

**A NEW SPECIES OF *MACROPHTHALMUS* DESMAREST, 1823
(CRUSTACEA: DECAPODA: BRACHYURA: MACROPHTHALMIDAE)
FROM BOHOL ISLAND, THE PHILIPPINES**

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ABSTRACT. – Many new taxa have already been described as a result of the PANGLAO 2004 Marine Biodiversity Project. We report a new species of the ocypodoid crab genus *Macrophthalmus* Desmarest from the Philippines. *Macrophthalmus pentaodon*, new species, can be distinguished from other species in the genus primarily by the presence of five anterolateral teeth on the carapace, the greatest known so far in the genus, and by its steeply oblique upper orbital margins. It can be further distinguished from closely allied species by its smaller size and shorter ocular peduncles.

KEYWORDS. – *Macrophthalmus pentaodon*, Brachyura, Macrophthalmidae, Philippines, Bohol, PANGLAO 2004.

INTRODUCTION

The brachyuran crab family Macrophthalmidae Dana, 1851 has been recognized as separate from Ocypodidae Rafinesque, 1815 on account of morphological and molecular evidence (see Kitaura et al., 2002; Mendoza & Ng, 2007; Ng et al., 2008). It is largely represented by the genus *Macrophthalmus* Desmarest, 1823, which contains 8 subgenera and 54 valid species (Barnes, 1977; Mendoza & Ng, 2007; Barnes & Davie, 2008; Naruse & Kosuge, 2008; Ng et al., 2008). There are currently eleven species of *Macrophthalmus* known from the Philippines: *M. barnesi* Serène, 1971; *M. convexus* Stimpson, 1858; *M. crinitus* Rathbun, 1913; *M. dagohoyi* Mendoza & Ng, 2007; *M. depressus* Rüppell, 1830; *M. definitus* Adams & White, 1849; *M. japonicus* (De Haan, 1835); *M. latreillei* (Desmarest, 1822); *M. philippinensis* Serène, 1971; *M. tomentosus* Souleyet, 1841; and *M. transversus* (Latreille, 1817). Three of these, *M. barnesi*, *M. dagohoyi* and *M. philippinensis*, have their type localities in the Philippines (cf. Ward, 1941; Estampador, 1959; Barnes, 1967; Serène, 1971; Manuel et al., 1991; Komai et al., 1995; Mendoza & Ng, 2007). *Macrophthalmus granulosus* De Man, 1904 was reported from the Gulf of Davao in the southern Philippines

by Ward (1941). *Macrophthalmus sandakani* Rathbun, 1914 was reported from Cebu by Estampador (1959) stating that “These crabs inhabit muddy beaches, and are quite abundant in the mouths of streams. The author has seen them collected for food at the mouth of Mambaling River in Cebu”. Both species have since been treated as junior synonyms of *M. latreillei* (Desmarest, 1822) (cf. Barnes, 1977).

Among the decapod Crustacea collected in the central Philippines by the PANGLAO 2004 Marine Biodiversity Project (see Bouchet et al., 2009) were some unusual macrophthalmid crabs. They differed sufficiently from any known species of *Macrophthalmus*, and were considered new to science. One species has since been described by Mendoza & Ng (2007), and a second new species is described in this paper.

MATERIALS AND METHODS

Carapace size is expressed as CW (carapace width) by CL (carapace length). The CW and the widths of the 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 National Museum of the Philippines, Manila (NMCR), Ryukyu University Museum, Fujukan, Okinawa, Japan (RUMF), Wakayama Prefectural Museum of Natural History, Wakayama, Japan (WMNH), and the Zoological Reference Collection, Raffles Museum of Biodiversity Research, National University of Singapore (ZRC).

TAXONOMIC ACCOUNT

MACROPHTHALMIDAE Dana, 1851

Macrophthalmus (*Macrophthalmus*) Desmarest, 1823

Macrophthalmus (*Macrophthalmus*) *pentaodon*, new species

Fig. 1

Material Examined. – Holotype: female (5.0 by 3.5 mm) (NMCR 27012), Stn. S21, reef slope with silt, 4–12 m, 9°41.7'N 123°50.9'E, Manga, Bohol Island, Philippines, coll. by PANGLAO 2004 Marine Biodiversity Project, 20 Jun.2004.

