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NOTES ON INDO-WEST PACIFIC SPECIES OF *MACROPHTHALMUS* (CRUSTACEA, BRACHYURA)

by

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With 4 plates and 2 text figures

The author examined material of *Sesarma* and *Macrophthalmus* in the collection of the Leiden Museum during a visit made in 1970. His main purpose was to check specimens identified by previous authors and take photographs of some of them. For the *Macrophthalmus* species, the work of Barnes (1971) has in the mean time cleared up some of the problems which he was considering, this is especially true for *M. brevis* and *M. quadratus*. The status of some other species remains unsatisfactory, however, and the second part of the present note is devoted to one of those: *Macrophthalmus telescopicus* of authors.

The same visit provided the author with an opportunity to examine a collection of unidentified material from New Guinea. A new species of *Macrophthalmus* sorted out during that examination was later sent to him on loan for study. It is described as *Macrophthalmus holthuisi* nov. spec. in the first part of the present paper.

I. A new species of Macrophthalmus from New Guinea

Macrophthalmus (Mareotis) holthuisi nov. spec.

(text-fig. 1a, b, pl. 1 fig. A-C, pl. 2 fig. A, B)

Material. — Mangroves near Mandon, a small village between Mokmer and Bosnek, south east coast of Biak Island, Western New Guinea; in mud; 20 March 1955; leg. J. Sisselaar and L. B. Holthuis, no. 723. — 1 ♂ holotype, 6 × 9 mm (RMNH. Crust. no. D 27452), 1 ♂ paratype, 4.0 × 5.8 mm (RMNH. Crust. no. D. 27453).

Description. — Holotype ♂. The front is broad and deflexed, the frontal width measures 0.29 times the carapace width. The anterior margin of the front is bilobed, the lateral margin is gently oblique towards the supra-orbital border and has no marked constriction between the eye peduncles.

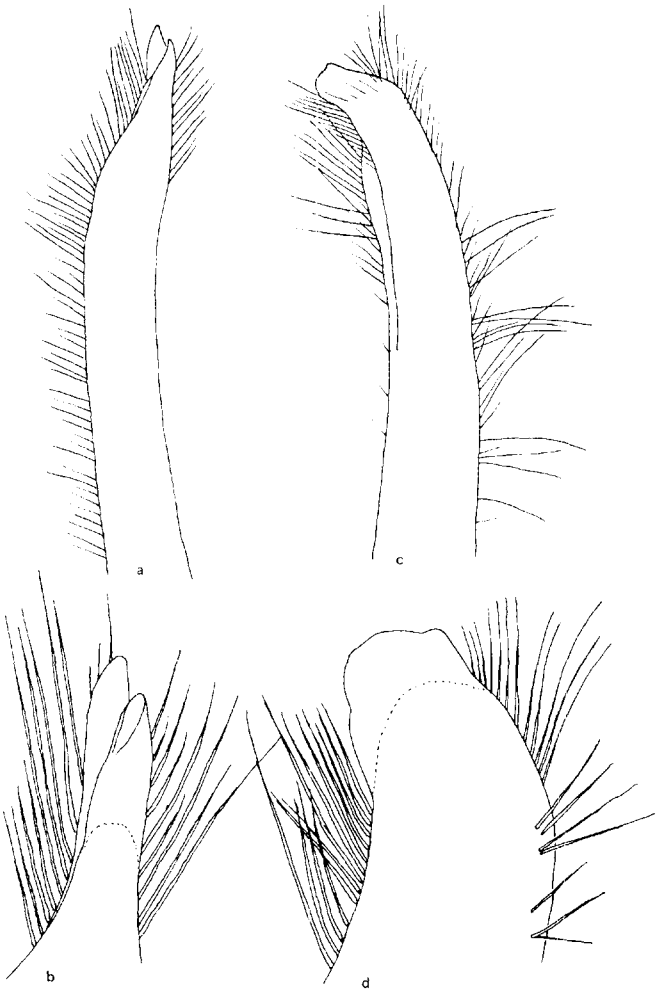

Fig. 1. First male pleopod. a, b, *Macrophthalmus (Marcotis) holthuisi* nov. sp., holotype ♂ (6 × 9 mm); c, d, *Macrophthalmus (Marcotis) crato* De Man, ♂ (9 × 12 mm), NMS. 1965.7.20.32. a, c, × 30; b, d, × 80.

There is a marked median furrow; a fine granular and convex transverse postfrontal rim extends on each side of the median frontal furrow at a level between the eye peduncles.

The eye peduncles are a little longer than the width of the front, they are relatively stout. The width of eye peduncles is one third of their length. The cornea does not reach the external orbital angle. The upper orbital border is slightly sinuous, nearly transverse; the margin is very finely

granular, almost smooth. The inner third of the lower orbital border has a ridge of 6 or 7 small granules starting from the base of the first article of the antenna; that ridge is followed outside by a smooth lobiform protuberance and a rim occupying the outer two-thirds of the lower orbital border. A short deep concavity exists between the granular ridge and the protuberance. The inner margin of the protuberance is abruptly straight below, rounded upward and gently joins the upper margin. The upper margin is feebly concave and softly slopes towards a smaller distal protuberance, which forms a sort of rounded lower extraorbital angle, and abruptly ends outside. Inside the margin of the lower orbital border there is a narrow horny rim which starts from the antennal base, runs parallel, and very close to the lower orbital border, and ends in a large protuberance, which has the upper margin slightly swollen. The horny rim partly fills the short concavity situated just medially of the large protuberance and is particularly visible at this point.

There are two large and one small antero-lateral teeth on the carapace. The external orbital angle is broad, directed outwards and forwards, and is pointed anteriorly; the anterior margin is almost smooth, like the supraorbital border; the outer margin bears small granules in its distal half. The external orbital angle is separated from the second antero-lateral tooth by a narrow V-shaped incision. This second antero-lateral tooth is large, broad, and triangular, it is directed outwards and forwards, and does not markedly project beyond the external orbital angle; its tip is strongly pointed; its anterior border is smooth, straight or slightly convex; the outer margin shows small granules. The third antero-lateral tooth is small, triangular with a pointed tip, and separated from the second by a shallow V-shaped incision.

The carapace width is 1.5 times the carapace length. The surface of the carapace is almost smooth; four indistinct hairy granular rows are present on each branchial region, the anterior of these extends across the anterior branchial region at the level of the third lateral tooth, the others are placed more posteriorly and are less distinct, they are subparallel. The width of the carapace across the tips of the second lateral teeth is subequal to the width across the tips of the external orbital angles. The postero-lateral margin is almost straight and nearly bare.

The external maxilliped has the merus a little shorter than the ischium and is feebly sculptured. The internal margin of the ischium is straight, the external margin concave. The internal and external margins of the merus are convex. The male abdomen has the lateral margins of segments 4 to 6 nearly straight.

