

A NEW SPECIES OF TROGLOBITIC FRESHWATER PRAWN OF THE GENUS *MACROBRACHIUM* FROM SOUTHERN CHINA (CRUSTACEA: DECAPODA: PALAEMONIDAE)

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ABSTRACT. – A new species of troglobitic freshwater prawn of the genus *Macrobrachium* from Guangxi Province in southern China is described and illustrated in detail. Morphological comparisons with allied epigean species and known troglobitic congeners are given. The new species is characterized by its highly degenerated eyes, smooth and slender second pereopods, elongated telson and the unarmed preanal region.

KEY WORDS. – New species, *Macrobrachium*, troglobitic, freshwater prawn, Guangxi, China.

INTRODUCTION

The cone karst of the Lingyun area forms part of the inclined and elevated Yungui Plateau, a vast area of limestone and sedimentary rock extending from southern Yunnan, through the northwest of Guangxi and into Guizhou. The limestone has been highly dissected, structurally altered and geomorphically modified, leading to several cycles of karstification, as evidenced by the large caves, often with two or three levels of passages and chambers (Clarke, 2002a). During a recent international speleological expedition to caves in the cone karst region of Lingyun County in northwestern Guangxi Province, some very interesting troglobitic (cave adapted) shrimps, fishes and terrestrial organisms were collected (Clarke, 2001a, 2001b, 2002b) including two recently described carabid beetles (Dueve, 2002, 2004). Most of the new troglobitic species found during the expedition were collected from the upper level relict karst passages or chambers in these large multi-level caves (Clarke, 2001a, 2001b). A subsequent expedition by the Institute of Zoology, Chinese Academy of Science, Beijing, also collected some troglobitic shrimps from the same cave (S. Li, pers. comm.).

The new prawn belongs to the family Palaemonidae, and represents the first record of a troglobitic *Macrobrachium*

species from China. The new species is described here and illustrated in detail jointly by an examination of all available specimens thus far. Morphological comparisons with allied epigean and known troglobitic species of *Macrobrachium* are highlighted. Type specimens are deposited in the Institute of Zoology, the Chinese Academy of Science (IZCAS), Zoological Reference Collection of the Raffles Museum of Biodiversity Research, National University of Singapore (ZRC) and the Tasmanian Museum in Hobart, Tasmania, Australia (TM). The abbreviation “cl” is referred to the postorbital carapace length.

Macrobrachium lingyunense, new species

(Figs. 1-3)

Material examined. – Holotype: Male, cl 13.6 mm, (IZCAS-DE-1) Shadong (Sand Cave), Guancang Village, Sicheng Town, Lingyun County, Guangxi Province, southern China (106°23' - 106°55'33"E 24°05' - 24°37'N), coll. Chunguang Zhang, 26 Nov.2001. Paratypes: 2 males, cl 11.4-12.1 mm (IZCAS-DE-3, 4), 1 female, cl 17.2 (IZCAS-DE-2), one juvenile, cl 14.3 mm (IZCAS-DE-4), data same as holotype; one female, cl 15.1 mm (ZRC), Shadong (Sand Cave), north of Lingyun Town, Lingyun County, Guangxi Province, southern China (106°36'33.12947"E 24°25'21.42550"N), coll. Arthur Clarke, 11 Oct.2000. 1 male, cl 12.8 mm; 1 female, cl 8.5

