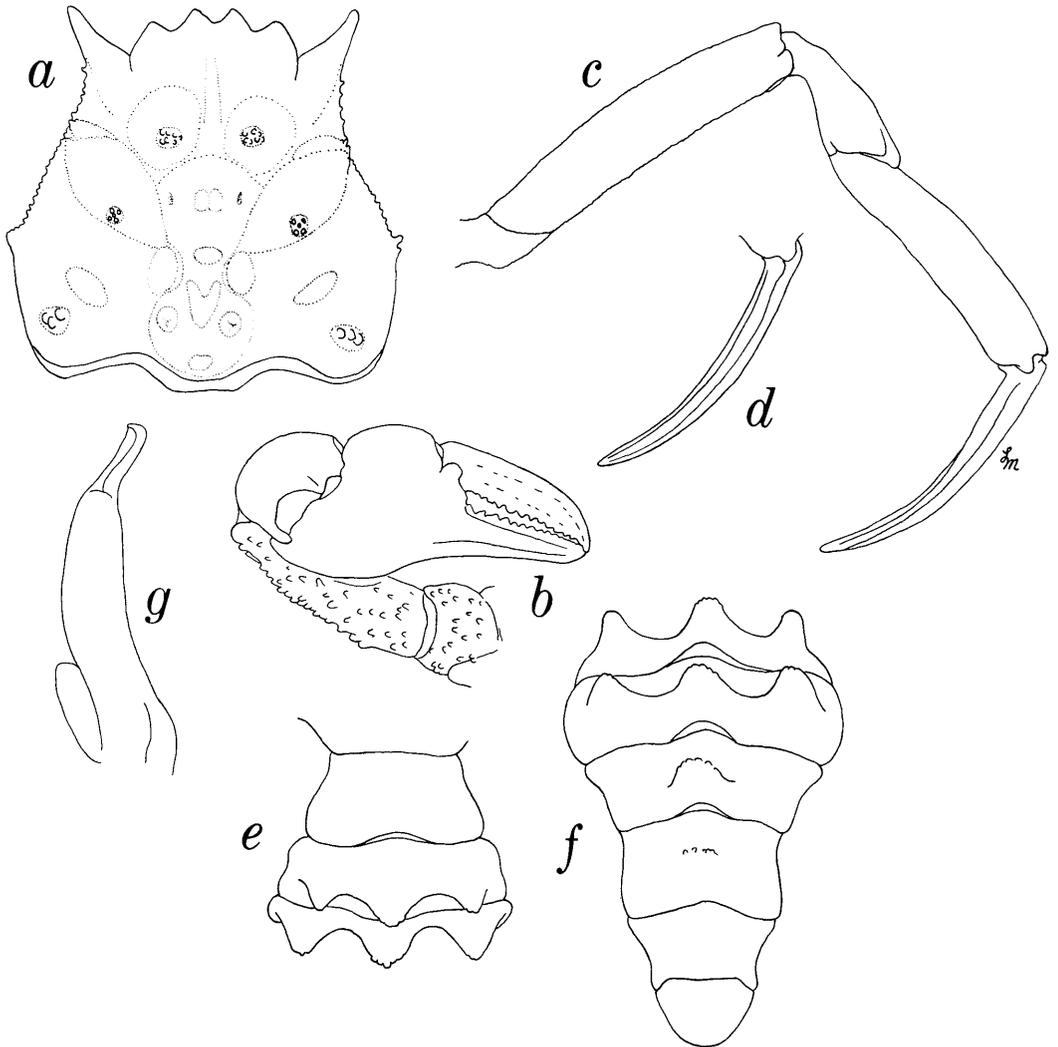


Figure 2. - *Dorippe frascone* (Herbst). a, carapace; b, cheliped; c, P3; d, dactylus of P3; e, abdomen, dorsal view; f, abdomen, ventral view; g, gonopod. a-f, male, cl 23 mm, Catbalogan; g, male, cl 33.5 mm, Mariveles.

Lateral branchial tubercle distinct but rather small, from it indistinct ridge with numerous very small granules extending forward below anterolateral margin of carapace. Anterior dorsal branchial tubercle ovate and granular; posterior dorsal branchial tubercle smaller, either rounded or also somewhat ovate. Anterolateral margin of carapace, between base of exorbital tooth and cervical groove, with 2 to 6 tubercles, very small and sometimes so obscure that margin appears smooth.

Frontal teeth rather low and rounded, separated by wide and relatively shallow V-shaped median incision. Frontal teeth only slightly narrower than inner orbital teeth and extending only slightly further than them.

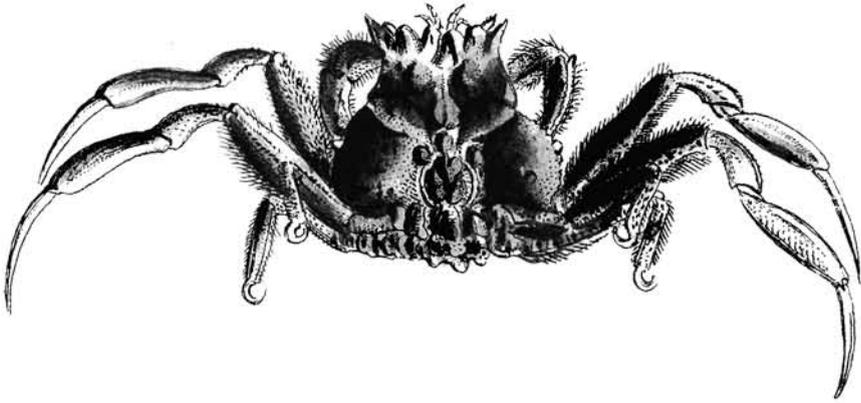


Figure 3. - *Dorippe frascoe* (Herbst). From Herbst, 1785, pl. 11: fig. 70.

Inner orbital tooth reaching forward beyond base of V-shaped median incision of front. No granules or spinules present on front or on upper orbital margin. Lower orbital margin showing row of about 3 to 5 spines at base of inner suborbital tooth. No additional denticles present on lower orbital margin.

Eyes slightly more than 3 times as long as cornea width. Cornea itself slightly less than half as long as eyes.

Carpus of cheliped with upper surface smooth, without granules, except for few in extreme basal part. Only a faint indication of distal part of longitudinal groove is visible.

Merus of second and third pereopods flattened, 0.6 times as thick as high. Merus of second leg 3.5 to 4 times as long as high, that of third leg 4 to 5 times as long as high. In females and young pubescence of merus short, inconspicuous, being almost absent. In adult males dense pubescence may be present along lower margin and in proximal third of merus. Carpus with dorsal granules and some hairs. Propodus and dactylus completely naked. Propodus 4 or almost 4 times as long as high. Dactylus slender, longer than propodus.

Both transverse carinae of sternite of first pereopod touching in midline of sternite. Ridges of following somite granular, and from their anterior margins short transverse grooves extend anteriorly. Few granules present near posterior margin of third sternite.

Second somite of male abdomen with median tooth blunt, wide, and granular. Lateral teeth of second somite narrower and smoothly rounded, about as high as central tooth. All 3 teeth of third somite of about equal size, with top broadly rounded and with a few granules. Median tooth of fourth somite broad and granular. Fifth somite with low, inconspicuous tooth, sometimes practically absent or represented by transverse row of granules.

Female abdomen with teeth of third abdominal somite bluntly topped, central tooth largest, granules between teeth inconspicuous or absent. Teeth of fourth somite blunt, central much larger than laterals, ridge between teeth bearing small, inconspicuous granules. Fifth somite with transverse ridge smooth or nearly so.

First pleopod of male of type characteristic of genus, as figured.

Color. - The original figure of *Cancer frascoe* by Herbst is in color. It shows the

animal greyish brown with the elevated parts in the median area of the carapace of a pink color. Herbst's figure (Figure 3) in all probability was made from a dry preserved specimen. Bosc (1802) reproduced Herbst's figure, using the same colors.

Size. - The examined specimens have the following dimensions: males, cl 19 to 33.5 mm, cb 19 to 34.5 mm; females, cl 14.5 to 31 mm, cb 15 to 32.5 mm. The length/width ratio of the carapace ranged from 0.9 to 1.0.

Distribution. - So far this species is known with certainty only from the Philippines and Indonesia. Most of the specimens reported in the literature as *Dorippe frascone* are either not recognizable from the available data or belong to another species, i.e. *D. quadridens* or *D. sinica*.

The type locality of *Cancer frascone* is "an den ostindischen Ufern" (Herbst, 1785:193). The type locality of *Cancer nodulosus* Olivier, 1791 (non Fabricius, 1781) is unknown. Through the neotype selection below, the type locality of both species becomes Ujung Pandang, Sulawesi (= Makassar, Celebes), Indonesia. Vosmaer's (1763, 1765) specimen came from Ambon (as Amboina), Indonesia.

Bosc (1802) and A.-G. Desmarest (1830), whose pl. 4: fig. 2 are clearly rough copies of Herbst's pl. 11: fig. 70, referred to both Herbst (1785) and Olivier (1791), and therefore are cited here in the synonymy of this species. However, both Bosc and A.-G. Desmarest gave as the locality for the species "dans la Méditerranée," and thus either made a mistake or had material of *Medorippe* before them. As all previous locality records for this species are vague, unknown, or unreliable, we can only rely on the localities of the examined specimens to provide an indication of the range of the species.

Habitat. - The examined specimens have been taken at depths between 2 and 1-10 meters (2, 3, 7, 7, and 1-10 meters) on a sandy bottom: sand (3x), sand and coral, and coral and sand; in most cases the material was obtained with a beach seine.

Biology. - The male specimen from Catbalogan was said to be "taken from a jelly-fish." There is no further information about this possible association. See also remarks under "Habitat" of *D. quadridens*.

Remarks. - The present species differs from all other species of *Dorippe* by the carpus of the chelipeds, which is smooth, not ornamented with granules. From *D. quadridens* it differs in this respect, in the usually less distinct surface sculpture of the carapace, and in the more widely triangular frontal teeth, which are separated by a shallower median incision and differ less strongly from the inner orbital teeth. Furthermore, the anterolateral teeth are more forwardly curved in this species. The legs are slenderer and their meri have the dorsal, and especially the anterodorsal part, naked. *Dorippe sinica* also has the surface sculpture of the carapace deeper than in *D. frascone*, its frontal teeth are more produced and more sharply pointed, its anterolateral margin is without granules, and its legs have the meri cylindrical and hairy.

The first mention of this species in the literature is by Vosmaer (1763, 1765), who described and figured it under the name *Notogastropus*. His material originated from Ambon, Indonesia, and was given to him by Mr. Cornelis van Hoeij, a well known collector. Vosmaer's description is short and his figures leave much to be desired, but the general shape of his female specimen and its slender legs make its identity with *D. frascone* very probable. As Vosmaer's work is not binominal, his generic name is not available.

Our identification of the present species with *Cancer frascone* Herbst needs some explanation. *Cancer frascone* Herbst without the least doubt is a species of *Dorippe* sensu stricto, as has been recognized by all previous authors. Before 1980, when all species of the genus *Dorippe* as recognized here were considered to be a single species (see Serène and Romimohtarto, 1969), the name *frascone* Herbst, 1785, being the oldest available name, was the valid name for this species. *Cancer nodulosus* Olivier, 1791, *Cancer quadridens* Fabricius, 1793, *Dorippe atropos* Lamarck, 1818, and *Dorippe rissoana* A.-G. Desmarest, 1822, all were considered to be junior synonyms of *Cancer frascone*.

In 1980 Chen split two new species, *Dorippe sinica* and *D. tenuipes*, from *D. frascone*, and considered that all the other names given above referred to but one species, *D. frascone*. When we found that *D. frascone*, as considered by Chen and most previous authors, consists of at least three distinct species (here for convenience named A, B, and C), it became important to ascertain to which of these species the types of *Cancer frascone*, *C. nodulosus*, *C. quadridens*, *D. atropos*, and *D. rissoana* belong. The types of *C. quadridens* are still extant; we examined them and found them to belong to our species A. In our material *Dorippe quadridens* is represented by the greatest number of specimens and has the widest geographical range.

The type of *Cancer frascone* is lost (see Serène and Romimohtarto, 1969:7). Herbst's description is rather general and his figure (Figure 3), by modern standards, is rather poor. He depicts the front of the carapace with the 4 anterior teeth (2 frontal and 2 inner orbital) rounded and of about the same size; in the description they are characterized as lobes: "Die Stirn ist gewissermassen vierlappig." This fits best our species B and C, and is quite different from the situation in our species A or the two species described by Chen. The anterolateral margin of the carapace in Herbst's figure shows no granules, which would fit either *Dorippe sinica* Chen or our *Dorippe* B in which these granules are often indistinct. Herbst did not mention this character in his German description, but in his Latin diagnosis he stated: "thorace ... lateralibus integris," which may refer to the smooth anterolateral margin of the carapace. The legs shown in Herbst's figure are rather crudely drawn, those of the right side are more slender (resembling most those of our species B or C) than those of the left side (resembling the legs of our species A). The fact that Herbst shows the merus in all of the legs as hairy over practically the entire surface reminds one more of species A and *Dorippe sinica* than of species B and C. Comparing Herbst's description of *Cancer frascone* with the five known species of *Dorippe* we can immediately rule out the identity of *C. frascone* with *D. tenuipes* Chen; the pereopods in Herbst's figure are far shorter than in Chen's species, their length falling within the range of that of the other species. *Cancer frascone* resembles mostly our species B and *D. sinica*. The type locality of *Cancer frascone*, from East Indian shores, if correct, would seem to rule out *D. sinica*. Taking all of this evidence into consideration we decided to apply the name *frascone* to our species B. This was the preferable course of action as *Dorippe sinica* and *D. tenuipes* already had names, and the name *D. quadridens* was available for species A. Species C, being a form from deeper water, could not be identified with any of the above species, and further none of the available names seemed to fit it. We have described it as *Dorippe irrorata* Manning and Holthuis (1986:363). As the knowledge of the identity of *Cancer frascone* is essential to solve the nomenclatural problem of the correct names for the various species of *Dorippe*, we have now selected a speci-

men of species B to be the neotype of *Cancer frascone*. This specimen, the larger male (cl 26 mm, cb 28 mm) from Ujung Pandang, Sulawesi (= Makassar, Celebes), Indonesia, is now in the collection of the Nationaal Natuurhistorisch Museum, Leiden, under reg. no. Crust.D. 820. It was collected between 1847 and 1849 by D.M. Piller. This specimen from the former Netherlands East Indies comes from a locality situated within the type locality (East Indian coasts) indicated by Herbst and agrees reasonably well with Herbst's description and figure (except for the lack of pubescence on the meri of P2 and P3). This neotype selection settles the identity of *Dorippe frascone* (Herbst).

*Cancer nodulosus* Olivier, 1791 is based by its author on (1) the type specimen of *Cancer frascone* (through Olivier's reference to Herbst's description and illustration), and, possibly, on (2) material from an unknown locality. Olivier's description could quite well be based on Herbst's account alone, and the possibility exists that he had no actual material before him. If this is so, Herbst's specimen would be the holotype of *Cancer nodulosus* Olivier, 1791; if not, we now select Herbst's specimen as the lectotype of *Cancer nodulosus* Olivier, 1791, which falls as a junior objective synonym of *Cancer frascone* Herbst, 1785. In any case, *Cancer nodulosus* Olivier, 1791 cannot be used for any species of dorippid, as it is a junior primary homonym of *Cancer nodulosus* Fabricius, 1781.

Bosc (1802) and A.-G. Desmarest (1830) placed *Cancer nodulosus* in the genus *Dorippe* (spelled *Doripe* by them). They both referred to Herbst and Olivier and produced a rough copy of Herbst's figure. Their locality indication ("Méditerranée") clearly is erroneous, unless they had before them material of *Medorippe lanata* (Linnaeus) which they had identified with Olivier's species.

*Dorippe atropos* Lamarck, 1818 and *D. rissoana* A.-G. Desmarest, 1817 are considered by us to be junior synonyms of *Dorippe quadridens* (Fabricius, 1793) and are discussed under that species.

Apart from some references dealing exclusively with Herbst's description and figure, mostly for nomenclatural purposes, all later records, whether they are under *Dorippe frascone* or another name, deal with species either different from the true *D. frascone* or ones that cannot be identified with certainty.

By assigning the name *Dorippe frascone* (Herbst) to the present species, *Cancer quadridens* becomes the oldest available name for our species A, which thus should be known as *Dorippe quadridens* (Fabricius, 1793).

### *Dorippe irrorata* Manning and Holthuis, 1986

#### Figure 4

*Dorippe irrorata* Manning and Holthuis, 1986:363, fig. 1a,b [type locality Andaman Sea, S of Mergui Archipelago, 9°54'N, 97°42'E, depth 73 m].

Material. - Burma: Andaman Sea, S of Mergui Archipelago, 9°54'N, 97°42'E, 73 m, 24 Mar 1963, *Anton Bruun* Cruise I, Sta. AB-21, 1 ♂ (holotype W, USNM 172495). - W of the Moscos Islands, 14°07'N, 97°05'E, 62 m, 30 Mar 1963, *Anton Bruun* Cruise I, Sta. AB-38, 1 ♀ (paratype, W).

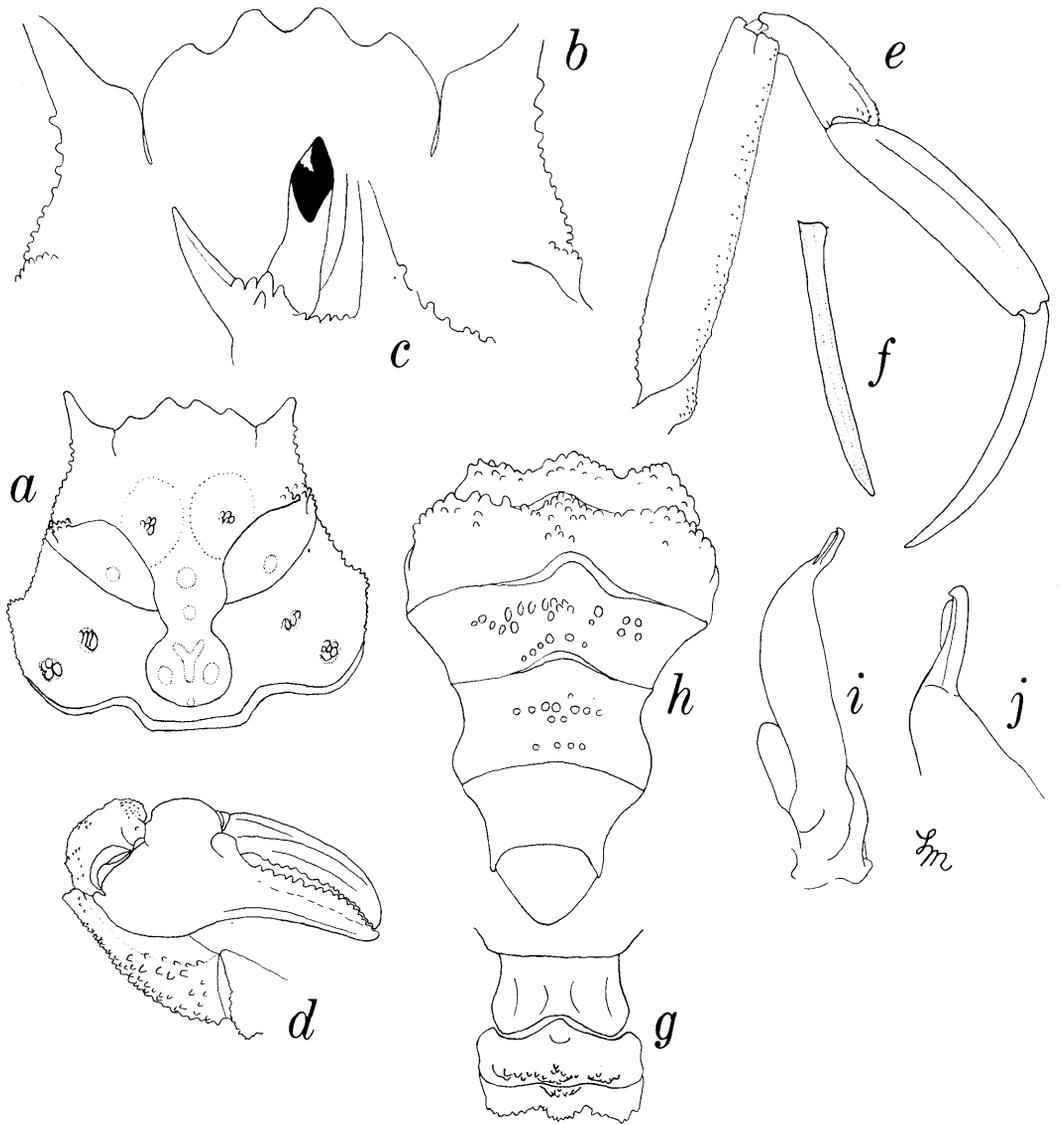


Figure 4. - *Dorippe irrorata* Manning and Holthuis. a, carapace; b, front; c, orbit, ventral view; d, cheliped; e, P3; f, dactylus of P3; g, abdomen, dorsal view; h, abdomen, ventral view; i, gonopod; j, apex of gonopod. Male holotype, cl 21.5 mm.

Description. - Carapace strongly sculptured, grooves deep, tubercles distinct; entire surface covered by short, stiff hairs implanted at regular intervals. Protogastric and mesogastric tubercles high, granular. Urogastric tubercle small, also granular. Of tubercles on ridge anterior to branchial groove, only largest present and granular; inner and outer 2 tubercles very low, either hardly visible or absent. Branchial lobes swollen but not granular. Lateral branchial tubercle large and granular, largest of all tubercles on branchial region; from it row of numerous small rounded granules extending forward, terminating below anterolateral margin of carapace. Dorso-

branchial tubercles distinct, irregular in shape, granular. Median ridge of cardiac region Y-shaped, all 3 tubercles distinct and conical, posterior smallest. Anterolateral margin of carapace bearing about 10 to 16 tubercles between base of exorbital tooth and cervical groove. Precervical ridge high, with 2 rows of granules.

Front with teeth low, triangular, with broadly rounded apices and rather shallow median V-shaped incision. Frontal teeth as wide as or wider than inner orbital teeth. Latter low, bluntly pointed, failing to reach base of V-shaped median incision of front. No spinules or granules present on anterior margin of front or on dorsal orbital margin. Fissure of dorsal margin deep, open anteriorly.

Lower margin of orbit showing cluster of about 5 strong spines on basal part of outer margin of inner suborbital tooth, row of sharp denticles present below cluster.

Eye about 3 times as long as cornea width. Cornea occupying slightly less than half length of eye.

Smaller chela about twice as long as high. Outer surface of palm entirely covered by granules and short stiff hairs. Upper groove shallow. Carpus also covered by short hairs and granules, longitudinal groove shallow.

Second and third legs with merus about 2/3 as wide as high. On P2 merus 4 times as long as high, on P3 5 times. In examined specimens merus naked with some granules basally. Carpus smooth, with few faint dorsal tubercles. Propodus of P2 4 times as long as high, that of P3 between 4.5 and 5 times as long as high. Dactyli slender, each longer than propodus.

Transverse carinae on sternite of P1 showing several rows of granules, granules also present on sternite behind carina; carinae on sternite separated in midline by very narrow median groove. Sternite of second leg (P2) showing single transverse granulated carina, that of third leg (P3) with 2 distinct transverse carinae, posterior-most near posterior margin of sternite.

Male abdomen with 3 teeth of second and third somites subequal, low, blunt, covered by distinct granules. Fourth somite with blunt, low, median tubercle, and faint indications of 2 lateral teeth. Fifth somite with low, median, granular tooth. On abdomen, granules not restricted to teeth but also occurring on remainder of upper surface of somites.

Female abdomen with teeth of third and fourth somites low, blunt, central higher than laterals. Transverse carina of fifth somite with indication of very low and wide median tooth. All teeth and carinae densely granular.

Gonopod as figured.

Size. - Male, cl 21.5 mm, cb 22 mm; female, cl 17 mm, cb 17.5 mm.

Distribution. - This species so far is known only from the eastern Andaman Sea, where it was taken in depths of 62 and 73 meters.

Remarks. - *Dorippe irrorata* most closely resembles *D. quadridens*, but it may be distinguished at once by the smooth inner margin of the dorsal surface of the exorbital tooth, by the wide frontal teeth, by the additional row of denticles below the large tooth of the lower orbital margin, by the granulated palm of the cheliped, and by the male abdomen having the teeth low and granulated.

This species also shows much resemblance to *D. tenuipes*, especially in the wide frontal teeth, the granulation of the lower orbital margin, and in the granulation of the teeth of the male abdomen, but it differs considerably from that species by having the legs far less elongate.

*Dorippe quadridens* (Fabricius, 1793)

## Figures 5-12

- Cancer dorsipes*. - Linnaeus, 1764:452; 1767:1053. - Holthuis, 1962:54-56. [Not *Cancer dorsipes* Linnaeus, 1758.]
- Cancer quadridens* Fabricius, 1793:464 [type locality Tranquebar, India]. - Holthuis, 1962:54, 55. - Zimsen, 1964:649. - Glaessner, 1969:R492. - Manning and Holthuis, 1981:30.
- Dorippe quadridens*. - Weber, 1795:93. - Fabricius, 1798:361. - Latreille, 1802:125, 128 [p.p.]; 1810: 96, 422; 1817:547; 1818:4, pl. 306: fig. 1. - A.-G. Desmarest, 1823:251; 1825:135. - H. Milne Edwards, 1840:103. - White, 1847:54 [p.p.]. - Stimpson, 1858:163. - De Man, 1887-1888a:6, 206. - Alcock and Anderson, 1894:204. - Rathbun, 1897:163. - Stimpson, 1907:167. - Roxas, 1930:17. - Estampador, 1937:514; 1959:65. - Zimsen, 1964:649. - Serène, 1968:40.
- Dorippe quadridens*. - Bosc, 1802:207.
- Dorippe astuta*. - Latreille, 1802:126 [not *Dorippe astuta* Fabricius, 1798 = *Dorippoides facchino* (Herbst, 1785)].
- Dorippe Rissoana* A.-G. Desmarest, 1817:509 [type locality unknown; "On ignore l'origine du débris qui à servis à l'établissement de cette espèce" (H. Milne Edwards, 1837:158)]; 1822:119, pl. 10: figs. 1-3. - H. Milne Edwards, 1837:158.
- Dorippe Nodosa* A.-G. Desmarest, 1817:510 [nomen nudum; type locality "la Nouvelle-Hollande" = Australia].
- Dorippe nodulosa*. - Lamarck, 1818:245. - Guérin Méneville, 1831-1833, in 1829-1844: pl. 13: fig. 2. - Griffith and Pidgeon, 1833:536, pl. 13: fig. 2. - Serène, 1968:40. [Not *Cancer nodulosus* Olivier, 1791.]
- Dorippe atropos* Lamarck, 1818:245 [type locality "Océan Indien"].
- Dorippe rissoana*. - Defrance, 1819:444.
- Dorippe nodosa*. - Defrance, 1819:444 [nomen nudum]. - A.-G. Desmarest, 1822:120 [nomen nudum]; 1823:251 [in synonymy]; 1825:135 [in synonymy].
- Dorippe quadridentata*. - H. Milne Edwards, 1837:156. - Gibbes, 1850:186. - Hilgendorf, 1878:812. - Nauck, 1880:49. - Haswell, 1882:137. - Serène, 1968:40.
- Dorippe quadridentata*. - Lucas, 1840:116.
- Dorippe Quadridens*. - Herklots, 1861:137 [p.p.].
- Dorippe lanata*. - A. Milne Edwards, 1868:72. - Barnard, 1926:120. - Serène, 1937:77. [Not *Medorippe lanata* (Linnaeus, 1767).]
- Dorippe dorsipes*. - Miers, 1884:185, 257 [p.p.]. - De Man, 1887-1888b:393. - Cano, 1889:254. - Henderson, 1893:404. - Alcock, 1896:277. - Rathbun, 1897:163. - Lanchester, 1900:769; 1902:553. - Borradale, 1903:439, pl. 22: fig. 1. - Nobili, 1903b:24. - Laurie, 1906:367. - Nobili, 1906a:95; 1906b:172. - Lenz, 1910:545. - Rathbun, 1910a:305; 1910b:609; 1911:197. - Laurie, 1915:410, 429. - Ihle, 1916:98-115, 148, figs. 41, 45, 51, 54, 58, 59, 61, 63C. - Balss, 1922:119 [p.p.]. - Rathbun, 1923:138. - Gee, 1925:160. - Gravely, 1927:142, pl. 25: fig. 41. - Glaessner, 1929:137. - André, 1931:638. - Shen, 1931:98, figs. 5-7, pl. 5: figs. 1, 2. - Chopra, 1933:50. - Serène, 1937:77. - Monod, 1937:2; 1938:96. - Suvatti, 1938:59. - Shen, 1940a:213; 1940b:70, 76. - Gravely, 1941:81, fig. 28: no. 1. - Stephensen, 1945:63, 200, 215, fig. 4A,B. - Lin, 1949:13. - Barnard, 1950:390, fig. 73a-c. - Suvatti, 1950:143. - Pillai, 1951:13. - Holthuis, 1956:325. - Macnae and Kalk, 1958:44, 70, 79, 126, fig. 17j. - Holthuis, 1962:54, 55. - Shen and Liu, 1963:142, 143. - Serène, 1968:40. - Macnae and Kalk, 1969:44, 70, 79, 126, fig. 17j. - Parenti, et al., 1971: DORIPPE (1). - Zarenkov, 1971:173. - Karim, 1973: legend of pl.

1: fig. 1. - Thomassin, 1974:309. - Basson, et al., 1977:81, 256. - Naiyanetr, 1980:26. [Not *Cancer dorsipes* Linnaeus, 1758.]

*Dorippe frascoe*. - De Man, 1896:371. - Tyndale-Biscoe and George, 1962:66, fig. 2: no. 1. - Sankaran-kutty, 1966:349. - Guinot, 1967:244. - Lundoer, 1974:4. - Naiyanetr, 1980:26. - Kensley, 1981:38. - Serène, 1981: pl. 1: figs. 3, 4. - Jeffries, et al., 1982:563, 564. - Chen, 1985:182, fig. 2a,b; 1986:119, 139, figs. 1:2, 4, 6, 8. - Vine, 1986:113, fig. on p. 114. - Chen, 1987:678, pl. 1: fig. A. - Ng, 1987:15. [Not *Cancer frascoe* Herbst, 1785.]

*Dorippe dripes*. - Maki and Tsuchiya, 1923:127.

*Dorippe doripes*. - Maki and Tsuchiya, 1923: pl. 15: fig. 1.

*Doryppe dorsipes*. - Dawydoff, 1952:139 [not *Cancer dorsipes* Linnaeus, 1758].

*Doryppe lunata*. - Dawydoff, 1952:139.

*Dorippe* sp.. - Fourmanoir, 1954:15.

*Dorippe atropos*. - Serène, 1968:40.

*Dorippe (Dorippe) frascoe*. - Serène and Romimohtarto, 1969:6, figs. 1, 5, 10, 15A,B, pl. 1: figs. A,B, pl. 3: figs. A-C. - Thomassin, 1978 (Annexe 3):61. - C.M. Yang, 1979:3. - Chen, 1980:157,158, 160, fig. 3, pl. 2: figs. 1, 2, 4, 6. [Not *Cancer frascoe* Herbst, 1785.]

*Dorippe (Dorippe) farscoe*. - Serène and Romimohtarto, 1969:32.

*Dorippe dorsippes*. - Karim, 1973:33.

*Dorippe frascoe*. - Vine, 1986: figure legend on p. 114.

Vernacular Name. - "Con cua áo to'i" (Vietnam; Serène, 1937).

Material. - Red Sea: Gulf of Suez, 29°49'-29°44'N, 32°30'-32°27'E, ca. 31 m, 13 Jan 1929, R.Ph. Dollfus, 1 ♀ (P). - Gulf of Suez, 25°05'N, 32°58'E, 32-33 fm (= 58-60 m), 11 Nov 1972, Ch. Lewinsohn, 3 ♀ (1 ovigerous) (L). - Sudanese Red Sea, Sta. IH, Miss Herdman, 1 juvenile (BM). - Southern Red Sea, 1957-1958, A. Ben-Tuvia, 1 ♀ (L). - Harkiko Bay, S of Massaua (as Massawa), Eritrea, Ethiopia, 15°32'N, 39°30'E, 16 Apr 1962, Israel South Red Sea Expedition, E62/4116, 1 ♂ (L); same locality, 19 Apr 1962, Israel South Red Sea Expedition, E62/11260, 1 ♀ (L). - Hawakil Bay, Eritrea, 14°58'N, 40°19'E, 5-6.5 fm (= 9-12 m), soft, muddy bottom, 17 Oct 1965, *Negus Solomon* Sta. 4, Israel South Red Sea Expedition, E65/1439, 1 ♀ (L).

Gulf of Aden: Obock, Djibouti, 11°36'N, 43°09'E, P. Jousseau, 1 ovigerous ♀ (P).

Gulf of Oman: Masqat (as Muscat), Oman, 23°37'N, 58°35'E, 5-20 fm (= 9-36 m), Col. J.B. Miles, 1 ♂, 2 juveniles (BM). - Gulf of Oman, 18-25 fm (= 33-45 m), try net, A.W. White, 2 ♂, 1 ♀ (BM). - 2 miles NW by N of buoy near Jask, Iran, 25°38'N, 57°46'E, 12 m, clay, 20 Apr 1937, G. Thorson Sta. 72D, 1 ovigerous ♀ (C).

Iran, Strait of Hormuz: 4 miles SW of Suza (as Suzeh), 26°47'N, 56°05'E, 9-11 m, sand, gravel, shells, 10 Apr 1937, G. Thorson, Sta. 61D, 1 ♂ (C). - 1 mile SE of Hormuz (as Hormuz), 27°06'N, 56°28'E, 15 m, clay, 22 Apr 1937, G. Thorson, Sta. 60D, 1 ♂ (C). - 5 miles NW by N 1/2 W of light-buoy of Qeshm (as Quism), 26°45'N, 55°45'E, 18 m, soft clay, trawl, 22 Apr 1937, G. Thorson, Sta. 81, 1 ♀ (C).

Arabian Gulf (= Persian or Iranian Gulf): E of Abu Musa, Iran, 25°49.5'N, 55°46'E, 21 m, 1 Oct 1966, Royal Dutch/Shell Exploration and Production Lab., 2 ♂ (L). - Buoy 7 off Mina Sulman, Bahrain, 26°00'N, 50°30'E, shrimp try net with small mesh cover, 1-2 fm (= 1.8-3.6 m), 3 Jun 1971, A.L. Rice, 1 ♂, 1 ♀ (BM). - Ash Shu'aybah (as Shuaiba), Kuwait, 29°03'N, 48°08'E, 40 m, trawl, 27 Mar 1979, D. Clayton, 1 ♂, 1 ovigerous ♀ (BM). - Off Khark Island (as Kharg Island), Iran, 29°13.5'N, 50°17.5'E, 14 Feb 1938, B. Løppenthin, Sta. 78, 1 ♂ (C).

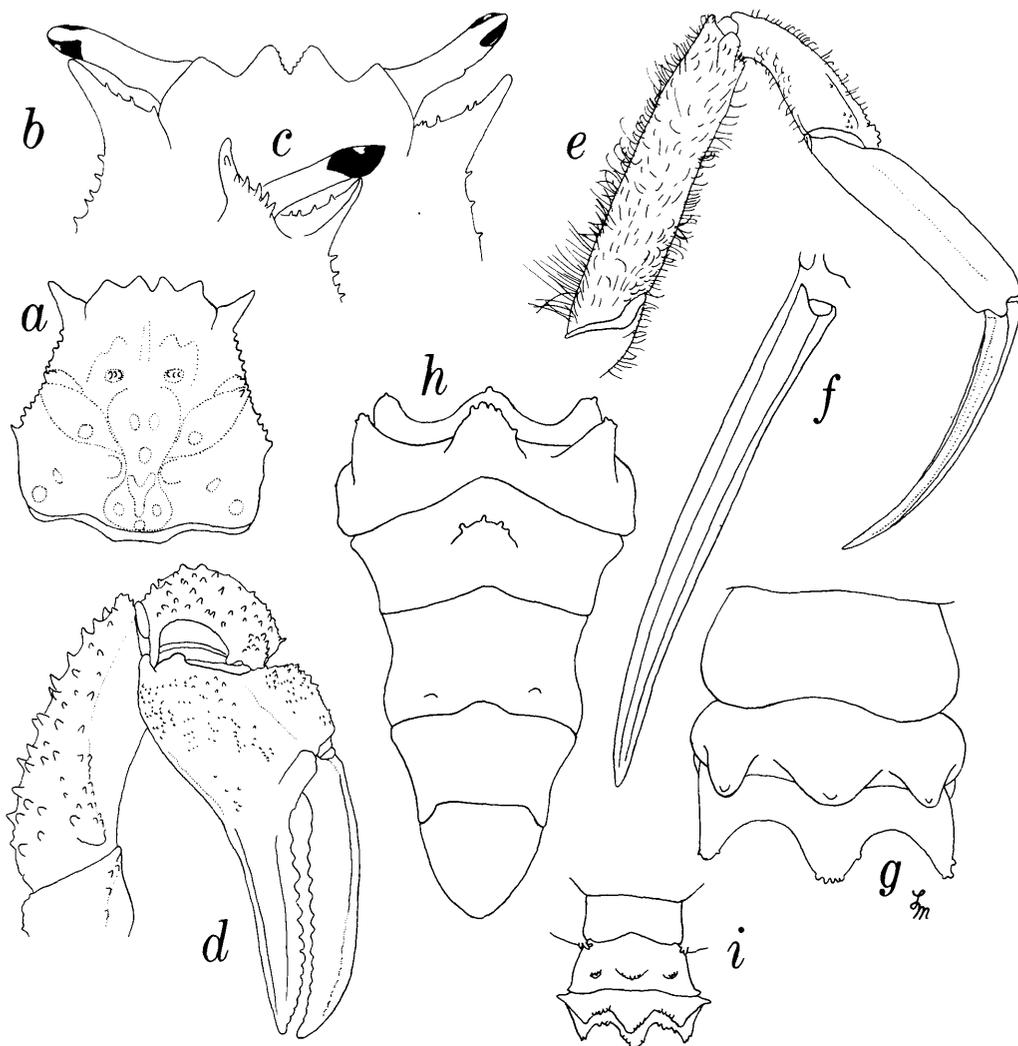


Figure 5. - *Dorippe quadridens* (Fabricius). a, carapace; b, front; c, orbit, ventral view; d, cheliped; e, P3; f, dactylus of P3; g, abdomen, dorsal view; h, abdomen, ventral view; i, abdomen, dorsal view. a-f, i, juvenile female (with abdomen shaped like male abdomen), cl 16 mm, Palawan; g, h, male, cl 20 mm, Pulau Kapal.

Tanzania: Zanzibar, 6°10'S, 39°12'E, A. Grandidier, 1 ♀ (P). - Zanzibar, 4-5 fm (= 7-9 m), 25 Apr 1964, I. Gordon, 1 juvenile (BM).

Mozambique: Mozambique, don. Museum Bologna, 1 ♀ (P). - Mongué Ferry, Morrumbene estuary, Inhambane, 23°41'S, 35°22'E, 15 Jan 1954, J.H. Day, 1 ♂ (BM). - Costa do Sol, Maputo, 25°48'S, 32°51'E, inner part of mudflat, 23 Sep 1967, G. Hartmann, 1 ♀ (L).

Madagascar: Northwestern coast of Madagascar, 12°55.2'S, 48°28.2'E, 42 m, trawl, 2 Aug 1973, A. Crosnier, 1 juvenile ♂ (P). - Ambaro Bay, ca. 13°23'S, 48°38'E, trawl, 24 Mar 1965, R. Plante, 5 ♂, 5 ♀ (4 ovigerous) (P). - Ambariaka, Ambaro Bay, 13°21'S, 48°45'E, 2-3 m, 7 Jan 1964, J. Rudloe, no. 27\*, 1 ♂ (W). - Near Ile aux Morts, Nosy Bé, 23°20'S, 48°15'E, ca. 10 m, trawl, 25 Mar 1971, M. Chavane, 1 ♂, 2 ♀ (1 ovigerous) (P). - Passe de Nosy Komba, 13°28'S, 48°21'E, 17-20 m, 13 Jan 1971, A. Crosnier, 1 juvenile ♂ (P); same locality, 17 m, shelly sand, 1 juvenile (P).

Western Indian Ocean: Indian Ocean, 1 ♀ (BM). - Cargados Carajos, 16°38'S, 59°38'E, 30 fm (= 55 m), 30 Aug 1906, H.M.S. *Sealark*, Sta. 1315 B15, 1 ♂ (W). - 1 mile off Anse Mator, west coast of Mahé, Seychelles, 4°40'S, 55°28'E, caught in bottom gill nets, 6 Jun 1974, C. Ratcliffe, 1 ♂ (BM). - 0.5 miles off west coast of Mahé, Seychelles, 22 fm (= 40 m), 1974, C. Ratcliffe, 1 ♂ (BM).

India: Pudumadam, Gulf of Mannar, 09°16.4'N, 79°E, 1960, C. Sankarankutty, 1 ♂ (L). - Tranquebar, 11°02'N, 79°51'E, 1790-1793, I.K. Daldorff, 4 ♂, 7 ♀ (1 male, cl 28 mm, cb 30 mm, lectotype, other specimens paralectotypes of *Cancer quadridens* Fabricius, 1793, C; some specimens labelled "Tranquebar," others "Ostindien" or unlabelled); same data, 1 ♀ (paralectotype of *Cancer quadridens* Fabricius, 1793, L). - ?Tranquebar, J. Banks Collection, I.K. Daldorff, 2 ♂, 1 ♀ (possibly paralectotypes of *Cancer quadridens* Fabricius, 1793 [see Remarks], BM). - Madras, 13°05'N, 80°17'E, J.A. Henderson, 2 ♂, 1 ♀ (BM).

Sri Lanka (= Ceylon): Sri Lanka, W.A. Herdman, 2 ♂, 1 ♀ (BM); same locality, E.W.H. Holdswatts, 2 ♂, 1 ♀ (BM). - Gulf of Mannar, Sri Lanka, coral reefs, W.A. Herdman, 10 ♂, 10 ♀ (BM).

Malaysia and Singapore: Off Batu Muang, Pinang Island, 5°17'N, 100°17'E, 30 m, trawled, 16 Jan 1983, W.T. Meng and L.B. Holthuis, 1 ovigerous ♀ (L). - Singapore, 1°20'N, 103°50'E, E. Deschamps, 10 ♂, 5 ♀ (W). - Singapore, shallow water, 4 Jun 1903 and 27 Jan 1910, Consul Sv. Gad, 1 ♂, 2 juveniles (C). - Siglap, Singapore, 1°19'N, 103°56'E, 10 fm (= 18 m), 2 Apr 1899, F.P. Bedford and W.F. Lanchester, 3 ♂ (BM).

Indonesia: Off Uleelheue (as Olehleh), Sumatra, 5°35'N, 95°18'E, 11-16 fm (= 20-29 m), sand, 11 Jun 1908, *Gier* Sta. IX.7, 1 ♀ (L). - Bengkulu (as Benkoelen), Sumatra, 3°48'S, 102°16'E, Nov 1925, H.C. Kellers, 1 ovigerous ♀ (W). - Lampung Bay, Sumatra, 5°53'S, 105°34'E, 25 m, muddy sand and pumice, Sigsbee trawl, 31 Jul 1922, Th. Mortensen, Sta. 85, 1 ♀ (C). - 5°33'S, 105°18'E, 27 m, Sigsbee trawl, 2 Aug 1922, Th. Mortensen, Sta. 98, 1 ♂ (C). - 5°28'S, 105°17'E, 25 m, mud, pumice, 3 Aug 1922, Th. Mortensen, Sta. 99, 1 ♀ (C). - E of Sebesi Island, Sunda Strait, 5°52'S, 105°34'E, 31 m, sandy mud, Sigsbee trawl, 31 Jul 1922, Th. Mortensen, Sta. 88, 1 ♀ (C). - Sunda Strait, 5°57'S, 105°32'E, 18 m, sandy mud with pumice, 31 Jul 1922, Th. Mortensen, Sta. 89, 1 ♀ (C). - Pulau Kapal (as Onrust Island), Sunda Strait, 6°02'S, 106°44'E, coral reef, 1 Apr 1929, Th. Mortensen, 1 ♂ (C). - Off southeastern coast of Sumatra, 5°25'S, 105°53'E, 12 m, sandy mud, 5 Aug 1922, Th. Mortensen, Sta. 110, 1 ♀ (C). - Pulo Babi, Java Sea, 5°54'S, 106°12'E, 24 m, sandy mud, shells, 27 July 1922, Th. Mortensen, Sta. 66, 2 juveniles (C). - Java Sea, 5°50'S, 106°16'E, 32 m, sand, 5 Aug 1922, Th. Mortensen, Sta. 106, 2 ♀ (C). - Java Sea, 5°53.5'S, 106°55'E, 20 m, sand, trawl, 12 May 1922, Th. Mortensen, Sta. 194, 1 juvenile (C). - Off Samalona, near Ujung Pandang, Sulawesi (as Makassar, Celebes), 5°07'S, 119°24'E, ca. 25 m, 29 Jun 1922, Th. Mortensen, 1 ♂ (C); same locality, ca. 35 m, 27 Jun 1922, Th. Mortensen, 1 juve-

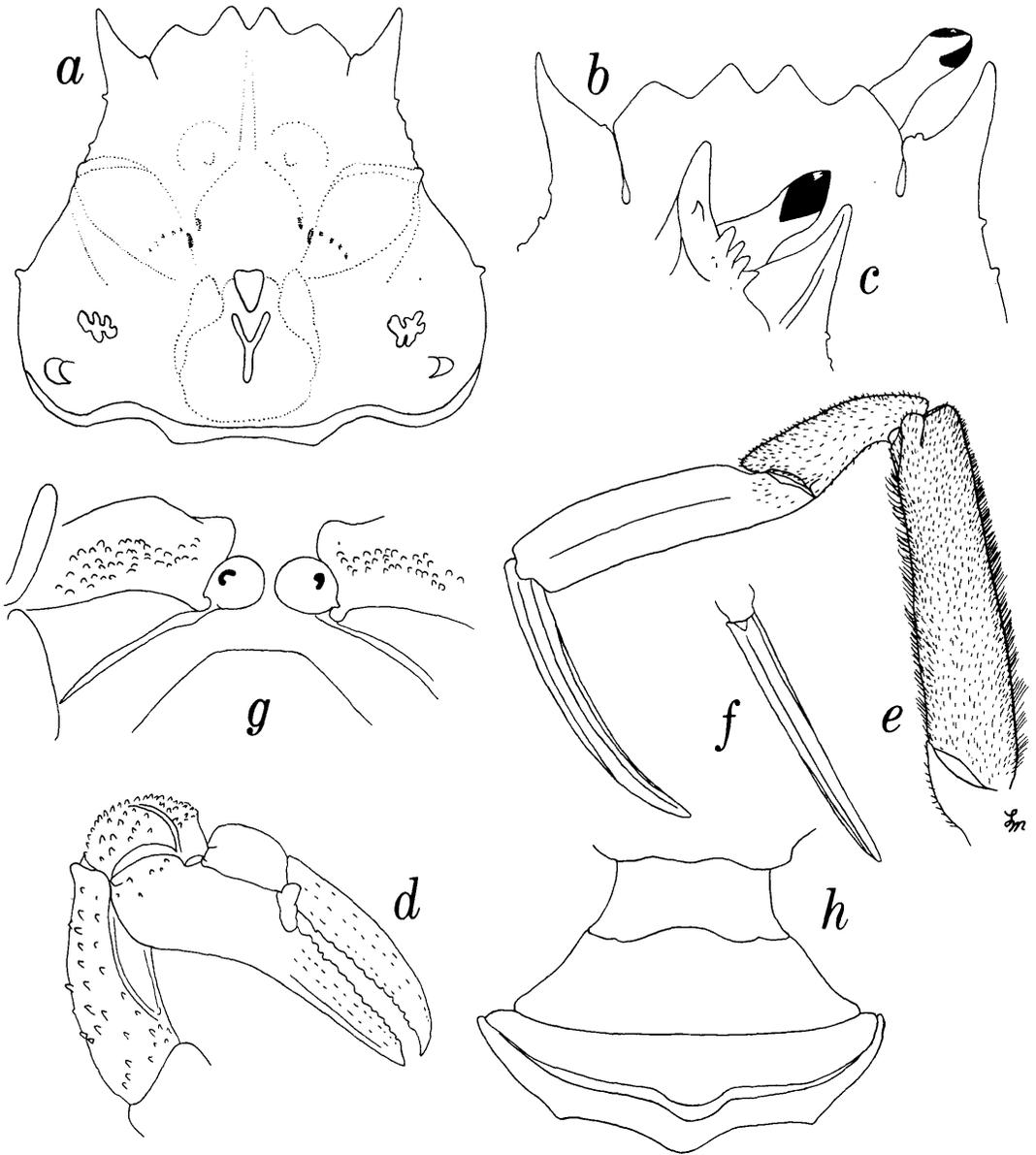


Figure 6. - *Dorippe quadridens* (Fabricius). a, carapace; b, front; c, orbit, ventral view; d, cheliped; e, P3; f, dactylus of P3; g, gonopores and sternum; h, abdomen, dorsal view. Ovigerous female, cl 26.5 mm, Benkulu.

nile (C). - Arafura Sea, 32-36 fm (= 58-66 m), R.W. Coppinger, *Alert Expedition*, 1881, 4 juveniles (BM). - N of Tual, Kai-Dulah, Kai (as Kei) Islands, 5°37.5'S, 132°43'E, 20 m, sand, trawl, 14 Apr 1922, Th. Mortensen, Sta. 19, 1 ovigerous ♀ (C). - Off Tual, 5°36.7'S, 132°43'E, 20 m, sand, 9 Apr 1922, Th. Mortensen, Sta. 11, 2 juveniles (C). - S of Duroa (as Doe Roa), Kai (as Kei) Islands, 5°35'S, 132°39'E, 40 m, sand, 10 Apr 1922, Th. Mortensen, Sta. 14, 1 juvenile (C).

Thailand: West coast of Thailand, 8°22'N, 98°15'E, 15 m, mud, "Amphioxus" sand, 9 Mar 1966, 5th Thai-Danish Exped., Sta. 1177, 1 ♂ (C). - 8°08'N, 98°16'E, 19 m, sandy mud, dredge, 9 Mar 1966, 5th Thai-Danish Exped., Sta. 1181, 1 ♀ (C). - 7°55'22"N, 98°49'45"E, 13-18 m, trawl, 14 Feb 1966, 5th Thai-Danish Exped., Sta. 23, 1 ♂ (W). - 7°53'09"-7°57'40"N, 98°50'07"-98°50'14"E, 16-20 m, trawl, 15 Feb 1966, 5th Thai-Danish Exped., Sta. 24, 1 ♂ (W). - No data available, 16 Feb 1966, 5th Thai-Danish Exped., Sta. 25, 1 ♂ (W). - 6°43'N, 99°34'E, 17-18 m, otter trawl, 23 Jan 1966, 5th Thai-Danish Exped., 1 ♂, 1 ♀ (C). - Naklua near Pattaya, Chonburi Province, washed ashore in fresh condition, 6 Apr 1984, A.C.J. Burgers and L.B. Holthuis, 3 ♂ (L). - Bay of Bangkok, between Naklua and Si Racha, Chonburi Province, about 150 km SE of Bangkok, from trawlers, 28-30 Dec 1987, A.C.J. Burgers and L.B. Holthuis, 2 ♂, 1 ♀ (L). - Koh Lan, northern Gulf of Thailand, 30 fm (= 55 m), mud, 2 Mar 1900, Th. Mortensen, 1 juvenile (C). - Koh Kam, 5 fm (= 9 m), gravel, 6 Feb 1900, Th. Mortensen, 1 juvenile (C). - Between Koh Mesan and Cape Liant, 9 fm (= 16 m), 4 Feb 1900, Th. Mortensen, 1 juvenile (W). - North side of Koh Mesan, 10-15 fm (= 18-27 m), stones and shells, Feb 1900, Th. Mortensen, 1 juvenile (C). - Tung Kaben, 6 fm (= 11 m), sand, mud and algae, 22 Feb 1900, Th. Mortensen, 1 ♀ (C). - Koh Kahdat, 5-8 fm (= 9-15 m), sandy mud, 16 Feb and 4 Mar 1900, Th. Mortensen, 1 juvenile (C). - Koh Kram, 12°42'N, 100°48'E, 30 fm (= 55 m), 2 or 21 Mar 1900, Th. Mortensen, 1 ♀ (W).

Vietnam: Vietnam (as Cochinchine), R. Germain, 1 ♂, 1 ♀ (P); same locality (as Indo-Chine), A. Krempf, campagne du *De Lanessan*, 2 ♀ (1 ovigerous) (P); same locality (ex Nhatrang collection), 1 ♂ (P). - Off western point of Honhon, Nhatrang, 12°14'N, 109°12'E, 6-8 m, 1959, A. Gaillarde, Sta. DN4, 1 juvenile (C).

Philippines: Philippine Islands, 1 ♀ (C). - Mantaquin Bay, Palawan Islands, 4 ft (= 1.2 m), sand, 130 ft seine, 1 Apr 1909, *Albatross*, 1 ♀ (W). - Subic Bay, Luzon, 14°45'N, 120°13'E, 20 ft (= 7 m), sand, 250 ft seine, 7 Jan 1908, *Albatross*, 1 ♀ (W).

China (general): China Sea, Consul Swinhoe, 1 ♂, 1 ♀ (BM).

China, Shanghai Shi: Shanghai, 31°13'N, 121°25'E, Mr. Jamrack, 2 ♀ (BM).

Hong Kong: Hong Kong (Hong Kong Island = 22°15'N, 114°11'E), Barney, 1930, 1 ♂ (BM).

Taiwan: Kao-Hsiung (as Takao; Takao Harbor = 22°37'N, 120°17'E), 16 Oct 1907, H. Sauter, 1 ♂, 1 ♀ (L).

Australia (general): Australia, 1 specimen (BM).

Australia, Western Australia: Holothuria Banks, 13°25'S, 126°00'E, Timor Sea, 20 fm (= 36 m), P.W. Bassett-Smith, 1 ♂ (BM). - Roebuck Bay, 18°04'S, 122°17'E, 1932, B. Grey, 3 ♂, 1 ♀ (BM). - Shark Bay, 25°30'S, 113°30'E, 1 juvenile ♀ (BM).

Australia, Queensland: Northeastern Australia, 1 ♀ (BM). - Queensland, 2 ♀ (BM). - Torres Strait, 1 ♂ (BM). - Thursday Island, 10°35'S, 142°13'E, 4-6 fm (= 7-11 m), R.W. Coppinger, *Alert Expedition*, 1 juvenile ♂ (BM). - Friday Island, 10°36'S, 142°10'E, 10 fm (= 18 m), R.W. Coppinger, *Alert Expedition*, 1 juvenile (BM). - Flinders, Clairmont, 11 fm (= 20 m), sand and mud, May 1881, R.W. Coppinger, *Alert Expedition*, 1 ovigerous ♀ (BM). - Dunk Island, 17°57'S, 146°10'E, 2 ♂ (BM). - Port Denison, 20°02'S, 148°15'E, 4 fm (= 7 m), sand and rock, 23 May 1881, R.W. Coppinger, *Alert Expedition*, 1 ♂ (BM). - Port Molle, 20°20'S, 148°51'E, 14 fm (= 25 m), rock, May 1881, R.W. Coppinger, *Alert Expedition*, 1 ♂ (BM). - Cumberland Island, 20°40'S, 149°09'E, 1 ♂

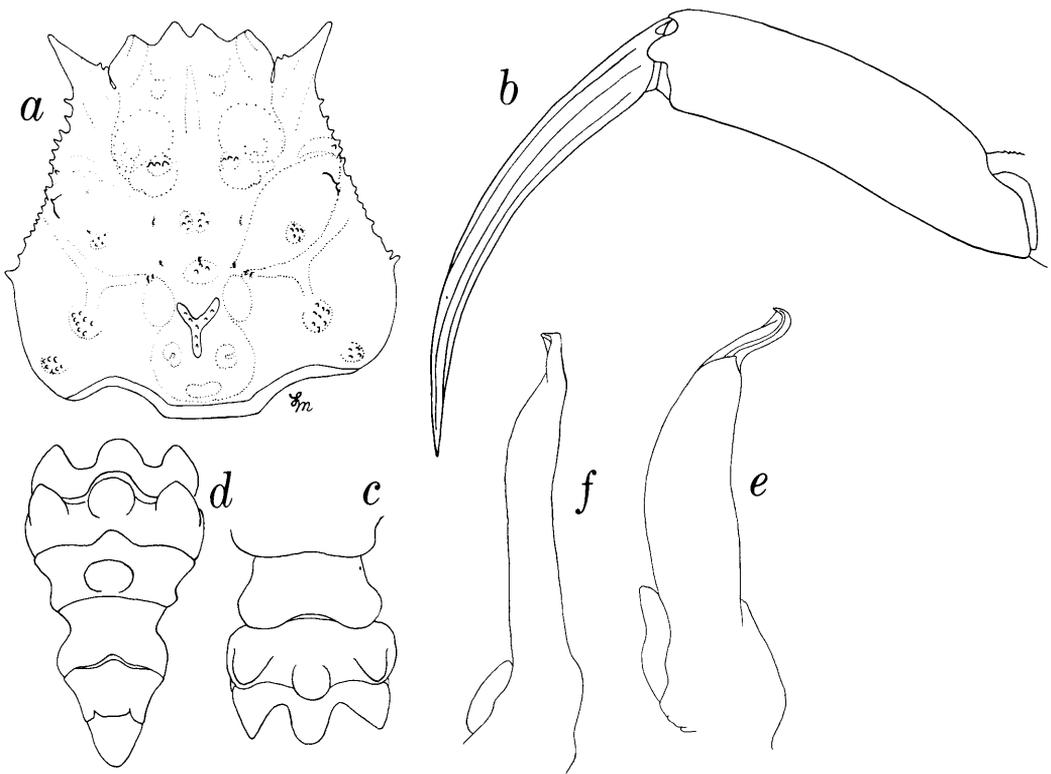


Figure 7. - *Dorippe quadridens* (Fabricius). *a*, carapace; *b*, propodus and dactylus of P3; *c*, abdomen, dorsal view; *d*, abdomen, ventral view; *e-f*, gonopod. *a*, *b*, male, cl 26 mm, Singapore; *c*, *d*, male, cl 21 mm, Ambaro Bay; *e*, *f*, male, cl 29.5 mm, Cargado Carajos.

(BM). - Between Cumberland Island and Slade Point, 21°04'S, 149°09'E, 1 ♂ (BM). - Moreton Bay, 27°15'S, 153°15'E, 1 ♂, 2 ♀ (BM).

