

## ***Macrophthalmus (Macrophthalmus) microfylacas*, a new species of sentinel crab (Decapoda: Brachyura: Ocypodidae) from western Japan**

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### **Abstract**

A new species of the *Macrophthalmus telescopicus* complex is described from Japan. The new species is closely allied to *M. telescopicus* (Owen, 1839), *M. milloti* Crosnier, 1965, and *M. serenei* Takeda & Komai, 1991. *Macrophthalmus microfylacas* sp. nov., however, is distinguished from these three species by the shape of the second and third anterolateral teeth, the shape of the gap between the first and second teeth, and a small body size. The new species can also be differentiated from *M. milloti* and *M. serenei* by the shape of the subproximal tooth of the male cheliped dactylus, while it differs from *M. telescopicus* by the shape of the G1.

**Keywords:** *Macrophthalmus microfylacas*, new species, Brachyura, Ocypodidae, taxonomy, Japan

### **Introduction**

The sentinel crab genus *Macrophthalmus* Desmarest, 1823 is a relatively well-studied group which contains seven subgenera (Barnes, 1967; Komai *et al.*, 1995), 41 valid species, 3 fossil species (Barnes, 1977; Manning & Holthuis, 1981; Poupin, 1997; Wada & Sakai, 1989), and four subspecies (Barnes, 1977; Tai & Song, 1984) from littoral to sublittoral environments. The *M. telescopicus* complex, characterized by a long ocular peduncle, has also been revised by several authors (Tesch, 1915; Kemp, 1919; Tweedie, 1937, 1950; Sakai, 1939; Crosnier, 1965; Barnes, 1976; Serène, 1973; Barnes, 1977; Takeda & Komai, 1991).

An undescribed species of *Macrophthalmus* from sublittoral to lower littoral environments in western to southwestern Japan was discovered during studies of the kelliid bivalve, *Pseudopythina macrophthalmensis*, an ectosymbiont of *Macrophthalmus* spp. Here we describe the new species and compare it with allied species based on material from the Ryukyus.

## Material and methods

The abbreviations CL, CW, G1, and G2 are used for carapace length, carapace width, male first gonopod, and male second gonopod, respectively. Carapace size is expressed as CL/CW. Specimens were measured using a stereomicroscope (Nikon SMZ-10) provided with an eye-piece micrometer to the nearest 0.1 mm. CW and female third and fifth abdominal segments were measured at the widest level, while other measurements follow Komai *et al.* (1995: Fig. 1). Extra-orbital ocular peduncle length (length of the ocular peduncle beyond the external orbital angle) was calculated by subtracting orbital length (from the base of the ocular peduncle to the tip of the external orbital angle) from ocular peduncle length. Specimens are deposited in the Osaka Museum of Natural History, Osaka, Japan (OMNH), the University of the Ryukyus Museum, Fujukan, Okinawa, Japan (RUMF), the Wakayama Prefectural Museum of Natural History, Wakayama, Japan (WMNH), and the Zoological Reference Collection, Raffles Museum of Biodiversity Research, National University of Singapore, Singapore (ZRC).

## Taxonomy

### *Macrophthalmus* (*Macrophthalmus*) *Desmarest, 1823*

#### *Macrophthalmus* (*Macrophthalmus*) *microfylacas* sp. nov.

(Figs. 1–3, 4a, b)

*Macrophthalmus telescopicus* — Sakai, 1939: 623 (part?), pl. 73, fig. 1.

*Macrophthalmus* (*Macrophthalmus*) *verreauxi* — Sakai, 1976: 610 (part).

*Macrophthalmus telescopicus* — Marumura & Kosaka, 2003: 70.

#### *Material examined*

Male holotype (6.5/10.4 mm), RUMF-ZC-257, Awase, Nakagusuku Bay, Okinawa I., Ryukyus (26°18.145' N, 127°50.653' E), coll. H. Oku & T. Masumoto, 21 Aug. 2005.

Paratypes. Three females (5.7/9.7–6.2/10.6 mm), 1 ovig. female (5.8/10.1 mm), RUMF-ZC-258, same data as holotype; 1 male (6.0/10.2 mm), 1 ovig. female (5.7/9.6 mm), OMNH Ar 7116, same data as holotype; 3 males (5.5/9.4–4.4/7.0 mm), 2 females (2.7/4.3, 2.9/4.7 mm), 3 ovig. females (4.7/7.7–5.8/9.8 mm), ZRC 2005.0147, Awase,

