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The freshwater prawns of the genus *Macrobrachium* Bate, 1868, of Thailand (Crustacea: Decapoda: Palaemonidae)

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The Thai freshwater prawns of the genus *Macrobrachium* are reviewed. A taxonomic synopsis is given here of the 25 species of *Macrobrachium* so far known from Thailand, including three new species, namely *M. thai*, *M. tratense* and *M. dolatum.* Nine species are recorded for the first time from Thailand, namely *M. amplimanus* Cai and Dai, 1999, *M. assamense* (Tiwari, 1955), *M. dienbienphuense* Dang and Nyuyen, 1972, *M. eriocheirum* Dai, 1984, *M. forcipatum* Ng, 1995, *M. hendersoni* (De Man, 1906), *M. malayanum* (Roux, 1934), *M. mieni* Dang, 1975 and *M. trompii* (De Man, 1898). A neotype is designated for *M. hirsutimanus* (Tiwari, 1952). Descriptions for new species, diagnosis for newly recorded species and taxonomic discussions for all species are provided. A key to all the known Thai *Macrobrachium* species is included.

KEYWORDS: Taxonomy, review, freshwater, prawns, *Macrobrachium*, Thailand.

Introduction

De Man (1879) recorded *Palaemon carcinus* Fabricius, 1798 (= *Macrobrachium rosenbergii dacqueti* (Sunier, 1925)) from Siam (Thailand), Burma (Myanmar) and Java. Lanchester (1902) subsequently recorded *P. carcinus*, *P. nipponensis* De Haan, 1849 (= *M. sintangense* (De Man, 1898), fide Holthuis, 1950) from Thailand and described a new species, *P. paucidens*. De Man (1911) pointed out that the name *P. paucidens* was already preoccupied and proposed a replacement name, *P. lanchesteri*. Kemp (1918a), on the basis of specimens collected by Dr Annandale from the Far East, reported *Palaemon carcinus*, *P. lanchesteri*, *P. elegans* De Man, 1892 (= *M. sintangense*, fide Holthuis, 1950), *P. sundaicus* (= *M. equidens* (Dana, 1852), fide Holthuis, 1950) and *P. lampropus* De Man, 1892 (= *M. latidactylus* (Thallwitz, 1891), fide Holthuis, 1950) from Lake Tale Sap and Patani river in southern Thailand. Suvatti (1937, 1950, 1967), in his overview of the crustacean fauna of Thailand, listed eight species of *Macrobrachium*, and was the first to record *M. pilimanus* (De Man, 1879) and *M. mirabile* (Kemp, 1917) from there. Tiwari (1952) diagnosed a new species, *P. hirsutimanus*, from north-western Thailand, a

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taxon that has never been listed in the crustacean fauna of Thailand since its original report. Kamita (1966, 1972) later reported two other species from Thailand. Lumubol (1980) reported eight species of *Macrobrachium* from Thailand, and added *M. asperulum*, *M. esculentum* and *M. nipponensis* to the Thai fauna. Shokita and Takeda (1989) subsequently described a new species, *M. niphanae*, from central Thailand. Naiyanetr (1980, 1992, 1998) updated the shrimp records for Thailand and, in the latest paper, listed the distribution data for the 14 known Thai species. Recently, Naiyanetr (2001) described a new species, *M. sirindhorn*, from northern Thailand.

The present paper treats the 25 species of *Macrobrachium* now known from Thailand, three of which are here described as new. Descriptions for the new species, diagnoses for new records and poorly known species and taxonomic discussions for all species are presented. A map (figure 1) is provided for the main drainage systems of Thailand. A key to all the known Thai *Macrobrachium* species is also included.

The name and the location of the provinces are as listed in Naiyanetr (1998). The abbreviation cl is used as carapace length (measured from the postorbital margin to the dorsal posterior margin of carapace). Notation for rostral formula follows that of Chace and Bruce (1993). Specimens examined in this study are deposited at the Chulalongkorn University, Bangkok, Thailand (CU); Zoological Reference Collection, Raffles Museum of Biodiversity Research, National University of Singapore, Singapore (ZRC); Institute of Zoology, Academia Sinica, Beijing, China (IZAS); Shanghai Fisheries University, Shanghai, China (SFU); Muséum National d'Historie Naturelle, Paris, France (MNHN); Naturhistorisches Museum, Wien, Austria (NHMW); National Museum of Natural History, Leiden, The Netherlands (RMNH); and Zoological Museum of Amsterdam, Amsterdam, The Netherlands (ZMA).

Taxonomy

Family PALAEMONIDAE Rafinesque, 1815
Genus *Macrobrachium* Bate, 1868
Macrobrachium rosenbergii dacqueti (Sunier, 1925)

Palaemon carcinus Fabricius, 1798: 402; Von Marten, 1868: 34; De Man, 1879: 167; Ortmann, 1891: 700; Lanchester, 1901: 565; Kemp, 1918a: 255.
P(alaemon) white Sharp, 1893: 122 [type locality: Bombay, India] (*nomen nudum*).
Palaemon d'Acqueti Sunier, 1925: cxvii [type locality: Java, Indonesia].
Macrobrachium rosenbergii schenkeli Johnson, 1973: 277 [type locality: Myanmar].
Macrobrachium carcinus: Suvatti, 1937: 49; 1967: 138.
Macrobrachium rosenbergii: Holthuis, 1950: 111 (part), figure 25; Johnson, 1961: 56; Lumubol, 1980: 500; Naiyanetr, 1980: 17; 1992: 17; 1998: 33.
Macrobrachium rosenbergii dacqueti: Holthuis, 1995:148; Cai and Dai, 1999: 233; Cai and Ng, in press.

Material examined

North-east Thailand. One specimen (CU), Maha Sarakham, no date.

Central Thailand. One ♂, cl 80 mm (CU), from market at Bangkok, no date; 2 ♂♂, cl 18.3–19.4 mm, 1 ovigerous ♀, cl 25.0 mm (CU 1997.232), Nonthaburi, 25 June 1980. Two ♂♂, cl 20.0 mm (CU 1997.70), Bangkok market, no date; 1 ovigerous ♀, cl 47.0 mm, Bangkok, no date; 1 ♀, cl 28.0 mm (CU 1997.73), Bangkok, no date.

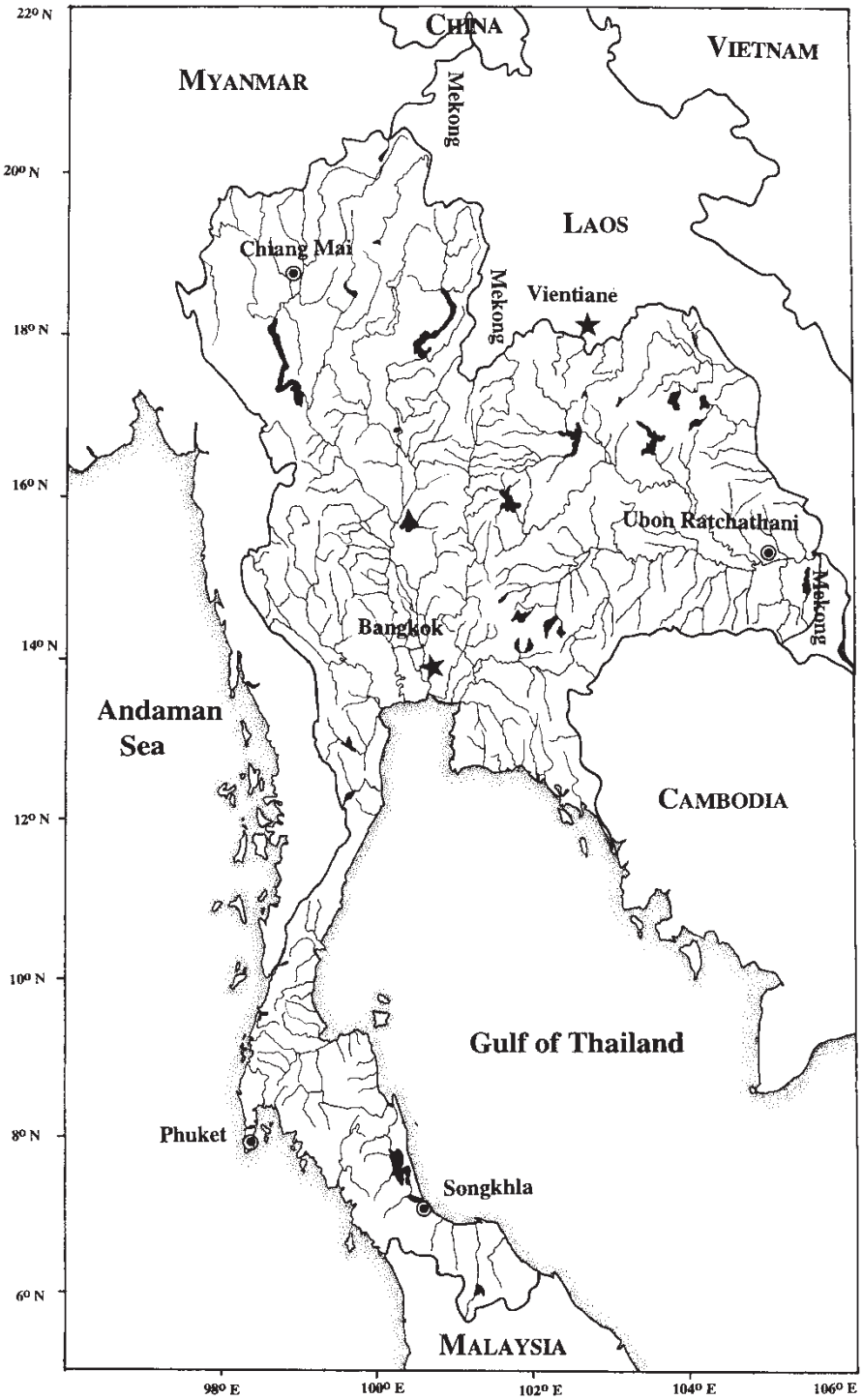


FIG. 1. Map of Thailand, showing the drainage system.

East Thailand. Seven ♂♂, cl 36.9–47.0 mm (ZRC 2000.0004), purchase from market in Chon Buri, coll. P. K. L. Ng *et al*., 11 November 1999.

South Thailand. Two specimens (CU 1997.93), Surat Thani, 21 October 1979.

Thai specimens with no specific locality. Two ♂♂, cl 26–35 mm, 8 ♀♀, cl 21.0–41.0 mm (CU 1997.74); six specimens (CU 1997.75); 3 ♂♂, cl 20.0–31.0 mm (CU 1997.77); 10 specimens (CU 1997.78).

Remarks

This well-known species has previously been reported from Thailand by De Man (1879), Lanchester (1901), Kemp (1918a), Suvatti (1937, 1967), Holthuis (1950), Lumubol (1980) and Naiyanetr (1980, 1992, 1998) under the names *Palaemon carcinus*, *Macrobrachium carcinus* and *Macrobrachium rosenbergii.* The subspecies status was proposed by Johnson (1960, 1973) and supported by Lindenfelser (1984). The correct names of the two subspecies have recently been discussed by Holthuis (1995) and followed by Cai and Dai (1999) and Cai and Ng (in press). The two subspecies are quite distinct and can be distinguished by a suite of reliable characters for both males and females, and all indications are that they are actually separate species (D. Wowor and P. K. L. Ng, unpublished data). Until these results are published, we follow convention in regarding both taxa as separate subspecies. Our specimens have a long rostrum, which distinctly reaches beyond the distal end of the scaphocerite, and undoubtedly belongs to the western subspecies, for which the name *M. rosenbergii dacqueti* should be used. This subspecies is distributed naturally in India, Myanmar, Thailand, Vietnam, Malay Peninsula, Borneo and Java. Naiyanetr (1998) listed it from various localities from all over Thailand except the north.

Macrobrachium rosenbergii dacqueti has been a key subject of aquaculture for the past four decades in South-East Asia and has been introduced to many parts of the world. It is sold as food at markets all over Thailand. With the striking red colour on the joints of legs and steel blue chelipeds, *M. r. dacqueti* has also become increasingly popular in the aquarium trade in Thailand in recent years.

Macrobrachium latidactylus (Thallwitz, 1891)

Palaemon latidactylus Thallwitz, 1891: 97 [type locality: Celebes (=Sulawesi, Indonesia); Thallwitz, 1892: 17, figure 3.

Palaemon (Macrobrachium) latidactylus: De Man: 1902: 805.

Palaemon lampropus De Man, 1892: 493, pl. 29: figure 49 [type locality: Celebes and Timor, Indonesia]; Kemp, 1918a: 267; Suvatti, 1937: 49; 1967: 139.

Macrobrachium latidactylus: Holthuis, 1950: 239, figure 50; 1980: 97; Costa, 1979: 57; Naiyanetr, 1980: 17; 1992: 18; Yeo *et al*., 1999: 236.

Material examined

Central Thailand. One ♂ (CU), Kut Island, Gulf of Thailand, Trat, coll. P. Naiyanetr, 8 April 1976.

South Thailand. Three ♂♂, cl 19.0–22.0 mm (CU 1997.105), Trang, 29 October 1988; 1 ♂, cl 11.5 mm, 3 ♀♀, cl 8–12.8 mm, 1 ovigerous ♀, cl 7.5 mm, eggs 0.4 × 0.6 mm (ZRC 2000.2601), Ranong Province: Kapoe District: Klong Ban Man waterfall, along highway 4 milestone, 22 km to Kapoe, 9°27′24.2″N, 98°30′31.1″E, coll. D. C. J. Yeo *et al*., 12 August 1997.

Remarks

Macrobrachium latidactylus was recorded from Patani river, southern Thailand by Kemp (1918a) and Suvatti (1937) as *Palaemon lampropus* De Man, 1892, a name that was synonymized with *M. latidactylus* by Holthuis (1950). Naiyanetr (1998: 32) also listed the species from Ko Kud, Trat, Eastern Thailand.

Macrobrachium latidactylus has been reported from Sri Lanka (Costa, 1979), Indonesia, Philippines, Malaysia, southern Thailand (Holthuis, 1950; Johnson, 1963; Chace and Bruce, 1993; Yeo *et al*., 1999), Hainan (Yu, 1936; Liu *et al*., 1990), Taiwan (Hwang and Yu, 1982; Shy and Yu, 1998) and the Ryukyu Islands (Shokita, 1979).

Macrobrachium lar (Fabricius, 1798)

Palaemon Lar Weber, 1795: 94 (*nomen nudum*).
Palaemon Lar Fabricius, 1798: 402 (type locality: 'in India Dom. Daldorf').
Palaemon (Eupalaemon) lar: De Man, 1902: 774; 1915: 415.
Macrobrachium lar: Holthuis, 1950: 176; Holthuis, 1980: 96; Kamita, 1972: 19; Naiyanetr, 1992: 18; 1998: 32; Yeo *et al*., 1999: 236; Cai and Ng, 2001: 683; in press.
Not *Macrobrachium lar*: Kamita, 1966: 138.

Material examined

Two ♀♀ (CU), no data; 1 ♂ (CU 1997.171), Surin Nua Island, coll. P. Naiyanetr, 13 April 1977; 1 ♀ (CU 1997.172), Surin Nua Island, coll. P. Naiyanetr, 13 April 1977.

Remarks

Kamita (1966) reported *Macrobrachium lar* from some unspecified locations in Thailand. According to his drawing and the rather detailed description, his specimen(s) is clearly not *M. lar* but *M. lanchesteri* (De Man) instead. *Macrobrachium lar* is a well-known species, which is distributed throughout the Indo-West Pacific region.

Macrobrachium idae (Heller, 1862)

Palaemon Idae Heller, 1862: 416, pl. 2: figures 40, 41 [type locality: Borneo].
Palaemon (Eupalaemon) ritsemae De Man, 1897: 774 [type locality: Atjeh, north-western Sumatra].
Palaemon (Eupalaemon) robustus De Man, 1902: 771, pl. 24: figure 48 [type locality: Halmahera, Indonesia].
Macrobrachium palawanensis Johnson, 1962: 307, figure 1 [type locality: Palawan Island, Philippines].
Macrobrachium idae: Holthuis, 1950: 142, figure 33; 1980: 92; Johnson, 1961: 56; Lumubol. 1980: 500, figure (under the name of *Macrobrachium equidens* (Dana), see Remark); Chace and Bruce, 1993: 27, figure 6; Naiyanetr, 1992: 18; 1998: 32; Yeo *et al*., 1999: 266; Cai and Ng, 2001: 678.

Material examined

South Thailand. One ♂ (ZRC 2000.2602), Ranong Province: Kapoe District: Klong Ban Man waterfall, along highway 4 milestone 22 km to Kapoe, 9°27′24.2″N, 98°30′31.1″E, coll. D. C. J. Yeo *et al*., 12 August 1997; 1 ♀, cl 8.8 mm (ZRC 2000.2603), Krabi Province, Khlong Sa Kein at Nan Nai Sa, coll. M. Kottelat, 5 November 1995; 2 ♂♂, cl 1.8–2.0 mm (ZRC 2000.2604), Narathiwat Province, 10 km north of Bocho on road Narathiwat-Sai Buri, coll. M. Kottelat, 1 November

1995; 3 ♂♂, cl 23.5–25.7 mm (CU 1997.16), Phang Nga; 1 ♂, 2 ♀♀, cl 12.0–20.0 mm (CU 1997.9), Narathiwat, 15 June 1983; 1 ♂, cl 14.0 mm, 2 ovigerous ♀♀, cl 15.0–20.0 mm (CU 1997.10), Ranong, 31 July 1988; 1 ♂, cl 21.5 mm (CU 1997.11), Thai Muang, Phang Nga, 28 August 1986; 3 ovigerous ♀♀, cl 13.5–14.5 mm (CU 1997.12), Narathiwat (from market), 11 January 1993; 3 ovigerous ♀♀, cl 17.5–19.0 mm, Thai Muang, 1993; 3 ♂♂, cl 6.0–12.0 mm, 6 ♀♀ (4 ovigerous), cl 8.5–10.0 mm, river in Phang Nga, 23 August 1986; 1 ♂, cl 6.5 mm, Ramru waterfall, Phang Nga, September 1986; 1 ♂, cl 7.5mm, 1 ♀, cl 6.0 mm, 1 ovigerous ♀, cl 8.5 mm, Thai Muang, Phang Nga, 6 August 1986; 1 ovigerous ♀, cl 11.0 mm (CU 1997.53), no data; 5 ♂♂, cl 15.0–18.5 mm (CU 1997.82), Naban, Phang Nga, no date; 2 ♂♂, cl 24.0 mm (CU 1997.85), Phang Nga, 7 September 1986; five specimens (CU 1997.91), Phang Nga, 7 September 1986; two specimens (CU 1997.157), Phang Nga, coll. P. Naiyanetr, 17 March 1982; 1 ♂, cl 21.8 mm (CU 1997.229), Songkhla, 7 November 1982; 13 specimens (ZRC 2000.2652), Krabi Province, spring pool, source of Khlong Sa keiu at Ban Sa Keiu, pH 6.5, coll. M. Kottelat, 6 November 1995.

Remarks

Macrobrachium idae has a wide distribution in the Indo-West Pacific region ranging from Madagascar to the Admiralty Islands and South-East Asia. Cai and Ng (2001) recently designated lectotypes for *P. idae* Heller, 1862, and *Palaemon (Eupalaemon) robustus* De Man, 1902, and confirmed the synonymy of *P. idae* with *P. (Eupalaemon) robustus* and *M. palawanensis* Johnson, 1962. *Macrobrachium idea* has previously been reported from Songkhla, and Nakhon Si Thammarat, Samut Sakhon and Ranong by Lumubol (1980). In the attached figures, Lumubol (1980) figured this species under the name '*Macrobrachium equidens* (Dana)', while the species he indicated as '*M. idae* (Heller)' is actually *M. equidens* instead.

Macrobrachium lanchesteri (De Man, 1911)

Palaemon paucidens Lanchester, 1902: 568, pl. 33, figure 4 [not De Haan, 1841; type locality: Songkla, southern Thailand].
Palaemon (*Eupalaemon*) *Lanchesteri* De Man, 1911: 264; Kemp, 1918a: 257.
Macrobrachium lanchesteri: Suvatti, 1937: 49; 1967: 139; Holthuis, 1950: 139; 1980: 96; Johnson, 1961: 56; 1966a: 279; 1966b: 423; Lumubol, 1980: 502, figure; Naiyanetr, 1980: 17, 1992: 17; 1998: 32; Chong and Khoo, 1988: 196; Wong, 1994: 297; Cai and Ng, in press.
Macrobrachium cf. *lanchesteri*: Ng, 1995: 75, figure 2.
Cryphiops (*Macrobrachium*) *lanchesteri*: Johnson, 1968: 233.
Macrobrachium lar: Kamita, 1966: 138.
Macrobrachium palaemonoides: Naiyanetr, 1992: 33 (not *M. palaemonoides* Holthuis, 1950).

Material examined

North Thailand. Seven specimens, cl 5.5–9.0 mm (ZRC 2000.2605), Mae Jio, 10 km from Chiang Mai, with water hyacinth, mud bank and substratum, warm and slightly flowing water, 18°58′25.6″N, 99°14′34.1″E, pH 8.0, coll. Y. Cai, 13 June 1998; six specimens (ZRC 2000. 2610), forest stream 95 km north from Nan town, Nan Province, about 15–20 km north from Ban Pon, Nam Gae, north of Ban Sala, near the border with Laos, coll. Y. Cai and Y. Y. Goh, 11 June 1998; 1 ovigerous ♀, cl 12 mm, 20 juvenile specimens (ZRC 2000.2622), Mae Nam Ping river, Chiang Mai, coll. Y. Cai, 13 June 1998; 20 specimens (ZRC 2000.2606), Ban Tho Market, outskirt of Chiang Mai city, Mae Nam Ping river, coll. Y. Cai and Y. Y. Goh,

13 June 1998; 12 specimens (ZRC 2000.2624), Mae Nam Ping river, 1–1.5 km below the Nakhon Phing Bridge of Chiang Mai city, water warm, turbid, mud bank, slow flowing, 18°58′25.6″N, 99°14′34.1″E, pH 8.0, coll Y. Cai and Y. Y. Goh, 13 June 1998; 10 specimens (ZRC 2000.2613), Ban Tho Market, outskirt of Chiang Mai city, caught from Mae Nam Ping river, coll. Y. Cai and Y. Y. Goh, 13 June 1998; 10 specimens (ZRC 2000.2607), Mae Nam Kham river on the way to Mae Sai, 20°7′31.7″N, 99°39′1.7″E, pH 7.8, coll. Y. Cai *et al*., 12 June 1998; 14 specimens (ZRC 2000.2609), Chiang Rai market, coll. Y. Cai and Y. Y. Goh, 13 June 1998; 1 ♂, 1 ♀ (CU 1997.194), coll. Loez, 11 March 1985.

West Thailand. Twenty-one specimens (CU 1997.86), Phrae, coll. P. Naiyanetr, 25 April 1980; 3 ♂♂, cl 17.0–18.5 mm (CU 1997.87), Tha Song Yang, Tak, 17 May 1985; 9 ovigerous ♀♀, cl 7.0–7.5 mm, eggs 0.9 × 0.6 mm (ZRC 2000.2626), Prachuap Khiri Khan Province, Thap Sakae District, stream under bridge of road to Ban Wong Hoi, 11°26′54.8″N, 99°28′58.2″E, coll. D. Yeo *et al*., 13 August 1997; 16 specimens (ZRC 2000.2615), Mae Sot, Mae Nam Moi, border with Myanmar Karen state, 16°41.22′N, 98°30.90′E, coll. H. H. Tan and H. H. Ng, 26 May 1999.

Central Thailand. Twenty-five ovigerous ♀♀, cl 5.8–6.7 mm, egg size 0.8 × 0.7 mm, 86 small specimens (ZRC 2000.2612), Lop Buri Province, Chai Badan, coll. Y. Cai, 20 June 1998; 21 specimens, cl 8.2–9.9 mm (CU 1997.196), Nakhon Nayok, 12 October 1980; 10 specimens (ZRC 2000.2608), Lam Thakong, outlet of dam at upper Mae Nam Mun, way from Sara Buri to Ratchasima, coll. Y. Cai and Y. Y. Goh, 16 June 1998; 25 specimens (11 ovigerous ♀♀) (CU 1997.198), Phetchabun, 12 January 1980; 2 ♂♂, cl 11.6–12.0 mm (CU 1997.200) Nakhon Nayok; 42 specimens (4 ovigerous ♀♀), cl 6.9–10.4 mm (CU), Nakhon Nayok, 1 November 1978; 67 specimens (4 ovigerous ♀♀), cl 5.1–9.8 mm (CU 1997.203), Kamphaeng Phet, 2 September 1986; 46 specimens (11 ovigerous ♀♀), cl 6.9–9.8 mm (CU), Nonthaburi, 14 November 1978; 75 specimens, cl 6.2–10.5 mm (CU 1997.205), Uthaithani, 26 September 1979; 16 specimens (ZRC 2000.2621), stream 15 km from Sara Buri, outside a temple, coll. Y. Cai and Y. Y. Goh, 20 June 1998; 45 specimens, cl 6.2–9.5 mm (CU), Ayuthaya, 25 June 1983; 36 specimens (4 ovigerous ♀♀), cl 6.4–10.8 mm (CU 1997.202), Ayuthaya, 5 January 1979; 75 specimens, cl 5.3–9.0 mm (CU 1997.207), Ayuthaya, 21 September 1982; 28 specimens (4 ovigerous ♀♀), cl 10.0–14.0 mm (CU 1997.208), Ayuthaya; 58 specimens, cl 7.4–9.7 mm, 51 other specimens, cl 6.3–10.5 mm (CU 1997.209), Lop Buri, 7 October 1980; 6 ovigerous ♀♀, cl 8.7–10.3 mm, 32 other specimens (CU 1997.211), Ang-thong, 22 March 1981; 90 specimens, cl 5.0–6.6 mm (CU 1997.212), Nakhon Nayok, 11 November 1977; 13 specimens (11 ovigerous ♀♀), cl 5.3–12.0 mm (CU 1997.213), Ang Thong, 8 June 1979; 23 specimens, cl 5.3–12.0 mm (CU 1997.214), Sing Buri, 8 June 1980; 65 specimens, cl 6.3–11.9 mm (CU 1997.216), Ayuthaya, 22 March 1981; 21 specimens (19 ovigerous ♀♀), cl 6.6–9.9 mm, Sukhothai (CU 1997.217), 3 October 1980; 42 specimens, cl 6.5–9.3 mm (CU 1997.218), Lop Buri, 23 November 1980; 126 specimens, cl 5.8–8.8 mm (CU 1997.219), Phichit, 2 October 1980; 28 ovigerous ♀♀, cl 8.6–13.9 mm, six other specimens, cl 6.4–10.8 mm (CU 1997.220), Phetchatbun, 19 October 1980; 21 specimens (one ovigerous ♀), cl 7.0–11.4 mm (CU), Singburi, 22 November 1979; 2 ♂♂, cl 8.0–10.5 mm (ZRC 2000.2723), road-side market 27 km from Nakhon Phenom, coll. Y. Cai, 17 June 1998.

North-east Thailand. Thirty-eight ♂♂, cl 9.0–16.0 mm, 12 ♀♀, cl 8.8–14.5 mm, 23 ovigerous ♀♀, cl 9.4–14.5 mm (ZRC 2000.2638), Warin Chamrap Market, coll. Y. Cai, 17 June 1998; 1 ♂, cl 6.5 mm, 3 ♀♀, cl 6.5–9.5 mm (ZRC 2000.2620), Mae

Nam Khek, East of Ban Bo, at km 42 on road from Phitsanulok to Loei, coll. M. Kottelat and K. Kubota, 29 January 1999; 1 ♂, cl 6.2 mm, 2 ♀♀, cl 7.0–9.0 mm, 2 ovigerous ♀♀, cl 8.0–9.5 mm (ZRC 1997.118), Nakhon Ratchasima Province, irrigation pond, road 2310 from Korat to Bangkok (9 km Chok Chai, 37 km Chiburi), unmarked trail, 14°48′47.9″N, 102°9′9.9″E, coll. H. H. Tan *et al.*, 16 June 1997; 10 specimens (ZRC 2000.2611), Ban Nan Khaisat, artificial lake for rice field, 50 km to Bung Kan, 18°13′26.2″N, 104°02′07.1″E, coll. Y. Cai and Y. Y. Goh, 18 June 1998; 35 specimens, cl 6.5–8.0 mm (ZRC 2000.2616), waterfall (22 km turn off from main road), 15°38′59.0″N, 101°25′9.0″E, coll. Y. Cai *et al.*, 20 June 1998; 20 specimens (ZRC 2000.2614), Phibun Mangsahan Market, 46 km east to Ubon Rachathani, coll. Y. Cai and Y. Y. Goh, 17 June 1998; 20 specimens (ZRC 2000.2617), Ban Phaeng, small dugout stream behind the village, draining into Mekong river, fast flowing, grass, mud bank, 17°57′26.2″N, 104°13′18.3″E, coll. Y. Cai and Y. Y. Goh, 18 June 1998; 30 specimens (ZRC 2000.2618), Khon Kean Market, coll. Y. Cai and Y. Y. Goh, 19 June 1998; 20 specimens (ZRC 2000.2623), artificial lake on the way to Chai Ya Pun, 82 km north of Khon Kean, with water lily, 16°22′19.6″N, 102°07′49.4″E, coll. Y. Cai and Y. Y. Goh, 20 June 1998; 20 specimens (ZRC 2000.2726), small stream at 19 km to Amnat Charoen, with water lilies, pH 7.1, 16°54′39.6″N, 104°09′09.6″E, coll. Y. Cai *et al.*, 17 June 1998.

East Thailand. One ♂, cl 7.8 mm, 1 ♀, cl 8.5 mm, four juveniles (ZRC 1997.114), Trat Province, Klong Kwan near Ban Klong Kwan (village), 12°19′36.6″N, 102°38′6.5″E, coll. H. H. Tan *et al.*; 1 ♂, 1 ♀ (CU), Chanthaburi, 9 February 1990; two specimens (CU 1997.169), Rayong, coll. S. Panha, 6 December 1981; 15 specimens (ZRC 2000.2728), lake 98 km from Buri Ram to Ubon Rachathani, coll. Y. Cai *et al.*, 16 June 1998.

South Thailand. One ♀, cl 8.2 mm, 1 ♀, cl 7.0 mm (ZRC 2000.2619), Narathiwat Province, padi fields along road from Narathiwat to Bacho, near Yi Ngo, 6°24.4′N, 101°24.7′E, coll. H. H. Tan *et al.*, 24 October 1998; 2 ♂♂, cl 4.2–7.2 mm, 2 ♀♀, cl 6.5–7.5 mm, 2 ovigerous ♀♀, cl 8.0–8.2 mm, eggs 1.1 × 0.8 mm (ZRC 2000.2625), Narathiwat Province, Phikuntha, Mae Nam Wan, Nara. 6°23.30′N, 101°52.23′E, pH 6.0, coll. H. H. Tan *et al.*, 15 January 1997; 1 ♂, cl 12.0 mm (CU), Phang Nga, 20 February 1987; 2 ♂♂, cl 8.0–9.0 mm, 9 ♀♀, cl 8.0–11.0 mm (CU 1997.26), Ton Sai waterfall, Thalang, Phuket, 10 December 1987; 1 ♀, cl 12.0 mm (CU 1997.27), Takua Thung river, Phnag Nga, 27 June 1986; 3 ♂♂, cl 5.0–7.0 mm, 1 ♀, cl 9.5 mm (CU 1997.28), Thalang, Phuket, 5 May 1986; 6 ♀♀ cl 6.0–10.0 mm (CU 1997.29), Kapong, 21 September 1986; 1 ♀, cl 10.0 mm, Takua Pa river, near sea, 21 September 1986; 6 ♂♂, cl 5.0–10.0 mm, 2 ♀♀, cl 9.0–12.0 mm (CU 1997.32), river near the sea, Thai Muang, Phang Nga, 28 August 1986; 1 ♂, cl 6.0 mm, 6 ♀♀, cl 7.0–9.0 mm (CU 1997.33), Thai Muang, Phang Nga, 17 September 1989; 2 ♀♀, cl 6.5 mm (CU 1997.35), Tao Tong waterfall, Thap Put, Phang Nga, 18 December 1987; one specimen (CU 1997.85), Phang Nga, 7 September 1986; numerous juveniles, Phathalung, 2 April 1982; 65 ovigerous ♀♀, cl 7.3–10.6 mm, 28 other specimens, cl 5.4–8.9 mm (CU 1997.215), Phathalung, 27 October 1982.