Description of female holotype. – Carapace (Fig. 1a) rectangular, regions not well-defined; dorsal surface naked, relatively smooth, with short transverse ridge on metabranchial region; greatest width across external orbital teeth, 1.4 times as wide as long. Front 0.2 times as wide as carapace, with shallow median furrow, not constricted at bases of ocular peduncles; frontal margin thinly rimmed. Upper orbital border steeply divergent posteriorly, with wide convexity on inner third, smooth, sub-cristate; lower orbital border sub-cristate, terminating just anterior to anterior margin of chelipedal coxa, outer half sparsely lined with very low granules. Lateral margins of carapace subparallel, armed with 5 anterolateral teeth (including external orbital tooth), followed posteriorly by small tubercles; external orbital tooth narrow, acute, exceeding all other subsequent teeth; tips of subsequent teeth more rounded, bases wider, third largest, fifth smallest; third tooth separated from fourth by wide V-shaped incision. Posterior margin of epistome (Fig. 1b) convex medially, without endostomial ridge.

Ocular peduncle (Fig. 1a, b) long and stout, margins slightly sinuous, exceeding external orbital tooth by 11.5% of its total length and half length of cornea in frontal view.

Third maxillipeds separated by median hiatus, not completely covering buccal cavern when closed; median length of ischium about 1.5 times that of merus; merus and ischium with setose inner margins; distal external margin of merus rounded. Exopod narrow (Fig. 1c).

Chelipeds (Fig. 1d) symmetrical, weak. Palm of chela smooth on inner surface, outer surface sparsely granulated,

upper margin with a single row of minute granules, lower margin with row of granules adjacent to it, extending as a distinct ridge onto fixed finger, proximal part on palm granular; fingers nearly flat, dactylus about 1.2 times longer than palm, slightly curved, cutting edge toothless, fixed finger slightly deflexed, cutting edge with a few minute teeth on the middle region.

Second to fifth pereopods (Fig. 1a) relatively long; meri of second to fifth pereopods with subdistal tooth, third and fourth pereopods with wider meri; dactyli with subrhomboidal cross-section, rather compressed laterally, dactylus of fourth pereopod about 0.8 times as long as propodus, sparsely setose on flexor surface.

Abdomen (Fig. 1e) wide, fully expanded, lateral margins convex; telson 2.3 times as wide as long, proximal margin straight, slightly narrower than and appearing embedded into distal margin of sixth segment; sixth segment 2.2 times wider than telson, distal margin concave; fifth segment 1.1 times wider than third; fourth segment widest; first segment with a transverse ridge dividing it into upper and lower halves.

Genital opening situated just posterior to distal margin of thoracic sternite 6; operculum sub-ovate, directed medially.

Comparative Material. – *Macrophthalmus* (*Macrophthalmus*) *philippinensis* Serène, 1971, holotype male (10.0 by 5.6 mm) (ZRC.1969.12.12.1), paratype male (10.0 by 5.6 mm) (ZRC.1969.12.12.2), Busuanga, Palawan, Philippines, coll. by Norton and Dayrit, 10–30 May.1933.

Macrophthalmus (*Macrophthalmus*) *ryukyuuanus* Naruse & Kosuge, 2008, holotype male (9.3 by 5.3 mm) (ZRC 2007.0524), paratype male (CL 3.5 mm) (RUMF-ZC-538) off mouth of Urauchi River, Iriomote Island, Ryukyu Islands, Japan (24°24.98'N, 123°46.04'E), 19 m depth, coll. T. Kosuge and K. Higa, dredge, 16 Aug.2005.

Macrophthalmus (*Tasmanoplax*) *latifrons* Haswell, 1882, 1 male (27.0 by 16.7 mm), 1 ovig. female (23.1 by 15.0 mm) (ZRC 1965.7.20.43–44), Oxford, Tasmania, coll. by Anonymous, 1941.