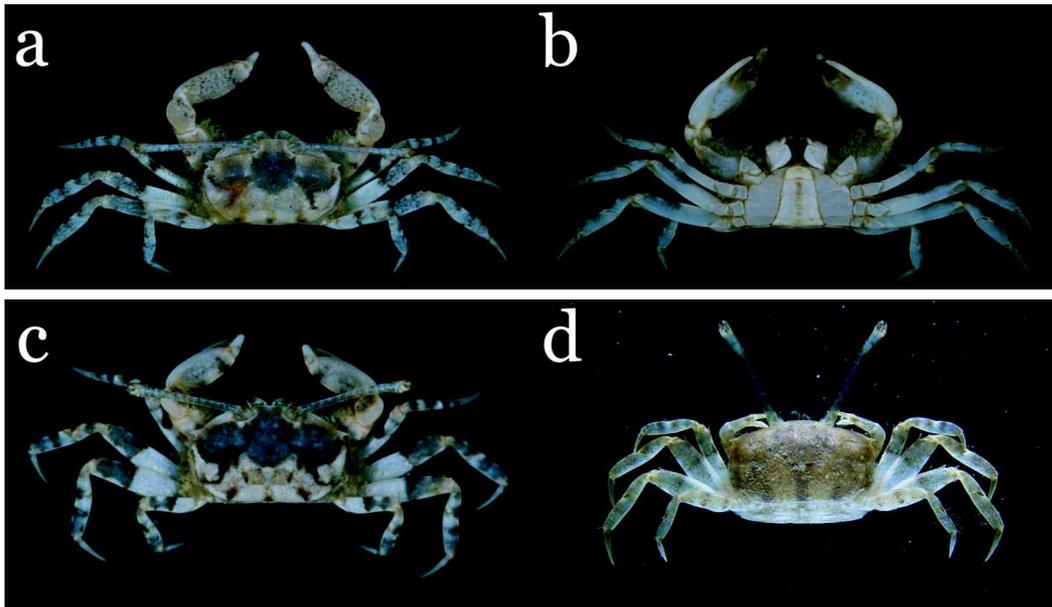
Nakagusuku Bay, Okinawa I., Ryukyus, coll. H. Oku, T. Inoue & T. Higuchi, 25, 26 Aug. 2005; 1 female (3.1/4.9 mm), RUMF-ZC-259, north of Sea Road, Kin Bay, Okinawa I., Ryukyus (26°20.313' N, 127°55.817' E), coll. M. Kubo, K. Nonaka, T. Nagai & T. Naruse, 28 Sep. 2005; 5 males (2.4/3.8–3.9/6.4 mm), 6 females (2.3/3.3–3.5/5.6 mm), 3 ovig. females (4.1/6.6–4.8/8.8 mm), RUMF-ZC-260, western breakwater, off Awase, Nakagusuku Bay, Okinawa I., Ryukyus (26°18.691' N, 127°51.755' E), coll. K. Nonaka, M. Kubo, T. Nagai & T. Naruse, 28 Sep. 2005; 1 female (3.5/5.6 mm), RUMF-ZC-261, Atsuta, Nakagusuku Bay, Okinawa I., Ryukyus (26°16.620' N, 127°49.217' E), coll. K. Nonaka, M. Kubo, T. Nagai & T. Naruse, 29 Sep. 2005; 1 male (2.5/3.7 mm), 1 female (3.0/4.8 mm), RUMF-ZC-262, Hamaya, Nakagusuku Bay, Okinawa I., Ryukyus (26°19.253' N, 127°52.740' E), coll. K. Nonaka, M. Kubo, T. Nagai & T. Naruse, 29 Sep. 2005; 2 females (3.1/4.8, 3.3/5.2 mm), RUMF-ZC-263, northwest of White Beach, Nakagusuku Bay, Okinawa I., Ryukyus (26°18.567' N, 127°53.299' E), coll. K. Nonaka, M. Kubo, T. Nagai & T. Naruse, 29 Sep. 2005; 1 male (3.3/4.7 mm), 1 female (4.2/6.9 mm), RUMF-ZC-264, Nakagusuku Bay, Okinawa I., Ryukyus, coll. Tokyo Kyuei Co. Ltd.; 1 male (2.6/3.8 mm), RUMF-ZC-265, Nakagusuku Bay, Okinawa I., Ryukyus, coll. Tokyo Kyuei Co. Ltd.; 1 male (6.2/10.5 mm), 4 ovig. females (5.7/9.3–6.0/10.4 mm), OMNH Ar 7117, Satoura, Oniki, Ushibuka City, Kumamoto Prefecture, Kyushu, coll. T. Watanabe, 20 Jun. 2004; 2 males (3.4/5.4, 5.4/8.9 mm), 1 ovig. female (5.4/8.9 mm), RUMF-ZC-266, Satoura, Oniki, Ushibuka City, Kumamoto Prefecture, Kyushu, coll. T. Watanabe, 7 Apr. 2004; 1 male (3.9/6.3 mm), 3 females (5.7/9.6–6.3/10.9 mm), 1 ovig. female (5.8/9.8 mm), ZRC 2005.0148, Satoura, Oniki, Ushibuka City, Kumamoto Prefecture, Kyushu, coll. T. Watanabe, 31. Aug. 2004, 2 ovig. females (5.1/8.6, 5.7/9.8 mm), RUMF-ZC-267, Satoura, Oniki, Ushibuka City, Kumamoto Prefecture, Kyushu, coll. T. Watanabe, 24. Jul. 2005; 1 female (4.8/7.8 mm), RUMF-ZC-268, Matsushima Watering Place, Kamiamakusa City, Kumamoto Prefecture, Kyushu, coll. T. Watanabe, 20 Jul. 2005; 1 female (6.2/10.7 mm), WMNH-Na-Cr 1205, Takahama, Ehime Prefecture, Seto Inland Sea coast of Shikoku I., 21 July 1990; 2 females (5.8/9.7, 6.8/11.6 mm), WMNH-Na-Cr 1205, Kamiura, Kushimoto, Kii Peninsula, Pacific Ocean coast of Kii Peninsula, 10 m, Dec. 1979.

Comparative material: *Macrophthalmus telescopicus* (Owen, 1839): 1 male (11.7/18.5 mm), 2 females (7.8/12.3, 11.1/18.2 mm), RUMF-ZC-269, Awase, Nakagusuku Bay, Okinawa I. (26°18.145' N, 127°50.653' E), coll. H. Oku & T. Masumoto, 21 Aug. 2005; 1 female (11.2/17.8 mm), RUMF-ZC-270, Awase, Nakagusuku Bay, Okinawa I., coll. H. Oku, T. Inoue & T. Higuchi, 25, 26 Aug. 2005; 2 males (10.3/15.4, 11.1/16.5 mm), 1 female (12.0/18.5 mm), 1 ovig. female (12.1/19.5 mm), ZRC 2005.0149, east of Cape Oh-Misaki, Nakagusuku Bay, Okinawa I. (26°18.104' N, 127°50.605' E), coll. M. Kubo & K. Nonaka, 24 Aug. 2005; 1 female (11.1/17.3 mm), RUMF-ZC-271, north of Sea Road, Kin Bay, Okinawa I. (26°20.313' N, 127°55.817' E), coll. M. Kubo, K. Nonaka, T. Nagai & T. Naruse, 28 Sep. 2005; 1 male (9.6/14.5 mm), RUMF-ZC-272, Hamaya, Nakagusuku Bay,