Thai specimens with no specific locality. Twenty-seven specimens (three ovigerous ♀♀), cl 5.7–8.3 mm (CU 1997.221).

Remarks

Macrobrachium lanchesteri was originally described from southern Thailand (Lanchester, 1902; De Man, 1911), and has also been reported from central Thailand

and peninsular Malaysia, with a doubtful record from Sabah in Borneo (Suvatti, 1937; Johnson, 1961, 1968; Chong and Khoo, 1988; Ng, 1995). Its general biology (Johnson, 1968), larval development (Wong, 1994) and taxonomy (Chong and Khoo, 1988) are better understood than almost any other species in South-East Asia except perhaps *M. rosenbergii*. *Macrobrachium lanchesteri* is a hardy species, adapting well to almost all kinds of freshwater bodies, e.g. rice field, ponds, reservoirs, streams and rivers. It is the most common species in Thailand, and is sold in markets all over Thailand, mainly for food.

Naiyanetr (1998: 33) listed *M. palaemonoides* Holthuis, 1950, from Thailand. His specimens from Surin, north-eastern Thailand, were re-examined and they are actually *M. lanchesteri* instead. *Macrobrachium palaemonoides* is known with certainty only from the type locality in Laut Tawar, Laulo Lake, northern Simaloer, off the west coast of Sumatra (Holthuis, 1950; Chace and Bruce, 1993). Kamita (1974: 6) reported *M. palaemonoides* from Nepal but this record should be rechecked. According to Kamita's description and figures, it is most probably *M. lamarrei* (H. Milne-Edwards, 1837) instead.

Macrobrachium lanchesteri have recently been found from Myanmar (Cai and Ng, in press), southern China (Y. Cai, personal observation) and Java, Indonesia (D. Wowor, personal communication).

Macrobrachium equidens Dana, 1852

Palaemon equidens Dana, 1852: 26 [type locality: Singapore].
Palaemon sundaicus: Lanchester, 1902: 568; Kemp, 1918a: 261.
Macrobrachium sundaicus: Suvatti, 1937: 49; 1967: 140.
Macrobrachium equidens: Holthuis, 1950: 162, figure 36; 1980: 90; Johnson, 1961: 56; Lumubol, 1980: 501, figure (under the name of *M. idae*, see Remarks under *M. idae*); Naiyanetr, 1980: 17; 1992: 18; 1998: 32; Chace and Bruce, 1993: 25, figure 4; Yeo *et al*., 1999: 226.
? *Macrobrachium nipponense*: Lumubol, 1980: 504, figure.

Material examined

Central Thailand. Two ♂♂, cl 22.6–23.9 mm, 1 ovigerous ♀, cl 21.9 mm (CU 1997.233), Nonthaburi, 10 February 1980; seven specimens, cl 9.0–14.4 mm (CU 1997.234), Samut Prakarn, 15 March 1981; 1 ♂, cl 21.6mm, 9 ovigerous ♀, cl 15.4–19.9mm (CU 1997.235), Samut Sakhon, 30 October 1980; 3 ♂♂, cl 13.6–20.7 mm, 2 ♀♀, cl 11.8–18.6 mm (CU 1997.236), Samut Sakhon, 13 December 1980; 7 ovigerous ♀♀, cl 12.6–16.0 mm (CU 1997.237), Samut Prakarn, 18 October 1980; 3 ♂♂, cl 14.7–19.4 mm, 1 ♀, cl 20.5 mm (CU 1997.238), Samut Songkhram, 21 March 1980; 4 ♀♀ (2 ovigerous), cl 19.0–20.6 mm (CU), Samut Songkhram, 13 December 1980; 3 ovigerous ♀♀, cl 15.3–22.0 mm (CU 1997.240), Nonthaburi, May 1980.

South Thailand. Ten ♂♂, cl 14.0–20.0 mm, 29 ovigerous ♀♀, cl 20–21.5 mm (CU 1997.9), Narathiwat, 15 June 1983; 9 ♂♂, cl 13.0–17.0 mm, 26 ♀♀ (2 ovigerous), cl 10.0–17.5 mm (CU), Narathiwat (from market), 11 January 1993; 1 ♂, cl 14.0 mm (CU 1997.14), Ranong (from mangrove), 27 July 1988; 4 ♂♂, cl 20.0–24.0 mm, 2 ovigerous ♀♀, cl 17.0 mm (CU), Trang, 29 October 1988; 2 ♂♂, cl 20–24 mm, 1 ovigerous ♀, cl 16 mm (ZRC 2000.2717), Trang, coll. P. Naiyanetr, 29 October 1988.

Thai specimens with no specific locality. Two ♀♀, cl 15.1–20.4 mm (CU 1997.75); 8 ovigerous ♀♀, cl 20.5–28.0 mm (CU 1997.71); 19 ovigerous ♀♀, cl 18.0–21.0 mm (CU 1997.81); 43 specimens (CU 1997.83).

Remarks

Macrobrachium equidens is usually a brackish water species, with smaller specimens being commonly found in mangrove creeks. The species is characterized by its upturned and sinuous rostrum. The variation in rostral form and body colour is considerable and this can sometimes cause taxonomic confusion. *Macrobrachium equidens* has previously been recorded from southern and central Thailand by Lanchester (1902), Kemp (1918a), Suvatti (1937), Holthuis (1950) and Naiyanetr (1980). It is known from a very wide area in the Indo-West Pacific, from Madagascar to the Solomon Islands. On the basis of his figures, specimens identified as '*Macrobrachium nipponense*' by Lumubol (1980: 504) probably belong to this species as well.

Macrobrachium neglectum (De Man, 1905)

Palaemon acutirostris De Man, 1888: 280, pl. 18; figure 7 (not Dana, 1852).
Palaemon (Eupalaemon) neglectus De Man, 1905: 201, pl. 15: figure 6 [type locality: Mergui Archipelago and north-eastern Sumatra].
Macrobrachium neglectus: Suvatti, 1937: 49; 1967: 140.
Macrcrochium javanicum: Holthuis, 1950: 190 (part); 1980: 94 (part); Chace and Bruce, 1993: 29 (part); Tiwari, 1955b: 232.
Macrobrachium javanicum neglectum: Johnson, 1960: 262, figure 2.
Macrobrachium neglectum: Ng and Choy, 1990: 15; Cai and Ng, in press.

Material examined

East Thailand. Ten specimens (CU 1997.192), Trat, 7 April 1976.

Southern Thailand. Two ovigerous ♀♀, cl 24–25 mm (ZRC 2000.2716), Narathiwat Province, Ban Sac tributary of Sungai Kolok, *ca* 19.5 km westward towards Waeng at T-junction from Sungai Kolok to Waeng and Sungai Padi, 5°47.49′N, 101°80′E, pH 7.6, coll H. H. Tan *et al*., 23 October 1998; 2 ♂♂, cl 13.5–21.5 mm, 25 ovigerous ♀♀, cl 10–17.5 mm (ZRC 2000.2628), Ranong Province: Kapoe District: Klong Ban Man waterfall, along highway 4 milestone 22 km to Kapoe, 9°27′24.2″N, 98°30′31.1″E, coll. D. C. J. Yeo *et al*., 12 August 1997; 1 ♂, cl 25 mm, 1 ♀, cl 16 mm (ZRC 2000.2702), Nam Tok Tone Sai, Phuket, 8°01.64′N, 98°21.74′E, pH 7.8, coll. P. K. L. Ng and H. H. Tan, 8 April 1999; 2 ♀♀, cl 10.5–16.0 mm (ZRC 2000.2631), Ranong Province, Khlong Phrae Sai at Ban Kreo Noi, km 8 on road branching east 32 km north of Ranong on road Ranong Kra Buri, coll. M. Kottelat, 6 November 1995; 1 ♂, cl 8.8 mm, 2 ♀♀, cl 9.6–10.2 mm, Narathiwat Province, stream on Phu Khao Thong, 6 km west of Ban Bu Ke Ta, pH 6.5, coll. 2 November 1995; 2 ♂♂, cl 14.6–21.2 mm, 1 ovigerous ♀, eggs 0.7 × 0.5 mm (ZRC 2000.2633), Ranong Province, stream north of Khura Buri, 100 km south of Ranong, pH 5.9, coll. M. Kottelat, 5 November 1995; 4 ♂♂, cl 10.0–13.5 mm, 1 ♀, cl 8.2 mm (ZRC 2000.2634), Narathiwat Province, strem at bridge about 1 km south of bridge on Mae Nam road Tod Deng, about 5 km north of Narathiwat, coll. M. Kottelat, 3 November 1995; 3 ♂♂, cl 9.8–10.3 mm, 1 ovigerous ♀, cl 13.2 mm (ZRC 2000.2627) Ranong Province, King Amphoe Suk Sam Lan: Ton Koi waterfall, 9°20′14.6″N, 98°27′18.9″E, coll. D. Yeo *et al*., 11 August 1997; 14 ♂♂, cl 10.8–18.3 mm (ZRC 2000.2627), Ranong Province, King Amphoe Suk Sam Lan, Ton Koi waterfall, 9°20′14.6″N, 98°27′18.9″E, coll. D. Yeo *et al*., 11 August 1997; 3 ♂♂, cl 13.4–21.5 mm, Ranong, coll. Priyawut, 28 January 1986; 1 ♂, cl 8.5 mm (CU 1997.23), Bang Pat waterfall, Thalang Phuket, 14 October 1986;

1 ♂, cl 31.0 mm (CU 1997.39), river Thap Put, Phang Nga, 24 August 1986; 2 ♂♂, cl 12.0–13.0 mm (CU 1997.40), Tao Hong waterfall, Thap Put, Phang Nga, 27 March 1987; 3 ♂♂, cl 16.0–20.0 mm, 3 ♀♀, cl 15.0 mm (CU 1997.41), Ban Pai waterfall, Thalang, Phuket, 1986; 1 ♀, cl 18.0 mm (CU 1997.42), Lumru waterfall, Kapong, 11 September 1986; 9 ♂♂, cl 18.5–30.0 mm, 2 ♀♀, cl 18.5 mm (CU 1997.43), Lumru waterfall, Kapong, 11 September 1986; 7 ♂♂, cl 15.0–22.0 mm, 2 ♀♀, cl 17.0–18.5mm (CU 1997.44), Ban Pai waterfall, Thalang, 8 May 1987; seven specimens, cl 9.0–16.0 mm (CU 1997.45), Tao Thong, Thap Put, 11 December 1986; three specimens, cl 14.0–20.0 mm (CU 1997.46), Lum Pee waterfall, Thai Muang, Phang Nga, 31 August 1987; 24 specimens, cl 11.0–22.5 mm (CU 1997.47), Bang Pa waterfall, Thalang, 8 May 1987; 2 ♂♂, cl 25.0 mm, 4 ovigerous ♀♀, cl 18.0–19.0 mm (CU 1997.48), Thai Muang, 8 August 1987; nine specimens, cl 8.0–12.0 mm (CU 1997.49), Bang Pa waterfall, Thalang, 8 May 1987; 4 ♂♂, cl 23.0–29.5 mm (CU 1997.50), Takua Pa, 28 August 1986; 20 specimens (CU 1997.51), Ton Sai waterfall, Thalang, 8 May 1987; 33 specimens (CU 1997.52), Lum Pee waterfall, Thai Muang, 20 April 1986; 4 ♂♂, cl 24.0–28.0 mm, 3 ♀♀, cl 14.0–17.0 mm (CU 1997.54), Bam Drik waterfall, Thai Muang, 25 July 1986; 4 ♂♂, cl 16.0–32.0 mm, 2 ♀♀, cl 11.5–16.0 mm, 30 other specimens, Lum Ru waterfall, Kapong, 11 September 1987; 19 specimens, cl 8.0–14.0 mm (CU 1997.56), Bang Pa waterfall, Thalang, 29 March 1986; 1 ♂, cl 30.0 mm (CU 1997.57), Ton Sai waterfall, Thalang, 6 July 1986; 1 ♂, cl 31.0 mm (CU 1997.58), Tao Thong Water, Thap Put, 20 July 1986; 1 ♂, cl 31.0 mm (CU 1997.59), Phang Nga, 20 July 1986; 11 ♂♂, cl 15.0–29.0 mm, 7 ♀♀, cl 11.0–16.0 mm (CU 1997.60), Ton Na Nua waterfall, Thai Muang, 8 May 1987; 3 ♂♂, cl 25.5–31.0 mm (CU 1997.61), Tone Na Nua waterfall, Phang Nga, 25 August 1986; 3 ♂♂, cl 16.0–17.0 mm, 40 other specimens (CU 1997.62), Patong waterfall, Phuket, 21 June 1986; eight specimens, Kanim waterfall, Phang Nga, 9 December 1980; 2 ♂♂, cl 14–22 mm, 1 ♀, cl 17 mm (CU 1997.89), Ranong, coll. Priyawut, 28 January 1986; two specimens (CU), Pun Sak Tan, Nakhon Si Thammarat, October 1976.

Thai specimens with no specific locality. Twenty-one specimens (CU 1997.66); one specimen (CU 1997.68); 19 specimens (CU 1997.69); 13 specimens (CU 1997.78); 2 ♂♂, cl 29.0–30.0 mm (CU 1997-63).

Remarks

De Man (1888) reported *Palaemon acutirostris* from Mergui. Subsequently, he (De Man, 1905) reassigned these specimens, together with some Sumatran ones to a new species, *P. (Eupalaemon) neglectus*. Holthuis (1950), however, thought this taxon was identical with *M. javanicum* (Heller, 1862). Johnson (1960) highlighted the differences between these two species, and considered them as two separate subspecies, *M. javanicum javanicum* and *M. javanicum neglectum*. Naiyanetr (1980), Ng and Choy (1990), and recently Cai and Ng (in press) treated both as good species.

This species seems to prefer streams with fast running waters or waterfalls. In Thailand, *M. neglectum* had previously been reported from Koh Chang by Suvatti (1937).

Macrobrachium mirabile (Kemp, 1917)

Palaemon mirabilis Kemp, 1917: 227, pl. 10 [type locality: Rangoon (Yangon), Burma (Myanmar)].

Macrobrachium mirabilis: Suvatti, 1937: 49; 1967: 139.

Macrobrachium mirabile: Holthuis, 1950: 174; 1980: 100; Chace and Bruce, 1993: 34; Ng, 1995: 75, figure 3; Cai and Ng, in press.

Material examined

South Thailand. Sixteen ♀♀, cl 8.3–10.7 mm (ZRC 2000.1805), 13 ovigerous ♀♀, cl 8.8–10.2 mm; eggs 0.65–0.75 × 0.45–0.55 mm, Tab Lee, Ranong, 2 July 1991.

Remarks

Macrobrachium mirabile was originally described by Kemp (1917) on the basis of specimens from Myanmar (Yangon and Moulmein) and the Gangetic Delta, India. The species is also known from Borneo (Holthuis, 1950; Ng, 1995). Suvatti (1937) recorded this species from Chao Phraya river, Pakret and Paknam, central Thailand. Naiyanetr (1998) listed one more locality, Chachoengsao, in eastern Thailand. The present record is from Ranong, south Thailand. As already stated by Kemp (1917: 230) and Chace and Bruce (1993: 34), this species should perhaps be better placed in its own genus. This matter is now being examined by A. J. Bruce and D. Wowor (personal communication). No male specimens are known from Thailand. A rediagnosis was recently given by Cai and Ng (in press) on the basis of this material.

The species is distributed in Gangetic Delta (Kemp, 1917), Myanmar (Kemp, 1917), Thailand (Suvatti, 1937) and Borneo (Holthuis, 1950; Ng, 1995).

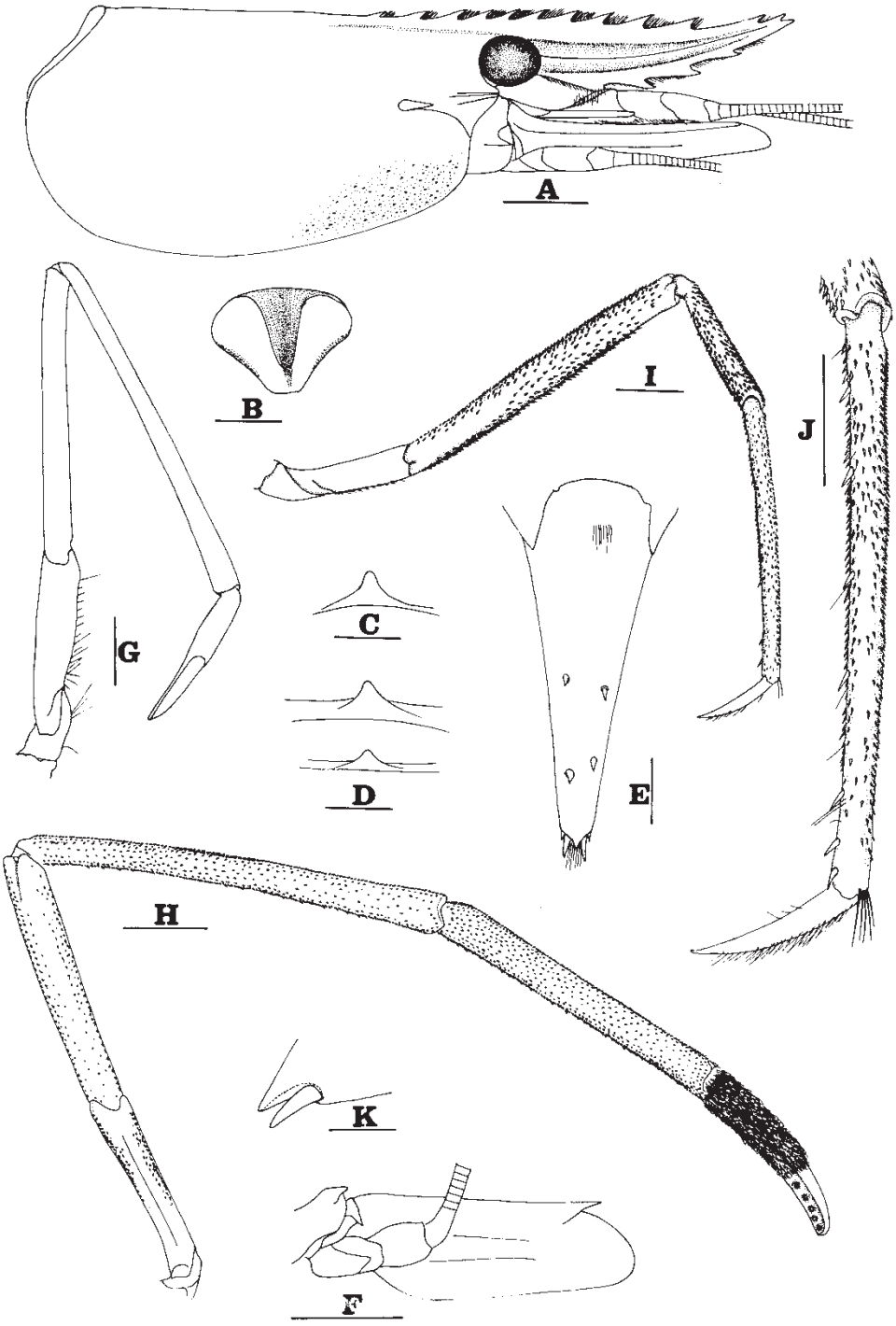
Macrobrachium sintangense (De Man, 1898)
(figure 2)

Palaemon (Eupalaemon) sintangensis De Man, 1898: 138, pl. 6 [type locality: Sintang, Kapuas river, Borneo].
Palaemon nipponensis: Lanchester, 1902: 566 (not *P. nipponensis* De Haan, 1849).
Palaemon elegans: Kemp, 1918a: 264 (not *P. elegans* De Man, 1892).
Macrobrachium elegans: Suvatti, 1937: 49; 1967: 139.
Macrobrachium sintangense: Holthuis, 1950: 151; 1980: 105; Johnson, 1968: 236; Lumubol, 1980: 502, figure; Naiyanetr, 1980: 17; 1992: 18, 1998: 33. Chace and Bruce, 1993: 38; Ng, 1995: 189; figure 6; not *Macrobrachium sintangense*: Kamita, 1974: 7.

Material examined

Central Thailand. Forty-nine ♂♂, cl 11.0–16.5 mm, 1 ♀, cl 10.5 mm, 6 ovigerous ♀♀, cl 10.0–12.0, eggs 1.3 × 0.9 mm (ZRC 2000.2635), Lop Buri Province, Chai Badan, coll. Y. Cai, 20 June 1998; 115 specimens, cl 5.0–15.3 mm (CU 1997.222), Phetchabun, 22 May 1982; 5 ♂♂, cl 14.4–19.9 mm, Saraburi, no date; 1 ♂, cl 15.8 mm, 1 ♀, cl 14.0 mm (CU 1997.887), Saraburi, 18 Jun 1980; 2 ♂♂, cl 12.4–15.0 mm, 3 ♀♀, cl 11.2–12.7 mm (CU 1997.228), Suphan Buri, 30 June 1980; 15 specimens (ZRC 2000.2651), Khoksamrong Market, 54 km from Chai Badan, coll. Y. Cai and Y. Y. Goh, 20 June 1998.

FIG. 2. *Macrobrachium sintangense* (♂, cl 19.6 mm, ZRC 2000.2636, Mekong river at Udon Thani, 17°47′57.2″N, 102°28′59.5″E, coll. Y. Cai, 19 June 1998). (A) Cephalothorax; (B) epistome; (C) fourth thoracic sternite with a small median process; (D) first two abdominal sternites with transverse ridge and median processes; (E) telson; (F) scaphocerite; (G) first pereiopod; (H) second pereiopod; (I) third pereiopod; (J) propodus and dactylus of third pereiopod; (K) movable spine of uropodal diaeresis. Scales: (A, F, H) 5 mm; (E, G, I, J) 2 mm; (B, C, D, K) 0.5 mm.



West Thailand. Three ♂♂, cl 11.8–13.8 mm, 30 small specimens (ZRC 2000.2650), Thailand, Prachuap Khiri Khan Province, Kui Buri District, stream near Ban Yang Chum, 12°3′18.7″N, 99°37′44.2″E, coll. D. Yeo *et al.*, July 1997.

North-east Thailand. One ♂, cl 19.6 mm (ZRC 2000.2636), Mekong river at Udon Thani, 17°47′57.2″N, 102°28′59.5″E, coll. Y. Cai, 19 June 1998; 5 ♂♂, cl 10.5–12.2 mm, 6 ♀♀ (3 ovigerous ♀, egg diameter: 1.2 × 0.9 mm) (CU 1997.169), Rayong, 6 December 1981, coll. S. Panha; 1 ♂, cl 9.6 mm (broken rostrum), 1 ♀, cl 9.0 mm (CU 1997.7), Yasothon, 12 March 1994; 30 specimens (ZRC 2000.2677), Warin Chamrap Market, coll. Y. Cai, 17 June 1998; 10 specimens (ZRC 2000.2637), Phibun Mangsahan Market, 46 km east to Ubon Rachathani, coll. Y. Cai, 16 June 1998; 10 specimens (ZRC 2000.2639), Ban Nan Khaisat, artificial lake for rice field, 50 km to Bung Kan, coll. Y. Cai and Y. Y. Goh, 18 June 1998; 10 specimens (ZRC 2000.2680), Khoksamrong Market, 54 km from Chai Badan, coll. Y. Cai and Y. Y. Goh, 20 June 1998.

East Thailand. Fifty-eight specimens (CU 1997.115), Chanthaburi, 9 February 1990; 21 specimens, Rayong, coll. S. Panha, 6 December 1981; 1 ♂, cl 17 mm (ZRC 2000.2712), Trat Province, stream at Ban Kraduk Chang road 3157 from Trat to Bora, 1–2 km after junction with road 3271, coll. M. Kottelat *et al*., 12 March 1993.

South Thailand. Three ♂♂, cl 5.6–10.0 mm (ZRC 2000.2629), Songkhla Province, Nam Tok Khao Chong km 25 on road to Trang from Phattalung, 7°39.71′N, 100°2.33′E, coll. H. H. Tan *et al*., 1998; 6 ♂♂, cl 6.0–12.0 mm, 1 ♀, cl 10.5 mm, 2 ovigerous ♀♀, cl 11.0 mm, egg size 1.2 × 1.0 mm (ZRC 2000.2632), Satun Province, stream in Ban Kong Kruat, pH 6.0, coll. M. Kottelat, 4 November 1995; 2 ovigerous ♀♀, egg size 0.8 × 0.6 mm (ZRC 2000.2630), Narathiwat Province, Ban Sac tributary of Sungai Kolok, *ca* 19.5 km westwards towards Waeng at T-junction from Sungai Kolok to Waeng and Sungai Padi, 5°47.49′N, 101°80′E, pH 7.6, coll H. H. Tan *et al.*, 23 October 1998; 3 ♂♂, cl 9.5–13.2 mm, 2 ♀♀, cl 6.5–7.5 mm, 6 ovigerous ♀♀, cl 9.5–10.5 mm, eggs with eye spot, eggs 0.9 × 0.6 mm (ZRC 2000.2642), Narathiwat Province, Nam Tok Sipo, downstream area, 6°16.06′N, 101°38.65′E, coll. H. H. Tan *et al*., 24 October 1998; 4 ♂♂, cl 9.0–14.8 mm, 4 ♀♀, 8.0–10.5 mm, 10 ovigerous ♀♀, cl 11.5–12.5 mm, eggs with eyes, 1.5 × 1.0 mm (ZRC 2000.2641), Narathiwat Province, hill stream in plantation at end of road branching west at about km 7 on road from Waeng to Ban Bu Ke Ta, pH 6.8, coll. M. Kottelat, 2 November 1995; 5 ♂♂, cl 10.3–16.0 mm, 1 ovigerous ♀, cl 9.3 mm (ZRC 2000.2640), Satun Province, stream in Ban Kong Kruat, pH 6.0, coll. M. Kottelat, 4 November 1995; 1 ♂, cl 13.0 mm (CU 1997.11), Thai Muaug, Phang Nga, 28 August 1986; 1 ♀, cl 15.0 mm, 50 ♂♂, cl 17.0–19.5 mm (CU), Phatthalung, 27 October 1982; 4 ♂♂, 2 ♀♀ (CU 1997.104), Songkhla, coll. P. Naiyanetr, 11 April 1983; 3 ♂♂ (CU 1997.105), Trang, 29 October 1988; 6 ♂♂, cl 10.3–11.0 mm, 2 ovigerous ♀♀, cl 9.6–9.7 mm, Ubon Rathathani, 1 April 1980; 76 specimens, cl 10.1–21.0 mm (CU 1997.229), Songkhla, 7 November 1982; 2 ♂♂, cl 7–14 mm (CU), Krabi, coll. P. Naiyanetr, 9 December 1986.

Thai specimens with no specific locality. Nine ♀♀, cl 10.5–14.6 mm (all ovigerous) (CU 1997.223); 1 ♂, cl 16.0 mm, 1 ♀, cl 15.5 mm, (CU 1997.97); 1 ♀, cl 13.0 mm (CU 1997.107); 2 ♀♀, 8 ovigerous ♀♀, cl 6.2–9.7 mm (CU 1997.188); 2 ♂♂, CU 1997.105, Trang, 29 October 1988; 1 ♂, cl 13.0 mm (CU 1997.90); 2 ♂♂, cl 11.2–12.5 mm (CU 1997.8).

Diagnosis

Rostrum varying from convex to straight or slightly upturned anteriorly, reaching to or slightly beyond end of scaphocerite, rostral formula: 2–3 + 6–10(7–8)/2–5(2–3), dorsal teeth unevenly spaced; first pereiopods with

carpus twice as long as chela; second pereiopods subequal in length, similar in form, carpus longer than merus, shorter than chela; fingers equal to or slightly longer than palm in young, shorter than palm in adults; two small teeth present on proximal third or fourth of cutting edge of fingers; adult males with distinct pubescence on proximal half to two-thirds of fingers; a row of tubercles on each side of cutting edge of dactylus; small spinules present on all joints of adult chelipeds.

Remarks

Macrobrachium sintangense is characterized by the fingers of the second pereiopod, with the proximal half densely covered with short setae in adult. The present Thai specimens agree well with De Man's original description with the exception of the rostral form. The rostrum of the type specimens (fide De Man, 1898) is straight, while those of the Thai specimens are only straight along the posterior part, with the anterior fifth distinctively upcurved. *Macrobrachium sintangense* has been reported from Thailand by Kemp (1918a), Suvatti (1937), Holthuis (1950), Lumubol (1980) and Naiyanetr (1980). Lanchester (1902) reported *Palaemon nipponensis* De Haan, 1849, from southern Thailand, but Holthuis (1950) pointed out that Lanchester's specimens are actually *M. sintangense* instead. Johnson (1963) stated that *M. sintangensis* inhabits slow-flowing rivers, canals and streams, being more common in open and disturbed sites than forest areas. Johnson (1966) also added that this species requires moderately hard water and cannot be found in waters with very low oxygen content.

Johnson (1968: 236) remarked that in Malaysia this species 'appears to have potential economic value'. In Thailand, it is a common species and is sold in the markets along the Mekong.

Kamita (1974) reported *M. sintangense* from Nepal, but according to his description and illustration, the rostral form, slightly compressed palm, the fingers having grooves, and being pubescent at the proximal half of cutting edges, his specimens should be referred to *M. dayanum* instead.

Macrobrachium sintangense is known with certainty from Borneo, peninsular Malaysia and Thailand. With the shorter convex rostrum, which does not reach beyond the end of antennular peduncle and the more prominent pubescence on the fingers of second pereiopods, *P. elegans* De Man, 1892, which has long been synonymized with *M. sintangense*, should be regarded as a distinct species (D. Wowor, personal communication).

Macrobrachium tratense sp. nov.
(figures 3, 4, 5A)

Material examined

HOLOTYPE: ♂, cl 16.4 mm (ZRC 1997.129), Khlong Fuai, road 3271, 12°23′44.8″N, 102°39′34.5″E, Trat Province, coll. H. H. Tan *et al.*, 15 January 1997.

PARATYPES: 5 ♂♂, cl 12.5–16.8 mm; 5 ♀♀, cl 8.0–11.2 mm (ZRC 2000.2734), eggs 1.1–1.15 × 0.8–0.9 mm, same data as holotype.