Ilyoplax dentata Ward, 1933, 1 male (5.5 by 4.0 mm) (ZRC 1995.959), estuarine muddy bay, 10.44°S, 142.33°E, far north of Queensland, Australia, coll. by J. Short, 26 Oct.1990.

Ilyoplax gangetica (Kemp, 1919), 1 male (7.0 by 4.5 mm) (ZRC 2001.2339), Stn. KR(S)1, mud, Ranong, Thailand, coll. by P. Clark, 11 Nov.2001.

Ilyoplax obliqua Tweedie, 1935, 1 male (4.6 by 3.3 mm), 1 ovig. female (4.7 by 3.2 mm) (ZRC 1987.227–228), Lim Chu Kang, Singapore, coll. by P.K.L. Ng, 19 Mar.1987.

Ilyoplax orientalis (De Man, 1888), 1 male (5.8 by 4.3 mm) (ZRC 1987.231–239), Lim Chu Kang, Singapore, coll. by P.K.L. Ng & S. Harminto, 3 Sep.1986.

Tmethypocoelis ceratophora (Koelbel, 1897), 1 male (6.4 by 3.8 mm) (ZRC 1993.622–625), Horikawa reef flat, Tamagusuku Village, Okinawa, Japan, coll. by P.K.L. Ng, Apr.1992.