Okinawa I. (26°19.253' N, 127°52.740' E), coll. T. Nagai, M. Kubo, K. Nonaka & T. Naruse, 29 Sep. 2005; 1 male (6.6/10.0 mm), WMNH-Na-Cr 1206 (labelled as *M. serenei*), Mikawa Bay, Pacific Ocean coast of Honshu, coll. Kimura, Nov. 1997. *Macrophthalmus serenei* Takeda & Komai, 1991: 1 male (11.3/18.8 mm), RUMF-ZC-273, Hisamatsu, Yonaha Bay, Miyako I., coll. T. Naruse, J. Nawa & H. Osada, 26 May 2005; 3 males (10.8/18.0–11.4/18.8 mm), 1 female (9.6/15.5 mm), ZRC 2005.0150, Hisamatsu, Yonaha Bay, Miyako I., coll. T. Naruse, J. Nawa & H. Osada, 26 May 2005; 7 males (4.5/6.8–9.8/15.8), 4 females (5.3/8.2–9.6/16.0 mm), RUMF-ZC-274, Awase, Nakagusuku Bay, Okinawa I. (26°18.145' N, 127°50.653' E), coll. H. Oku & T. Masumoto, 21 Aug. 2005; 1 female (7.9/12.8 mm), RUMF-ZC-275, Awase, Nakagusuku Bay, Okinawa I., coll. H. Oku, T. Inoue & T. Higuchi, 25, 26 Aug. 2005; 2 males (9.8/14.8, 11.7/18.7 mm), WMNH-Na-Cr 1206 (labelled as *M. serenei*), Kamiura, Kushimoto, Wakayama Prefecture, Jun. 1985. *Macrophthalmus milloti* Crosnier, 1965: 2 ovig. females (8.4/14.3, 10.2/17.4 mm), RUMF-ZC-276, Shirahama, Iriomote I., coll. T. Naruse & T. Nagai, 24 Mar. 2005; 1 male (5.7/9.3 mm), 1 female (7.9/12.7 mm), 1 ovig. female (8.6/14.7 mm), RUMF-ZC-277, intertidal flat of north of Motonagura, Ishigaki I., coll. T. Naruse, 13 Apr. 2005; 7 males (4.1/6.2–8.1/13.7 mm), 2 females (6.9/11.0, 9.6/- mm), ZRC 2005.0151, Motonagura intertidal flat, Ishigaki I., coll. T. Naruse, 22 May 2005; 1 female (5.1/8.3 mm), RUMF-ZC-278, Awase, Nakagusuku Bay, Okinawa I. (26°18.145' N, 127°50.653' E), coll. H. Oku & T. Masumoto, 21 Aug. 2005; 2 males (8.1/13.7, 9.6/15.8 mm), RUMF-ZC-279, Awase, Nakagusuku Bay, Okinawa I., coll. H. Oku, T. Inoue & T. Higuchi, 25, 26 Aug. 2005; 2 females (7.9/13.3, 10.3/18.3 mm), WMNH-Na-Cr 1206 (labelled as *M. serenei*), Yakata, Onna Village, Okinawa I., 25 Feb. 1993; 1 male (4.9/7.0 mm), 1 female (4.7/7.1 mm), WMNH-Na-Cr 1209 (labelled as *M. philippinensis*), Nakagusuku Bay, Okinawa I., coll. Kubo, 7 Dec. 1992; 1 male (6.3/9.9 mm), WMNH-Na-Cr 1218 (labelled as *Macrophthalmus* sp. 1), Yakata, Onna Village, Okinawa I., Nov. 1991.

#### Description

Carapace rectangular, moderately wide, CW 1.43–1.84 (mean 1.62, n = 41) times CL; dorsal surface smooth, shiny, regions ill-defined. Front relatively wide, with strong constriction across bases of ocular peduncles; frontal margin thinly rimmed. Supraorbital margin rimmed, gently sinuous; infraorbital margin cristate, granulated, granules set closer in inner, sparsely in outer, outer extreme of margin interrupted as wide as ocular peduncle. Epistome with posterior margin medially convex, submedially concave. Anterolateral margin with 3 teeth including external orbital angle, first tooth acute, largest, disconnected from second tooth by deep U-shaped notch, second, third teeth indistinct, lamellar, never spiniform, maximum width of carapace across first or following teeth in males, while across third teeth in females; anterolateral region with short transverse ridge behind supraorbital margin; posterolateral margin granulated, posterolateral region with few granules.



**FIGURE 1.** *Macrophthalmus microfylacas* sp. nov. a, Specimen from Okinawa I., Ryukyu Is., Japan, holotype, male, RUMF-ZC-257, CL/CW 6.5/10.4 mm; b, holotype; c, specimen from Okinawa I., paratype, male, RUMF-ZC-258, CL/CW 5.7/9.7 mm; d, specimens from Amakusa, Japan, paratype, female, RUMF-ZC-268, CL/CW 4.8/7.8 mm.

Eyes with extremely slender peduncle, peduncle reaching beyond external orbital angle by its 44.1–58.6% length (mean = 51.8 %, n = 30).

Third maxilliped rectangular, with narrow rhomboidal hiatus when closed; exopod narrow, with long flagellum.

Male chelipeds equal; merus with granular dorsal surface, ventral surface with granular, laterally convex margins, with mat of pubescence, inner surface without horny ridge; chela with flat manus, outer surface shiny, but covered with microscopic granules, single row of small granules from proximal lower part to immovable finger; immovable finger shorter than movable finger, tip pointed, lower margin concave near base, cutting edge with differentiated, distally directed tooth, top of tooth placed on distal third of margin, followed proximally by small granules; movable finger curved downwards, backwards, tip pointed, with differentiated, quadrate tooth, distal margin of tooth placed on proximal third of edge; inner surfaces of fingers with mats of pubescence from bases of fingers to distal third of immovable, distal quarter of movable fingers, pubescence extending to outer surface of cutting edge in movable finger, so subproximal tooth hidden in outer view.