Others. Three ♂♂, cl 13–16 mm, 2 ♀♀, cl 11–12 mm (ZRC 1997.123), Klong Pheet (stream), *ca* 35 km from Trat, Chantaburi Province, 12°28′04.5″N, 102°37′07.1″E, coll. H. H. Tan *et al.*, 14 January 1997; 4 ♀♀, cl 9.5–12.5 mm (ZRC 2000.2704), Trat Province, Khlong Huai Raeng, km 18 on road 3271 from Trat to

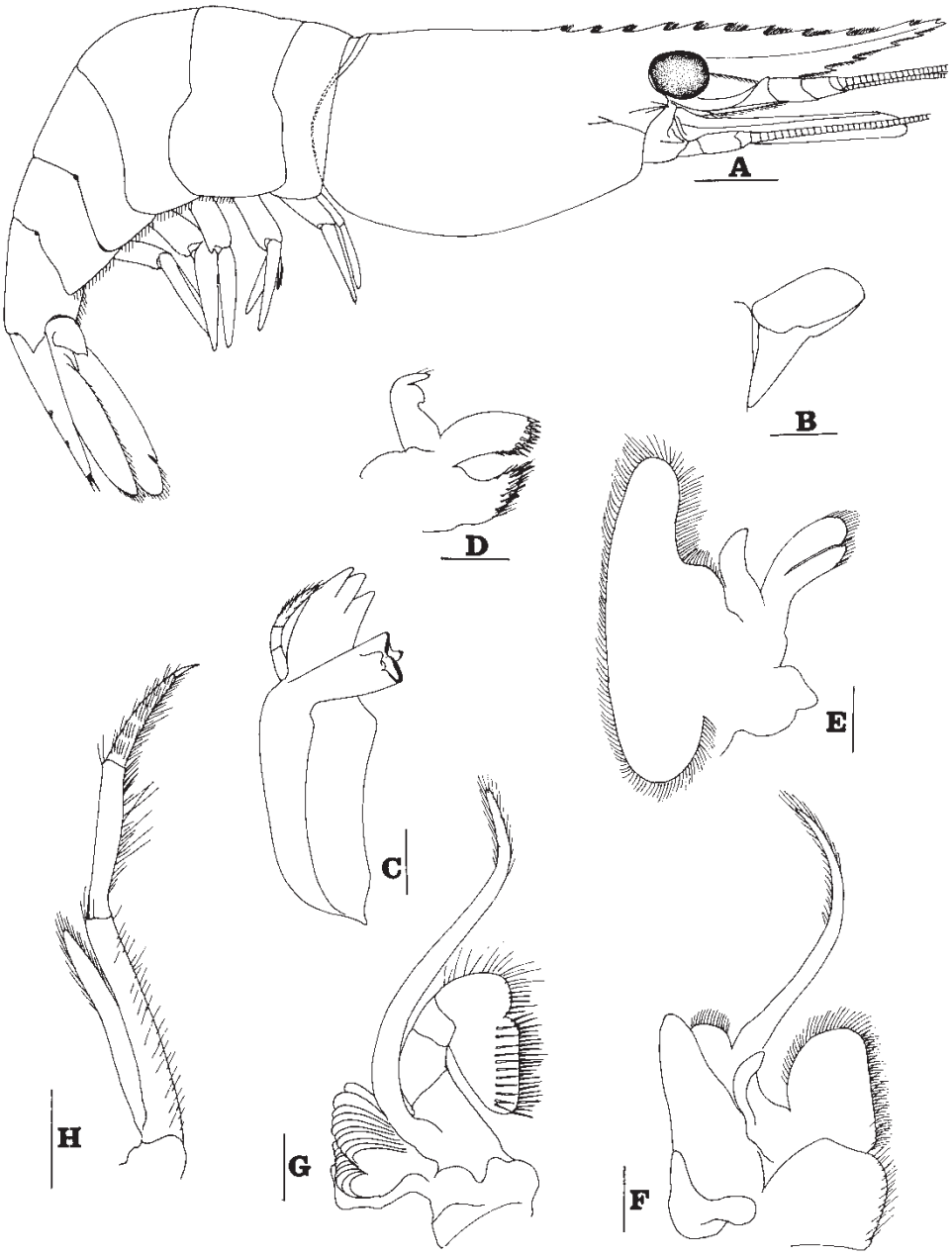


FIG. 3. *Macrobrachium tratense* sp. nov. (♂, cl 16.8 mm, paratype, ZRC 2000.2734, Khlong Fuai (road 3271), 12°23′44.8″N, 102°39′34.5″E, Trat Province, coll. H. H. Tan *et al.*, 15 January 1997). (A) Body; (B) paragnathus; (C) mandible; (D) maxillula; (E) maxilla; (F) first maxilliped; (G) second maxilliped; (H) third pereiopod. Scales: (A) 5 mm; (H) 2 mm; (B–G) 1 mm.

Bo Rai, coll. M. Kottelat *et al.*, 3 December 1993; 2 ♂♂, cl 13.5–14.0 mm, 2 ♀♀, cl 12–17 mm (ZRC 2000.2688), Trat Province, Khlong Huai Raeng, km 18 on road 3271 from Trat to Bo Rai, coll. M. Kottelat *et al.*, 3 December 1993.

Description

Rostrum (figure 4A) straight at base, upcurved along anterior one-quarter of its length, reaching beyond end of scaphocerite, as long as carapace length, dorsal margin of rostrum with 9–12 teeth (mode 11), ventral with five to six (mode 5), two to three (mode two) dorsal teeth behind postorbital margin, occupying about one-third to one-quarter length of carapace, postorbital teeth more widely spaced than others. Antennal spine sharp, situated below inferior orbital angle. Hepatic spine smaller than antennal spine, lying behind and slightly below latter. Carapace smooth.

Third thoracic sternite with indistinct transverse ridge, fourth thoracic sternite with median process (figure 4D). Abdomen (figure 3A) smooth, glabrous, first to third pleurites broadly rounded, fourth and fifth feebly posteriorly produced, fourth subtriangular, fifth subrectangular, sixth abdominal somite 1.6 times as long as fifth, posterolateral angle strongly produced, acute, posteroventral angle feebly produced, subacute. Telson (figure 4F) 1.4 times length of sixth abdominal segment, with two pairs of small dorsal spines, ending in a small acute median point, lateral spines small, smaller than dorsal spines, intermediate spines well developed, with several pairs of long plumose setae. First to third abdominal sternites with transverse ridge, with median tooth in first two (figure 4E), that of second abdominal sternite larger, pointed, that of third sternite less prominent, fourth and fifth sternite with indistinct bluntly triangular ridges. Preanal region unarmed.

Eyes well developed, cornea longer, broader than stalk. Basal segment of antennular peduncle broad. Stylocerite distinctly pointed, reaching middle of basal segment. Anterolateral tooth reaching about middle of second segment. Second segment as long as third segment. Scaphocerite (figure 4B) 3.3 times as long as broad, with straight outer margin.

Epistome as in figure 4C, bilobed by a shallow depression.

Mouth parts as in figure 3. Mandibular palp slender, three-segmented; incisor process robust; metastoma with paragnathus (figure 3B) proximally fused forming a broad corpus with well-developed anterior median depression, paragnaths distally bilobed, upper lobe large, elliptical. Maxillular (figure 3D) palp bilobed, upper lobe slender, lower lobe stout; maxilla (figure 3E) with simple palp, basal endite deeply bilobed, scaphognathite normal; first maxilliped (figure 3F) with setose palp, basal and coxal endites distinct, flagellum of exopod with numerous plumose setae distally, epipod deeply bilobed; second maxilliped (figure 3G) with normal endopod, flagellum with numerous plumose setae distally, epipod simple, with well-developed podobranch; third maxilliped (figure 3H) with robust endopod, exopod with numerous plumose setae distally, reaching to distal margin of ischiomerus.

First pereiopod (figure 4G) very slender, reaching beyond scaphocerite by entire chela, equal in length, similar in form. Palm as long as fingers, carpus 2.4 times as long as chela, merus slightly shorter than carpus, twice as long as ischium. Male second pereiopods (figures 4H, I) equal in length, similar in form. Second pereiopod reaching beyond scaphocerite by carpus, slightly shorter or as long as total body length. Fingers of chela straight, with curved pointed tips, not gaping when closed, cutting edges with sharp ridges except one or two indistinctive denticles proximally at base; slightly shorter than palm. Palm cylindrical, 5.3 times as long as broad. Carpus longer than palm, conical. Merus slightly shorter than palm. Last three pereiopods slender, similar in form. Third pereiopod (figure 4J, K) reaching beyond scaphocerite by one-third of carpus. Dactylus relatively short but slender, 5.7 times

as long as broad. Propodus 3.3 times as long as dactylus, with about 10 spinules on posterior margin. Fifth pereiopod more slender than third one, reaching end of antennular peduncle.

Endopod of male first pleopod with inner margin concave, outer margin convex. Appendix masculina of male second pleopod longer, stouter than appendix interna, with numerous stiff spines.

Uropodal diaeresis with inner movable spine, longer than outer angle. Egg size 0.8–0.9 × 1.1–1.2 mm in diameter.

Etymology

The species is named after the type locality, Trat Province, East Thailand.

Habitat

Macrobrachium tratense was collected from mountain streams from and near Trat, East Thailand.

Remarks

Macrobrachium tratense sp. nov. morphologically resembles *M. inflatum* Liang and Yan, 1985, which was originally described from Kunshan, Jiangsu Province, in eastern China and recently recorded from Xishuangbanna of Yunnan Province (Cai and Dai, 1999). However, it differs from *M. inflatum* (figure 5B–F, M, cl 15.5 mm, paratype, SFU 57-48-04, Kunshan County, Jiangsu Province, eastern China, coll. Liang and Yan, April 1957) by the rostral formula, which has more ventral teeth (five to six versus two to four in *M. inflatum*); the shorter dactylus on third pereiopod (propodus 3.3 times as long as dactylus versus 2.5 times in *M. inflatum*); and the longer diaeresis spine (longer than outer angle versus shorter). With regards to the form of rostrum, in Thailand, *M. tratense* is most similar to *M. sintangense*. But it can easily be distinguished from *M. sintangense* by the second pereiopods which are smooth and have no velvety setae or tubercles on the fingers (versus covered by spinules on whole leg, with velvety setae on basal half of the fingers and with tubercles on the inner margin of the fingers); the less prominent median processes on the first two abdominal sternites (cf. figure 4E with 2D), and the larger uropodal diaeresis spine (longer than outer angle versus shorter).

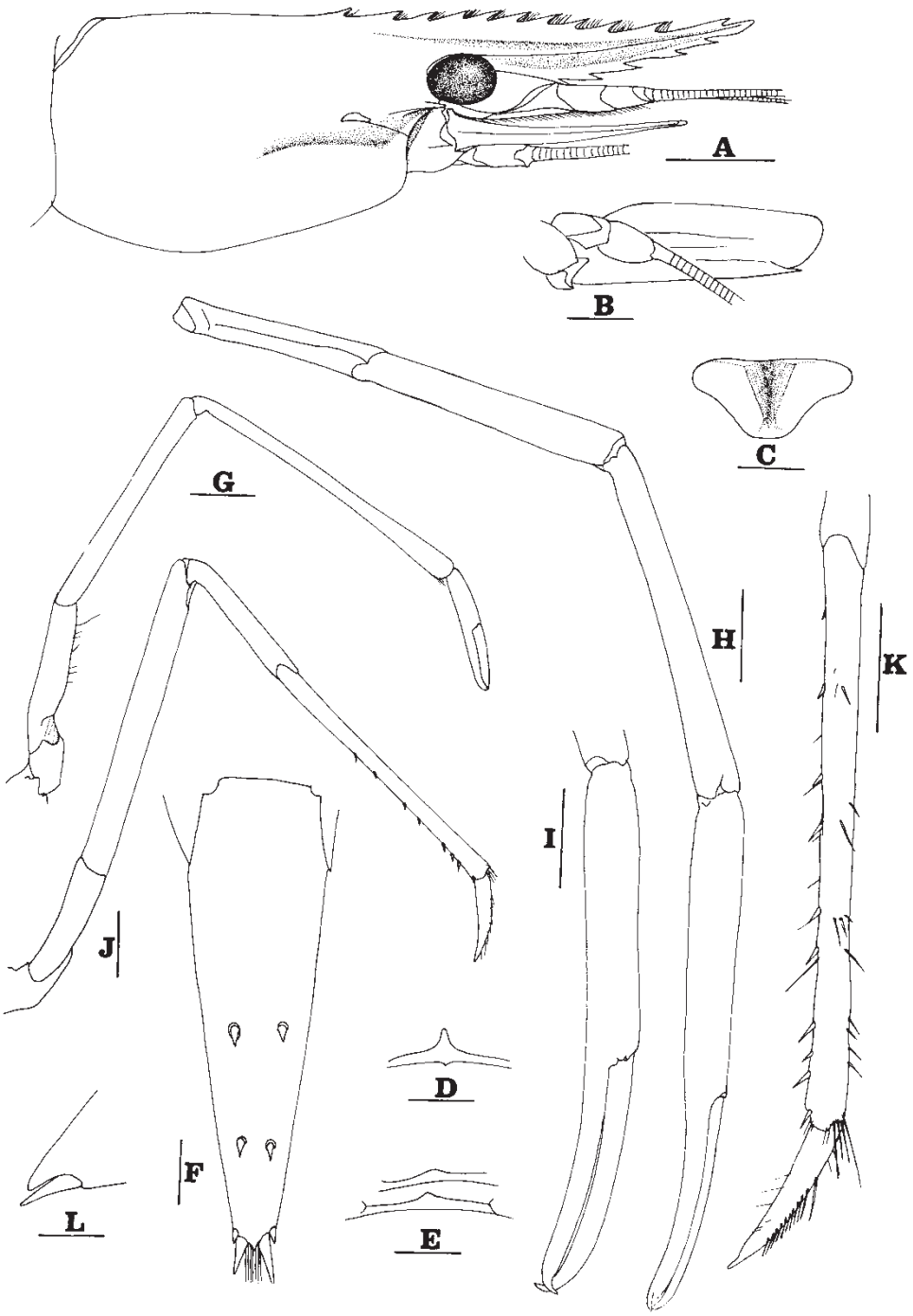
Macrobrachium dolatum sp. nov.
(figures 6, 7)

Material examined

HOLOTYPE: ♂, cl 22.5 mm (ZRC 2000.2644), Trang, South Thailand, 29 October 1988.

PARATYPE: 1 ♂, cl 20 mm (CU 1997.105), same data as holotype.

FIG. 4. *Macrobrachium tratense* sp. nov. (♂, cl 16.4 mm, holotype, ZRC 1997.129, Khlong Fuai (road 3271), 12°23′44.8″N, 102°39′34.5″E, Trat Province, coll. H. H. Tan *et al.*, 15 January 1997). (A) Cephalothorax; (B) scaphocerite; (C) epistome; (D) fourth thoracic sternite with a small median process; (E) first two abdominal sterna with transverse ridge, with median processes; (F) telson; (G) first pereiopod; (H) second pereiopod; (I) chela of second pereiopod; (J) third pereiopod; (K) propodus and dactylus of third pereiopod; (L) movable spine of uropodal diaeresis. Scales: (A, B, H, I) 5 mm; (G, J, K) 2 mm; (C, D, E, F) 1 mm; (L) 0.5 mm.



Description

Rostrum (figure 7A) reaching to or slightly beyond end of scaphocerite, dorsal margin sinuous, 0.65 times as long as carapace length, dorsal margin of rostrum

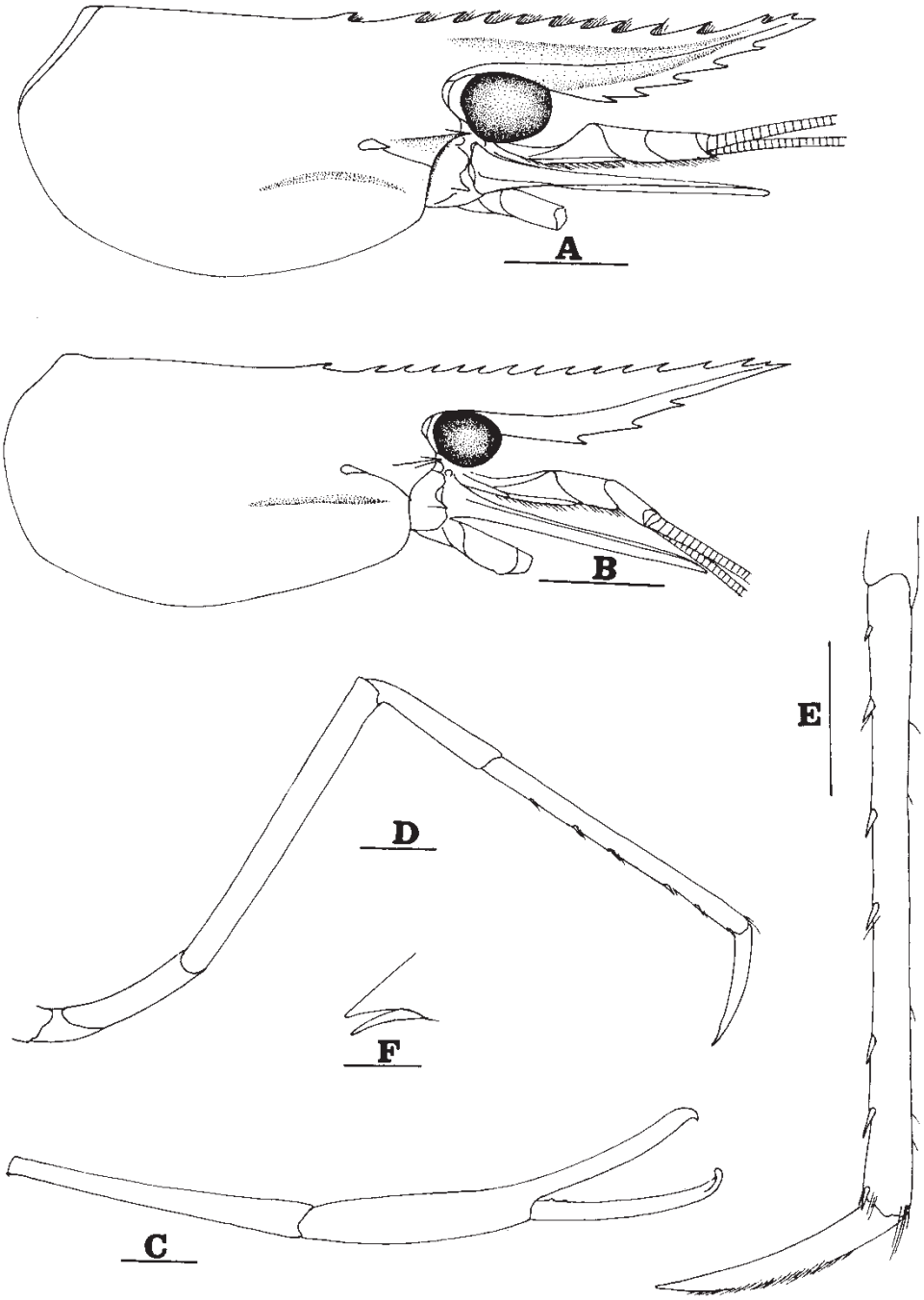


FIG. 5. *Macrobrachium tratense* sp. nov. (♀, cl 11.2 mm, paratype, ZRC 2000.2734, Khlong Fuai (road 3271), 12°23′44.8″N, 102°39′34.5″E, Trat Province, coll. H. H. Tan *et al*., 15 January 1997): (A) Cephalothorax. *Macrobrachium inflatum* (♂, cl 15.6 mm, paratype, SFU 57-48-04, Kunshan County, Jiangsu province, eastern China, coll. Liang and Yan, April 1957): (B) cephalothorax; (C) carpus and chela of second pereiopod; (D) third pereiopod; (E) propodus and dactylus of third pereiopod; (F) movable spine of uropodal diaeresis. Scales: (B) 5 mm; (A) 3 mm; (C, D, E) 2 mm; (F) 0.5 mm.

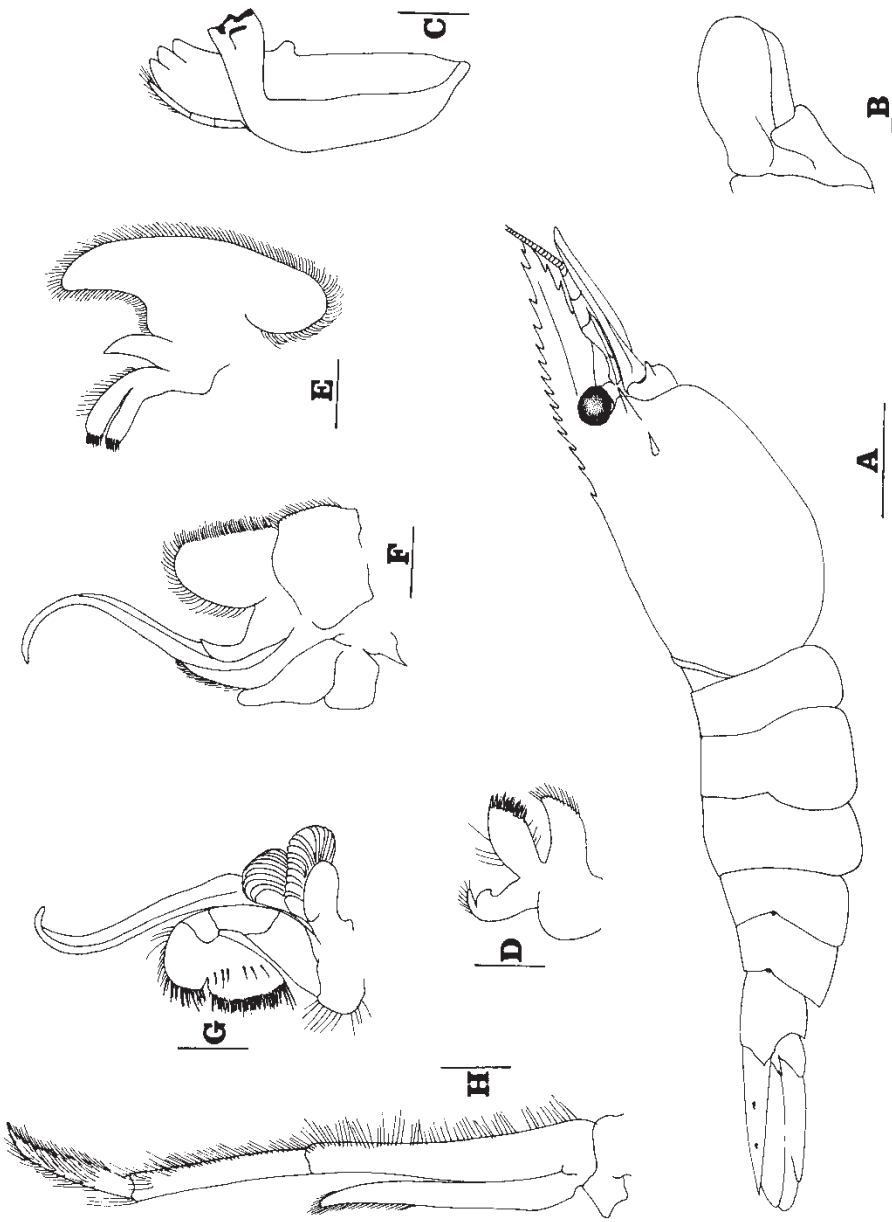


FIG. 6. *Macrobrachium dolatum*, sp. nov. (♂, cl 22.5 mm, holotype, ZRC 2000.2644, Trang, south Thailand). (A) Body; (B) paragnathus; (C) mandible; (D) maxillula; (E) maxilla; (F) first maxilliped; (G) second maxilliped; (H) third pereiopod. Scales: (A) 5 mm; (B) 1 mm; (C–H) 2 mm.

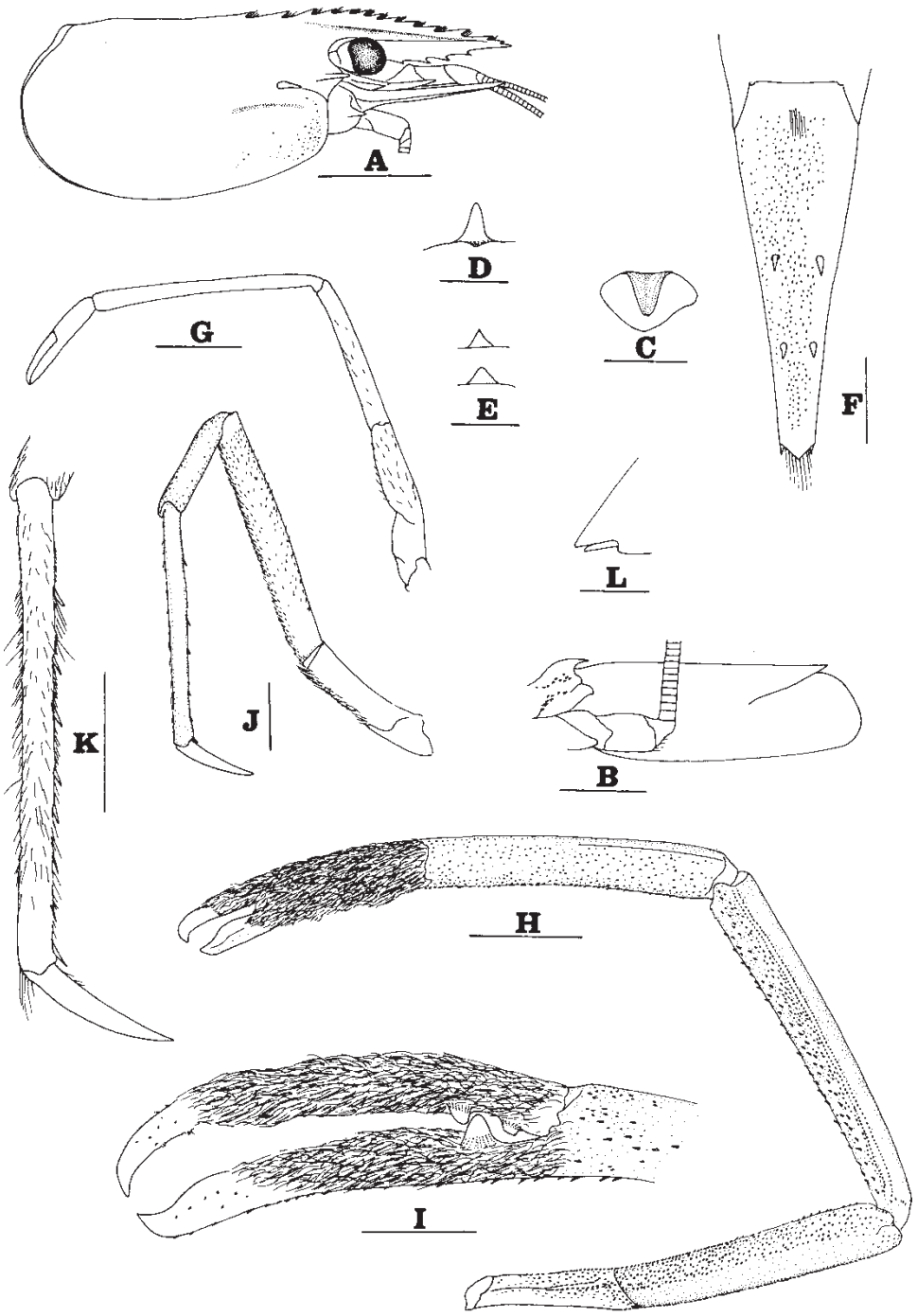


FIG. 7. *Macrobrachium dolatum*, sp. nov. (♂, cl 22.5 mm, ZRC 2000.2644, Trang, south Thailand). (A) Cephalothorax; (B) scaphocerite; (C) epistome; (D) fourth thoracic sternite with a small median process; (E) first two abdominal sterna with transverse ridge, with median processes; (F) telson; (G) first pereiopod; (H) second pereiopod; (I) chela of second pereiopod; (J) third pereiopod; (K) propodus and dactylus of third pereiopod; (L) movable spine of uropodal diaeresis. Scales: (A–C, F–H) 5 mm; (D, E, J–L) 2 mm; (I) 2.5 mm.

with 13 teeth, ventral with four teeth, three dorsal teeth behind postorbital margin, occupying about one-third length of carapace, postorbital teeth more widely spaced than others. Antennal spine sharp, situated slightly below inferior orbital angle. Hepatic spine smaller than antennal spine, lying behind and slightly below antennal spine. Carapace with fine spinules.

Third thoracic sternite with indistinct transverse ridge, fourth thoracic sternite with prominent median process (figure 7D). Abdomen (figure 6A) smooth, glabrous, first to third pleurites broadly rounded, fourth and fifth feebly posteriorly produced, fourth and fifth subtriangular, sixth abdominal somite 1.3 times as long as fifth, posterolateral angle strongly produced, acute, posteroventral angle feebly produced, subacute. Telson (figure 7F) 1.8 times length of sixth abdominal segment, with two pairs of small dorsal spines, ending in a small acute median point, lateral spines small, smaller than dorsal spines, intermediate spines well developed, with several pairs of long plumose setae. First to third abdominal sternites with transverse ridge, with median tooth in first two sternites (figure 7E), that of second abdominal sternite larger, pointed, that of third indistinct. Preanal region unarmed.

Eyes well developed, cornea longer, broader than stalk. Basal segment of antennular peduncle broad. Stylocerite distinctly pointed, reaching middle of basal segment. Anterolateral tooth reaching about middle of second segment. Second segment as long as third segment. Scaphocerite (figure 7B) 2.8 times as long as broad, with straight outer margin.

Epistome as in figure 7C, bilobed by a deep depression.

Mouth parts as in figure 6. Mandibular palp slender, three-segmented; incisor process robust (figure 6C); metastoma with paragnathus (figure 6B) proximally fused forming a broad corpus with well-developed anterior median depression, paragnaths distally bilobed, upper lobe large, elliptical. Maxillular (figure 6D) palp bilobed, upper lobe slender, lower lobe stout; maxilla (figure 6E) with simple palp, basal endite deeply bilobed, scaphognathite normal; first maxilliped (figure 6F) with setose palp, basal and coxal endites distinct, flagellum of exopod with numerous plumose setae distally, epipod deeply bilobed; second maxilliped (figure 6G) with normal endopod, flagellum with numerous plumose setae distally, epipod simple, with well-developed podobranch; third maxilliped (figure 6H) with robust endopod, exopod with numerous plumose setae distally, reaching to distal margin of ischiomerus.

First pereiopod (figure 7G) slender, reaching beyond scaphocerite by entire chela, equal in length, similar in form. Palm as long as fingers, carpus 2.2 times as long as chela, merus shorter than carpus. Male second pereiopods (figure 7H) equal in length, similar in form. Second pereiopod reaching beyond scaphocerite by one-quarter of merus, distinctly longer than total length. Fingers (figure 7I) covered by dense velvety pubescence on proximal two-thirds of length; both fingers curved inwards, with tips crossing when fingers closed, small gaping, one large tooth at proximal sixth of fixed finger, two large teeth at proximal one-quarter of movable finger, tooth at fixed finger larger than those of movable finger, fitting into gap between smaller teeth of movable finger when closed; cutting edge of distal one-third of the fixed finger with razor-like edge; cutting edge of movable finger with two small granules; fingers slightly shorter than palm. Palm cylindrical, 6.0 times as long as broad. Carpus distinctly shorter than chela, longer than palm. Merus slightly shorter than palm. Last three pereiopods slender, similar in form. Third pereiopod (figure 7J, K) reaching beyond scaphocerite by one-quarter of carpus. Dactylus short but slender, 5.8 times as long as broad. Propodus 3.1 times as long as dactylus, with

about 10 spinules on posterior margin. Fifth pereiopod more slender than third one, with entire dactylus reaching beyond end of scaphocerite.

Endopod of male first pleopod reaching half of exopod, with inner margin concave, outer margin convex. Appendix masculina of male second pleopod longer, stouter than appendix interna, with numerous stiff spines.

Uropodal diaeresis with inner movable spine (figure 7L), shorter than outer angle.

Etymology

The name of the species is adopted from the Latin, *dolo*, for cut and hew, alluding to the razor-like cutting edge of the fixed finger.

Habitat

Unknown.

Remarks

Macrobrachium dolatum sp. nov. resembles *M. sintangense* (De Man, 1898). However, it can be distinguished from *M. sintangense* by the form of the rostrum, which is sinuous along the dorsal margin (straight in *M. sintangense*); the distinct and sharp median process on the fourth thoracic sternite and the first two abdominal sternites (figure 7D, E versus figure 2C, D); the stouter second pereiopod (figure 7H versus figure 2H); the cutting edge of the distal one-third of the fixed finger with razor-like edge (versus cutting edge not razor-like in *M. sintangense*); and the relatively shorter spine at the uropodal diaeresis (shorter than outer angle versus longer or as long as in *M. sintangense*).

Macrobrachium malayanum (Roux, 1934)

Palaemon (Macrobrachium) pilimanus malayanus Roux, 1934: 32 [type locality: Lasah, Plus valley, Perak, Malaysia].

Macrobrachium geron Holthuis, 1950: 258, figure 52 [type locality: Banka island off Sumatra, Indonesia]; Holthuis, 1980: 91; Johnson, 1961: 57.

Macrobrachium malayanum: Chong and Khoo, 1987b: 903; Ng and Choy, 1990: 13; Ng, 1992: 793.

Material examined

South Thailand. Two ovigerous ♀♀, cl 12.0–14.3 mm, eggs with eye spot, 1.3 × 0.9 mm, (ZRC 2000.2645), Narathiwat Province, Nam Tok Sipo, downstream area, 6°16.06′N, 101°38.65′E, coll. H. H. Tan *et al.*, 24 October 1998.

Diagnosis

Rostrum straight, reaching to or slightly beyond end of scaphocerite; rostral formula: 3–4 + 5–8/3–6 (mode 3–4). Male second pereiopods unequal in length, dissimilar in form; carpus shorter than merus and chela, fingers shorter than palm; two teeth present on cutting edges of fingers, with two to three smaller ones posterior of proximal large teeth; palm inflated; entire chela of large leg covered with dense carpet of soft, short velvety pubescence; small spinules present on surface of palm; movable spine on uropodal diaeresis longer than outer angle. Ovigerous females with eggs 1.3 × 0.9 mm in diameter.