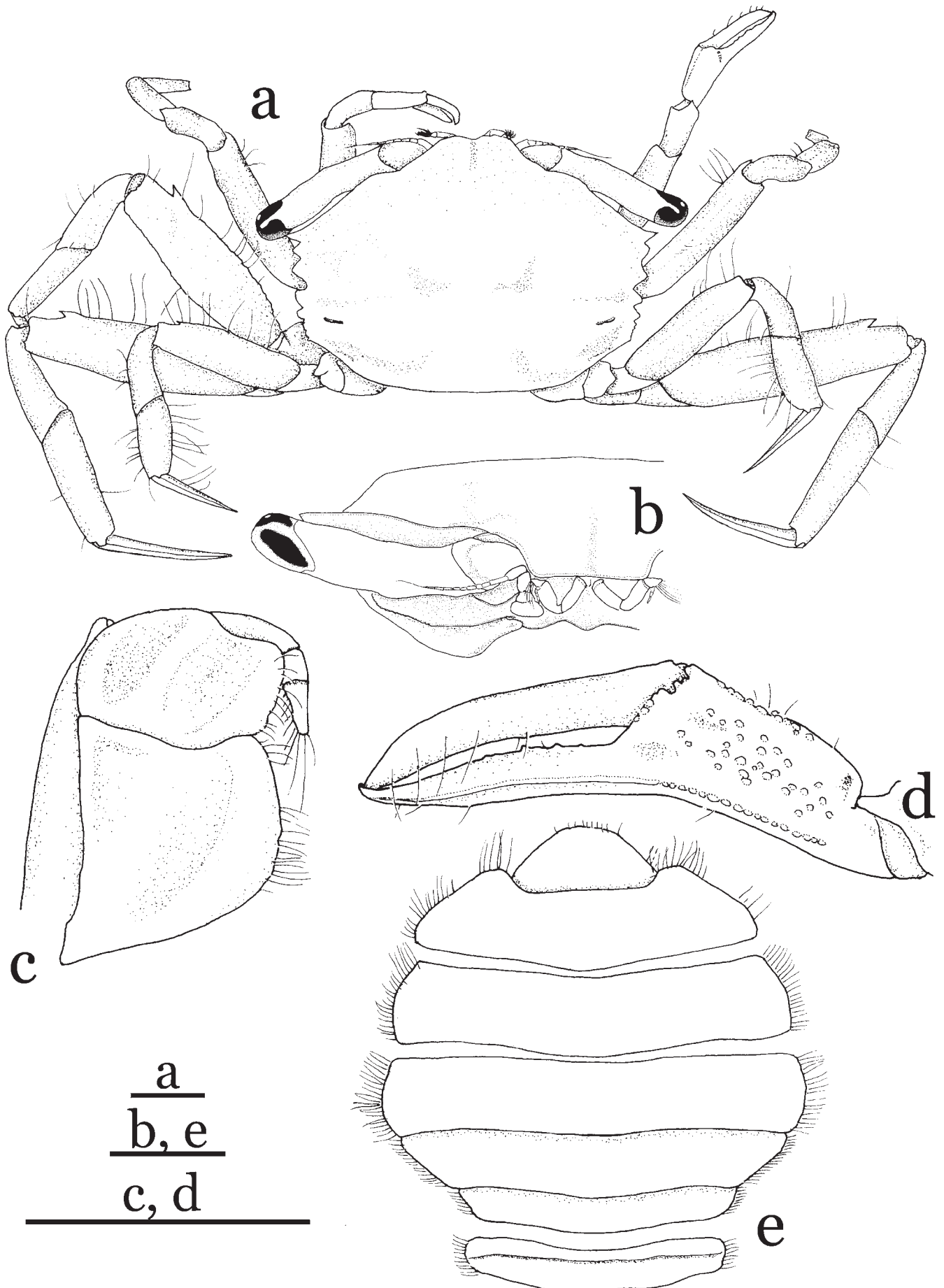


Fig. 1. Holotype of *Macrophthalmus (Macrophthalmus) pentaodon*, new species, NMCR 27012 (5.0 by 3.5 mm). a, habitus; b, frontal view showing eye, front, antenna, antennules & epistome; c, right third maxilliped; d, left chela, external view; e, telson and abdominal segments. Scales, 1 mm.

Habitat and Distribution. – The sole specimen of *Macrophthalmus* (*Macrophthalmus*) *pentaodon*, new species, was found in muddy to silty bottoms at depths ranging from 4 to 12 m. This species, collected by vacuum suction of the bottom sediment, is reported, thus far, only from the type locality, Bohol island, Philippines.

Etymology. – The specific epithet, *pentaodon*, is an arbitrary combination from the Greek words *penta* (n., five) and *odon* (n., tooth), referring to the five anterolateral teeth on the carapace of this species. Used as a noun in apposition.

Remarks. – *Macrophthalmus* (*Macrophthalmus*) *pentaodon*, new species, is morphologically unique in the Macrophthalmidae in its posteriorly divergent upper orbital borders. The new species clearly belongs to Macrophthalminae, typically possessing the features of the subfamily such as elongated eyestalks, a rectangular carapace, antennules that fold transversely or obliquely, a narrow inter-antennular septum, and external maxillipeds that do not completely close the buccal cavern (Barnes, 1967; Sakai, 1976; Davie, 2002). It can easily be distinguished from Dotillidae Stimpson, 1858, and superficially similar genera such as *Ilyoplax* Stimpson, 1858 and *Tmethypocoelis* Koelbel, 1897, by having a more rectangular carapace (Fig. 1a) (vs. more quadrate in dotillids); having rectangular merus of the third maxilliped about half the size of the ischium (Fig. 1c) (vs. merus oval, larger or as large as ischium in dotillids); having no tympani on the merus of the walking legs (vs. present in some species of *Ilyoplax*); and having a distinct and acute subdistal spine on the anterior margin of the merus of the walking legs (vs. no subdistal spine) (Fig. 1a). (cf. Kemp, 1919; Serène & Lundoer, 1974; Davie, 1990). Members of Camptandriidae Stimpson, 1858 have various carapace shapes. Since the most discriminative character of the family is the strongly recurved G1 of the male, it is sometimes difficult to identify the familial place of female specimens. However, *Macrophthalmus pentaodon* has relatively long ocular peduncles and a narrow front, and in this regard, this new species can be easily distinguished from Camptandriidae.