Description. - Carapace strongly sculptured, bearing long, flexible hairs. In younger specimens hairs quite conspicuous, longer than tubercles; in older specimens hairs usually worn off. Tubercles usually well indicated and rather high, sometimes low and inconspicuous; in large males, tubercles showing as elevated, smooth warts; in females, tubercles lower, in young specimens tubercles usually ornamented with granules. Protogastric tubercles, especially in large specimens, crater-like, depressed in center. Inner protogastric tubercle, on ridge along anterior margin of branchial groove, low, inconspicuous; second protogastric tubercle high and distinct; other tubercles on ridge inconspicuous or absent. Urogastric tubercle and tubercles on branchial lobes distinct, smooth, or in juveniles, bearing at most a single granule. Two lateral tubercles on cardiac area well developed; posteriormost, a single tubercle or short bar in some specimens, smallest. Cardiac ridge Y-shaped in males, less distinct and sometimes more V-shaped in females, occasionally granular in juveniles. Lateral branchial tubercle distinct and sharp, ridge extending anteriorly from it carrying up to 12 small, sharp spinules, sometimes (especially in large specimens)

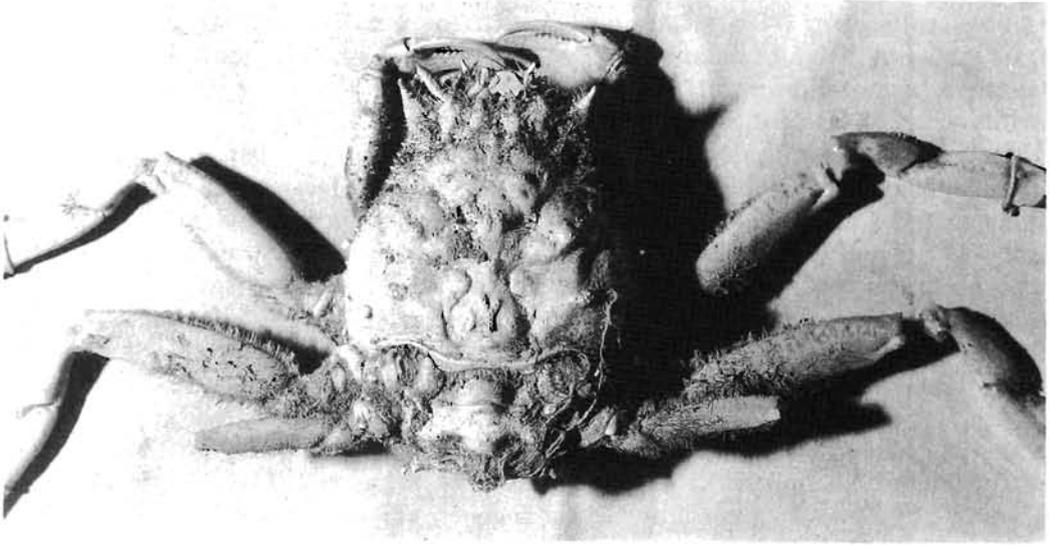


Figure 8. - *Dorippe quadridens* (Fabricius). Male lectotype, cl 28 mm, Tranquebar.

less conspicuous and irregularly placed. Posterior dorsobranchial tubercle rounded or oval, smooth and wart-like in larger specimens, granular in small. Anterior dorso-branchial tubercle irregular in outline, usually wider than long, granular in young, smooth in adult.

Frontal teeth flat, triangular, with narrowly rounded apex, separated by a deep but open V-shaped incision. Inner margin of frontal teeth tuberculate; tubercles in juveniles distinct, spinule-like, in adults hardly visible or even entirely absent. Of 2 tubercles behind each frontal tooth, anterior broad, rounded, other smaller, transversely ovate. Inner orbital tooth much broader than frontal teeth, reaching to or beyond base of V-shaped median incision separating frontal teeth. Outer orbital tooth long, straight, reaching beyond front, inner dorsal margin with 1-4 granules basally. Anterolateral margin of carapace, between base of exorbital tooth and cervical groove, with 3 to 9 sharp spinules.

Lower margin of orbit with row of 4 to 7 spines on outer margin of inner suborbital tooth. Spines confined to basal half of tooth in large specimens, possibly extending nearer apex in juveniles; 1 or 2 slightly smaller spines may be present behind larger spines.

Eyes 3 to 4 times as long as wide, slenderer in young than in adults. Cornea occupying less than half length of eye.

Small chela 2 to 2.5 times as long as high, slenderer in young than in adults. Palm with granules basally, remainder of surface smooth. Fingers about 4 times as long as dorsal margin of palm. Longitudinal groove present on upper part of outer surface of palm. Upper surface of carpus covered with distinct spinules and hairs, with faint indication of longitudinal groove in extreme distal part; groove more distinct in juveniles than in adults. In males larger than cl 24 mm, right chela may be distinctly larger than left, with fingers only about twice length of palm.

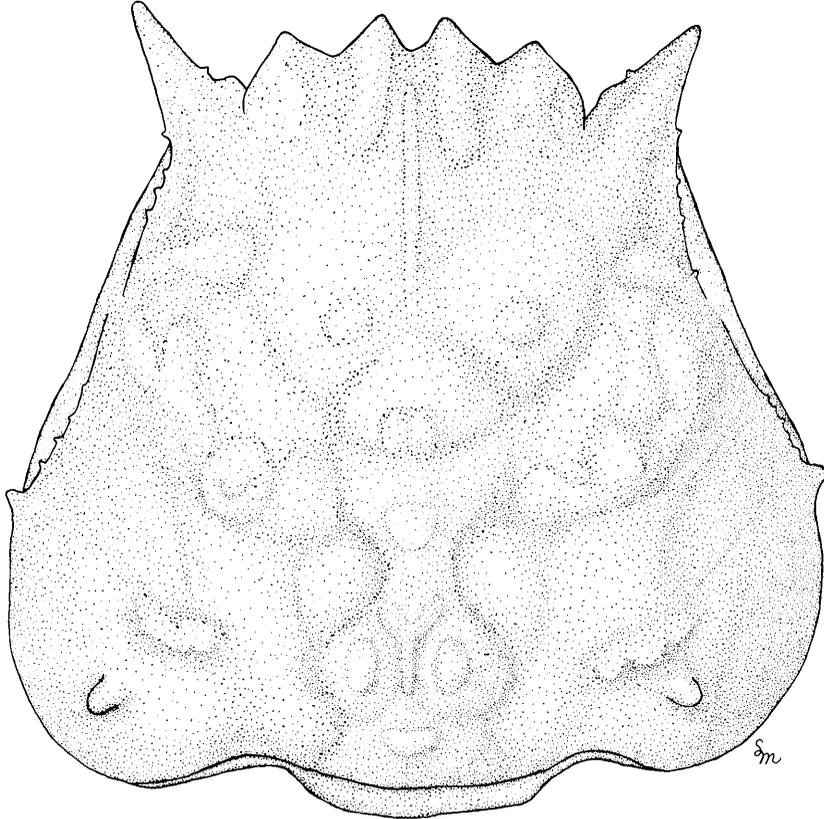


Figure 9. - *Dorippe quadridens* (Fabricius). Carapace of female paralectotype, cl 22 mm, Tranquebar.

Merus of second and third pereiopods flattened, about 1.5 times as high as wide. Merus of second walking leg slightly more than 3 to 3.5 times as long as high, that of third walking leg 4 to 4.5 times as long as high. Meri covered all over with dense short pubescence, in adult males longer and denser along posterior margin. Propodus and dactylus naked, dactylus longer than propodus.

Sternite of first pereiopod of male with transverse carinae slightly oblique and with single row of granules or spinules. Left and right carinae separated in midline of sternite by narrow median groove, narrower in adults than in juveniles. Carina of second sternite better developed, granular, or spinulose; carina of third sternite very oblique. In female, first carina with double row of granules; third row often present behind these; second carina as in males, third carina absent.

Male abdomen with 3 distinct teeth on second somite, all 3 triangular, median broader than laterals; in some specimens teeth slightly more rounded, in others teeth sharper. Teeth of third somite triangular with rounded tips; median sometimes much more rounded than laterals and occasionally with granules, especially in juveniles. Fourth somite with single strong median tooth, either triangular or rounded, sometimes somewhat granular. Fifth somite bearing transverse ridge but no median tooth; small median tooth sometimes present. Abdomen of adult female with 3 teeth on both third and fourth somites, between these a row of granules usually present. Median tooth wider and more rounded than laterals; sometimes all teeth low and inconspicuous. In juvenile females abdomen like that of males, with 3 low, granular teeth on second somite, larger granular teeth on somites 3 and 4. Fifth somite with straight, sharp transverse carina. Small blunt spine present on coxa of fifth leg in female, close to lateral margin of abdomen.

The male first pleopod was figured by Stephensen (1945:64, fig. 4A), Barnard (1950:389, fig. 73c), Serène and Romimohtarto (1969:21, 24, figs. 1, 15A,B), and by Chen (1980:157, fig. 3, no. 5). The gonopod is short and straight, ending in a single, narrow, bluntly rounded tip, lacking a basal lobe. The second pleopod was figured by Stephensen (1945:64, fig. 4B).

Color. - Stimpson (1907:167) described the color of the living animal: "The so-called teeth of the abdomen in this species are large, round, glossy tubercles, of a bright orange color, and very conspicuous among the rough hairy coatings which cover the general surface of the body. The bare surfaces of the last two joints of the chelipeds and the long ambulatory feet are also of a deep orange color in life. Beneath the naked parts are white." Fourmanoir (1954:15) reported that the color of this species was "ocre-jaune."

Griffith and Pidgeon (1833:536) mentioned that the color of the species is "light yellow", but this evidently refers to preserved specimens. Also Shen's (1931:100) rather elaborate description refers to preserved material: "In alcohol, hairs covering the general surface of the body dull citrine, naked parts drab gray. Nodules on branchial region light salmon orange. Nodules on abdomen, two terminal segments of chelipeds and two first legs all light ochraceous salmon."

Guérin Méneville's (1831-1833, in 1829-1844, pl. 13: fig. 2) colored figure (Figure 10a) is the only one we know of the species. It shows the animal with the carapace and abdomen yellowish grey, the chelipeds very pale brownish grey, the second and third pereopod with dactylus and propodus almost whitish, the rest of the leg brownish yellow, the carpus darkest and the distal part of the merus paler. The last two pereopods are brownish yellow. This probably was the color of a preserved specimen.

The specimens from Naklua, Thailand, were collected dead, but in fresh condition. They had the carapace dorsally pale purplish brown, tinged with yellow on the sides. The tubercles, especially the six large branchial and the three meso- and protogastric ones, were dark blue, almost black; later, in alcohol, this color turned bright red. The hairs of the dorsal pubescence were pale brownish grey. The tubercle on the second somite of the male abdomen was pink, those on the third and fourth somites were either bright white or orange. The legs were purplish dorsally; the pubescence of the basal segments (coxa - carpus) gave those a more brownish color. The lower surface of the body was whitish with brownish grey hairs.

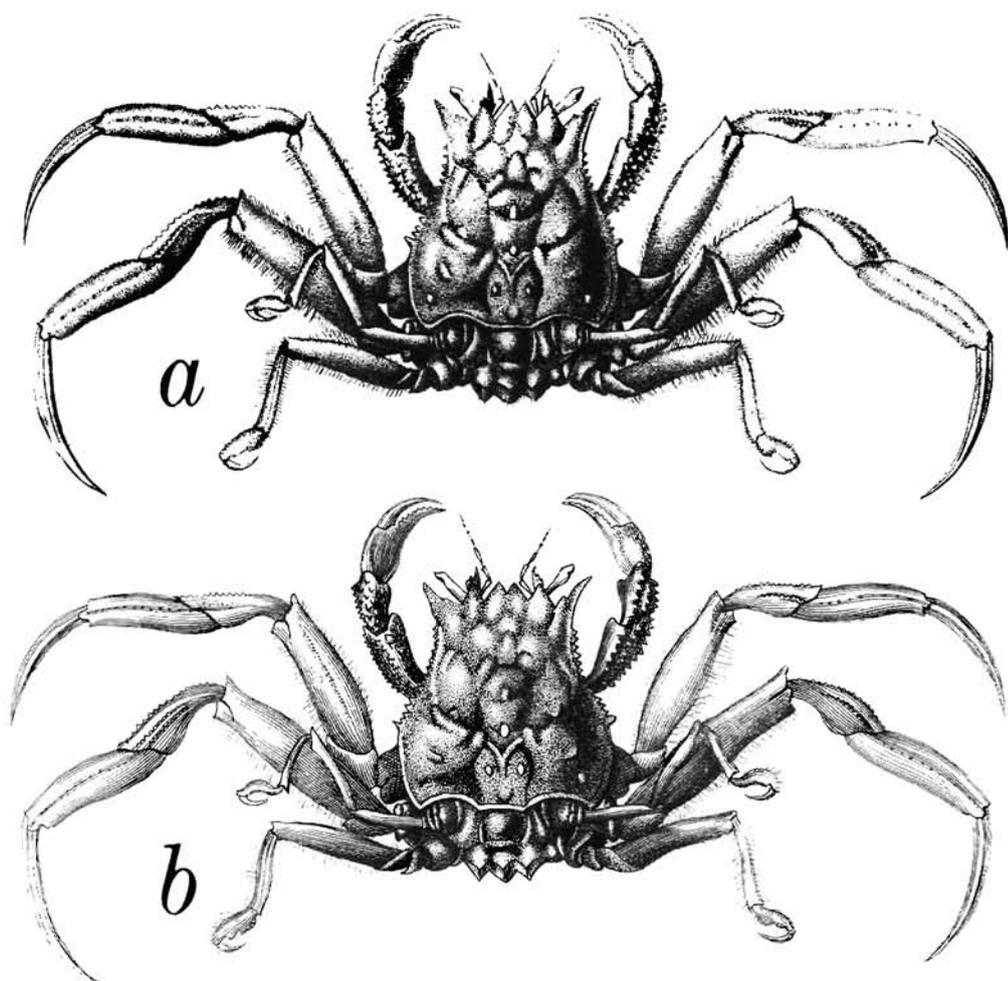


Figure 10. - *Dorippe quadridens* (Fabricius). *a*, from Guérin Méneville, 1831-1833 in 1829-1844, pl. 13: fig. 2; *b*, from Griffith and Pidgeon, 1833, pl. 13: fig. 2.

The specimen from off Anse Mator, Mahé, Seychelles, carried the following field observation on the label: "sand coloured spider."

Size. - Males, cl 5.8 to 42 mm, cb 5.9 to 37.5 mm; females, cl 10 to 36 mm, cb 11.5 to 37 mm; ovigerous females, cl 21 to 36 mm. The width/length ratio in our material varies from 0.94 to 1.07. Although the carapace looks longer than wide, it usually is slightly wider than long, if the width measured includes the lateral branchial tubercles. It is possible that some of the measurements published in the literature were taken without including the lateral tubercles in the carapace width, and in those cases the length of the animals may seem slightly flattered.

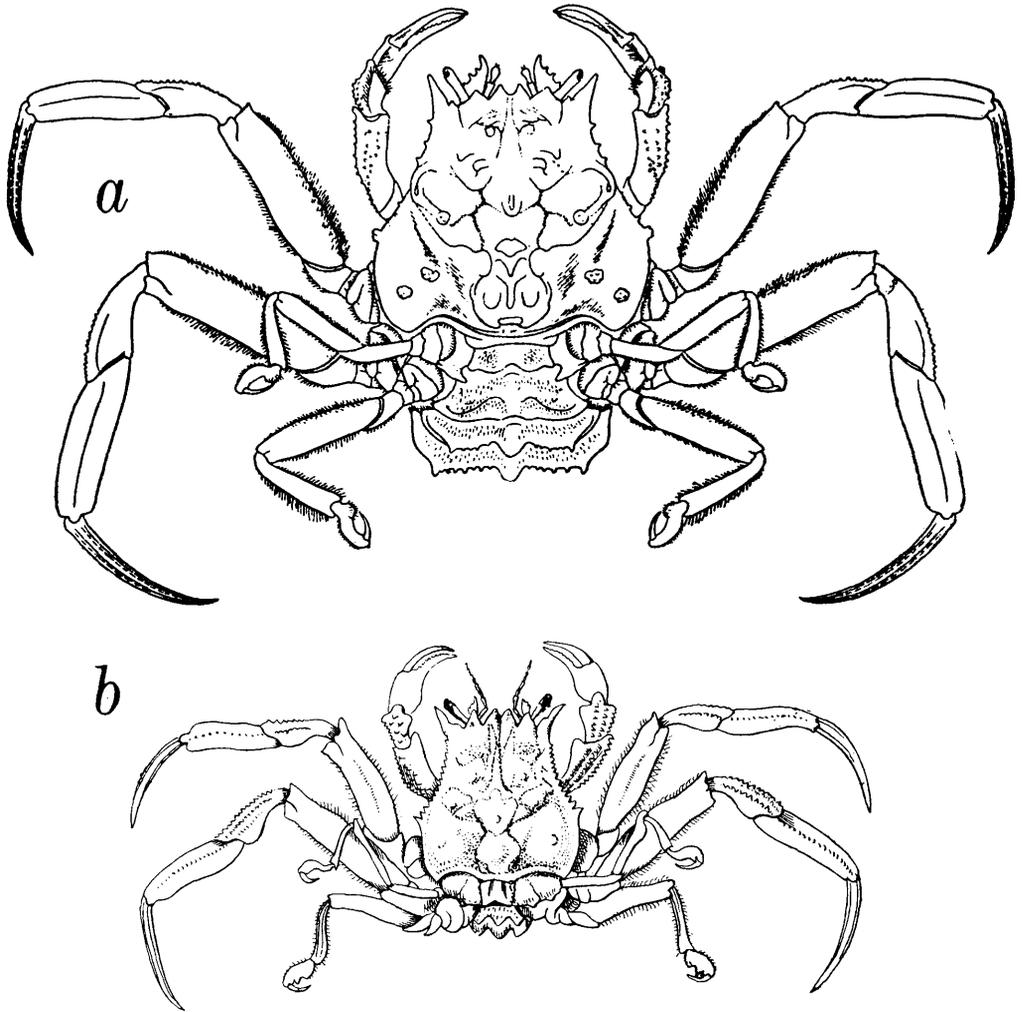


Figure 11. - *Dorippe quadridens* (Fabricius). *a*, from Shen, 1931, fig. 5; *b*, from Borradaile, 1903, pl. 22: fig. 1.

Distribution. - This species has a wide distribution within the Indo-West Pacific region, extending from the Suez Canal, the Red Sea and southeastern Africa to Hong Kong, the Philippines, Indonesia, and Australia. It is one of the most widely distributed species of Dorippinae. All Japanese material of *Dorippe* seen by us, except for one lot with questionable data (?Japan, F.C. Dale and P.L. Jouy, U.S.S. Palos, Tank Box 2138, 1 male, W, USNM 17873), proved to be *D. sinica*, but the range of that species and *D. quadridens* overlap in southern China. The records of *Dorippe quadridens* in the literature are the following:

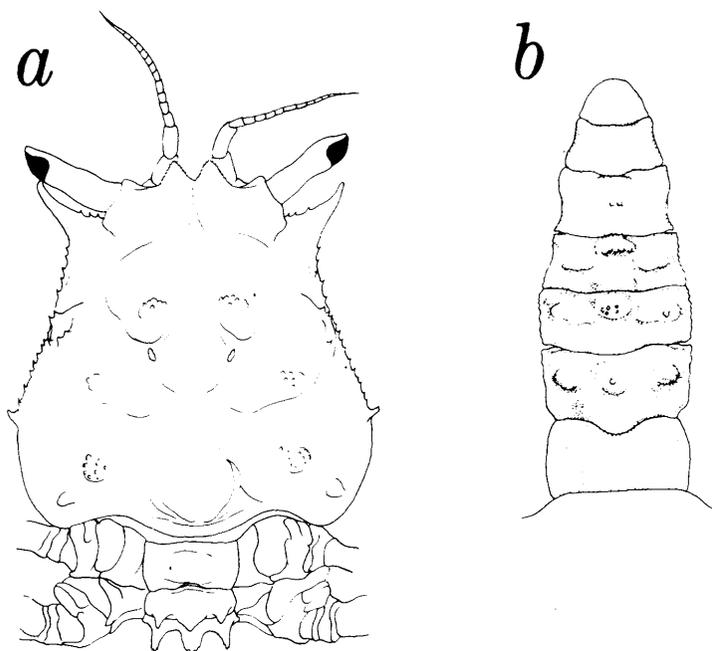


Figure 12. - *Dorippe quadridens* (Fabricius). a, carapace, and b, abdomen of immature male. From Chen, 1980, fig. 2a,b.

Indian Ocean: "In India orientali" (Fabricius, 1793; Zimsen, 1964). - "in Oceano Indico" (Fabricius, 1798). - "la mer des Indes" (Bosc, 1802). - "Océan Indien" (Latreille, 1802; Lamarck, 1818; H. Milne Edwards, 1837; Lucas, 1840). - "Indes orientales" (A.-G. Desmarest, 1823, 1825). - "mers orientales" (H. Milne Edwards, 1840). - "Indian Ocean" (Miers, 1884). The records by Fabricius (1793, 1798) are based on material from Tranquebar, India (see there), and most of the subsequent records are not original but are based on those by Fabricius.

Red Sea: Red Sea (Henderson, 1893; Vine, 1986). - Suez Canal (Monod, 1937; Holthuis, 1956). - Lake Timsah, Suez Canal (Monod, 1938). - Suez Bay (Laurie, 1915). - Near Suez, 29°44'-29°49'N, 32°27'-32°30'E (Monod, 1938).

Gulf of Aden: Obock (Nobili, 1906b). - Near Barim (= Perim) Island, 12°40'N, 43°25'E, Strait of Bab al Mandab (Zarenkov, 1971).

Arabian Gulf (= Persian or Iranian Gulf): Arabian Gulf (Alcock, 1896). - W of Khark (as Kharg), 29°13.5'N, 50°17.5'E (Stephensen, 1945). - Tarut Bay to Safaniya, coast of Saudi Arabia, 24°45'-28°12'N (Basson, et al., 1977). - NE of Arzanah Island, Saudi Arabia, 24°47'N, 52°34'E (Nobili, 1906a). - Pearl banks off Dubai, 25°10'N, 55°10'E-24°55'N, 54°40'E (Nobili, 1906a). - 5 miles NW by N 1/2 W light buoy of Qeshm (as Quism), Strait of Hormuz, 26°45'N, 55°45'E (Stephensen, 1945). - 4 miles SW of Suza (as Suzeh), 26°47'N, 56°05'E (Stephensen, 1945). - 1 mile SE of Hormoz (as Hormuz), Strait of Hormuz, 27°06'N, 56°28'E (Stephensen, 1945). - 2 miles NW by N of buoy of Jask, Iran, 25°38'N, 57°46'E (Stephensen, 1945).

Pakistan: Fish Harbor, Karachi (Karim, 1973).

Tanzania: Zanzibar, 6°10'S, 39°12'E (A. Milne Edwards, 1868; Miers, 1884; it is possible that Miers' record from Zanzibar is based on A. Milne Edwards (1868)).

Mozambique: Mozambique (Kensley, 1981). - Maputo Bay (as Delagoa Bay), 25°48'S, 32°51'E (Barnard, 1950). - Off Mozambique, 26°17'S, 33°10'E (Barnard, 1927, 1950; in 1950 erroneously cited as 27°17'S; Kensley, 1981, based on Barnard's 1927 record). - West coast of Inhaca Island, about 26°S, 33°E (Macnae and Kalk, 1958, 1969). - Ibo, Cabo Delgado Province, 12°20'S, 40°35'E (Hilgendorf, 1878).

Madagascar, northwestern coast: Mitsio Islands, 12°54'S, 48°36'E; 12°55.2'S, 48°28.2'E; Nosy Be, 13°20'S, 48°15'E; Ambaro Bay, 13°23'S, 48°38'E; Nosy Komba, 13°28'S, 48°21'E; Narendry Bay, 14°55'S, 47°30'E (Chen, 1987).

Madagascar, southeastern coast: Tuléar, 23°21'S, 43°40'E (Lenz, 1910; Thomassin, 1974, 1978). - Soalara, 23°36'S, 43°44'E (Fourmanoir, 1954).

Western Indian Ocean: Haddumati Atoll, 1°55'N, 72°25'E, Republic of the Maldives (Borradaile, 1903). - Cargados Carajos, 16°38'S, 59°38'E (Rathbun, 1911).

India: India (White, 1847). - Trivandrum, 8°29'N, 76°55'E (Pillai, 1951). - Pudumadam, Gulf of Mannar, 9°16'N, 79°00'E (Sankarankutty, 1966). - Krusadai Island, 9°14'N, 79°13'E (Gravely, 1927). - Rameswaram, Gulf of Mannar, 9°17'N, 79°18'E (Henderson, 1893). - East coast of India from Ganjam to Palk Strait (Alcock, 1896). - Palk Strait, 10°00'N, 79°45'E (Parenti, et al., 1971). - Tranquebar, 11°02'N, 79°51'E (Fabricius, 1793, 1798; Bosc, 1802; Latreille, 1802; A.-G. Desmarest, 1823, 1825; Herklots, 1861 (as "Bengale"); most by implication). - Madras, 13°05'N, 80°17'E (Henderson, 1893; Alcock and Anderson, 1894; Gravely, 1941). - Sandheads, mouth of Hooghly River, ca. 21°N, 88°E (Chopra, 1933). - Andaman Islands, India (Alcock, 1896).

Sri Lanka (= Ceylon): Sri Lanka (Miers, 1884; Henderson, 1893). - Gulf of Mannar (Laurie, 1906). - Silavatturai Paar (as Silavaturai Par), Gulf of Mannar, 8°46'N, 79°53'E (Henderson, 1893). - South end of Cheval Paar, 8°40'N, 79°46'E (Laurie, 1906). - Galle, 6°02'N, 80°13'E (Laurie, 1906).

Burma: Mergui Archipelago (De Man, 1887-1888a; Alcock, 1896).

Malaysia and Singapore: Pulau Bidan, Pinang (as Penang), 5°17'N, 100°17'E (Lanchester, 1902). - Singapore, 1°20'N, 103°50'E (Lanchester, 1900; Nobili, 1903b; Jeffries, et al., 1982). - Siglap, Singapore, 1°19'N, 103°56'E (Serène and Romimohtar-to, 1969; C.M. Yang, 1979).

Indonesia: Java Sea (De Man, 1896). - Ujung Pandang, Sulawesi (as Makassar, Celebes), 5°07'S, 119°24'E (Ihle, 1916). - Labuhanbajo (as Bay of Badjo), 8°29'S, 119°54'E, west coast of Flores (Ihle, 1916). - South coast of Timor, 10°12.2'S, 124°27.3'E (Ihle, 1916). - Ambon (as Amboina), Moluccas, 3°41'S, 128°10'E (De Man, 1887-1888b). - Jedan Island, 5°23'S, 134°41'E, Aru Islands (Ihle, 1916). - Arafura Sea (Miers, 1884).

Thailand: Andaman Sea (Naiyanetr, 1980). - Gulf of Thailand (Naiyanetr, 1980). - Vicinity of Koh Phuket, 8°00'N, 98°22'E (Lundoer, 1974). - Mouth of Menam River (Balss, 1922). - Koh Lan, Koh Kram, Koh Kam, between Koh Mesan and Cape Liant, Tung Kaben, and Koh Kahdat, Gulf of Thailand (Rathbun, 1910a; Suvatti, 1938, 1950).

Vietnam: Indochine (André, 1931; Serène, 1937). - Vietnam (?) (Dawydoff, 1952; Serène, 1981). - Mui Nay (as [Capel] Varella), 12°54'N, 109°27'E; Cam Ranh Bay, 11°54'N, 109°14'E; Vung Tau (as Cap Saint-Jacques), 10°22'N, 107°06'E; Con Son (as Poulo Condore), 8°39'N, 106°37'E; W of Hao Tae Island; between Hon Rom and Baie Guno; 10 miles S of Banc de Butto (André, 1931).

Philippines: Philippines (White, 1847; Miers, 1884). - Manila, Luzon, 25°03'N, 81°07'E (A.-G. Desmarest, 1823, 1825). - Puerto Galera, Mindoro, 13°30'N, 120°57'E (Roxas, 1930; Estampador, 1937, 1959). - Cebu (Cebu Island = 10°15'N, 123°40'E) (Estampador, 1937, 1939).

China (general) or China Seas: China (Miers, 1884; Shen and Liu, 1963; Chen, 1986).

China, Shanghai Shi: Shanghai, 31°13'N, 121°25'E (Miers, 1884).

China, Fujian Province (= Fukien Province): Xiamen (as Amoy), 24°26'N, 118°07'E (Shen, 1940b).

China, Guangdong Province (= Canton Province): Guangdong Province (Miers, 1884; Shen, 1931).

Hong Kong: Hong Kong (Hong Kong Island = 22°15'N, 114°11'E) (Stimpson, 1858, 1907; Gee, 1925; Shen, 1931, 1940a). - Aberdeen and Cheung Chau (Shen, 1940a).

Taiwan: Taiwan (as Formosa) (Balss, 1922). - Chilung (as Keelung), 25°10'N, 121°43'E (Maki and Tsuchiya, 1923, vide Lin, 1949:13). - Hsiak'unshen and Tingch'i-eting (Lin, 1949).

Australia (general): "Mers australes" (Lamarck, 1818). - "Nouvelle-Hollande" (A.-G. Desmarest, 1817, 1822; Defrance, 1819).

Australia, Western Australia: Flying Foam Passage, Dampier Archipelago, 20°28'S, 116°51'E; Maud Landing, 23°06'S, 113°46'E; Shark Bay or Exmouth Gulf (all Tyndale-Biscoe and George, 1962). - Shark Bay, 25°30'S, 113°30'E (Miers, 1884).

Australia, Queensland: Torres Straits (White, 1847; Miers, 1884). - Thursday Island, 10°35'S, 142°13'E (Miers, 1884). - Friday Island, 10°36'S, 142°10'E (Miers, 1884). - Flinders, Clairmont, northeastern Australia (Miers, 1884). - Dunk Island, 17°57'S, 146°10'E (Miers, 1884). - Port Denison, 20°02'S, 148°15'E (Haswell, 1882; Miers, 1884). - Port Molle, 20°20'S, 148°51'E (Miers, 1884). - Near Cumberland Island, 20°40'S, 149°09'E (Miers, 1884). - 25 miles SE of Double Island Point, 25°56'S, 153°11'E (Rathbun, 1923). - Platypus Bay, 24°55'S, 153°07'E (Rathbun, 1923).

Cano (1889:254) reported this species from Paita, Peru (as Payta). As no *Dorippinae* are known from American waters, this record seems most doubtful. Rathbun (1910b:609) therefore correctly ranged the record under "species of which the locality is incorrect or doubtful," together with numerous other records, mostly from "Payta," by Cano. Evidently the labelling of the material of the "Caracciolo" Expedition left much to be desired. That Cano's specimen is indeed *Dorippe quadridens* is clear from his short description in which he managed to include all essential characters of the species: "un rango di tubercoli s'estendo dietro queste dente [= anterolateral teeth of carapace] sul bordo laterale del carapazio. Il braccio ed il carpo sono minutamente granulosi."

Fossil Record. - A.-G. Desmarest (1817, 1822) described a fossil of unknown origin as *Dorippe Rissoana*.

**Habitat.** - The depth from which this species has been reported varies from 1 to 73 meters (with one record from 415 meters). Most (75%) of the records are from between 1 and 30 meters. Macnae and Kalk (1958, 1969:126) reported it from the "infralittoral fringe." The species is found on rather flat bottoms of mud and/or sand (soft mud, mud (7x), sandy mud (2x), sand + mud + phanerogams, gravelly mud, soft clay, clay (2x), sand (5x), sand + weeds + rocks, sand + shells, sand + gravel + shells, stones + shells), sometimes with weeds, corals ("polypiers"), or sponges; it has also been reported from coral reefs and oyster banks. Basson, Burchard, Hardy and Price (1977:81) reported the species from the *Murex/Cardium* mud bottom community, but on p. 256 listed it among the species of grassbeds. Thomassin (1974) reported it from Tuléar in muddy-sand bottoms on the back reef lagoon, without sea-grass meadows.

**Biology.** - Notwithstanding the fact that the last two legs are turned dorsally over the carapace, there are hardly any reports that members of this species carry objects with them. Henderson (1893:404) emphatically stated: "I have never met with an individual protected by a shell." Borradaile (1903:439), however, observed a *Dorippe quadridens* which "carried a sponge when taken." His statement on p. 435 that *Dorippe* conceals itself by holding a sponge or some other object over its back is too general to be intended for the present species alone. Ng (1987:15) commented that "the more heavily armoured *Dorippe frascone*, carries pieces of shell or debris."

In a footnote, Estampador (1937:514; 1959:65) commented: "These crabs are usually found (hooked) under the umbrella of a jellyfish belonging to the genus *Cassiopea*. The last pair of the legs are placed farther on the dorsal side and are modified for hooking." Under our account of *D. frascone*, a specimen from Catbalogan, Philippines, is mentioned as "taken from a jellyfish." It is not clear whether the specimen reported by Estampador is *D. quadridens* or *D. frascone*, and a closer study of the relation between either species with jellyfish is essential.

Macnae and Kalk (1958, 1969:44, 71) reported that at Inhaca Island, Mozambique, the species is associated with the scutellid sea urchin *Echinodiscus*, which it carries with the last two pairs of legs.

No other records of *Dorippe quadridens* carrying objects are known to us and none of our specimens did so.

Two specimens from the Strait of Hormuz, a large male from southeast of Hormoz (see also Stephensen, 1945:63) and a female from Qeshm, carried stalked barnacles on the legs; the male also carried balanids and hydroids. Several specimens from Ambaro Bay and Nosy Bé, Madagascar, also showed stalked barnacles on the carapace and legs.

Jeffries, et al. (1982) reported that two of four specimens of this species examined by them were infested with the barnacle *Octolasmis warwickii* Gray, 1825.

André (1931) found an ovigerous female taken in Vietnam in December. In the present material there are ovigerous females taken in January (Pinang), March (Kuwait, Madagascar), April (Gulf of Oman, Kai Islands), May (Queensland), and November (Gulf of Suez).

Ihle (1916) studied the general anatomy of the species. Noack (1880) described the gastric mill.

**Remarks.** - Linnaeus (1764:452) incorrectly identified a specimen of this species from "Indiis" in the collection of Queen Louisa Ulrika of Sweden with *Cancer dorsipes* Linnaeus, 1758. The species recorded in 1758 is not a *Dorippe*, but belongs to the

raninid genus *Notopus*, and at present is known as *Notopus dorsipes* (Linnaeus, 1758). The first valid name for the present *Dorippe* is *Cancer quadridens* Fabricius, 1793; the species later was placed by Fabricius (1798) in the genus *Dorippe* Weber, 1795, of which it became the type species. Fabricius' material of *Cancer quadridens* was collected at Tranquebar, India, by I.K. Daldorff, a Danish officer at the Danish settlement of Tranquebar, where he stayed from 1790 to 1793. The material, or at least part of it, is still extant; three specimens, owned by the Zoological Museum of Kiel, were transferred to the Zoological Museum, Copenhagen around 1964 (see Zimsen, 1964:7). The single specimen in the Nationaal Natuurhistorisch Museum, Leiden was acquired, with other Fabrician crustacean types, by Wilhem de Haan, curator of invertebrates at the Leiden Museum, when, in 1826, he visited several museums in Germany and obtained material in exchange for Javanese insects. In Kiel De Haan was the guest of Friedrich Boie, brother of Heinrich Boie, who was curator of vertebrates of the Leiden Museum. Friedrich Boie held a high position in the town of Kiel and was himself much interested in natural history. It is possible that the three dry specimens in the collection of the British Museum also were seen by Fabricius. All three are attached to a piece of stiff paper. One female bears the label "Cancer Fallax.Faem. Banks Coll.", a male has the label "D.nodulosa. Banks Coll.F.", and another male "Cancer Fallax. Mas. Dald. Banks Coll.". *Fallax* could be a manuscript name of Fabricius.

At the end of the 18th and the beginning of the 19th century several names were proposed for species of *Dorippe*, viz.: *Cancer frascone* Herbst, 1785, *Cancer nodulosus* Olivier, 1791, *Cancer quadridens* Fabricius, 1793, *Cancer atropos* Lamarck, 1818, *Dorippe rissoana* A.-G. Desmarest, 1817, *Dorippe nodosa* A.-G. Desmarest, 1822 (nomen nudum). As shown under *Dorippe frascone*, *Cancer frascone* and *C. nodulosus* are synonyms of that name. Lamarck (1818) referred to *Dorippe nodulosa* a specimen collected by F. Péron, probably in Australia, which was visited by Péron in 1801 and 1802 during the voyage of the *Géographe*, during which much Australian material was acquired. Péron's specimen had previously been referred to, but not described, by A.-G. Desmarest (1817) as *Dorippe nodosa*; this name is either a nomen nudum or an erroneous spelling of *D. nodulosa*. Guérin Méneville (1831-1833, in 1829-1844) published an excellent figure of Péron's specimen (Figure 10a) making it clear that it belongs to *Dorippe quadridens*; the figure shows the carpus of the cheliped and the anterolateral margin of the carapace both spinulose. Guérin's figure was copied by Griffith and Pidgeon (1833) (Figure 10b).

*Dorippe atropos* Lamarck, 1818, was described very briefly by Lamarck, and its identity cannot be made out from the original description. Lamarck's reference to Roemer's (1789, pl. 31: fig. 1) illustration of "*Inachus mascaronius*" (= *Ethusa mascarone* (Herbst, 1785)) would suggest that it might be a *Neodorippe* rather than a *Dorippe*. However, H. Milne Edwards (1837:156), who evidently saw Lamarck's type, considered it a female of *Dorippe quadridens* (which Milne Edwards erroneously spelled *D. quadridentata*). Unless the type of *D. atropos* can be examined, it seems best to follow here H. Milne Edwards, whose taxonomic judgement as a rule proves to have been very sound.

A.-G. Desmarest (1817, 1822), in his accounts of the fossil Crustacea, described and figured a new fossil species, *Dorippe rissoana*. A slightly modified version of Desmarest's 1817 description was provided by DeFrance (1819). As Desmarest remarked, and

as his figures distinctly show, this new species is remarkably similar to Péron's *Dorippe nodosa* (= *D. quadridens*), and cannot be distinguished from that species. Desmarest (1822:121) doubted whether the specimen was a true fossil, as it, although brown and shiny like most East Indian fossil crabs, was much lighter in color, more friable, and not so strongly embedded in clay as true fossils. Glaessner (1929:137) considered Desmarest's specimen to be subfossil, and treated *D. rissoana* as a synonym of *D. quadridens*, in which we follow him here.

Latreille's (1802:125, 126) *Dorippe quadridens* is, at least in part, identifiable with *Medorippe lanata* (Linnaeus, 1767), as he mentioned material from Rimini, Italy. A year later (Latreille, 1803) the same author used the name *D. quadridens* exclusively for *Medorippe*.

Latreille (1802:127) remarked that the specimen from the Muséum National d'Histoire Naturelle, Paris that he identified as *Dorippe astuta* has "une dent de chaque côté, quoique Fabricius dise que les côtés du corselet soient inermes." This remark indicates that Latreille's animal is a *Dorippe* (or *Medorippe*) rather than a *Neodorippe* or *Dorippoides*; most likely it is *D. quadridens*, the commonest species of the genus.

Many records of *Dorippe quadridens* or its synonyms cannot reliably be referred to that species. All Japanese records probably refer to *D. sinica* (q.v.). The fact that type specimens of *Cancer quadridens* still exist makes the identity of that species beyond any doubt. The figure published by Latreille (1818:4, pl. 306: fig. 1) as *D. quadridens* definitely shows that species: the carpus of the chelipeds is granular, spinules are present on the anterolateral margins of the carapace, and the meri of P2 and P3 are wide and hairy as in the present species. Likewise, Péron's specimen from Australia, referred to by Lamarck (1818) and A.-G. Desmarest (1817, 1822), and figured by Guérin Méneville (1831-1833, in 1829-1844) and Griffith and Pidgeon (1833), is a true *D. quadridens*, as shown by the illustration (Figure 10). Also the figures published by Borradaile (1903) (Figure 11*b*), Gravely (1927), Shen (1931) (Figure 11*a*), Barnard (1950), Serène and Romimohtarto (1969) and Chen (1980), clearly show the identity of their material with *D. quadridens*. The material reported upon by White (1847), Miers (1884), De Man (1887-1888*a*), Rathbun (1910*a*), Lanchester (1906), Ihle (1916), and Stephensen (1945), has been examined by us. The specimen collected at Zanzibar by Alfred Grandidier and reported upon by A. Milne Edwards (1868:72) as *Dorippe lanata* is preserved dry in the collection of the Muséum National d'Histoire Naturelle, Paris, and on examination proved to be *D. quadridens*.

Karim (1973) gave an unsatisfactory account of a species from Pakistan under the name *Dorippe dorsippes*. His measurements (males, average cl 27.75 mm, cb 23.75 mm; females average cl 34.5 mm, cb 36.5 mm) show that his species is too large to be *Neodorippe callida*, and he noted that the male pleopod was not like that of *Dorippe astuta* (Pakistani records for which are referable to *Dorippoides nudipes*). His figure of the male pleopod vaguely resembles that of *Dorippe quadridens*.

*Dorippe quadridens*, probably the most common species of the genus, can be distinguished from the other species by having spinules or granules on the anterolateral margins of the carapace and on the dorsal surface of the carpus of the chelipeds, by the relatively short legs, and by the narrow frontal teeth. The differences with *D. frascione* and *D. sinica* have been pointed out under those species.

*Dorippe sinica* Chen, 1980

## Figures 13-16

- ?*Dorippe facchino*. - Latreille, 1818:4, pl. 306: fig. 3 [not *Cancer facchino* Herbst, 1785].
- Dorippe quadridens*. - De Haan, 1839: pl. 31: fig. 3; 1841:121; 1844: pl. J. - White, 1847:54 (p.p.). - Von Siebold, 1850:xiii. - Neuville, 1938:51, fig. 3 (right). [Not *Cancer quadridens* Fabricius, 1793.]
- ?*Dorippe quadridentata*. - Berthold, 1845:45; 1846:20.
- Dorippe Quadridens*. - Herklotz, 1861:137 [p.p.; not *Cancer quadridens* Fabricius, 1793].
- Dorippe dorsipes*. - Miers, 1884:257, 258 [p.p.]. - Ortmann, 1892:562. - Stebbing, 1893:132. - Doflein, 1902:653. - Rathbun, 1902:31. - Anonymous, 1904:55, pl. 51: fig. 1. - Parisi, 1914:300. - Balss, 1922:119 [p.p.]. - Urita, 1926:ii, 40. - Komai, et al., 1927:294. - Sakai, 1934:283; 1936:40, pl. 6: fig. 3; 1937:73, pl. 10: fig. 4. - Neuville, 1938:51, 53, fig. 3 (right). - Sakai, 1940:40, 43. - Shiino and Yamada, 1951:83. - Sakai, 1956: (1) 6, (2) 25, fig. 8: no. 1. - Utinomi, 1956:69, pl. 35: fig. 1. - Miyake, 1961a:13; 1961b:170. - Miyake, et al., 1962:126. - Kamita, 1963:21. - Liu and Hsu, 1963:312, fig. 1. - Sakai, 1965:21 [English text], 10 [Japanese text], pl. 10: fig. 4. - Utinomi, 1969:69, pl. 35: fig. 1. - Holthuis and Sakai, 1970:90, 288. - Nishimura and Suzuki, 1971:104, pl. 35: fig. 7. - Suzuki, 1979:306, pl. 20: fig. 245. - Terada, 1981:21-31, figs. 1B, 2B, 3B, 4B. - Ingle, 1982:650. [Not *Cancer dorsipes* Linnaeus, 1758.]
- Dorippe doripes*. - Urita, 1926:ii.
- [Japanese name] Sakai, ca. 1930: pl. 9: fig. 1. - Odawara, 1973: pl. 1: fig. - Sakai, 1980:41, fig. 13: no. 1.
- Dorippe frascone*. - Takeda, 1975:121, colored fig., 231; 1978:33; 1982a:18; 1982b:93, colored fig; 1983:121, colored fig., 231. - Miyake, 1983:17, pl. 6: fig. 2. - Hamano, et al., 1985:5, 21. - Sakai, 1985:330, 332, 335, 336, figs. 2 (no. 1), 4 (lower). - Quintana, 1987:234, figs. 1-7, 20A,a, 21A,a,B,C, 22A-C,G, 223A-D, 24A. [Not *Cancer frascone* Herbst, 1785.]
- Dorippe (Dorippe) frascone*. - Sakai, 1976: English text:60, Japanese text:49, pl. 22: fig. 3. - Yamaguchi, et al., 1976:34. - Sakai, et al., 1983: fig. on p. 29. - K. Sakai and Nakano, 1983:80. - Muraoka and Konishi, 1988:125. - Yamaguchi, et al., 1987:8, pl. 1: fig. 9. [Not *Cancer frascone* Herbst, 1785.]
- Dorippe (Dorippe) sinica* Chen, 1980:154, 159, fig. 1, pl. 1 [type locality Nan'ao Island, Guangdong Province, China]; 1986:121, 139, figs. 1:1,3,5,7.

Vernacular Names. - The generally accepted Japanese name for the species is Kimen gani (= Devil-faced crab) (De Haan, 1841:121, as "Ki mem gani i.e. Demonis facie Cancer"; Von Siebold, 1850: xiii, as Kimen gani; Urita, 1926:40, as Kimen-Gani; Neuville, 1938:53, as Ki men gani; Sakai, 1976:60; and many others).

Material. - Japan (general): Japan (probably near Nagasaki, Kyushu), 1823-1834, P.F. von Siebold and H. Bürger, 9 ♂, 5 ♀ (BM,L,W).

Japan, east coast of Honshu Island: Sagami Bay, 35°15'N, 139°25'E, T. Sakai, 1 ♀ (BM). - Osasaki, Suruga Bay, 35°02'N, 138°47'E, 65 fm (= 118 m), volcanic sand, shells and rock, 11 May 1900, *Albatross* Sta. D.3718, 1 ovigerous ♀ (W). - Tanabe Bay (Tanabe = 33°44'N, 135°22'E), Wakayama Prefecture, 18 Apr 1961, Mr. Yamamoto, 1 ♂ (BM). - Mirume, near Kobe (Kobe = 34°40'N, 135°12'E), beach, 28 Sep 1906, H. van Oordt van Lauwenrecht, 1 ♀ (L).

Japan, Shikoku Island: Tosa Bay, 33°20'N, 133°40'E, Apr 1960, K. Sakai, 1 ♂ (BM). - Mimase, near Kochi (Kochi = 33°33'N, 133°33'E), 17 May 1979, from trawlers, K. Sakai, H. Suzuki, and L.B. Holthuis, 6 ♂, 3 ovigerous ♀ (L).

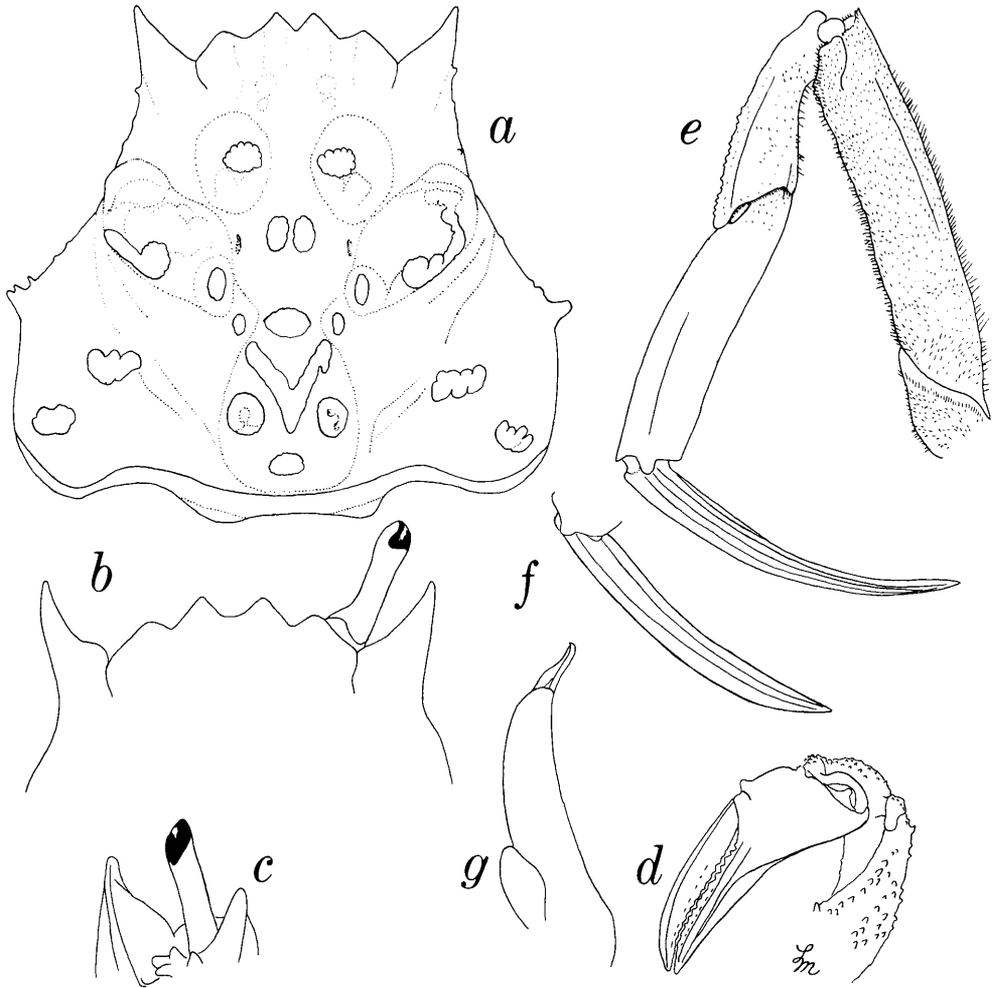


Figure 13. - *Dorippe sinica* Chen. a, carapace; b, front; c, orbit, ventral view; d, cheliped; e, P3; f, dactylus of P3; g, gonopod. a, c-f, ovigerous female, cl 30 mm, Honshu; b, male, cl 23 mm, Nagasaki; g, male, cl 35 mm, Fuzhou.

Japan, Kyushu Island: Nagasaki, 32°45'N, 129°52'E, 1900, D.S. Jordan and J.O. Snyder, 2 ♂, 1 ♀ (W); same locality, 1911, J. Jordan, 2 ♂ (C). - Ikeshima, Matsushima, Amakusa Archipelago, 32°20'N, 130°15'E, 11 Jun 1976, T. Yamaguchi, 2 ♂, 1 ♀ (L).

China, Fujian Province (= Fukien Province): N and E of Fuzhou (as Foochow), 26°09'N, 119°17'E, from fishermen, S.F. Light, 1 ♂ (W).

China: Guangdong Province (= Canton Province): Guangdong Province, 4 specimens (BM).

Hong Kong: Hong Kong (Hong Kong Island = 22°15'N, 114°11'E), 1930, Barney, 3 ♂, 1 ♀ (BM). - 1 km N of Tung Lung, 22°15.3'N, 114°18.8'E, 25 m, mud, Agassiz trawl, 27 May 1974, R.G. Wear, 1 ♀ (W).

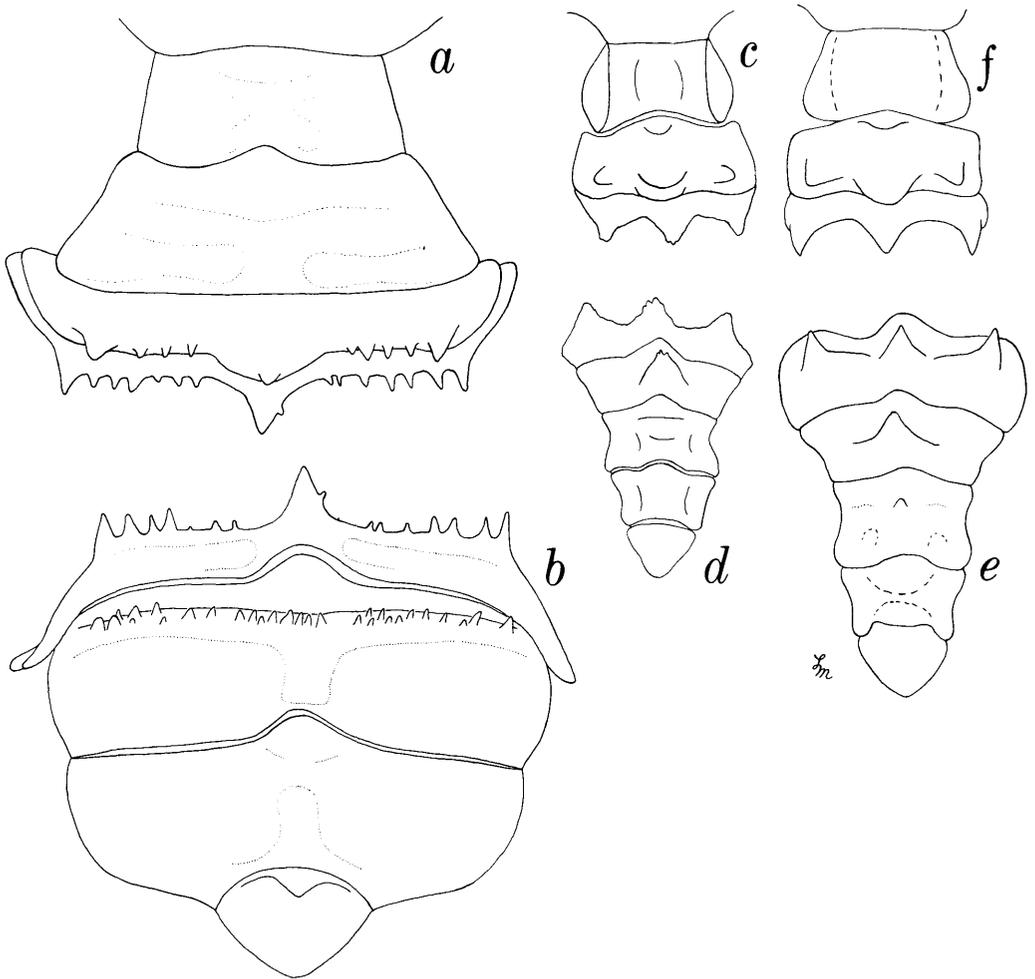


Figure 14. - *Dorippe sinica* Chen. *a, c, f*, abdomen, dorsal view; *b, d, e*, abdomen, ventral view. *a, b*, female, cl 37 mm, Hong Kong; *c, d*, male, cl 35 mm, Fuzhou; *e, f*, male, cl 23 mm, Nagasaki.

**Description.** - Carapace very strongly sculptured, with deep grooves and conspicuous wart-like tubercles. Proto-, meso-, and urogastric and 2 dorsobranchial tubercles as well, strongly elevated, sharply set off from carapace surface. Ridge before branchial groove showing 4 tubercles, inner 2 large, outer 2 lower, sometimes quite inconspicuous or absent. Cardiac ridge Y-shaped, with 3 distinct tubercles. Branchial lobes each with 1 tubercle. Dorsobranchial tubercles large, irregular, often formed by several smaller tubercles. Lateral branchial tubercle distinct but smaller than dorsal; granulated ridge extending anteriorly and somewhat downward from each lateral branchial tubercle.

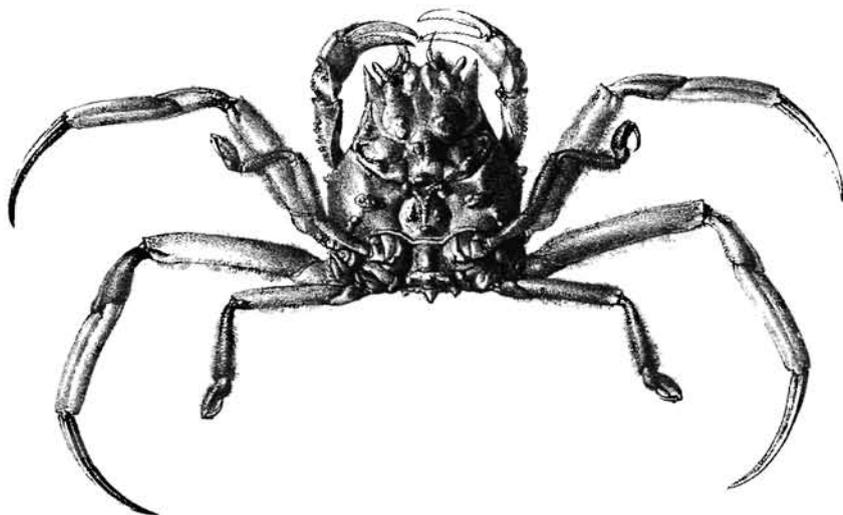


Figure 15. - *Dorippe sinica* Chen. From De Haan, 1839, pl. 31: fig. 3.

Frontal teeth convex dorsally, triangular, rounded anteriorly, about as wide as inner orbital teeth. Inner orbital angles not reaching level of base of triangular median incision of front. Both frontal margin and dorsal margin of orbit unarmed. Exorbital teeth distinctly overreaching frontal teeth.

Anterolateral margin of carapace, between base of exorbital tooth and cervical groove smooth, showing no tubercles or spinules. Precervical ridge elevated, lacking granules.

Lower margin of orbit with cluster of 2-6 spines near base of inner suborbital tooth, spines not placed in regular row; rest of orbital margin smooth. Cluster of spines separated from apex of inner suborbital tooth by long, smooth gap.

Eyes very slender, length 4 times cornea width. Length of cornea  $\frac{1}{3}$  that of whole eye.

Smaller cheliped about 3 times as long as high. Palm smooth and naked. Carpus with upper surface granular, with row of granules visible along anterior margin; dorsal groove rather distinct.

Meri of P2 and P3 almost cylindrical, being almost as wide as high. Merus of P2 about 4 times as long as high, that of P3 5 times. Meri entirely covered by sparse, short, stiff pubescence, granules also present. Carpus with some anterodorsal granules and some pubescence dorsally. Propodus and dactylus naked. Propodus 3.5 to 4 times as long as high. Dactylus longer than propodus.

Sternite of P1 with transverse carina slightly oblique and coarsely granular, 2 carinae separated by deep and rather wide median groove. Ridges of following segments also coarsely granular.

Second somite of male abdomen with median tooth large and bluntly pointed, lateral teeth smaller and acute. All 3 teeth of third somite and single tooth of fourth sharply pointed. In female teeth of third somite acute, separated by distinct, acute granules. Fourth somite with median tooth large and sharp, lateral teeth smaller,

being slightly larger than acute intermediate denticles placed between central and lateral teeth; all these teeth sharply pointed. Fifth somite bearing row of denticles on transverse carina, median denticle by far largest.

Male pleopod as figured.

Color. - Colored figures of the species have been published by Sakai (1936, pl. 6: fig. 3; 1937, pl. 10: fig. 4; 1965, pl. 10: fig. 4; 1976, pl. 22: fig. 3), Utinomi (1956, pl. 35: fig. 1; 1969, pl. 35: fig. 1), Nishimura and Suzuki (1971, pl. 35: fig. 7), Takeda (1975:121, fig.; 1982b:93, fig.; 1983:121, fig.), Miyake (1983, pl. 6: fig. 2), and Sakai, et al. (1983, figs. on p. 29).

Size. - Males, cl 19 to 38 mm, cb 25 to 43 mm; females, cl 30 to 41 mm, cb 34 to 46 mm; ovigerous females, cl 32 mm, cb 35 and 36 mm. The measurements given in the literature all fall within the above range, except that in the original material of *Dorippe sinica* there is a specimen with cl 45 mm (Chen, 1980:160). The width/length ratio in this species is 1.00 to 1.12.

