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***Mongolodiptomus dumonti* n. sp., a new freshwater copepod (Calanoida, Diaptomidae) from Thailand**

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Abstract

Mongolodiptomus dumonti n. sp. from several localities in northeast Thailand is described and figured. The new species shares some features with *Mongolodiptomus gladiolus* (Shen & Lee), *M. calcarus* (Shen & Tai) and *M. rarus* (Reddy, Sanoamuang & Dumont), thus the *gladiolus*-group is created. However, it stands out in the female, by the extraordinary large postero-laterally spine at left proximal margin of genital somite. In the male, the right caudal ramus has a large tooth and a bilobed knob on ventral side; basis of the right P5 has a distinct, spur-like process on mid-distal surface; the second exopodite-segment of the right P5 has characteristically irregular outer margin, enlarged at proximal 1/3, but narrowed at distal 2/3 and bearing three lateral spines of unequal sizes; the inner margin of basis of the left P5 is fringed with a narrow hyaline lamella and dilated distally in lateral angle.

Introduction

A new criterion relating to the armature details of the second exopodite-segment of the male right P5 has been introduced recently to separate the genus *Mongolodiptomus* Kiefer from the closely allied *Neodiaptomus* Kiefer and *Allodiaptomus* Kiefer (Reddy et al., 2000). Accordingly, four species of the diaptomid copepods in Thailand have been transferred to *Mongolodiptomus*; namely *M. calcarus* (Shen & Tai, 1965), *M. botulifer* (Kiefer, 1974), *M. malaindosinensis* (Lai & Fernando, 1978) and *M. rarus* (Reddy et al., 1998). Meanwhile, the fifth congener, *M. uenoi* (Kikuchi, 1936) has been added to the Thai checklist (Sanoamuang, 1999; Reddy et al., 2000). During my continuing investigation of diaptomid copepods, I have come across another undescribed species of this genus. This contribution provides an illustrated description of *Mongolodiptomus dumonti* n. sp. and compares an affinity to its congeners.

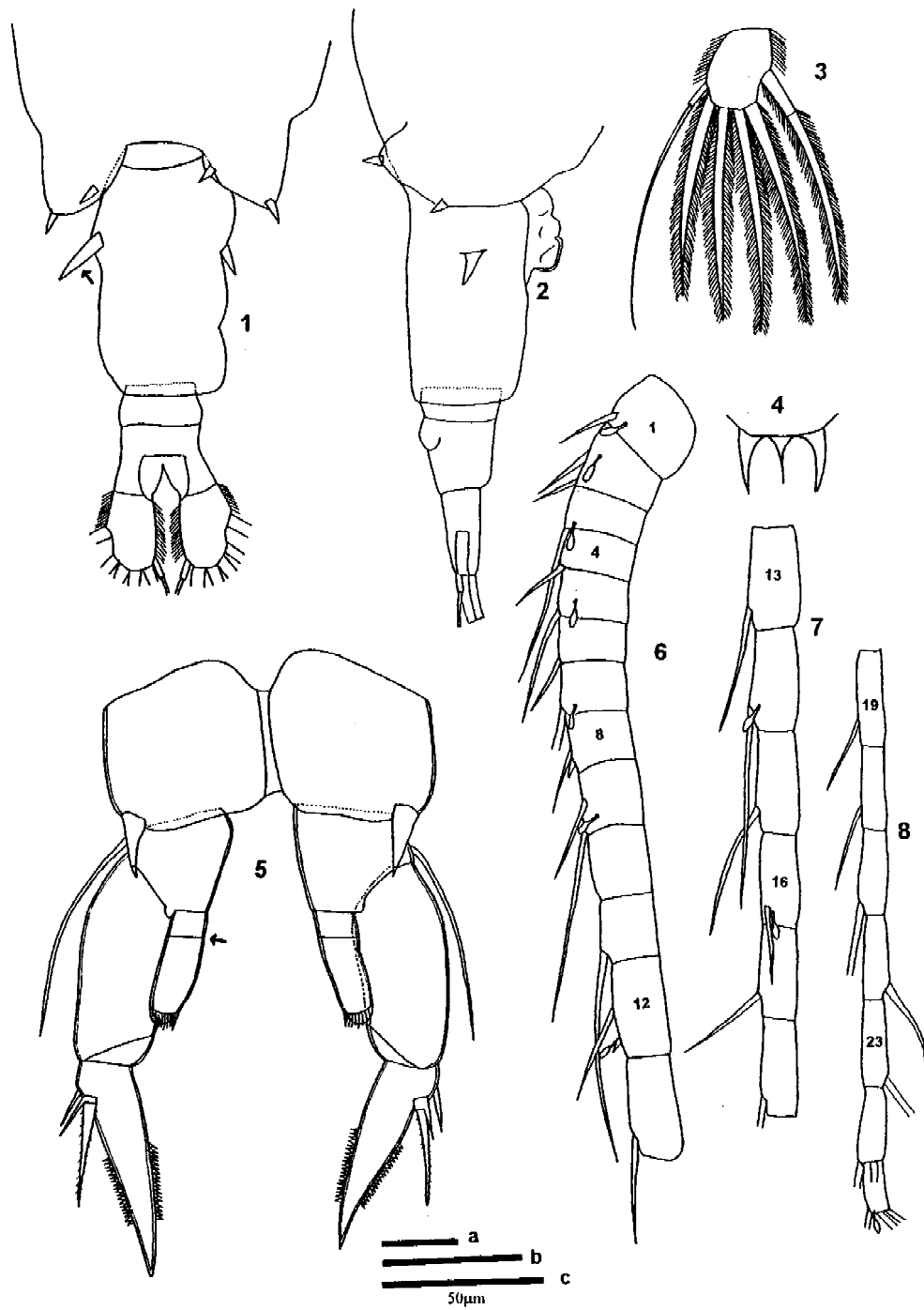
***Mongolodiptomus dumonti* n. sp. (Figs 1–51)**