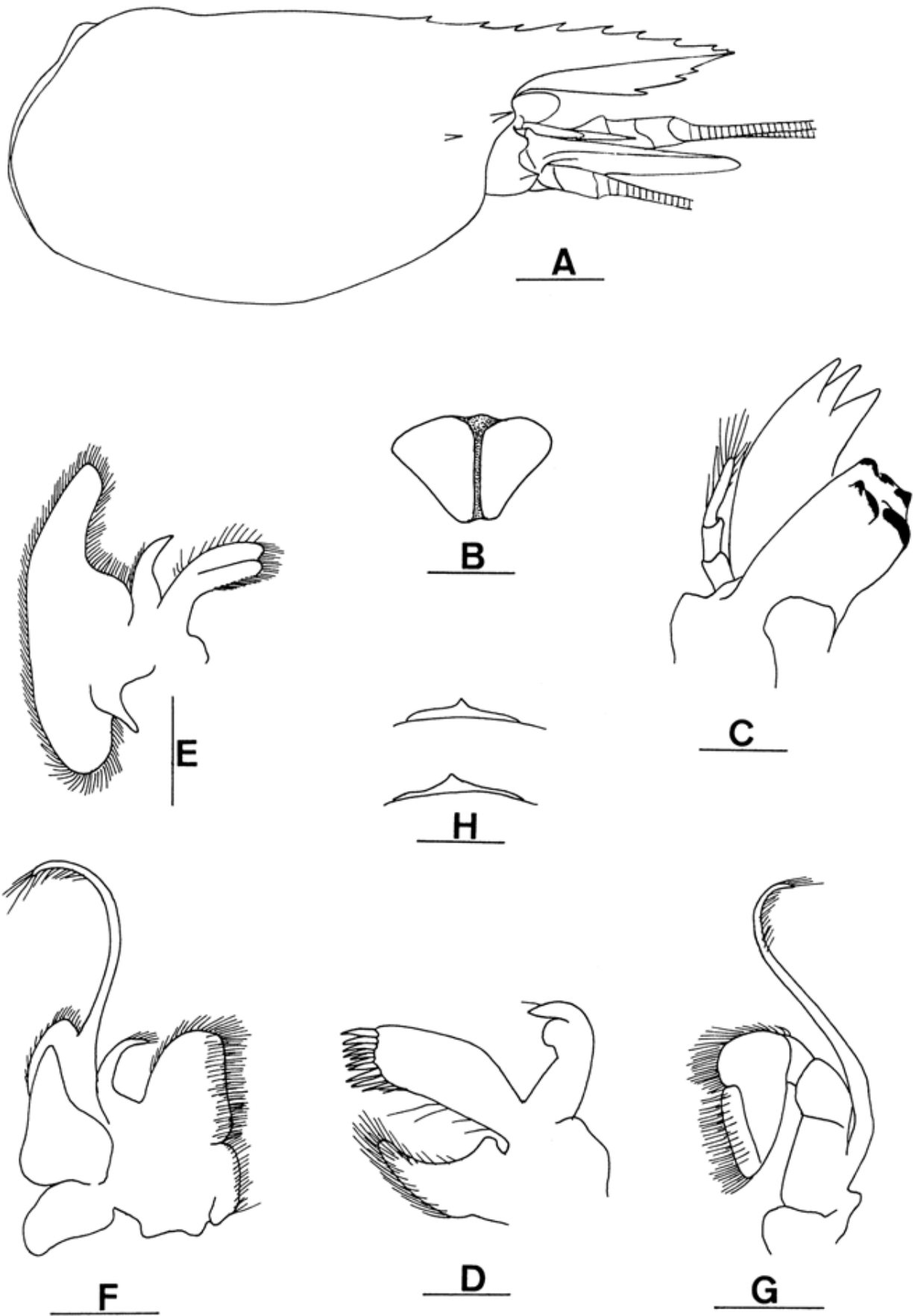


Fig. 1. *Macrobrachium lingyunense*, new species: A, cephalothorax; B, epistome; C, mandible; D, maxillula; E, maxilla; F, first maxilliped; G, second maxilliped; H, first two abdominal sterna with transverse ridge and median tooth. A, paratype, female, cl 15.1 mm (ZRC 2005.0138); B-H, paratype, male, cl 12.8 mm (ZRC 2005.0138). Scale bars: A = 2 mm; B-D, H = 0.5 mm; E-G = 1 mm.

mm (ZRC 2005.0138), Shadong (Sand Cave), north of Lingyun Town, Lingyun County, Guangxi Province, southern China (106°36'33.12947"E 24°25'21.42550"N), coll. Arthur Clarke, 11 Oct.2000; 1 male, cl 11.5 mm, TM, Shadong (Sand Cave), north of Lingyun Town, Lingyun County, Guangxi Province, southern China (106°36'33.12947"E 24°25'21.42550"N), coll. Arthur Clarke, 11 Oct.2000.