Distribution. - So far this species is known only from localities in Japan, from Oga Peninsula on the west coast and Inubozaki on the east coast, southward, and from Guangdong Province, southern China, and Hong Kong. The following are the records in the literature:

Japan (general): Japan (De Haan, 1841; White, 1847; Herklots, 1861; Miers, 1884; Sakai, 1930, 1936, 1956, 1980; Utinomi, 1956, 1969; Nishimura and Suzuki, 1971; Takeda, 1975, 1982b, 1983; Miyake, 1983; Sakai, et al., 1983). The specimens reported on by De Haan, White, Herklots, and Miers probably originate from Nagasaki (q.v.).

Japan, west coast of Honshu Island: Oga Peninsula, 39°55'N, 139°50'E (Sakai, 1976). - Yamagata Prefecture (Suzuki, 1974). - Niigata, 37°55'N, 139°03'E (Miyake, et al., 1962). - Toyama Bay, 36°50'N, 137°10'E (Sakai, 1940; Miyake, et al., 1962). - Ishikawa Prefecture (Anonymous, 1904). - San-in District (Kamita, 1963). - Tottori, 35°30'N, 134°14'E (Miyake, et al., 1962).

Japan, east coast of Honshu Island: Off Inubozaki, 35°42'N, 140°52'E (Sakai, 1976). - Tokyo Bay (Ortmann, 1892; Sakai, 1937, 1940, 1976). - Boso (as Boshu) Peninsula, Tokyo Bay (Balss, 1922). - Tateyama Bay, 35°00'N, 139°50'E (Sakai, 1937). - Sagami Bay (Doflein, 1902; Parisi, 1914; Sakai, 1976). - Misaki, Sagami Bay, 35°08'N, 139°37'E (Balss, 1922). - W of Jogashima, 35°08'N, 139°37'E (Sakai, 1965). - Off Kameki Reef, 35°12'N, 139°35'E (Sakai, 1965). - Zushi (as Dzushi), 35°18'N, 139°35'E (Balss, 1922). - Enoshima, 35°18'N, 139°29'E (Parisi, 1914; Sakai, 1965). - Manazuru, 35°09'N, 139°08'E (Sakai, 1937). - Izu Peninsula (Sakai, 1937). - Ito, 34°58'N, 139°05'E (Balss, 1922). - Off Izu Peninsula, 34°44.4'N, 139°02.0'E-34°44.5'N, 139°01.8'E (Takeda, 1982a). - Shimoda, off Norosi and Kisami, Izu Peninsula, mouth of Sagami Bay, 34°40'N, 138°57'E (Sakai, 1937). - Haidashi Bank, ?Sagami Bay (Balss, 1922). - Fukuura, ?Sagami Bay (Balss, 1922). - Enshu Nada, Shizuoka Prefecture, 34°27'N, 137°38'E (Terada, 1981). - Kii Peninsula (Sakai, 1937). - Wakanoura, Kii (Wakanoura Bay = 34°10'N, 135°10'E) (Rathbun, 1902). - Mie Prefecture (Shiino and Yamada, 1951). - Ise Bay (Sakai, 1937). - Minabe, Hidakagun, Wakayama Prefecture, 33°46'N, 135°19'E (K. Sakai and Nakano, 1983). - Seto, south side of Tanabe Bay (Tanabe = 33°44'N, 135°22'E), Wakayama Prefecture (Komai, et al., 1927).

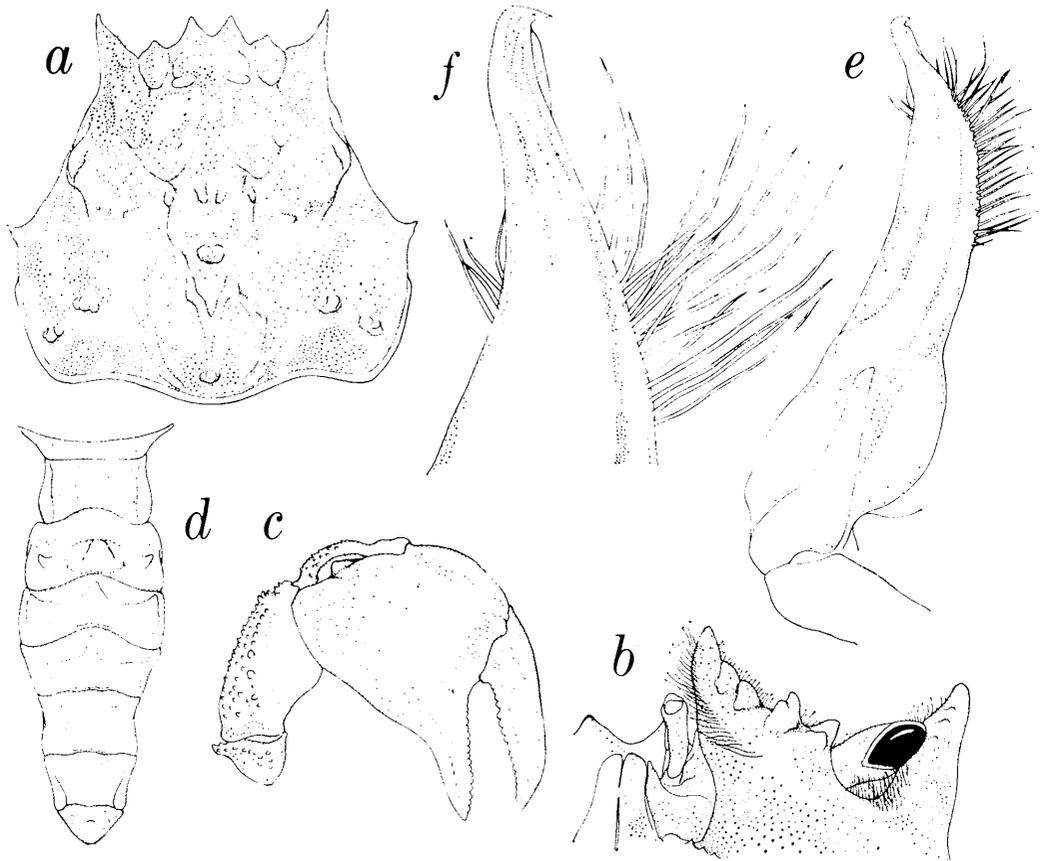


Figure 16. - *Dorippe sinica* Chen. a, carapace; b, orbit, ventral view; c, cheliped; d, abdomen; e, f, gonopod. From Chen, 1980, fig. 1.

Japan, Shikoku Island: Off Matsushige, Itaogun; Tsubakidomari, Anan; and Kainan-Asakawa, Kaifugun, all Tokushima Prefecture (K. Sakai and Nakano, 1983). - Kochi, 33°33'N, 133°33'E (Ortmann, 1892). - Tosa Bay, 33°20'N, 133°40'E (Sakai, 1937; Quintana, 1987).

Japan, Kyushu Island: Tsuyazaki, 33°47'N, 130°28'E (Miyake, et al., 1962). - Hakata Bay, 33°37'N, 130°23'E (Hamano, et al., 1985). - Sea of Ariaké, 33°05'N, 130°15'E (Miyake, et al., 1962). - Nagasaki, 32°44'N, 129°52'E (?De Haan, 1841; ?White, 1847; ?Herklots, 1861; ?Miers, 1884; Rathbun, 1902; Balss, 1922; Sakai, 1934, 1937). - Aitsu, 32°30'N, 130°26'E (Yamaguchi, et al., 1976). - Amakusa, 32°20'N, 130°15'E (Miyake, 1961a,b; Miyake, et al., 1962; Takeda, 1978). - Amakusa Islands (Yamaguchi, et al., 1987). - Kagoshima, 31°35'N, 130°34'E (Ortmann, 1892; Sakai, 1937). - Shibushi, Osumi (as Sibusi, Ohsumi), Kagoshima Prefecture, 31°28'N, 131°07'E (Urita, 1926).

China (general): China (?Berthold, 1845, 1846; ?Neuville, 1938; Chen, 1986).

China, Guangdong Province (= Canton Province): Nan'ao Island, 23°25'N, 117°06'E (Chen, 1980). - Shanwei, 22°48'N, 115°22'E (Chen, 1980). - Off Guangdong Province, 21°N, 112°E (Chen, 1980).

Taiwan: Taiwan (Lin, 1949).

So far *D. sinica* is the only species of the genus known with certainty from Japan, but in southern China the ranges of *D. sinica* and *D. quadridens* overlap. Stimpson's (1858, 1907) specimens, identified as *D. quadridens*, indeed belong to that species as shown by his remark (1907:167) that "the so-called teeth of the abdomen in that species are large, round glossy tubercles." Also the specimens from Hong Kong described and extensively figured by Shen (1931) as *D. dorsipes* clearly are *D. quadridens* and not *D. sinica*. Berthold (1846) did not give enough information about his specimens to enable us to identify his material.

Habitat. - The species has been reported from the shore (on the tidal flat, ELWS; Yamaguchi, et al., 1987) and from depths between 15-50 and 118 meters (15-50, 20, 20-50, 25, 30-100, 50, 60, 85, 92-100, 118 meters); one record is from a beach, possibly of a specimen washed ashore. The specimens were taken from bottoms of mud, sand, and "Volcanic sand, shells, and rock." K. Sakai and Nakano (1983) reported that several specimens were taken in lobster nets.

Biology. - Oviparous females have been found in late June and from April to July at Amakusa (Miyake, 1961b; Yamaguchi, et al., 1987) and in May at Mimase (present material).

Four zoeal stages were described and figured by Terada (1981). Quintana (1987) described the third and fourth zoea, the megalopa, the first crab stage and the adult.

Sakai (1976:61) remarked that "The animal is protected by a dead shell, which is held by the reduced posterior pairs of legs on its back." It is remarkable, however, that no other records supporting this have ever been published, apart from the general statement by Sakai (1937:74) that the habits of *D. sinica* (reported as *D. dorsipes*) are the same as those of *D. japonica* (= *Heikea japonica*). Also the closely related *D. quadridens* seems to rarely carry shells (see there).

Remarks. - An examination of our Japanese material of *Dorippe* led us to the conclusion that all specimens belong to a species different from *D. quadridens* or *D. frascone*. When we received Chen's (1980) publication it became clear that our material has to be assigned to her *Dorippe sinica*. The Japanese *Dorippe* specimens described and figured in the literature also all proved to belong to *D. sinica*, except for those records that provided not enough details for a certain identification.

The first published record of *D. sinica* probably is the figure published by Latreille (1818, pl. 306: fig. 3) under the name *Dorippe facchino*. Latreille's figure shows a *Dorippe* with a smooth anterolateral margin on the carapace and slender cylindrical meri of the second and third legs. Otherwise the sketch is rather poor and a positive identification is not possible. It is interesting, however, to compare this fig. 3 with fig. 1 of the same plate showing *Dorippe quadridens*.

The Japanese material dealt with by De Haan (1839-1844), White (1847), and Miers (1884) was collected in Japan between 1823 and 1834 by P.F. von Siebold. It was examined by us and proved to be *D. sinica*. Also Rathbun's (1902) material was available to us and could be assigned to that species.

*Dorippe sinica* is very close to *D. quadridens*. It is distinguished from that species by the absence of spinules on the lateral margin of the carapace behind the exorbital teeth, by the more slender second and third pereopods, in which the merus is more cylindrical, and in the more acute teeth on the abdomen of the males. Furthermore the frontal teeth in *D. sinica* are about as wide as the inner orbital teeth. In *D. frasc-*

*cone* the carpus of the cheliped is without granules, while the distal groove of that segment is absent or faint.

Neuville (1938) discussed the role played by the genus *Dorippe* in Japanese and Chinese folklore. His fig. 3 is copied from a part of De Haan's (1839) pl. 31: fig. 3.

### *Dorippe tenuipes* Chen, 1980

#### Figures 17-18

*Dorippe callida*. - White, 1847:54 [not *Dorippe callida* Fabricius, 1798].

*Dorippe dorsipes*. - Miers, 1884:258 [p.p.; not *Cancer dorsipes* Linnaeus, 1758].

*Dorippe (Dorippe) tenuipes* Chen, 1980:156, 160, fig. 2, pl. 2: figs. 3,5,7,8 [type locality 20°N, 113°30'E, off Guangdong Province, China, depth 76 m].

*Dorippe miersi* Serène, 1981:1128, figs. 1-3, pl. 1: figs. 1,2, pl. 2: figs. 1-4 [type locality 12°15'N, 109°12'E, Nhatrang Bay, Vietnam, depth 15-20 m]. - Sakai, 1985:332, 335, fig. 4 (upper).

*Dorippe frascoe*. - Serène and Vadon, 1981:120, 121 [not *Cancer frascoe* Herbst, 1785].

*Dorippe tenuipes*. - Chen, 1985:181, fig. 1, 2c,d; 1986:121, 139, figs. 2:9-13.

**Material.** - Indonesia: Off Halmahera, 00°50'N, 127°37.2'E, 49-53 m, 14 Jul 1979, *Alpha Helix* Sta. 119, 1 ♂ (L).

Vietnam: Nhatrang Bay, 12°15'N, 109°12'E, 15-20 m, muddy sand with shells, in trawl catches, N.V. Luom, 1 ♀ (paratype of *D. miersi*, P, B.7280); same data, 1 ♂ (holotype of *D. miersi*, P, B.7279).

Philippines: N of Cebu, 11°28'39"N, 123°50'05"E, 75 m, otter trawl, 6 Jun 1978, Smithsonian Institution Philippine Expedition, *Sting Ray V*, T.16, 1 ♂ (W). - Cebu (as Zebu; Cebu Island = 10°15'N, 123°40'E), 1827, H. Cuming, 2 ♂ (BM).

China, Guangdong Province: Off Guangdong Province, 20°00'N, 111°30'E, 81 m, muddy sand, 6 Feb 1959, C. Huilian, 1 ♀ (paratype of *Dorippe tenuipes*, P, B.8936); same area, 20°30'N, 113°00'E, 68 m, muddy sand, 18 Apr 1960, C. Huilian, 1 ♂ (paratype of *D. tenuipes*, P, B.8937).

Hong Kong: Hong Kong (Hong Kong Island = 22°15'N, 114°11'E), 1930, Barney, 2 ♂, 3 ♀ (BM).

**Description.** - Carapace strongly sculptured, with grooves and tubercles distinct. Protogastric and mesogastric tubercles high and granular, urogastric low and inconspicuous. Of 2 larger tubercles on carina before branchial groove, outer high and granular, inner low and obscure; other tubercles not visible on ridge. Precervical ridge short, bearing few granules distally. Branchial lobes swollen, distinct. On cardiac region, median ridge Y-shaped, with short stem; of 3 tubercles on this region laterals distinct, posterior obscure; transverse ridge visible in some specimens. Lateral branchial tubercle distinct, wide, carrying numerous pointed granules; about 20 granules also visible on ridge extending forward from lateral tubercle and ending below anterolateral margin of carapace; 2 dorsobranchial tubercles of about same size, both large and granular.

Frontal teeth triangular, rounded dorsally. Inner orbital angles much shorter than frontal teeth, reaching to base of V-shaped median incision of front. Anterior margin of front and posterior dorsal margin of orbit unarmed. Anterolateral margin of

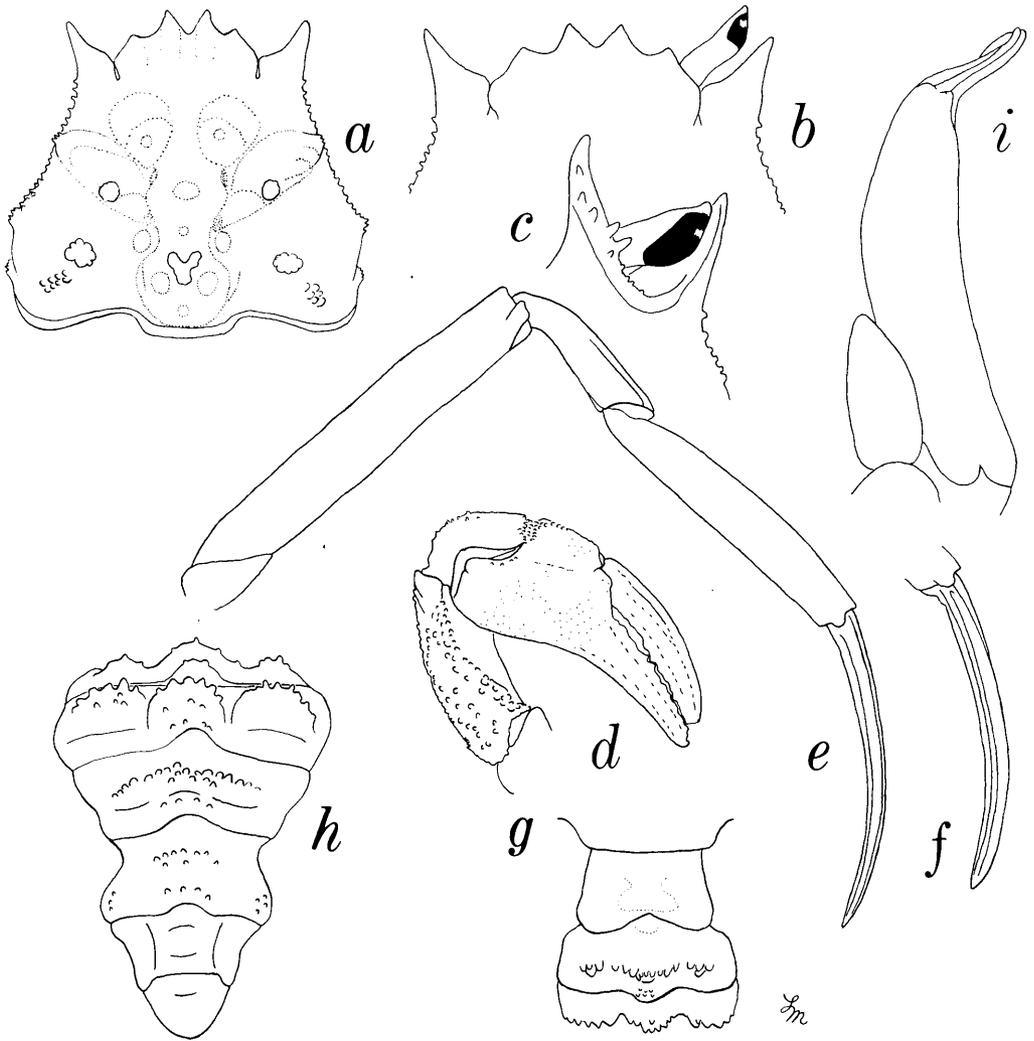


Figure 17. - *Dorippe tenuipes* Chen. *a*, carapace; *b*, front; *c*, ventral view of orbit; *d*, cheliped; *e*, P3; *f*, dactylus of P3; *g*, abdomen, dorsal view; *h*, abdomen, ventral view; *i*, gonopod. Male, cl 18 mm, Cebu.

carapace bearing 7 or 8 denticles between base of exorbital tooth and cervical ridge.

Lower margin of orbit showing row or patch of about 4-6 spines on outer margin of inner suborbital tooth; spines occupying greater part of inner margin of tooth. Below larger spines orbital margin showing some spinules.

Eyes 3.5 times as long as cornea width. Cornea slightly less than half as long as eye.

Chela of first pereopod twice as long as high. Outer surface of palm naked and smooth, apart from very few granules in extreme basal part. Groove on upper margin of outer surface of palm distinct and wide. Carpus with upper surface granular and with shallow groove.

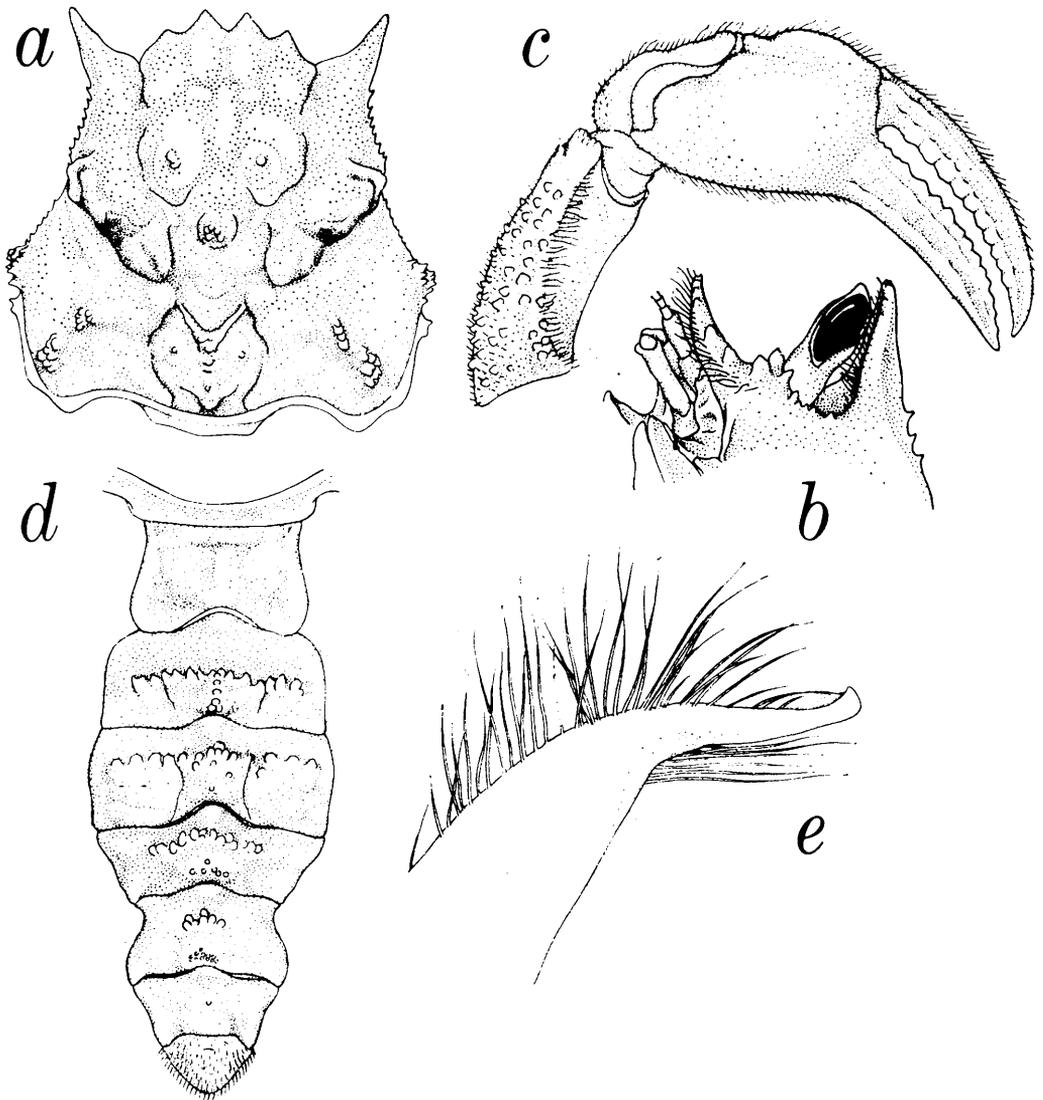


Figure 18. - *Dorippe tenuipes* Chen. a, carapace; b, orbit, ventral view; c, cheliped; d, abdomen; e, apex of gonopod. From Chen, 1980, fig. 2.

Second and third pereopods very long and slender. Meri about 1.5 times as high as wide, not strongly flattened. Merus of P2 5.5 times as long as high, with very few granules, mostly in proximal part, and fewer hairs. Carpus with at most few granules on anterior margin. Propodus 5 times as long as high, naked. Dactylus about as long as propodus. On P3 merus almost 7 times as long as high, with few proximal granules and very little hair. Carpus with few anterior granules. Propodus 6 times as long as high. Dactylus about as long as or shorter than propodus.

Sternite of P1 of male bearing 2 oblique, transverse granular ridges, separated by distinct median groove. Distinct second granular ridge present behind each ridge, second ridge touching first laterally, ridges diverging mesially. Elevated granular ridge also present on following somite. Third sternite with 1 long granular ridge, followed by short one, latter on posterior margin of sternite.

First somite of male abdomen with low median elevation near posterior margin. Second abdominal somite with transverse carina with median and 2 lateral elevations, rounded and granular; another granular tubercle present immediately behind median elevation. Median carina of third somite broad, granular, with median and 2 lateral elevations, all rather low and granular. Median granular elevation also present on fourth somite, with granules also forming transverse row on either side; behind median elevations some other tubercles present. Fifth somite also with 2 slight, granular median elevations, one behind the other, posteriormost of these not very distinct.

Male pleopod as figured.

Size. - Males, cl 18 to 20 mm, cb 19 to 24 mm; females, cl 19 to 23 mm, cb 21 to 26 mm. Chen (1980) reported the carapace length in her material to be up to 25 mm, and gave cl and cb of a male as 18.5 and 20.5 mm, respectively, and those of a female as 18.5 and 21.2 mm, respectively. The male holotype of *D. miersi* has cl 19 mm and cb 20 mm; in the two paratype females cl is 23 and 24 mm, cb 25 and 26 mm. The immature male reported upon by Serène and Vadon (1981) and Chen (1985) has both cl and cb 8.0 mm. The width/length ratio in the males is 1.05 to 1.11, in the females 1.08 to 1.15, and in the juvenile 1.00; the females thus on the average seem slightly wider.

Distribution. - The type locality of *Dorippe tenuipes* is in the South China Sea off Guangdong Province, China, at 20°N, 113°30'E. The type locality of *Dorippe miersi* is Nhatrang Bay, Vietnam, 12°15'N, 109°12'E. The species is known from southern China, Vietnam, the Philippines, and now from Indonesia. The records in the literature are:

Vietnam: Nhatrang Bay, 12°15'N, 109°12'E (Serène, 1981).

Philippines: Off the entrance of Manila Bay, Luzon, 14°15'N, 120°31.2'E (Serène and Vadon, 1981; Chen, 1985). - Cebu (as Zebu; Cebu Island = 10°15'N, 123°40'E) (White, 1847; Miers, 1884).

China (general): China (Chen, 1986).

China, Guangdong Province: Off Guangdong Province, 20°N, 113°30'E, 20°30'N, 113°E, and 21°15'N, 113°30'E (Chen, 1980).

Habitat. - The depths from which *D. tenuipes* has been reported are 15-20 meters (Serène, 1981), 52, 76, and 92 meters (Chen, 1980), 76-70 meters (Serène and Vadon, 1981; Chen, 1985), and 49-53 meters. Chen (1985:181) gave the depth range of the species as 33-128 meters, without further explanation.

Cuming's specimens were accompanied with a note stating "These curious crabs are found at low water, sandy mud." Other reports describe the bottom as "sand, mud," "muddy sand," and "sand" (Chen, 1980), and "sable coquillier vaseux" (Serène, 1981). In the box with Cuming's dry specimens is a piece of paper to which a leaf was attached with a pin, carrying the inscription "attached to one of these animals which float in the water below it, by which you cannot see the crab. H. C[uming], Zebu,

1827." It is not fully certain that Cuming's notes belong to *Dorippe tenuipes* and not to *Neodorippe callida*, which he also collected in the Philippines.

Remarks. - White (1847:54) listed two specimens of "*Dorippe callida* Fabr." from "Philippine Islands (Zebu). From Mr. Cuming's collection." Later, Miers (1884) assigned this material to *Dorippe quadridens* (which he named *D. dorsipes*), but because of their elongate legs and their obsolescent surface sculpture the specimens were considered by Miers as possibly belonging to a distinct form. Serène considered these specimens to belong to his new species *D. miersi*. Examination of the material, still present in the collections of the British Museum, proved Serène's opinion to be correct. When Serène described his new species he evidently was not aware that it had been described one year earlier by Chen under the name *Dorippe tenuipes*. A comparison of the two descriptions as well as type material of both species leaves little doubt that the two are synonymous.

The present species is distinguished from all other species of *Dorippe* by the very long and slender legs. Furthermore the surface sculpture, especially that of the abdomen, is far less pronounced than in most other species of the genus. Although Miers (1884) already noted these differences, it was almost 100 years before the species was established as distinct.

### Genus *Dorippoides* Serène and Romimohtarto, 1969

*Dorippe* (*Dorippoides*) Serène and Romimohtarto, 1969:3, 4, 8 [type species *Cancer facchino* Herbst, 1785, by original designation and monotypy; gender masculine; described as subgenus of *Dorippe* Fabricius, 1798; name placed on the Official List of Generic Names in Zoology in Opinion 1437 (see International Commission, 1987a:139)]. - Manning and Holthuis, 1981:30. - Holthuis and Manning, 1985:304, 305.

Definition. - Carapace wider than long, surface rather smooth and even, but with grooves; lateral and anterior parts granular but lacking large tubercles or spines. Cervical groove distinct in small specimens and males, sometimes indistinct or interrupted in females. Mesogastric region with 2 oblique submedian pits, sometimes connected with cervical groove, sometimes isolated. Posterolateral margins of mesogastric region with row of short, narrow, sharply defined grooves that end at cervical groove. Branchial grooves distinct. Urogastric region a convex circular or oval area flanked by larger rounded and convex branchial lobes. Branchiocardiac grooves distinct. Lateral margin of carapace lacking lateral branchial spine. Eyes short and stout, cornea ventrolateral.

Front consisting of 2 triangular teeth directed forward or slightly outward, exhalant canal visible in dorsal view between frontal teeth. Inner orbital angle triangular, blunt. Posterior margin of orbit with fissure but without teeth. Exorbital tooth slightly surpassing or just reaching level of front. Inner suborbital tooth strong, extending to or beyond level of exorbital tooth. Lower orbital margin with few tubercles at base of exorbital tooth.

Chelipeds of females and most males equal in size and shape; in adult males chelae distinctly unequal, right larger. On small chelae fingers slender and curved somewhat downward, forming slight angle with axis of palm. Fingers 2.5 to 3 times as

long as upper margin of palm, each with 2 uninterrupted grooves on both inner and outer surfaces; 1 such groove on upper surface of dactylus and on lower surface of fixed finger. Cutting edges with 12-15 teeth of equal size, sharper and more triangular in smaller than in larger specimens. Outer surface of palm smooth and slightly pitted, often with a minute, shagreen-like granulation. Upper part of outer surface of palm with inconspicuous groove extending from articulation with carpus to that with dactylus. Inner surface of palm smooth but pitted. Dorsal margin of palm and dactylus with fringe of long hairs; lower margin of palm with double fringe of shorter, less conspicuous hairs; lower margin of fixed finger without setae. Carpus and merus smooth or finely granular, with larger granules on upper and lower margins.

Second and third pereopods long, third leg longest of all legs, segments flattened, unarmed. Dactyli flattened, twisted, without fringes of hair. Lower margin of merus, carpus, and propodus sometimes densely pubescent, dorsal margins lacking pubescence. Ischium of P3 of female with narrow, granular, spur-like process on anterior margin; similar but smaller process sometimes also present on ischium of P2. These processes completely absent in males. Coxa of P3 of female with dorsal, often whitish, sausage-like callosity, fused to posterolateral margin of carapace.

Sternum smooth or minutely granular. Sternite of P1 with 2 distinct, white, rounded or transversely oval submedian tubercles protruding through pubescence. Sternites of P2 and P3 with blunt, naked, transverse ridge. In male, first 3 sternites exposed; in adult female, third sternite covered by abdomen. Female gonopores on raised, papilla-like tubercles on third sternite. No median spine present on any sternite.

First somite of male abdomen trapezoidal, widening posteriorly, posterior margin deeply excavate in middle; upper surface with oblique longitudinal groove on each half. Second somite also widening posteriorly, with low, transverse ridge or 2 broad, blunt tubercles placed in transverse row, lacking erect tubercles or spines. Third somite with lateral parts swollen, separated from low median part by indistinct groove; indistinct transverse elevation present on anterior part of somite. Fourth somite short, with blunt median elevation. Fifth somite with anteromedian and 2 posterolateral blunt elevations. Sixth somite flat, with shallow, transverse groove in anterior part and an oblique longitudinal groove parallel with each lateral margin, posterolateral angles produced. Telson bluntly triangular, with constricted base. No tubercles or spines on abdomen.

Female abdomen wide and rounded, somites 2 to 5 with blunt but distinct transverse carina. Fifth somite widest, fifth and sixth longest. Telson small, posterior margin semicircular. No tubercles or teeth on abdomen of female.

First pleopod of male short, stubby, straight, with simple, twisted process apically, either triangular or ending in long, slender, spiral-shaped point; rounded lobe present basally.

Remarks. - Serène and Romimohtarto (1969) established *Dorippoides* as a subgenus of *Dorippe* Weber, 1795. In our opinion, however, the differences between *Dorippe* sensu stricto and *Dorippoides* are such that they should be considered separate genera.

Another subgenus established in *Dorippe* by Serène and Romimohtarto (1969:3, 4, 11) is *Neodorippe*, for which they indicated *Dorippe astuta* Fabricius as the type. As shown below, *Dorippe astuta* Fabricius, 1798, is a junior synonym of *Cancer facchino*

Herbst, 1785, the type species of *Dorippoides*, and the species for which Serène and Romimohtarto used the name *D. astuta* actually should be known as *D. callida* Fabricius, 1798. Under a strict application of the rules of the *International Code of Zoological Nomenclature*, however, *Dorippoides* Serène and Romimohtarto, 1969, and *Neodorippe* of the same authors are synonyms. In order to save the name *Neodorippe* and to have it used in the sense intended by Serène and Romimohtarto, we (Holthuis and Manning, 1985:304, 305) submitted a proposal to the International Commission on Zoological Nomenclature. In this proposal the Commission was requested to designate under its plenary power as the type species of *Neodorippe* the nominal species *Dorippe callida* Fabricius. In their Opinion 1437, the International Commission (1987a:139) granted this request, and under their Plenary Powers designated *Dorippe callida* Fabricius, 1798 as the type of the genus *Neodorippe* Serène and Romimohtarto, 1969, and placed both that generic name and *Dorippoides*, with *Dorippe facchino* as its type, on the Official List of Generic Names in Zoology.

*Dorippoides* includes two species, which can be distinguished with the following key.

#### Key to Species of *Dorippoides*

- Dactylus of P2 and P3 broadest in basal half, narrowing anteriorly, usually shorter than propodus. Adult males with dense pubescence on posterior margin of merus, carpus, and propodus of P2 and P3. Posterior branchial surface laterally with a smooth area ..... *D. facchino*
- Dactylus of P2 and P3 broadest in distal half, paddle-shaped, longer than propodus. Adult males with at most some pubescence on distal part of posterior margin of merus of P3. Posterior branchial surface evenly granular laterally ..... *D. nudipes*

#### *Dorippoides facchino* (Herbst, 1785)

##### Figures 19-25

*Cancer Facchino* Herbst, 1785:190, pl. 11: fig. 68 [type locality "sowohl am mittelländischen Meere, als an den ostindischen Küsten," here restricted to Tranquebar, southeastern India (see Herbst, 1796); name placed on the Official List of Specific Names in Zoology in Opinion 1437 (see International Commission, 1987a:139)].

*Cancer facchino*. - Herbst, 1796:215; 1803:12. - André, 1937:78. - Manning and Holthuis, 1981:30. - Holthuis and Manning, 1985:304, 305.

*Dorippe astuta* Weber, 1795:93 [nomen nudum].- Fabricius, 1798:361. - Zimsen, 1964:651. - ?Pillai and Nair, 1970:384, 385; 1976:754-758, 764-766, fig. 7. - Manning and Holthuis, 1981:30.

*Dorippe astuta*. - Bosc, 1802:208.

*Dorippe facchino*. - Bosc, 1802:208. - A.-G. Desmarest, 1830:264.

*Dorippe astuta*. - A.-G. Desmarest, 1830:263.

*Dorippe sima* H. Milne Edwards, 1837:157, pl. 20: fig. 11 [type locality "les côtes de l'Inde"]. - White, 1847:53. - Gibbs, 1850:186. - Miers, 1880:317. - Walker, 1887:111. - ?Gee, 1925:160.

*Dorippe Facchino*. - De Haan, 1841:123. - Herklots, 1861:137.

*Dorippe*. - White, 1847:53. - Stimpson, 1855:376. - De Man, 1887-1888a:6, 206. - Walker, 1890:85.

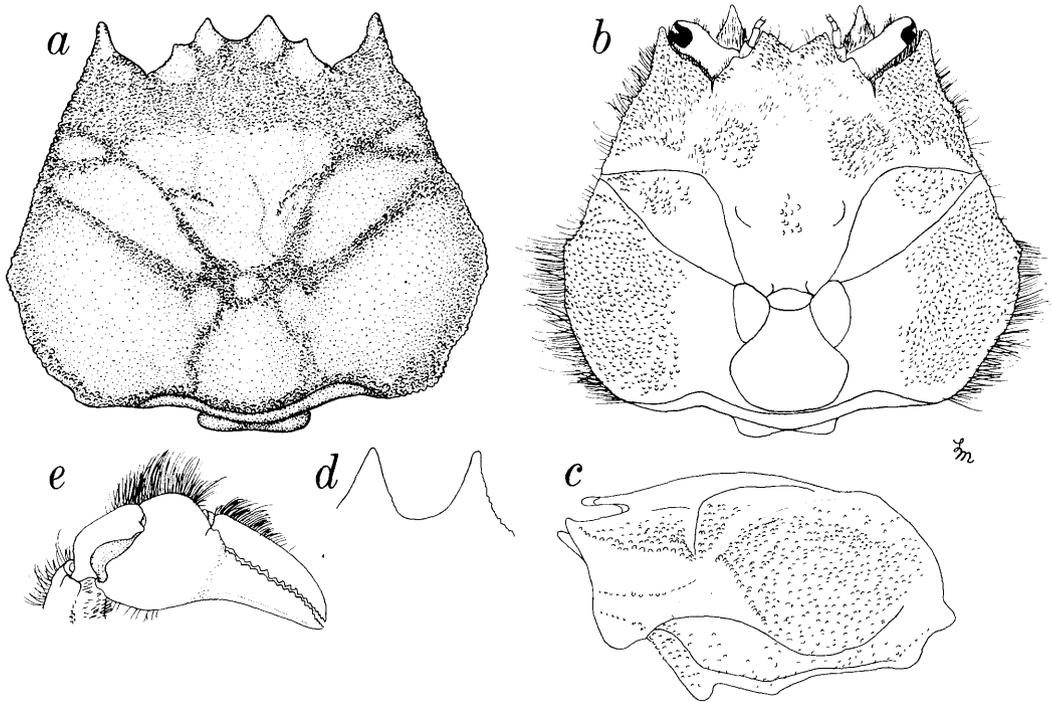


Figure 19. - *Dorippoides facchino* (Herbst). *a, b*, carapace; *c*, carapace, lateral view; *d*, orbit, ventral view; *e*, chela. *a*, male syntype of *Dorippe astuta* Fabricius, cl 17 mm, Tranquebar; *b*, male, cl 14 mm, Thailand; *c, d*, female, cl 18 mm, Singapore; *e*, female, cl 22 mm, Thailand.

?*Dorippus sima*. - Dana, 1852:398.

*Dorippe facchino*. - Stimpson, 1858:163. - Verrill, 1869a:26, pl. 2: fig. 1; 1869b:249. - Miers, 1886:328. - Ortmann, 1892:561. - Stebbing, 1893:130, 132 [p.p.]. - Henderson, 1893:405. - Alcock, 1896:278. - De Man, 1896:369. - Lanchester, 1900:768; 1902:553. - Sheldon, 1905:358. - Laurie, 1906:367. - Rathbun, 1910a:305. - Ihle, 1916:153, 156. - Shelford, 1916:229. - Gee, 1925:160. - Hose, 1929:31. - André, 1931:639. - Shen, 1931:100, fig. 8, pl. 5: figs. 3,4. - Chopra, 1933:50. - André, 1937:79. - Serène, 1937:77. - Suvatti, 1938:59. - Shen, 1940a:213; 1940b:70, 75. - Gravely, 1941:81. - Suvatti, 1950:143. - Shen and Liu, 1963:142. - Guinot, 1967:244 [p.p.]. - Serène, 1968:40. - Parenti, et al., 1971: *DORIPPE* (1). - Naiyanetr, 1980:26. - Chen, 1985:185, fig. 4. - Dai and Song, 1986:61. - Ng, 1987:15. - Tan and Ng, 1988:149, fig.

*Dorippe granulata*. - ?Alcock, 1896:279. - ?Serène, 1937:77. - Sankarankutty, 1966:349, fig. 15. - Morton and Morton, 1983:187, 201, fig. 10.4,7. [Not *Dorippe granulata* De Haan, 1841.]

*Dorippe facchino Alcocki* Nobili, 1903b:25 [type locality "Oceano Indiano" (= Singapore and Bay of Bengal from Mergui to Madras; Alcock, 1896:280)].

*Dorippe facchino alcocki*. - Ihle, 1916:153, 156. - Chopra, 1933:51. - Serène, 1968:40. - Parenti, et al., 1971: *DORIPPE* (1).

*Dorippe fachhino*. - Chopra, 1933:27.

*Dorippe fachhino*, var. *alcocki*. - Chopra, 1933:27.

*Doryppe facchino*. - Dawydoff, 1952:139.

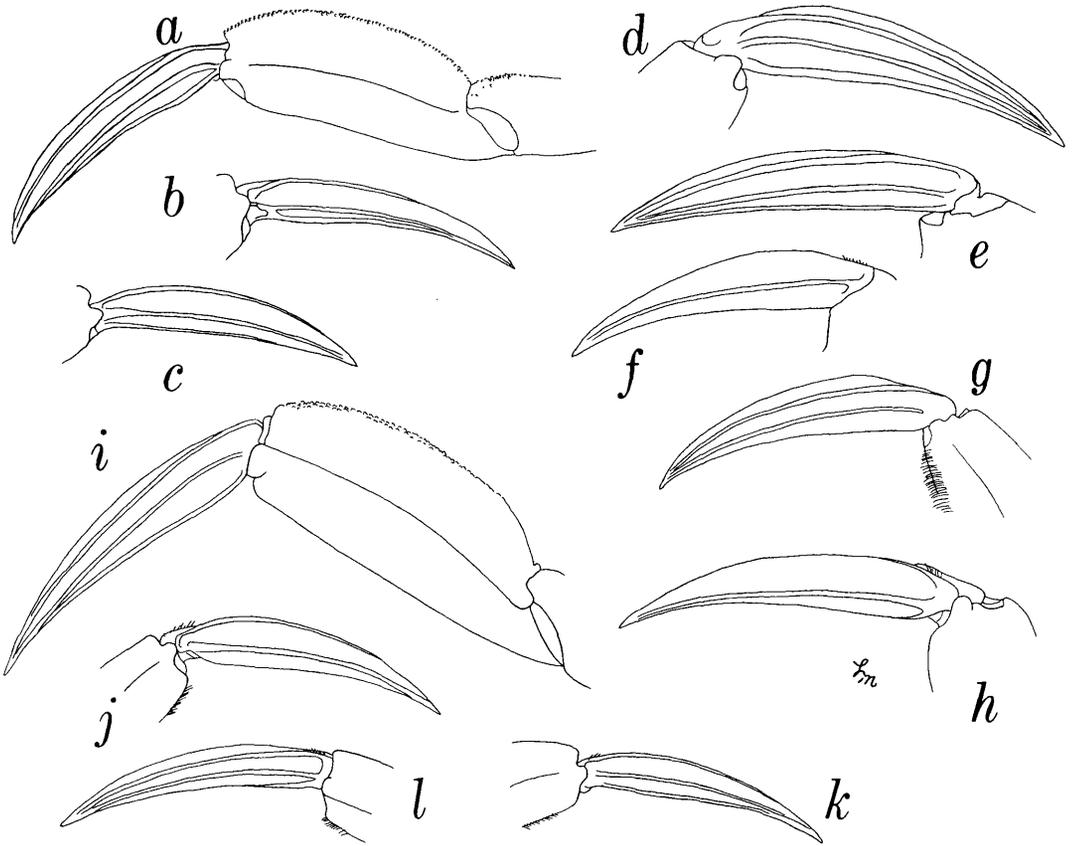


Figure 20. - *Dorippoides facchino* (Herbst). Dactyli of P2 and P3 in dorsal and posterior views to show variation in shape and carination. *a, e, i, l*, P2, ventral view; *b, c, f, k*, P2, dorsal view; *d, g*, P3, ventral view; *h, j*, P3, dorsal view. *a-c*, female, cl 18 mm, Singapore; *d-f, h*, ovigerous female, cl 27 mm, Fuzhou; *g, j-l*, male, cl 19 mm, [incorrectly labelled] "Japan"; *i*, ovigerous female, cl 22 mm, Thailand.

*Dorippe (Dorippoides) facchino*. - Serène and Romimohtarto, 1969:4, 8, figs. 2, 6, 11, 16A-D, pls. 1C, 3D.  
- C.M. Yang, 1979:3.

*Dorippoides facchino*. - Holthuis and Manning, 1985:304. - Chen, 1986:121, 139, figs. 3:14-16.

Vernacular Name. - "con cua áo to'i" (Vietnam; Serène, 1937). Porter crab (Singapore; Tan and Ng, 1988).

Derivatio Nominis. - The specific name *facchino* for this species is the result of Herbst's (1785) incorrect identification of Plancus' (1760:36-38, pl. 5: fig. 1) *Cancer hirsutus personatus maris Superi, vulgo Facchino Ariminensibus dictus* with the present species, as discussed below. James Plancus (a latinization of Simon Giovanni Bianchi, 1693-1775) actually described the species *Medorippe lanata* (Linnaeus), which was said by him to be given the vernacular name "Facchino" by the people of Rimini on the Italian coast of the northern Adriatic, where Plancus himself was born.

Through the lectotype selection for *Cancer facchino* by Serène and Romimohtarto (1969) the specific name is now definitely linked to the Indo-West Pacific rather than the Mediterranean species. The Italian word *facchino* means porter or carrier, but Plancus only referred in this connection to the fact that the carapace of *Medorippe* resembles an ugly human face, as he supposed to be often found among members of the porter profession; no mention was made of the possibility that the animals may carry objects with the last two pairs of legs.

Material. - Indo-West Pacific: Eastern Seas, 1 ♂ (BM). - East Asia, Svenson, 1 ovigerous ♀ (C).

India: India, 4 specimens (P). - Pamban, Tuticorin, 1890, E. Thurston, 1 ovigerous ♀ (BM). - Tranquebar (also labelled Bengale or Mare Indico), 11°02'N, 79°51'E, 1790-1793, I.K. Daldorff, 4 ♂, 3 ♀ (syntypes of *Dorippe astuta* Fabricius, C); same data, 3 ♂ (syntypes of *Dorippe astuta* Fabricius, L). - Pondicherry, 11°56'N, 79°50'E, Leschenault de la Tour, 1 ♂, 3 ♀ (P); same locality, Aug 1901, Maindron, 5 ♂, 3 ♀ (2 ovigerous) (P). - Madras, 13°05'N, 80°17'E, 1889, F. Day, 4 ♂, 1 ovigerous ♀ (BM); same locality, J.R. Henderson, 6 ♂, 3 ♀ (1 ovigerous) (BM). - Off the delta of the Ganges River, 20°51'N, 87°58'E, 43-52 m, mud, 26 Apr 1951, *Galathea* Sta. 305, 1 ♀ (C).

Sri Lanka (= Ceylon): Pearl banks in Gulf of Mannar (as Manaar), 1907, W.A. Herdman, 2 ♂ (BM). - No locality, from Colombo Museum, 2 ♂ (ZRC).

Burma: Andaman Sea off Burma, 15°04'N, 95°51'E, 29-33 m, 31 Mar 1963, *Anton Bruun* Sta. AB-41A, 2 ovigerous ♀ (W). - Mergui Archipelago, J. Anderson, 1 juvenile ♀ (ZSI).

Malaysia and Singapore: Pinang (as Penang), 5°17'N, 100°17'E, 1 ♂ (BM); same locality, Macnae, 22 Jan 1972, 1 ♂ (P); same locality, *Galathea*, 7 ♂, 2 ♀ (1 ovigerous) (C). - Off Batu Muang, Pinang, 30 m, trawled, 16 Jan 1983, W.T. Meng and L.B. Holthuis, 2 ♂, 1 ♀ (L). - Pulau Kendi, SW of Pinang, 3 Nov 1961, E. Alfred, 21 ♂, 19 ♀ (12 ovigerous) (L). - Melaka (as Malacca), 2°12'N, 102°15'E, 2-6 fm (= 4-11 m), mud, W.F. Lanchester, 1 ♂, 1 ♀ (BM); same locality, Aug 1907, Jensen, 1 ovigerous ♀ (C). - Pahang, ca. 3°30'S, 102°45'E, R. Serène, 1 ♂ (ZRC). - Pontian, Johore, 1°30'S, 103°30'E, 28 Mar 1983, S.L. Yang, 1 ♂, 1 ♀ (ZRC). - Singapore, 1°20'N, 103°50'E, E. Deschamps, 91 ♂, 92 ♀ (W); same locality, 2-6 fm (= 4-11 m), mud, W.F. Lanchester, 1 ♂, 1 ♀ (BM). - Off Belok, Singapore, 1°19'N, 103°56'E, 8 Sep 1951, M.W.F. Tweedie, 2 ♀ (1 ovigerous) (ZRC). - Siglap, Singapore, 1°19'N, 103°56'E, Dec 1933, M.W.F. Tweedie, 1 ♀ (ZRC). - South China Sea near Horsburgh Lighthouse near Singapore, 1°20'N, 104°24'E, 26 Nov and 15 Dec 1982, H. Huat, 1 ♂, 1 ♀ (ZRC). - South China Sea about 150 miles off Singapore, 28 Aug 1893, H. Huat, 1 ovigerous ♀ (ZRC). - South China Sea about 180 miles off Singapore, 19 Aug 1983, H. Huat, 5 ♂, 7 ♀ (ZRC). - Borneo, 1880, 1 ovigerous ♀ (BM).

Indonesia: Off lighthouse at Lhokseumawe, northeastern coast of Sumatra, 5°10'N, 97°08'E, 5-40 fm (= 9-73 m), trawled, 2 Jul 1974, W. Abbott, 1 ♂, 1 ♀ (W). - Sunda Strait, 5°55'S, 105°31'E, 38 m, sandy mud, pumice, 11 Jul 1922, Danish Expedition to the Kai (as Kei) Islands, 1 ♀ (C). - Java, P. Bleeker, 1 ♀ (L). - Labuhan, Sunda Strait, West Java, Apr 1924, H.C. Delsman, J.G. de Man Collection, 1 ♂, 1 ♀ (A). - Cirebon (as Cheribon), 6°46'S, 108°33'E, north coast of Central Java, 1970, Andrea, 1 ♂ (C). - Surabaya, 7°15'S, 112°45'E, north coast of East Java, 1870, Andrea, 1 ♂ (C). - Java Sea, 05°58'S, 106°38'E, 17 m, 7 Aug 1922, Danish Expedition to the Kai (as Kei) Islands, Sta. 117, 1 ♀ (C). - Java Sea, 5°53'S, 107°02'E, 27 m, mud, 8 Aug 1922,

Danish Expedition to the Kai (as Kei) Islands, Sta. 122, 1 juvenile (C). - Java Sea off southeast coast of Borneo, 4°20'S, 114°12'E, 80 m, 11 Apr 1929, Th. Mortensen, 1 ♀ (C). - West coast of Celebes, Capt. Storm, donated by Museum Lübeck, 1 ♂ (W); same locality, Capt. Storm, J.G. de Man Collection, 1 ♂ (A).

Thailand: Thailand, R. Serène, 1 ♂ (ZRC). - Songkhla Channel between Songkhla City (Songkhla = 7°13'N, 100°34'E) and Goh Gnu Island, 3 Nov 1957, G. Vanderbilt Foundation, no. 53, 1 ♂, 1 ♀ (W). - Chonburi, Bay of Bangkok, 13°24'N, 100°59'E, 1983, P. Naiyanetr, 1 ♀ (L). - Bay of Bangkok, between Naklua and Si Racha, Chonburi Province, about 150 km SE of Bangkok, from trawlers, 28-30 Dec 1987, A.C.J. Burgers and L.B. Holthuis, 3 ♀ (2 ovigerous) (L). - Bangplasoi, Bay of Bangkok, 15 Feb 1924, 1 ovigerous ♀ (W). - Laem Ngop, eastern Gulf of Thailand, 0-1 fm (= 0-2 m), stones and sand, Dec 1899, Th. Mortensen, 1 ♀ (C). - Koh Chang, 3-5 fm (= 5-9 m), soft clay bottom, 1900, Th. Mortensen, 1 juvenile (C). - Koh Kahdat, 8-10 fm (= 15-18 m), mud, 27 Feb 1900, Th. Mortensen, 1 ♀ (C); same locality, 5-8 fm (= 9-15 m), sandy mud, 16 Feb-4 Mar 1900, Th. Mortensen, 1 ovigerous ♀ (C); same data, 2 ♀ (W).

Vietnam: Gulf of Tonkin, 22 m, A. Krempf, 1 ♂ (P). - Nhatrang, 12°15'N, 109°12'E, 20 m, mud, 4 Jan 1960, V.A. Gallardo, 1 juvenile (W).

China (general): Coast of China, 20 fm (= 36 m), mud, dredged, 1 ♂, 4 ♀ (BM). - Formosa Strait, 30 fm (= 55 m), 23 Aug 1897, Svenson, 1 ♀ (C).

China, Fujian Province (= Fukien Province): E to N of Fuzhou (as Foochow), 26°09'N, 119°17'E, S.F. Light, from fishermen, 1 ovigerous ♀ (W); same locality, C.C. Tang, 1 ♀ (W).

China, Guangdong Province (= Kwantung Province): Nan'ao (as Namoa) Island, 23°25'N, 117°06'E, N of Shantou (as Swatow), Svenson, Dec 1893, 3 ♂ (C).

Hong Kong: Hong Kong (Hong Kong Island = 22°15'N, 114°11'E), 1 ♂, 1 ♀ (BM); same locality, 1917, Boston Society of Natural History, 1 ♂, 1 ♀ (W). - Lamma Island, 1 Oct 1881, P. Jouy, 1 specimen (W). - East Lamma Channel, 22°14.4'N, 114°8.5'E, 22 and 27 m, 29 Apr and 27 May 1974, R.G. Wear nos. 39, 40, 1 ♂, 2 ♀ (1 ovigerous) (W). - Off Hong Kong, 21°54'N, 114°46'E, 37 fm (= 67 m), soft gray mud, 24 Oct 1908, *Albatross* Sta. 5305, 1 ♂ (W).

Incorrect or doubtful localities: Mediterranean, 1 ♂ (BM). - Japan, U.S.S. *Palos*, F.C. Dale and P.L. Jouy, 1 ♂, 1 ovigerous ♀ (W). - Locality unknown, "Cancer pinnophylax *F. callidus* Dald.Mas. F. Banks Coll.", 1 ♂ (BM); "Cancer pinnophylax," Kiel Collection, 1 ♂, 1 ♀ (C); Kiel Collection, 1 ♂ (C) (all three lots possibly types of *Dorippe astuta* Fabricius, 1798). - Locality unknown, 3 ♂, 1 juvenile (BM).

Description. - Carapace convex laterally and posteriorly, more flattened in middle and anteriorly. In large specimens carapace appearing flatter than in small specimens. Cervical groove deep and continuous in males and smaller females, indistinct and interrupted in middle in large females. Carapace covered by pubescence in smaller specimens; pubescence confined to granular areas in larger specimens. Posterior branchial region with smooth or minutely granular area on lateral surface, often separated from dorsal granulated area by short longitudinal ridge.

Front consisting of 2 distinct, triangular teeth, directed forward, or of blunter teeth, directed outward. Inner orbital angle triangular or blunt. Outer orbital tooth sharp, pointed, reaching slightly beyond frontal teeth, falling short of tip of lower orbital angle. Inner margin of suborbital spine smooth.

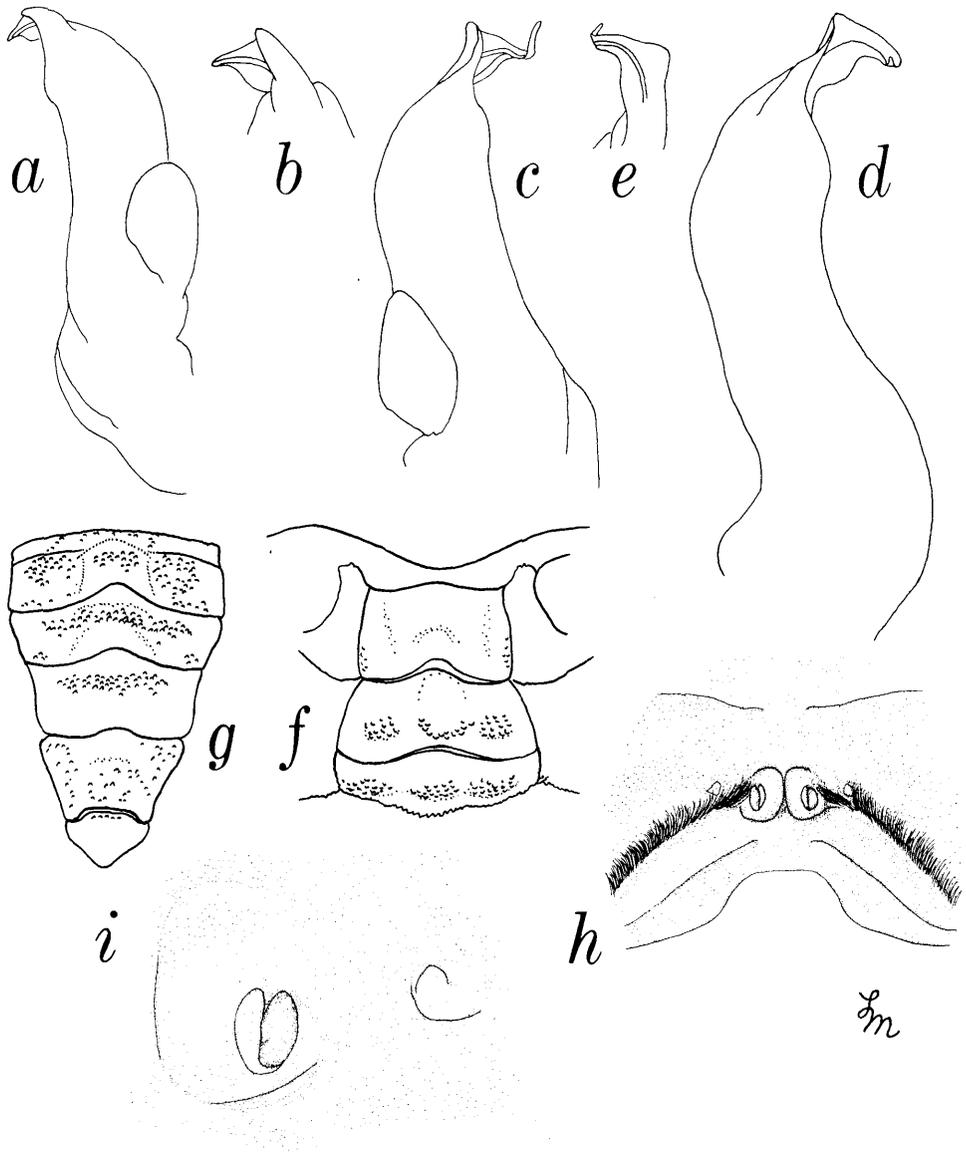


Figure 21. - *Dorippoides facchino* (Herbst). Gonopods (*a*, *c*, *d*) and their apices (*b*, *e*) of males from: *a*, *b*, Hong Kong, cl 18 mm; *c*, *d*, [incorrectly labelled] "Japan", cl 19 mm; *e*, Singapore, cl 16 mm. Abdomen in dorsal (*f*) and ventral (*g*) views of male, cl 17 mm, Hong Kong. Sternum showing gonopores (*h*) and gonopore (*i*) of ovigerous female, cl 27 mm, Fuzhou.