The merus of the male cheliped has the lower anterior margin finely granular, distally it is convex, the lower posterior margin and the upper margin are smooth. The margins are almost without hairs, save for some long scattered hairs on the anterior margin. A horny ridge, the musical crest, is situated in the proximal part of the anterior margin of the merus. The carpus has the upper and lower margins and the outer surface smooth; a cluster of 2 or 3 small granules marks the acute inner angle. The palm has the upper and lower margins almost smooth; the outer surface is almost smooth, and shows no longitudinal ridge of granules near the lower margin; the inner surface is also smooth, it has no spiniform protuberance, neither does it show hairs, save close to the cutting edges of the fingers. The index finger is slightly deflexed, almost straight, with the lower margin sinuous; the outer and inner surfaces are smooth; furry hairs are present all along the cutting edge, which also bears a long low subdistal crenulated tooth. The dactylus is curved and distinctly longer than the index finger. Its upper margin and its outer and inner surfaces are almost smooth; furry hairs are placed all along the cutting edge, which also has a very small quadrangular subproximal tooth, that is normally concealed by the hairs. When closed, the two fingers are separated by a wide gap in their proximal half. The tips of the two fingers in both chelipeds have a fringe of stiff long hairs parallel to the margin of their cutting edge.

Pereiopods 2 to 5 are narrow and long. The merus of pereiopod 4 is 4.25 times as long as broad; it bears a few scattered hairs along the upper border. A dense brush of woolly setae entirely covers the inferior border of merus and propodus and the proximal half of the dactylus of pereiopod 2.

The first male pleopod (fig. 1a, b) has two distinct triangularly elongated chitinous processes at the apex.

The epistome has a convex central prominence.

The much smaller male paratype has the chelipeds slightly different; on the dactylus the proximal tooth of the cutting edge is lower, longer and larger; on the fixed finger the subdistal tooth of the cutting edge is lower; the fingers are straighter and longer as compared to the palm. The tufts of woolly setae on the inferior border of the pereiopod 2, in the merus are less developed and limited to its proximal part, in the propodus and dactylus they are well developed. The chitinous rim running inside the true margin of the lower orbital border is comparatively more clear here than in the holotype.

Affinities. — The structure of the lower orbital border, the horny ridge on the merus of the male cheliped, the shape of the carapace and the size indicate a close relationship of *M. holthuisi* with *M. crato* De Man, *M.*

quadratus A. Milne Edwards and *M. boteltobagoe* (Sakai), which are included by Barnes (1971) in *Marcotis*. *Macrophthalmus holthuisi* clearly differs from these closely related species by the position of the horny ridge (stridulating apparatus) in the male cheliped. Nothing is known of the situation of this ridge in *M. boteltobagoe*. In *M. erato* the horny ridge is "situated close to and just distal to centre of inner margin, ridge mounted on flange extending further distally and making an acute angle with plane of inner surface" (Barnes, 1970: 234). In *M. quadratus* the situation is similar but "ridge mounted on short flange, no longer than length of ridge, arising from inner surface at angle of approx. 90°" (Barnes, 1971). In *M. holthuisi* the horny ridge, also mounted on a flange arising from the inner surface of the merus, is as long as the flange but situated in the proximal fourth of the margin and very close to the margin itself. Its situation is somewhat the reverse of that of *M. tomentosus* as illustrated by Barnes (1970, fig. 8b), the ridge in *M. holthuisi* being proximal instead of distal like in *M. tomentosus*.

A comparison of the holotype of *M. holthuisi* with several specimens of *M. erato* demonstrated numerous differences between the two species as well as intraspecific variations in *M. erato*. The most important variations in *M. erato* are related to the size of the specimens and affect the merus, palm and fingers of the male cheliped. Generally in large specimens of *M. erato* (like in *M. holthuisi*) the proximal tooth of the dactylus is comparatively smaller, the subdistal tooth of the fixed finger is shorter but much higher. However, between specimens of the same size but from different localities there are also differences in other characters. The most significant is in the case of a specimen from Vietnam (NMS. 1970.1.23.26) which has a slightly different carapace and cheliped and only one protuberance on the outside of the lower orbital border; but subdistal and not distal like in *M. holthuisi*. More observations on *M. erato* are needed.

The examination of series of specimens of *M. erato* demonstrates that several characters here described for *M. holthuisi* have been overlooked in the descriptions of *M. erato* by various authors. The transverse postfrontal rim mentioned for *M. holthuisi*, also exists in *M. erato*. The narrow horny rim, running in *M. holthuisi* inside the margin of the lower orbital border behind the granular ridge and the large protuberance, in *M. erato* is replaced by a groove, with a row of setae at the level of the short deep concavity preceding the large protuberance; the latter is also distinct in *M. erato*. I do not have the opportunity to examine this character in specimens of *M. quadratus*. The fringe of long setae running parallel to the

cutting edge of the tips of both fingers of the male chelipeds exists both in *M. crato* and in *M. holthuisi.*

Pereiopods 2 to 5 of the two species present sufficient differences to permit their easy separation. In *M. crato* these pereiopods are broad, with the merus of pereiopod 4 three times as long as broad instead of nearly five times as in *M. holthuisi.* Its long and nearly bare ambulatory legs characterize *M. holthuisi* at first view. As described before, patches of woolly setae ornament only the lower border of pereiopod 2 in *M. holthuisi.* In *M. crato,* the patches of woolly setae ornament the outer surface of the segments of all of pereiopods 2 to 5 and never are found on the lower border; in pereiopod 2 they cover the merus, carpus and the proximal half of the propodus; in pereiopod 3 they are found in the proximal half and upper parts of the merus; in pereiopod 4 the upper and lower parts of the merus and the entire carpus and propodus are hairy; in pereiopod 5 only the two margins of the merus, carpus and propodus are setose.

The distribution on the pereiopods of the patches of woolly hair, which are somewhat similar to those of the inner surface of the palm of the male cheliped, provide a valid character for specific differentiation. This character has as yet received little attention in the studies of the species of *Macrophthalmus.* However, Tweedie (1950: 128) referred to such a character in suggesting the existence in the South East Asian region of two distinct species, until then confused under the name *Macrophthalmus telescopicus,* in which respect I share his views (see the second part of this paper).

The absence of a mat of hairs on the inner surface of the palm of the small cheliped clearly distinguishes *M. holthuisi* from *M. crato* and *M. quadratus,* but is a character the new species has in common with *M. boteltobagoe* (Sakai, 1939). The latter species is only known from the single male holotype (5.8 × 8 mm) from South Formosa, a specimen lacking the ambulatory legs. *M. holthuisi* differs by (1) the shape of the infraorbital ridge, which in *M. boteltobagoe* has in its outer half "three or four crests, the innermost one being very elongate and the outer two or three sharpish tuberculiform" (Sakai, 1939), (2) the eye peduncles which are longer, and have the cornea comparatively much closer to the external orbital angle, (3) the merus of the male cheliped which is not cristate on the anterior margin and is longer; in *M. boteltobagoe* the "chelipeds are not elongated as in *Euplax*" (Sakai, 1939), (4) the palm and fingers of the male cheliped in which the cutting edge of the dactylus has a smaller proximal tooth, the cutting edge of the fixed finger has a low subdistal tooth, and the cutting edges of the two fingers show a fur of setae on the inner side

(the last two characters of (4) are not indicated in the description of *M. boteltobagoe*).