Description. – Carapace smooth. Rostrum (Fig. 1A) straight, reaching distal end of scaphocerite, rostral formula: 2-4+5-7/3-4. Teeth more widely spaced on above orbit region than on anterior and postorbital regions. Antennular peduncle about 0.4 times as long as carapace. Antennal spine sharp, situated at lower orbital angle, not reaching anterior margin. Hepatic spine smaller than antennal spine, lying behind and slightly below latter. Carapace smooth.

Fourth thoracic sternite without median process. Abdomen smooth, glabrous, first to third pleurites broadly rounded, fourth and fifth pleurites feebly produced posteriorly, fourth pleurite sub-triangular, fifth pleurite sub-rectangular, sixth abdominal somite slightly longer than fifth, with posteroventral angle feebly produced, subacute. Telson (Fig. 2G) long, slender, 3.8 times as long as wide, 1.8 times as long as sixth abdominal segment, with a shallow median groove on dorsal surface, with 2 pairs of dorsal spines, ending in a small acute median point, lateral spines slightly larger than dorsal spines, sublateral pair of spines well developed, long and stout, more than 3 times as long as lateral pair, with 2-4 pairs of intermediate plumose setae. First 2 abdominal sternites (Fig. 1H) with transverse ridge and a median tooth each, second abdominal sternite very prominent, more