Type locality

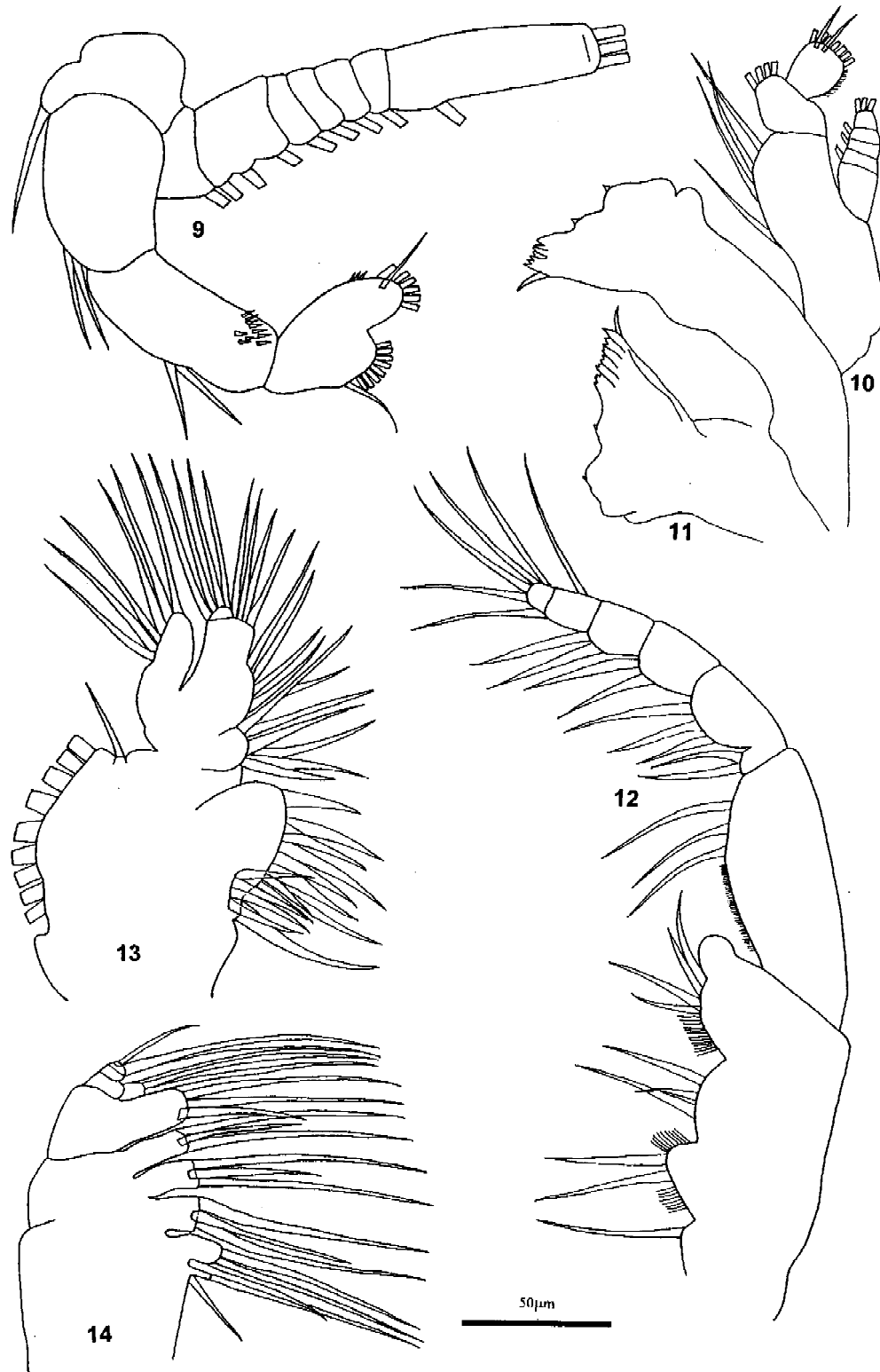
Lam Nang Rong reservoir, Non Din Daeng district, Buriram Province, Thailand. Twenty males, 20 females from a plankton sample, December 6, 1998. Water temperature 27 °C, pH 7.1, conductivity 140 $\mu\text{S cm}^{-1}$. Details of other localities are given in Table 1.