The following amendments are suggested for the key to the species of *Macrophthalmus* provided by Barnes (1971):

3. Inner surface of palm of male chela with large spine near articulation with carpus . . . . . *crato* De Man
3a. Inner surface of palm of male chela without spine 4
4. Carapace distinctly narrowed anteriorly with anterolateral borders divergent; index of male chela markedly deflexed; horny ridge distally situated on merus of male cheliped. Middle-sized species . . . . . *tomentosus* Souleyet
4a. Carapace not distinctly narrowed anteriorly. Index of male chela straight or nearly so. Horny ridge not distally situated. Small species 5
5. Inner surface of palm of male chela with mat of hairs; horny ridge situated submedially on merus of male chela. Outer surface of palm and index of male chela with row of granules near lower margin . . . *quadratus* A. Milne Edwards
5a. Inner surface of palm of male chela without mat of hairs; outer surface of palm and index of male chela without row of granules near lower border . . . 5'
5'. Merus of male chela elongate; index slightly deflexed with low subdistal tooth; mat of hairs along cutting edge of both fingers; horny ridge proximally situated on merus of male chela . . . . . *holthuisi* nov. sp.
5'a. Merus of male chela short; index straight without tooth; no mat of hairs along cutting edge of fingers; horny ridge unknown . . . . . *boteltobagoe* (Sakai)

I support the proposal of Barnes (1967) to establish several subgenera to better organize the grouping of the species of *Macrophthalmus*, being it understood, however, that the subgeneric characters need to be improved. The margin of the epistome, for example, among the subgeneric characters has in the key of Barnes (1967) a priority which further observations have demonstrated to be overrated. Barnes (1971) commented on the matter with reference to his removal of *M. crato*, *M. quadratus*, *M. boteltobagoe* from *Mopsocarcinus* to *Marcotis*. The situation of *M. holthuisi* in *Marcotis* with a median convexity on the epistome is similar to that of *M. teschi* Kemp on which Barnes (1970: 30) comments. Among the thirteen other species included into *Marcotis*, six (*M. tomentosus* Souleyet, *M. crato* De Man, *M. quadratus* A. Milne Edwards, *M. boteltobagoe* (Sakai), *M. crinitus* Rathbun, and *M. darwinensis* Barnes) are said to have the epistome straight; seven (*M. japonicus* De Haan, *M. abercrombici* Barnes, *M. definitus* Adams & White, *M. setosus* H. Milne Edwards, *M. depressus* Rüppell, *M. leptophthalmus* H. Milne Edwards, *M. pacificus* Dana) have the epistome concave. However, Barnes (1967, 1970, 1971) in his descriptions of those seven species does not mention the character of the epistome.

Generally the species with a median convexity on the epistome belong to the subgenera *Tasmanoplax* and *Macrophthalmus*. According to the key of Barnes (1971), that character exists in *M. grandidieri* A. Milne Edwards,

M. brevis (Herbst), *M. laevimanus* H. Milne Edwards, *M. dilatatus* (De Haan), *M. sulcatus* H. Milne Edwards, *M. crassipes* H. Milne Edwards, *M. convexus* Stimpson, *M. parvimanus* Guérin, *M. latifrons* Haswell. It also exists in some other species which are situated in the key without prior consideration given to that character; for example, *M. dentatus* and all the species with ocular peduncles extending beyond the external orbital angle. The condition of the epistome of *M. holthuisi* was compared with that in a specimen of *M. latifrons* and was found to be identical.

II. Note on the species closely allied to Macrophthalmus (Macrophthalmus) telescopicus (Owen, 1839)

The status of the species *Macrophthalmus (Macrophthalmus) telescopicus* (Owen, 1839), *M. (M.) verreauxi* H. Milne Edwards, 1852, and *M. (M.) milloti* Crosnier, 1965, is revised here. The reference material used for the study of those species belongs to the collection of the National Museum of Singapore (NMS).

Tweedie (1937: 164) expressed his "agreement with Kemp's remarks (1919, p. 387) concerning this species [= *M. telescopicus*], and consider[ed] it probable that two or more forms have been included under the names in Tesch's synonymy (1915, p. 161)." Tweedie (1950) considered that in the Indian and Malayan regions at least two distinct species exist. The first species has no furry patches on the under side of pereiopod 2, its ocular peduncles are greatly elongated, the denticulation of the fixed finger of the chela is as illustrated by Kemp (1919, pl. 24 fig. 10) for a specimen from the Gulf of Manaar, and the first male pleopod has a slender distal chitinous projection. The second species has a furry patch on the under side of the pereiopod 2 (at least in the male), the ocular peduncles are moderately elongated, the dentition of the fixed finger of the chela is as illustrated by Kemp (1919, pl. 24 fig. 11) for a specimen from Port Blair, and the first male pleopod does not have a slender distal chitinous projection. Through lack of material and information Tweedie (1950: 129) was unable to "decide on which of these (if, indeed, either) Owen based his *Gelasimus telescopicus*, or otherwise to elucidate the accepted synonymy".

Tweedie (1950) reported twelve specimens from Cocos Keeling Islands to the first species and one male from Pulau Senang, Singapore to the second species. The female specimen recorded by Tweedie (1937) from Telok Paku, Singapore, was re-examined and found to belong to the second species. Tweedie (1937) commented upon the specific identity of this specimen with the specimen from Singapore identified as *M. podophthalmus* by Lanchester (1900), which Tweedie had examined in the British

Museum and on their differences from specimens from Djeddah examined by him in the Leiden Museum.

There is no doubt about the identity of the second species with *M. milloti* Crosnier, 1965. The eye peduncles, first male pleopod as well as the shape of the antero-lateral teeth are exactly as described by Crosnier. Crosnier did not mention the furry patch on the under side of the second pereiopod. Specimens of the first species were found in the collection of the National Museum at Singapore, identified as "*Macrophthalmus excubitor,* Type", with a label in Dr. Tweedie's handwriting. They are brought here to *M. verreauxi.*

The collection of National Museum also contains 2 topotypes of *M. telescopicus* from Hawaii kindly sent by the Bishop Museum to Dr. Tweedie, who probably did not find the time before his departure from Singapore to publish the results of his observations. My examination of all that material confirms that Dr. Tweedie was correct when he stated that three different species might be included under the name *M. telescopicus* s.l.

Macrophthalmus (Macrophthalmus) verreauxi H. Milne Edwards, 1848

(text-figs. 2 a, b, pl. 3 figs. C, D)

Macrophthalmus verreauxi H. Milne Edwards, 1848: 358; H. Milne Edwards, 1852: 155, pl. 14 fig. 25; Hess, 1865: 142, 171; De Man, 1880: 184; Haswell, 1882: 89; Alcock, 1900: 237; Borradaile, 1903: 433; Nobili, 1906: 317; Rathbun, 1910: 332, fig. 6; Laurie, 1915: 472, fig. 5.

Macrophthalmus telescopicus, Tesch, 1915: 161, pl. 5; Tesch, 1918: 58; Kemp, 1919: 387 (part), pl. 24 fig. 10 (not pl. 10 fig 11 = *M. milloti*); Crosnier, 1965: 126, fig. 226, 229 (not fig. 225 = ? *M. telescopicus* Owen, 1839).

? *Macrophthalmus telescopicus,* Stephenson et al., 1931: 56; Balss, 1934: 522; Sakai, 1934: 320, pl. 18 fig. 9; Sakai, 1936: 217, pl. 60 fig. 1; Balss, 1938: 76; Sakai, 1939: 623, pl. 73 fig. 1.