Remarks

Only two ovigerous Thai specimens were available. The specimens agree well with the description by Chong and Khoo (1987b). This is the northernmost record for *M. malayanum*, and also a new record for Thailand. *Macrobrachium malayanum* is distributed throughout the Malay Peninsula, Borneo and Sumatra (Roux, 1934; Holthuis, 1950; Chong and Khoo, 1987a; Ng and Choy, 1990; Ng, 1992), and its presence in southern Thailand is not unexpected.

Macrobrachium trompii (De Man, 1898)

Palaemon trompii De Man, 1898: 144, pl. 7 [type locality: Borneo].
Palaemon (Parapalaemon) thienemanni Roux, 1932: 570, figure a, b [Sumatra, Indonesia].
Palaemon (Parapalaemon) trompii armatus Roux, 1936: 30 [type locality: Gunong Pulai, Malaysia].
Macrobrachium trompii: Holthuis, 1950: 211; 1980: 106; Johnson, 1961: 57; 1968: 236; Ng and Choy, 1990: 309, figure 1E–H; 1990b: 13; Ng and Chong, 1992: 46, figures 1–3.

Material examined

South Thailand. One ovigerous ♀, cl 10.3 mm, eggs 1.6 × 1.1 mm (ZRC 2000.2646), Satun Province, stream in Ban Kong Kruat, pH 6.0, coll. M. Kottelat, 4 November 1995; 3 ♂♂, cl 8.5–13.5 mm, 8 ♀♀, cl 5.5–10.5 mm, 3 ovigerous ♀♀, cl 10.0–11.0 mm, eggs 1.3 × 0.9 mm (ZRC 2000.2647), Narathiwat Province, stream along road, branching west at about km 7 on road from Waeng to Ban Bu Ke Ta, pH 6.8, coll. M. Kottelat, 2 November 1995; 3 ♀♀, cl 10–10.54 mm (ZRC 2000.2700), southern Thailand, coll. M. Kottelat, November 1995.

Diagnosis

Rostrum upturned distally, reaching to or slightly beyond end of scaphocerite. Rostral formula 4–7(5–6) + 5–6/3–5. Second pereiopods subequal, long, slender; carpus slightly longer than merus and palm but shorter than chela; in large adult, carpus may be shorter than palm; carpus and merus with scattered tubercles; chela with moderately dense tufts of very short pubescence on fingers and palm; fingers with five or six teeth on proximal quarter of cutting edges, distal two teeth larger than proximal; movable spine on uropodal diaeresis longer than outer angle. Ovigerous females with eggs 1.6 × 1.1 mm in diameter.

Remarks

Macrobrachium trompii is commonly found in highly acidic waters of freshwater and peat swamp forests, and is known from many parts of peninsular Malaysia, Borneo and Sumatra (Holthuis, 1950; Ng and Choy, 1990; Ng and Chong, 1992). The two samples we examined were caught from somewhat less acidic water with a pH of 6.0 and 6.8. This is the first record of this species from Thailand.

Macrobrachium thai sp. nov.
(figures 8, 9)

Material examined

HOLOTYPE: ♂, cl 14.0 mm, Nong Khai, north-east Thailand, 14 December 1990 (ZRC 2000.2648).

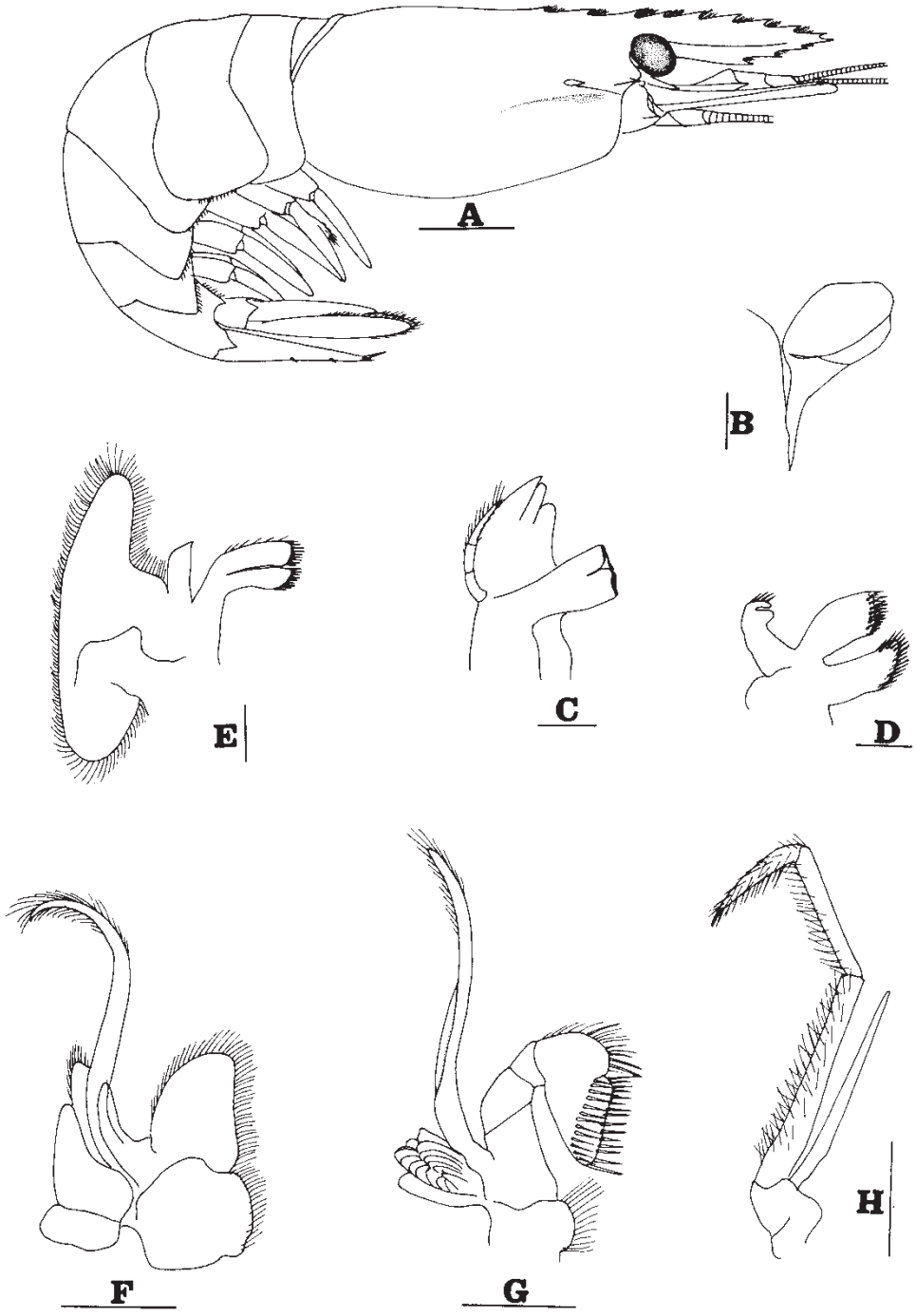


FIG. 8. *Macrobrachium thai*, sp. nov. (♂, cl 11.5 mm, paratype, CU 1997–99a, Nong Khai, north-east Thailand, 14 December 1990). (A) Body; (B) paragnathus; (C) mandible; (D) maxillula; (E) maxilla; (F) first maxilliped; (G) second maxilliped; (H) third pereiopod. Scales: (A) 5 mm; (F–H) 2 mm; (B–E) 1 mm.

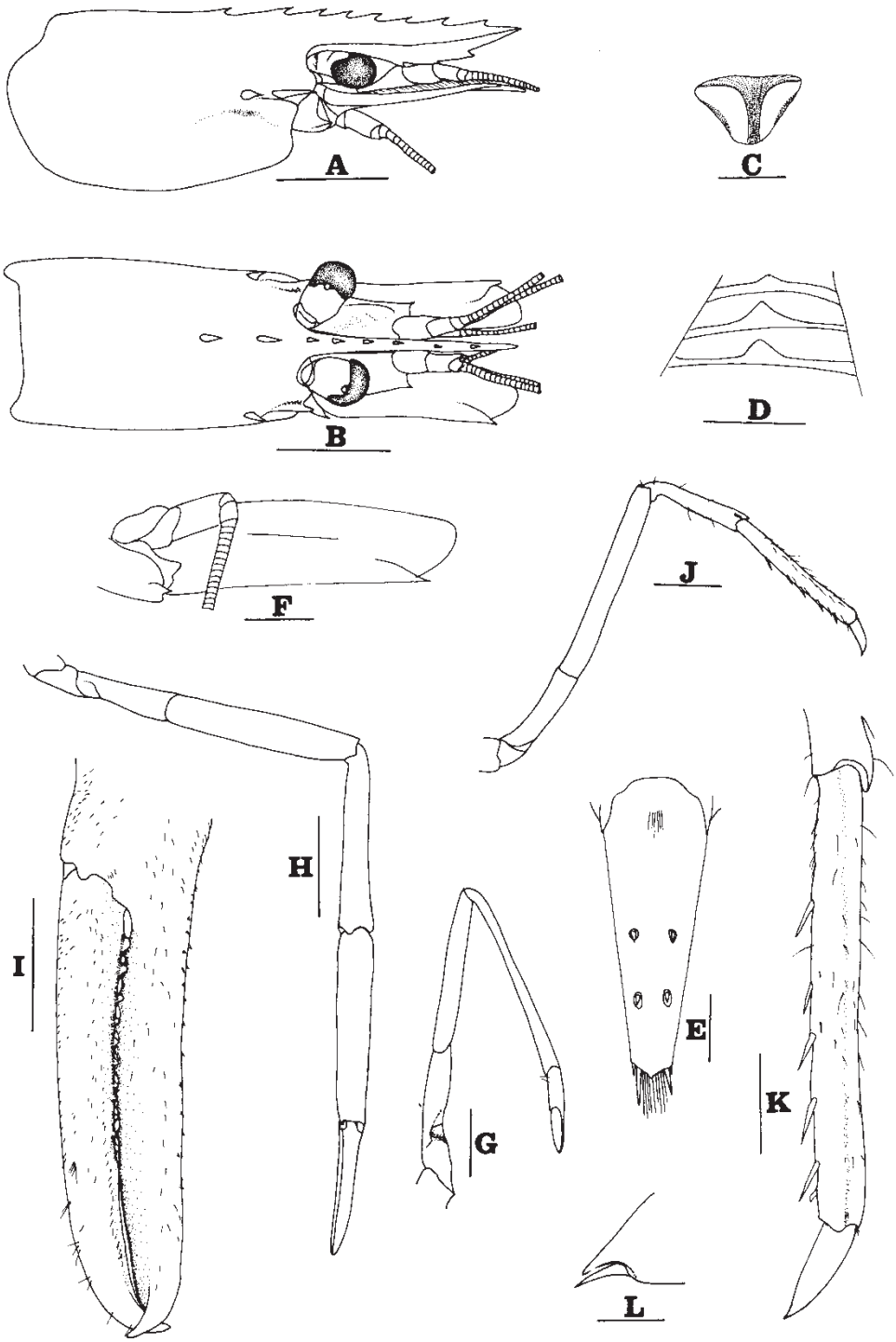


FIG. 9. *Macrobrachium thai*, sp. nov. (♂, cl 11.5 mm, paratype, CU 1997–99a, Nong Khai, north-east Thailand, 14 December 1990). (A) Cephalothorax, lateral view; (B) cephalothorax, dorsal view; (C) epistome; (D) first two abdominal sterna with transverse ridge, with median processes; (E) telson; (F) scaphocerite; (G) first pereiopod; (H) second pereiopod; (I) fingers of second pereiopod; (J) third pereiopod; (K) propodus and dactylus of third pereiopod; (L) movable spine of uropodal diaeresis. Scales: (A, B) 5 mm; (H) 3 mm; (D–G, I–K) 2 mm; (C, L) 0.5 mm.

PARATYPES: 6 ♂♂, cl 10.5–14.0 mm, 8 ♀♀, cl 10.0–13.0 mm (CU 1997.99), same data as holotype.

Other specimens. *Central Thailand.* Nine specimens (CU 1997.173), Kaeng Khoi, Saraburi, no date.

East Thailand. Two ♂♂, cl 10.5–11.0 mm (CU 1997-106), Prachinburi, coll. P. Naiyanetr, 28 October 1980.

North-east Thailand. Eight ♂♂, cl 10.2–14.3 mm, 1 ovigerous ♀, cl 8.8 mm (ZRC 2000.2713), Yasothon, 12 March 1994; 6 ♂♂, cl 8.8–10.3 mm, 4 ovigerous, ♀♀, cl 5.7–5.8 mm, 21 specimens, cl 7.5–9.5 mm (ZRC 2000.2721), Phibun Mangsahan Market, 46 km east to Ubon Rachathani, coll. Y. Cai, 16 June 1998; 64 ♂♂, cl 6.8–8.8 mm, 26 ovigerous ♀♀, cl 6.5–7.5 mm, eggs 1.7 × 0.9 mm (ZRC 2000.2679), Khan Tit, 800 m turn off from Wiang Bun, 90 km to Chiang Khan, small stream 0.1–0.5 m in depth, 1–3 m in width, near a bamboo forest and rice field, 18°7′49.8″N, 102°11′0.5″E, coll. Y. Cai *et al.*, 19 June 1998; 14 ♂♂, cl 6.5–9.8 mm, 5 ♀♀, cl 8.5–13.6, 5 ovigerous ♀♀, cl 10.6–12.0 mm, eggs with eyes, 1.4 × 0.95 mm (ZRC 2000.2724), Warin Chamrap Market, coll. Y. Cai, 17 June 1998; 12 ♂♂, cl 6.5–9.0 mm, 4 ♀♀, cl 9.0–13.5 mm, 5 ovigerous ♀♀, cl 10.5–12 mm (ZRC 2000.2714), Phulangka waterfall (Nam Tok) National Park, downstream grass and hard mud bank, flooded-covering 1 m aside ground grass, cool water, 17°57′18.9″N, 104°09′35.8″E, coll. Y. Cai and Y. Y. Goh, 18 June 1998; 9 ♂♂, cl 7–11 mm, 6 ♀♀, cl 7–10 mm, 14 ovigerous ♀♀, cl 7.5–11.5 mm, 37 juveniles (ZRC 2000.2725), lake 20 km south from Nakhon Phanom, pH 6.6, coll. Y. Cai and Y. Y. Goh, 17 June 1998.

Description

Rostrum (figures 8A, 9A, B) straight, reaching to distal end of scaphocerite, tip slightly upturned; rostral formula: 2–3 (mode 2) + 5–8 (mode 6–7)/2–3 (mode 3). Teeth placed more widely posteriorly than anteriorly. Antennal spine below inferior orbital angle, hepatic spine small, located just behind antennal spine, nearly at same level. Antennular peduncle about 0.6 times as long as carapace. Antennal spine sharp, situated below lower orbital angle. Carapace smooth.

Fourth thoracic sternite without median process. Abdomen (figure 8A) smooth, glabrous, first to third pleurites broadly rounded, fourth and fifth feebly produced posteriorly, fourth subtriangular, fifth subrectangular; sixth abdominal somite 1.3 times as long as fifth one, with posteroventral angle feebly produced, subacute. Telson (figure 9E) 1.2 times as long as sixth abdominal segment, with two pairs of dorsal spines, ending in a small acute median point, latter spines small, smaller than dorsal spines, intermediate spines well developed, with about six pairs of long plumose setae. First to third abdominal sternites (figure 9D) with transverse ridge and a median tooth, that of second abdominal sternite most prominent, that of first abdominal sternite less prominent, that of third one smaller than previous two. Preanal region with small ridge, smooth.

Eyes (figure 9A, B) well developed, cornea longer, broader than stalk. Basal segment of antennular peduncle broad. Stylocerite distinctly pointed, reaching middle of basal segment. Antenna (figure 9F) with stout basicerite, with strong distoventral tooth, carpocerite reaching to about 0.4 times of scaphocerite length. Scaphocerite slender, about four times as long as wide, with straight outer margin.

Epistome as in figure 9C, bilobed by a shallow depression. Mouthparts typical of genus (figure 8B–H).

First pereiopod (figure 9G) reaching beyond distal end of scaphocerite by entire chela, propodus 2.6 times as long as chela, chela with fingers as long as palm. Second pereiopods (figures 9H, I) of male unequal in length, similar in form. Major second pereiopod distinctively longer than body length, reaching with one-sixth length of carpus beyond distal end of scaphocerite, carpus slightly shorter than, or as long as merus, distinctively shorter than palm; fingers short, about 0.3–0.4 times length of palm, cutting edge with a row of 10–20 small teeth at proximal two-thirds or along entire cutting margin. Minor second pereiopod about same length as body. Third pereiopod (figure 9J, K) reaching end of scaphocerite, propodus nine times as long as broad, 4.2 times as long as dactylus; dactylus 3.5 times as long as wide, terminating in small claw.

Uropodal diaeresis with a spine (figure 9L) longer than outer angle. Ovigerous female with egg 1.55×1.10 mm in diameter.

Etymology

Macrobrachium thai is named after the type locality. The name is used as a noun in apposition.

Habitat

The present new species was found from mountain streams and small rivers in central and north-eastern Thailand.

Remarks

With respect to the form of the rostrum and second pereiopod, *Macrobrachium thai* sp. nov. is most similar to *M. vietnamense* Dang, 1975, described from northern Vietnam. *Macrobrachium thai* can, however, easily be distinguished from *M. vietnamense* by the rostrum, which has fewer postorbital teeth (two to three, mode two versus four); the smaller egg size (1.55×1.1 mm versus $1.9–2.0 \times 1.3–1.45$ mm) and the teeth along the cutting edges of the fingers of the second pereiopod possessing a row of 10–13 small teeth (versus with only two large teeth) (cf. Dang, 1975). *Macrobrachium thai* is also similar to *M. mieni* Dang, 1975, from Vietnam, central and north-east Thailand in the form of rostrum and the second pereiopods, but can be differentiated by the fingers of the second pereiopod having more teeth on the cutting edge (10–20 versus 8–10); the propodus of the third pereiopod is 4.2 times as long as the dactylus (versus 3.4 times), and the movable spine on the uropodal diaeresis is longer than outer angle (versus shorter).

Macrobrachium niphanae Shokita and Takeda, 1989

Macrobrachium niphanae Shokita and Takeda, 1989: 147, figures 1a–o, 2a–g, pl. 1 [type locality: Nang Rong waterfall, Klong Yai and Khao Chamao, Thailand].

Macrobrachium secamanense Dang, 1998: 1, figure 1 [type locality: Buon luoi, Tay Nguyen and Secaman, southern Laos].

Material examined

West Thailand. Four ovigerous ♀♀, cl 6.8–8.0 mm, eggs 1.8×1.3 mm (ZRC), Prachuap Khiri Khan Province, Thap Sakae District, stream under bridge of road to Ban Wong Hoi, 11°26′54.8″N, 99°28′58.2″E, coll. D. Yeo *et al.*, 13 August 1997.

Central Thailand. Thirty specimens, cl 7.8–8.2 mm (ZRC 2000.2649), Saraburi Province, Muang Saraburi Phu Khae National Park, coll. D. Yeo and Y. Cai, 9 August 1997; 1 ♂, cl 9.6 mm (CU 1997.134), Uthaithani, 30 January 1982; one specimen, Lan Sak, Uthaithani, 30 January 1982; 2 ovigerous ♀♀, cl 7.0–9.0 mm (CU), waterfall at Chai Badon, Lop Buri, coll. P. Naiyanetr, 20 October 1979.

East Thailand. One ♂, cl 9.5 mm, 4 ♀♀, cl 6.4–9.0 mm, 5 ovigerous ♀♀, cl 7.0–9.2 mm (ZRC 1997.126), Chantaburi Province, downstream of Nam Tok Phliu (waterfall), 12°31′14.0″N, 102°10′36.1″E, coll. H. H. Tan *et al.*, 14 January 1997; 6 ♂♂, cl 8.0–9.5 mm, 15 ovigerous ♀♀, cl 7.2–8.8 mm, eggs 1.8 × 1.2 mm (ZRC 1997.114), Trat Province, Klong Kwan near Ban Klong Kwan (village), 120°19′36.6″N, 102°38′6.5″E, coll. H. H. Tan *et al.*, 15 January 1997.

South Thailand. Sixteen ovigerous ♀♀, cl 6.8–8.4 mm (ZRC 2000.2660), Ranong Province: Kapoe District: Klong Ban Man waterfall, along highway 4 milestone 22 km to Kapoe, 9°27′24.2″N, 98°30′31.1″E, coll. D. C. J. Yeo *et al.*, 12 August 1997; 1 ♂, cl 9.5 mm, 1 ovigerous ♀, cl 8.2 mm, eggs 1.8 × 1.2 mm (ZRC 2000.2653), Satun Province, Khlong Wang Pheniat at Ban Tha Khong, pH 6.1, coll. M. Kottelat, 4 November 1995.

Thai specimens with no specific locality. One ovigerous ♀♀ (CU 1996.102), cl 7.0 mm.

Diagnosis

Rostrum straight, reaching slightly beyond end of antennular peduncle, rostral formula: 2–3 + 5–8/2–3. Scaphocrite 3.6 times as long as wide. Second pereiopods cylindrical, unequal in length but similar in form; major leg longer than body, merus longer than carpus, carpus shorter than palm; both merus and carpus covered with very fine velvety pubescence, that of merus sometimes absent. Fingers distinctly shorter than palm; with more than 20 small denticles along entire cutting edge. Third pereiopod with propodus three times as long as dactylus; movable spine on uropodal diaeresis slightly longer than outer angle. Ovigerous females with eggs 1.10–1.20 × 1.5–1.80 mm in diameter.

Remarks

The present specimens from Thailand agree well with the original description of *M. niphanae*, although we observe some variation in the density of the velvety pubescence of the second pereiopod. The carpus, as a rule, is always covered by short velvety pubescence, but the pubescence on the merus and ischium can sometimes be scarce.

Dang (1998: 1) recently described a new species, *M. secamanense*, from southern Laos. This species has a setose carpus and merus of the second pereiopod, almost identical to the condition in *M. niphanae*, and according to the measurements provided in his table, the ratio of the various joints are also almost exactly the same as *M. niphanae*. Dang (1998: 1) compared his new species with *M. sabanus* Ng, 1995 and *M. lar* (Fabricius, 1798), and was apparently unaware of the description of *M. niphanae* by Shokita and Takeda (1989). The present authors can find no difference between *M. niphanae* and *M. secamanense*. Both species also come from the same drainage, the Mekong. As such, *M. secamanense* Dang, 1998, is here synonymized with *M. niphanae* Shokita and Takeda, 1989.

Macrobrachium yui Holthuis, 1950
(figure 10)

Palaemon brevicarpus var. *heterochirus* Yu, 1936: 305, figures 1, 2 [type locality: Ninger, Puer County, Yunnan, China].

Macrobrachium yui: Holthuis, 1950: 211; Liu *et al*., 1990: 123, figure 20; Naiyanetr, 1992: 18; Cai and Dai, 1999: 237.

Macrobrachium yeti Dang, 1975: 67, figure 1 [type locality: northern Vietnam]; Dang, 1980: 386, figures 221.

Material examined

North Thailand. One ♀, cl 8.0 mm, 1 ovigerous ♀, cl 12.6, eggs 1.9 × 1.5 mm (ZRC 2000.2708), Mae Hong Song: Nae Mae Yuam basin: Nam Tok Natae Rachan, innamed torrent, 16 road-km east of Ban Mae La Noi, coll. M. Kottelat and K. Kubota, 9 April 1998; 1 ♀, cl 13.3 mm (ZRC 2000.2707), Mae Hong Son, Nam Mae Sarieng at dam upriver of Mae Sarieng, coll. M. Kottelat and K. Kubota, 9 April 1998; 1 ♀, cl 13.0 mm, 1 ovigerous ♀, cl 7.5 mm, eggs 1.2 × 0.85 mm (ZRC 2000.2697), Carp Paliu Cheh Mae Nam Khwae Noi basin, Nam Khung near Ban Huai Pak Khungm coll. M. Kottelat and K. Kubota, 4 April 1998; 1 ♂, cl 20.0 mm (CU 1997.95), Mae Hong Son, 7 December 1980; 1 ♂, cl 24.0 mm (ZRC 2000.2730), Mae Hong Son, 23 March 1978; 2 ♂♂, cl 11.5–27.0 mm, 1 ♀, cl 15.0 mm (CU 1997.111), Mae Hong Son, coll. C. Vidthayanon, no date; 3 ♂♂, Chiang Dao, Chiang Mai, no data; 23 specimens (CU 1997.88), Chai Badan and Lopburi, coll. P. Naiyanetr, 16 June 1982; 2 ♂♂, cl 26–27 mm, 4 ♀♀, 13–20 mm (ZRC 2000.2654), Pai river near Lod Cave, Mae Hong Son, coll. C. M. Yang and T. B. Lim, 9 September 1998; 3 ♂♂, cl 13.5–15 mm, 4 ♀♀, cl 11–17 mm (ZRC 2000.2655), Pai river near Lod Cave, Mae Hong Son, coll. C. M. Yang and T. B. Lim, 9 September 1998.

Diagnosis

Rostrum slightly convex, reaching to base of third segment of antennular peduncle, or to end of this segment. Rostral formula: 3–5 + 5–8/1–3. Hepatic spine small. Antennular peduncle 0.4 times as long as carapace. Scaphocerite 2.6 times as long as wide. First pereiopod reaching with one-third of carpus beyond distal end of scaphocerite; chela with fingers shorter than palm, 0.55 times as long as propodus. Second pereiopods of male unequal in length, similar in form. Major second pereiopod reaching with one-third of carpus beyond distal margin of scaphocerite; carpus slightly shorter than merus, palm inflated, longer than merus, slightly shorter than fingers; fingers with five to six teeth on proximal third of cutting edge. Whole leg covered by tiny spinules. Second pereiopods of female much shorter than that of male, equal in length, similar in form. Third pereiopod reaching beyond scaphocerite by half length of propodus, propodus eight times as long as broad, three times as long as dactylus; dactylus with a long, slender claw, 3.2 times as long as broad. Uropodal diaeresis without spine in adult but with a small spine in young. Ovigerous female with eggs 1.5–1.6 × 1.1–1.2 mm in diameter.

Habitats

Macrobrachium yui is commonly found in fast flowing waters, and it seems like to hide in the crevices between granitic rock.

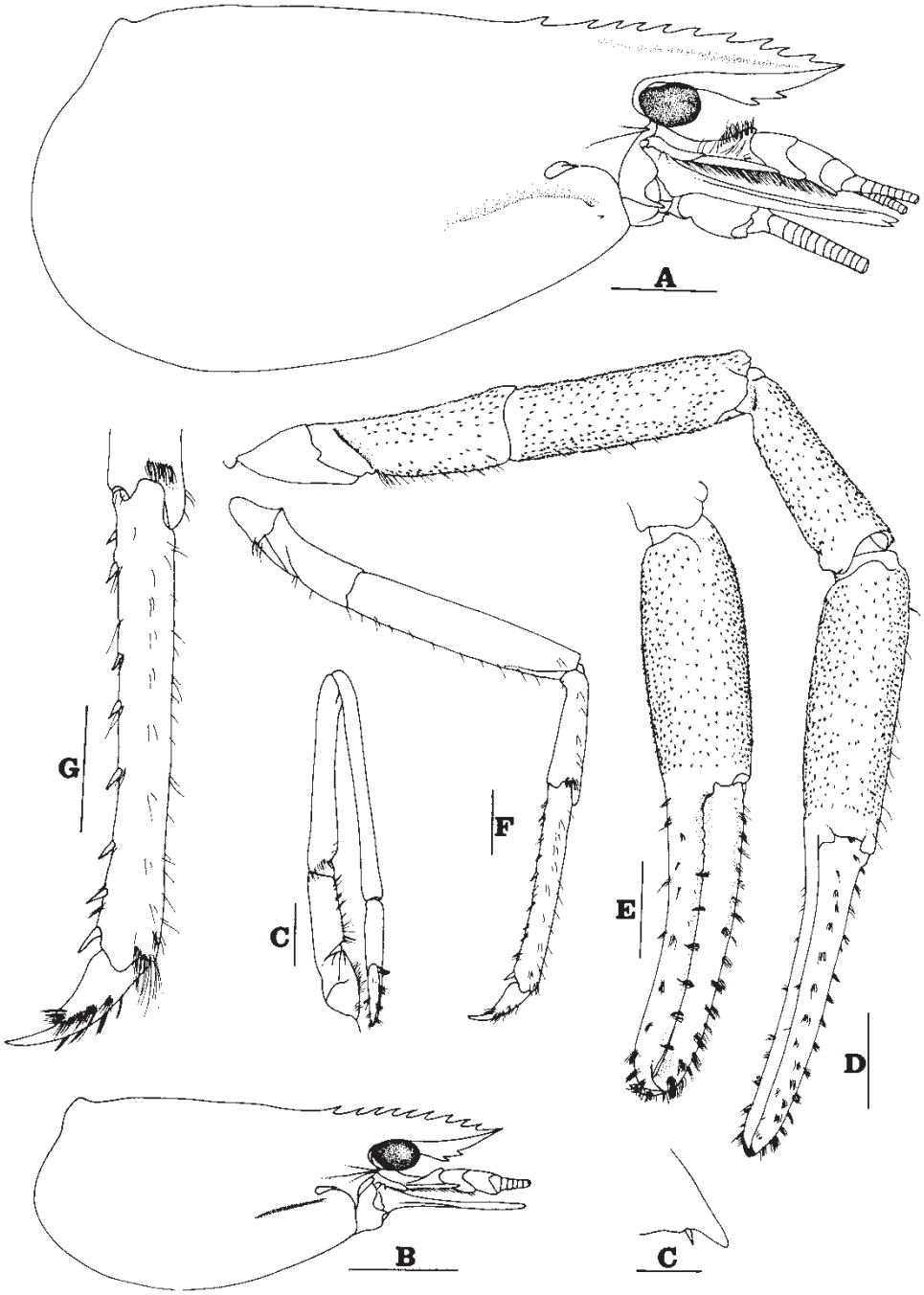


FIG. 10. *Macrobrachium yui* (♂, cl 26.1 mm, CU 1997.111, Mae Hong Son, northern Thailand). (A) Cephalothorax; (C) first pereiopod; (D) second pereiopod; (E) chela of second pereiopod; (F) third pereiopod; (G) propodus and dactylus of third pereiopod; (L) movable spine of uropodal diaeresis. (B) (♂, cl 14.6 mm, CU 1997.111, Mae Hong Son, northern Thailand). Scales: (A, B, D, E) 5 mm; (C, F, G) 2 mm; (H) 0.5 mm.

Remarks

Macrobrachium yui was originally described from Yunnan in southern China. The species was previously reported from Thailand by Naiyanetr (1992).

Cai and Dai (1999) pointed out that *Macrobrachium yeti* Dang, 1975, is very close to *M. yui* and are very difficult to distinguish. Only two differences separate *M. yeti* from *M. yui*, namely, the postorbital carapace teeth number (three in *M. yeti* and four to five in *M. yui*) and the form of the second pereiopods, which is slightly more slender in *M. yeti*, with various joints having slightly different proportions. The proportion of the various joints in *M. yeti*, however, fall into the known intraspecific variation of *M. yui*. Hence, *M. yeti* must be regarded as a junior synonym of *M. yui*.

Macrobrachium mieni Dang, 1975
(figure 11)

Macrobrachium mieni Dang, 1975: 68, figure 2 [type locality: Hoa Binh, northern Vietnam]; Dang, 1980: 389, figure 223.
? *Macrobrachium asperulum* Lumubol, 1980: 503, figure.

Material examined

Central Thailand. Three ♂♂, cl 15–17.5 mm (ZRC 2000.2718), Phetchabun, central Thailand, 8 January 1981.

North-east Thailand. Four ♂♂, cl 10.1–14.2 mm, 4 ♀♀, cl 8.5–11.5 mm (two ovigerous, eggs 1.5 × 1.2 mm) (ZRC 2000.2656), coll. P. Naiyanetr, 29 March 1976.