In females and small males, up to cl 20 mm, both chelipeds similar in size. In large male (cl 29 mm), chelipeds distinctly unequal, right larger, left as in female. Right cheliped with fingers slender, directed obliquely downward (much more so than in smaller cheliped). Fingers twice as long as dorsal margin of palm, latter smooth, swollen, almost twice as high as dorsal length. Lower margin of palm ending in 2

rather large, blunt, swollen tubercles near base of fixed finger; tubercles placed side by side, inner smaller, together with lower margin of fixed finger forming distinct indentation in lower outline of chela. In smaller chela, fingers 3 times as long as dorsal margin of palm, being slenderer than in *D. nudipes*.

Second and third pereopods slender. P2 reaching beyond front with 1/3 to 2/5 length of merus, P3 surpassing front with carpus or with very small part of merus. P2 merus about 4 times as long as wide, slightly slenderer in males (l/w about 4.3) than in females (l/w about 3.7). Merus of P3 showing about same ratio (in males l/w about 4.2, in females about 3.5). Propodi of both P2 and P3 about 3 times as long as wide, 3.0-3.3 in males, 2.8-3.1 in females. Dactylus of P2 showing, on posterior surface, 1 longitudinal carina over middle; area anterior to carina wider than that posterior to it. Ventral surface of dactylus bearing 2 carinae, dividing dactylus into 3 parts of about equal width. Dactylus as long as or shorter than propodus, greatest height in proximal half, from there tapering towards apex. Dactyli higher in larger specimens, sometimes much higher than in smaller specimens. Dactylus of P3 similar to that of P2.

Large males with heavy pubescence of densely placed hairs on posterior margin of merus, carpus, and propodus; anterior margins of these segments as well as both margins of dactylus naked (except for very small tuft of extremely short hairs in basal part of upper margin of dactylus). Pubescence of merus and carpus present in small males, less dense than in larger specimens; pubescence of propodus consisting of single row of rather short hairs, rubbed off in some specimens. In larger females merus sometimes showing pubescence on posterior margin; pubescence light or absent in smaller females, heavier in larger ones. Pubescence of posterior margin of carpus in females even less conspicuous; pubescence absent on propodus.

First abdominal somite of male somewhat less than twice as wide as long. Second somite, as long as first, widening posteriorly, posterior margin being about twice as wide as anterior. Second somite with transverse, low, inconspicuous ridge, showing 2 small depressed areas before ridge, 4 behind it; anterior 2 and middle 2 of posterior 4 placed in one line, forming continuation of 2 longitudinal ridges of first somite. Third somite about as long as and slightly wider than second, swollen laterally, with 2 transverse longitudinal depressions, and a hairy, granular elevation extending over full width. Fourth somite narrower and shorter than third, narrowing posteriorly; surface not swollen, but showing rather flat, irregular elevation over entire width, elevation highest in middle. Fifth somite as long as fourth, narrowing more posteriorly, with elevated median transverse area showing 2 submedian depressions. Sixth somite as long as fifth, narrowest of all, lateral margins concave, showing 2 short, blunt median ridges basally; distal margin about half as wide as basal margin, posterolateral angles posteriorly produced on either side of base of telson. Latter lance-shaped, widening rather abruptly from base, widest at proximal third, from there narrowing to blunt apex.

Gonopod short and wide, ending in horn colored projection, twisted about 90°, ending in narrow apex. In large specimens tip triangular, in smaller specimens apex produced into slender point. Latter, in smallest specimens, ending in very long, slender, upwardly curved projection.

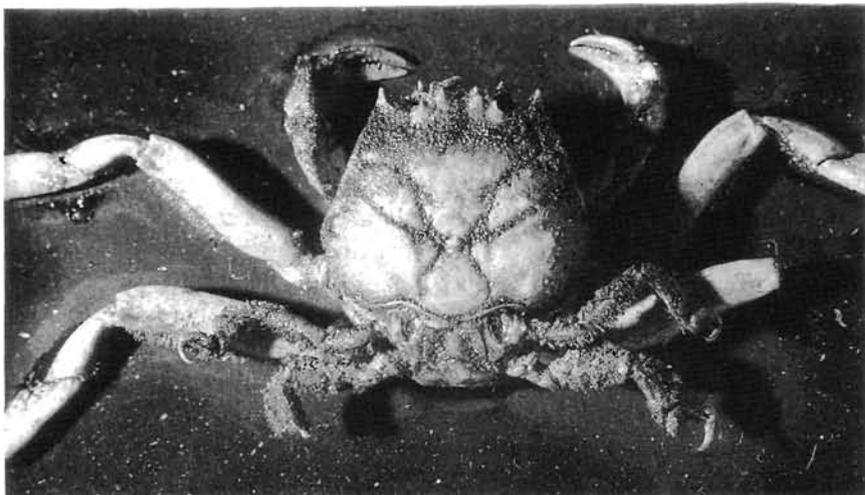


Figure 22. - *Dorippoides facchino* (Herbst). Male syntype of *Dorippe astuta* Fabricius, cl 17 mm, Tranquebar.

Color. - "Mud-coloured" (Gravely, 1941:81); "carapace and legs wood brown" (Shen, 1931:101). A color photograph of the species carrying a sea anemone was published by Tan and Ng (1988:149).

In living specimens from Batu Muang, Pinang, the upper surface of the carapace was greyish to reddish brown. The chelipeds were white, with a brownish tinge on the distal part of the upper surface of the merus, and the hairs were yellowish brown. The second and third pereopods were pale brownish red on the dorsal surface of the merus, carpus, and propodus; the basal part of the leg, including the basal part of the merus, was paler than the rest, and the dactylus was white. The last two legs were greyish brown dorsally. The ventral surface of the body and the legs was very pale, nearly white.

Size. - Males, cl 9 to 30 mm, cb 11 to 37 mm; non-ovigerous females, cl 7.5 to 28 mm, cb 9 to 34 mm; ovigerous females, cl 14 to 27.5 mm, cb 16.5 to 34 mm. The width/length ratio of the carapace varies from 1.1 to almost 1.3, being slightly greater in the females than in the males.

Distribution. - This species is known from Sri Lanka and southern India eastward to southern China, Vietnam, Thailand, Malaysia, and Indonesia; there are no definite records from either Japan or the Philippines. The records in the literature are the following:

Indian Ocean: "Ostindische Küsten" (Herbst, 1785). - "in mari Indico" (Fabricius, 1798; Zimsen, 1964). - "mer des Indes" (Bosc, 1802; A.-G. Desmarest, 1830). - Indian Ocean (White, 1847; Ortmann, 1892).

India: "les côtes de l'Inde" (H. Milne Edwards, 1837). - South coast of India (Henderson, 1893). - Shores of the Bay of Bengal (Alcock, 1896). - Tuticorin, 8°50'N, 78°09'E (Henderson, 1893). - Pudumadam, 9°16'N, 79°00'E, Gulf of Mannar (Sankarankutty, 1966). - Rameswaram, 9°17'N, 79°18'E (Henderson, 1893). - Tranquebar, 11°02'N, 79°51'E (Herbst, 1796; Fabricius, 1798 [by implication, given as "in mari Indico"]); De Haan, 1841; Herklots, 1861 [as "Bengale"]. - Madras, 13°05'N, 80°17'E

(Henderson, 1893; Alcock, 1896; Gravely, 1941). - Devi River, ca. 20°N, 86°24'E (Parenti, et al., 1971). - The east coast from the mouth of the Hooghly [River] to Madras (Alcock, 1896). - Sandheads, mouth of the River Hooghly, ca. 21°N, 88°E (Chopra, 1933). - Andaman Islands (Alcock, 1896).

Sri Lanka (= Ceylon): Sri Lanka (C.M. Yang, 1979). - Pearl banks, Gulf of Mannar (Laurie, 1906).

Burma: Mergui Archipelago (De Man, 1887-1888a; Alcock, 1896).

Malaysia and Singapore: Patani (Lanchester, 1902). - Melaka (as Malacca), 2°12'N, 102°15'E (Lanchester, 1900). - Pulau Pisang, 1°29'N, 103°15'E, Malacca Strait (C.M. Yang, 1979). - Singapore, 1°20'N, 103°50'E (?Dana, 1852; Walker, 1887; Lanchester, 1900; Nobili, 1903b; Parenti, et al., 1971; Tan and Ng, 1988). - Siglap, Singapore, 1°19'N, 103°56'E (C.M. Yang, 1979). - Off Bedok, 1°19'N, 103°56'E, Singapore (C.M. Yang, 1979). - Pahang, east coast of Malay Peninsula (C.M. Yang, 1979). - Borneo (Miers, 1880). - Santubong, Sarawak, 1°43'N, 110°18'E (Shelford, 1916). - Sarawak (Hose, 1929).

Indonesia: Aceh (as Atjeh), northern Sumatra (De Man, 1896). - Western Celebes (De Man, 1896).

Thailand: Thailand (C.M. Yang, 1979). - Gulf of Thailand (Naiyanetr, 1980). - Laem Ngop (as Lem Ngob), Koh Kahdat, sound at Koh Chang, all Gulf of Thailand (Rathbun, 1910a; Suvatti, 1938, 1950). - Bangplaso (Suvatti, 1950).

Vietnam: Gulf of Tonkin (André, 1931; Dai and Song, 1986). - Récolte 102, Annam ("à proximité de la Station Maritime de Cauda, Nhatrang") (Serène, 1937).

China (general): China (White, 1847; Chen, 1986). - China Seas (Shen and Liu, 1963).

Zhejiang Province (= Chekiang Province): Ningbo (as Ningpo), 29°53'N, 121°33'E (Gee, 1925).

Fujian Province (= Fukien Province): Fujian Province (Shen, 1931). - Jimei (as Tsimei), 24°39'N, 118°06'E (Shen, 1940b). - Fuzhou (as Foochow), 26°09'N, 119°17'E (Gee, 1925; Shen, 1940b). - Shaotsun (Shen, 1940b).

China, Guangdong Province (= Kwantung Province): Guangdong Province (Shen, 1931).

Hong Kong: Hong Kong (Hong Kong Island = 22°15'N, 114°11'E) (Stimpson, 1855, 1858; Verrill, 1869a,b; Miers, 1886; Stebbing, 1893; Shen, 1931; Morton and Morton, 1983). - Shau Kei Wan (as Shaukiwan) (Shen, 1931, 1940a). - Aberdeen and Cheung Chau (Shen, 1940a).

Shen (1931), when citing the general distribution of this species, included Japan in its range, but this probably is a mistake, as so far there are no definite records of *D. facchino* from Japan. The National Museum of Natural History, Smithsonian Institution, holds some specimens labelled Japan, collected by the U.S.S. *Palos*; the labels of this collection proved on several occasions to be unreliable and have to be treated with much reserve. It seems best, therefore, not to include Japan in the range of this species until and unless reliable records become available. In our figures of this species we have included sketches of some features of the apparently mislabelled material from Japan to document the identification of the specimens.



Figure 23. - *Dorippoides facchino* (Herbst). From Herbst, 1785, pl. 11: fig. 68.

Herbst (1785), who based his description and figure of *Cancer facchino* on material from East India (most likely on material from Tranquebar collected by the missionary John (see Herbst, 1796:215), mistakenly included in this species a reference to Plan-  
cus' (1739) description of the Mediterranean species at present known as *Medorippe lanata* (Fabricius) (see André, 1936). For this reason Herbst incorrectly reported *Cancer facchino* as occurring also in the Mediterranean. Bosc (1802) and A.-G. Desmarest (1830), evidently on the authority of Herbst, repeated the record from the Mediterranean. In the British Museum collection there is a dry male (cl 26 mm, cb 31 mm) of the present species labelled "Mediterranean." This evidently is the specimen listed by White (1847:53) as "*Dorippe* --" and also the one mentioned by Miers (1886:328, footnote 1) as "a specimen purporting, though not upon reliable authority, to have been taken in the Mediterranean, in the collection of the [British] Museum." Stebbing (1893:130) repeated the Mediterranean record as well as that for Hong Kong.

The specimens in the British Museum labelled "*Cancer pinnophylax* F. *Callidus* Dald. Mas F Banks Coll." may have belonged to Fabricius' type series of *Dorippe astuta*, but there are not enough data to definitely confirm this.

Habitat. - This species has been reported from depths between 2 and 80 meters, mostly between 10 and 30 meters (30 org. in Stimpson, 1858). The bottom on which the animals were found has been recorded in 14 instances: 13 mentioned it to be mud (2 sandy mud, 1 soft clay, and 1 soft gray mud) and only one author reported it from "stones and sand."

Biology. - The peculiar association of this species with sea anemones has attracted much attention. In the examined material numerous specimens from all over the range of the species were noted to be "with sea anemone." The specimens from Labuhan, West Java, were said to carry on their back a small shell to which was attached a large anemone. Each of those from between Naklua and Si Racha, Thailand, were observed carrying an anemone with a hardened base in the middle of which a small shell could be seen.

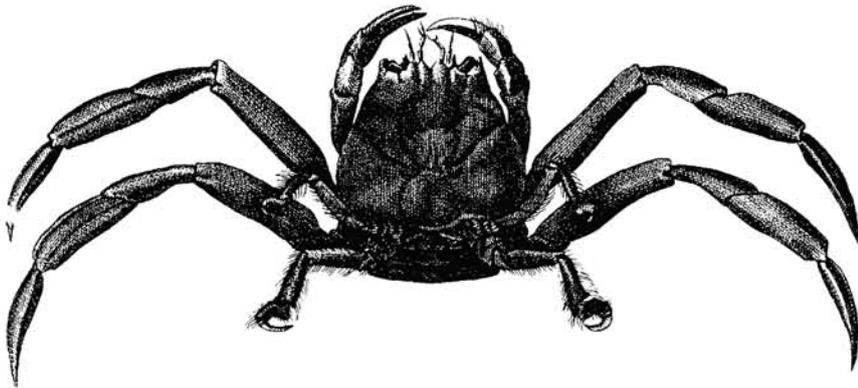


Figure 24. - *Dorippoides facchino* (Herbst). From H. Milne Edwards, 1837, pl. 20: fig. 11.

Herbst (1796:215) cited an observation by the missionary John of Tranquebar indicating that the last two pairs of legs of the dorippids ("Canc. lanatus, Facchino etc" - by his citation of "pl. XI fig. 67-70" he shows that the "etc." stands for [*Ethusa*] *mascarone* and [*Dorippe*] *frascone*) are used "eine halbe zweyschalige Muschel damit festzuhalten, und damit kleine Fische zu ihrer Nahrung zu fangen, welches ich mit Vergnügen gesehen habe, da mehrere eine halbe Muschel festhielten, worin ein Fischgen, Krebschen, oder anderes Thierchen eingeschlossen war" (to hold half a bivalve, to catch with it small fishes that are used for food; which I observed with much pleasure, as several crabs held half a bivalve in which a small fish, a small crustacean, or some other small animal was enclosed). Either John interpreted his observations incorrectly or Herbst did: It is difficult to visualize how a dorippid can catch fishes with a single half of a shell. It is likely that John observed *Dorippoides facchino*, and what he thought to be a shell was the hardened base of the sea anemone, and that he took the rest of the sea anemone to be a (piece of) fish.

The first definite record of the association of *Dorippe facchino* with an actinian was by Stimpson (1855:376) in a preliminary paper dealing with coelenterates of the 1853-1856 North Pacific Exploring Expedition. In this paper Stimpson described a new genus and species of sea anemone as *Cancrisocia expansa*, and remarked that it was "found on the common *Dorippe* of the China seas, attached by the posterior legs of the animal." In his preliminary account of the Dorippidae of the expedition, Stimpson (1858:61) did not mention the sea anemone, but that the *Dorippe* of his 1855 paper was *Dorippoides facchino* is clear from the fact that in 1858 he noted that *D. facchino* occurred "in mari Sinensi prope Hong Kong; in fundis arenosis et limosis prof. 6-30 org. vulgaris." Unfortunately, in Stimpson's (1907:167) full account of the Brachyura of the North Pacific Exploring Expedition the text of his complete account of *Dorippe facchino* is not reproduced as it was missing from the manuscript (p. 167, footnote 2). Verrill (1869a:58-60), in dealing with the Coelenterata of the North Pacific Exploring Expedition, gave a more extensive description and illustrations of *Cancrisocia expansa* Stimpson, and remarked that it was found "Near Hong Kong, China, only on the back of *Dorippe facchino* (?) which was common in six fathoms, mud, April, 1854, Dr. William Stimpson." Verrill's pl. 2: fig. 1 (Figure 25a) shows the crab carrying the anemone. In a paper published later in the same year, Verrill (1869b:249) dealt more extensively with the association of crab and anemone: "*D. facchino*, was dredged at

Hong Kong, carrying upon its back a beautiful Sea-anemone, *Cancrisocia expansa* St., which completely covers the back of the crab, and, like *Adamsia*, secretes from its base a thin, firm pellicle, to which it adheres, and by which the crab holds it in position with his four posterior [p.250:] legs. It appears that when very young the crab holds over its back a minute bit of shell or gravel upon which the Anemone lodges, and afterwards by expanding its basal pellicle as the crab grows, provides it with a permanent protection. This Anemone was never found except upon the crab's back, and the crab was not found without it."

In the file on Dorippidae compiled by Miss Mary J. Rathbun, now kept in the Division of Crustacea, National Museum of Natural History, there is a printed, but so far as we can determine, unpublished, figure of *Dorippe facchino* holding an anemone (Figure 25*b*). This figure is strongly reminiscent of the figure published by Verrill (1869*a*, pl. 2: fig. 1), and there cannot be any doubt that the two figures were made from the same original. The unpublished figure is lighter in color, with the tentacles of the anemone slightly differently arranged, and with a conspicuously cone-shaped center of the oral field of the anemone. This print bears the inscription "*Cancrisocia expansa* St. on *Dorippe facchino*, Fab." in an unknown handwriting, which definitely is not that of either Stimpson or Verrill. It is possible that the figure was prepared to illustrate Stimpson's final paper on the Brachyura of the North Pacific Exploring Expedition, but that it was not included in Stimpson's 1907 report, for, as noted above, the text of *Dorippe facchino* was missing from the manuscript. It seems of interest to publish here (Figure 25*b*) both this unpublished figure with its handwritten legend, and, for comparison, Verrill's 1869 version of it (Figure 25*a*).

The next information about the association is by Henderson (1893:405), who observed that "individuals are often met with protected by the valve of some flat Lamelibranch, e.g. *Placuna*, to which an Actinia is attached." Alcock (1896:279) remarked "I have rarely found it [*D. facchino*] without a protective bivalve shell and sea-anemone." Lanchester (1900:769) found a small, just molted female from Singapore "which carries on its dorsum a small anemone, with a bivalve shell interposed... The base of the anemone rests directly on the shell; but, the latter being only half the size of the anemone's base, it follows that the outer edge of the base projects beyond the shell on every side. Between this part of the base and the dorsum of the *Dorippe* is found a circular flattened ring, with a wrinkled surface; with the appearance and consistency of mud supported by a few scattered fibres. There is also another female from Malacca, which carries an anemone. There is no shell interposed between the base of the anemone and the crab, but only what appears to be the operculum of a large Gastropod. The circular flattened ring mentioned above is evidently the remains of a similar structure."

Lanchester (1902) mentioned an individual of this crab from Patani "that bears a small anemone on its back with a bivalve shell and ?Gastropod operculum interposed." The gastropod operculum mentioned by Lanchester (1900, 1902) probably is nothing but the hardened base of the anemone as described by Verrill (1869*a,b*). Sheldon (1905) commented on the association but added no new information.

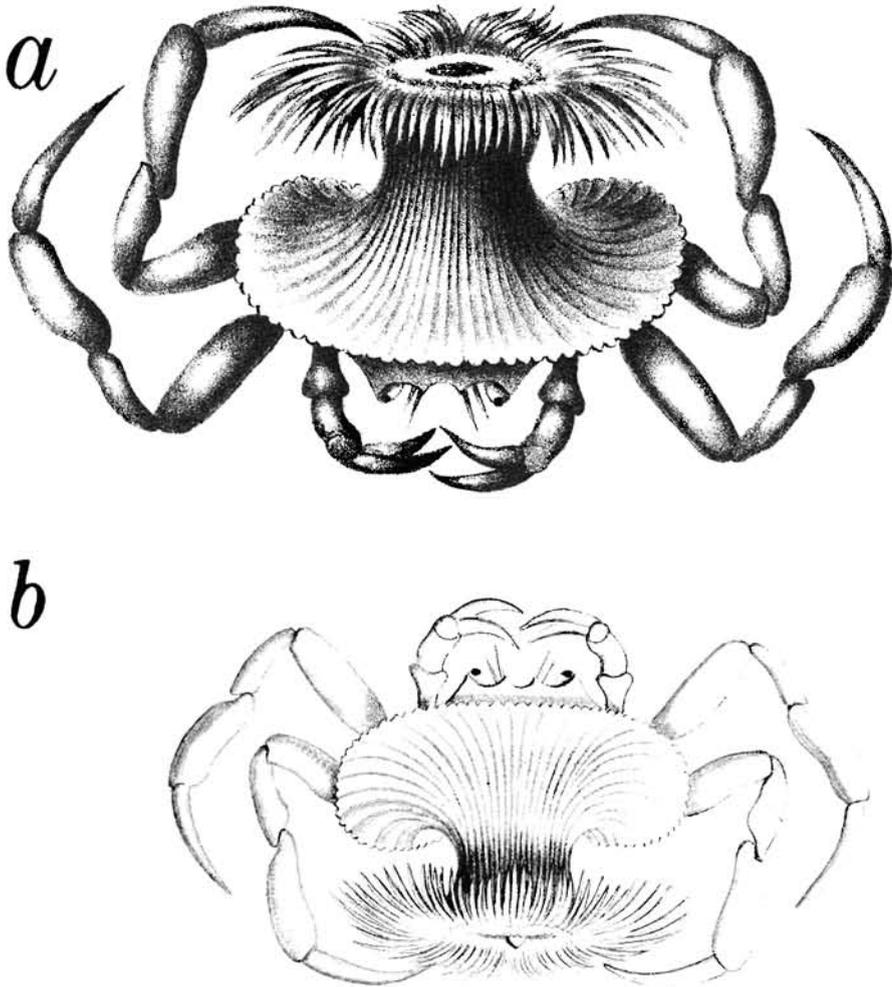


Figure 25. - The anemone *Cancrisocia expansa* Stimpson on *Dorippoides facchino* (Herbst): a, from Verrill, 1869a, pl. 2: fig. 1; b, from USNM files.

Shelford (1916:299-300) gave interesting field observations on this species from Santubong, Sarawak: "the two hinder pairs of walking legs ... hold in their claws an oval gelatinous plate on which grows a little Sea-Anemone; the crab rests with the hinder part of the body buried in the soft mud or sand, the front part of the body and the big claws being exposed, but the former partially sheltered by the sea-anemone growing on the plate that is borne aloft by the peculiarly modified hind-legs of the crab. This is a very interesting case of symbiosis, and no doubt the crab derives much advantage from the association, for the Sea-Anemone is furnished with stinging powers that render it an unsavoury morsel to fish and other enemies of the crab. Whether the Sea-Anemone is also benefited is not so certain, but at least it is provided with a *pied-à-terre* in an environment where these creatures cannot usually flourish owing to the shifting, unstable nature of the sea-bottom. The little plate on which the

Sea-Anemone grows is secreted by the crab itself, it is always of the same outline and size as the base of the Sea-Anemone, and it is marked by concentric lines of growth, showing that it has [p. 300:] increased in size as the associated animal has grown in girth. If a crab be deprived of its burden, it manifests every sign of disturbance, and hunts about the vessel in which it is confined until it finds the object of its search, which is then hoisted up in the two hinder legs into the old position, the crab then backing down into the mud until almost concealed from view. It is difficult to imagine how the association of the two creatures commences; how does the newly formed crab succeed in getting hold of a young unattached Sea-Anemone? That is a very pretty problem for someone to settle." Shelford's suggestion that the hard plate is secreted by the crab seems rather unlikely; it is more logical that the plate is made by the anemone. Shelford seems to be the first to have observed closely the habits of the living crabs.

Hose (1929:31) also observed the species: "a more interesting, and even a ridiculous sight, is that of a small crab known as *Dorippe facchino*, or the Porter. It is so called because in the claws of one pair of legs it holds an oval gelatinous plate, on which there grows a little Sea-Anemone; this the crab carries above its head like an umbrella, or parcel from the luggage-van. It seems to be a case of mutual help; for the Sea-Anemone has stinging powers which would render it a nasty [p. 32:] mouthful for fish or other enemies of the crab. What the Sea-Anemone gets out of it, I cannot say; nor is it easy to imagine how the partnership can have started. How does the Crab know that the Sea-Anemone can be useful to it? and how does he first pick up a young unattached Sea-Anemone?" Hose's account for the larger part seems to be based on that by Shelford and adds hardly any new information.

Shen (1931:101) reproduced the following note on the commensalism by Mr. G.A.C. Herklots, from whom he obtained his specimens from Hong Kong: "This species of *Dorippe* is characterized by the fact that each specimen, when received from the collector, had a Coelenterate (sea anemone) on its back. This Coelenterate was held in position by the hooks on the ends of the last two pairs of thoracic legs. Every single specimen possessed a living Coelenterate thus attached. As the crabs died, or when killed in alcohol, in most cases the Coelenterate was released. The grey Coelenterate withdrew its tentacles, collapsed and became dehydrated in the alcohol appearing as a leathery black, or grey, flattened disk roughly 2" x 1" (= 50 x 25 mm)." Shen's suggestion that the coelenterate is *Vellela lata* Chamisso and Eysenhardt seems rather unlikely as that species is a pelagic siphonophore and not a sea anemone, as has already been pointed out by Serène and Romimohtarto (1969). It is almost certain that the anemone is *Cancrisocia expansa* Stimpson, the more as it is found on the type host of that species and in the type locality.

According to Gravely (1941:81), *D. facchino* is the commonest species near Madras, India, and specimens are "sometimes brought up in large numbers by fishing nets, holding over their back a lamellibranch shell, usually a Tellinid, to which a sea-anemone is attached. A specimen [was] collected by Mr. Crichton holding a shell of the clam *Catelaysia opima*, without a sea-anemone..."

Serène and Romimohtarto (1969:11) gave an excellent description of the situation and remarked that in "our specimens, we always found a small valve of lamellibranch in the middle of the ventral face of the sole of the Actinian. The shell is much smaller than the dorsum of the carapace of the *Dorippe*, the sole of the Actinian on the con-

trary is much larger and laterally extends over the carapace covering partly the pereopods 2-3. Probably the young crab hooks a small valve of lamellibranch on which the Actinian begins to develop. The Actinian becomes larger and larger at the same time that the carapace of the crab increases (but comparatively much less) in size. The crab can always let slip away the Actinian, but we think that the association of the two organisms is the same individual one for the life time."

Morton and Morton (1983) reported that at Hong Kong *D. facchino* (named *Dorippe granulata* by them) carried a flat grey sea anemone, *Carcinactis ichikawai*, for protection. *Carcinactis ichikawai* was described by Uchida (1960) from near Otaru, Japan, as a species associated with *Paradorippe granulata*, and different from *Cancrisocia*. It seems likely, judging by host, locality, and method of attachment, that the animal reported upon by Morton and Morton (1983) is *Cancrisocia* and not *Carcinactis*. Morton and Morton's figure shows the crab holding the anemone by its flat hardened base as is usually the case in *Cancrisocia*, while *Carcinactis* is reported to be attached to a larger bivalve shell that is carried by the crab (see under *Paradorippe granulata*, below).

Tan and Ng (1988:149, fig.) published an excellent color photograph of the crab with its sea anemone and remarked that the association is "the most intimate, the anemone actually growing with the crab!"

Ng (1987:15) remarked that "Another species, *Dorippe facchino*, always carries an anemone on its back."

All of these accounts make clear the very close and constant association between *Dorippoides facchino* and *Cancrisocia expansa*. It seems likely that the association starts with a young crab holding a small bivalve shell, or part of one, on which the anemone settles; when, during growth, the base of the anemone starts to extend beyond the shell, the part of the base not touching the shell hardens and takes over the role of the shell.

There are no records of this species holding leaves over its back (as does *Neodorippe callida*), and only one of carrying shells without anemones (Gravely, 1941). Chopra (1933) mentioned that most of his specimens carried bivalve shells, but he did not refer to the presence or absence of sea anemones.

Other records of associations in the present species concern stalked barnacles: Henderson (1893:405) found "a *Lepas* ... frequently ... attached to the legs, and occasionally a *Balanus* on the under surface of the abdomen." Gravely (1941:81) observed "a fleshy pinkish stalked barnacle attached at the base of the right leg of the penultimate pair and near the end of the left leg of the last pair." Morton and Morton (1983:201) mentioned the presence of the stalked barnacle, *Octolasmis warwickii* Gray, on the carapace and legs of specimens of this species (as *Dorippe granulata*) from Hong Kong. One of the specimens from Pondicherry examined by us carried balanids on its carapace and some legs.

In our material, ovigerous females have been collected in February (Thailand), March (Burma), April-May (Hong Kong), August (Pondicherry, Melaka, and South China Sea), September (Singapore), and November (Pinang).

Remarks. - *Dorippoides facchino* was originally described and figured by Herbst (1785), whose account leaves no doubt as to the identity of his material. Herbst included in his description a reference to Plancus' (1739) description and figure of the Mediterranean *Medorippe lanata*; Plancus' specimen thereby becomes a syntype of

*Cancer facchino* Herbst. Herbst's action is even more difficult to understand as in the same volume he described and figured the Mediterranean species under the name *Cancer lanatus* (1785:189, pl. 11: fig. 67). As Herbst's *Cancer facchino* is a composite species, Serène and Romimohtarto (1969) selected the specimen figured on Herbst's pl. 11: fig. 68 (Figure 23) as the lectotype of Herbst's species, thereby fixing the identity of the species and making *facchino* its valid name.

The species was next described, as *Cancer astutus*, by Fabricius (1798:361). His description is short and was misunderstood by Herbst (1803:45, pl. 55: fig. 6) who under the name *Cancer astutus* Fabr. gave a description and figure of *Neodorippe callida*. Most later authors based themselves on Herbst's description, and the name *astuta* (or *astutus*) has rather consistently been used for *N. callida*. Examination of the type specimens of *Dorippe astuta* in the Zoological Museum, Copenhagen and the Nationaal Natuurhistorisch Museum, Leiden showed that species to be synonymous with *Cancer facchino* Herbst, a fact already observed by Mary J. Rathbun when she visited Europe in 1896 and examined Fabricius' type material in the Zoological Museums of Copenhagen, Kiel, and Berlin. Among the notes left by Miss Rathbun and in the files of the Division of Crustacea, National Museum of Natural History, we found one that reads:

"As I make it out, the species of *Dorippe* are as follows, the first name being the right:

- D. callida F. = astuta H. not F. Small, slender legs.
- D. facchino H. = astuta F. = sima M. Edw. Broad, no marginal tooth.
- D. lanatus L., H. European.
- D. frascone H., 1785 = quadridens F., 1793. Tuberculate."

The Fabrician type material in the Nationaal Natuurhistorisch Museum, Leiden, was obtained by W. de Haan, curator of invertebrates of the Museum, when in 1826 he made a visit to Kiel and received some Fabrician types in exchange for Javanese insects. De Haan (1841:123) mentioned the Fabrician type specimens of *D. astuta* as "D.Facchino ... quae e collectione Daldorfiana nobis fuit communicata." Herklots (1861:137) listed these specimens under *D. Facchino* from "Bengale."

In his original description of *Dorippe astuta*, Fabricius (1798:361) cited in the synonymy "*Cancer pinnophylax* Linnaeus 1767, Syst. Nat. (ed. 12) 1: 1039," and later citations of that reference (Herbst, 1785:104, pl. 2: fig. 27; Fabricius, 1793:444) as well as a reference to *Cancer parasiticus* of Linnaeus (1763:415). These references have puzzled many authors, and the species involved have been variously identified as dorippids or pinnotherids. Among the first of these to have been puzzled is Herbst (1803:45) who denied that the material he himself in 1785 mentioned and figured under the name *Cancer pinnophylax* had anything in common with *Dorippe astuta*, and he likewise doubted the identity of Fabricius' species with *Cancer pinnophylax* Linnaeus. Schmitt, McCain, and Davidson (1973:53, under *Pinnotheres maculatus*) showed that the specimen figured as *Cancer pinnophylax* by Herbst, as well as most of the specimens mentioned in the publications referred to by Herbst under that species, most likely are *Pinnotheres pinnotheres* (Linnaeus).

*Cancer pinnophylax* Linnaeus, 1767, which is a new name for *Cancer parasiticus* Linnaeus, 1763, was synonymized, with a great amount of doubt by Schmitt, McCain, and Davidson (1973:53) with *Pinnotheres maculatus* Say, 1818. Linnaeus' (1763:415) original description of *Cancer parasiticus* is as follows:

"CANCER *parasiticus* brachyurus, thorace inaequali orbiculato ciliato, pedibus dorsalis quatuor.

*Habitat in America intra Camam lazarus D.D. Jaquin. Testa magnitudine dimidii imperialis. Thorax orbiculatus, integerrimus, convexus, cinereus, laevis, subinaequalis tuberculis paucis minutissimis. In Dorso pedes 4 minores; unguibus duobus aduncis. Pedes subtus 4 praeter manus, Cauda inflexa brevis."*

This description does not fit any pinnotherid and therefore the species has always been considered incertae sedis. A new examination of Linnaeus' account convinced us that *Cancer parasiticus* (= *Cancer pinnophylax*) is not a pinnotherid, but far more likely a species of the dromiid genus *Hypoconcha*. This would explain the mention in Linnaeus' diagnosis of the presence of ciliae (the lateral margin of the carapace of *Hypoconcha* indeed is conspicuously ciliated), and that of 4 legs carried dorsally, which is the case in *Hypoconcha*, but not in the Pinnotheridae. Furthermore, the convex valve of *Chama* could be used by a *Hypoconcha*. Elsewhere (Holthuis and Manning, 1987) we have shown that *Cancer parasiticus* Linnaeus, 1767, is an older name for the American species now known as *Hypoconcha sabulosa* (Herbst, 1785).

Fabricius' synonymizing of *Cancer pinnophylax* with his *Dorippe astuta* makes much more sense if the former is a *Hypoconcha* rather than a *Pinnotheres*. Also, *Dorippoides* and *Hypoconcha* both carry a bivalve shell rather than live inside a living bivalve as *Pinnotheres* does. Fabricius' identification of *Dorippe astuta* and *Cancer pinnophylax*, furthermore, may be an indication that at the time he studied his material of *D. astuta* it still carried a shell or sea anemone.

As pointed out by several authors, *Dorippe sima* H. Milne Edwards, 1837, is a junior synonym of *D. facchino*. As shown by Serène and Romimohtarto (1969:9), H. Milne Edwards erred in describing the inner lower orbital tooth as short and rounded, for in his figure (Figure 24) it is shown to be large and pointed as is normal for the species.

Dana (1852:398) reported *Dorippe sima* from Singapore, without giving details of his material. There would have been no reason for doubting the correctness of Dana's record, were it not that Stimpson (1858:61), when citing *Dorippe sima* H. Milne Edwards in the synonymy of *D. facchino*, added "(non Dana; Exp. Exp. Cr. i. 389)." As Stimpson did examine Dana's material, his remark should be taken seriously. Unfortunately Stimpson did not give the actual identity of Dana's material, which evidently was destroyed, together with a great number of other specimens from Dana's collection borrowed by Stimpson, during the 1871 Chicago fire.

The form that De Man (1887-1888a) named *Dorippe* sp., and that was assigned with some doubt by Alcock (1896) to *Dorippe granulata*, was recognized by Nobili (1903b) as belonging to the present species and was described by him as var. *Alcocki*. Chopra (1933) showed the variability of the characters separating *D. facchino alcocki* from the typical form, and Serène and Romimohtarto (1969), after examination of some of Alcock's specimens, came to the conclusion that *D. facchino alcocki* is based on young specimens of *D. facchino*, and they sank var. *Alcocki* as a synonym.

Morton and Morton (1983:187, 201, fig. 10.4: no. 7) reported "*Dorippe granulata*" from Hong Kong. Their figure, however, shows that their specimen actually is *Dorippoides facchino*. The second and third pereopods are shown there with long hairs on the merus, carpus, and propodus, as found in *D. facchino*; in *Paradorippe granulata* the hairs on these legs, if visible at all, are very short. The sea anemone carried by the crab in Morton and Morton's figure clearly is *Cancrisocia expansa*, as the crab holds on to the hardened base of the anemone, while *Carcinactis ichikawi*, the sea anemone commensal of *Paradorippe granulata*, is attached to a shell that the crab carries about.

As suggested below under *Neodorippe callida*, the material that Pillai and Nair (1970, 1976) reported from off Cochin, southwestern India, as *D. astuta* cannot belong to *Neodorippe*, the specimens being far too large. It is possible that the species before Pillai and Nair was a *Dorippoides*, for they did point out that their species was a shelf species, i.e., it lived offshore; Gravely (1941) reported that *D. facchino* is the commonest species off Madras, taken in large numbers in fishing nets. Without a reexamination of their material no definite identification can be made. This is the more unfortunate as the authors' investigations on the breeding of the species are the first ever to have been made for any species of Dorippidae.

Gee (1925) mentioned both *Dorippe sima* and *D. facchino* from southern China. If his material indeed belongs to two species, then his *D. sima* must have been identified incorrectly, as part of his *D. facchino* material is in the collection of the Division of Crustacea, National Museum of Natural History and could be examined by us. Therefore we have questioned Gee's record of *D. sima* from Ningbo. Fauvel (1880) also recorded *D. sima* from Ningbo; we have assigned his record to *Heikea japonica* (see below), and Gee's material may belong to that species, too.

### *Dorippoides nudipes* Manning and Holthuis, 1986

#### Figure 26

- Dorippe (facchino?)*. - Stephensen, 1945:64, 200, 215, fig. 4C,D [not *Dorippe facchino* (Herbst, 1785)].  
*Dorippe facchino*. - Barnard, 1954:103. - Guinot, 1967:244 [p.p.]. [Not *Dorippe facchino* (Herbst, 1785)].  
*Dorippe ?facchino*. - Basson, et al., 1977:243 [not *Dorippe facchino* (Herbst, 1785)].  
*Dorippe (Dorippoides) facchino*. - Tirmizi and Kazmi, 1983:367.  
*Dorippe (Dorippoides) facchino*. - Tirmizi and Kazmi, 1983:376 [not *Dorippe facchino* (Herbst, 1785)].  
*Dorippoides nudipes* Manning and Holthuis, 1986:364, fig. 1c [type locality Massaua, Ethiopia, Red Sea]. - Chen, 1987:678, fig. 1, pl. 1: figs. B,C.

Material. - Red Sea: Harkiko Bay, Massaua (as Massawa) Channel, Ethiopia, 15°32'N, 39°30'E, trawl, 3 Apr 1961, E. Gottlieb, 1 ♀ (L). - Massaua (as Massawa), 13°35'N, 39°29'E, Ethiopia, trawled, 8 Apr 1962, J. Stock, Israel South Red Sea Expedition, 3 ♂, 2 ♀ (L, W); same locality, trawled, Israel South Red Sea Expedition no. E62/4115, 2 ♂, 1 ovigerous ♀ (1 male is holotype, L Crust.D. 35530).

Gulf of Aden: Aden, Yemen, 1895, Shoplund coll., 2 ♀ (1 ovigerous) (BM).

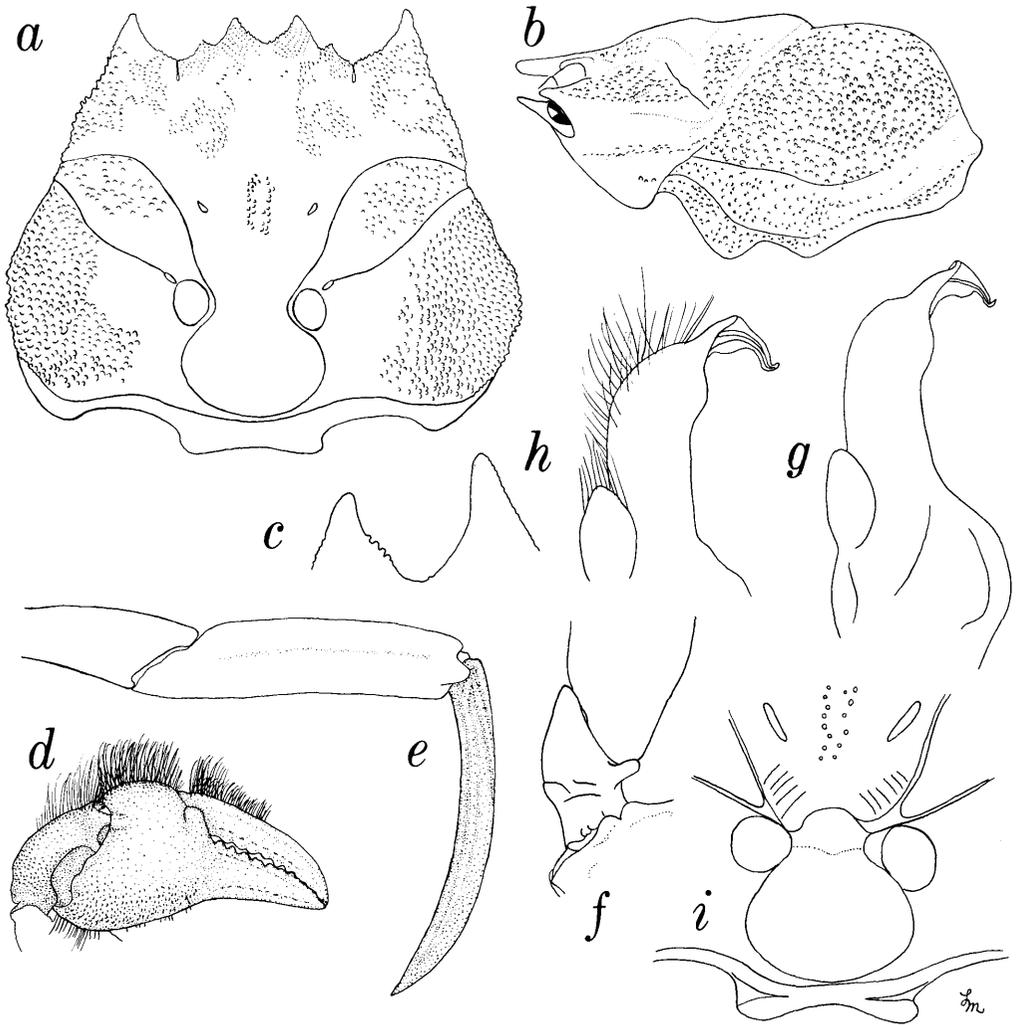


Figure 26. - *Dorippoides nudipes* Manning and Holthuis. *a*, carapace; *b*, carapace, side view; *c*, orbit, ventral view; *d*, cheliped; *e*, distal segments of P3; *f*, base of P3; *g*, *h*, gonopod; *i*, sternum and gonopores. *a-f*, female, cl 19 mm, Harkiko Bay; *g*, male, cl 18 mm, Massaua; *h*, male, cl 25 mm, Madagascar; *i*, ovigerous female, cl 21 mm, Madagascar.

Gulf of Oman: Iran, 24 miles WNW of R'as-E Meydani (as Ras Maidani), 25°24'N, 59°06'E, 10 m, hard clay and sand, 1 Apr 1938, B. Løppenthin, Sta. 107, 1 ♀ (C). - Iran, 2 miles NW by N of buoy of Jask, clay, 20 Apr 1937, G. Thorson, Sta. 72D, 1 ♂ (C).

Arabian Gulf (= Persian or Iranian Gulf): Arabian Gulf, 1938, B. Løppenthin, 1 ♀ (C). - Ash Shu'aybah (as Shuaiba), Kuwait, 29°03'N, 48°08'E, 27 Feb 1879, D. Clayton, 1 ♂, 1 ♀ (BM). - Iran, 11 miles NW of innermost light buoy of Bushehr (as Buchire), 28°59'N, 50°50'E, 27 m, 25 Jan 1938, B. Løppenthin, Sta. 66B, 1 ♂, 1 ♀ (C).

Pakistan: Karachi fishmarket, 16 Jul 1966, N.M. Tirmizi, 1 ♂, 1 ovigerous ♀ (W).

Madagascar: Ambariaka, Ambaro Bay, 13°21'S, 48°45'E, 2-3 m, 7 Jan 1964, J. Rudloe no. 27, 1 ♂, 1 ovigerous ♀ (W). - Ambaro Bay, 3 m, trawl, 3 ♂, 3 ♀ (1 ovigerous) (P, B.11165).

All specimens examined, other than the holotype and the two specimens from Karachi, are paratypes.

Description. - Carapace convex posteriorly, rather flat anteriorly. Branchial and branchiocardiac grooves deep. Cervical groove vaguely or not at all indicated in median area, quite distinct in extreme lateral part behind orbit; in between groove entirely absent in female, vague in male. Mesogastric area with 2 deep submedian pits. Posterior branchial region rounded, convex, covered with distinct, closely placed tubercles, usually without hairs. Granulation of upper surface continuing onto lateral surface without interruption, lateral surface lacking smooth area. Smaller and fewer tubercles present in area between cervical and branchial grooves and in anterior part of carapace; cardiac and intestinal regions and much of mesogastric region smooth. No large tubercles or spines present anywhere on carapace; hairs usually absent or obscure.

Front consisting of 2 distinct, sharp, triangular teeth, separated by wide V-shaped median incision, opening of exhalent canal scarcely or not at all visible in dorsal view. Inner orbital angle triangular, quite sharp in some specimens, with narrowly rounded apex, separated from frontal tooth by rather deep, rounded excavation, exposing base of antenna. Orbital margin showing narrow, posteriorly directed fissure merging at each side with orbital margin under rounded curve. Exorbital tooth strong, sharp, reaching as far forwards as or slightly farther than the frontal teeth. Lateral margin of carapace lacking spine or tooth. Anterior to cervical groove, anterior half of lateral margin straight or slightly concave, posterior half slightly or distinctly convex; posterior to cervical groove margin distinctly convex. Frontal and lateral margins of carapace granular. Suborbital margin, between exorbital tooth and lower inner orbital tooth deeply concave, with some tubercles at base of inner orbital tooth, latter about as long as or slightly longer than outer, less narrow.

In most specimens examined chelipeds of same size and shape; fingers about 2.5 times as long as upper margin of palm. In a male cl 22 mm from Madagascar right chela inflated, finger only twice as long as palm. Merus and carpus with dorsal and ventral fringe of hairs, extending on to propodus ventrally in some specimens. Second and third pereopods slender, second reaching beyond front with carpus or with small part of merus, third with part of carpus; third distinctly longer than second. Dactylus slightly to distinctly longer than propodus, somewhat twisted, distal part of outer surface forming an angle with that of proximal part. Dactylus widening distally, widest at base of distal fourth, laterally compressed, with 2 longitudinal carinae on either surface, ending in horn-like tip; lower carina on dorsal surface rather inconspicuous. No hairs or granules on dactylus, except for few inconspicuous, short hairs in extreme basal part of dorsal margin. Propodus thicker than dactylus, 4 times as long as wide, with pitted groove over middle of either surface; fine granulation present both dorsally and ventrally, pubescence completely lacking. Carpus showing blunt longitudinal ridge on upper part of outer surface; granulation on upper surface more extensive than on propodus, covering outer ridge. Merus somewhat shorter than propodus and carpus together, 4 to 5 times as long as wide. Merus almost covered with granules, with some pubescence distally; pubescence well marked on distal half

of posterior margin in very large males. Merus of fourth leg reaching slightly beyond base of merus of third, that of fifth leg extending about to middle of merus of third. Fourth and fifth legs smooth, somewhat hairy.

Sternite of P1 with raised, oblique, smooth swelling on each side. Sternites of next 2 legs lacking sharp ridges, with broad, transverse ridge on sternite of P2, an oblique ridge on following sternite.

First somite of male abdomen about twice as wide as long, entirely smooth, with longitudinal depression in each half, widening posteriorly, posterior margin deeply concave. Second somite as long as but much wider than first, also with 2 longitudinal grooves, wider and less conspicuous than grooves of first somite; elevated, narrow, transverse band of granules extending over middle of somite; in large specimens tubercles closest in middle. Third somite shorter than second, especially in middle, also with 2 longitudinal grooves and transverse band of granules; lateral parts swollen. Fourth somite similar to third, shorter, and with median part, not laterals, swollen. Fifth somite narrower than fourth, longitudinal grooves obsolete, but transverse band of granules present; central part of somite elevated, surrounded by narrow, flat, low rim, elevated part consisting of 3 tubercles, sometimes only vaguely indicated. Sixth somite narrowing further, lateral margins concave; apart from anterior transverse groove, surface rather flat, showing some granules. Telson triangular, rounded apically, slightly shorter than wide, base enclosed between produced posterolateral angles of sixth somite.

Female abdomen wide; third and fourth somites each with distinct granular transverse ridge; second somite with inconspicuous ridge, latter absent on first and sixth somites. Eggs numerous and small.

First male pleopod short and stubby, curved slightly outwards, ending in flattened, rectangular, horn-colored projection; apex slightly concave externally, with posterior angle produced into narrow, whip-like appendage, directed backward then curving abruptly forward.

Size. - Males, cl 15 to 25 mm, cb 17 to 30 mm; females, cl 10 to 22 mm, cb 11 to 26 mm; ovigerous females, cl 16 to 22 mm, cb 19 to 26 mm. The width/length ratio varies from 1.12 to 1.25.

Distribution. - It seems that this species is restricted to the extreme western part of the Indo-West Pacific region, from the southern Red Sea southward to Madagascar (and South Africa?) and eastward to Pakistan. The following records are in the literature:

Red Sea: Massaua (as Massawa), 13°35'N, 39°29'E, Ethiopia (Manning and Holthuis, 1986; Chen, 1987).

Gulf of Oman: 2 miles NW by N of the buoy of Jask, Iran; 24 miles WNW of R'as-E Meydani (as Ras Maidani), 25°24'N, 59°06'E (Stephensen, 1945).

Arabian Gulf (= Persian or Iranian Gulf): Saudi Arabia (Basson, et al., 1977). - 11 miles NW of the innermost light buoy of Bushehr (as Buchire), 28°59'N, 50°50'E, Iran (Stephensen, 1945).

Pakistan: Pakistan (Tirmizi and Kazmi, 1983).

Madagascar: Ambaro Bay, 13°23'S, 48°38'E; Pracel Shoal, 17°00'S, 43°30'E; Maintirano, 18°03'S, 44°01'E (all Chen, 1987). - Bay of St. Augustin, near Tuléar (Tuléar = 23°21'S, 43°40'E) (Barnard, 1954).

Barnard's (1954) specimen from Madagascar, identified as *Dorippe facchino*, most likely belongs here. Barnard's description of the male (cl 20 mm) checks very well with the present species, especially the fact that the first two pairs of walking legs (pereiopods 2 and 3) are described as "complètement sans soies."

In the crustacean collection of the National Museum of Natural History, Smithsonian Institution, Washington, there is a very small damaged specimen (cl ca. 4.5 mm, all legs missing) from off Natal, South Africa, 29°26'S, 31°46'E (depth 77 m, Agassiz trawl, 9 Sep 1964, *Anton Bruun* Cruise 7, Sta. 391-F) that might belong to this species, but the condition of the specimen makes a certain identification impossible.

Habitat. - The species has been recorded from depths between 2-3 meters and 65 meters (up to 77 meters if the juvenile from Natal belongs here). It lives on a flat bottom, as evidenced by the fact that it is caught in trawls. Stephensen (1945) reported that his specimens were taken on bottoms of clay and hard clay. Barnard (1954) reported it from mud and Chen (1987) from grey mud. According to Basson, et al. (1977), their material was taken in subtidal sand.

Biology. - Ovigerous females were collected in January (Madagascar), April (Massaua), and July (Karachi).

A male from the Arabian Gulf (near Bushehr) carried many stalked barnacles and bryozoans on the posterior legs; the largest male from Ambaro Bay (P, B.11165) has stalked barnacles on P5 and on the carapace.

Remarks. - Stephensen (1945:64) was the first to note that material identified with *Dorippe facchino* from the Arabian Gulf differed from material from Thailand identified with that species by Rathbun (1910) by having "the two distal joints of 2nd and 3rd pairs of walking legs [P2 and P3] ... a little too narrow," evidently referring to the fact that the dactylus and propodus of pereiopods 2 and 3 in the present species never are so high as in most specimens of *Dorippoides facchino*. Stephensen (1945, fig. 4C) also figured the gonopod of this species. His drawing, although rather crude, agrees reasonably well with what we found in this species.

*Dorippoides nudipes* is very close to *D. facchino*. The latter species differs from *D. nudipes* in the following characters:

1. The carapace (especially in larger specimens) is somewhat flatter; it often is covered by short hairs that obscure the granulation, and the granulation is less dense and less extensive.
2. The frontal and orbital teeth are less slender.
3. The posterior branchial region shows, near the lateral margin of the carapace, a longitudinal or curved ridge that separates the dorsal granular surface from a smooth lateral region.
4. The second and third legs are relatively longer and reach further forward.
5. The merus and carpus of P2 and P3 are wider.
6. The dactylus of the second and third pereiopods usually is shorter than the propodus, and it has its greatest height in the basal half.
7. The posterior margin of the merus, carpus, and propodus of the second and third pereiopods of the adult males shows a dense pubescence.
8. The fourth and fifth legs are less slender and more hairy than in *D. nudipes*.

*Heikea*, new genus

Type Species. - *Dorippe japonica* Von Siebold, 1824. Gender feminine.

Derivatio Nominis. - The new generic name is derived from the patronym Heike of a Japanese feudal family, whose defeat against the family of the Genji in 1185 gave rise to a legend which caused the type species of this genus to be named Heike-gani by Japanese fishermen (see Frontispiece and Remarks below, under *H. japonica*).

Definition. - Carapace convex, 1.03 to 1.11 times wider than long, moderately sculptured. Lateral margin and dorsal surface without granules. Protogastric regions smooth, evenly convex, without protuberances. Cervical and branchial grooves deep. Submedian pits present in mesogastric region, sometimes connected to cervical groove, sometimes isolated. Posterolateral margin of mesogastric region ornamented with short, narrow, sharply defined parallel grooves ending in cervical groove. Epibranchial region with longitudinal groove in distal part and some parallel oblique impressions extending laterally from cervical groove; no transverse groove in mesial part of region. Branchial region without lateral spine or tubercle, but with rather long dorsal carina. Urogastric region reduced. Branchiocardiac grooves distinct, deep. Cardiac region wider than long, slightly convex, with some depressions anteriorly.

Front consisting of 2 broad, triangular teeth with bluntly angular apices, teeth separated by wide, V-shaped emargination. Openings of exhalant canal scarcely or not at all visible in dorsal view. Front extending somewhat beyond exorbital teeth. Inner orbital angles about straight, not much set off from frontal teeth. Posterior orbital margin with closed fissure, without teeth on either side. Exorbital angle broadly triangular. Inner suborbital tooth far shorter than front. Eyes short and stout, cornea ventrolateral.

Chelipeds in female and smaller males equal in size and shape; in adult males, P1 distinctly unequal, right larger. In small chelae, fingers slender, curved, about 3 times as long as upper margin of palm, or less; cutting edges with 9-12 teeth. Fingers each with 2 uninterrupted grooves on both inner and outer surfaces. Upper part of outer surface of palm with inconspicuous groove extending from articulation with carpus almost to that with dactylus. Inner surface of palm smooth, surface obscured by low, tomentose pubescence. Dorsal margin of palm and proximal part of dactylus with fringe of long hairs.

Second and third pereopods long, third longest of all legs, segments flattened, unarmed. Fringes of long hairs present on upper margin of dactylus, propodus, and distal part of carpus, and on lower margin of propodus and proximal part of dactylus. Ischium of P2 and P3 without spur. Coxa of P3 without sausage-like callosity.

Sternite of first pereopod with transverse ridge, each half of ridge bilobed mesially, outer lobe larger, often smooth and white. Sternite of second pereopod with granular transverse ridge on each side. Sternite of third pereopod in male with similar ridges. Sternite of third pereopod of female with oblique genital openings at mesial end of transverse carina, 1 tubercle present in anterior part of outer margin of opening. Small but sharp median spine present on fourth sternite of female.

First abdominal somite of male trapezoidal, with wide longitudinal groove on either side. Second somite with wide and blunt transverse ridge. Third somite with 2

large, blunt, submedian teeth, separated by concave depression. Fourth somite small, narrowing posteriorly, smooth. Fifth and sixth somites smooth. Telson rounded.

Male first pleopod slender, curved in C-shape, ending in 2 elongate, blunt-topped lobes, 1 broadly rounded, other narrower. 2 subdistal processes present: 1 narrow, finger-like on convex margin, other, on concave side, short, broadly rounded.

Remarks. - This genus differs from *Nobilum* in having only three prominences on the gastric region, lacking a spine on the orbital margin, and in having the gonopod terminate in two blunt lobes rather than in three petaloid lobes.

*Heikea* contains two species, which may be distinguished with the following key.

### Key to Species of *Heikea*

Merus of P3 6.6 to 7.3 times as long as high ..... *H. arachnoides*  
 Merus of P3 less than 6.3 times longer than high ..... *H. japonica*

### *Heikea arachnoides* (Manning and Holthuis, 1986),

#### new combination

#### Figures 27-28

*Dorippe japonica*. - Miers, 1886:xxx, 327, 328. - Doflein, 1904:292. [Not *Dorippe japonica* Von Siebold, 1824.]

*Nobilum arachnoides* Manning and Holthuis, 1986:364, fig. 1d [type locality Inland Sea of Japan, near Kobe, 34°38'N, 135°01'E, depth 8-50 fm].

Material. - Japan, east coast of Honshu Island: Inland Sea, near Kobe, 34°38'N, 135°01'E, dredged in 8-50 fm (= 15-91.5 m), sand, 19 May 1875, *Challenger* Sta. 233A, 1 ♂ (holotype, BM 84.44). - Inland Sea, R. Gordon Smith, 1 ♂ (paratype, BM 1903.6.7.10); same locality, deep water, R. Gordon Smith, 1 ♂ (paratype, BM 1903.6.7.5).

Description. - Carapace convex, moderately sculptured, 1.07 to 1.11 times broader than long. Carapace appearing smooth, naked, frontal regions sparsely hairy, remainder of surface almost naked. Branchial and branchiocardiac grooves very distinct, cervical groove distinct but less deep. Branchial regions swollen, each with an oblique dorsal carina. Mesogastric region prominent, swollen, protogastric region lacking distinct tubercles or oblique swellings. Front consisting of 2 narrow, blunt teeth, separated by a wide emargination. Outer margin of front separated from inner orbital lobe by shallow but distinct concavity. Inner orbital lobe sinuous. Postorbital fissure distinct, open anteriorly. Outer orbital lobe unarmed, inconspicuous. Exorbital tooth well developed, slender, falling well short of front. Suborbital margin, between strong exorbital tooth and much shorter, rounded inner orbital tooth, straight or shallowly concave, margin smooth, unarmed.