Macrophthalmus cf. *telescopicus* (part), Tweedie, 1950: 128.

Macrophthalmus (*Macrophthalmus*) *telescopicus,* Barnes, 1967: 205 (part), fig. 1 (not pl. 1 fig. a = *M. milloti*); Barnes, 1970: 219 (part).

Type locality: Australia. The type specimen is in the Muséum National d'Histoire Naturelle, Paris.

Material. — Cocos Keeling Island, 1940, coll. C. A. Gibson-Hill, 8 males, 5 females (1 ♂ 12 × 20.5 mm, NMS. 1969.11.20.3; 1 ♂ 10.5 × 18 mm, NMS. 1965. 7.20.103; rest NMS 1965. 7.20.104-115). Identified by Tweedie (1950: 128) as *M.* cf. *telescopicus.*

Padang, Indian Ocean coast of Sumatra, 1963, coll. R. Serène, 1 male (9.5 × 16 mm), and 1 little larger female (NMS. 1969.11.20.1-2).

Phuket, Thailand, 6 February 1966, coll. R. Serène; 1 smallish female (NMS. 1970.1.20.45).

Observations. — Crosnier (1965) compared the Madagascar specimens that he assigned to *M. telescopicus* with the type of *M. verreauxi* and found

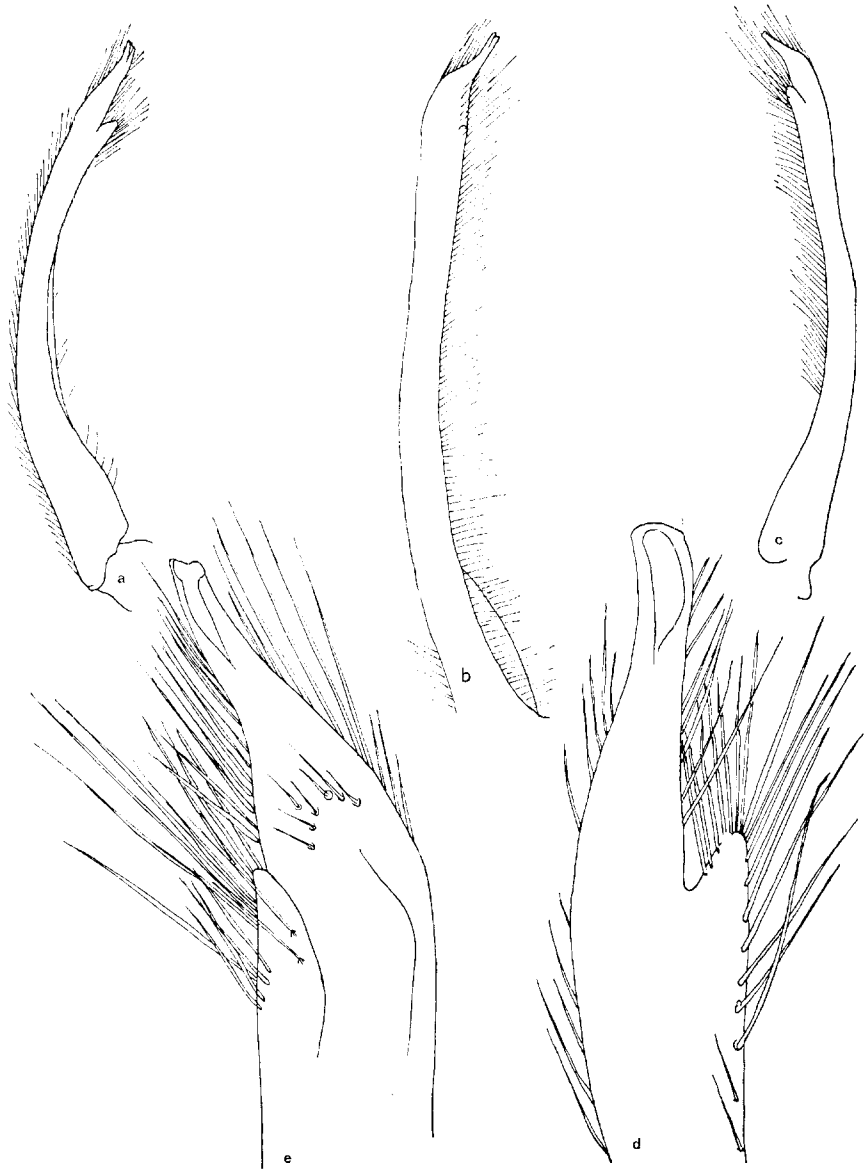

Fig. 2 First male pleopod. a, b, *Macrophthalmus* (*M.*) *verreauxi* H. Milne Edwards, male of 20 × 36 mm. c-e, *Macrophthalmus* (*M.*) *telescopicus* (Owen). c, male of 16 × 28 mm (NMS. 1967.7.20.95); d, e, male of 20 × 36 mm (NMS. 1967.2.20.94). a, c, d, × 12; b, × 48; e, × 30.

them identical. His specimens therefore belong to *M. verreauxi* and not to *M. telescopicus*.

The identifications of *M. verreauxi* by previous authors generally are correct and its description by Alcock (1900) is accurate. As guessed by Kemp (1919), the confusion between those closely related species started with their synonymizing by Tesch (1915), who probably did not examine any specimen of the true *M. telescopicus*. The present species is accurately described and illustrated as *M. telescopicus* by Tesch (1915) and Crosnier (1965). It is of medium size and probably does not reach a carapace width of 25 mm.

Crosnier (1965) also examined the type specimen of *M. podophthalmus* Souleyet and illustrated the antero-lateral border of its carapace. Crosnier (1965), in my opinion, illustrated the three different species reviewed in the present paper: his text-figs. 217-220, 222-223, 228, and pl. 11 fig. 4 represent *M. milloti*; his text-figs. 226-227, 229 *M. verreauxi*, and his text-fig. 225 *M.telescopicus*, of which *M. podophthalmus* is a synonym.

Barnes (1967: 208) commented on the variations of *M. telescopicus*. In his opinion *M. telescopicus* could be "composed of a number of sibling species", or it could also "possess a large degree of variation" which would substantiate Tesch's synonymy. In his works, Barnes (1967, 1968, 1970) seems to favour the views of Tesch. As it will be further noted, his material of *M.telescopicus* from Australia seems to include specimens both of *M. verreauxi* and *M. milloti*, and perhaps also of *M. telescopicus*. Similarly the material of the British Museum seems to include specimens of *M. verreauxi* and *M. milloti*.

The "small" (6.5 × 10.5 mm) specimen of Sakai (1939) described with the palm of the male cheliped high, a "very wide gap" between the fingers and no tooth on the cutting margin of the dactylus could belong to a different species not yet described.

Macrophthalmus (Macrophthalmus) telescopicus (Owen, 1839)

(text-figs. 2 c-e, pl. 3 figs. A, B, pl. 4 fig. D)

Gelasimus telescopicus Owen, 1830: 78, pl. 24 fig. 1.

Macrophthalmus compressipes Randall, 1840: 123; Gibbes, 1850: 180.