Diagnosis

Rostrum straight, reaching to or slightly beyond distal end of antennular peduncle. Rostral formula: 2–5 + 5–7/1–3, third tooth situated just above postorbital margin, teeth placed more widely posteriorly than anteriorly. Antennular peduncle 0.55 times as long as carapace. Scaphocerite 3.0 times as long as wide. First pereiopod reaching with entire chela beyond end of scaphocerite, fingers as long as palm; chela 0.5 times as long as propodus. Second pereiopods of males slightly longer than body (excluding rostrum), equal in length, similar in form, reaching with one-third of carpus beyond distal margin of scaphocerite; carpus shorter than merus, about two-thirds length of palm. Palm cylindrical, broader than carpus; fingers slightly shorter than palm, with 8–10 small teeth at proximal half of cutting edges. Third pereiopod reaching with dactylus beyond distal margin of scaphocerite, propodus 10 times as long as broad, 3.4 times as long as dactylus; dactylus with very short claw, four times as long as broad. Uropodal diaeresis with a spine slightly shorter than outer angle. Ovigerous females with eggs 1.5 × 1.2 mm in diameter.

Remarks

Macrobrachium mieni closely resembles *M. yui*, but can be distinguished by its longer rostrum which reaches to distal end of scaphocerite (versus not beyond end of antennular peduncle); the form of the second pereiopods (equal in length versus unequal); the longer antennular peduncle (0.55 times as long as carapace versus 0.4 times); the scaphocerite 3.0 times as long as wide (versus 2.6 times); the third pereiopod with a propodus 10 times as long as broad (versus eight times); and the dactylus has a short claw (versus long, slender claw). *Macrobrachium mieni* is also

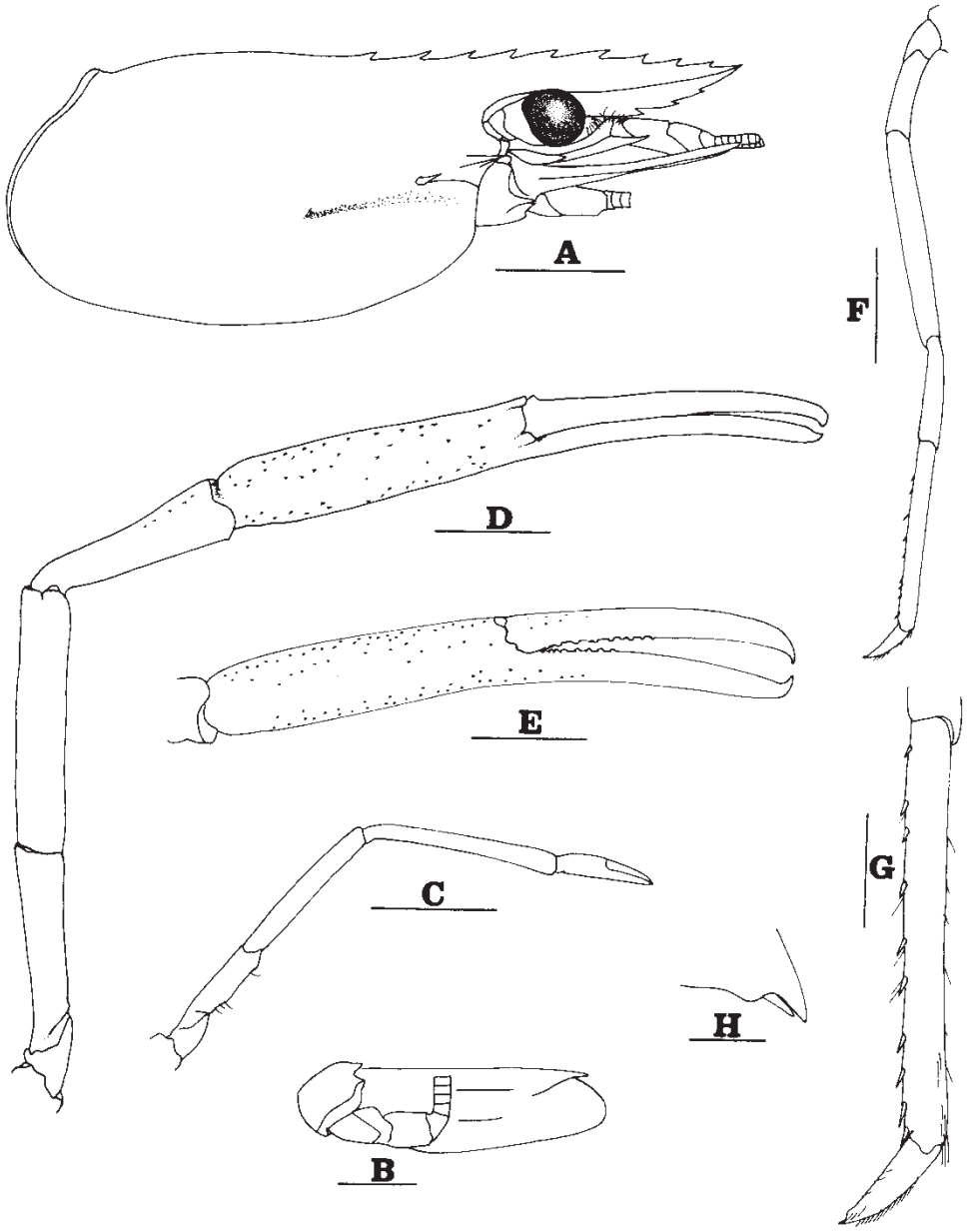


FIG. 11. *Macrobrachium mieni* (♂, cl 17.5 mm, CU 1997.100, Phetchabun, central Thailand, 8 January 1981). (A) Cephalothorax; (B) scaphocerite; (C) first pereiopod; (D) second pereiopod; (E) chela of second pereiopod; (F) third pereiopod; (G) propodus and dactylus of third pereiopod; (H) movable spine of uropodal diaeresis. Scales: (A, C–F) 5 mm; (B, G) 2 mm; (H) 0.5 mm.

similar to *M. thai* sp. nov., but it can be separated by having fewer teeth on the cutting edges of the second pereiopod, relatively shorter propodus of the third pereiopod and a shorter movable spine on the uropodal diaeresis (see Remarks for *M. thai*).

Macrobrachium yui is commonly found in fast-flowing waters in the mountains of southern China, northern Thailand and Vietnam, while *M. mieni* seems to replace *M. yui* in the Mekong basin, living in relatively slower-flowing water.

The present Thai material differs from the original description and figures in the number of postorbital rostral teeth, which is two or three (mode three), rather than four or five in the types. This may be due to variation. We can discern no other differences. As the types are almost certainly lost (H. T. Dang, personal communication) and we do not have any Vietnamese material of this species on hand, we prefer to use the name *M. mieni* for the Thai material for the time being.

Lumubol (1980: 503) reported *M. asperulum* (Von Marten) from Khon Kaen. *M. asperulum*, however, has so far been reported only from mainland China and Taiwan. On the basis of his figure which shows 12 dorsal rostal teeth (three of them postorbital) and the carpus of the second pereiopod being shorter than palm, Lumubol's specimens are probably *M. mieni* instead.

Macrobrachium hendersoni (De Man, 1906)
(figure 12)

Palaemon hendersoni De Man, 1906: 405 [type locality: Darjeeling, northern India]; Kemp, 1913: 303, figures 19–23; 1918: 95; 1924: 41, pl. 3, figure 5; Tiwari, 1955a: 189; 1955b: 233.
Palaemon yunnanensis Yu, 1936: 308, figure 3, 4 [type locality: Mann-Tchi-Pan, Yunnan, China].
Macrobrachium hendersoni: Holthuis, 1950: 209.

Material examined

North Thailand. Five ♂♂, cl 15.2–19.5 mm, 1 ovigerous ♀, cl 7.0 mm, eggs 1.8 × 1.3 mm (ZRC 2000.2729), Mae Sariang district, Mae Hong Son river, coll. Kitisan Suprepapon, 20 February 1994; 8 ♂♂, cl 12.0–14.0 mm, 2 ovigerous ♀♀, cl 13.7–15.0 mm (CU 1997.183), Mae Hong Son, 21 March 1978; 1 ♂, cl 8.5 mm, 2 ovigerous ♀♀, cl 10.8–12.3 mm (CU 1997.187), Mae Hong Son, 21 March 1978; six specimens, Mae Hong Son, coll. P. Naiyanetr, 26 April 1986; 12 specimens (CU 1997.187), Mae Hong Son, 21 March 1978; 3 ♂♂, cl 19.5–25.0 mm (CU 1997.109), no data; 1 ♂, 1 ovigerous ♀, Tha Song Yang, 17 May 1985.

West Thailand. Three ♂♂, cl 14.5–24.5 mm (CU 1997.109), near hot spring water, Hin Lad Amphoe, Thongphaphum, Kanchanaburi, 15 April 1985; 1 ♀, cl 9.2 mm (ZRC 2000.2709), Kanchanaburi: Mae Nam Khwae Noi basin: small forest tributary of Nam Khung, 14°36′32″N, 98°31′52″E, coll. M. Kottelat and K. Kubota, 3 April 1998; 1 ovigerous ♀, cl 14.5 mm, eggs 1.5 × 1.0 mm (ZRC 2000.2711), Tak Province: Mae Nam Moei at Ban Wale, coll. M. Kottelat and K. Kubota, 7 April 1998; 2 ♂♂, cl 9.3–10.1 mm, 2 ♀♀, cl 5.5–11.7 mm (ZRC 2000.2699), Kanchanaburi Province: Mae Nam Khwae Noi basin, Nam Khung, upstream of Ban Huai Pak Khung, riffles, between second ford and reservoir, coll. M. Kottelat and K. Kubota, 3 April 1998; 4 ♂♂, cl 9.5–17.0 mm, 1 ♀, cl 8.0 mm, 1 ovigerous ♀, cl 13.0 mm, eggs 1.5 × 1.1 mm (ZRC 2000.2657), road from Songkhla Buri to Kanchanaburi, km 12 on road going to small waterfall, coll. K. Kubota, April 1998; 6 ♂♂, cl 6.4–9.6 mm, 8 ♀♀, 1 ovigerous ♀, cl 11.1 mm, eggs 1.7 × 1.3 mm (ZRC 2000.2735), Ratchaburi Province, Mae Nam Phachi basin, Nam Tok Suan Phung, coll. M. Kottelat and K. Kubota, 2 April 1998; 4 ♂♂, cl 14.5–21.0 mm, 1 ♀, cl 12.0 mm (ZRC 2000.2659), Tak Province, Salwean basin, stream at km 57 on road Mae Sot-Wa Rai, 5 km before Wa Rai, 16°20′8.2″N, 98°41′23.9″E, coll. M. Kottelat, 8 November 1995;

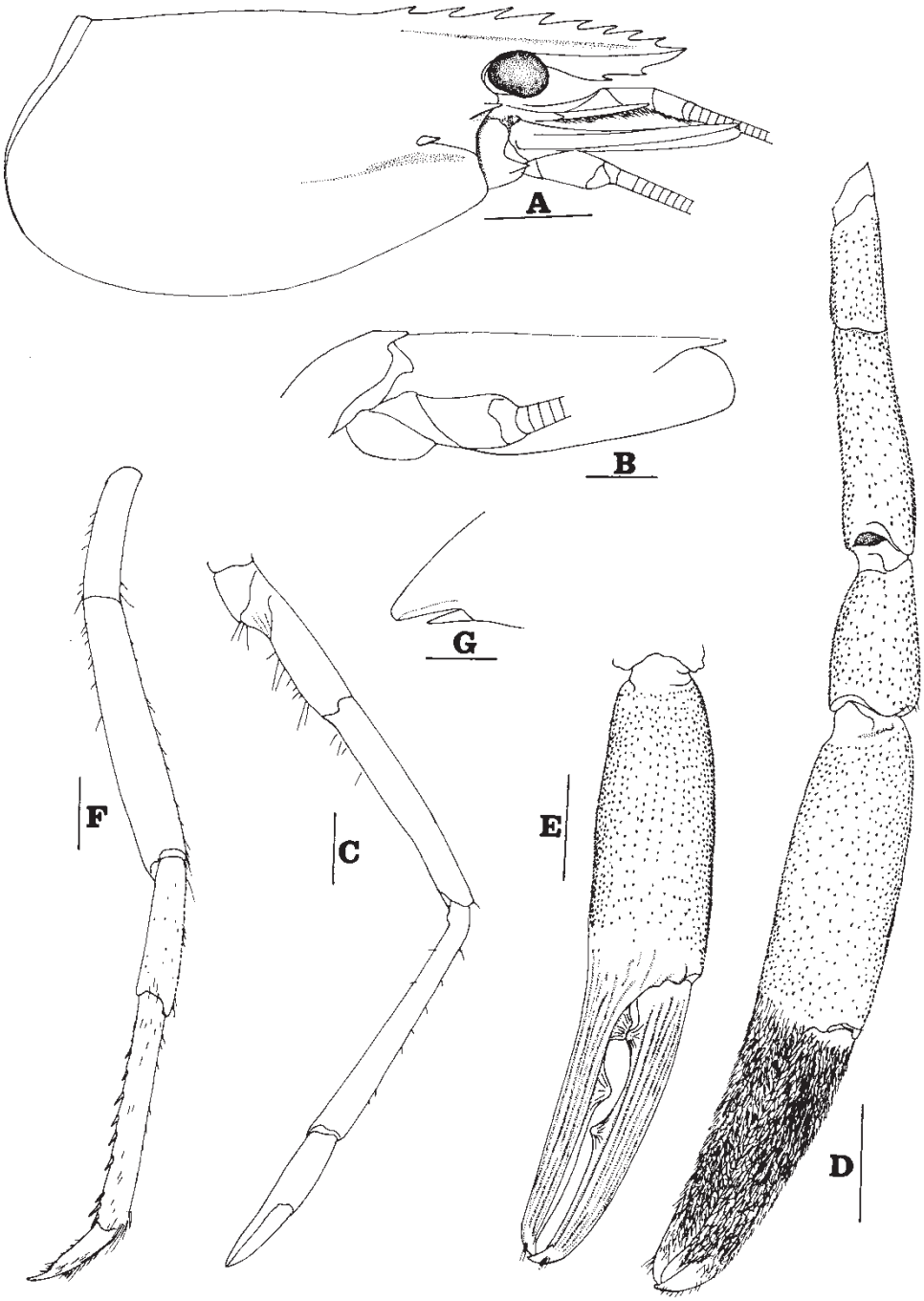


FIG. 12. *Macrobrachium hendersoni* (♂, cl 24.5 mm, CU 1997.109, near spring hot water, Hin Lao Amphoe, Thongphaphum, Kanchanaburi, west Thailand, 15 April 1985). (A) Cephalothorax; (B) scaphocerite; (C) first pereiopod; (D) second pereiopod; (E) chela of second pereiopod; (F) third pereiopod; (G) movable spine of uropodal diaeresis. Scales: (A, D, E) 5 mm; (B, C, F) 2 mm; (G) 0.5 mm.

2 ♂♂, cl 13.5–18.2 mm, 1 ♀, cl 13.4 mm (ZRC 2000.2658), Tak Province, Salween basin, Mae Nam Moei at Ban Wa Rei, 16°17′23.2″N, 98°42′19.66″E, coll. M. Kottelat, 8 November 1995; 5 ♂♂, cl 8.5–16.0 mm, 1 ♀, cl 8.5 mm (ZRC 2000.2662), Tak Province, Salween basin, Huey Moon Hing Leak Phai at Moon Hing Leak Phai, km 26, stone 22, on road Mae Sot-Umphang, 24 km before Phop Phra, coll. M. Kottelat, 8 November 1995; 6 ♂♂, cl 8.4–13.5 mm (ZRC 2000.2663), Rachaburi Province, Suan Pheng District, Suan Pheng waterfall, 13°31′12.6″N, 99°14′19.9″E, coll. D. Yeo *et al*., 15 August 1997; 3 ♂♂, cl 11.8–16.0 mm, 2 ♀♀, cl 12.2–11.6 mm (CU 1997.195), Sai Yok waterfall, Kanchanaburi; seven specimens, cl 10.5–12.0 mm, no data; three specimens, Sai Yok waterfall, Kanchanaburi, 18 August 1989; 1 ♂ (CU 1997.178), Si Sawat, Kanchanaburi, 3 November 1979; two specimens (CU 1997.179), Phop Phra Tak, 7 January 1985; three specimens, Thong Pha Phum, Kanchanaburi, 21 July 1986; five specimens (CU), Phop Phra Tak, 13 August 1988; two specimens, Thong Pha Phum, Kanchanaburi, 5 May 1985; 2 ♂♂ (CU 1997.189), Sai Yok waterfall, Kangchanaburi; 20 specimens (CU 1997.185), Thap Sakae, Prachuap Khiri Khan, 22 June 1977; three specimens, Suan Pheng Raichabai, no data; 1 ♂, cl 15.5 mm, 1 ♀, cl 11.0 mm, 1 ovigerous ♀, cl 11.0 mm, eggs 2.2 × 1.8 mm (ZRC 2000.2710), Kanchanaburi Province: Mae Nam Khwae Noi basin: Huai Kroeng Kawia, on road from Thong Pha Phum to Thung Yai National Park, coll. M. Kottelat and K. Kubota, 4 April 1998; 1 ♂, cl 23.3 mm, 2 ♀♀, cl 10.0–10.5 mm (ZRC 2000.2661), Tak Province: Mae Nam Moei basin, Huai Mae Lamno, about 2 km north of road 105, on road going to Ban Mae Lamao and Ban Mae Ramat, coll. M. Kottelat and K. Kubota, 6 April 1998; 1 ♂, 17.5 mm (CU 1997.116), Sai Yok waterfall, Kanchanaburi, coll. P. Naiyanetr, 18 August 1989.

Diagnosis

Rostrum short, or slightly convex at dorsal margin, reaching to end of second segment of antennular peduncle, or to end of antennular peduncle, mostly reaching distal half of third segment of antennular peduncle. Antennal and hepatic spines present. Antennular peduncle 0.6 times as long as carapace. Scaphocerite 2.8 times as long as wide. First pereiopod reaching with entire chela beyond distal end of scaphocerite, fingers slightly shorter than palm; chela 0.65 times as long as carpus. Second pereiopods unequal in length, similar in form. Major second pereiopod slightly shorter than body, with one-third of carpus reaching beyond distal end of scaphocerite; carpus cylindrical, shorter than merus, half length of palm; palm slightly broader than carpus, fingers subequal to palm in length, with distinctive longitudinal grooves, densely covered by velvety setae, fingers not gaping even when closed, with two pairs of strong teeth at proximal half of cutting edge, proximal tooth of fixed finger blunt, with two or more tubercles distally. Third pereiopod reaching with entire dactylus beyond distal end of scaphocerite; propodus seven times as long as wide, 2.1 times as long as dactylus. Uropodal diaeresis with a spine much smaller than outer angle. Ovigerous female with egg size 1.7–2.2 × 1.4–1.8 mm in diameter.

Remarks

Compared to the types (see De Man, 1906), the rostrum of the Thai specimens are slightly longer, but still fall within the concept of *M. hendersoni hendersoni* as defined by Tiwari (1952). The form of the setae-clothed fingers and the distinctive shape of the proximal tooth at the fixed finger, described in detail by Kemp (1913),

are very characteristic for the species. Tiwari (1952) had described two subspecies, *Palaemon hendersoni platyrostris* and *P. h. cacharensis*, both from Assam, northern India. According to the original description, *P. h. platyrostris* has a rostrum that is longer than *P. h. hendersoni*, reaching to the end of the antennular peduncle, and deeper than the latter. *Palaemon h. cacharensis* resembles *P. h. platyrostris* in the character of the rostrum and the shape of second pereiopod, but its main distinguishing feature is the absence of the longitudinal grooves and pubescence on the distal part of the fingers of the male second pereiopod. The form of the carpus is quite different between *M. hendersoni hendersoni* and Tiwari's two subspecies, i.e. it is short, and cup-shaped in the nominal subspecies but elongate in the other two. Since the differences are so obvious and consistent, Cai and Ng (in press) recently treated these taxa as three separate species. Six more species in this group were recognized by Tiwari (1955a; 1968), mamely *M. cavernicola* (Kemp, 1918), *M. assamense* (Tiwari, 1968), *M. peninsularis* (Tiwari, 1968), *M. siwalikensis* (Tiwari, 1952), *M. dayanum* (Henderson, 1893) and *M. hendersodayanum* (Tiwari, 1952).

Macrobrachium assamense (Tiwari, 1955)
(figures 13, 14A–F)

Palaemon assamensis assamensis Tiwari, 1955a: 190 [type locality: Someswari river, near Siju, Garo Hill, Assam, India]; 1955b: 234; 1968: 297.

Palaemon assamensis peninsularis; Tiwari, 1955a: 190 [type locality: Nerbudda river at Khetgaon, Mandla District, Madhya Pradesh, India]; 1955b: 234; 1968: 298.

Macrobrachium assamense assamense; Cai and Ng, in press.

Material examined

West Thailand. One ♂, cl 17 mm (CU 1997.87), Tak, coll. P. Naiyanetr, 17 May 1985; 1 ♂, 18.5 mm (ZRC), Tak, coll. P. Naiyanetr, 17 May 1985; 1 ♂, cl 18.7 mm, 1 ♀, cl 15 mm (CU 1997.167), Suam Pheng, Ratchaburi, no date.

Description

Rostrum (figure 13A) straight, high, reaching to distal end of scaphocerite, tip slightly upturned; rostral formula: 2 + 5–7/3–4. Teeth placed more widely posteriorly than anteriorly. Antennal spine below inferior orbital angle; hepatic spine smaller than antennal spine, lying behind and slightly below antennal spine. Antennular peduncle about 0.6 times as long as carapace. Carapace smooth.

Fourth thoracic sternite with small median process (figure 14C). Telson (figure 14E) with two pairs of dorsal spines, ending in a small acute median point, dorsolateral spines small, smaller than dorsal spines, intermediate spines well developed, with about six pairs of long plumose setae. First to third abdominal sternites (figure 14D) with transverse ridge and a median tooth, that of second abdominal sternite most prominent, that of first abdominal sternite less prominent, that of third one smaller than previous two. Preanal region with small ridge, smooth.

Eyes (figures 13A, 14A) well developed, cornea longer, broader than stalk. Basal segment of antennular peduncle broad. Stylocerite distinctly pointed, reaching middle of basal segment. Antenna (figure 14F) with stout basicerite, with strong distoventral tooth, carpocerite reaching to about 0.4 times of scaphocerite length. Scaphocerite slender, about 3.2 times as long as wide, with straight outer margin.

Epistome as in figure 14B, bilobed by deep depression. Mouthparts typical of genus.

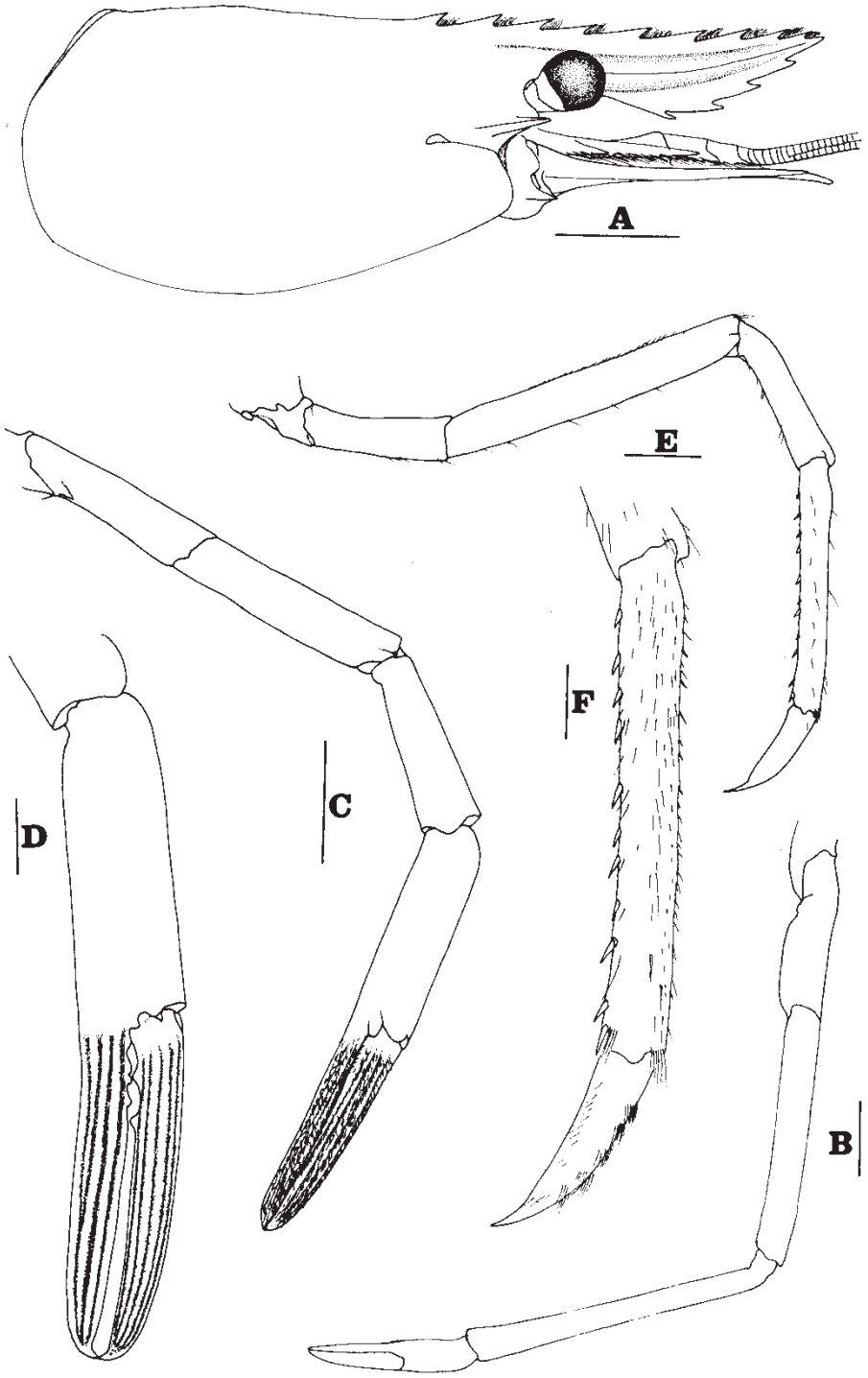


FIG. 13. *Macrobrachium assamense* (♂, cl 18 mm, CU, Lampang, Tak, west Thailand, coll. P. Naiyanetr). (A) Cephalothorax; (B) first pereiopod; (C) second pereiopod; (D) chela of second pereiopod; (E) third pereiopod; (F) propodus and dactylus of second pereiopod. Scales: (A, C) 5 mm; (B, D, E) 2 mm; (F) 1 mm.

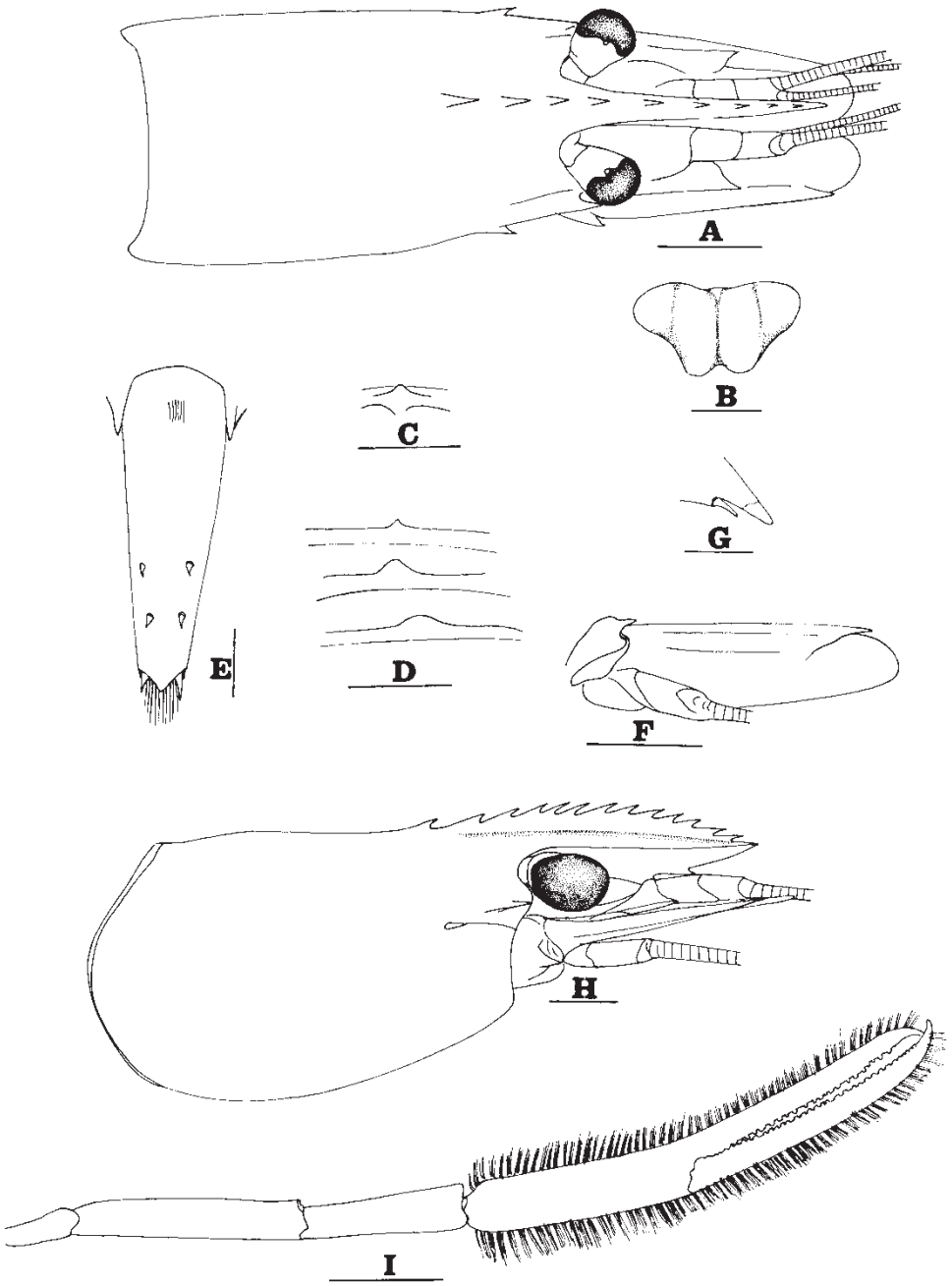


FIG. 14. *Macrobrachium assamense* (♂, cl 18 mm, CU, Lampang, Tak, west Thailand, coll. P. Naiyanetr): (A) cephalothorax; (B) epistome; (C) fourth thoracic sternite with a small median process; (D) first three abdominal sterna with transverse ridge, with median processes; (E) telson; (F) scaphocerite; (G) movable spine of uropodal diaeresis. *Macrobrachium dienbienphuense* (♂, cl 11.2 mm, ZRC 2000.2732, forest stream 95 km north from Nan town, Nan Province (about 15–20 km north from Ban Pon.), Nam Gae, north of Ban Sala, near Loas, coll. Y. Cai *et al.*): (H) cephalothorax; (I) second pereiopod. Scales: (A, F, I) 5 mm; (E, H) 2 mm; (B–D) 1 mm; (G) 0.5 mm.

First pereiopod (figure 13B) reaching with entire chela beyond distal end of scaphocerite, propodus 1.8 times as long as chela; chela with fingers as long as palm. Second pereiopods of male (figure 13C, D) unequal in length, similar in form. Major second pereiopod distinctively shorter than body length, reaching with length of carpus beyond distal end of scaphocerite, carpus 3.2 times as long as broad, slightly shorter than merus, distinctively shorter than palm; fingers short, as long as palm, with distinctive longitudinal grooves, densely clothed by velvety setae, not gaping even when closed, cutting edge with two pairs of small teeth at proximal one-third. Third pereiopod (figure 13E, F) reaching end of scaphocerite, propodus 7.6 times as long as broad, 2.3 times as long as dactylus; dactylus 3.5 times as long as wide, terminating in small claw.

Uropodal diaeresis with a spine (figure 14G) about half length of outer angle.