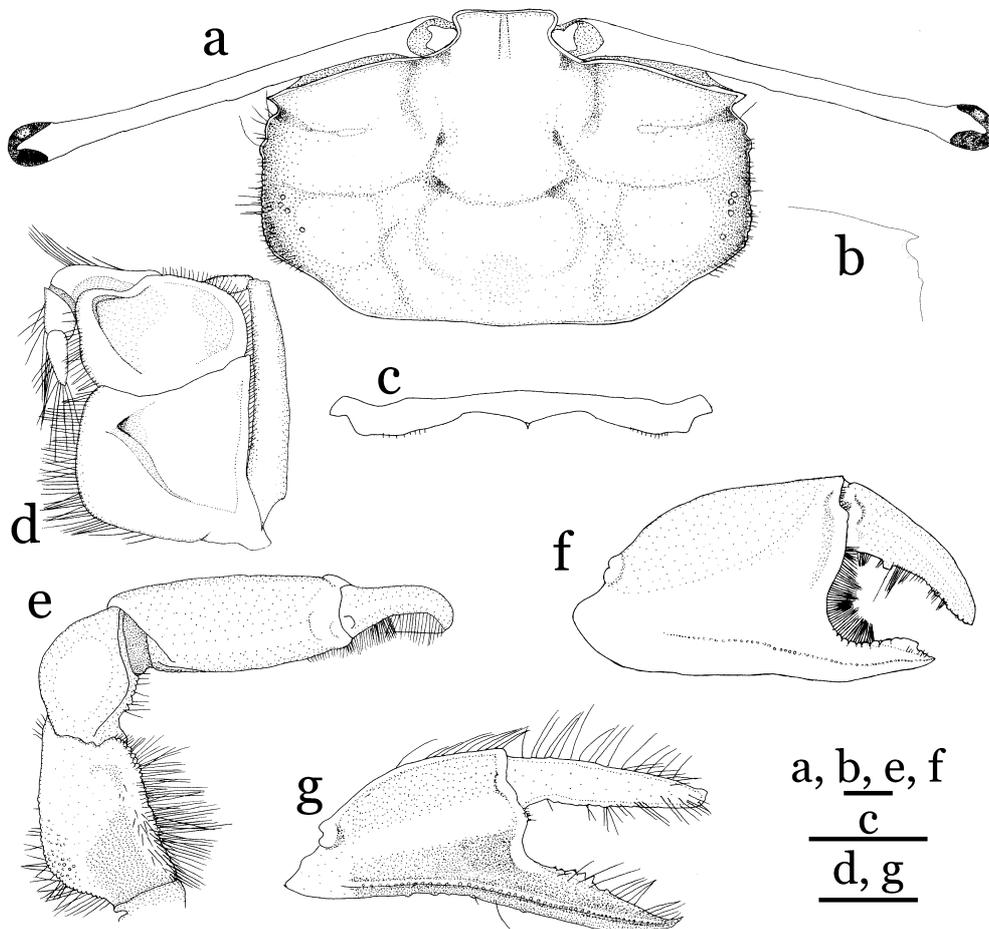
Female chelipeds feeble; merus short, lower surface glabrous, with granular, foliaceous small projection on distal inner margin; carpus with row of setae along inner margin; chela very flat, with row of tiny granules along lower margin, extending from base of manus to immovable finger; fingers curved backwards, tips slightly scoop-shaped.

of manus to immovable finger; fingers curved backwards, tips slightly scoop-shaped.

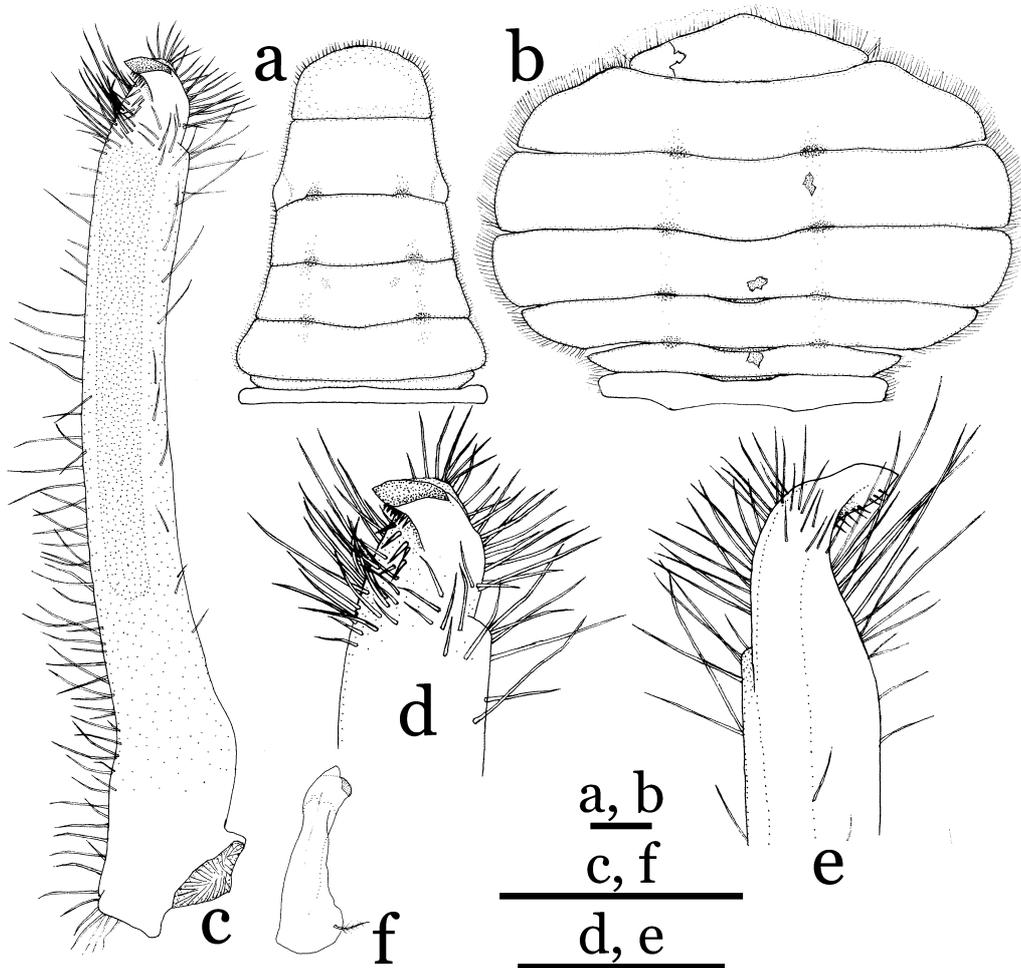
Ambulatory legs slender; meri sparsely fringed with long setae on anterior, posterior margins, but without black, stiff setae; male with slender meri, length to width ratio 3.15–4.31 (mean = 3.63, n = 11), 2.71–3.47 (mean = 3.09, n = 13) in female, anterior three legs with meri with subdistal sharp tooth on anterior margin; dactyli spiniform, slightly incurved; propodi, dactyli sparsely lined with long setae on inner margin of third leg, inner, outer margins of fourth legs

Telson, abdominal segment bell-shaped, base of sixth abdominal segment projected laterally.

G1 slender, straight; distal end corneous, stout, abruptly curved outwardly.