Macrophthalmus podophthalmus Souleyet, 1841: 241, pl. 3 fig. 67; H. Milne Edwards, 1852: 155; Stimpson, 1858: 96.

Macrophthalmus telescopicus, H. Milne Edwards, 1852: 155; Dana, 1852: 314; Rathbun, 1906: 834; ? Balss, 1922: 146; Edmondson, 1946: 311, fig. 185a; Edmondson, 1962: 20, fig. 8b.

? *Macrophthalmus telescopicus*, Stimpson, 1858: 96; Stimpson, 1907: 95 [? = *M. verreauxi*].

? *Macrophthalmus podophthalmus*, Haswell, 1882: 88; Miers, 1886: 249.
? *Macrophthalmus podophthalmus*, Lanchester, 1900: 760 [= ? *M. milloti*].
Macrophthalmus telescopicus (part), Crosnier, 1965, fig. 225 only.
? *Macrophthalmus* (*Macrophthalmus*) *telescopicus*, Barnes, 1967: 205. (The material from Lord Howe Island only).

Material. — Hawaii, Bishop Museum donated, 2 males (20 × 30 mm, and 16 × 28 mm; NMS., 1967.7.20.94-95).

Observations. — The two topotypical specimens examined by me differ from the specimens of *M. verreauxi* in the following characters: (1) the ocular peduncle is longer, its length is 1.69 time the length of the orbital border instead of 1.50 as in *M. verreauxi*, (2) the palm of the male cheliped is less high, its length is 2.03 times its height in the largest male and 2.16 times in the smaller; in *M. verreauxi* its length is 1.84 times its height, (3) the longitudinal rim parallel to the lower border of the palm of the male cheliped is more marked, (4) the subproximal tooth on the cutting edge of the dactylus of this cheliped is entirely absent in the small male and in the large male it is comparatively much smaller than in *M. verreauxi*, (5) the inner surface of the palm of the cheliped is more densely and acutely granular; it is entirely hairy in the smaller specimen, with a row of hairs running parallel to the upper border in the largest (the much smaller cheliped of the small male indicates that it has not yet reached the adult size), (6) the external orbital angle is more anteriorly directed, (7) the branchial region has a coarser and more extensive granulation.

Several of these characters of *M. telescopicus* agree with those described by Barnes (1967) for his specimens from Lord Howe Island. It would be interesting to know whether the specimens described by Barnes were the largest (over 20 mm) and what is the condition of their chelipeds in regard to those of other specimens, which belong to *M. verreauxi* and *M. milloti*.

Edmondson (1962), quoting a specimen of 32 mm carapace width, correctly remarked that *M. telescopius* is a large species and not a small one as indicated by Sakai (1939). Edmondson (1962), who gave the sole description of *M. telescopicus* available to me, described the dactylus of the cheliped "with cutting edge entire". The subproximal tooth which is very small and marked only in large specimens may have escaped Edmonson's attention. The present male of 28 mm has neither a differentiated tooth on the dactylus, nor on the fixed finger. I guess that the male chelipeds of *M. telescopicus*, like those of other large species of *Macrophthalmus* (for example *M. latreillei*) do not show their adult size and shape in specimens below a given size (probably about 30 mm carapace width for *M. telescopicus*).

Edmondson (1962) described the "external orbital angle [as] a narrow sharp spine curving outward and forward". In *M. verreauxi* the external orbital angle is directed straight outward and sometimes a little backward (see Crosnier, 1965, figs. 226, 227). This character seems to confirm the identity of *M. telescopicus* with *M. podophthalmus* Souleyet (see Crosnier, 1965, fig. 225) which was also described from Hawaii, as also *M. compressipes* Randall, which is another synonym of *M. telescopicus*. It seems probable that *M. telescopicus* is a large species of the Central Pacific region extending south to the Australian waters. The material of some authors needs a re-examination to establish its correct identity.

Several characters of *M. telescopicus* are closer to those of *M. milloti* than to those of *M. verreauxi*, but indeed the species are different. For example, *M. verreauxi* seems to have the carapace comparatively shorter; the carapace length is 0.55 times the carapace breadth in *M. telescopicus*, 0.56 times in *M. milloti*, while it is 0.61 times in *M. verreauxi*.

Barnes (1970) remarked that "the breadth of the carapace increases relatively to the carapace length with increase in size of these [British Museum] specimens . . . but contrary to the figures given previously for *M. telescopicus* (Barnes, 1968b). Only small samples have, as yet, been available; further material should resolve this discrepancy". If the British Museum material examined by Barnes (1970) belongs to *M. verreauxi* and *M. milloti* and the material examined by Barnes (1967 and 1968b) includes specimens of *M. verreauxi*, *M. milloti* and *M. telescopicus*, like I suggest, this discrepancy can be explained.

The very short chitinous distal process of the male pleopod of *M. milloti* (see Crosnier, 1965, fig. 228) provides a clear specific character. This chitinous distal process is much longer in *M. telescopicus* and *M. verreauxi*. Referring to the present specimens of *M. telescopicus* and *M. verreauxi*, the pleopod illustrated by Crosnier (1965) and Barnes (1967) seems to be that of *M. verreauxi*.

The male pleopods of *M. telescopicus* and *M. verreauxi* present some slight differences, which are more clearly seen in ventral view. In the two species, the pleopod is nearly straight (vaulted, concave on ventral side) with hairs in a regular row all along the outer border, only a few on the inner border and a large bunch distally. In *M. telescopicus* the outer border presents subdistally, at the base of the tapering apex, a marked convexity which is nearly obsolete in *M. verreauxi*. In both species the inner border of the pleopod presents a small tongue-like subdistal lobe, which is well indicated in the figure of Crosnier (1965, fig. 229). This lobe is more salient and better developed in *M. verreauxi* than in *M. tele-*

scopicus. The part of the tapering apex situated distally of the subdistal lobe of the inner border is longer in *M. verreauxi* than in *M. telescopicus*.

Macrophthalmus (Macrophthalmus) milloti Crosnier, 1965

(pl. 4 figs. A-C)

? *Macrophthalmus podophthalmus*, Lanchester, 1900: 760 (not *M. podophthalmus* Souleyet, 1841 (= *M. telescopicus*)).
Macrophthalmus telescopicus (part) Kemp, 1919: 387, pl. 21 fig. 11 (not pl. 24 fig. 10 = *M. verreauxi*).
Macrophthalmus cf. *telescopicus*, Tweedie, 1937: 164.
Macrophthalmus cf. *telescopicus* (part) Tweedie, 1950: 128.
Macrophthalmus milloti Crosnier, 1965: 124, figs. 217-220, 222, 223, pl. 11 fig. 4.
Macrophthalmus (*Macrophthalmus*) *milloti*, Barnes, 1967: 203 (in list).
? *Macrophthalmus* (*Macrophthalmus*) *telescopicus* (part), Barnes, 1967, pl. 1 fig. a.

Type locality. — Madagascar. The types are held by the Muséum National d'Histoire Naturelle, Paris.

Material. — Pulau Senang, Singapore, 1 ♂, 9 × 16 mm (NMS. 1965.7.20.92; identified by Tweedie (1950: 128) as *M.* cf. *telescopicus*).