Remarks

Tiwari (1955a, 1955b, 1968) recognized two subspecies, mamely *M. a. assamense*, from Assam and Myanmar, and *M. a. peninsularis*, from the Indian Peninsula. According to Tiwari (1955a, 1955b, 1968), the nominal subspecies differs from the peninsular subspecies by the longer rostrum (0.6–0.8 times as long as carapace versus 0.5–0.6 times) and the elongated carpus (3.5–4.0 times as long as broad versus 3.0–4.5 times). Two lots of specimens from western Thailand agree well with the diagnosis of *M. assamense* by Tiwari (1955a, 1955b, 1968). We are unable to assign them to either subspecies. The rostrum, about 0.7 times as long as carapace, fits with the nominal subspecies, but the carpus, about 3.2 times as long as broad, fits with the peninsular subspecies. There is a possibility that the Thai specimens may represent a third subspecies. Since the material we have on hand is not substantial enough to be confident and we have not seen the types of *M. assamense*, we prefer to merely refer the Thai specimens to *M. assamense sensu lato* for the time being. With regards to the second pereiopod, which has the distinctive longitudinal grooves densely clothed by velvety setae, *M. assamense* was assigned to the *M. hendersoni* species group (Tiwari, 1955a, 1955b, 1968). However, because of the higher and longer rostrum, together with the less prominent teeth along the cutting edge of the fingers, it can be easily separated from other members in this group.

Macrobrachium hirsutimanus (Tiwari, 1952)

(figure 15)

Palaemon hirsutimanus Tiwari, 1952: 31 [type: Doi Chuang, North Thailand].

Material examined

NEOTYPE: ♂, cl 15 mm (ZRC 2000.2668), forest stream 95 km north from Nan Town, Nan Province, about 15–20 km north from Ban Pon, Nam Gae, north of Ban Sala, near Laos, North Thailand, coll. Y. Cai, 11 June 1998.

North Thailand. Four ♂♂, cl 13.3–16.0 mm, 1 ♀, cl 11.0 mm, 7 ovigerous ♀♀, cl 9.6–10.5 mm (ZRC 2000.2664), forest stream 95 km north from Nan town, Nan Province, about 15–20 km north from Ban Pon, Nam Gae, north of Ban Sala, near Laos, coll. Y. Cai, 11 June 1998; 3 ♀♀, cl 10.2–12.9 mm (ZRC), Nam Wa river at Ban Nam Wa, Nan, coll. A. Dot, 31 Jane 1992; 2 ♀♀, cl 9.7–12.5 mm (ZRC 2000.2665), Mae Nam Lin, stream, 14 km to Mae Khachan, 33 km to Wiang Pa Pao, 55 km to Chiang Mai, 19°6′46.7″N, 99°28′35.8″E, pH 8.2, coll. Y. Cai *et al.*,

13 June 1998; 1 ♀, cl 11.3 mm (CU), Chiang Mai, 4 November 1977; 2 ♂♂, cl 16.3–17.0 mm (CU 1997.153), Uttaradit, no date; 4 ♂♂, cl 10.0–11.0 mm, 1 ovigerous ♀, cl 11.6 mm, eggs 1.5 × 1.2 mm, CU1997.122, Phrae, 28 December 1988; 1 ♂ (CU1997.139), Fang, Chiang Mai, coll. Bwn Ket, 17 May 1976; 5 ♂♂ cl 14.5–15.5 mm, 1 ♀, cl 14.0 mm, 2 ovigerous ♀♀, (CU 1997.140), Lampang, 12 February 1977; 1 specimen (CU 1997.142), Chiang Mai, 4 November 1977; four specimens (CU 1997.193), Lampang, 19 May 1996; one specimen (CU), Chiang Mai, coll. P. Naiyanetr, 20 April 1976.

North-east Thailand. Ten ♂♂, cl 8.2–13.0 mm, 3 ♀♀, cl 6.0–11.4 mm (ZRC 1997.119), Nakhon Rachasima (Korat) Province, outlet of Lam Takong reservoir, 14°15′53.3″N, 101°33′53.4″E, coll. H. H. Tan *et al.*, 16 January 1997; 8 ♂♂, cl 8.0–12.0 mm (ZRC 2000.2666), Lam Thakong, outlet of dam at upper Mae Nam Mun, way from Sara Buri to Ratchasima, 14°52′3.1″N, 101°33′35.3″E, pH 8.9, coll. Y. Cai *et al.*, 16 June 1998; 11 ♂♂, cl 8.3–15.2 mm (CU 1997.137), Ubon Ratchathani, coll. P. Naiyanetr, no date; 1 ♂, cl 16.8 mm (CU 1997.141), Nakhon Ratchathani, 6 June 1980; four specimens (CU 1997.160), Maha Sarakham, no date.

West Thailand. Six ♂♂, cl 10.3–14.3 mm (CU), Tak, 16 December 1984.

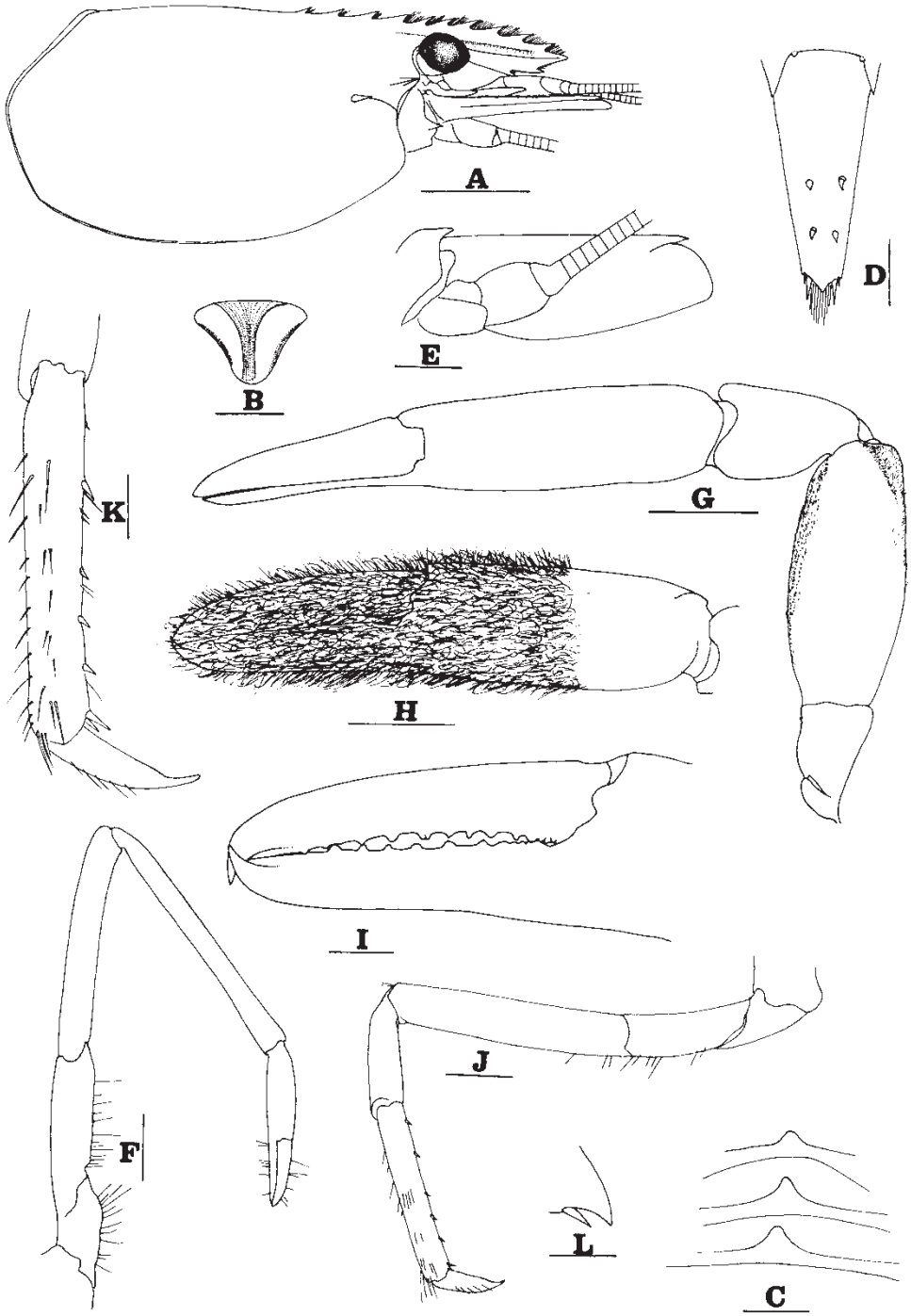
Central Thailand. Seven ♂♂, cl 12.3–15.0 mm, 1 ovigerous ♀, cl 9.6 mm, eggs 1.4 × 1.05 mm (CU), Uthathani, February 1986; 17 specimens (CU), Uthathani, 6 February 1986; 31 specimens (CU), Lan Sak Uthathani, coll. P. Naiyanetr, 30 January 1982.

East Thailand. 15 ♂♂, cl 9.0–12.0 mm, 5 ♀♀, cl 9.0–10.0 mm (ZRC 1997.124), Chantaburi Province, Klong Pheet (stream) *ca* 35 km from Trat, 12°28′4.5″N, 102°37′7.1″E, coll. H. H. Tan, 14 January 1997; five specimens (ZRC 2000.2667), waterfall, 22 km turn off from main road, 15°38′59.0″N, 101°25′9.0″E, coll. Y. Cai, 20 June 1998; 6 ♂♂, cl 8.0–11.0 mm, 5 ♀♀, cl 8–14 mm (ZRC 2000.2689), Trat Province, Nam Tok Salas Phai, about 5–10 km north-west of road 3157, coll. M. Kottelat *et al.*, 3 December 1993.

Diagnosis

Rostrum reaching to third segment of antennular peduncle or slightly beyond tip; dorsal margin slightly convex, rostral formula: 3–5 + 6–7/1–4 (mode 2), carapace slightly inflated laterally, surface smooth. Eyes about 0.15–0.20 times of carapace length. Second pereiopods as long as, or slightly longer than body length, distinctly unequal in adult males; merus cylindrical, distal half more inflated than proximal half, outer surface with numerous spinules; chela covered with dense, long pubescence; fingers elongate, slender, subequal to palm; cutting edge with 12–20 closely spaced teeth and denticles; third pereiopod with propodus stout, 2.0–2.5 times as long as dactylus; eggs 1.4–1.7 × 1.0–1.25 mm in diameter.

FIG. 15. *Macrobrachium hirsutimanus* (♂, cl 15 mm, neothtype, ZRC 2000.2640, forest stream 95 km north from Nan Town, Nan Province, about 15–20 km north from Ban Pon, Nam Gae, north of Ban Sala, near Laos, North Thailand). (A) Cephalothorax, lateral view; (B) epistome; (C) first three abdominal sterna with transverse ridge, with median processes; (D) telson; (E) scaphocerite; (F) first pereiopod; (G) second pereiopod; (H) chela of second pereiopod; (I) fingers of second pereiopod; (J) third pereiopod; (K) propodus and dactylus of third pereiopod; (L) movable spine of uropodal diaeresis. Scales: (A, G, H) 5 mm; (H) 3 mm; (D, E, I) 2 mm; (B, C, F, J, K) 1 mm; (L) 0.5 mm.



Description of neotype

Rostrum (figure 15A) short, slightly convex, reaching beyond end of second segment, but not end of antennular peduncle, dorsal margin of rostrum with 10

teeth, ventral with two to four dorsal teeth situated behind postorbital margin, occupying about one-third length of carapace, teeth above eye more closely spaced than rest. Antennal spine sharp but short, situated below lower orbital angle. Hepatic spine smaller than antennal spine, lying behind and distinctly below latter. Carapace smooth.

Third thoracic sternite with indistinct transverse ridge, fourth thoracic sternite without projection. Abdomen smooth, glabrous, first to third pleurites broadly rounded, fourth and fifth feebly produced posteriorly, fourth subtriangular, fifth subrectangular, sixth abdominal somite 1.6 times as long as fifth one, with posterolateral angle strongly produced, acute, posteroventral angle produced feebly, subacute. Telson (figure 15D) 1.4 times length of sixth abdominal segment, with two pairs of small dorsal spines, ending in a median point, lateral spines small, smaller than dorsal spines, intermediate spines well developed, with about six pairs of long plumose setae. First to third abdominal sternites (figure 15C) with transverse ridge, with median tooth, that of second abdominal sternite largest, that of third less prominent. Preanal region with rounded ridge.

Eyes well developed, cornea longer, broader than stalk, 0.15 times as long as carapace. Basal segment of antennular peduncle broad. Stylocerite distinctly pointed, reaching middle of basal segment. Anterolateral tooth reaching about middle of second segment. Second segment longer than third segment. Antenna with stout basicerite, with strong distoventral tooth, carpocerite reaching to about 0.4 times of scaphocerite length. Scaphocerite (figure 15E) 3.1 times as long as broad, with straight outer margin.

Epistome as in figure 15B, bilobed by depression. Mouth parts typical of genus.

First pereiopods (figure 15F) very slender, reaching beyond scaphocerite by half of carpus, equal in length, similar in form. Palm 1.3 times as long as fingers, carpus 1.7 times as long as chela, merus shorter than carpus, twice as long as ischium. Second pereiopods unequal. Major second pereiopod (figure 15G, H) as long as body length (rostrum excluded), reaching beyond scaphocerite by carpus. Fingers (figure 15I) of chela straight, with curved pointed tips, slightly gaping when closed, shorter than palm, with about 15 blunt teeth along both cutting edges. Palm slightly inflated, 2.6 times as long as broad, with densely packed long velvety setae on whole surface, setae more densely packed dorsally than ventrally. Carpus short, conical, about 0.3 times as long as chela. Merus 2.0 times as long as carpus. Minor second pereiopod short, about 0.8 times of body length, fingers longer than palm, with numerous blunt teeth on both cutting edges. Chela 1.8 times as long as carpus. Merus 1.5 times as long as carpus, with setae as on major second pereiopod. Third pereiopod (figure 15J, K) reaching end of scaphocerite. Dactylus slender, pointed, 2.8 times as long as broad. Propodus 2.5 times as long as dactylus, with about six spinules on posterior margin.

Endopod of male first pleopod with concave inner margin, outer margin convex. Appendix masculina of male second pleopod longer, stouter than appendix interna, with numerous stiff spines.

Uropodal diaeresis (figure 15L) with movable spine, weaker, shorter than outer angle.

Remarks

Tiwari (1952) established *M. hirsutimanus* from northern Thailand with a very short diagnosis. This species has never been reported and has been totally ignored

since. It has also been ignored by all workers on the *Macrobrachium pilimanus* species group although the original diagnosis clearly indicates that it is a member of this group (see Johnson, 1960; Holthuis, 1979; Dai, 1984; Chong, 1989; Chong and Khoo, 1987a, 1987c; Ng, 1995). According to the original diagnosis, the rostral formula of *M. hirsutimanus* is unclear. In the text, Tiwari (1952) stated that the rostral formula is 1–3 + 7–8/1. However, he also mentioned that the rostral form and the formula were the same as *M. latimanus*, which has a formula '2–3 + 7–8/2–4'. The rostral formula of *M. hirsutimanus*, as stated by Tiwari (1952), in fact, is an extremity of specimens from northern Thailand, and most probably, is a typographical mistake. The type material is supposedly deposited in the Zoological Survey of India but could not be located and is probably lost (H. H. Ng and D. Yeo, personal communication). To stabilize the taxonomic status of *M. hirsutimanus*, as well as the *M. pilimanus* species group, we hereby designate a neotype (a ♂, cl 15 mm, ZRC 2000.2668, northern Thailand) for *M. hirsutimanus* and redescribe it in detail.

To date, there are 12 recognized species in the *Macrobrachium pilimanus* group, namely *M. pilimanus* (De Man, 1879), *M. leptodactylus* (De Man, 1892), *M. hirsutimanus* (Tiwari, 1952), *M. dienbienphuense* Dang and Nguyen, 1972, *M. eriocheirum* Dai, 1984, *M. ahkowi* Chong and Khoo, 1987, [= *M. johnsoni* Chang and Khoo, 1987c.] *M. gua* Chong, 1989, *M. forcipatum* Ng, 1995, *M. platycheles* Ou and Yeo, 1995, *M. pilosum* Cai and Dai, 1999, *M. amplimanus* Cai and Dai, 1999, and *M. sirindhorn* Naiyanetr, 2001 (see also Cai and Dai, 1999; Naiyanetr, 2001). With regards to the presence of pubescence on the merus, this can be used to easily distinguish *M. sirindhorn* and *M. pilosum* from other members of the *M. pilimanus* species group. As such, *M. pilosum* and *M. sirindhorn* are here not regarded as members of the *M. pilimanus* species group. Among members of the *M. pilimanus* species group, *M. hirsutimanus* most closely resembles *M. pilimanus*, *M. eriocheirum* and *M. forcipatum*, in the form of rostrum and the pereiopods. *Macrobrachium hirsutimanus* can be distinguished from *M. pilimanus* (cf. lectotype, here designated: ♂, cl 14.5 mm, RMNH D 1477, Moearalaboeh, West Sumatra, Indonesia, Midden Sumatra Expedition, 1877; paralectotypes: 3 ♂♂, cl 8.0–12.6 mm, 1 ♀, cl 13.4 mm, data same as lectotype; 3 ♂♂, cl 10.6–13.5 mm, 2 ♀♀, cl 9.5–12.5 mm, 2 ovigerous ♀♀, cl 12.0–12.5 mm, with eggs 1.5–1.75 × 2.0 mm (ZMA-De 240494), Kotaboro in swamp, Padang Pandjang, Sumatra, Indonesia, leg. E. Jacobson, February 1925; 3 ♂♂, cl 9.8–13.5 mm, 1 ♀, cl 13 mm, Lake Danau di Bawah, Sumatra, Indonesia, leg. Weber, 1949) by the more prominent processes on the abdominal sternites (figure 15C versus figure 16D); the form of the epistome (figure 15B versus figure 16C); the propodus of the third pereiopod 2.0–2.5 times being as long as the dactylus (versus 3.2 times); the postorbital teeth being more widely spaced than the anterior (versus closer spaced); the postorbital teeth occupying 0.33 times the length of the carapace (versus 0.15–0.20 times) and the smaller egg size (1.0–1.2 × 1.4–1.6 mm versus 1.5–1.75 × 2.0 mm). It can be separated from *M. eriocheirum* by its bilobed epistome (versus trilobed; see figure 15B versus 18B); the less prominent process on the third abdominal sternite (figure 15C versus figure 18C) and the propodus of the third pereiopod being 2.0–2.5 times as long as the dactylus (versus 3.3 times). *Macrobrachium hirsutimanus* differs from *M. forcipatum* by the more prominent process on the third abdominal sternite (figure 15C versus figure 19C); the propodus being 2.0–2.5 times as long as the dactylus (versus 2.6–3.0 times), and the more numerous but smaller teeth on the cutting edges of male second pereiopods (12–20 versus less than 10).

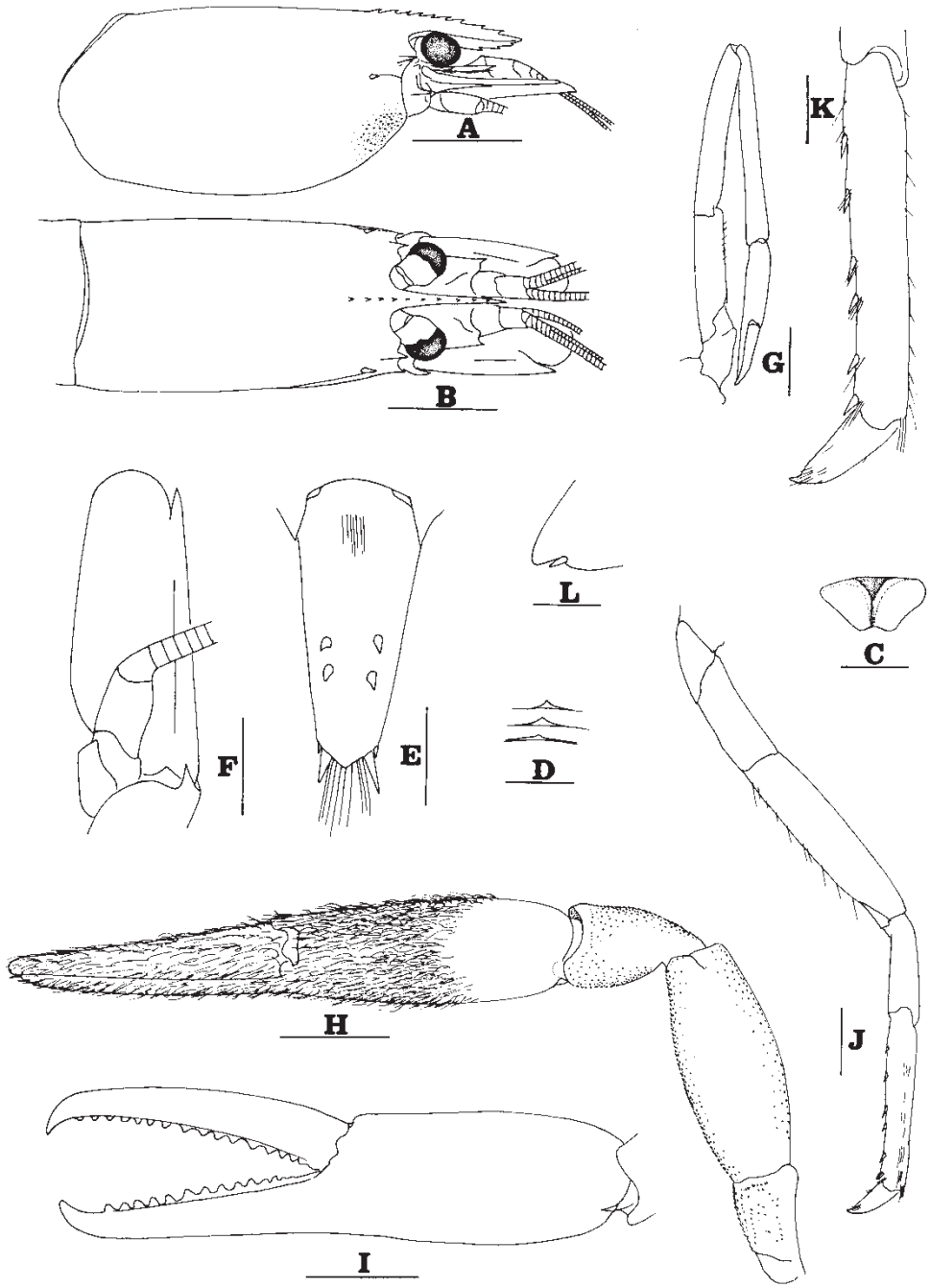


FIG. 16. *Macrobrachium pilimanus* (♂, cl 14.5 mm, lectotype, RMNH D 1477, Moearalaboeh, west Sumatra, Indonesia, Midden Sumatra Expedition, 1877). (A) Cephalothorax, lateral view; (B) cephalothorax, dorsal view; (C) epistome; (D) first three abdominal sterna with transverse ridge, with median processes; (E) telson; (F) scaphocerite; (G) first pereiopod; (H) second pereiopod; (I) chela of second pereiopod; (J) third pereiopod; (K) propodus and dactylus of third pereiopod; (L) movable spine of uropodal diaeresis. Scales: (A, B, H, I) 5 mm; (C–G, J) 2 mm; (K) 1 mm; (L) 0.5 mm.

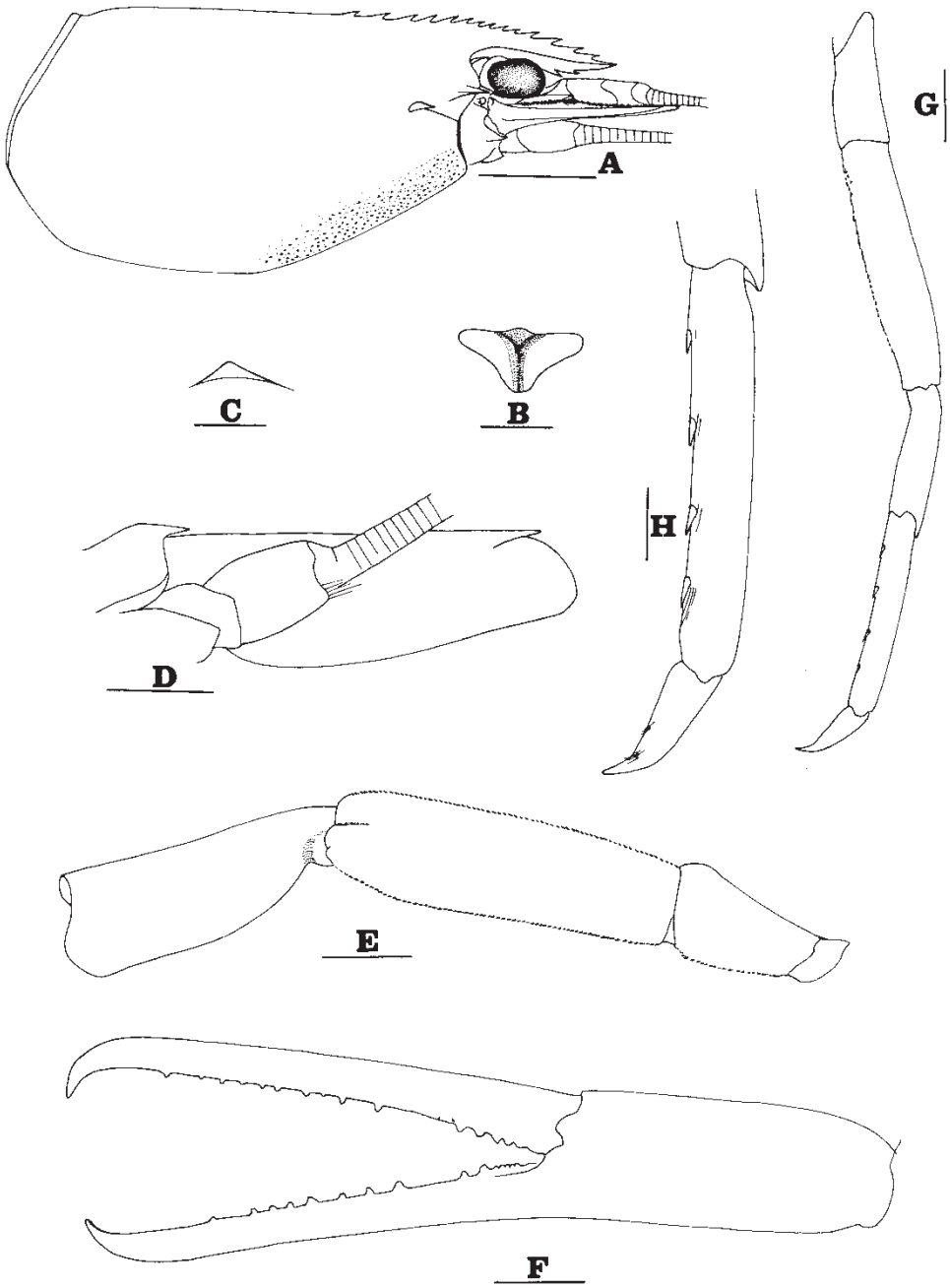


FIG. 17. *Macrobrachium leptodactylus* (♂, cl 16 mm, lectotype, RMNH D 1801, Buitenzorg (=Bogor), Java, Indonesia, leg. M. Weber, March to September 1888). (A) Cephalothorax; (B) epistome; (C) preanal carina; (D) scaphocerite; (E) carpus, merus and ischium of second pereiopod; (F) chela of second pereiopod; (G) third pereiopod; (H) propodus and dactylus of third pereiopod. Scales: (A, E, F) 5 mm; (B, C, D, G) 2 mm; (H) 1 mm.

As far as is known, *M. hirsutimanus* is distributed in north Thailand, north-east Thailand and central Thailand. It is commonly sold in local markets in these areas.

Lumubol (1980: 503) reported *M. esculentum* from Lam Nam Phong, Khon Kaen, north-east Thailand. This record was followed by Naiyanetr (1998: 32). It is, however, very doubtful as indicated by the attached figure, which clearly shows the characteristic pubescence covering the whole surface of chela, carpus and merus of the second pereiopod, a character which does not occur on any known Thai species of *Macrobrachium*. It is most probably a member of the Thai *Macrobrachium pilimanus* group.

Macrobrachium eriocheirum Dai, 1984
(figure 18A–D)

Macrobrachium eriocheirum Dai, 1984: 247, figure 13 [type locality: Jingshan, Xishuangbanna, Yunnan, China]; Cai and Dai, 1999: 230, figure 13.

Macrobrachium dienbienphuense: Liu *et al.*, 1990a: 121 (part, not *Macrobrachium dienbienphuense* Dang and Nguyen, 1972.

Material examined

Holotype: ♂, cl 20 mm (IZAS), Jingsan, Yunnan, southern Thailand, coll. C. Wang, April 1957.

Paratypes: one ♂, cl 11.5 mm (IZAS, No. 10409), 1 ovigerous ♀, cl 15 mm (IZAS, No. 10363), data same as holotype.

North Thailand. One ♂, cl 6.7 mm (CU 1997.140), Lampang, no date; 1 ♂, cl 16.2 mm (ZRC 2000.2669), Huai Rong waterfall, downstream from National Park, Wai Long Ngau, coll. Y. Cai *et al.*, 11 June 1998.

North-east Thailand. One ♂, cl 9.5 mm (ZRC 2000.2727), Phibun Mangsahan market, 46 km east to Ubon Rachathani, coll. Y. Cai, 16 June 1998; 17 ♂♂, cl 10.5–12.5 mm, 7 ovigerous ♀♀, cl 8.4–10.8 mm, egg size 1.7 × 1.2 mm (ZRC 2000.2670), Phibun Mangsahan market, 46 km east to Unbon Rachathani Province, coll. Y. Cai *et al.*, 16 June 1998; 8 ♂♂, cl 9.2–11.6 mm, 11 ovigerous ♀♀, cl 7.8–8.4 mm (ZRC 2000.2678), Ubon Rachathani Mae Nam Moon, Phibun, Mansahan market, coll. Y. Cai *et al.*, 16 June 1998; 10 specimens (ZRC 2000.2695), Phibun Mangsahan market, 46 km east to Unbon Rachathani Province, coll. Y. Cai *et al.*, 16 June 1998.

South-east Thailand. Two ♂♂, cl 6.0–8.5 mm, 1 ♀, cl 6.8 mm, 1 ovigerous ♀, cl 8.2 mm, eggs with eyes, eggs 1.5 × 1.0 mm (ZRC 1997.115), Chantaburi Province, Pong Nam Ron District, Klong Nam Ron (stream), *ca* 54 km north from Chantaburi, 12°54′44.3″N, 102°22′16.2″E, coll. H. H. Tan *et al.*, 14 January 1997; 6 ♂♂, cl 7.2–11.0 mm, 2 ♀♀, cl 8.0–9.5 mm (ZRC), Thailand, Trat Province, Khlong Fuai (road 3271), 12°23′44.8″N, 102°30′34.5″E, coll. H. H. Tan *et al.*, 15 January 1997; 6 ♂♂, cl 9.0–15.5 mm (CU 1997.115), Chanthaburi, 9 February 1990.

West Thailand. Six ♂♂, cl 9.8–13.0 mm, Tak, coll. P. Naiyanetr, 16 December 1984; 1 ♂♂, cl 12.8–14.8 mm, 1 ovigerous ♀, cl 9.8 mm, (CU 1997.118), Uthathani, coll. P. Naiyanetr, 6 December 1986.