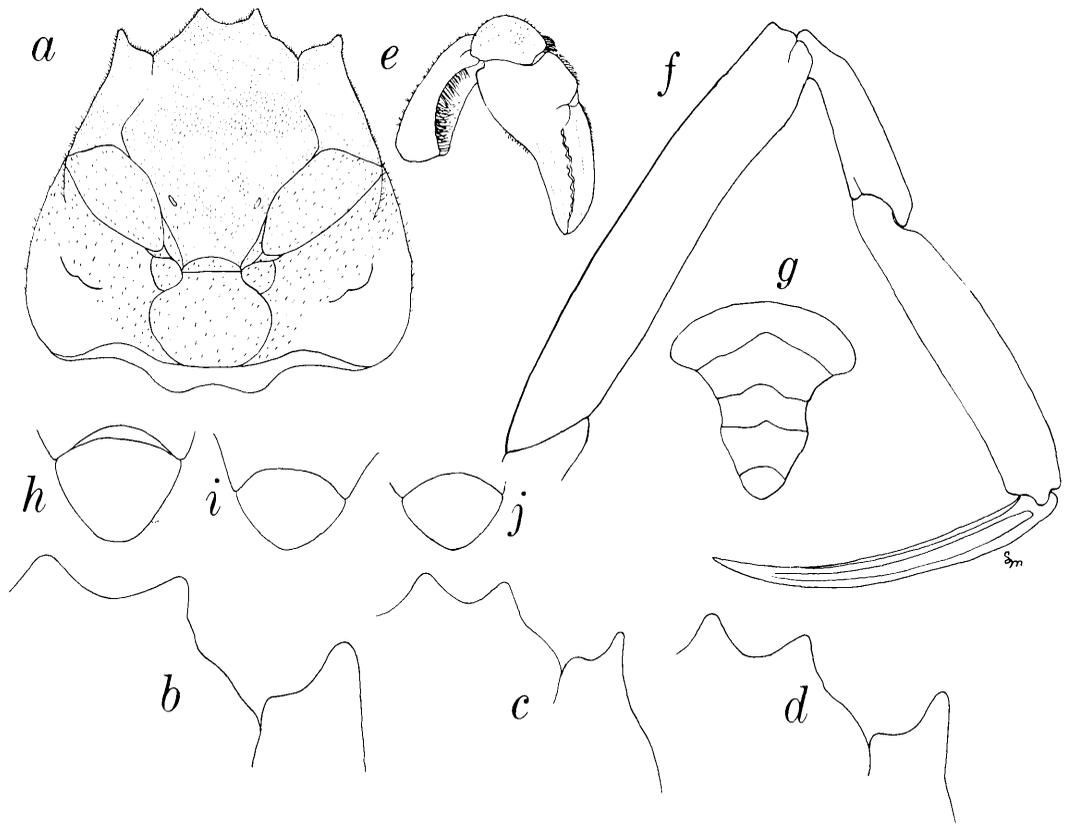


Figure 27. - *Heikea arachnoides* (Manning and Holthuis). *a*, carapace, to show setation; *b-d*, orbit; *e*, cheliped; *f*, P3; *g*, abdomen, ventral view; *h-j*, telson. *a*, *b*, *e-h*, male holotype, cl 15.8 mm, Japan; *c*, *i*, male paratype, cl 14.1 mm, Japan; *d*, *j*, male paratype, cl 11.1 mm, Japan.

Chelipeds equal in size and shape in all specimens examined. Fingers slightly less than 3 times as long as palm, cutting edges with 10-11 subequal, subtriangular or rounded teeth. Dorsal and ventral margins of chelae lined with setae.

Second and third legs very slender, long, each reaching beyond front with about half of merus, neither leg spined, each grooved only on dactylus. Dactyli of P2 and P3 longer than their propodi, longitudinally carinate; most of dorsal margin and about half of ventral margin fringed with setae. Propodi slightly flattened, not conspicuously carinate, but each with indistinct, shallow, longitudinal groove on posterior surface, dorsal and ventral margins fringed with setae. Carpus shorter than propodus, less than half as long as merus, with indistinct dorsal fringe of setae. Merus flattened, slender and elongate, length 6.6 to 7.3 times height. Fourth leg reaching with merus to proximal fourth of merus of third leg. Merus of fifth leg extending beyond merus of fourth by half merus length.

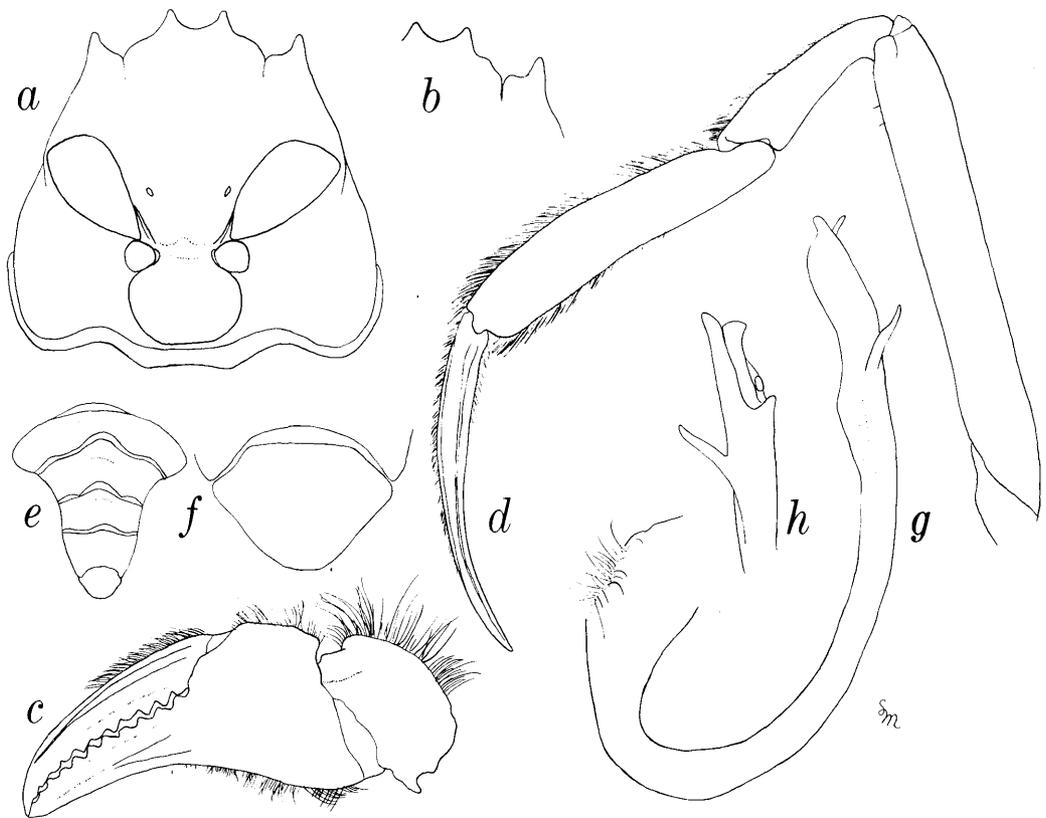


Figure 28. - *Heikea arachnoides* (Manning and Holthuis). a, outline of carapace; b, front and orbit; c, chela; d, P3; e, abdomen, ventral view; f, telson; g, h, gonopod. Male holotype, cl 15.8 mm, Japan.

In male, sternite of first leg with longitudinal median groove, flanked on each side by 2 coalesced tubercles, each clean, white. Sternites of second and third pereopods with granular ridge on each side, ending mesially in angled knob, lighter colored than surface on second somite. Ridges shorter on third sternite. Sternum slightly tomentose in some specimens.

Second abdominal somite in male with median swelling, third somite with 3 swellings, coalesced, laterals larger than median. Fourth somite with 2 median tubercles, anterior larger, almost sharp. Fifth and sixth somites with low median prominences. Telson short, broader than long.

Male pleopod as figured.

Size. - Males only examined, cl 11.1, 14.1, and 15.8 mm, cb 12.0, 15.7, and 16.7 mm, respectively.

Distribution. - Known only from the Inland Sea of Japan. This species may have been recorded from east of Owashi in 132 meters as *Dorippe japonica* by Yokoya (1933) and Horikoshi, et al. (1982). Sakai (1937) also recorded material from depths to 130 meters, and his specimens from deeper water may actually belong to *H. arachnoides*.

Habitat. - The only information available is that one specimen was taken by the *Challenger* in 8-50 fathoms (= 15-91.5 meters) (not 8-15 fathoms as cited by Miers, 1886:328), and another was taken in deep water.

Remarks. - It was with some hesitation that we named this species, which is very similar to *H. japonica*, differing in having much slenderer and longer third pereopods, especially since this was the feature used by Serène and Romimohtarto (1969) to distinguish their *Neodorippe japonicum taiwanensis* from *N. japonicum* proper.

In *H. arachnoides* the merus of the third leg is 6.6 to 7.3 times longer than high, whereas in material of *H. japonica* examined by us the third leg is 4.0 to 6.3 times longer than high; in the majority of specimens examined it is less than 6 times longer than high. In the specimens reported by Serène and Romimohtarto (1969) the merus was 5.9 times longer than high in their var. *taiwanensis*, 5.3 times in their *japonicum* sensu stricto.

The range of the merus length/height ratio in the material examined by us is as follows:

| Ratio     | Number of Specimens |                       |
|-----------|---------------------|-----------------------|
|           | <i>H. japonica</i>  | <i>H. arachnoides</i> |
| 4.0 - 4.4 | 3                   | -                     |
| 4.5 - 4.9 | 3                   | -                     |
| 5.0 - 5.4 | 9                   | -                     |
| 5.5 - 5.9 | 11                  | -                     |
| 6.0 - 6.4 | 2                   | -                     |
| 6.5 - 6.9 | -                   | 1                     |
| 7.0 - 7.4 | -                   | 2                     |

*Heikea arachnoides*, like *Dorippe tenuipes*, can be distinguished from other species of its genus by its extremely long and slender legs.

***Heikea japonica* (Von Siebold, 1824),  
new combination**

Figures 29-35

*Dorippe Japonica* Von Siebold, 1824:14 [type locality Shimonoseki, Japan]; 1826:18; 1850:xiii. - Stimpson, 1858:163. - Herklots, 1861:137. - Ives, 1891:216. - Serène, 1937:77.

*Dorippe japonica*. - Nees von Esenbeck, 1825:87. - De Haan, 1841:122. - Stebbing, 1893:131, 132, fig. 10. - De Man, 1896:370. - Rathbun, 1902:31. - Terazaki, 1902:87. - Anonymous, 1904:55, pl. 51: fig. 2. - Stimpson, 1907:167. - Parisi, 1914:302. - Ihle, 1916:153, 160. - Balss, 1922:119. - Maki and Tsuchiya, 1923:126, pl. 14: fig. 2. - Urita, 1926:ii, 40. - Rathbun, 1931:99. - Shen, 1931:101, pl. 6: figs. 1, 2; 1932:11, figs. 6, 7a-e. - Yokoya, 1933:108, 214. - Sakai, 1934:283. - Kamita, 1934:540, fig. 1; 1935:61, 62, 69. - Sakai, 1936:41, fig. 5; 1937:72, pl. 10: fig. 1. - Shen, 1937a:169, 171; 1937b:305. - Ward, 1937: fig. on p. 4. - Neuville, 1938:49 [p.p.], figs. 1, 2 [upper]. - Sakai, 1940:49. - Shen, 1940a:213; 1940b:75. - Kamita, 1941a:238; 1941b:26, 28, figs. 5, 6. - Shen, 1948:105. - Lin, 1949:12. - Huxley, 1952:67, fig. - Sakai, 1956:(1) 7, (2) 21, fig. 7. - Kaneko, 1958:331, 332, 336, fig. 10. - Miyake, 1961a:13; 1961b:165, 169. - Miyake, et al., 1962:126. - Kamita, 1963:21. - Shen and Liu,

- 1963:144. - Sakai, 1965:21. - Serène, 1968:40. - Kim, 1970:9. - Holthuis and Sakai, 1970:46, 90, 116, 309, pl. 8: fig. 3. - Nishimura and Suzuki, 1971:102, fig. - S.L. Yang, 1986:152. - Zhou and Sun, 1986:223.
- Dorippe callida*. - De Haan, 1839: pl. 31: fig. 1. - Neuville, 1938:49, fig. 1. [Not *Dorippe callida* Fabricius, 1798.]
- Crabes fort curieux. - Fauvel, 1880:31.
- Dorippe sima*. - Fauvel, 1880:196 [not *Dorippe sima* H. Milne Edwards, 1837 = *Dorippoides facchino* (Herbst, 1785)].
- Dorippe granulata*. - Balss, 1922:118 [not *D. granulata* De Haan, 1841].
- Dorippe histrio*. - Rathbun, 1931:99. - Shen, 1940b:70, 76. [Not *Dorippe histrio* Nobili, 1903.]
- Dorippe*. - Schmitt, 1931:222, pl. 64; 1965:143, fig. 63. - Ingle, 1982:650.
- Dorippe japonica*. - Kamita, 1936:30.
- "crabs". - Ward, 1937:8. - Sagan, 1980:15, 16.
- "warrior crab". - Anonymous, 1944: left fig. on p. 4.
- Doryppe japonica*. - Dawydoff, 1952:139.
- Neodorippe (Neodorippe) japonica*. - Serène and Romimohtarto, 1969:5, 13, figs. 19, 20, pl. 2: fig. A, pl. 5: fig. C, pl. 6: fig. A. - Kim, 1973:290 [Korean text], 610 [English text], figs. 85, 87, pl. 76: fig. 57. - Yamaguchi, et al., 1976:34. - Sakai, 1976:61 [English text], 49 [Japanese text], pl. 22: fig. 1. - Morita, 1977:16, pl. 2: figs. 1-4. - C.M. Yang, 1979:3. - K. Sakai and Nakano, 1983:81.
- Neodorippe (Neodorippe) japonica* var. *taiwanensis* Serène and Romimohtarto, 1969:14, figs. 21, 22, pl. 5: figs. A,B,D [type locality Chilung, Taiwan]. - C.M. Yang, 1979: vii, 3.
- [Japanese name]. - Imajima, et al., 1970:16, colored figure. - Odawara, 1973: pl. 1. - Sakai, 1980:41, fig. 12.
- Neodorippe japonica*. - Takeda, 1975:121, colored fig.; 1978:33; 1982b:93, colored fig.. - Terada, 1981:21-28, 30, 31, figs. 1A, 2A, 3A, 4A. - Horikoshi, et al., 1982:126. - Takeda, 1983:121, colored fig., 303. - Sakai, 1985:330, 331, 333-336, figs. 1-3, vignette on p. 326. - Muraoka, 1985:259.
- Nobilium japonicum japonicum*. - Manning and Holthuis, 1981:31. - Miyake, 1983:17, pl. 6: fig. 1. - Quintana, 1987:245, figs. 8-12, 20. - Muraoka and Konishi, 1988:125.
- Nobilium japonicum taiwanense*. - Manning and Holthuis, 1981:31.
- Heike-gani. - Sagano, 1981: 124-131, fig. 39.
- Nobilium japonicum*. - Chen, 1986:123, fig. 5: 23-27. - Yamaguchi, et al., 1987:8, pl. 1: fig. 10.

Vernacular Names. - The Japanese name Heike-gani was first mentioned in the European literature by Von Siebold (1824:14) and De Haan (1841:122); Von Siebold used the spelling "Heike-Kani," and explained in a footnote: "Heike est nomen imperatoris antiquii." Many later authors confirm that this is the best known Japanese name for the species (Sakai, 1965:21, 1976:61, 1985:334; Neuville, 1938:53; Holthuis and Sakai, 1970:116; Sagano, 1981:124, and many others). Von Siebold (1850: xiii) cited the name as Feike-Gani; Ward (1937:8) as Heike crab and Heike-gani. Sakai (1985:334) also cited to the now obsolete names Takebun-gani and Shimamura-gani, used in a Japanese encyclopedia published in the first part of the 18th century. For the derivation of the names, see below under Remarks.

In China the names Kuan Kung Hsieh (= General Kuan Kung's crab) and Kuei Lien Hsieh (= Ghost or Demon faced crab) are used (see Shen, 1931:102 and Neuville, 1938:53, 54). Fauvel (1880:31, 196) cited the Chinese vernacular name Jen mien Hsieh.

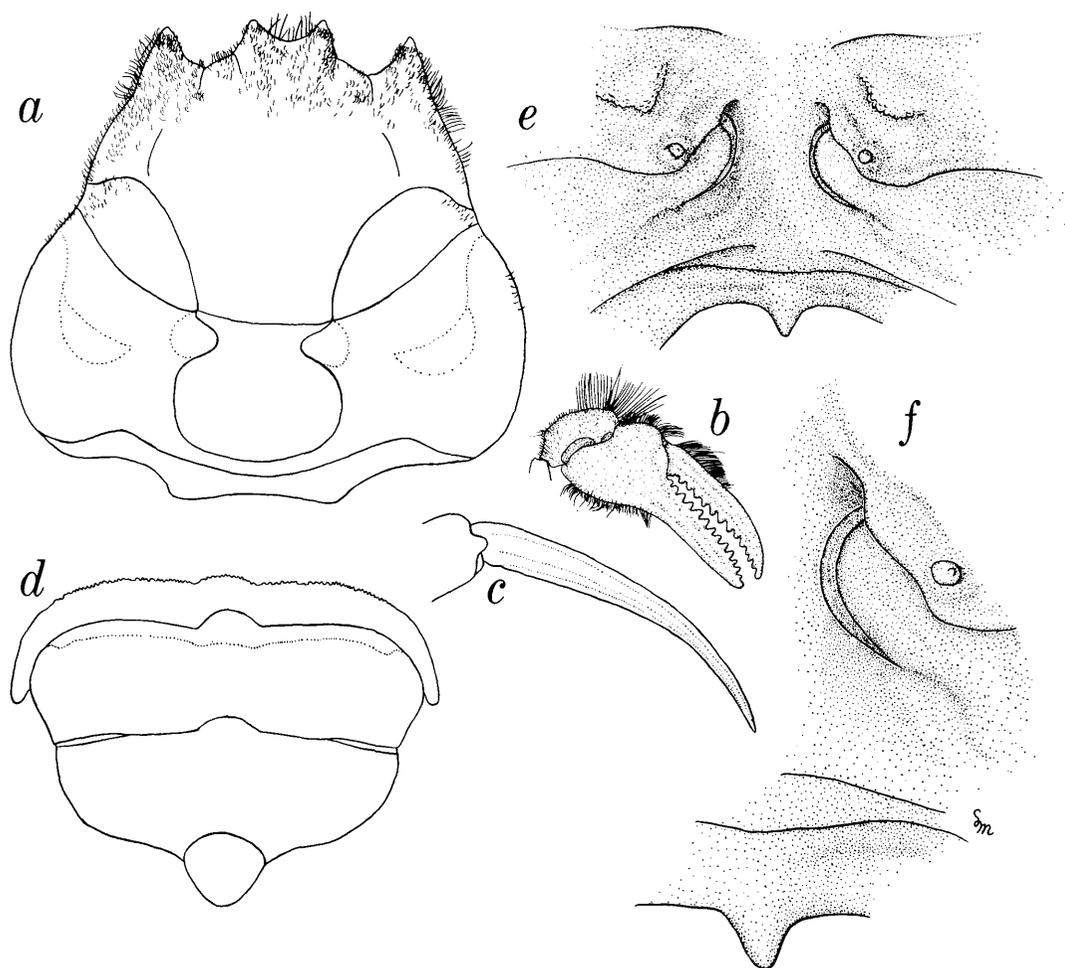


Figure 29. - *Heikea japonica* (Von Siebold). *a*, carapace; *b*, cheliped; *c*, dactylus of P3; *d*, abdomen, ventral view; *e*, sternum and gonopores; *f*, gonopore, enlarged. Female, cl 19 mm, Jimei.

Serène (1937:77) reported that his species and other Dorippinae from Vietnam all had the local common name "con cua áo to'i."

Material. - Japan (general): Japan (probably near Nagasaki), 1823, P.F. von Siebold, 2 ♂, 3 ♀ (syntypes, L). - Japan, 1823-1834, P.F. von Siebold and H. Bürger, 7 ♂, 6 ♀ (L); same locality, 1 ♀ (P). - Japan, F.C. Dale and P.L. Jouy, 1 ♂ (W); same locality, P.L. Jouy, 9 ♀ (W); same locality, Chaffanjon, 1 ♂, 1 ♀ (P); same locality, C.A. White, 1 ♀ (W). - Japan and China, 1 ♀ (BM).

Japan, east coast of Honshu Island: Kobe, 34°40'N, 135°12'E, 17 Aug 1886, P.L. Jouy, 4 ♀ (W). - Kobe, P.L. Jouy, 3 ♂, 16 ♀ (W). - Wakanoura (Wakanoura Bay = 34°10'N, 135°10'E), Kii Peninsula, 1900, D.S. Jordan and J.O. Snyder, 1 ♀ (W).

Japan, Kyushu Island: Kagoshima, 31°37'N, 130°32'E, Imperial University of Tokyo, 18 ♂, 10 ♀ (W).

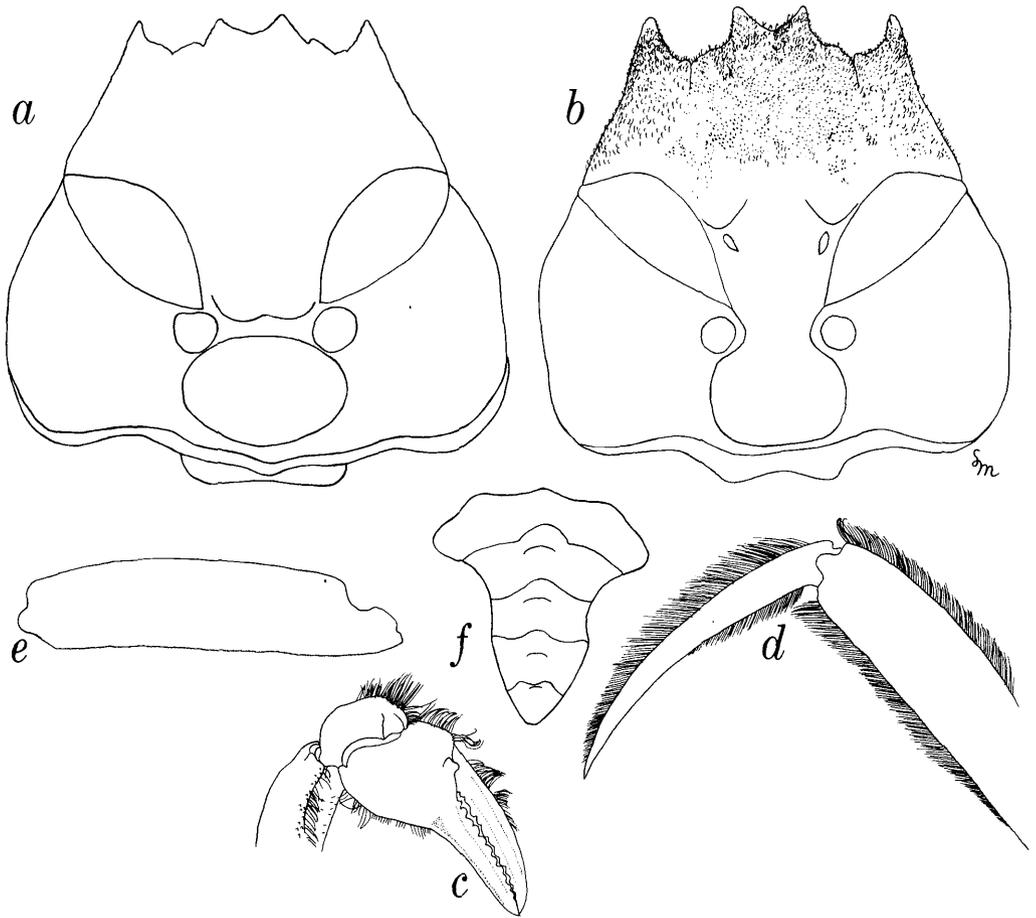


Figure 30. - *Heikea japonica* (Von Siebold). *a*, *b*, carapace; *c*, cheliped; *d*, P3 dactylus; *e*, P3 propodus (setae omitted); *f*, abdomen, ventral view. *a*, male syntype, cl 20 mm, Japan; *b-f*, male, cl 19.5 mm, Japan.

China (general): North China, 1 ♀ (BM).

China, Tianjin Shi: Beitang (as Peitang), 39°07'N, 117°42'E, Bo Hai Gulf, C.J. Shen, 1 ♂, 1 ovigerous ♀ (BM). - Tanggu (as Tangku), 39°00'N, 117°42'E, Bo Hai Gulf, 20 Apr 1930, C.J. Shen, 1 ♂, 1 ♀ (W).

China, Shanghai Shi: Shanghai, 31°13'N, 121°25'E, 1 ovigerous ♀ (BM).

China, Zhejiang Province (= Chekiang Province): Zhejiang Province, C. Ping, 1 ♂ (BM). - Yen t'ing, 27°27'N, 120°39'E, 18 Jul 1923, C. Ping, 1 ♂ (W).

China, Fujian Province (= Fukien Province): Fuzhou (as Foochow), 26°09'N, 119°17'E, C.R. Kellogg, 1 ♀ (W); same locality, Dec 1926, C.R. Kellogg, 2 ♂ (W). - Jimei (as Tsimei), 24°39'N, 118°06'E, Jun 1923, S.F. Light, 1 ♂, 2 ♀ (W). - Xiamen (as Amoy), 24°26'N, 118°07'E, outer harbor, from nets, Apr 1927, S.F. Light, 1 ♂, 1 ovigerous ♀ (W); same locality, Jul 1925, C.F. Weng, 1 ovigerous ♀ (P).

China, Guangdong Province: Nan'ao Island (as Namoa Island), 23°25'N, 117°06'E, N of Shantou, Suenson, 1 ♂, 1 ♀ (C).

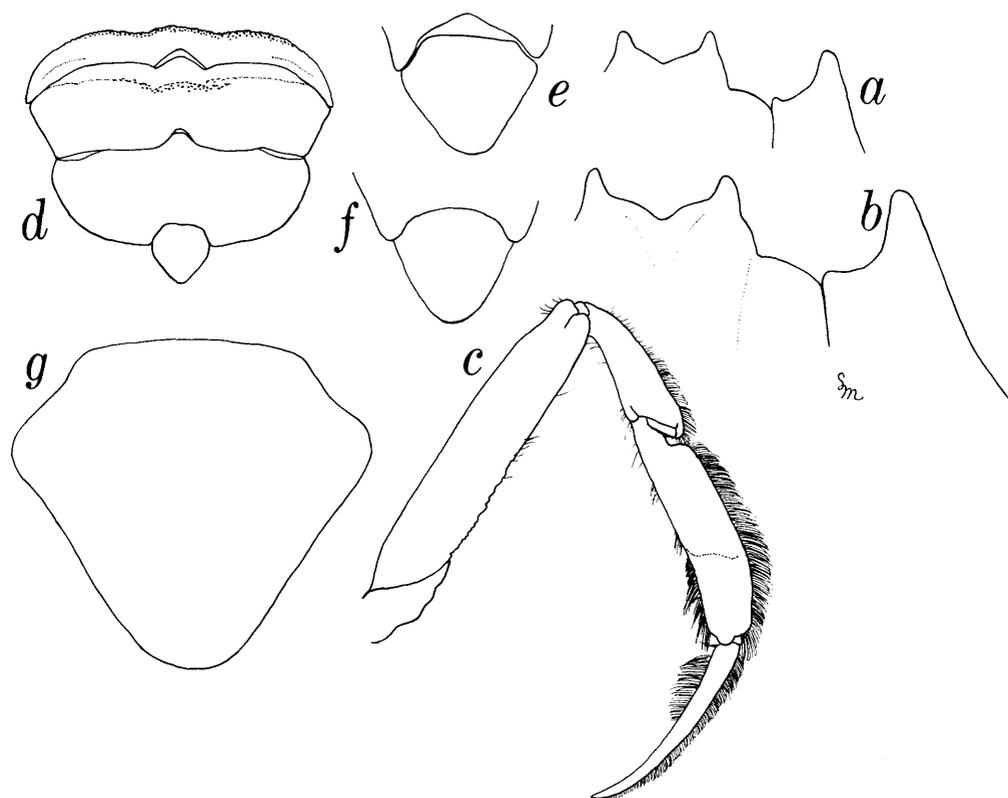


Figure 31. - *Heikea japonica* (Von Siebold). *a, b*, front and orbit; *c*, P3; *d*, abdomen, ventral view; *e, f, g*, telson. *a, f*, female, cl 24 mm, Jimei; *b, c, g*, male, cl 22 mm, Jimei; *d, e*, female, cl 19 mm, Jimei.

Hong Kong: Hong Kong (Hong Kong Island = 22°15'N, 114°11'E), 1 ♀ (BM); same locality, 10-20 fm (= 18-37 m), Barney, 1 ♂, 2 ♀ (BM). - Hong Kong, 22°20'N, 114°04.3'E, 25 m, 25 Jun 1974, R.G. Wear no. 131, 2 ♂, 2 ovigerous ♀ (W). - 200 m west of Centre Island (Ah Chau), 22°26.4'N, 114°13'E, 4 fm (= 7 m), mud, 17 May 1974, R.G. Wear no. 42, 1 ♀ (W).

Taiwan: Chilung (as Keelung), 25°10'N, 121°43'E, 1963, Fisheries Research Institute, 1 ♂ (holotype of *Neodorippe japonica* var. *taiwanensis*; ZRC).

Description. - Carapace convex, moderately sculptured, 1.03 to 1.08 times broader than long. Frontal region distinctly hairy, remainder of carapace much less so. Branchial and branchiocardiac grooves very distinct, cervical groove distinct but less deep. Branchial regions swollen, each with an oblique dorsal carina. Mesogastric region low, protogastric region lacking distinct tubercles or oblique swellings. Front consisting of 2 blunt teeth, separated by wide, shallow, U-shaped emargination. Outer margin of front separated from inner orbital lobe by concavity, inner orbital lobe straight or sinuous. Postorbital fissure narrowly open in some specimens. Outer orbital lobe unarmed, inconspicuous. Exorbital tooth well developed, slender or blunt, falling short of front. Suborbital margin, between strong exorbital tooth and short, rounded inner orbital tooth, evenly concave, margin granular but unarmed.

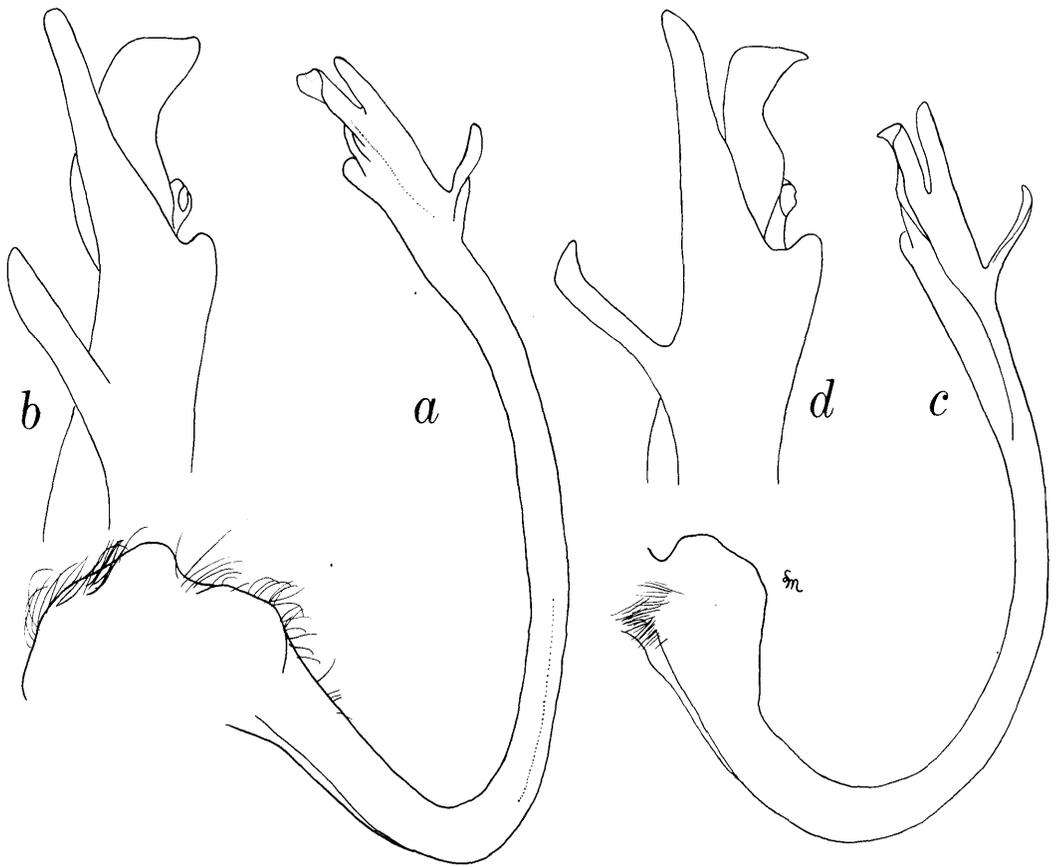


Figure 32. - *Heikea japonica* (Von Siebold). Gonopod and apex of gonopod of: *a, b*, male, cl 22 mm, Jimei; *c, d*, male, cl 21 mm, Hong Kong.

Chelipeds equal in size and shape in young males and females, but in adult male right chela greatly inflated. Chela may be inflated in males as small as cl 19.5 mm in material examined by us, usually inflated in males larger than cl ca. 22 mm. Inflated chelae generally lacking line of long setae dorsally and ventrally on palm and fingers, surface of palm smooth and even. Base of fixed finger with swollen lobe ventrally on both inner and outer surfaces. Fingers of swollen male chela about 1.5 times as long as upper margin of palm; in females and young males fingers about 3 times length of palm. Cutting edges of fingers with 9-12 equal teeth, smaller, blunter, and fewer on inflated chela of large male.

Second and third legs slender, long, both reaching beyond front with distal end of merus, neither spined nor strongly granular, with scattered short hairs on surface. Third leg distinctly longer than second. Dactyli of P2 and P3 as long as or slightly longer than their respective propodi; most of dorsal margin and at least half of ventral margin of dactyli fringed with setae. Propodi strongly flattened, not conspicuously

carinate, but with shallow longitudinal groove on upper (posterior) and lower surfaces. Carpus with indistinct dorsal fringe of setae, shorter than propodus and almost half as long as merus. Merus of P3 flattened, length ranging from 4 to more than 6 times height (4.0 to 6.3 times), usually from 5 to 5.9 times longer than high. Fourth leg reaching with merus slightly beyond base of merus of third. Merus of fifth leg overreaching base of merus of fourth.

Sternite of first leg in males with short, granular, transverse ridge on each side, terminating mesially in 2 tubercles, lateralmost larger. Sternite of second leg with granular transverse ridge, that of third leg with oblique granular ridge. In female, sternite of first leg with ridge also ending mesially in 2 tubercles, lateralmost larger, separated by a sulcus. Sternite of second somite with oblique, curved ridge. Sternites of other legs covered by abdomen.

First somite of male abdomen widening posteriorly, with median elevation flanked by longitudinal sulcus on each side. Second somite wider than long, wider than first, with smooth, coalesced median and lateral elevations. Third somite slightly shorter than second, with smooth, coalesced median and submedian elevations, latter most prominent on this somite. Fourth somite shorter than third, with low median elevation. Fifth somite shortest of all, with low median elevation. Sixth somite longer than fifth, slightly inflated, with 2 short longitudinal sulci posteriorly. Telson shorter than sixth somite, broader than long, triangular.

Female abdomen smooth, with no sharp teeth or spines, each somite with median prominence, second to fifth somites crossed by smooth carina. Telson subtriangular.

Male pleopod as figured.

Color. - Illustrations in color in the literature show a generally purplish crab (Holthuis and Sakai, 1970, pl. 8: fig. 3; Sakai, 1976, pl. 22: fig. 1), or a purplish crab with some green anteriorly on the carapace (Sakai, 1937, pl. 10: fig. 1). Other color figures have been published by Imajima, et al. (1970; pale brown), Nishimura and Suzuki (1971), Takeda (1975 and 1983, both purple; 1982, almost black), and Miyake (1983, greyish). De Haan (1841:132) described the color as "in vivis rubro-violaceus." Fauvel (1880:31) gave it as "d'un violet lie de vin." Shen (1931:102) noted that "In alcohol, carapace and legs pinkish buff on dorsal surface," and (1932:14) "In life, carapace light phlox purple to argyle purple; in alcohol, pinkish buff." Holthuis and Sakai (1970:16), quoting H. Bürger's manuscript notes, stated that this species is "usually reddish purple and white." Sakai (1985:335) reported that the species is "dark purple in natural" color.

Size. - Males, cl 11 to 28.5 mm, cb 12 to 31 mm; non-ovigerous females, cl 15 to 26.5 mm, cb 19 to 30 mm; ovigerous females, cl 20.5 to 23.5 mm, cb 23 to 28 mm. The largest specimens examined by us are larger than any reported in the literature.

Distribution. - Western Pacific, from southern Japan to Nhatrang, Vietnam. Sakai (1976:62) commented: "The distribution of this crab is restricted to the East Asia, Japan, Korea and China. In Japan it is abundant in the Inland Sea and also in the Ariake Bay. The localities formerly recorded for this species, such as Hakodate, Sagami Bay and Suruga Bay are due to error. On the coast of Mikawa Bay, Kii Peninsula, and Tosa Bay this species seems to be rare. In Korea it is common on the Yellow Sea side only; in China it seems to be common from North to South and also to Formosa."

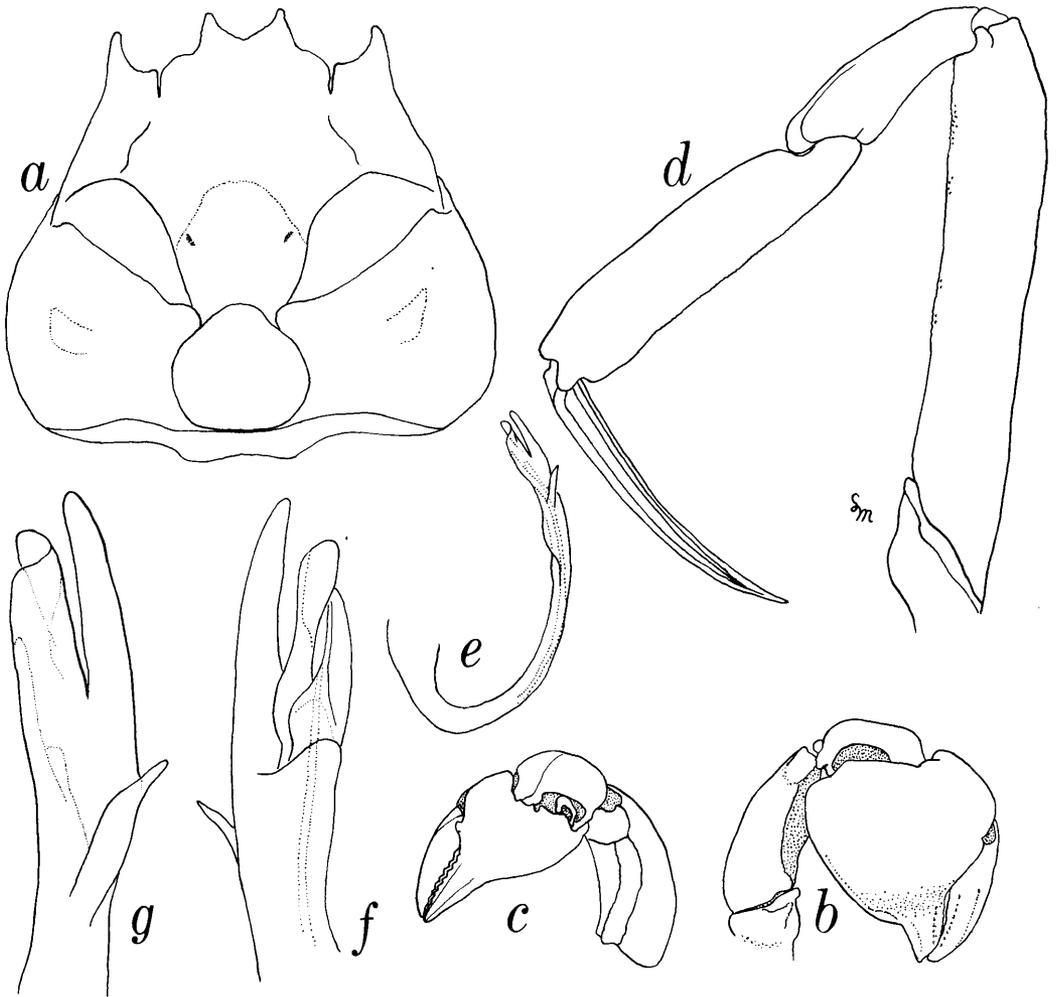


Figure 33. - *Heikea japonica* (Von Siebold). a, carapace; b, c, chelipeds; d, P3; e, gonopod; f, g, apex of gonopod. Holotype of *Neodorippe japonica* var. *taiwanensis* Serène and Romimohtarto, male, cl 15 mm, Taiwan.

From this, and in the absence of subsequent substantiated records, we assume the following record to be erroneous: Hakodate (Stimpson, 1858, 1907). We are unable to place the record by Parisi (1914) of Kujiukuri, Hitachi, reported by Balss as Kujinkuri (Hitachi); if this is Hitachi, at 36°35'N, 140°40'E, on the east coast of Honshu Island, the record certainly is erroneous. Parisi's locality may be in Suruga Bay; we are unable to locate any records from that bay in the literature and Sakai specifically questioned a record from there.

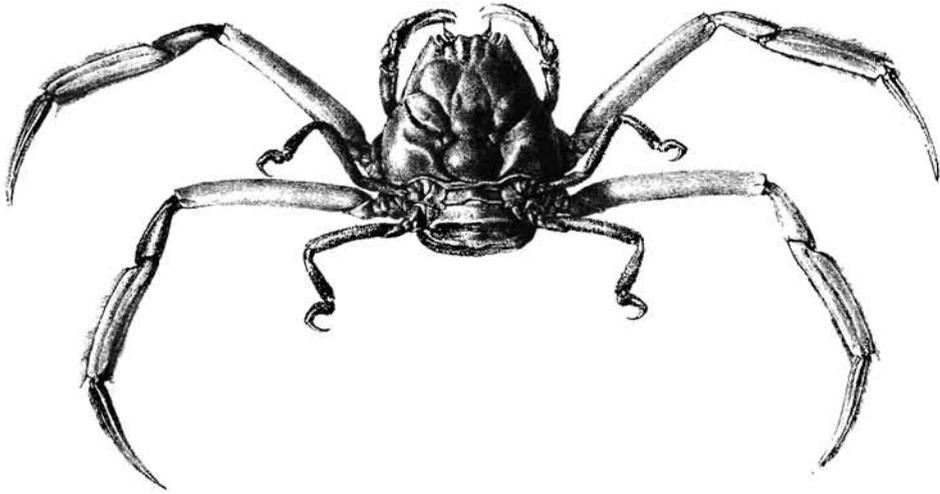


Figure 34. - *Heikea japonica* (Von Siebold). From De Haan, 1839, pl. 31: fig. 1.

Records for this species in the literature include:

Japan (general): Japan (Von Siebold, 1824, 1826; De Haan, 1841; Herklots, 1861; Ives, 1891; De Man, 1896; Parisi, 1914; Sakai, 1936, 1940, 1956, 1980, 1985; Imajima, et al., 1970; Nishimura and Suzuki, 1971; Odawara, 1973; Takeda, 1975, 1982b, 1983; Miyake, 1983).

Japan, west coast of Honshu Island: Ishikawa Prefecture (Anonymous, 1904; Sakai, 1940). - San-in District (Kamita, 1963).

Japan, east coast of Honshu Island: Estuary of Oi-gawa (= Ohi River), 34°46'N, 138°18'E (Terada, 1981). - Enshu Nada, Shizuoka Prefecture, 34°27'N, 137°38'E (Terada, 1981). - Nagoya, Ise Bay, 35°10'N, 136°55'E, fossil (Morita, 1977). - Kii Peninsula (Urita, 1926). - East of Owashi (as Owase, Mie-ken), east coast of Kii Peninsula; 34°02'42"N, 136°20'28"E (Yokoya, 1933, and Horikoshi, et al., 1982, as Tosa Bay). - Wakanoura, Kii (Wakanoura Bay = 34°10'N, 135°10'E) (Rathbun, 1902). - Okayama, 34°39'N, 133°55'E, Inland Sea (Balss, 1922). - Onomichi, 34°25'N, 133°11'E, Inland Sea (Sakai, 1937, 1976). - Yashima, Inland Sea, in a souvenir shop (Sakai, 1937, 1976). - Misaki, Osaka Bay, 33°23'N, 132°08'E (Balss, 1922; Urita, 1942). - Shimonoseki (as Zimonozoki or Zimonoseki), 33°57'N, 130°57'E (Von Siebold, 1824; Nees von Esenbeck, 1825).

Japan, Shikoku Island: Off Matsushige, Itanogun, Tokushima Prefecture (K. Sakai and Nakano, 1983). - Tosa Bay (Quintana, 1987). - Mimase, Tosa Bay, 33°20'N, 133°40'E (Sakai, 1937).

Japan, Kyushu Island: Hizen Hama, Saga Prefecture (Sakai, 1976). - Mizuho, Shimabara Peninsula, 32°45'N, 130°15'E (Sakai, 1976). - Shimabara Peninsula (Miyake, 1961b). - Yasugura, Tomonotu, Bitchu, 32°30'N, 130°44'E (Urita, 1926). - Sea of Ariake (Sagano, 1981). - Off Arao City, and Nanaura, Kashima City, Sea of Ariake (Miyake, 1961b). - Nagasaki, 32°45'N, 129°52'E (De Haan, 1841; Sakai, 1934, 1937; Serène and Romimohtarto, 1969; Sakai and Holthuis, 1970; C.M. Yang, 1979). -

Vicinity of Aitsu Marine Biological Station (Aitsu = 32°30'N, 130°26'E) (Yamaguchi, et al., 1976). - Amakusa, 32°20'N, 130°15'E (Miyake, 1961a, 1961b; Miyake, et al., 1962; Takeda, 1978). - Amakusa Islands (Yamaguchi, et al., 1987). - Teuchi, Shimokoshi-shima (as Teuti, Simonosiki Island), 31°38'N, 129°42'E (Urita, 1926). - Off Shibusu, Osumi (as Sibusi, Ohsumi), 31°28'N, 131°07'E, Kagoshima Prefecture (Urita, 1926).

Korea: Distribution of *H. japonica* in Korea is shown in Kim (1973, fig. 5); Korean localities are listed on p. 8 and are shown in a map on p. 9. Kim (1970, fig. 1, Table 1) provides additional data on localities within Korea. We have been unable to pinpoint most of the Korean localities recorded for this species in the literature (e.g., records in Kamita (1934, 1935, 1936, 1941a,b) and Park (1964) and have had to rely on the works of Kim for locality data. Records in the literature include: Korea (Kamita, 1941b). - Yellow Sea (Kamita, 1934, 1935, 1941a). - Korea Strait (Kamita, 1936, 1941a). - Jinsen (Urita, 1926). - Zinsen (Sakai, 1937; shown in a map by Sakai (1940, fig. 3)). - Wido Island (Kim, 1970, 1973). - Busan, Jinhae, Masan, Asan, Juan, Hancheon, Nanseo, Myeon, and Suun Island (Kamita, 1941b, from Kim, 1973).

China (general): China (S. Yang, 1986; Chen, 1986). - China Seas (Shen and Liu, 1963). - North China (Shen, 1937b).

China, Liaoning Province: Liaoning Province (Zhou and Sun, 1986). - Hulutao, 40°47'N, 121°00'E, Liaodong Wan (as Liaotung Bay), Takushan, Chwangho, 39°40'N, 123°00'E, and Yingkou, 40°40'N, 122°17'E, Liaodong Bandao (as Liaotung Peninsula) (Shen, 1932).

China, Hebei Province: Bo Hai Gulf (as Gulf of Peichihli) (Shen, 1937a). - Qinhuangdao (as Chinwangtao), 39°55'N, 119°37'E, Beidahe (as Peitaiho), 39°50'N, 119°32'E, Yanghokou, and Tapuho (Shen, 1932).

China, Tianjin Shi: Beitang (as Peitang), Chentoukou, Tanggu (as Tangku), 39°00'N, 117°42'E, Bo Hai Gulf (as Peichihli Bay) (Shen, 1932).

China, Shandong Province (= Shantung Province): Yantai (as Chefoo), 37°30'N, 121°22'E, and Yang-ma Tao Island (as Yangmatao), 37°28'N, 121°37'E, northern side of Shandong Bandao (as Shantung Peninsula); Langnuankou, Hsinchiakou, Tapuwei, Haiyang, 36°45'N, 121°15'E, Tingzuchiang, Lutao, Makungtao, Yangchun, Shatsukou, and Qingdao (as Tsingtao), 36°04'N, 120°22'E, southern side of Shandong Bandao (as Shantung Peninsula) (Shen, 1932). - Jiaozhou Wan (as Kiachow Bay); Shandong Bandao (as Shantung Peninsula) (Shen, 1948).

China, Zhejiang Province (= Chekiang Province): Ningbo (as Ningpo), 29°53'N, 121°33'E (Fauvel, 1880; Shen, 1940b). - Wu-sha (as Ou-sha), island near Zhoushan (Zhoushan Islands = 30°05'N, 122°06'E) (Fauvel, 1880). - Haimen, 28°41'N, 121°27'E (Shen, 1940b). - Yen t'ing (as Yenting), 27°27'N, 120°39'E (Rathbun, 1931; Shen, 1940b).

China, Fujian Province (= Fukien Province): Fuzhou (as Foochow), 26°09'N, 119°17'E; Jimei (as Tsimei), 24°39'N, 118°06'E; Xiamen (as Amoy), 24°26'N, 118°07'E (Rathbun, 1931; Shen, 1940b). - Chuanshih (Shen, 1940b).

Hong Kong: Hong Kong (Hong Kong Island = 22°15'N, 114°11'E) (Shen, 1931). - Shaukiwan District (Shen, 1931, 1940a). - Cheung Chau (Shen, 1940a).

Taiwan: Anping, 23°01'N, 120°08'E (Maki and Tsuchiya, 1923; vide Lin, 1949). - Chilung (as Keelung), 25°10'N, 121°43'E (Serène and Romimohtarto, 1969; C.M. Yang, 1979). - Hsiak'unshen and Tingch'ieting (Lin, 1949).

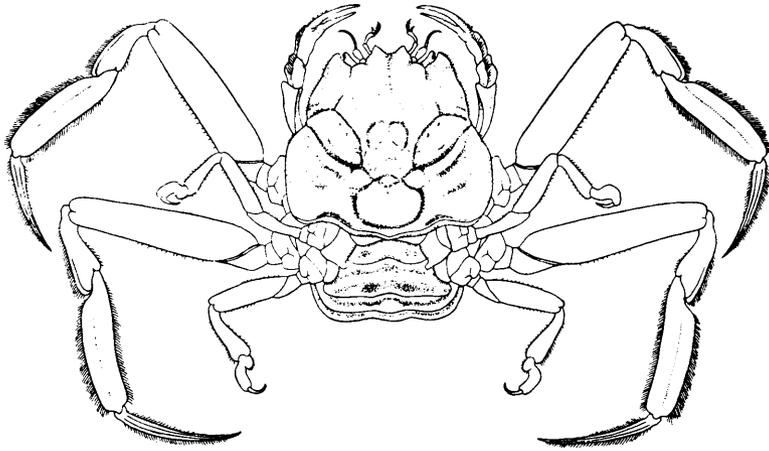


Figure 35. - *Heikea japonica* (Von Siebold). From Shen, 1932, fig. 6.

Vietnam: Gulf of Tonkin (as Beibu Gulf) (Dai and Song, 1986). - Nhatrang Bay, 12°15'N, 109°12'E (Serène and Romimohtarto, 1969; C.M. Yang, 1979). - Récolte 102, Annam ("à proximité de la Station Maritime de Cauda, Nhatrang") (Serène, 1937).

South China Sea: Paracels (Paracel Islands = 16°30'N, 112°15'E) (Dawydoff, 1952).

Fossil Record. - Holocene fossils of *H. japonica* have been recorded by Kaneko (1958) from the Umeda Formation, Osaka City, and by Morita (1977) from Nagoya, Ise Bay.

Habitat. - Judging from the limited (and conflicting) information available, this is a sublittoral species, often taken in fishermen's nets. We have found the following observations in the literature: Dredged in about 8 to 15 fathoms (= 15-27 meters) on sand and muddy bottoms (Shen, 1931) and taken by fishing nets, not far from the coast (Shen, 1932, who studied more than 200 specimens). Dredged not far from the coast, in 8 to 15 fathoms - very common in North China (Shen, 1937a), where it was taken with *Paradorippe granulata*. Sakai (1937:73) noted that it was "Found on sandy or muddy bottoms at 50 to 130 metres deep," but later (1976:61) commented that it was "Found on the mud-flats or shallow waters, about 20 to 30 metres deep." Yokoya (1933) recorded a specimen from a depth of 132 meters and Horikoshi, et al. (1982) reported the same material from sand/shells; they may have been dealing with *H. arachnoides*. Serène and Romimohtarto (1969) reported a specimen taken by fishing trawlers on a sandy, muddy bottom in 12 meters. Miyake's (1961b) material was collected with a shrimp trawl. Holthuis and Sakai (1970:116) noted that "During the summer months this species is often caught in seines, together with small *Portunus* species, around Nagasaki, but is seldom eaten." K. Sakai and Nakano (1983) reported specimens collected at a depth of 20 meters.

Specimens examined by us were taken in depths of 7, 25, and 18-37 meters; with one lot there was a notation that the species was taken in nets.

Biology. - Like other members of the Dorippinae, *H. japonica* may carry an object over its back. In one of the lots (from Nan'ao Island) studied by us from the collections of the Zoological Museum in Copenhagen the specimens are accompanied by an anemone. Sakai (1937:73) remarked that "The animal is always protected by a dead shell or other material such as a piece of dead *Laganum* [a sand dollar], which are held by aid of the reduced posterior pairs of the legs," and (1976:61) "The animal is always protected by a piece of bivalved shell, *Laganum* or wooden-piece, which are held by aid of the reduced posterior two pairs of the legs."

Our material included ovigerous females taken in April (Xiamen), June (Hong Kong), and July (Xiamen). Balss (1922) recorded an ovigerous female taken in October, and Shen (1932) recorded ovigerous females taken from May to August. Miyake (1961b) and Yamaguchi, et al. (1987) noted that the egg bearing season in Amakusa was late May.

The four zoeal stages were described and figured by Terada (1981). Quintana (1987) described the megalopa, the first crab stage, and the adult.

The gastric mill of this species was studied by S. Yang (1986).

Remarks. - The species is too small to be of importance as food. H. Bürger, who collected in Japan between 1826 and 1834, stated (in manuscript) that near Nagasaki the "species is often caught in seines ... but is seldom eaten" (Sakai and Holthuis, 1970:116). Also Sakai (1985:335) remarked that "*Neodorippe japonica* is rather small and lacking in meat, so that no one has interest in using them for food." The only commercial use that is made of specimens of Heike gani seems to be by the souvenir trade.

The idea that fishermen would throw back specimens of this crab because of the Heike-Genji legend seems highly unlikely. Specimens are not kept because they are not appreciated as food. To see a kind of "artificial selection" in this rejection of the species on the part of fishermen, as suggested by J.S. Huxley (1952) and Carl Sagan (1980), is ludicrous, as Sakai (1985:335, 336) made amply clear.

Serène and Romimohtarto (1969:13), in their account of *Neodorippe* (*Neodorippe*) *japonica*, noted apparent differences between accounts of this species from China (Shen, 1932:11) and Japan (Sakai, 1937:72), and related these differences to their material of *Heikea japonica* from Vietnam and Japan. They also (p. 14) recognized a subspecies of *H. japonica*, which they named *Neodorippe* (*Neodorippe*) *japonica* var. *taiwanensis* from an undetermined locality off Taiwan, based on the following characters: 1), smaller size of adults, a male of cl 15.5 mm having an inflated palm; 2), longer and slimmer ambulatory legs (P2 and P3); and 3), slight differences in the apex of the second male pleopod.

They noted that according to Shen's account, *Heikea japonica* from China had relatively short P2 and P3, with P3 less than 3 times as long as the carapace, and the merus on P3 4.5 rather than 5 times longer than high, as in their material and in Sakai's figure. This latter figure (Sakai, 1937, pl. 10: fig. 1), based on material from Japan, shows a male *H. japonica*, 20 mm long, with relatively sharp frontal teeth, subequal chelipeds, and long slender walking legs. Serène and Romimohtarto (1969:13) concluded that "The position of the specimens of Shen in regard to *japonica* is doubtful and the variations of the species need further observations."

The characters used by Serène and Romimohtarto to distinguish their subspecies *taiwanensis* appear to us to be too variable to be reliable. As pointed out by them, the male they identified with their subspecies showed an inflated palm on the right chela at cl 15.5 mm; in our material the chela may be inflated in specimens as small as cl 19.5 mm, but not in all specimens; it is inflated in all males above cl 22 or 23 mm. As we note below under our account of *Paradorippe granulata* (q.v.), populations of that species showed considerable variation in the size at sexual maturity. Although Shen (1932, legend to fig. 7c) suggested that the inflated chela in a male was an abnormal development, we have found it to be a normal feature of adult males within the Dorippinae.

The longer, slimmer legs said by Serène and Romimohtarto to be characteristic of their subspecies appear to us to fall within the range of variation of this feature in *H. japonica*. They noted that the merus of P3 was 5.93 times longer than high in *H. j. taiwanensis*, 5.25 times longer than high in *H. japonica* proper. This ratio in our material ranged from 4.0 to 6.3; it varied from 4.0 to 5.8 in males from the same lot (from Kagoshima). In another lot of females from Japan, cl 20 to 23.5 mm, the ratio ranged from 5.8 to 6.3.

The material of *Heikea japonica* available to us, including one of the types of *Neodorippe japonica* var. *taiwanensis*, leads us to believe that the features used to distinguish *H. japonica taiwanensis* from *H. japonica* fall within the range of variation of *H. japonica*. We consider *H. japonica taiwanensis* to be a synonym of *H. japonica*.

However, we have recognized a second species of *Heikea* from Japan, *H. arachnoides*, on the basis of slenderness and length of P2 and P3. These differences are discussed above under the account of *H. arachnoides*.

*Heikea japonica* has a prominent position in Chinese and Japanese folklore, considered in some detail by Neuville (1938) and Sakai (1985), and to a lesser extent by Ward (1937) and Muraoka (1985).

Balss (1922:118) quoted a letter from Herr Lampert, from Stuttgart, as follows:

"Es wird Sie interessieren, näheres über eine abergläubige Vorstellung zu erfahren, welche die Japaner mit diesem Krebs verbinden. Er wird bei Shimonoseki gefunden und und heisst Heiki; in ihn sollen die Seelen der Ertrunkenen gefahren sein, welche bei einer zwischen den grossen Geschlechtern Minamoto und Taira (chinesisch: Heika) im 12. Jahrhundert stattgehabten gewaltigen Seeschlacht ums Leben gekommen sind. Die Krebse werden in Japan, speziell in Shimonoseki als Kuriosum verkauft; meinem Freunde wurde dabei auch diese Sage erzählt, interessanterweise aber anstelle der Seeschlacht von Danno-ura im 12. Jahrhundert die Seeschlacht von Tsushima gesetzt." Balss' correspondent had incorrectly attributed this observation to *Paradorippe granulata* instead of *Heikea japonica*.