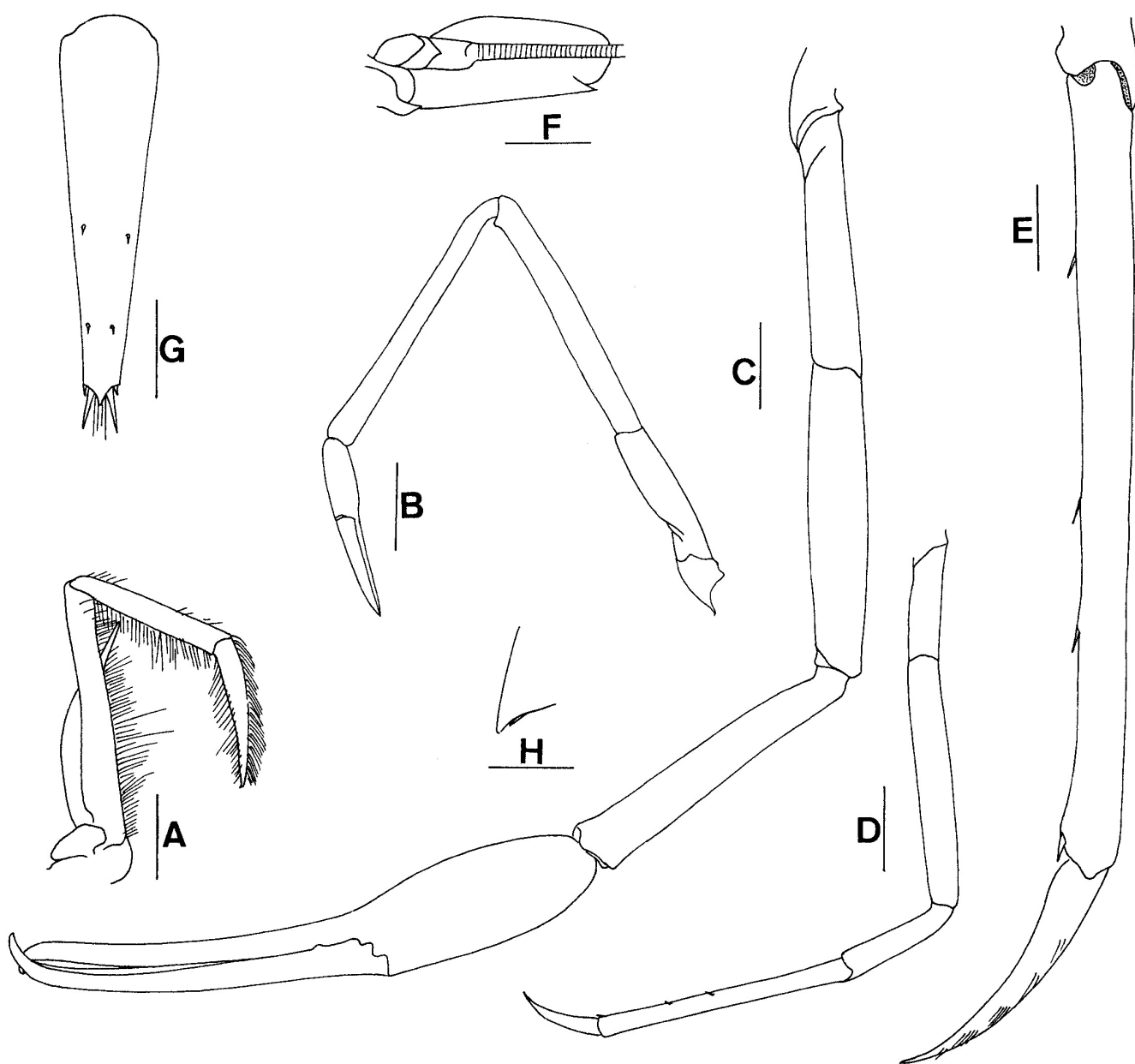


Fig. 2. *Macrobrachium lingyunense*, new species: A, third maxilliped; B, first pereopod; C, male major second pereopod; D, third pereopod; E, propodus and dactylus of third pereopod; F, scaphocerite; G, telson; H, uropodal diaeresis. A, paratype, male, cl 12.8 mm (ZRC 2005.0138); B-H, paratype female, cl 15.1 mm (ZRC 2005.0138). Scale bars: A-D, F = 2 mm; E, H = 0.5 mm; G = 1 mm.

developed than first abdominal sternite. Preanal region unarmed, smooth.

Eyes strongly reduced, small, rounded, lacking faceted cornea, no pigment visible, anterior end only reaching middle of basal segment of antennular peduncle. Stylocerite pointed, reaching 0.7 basal segment. Antenna with stout basicerite and strong distoventral tooth. Carpocerite reaching to about 0.3 times of scaphocerite length. Scaphocerite (Fig. 2F), about 2.4 times as long as wide, with straight outer margin.

Epistome (Fig. 1B) bilobed by a depression. Mouth parts typical of genus. Mandible (Fig. 1C) with 3-segmented slender palp; incisor process robust; maxillular palp bilobed (Fig. 1D), upper lobe slender, pointed, lower lobe stout; maxilla (Fig. 1E) with simple palp, basal endite deeply bilobed, scaphognathite normal; first maxilliped (Fig. 1F) with simple palp, basal and coxal endites distinct, flagellum of exopod with numerous plumose setae distally, epipod deeply bilobed; second maxilliped with normal endopod (Fig. 1G), flagellum with numerous plumose setae distally, epipod simple, with well developed podobranch; third maxilliped (Fig. 2A) with robust endopod, exopod short, with numerous plumose setae distally.

First pereopods (Fig. 2B) very slender, reaching beyond scaphocerite by entire chela and 0.2 carpus length, equal in length, similar in form, carpus 1.5 times as long as chela, chela with fingers slightly longer than palm. Second pereopods (Fig. 2C) not sexually dimorphic; both cylindrical, equal in length, similar in form, smooth, slightly longer than body length, reaching beyond distal end of scaphocerite by both entire carpus and chela; merus as long as carpus, both segments distinctly longer than palm but shorter than fingers; palm slightly inflated, fingers about twice as long as palm, with only 1 pair of very small teeth at base. Third pereopods (Fig. 1D, E) slender, reaching beyond scaphocerite by entire dactylus and 0.25 times of propodus length, propodus 12 times as long as broad, 3.0 times as long as dactylus; dactylus 6.0 times as long as wide, terminating in a small claw. Fourth pereopods slender, longer than third pereopod, similar in

form. Fifth pereopods most slender, longest, reaching beyond scaphocerite by entire dactylus, slightly more than 0.5 times length of propodus.

Endopod of male first pleopod about 0.4 times as long as exopod, weakly broadened distally, slightly curved mesially. Appendix masculina of male second pleopod with numerous spiniform setae on dorsal surface. Appendix interna of male second pleopod slender, reaching to 0.6 length of appendix masculina.