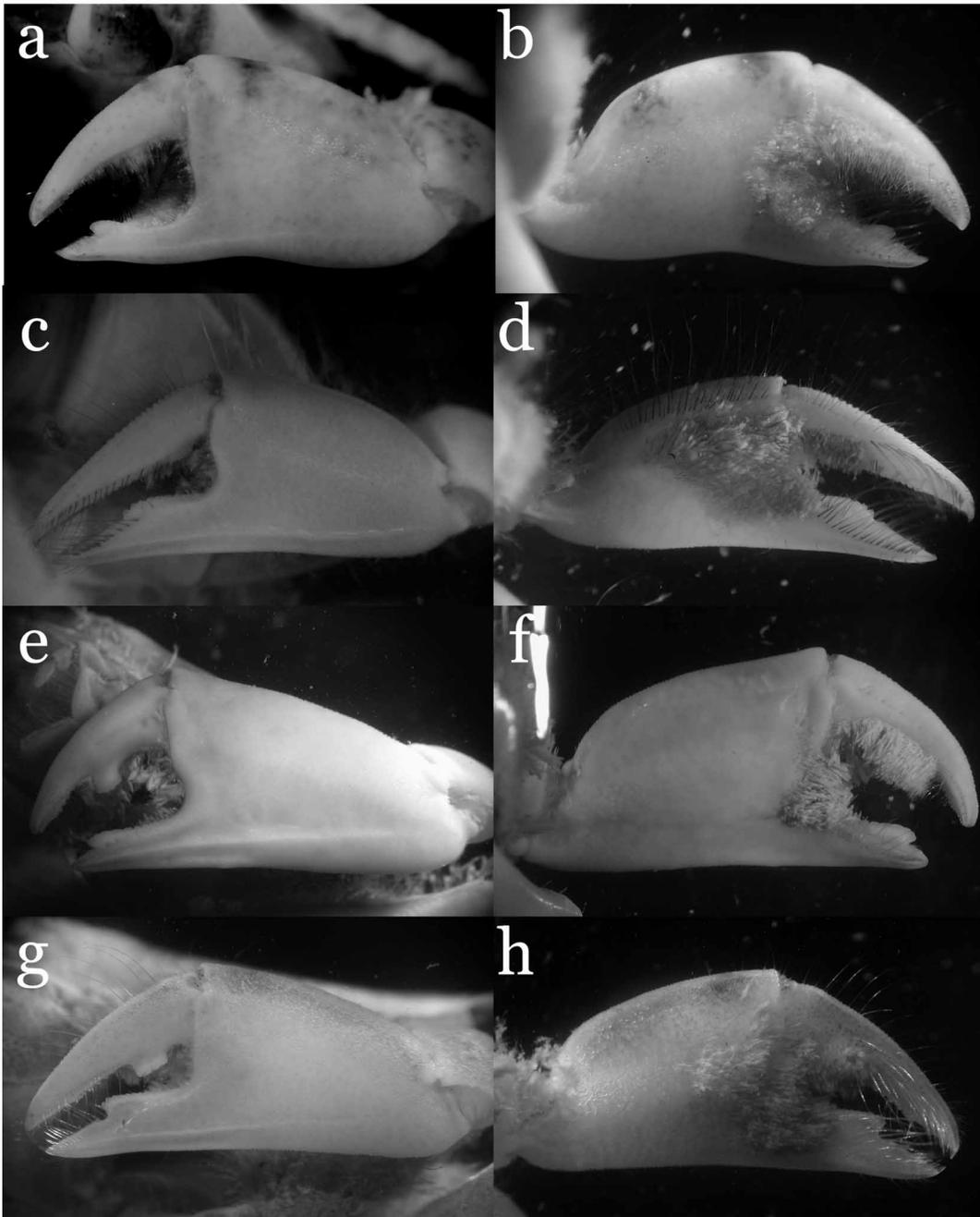
**FIGURE 2.** *Macrophthalmus microfylacas* sp. nov. a, male carapace and eyes; b, female anterolateral margin; c, epistome; d, third maxilliped; e, male cheliped, upper view; f, male chela, outer view (setae of movable finger are partially removed); g, female chela, outer view. a, c–f, holotype, male, RUMF-ZC-257, CL/CW 6.5/10.4 mm; b, g, paratype, female, RUMF-ZC-258, CL/CW 5.9/10.3 mm. Scales, 1 mm.



**FIGURE 3.** *Macrophthalmus microfylacas* sp. nov. a, male abdomen and telson; b, female abdomen and telson; c, G1, dorsal view; d, distal end of G1, dorsal view; e, distal end of G1, ventral view; f, G2. a, c–f, holotype, male, RUMF-ZC-257, CL/CW 6.5/10.4 mm; b, paratype, female, RUMF-ZC-258, CL/CW 5.9/10.3 mm. Scales, a–c, f, 1 mm; d, e, 0.5 mm.

#### *Colouration*

Okinawa specimens of *M. microfylacas* sp. nov. are slightly pink-ivory with black irregular patterns on the branchial and gastric regions, distal half of the ambulatory meri, outer part of the third maxilliped meri, pterygostomial region, and other regions (Fig. 1a–c). In contrast, specimens from Amakusa are yellowish grey with white spots (Fig. 1d). These colour variations are corresponding to the substratum colour (see habitat section below). Colouration of the ocular peduncles is similar in specimens of both localities: black patches and blue spots scattered throughout their lengths, subproximal to distal 1/3 of the peduncles transparent in life (Fig. 1d).



**FIGURE 4.** Male left chelae of *Macrophthalmus microfylacas* sp. nov. and allied species. a, b, *M. microfylacas* sp. nov., paratype, RUMF-ZC-258, CL/CW 5.7/9.7 mm; c, d, *M. telescopicus* (Owen, 1839), ZRC 2005.0149, CL/CW 10.3/15.4 mm; e, f, *M. serenei* Takeda & Komai, 1991, ZRC 2005.0150, CL/CW 11.2/18.9 mm; g, h, *M. milloti* Crosnier, 1965, ZRC 2005.0151, CL/CW 8.1/13.7 mm. a, c, e, g, outer view; b, d, f, h, inner view.

### Habitat

*Macrophthalmus microfylacas* sp. nov. occurs mostly at depths of 2–4 m in bays with canescent sandy or small coral-rubble bottoms in Okinawa. Some substrates have *Thalassia hemprichii* seagrass beds. *Macrophthalmus telescopicus* and *M. serenei* were also collected from the same habitat. In Amakusa the new species is found in lower littoral zone of bays with relatively solid, dark, and sandy to muddy substrates, with seagrasses absent.

### Etymology

The name of the new species derives from the Greek *micros* (small) and *fylakas* (watchman), alluding to its small size and the common name for the species of *Macrophthalmus*, the sentinel crabs. The name is used as a noun in apposition.