Telok Paku, Singapore, 1 ♀, 10 × 16.5 mm (NMS. 1969.12.1.1; identified by Tweedie (1937: 164) as *M.* cf. *telescopicus*).

Pulau Paway, Singapore, 1965, coll. R. Serène, 1 male (a molt, complete and in good condition), 11 × 19 mm (NMS. 1971.6.11.1). This specimen has approximately the size of the holotype.

Observations. — The present material was compared with the series of specimens of *M. verreauxi*. It was found that *M. milloti* differs in the following characters: (1) the length of the ocular peduncles is 1.26 times the length of the external orbital angle instead of 1.55 times as in *M. verreauxi*, (2) the external orbital angle is longer, and separated from the first anterolateral tooth by a deeper sulcus, the tip of the external orbital angle is directed slightly forward, instead of slightly backward as in *M. verreauxi*, (3) the palm of the male cheliped is less high, its length is 2.13 times its height, instead of 1.84 times as in *M. verreauxi*, (4) the subproximal tooth on the cutting edge of the dactylus of this cheliped is larger, (5) the median tooth on the cutting edge of the fixed finger of the cheliped in *M. milloti* is larger and higher, being more differentiated as a subquadrate molariform tooth, placed almost submedian; in *M. verreauxi* this tooth is low and placed almost subdistal, (6) the concavity on the distal border of the palm of the cheliped below the articulation with the dactylus is clearly less deep in *M. milloti*, (7) the inner surface of the palm of the cheliped is densely covered with acute granules (like small spines) instead of being ornamented by a few smaller low granules as in *M. verreauxi*. The furry patch is limited to the area around the fingers in both species,

(8) a furry patch is present on the lower inside border of the merus of pereiopod 2, and another, smaller, at the same position in the carpus and propodus; no such patches exist in *M. verreauxi,* (9) the first male pleopod has a short distal chitinous apex instead of a long one as in *M. verreauxi.*

Special attention was given in our material to the presence of furry patches or mats of woolly hairs on the pereiopods. In both *M. milloti* and *M. verreauxi* the anterior border of the merus of the cheliped is ornamented with a large mat of woolly hairs mixed with long stiff hairs. Only in *M. milloti,* and not in *M. verreauxi,* the lower borders of the merus, carpus and propodus of pereipod 2 present a mat of woolly hairs. The mats are situated on the anterior surface of the segments opposite the merus of the cheliped. They start at the border with the lower surface which is bare. The mat of the merus is the largest, but like the others covers only a part of the length of the segment; it covers the proximal half of the anterior surface of the merus entirely from the lower to the upper margin. A smaller similar mat exists in the upper part of the proximal third of the anterior surface of the merus of the third perciopod. In *M. verreauxi,* a small mat of hairs marks only the proximal third of the upper margin of the merus of pereiopod 2, but it does not extend on the anterior surface of the segment. Those furry patches were already noticed by Kemp (1919), and clearly indicate that he correctly distinguished the two species now identified as *M. verreauxi* and *M. milloti.* However, it could be confusing to refer to the illustrations of the chelipeds given by Kemp (1919) for their identification. Tweedie (1950), namely, already remarked that Kemp's specimens had not yet reached their full size; the specimen from Port Blair (fig. 11 = *M. milloti*) measures only 4.2 × 6.7 mm; the one from the Gulf of Manaar (fig. 10 = *M. verreauxi*), measuring 7.8 × 12.4 mm, is also relatively small. The cheliped illustrated by H. Milne Edwards (1852, pl. 4 fig. 25c) is that of a female. Particular attention is given in the present paper to illustrate for each species the largest specimens of approximately the same size. At first view, the cheliped of my specimen of *M. verreauxi* (pl. 3 fig. C) seems closer to that figured by Kemp (1919, pl. 24 fig. 11) from Port Blair (= *M. milloti*) and that of my specimen of *M. milloti* (pl. 4 fig. B) seems closer to Kemp's specimen (1919, pl. 24 fig. 10) from the Gulf of Manaar (= *M. verreauxi*). It is safer to separate the two species by referring to the first male pleopods, the length of the ocular peduncles and the furry patches of pereiopod 2.

As already mentioned, Barnes (1967, 1970) probably did not separate *M. milloti* from *M. telescopicus.* Referring to the remark by Tweedie (1937), I suppose that the specimens of *Macrophthalmus* in the British Museum,

mentioned by Lanchester (1900) and identified by Barnes (1970) as *M. telescopicus* probably belong to *M. milloti*. There is little doubt that the specimen illustrated by Barnes (1967, pl. 1 fig. a) is *M. milloti*, judging by the size of its ocular peduncle. A reexamination of that specimen probably would demonstrate that it has furry patches on the under side of the pereiopod 2, dense spinous granules on the inner surface of the palm of the cheliped and a short distal chitinous process on the first male pleopod. The other illustrations of Barnes (1967) seem to depict *M. verreauxi*. The male abdomen (Barnes, 1967, fig. 1c) has the outer margin of segment 6 proximally strongly broadened and nearly angular; in *M. milloti*, as in Crosnier's (1965, fig. 219) illustration, it it much less broadened. Similarly the outer margin of segment 5 is marked by a median concavity, which does not exist in *M. milloti*, although the concavity in *M. verreauxi* is generally less marked than the one shown in the figure of Barnes. In *M. telescopicus*, the male abdomen resembles more that of *M. verreauxi*.

It is suggested to amend the key of Barnes (1971) as follows:

10a — Ocular peduncle without any filament distal to cornea 11
11 — Four distinct antero-lateral carapace teeth; length of merus of male cheliped larger than carapace length . . . . . *philippinensis* Serène
11a — Three distinct antero-lateral carapace teeth; length of merus of male cheliped smaller than carapace length . . . . . 11'
11' — Cutting edge of dactylus of male chela without differentiated tooth, except in specimens of more than 30 mm carapace breadth. Ocular peduncles projecting beyond tip of external orbital angle for much more than half orbital border length. Large species . . . . . *telescopicus* (Owen)
11'a — Cutting edge of dactylus of male chela with a differentiated tooth; medium sized species . . . . . 11"
11" — Ocular peduncle projecting beyond tip of external orbital angle for half the orbital border length. No patch of woolly hairs under the inside border of the merus of perciopod 2; long chitinous apex on male pleopod 1 . . . . . *verreauxi* H. Milne Edwards
11"a — Ocular peduncle projecting beyond tip of external orbital angle for a quarter of the orbital border length. Patches of woolly hairs under the inside border of the merus of perciopod 2; short chitinous apex on male pleopod 1 . . . . . *milloti* Crosnier

Geographical distribution and ecology. — Referring to the corrected identifications suggested in the present paper, *M. verreauxi* and *M. milloti* seem to have a wide geographical distribution in the tropical zone of the Indo-pacific region, from the African coast (Madagascar to Red Sea) to Australia. On the contrary, *M. telescopicus* inhabits only the Central Pacific Region from Hawaii to probably Australia. *M. verreauxi* is recorded from Australia (H. Milne Edwards, Hess, Haswell, Barnes), Indonesia (De Man, Tesch), Gan Island (Rathbun), Red Sea (Nobili), India (Alcock,

Borradaile, Kemp, Chopra & Das), Gulf of Thailand (Rathbun), Madagascar (Crosnier, Balss), Cocos Keeling (Tweedie). *M. milloti* is recorded from Madagascar (Crosnier), Andaman Islands (Kemp), Singapore (Tweedie) and ? Australia (Barnes). *M. telescopicus* is recorded from Hawaii (Owen, Randall, Souleyet, Rathbun, Edmondson) and ? Australia (Barnes).