Within Macrophthalminae, *M. pentaodon* clearly falls under the genus *Macrophthalmus* primarily due to condition of the third maxilliped, wherein the merus is wider than long and is much smaller than the ischium, which is longer than wide; the long ocular peduncles; and the anteriorly divergent lateral carapace margins (cf. Barnes, 1967). It can easily be distinguished from *Australoplax* Barnes, 1966, under which there is only one species, *A. tridentata* (A. Milne-Edwards, 1873) by 1) the more rectangular carapace outline (vs. more quadrate in *A. tridentata*) (Fig. 1a); 2) the straight frontal margin (vs. obtusely convex) (Fig. 1a, b); 3) having 5 triangular anterolateral teeth (vs. having 3 quadrangular anterolateral teeth) (Fig. 1a); 4) having long eyes that go beyond the external orbital tooth (vs. short eyes that do not go beyond external orbital tooth) (Fig. 1a); 5) the merus of the third maxilliped which is half as large as the ischium (vs. merus and ischium subequal) (Fig. 1c); 6) having the exopod of the third maxilliped reaching up to the anterior

margin of the merus (vs. exopod shorter, reaching only to mid-level of merus) (Fig. 1c); and 7) the relatively longer and more slender walking legs (vs. shorter and stouter) (Fig. 1a) (cf. Barnes, 1966: pl. XXIV; Barnes, 1967: 241–244, fig. 14, pl. IV). *Macrophthalmus pentaodon* can also be easily distinguished from the monotypic genus *Enigmaplax* Davie, 1993, which contains *E. littoralis* Davie, 1993, by the following characters: 1) the more rectangular carapace outline, with the lateral margins divergent anteriorly (vs. more squarish, lateral margins subparallel to convergent in *E. littoralis*) (Fig. 1a); 2) the relatively narrower front (vs. very wide front in *E. littoralis*) (Fig. 1a, b); 3) the steeply oblique upper orbital border (vs. horizontal in *E. littoralis*); 4) the relatively longer ocular peduncles, which go just beyond the tip of the external orbital tooth (vs. short and stout, not reaching or just reaching the tip of the external orbital tooth) (Fig. 1a); 5) the convex central portion of the epistome posterior margin (vs. concave) (Fig. 1b); 6) and the rectangular aspect of the third maxilliped, without any external or internal extensions in either merus or ischium (vs. the sigmoidal aspect of the third maxilliped, due to an anterolateral extension in the merus and a posteromesial extension in the ischium) (Fig. 1c) (cf. Davie, 1993: 5–9, figs. 1, 2).

At the subgeneric level, we believe that *M. pentaodon* belongs in the subgenus *Macrophthalmus* (see Barnes, 1967; Komai et al., 1995) wherein the posteromedian margin of the epistome is protuberant, not concave, and the ocular peduncles are more than 0.5 times as long as the carapace (Figs. 1a, b). It differs from the subgenus *Tasmanoplax* Barnes, 1967, the only other subgenus with a protuberance in the epistome's posteromedian margin, in that the ischium of the third maxilliped is distinctly larger than the merus (Fig. 1c), whereas in *Tasmanoplax* they are subequal (cf. Barnes, 1967). *Macrophthalmus pentaodon* differs from all other species in the subgenus *Macrophthalmus* in having five anterolateral teeth, the greatest number for this genus, thus far. By contrast, other species of *Macrophthalmus* (*Macrophthalmus*) have either two or three (rarely four) anterolateral teeth, including the external orbital angle (cf. Barnes, 1967; 1970; 1971; 1977). Species in the subgenus *Macrophthalmus* tend to have relatively thicker ocular peduncles as juveniles, this was also observed in *M. pentaodon* although the female holotype is clearly adult as it already possesses a fully expanded abdomen (Fig. 1e). In most other species the adults have thin ocular peduncles together with bulbous corneas. The relatively thick ocular peduncle and small cornea (Fig. 1a, b) of *M. pentaodon* can be also considered as a unique character of this small species.