Schmitt (1931:222; 1965:143) commented that in some places in the Orient *Dorippe* [sensu lato] is considered to be sacred, and that the "face" on the crab is the reflection of a dead relative whose soul resides in the crab. Ingle (1982:650), who dealt with *Dorippe sinica*, remarked that "In parts of the Orient *Dorippe* is regarded as sacred because the "face" is thought to be that of a deceased relative whose soul has passed into the crab."

The best known legend inspired by the resemblance of the surface sculpture of the carapace in this species to a fierce looking human face is that of the Japanese Heike family. According to Sakai (1985:334), in 1185 two Japanese feudal families fought desperate sea battles at Yashima, Kagawa Prefecture, and at Dannoura, Yamaguchi Prefecture, deciding the fate of these families. 24 March [1185] is the day when the Heikes were annihilated at Dannoura by the Genjis (see Frontispiece). The historical fact gave rise to a legend that departed spirits of the Heikes appeared in the guise of the crab whose carapace looked like a human face, expressing fierce anger and deep grief. As pointed out by Sakai, other names have been given to the species, based on the names of well known Japanese historical personalities who drowned or were slain.

Neuville (1938) also summarized the Heike versus Genji story, and pointed out that the same species appeared in similar legends in Chinese coastal areas. He also showed that the face-like arrangement of grooves and bumps on the carapace of the crabs inspired Japanese artists, who used it as a decoration on various objects. Muraoka (1985) also commented on the legend, and it was repeated in Anonymous (1944), in the legend to a figure of *H. japonica*.

### Genus *Medorippe* Manning and Holthuis, 1981

*Medorippe* Manning and Holthuis, 1981:31 [type species *Cancer lanatus* Linnaeus, 1767, by original designation and monotypy; gender feminine].

Definition. - Carapace wider than long, lacking large tubercles or spines, except lateral branchial tooth, but with many low, small tubercles; ridges distinct, relatively low; grooves distinct, relatively shallow. Surface bare or covered with low pubescence, often dense enough to obscure details of surface sculpture. Cervical groove indistinct. Branchial grooves deep and well-defined, anterior margin defined by raised ridge, recurved mesially at epibranchial margin. Branchiocardiac groove moderately deep. Protogastric region with low tubercle on each side. Mesogastric region low, ornamented anteriorly with submedian pit on each side, posterolaterally by row of short, narrow grooves, ending in pits along cervical groove. Cardiac region usually with distinct V- or Y-shaped ridge, flanked laterally by low tubercle. Mesobranchial region with strong lateral branchial tooth, a curved dorsobranchial ridge, and 1 dorsobranchial tubercle.

Front with 2 obtuse, triangular teeth; exhalent canal visible in dorsal view. Inner orbital teeth very low, falling short of level of frontal teeth. Dorsal surface of frontal teeth with low but distinct conical projection. Posterior margin of orbit with fissure. Outer orbital tooth triangular, pointed, reaching well beyond front. Lower orbital margin smooth; inner suborbital tooth slender, reaching to level of outer orbital tooth. Eyes elongate but stout, cornea ventrolateral.

Left and right chelipeds equal and similar in both sexes (possibly unequal in very large males). Palm tuberculate, covered sparsely with short hairs, lower margin smooth, merging evenly with margin of fixed finger. Fingers about twice palm length, both fingers with 2 grooves separated by a ridge. Upper margin of dactylus ridged, lower margin of fixed finger grooved. Cutting edges of fingers with about 13 low, rounded teeth, evenly distributed over edge. Palm with shallow longitudinal

groove in upper part of outer surface. Dorsal margin of palm and basal part of dorsal margin of dactylus with fringe of short hairs. Lower surface of palm tuberculate, with ridge lined with hairs on either side. Carpus sparsely tuberculate and hairy. Merus sparsely tuberculate and hairy, with larger tubercles ventrally.

Second and third pereopods longest, third longest of all legs. Merus distinctly flattened, with line of erect spines or lower spinules dorsally and with distal dorsal spinule, covered by short pubescence; some longer hairs present dorsally. Carpus and propodus pubescent, with some longer hairs dorsally; ventral margin of propodus serrate. Dactylus naked and twisted. P3 of female lacking spur on ischium. Coxa of P3 in both sexes lacking swollen, sausage-like callosity.

Sternum finely granular and tomentose. Sternite of P1 with low ridge on each side, flanked anteriorly by deep pit. Sternites of following two somites with indistinct transverse ridge on each half. In male all three sternites exposed, in female first two and part of third exposed. Female gonopore on swollen tubercle but not on ridge. No median spine present on any thoracic sternites in female. Abdomen of male with first somite trapezoidal, widening posteriorly, posterior margin concave; upper surface with median swelling. Second somite longer and wider than first, with 3 low prominences in transverse row. Third somite widest of all, with 3 low, rounded tubercles. Fourth somite narrowing, with low transverse ridge. Fifth somite narrowing posteriorly, with low transverse swelling. Sixth somite strongly narrowing posteriorly. Telson triangular, with rounded apex.

Abdomen of adult female very wide, unarmed, with conspicuous transverse ridges on second to fifth somites. Telson about as long as wide, apex rounded.

First pleopod of male short, stout, and straight, with lobe at outer margin of base, apex acute, sharp, abruptly turned outward, without distal or subdistal appendages.

Remarks. - This genus is represented in the Indo-West Pacific region by one species, *Medorippe lanata* (Linnaeus, 1767). This species, otherwise a common species known only from localities in the Mediterranean and off tropical West Africa (Manning and Holthuis, 1981), is known to occur from southern Africa to Madagascar.

The generic definition also serves as a species description.

### *Medorippe lanata* (Linnaeus, 1767)

Figures 36-38

*Cancer lanatus* Linnaeus, 1767:1044 [type locality "in M. Mediterraneo"].

*Dorippe lanata*. - Stebbing, 1910:339. - Barnard, 1950:389, fig. 73d; 1955:4. - Guinot, 1967:244. - Kensley, 1981:38.

*Medorippe lanata*. - Manning and Holthuis, 1981:31, fig. 4a-h.

*Medorippe crosnieri* Chen, 1987:681, fig. 2, pl. 1: figs. D,E [type locality northwest coast of Madagascar, 15°20'S, 46°11.8'E, depth 245-250 m].

Material. - Mozambique: 25°02.2'-25°05'S, 34°50.3'-34°44.2'E, 90-92 m, 25 Nov 1988, B. Collette, *Vityaz* Sta. 2634A, 1 ♂ (W).

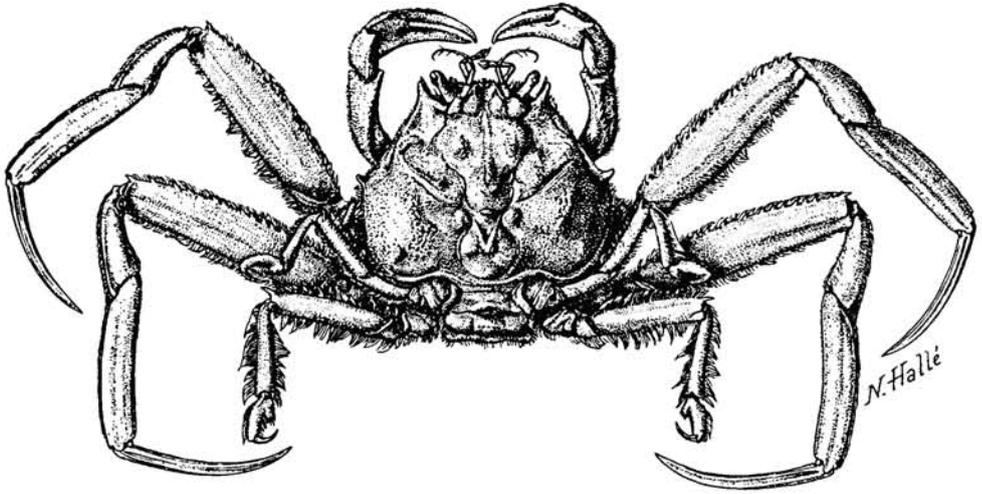


Figure 36. - *Medorippe lanata* (Linnaeus). From Monod, 1956, fig. 103.

South Africa: Off Durban, Natal, 29°54'25"S, 31°09'45"E, 128 m, sand, gravel, dredge, 28 Aug 1929, Th. Mortensen, Sta. 31, 1 ♀ (C). - 29°54'40"S, 31°22'10"E, 75 m, sand with concretions, dredge, 26 Aug 1929, Th. Mortensen, Sta. 26, 1 ♂, 1 ovigerous ♀ (C). - Off South Africa, trawl 1 + 3, 25 Dec 1977, H. Champion, 1 ♂, 4 ♀ (3 ovigerous) (SAM).

Size. - The recorded maximum size for the species is cl 30 mm, cb 40 mm. In the specimens examined, males have cl 12.4 to 16.5 mm, cb 14.4 to 21 mm; non-ovigerous females have cl 14.5 to 16 mm, cb 18.4 to 22 mm; ovigerous females have cl 13.7 to 17.6 mm, cb 17.9 to 22.6 mm. The types of *M. crosnieri*, all juveniles, have cl ranging from 9.9 to 15.7 mm, cb 12 to 19.9 mm (Shen, 1987).

Distribution. - Mediterranean Sea and Portugal to Angola (Manning and Holthuis, 1981); southern Africa from Natal, South Africa, to Mozambique, and Madagascar. Indo-West Pacific records are as follows:

Mozambique: Maputo Bay (as Delagoa Bay), 25°48'S, 32°51'E (Barnard, 1955).

Madagascar: 15°25.7'S, 46°01'E; 15°21'S, 45°12.5'E; 15°20'S, 46°11.8'E (all Chen, 1987).

South Africa: Natal, off mouth of Umdloti (as Umhloti) River, 29°39'S, 31°08'E (Stebbing, 1910; Barnard, 1950). - Off Tugela River mouth, 29°14'S, 31°30'E, and Great Fish Point, 33°32'S, 27°02'E (Barnard, 1950).

A. Milne Edwards (1868) listed this species from Zanzibar, but gave no details of his material other than that it had been collected by Alfred Grandidier. In the old collection of the Muséum National d'Histoire Naturelle, Paris there is one specimen of *Dorippe* sensu lato from Zanzibar, collected by Grandidier. A. Milne Edwards' record clearly was based on this specimen which proves to belong to *Dorippe quadridens*. Miers (1884:185) included Zanzibar in the range of *Dorippe quadridens* without citing any material from these in the collections examined by him; his record may have been based on that of Milne Edwards.

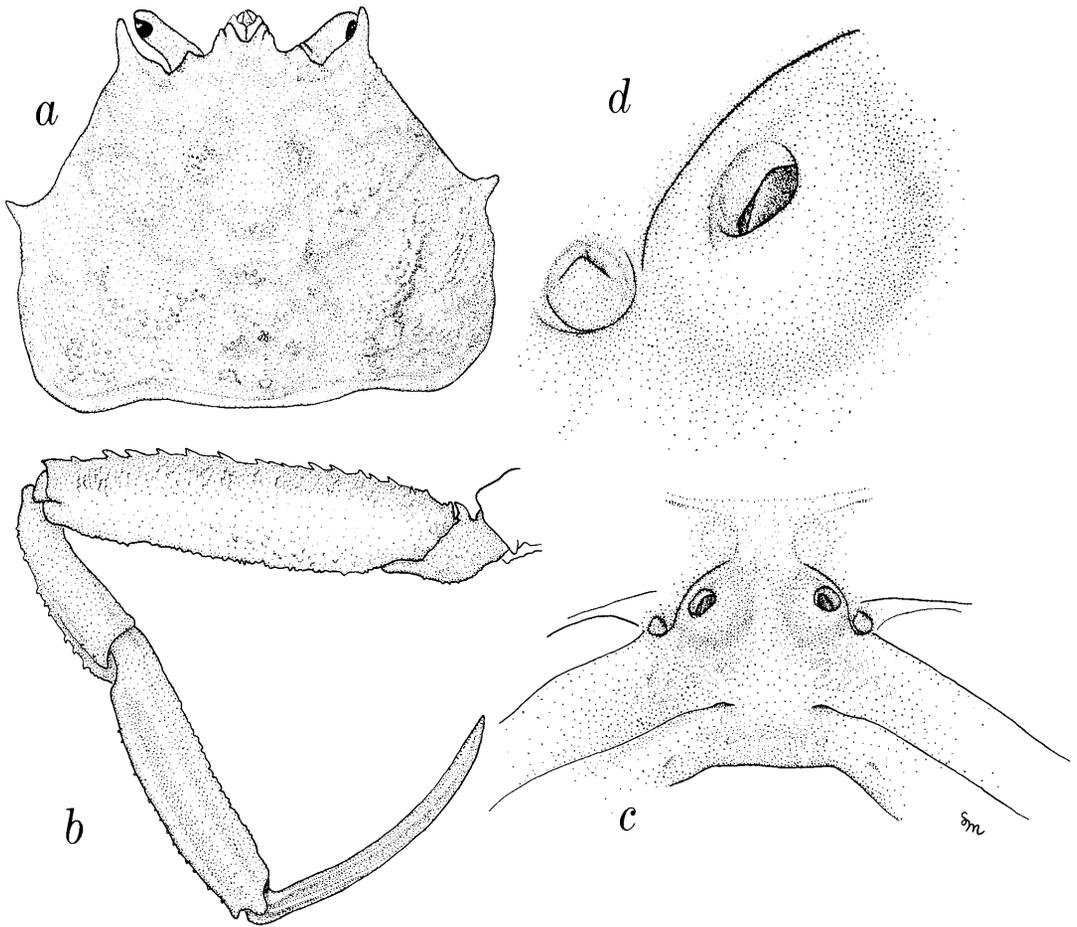


Figure 37. - *Medorippe lanata* (Linnaeus). a, carapace; b, P3; c, sternum and gonopores; d, gonopore, enlarged. Oviparous female, cl 16 mm, South Africa.

Barnard's (1926) record of *Dorippe lanata* from Mozambique ( $26^{\circ}17'S$ ,  $33^{\circ}10'E$ , in 415 meters), however, was a lapsus and actually was based on *Dorippe quadridens* (see the account of that species in Barnard, 1950:391).

We have placed Seréne's (1937:77) record of *D. lanata* from Indo-China under *D. quadridens*, above.

Habitat. - Off southern Africa this species has been recorded in depths between 46 meters (Stebbing, 1910) and 30-46 fathoms (= 55-84 meters) (Barnard, 1950); Kensley (1981) gave the depth range off South Africa as 48-90 meters. Chen's material from Madagascar was taken in 150, 200-210, and 245-250 meters. Material reported here was collected in 75, 90-92, and 128 meters.

Habitat indications that accompanied our specimens included sand and gravel and sand with concretions.

Elsewhere the species generally occurs in depths of less than 100 meters (Manning and Holthuis, 1981).

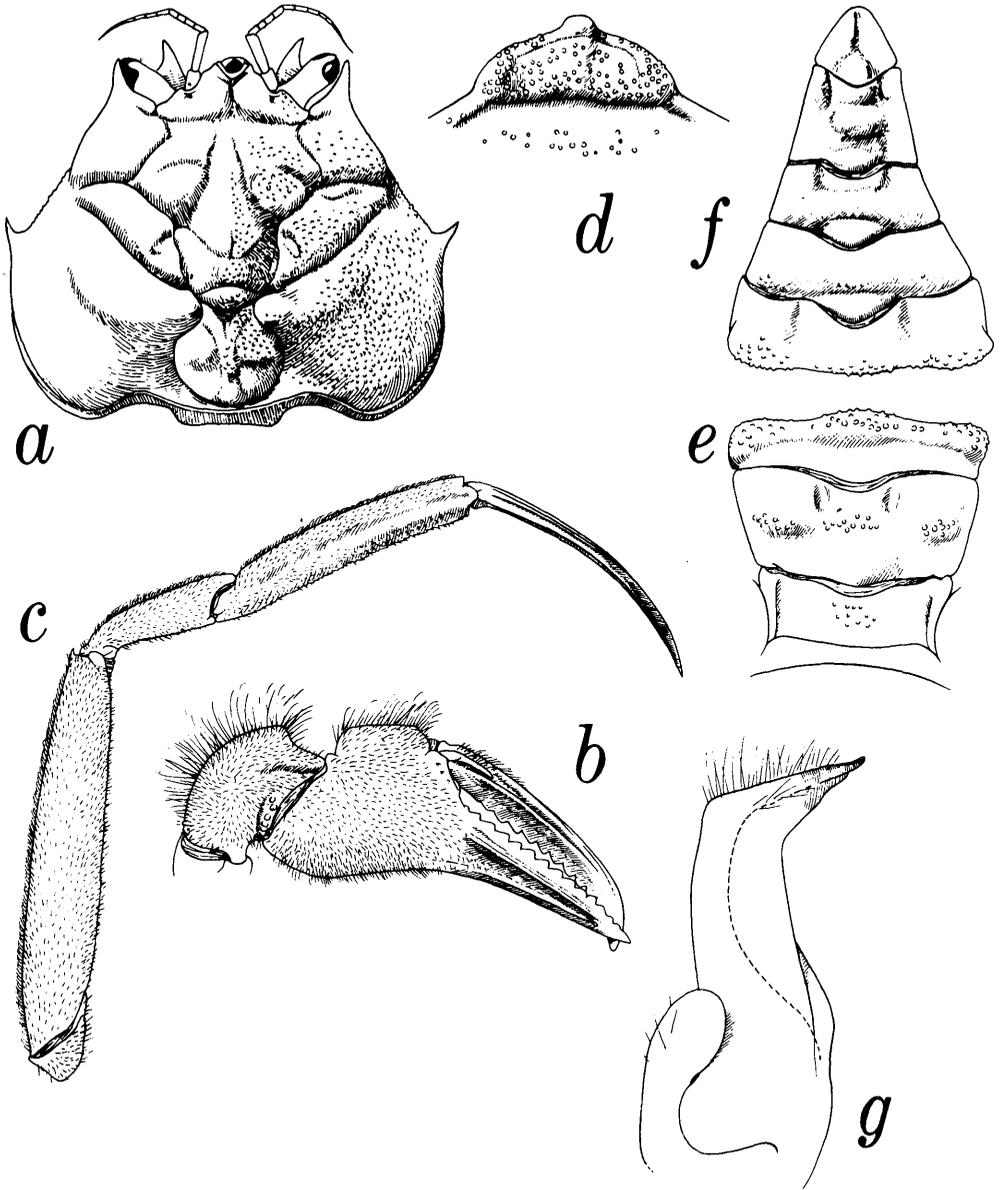


Figure 38. - *Medorippe lanata* (Linnaeus). *a*, carapace; *b*, chela; *c*, P2; *d*, sternum; *e*, abdomen, dorsal view; *f*, abdomen, ventral view; *g*, gonopod. Male holotype of *M. crosnieri* Chen, cl 15.7 mm, Madagascar. From Chen, 1987, fig. 2.

Biology. - One ovigerous female was taken off Durban in August; others were taken off South Africa in October.

Remarks. - As we pointed out earlier (Manning and Holthuis, 1981:34), the figures of *Medorippe lanata* and *Phyllodorippe armata* in Monod's 1956 monograph were reversed; his fig. 102 shows *Phyllodorippe armata* and fig. 103 shows *Medorippe lanata*.

We believe that *Medorippe crosnieri* Chen is based upon juveniles of *Medorippe lanata* (Linnaeus). The characters used by Chen prove to be variable in the large series of *M. lanata* from the eastern Atlantic available to us. The characters used by Chen to differentiate *M. crosnieri* include: (1) The body with short, thin hairs rather than short, club hairs; the condition of the hairs on the body is very variable, especially in smaller specimens. (2) The granules of the body are less prominent; again, this is characteristic of juveniles. (3) The anterior borders of the merus of P2 and P3 are smooth except on the basal part of the merus of P2; the spines on the anterior margin of the merus often are poorly developed in juveniles. The meral spines on P2 and P3 are visible in all five specimens from the collection of the South African Museum, but they are concealed by hairs. They are very small of a female TL 17.6 mm, more visible proximally on P2 than on the remainder of the meral surfaces. (4) *M. crosnieri* is less densely covered with short hairs; this feature apparently varies throughout the range of *M. lanata*. Further, the gonopod of *M. crosnieri* (Figure 38g) appears to be indistinguishable from that of *M. lanata* from the eastern Atlantic.

We could find no differences in the armature of the walking legs and the structure of the male gonopod and female gonopore in representatives of this species from the Indian Ocean and the eastern Atlantic. The V-shaped ridge on the cardiac region may be less prominent in Indian Ocean specimens of this species than it is on material from the eastern Atlantic.

For other references to *M. lanata*, accounts of the species in Monod (1956) and Manning and Holthuis (1981) should be consulted.

### Genus *Neodorippe* Serène and Romimohtarto, 1969

*Neodorippe* Serène and Romimohtarto, 1969:3, 4, 11 [type species *Dorippe callida* Fabricius, 1798, by designation by the International Commission on Zoological Nomenclature; gender feminine; name placed on the Official List of Generic Names in Zoology in Opinion 1437 (see International Commission, 1987a:139)].

*Dorippe*. - Manning and Holthuis, 1981:30. - Holthuis and Manning, 1985:304, 305.

Definition. - Carapace distinctly flattened, longer than wide or with length and width subequal, appearing elongate, surface smooth, lacking large tubercles or spines, grooves distinct but relatively shallow. Surface generally bare, occasionally with short hairs, especially laterally. Mesogastric region low, ornamented anteriorly with submedian pit on each side, posteriorly with row of short, narrow grooves ending in cervical groove. Branchial grooves distinct. Epibranchial region posteriorly with transverse, irregular row or rows of pits. Urogastric region a low, rounded prominence flanked anterolaterally by low branchial lobes, latter scarcely distinct from mesobranchial region. Lateral margin of carapace lacking lateral branchial spine, margin smooth or granular, occasionally with short hairs.

Front consisting of 2 triangular teeth directed anteriorly, opening of exhalent canal not visible in dorsal view. Inner orbital angle low but distinct, a flattened or convex lobe. Posterior margin of orbit with closed fissure but no tooth, shallow, sinuous groove extending posteriorly from fissure to cervical groove. Exorbital tooth extending to anterior margin of inner orbital lobe, falling far short of front. Inner suborbital tooth bluntly triangular, falling short of apices of exorbitals. Lower orbital margin smooth. Eyes short and stout, widening distally, cornea ventrolateral.

Chelipeds of females and most males equal in size and shape; in adult males chelipeds distinctly unequal, right larger. Small chelae with fingers slender, curved downward at slight angle to palm, each finger with 2 uninterrupted grooves on both inner and outer surfaces; 1 such groove on upper surface of dactylus and on lower surface of fixed finger. Cutting edges of chelae with 14-15 teeth of equal size; on smaller specimens and on smaller chelae, teeth sharper and more triangular than on larger specimens or larger chelae. Outer surface of palm smooth, at most lightly pitted, with some short hairs scattered over surface, especially laterally. Upper part of outer surface of palm with shallow, inconspicuous groove extending from articulation with carpus to that with dactylus. Inner surface of palm smooth, with line of setae extending proximally from fixed finger. Dorsal margin of palm and dactylus with fringe of short hairs, lower margin of palm with irregular rows of short hairs, longer distally, reduced on enlarged chelipeds. Carpus and merus smooth, with short setae but no enlarged granules.

Second and third pereopods long, third longest of all legs, segments flattened, unarmed, surface smooth, at most sparsely and lightly granular, with scattered short setae. Dactyli flattened, with long fringes of setae on dorsal and ventral margins. Lower margin of carpus and especially propodus with fringe of long hairs, posterior surface usually naked, occasionally lightly pubescent or sparsely setose. P3 of female lacking spur-like process on ischium as well as sausage-like callosity on coxa.

Sternum smooth. Sternite of P1 with transverse carina on each side, not terminating mesially in distinct tubercle. Sternites of second and third pereopods with broad, low, indistinct, transverse ridge on each side. In male anterior 3 sternites exposed, in adult female most of third sternite covered by abdomen. Exposed part of this sternite in female showing very faint ridge; part of sternite covered by abdomen lacking any trace of ridge. Female gonopores oval, placed slightly obliquely in submedian area of sternite, not sunken at all, being completely visible when abdomen is lifted. Sternite 4 of female with distinct median spine.

First somite of male abdomen trapezoidal, widening posteriorly, posterior margin excavate in middle, upper surface with oblique longitudinal groove on each side. Second somite widening posteriorly, with low, rounded, median protuberance. Third somite trilobed, lateral parts more swollen than median. Fourth to sixth somites with low, blunt median elevation and shallow, transverse groove anteriorly. Telson triangular, apex rounded. No tubercles or teeth on abdomen.

First pleopod of male enlarged basally, distal 2/3 slender. Apex with proximal rounded lobe and straight, sharp distal projection.

Remarks. - The genus *Neodorippe* was established by Serène and Romimohtarto in 1969. They subdivided it into two subgenera: *Neodorippe* sensu stricto and *Nobilum*. They assigned the species *Dorippe callida* (named by them *Neodorippe* (*Neodorippe*) *astuta*) and *Dorippe japonica* Von Siebold to the subgenus *Neodorippe*, and *Dorippe*

*histrion* Nobili to the subgenus *Nobilum*. In our opinion, Serène and Romimohtarto's subgenera are sufficiently distinct that they should be recognized as genera. *Dorippe japonica*, transferred by us (Manning and Holthuis, 1981:31) to *Nobilum*, has been assigned herein to the new genus *Heikea*. We recognize *Nobilum* for *Dorippe histrion*, and *Neodorippe* as a monotypic genus, containing only *Dorippe callida*.

Serène and Romimohtarto (1969) designated *Dorippe astuta* Fabricius, 1798, as the type species of their new genus *Neodorippe*. The type specimens of *Dorippe astuta*, when examined by us, showed that *D. astuta* is synonymous with *Cancer facchino* Herbst, 1785, and that the species that Serène and Romimohtarto named *D. astuta* actually should be known as *D. callida* Fabricius, 1798. The type selection for *Neodorippe* thus rests on a misidentification. In compliance with Article 70(b) of the *International Code of Zoological Nomenclature*, we referred the case (Holthuis and Manning, 1985) to the International Commission on Zoological Nomenclature with the request that under their Plenary Powers *Dorippe callida* Fabricius, 1798 be made the type species of the genus *Neodorippe* so that the latter name can continue to be used in the sense intended by Serène and Romimohtarto (Manning and Holthuis, 1981:30, 31). In their Opinion 1437, the International Commission (1987a:139) granted this request, and, under their Plenary Powers, designated *Dorippe callida* Fabricius, 1798, as the type species of the genus *Neodorippe*.

The forwardly produced front, the narrow and smooth carapace, the small size of the animal, the fringes of long hairs on both margins of the dactyli of the second and third pereopods, and the shape of the male gonopod all distinguish this genus from the other genera of the subfamily Dorippinae.

The type and only species of the genus *Neodorippe* is:

### *Neodorippe callida* (Fabricius, 1798)

Figures 39-42

*Dorippe callida* Weber, 1795:93 [nomen nudum]. - Fabricius, 1798:362 [type locality in Mari Asiatico (? = Tranquebar, India)]. - Latreille, 1802:127. - H. Milne Edwards, 1837:157. - De Haan, 1841:123. - Herklots, 1861:138. - Zimsen, 1964:651. - Manning and Holthuis, 1981:30. - Holthuis and Manning, 1985:304, 305. [Name placed on the Official List of Specific Names in Zoology in Opinion 1437 (see International Commission, 1987a:139).]

*Dorippe callida*. - Bosc, 1802:208.

*Cancer astutus*. - Herbst, 1803:45, pl. 55: fig. 6 [not *Dorippe astuta* Fabricius, 1798 = *Dorippoides facchino* (Herbst, 1785)].

*Dorippe calida*. - A.-G. Desmarest, 1830:263.

*Dorippe astuta*. - H. Milne Edwards, 1837:157. - White, 1847:54. - Walker, 1887:108, 111. - Ortmann, 1892:562. - Henderson, 1893:405. - Alcock, 1896:280. - De Man, 1896:370. - Lanchester, 1900:769. - Nobili, 1900:496; 1903a:12; 1903b:26. - Rathbun, 1910a:305. - Ihle, 1916:151-153, 156. - Shelford, 1916:300. - Rathbun, 1931:99. - Suvatti, 1938:59. - Gravely, 1941:81. - Chhapgar, 1957a:409, pl. 3: figs. d,e; 1957b:524, 532, 542; 1957c:11, 62, 80, pl. 3: figs. d,e. - Hashmi, 1963:238. - Shen and Liu, 1963:142. - Serène, 1968:40. - Parenti, et al., 1971: *DORIPPE* (1). - Starobogatov, 1972:333. - Naiyanetr, 1980:25. - Manning and Holthuis, 1981:30. - Holthuis and Manning, 1985:304. - Dai and Song, 1986:61.

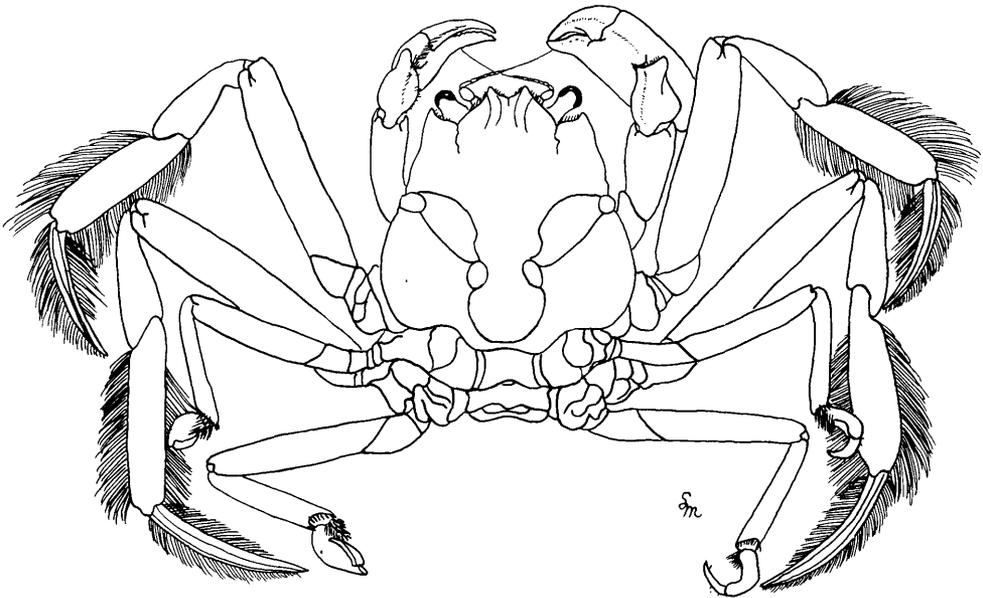


Figure 39. - *Neodorippe callida* (Fabricius). Male, cl 13 mm, Jimei.

*Dorippe astuta*. - Lucas, 1840:116.

*Dorippe Astuta*. - Herklots, 1861:138.

*Dorippe* Walker, 1890:86.

*Dorippe satuta*. - Shen, 1940b:70, 76.

*Dorippe astuda*. - Suvatti, 1950:143.

*Doryppe astuta*. - Dawydoff, 1952:139.

*Neodorippe (Neodorippe) astuta*. - Serène and Romimohtarto, 1969:11, figs. 3, 7, 27, 17A,B, pls. 1D, 4A,B. - C.M. Yang, 1979:3.

*Dorippe astuta*. - Khan and Ahmad, 1975:75.

*Dorippe (Neodorippe) astuta*. - Tirmizi, 1980:104. - Tirmizi and Kazmi, 1983:367, 376.

*Neodorippe callida*. - Manning and Holthuis, 1981:31. - Holthuis and Manning, 1985:304. - Chen, 1986:122, 139, figs. 4:17-19. - Ng, 1987:15, 16, figs. in color.

*Neodorippe (Neodorippe) callida*. - Ng and Tan, 1986:45, fig. 1. - Tan and Ng, 1988:102, fig. 1.

Vernacular Name. - "Puh [= crab] Mangmum" (Thailand; on field label of specimen from Lem Sing, Gulf of Thailand). - Leaf porter crab (Ng, 1987).

Material. - Red Sea: Red Sea, 4 ♂, 1 ♀ (L).

Indian Ocean: Indian Ocean, 1 ♂, 1 ♀ (BM).

Pakistan: Karachi (Karachi Harbor = 24°47'N, 66°59'E), 1982, 1 ♂, 2 ♀ (BM).

India: Asiatic Seas (? = Tranquebar, India, 11°02'N, 79°51'E), 1793-1798, I.K. Daldorff, 1 ♂, 1 ♀ (lectotype and paralectotype, respectively, of *Dorippe callida* Fabricius, C). - "Cancër Astutus Faem. Banks. Coll.F.", 1 ♀ (BM). - Madras, 13°05'N, 80°17'E, 1892, J.R. Henderson, 1 ♂, 1 ♀ (BM).

East Indies: East Indies, 1881, Capt. Thomsen, 2 ♂ (C).

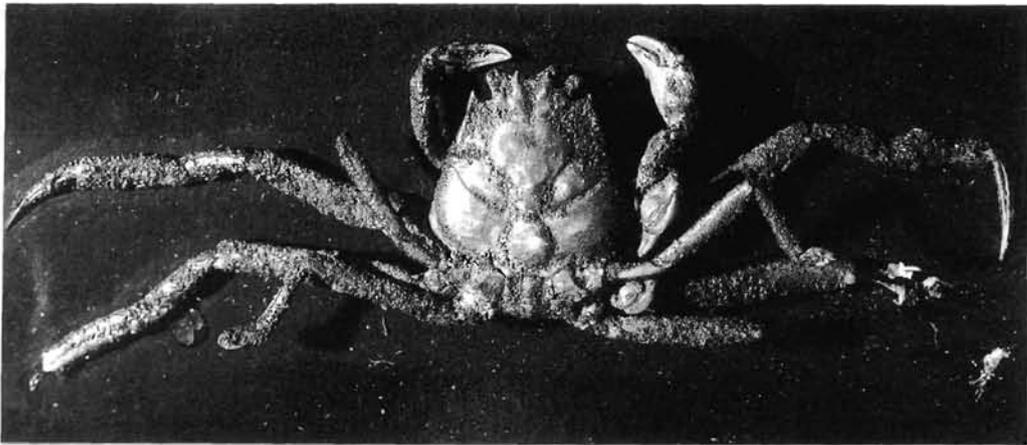


Figure 40. - *Neodorippe callida* (Fabricius). Male lectotype, cl 12.6 mm, Tranquebar.

Malaysia and Singapore: Pinang (as Penang), 5°24'N, 100°14'E, *Galatea*, 1 ♂, 2 juveniles (C). - Batu Muang, Pinang, 5°17'N, 100°17'E, trawled in ca. 30 m depth, 16 Jan 1983, W.T. Meng and L.B. Holthuis, 1 ♂ (L). - Melaka (as Malacca), 2°12'N, 102°15'E, 2 fm (= 3.7 m), mud, 1900, W.F. Lanchester, 6 ♂, 5 juveniles (BM). - Muar River, Johore, 11 Jun 1983, K.L. Yeo, 1 ♂, 1 ♀ (ZRC). - Pulau Pisang, Johore, 1°28'N, 103°15'E, 10-15 fm (= 18-28 m), dredge, Jan 1934, M.W.F. Tweedie, 3 juveniles (ZRC). - Kuala Johore, Sungai Johore, 1°27'N, 104°02'E, 10-13 fm (= 18-24 m), mud and mussel beds, 17 Jun 1959, 1 ♀ (ZRC). - Sungai Punggol, Singapore, 1°25'N, 103°54'E, Apr 1933, M.W.F. Tweedie, 1 ♂, 1 ♀ (ZRC); same locality, 2 Apr 1969, D.S. Johnson, 1 ♀ (ZRC). - Changi Point, 1°23'N, 104°00'E, 9 May 1982, 1 ♀ (ZRC); same locality, early 1981, L. Tan, 1 ♂ (ZRC). - Singapore, 1°20'N, 103°50'E, probably east coast, 1981, P.K.L. Ng, 1 ♂, 1 ovigerous ♀ (ZRC). - Bedok, 1°19'N, 103°56'E, 7 Feb 1959, P. Yeo, 1 juvenile (ZRC); same locality, 18 Nov 1981, 1 ♂ (ZRC). - Siglap, Singapore, 1°19'N, 103°56'E, Dec 1933, M.W.F. Tweedie, 1 ♂ (specimen figured by Serène and Romimohtarto, 1969) (ZRC); same locality, Oct 1933-Jul 1934, 3 ♂, 8 ♀ (1 ovigerous) (ZRC); same locality, beach seine, 1951, D.S. Johnson, 2 ♀, 1 juvenile (ZRC). - Singapore, 1°20'N, 103°50'E, E. Deschamps, 6 ♂, 9 ♀ (W). - Singapore, beach, *Alert*, 1 ♂ (BM); same locality, 24 Jan 1910, 1 ♀ (C); same locality, C.L. Soh, 2 ♀ (ZRC). - Marine Parade, Singapore, 20 Aug 1960, 1 ♀ (ZRC). - Pasir Ris, Singapore, 1°22'N, 103°57'E, Apr 1962, 1 ♀ (ZRC). - Off Singapore, 1961, 1 ♂ (BM). - Sandy mud flats SE of Pulau Tekong, NE of Singapore, 28 May 1951, *Galathea* Sta. 351, 1 ♂, 1 ♀ (C). - Sandakan harbor, northeast Borneo, 5°45'N, 118°05'E, 28 Jun 1929, A.W. Herre, 1 ♂ (W).

Indonesia: Sunda Strait, 6°22'S, 105°44'E, 30 m, bottom mud, 20 Jul 1922, Danish Expedition to Kai (as Kei) Islands, Sta. 77, 1 ♂ (C). - Bay of Jakarta (as Batavia), 6°08'S, 106°45'E, West Java, Feb 1927, P. Buitendijk, 1 ♂ (L). - Tandjong Priok, near Jakarta (as Batavia), Nov 1925, P. Buitendijk, 1 ♀ (L); same locality, 3 Dec 1927, P. Buitendijk, 1 ♂ (L); same locality, beach, Nov 1928, P. Buitendijk, 1 ♂ (L). - Off Semarang, 6°58'S, 110°25'E, north coast of Central Java, May 1914, P. Buitendijk, 2

♀ (L). - Pasaruan, north coast of East Java, Feb 1929, P. Buitendijk, 1 ♂ (L). - Panarukan, north coast of East Java, 7°40'S, 113°55'E, May 1914, P. Buitendijk, 2 ♀ (L).

Thailand: Songkhla, 7°12'N, 100°36'E, 3 Oct 1924, R. Havmoller, 1 ♂ (C). - Songkhla Channel between Songkhla City and Goh Gnu Island, 3 Nov 1957, George Vanderbilt Foundation, No. 53, 1 ♂ (W). - Lem Sing, Gulf of Thailand, 14 Jun 1926, 6 ♂, 5 ♀ (W). - Banghia River, 2 Jul 1923, H.M. Smith, 1 ♂, 1 ♀ (W). - Paknamwen, mouth of the river, in Chinamen's tow nets, 30 Jan 1900, Th. Mortensen, 1 ♂ (C). - Koh Chik (Klung), 12°17'N, 102°15'E, 2 Feb 1900, Th. Mortensen, 1 ovigerous ♀ (C). - Koh Chang, 12°03'N, 102°21'E, near the station, low tide, 10 Mar 1900, Th. Mortensen, 1 juvenile ♀ (W).

Philippines: Philippine Islands, H. Cuming, 1 ♂, 1 ♀ (BM). - Palawan Island, Ulugan Bay, 10°05'N, 118°47'E, near mouth of Baheli River, seine, 28 Dec 1908, *Albatross*, 1 ♀ (W). - Off Cliff Island, 10°50'30"N, 119°22'10"E, 7 fm (= 13 m), mud, 26 Dec 1908, *Albatross* Sta. 5346, 2 ♀ (W). - Off Endeavour Point, 10°56'55"N, 119°17'24"E, 14-25 fm (= 26-46 m), grey mud, 23 Dec 1908, *Albatross* Sta. 5342, 1 ♀ (W). - Mactan Island, 10°18'N, 123°58'E, in tide pools, 31 Aug 1909, *Albatross*, 1 ♀ (W). - Taba Bay, Mindanao, 12 Mar 1914, Th. Mortensen, 1 ♀ (C).

China, Fujian Province (= Fukien Province): Jimei (as Tsimei), 24°39'N, 118°06'E, near Xiamen (as Amoy), Jun 1923, S.F. Light, 6 ♂, 3 ovigerous ♀ (W). - Xiamen (as Amoy), 24°26'N, 118°07'E, 1935, C.J. Shen, 2 ♂ (BM); same locality, Jul 1925, C.F. Wang, 4 ♂, 3 ♀ (P).

Description. - Carapace as long as or slightly longer than wide. Upper surface flat (more so in males than in females; in latter, surface may be slightly convex), smooth, without tubercles or spines, but with deep cervical, precervical, and branchiocardiac grooves. Postorbital groove less deep, indistinct. Carapace narrowest at outer orbital angles, widening posteriorly. Anterolateral margin straight anterior to cervical incision, convex behind incision, lacking spines or tubercles.

Front consisting of 2 wide, blunt teeth separated by shallow and wide emargination, frontal teeth extending distinctly beyond exorbital teeth. Outer sides of frontal teeth evenly merging with inner margin of orbit, only slight emargination visible at juncture. Posterior margin of orbit showing distinct incision but no teeth. Lower margin of orbit wide, shallowly concave between large, bluntly triangular exorbital tooth and inner lower tooth. Exorbital tooth blunt, directed forward, inner suborbital tooth blunter, smaller than exorbital.

Chelipeds of adult male strongly different, right larger. Chela swollen, fingers directed obliquely downward, dactylus about twice as long as fixed finger and about 1.5 times as long as upper margin of palm, with a deep longitudinal groove on outer surface. Lower margin of palm distinctly convex, forming a concave angle with lower margin of fixed finger. Left chela of male resembling chela of female; chelae equal and not swollen in latter and in juveniles. Fingers directed along long axis of palm, not deflected, of about equal length, twice as long as upper margin of palm.

Second and third pereopods slender, third distinctly longer. Dactylus and propodus subequal in length, with fringe of hairs on both upper and lower margins. Propodus with longitudinal median groove on both upper and lower surfaces. Carpus slightly shorter than propodus, lacking fringes. Merus about twice as long as carpus. Third leg longest of all legs, merus longer than carapace and about 5 times as long as high; meri of both P2 and P3 extending beyond front. Merus of P4 reaching about to

middle of merus of P3, that of P5 reaching 2/3 of merus of P3. Merus of P5 slender, 5 times as long as high, reaching to or slightly beyond exorbital tooth. P2 and P3 each with fringe of long hairs on either edge of dactylus and propodus; male sometimes with distal fringe dorsally on carpus. Other parts of legs of male lacking fringes, occasionally with short hairs. In female P2 and P3 propodus and dactylus with long fringes ventrally and dorsally, carpus with slightly less distinct dorsal fringe; indistinct ventral fringe on carpus of P2. P4 and P5 may have scattered short hairs in male; in females fringes also may be present.

Sternite of P1 in male with angular transverse ridge, produced forward in middle. Other sternites evenly and slightly convex, separated from each other by grooves. Sternum less sculptured in females.

Male abdomen with no pointed tubercles, each somite with median longitudinal ridge with depression on each side. Only third somite with large, swollen area on each side.

Male pleopod as figured.

Color. - "Ashy grey" (Chhappgar, 1957a:409; 1957c:11; Khan and Ahmed, 1975:75). A color photograph was published by Ng and Tan (1988: fig. 102) and several colored figures, showing a tan crab, were published by Ng (1987:14, 15).

Size. - Males, cl 6.0 to 14.5 mm, cb 6.0 to 14.7 mm; males with inflated chelae, cl 10.7 to 13.5 mm, cb 10.4 to 14.0 mm; non-ovigerous females, cl 9.2 to 16.5 mm, cb 8.9 to 15.5 mm; ovigerous females, cl 11.9 to 14.3 mm, cb 11.8 to 15.2 mm; juveniles, cl 4.2 and 6 mm. Measurements given in the literature for this species fall within the above ranges.

Distribution. - *Neodorippe callida* has a wide range, having been reported from the Red Sea, Pakistan and India east to South China, the Philippines, Vietnam, and Indonesia. The type locality is "in Mari Asiatico." As I.K. Daldorff, the collector of the type material, was in Tranquebar, India and in Sumatra, Indonesia before 1798, one of these places, and most likely Tranquebar, must be the type locality. In the literature the species has been reported from the following localities:

Asiatic Seas (as Mari Asiatico or Mers d'Asie): (Fabricius, 1798; Latreille, 1802; Lucas, 1840; H. Milne Edwards, 1837; Zimsen, 1964).

Indian Ocean (as Mers des Indes): (Bosc, 1802; A.-G. Desmarest, 1830; White, 1847).

Red Sea: Red Sea (Herklots, 1861).

Pakistan: Pakistan (Tirmizi, 1980; Tirmizi and Kazmi, 1983). - Korangi Creek, Break-water, Keamari, and Manora Island (all in vicinity of Karachi; Karachi Harbor = 24°47'N, 66°59'E) (Hashmi, 1963). - Korangi Creek and Manora Island (Khan and Ahmed, 1975).

India: Bombay (Chhappgar, 1957a,b,c). - ?Tranquebar, 11°02'N, 79°51'E (Fabricius, 1798). - Madras, 13°05'N, 80°17'E (Henderson, 1893; Gravely, 1941). - Orissa coast, northeast India (Alcock, 1896). - Andaman Islands (Alcock, 1896).

Burma: Mergui Archipelago (Alcock, 1896).

East Indies: East Indies (Herbst, 1803).

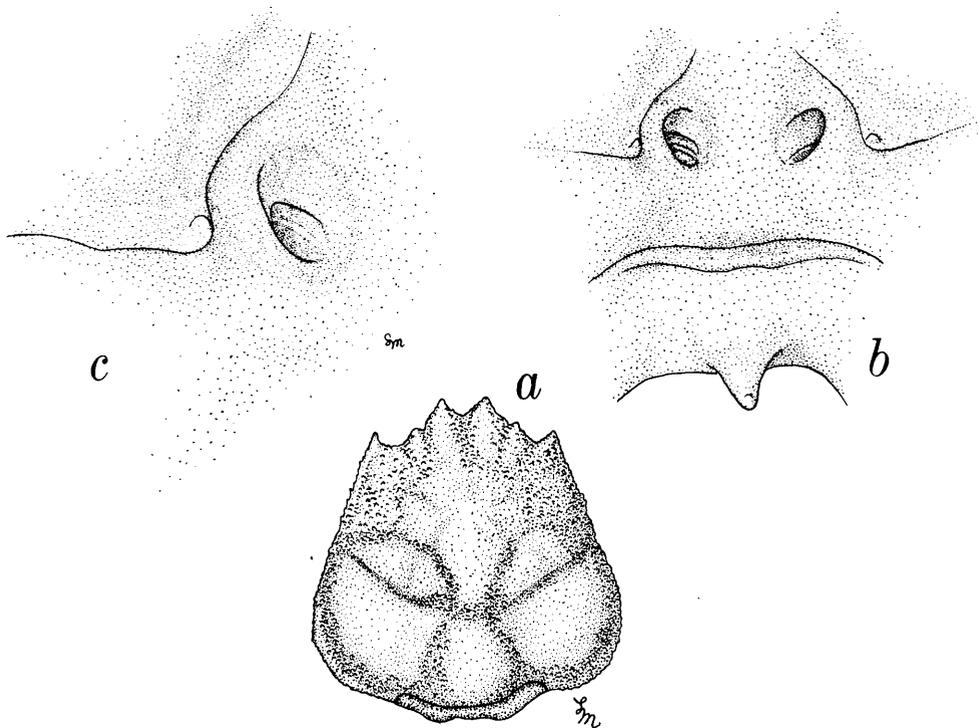


Figure 41. - *Neodorippe callida* (Fabricius). *a*, carapace, *b*, sternum and gonopores; *c*, gonopore. *a*, male, cl 13 mm, Jimei; *b,c*, female, cl 12 mm, Jimei.

Malaysia and Singapore: Melaka (as Malacca), 2°12'N, 102°15'E, Malaysia (Lanchester, 1900). - Singapore, 1°20'N, 103°50'E (Walker, 1887, 1890; Ortmann, 1892; Nobili, 1903b; Parenti, et al., 1971; Ng and Tan, 1986; Tan and Ng, 1988). - Siglap, Singapore, 1°19'N, 103°56'E, (Serène and Romimohtarto, 1969). - Buntal, Sarawak, Borneo, 1°41'N, 110°22'E (Nobili, 1903a). - Santubong, Sarawak, 1°43'N, 110°18'E (Shelford, 1916).

Indonesia: Lagundi Bay, Nias, west of Sumatra (Nobili, 1900). - Java Sea (De Man, 1896).

Thailand: Gulf of Thailand (Naiyanetr, 1980). - Mouth of the river, Paknam-wen; Koh Chik; Koh Chang (all Rathbun, 1910a; Suvatti, 1938). - Lem Sing, Banghia River (Suvatti, 1950).

Vietnam: Gulf of Tonkin (= Beibu Gulf) (Dai and Song, 1986). - Ban-Lia near Hai-Phong (20°52'N, 106°41'E), and estuary of Bag-Lia River (? = Bac Liêu River, 9°21'N, 105°52'E), Gulf of Tonkin (Starobogatov, 1972). - Con Son (as Poulo Condore), 8°39'N, 106°37'E (Dawydoff, 1952).

Philippines: Philippine Islands (White, 1847).

China (general): China seas (Shen and Liu, 1963). - China (Chen, 1986).

China, Fujian Province (= Fukien Province): Sandu-Ao (as Santuao); Chuanshih (both Shen, 1940b). - Jimei (as Tsimei), 24°39'N, 118°06'E (Rathbun, 1931; Shen, 1940b). - Xiamen (as Amoy), 24°26'N, 118°07'E (Rathbun, 1931; Shen, 1940b).

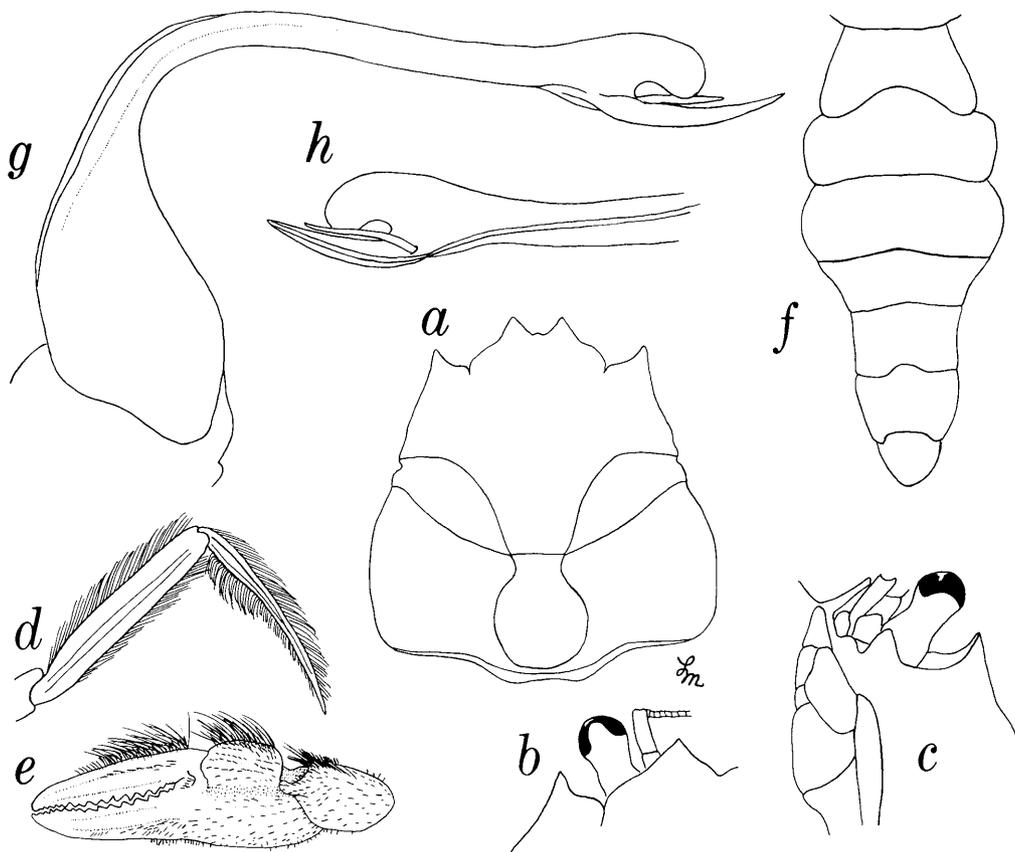


Figure 42. - *Neodorippe callida* (Fabricius). a, carapace; b, orbit; c, orbit, ventral view; d, distal segments of P3; e, chela; f, abdomen; g, h, gonopod. a-d, f-h, male, cl 13 mm, Jimei; e, female, cl 12 mm, Jimei.

Bosc's (1802) locality indication "les côtes d'Amerique" for *Dorippe callida* clearly is in error, as Bosc had no material of the species and based his account exclusively on the original description. A.-G. Desmarest's (1830) account was based on that of Bosc.

According to Nobili (1903b:26), De Man reported the species from Celebes, but no such record by De Man is known to us and it has not been referred to by other authors. De Man (1896:369) did report *Dorippoides facchino* from West Celebes, and this may have been the source of Nobili's error.

Habitat. - The species has been reported from tide pools and from shallow water in depths from 3.6 to 30 meters, with one record from 16-46 meters. It is found on mud or sandy mud bottoms and is said to be very common in mangrove swamps (Serène and Romimohtarto, 1969).

Biology. - As in most other members of the Dorippinae, specimens of *Neodorippe callida* carry objects over their backs, held by the last two pairs of pereopods. Although Alcock (1896:281) remarked that one of his specimens "carries on its back a large (inhabited) worm tube, which is said by Dr. Giles to be a habit with this

species," most of the reports in the literature mention that the object carried is a mangrove leaf. So Lanchester (1900:770) described a male from Melaka that was "still carrying a comparatively large leaf, beneath which it is entirely concealed when the legs are flexed." Rathbun (1910a:5) reported that a juvenile from Koh Chang "crept about with a large leaf over it." Shelford (1916:300) gave a good description of the leaf-carrying habit of the species: "The sea-bottom was of a harder sand, and here lived another *Dorippe*, *D. astuta*, which did not bury itself in the sand, but moved about freely. It was protected from observation by a large leaf, which it invariably bore aloft in the two hinder pair of legs, and with which it covered the body completely. So close was the resemblance between one of these leaf-covered crabs and a water-logged leaf washing to and fro in the gentle bottom-currents, that the closest scrutiny was needed to detect the presence of the crab." According to Chhapgar (1957b:542; 1957c:80) "Many of the Dorippidae carry about a house of their own by roofing themselves over with a shell, held by the last two pairs of legs (e.g., *Dorippe astuta*)." Serène and Romimohtarto (1969:12) remarked that the species is "very common on the mangrove swamps and generally all specimens hook a leaf of a mangrove tree on their backs." The specimens from Pulau Tekong (Singapore) are accompanied with a field label stating that they were "with leaves." Also, the label of a female from Sungai Punggol, Singapore, stated that it was carrying a leaf over its back.

Walker (1887:108) cited field notes describing two species of crabs from Singapore, observed by the collector on sand and mud banks exposed at low tide. These crabs, which were not identified, had "curved hooks on their hindmost claws, by means of which they hold on to a mangrove-leaf or dead valve of a shell which conceals the animal from view; these leaves and dead valves may be seen apparently walking along on the shore." As Walker pointed out, "these crabs are probably *Dorippe sima* [= *Dorippoides facchino* (Herbst)] and *D. astuta* [= *Neodorippe callida* (Fabricius)], also *Conchaecetes conchifera*," all three species being represented in the collection studied by Walker. In a later paper Walker (1890:86) again referred to these observations: "crabs of the genus *Dorippe* protecting themselves (probably from the scorching tropical sun), at low tide, on the mud flats at Singapore, by carrying leaves over their backs." It seems very likely that the leaf-carrying specimens belong to *Neodorippe callida*.

The collection of the British Museum holds two male specimens of *Dorippe tenuipes* Chen collected by H. Cuming at Cebu, Philippines (see above, under *D. tenuipes*), which, according to the accompanying label, carried a leaf when alive. It is possible, however, that this label actually belongs to a male and female of the present species also collected by Cuming in the Philippine Islands and examined by us.

The most extensive and most detailed account of the leaf carrying habit was only recently published. Ng and Tan (1986:45-46) showed that the association of the species with mangrove leaves is a very close one and not just temporary; they made the following observations: "all the specimens that the authors have examined so far ... carried leaves ... During the day, *Neodorippe callida* is buried in the mud, with only the leaf showing. At night, they swim up to the surface of the water still holding the leaf. Once swimming, they reverse their orientation and swim upside down with their ventral surface facing the water surface and the leaf downwards. Many of these upside-down crabs can be seen near kelongs (palisade fish traps) at night, presumably attracted by the bright lights used for luring the fish. They can also occasionally be

seen in the waters surrounding mangrove swamps in the late evening. The animals are slow, but competent swimmers, using their first two pairs of legs ... Crabs which have lost their leaves still swim upside down, day or night. On touching the bottom, it immediately flips back to an upright position." "In the aquaria, the crabs mate on the bottom, with both animals facing each other at about 45 degrees, and still holding onto their leaves. Some of the specially modified legs of the male, normally used for carrying leaves, are also used to grasp the female." "Mangrove leaves of the genera *Avicennia*, *Bruguiera* and *Rhizophora* have been observed to be used, the average size leaf usually covering the animal completely." In 1988 Ng and Tan published a color photograph of the crab and its leaf and gave an abbreviated account of the habits of the crab. In 1987 Ng published a short account of the behavior of the crab, and gave several colored photographs of a crab swimming, with and without a leaf, as well as a photograph of crabs mating.

Alcock (1896) mentioned that several of the specimens seen by him were "encrusted with a small species of *Scalpellum*." The male lectotype of *Dorippe callida* Fabricius has stalked barnacles on the dorsal surface of the bases of the legs on the right side.

In our material, ovigerous females have been collected in February (Thailand), June (Jimei), and October (Siglap).

Remarks. - A re-examination of Fabricius' types of *Dorippe callida* and *Dorippe astuta* in the collections of the Zoological Museum, Copenhagen and the Nationaal Natuurhistorisch Museum, Leiden showed that *Dorippe astuta* has been interpreted incorrectly by virtually all authors starting with Herbst (1803). The type specimens of *Dorippe astuta* Fabricius, 1798, proved to be conspecific with *Dorippoides facchino* (Herbst, 1785) and not with the present species. Fabricius' name *astuta* thus disappears as a junior synonym of *facchino* Herbst. *Dorippe callida* Fabricius, 1798, had been considered a species incerta and was generally ignored by authors. H. Milne Edwards (1837:157) remarked on the close similarity of *D. callida* and the species that he called *D. astuta*, while Lanchester (1900:769, 770) placed *D. callida*, with a question mark, in the synonymy of *D. astuta*. M.J. Rathbun's study notes, kept in the National Museum of Natural History, Washington, showed that she, after examination of Fabricius' type material, reached the same conclusions that we did, but evidently did not find the occasion to publish her results. Serène and Romimohtarto (1969), in their revision of the group, did not mention *D. callida* at all.