I collected *M. verreauxi* at Padang (Indian Ocean coast of Sumatra), Ambon, Nhatrang (Vietnam), Phuket (Thailand), and Palawan (Philippines), and *M. milloti* at Singapore. The two species inhabit soft muddy bottoms in the intertidal zone of estuarine areas. They generally occupy small pools on the dead coral reef platforms, never too far from freshwater influence, but always on shores of the open sea, never on the river banks. *M. verreauxi* was collected near the mouth of Galala River at Ambon, near the mouth of Cua Be River at Nhatrang, on a dead coral reef platform at Quezon (Palawan) and near Padang Harbour (Sumatra). The molt of *M. milloti* was collected at Pulau Paway, a small island off Singapore Harbour, in a pool with muddy sand bottom on a coral reef. All specimens were collected at low tide; the crabs living near the low tide mark. The holes of these species are dug obliquely, not vertically like those of *Uca*. Being built in soft mud, the opening of the burrows is hardly kept open when exposed at low tide. Generally some water is kept in the pool which they inhabit and the crabs themselves seldom go out of the water neither do they go far from their hole. They climb on small stones or on debris to reach the surface of the water, usually only their ocular peduncles reach out of the water.

I am inclined to think that *M. telescopicus* has a different habitat, a little below the intertidal zone, but this is only a guess.

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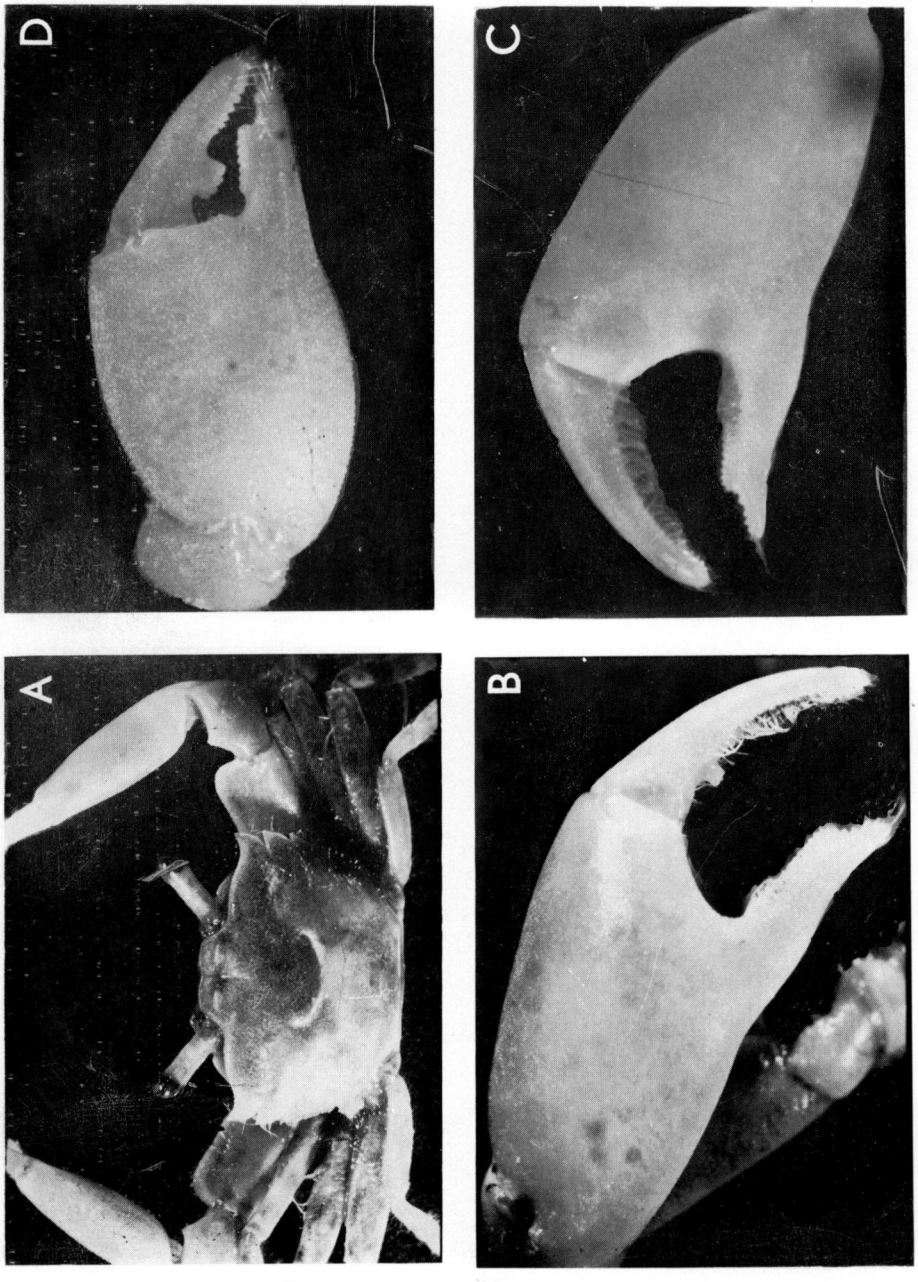

Plate I

A-C, *Macrophthalmus* (*Mareotis*) *holthuisi* nov. sp., holotype, male of 6 × 9 mm. A, dorsal view; B, palm of right cheliped with hairs on cutting edge of dactylus partly removed to show the small subproximal tooth; C, left cheliped.

D, *Macrophthalmus* (*Mareotis*) *erato* De Man, male of 5 × 8.7 mm (NMS. 1969.12.5.9), palm of cheliped.