### Distribution

Okinawa I., Ryukyu Islands; Amakusa, Kumamoto, Kyushu; Shimabara, Nagasaki, Kyushu; Takahama, Ehime, Seto Inland Sea coast of Shikoku I.; Kushimoto, Kii Peninsula, Pacific Ocean coast of Honshu; Shimoda, Izu Peninsula, Pacific Ocean coast of Honshu.

### Remarks

The taxonomy of *M. telescopicus* (Owen, 1839), *M. serenei* Takeda & Komai, 1991 (= *M. verreauxi* sensu Serène, 1973 = *M. kempii* sensu Serène, 1981), and *M. milloti* Crosnier, 1965 was unclear until their revision by Serène (1973) (also see Serène, 1981; Takeda & Komai, 1991). *Macrophthalmus microfylacas* sp. nov. shares with these three species their extremely long ocular peduncles (cornea distinctly reaching beyond external orbital angle), the presence of three anterolateral teeth, and the smooth dorsal and ventral margins of the manus. *Macrophthalmus microfylacas* sp. nov. is distinguished from these three species (Table 1) by the blunt second and third anterolateral teeth (Fig. 2a, b), the U-shaped notch between the first and second teeth (Fig. 2a, b), the convex lower margin of the cheliped immovable finger of males (Figs. 2f, 4a), the shape of the mats of pubescence of the cheliped fingers of males (Figs. 4b), and the small body size (see below). Furthermore, *M. microfylacas* sp. nov. can be differentiated from *M. serenei* and *M. milloti* by the smaller subproximal tooth on the cutting edge of the movable finger of the cheliped (Fig. 2f) [vs. distinct and rectangular (Fig. 4e, g; Crosnier, 1965: 126 (part), figs. 220, 227)], while *M. microfylacas* sp. nov. differs from *M. telescopicus* by the short distal projection of the G1 which is abruptly curved outwards (Fig. 3c–e) [vs. moderately long and slender (Fig. 5g)].

Several authors have focused on the ocular peduncle length and body size to characterize the *M. telescopicus* complex (e.g. Serène, 1973; Barnes, 1976; Takeda, 1981). *Macrophthalmus microfylacas* sp. nov. tends to have a larger percentage of the extra-orbital ocular peduncle length as a portion of total peduncle length, ranging from 44.1 to

58.6 % length (mean = 51.8 %, n = 30) (Fig. 6). In contrast, the percentage in *M. milloti* is low; it never overlaps with those of the other three species (26.3–35.7 %, mean = 30.6 %, n = 16). The ranges of *M. telescopicus* (43.3–50.6, mean = 47.2, n = 11) and *M. serenei* (38.3–49.1 %, mean = 44.0 %, n = 17) largely overlap, but *M. telescopicus* tends to have a larger percentage than in *M. serenei* when specimens of similar body sizes are compared.

**TABLE 1.** Key characters of *Macrophthalmus microfylacas* sp. nov. and allied species.

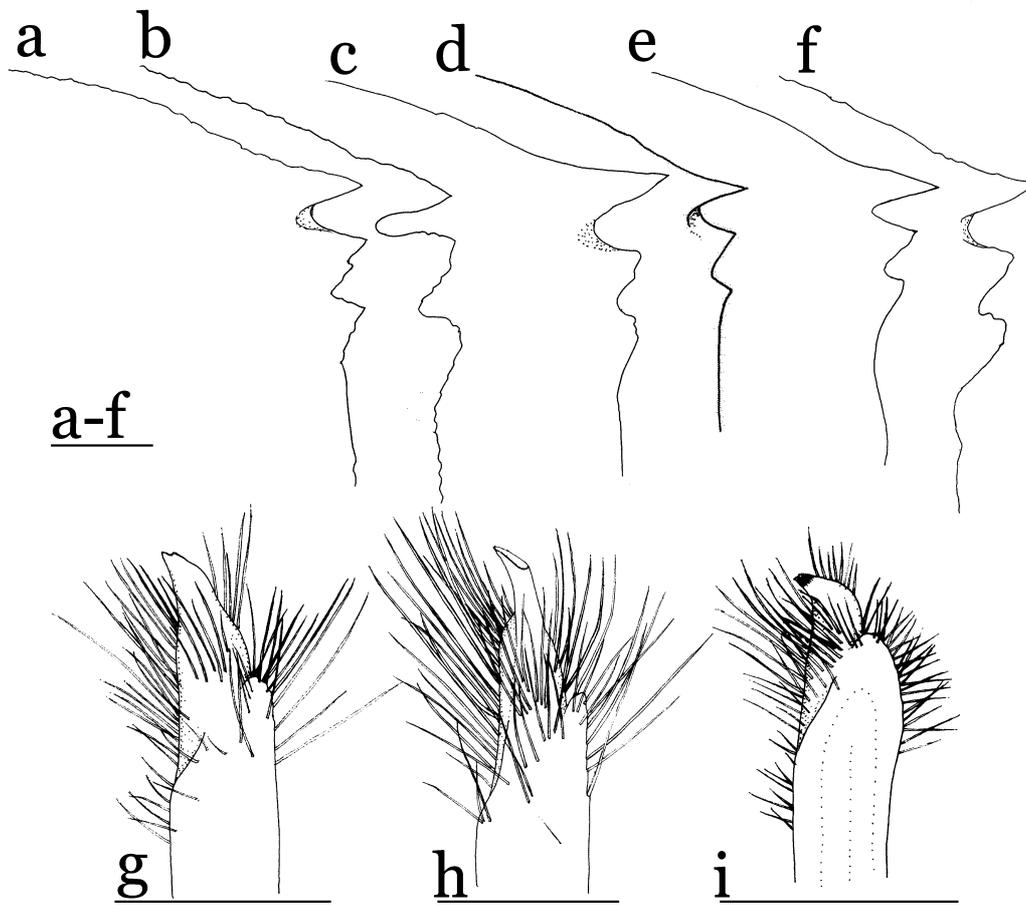
| Character  | <i>M. microfylacas</i> sp. nov.                                   | <i>M. telescopicus</i>                                    | <i>M. serenei</i>  | <i>M. milloti</i>  |
|--|---|---|--|--|
| Minimal female size (CL/CW) with 5th abdominal segment wider than that of 3rd segment (see Fig. 7) | 3.1/4.9 mm  | 7.8/12.3 mm   | 7.7/12.1 mm  | 7.9/12.7 mm  |
| Widest breadth of carapace (male)  | Across 1st or following teeth (Fig. 2a)                           | Across 2nd teeth (Fig. 5a)                                | Across 1st teeth (Fig. 5c)   | Across 1st teeth (Fig. 5e)   |
| Widest breadth of carapace (female)  | Across 3rd teeth (Fig. 2b)  | Across 2nd teeth (Fig. 5b)                                | Across 1st or 2nd teeth (Fig. 5d)                                    | Across 1st teeth (Fig. 5f)   |
| Notch between 1st & 2nd teeth  | U-shaped (Figs. 2a, b)  | V-shaped in male, subparallel in female (Figs. 5a, b)     | V-shaped (Figs. 5c, d)   | V-shaped (Figs. 5e, f)   |
| Branchial region   | Naked   | Black, long setae   | Pubescence   | Pubescence   |
| Colouration of ocular peduncle   | Black patchy pattern  | Black patchy pattern                                      | Black border patterns  | Black patchy pattern   |
| Extra-orbital ocular peduncle length (see Fig. 6)  | 44.1–58.6 % (mean = 51.8 %, n = 30)                               | 43.3–50.6 % (mean = 47.2 %, n = 11)                       | 38.3–49.1 % (mean = 44.0 %, n = 17)                                  | 26.3–35.7 % (mean = 30.6 %, n = 16)                                  |
| Tooth on cutting edge of immovable finger of male chela  | Differentiated, top on distal 1/3 of edge (Figs. 2f, 4a)          | Indifferentiated, top on middle of edge (Fig. 4c)         | Differentiated, top on distal 1/4 of edge (Fig. 4e)                  | Differentiated, top on distal 2/5 of edge (Fig. 4g)                  |
| Lower margin of base of immovable finger of male chela   | Convex (Figs. 2f, 4a)   | Concave (Fig. 4c)   | Straight (Fig. 4e)   | Straight (Fig. 4g)   |
| Tooth on cutting edge of movable finger of male chela  | Differentiated, quadrate, distal margin on proximal 1/3 (Fig. 2f) | Indifferentiated, distal margin on proximal 1/4 (Fig. 4c) | Differentiated, rectangular, distal margin on proximal 1/2 (Fig. 4e) | Differentiated, rectangular, distal margin on proximal 1/3 (Fig. 4g) |