Uropodal diaeresis (Fig. 2H) with a very small spine, distinctly shorter than outer angle.

Habitat. – Some paratypes of the present new species were collected from a one-meter deep water pool at about 1.5 km from the only known entrance of the sand cave. It was in total darkness and situated in an upper level relict karst passage where the dominant hydrology is percolation seepage (Clarke, 2002b).

Colouration. – All appendages generally transparent to translucent; carapace and abdomens whitish to yellowish (Fig. 3).

Etymology. – The new species is named after the type locality: Lingyun County, NW Guangxi Province, China.

Remarks. – *Macrobrachium lingyunense*, new species, is the first troglobitic *Macrobrachium* species found in China. Compared to epigean species, it is morphologically closest to *M. guangxiense* Liang and Yan, 1981, a species known only from Guangxi Province, especially when taking the slenderness of the second pereopods into consideration. *Macrobrachium lingyunense*, however, differs remarkably from *M. guangxiense* by the highly reduced eyes and the relatively lower rostral base with smaller number of dorsal rostral teeth (7-10 vs. 12-16). The general appearance and the ratios of various segments of the second pereopods of this new species are also similar to those of *M. inflatum* Liang & Yan, 1985. However, *M. lingyunense* can be easily distinguished from *M. inflatum* by the reduced eyes and proportionately shorter and less curved rostrum (vs. relatively longer and distinctly curved rostrum). *Macrobrachium inflatum* was originally described from Jiangsu Province, eastern China (Liang & Yan, 1985) but has subsequently been found in Yunnan (Cai & Dai, 1999). *Macrobrachium lingyunense* also resembles sub-adult specimens of *M. nipponense* (De Haan, 1849) in the form of the rostrum and the second pereopods, but can be easily separated by the degenerated eyes and the far more elongated fingers of the second pereopods.

Holthuis (1986) listed six troglobitic *Macrobrachium* species i.e., *M. cavernicola* (Kemp, 1924), *M. villalobosi* Hobbs, 1973, *M. lucifugum* Holthuis, 1974, *M. acherontium* Holthuis, 1977, *M. microps* Holthuis, 1978 and *M. poeti* Holthuis, 1984. Chong (1989) described *M. gua* from Sabah, Malaysia, Hobbs & Hobbs (1995) described *M. cationium* from Middle America, and Komai & Fujita (2005) recently reported



Fig. 3. Color photograph of *Macrobrachium lingyunense*, new species: paratype, female, cl 15.1 mm (ZRC 2005.0138).

another new troglobitic species, *M. miyakoense* from the Ryukyu Islands, Japan, bringing to a total of nine troglobitic species. Of these nine mentioned species, only *M. villalobosi* from Oaxaca, Mexico, could be confused morphologically with *M. linyunense*. In the Mexican species, the eyes have no pigment and lack faceted cornea; the chelae of the slender second pereopods are subequal in size, lacking teeth, spines and conspicuous mats of setae on finger or palm. However, it can be distinguished by its proportionately much longer carpus of the second pereopods, which is even longer than the chela (vs. shorter in *M. linyunense*).

Of the remaining cave species, *M. lucifugum* and *M. gua* actually do not possess specific troglobitic characters, though the former has been found in caves of several islands in the West Indies, and the latter has only been found from a cave in Sabah, East Malaysia, Borneo. *Macrobrachium cavernicola*, *M. microps*, *M. poeti*, *M. acherontium*, and *M. miyakoense* can easily be separated from *M. linyunense* by their less prominently reduced eyes. In particular, the American *M. acherontium* is morphologically close to *M. linyunense* in the form of the various legs and ratios of the various joints of the second pereopods, but in addition to its larger eyes, it also has a proportionately shorter and higher rostrum. *Macrobrachium cavernicola* from Siju Cave in Assam, India, was the first troglobitic *Macrobrachium* species to be described and it differs from all the other congeners by the peculiar two-segmented mandible palp.