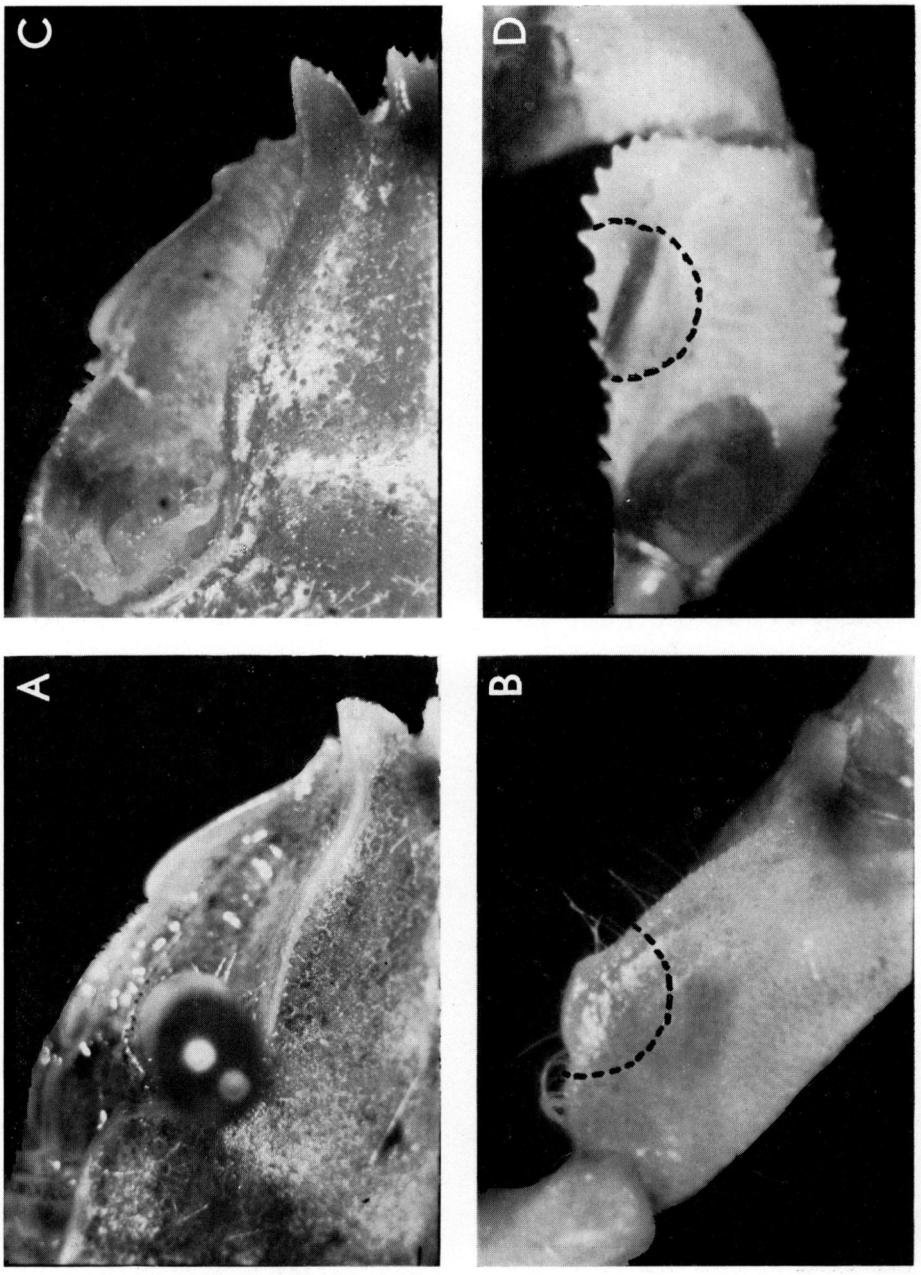

Plate 2

A, B, *Macrophthalmus* (*Mareotis*) *holthuisi* nov. sp., holotype, male of 6 × 9 mm. A, lower orbital border; B, horny ridge on merus of cheliped.

C, D, *Macrophthalmus* (*Mareotis*) *erato* De Man. C, lower orbital border of male of 5 × 8.7 mm (NMS. 1969.12.5.9); D, horny ridge on merus of cheliped of male of 6.5 × 9 mm (NMS. 1970.1.23.26).

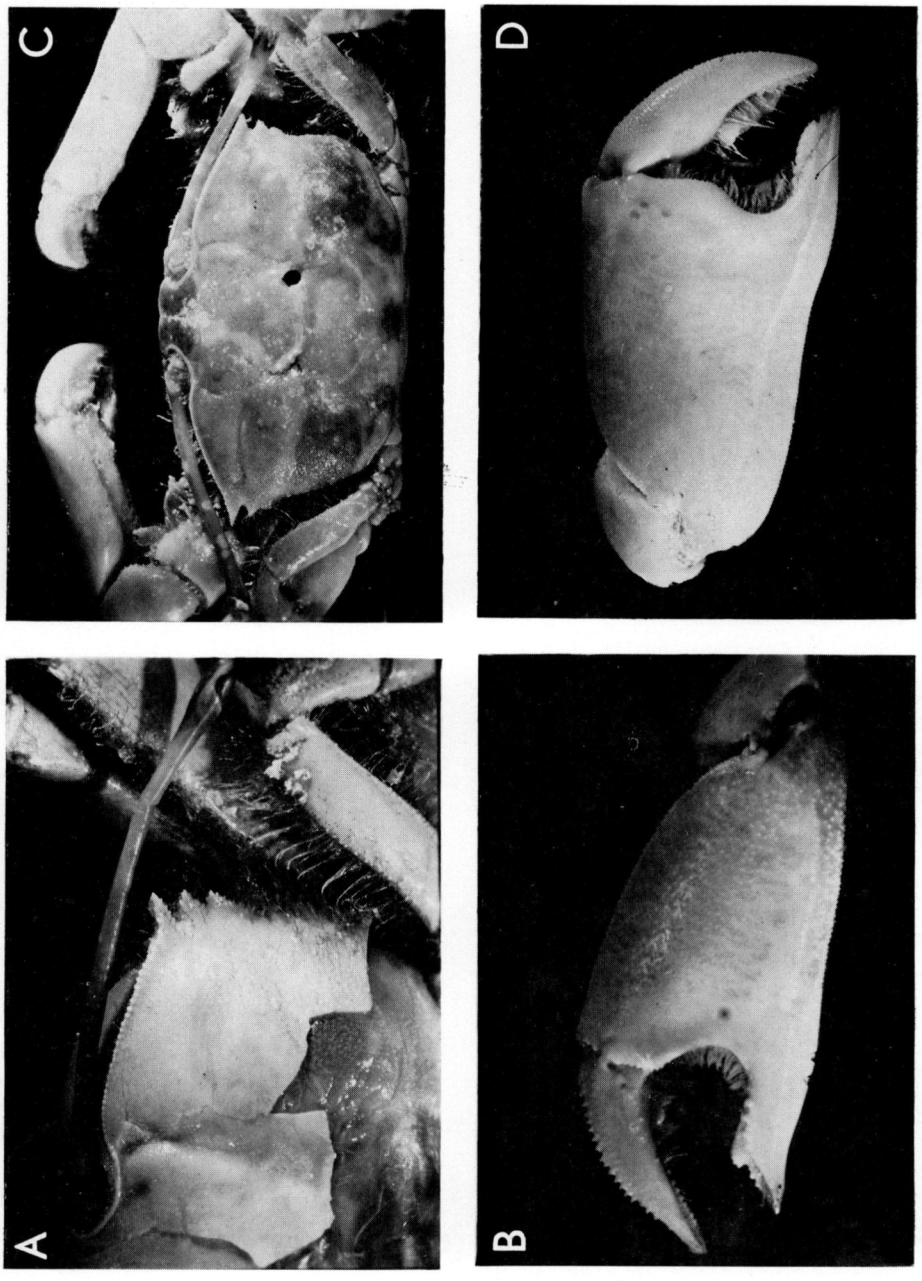

Plate 3

A, B, *Macrophthalmus* (*Macrophthalmus*) *telescopicus* (Owen), male of 20 × 36 mm (NMS. 1965.7.20.94). A, dorsal view of part of carapace; B, palm of cheliped.

C, D, *Macrophthalmus* (*Macrophthalmus*) *verreauxi* H. Milne Edwards, male of 12 × 19.5 mm (NMS. 1965.7.20.103). C, dorsal view; D, palm of cheliped.