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TABLE 1 (continued)

| Character  | <i>M. microfylacas</i> sp. nov.   | <i>M. telescopicus</i>   | <i>M. serenei</i>   | <i>M. milloti</i>  |
|--|---|--|---|--|
| Mat of pubescence on inner surface of male chela | From base to distal 1/3 of immovable and distal 1/4 of movable fingers; extending to cutting edge of dactylus (Fig. 4b) | From proximal 1/3 of middle height of palm to proximal 1/3 of immovable and movable fingers; not extending to cutting edge of dactylus (Fig. 4d)   | From base to proximal 1/3 of immovable and proximal 2/3 of movable fingers; not extending to cutting edge of dactylus (Fig. 4f) | From distal 1/3 of middle height of palm to proximal 1/3 of immovable and proximal 1/2 of movable fingers; not extending to cutting edge of dactylus (Fig. 4h) |
| Distal chitinous projection of G1                | Short, abruptly curving outwards (Fig. 3c–e)  | Long, slightly curving outwards (Fig. 5g)  | Long, slightly curving outwards (Fig. 5h)   | Short, abruptly curving outwards (Fig. 5i)   |
| Holotype   | RUMF-ZC-257.<br>Type locality: Okinawa I. (Present study)   | Originally deposited in the Museums of the Royal College of Surgeons of England, but most probably destroyed (Dr. Simon Chaplin, pers. comm.)<br>Type locality: Oahu I., Hawaii. (Owen, 1839: 78, figs. 1, 1a–f) | MNHN B7284.<br>Type locality: Red Sea. [Crosnier, 1965: 126 (part), Fig. 227; Serène, 1981: 1140]                               | MNHN.<br>Type locality: Madagascar. (Crosnier, 1965: 124, Figs. 217–220, 222, 223, 228, Pl. XI, Fig. 4.)   |

The new species is also characterised by its small body size, minimum size in ovigerous female being 6.6 mm CW (RUMF-ZC-260). In *M. microfylacas* sp. nov., the width of the female fifth abdominal segment begins to exceed that of the third segment by an individual with CL/CW 3.1/4.9 mm (Fig. 7). In contrast, individuals with a wider fifth segment are much larger in *M. serenei* (7.7/12.1– mm) and *M. milloti* (7.9/12.7– mm). Small individuals of *M. telescopicus* could not be examined, but *M. telescopicus* is a clearly larger than *M. microfylacas* sp. nov.

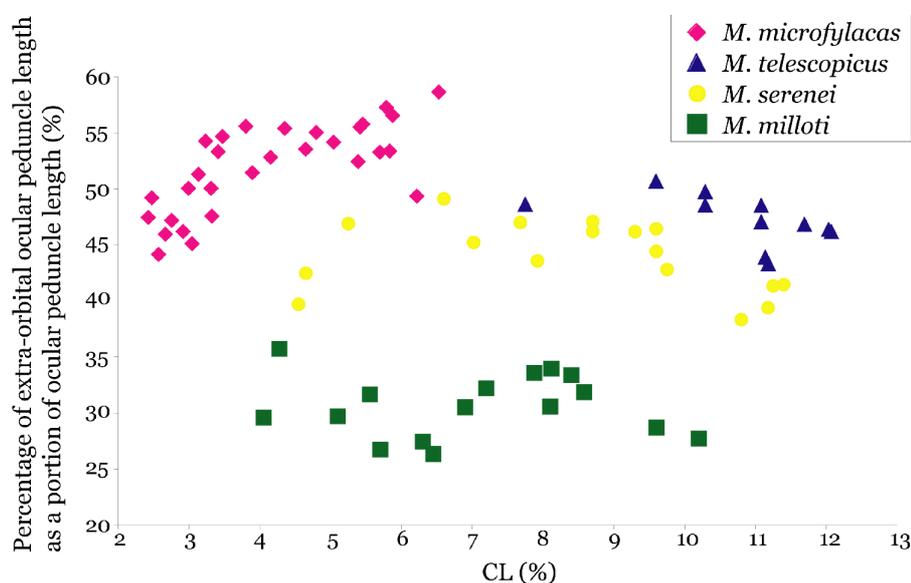


**FIGURE 5.** Anterolateral margins of carapace and G1s of *Macrophthalmus telescopicus* (Owen, 1839), *M. serenei* Takeda & Komai, 1989, and *M. milloti* Crosnier, 1965. a, g, *M. telescopicus*, male, ZRC 2005.0149, CL/CW 10.3/15.4 mm; b, *M. telescopicus*, female, ZRC 2005.0149, CL/CW 12.0/18.5 mm; c, h, *M. serenei*, male, ZRC 2005.0150, CL/CW 11.2/18.9 mm; d, *M. serenei*, female, RUMF-ZC-274, CL/CW 7.7/12.1 mm; e, i, *M. milloti*, male, ZRC 2005.0151, CL/CW 8.1/13.7 mm; f, *M. milloti*, female, RUMF-ZC-276, CL/CW 10.2/17.4 mm. Scales, 1 mm.