Macrobrachium microps was originally described by Holthuis (1978) from Danmin Cave, New Ireland (Papua New Guinea) on the basis of only one adult male, collected from a fast flowing subterranean river, at altitude of 600-700 meters. *Macrobrachium microps* can be easily separated from *M. linyunense* by the stout and spiny second pereopods (smooth in *M. linyunense*). Bruce & Iliffe (1993) reported a second occurrence of *M. microps* from an anchialine lava tube in Samoa. Short & Marquet (1998: 408) reported two other "immature" male specimens from a cave in the Lifou Island, New Caledonia. In a subsequent paper, Short & Meek (2000) reported one adult female and one undeveloped male of *M. microps* from Daniel Roux Cave, Christmas Island, in the Indian Ocean.

Holthuis (1984) described *M. poeti*, from a cave on the south coast of Java, Indonesia. Apart from the partially reduced eyes, *M. poeti* is similar to young specimens of *M. pilimanus* group, a group of landlocked species distributed in the Greater Sunda Islands, Peninsular Malaysia, and Indochina. Among those species, it is most similar to the Javan endemic *M. leptodactylus* (De Man, 1892). *Macrobrachium poeti* can easily be separated from *M. linyunense* by its very short carpus of the second pereopod.

Hobbs & Hobbs (1995) described *M. catonium* from two caves on the Vaca Plateau, Cayo District of Belize, Middle America. It could be easily separated from *M. linyunense* by its much longer carpus of second pereopod, which is 1.2 times as long as the chela (vs. much shorter than chela).

Komai & Fujita (2005) described *M. miyakoense* from an anchialine cave in Miyako Island, the Ryukyu Islands, southern Japan. With regard to the chelipeds, it is superficially close to *M. linyunense*. However, it can be easily separated by the better developed eyes, the larger number of dorsal rostral teeth (11-13 vs 7-9 in *M. linyunense*), the proportionately stouter telson (Fig. 2F in Komai & Fujita, 2005 vs. Fig. 2G in this paper) and a relatively higher and more prominent preanal carina.

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LITERATURE CITED

- Bruce, A. J. & T. M. Iliffe, 1993. The second occurrence of the troglobitic shrimp *Macrobrachium microps* Holthuis (Crustacea, Decapoda, Palaemonidae), in Samoa. *International Journal of Speleology*, **22**: 83-96, Figs. 1-6.
- Cai, Y. & Y. Dai, 1999. Freshwater shrimps (Crustacea: Decapoda: Caridea) from the Xishuangbanna region of Yunnan Province, southern China. *Hydrobiologia*, **400**: 211-241, Figs. 1-16.
- Chong, S. S. C., 1989. A new species of freshwater prawn, *Macrobrachium gua* sp. nov. (Decapoda, Caridea, Palaemonidae) from Sabah, East Malaysia, Borneo. *Crustaceana*, **56**(1): 31-38, Figs. 1, 2.
- Clarke, A., 2001a. Checklist of the aquatic and terrestrial troglobites from southern China. 15th International Symposium of Biospeleology, Intervalles, São Paulo, Brazil, July 8-15, 2001.
- Clarke, A., 2001b. Cavernicole diversity in western Guangxi Province, SW China. *Speleo Brazil 2001. Abstracts of the Proceedings of XIII International Congress of Speleology*, July 15-22, 2001, Brasilia, Brazil, p. 152.
- Clarke, A., 2002a. Cone karst, caves, cave fauna & karst management in southern China. In: Henderson, K. (ed.), *Cave Management in Australasia 14. Proceedings of the Fourteenth Australasian Conference on Cave and Karst Management, Wombeyan, New South Wales, May, 2001*: 38-56.
- Clarke, A., 2002b. Exploration of caves in western Guangxi Province, SW China 11th Britain-China Expedition, October 2000. In: Brown, C. (ed.), *Proceedings of 2001: A Cave Odyssey – 23rd Australian Speleological Federation Conference, Bathurst, NSW*: 154-192.