Macrophthalmus pentaodon, new species, is perhaps most similar to *M. ryukyuanus* Naruse & Kosuge, 2008, in being relatively small in size and in having the ocular peduncle only weakly exceeding beyond the external orbital tooth. However, *M. pentaodon* differs from *M. ryukyuanus* in the following features: (1) absence of a constriction on the front across the bases of the ocular peduncles (Fig. 1a) (vs. present in *M. ryukyuanus*), (2) steeply oblique upper orbital

border (Fig. 1a) (vs. moderately oblique in *M. ryukyuanus*), (3) five teeth on the anterolateral margin of the carapace (Fig. 1a) (vs. three teeth on the anterolateral margin of the carapace in *M. ryukyuanus*), and (4) acicular dactylus of the fourth ambulatory leg (vs. lanceolate dactylus of the fourth ambulatory leg in *M. ryukyuanus*) (cf. Naruse & Kosuge, 2008). In addition to this, *M. pentaodon* differs from *M. ryukyuanus* in the relative length of the ocular peduncle and in body size. The extent to which the ocular peduncles exceed the length of the orbit in *M. pentaodon* is 11.5% of its total length (holotype, CW 5.0 mm), whereas it is 21% in *M. ryukyuanus* (holotype, CW 9.3 mm). *Macrophthalmus pentaodon* is also superficially similar to *M. philippinensis* due to their small size and the general carapace outline. However, it can be distinguished from *M. philippinensis* by 1) the 5 anterolateral teeth on the carapace (vs. 3 anterolateral teeth in *M. philippinensis*); 2) the absence of a constriction on the front across the bases of the ocular peduncles (vs. present); and 3) the shorter, thicker ocular peduncles with small corneas (vs. longer ocular peduncles, half their length going beyond the tip of the external orbital angle, with larger, bulbous corneas) (cf. Serène, 1971).