The specimens from Cochin, India, that Pillai and Nair (1970, 1976) identified with the present species (under the name *D. astuta*), as shown by their measurements (cb 20 to 35 mm for 148 specimens), cannot belong here and possibly are *Dorippoides facchino*.

The type material of *Dorippe callida* Fabricius, 1798, is in the collection of the Zoological Museum at Copenhagen and consists of two dry specimens, a male (cl 12.6 mm, cb 12.3 mm), with most legs intact, and a female (cl 10.3 mm, cb 10.6 mm) with most legs off. We now select the male (Figure 40) as the lectotype of the species; the female is a paralectotype.

**Genus *Nobilum* Serène and Romimohtarto, 1969**

*Neodorippe (Nobilum)* Serène and Romimohtarto, 1969:3, 5, 14 [type species *Dorippe histrio* Nobili, 1903, by original designation and monotypy; gender neuter].

*Nebilum*. - Chen, 1980:154 [erroneous spelling of *Nobilum*].

*Nobilum*. - Manning and Holthuis, 1981:31.

**Definition.** - Carapace convex, about as long as wide, deeply sculptured, grooves distinct. Anterolateral margins with small tubercles, branchial regions minutely granular laterally and posterolaterally. Each protogastric region with 2 distinct protuberances. Cervical and branchial grooves distinct. Mesogastric region with 2 oblique submedian pits, sometimes connected to cervical groove; region bilobed or rounded anteriorly, posterolateral margins ornamented with row of short, narrow, sharply defined grooves ending in cervical groove. Epibranchial region with oblique, almost transverse, groove mesially, and with short groove, often inconspicuous, in median part of posterior area close to and parallel with cervical groove; oblique groove defining a triangular mesial part of epibranchial region. Branchial regions lacking lateral spine, with short and high dorsal ridge. Urogastric region reduced. Branchiocardiac grooves distinct and deep. Cardiac region longer than wide, raised, with anterior or anterolateral depressions.

Front consisting of 2 sharply pointed triangular teeth, separated mesially by shallow depression, extending beyond exorbital teeth. Opening of exhalent canal not visible in dorsal view. Inner orbital angle a rounded lobe. Posterior margin of orbit with open, triangular fissure. Outer orbital lobe with erect spine near fissure. Exorbital tooth falling short of level of front. Inner suborbital tooth falling short of front. Lower orbital margin minutely tuberculate. Eyes short and stout, widening distally, cornea ventrolateral.

Chelipeds of females and small males equal in size and shape. In small chelipeds, fingers slender, curved downward, forming slight angle with axis of palm. Fingers about 4 times as long as upper margin of palm, each with 2 uninterrupted grooves on both inner and outer surfaces; 1 such groove on upper surface of dactylus and lower surface of fixed finger. Cutting edges with about 17 teeth of equal size, in smaller specimens sharper and more triangular than in larger ones. Upper part of outer surface of palm with inconspicuous groove extending from articulation with carpus almost to that with dactylus. Inner surface of palm smooth, surface obscured by low, tomentose coat of hairs. Dorsal margin of palm and proximal part of dactylus with fringe of long hairs; lower margin of palm with double row of short hairs. Carpus with line of long setae on upper and lower margins.

Second and third pereopods long, third slightly longer than second, third longest of all legs; segments flattened, unarmed. Propodi with short dorsal and ventral fringes of setae. Dactyli flattened, dorsal margins fringed with setae, fringe present proximally only on ventral margin. Ischia of P2 and P3 without spur-like process, but with an inconspicuous lobe in extreme basal part of lower margin. Coxa of P3 lacking sausage-like callosity, smooth and not swollen.

Sternite of first pereopod with transverse ridge on each half, each ridge with single, mesial, pearly tubercle, smooth and white. Sternite of P2 with transverse ridge on each side, each ridge with mesial tubercle and inconspicuously granular. Sternite

of P3 with similar ridges in male, covered by abdomen in female. Sternite of P3 exposed in male, with similar ridges as on previous sternite. In female, sternite of P3 covered by abdomen, with low and indistinct transverse ridge ending at gonopore; inner part of ridge with row of setae, innermost of setae covering gonopore. Latter a deeply sunken narrow, longitudinal slit in submedian part of sternite, forming an almost vertical wall to sunken median part. Centrally, gonopore overhung by rounded and slightly swollen end of transverse ridge forming its outer margin. Small but distinct tubercle visible on sternite of P2, near its posterior margin, almost against ridge of sternite of P3 and not far from gonopore. Sternite of P4 with distinct median tubercle near posterior border.

First somite of male abdomen trapezoidal, widening posteriorly, posterior margin deeply excavate in middle; upper surface with longitudinal groove on each side. Second somite widening posteriorly, with broad, transverse, inconspicuously granular ridge and 2 submedian triangular depressions. Third somite trilobed, lateral parts swollen, separated from smaller median lobe by distinct grooves. Fourth somite short, narrowing posteriorly, with transverse groove anteriorly and tooth-like dorsal elevation on middle. Fifth somite short, rectangular, with median swelling. Sixth somite trapezoidal, narrowing towards telson, with 2 median, bluntly tooth-like elevations, 1 in middle, 1 near anterior margin. Telson broadly rounded.

First pleopod of male stout basally, distal 2/3 very slender, C-shaped, curved outward, terminating in 3 subequal, short, broadly rounded processes.

Remarks. - *Nobilum* contains only the following species.

### *Nobilum histrio* (Nobili, 1903)

#### Figure 43

*Dorippe histrio* Nobili, 1903b:24, fig. on plate [type locality Singapore]. - Ihle, 1916:153, 160. - Serène, 1968:40. - Serène and Romimohtarto, 1969:3. - Parenti, et al., 1971: *DORIPPE* (1). - Sakai, 1985:332, 335, fig. 5.

*Doryppe histrix*. - Dawydoff, 1952:139.

*Neodorippe (Nobilum) histrio*. - Serène and Romimohtarto, 1969:5, 15, figs. 4, 8, 13, 18, pl. 2: fig. B, pl. 4: figs. C,D. - C.M. Yang, 1979:3.

*Nobilum histrio*. - Manning and Holthuis, 1981:31. - Chen, 1986:123, 139, fig. 4: 20-22.

Material. - Malaysia and Singapore: Telok Bahang, Pinang, 5°28'N, 100°15'E, trawled, ca. 30 m, 19 Jan 1983, A.C.J. Burgers, L.B. Holthuis, and W.T. Meng, 2 ♂, 1 ♀ (L). - Batu Muang, Pinang, 5°17'N, 100°17'E, trawled, ca. 30 m, 16 Jan 1983, W.T. Meng and L.B. Holthuis, 1 ♂ (L). - Singapore, 1°20'N, 103°50'E, E. Deschamps, 1 ♂ (W).

Description. - Carapace convex, strongly sculptured, about as long as wide, cb/cl in males 0.97 to 1.10, in females 1.02 to 1.10. Branchial and branchiocardiac grooves very distinct, precervical grooves also distinct but less deep. Branchial regions swollen, with central tubercle, tuberculate posterolaterally. Epibranchial region divided into 2 raised areas by groove. Gastric region with 2 broad median tubercles, one behind the other, just anterior to cervical groove; short, oblique ridge present on

either side obliquely before anterior tubercle, smaller tubercle present ahead of and slightly lateral to ridge. Cardiac region obscurely sculptured, surface star-shaped in some specimens. Front consisting of 2 sharp teeth separated by wide U-shaped emargination, outer margin of each tooth separated from inner orbital lobe by concavity at level of base of antenna. Posterior margin of orbit with deep incision, margin mesial to incision slightly convex; distinct, upraised tooth flanking incision laterally. Exorbital tooth strong and acute, falling short of front. Suborbital margin, between strong exorbital tooth and blunter, lower inner orbital tooth, smooth, deeply concave.

In examined males, chelipeds of same size and shape. Fingers forming continuation of palm, slender, with about 17 teeth on cutting edges, about 4 times as long as upper margin of palm.

Second and third legs slender, reaching beyond front with distal end of merus. Dactylus and propodus of similar length, provided with hair fringe on dorsal and ventral margins, distal fourth or third of lower margin naked; dorsal margins of these segments with less distinct fringe. Carpus distinctly shorter than propodus, about half as long as merus. Merus of third leg about 6 times as long as high (5.6 to 6.0 times in males, 6.6 times in female), longer than carapace and abdomen together (in dorsal view). Fourth leg reaching with merus slightly beyond base of merus of third. Merus of fifth leg failing to reach middle of merus of third leg. Both posterior legs showing scattered hairs, but no fringes.

Sternite of cheliped with median longitudinal groove and distinct submedian tubercle on each side. Sternite of following somite with short, transverse ridge, ending mesially in knob, on each side.

Abdomen of male with H-shaped ridge on each side, horizontal bar of H formed by median longitudinal carina. Somite 2 with transverse ridge, slightly elevated mesially. Somite 3 with small median tubercle and 2 lateral conical elevations, 1 on each side. Somites 4 to 6 with median part of anterior margin elevated, in somite 6 strongly so, so that margin overlaps somite 5. Somites 4 to 7 each with central tubercle, sixth somite with second tubercle anteriorly. Telson short, trapezoidal, longer than broad.

Male pleopod as figured.

Size. - Males, cl 17.9 to 20.9 mm, cb 19.5 to 22.5 mm; female, cl 20.6, cb 22.6 mm. Recorded measurements in the literature include specimens with cl 16.5 to 22.5 mm, cb 16 to 23 mm.

Habitat. - Almost nothing is known of the habitat or biology of this species. Serène and Romimohtarto (1969) reported that their specimens had been taken in a fishing trap, and two of the specimens studied by us were taken in trawls at a depth of about 30 meters.

Distribution. - Known only from China, Malaysian waters and Vietnam; our specimens came from Pinang and Singapore. Records in the literature include:

China (general): China (Chen, 1986).

Malaysia: Singapore, 1°20'N, 103°50'E (Nobili, 1903b; Parenti, et al., 1971). - Pinang (as Penang), 5°17'N, 100°17'E (Serène and Romimohtarto, 1969; C.M. Yang, 1979).

Vietnam: Gulf of Thailand (Dawydoff, 1952).

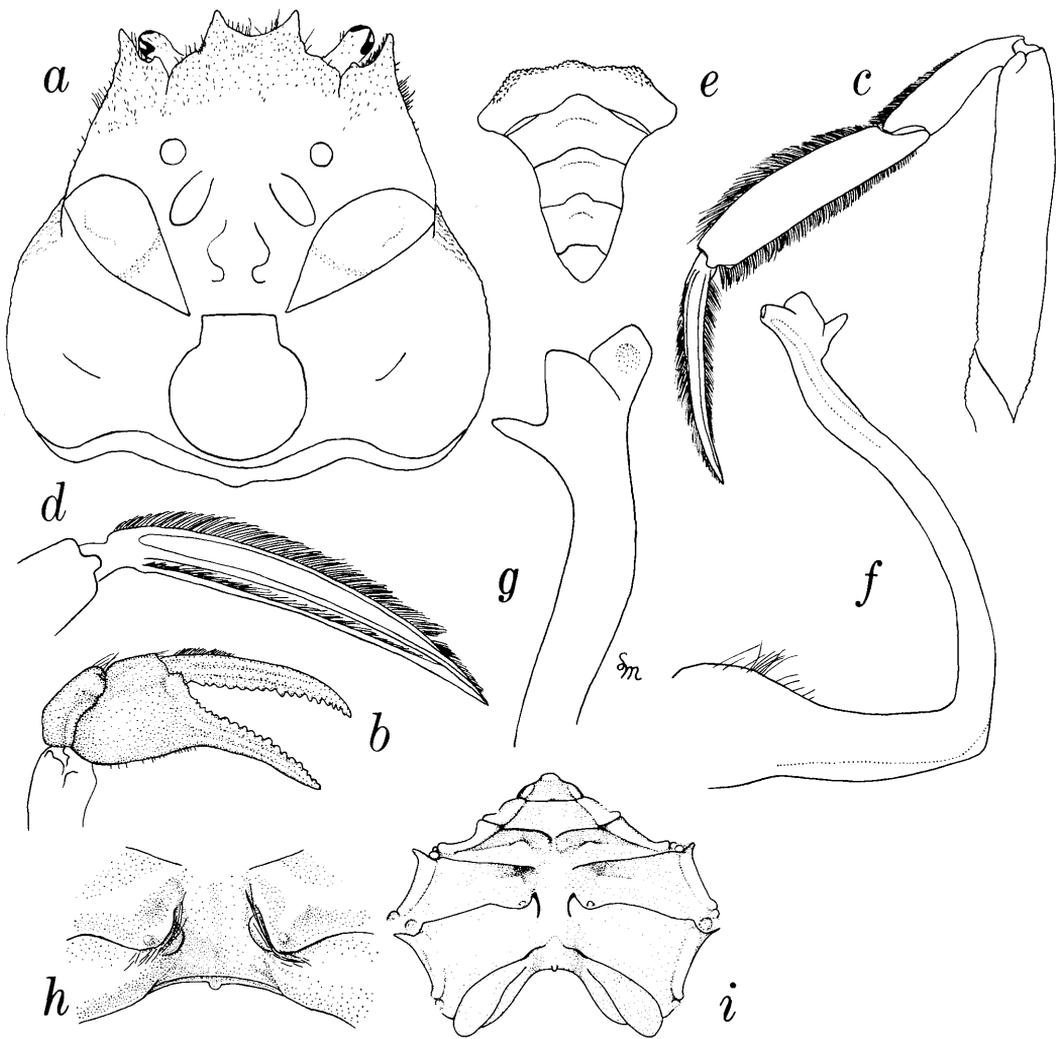


Figure 43. - *Nobilum histrio* (Nobili). a, carapace; b, chela; c, P3; d, P3 dactylus; e, abdomen, ventral view; f, g, gonopod and apex; h, sternum and gonopores; i, gonopores, enlarged. a-g, Male, cl 17.9 mm, Singapore; h,i, female, cl 20.6 mm, Pinang.

Remarks. - Males of *Nobilum histrio* can be distinguished at once from males of *Heikea* by the form of the male pleopod, which in the present species is extremely slender, terminating in three petaloid lobes. *Nobilum histrio* further differs from the species of *Heikea* in having five prominences on the gastric region and a distinct spine on the postorbital margin.

**Genus *Paradorippe* Serène and Romimohtarto, 1969**

*Paradorippe* Serène and Romimohtarto, 1969:3, 5, 15 [type species *Dorippe granulata* De Haan, 1841, by original designation; gender feminine].

*Paradorippe*. - Manning and Holthuis, 1981:31.

Definition. - Carapace wider than long in adults, surface lacking erect spines or prominent tubercles, but with grooves; surface completely granulate, partially so, or entirely smooth. Cervical groove shallow but distinct. Mesogastric region with 2 oblique, submedian pits, distinct from cervical groove. Posterolateral margins of mesogastric region with row of short, narrow, sharply defined grooves that end in cervical groove. Branchial grooves usually distinct. Urogastric region an indistinct circular or oval area flanked by larger, rounded, convex branchial lobes. Branchio-cardiac grooves distinct. Lateral margin of carapace lacking branchial spine.

Front consisting of 2 bluntly triangular teeth directed anteriorly, often extending to but not overreaching exorbital spines; opening of exhalent canal visible in dorsal view between frontal teeth. Inner orbital angle a broad, triangular tooth or rounded lobe. Posterior margin of orbit with fissure but without teeth. Exorbital tooth just reaching to or slightly surpassing front. Inner suborbital tooth small, falling far short of level of exorbital tooth. Lower orbital margin smooth or denticulate. Eyes short and stout, tapering distally, cornea ventrolateral.

Chelipeds of females and most males equal in size and shape; in adult males, chelipeds distinctly unequal, right larger. On small chelae, fingers slender and curved somewhat downward, forming slight angle with longitudinal axis of palm. Fingers about 2.5 to 3 times as long as upper margin of palm, each with 2 uninterrupted grooves on both inner and outer surfaces, lacking distinct groove on upper surface of dactylus and lower surface of fixed finger. Cutting edges with 12 to 15 teeth of equal size, sharper and more triangular in smaller specimens. Outer surface of palm smooth, punctate, or granular, with or without short hairs. Upper surface of outer edge of palm with inconspicuous groove extending from articulation with carpus to that with dactylus. Inner surface of palm smooth or lightly pitted, with line of pits extending proximally from base of fixed finger. Dorsal margin of palm and proximal part of dactylus with fringe of long hairs, lower margin of palm, except in inflated chelae, variously fringed; lower margin of fixed finger without setae. Carpus and merus smooth or granular, often with larger granules on upper and lower margins.

Second and third pereopods long, third slightly longer, longest of all legs, with segments flattened, unarmed. Dactyli flattened, twisted, without fringes of hair. Lower margin of merus granulate or smooth, ornamented at most with sparse coat of short hairs. In female, ischium of third pereopod lacking spur-like process, coxa of third pereopod lacking sausage-like callosity.

Sternum minutely or coarsely granular. Sternite of first pereopod with short carina on each side, lacking distinct, white, submedian tubercles. Sternites of second and third pereopods with blunt, transverse ridge on each side. In male, first 3 sternites exposed; in adult female third sternite covered by adomen. Female gonopore outlined, at least partially, by raised ridge, situated under raised tubercle at end of ridge. Fourth sternite of female lacking median spine.

First somite of male abdomen trapezoidal, widening posteriorly, posterior margin deeply excavate in middle; upper surface with oblique longitudinal groove in each half. Second somite also widening posteriorly, with low transverse ridge, often appearing trilobed in dorsal view. Third somite with lateral parts swollen, separated from low median part by indistinct groove. Fourth and fifth somites short, each with low, transverse ridge. Sixth somite with 3 lobes on surface and with submedian longitudinal groove on each side, posterolateral angles produced. Telson bluntly triangular. No strong tubercles or spines on abdomen, but ridges and bumps often strongly granular.

Female abdomen wide and rounded, somites 2 to 5 usually with blunt but distinct transverse carina, variously granular or smooth. Fourth and fifth somites widest, fifth and sixth longest. Telson small, posterior margin semicircular or subtriangular. No tubercles or teeth on abdomen.

First pleopod of male stout, lacking rounded lobe or lappet at base, constricted and bent near midlength, with several apical projections.

Remarks. - We place four species in *Paradorippe*, as follows: *P. australiensis* (Miers, 1884), from Australia; *P. cathayana* Manning and Holthuis, 1986, from China and Vietnam; *P. granulata* (De Haan, 1841), from localities between Vladivostok and Hong Kong; and *P. polita* (Alcock and Anderson, 1894), from India and Malaysia.

These four species are widely disparate in size as adults: the largest specimen of *P. polita* known has cl 11.5 mm, and *P. cathayana*, at cl 17 mm, and *P. australiensis*, at cl 22 mm, are somewhat larger species. *Paradorippe granulata*, in contrast, may get as large as cl 28 mm.

The species may be distinguished by means of the following key.

#### Key to Species of *Paradorippe*

1. Surface of carapace distinctly granular. Carpus of cheliped granular..... 2
- Surface of carapace appearing smooth, at most lightly granular under magnification. Carpus of cheliped smooth ..... 3
2. All of surface of carapace coarsely granular. Outer surface of palm of chela and dorsal surface of meri of P2 and P3 granular. Merus, carpus, and propodus of P2 and P3 pubescent ..... *P. granulata*
- Anterolateral margin and branchial regions of carapace finely granular, gastric and cardiac regions smooth or nearly so. Palm of chela and dorsal surfaces of meri of P2 and P3 smooth, neither granular nor pubescent ..... *P. australiensis*
3. Orbital fissure narrow, closed. Inner suborbital tooth triangular. Propodus of P3 less than 3 times as long as high ..... *P. cathayana*
- Orbital fissure narrow but open anteriorly. Inner suborbital tooth blunt, apex flattened. Propodus of P3 more than 3 times longer than high ..... *P. polita*

*Paradorippe australiensis* (Miers, 1884)

## Figures 44-45

*Dorippe astuta*. - Haswell, 1882:136 [not *Dorippe astuta* Fabricius, 1798 = *Dorippoides facchino* (Herbst, 1785)].

*Dorippe australiensis* Miers, 1884:258, pl. 26: figs. D, d [type localities Port Denison, Queensland, depth 4 fm, Moreton Bay, Queensland, and "the Australian coast"]. - Grant and McCulloch, 1906:26. - Ihle, 1916:153, 156. - Rathbun, 1924:27. - Tyndale-Biscoe and George, 1962:66, 93, figs. 2-2, 2-3. - Serène, 1968:40.

*Paradorippe australiensis*. - Serène and Romimohartto, 1969:6, 16, figs. 9, 14, 26, 28, pl. 2: fig. D, pl. 6: figs. B, D. - Stephenson, et al., 1978:212. - C.M. Yang, 1979:3. - Manning and Holthuis, 1981:31.

Material. - Australia (general): Australia, purchase, Mr. Bowerbank, 2 ♂, 2 ♀ (syntypes, BM 66.75). - Northwest Australia, Mrs. B. Grey, 1 ♀ (BM).

Australia, Queensland: Albany Passage, northern Queensland, 10°44'S, 142°36'E, 1 ♂ (BM). - Port Denison, 20°02'S, 148°15'E, 1 ♀ (syntype, BM 81.31). - Off Gatcombe Head, 23°52'S, 151°23'E, facing island, Port Curtis, dredged, 9-12 fm (= 16.5-22 m), M. Ward, Dec 1929, 1 ovigerous ♀ (W). - Moreton Bay, 27°15'S, 135°15'E, 1 ♂ (syntype, BM 52.71).

Description. - Carapace flattened, 1.02 to 1.09 times wider than long, lateral margins and branchial regions noticeably granular, postfrontal area and gastric and cardiac regions much smoother, less or not at all granular. Surface almost naked, with at most few scattered plumose hairs, especially laterally. Cervical and branchial grooves well marked but shallow, only faintly indicated across midline. Paired submedian branchial lobes distinct, especially medially. Frontal teeth sharp, smaller and broader than exorbitals, latter extending to or slightly beyond front. Inner orbital lobe a well marked blunt tooth, distinct from outer frontal tooth. Postorbital fissure narrowly open anteriorly, closed for most of its length. Suborbital margin granular, forming a narrow, U-shaped cup. Inner suborbital tooth very short, bluntly triangular, falling short of anterior margin.

Chelipeds unequal in larger males, right chela larger, inflated; chelipeds equal in smaller males and all females. Merus and carpus of cheliped granular in both sexes, palm and fingers largely smooth, with some granules dorsally on upper and outer faces in both sexes. Surface of cheliped largely naked, upper and lower margins with fringes of hairs.

P2 and P3 long, merus shorter than carapace but longer than frontorbital width in both sexes. On both legs, segments naked, largely smooth, merus minutely granulate on lower edge. Carpus of both legs strongly carinate, with 1 anterior and 2 dorsal carinae, all carinae smooth, not granular. Propodi of both legs flattened, smooth and naked. Dactyli of both legs naked, slender, tapering distally, longer than respective propodus in both sexes. P4 and P5 short, naked except for some short hairs anteriorly, merus about half carapace length in females, shorter in males.

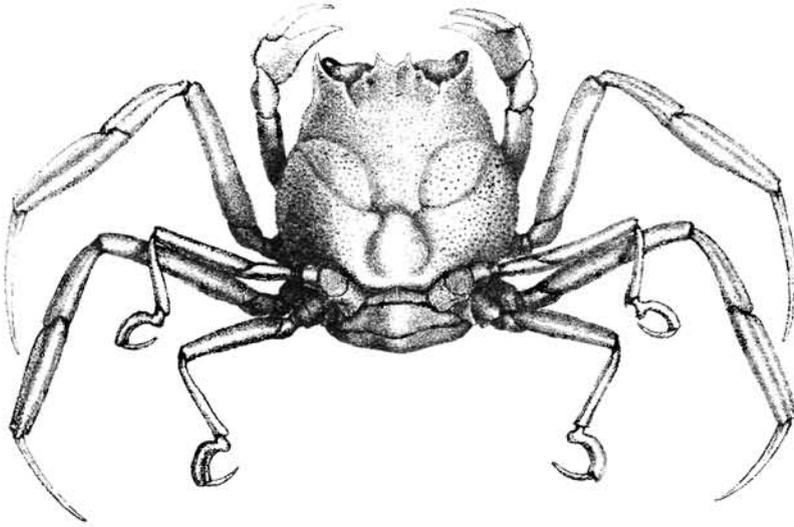


Figure 44. - *Paradorippe australiensis* (Miers). From Miers, 1884, pl. 26: fig. D.

Surface of male abdomen noticeably granular. First somite trapezoidal, widening posteriorly, with low median prominence. Second somite with low median and submedian prominences, crossed by indistinct granular ridge. Third somite widest, with low median and enlarged submedian prominences, latter much larger than median, all prominences granular. Fourth and fifth somites each with low median prominence, crossed by indistinct line of granules. Sixth somite about as long as fifth and telson, with raised rectangular area on surface. Telson triangular, slightly longer than broad, apex rounded.

Female abdomen appearing smooth, with sparse coat of short, scattered setae, broadest at third to fifth somites. Third and fourth somites shortest, fifth and sixth longest. Each somite with low but distinct median prominence, second to sixth somites each crossed by low, transverse swelling. Telson subtriangular, wider than long.

Male pleopod stout basally, abruptly constricted and bent near midlength, terminating in 3 corneous processes, as figured.

Color. - Tyndale-Biscoe and George (1962) mention that in preservative this species is a uniform pinkish-grey.

Size. - Males, cl 13 to 18 mm, cb 13 to 19 mm; non-ovigerous females, cl 8 to 14 mm, cb 8.5 to 15 mm; ovigerous female, cl 22 mm, cb 24 mm.

This is a relatively small species, the largest known specimen being the ovigerous female reported here, with cl 22 mm. In all specimens examined or recorded in the literature, the carapace is slightly broader than long.

Distribution. - This species is known only from localities in Australia. Records in the literature include:

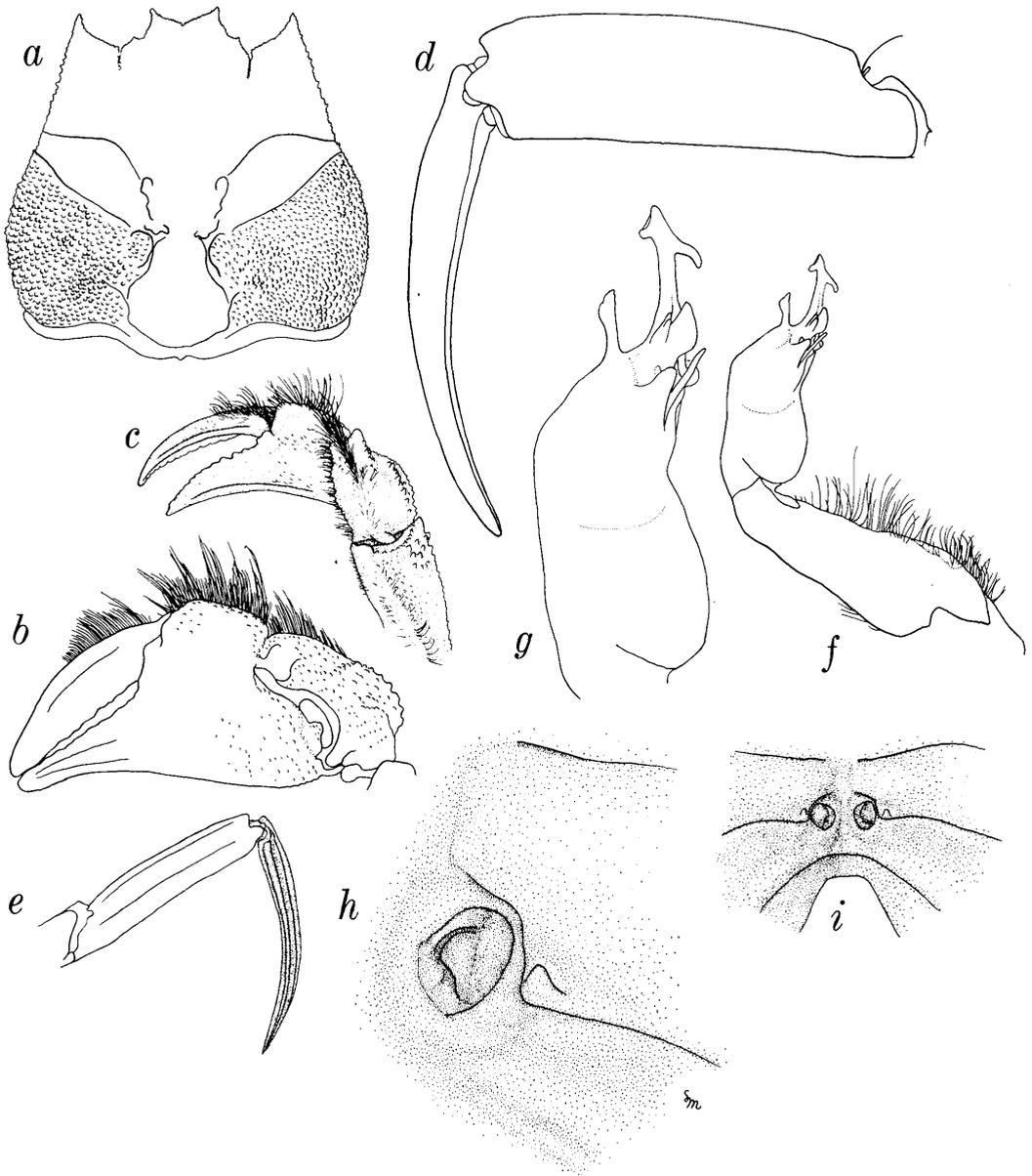


Figure 45. - *Paradorippe australiensis* (Miers). a, carapace; b, chela; c, cheliped; d-e, distal segments of P3; f, g, gonopod; h, sternum and gonopores; i, gonopore, enlarged. a, c, e-g, male syntype, cl 18 mm, Australia; b, d, h, i, ovigerous female, cl 22 mm, Port Curtis.

Australia (general): Australian coast (Miers, 1884).

Australia, Western Australia: Yampi Sound, 16°08'S, 123°38'E (Tyndale-Biscoe and George, 1962; C.M. Yang, 1979). - Cape Jaubert, 18°57'S, 121°33'E, 45 miles WSW (Rathbun, 1924). - Port Walcott, 20°35'S, 117°11'E (Tyndale-Biscoe and George,

1962). - Cockburn Sound, 32°10'S, 115°44'E (Tyndale-Biscoe and George, 1962; Serène and Romimohtarto, 1969; C.M. Yang, 1979). - Garden Island, 32°13'S, 115°41'E (Tyndale-Biscoe and George, 1962).

Australia, Queensland: Port Denison (Haswell, 1882; Miers, 1884). - Port Curtis, 23°55'S, 151°21'E (Grant and McCulloch, 1906). - Moreton Bay (Miers, 1884). - Middle Banks, Moreton Bay (Stephenson, et al., 1978).

Habitat. - Apparently this is a shallow water species. It has been taken under stones on a reef flat to a depth of 22 meters, on mud at 18 meters, and on sand and occasional sponge and coral at 15 meters.

Biology. - Rathbun (1924) reported that a small male of this species was carrying on its back the valve, 16 mm long, of *Antigona (Venus) laqueta* Sowerby.

An ovigerous female was taken near Port Curtis in December.

Remarks. - *Paradorippe australiensis* is a comparatively smoother species than *P. granulata*, but with the carapace much more granulate than in *P. polita* or *P. cathayana*. This species differs from *P. granulata* in having the granulation on the carapace largely restricted to the posterolateral surfaces, in having most or all of the outer surface of the palm smooth (some granules may be present proximally on the palm, but almost all of the outer surface is smooth and polished), and in lacking granules on the merus and carpus of the walking legs. *Paradorippe australiensis* differs from both *P. polita* and *P. cathayana* in having the carpus of the cheliped granular as well as in the more extensive surface granulation of the carapace.

This is also a much smaller species than *P. granulata*, with adults not exceeding cl 22 mm; *P. granulata* may exceed cl 30 mm as an adult.

### *Paradorippe cathayana* Manning and Holthuis, 1986

#### Figures 46-47

*Dorippe polita*. - Rathbun, 1931:99. - Shen, 1932:8, 289, figs. 4, 5, pl. 1: fig. 11; 1937a:169, 171; 1937b:305. - André, 1937:79 [p.p.]. - Serène, 1937:77. - Shen, 1940b:76. - Serène, 1968:40. - Sakai, 1985:331, 335, fig. 3. - S.L. Yang, 1986:152. - Dai and Song, 1986:61. - Zhou and Sun, 1986:223. [Not *Dorippe polita* Alcock and Anderson, 1894.]

*Paradorippe ? polita*. - Serène and Romimohtarto, 1969:17 [p.p.].

*Paradorippe polita*. - Manning and Holthuis, 1981:31. - Chen, 1986:125, 139, figs. 7:33-35.

*Paradorippe cathayana* Manning and Holthuis, 1986:365, fig. 1e [type locality Jimei, Fujian Province, China].

Vernacular Name. - "Con cua áo to'i" (Vietnam; Serène, 1937).

Material. - China, Hebei Province: Qinhuangdao, Bo Hai Gulf (as Chinwangtao, Peichili Bay), 39°55'N, 119°37'E, 24 Jul 1930, C.J. Shen, 1 ♂, 1 ovigerous ♀ (W); same data, 1 ♂, 1 ♀ (BM).

China, Fujian Province (= Fukien Province): Fuzhou (as Foochow), 26°09'N, 119°17'E, 1923, C.R. Kellogg, 1 ovigerous ♀ (W). - Jimei (as Tsimei), 24°39'N, 118°06'E, 24 Jun 1923, S.F. Light, 2 ♂, 2 ovigerous ♀ (L,W; 1 male is holotype, W, USNM 57762).

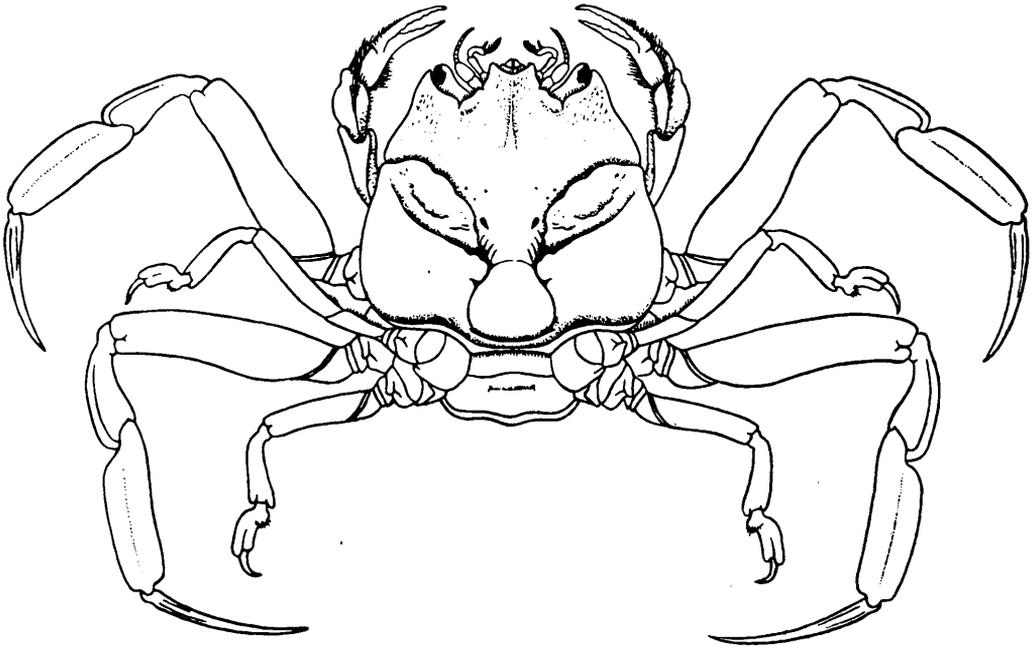


Figure 46. - *Paradorippe cathayana* Manning and Holthuis. From Shen, 1932, fig. 4.

Description. - Carapace 1.04 to 1.14 times broader than long, convex posterolaterally, flat anteriorly, with regions very poorly marked, grooves very shallow. Precervical groove deeper and better marked than cervical, deepest at lateral margins, forming distinct indentation there. Mesogastric region with 2 submedian pits, forming, with branchiocardiac grooves, an H-shaped depression. Postfrontal area of carapace sparsely tuberculate, with low pubescence in female, almost entirely smooth and hairless in male. Posterolateral corners of carapace finely and more densely granular than postfrontal area. No large tubercles or long hairs present anywhere on carapace; pubescence as described for female and in deeper grooves only. Front consisting of 2 triangular teeth, sharper than exorbitals, separated by broadly U-shaped median emargination. Roof and entire opening of exhalent canal visible in dorsal view. Inner orbital angle bluntly rounded, separated from frontal tooth by incision. Postorbital fissure narrow; lateral to fissure orbital margin smooth, evenly concave. Exorbital tooth blunt and strong, reaching to same level as frontal teeth, lateral margin smooth or finely granular, lacking large tubercles or teeth. In front of precervical notch, lateral margin straight or slightly concave. Suborbital margin forming almost rectangular depression between exorbital tooth and much smaller inner orbital tooth.

Chelipeds strongly unequal in adult males, right larger; in females chelipeds equal, resembling smaller male cheliped. In larger cheliped, fingers 1.6 times as long as upper margin of palm, bent downward, forming angle with long axis of chela. Cutting edges with 9-10 blunt, broad, rectangular teeth. Movable finger with 1 shallow longitudinal groove, fixed finger with 2 grooves. Palm height almost twice length of upper margin. Outer surface of chela smooth, evenly inflated, with inflated ridge ventrally

proximal to fixed finger, set off from palm by depression. Inner surface of palm smooth, evenly rounded, except for bulbous protuberance ventrodistally. Cheliped of male at cl 16.8 mm markedly more inflated than in one of cl 15.8 mm. Remainder of cheliped entirely smooth, lacking hairs over surface but with broad line of pubescence or short hairs on inner dorsal surface extending from middle of movable finger to base of merus (i.e., along that part of cheliped nearest to carapace when leg is folded), with second line extending vertically at inner distal end of merus. Carpus of cheliped smooth except for long, low ridge. Fingers of smaller male cheliped also deflected, about 2.4 times as long as upper margin of palm. Cutting edges with 8-9 blunt, triangular teeth; movable finger with 1 longitudinal, shallow groove, fixed finger with 2. Height of palm also about twice length of upper margin, latter only half as long as in major cheliped. Shallow groove on upper surface of palm extending between articulation with carpus to that with dactylus. Inner and outer surfaces of palm smooth and naked. Remainder of segments of cheliped smooth, with furry line dorsally and ventrally, extending to base of cheliped from middle of movable finger dorsally and from middle of palm ventrally. Merus lacking inner, distal line of hairs. Equal chelipeds of female similar to smaller chelipeds of male in size and shape, differing in that distinct ventral ridge present on chela and dorsal and ventral fringes of hairs longer.

Second and third pereopods slender, lacking hairs, second extending to front with its merus or overreaching front with distal fifth of merus. Merus of third leg falling short of front in both sexes. Dactylus longer than propodus, slightly twisted, with well developed longitudinal carina on anterior and posterior faces. Propodus smooth, wider than dactylus, less than 3 times longer than high. Carpus with smooth dorsal ridge. Merus subequal to or slightly shorter than carpus and propodus combined, about 4 times longer than high, completely smooth. Merus of fourth leg reaching slightly beyond merus of third, that of fifth leg reaching about middle of merus of third. Posterior two legs with few hairs along superior margin, especially distally on carpus and proximally on opposable margin of propodus, legs otherwise naked and entirely smooth.

Sternite of first pereopod of male with shallow median longitudinal depression, and, on each side, a short tuberculate ridge, lined with hairs, flanking well-marked but shallow depression. Sternites 2 and 3 quite smooth. Only first sternites visible in female, resembling those of males.

First male abdominal somite almost twice as wide as long, surface generally smooth but slightly pitted, with shallow depression on either side of midline. Second somite as long as but much wider than first, with low submedian prominences. Third somite shorter than second in middle, submedian prominences more conspicuous. Next three somites each succeeding narrower and with rounded central prominence. Sixth somite with 2 low, rounded tubercles distolaterally. Telson triangular, broader than long.

Female abdomen smooth, polished, widest at fourth and fifth somites. Third and fourth somites shortest, fifth and sixth longest. Each somite with low median swelling. Telson subtriangular, broader than long.

Male pleopod stout, with strong constriction and angled at midlength. Apical projections as figured.

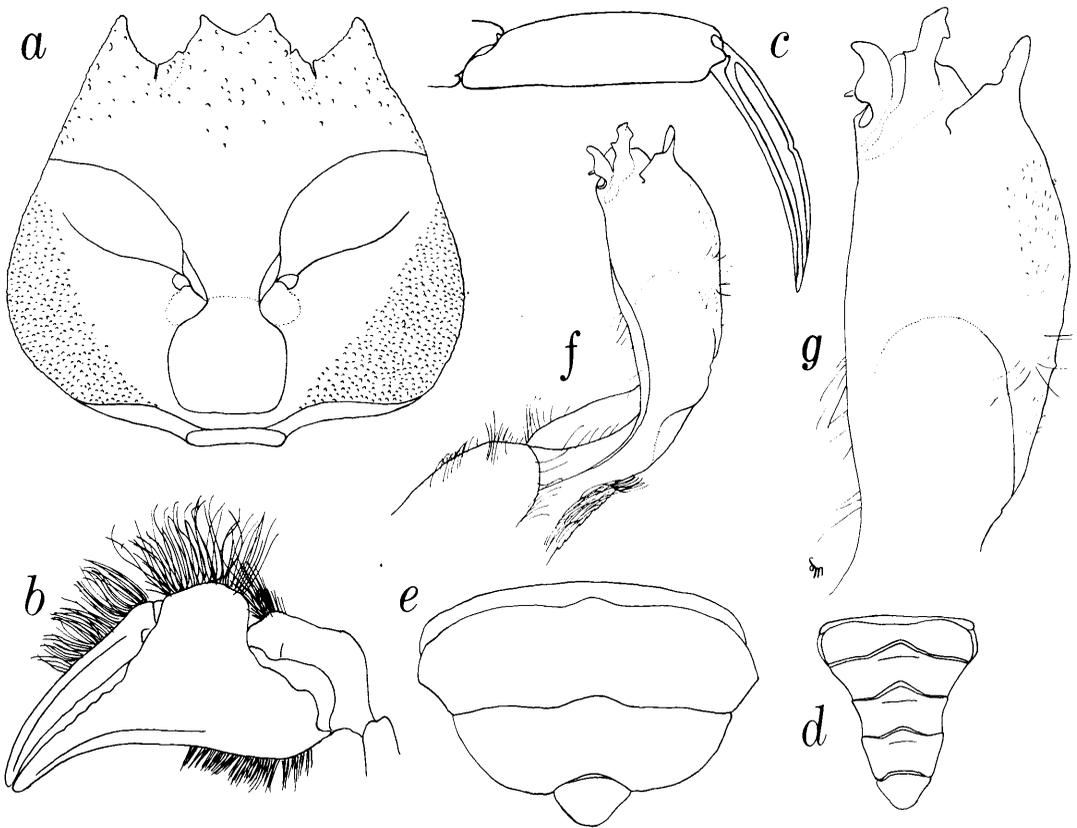


Figure 47. - *Paradorippe cathayana* Manning and Holthuis. a, carapace; b, chela; c, distal segments of P3; d, e, abdomen, ventral view; f, g, gonopod. a, e, ovigerous female, cl 17 mm, Fuzhou; b-d, f, g, male holotype, cl 16.8 mm, Jimei.

Color. - "Carapace light buff to pinkish buff, sometimes hyssop violet to argyle purple" (Shen, 1932:11).

Size. - Males, cl 12 to 17 mm, cb 13 to 18 mm; non-ovigerous females, cl 11 to 13.5 mm, cb of smaller specimen 12 mm; ovigerous females, cl 12 to 17 mm, cb 14 to 18.5 mm. In all specimens examined, the carapace is broader than long.

Distribution. - This species is known mainly from localities in China, with two records from Vietnam. Records in the literature include:

Vietnam: Gulf of Tonkin (as Beibu Gulf) (Dai and Song, 1986). - Récolte 102, Annam ("à proximité de la Station Maritime de Cauda, Nhatrang") (Serène, 1937).

China (general): China (S. Yang, 1986; Chen, 1986). - North China (Shen, 1937b).

China, Liaoning Province: Liaoning Province (Zhou and Sun, 1986).

China, Hebei Province: Qinhuangdao, Bo Hai Gulf (as Peichili Bay), 39°55'N, 119°37'E (Shen, 1932, 1937a). - Beidahe (as Peitaiho, Peichili Bay), 39°50'N, 119°32'E (Shen, 1932).

China, Shandong Province: Ju-shan k'ou (as Jushankou), 36°44'N, 121°25'E, southern Shandong Peninsula (Shen, 1932).

China, Fujian Province (= Fukien Province): Fuzhou (as Foochow), 26°09'N, 119°17'E, and Jimei (as Tsimei), 24°39'N, 118°06'E Province (Rathbun, 1931; Shen, 1940b; Manning and Holthuis, 1986). - Xiamen (as Amoy), 24°26'N, 118°07'E (Shen, 1940b).

Habitat. - "Found in tidepools on sandy beaches" (Shen, 1932:11); "inhabits in shallow pools of clear water, along the sand beach" (Shen, 1937a:171).

Biology. - Shen (1932:11) provided the following observations on this species: "This crab always protects itself by holding a bivalve shell upon its dorsal surface with its two prehensile posterior legs. When it was frightened, it soon stopped to move in water and concealed itself quietly under the shell or suddenly threw it off and fled away when any danger approaches to it. "André (1937:79) cited Shen's observations, adding nothing new. Shen (1937a:171) also reported that "When it moves under sunlight, it always bears a piece of bivalve shell on the carapace with the two posterior prehensile legs. But is soon throws the shell off and buries itself in the sand when any danger approaches to it."

Ovigerous females have been collected in June (Qinhuangdao, Shen, 1932 and herein; Peitaho, Shen, 1932) and July (Jimei, herein; Qinhuangdao, Shen, 1932).

This must be a relatively common species. Shen (1932) studied more than 400 specimens, of which only 10 were ovigerous females.

S.L. Yang (1986) studied the gastric mill of this species.

Remarks. - This is a much smoother species than either *P. australiensis* or *P. granulata*. Like *P. polita*, this species completely lacks granulation on the carpus of the cheliped; in this feature alone, *P. cathayana* can be distinguished from either *P. australiensis* or *P. granulata*. *Paradorippe cathayana* is a larger species than *P. polita*, and the simplest way to distinguish it from the latter is by its relatively short walking legs. The propodus of the third pereopod is more than 3 times longer than high in *P. polita*, less than three times as long as high in *P. cathayana*. The male pleopod is different in each of the species of *Paradorippe*, as shown in the figures.

The holotype is a male, cl 16.8 mm, cb 18.2 mm, from Jimei (USNM 57762). The other specimens examined are paratypes.

### *Paradorippe granulata* (De Haan, 1841)

#### Figures 48-51

*Dorippe sima*. - De Haan, 1839: pl. 39: fig. 2. - Döderlein, 1883:109. - Neuville, 1938: fig. 3 (left). [Not *Dorippe sima* H. Milne Edwards, 1837 = *Dorippoides facchino* (Herbst, 1785).]

*Dorippe granulata* De Haan, 1841:122, pl. 3: fig. 2 [type locality Japan]. - Stimpson, 1858:163. - Targioni-Tozzetti, 1877:238, pl. 2: fig. 5. - Ortmann, 1892:561. - Bouvier, 1899:176. - Rathbun, 1902:31. - Nobili, 1903b:26. - Anonymous, 1904:58, pls. 52, 53. - Stimpson, 1907:167. - Parisi, 1914:301. - Ihle, 1916:153, 156. - Balss, 1922:119 [not p. 118 = *Heikea japonica* (Von Siebold, 1824)]. - Gee, 1925:160. - Urita, 1926:ii, 40. - Shen, 1931:102, pl. 6: figs. 3, 4; 1932:15, figs. 8, 9, pl. 1: fig. 12. - Yokoya, 1933:107, 211, 218. - Sakai, 1934:283. - Kamita, 1934:540, figs. 2, 5; 1935:61, 62, 69. - Sakai, 1936:41, pl. 6: fig. 4; 1937:74, 180, pl. 10: fig. 5. - Aikawa, 1937:99, fig. 6. - Shen, 1937a:169, 171; 1937b:305. - Neuville, 1938:53, fig. 3 [left]. - Sakai, 1940:49, 53. - Shen, 1940a:214; 1940b:75. - Kamita, 1941a:238; 1941b:26, figs. 4, 5. - Urita, 1942:54. - Lin, 1949:13. - Vinogradov, 1950:234, pl.

41: fig. 145. - Shimoizumi and Tanemura, 1950 or 1955:75, fig. 221. - Shiino and Yamada, 1951:83. - Kobjakova, 1955:155, pl. 49: fig. 1a,b. - Sakai, 1956:(1) 7, (2) 25, 26, fig. 8, no. 2, fig. 9. - Uchida, 1960:595, 600, pl. 1: fig. 1. - Miyake, 1961a:13; 1961b:170. - Miyake, et al., 1962:126. - Park, 1964:16. - Kurata, 1964:71-74, figs. 1, 2. - Sakai, 1965:22 [English text], 10 [Japanese text], pl. 11: fig. 1. - Dales, 1966:308. - Kobjakova, 1966:212, pl. 49: fig. 1a,b; 1967:241. - Serène, 1968:40. - Holthuis and Sakai, 1970:90, 288. - Kim, 1970:9. - Kobjakova, 1971:313. - Nishimura and Suzuki, 1971:104, pl. 35: fig. 8. - Vaskovsky and Suppes, 1972:604. - Watabe, 1974:138. - Levin, 1976:54, fig. 106. - Suzuki, 1979:305. - Terada, 1981:21-31, figs. 1C, 2C, 3C, 4C. - Horikoshi, et al., 1982:25, 27, 29, 31, 35, 36, 43. - S.L. Yang, 1986:152. - Hines, 1986:457. - Zhou and Sun, 1986:223.

*Dorippe Granulata*. - Herklots, 1861:137.

*Dorippe*. - Targioni-Tozzetti, 1872a:397; 1872b:469. - Patton, 1967:1232.

*Dorippe granutata*. - Nobili, 1903b:26.

[Japanese name]. - Sakai, ca. 1930: pl. 8: fig. 2; 1980:41, figs. 13-2, 15. - Imajima, et al., 1970:16, fig.. - Muraoka, 1982:32.

*Dorippe granulata*. - Kamita, 1936:30.

*Doryppe granulata*. - Dawydoff, 1952:139.

*Dorippe granulata*. - Kamita, 1963:21.

Japanese crab. - Burton, 1969:63, fig. on p. 64.

*Paradorippe granulata*. - Serène and Romimohtarto, 1969:3, 6, 15, figs. 23-25, 29, pl. 2: fig. C, pl. 6: fig. C. - Takeda and Miyake, 1970:193, 195, 208; 1972:64, 69. - Takeda, 1973a:10, 11; 1973b:25, 28, 60, 61. - Kim, 1973:291 [Korean text], 610 [English text], figs. 85, 88, pl. 11: fig. 58. - Takeda, 1974:13; 1975:121, colored fig., 247. - Yamaguchi, et al., 1976:34. - Sakai, 1976:62 [English text], 50 [Japanese text], pl. 22: fig. 2. - Morita, 1977:16, pl. 2: figs. 5-8, unnumbered figure. - Takeda, 1978:33. - C.M. Yang, 1979:3. - Manning and Holthuis, 1981:31. - Horikoshi, et al., 1982:34, 80, 126, 171, 240, 245. - Takeda, 1982a:18; 1982b:94, fig.. - Sakai, et al., 1983: 2 figs. on p. 29. - Miyake, 1983:17, pl. 6: fig. 3. - K. Sakai and Nakano, 1983:81. - Takeda, 1983:121, colored fig., 247. - Horikoshi, et al., 1983:12. - Hamano, et al., 1985:5, 6, 15, 21. - Muraoka, 1985:259, figure. - Sakai, 1985:333, 335, 336, fig. 2: no. 2. - Chen, 1986:125, 139, figs. 6:28-32. - Quintana, 1987:253, figs. 13-19, 20C,c, 21G,g,H,I, 22D-F, H, 23E-H, 24B,D,E. - Yamaguchi, et al., 1987:8, pl. 1: fig. 8. - Muraoka and Konishi, 1988:125.

Vernacular Name. - Samehada-Heiki-gani (Japan; Urita, 1926, 1942).

Material. - Russia: Vladivostok, 43°06'N, 131°50'E, 1872, H. Rock, 1 ♀ (C).

Japan (general): Japan, P.F. von Siebold and H. Bürger, 1829-1834, 4 ♂, 2 ♀ (syntypes, L); same locality, H. Bürger, 1830-1834, 12 ♂, 10 ♀ (syntypes, L); same locality, no other data, 2 ♂, 1 ♀ (BM); same locality, H. Loomis, 13 ♂, 13 ♀ (W); same locality, U.S.S. *Palos*, F.C. Dale No. 2325, 2 ♂, 2 ♀ (W); same locality, H.A. Ward, 1891, 1 ♀ (W); same locality, P.L. Jouy, 1881, 1 ♂ (W).

Japan, Hokkaido Island: Otaru, 43°14'N, 140°59'E, University of Tokyo, 2 ovigerous ♀, 1 juvenile (W). - Hakodate, 41°46'N, 140°44'E, M. Sasaki #19, 2 ♂, 1 ♀ (W). - Hakodate fishmarket, 30 Jun 1906, *Albatross*, 1 ♀ (W).

Japan, west coast of Honshu Island: Toyama Bay (Toyama = 36°42'N, 137°14'E), K. Kikuchi, 1 ♂, 1 ♀ (W). - Toyama Bay; 1925; Hokkaido Imperial University, M. Sasaki #215, 3 ♀ (W). - Yamagata Prefecture, Aug 1917, M. Sasaki #20, 1 ♀ (W).

Japan, east coast of Honshu Island: Miyako, Rikuchu (as Minyako, Rikuzen), 39°03'N, 141°38'E, 1900, D.S. Jordan and J.O. Snyder, 1 ♂ (W). - 2.3 miles off Oboro Saki (S of Kinkazan To, 38°17'N, 14°34'E), 14-18 fm (= 26-33 m), grey sand, 5 Jun 1900, *Albatross* Sta. 3767, 2 ♀ (W). - 4.25 miles S of Daikoku Saki (S of Kinkazan To), 25-27 fm (= 46-49 m), light grey sand, 5 Jun 1900, *Albatross* Sta. 3768, 2 ♂ (W). - 5.3 miles off Nagane Saki (S of Kinkazan To), 40-42 fm (= 73-77 m), green mud, sand, 5 Jun 1900, *Albatross* Sta. 3769, 1 juvenile (W). - Yenoshima, mouth of Tokyo Bay (as Bay of Jeddo; Tokyo = 35°40'N, 139°45'E), E.L. Morse, Boston Society of Natural History, 3 ♂ (W). - Yenoshima, Imperial University of Tokyo, 3 ♂, 5 ♀ (W). - Enoshima, 35°18'N, 139°29'E, Sagami Bay, P.L. Jouy, 10 ♂, 4 ♀ (W). - Manazuru, 35°08'N, 139°10'E, Sagami Bay, 6 Jun 1961, I. Gordon, 1 ♂ (BM). - Kii Peninsula, T. Sakai, 2 ♂ (BM). - Tanabe Bay, 33°43'N, 134°50'E, Kii Peninsula, 18 Apr 1961, Mr. Yamamoto, 1 ♀ (BM). - Fukura, Awaji Island, 34°20'N, 135°22'E, Inland Sea, Y. Hirase, 1 ♂ (W). - Misaki, Osaka Bay, 33°23'N, 132°08'E, ca. 25 fm (= 46 m), sand, 9 Jun 1914, Th. Mortensen, 1 ♂, 1 ♀ (C). -

Japan, Shikoku Island: Mimase, near Kochi, 33°20'N, 133°40'E, Tosa Bay, south-eastern coast, 17 May 1979, H. Suzuki, K. Sakai, L.B. Holthuis, 5 ♂, 2 ♀ (L).

Japan, Kyushu Island: Nagasaki, 32°45'N, 129°52'E, 1900, D.S. Jordan and J.O. Snyder, 1 ♂, 2 ♀ (W). - Off Tomioka, Amakusa, 32°31'N, 130°02'E, 60-70 m, Aug 1983, T. Yamaguchi, 3 ♂, 2 ♀ (L).

China, Shandong Province: Qingdao, 36°04'N, 120°22'E, Shandong Peninsula [as Tsingtao, Shantung Peninsula], Aug 1926, A. de C. Sowerby, 2 ovigerous ♀ (W).

China, Zhejiang Province: Zhoushan (as Chusan; Zhoushan Island = 30°05'N, 122°06'E), P. Bassett-Smith, 1 ♂, 3 ♀, 3 juveniles (BM).

China, Fujian Province (= Fukien Province): Jimei (as Tsimei), 24°39'N, 118°06'E, Jun 1923, S.F. Light, 2 ♂, 2 ovigerous ♀ (W). - Xiamen (as Amoy), 24°26'N, 118°07'E, C.J. Shen, 2 ♂, 1 ♀ (BM).

Hong Kong: Hong Kong (Hong Kong Island = 22°15'N, 114°11'E), 1 ♂, 1 ♀ (BM).

Description. - Carapace 1.00 to 1.16 times broader than long, flattened. Most of dorsal surface, including gastric and cardiac regions, coarsely granular, granulation visible to the naked eye; anterior fourth of carapace much less granular than remainder of surface and lateral margins. Surface also covered with scattered short hairs, not dense enough to obscure granulation. Cervical and branchial grooves well marked, not granulate, both deeper anterolaterally than across midline. Paired submedian branchial lobes prominent. Frontal teeth blunter and broader than exorbitals, latter extending to or slightly beyond front. Inner orbital lobe obtuse, usually well marked, often separated from outer margin of frontal tooth by rounded notch. Postorbital fissure narrowly open. Suborbital margin granular, forming narrow, U-shaped cup. Inner suborbital tooth triangular, apex acute, falling well short of front.

Chelipeds very unequal in larger males (cl ca. 15 mm and larger), right larger, chela inflated; chelipeds equal in smaller males and in females. Merus, carpus, and palm of cheliped granular in both sexes, fingers smooth. Surface of cheliped with scattered short hairs, upper and lower margins fringed with longer hairs.