- De Haan, W., 1833-1850. Crustacea. In: P. F. von Siebold (ed.), *Fauna Japonica sive Descriptio Animalium, quae in Itinere per Japoniam, Jussu et Auspiciis Superiorum, qui Summum in India Batava Imperium Tenent, Suscepto, Annis 1823-1830 Collegit, Notris, Observationibus et Adumbrationibus Illustravit*, i-xxxix, ix-xvi, 1-243, Pls. A-J, 1-Q, 1-55, circ. tab. 2. Lugduni-Batavorum, Leiden.
- Deuve, T., 2002. Deux remarquables Trechinae anophtalmes des cavités souterraines du Guangxi nord-occidental, Chine (Coleoptera, Trechidae). *Bulletin de la Société entomologique de France*, **107**(5): 515-523.
- Denve, T., 2004. Deux nouvelles Juiroa cavernicoles du sud de la Chine et du nord du Vietnam (Coleoptera, Caraboidea). *Bulletin de la Société entomologique de France*, **109**(4): 361-366.
- Hobbs, H. H., 1973. Two new troglobitic shrimps (Decapoda: Alpheidae and Palaemonidae) from Oaxaca, Mexico. *Association of Mexican Cave Studies, Bulletin* **5**: 73-80, Figs. 1-3.
- Hobbs, H. H. III & H. H. Hobbs, Jr., 1995. *Macrobrachium cationium*, a new species troglobitic shrimp from the Cayo District of Belize (Crustacea: Decapoda: Palaemonidae). *Proceeding of the Biological Society of Washington*, **108**(1): 50-53, Fig. 1.
- Holthuis, L. B., 1974. Subterranean Crustacea Decapoda Macrura collected by Mr. L. Botosaneanu during the 1973 Cuban-Rumanian Biospeleological Expedition to Cuba. *International Journal of Speleology*, **6**: 231-242, Figs. 1-3.
- Holthuis, L. B., 1977. Cave shrimps (Crustacea, Decapoda, Natantia) from Mexico—Subterrean fauna of Mexico. Part III. Further results Italian zoological mission to Mexico, sponsored by the National Academy of Lincei (1973 and 1975). *Problemi attuali di Scienze e di Cultura, Accademia nazionale dei Lincei*, **171**(3): 173-195, Figs. 1-8.
- Holthuis, L. B., 1978. Zoological results of the British speleological expedition to Papua New Guinea 1975. 7. Cavernicolous shrimps (Crustacea Decapoda, Natantia) from New Ireland and the Philippines. *Zoologische Mededelingen*, **53**(19): 209-224, Figs. 1-6.
- Holthuis, L. B., 1984. Freshwater prawns (Crustacea Decapoda: Natantia) from subterranean waters of the Gunung Sewu area, central Java, Indonesia. *Zoologische Mededelingen*, **58**(9): 141-149, Fig. 1.
- Holthuis, L. B., 1986. Decapoda. In: Botosaneanu, L. (ed.), *Stygofauna Mundi*. Brill, Leiden. Pp. 589-615, Figs. 1-18.
- Kemp, S., 1924. Crustacea Decapoda of the Siju Cave, Garo Hills, Assam. *Records of Indian Museum*, **26**: 42-48, Figs. 1-5.
- Komai, T. & Y. Fujita, 2005. A new stygiobiont species of *Macrobrachium* (Crustacea: Decapoda: Caridea: Palaemonidae) from an anchialine cave on Miyako Island, Ryukyu Islands, *Zootaxa*, **1021**: 13-27.
- Liang, X. & S. Yan, 1981. A new genus and two new species of freshwater prawns (Crustacea Decapoda) from Guangxi, China. *Acta Zootaxonomica Sinica*, **6**(1): 31-35, Figs. 1-20. (In Chinese with English abstract).
- Liang, X. & S. Yan, 1985. New species and new record of Palaemoninae from China. *Acta Zootaxonomica Sinica*, **10**(3): 253-258, Figs. 1-4. (In Chinese with English abstract).
- Short, J. W. & G. Marquet, 1998. New Records of freshwater Palaemonidae (Crustacea, Decapoda) from New Caledonia. *Zoosystema*, **20**(2): 401-410, Figs. 1-4.
- Short, J. W. & P. Meek, 2000. New records of *Macrobrachium* (Crustacea: Decapoda: Palaemonidae) from Christmas Island, Indian Ocean. *Records of the Australian Museum*, **20**: 81-86, Figs. 1-3.