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LITERATURE CITED

- Adams, A. & A. White, 1849. The Crustacea. In: Adams, A. (ed.), *The Zoology of the voyage of the H.M.S. Samarang, 1843–1846*. London: Reeve, Benham & Reeve. 66 pp.
- Barnes, R. S. K., 1966. The status of the genus *Euplax* H. Milne Edwards, 1852; and a new genus *Australoplax* of the subfamily Macrophthalminae Dana, 1851. (Brachyura: Ocypodidae). *Australian Zoologist*, **13**: 370–376.
- Barnes, R. S. K., 1967. The Macrophthalminae of Australasia; with a review of the evolution and morphological diversity of the type genus *Macrophthalmus* (Crustacea: Brachyura). *Transactions of the Zoological Society of London*, **31**: 195–262.
- Barnes, R. S. K., 1970. The species of *Macrophthalmus* (Crustacea: Brachyura) in the collections of the British Museum (Natural History). *Bulletin of the British Museum, Natural History, Zoology*, **20**: 203–251.
- Barnes, R. S. K., 1971. Biological results of the Snellius Expedition. XXIII. The genus *Macrophthalmus* (Crustacea: Brachyura). *Zoologische Verhandelingen, Leiden*, **115**: 1–40.
- Barnes, R. S. K., 1977. Concluding contributions towards a revision of, and a key to, the genus *Macrophthalmus* (Crustacea: Brachyura). *Journal of Zoology (London)*, **182**: 267–280.
- Barnes, R. S. K. & P. J. F. Davie, 2008. A new species of the sentinel crab *Macrophthalmus (Mareotis)* Barnes, 1967 (Crustacea: Brachyura: Macrophthalmidae) from Western Australia. *Zootaxa*, **1807**: 63–68.
- Bouchet, P., P. K. L. Ng, D. Largo & S.-H. Tan. 2009. PANGLAO 2004 – Investigations of the marine species richness in the Philippines. *Raffles Bulletin of Zoology*, Supplement No. **20**: 1–19.
- Dana, J. D., 1851. Conspectus crustacearum quae in orbis terrarum circumnavigatione, Carolo Wilkes e classe Reipublicae Foederatae Duce, lexit et descriptis J.D. Dana. *Proceedings of the Academy of Natural Sciences of Philadelphia*, **5**: 247–254.
- Davie, P. J. F., 1990. New and rare crabs of the subfamily Dotillinae (Crustacea: Ocypodidae) from northern Australia and Papua New Guinea. *Memoirs of the Queensland Museum*, **28**(2): 463–473.
- Davie, P. J. F., 1993. A new genus of macrophthalmine crab (Crustacea: Decapoda: Ocypodidae) from eastern Australia. *Records of the Australian Museum*, **45**: 5–9.
- Davie, P. J. F., 2002. Crustacea: Malacostraca: Eucarida (Part 2): Decapoda – Anomura, Brachyura. In: Wells, A. & Houston, W.W.K. (eds.), *Zoological Catalogues of Australia. Vol. 19.3B*. Melbourne: CSIRO Publishing, Australia. 641pp.
- Desmarest, A. G., 1822. Les Crustacés proprement dits. In: *Histoire naturelle des Crustacés fossiles*. Paris, F.G. Levrault. pp. 67–154, Pls. 5–11.
- Desmarest, A. G., 1823. Dictionnaire des Sciences Naturelles, vol. 28. F.G. Levrault, Paris, Pp.138–425.
- Estampador, E. P., 1959. Revised checklist of Philippine crustacean decapods. *Natural and Applied Science Bulletin*, **17**: 1–127.
- Haan, H. M. de, 1833–1849. Crustacea. In: P.F. von Siebold (ed.), *Fauna Japonica sine descriptio animalium, quae in itinere per Japoniam jussu et auspiciis superiorum, qui summum in India Batava Imperium tenent, suscepto, annis 1823–1830 collegit, notis, observationibus et adumbrationibus illustravit*. Amsterdam: J. Muller & Sons. i–xvii + i–xxx + iix–xvi + 1–243, Pls. A–J, L–Q, 1–55, Circ. Table 2.
- Haswell, W. A., 1882. On some new Australian Brachyura. *Proceedings of the Linnaean Society, New South Wales*, **6**: 540–551.
- Kemp, S., 1919. Notes on the Crustacea Decapoda in the Indian Museum. XII – Scopimerinae. *Records of the Indian Museum*, **16**(5): 305–348, Pl. 12.
- Kitaura, J., K. Wada, & M. Nishida, 2002. Molecular phylogeny of grapsoid and ocypodoid crabs with special reference to the genera *Metaplex* and *Macrophthalmus*. *Journal of Crustacean Biology*, **22**: 682–693.