Diagnosis

Rostrum short, straight or slightly convex, reaching to base of third segment of antennular peduncle or end of the segment; rostral formula 4–5 + 6–8/2–3, dorsal teeth more widely spaced posteriorly than anteriorly. Antennal spine sharp, hepatic spines small, situated below and behind antennal spine. Eyes well developed, about

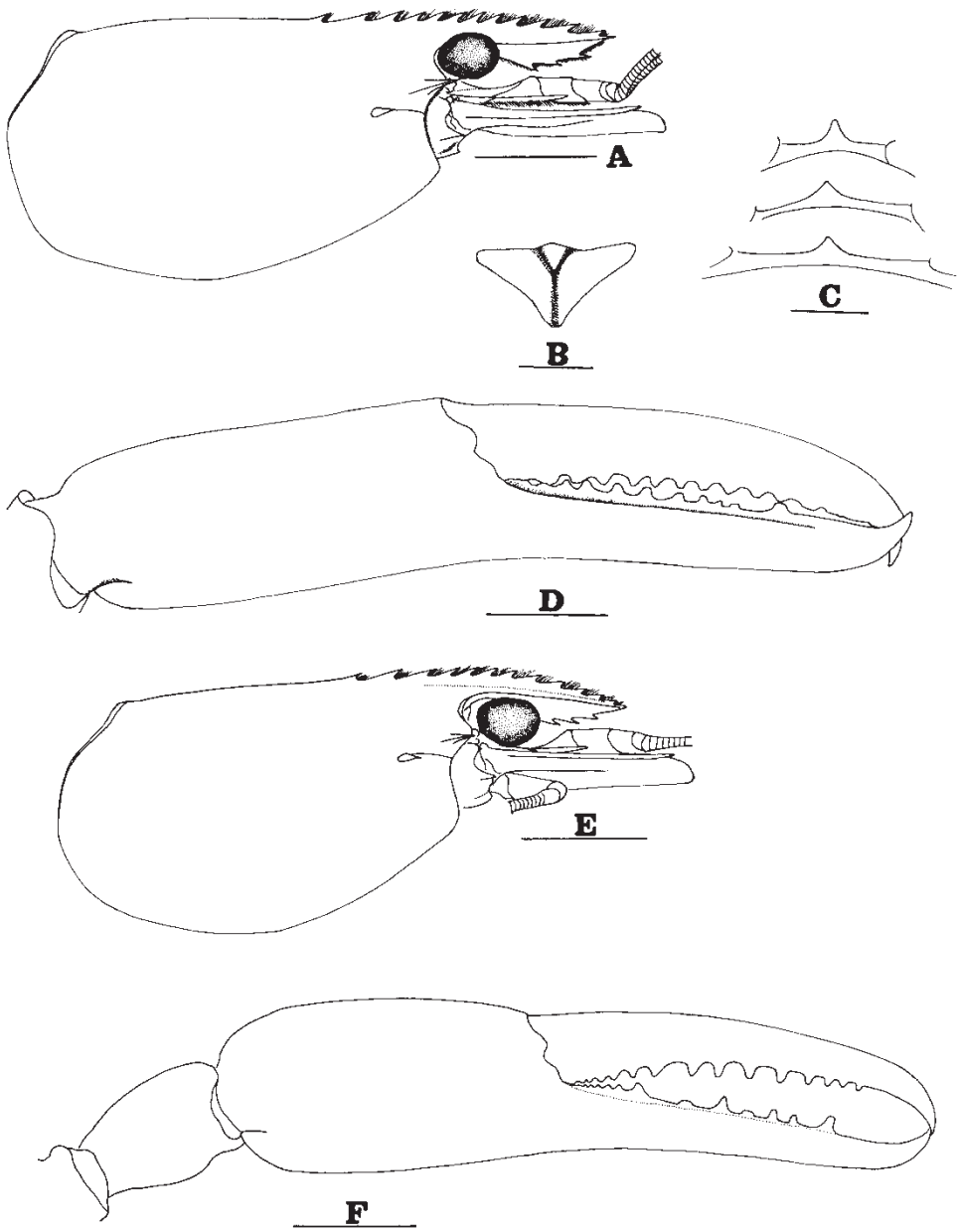


FIG. 18. *Macrobrachium eriocheirum* (♂, cl 16.2 mm, Huai Rong waterfall, downstream from National Park, Wai Long Ngau, coll. Y. Cai *et al.* (ZRC 2000.2669), 11 June 1998): (A) cephalothorax; (B) epistome; (C) first three abdominal sterna with transverse ridge, with median processes; (D) chela of second pereiopod. *Macrobrachium forcipatum* (♂, cl 15.3 mm, CU 1987.135, Satum, south Thailand, coll. P. Naiyanetr, 22 March 1982): (E) cephalothorax; (F) capus and chela of second pereiopod. Scales: (A, D, E, F) 5 mm; (B, C) 2 mm.

0.16 times as long as carapace. Scaphocerite 2.4 times as long as broad, with straight outer margin. Epistome as in figure 18B, trilobed by two depressions. First to third abdominal sternites (figure 18C) with transverse ridge, with median tooth, that of third abdominal sternite largest, that of first two similar in form, less prominent. First pereiopod with fingers as long as palm, chela 0.6 times as long as carpus. Male second pereiopods unequal in length; major male second pereiopod distinctively longer than body, reaching beyond scaphocerite by half length of merus; covered with dense tufts of velvety pubescence on palm and fingers; fingers as long as or slightly longer than palm, with 12–15 teeth on both cutting edges, not gaping, tips crossed when fingers closed; chela four times as long as carpus, carpus 1.3–1.7 times as long as wide. Third pereiopod reaching beyond scaphocerite by length of entire dactylus; propodus 2.6 times as long as dactylus. Uropodal diaeresis with a spine about half length of outer angle. Ovigerous females with eggs 1.0–1.25 × 1.4–1.6 mm.

Remarks

When Dai (1984) described *M. eriocheirum*, she compared her new species to *M. pilimanus*, apparently unaware of the *M. hirsutimanus*. However, *M. eriocheirum* can be separated from *M. hirsutimanus* by the more elongated third pereiopod, the trilobed epistome and the abdominal sternites (see Remarks on *M. hirsutimanus*). *Macrobrachium eriocheirum* differs from *M. pilimanus* (material for comparison see Remarks on *M. hirsutimanus*) by the form of the rostrum (0.34 times as long as carapace versus 0.14–0.2 times); the trilobed epistome (versus bilobed, figure 18C versus figure 16D); and the more prominent process of the first three abdominal sternites (figure 18C versus figure 16D). *Macrobrachium eriocheirum* can also be distinguished from *M. forcipatum* by the more prominent process of the first abdominal sternite (figure 18C versus figure 19C); in having more teeth on the cutting edges of fingers of the male second pereiopod (12–15 versus less than 10) and by the presence of a preanal carina (versus absent).

Macrobrachium eriocheirum is a common river fishery species along the Mekong Basin. It is distributed from Xishuangbanna of Yunnan Province, southern China (Cai and Dai, 1999), to north Thailand, west Thailand, north-east Thailand and east Thailand.

Macrobrachium forcipatum Ng, 1995
(figures 18E, F, 19)

Macrobrachium forcipatum Ng, 1995: 249, figures 2–4 [type locality: Tasek Temengor, northern peninsular Malaysia].

Materials examined

Holotype: ♂, cl 14.1 mm (ZRC 1995.264), Tasik Temengor, south of Banding, Sungai Halong, coll. K. K. P. Lim and H. H. Tan, 1–4 November 1993.

Paratypes: 12 ♂♂, 2 ovigerous ♀♀, cl 8.6–10.4 mm, eggs 1.7 × 1.1 mm (ZRC 1995.265), data same as holotype.

South Thailand. Twelve ♂♂, cl 10.0–14.0 mm, 8 ♀♀, cl 8.5–11.5 mm, 6 ovigerous ♀♀, cl 8.2–9.2 mm, egg with eyes, 1.2 × 1.0 mm (ZRC 2000.2643), Narathiwat Province, Ban Sac tributary of Sungai Kolok, *ca* 19.5 km westwards towards Waeng at T-junction from Sungai Kolok to Waeng and Sungai Padi, 5°47.49′N, 101°80′E, pH 7.6, coll H. H. Tan *et al.*, 23 October 1998; 12 ♂♂, cl 7.5–13 mm, 3 ♀♀, cl

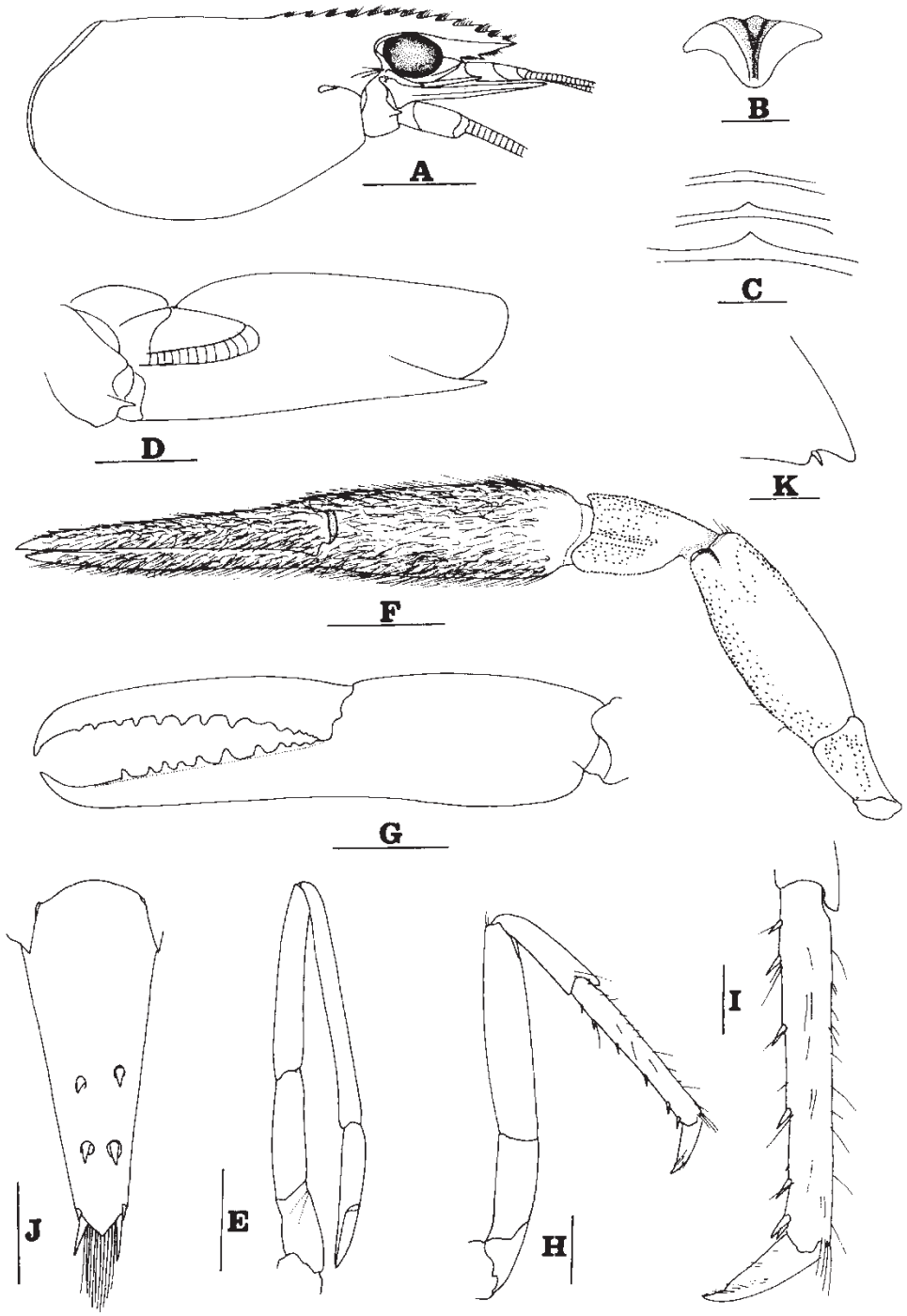


FIG. 19. *Macrobrachium forcipatum* (♂, cl 14.5 mm, CU 1997.135. Satun, southern Thailand, coll. P. Naiyanetr, 22 March 1982). (A) Cephalothorax; (B) epistome; (C) first three abdominal sterna with transverse ridge, with median processes; (D) scaphocerite; (E) first pereiopod; (F) second pereiopod; (G) chela of second pereiopod; (H) third pereiopod; (I) propodus and dactylus of third pereiopod; (J) telson; (K) movable spine of uropodal diaeresis. Scales: (A, F, G) 5 mm; (D, E, H, J) 2 mm; (B, C, I) 1 mm; (K) 0.5 mm.

7.5–12 mm, 16 ovigerous ♀♀, cl 8–12 mm (ZRC 2000.2703), Nam Tok Tone Sai, Phuket, coll. P. K. L. Ng and H. H. Tan, 8 April 1998; 12 ♂♂, cl 12–14 mm, 3 ovigerous ♀♀, cl 9–11 mm (ZRC 2000.2675), Nam Tok Ton Sai, Phuket; 7°55.96′N, 98°19.43′E, coll. P. K. L. Ng and H. H. Tan, 8 April 1999; 3 ♂♂, cl 11.1–15.3 mm (CU 1997.135), Satun, coll. P. Naiyanetr, 22 March 1982; 3 ♂♂, cl 9.8–16.5 mm, 3 ♀♀, cl 7.5–8.0 mm, 8 ovigerous ♀♀, cl 8.5–10.5 mm, eggs with eye spot, 1.5 × 1.2 mm (ZRC 2000.2672), Narathiwat Province, Nam Tok Sipo, downstream area, 6°16.06′N, 101°38.65′E, coll. H. H. Tan *et al.*, 24 October 1998; 6 ♂♂, cl 9.7–11.4 mm, 4 ♀♀, cl 8.5–9.2 mm, 10 ovigerous ♀♀, cl 8.5–11.5 mm, eggs 1.4 × 1.0 mm (ZRC 2000.2671), Songkhla Province, Nam Tok Khao Chong km 25 on road to Trang from Phattalung, 7°39.71′N, 100°2.33′E, coll. H. H. Tan *et al.*, 26 October 1998; 16 ♂♂, cl 10.0–12.6 mm, 5 ovigerous ♀♀, cl 8.2–9.6 mm, 46 specimens (ZRC 2000.2674), Songkhla Province, Plak Khlong, Padi fields on road to Thale Noi from Phatalung, 7°44.46′N, 100°4.83′E, coll. H. H. Tan *et al.*, 25 October 1998; 1 ♂, cl 13.5 mm, 1 ovigerous ♀, cl 8.0 mm, eggs 1.5 × 1.0 mm (ZRC 2000.2676), Satun Province, stream in Ban Kong Kruat, pH 6.0, coll. M. Kottelat, 4 November 1995; nine specimens (5 ovigerous ♀♀), Narathiwat Province, stream at Phu Khao Tong, 6 km west of Ban Buke Ta, pH 6.5, coll. M. Kottelat, 2 November 1995; 2 ♂♂, cl 7.8–11.6 mm, 1 ♀, cl 8.5 mm, 1 ovigerous ♀, cl 10.0 mm, eggs with eyes, 0.8 × 1.4 mm (ZRC 2000.2673), Narathiwat Province, Bocha Bhudo Padee National Park, 6°29.99′N, 101°38.15′E, pH 7.2, coll. H. H. Tan *et al.*, 24 October 1998; 1 ♂, cl 12.0 mm, 3 ovigerous ♀♀, cl 9.5–11.0 mm (ZRC 2000.2681), Sungai Kolok, coll. K. Kobota, no date; 3 ♂♂, four other specimens, Phuket, 18 March 1982; 1 ♂, cl 13.0 mm (CU 1997.138), Kakhon, Si Thammarat, 19 May 1976, coll. P. Naiyanetr; 1 ♂, cl 13.1 mm (CU 1997.127), Krabi, 28 October 1988; 1 ♂, cl 9.0 mm, 1 ovigerous ♀, cl 9.0 mm, seven other specimens (CU 1997.17), Bang Pat waterfall, Phuket, 9 August 1986; 20 specimens (CU 1997.18), Kathu waterfall, Phuket, 17 October 1986; 1 ♂, cl 8.0 mm, 1 ovigerous ♀, Thai Muang, Phang Nga, 25 August 1986; 15 specimens, cl 9.0–11.0 mm (CU 1997.22), Phang Nga, 1 April 1986; 1 ♂, cl 12.5 mm, 1 ovigerous ♀♀, cl 9.0 mm, Thap Put river, 24 August 1986; four specimens (CU 1997.85), Phang Nga, 7 September 1986; 3 ♂♂ (CU 1997.124), Phang Nga, 16 March 1989; 1 ♂ (CU 1997.152), Satun, coll. P. Naiyanetr, 22 March 1982; five specimens, Uttaradit, 20 February 1997; five specimens (CU 1997.157), Phang Nga, coll. P. Naiyanetr, 17 March 1982; 3 ♂♂, cl 13.2–13.4 mm (CU 1997.136), Songkhla, 22 March 1982; 5 ♂♂, cl 12.5–14.45 mm (CU 1997.130), Songkhla, 22 May 1982; 2 ♂♂, cl 13.3–12.5, 1 ♀, cl 11.9 mm (CU 1997.124), Phang Nga, 16 March 1989; 2 ♂♂, cl 11.2–11.3 mm, 1 ovigerous ♀, eggs 1.3 × 1.0 mm (CU 1997.151), coll. Sari Chumphon, 12 December 1981; 1 ♂, cl 12.7 mm (CU 1997.125), Pattani, coll. S. Panha, 25 March 1982; 2 ♀♀, cl 8.2–11.0 mm (one ovigerous, eggs with eye spots, 1.6 × 1.3 mm) (CU 1997.128), Nakhon Si Thammarat, 19 May 1976; 2 ♂♂, cl 11.2–13.0 mm (CU 1997.145), Nakhon Si Thammarat, coll. P. Naiyanetr, 9 March 1976; 2 ♂♂, cl 13.0–14.5 mm (CU 1997.154), Sarat Thani, 27 March 1982; 6 ♂♂, cl 9.5–14.0 mm, 2 ovigerous ♀♀, cl 0.85 mm (CU 1997.1), Phang Nga, coll. P. Naiyanetr, 1989; 2 ♂♂, cl 11.5–12.5 mm, 3 ovigerous ♀♀, cl 8.0–8.5 mm (CU 1997.2), Ramun waterfall, 2 km from Phang Nga, 9 August 1982; 6 ♂♂, cl 10.0–12.5 mm, 1 ovigerous ♀, cl 10.0 mm (CU 1997.3), Tao Thong waterfall, Thap Put Phang Nga, 8 March 1986; 3 ♂♂, cl 7.8–9.5 mm, 2 ♀♀, cl 7.2–8.0 mm (CU 1997.4), Takua Thung, Phang Nga, 27 June 1986; 3 ♂♂, cl 7.0–10.5 mm, 5 ♀♀, cl 8.0–9.5 mm (CU 1997.5), Kapong waterfall, Phang Nga, 21 June 1986; 1 ♂, cl 11.0 mm (CU 1997.6), Lumru waterfall,

Kapong, Phang Nga, 12 July 1986; 37 specimens, cl 10.0–13.0 mm (CU 1997.21), Ton Sai waterfall, Thalang, Phuket, 8 April 1987; 2 ♂♂, cl 9.0–12.0 mm, 2 ovigerous ♀♀, cl 8.0–9.0 mm, 14 other specimens (CU 1997.23), Bag Pa waterfall, Thalang, Phuket, 14 October 1986; 10 ♂♂, cl 8.0–13.0 mm, 2 ovigerous ♀♀, cl 7.5–9.5 mm (CU 1997.25), Thap Put Tao Thong waterfall, Pang Nga, 27 March 1987; six specimens (CU 1997.68), no data; 1 ♂, cl 13.0 mm (CU 1997.127), Krabi, 28 October 1988; three specimens, Satun, coll. P. Naiyanetr, 22 March 1982; 2 ♂♂, cl 10–105 mm (CU 1997.120), Nakhon Si Thammarat, coll. Pen Sak Tan, October 1976; 1 ovigerous ♀, cl 12.5 mm, 1 ♀, cl 18.5 mm (CU 1997.128), Nakhon Si Thammarat, 19 May 1976; one specimen, Nakhon Si Thammarat, 13 October 1988; four specimens (CU 1997.146), Chumphon, 23 July 1977; two specimens (CU 1997.148), Phatthalung, coll. P. Naiyanetr, 28 May 1976; four specimens (CU1997.149), Phuket, 18 May 1982; two specimens (CU 1997.150), Narathiwat, 28 May 1977; three specimens (CU 1997.151), Sawi, Chumphon, 12 December 1981; nine specimens (CU 1997.154), Surat Thani, coll. P. Naiyanetr, 27 March 1982.

West Thailand. One ♂, cl 7.8 mm, 2 ♀♀, cl 6.2–8.5 mm, 1 ovigerous ♀, cl 7.5 mm, eggs 1.0 × 1.5 mm (ZRC 2000.2682), Ratchaburi, Mae Nam Phachi at Ban Phachi, coll. M. Kottelat and K. Kubota, 2 April 1998.

Thai specimens with no specific locality. One ♂, cl 7.5 mm, 1 ♀, cl 8.0 mm, 1 ovigerous ♀, cl 10.0 mm (CU 1997.53); 2 ♂♂, cl 8.3–8.9 mm, 1 ♀, cl 11.5 mm, 1 ovigerous ♀, cl 7.0 mm, 2 ♂♂, cl 13.4–15.0 mm (CU 1997.144).

Diagnosis

Rostrum short, straight or slightly convex, reaching to third segment of antennular peduncle or slightly beyond end of this segment; rostral formula 3–5 + 5–8/1–3, dorsal teeth more widely spaced posteriorly than anteriorly. Antennal spine sharp, hepatic spine small, situated below and behind antennal spine. Eyes well developed, large, about 0.25 times as long as carapace. Scaphocerite 2.7 times as long as broad, with straight outer margin. Epistome as in figure 19B. First to third abdominal sternites (figure 19C) with transverse ridge, with median tooth, that of first abdominal sternum largest, that of second small, that of third absent. First pereiopod with fingers slightly shorter than palm, chela 0.6 times as long as carpus. Male second pereiopods unequal in length; major male second pereiopod distinctively longer than body, covered with dense tufts of velvety pubescence on palm and fingers; fingers as long as or slightly longer than palm, with 7–10 large teeth on both cutting edges, not gaping when fingers closed; chela 4.8 times as long as carpus, carpus 1.4 times as long as wide. Third pereiopod reaching beyond scaphocerite by length of entire dactylus; propodus 2.6–3.0 times as long as dactylus. Uropodal diaeresis with a spine about half length of outer angle. Ovigerous females with eggs 1.0–1.1 × 1.4–1.7 mm.

Remarks

With regards to its relatively larger eye, small egg size, and the fewer number of larger teeth and denticles on the cutting edges of the fingers, *M. forcipatum* can easily be separated from its closest congeners, *M. hirsutimanus* and *M. eriocheirum* (see Remarks on *M. hirsutimanus* and *M. eriocheirum* for details). *Macrobrachium forcipatum* can be distinguished from *M. pilimanus* by the form of rostrum, postorbital teeth occupying one-third the carapace length (versus 0.14–0.20 times), more widely spaced postorbital teeth (versus more closely spaced postorbital than anterior

dorsal rostal teeth) and the fewer number of teeth on the cutting edges of the fingers of the male second pereiopod (7–10 versus 14–17). *M. forcipatum* is distributed in northern peninsular Malaysia and southern Thailand.

Macrobrachium dienbienphuense Dang and Nguyen, 1972
(figures 14H, I, 20)

Macrobrachium dienbienphuense Dang and Nguyen, 1972: 4, figure 3 [type locality: Dien Bien Phu, northern Vietnam].

Macrobrachium dienbienphuense Dang, 1980: 384, figure 220; Liu *et al*., 1990a: 121, figure 19 (part); Cai and Dai, 1999: 223, figure 9.

Macrobrachium longidigitum Dai, 1984: 248, figures 18–22 [type locality: Ganlanba, Lancang river, Xishuangbanna, Yunnan, China] (not *Macrobrachium longidigitum* Bate, 1868, see Cai and Dai, 1999).

Material examined

North Thailand. Three ♂♂, cl 12.2–13.0 mm, 1 ♀, cl 11.8 mm (ZRC 2000.2736), afternoon Ban Tho market, outskirt of Chiang Mai city, from Mae Nam Ping river, coll. Y. Cai, 13 June 1998; 2 ♂♂, cl 12.8–13.4 mm (ZRC 2000.2683), roadside store from Nan to Chiang Mai, coll. Y. Cai, 11 June 98; 1 ♂, cl 11.2 mm (ZRC 2000.2732), forest stream 95 km north from Nan town, Nan Province, about 15–20 km north from Ban Pon, Nam Gae, north of Ban Sala, near Laos, coll. Y. Cai *et al*., 11 June 1998; 2 ♂♂, cl 10.5–13.0 mm, 3 ♀♀, cl 6.5–8.5 mm, 1 ovigerous ♀, cl 7.8 mm (ZRC 2000.2684), Mae Lao river, 40 km from Chiang Rai, 19°58′52.6″N, 99°41′46.1″E, pH 7.8, coll. Y. Cai and Y. Y. Goh, 13 June 1998; 3 ♂♂, cl 7.5–9.5 mm, 5 ovigerous ♀♀, cl 9.5–11.5 mm (ZRC 2000.2720), Chiang Dao river, 11 km from Chiang Dao to Chiang Rai, 83 km from Chiang Mai, 19°4′16.8″N, 99°32′25.3″E, pH 8.1, coll. Cai *et al*., 12 June 1998; 2 ♀♀, cl 10–11 mm, four juveniles (ZRC 2000.2722), Mae Nam Kham river on the way to Mae Sai, 20°07′31.7″N, 99°39′01.7″E, coll. Y. Cai *et al*., 12 June 1998; three specimens (CU 1997.156), Fang, Chiang Mai, 19 March 1979; 3 ♂♂, cl 8–11 mm, 1 ovigerous ♀, cl 9.5 mm (ZRC 2000.2731), Chiang Dao river, 11 km from Chiang Dao to Chaing Rai, 83 km from Chiang Mai, 19°4′16.8″N, 99°32′25.3″E, pH 8.1, coll. Cai *et al*., 12 June 1998; 1 ♂, cl 9.0 mm, 1 ♀, cl 9.5 mm (ZRC 2000.2733), Mae Nam Ping river, 1–1.5 km below the Nakhon Phing bridge of Chiang Mai city, water warm, turbid, mud bank, slow flowing, 18°58′25.6″N, 99°14′34.1″E, pH 8.0, coll Y. Cai and Y. Y. Goh, 13 June 1998.

East Thailand. Four ♂♂, cl 12.5–16.5 mm, 2 ♀♀, cl 7.5 mm, 1 ovigerous ♀, cl 8.3 mm, eggs 1.1 × 0.8 mm (ZRC 2000.2701), Trat Province, Khlong Huai Raeng, 18 km on road 3271 from Trat to Bo Rai, coll. M. Kottelat *et al*., 3 December 1993; 4 ♂♂, cl 9.0–16.2 mm, 2 ovigerous ♀♀, cl 11.0–11.6 mm (ZRC 1997.125), Chantaburi Province, downstream of Nam Phliu (waterfall), 12°31′14.00″N, 102°10′35.1″E, coll. H. H. Tan *et al*., 14 January 1997; 5 ♂♂, cl 8.7–11.4 mm, 2 ♀♀, cl 9.5–11.8 mm (ZRC 1997.120), Thailand, Trat Province, Nam Tok Saphan Hin (waterfall), near Ban Saphan Hin, 12°6′00″N, 102°42′55.06″E, coll. H. H. Tan *et al*., 15 January 1997; 4 ♂♂, cl 6.0–14.0 mm, 1 ♀, cl 7.1 mm (ZRC 1997.113), Thailand, Trat Province, Klong Kwan near Ban Klong Kwan (village), 12°19′36.6″N, 102°38′6.5″E, coll. H. H. Tan *et al*., 15 January 1997; 1 ♂, cl 10.0 mm (ZRC 1997.126), Thailand, Chantaburi Province, downstream of Nam Tok Phliu (waterfall), 12°31′14.0″N, 102°10′36.1″E, coll. H. H. Tan *et al*., 14 January 1997; 1 ♂, cl 13.0 mm (CU 1997.15), Chanthaburi, 4 December 1988.

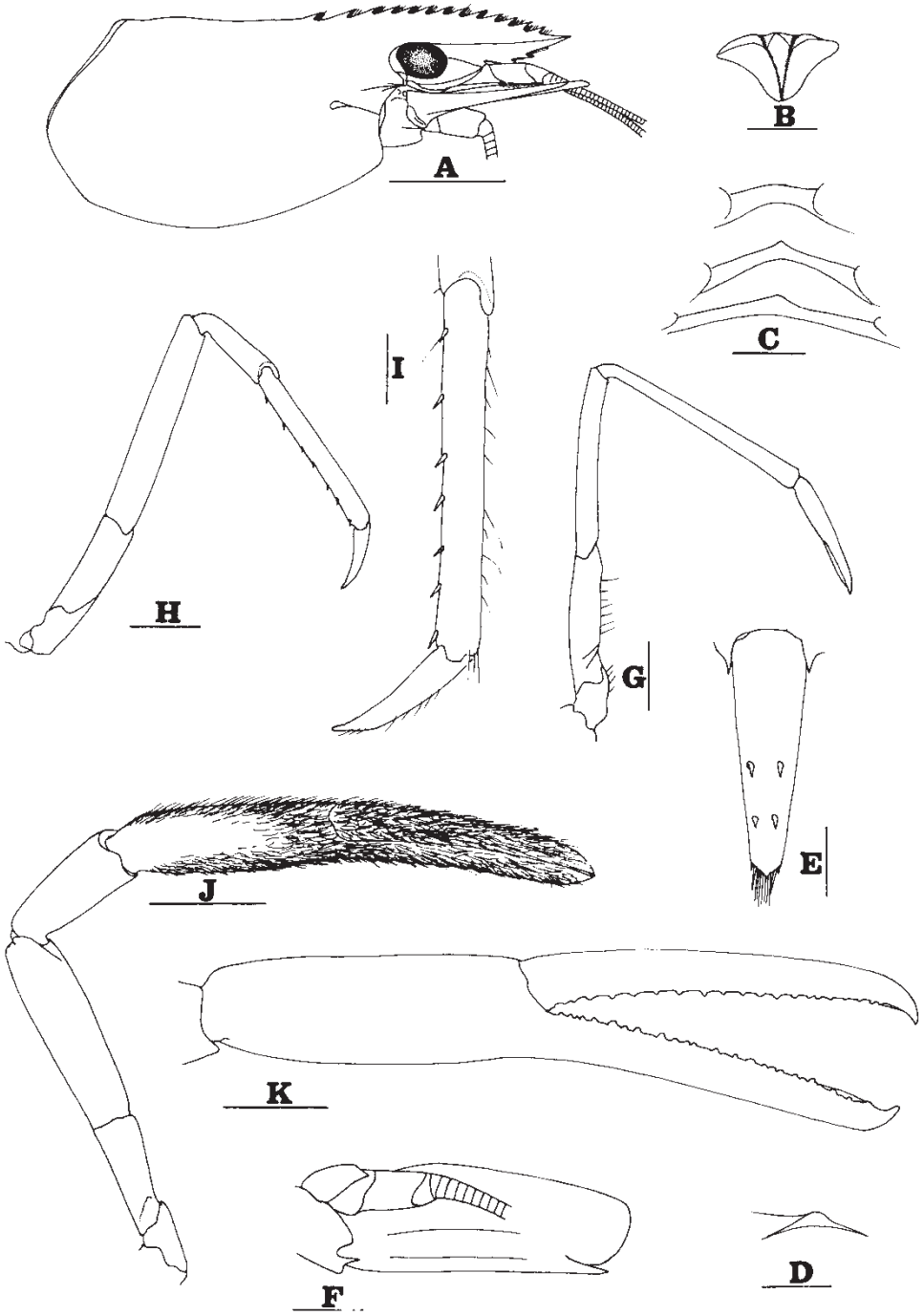


FIG. 20. *Macrobrachium dienbienphuense* (♂, 13.0 mm, ZRC 2000.2736, afternoon Ban Tho market, outskirt of Chiang Mai city, from Mae Nam Ping river, coll. Y. Cai, 13 June 1998). (A) Cephalothorax; (B) epistome; (C) first three abdominal sterna with transverse ridge, with median processes; (D) preanal carina; (E) telson; (F) scaphocerite; (G) first pereiopod; (H) third pereiopod; (I) propodus and dactylus; (J) second pereiopod; (K) chela of second pereiopod. Scales: (A, J, K) 5 mm; (E–H) 2 mm; (B–D) 1 mm.