Sakai (1939) recorded *M. telescopicus* from Shimoda (Pacific coast of Honshu), Nagasaki (Kyushu), and Loo Choo (= the Ryukyu Is.), and he recognized it as a small-size species (e.g. a male with CL/CW 6.5/10.5 mm). Serène (1973) concluded that Sakai's (1939) material belonged to an undescribed species not only because of their small size but of the high manus of males, the wide gap between fingers, and the absence of a tooth on the cutting edge of the dactylus. Sakai (1976), however, identified the material from Shimoda and Nagasaki, together with specimens from Noto Peninsula (Japan Sea coast of Honshu) and Wakayama (Pacific coast of Honshu), as *M. verreauxi* sensu Serène, 1973 (= *M. serenei*). *Macrophthalmus microfylacas* sp. nov. indeed fits Sakai's (1939) *M. telescopicus* except for the absence of the tooth on the cutting edge of the cheliped

dactylus of males in the Shimoda specimens. The tooth of *M. microfylacas* sp. nov. is covered by dense pubescence and hidden from outer view which was probably missed by Sakai (1939). The Shimoda and Nagasaki specimens are most probably *M. microfylacas* sp. nov. Sakai's (1976: fig. 334) material from Noto Peninsula clearly belongs to *M. serenei* (= *M. verreauxi* sensu Serène, 1973), while the identity of his specimens from the Ryukyus and Wakayama remains unconfirmed.

The third author could examine the late Mr. Seiji Nagai's crab collection, which was catalogued by Marumura & Kosaka (2003). The specimens identified as *M. telescopicus* (WMNH-Na-Cr 1205) from Kushimoto, Kii Peninsula and Takahama, Shikoku I. are *M. microfylacas* sp. nov. The identities of the *M. telescopicus* complex listed in the catalogue were corrected in the material examined section above.

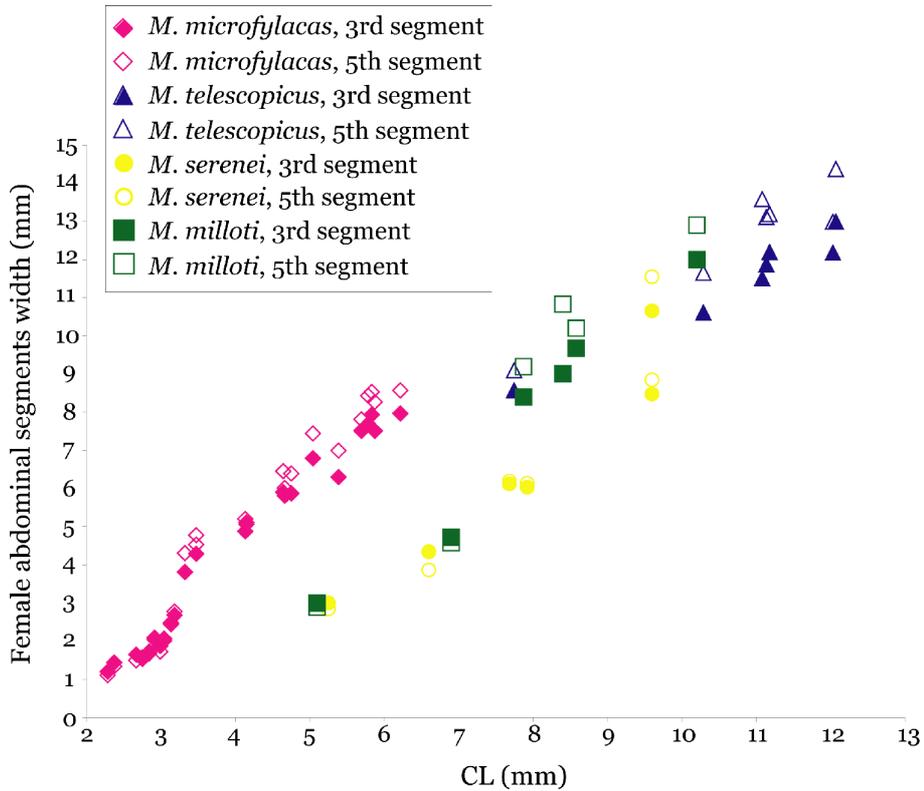


**FIGURE 6.** Percentage of the extra-orbital ocular peduncle length in the total ocular peduncle length of *Macrophthalmus microfylacas* sp. nov. and allied species.

**The key to the species of *Macrophthalmus* provided by Barnes (1977) are partially modified as follows:**

- 12 Ocular peduncles extend beyond tip of external orbital angle for less than 36% of their length and for less than a distance equal to twice the length of the cornea.....  
..... *M. milloti*
- 12(a) Ocular peduncles extend beyond tip of external orbital angle for more than 38% of their length and for more than a distance equal to twice the length of the cornea... 13
- 13 Teeth on cutting edges of cheliped fingers indifferntiated; lower margin of immovable fingers concave..... *M. telescopicus*

- 13(a) Teeth on cutting edges of cheliped fingers differentiated, lower margin of immoveable fingers straight or convex ..... 13'
- 13' Movable finger of cheliped with a rectangular tooth, distal margin on proximal 1/2 of cutting edge, mat of pubescens not extending to cutting edge; second and third anterolateral teeth of carapace with acute tips; medium size species ..... *M. serenei*
- 13'(a) Movable finger of cheliped with a quadrate tooth, distal margin on proximal 1/3 of cutting edge, mat of pubescens extending to cutting edge; second and third anterolateral teeth of carapace lamellar; small size species (maximum CL/CW, 6.2/10.6 mm) ..... *M. microfylacas*



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