- Koelbel, K., 1897. Beschreibung der Krebse. In *Die wissenschaftlichen Ergebnisse der Reise des Grafen Béla Széchenyi in Ostasien*. Bd. 2: 709–718, pl. 1. [not seen]
- Komai, T., S. Goshima & M. Murai, 1995. Crabs of the genus *Macrophthalmus* of Phuket, Thailand (Crustacea: Decapoda: Ocypodidae). *Bulletin of Marine Science*, **56**: 103–149.
- Latreille P. A., 1817. Nouveau dictionnaire d'histoire naturelle: appliquée aux arts, à l'agriculture, à l'économie rurale et domestique, à la médecine, etc. 2nd Ed., Vol. 13. Paris, Deterville. p. 295.
- Man, J. G. de, 1887–1888. Report on the podophthalmous Crustacea of the Mergui Archipelago, collected for the Trustees of the Indian Museum, Calcutta, by Dr. John Anderson, F.R.S., Superintendent of the Museum. *Journal of the Linnaean Society, Zoology*, **22**: 1–312, Pls. 1–19.
- Man, J. G. de, 1904. Beschreibung einiger brachyurer Krebse aus posttertiären Schichten der Minahassa, Celebes. *Sammlungen des Geologischen Reichsmuseums in Leiden, 1 te Serie*, **7**: 254–278, Pls. 9, 10.
- Manuel, M. R., P. C. Gonzales & L. Basmayor, 1991. Crustacean fauna of Natunawan Cove in Tabaco, Albay, (Crustacea: Brachyura, Macrura and Stomatopoda). *National Museum Papers*, Manila, **2**(1): 59–102.
- Mendoza, J. C. E. & P. K. L. Ng, 2007. *Macrophthalmus* (Euplax) H. Milne-Edwards, 1852, a valid subgenus of ocypodoid crab (Decapoda: Brachyura: Macrophthalmidae), with description of a new species from the Philippines. *Journal of Crustacean Biology*, **27**(4): 860–870.
- Milne-Edwards, A., 1873. Recherches sur la faune carcinologique de la Nouvelle Calédonie. 2. *Nouvelles archives du Muséum d'Histoire naturelle de Paris*, **9**: 155–332.
- Naruse, T. & T. Kosuge, 2008. A new species of *Macrophthalmus* (Crustacea: Decapoda: Brachyura: Macrophthalmidae) from Iriomote Island, Ryukyu Islands, Japan. *Species Diversity*, **13**: 117–122.
- Ng, P. K. L., D. Guinot & P. J. F. Davie, 2008. Systema Brachyurorum: Part I. An annotated checklist of the extant brachyuran crabs of the world. *Raffles Bulletin of Zoology*, Supplement No. **17**: 1–286.
- Rafinesque, C. S., 1815. *Analyse de la nature ou tableau de l'univers et des corps organisés*. l'Imprimerie de Jean Barravechia, Palermo. 224 pp.
- Rathbun, M. J., 1913. Descriptions of new species of crabs of the family Ocypodidae. *Proceedings of the United States National Museum*, **44**: 615–620.
- Rathbun, M. J. 1914. New species of crabs of the families Grapsidae and Ocypodidae. *Proceedings of the United States National Museum*, **47**: 69–85.
- Rüppell, E. S., 1830. *Beschreibung und Abbildung von 24 Arten kurzschwänzigen Krabben, als Beitrag zur Naturgeschichte des rothen Meeres*. H.L. Brönnner, Frankfurt. Pp. 1–28, pls 1–6.
- Sakai, T., 1976. Crabs of Japan and the Adjacent Seas. Kodansha Ltd., Tokyo. 3 vols. xxix + 773 pp., 379 figs. (in English): 1–461 (in Japanese): 1–16, Pls. 1–251.
- Serène, R., 1971. Observations préliminaires sur des brachyours nouveaux ou mal connus du Sud-est Asiatique (Crustacea Decapoda). *Bulletin du Muséum national d'Histoire naturelle*, **42**(5): 903–918, Pls. 1–6.
- Serène, R. & S. Lundoer, 1974. Observations on the male pleopod of the species of *Ilyoplax* Stimpson with a key to the identification of the species. *Phuket Marine Biological Center Research Bulletin No. 3*, Phuket, Pp. 3–10.
- Souleyet, L. F. A., 1841. Crustacés. In: F. Eydoux & L.F.A. Souleyet (eds.), *Voyage autour de monde exécuté pendant les années 1836 et 1837 sur la corvette La Bonite, commandée par M. Vaillant*, Paris, **1**: 219–244.
- Stimpson, W., 1858. Crustacea Ocypodoidea: Prodomus descriptionis animalium evertibratorum, quae in Expeditione ad Oceanum Pacificum Septentrionalem, a Republica Federata missa, Cadwaladaro Ringgold et Johanne Rodgers Ducibus, observatit et descripsit W. Stimpson. Pars V. *Proceedings of the Academy of Natural Sciences of Philadelphia*, **10**: 93–110.
- Tweedie, M. W. F., 1935. Notes on the genus *Ilyoplax* Stimpson (Brachyura, Ocypodidae). *Bulletin of the Raffles Museum*, **10**: 53–61, Pls. 2–3.
- Ward, M., 1933. New genera and species of marine Decapoda Brachyura. *Australian Zoologist*, **7**: 377–394.
- Ward, M., 1941. New Brachyura from the Gulf of Davao, Mindanao, Philippine Islands. *American Museum Novitates*, **1104**: 1–15.