North-east Thailand. Nine ♂♂, cl 10.2–11.7 mm, Phibun, Mangsahan, Ubon Rachathanim Mae Nam Moon, Mangsahan afternoon market, coll. Y. Cai *et al.*, 16 June 1998; 20 ♂♂, cl 10.0–12.0 mm (ZRC 2000.2685), Phibun Mangsahan market, 46 km east to Ubon Rachathani, coll. Y. Cai, 16 June 1998; 6 ♂♂, cl 10.8–14.0 mm (ZRC 2000.2687), Warin Chamrap market, coll Y. Cai, 17 June 1998; 1 ♂, cl 13.7 mm, That Phanom market on the way from Mukdahan to Nakhon Phanom, coll. Y. Cai *et al.*, 17 June 1998; 32 specimens (CU 1997.67), Surin, 17 November 1993; 44 specimens (CU 1997.119), Loei, coll. P. Naiyanetr, 9 April 1987; 2 ♂♂, cl 13.8–16.3mm, 1 ♀, cl 9.0 mm (CU 1997.147), Nong Bua Lam Phun, 11 December 1982; 1 ♂, cl 9.4 mm, Nakhon Ratchasima, 9 February 1990; 1 ♂, cl 9.5 mm (CU 1997.143), Nakhon, Ratchasima, 6 June 1980; four specimens (ZRC 2000.2698), Mekong river from Ban Phaeng, 2 km from the village, with murky water, sand and mud bank, coll Y. Cai and Y. Y. Goh, 18 June 1998; one specimen (ZRC 2000.2694), Trat Phenom market, 52 km from Phanom Nakhon, coll. Y. Cai and Y. Y. Goh, 17 June 1998.

Central Thailand. Ten ♂♂, cl 9.0–11.0 mm, 5 ovigerous ♀, cl 6.7–8.3 mm, eggs 1.3 × 1.0 mm (ZRC 2000.2693), Lop Buri Province, Chai Badan, coll. Y. Cai, 20 June 1998; two specimens (ZRC 2000.2686), Lam Thakong, outlet of dam at upper Mae Nam Moon, way from Sara Buri to Ratchasima, coll. Y. Cai and Y. Y. Goh, 16 June 1998.

South Thailand. Three ♂♂, cl 7.5–12.0 mm (ZRC 2000.2715), Narathiwat Province, Ban Sac tributary of Sungai Kolok, *ca* 19.5 km westwards towards Waeng at T-junction from Sungai Kolok to Waeng and Sungai Padi, 5°47.49′N, 101°80′E, pH 7.6, coll H. H. Tan *et al.*, 23 October 1998; 1 ♂, cl 14 mm, 1 ovigerous ♀, cl 8.3 mm (CU 1997.158), Krabi, coll. P. Naiyanetr, 18 May 1976; 1 ♂, cl 7.5 mm, 1 ♀, cl 7.4 mm (CU 1997.148), Phatthalung, coll. P. Naiyanetr, 28 May 1976.

Thai specimens with no specific locality. Two ♂♂, cl 13.2–15.3 mm (CU); 7 ♂♂, cl 10.3–14.5 mm, 2 ♀♀ cl 10.4–12.0 mm, 1 ♀, cl 8.8 mm (ovigerous, eggs 1.7 × 1.5 mm) (CU); 2 ♂♂, cl 8.8–16.0 mm, 2 ♀♀, cl 9.8–10.2 mm, 1 ovigerous, eggs 1.4 × 0.95 mm (CU 1997.97); 6 ♂♂, cl 9.2–12.9 mm (CU).

Diagnosis

Rostrum convex, reaching to or slightly beyond end of antennular peduncle; rostral formula 3–5 + 5–9/1–3, dorsal teeth more widely spaced posteriorly than anteriorly. Antennal spine sharp, hepatic spines small, situated below and behind antennal spine. Eyes well developed, about 0.19–0.21 times as long as carapace. Scaphocerite 2.6 times as long as broad, with straight outer margin. Epistome as in figure 20B, trilobed by two depressions. First to third abdominal sternites (figure 20C) with transverse ridge, with median tooth, that of second abdominal sternite largest, that of first less prominent, that of third absent. First pereiopod with fingers as long as palm, chela 0.55 times as long as carpus. Male second pereiopods slender, cylindrical, unequal in length; major male second pereiopod distinctively longer than body; covered with dense tufts of velvety pubescence on palm and fingers; fingers distinctly longer than palm, with 20–32 teeth on both cutting edges, not gaping when closed, tips crossed when fingers closed; palm 3.0–3.7 times as long as wide, carpus elongated, 2.1–3.7 times as long as wide, 0.3 times as long as chela. Third pereiopod reaching beyond scaphocerite by length of entire dactylus; propodus 8.7 times as long as broad, 2.8 times as long as dactylus.

Uropodal diaeresis with a spine about half length of outer angle. Eggs 1.10–1.23 × 1.5–1.62 mm in diameter.

Remarks

With its elongate second pereiopods, *M. dienbienphuense* can readily be differentiated from the other members of the *M. pilimanus* species group, except *M. leptodactulus* (De Man, 1892). However, it can be distinguished from *M. leptodactylus* (cf. lectotype: ♂, cl 16 mm, RMNH D 1801, Buitenzorg (= Bogor), Java, Indonesia, leg. M. Weber, March to September, 1888, designated by Chong, 1989, see figure 17) by the form of the rostrum, which is high and reaches to the end of antennular peduncle or slightly beyond this end (versus narrow, not reaching end of antennular peduncle); the fewer number of postorbital teeth (three to five versus five to six); the larger number of teeth on the cutting edges of the second pereiopods (20–32 versus 15) and the more slender propodus of the third pereiopod (8.7 times as long as broad versus 6.5 times). *Macrobrachium dienbienphuense* seems to be a widely distributed species, occurring from southern China to southern Thailand.

Macrobrachium amplimanus Cai and Dai, 1999

Macrobrachium amplimanus Cai and Dai, 1999: 231, figures 14–16 [type locality: Xishuangbanna, Yunnan, China].

Material examined

HOLOTYPE: ♂, cl 14 mm (IZAS), forest stream near Mengla County, coll. J. Li and Y. Wei, 20 March 1983.

PARATYPE: One ♂, cl 12.5 mm (ZRC 2000.2737), same data as holotype.

North Thailand. Fifteen ♂♂, cl 9.5–13.5 mm, 2 ♀♀, cl 10.7–13.2 mm, 2 ovigerous ♀♀, cl 10.3–13.8, eggs 1.6 × 1.2 mm (ZRC 2000.2692), roadside market from Nan to Chiang Mai, coll. Y. Cai, 11 June 1998; 4 ♂♂, cl 12.7–15.23 mm (CU 1997.133), Chiang Mai, 5 May 1972; 5 ♂♂, cl 13.3–17.5 mm, 1 ovigerous ♀, cl 11.5 mm (CU 1997), Chiang Mai, 22 February 1992; seven specimens (CU 1997.132), Chiang Mai, 22 February 1992.

North-east Thailand. Two ♂♂, 9.2–11.7 mm, 3 ♀♀, cl 7.8–10.0 mm (ZRC 2000.2691), Loei Province, Mekong basin, Nam Huang, rapids at Bau Keng Tou, 17°42′2″N, 101°24′24″E, coll. M. Kottelat and K. Kubota, 31 January 1999.

West Thailand. Six ♂♂, cl 8.0–12.6 mm, 4 ♀♀ (one ovigerous, eggs 1.5 × 0.95 mm), cl 8.5–9.0 mm (CU1997.129), Kanchanaburi, no date.

South Thailand. One ♂, cl 13.5 mm (ZRC 2000.2690), Narathiwat province, hill stream in plantation at end of road branching west at about km 7 on road from Waeng to Ban Bu Ke Ta, 5°52′6.6″N, 101°49′47.1″E, pH 6.8, coll. M. Kottelat, 2 November 1995.

Diagnosis

Rostrum short, straight, reaching to or slightly beyond base of third segment of antennular peduncle, not reaching middle of this segment; rostral formula 3–4 + 6–8/2–4. Male second pereiopod unequal. Major male second pereiopod slightly longer than body, reaching beyond scaphocerite by one-third length of merus; covered with dense tufts of velvety pubescence on almost entire chela; fingers

subequal to palm, with 11–15 teeth on both cutting edges, not gaping when closed, tips crossed; palm laterally inflated, height 1.3 times as long as width; carpus short, conical, about half length of palm; merus slightly shorter than palm, greatly inflated, 2.1 times as long as wide, 2.4 times as long as high. Third pereiopod propodus 2.6 times as long as dactylus. Eggs 0.95–1.20 × 1.5–1.6 mm in diameter.

Remarks

The short, stout and inflated second pereiopods easily distinguishes *M. amplimanus* from the rest of the *M. pilimanus* species group. Even females of *M. amplimanus* have stout, inflated second pereiopods, as in males. *Macrobrachium amplimanus* differs from *M. pilimanus* by the form of the rostrum, the postorbital teeth being more widely spaced than the anterior dorsal rostral teeth and occupying one-third the length of the carapace (versus postorbital teeth more closely spaced than the anterior dorsal rostral ones and occupying 0.14–0.20 times the length of the carapace), the prominent preanal carina (versus indistinct), the trilobed epistome (versus bilobed, see figure 16A in Cai and Dai, 1999 versus figure 16C in present paper); the more pointed processes on the first three abdominal sternites (figure 14B in Cai and Dai, 1999 versus figure 16D in present paper), and the propodus of the third pereiopod being 2.5 times as long as the dactylus (versus 3.2 times). *Macrobrachium amplimanus* can be separated from *M. hirsutimanus* by the trilobed epistome (versus bilobed, figure 15B); and the less prominent processes on the first three abdominal sternites. *Macrobrachium amplimanus* can be distinguished from *M. eriocheirum* by the propodus of the third pereiopod being 2.6 times as long as dactylus (versus 3.3 times); the shorter fingers of the second pereiopod (shorter than palm versus subequal to palm in *M. eriocheirum*) and the more inflated palm (1.6 times as long as wide versus 2.0 times in *M. eriocheirum*). *Macrobrachium amplimanus* can be differentiated from *M. forcipatum* by the relatively shorter rostrum (not reaching beyond middle of third segment of antennular peduncle versus reaches beyond), the pointed process on the third abdominal sternite (versus absence of process); and the shorter fingers of second pereiopod (shorter than palm versus subequal to palm).

Macrobrachium sirindhorn Naiyanetr, 2001
(figures 21, 22)

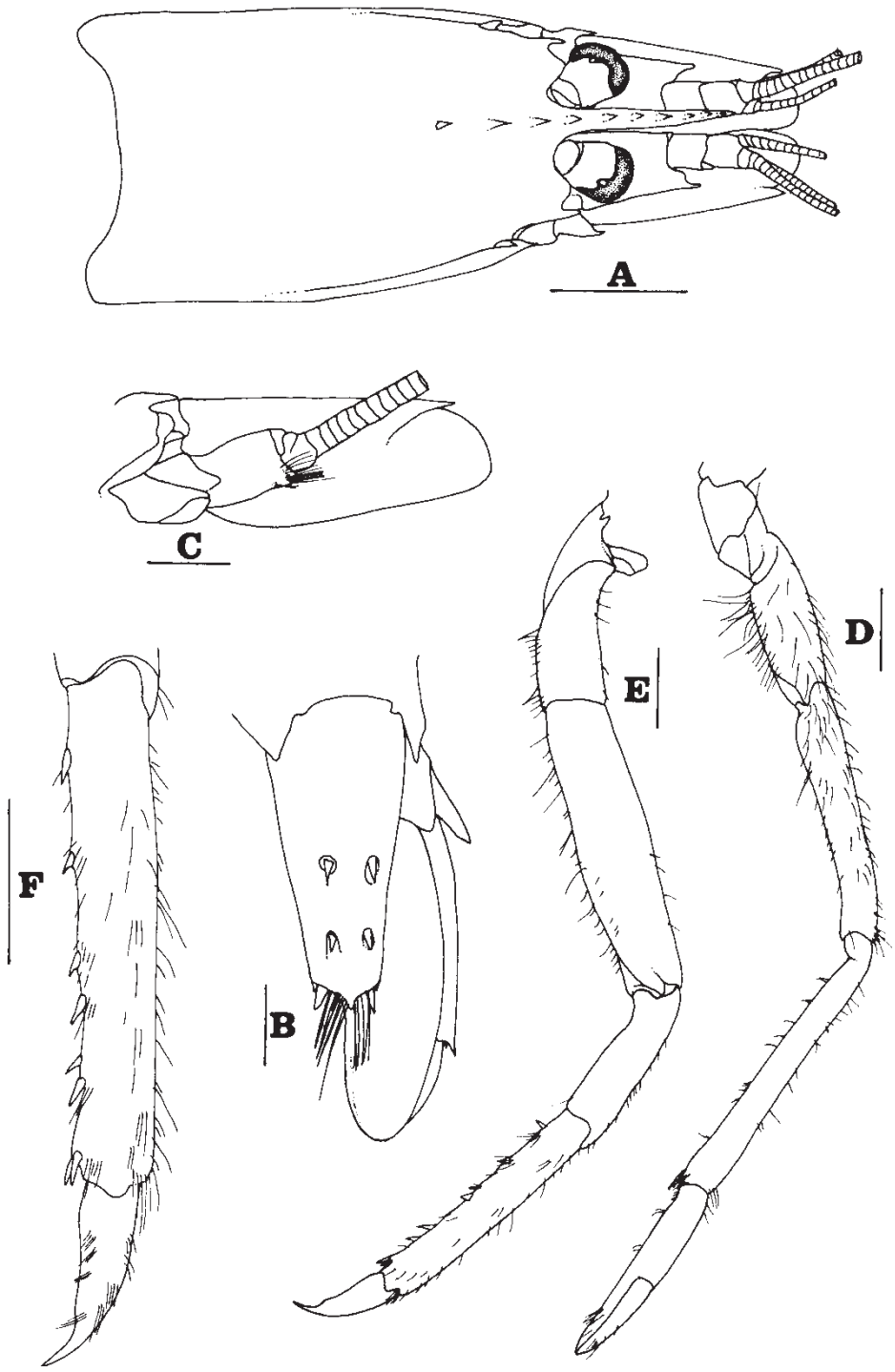
Macrobrachium sirindhorn Naiyanetr, 2001: 609–616, figures 1–2, pl.1 [type locality: Pong Nam Dung waterfall, Mae Soon, Amphoe Fang, Chiang Mai Province, northern Thailand].

Material examined

HOLOTYPE: ♂, cl. 17.6 mm (RMNH D 48632), Pong Nam Dung waterfall, Mae Soon, Fang, Chiang Mai, northern Thailand, coll. P. Naiyanetr, 23 April 1976.

PARATYPES: two ♂♂, cl 12.5–14.5 mm (ZRC 2000.2705), data same as holotype;

FIG. 21. *Macrobrachium sirindhorn* (♂, cl. 16.0 mm, holotype, RMNH-CU 1997.162, stream near Fang, Chiang Mai, northern Thailand, coll. P. Naiyanetr, 23 April 1976). (A) Cephalothorax; (B) epistome; (C) first three abdominal sterna with transverse ridge, with median processes; (D) major second pereiopod; (E) chela of same leg, denuded; (F) merus and carpus of minor second pereiopod; (G) chela of same leg; (H) movable spine on uropodal diaeresis. Scales: (A, D) 5 mm; (B, C) 1 mm; (E–H) 0.5 mm.



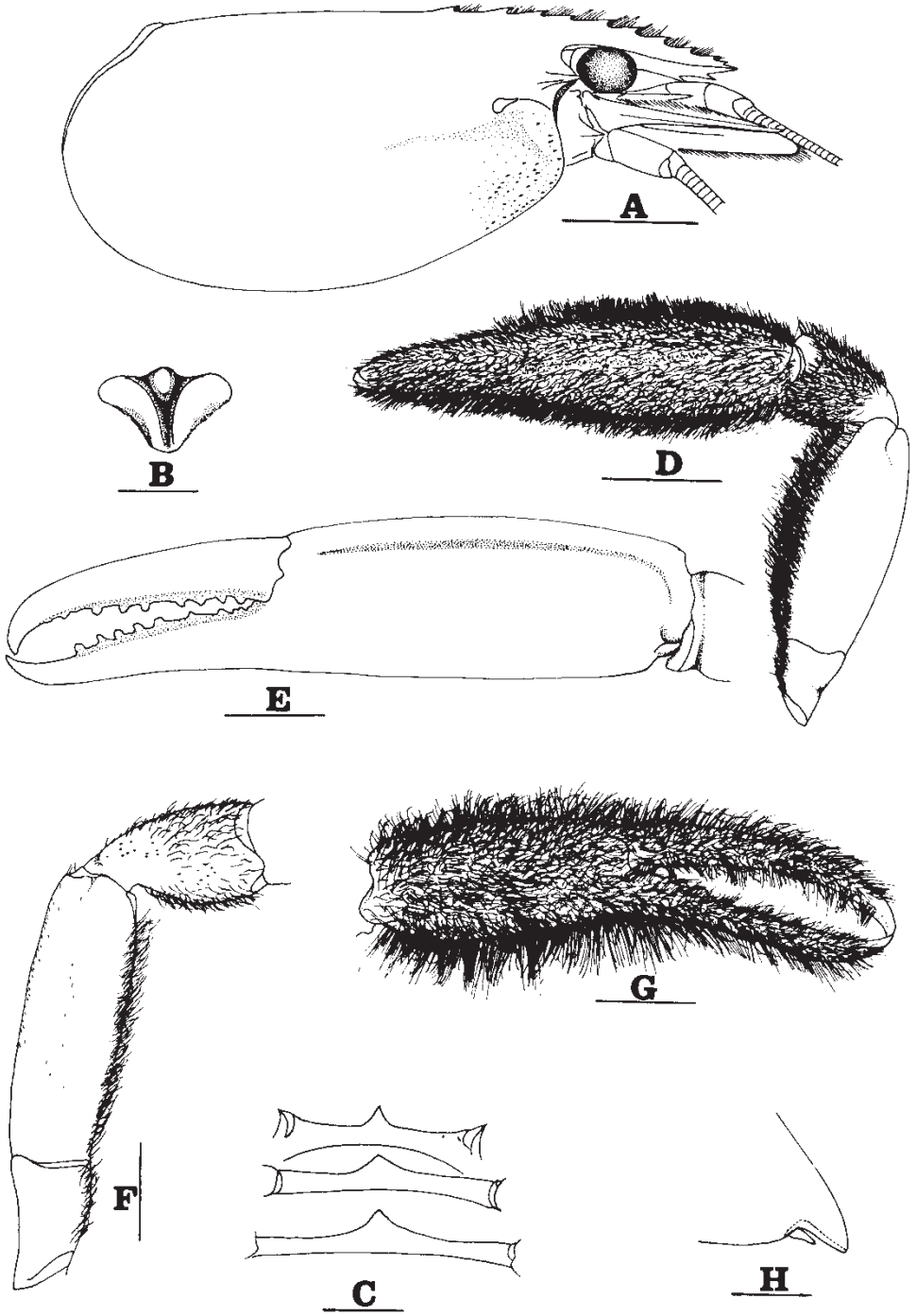


FIG. 22. *Macrobrachium sirindhorn* (♂, cl. 17.6 mm, holotype, RMNH, stream near Fang, Chiang Mai, northern Thailand, coll. P. Naiyanetr, 23 April 1976). (A) Cephalothorax; (B) telson; (C) scaphocerite; (D) first pereiopod; (E) third pereiopod; (F) propodus and dactylus. Scales: (A) 5 mm; (B–F) 2 mm.

2 ♂♂, cl 10.7–17.6 mm (CU1997.162), same data as holotype; 1 ♂, cl 16.2 mm (CU 1997.166), Ban Yang waterfall, Mae Ngon, Fang, Chiang Mai, 1 May 1977; 1 ♂, cl 14.0 mm, 1 ♀, cl 8.0 mm (ZRC 2000.2696), Phu Sang Water, Chiang Kham, Phayao, 29 April 1976.

Others. One specimen (CU 1997.164), Huai Chongkham, Muang, Mae Hong Son, 23 March 1979; 3 ♂♂, cl 13.5–14.5 mm, 1 ovigerous ♀, cl 11 mm (ZRC 2000.2706), Huai Khan, Muang, Mae Hong Son, 23 March 1979; 1 ♂, cl 16.2 mm (CU 1997.139), Fang, Chiang Mai, 23 March 1979; one specimen (CU 1997.163), Ban Yang waterfall, Mae Ngon, Fang, Chiang Mai, coll. P. Naiyanetr, 24 April 1976; three specimens (MNHN), northern Thailand, coll. Pavie, no date.

Diagnosis

Rostrum short, straight or slightly convex, reaching to base of third segment of antennular peduncle or end of segment; rostral formula 3–4 + 5–7/2–3. Antennal and hepatic spines small. Eyes well developed, about 0.15 times as long as carapace. Scaphocerite 3.0 times as long as broad, with straight outer margin. First pereiopod with fingers as long as palm, chela 0.6 times as long as carpus. Male second pereiopods unequal. Major male second pereiopod distinctively longer than body, reaching beyond scaphocerite by half length of merus; covered with dense tufts of velvety setae along almost entire leg; fingers 0.5–0.7 times as long as palm, with 8–10 teeth on both cutting edges, not gaping with tips crossed when closed; palm laterally inflated, height 1.2 times as long as width, length 2.6 times as long as width; carpus short, conical, about half length of palm; merus slightly shorter than palm, greatly inflated. Minor male second pereiopod shorter than body, with fingers gaping when closed, entire leg covered with dense velvety setae as on major one. Third pereiopod reaching beyond scaphocerite by length of entire dactylus; dactylus 3.3 times as long as broad; propodus 6.0 times as long as broad, 2.6 times as long as dactylus. Uropodal diaeresis with a spine about half length of outer angle.

Remarks

Macrobrachium sirindhorn is most similar to *M. pilosum* Cai and Dai, 1999, but can easily be separated by the much stouter form of the second pereiopod, shorter fingers (0.5–0.7 times as long as palm versus slightly shorter than palm); the fingers with only 8–10 teeth on the cutting edge (versus 17); the more inflated palm (2.6 times as long as width versus 3.4 times); and most importantly, the strongly inflated merus (versus not inflated). The presence of the velvety setae on the inner margin of the merus can be used to easily separate *M. sinrindhorn* from other members of the *M. pilimanus* species group.

Macrobrachium sp.
(figure 23)

Material examined

One ♀, cl 16 mm (CU 1997.166), Fang, Chiang Mai, northern Thailand, coll. P. Naiyanetr, 1 May 1977.

Diagnosis

Rostrum (figures 23A, B) slightly downturned, reaching to end of antennular peduncle or end of segment; rostral formula 3 + 7/2. Antennal sharp, situated at

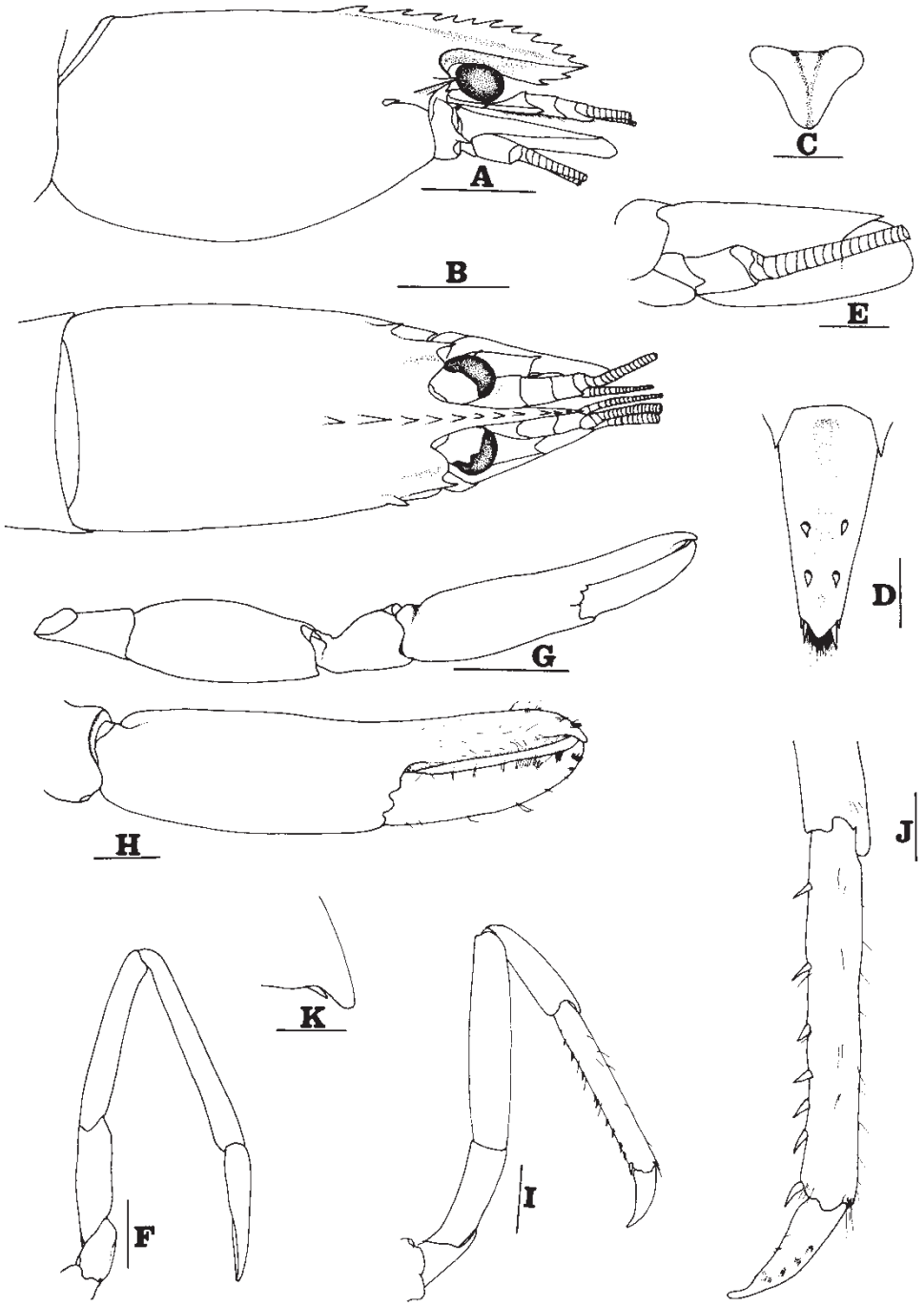


FIG. 23. *Macrobrachium* sp. (♀, cl 16 mm (CU 1997.166) Fang, Chiang Mai, coll. P. Naiyanetr, 1 May 1977). (A) Cephalothorax, lateral view; (B) cephalothorax, dorsal view; (C) epistome; (D) telson; (E) scaphocerite; (F) first pereiopod; (G) second pereiopod; (H) chela of same leg; (I) third pereiopod; (J) propodus and dactylus of same leg; (K) spine of uropodal diaeresis. Scales: (A, B, G) 5 mm; (D–F, H, I) 2 mm; (C, J) 1 mm; (K) 0.5 mm.

inferior orbital angle; hepatic spines small, lying behind and below antennal spine. Eyes well developed, 0.15 times as long as carapace. Telson (figure 23D) 2.1 times as long as wide, with two pairs of small dorsal spines, ending in a median point, lateral spines small, smaller than dorsal spines, intermediate spines well developed, with long plumose setae at distal margin. Epistome (figure 23C) trilobed by two shallow grooves. Basal segment of antennular peduncle distinctly longer than both second and third segments. Scaphocerite (figure 23E) 2.5 times as long as broad, with straight outer margin. First pereiopod (figure 23F) reaching beyond end of scaphocerite by half of carpus, with fingers slightly shorter than palm, chela 0.7 times as long as carpus. Second pereiopod distinctively shorter than body, reaching beyond scaphocerite by carpus; smooth, merus 2.5 times as long broad; carpus conical, cup-shaped, 1.7 times as long as high; chela with fingers 0.6 times as long as palm, no denticles on cutting edges; palm 2.5 times as long as broad. Third pereiopod reaching beyond end of scaphocerite by length of entire dactylus; propodus 7.0 times as long as broad, 3.0 times as long as dactylus. Uropodal diaeresis with a spine about half length of outer angle.

Remarks

With regards to the form of the rostrum and second pereiopod, the present specimen is close to *M. amplimanus* except for the surface of the leg, which is glabrous while that of *M. amplimanus* is covered by velvety pubescence, and the cutting edges on the fingers of the second pereiopod are unarmed (versus with teeth). We are unable to assign this single female specimen with certainty to any of the known *Macrobrachium* species and it seems to belong to an undescribed taxon. The lack of a male specimen, which would show more characters, prevents us from formally naming it for the time being.

Key to species of *Macrobrachium* from Thailand

1 Major pereiopod 2 with dense velvety pubescence 2
– Major pereiopod 2 without pubescence 13

2 Pubescence present on merus and carpus 3
– Pubescence not present on merus 4

3 Pubescence present on chela, carpus and inner surface of merus . . . *M. sirindhorn*
– Pubescence present only on merus and/or carpus . . . . . *M. niphanae*

4 Pubescence present on both palm and fingers 5
– Pubescence present only on fingers 11

5 Movable spine on uropodal diaeresis distinctly longer than outer angle 6
– Movable spine on uropodal diaeresis smaller than outer angle 7

6 Carpus shorter than merus and palm . . . . . *M. malayanum*
– Carpus longer than merus and palm . . . . . *M. trompii*

7 Carpus cup-shaped, less than twice as long as high, cutting edges of fingers of second pereiopod with less than 18 teeth 8
– Carpus elongated, more than twice as long as high, cutting edges of fingers of second pereiopod with more than 20 teeth . . . . . *M. dienbienphuense*

8 Propodus of third pereiopod more than 3.0 times as long as dactylus 9
– Propodus of third pereiopod 2.0–2.6 times as long as dactylus 10

9 Epistome trilobed, cutting edges of fingers of second pereiopod with 12–15 teeth . . . . . *M. eriocheirum*

– Epistome bilobed, cutting edges of fingers of second pereiopod with 7–10 teeth . . . . . *M. forcipatum*

10 Epistome trilobed, female second pereiopod similar to that of male in form . . . . . *M. amplimanus*
– Epistome bilobed, female second pereiopod much smaller than that of male in form . . . . . *M. hirsutimanus*

11 Fingers with longitudinal grooves, velvety pubescence present throughout length of fingers 12
– Fingers without any longitudinal groove, velvety pubescence present only on proximal half or third of fingers 13

12 Rostrum convex, reaching to end of second segment of antennular peduncle or end of antennular peduncle . . . . . *M. hendersoni*
– Rostrum straight, reaching to end of scaphocerite . . . . . *M. assamense*

13 Cutting edge of distal one-third of fixed fingers forming razor-like edge . *M. dolatum*
– Cutting edge of fixed finger not razor-like . . . . . *M. sintangense*

14 Carpus distinctly longer than chela 15
– Capus as long as or shorter than chela 16

15 Rostrum straight, not reaching beyond end of scaphoceite, second pereiopods distinctly longer than body, rostral teeth present throughout length of rostrum . *M. idae*
– Rostrum upturned, reaching distinctly beyond end of scaphocerite, second pereiopods shorter than body, anterior of rostrum unarmed . . . . . *M. lanchesteri*

16 Carpus of major second pereiopod longer than palm but shorter than chela . . . 17
– Carpus of major second pereiopod shorter than palm 20

17 Rostrum with a high crest or upturned 18
– Rostrum straight, no visible crest, reaches to end of scaphocerite . . . *M. tratense*

18 Rostrum upturned, reaching beyond end of scaphocerite, fingers of second pereiopods with teeth on cutting edges 19
– Rostrum with a high crest, not reaching beyond end of antennular peduncle, fingers of second pereiopods without teeth on cutting edges . . . . . *M. mirabile*

19 Rostrum with less than eight ventral teeth . . . . . *M. equidens*
– Rostrum with more than 10 ventral teeth . . . . . *M. rosenbergii dacqueti*

20 Male second pereiopods equal or subequal in length, similar in form 21
– Male second pereiopods unequal in length, dissimilar in form, palm of major leg strongly inflated . . . . . *M. latidactylus*

21 Second pereiopods equal in length, similar in form, movable spine on uropodal diaeresis shorter than outer angle 22
– Second pereiopods subequal in length, similar in form, movable spine on uropodal diaeresis longer than outer angle 23

22 Rostrum not reaching beyond end of antennular peduncle, antennular peduncle 0.4 times as long as carapace . . . . . *M. yui*
– Rostrum reaching beyond end of antennular peduncle, antennular peduncle 0.55 times as long as carapace . . . . . *M. mieni*

23 Fingers of second pereiopod with less than six teeth on cutting edges 24
– Fingers of second pereiopod with one row of 10–20 small teeth on cutting edges . . . . . *M. thai*

24 Carapace with one to two postorbital rostral teeth, finger of second pereiopod with two large teeth on cutting edges . . . . . *M. lar*

– Carapace with three to four postorbital rostral teeth, finger of second pereiopod with one large tooth and four to five small teeth on cutting edges . . . . *M. neglectum*

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