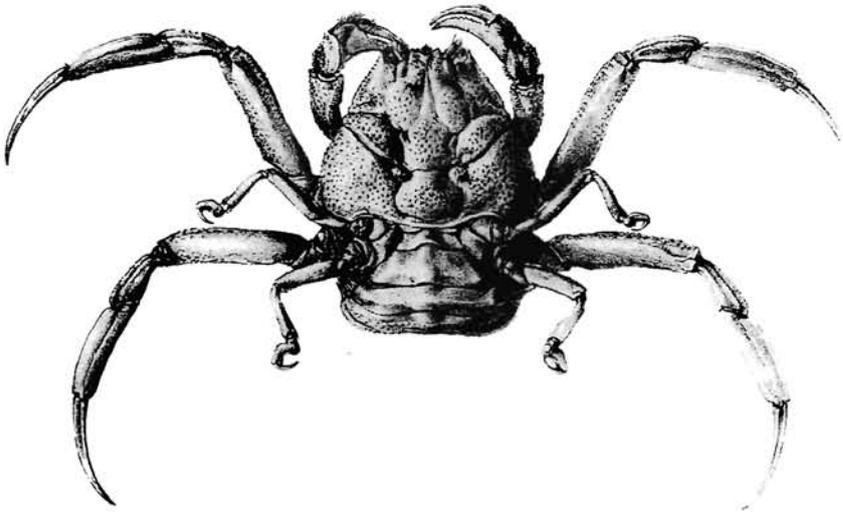


Figure 48. - *Paradorippe granulata* (De Haan). From De Haan, 1839, pl. 3: fig. 2.

Second and third pereopods long, but merus shorter than carapace and larger than frontorbital width in both sexes. On both legs, merus and carpus coarsely granular and covered with short, scattered hairs. Carpus strongly bicarinate, with 1 anterior and 1 dorsal carinae, both granular. Propodi of both legs flattened, less granular and less hairy than preceding segments, appearing naked. Dactyli of both legs naked, slender, tapering distally, longer than respective propodus in both sexes. Fourth and fifth pereopods short, merus less than half carapace length, covered with short hairs.

Surface of male abdomen granular and setose. First somite trapezoidal, almost twice as wide as long. Second somite longer and wider than first, with 3 granular prominences, 1 median and 2 submedian. Third somite widest, with small median and 2 enlarged submedian prominences, crossed by line of granules. Fourth somite shorter than fifth or sixth, crossed by transverse granular line, with median prominence. Fifth somite laterally constricted at midlength, with low median prominence. Sixth somite as long as fifth, tapering distally, with median and submedian prominences. Telson shorter than sixth somite, subtriangular, slightly wider than long.

Female abdomen granular, with sparse coat of short setae. Third and fourth somites shortest, fifth and sixth longest, abdomen widest at fourth and fifth somites. Each somite with low but distinct median prominence, second and fifth crossed by raised line of large granules, largest on fifth somite. Telson subtriangular, wider than long.

Male pleopod as illustrated.

Color. - Several authors have provided observations on color of this species, as follows: "Color in life reddish above, white below" (Stimpson, 1907:167). "In alcohol, carapace pompeian red above, sea shell pink below. Outer surface of manus of cheliped naphthalene yellow" (Shen, 1931:103). "In alcohol, dorsal surface of carapace begonia rose, ventral light buff; dorsal surface of ambulatory legs seashell pink, ventral light" (Shen 1932:17); "reddish above, white below" (Urita, 1942:54).

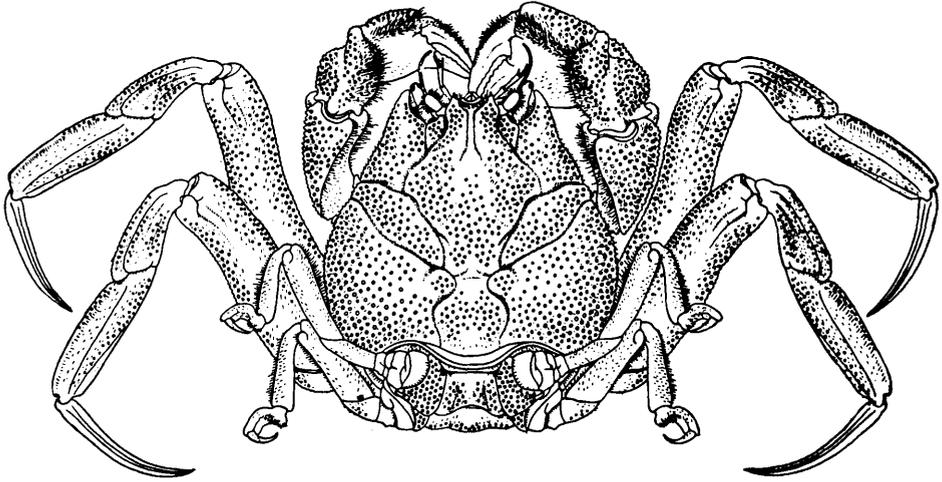


Figure 49. - *Paradorippe granulata* (De Haan). From Shen, 1932, fig. 8.

The colored figure in Imajima, et al. (1970) shows a crab with the carapace dark brown overall, the grooves lighter, legs pale greyish brown, chelae and distal part of carpus of chelipeds whitish.

Colored figures have been published by Sakai (1936, pl. 6: fig. 4; 1937, pl. 10: fig. 5; 1965, pl. 11: fig. 1; and 1976, pl. 22: fig. 2), Imajima, et al. (1970:16, fig.), Kim (1973, pl. 11: fig. 58), Takeda (1975:121, fig.; 1982b:94, fig.; 1983:121, fig.), Muraoka (1982:32, fig.), Miyake (1983, pl. 6: fig. 3), and Sakai, et al. (1983, 2 figs. on p. 29).

Size. - Males, cl 5.5 to 28.3 mm, cb 5.0 to 32.5 mm; non-ovigerous females, cl 10.9 to 25.5 mm; ovigerous females, cl 14 to 24 mm, cb 15 to 26 mm. This is the largest of the species of *Paradorippe*.

Distribution. - This species lives far to the north of any of the Indo-West Pacific species of Dorippinae, occurring in Peter the Great Bay in Russia and on Hokkaido Island in Japan. It is apparently abundant along the entire coast of Korea and China, south to Hong Kong. Records in the literature include:

Russia: Far Eastern Seas (Kobjakova, 1955, 1966). - Far East (Vinogradov, 1950). - Off Kril'on, Kril'onsky Poluostrov, Sakhalin (as Siranusi, Notoro Peninsula, Saghalien), 45°57'N, 142°01'E (Urita, 1942). - Vladivostok, 43°06'N, 131°50'E (Balss, 1922). - Zaliv Petri Velikogo (as Peter the Great Bay), 42°40'N, 132°00'E (Levin, 1976). - Zaliv Posyete (as Posiet or Posjet Bay), 42°38'N, 103°47'E (Kobjakova, 1967, 1971; Vaskovsky and Suppes, 1972).

Japan (general): Japan (De Haan, 1841; Herklots, 1861; Bouvier, 1899; Parisi, 1914; Sakai, 1930, 1936, 1940, 1956, 1980, 1985; Shimoizumi and Tanemura, 1950 or 1955; Nishimura and Suzuki, 1971; Takeda, 1975, 1982b, 1983; Muraoka, 1982; Miyake, 1983; Sakai, et al., 1983). - Off northeastern coast of Japan (as Nippon) (Stimpson, 1858, 1907).

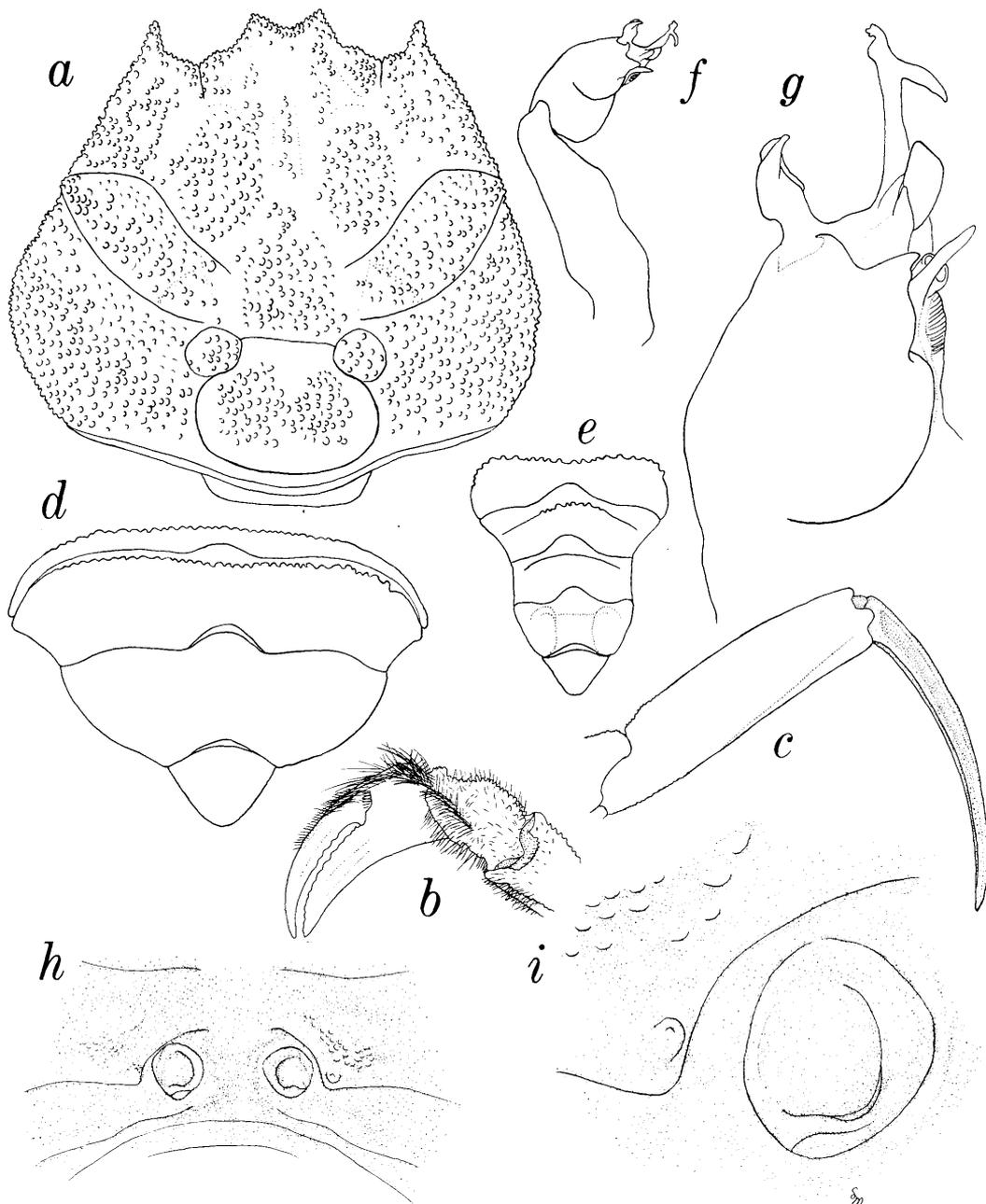


Figure 50. - *Paradorippe granulata* (De Haan). *a*, carapace; *b*, chela; *c*, distal segments of P3; *d*, *e*, abdomen, ventral view; *f*, gonopod; *g*, apex of gonopod; *h*, gonopores and sternum; *i*, gonopore, enlarged. *a*, female syntype, cl 19.8 mm, Japan; *b*, *d*, ovigerous female, cl 19.8 mm, Japan; *c*, *e*-*g*, male, cl 19.4 mm, Japan; *h*, *i*, ovigerous female, cl 19.8 mm, Japan.

Japan, Hokkaido Island: Hokkaido (Kurata, 1964). - Otaru, 43°13'N, 141°00'E (from Terazaki, vide Urita, 1942). - Off Oshoro Bay near Otaru (Uchida, 1960). - Shioya, Shiribeshi (as Sioya, Siribesi), 43°13'N, 140°56'E (Urita, 1942). - Bay of Hakodate (Hakodate = 41°46'N, 140°44'E) (Stimpson, 1858, 1907).

Japan, west coast of Honshu Island: Mutsu Bay, 41°05'N, 140°55'E, Tohoku District (Takeda, 1974). - From Wakasa Bay to Tsugaru (as Tugaru) Strait, 41°06'17"N, 140°09'50"E (W of Lake Zyusan-gata, Aomori-ken) and 40°06'30"N, 139°44'30"E (N of Oga) (Yokoya, 1933; Horikoshi, et al., 1982 [these authors reported upon the same collections; Yokoya's localities are in parentheses]). - Aomori, 40°49'N, 140°45'E (Balss, 1922). - Yamagata Prefecture (Suzuki, 1979). - Niigata, 37°57'N, 139°04'E (Miyake, et al., 1962; Kamita, 1963). - Toyama Bay (Toyama = 36°42'N, 137°14'E) (Kamita, 1933; Urita, 1942). - Toyama Prefecture (Miyake, et al., 1962). - Ishikawa Prefecture (Anonymous, 1904). - San-in District (Kamita, 1963). - Katsuyama (as Katsiyama, Ortmann, 1892; Urita, 1942).

Japan, east coast of Honshu Island: Miyako, Rikuchu (as Minyako, Rikuzen), 39°03'N, 141°38'E (Rathbun, 1902). - From Siriyazaki to Kinkazan, 39°21'50"N, 142°04'50"E (near Todo-saki) and 38°16'N, 141°19'E (W of Kinkazan); from Sunosaki to Siriyazaki, 38°16'45"N, 141°25'40"E (near Kinkazan) and 38°15'20"N, 141°26'50"E (near Kinkazan); from Sunosaki to Kinkazan, 37°48'30"N, 141°16'30"E (S of Kinkazan), 37°39'N, 141°12'30"E (between Siwoya-zaki and Kinkazan), 36°06'N, 140°46'E (N of Inuboe-zaki), 35°39'15"N, 140°57'E (near Inuboe-zaki), and 35°36'N, 140°46'50"E (SW of Inuboe-zaki) (all Yokoya, 1933 [localities in parentheses] and Horikoshi, et al., 1982). - Onagawa Bay, 38°26'N, 141°28'E (Balss, 1922). - Kominato, Boso Peninsula (as Kominato, Boshu), 35°09'N, 140°11'E (Balss, 1922). - Tokyo Bay (Tokyo = 35°40'N, 139°45'E) (Ortmann, 1892; Parisi, 1914; Balss, 1922; Sakai, 1937). - Yokohama, 35°28'N, 139°28'E (Targioni-Tozzetti, 1872a,b, 1877; Nobili, 1903b; Parisi, 1914). - Tateyama, Tokyo Bay, 34°59'N, 139°50'E (Balss, 1922; Sakai, 1976). - Sagami Bay, 35°15'N, 139°25'E (Sakai, 1937; Watabe, 1974). - Sagami Bay, 34°44'N, 138°31'10"E (Suruga Bay) (Yokoya, 1933 and Horikoshi, et al., 1982). - Kanagawa Prefecture (as Tanagava) (Ortmann, 1892). - Off Enoshima, 35°18'N, 139°29'E, Kameki Reef, and off Jogashima, Sagami Bay (Sakai, 1965, 1976). - West and southwest coast of Enoshima (Döderlein, 1883). - Enoshima (Urita, 1942). - Between Ito, 34°58'N, 139°04'E, and Hatsushima, 35°02'N, 139°10'E (Balss, 1922). - Sagami Sea, off southeastern coast of Izu Peninsula, 6 stations between 34°40.6'-45.1'N, 138°59.7'-139°02.2'E (Takeda, 1982). - Shimoda, 34°40'N, 138°55'E (Sakai, 1937, 1976). - Uchiura Inlet, Suruga Bay, 35°02.4'N, 138°51.5'E, and 35°02.6'N, 138°50.2'E (Horikoshi, et al., 1983). - Okitsu, Suruga, 35°04'N, 138°30'E (Parisi, 1914). - Mikawa Bay, 34°45'N, 138°30'E (Serène and Romimohtarto, 1969; C.M. Yang, 1979). - Mikawa Isshiki (Sakai, 1976). - Enshu Nada, Shizuoka Prefecture, 34°27'N, 137°38'E (Terada, 1981). - Ise Bay, 34°43'N, 136°43'E (Sakai, 1937). - Mie Prefecture (Shiino and Yamada, 1951). - Tsu, 34°41'N, 136°36'E, Ise (Balss, 1922). - Kii Nagashima, 34°11'N, 136°20'E (Sakai, 1976). - Kii Minabe, 33°47'N, 135°20'E (Sakai, 1976). - Wakanoura, Kii (Wakanoura Bay = 34°10'N, 135°10'E) (Rathbun, 1902). - Misaki, Osaka Bay, 33°23'N, 132°08'E (Balss, 1922).

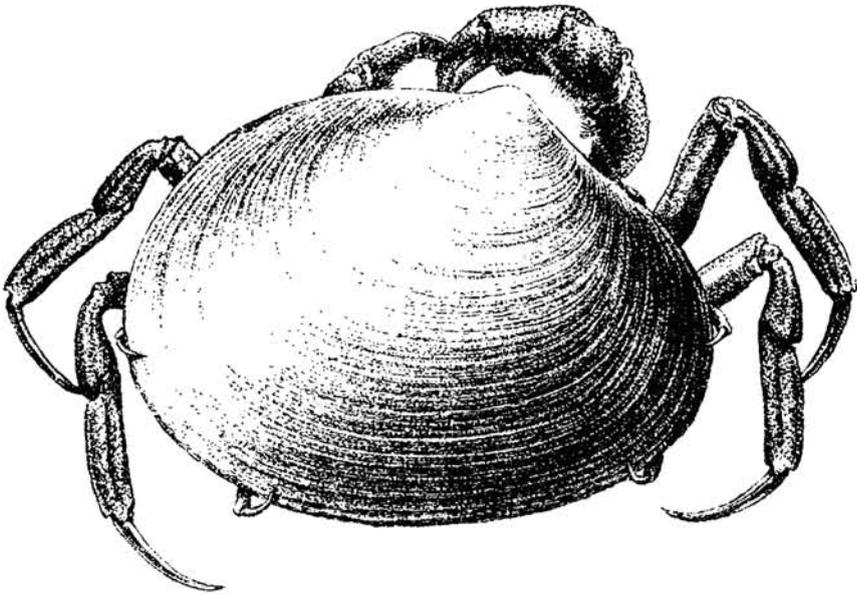


Figure 51. - *Paradorippe granulata* (De Haan), carrying a bivalve. From Kobjakova, 1966, pl. 49: fig. 1a.

Japan, Shikoku Island: Off Matsushige, Itanogun; Tsubakidomari and Ishima, Anan; all Tokushima Prefecture (K. Sakai and Nakano, 1983). - Tosa Bay (Quintana, 1987). - Tosa Bay,  $34^{\circ}02'42''\text{N}$ ,  $136^{\circ}20'28''\text{E}$  (E of Owase, Mie-ken) (Yokoya, 1933 and Horikoshi, et al., 1982).

Japan, Kyushu Island: Off Tsushima Islands,  $34^{\circ}45.9'\text{N}$ ,  $129^{\circ}5.9'\text{E}$  (Takeda, 1973a,b). - Tsushima (as Tusima) Strait,  $33^{\circ}33'\text{N}$ ,  $129^{\circ}15'\text{E}$  (N of Goto Islands, W of Hirato) and  $33^{\circ}56'40''\text{N}$ ,  $130^{\circ}10'\text{E}$  (between Simonoseki and Iki Island) (Yokoya, 1933 and Horikoshi, et al., 1982). - Tsushima Strait, off Goto Islands (Yokoya, 1933). - Tsuyazaki,  $33^{\circ}49'\text{N}$ ,  $130^{\circ}27'\text{E}$  (Miyake, et al., 1962). - Hakata Bay,  $33^{\circ}37'\text{N}$ ,  $130^{\circ}23'\text{E}$  (Hamano, et al., 1985). - Sea of Ariake,  $33^{\circ}05'\text{N}$ ,  $130^{\circ}15'\text{E}$  (Miyake, 1961b; Miyake, et al., 1962). - Nagasaki,  $32^{\circ}45'\text{N}$ ,  $129^{\circ}52'\text{E}$  (Balss, 1922; Sakai, 1934, 1937). - Nagasaki, Hizen (Rathbun, 1902). - Vicinity of Aitsu Marine Biological Station (Aitsu =  $32^{\circ}30'\text{N}$ ,  $130^{\circ}26'\text{E}$ ) (Yamaguchi, et al., 1976). - Amakusa Islands (Yamaguchi, et al., 1987). - Amakusa,  $32^{\circ}20'\text{N}$ ,  $130^{\circ}15'\text{E}$  (Miyake, 1961a; Miyake, et al., 1962; Takeda, 1978). - Kagoshima (as Kagosima),  $31^{\circ}37'\text{N}$ ,  $130^{\circ}32'\text{E}$  (Ortmann, 1892; Urita, 1926, 1942). - Takamatsu, Kagoshima (as Takamatu, Kagosima) (Urita, 1942). - Shibushi, Osumi (as Sibusi, Ohsumi), Kagoshima Prefecture, and Ibusuki,  $31^{\circ}28'\text{N}$ ,  $131^{\circ}07'\text{E}$  (Urita, 1926, 1942). - Izaku and Satsuma (as Satuma),  $31^{\circ}31'\text{N}$ ,  $130^{\circ}21'\text{E}$  (Urita, 1926, 1942).

Korea: *Paradorippe granulata* has been recorded from Korea by several authors, including Kamita (1934, 1935, 1936, 1941a,b), but we have been unable to pinpoint the localities recorded for it. We have had to rely on Kim (1970, 1973) for the distri-

bution of this species in Korea. Kim (1973, fig. 85) listed Korean localities for this species on page 8, and they are shown in a map on page 9. Other localities in the literature are as follows: Yellow Sea (Kamita, 1934, 1935, 1941a). - Korea Strait (Kamita, 1936, 1941a). - Japan Sea (Kamita, 1941a). - eastern Sea of Korea (Park, 1964). - Zinsen (Sakai, 1937; shown by Sakai (1940, fig. 3) in a map). - Cheongsura, Nojin, Gyeongsong, Gunseon, Sinpo, Samho, Seohojin, Weonsan, Heubgog, Gojeo, Jumunjin, Busan, Tong-yeong, Yeosu, and Asan (Kamita, 1941b). - Yeong-il Bay, Guryongpo, and Mugho (Park, 1964; localities listed in Kim, 1973). - Dolsan-do Island (Kim, 1970). - Sogcho (Kim, 1973). - Chunmunjin; Bangjuggpo, Dolsan-do Island; Jinhae; Namcheongdong, Pusan; Yeong-il Bay; and Haeundae, Pusan (Kim, 1970, 1973).

East China Sea: East China Sea (Takeda and Miyake, 1970). - 28°32'N, 126°18.8'E (Takeda and Miyake, 1972).

China (general): China (S. Yang, 1986; Chen, 1986). - North China (Shen, 1937b). - Chinese Seas (Gee, 1925).

China, Liaoning Province: Liaoning Province (Zhou and Sun, 1986).

China, Shandong Province: North coast of Shandong Peninsula (as Shantung Peninsula) (Shen, 1932, 1937a). - Penglai (= Tengchow), 37°50'N, 120°45'E, and Weihai (= Weihaiwei), 37°30'N, 122°04'E (Shen 1932).

China, Fujian Province (= Fukien Province): Jimei (as Tsimei), 24°39'N, 118°06'E, Xiamen (as Amoy), 24°26'N, 118°07'E, and Liuwutien (on mainland opposite Xiamen, across bay from Jimei), 24°34'N, 118°12'E (Shen, 1940b).

Hong Kong: Hong Kong (Hong Kong Island = 22°15'N, 114°11'E) (Ortmann, 1892). - Hong Kong Harbor (Stimpson, 1858, 1907). - Shaukiwan District, Hong Kong (Shen, 1931a, 1940a). - Aberdeen, 22°14'N, 114°09'E (Shen, 1940a),

Taiwan: Off Chilung, 25°10'N, 121°43'E (Takeda and Miyake, 1970). - Tingch'ieting (Lin, 1949).

Fossil Record. - Holocene fossils of this species have been recorded from Nagoya, Ise Bay, Honshu Island (Morita, 1977), and from Osaka City, Honshu Island (Kaneko, 1958).

Habitat. - This is a sublittoral species, living in depths between about 2 to 154 meters; of the available depth records, five are from less than 20 meters, 18 from 21 to 50 meters, 16 from 51 to 100 meters, and 10 from depths in excess of 100 meters. Döderlein (1883) reported it from a sandy bottom. Horikoshi, et al. (1982) reported that it was taken on sand, fine sand, sand and pebbles, sand and shells, sandy mud, muddy sand and shells, gravel and clay and rock. Shen (1932) reported that it was dredged on sand or muddy bottom, and (1937a) he commented that it was rare, dredged out, not far from the coast, in 8-15 fathoms (= 15-27 meters), taken together with *H. japonica*. Sakai (1976) had material from sandy or shelly bottoms. It was taken by the *Albatross* off eastern Honshu on light grey sand in 46 to 49 meters, on grey sand in 26 to 33 meters, and on green mud and sand in 73 to 77 meters.

Biology. - Almost nothing is known about the biology of this species. Like *Doripoides facchino* and *Neodorippe callida*, it uses the last two pairs of pereopods to hold an object over the dorsum of its carapace. In *P. granulata* these objects seem to be mostly shells of the lamellibranch genus *Macoma* on which sea anemones often are fastened. The first record is that by Döderlein (1883:109) who observed that "diese kleine Krabbe benutzt ihre zwei Paare von Rückenfüssen, um eine Bivalvenschale (Tellina) als Schild über sich zu halten, unter der der ganzen Körper des Thieres sicht

versteckt mit Ausnahme des langen zweiten und dritten Fusspaares." Uchida (1960:595) described a new genus and species of sea anemone, *Carcinactis ichikawai*, found on the dead shells of *Macoma sector* (Von Martens, 1865) and *M. incongrua* Oyama, 1950 carried by *Paradorippe granulata* from off Oshoro Bay near Otaru, Hokkaido, Japan. Usually one but sometimes two or three anemones are found on a single shell that is carried by the crab. "The crabs show a special preference for those shells bearing the anemone and when placed in an aquarium containing clam shells with and without attached anemones choose those shells with anemones. A crab will seize a clam shell with its pincers and transfer the shell to the back legs which then hold it over the back of the crab" (Uchida, 1960:595). Dales (1966) summarized Uchida's observations.

This habit was misinterpreted by Burton (1969, fig. on p. 64), who briefly described the crab-anemone relationship, but, in his figure, showed a spider crab (possibly a *Macrocheira*, with 11 legs!) holding in each claw a bivalve to which is attached an anemone (Figure 52).

Kobjakova (1966:212) reported that this species was "Given the common name of 'shy crab' because it usually hides its carapace under the valve of *Macoma* onto which it holds with the hooks of the 2 pairs of walking legs." A specimen under a *Macoma* shell was shown by Kobjakova in plate 49, fig. 1a in 1955 and 1956; this figure was reproduced by Levin (1976, fig. 106a) and is shown here (Figure 52). Also Sakai (1956:26, fig. 9; 1980:43, fig. 15) showed the species carrying a clam shell. In both Kobjakova's and Sakai's figures no anemones are shown on the clams. Sakai, et al. (1983, fig. on p. 29) show a *P. granulata* carrying a shell.

Patton (1967:1232), in referring to this species, noted that "Certain species of *Dorippe* which carry fragments of shell on their backs, prefer pieces of shell containing sea anemones."

Miyake (1961b) reported that the species was taken in the stomachs of the shark *Mustelus manazo* Bleeker, 1854 in the deepest parts of the Sea of Ariaké; he also noted that there the egg bearing season was in mid-September. Ovigerous females also have been reported in June (Sagami Bay: Watabe, 1974), July (Tsushima Strait: Yokoya, 1933 and Horikoshi, et al., 1982), August (Penglai, Shandong Province: Shen, 1932; Amakusa Islands: Yamaguchi, et al., 1987), and November (off Chilung, Taiwan: Takeda and Miyake, 1970). In our material ovigerous females have been taken in June (Jimei) and August (Qindao).

Aikawa (1937) described and figured the first zoea. The four zoeal stages have been described and figured by Terada (1981). Quintana (1987) described and figured the fourth zoea, the megalopa, the first crab stage, and the adult. Kurata (1964) identified larval stages from the plankton off Hokkaido with this species, and Hines (1986) cited Kurata's data.

Although Balss (1922:118) connected this species with the Japanese legend of Heike gani, it is certain that he meant to attribute this legend to *Heikea japonica* (see above). Neuville (1938, fig. 3, left) showed the carapace of *P. granulata* as that of a species similar to *H. japonica*. Muraoka (1985) figured *P. granulata* in his Japanese account of Heike-gani.

Vaskovsky and Suppes (1962) tested the hepatopancreas of *P. granulata* for Phospholipase A activity and found none.

S.L. Yang (1986) studied the gastric mill of this species.

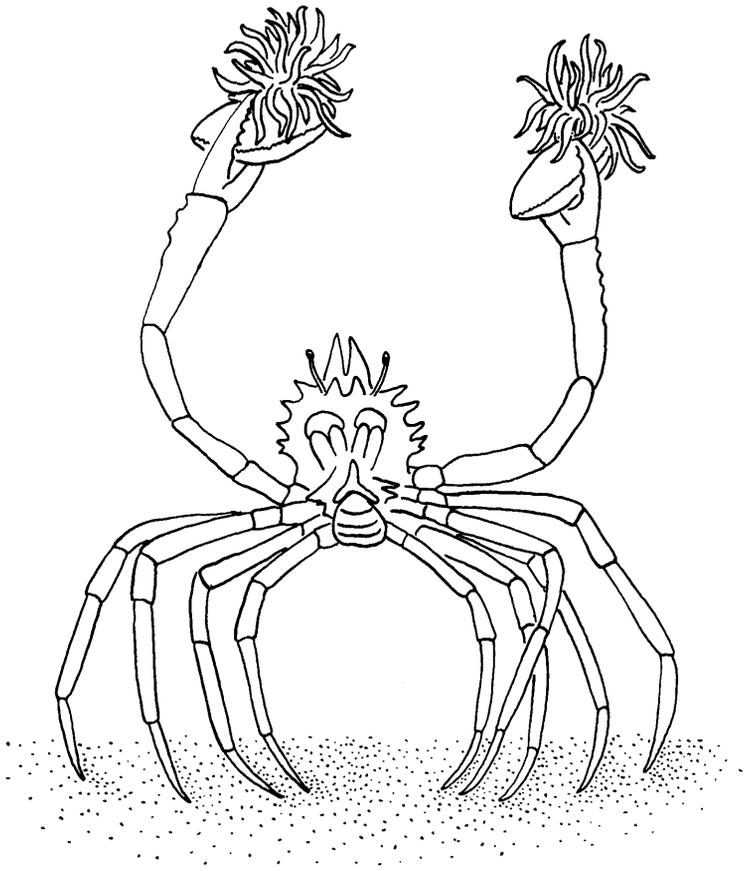


Figure 52. - The association of *P. granulata* (De Haan) and an anemone, as presented by Burton (1969). Redrawn from Burton, 1969, fig. on p. 64.

Remarks. - This species can be distinguished from all of the other species of *Paradorippe* by the size of the granules on the carapace and the extent of granulation on the carapace and legs. The granules on the carapace are coarser and far more numerous than in any of the other species of the genus. This is the only species in the genus in which the entire surface of the palm is covered with granules. As in *P. australiensis* the carpus of the cheliped is covered with granules, a feature which distinguishes *P. australiensis* and *P. granulata* from *P. cathayana* and *P. polita*, in which the carpus of the cheliped is entirely smooth. *Paradorippe granulata* further differs from *P. australiensis* in having the parallel ridges on the carpus of the second and third pereopods noticeably granular, as pointed out by Miers (1884:259); in *P. cathayana* and *P. polita* as well these ridges are smooth.

*Paradorippe granulata* is the largest species in the genus, attaining a carapace length in excess of 28 mm. Specimens of *P. australiensis* and *P. cathayana* are not known to exceed 20 mm in length, and *P. polita* is smaller than cl 12 mm as an adult.

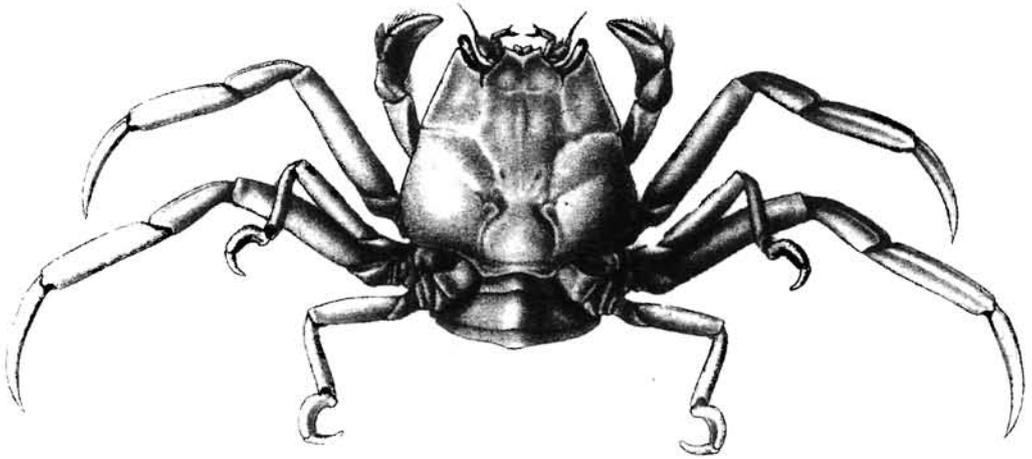


Figure 53. - *Paradorippe polita* (Alcock and Anderson). From Alcock and Anderson, 1896, pl. 24: fig. 4.

Smaller specimens of *P. granulata*, cl less than 13 mm, may have the carapace length and width equal or the width only slightly greater (ratio 1.00 to 1.06); in larger specimens the carapace may be as much as 1.16 times wider than long.

In both males and females of *P. granulata* the abdomens are noticeably rough and granular; the abdomens of females of other species in the genus appear to be smooth.

Morton and Morton (1983:187, 201, fig. 10.4 no. 7) reported *Dorippe granulata* from Hong Kong. Their specimens actually are identifiable with *Dorippoides facchino* (q.v.).

### *Paradorippe polita* (Alcock and Anderson, 1894)

#### Figures 53-56

*Dorippe polita* Alcock and Anderson, 1894:208 [type locality Palk Straits, India, depth 7 fm]; 1896: pl. 24: fig. 4. - Alcock, 1896:281. - Ihle, 1916:153, 160. - Sankarankutty, 1966:349, fig. 16. - Serène, 1968:40.

*Dorippe polita*. - Alcock and Anderson, 1894:198.

*Paradorippe ? polita*. - Serène and Romimohtarto, 1969:6, 17 [p.p.].

*Paradorippe polita*. - Manning and Holthuis, 1981:31.

Material. - India: Palk Straits, 9°51'50"N, 79°53'22"E, 7 fm (= 13 m), shell, coral and mud, Agassiz trawl, 13 Apr 1894, *Investigator* Sta. 174, 1 ovigerous ♀ (holotype, ZSI 9081/6, 4544/7).

Malaysia: Pinang, 5°24'N, 100°14'E, *Galatea*, 1 ♂, 2 ♀ (C,W).

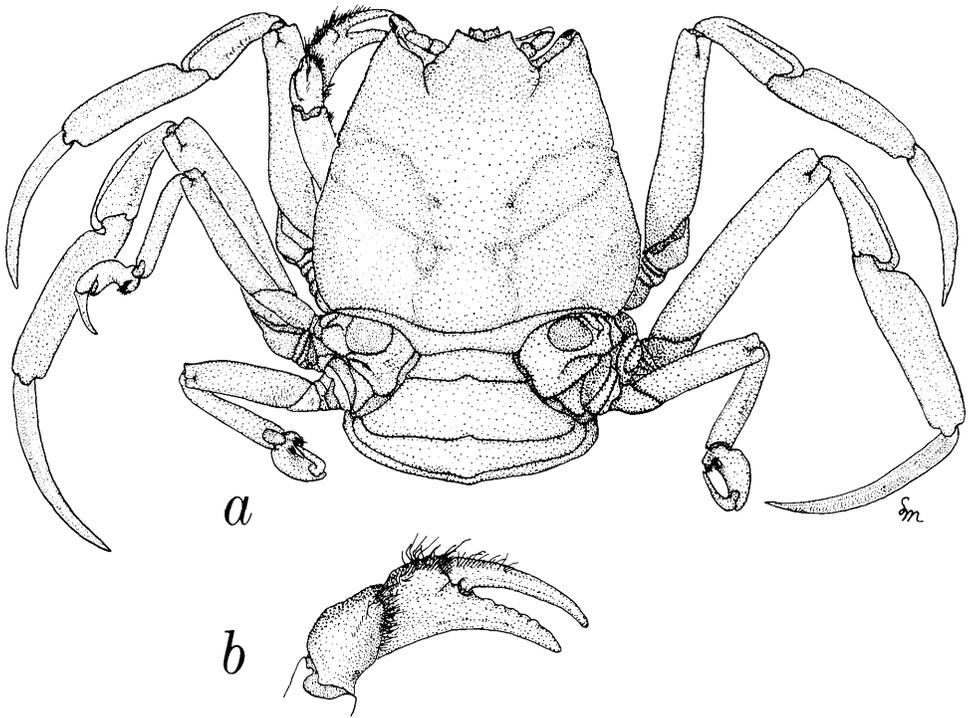


Figure 54. - *Paradorippe polita* (Alcock and Anderson). a, dorsal view; b, chela. Holotype, ovigerous female, cl 11 mm, Palk Strait.

Description. - Carapace 1.06 to 1.08 times broader than long, appearing smooth, polished, naked or nearly so, anterolateral margins and margins of branchial regions minutely granular. Cervical groove deep, well marked, branchial groove indistinct laterally. Prominent paired submedian branchial lobes present, distinct mesially, indistinct laterally. Frontal teeth broader and sharper than exorbitals, apices of former each a sharp tubercle; apices of exorbitals extending slightly beyond front. Inner orbital lobe low, poorly marked, appearing faintly bilobed in one specimen, usually scarcely changing line of outer margin of frontal tooth. Postorbital fissure V-shaped, broadly open anteriorly, closed posteriorly. Suborbital margin minutely granular, forming a narrow, U-shaped cup, inner orbital tooth subrectangular, with blunt or flattened apex, falling well short of front.

Chelipeds unequal in only male examined, cl 9.7 mm, right chela larger, inflated; chelipeds equal in females. All segments of chelipeds smooth and naked, except for dorsal and ventral fringes of long hairs. Carpus of cheliped with outer carina.

Second and third pereopods long, but merus shorter than carapace and greater than frontorbital width on both legs in both sexes. On both legs, all segments naked and smooth. Carpus with 2 carinae, anterior and dorsal, neither granular. Propodus flattened, on P3 3.2 to 3.3 times longer than high. Dactylus slender, tapering distally, longer than respective propodus on both legs in both sexes. Fourth and fifth pereopods short, largely naked and smooth but with some scattered hairs, merus of fifth leg more than half as long as carapace in both sexes.

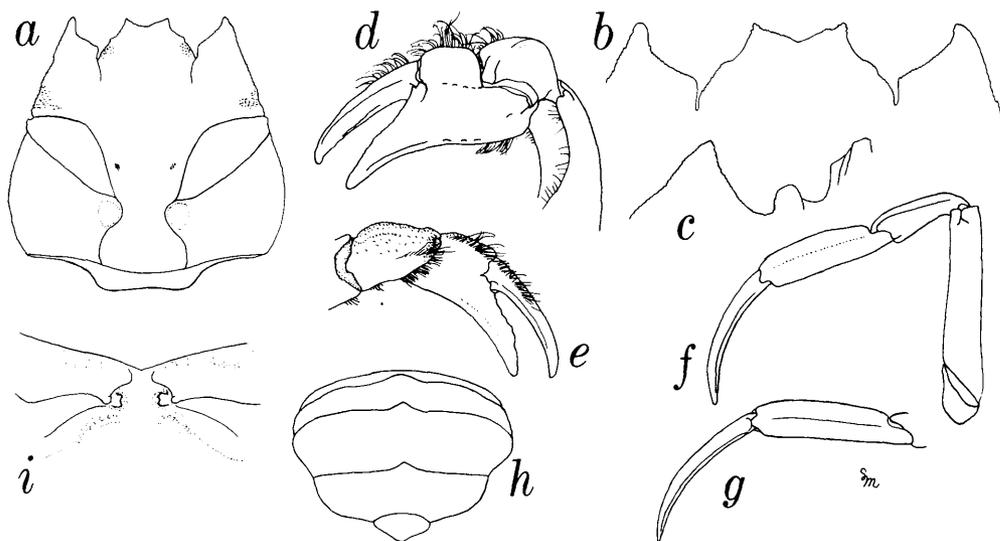


Figure 55. - *Paradorippe polita* (Alcock and Anderson). a, carapace; b, front; c, orbit; d, e, chela; f, P3; g, P3 distal segments; h, abdomen, ventral view; i, sternum and gonopores. Holotype, ovigerous female, cl 11 mm, Palk Strait.

Male abdomen appearing smooth and highly polished, surface ornamented with few, widely scattered, short setae. Abdominal somites largely lacking surface sculpture, third somite with 2 submedian swellings, fourth and sixth somites with low median swelling. Telson subtriangular, length about 2/3 width.

Female abdomen appearing smooth and polished, with faint median prominences on second to fifth somites, most pronounced on third somite. Telson triangular, only slightly wider than long. Ova small, 0.3 to 0.4 mm in diameter.

Gonopod as illustrated.

Size. - Examined specimens: male, cl 9.7 mm, cb 10.5 mm; non-ovigerous females, cl 6.9 and 7.3 mm, cb 7.3 and 7.9 mm; ovigerous female, cl 11.0 mm, cb 11.9 mm.

Alcock (1896) reported that the largest of two ovigerous females in the collections of the Indian Museum (= Zoological Survey of India) measured 11.5 mm long, 12 mm wide; Alcock and Anderson (1894) gave the same measurements but recorded only one specimen, the holotype. Only one ovigerous female was in the type lot examined by us, but the specimen was accompanied by two catalog numbers, suggesting that there was a second specimen at some time in the past, evidently obtained between 1894 and 1896.

Distribution. - Known only from three localities, two off southeastern India, and now from Pinang, Malaysia. Records in the literature include:

India: Palk Straits, 9°51'50"N, 79°53'22"E (Alcock and Anderson, 1894; Alcock, 1896). - Pudumadam, ca. 9°16'N, 79°E, Gulf of Mannar (Sankarankutty, 1966).

Habitat. - The only information available is that the type was taken in 7 fathoms (= 13 meters) on a bottom of shell, coral, and mud.

Biology. - The holotype, an ovigerous female, was collected in the month of April. A male specimen from Pinang carried a serpulid worm on the dorsal surface of the carapace (Figure 56a).

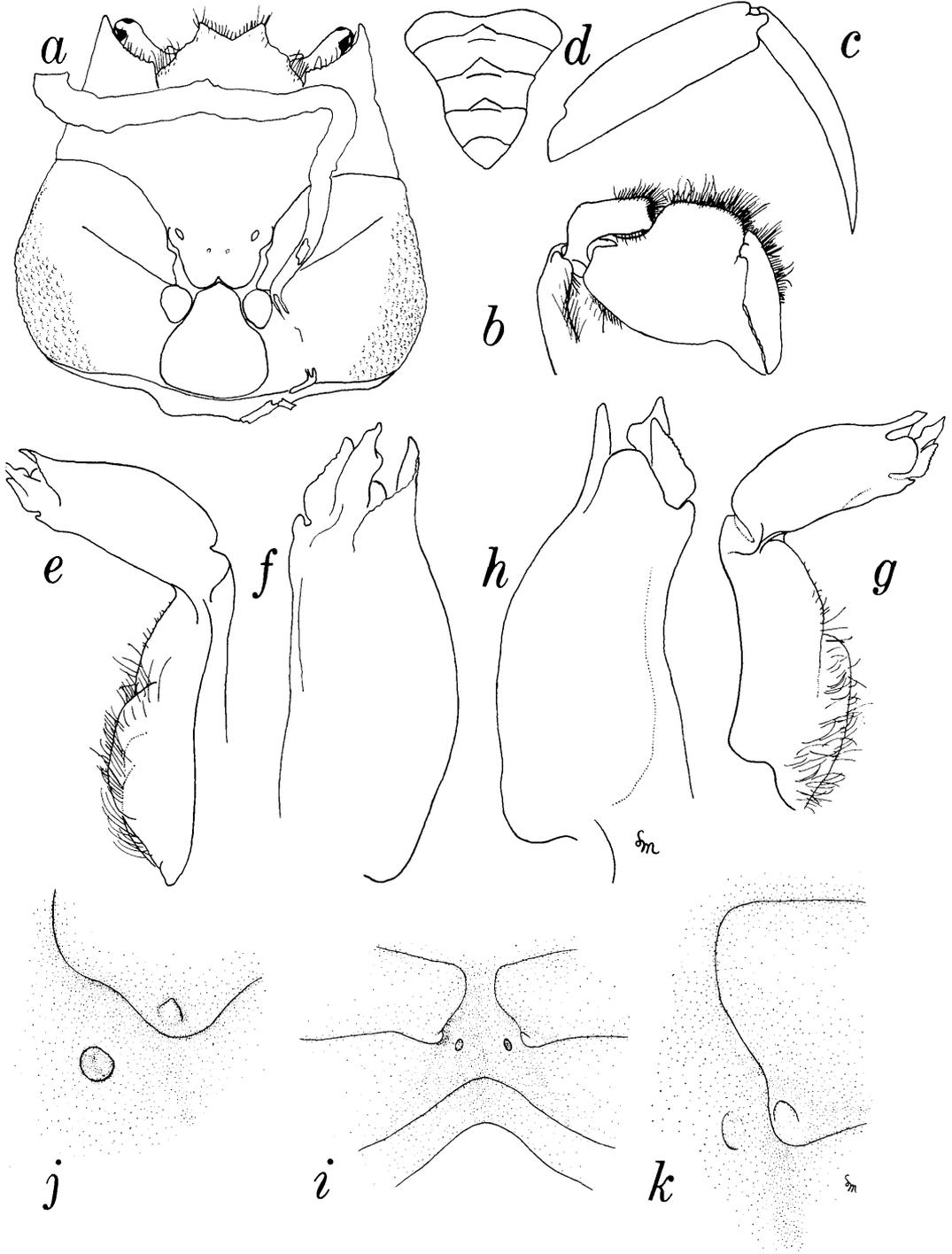


Figure 56. - *Paradorippe polita* (Alcock and Anderson). a, carapace; b, chela; c, P3 distal segments; d, abdomen, ventral view; e-h, gonopod; i, sternum and gonopores; j, k, gonopore, enlarged. a-h, male, cl 9.7 mm, Pinang; i-k, female, 7.3 mm, Pinang.

Remarks. - This is the smallest of the species of *Paradorippe*. It is much smoother than *P. cathayana*, and has much slenderer legs than that species, with which it was identified by Shen (1932). The slender walking legs, with the propodus more than 3 times as long as high, the smooth body, and the form of the first male pleopod will separate these two species.

### Genus *Philippidorippe* Chen, 1985

*Philippidorippe* Chen, 1985:182 [type species: *Philippidorippe philippinensis* Chen, 1985, by original designation and monotypy; gender feminine].

Definition. - Carapace wider than long, slightly inflated, surface naked and finely granular, especially on prominences; grooves well-marked, but no sharp spines present dorsally or laterally. Cervical groove distinct but irregular. Mesogastric region with 2 deep pits placed in cervical groove. Branchial grooves deep and well-defined. Protogastric region inflated. Urogastric region with low, transverse ridge. Branchial lobes low, convex. Cardiac region with obscure, X-shaped ridge. Epibranchial region with short, sharp ridge extending mesially from end of branchial groove. Mesobranchial region inflated, with L-shaped ridge anteromesially.

Front with 2 triangular submedian teeth; opening of exhalent canal visible in dorsal view. Inner orbital teeth very low, each reduced to a bulge on outer margin of frontal tooth. Dorsal surface of frontal teeth convex. Posterior margin of orbit with fissure. Outer orbital tooth triangular, slender and pointed, overreaching frontal teeth. Lower orbital margin unarmed. Inner suborbital tooth large and sharp, extending to or overreaching outer suborbital tooth. Eye stout, cornea ventrolateral.

Left and right cheliped of small males and female equal, in adult male right cheliped stronger. In large cheliped, fingers about 2.5 times as long as palm, directed downward. Palm smooth, except for some basal tubercles, inflated, much higher than long dorsally; lower margin smooth, merging through concave curve with fixed finger. Smaller cheliped with fingers about 3 times as long as palm, both fingers with 2 grooves separated by ridge. Upper and lower margins of dactylus and fixed finger with shallow groove. Cutting edges with about 14 rounded or bluntly triangular teeth, regularly distributed over surface. Palm with shallow, longitudinal groove on upper part of outer surface, some tubercles present basally, surface tomentose. Dorsal margin of palm and basal part of dorsal margin of dactylus with fringe of hairs. Lower margin of palm with row of hairs, remainder of lower margin of chela naked. Carpus and merus tomentose and tuberculate.

Second and third pereopods long, third longest of all legs. Merus flattened, surface tomentose, with erect dorsal spine basally, especially on P3, dorsal and ventral margins tuberculate. Carpus granulate dorsally, with some hairs. Propodus granulate, especially dorsally and ventrally, with some hairs proximally on dorsal margin. Dactylus naked. P3 of female lacking spur on ischium. Coxae of P3 in both sexes lacking swollen callosity.

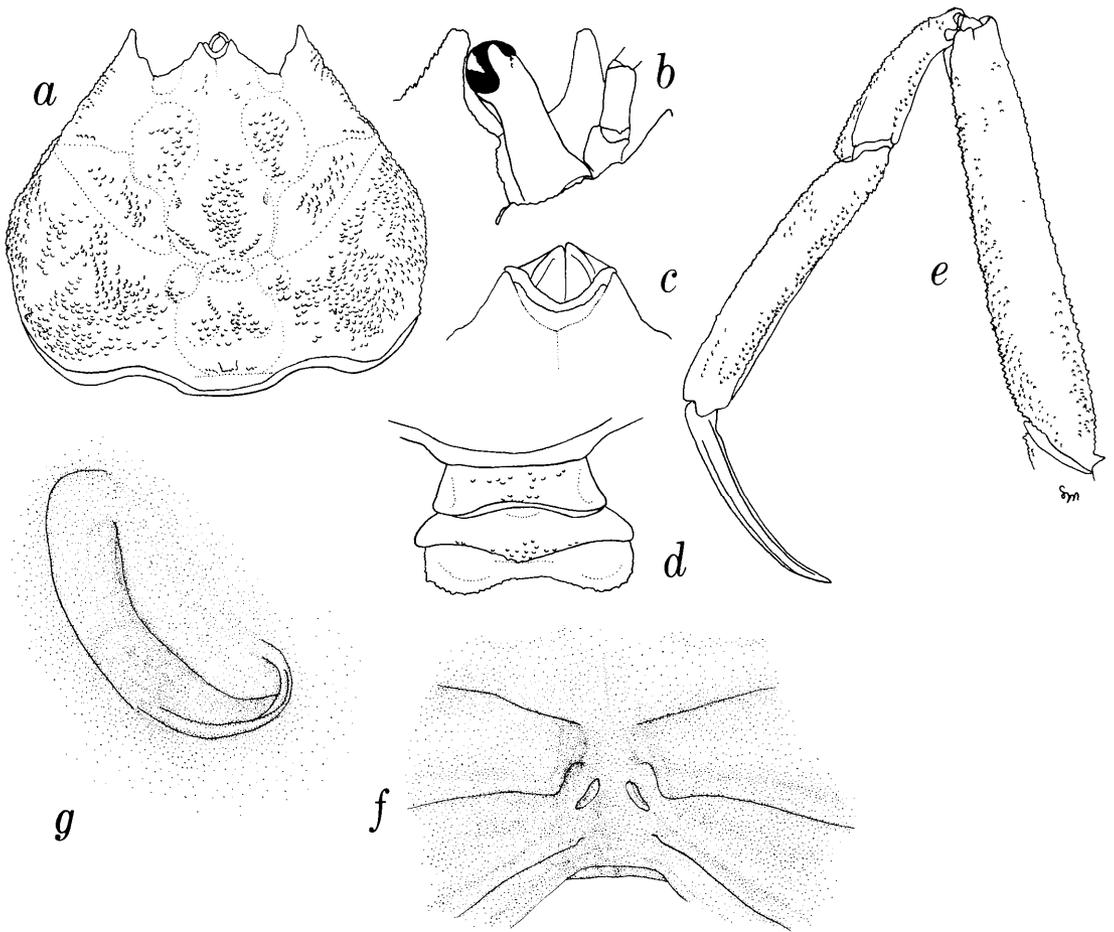


Figure 57. - *Philpidorippe philippinensis* Chen. *a*, carapace; *b*, orbit, ventral view; *c*, opening of exhalant canal; *d*, abdomen, dorsal view; *e*, P3; *f*, sternum and gonopores; *g*, gonopore, enlarged. *a-e*, male holotype, cl 24 mm, Philippines; *f,g*, female paratype, cl 23 mm, Philippines.

Sternum granulate and tomentose. Sternite of P1 with broad, transverse ridge on each side, separated by median groove. Sternites of P2 and P3 not markedly ridged. In male first three sternites exposed, in female first two and part of third. Female gonopore not on ridge or raised tubercle. No median spine present on any thoracic sternites in female.

Abdomen of male with some low tubercles but no large spines. First somite trapezoidal, widening posteriorly, posterior margin deeply indented medially. Second somite longer in midline, widening laterally, with low, transverse ridge. Third somite widest of all, with 2 large, rounded, submedian projections, visible in dorsal view. Fourth somite narrowing posteriorly, with low swelling on surface. Fifth and sixth somites narrowing posteriorly, with indistinct median convexity. Telson short, rounded.

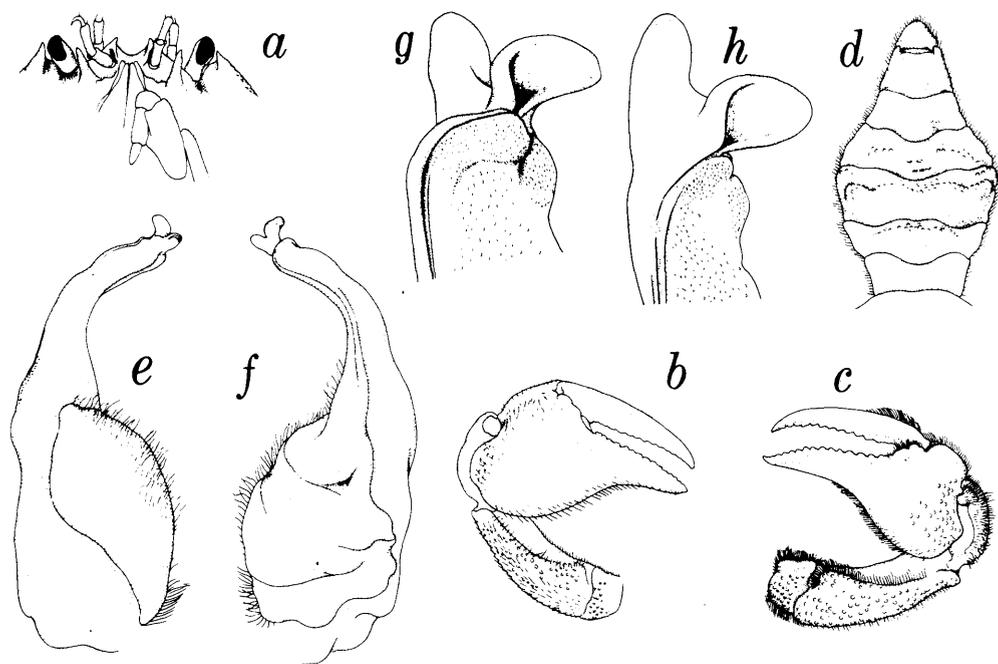


Figure 58. - *Philpidorippe philippinensis* Chen. a, front, ventral view; b, c, chelipeds; d, abdomen; e, f, gonopod; g, h, apex of gonopod. From Chen, 1985, fig. 3.

Abdomen of female very wide, surface tomentose and granulate, with transverse ridges on second to fifth somites, ridge on fourth somite interrupted by shallow median depression, appearing biconvex in dorsal view. Telson longer than wide.

Gonopod stout, curved, tapering distally, with rounded lobe at base, terminating in 2 auricular lobes.

Remarks. - *Philpidorippe* contains only the type species. The definition of the genus applies to the species.

### *Philpidorippe philippinensis* Chen, 1985

Figures 57-58

*Dorippe* sp.. - Serène and Vadon, 1981:120, 121.

*Dorippe* aff. *granulata*. - Serène and Vadon, 1981:119, 120, 121.

*Philpidorippe philippinensis* Chen, 1985:183, fig. 3, pl. 1: fig. 3, pl. 2: fig. 4 [type locality Philippines, west of central Luzon, 13°56.5'N, 120°20.7'E, depth 136-152 m].

Material. - Philippines: 14°00'N, 120°18'E, 193-200 m, 1 Jun 1985, MUSORSTOM 3, *Coriolis* Sta. CP103, 1 ♀ (P). - 13°56'N, 120°21'E, 136-152 m, 20 Nov 1980, MUSORSTOM 2, Sta. CP6, 1 ♂ (holotype, P).

Size. - Males, cl 12 to 25 mm, cb 15 to 30 mm; females cl 23 to 26 mm, cb 30 to 32 mm (Chen, 1985 and present data).

Distribution. - Known only from localities within the Philippine Islands. Records in the literature include: 14°01.3'N, 120°18.7'E; 14°00.9'N, 120°16.8'E; 14°00.8'N, 120°15.8'E; 13°53.1'N, 120°08.9'E (Serène and Vadon, 1981; Chen, 1985). - 13°56.5'N, 120°20.7'E; 13°53.1'N, 120°13.2'E (Chen, 1985)

Serène and Vadon (1981) reported material of *Dorippe* aff. *granulata* from two other stations (MUSORSTOM Expedition I, Stats. 31 and 53). These records may have been in error, as material from these stations was not recorded by Chen (1985) who reported upon all of the dorippids taken by the MUSORSTOM Expeditions and included in her account of *P. philippinensis* all of the other specimens identified with *Dorippe* aff. *granulata* by Serène and Vadon.

Habitat. - This is a deep water species, taken in depths between 96-107 and 193-200 meters (96-107, 129-134, 136-152, 177-186, 189, 191-195, and 193-200 meters). Another indication that this species was erroneously reported at one station by Serène and Vadon (1981) is that the depth is given as 40-50 meters, well below the apparent normal depth range for the species.

### Summary

Seventeen species of Dorippinae, distributed among eight genera, are recognized from the Indo-West Pacific region. The genera include *Dorippe*, with five species, *Paradorippe*, containing four species, *Dorippoides*, with two species, *Heikea*, new genus, recognized for two species formerly assigned to the genus *Nobilum*, and *Medorippe*, *Neodorippe*, *Nobilum*, and *Philippidorippe*, each containing one species. Representatives of all but one of the recognized genera of Dorippinae, *Phyllodorippe* Manning and Holthuis, 1981, containing one West African species, occur in the Indo-West Pacific. One genus and species that occurs in the eastern Atlantic and Mediterranean, *Medorippe lanata* (Linnaeus, 1767), is known from off South Africa and Madagascar. Otherwise the members of this subfamily are restricted to Indo-West Pacific localities. Several species of Dorippinae hold objects or species of anemones on their backs with their modified fourth and fifth legs, and representatives of several species play prominent roles in Chinese and Japanese folklore. In general, distribution patterns of known species are limited; no species extends across the Indo-West Pacific from the Red Sea and South Africa to Japan.

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