Material examined

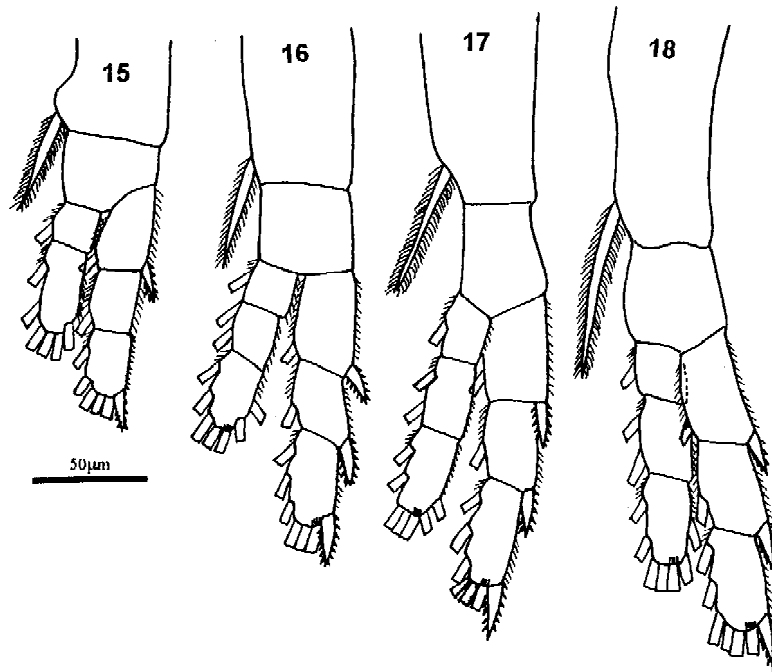
The male holotype, female allotype, and 10 male and 10 female paratypes from the type locality were deposited in the British Museum (Natural History), London. Twenty male and 20 female paratypes were deposited in the Science Museum of Khon Kaen University (KKU), Thailand and the Natural History Museum, Prince of Songkla University (PSU). All type specimens preserved whole, in 5% formalin.



Figures 1–8. *Mongolodiptomus dumonti* n. sp. Female. 1: Pedigers 4, 5 and urosome, dorsal (arrow points to postero-lateral spine on genital somite). 2: Same, lateral. 3: Right caudal ramus dorsal. 4: Rostral spines. 5: P5, posterior (arrow points to septum on endopodite). 6–8: Antennule. Scale bar (a) Figures 1–3, 6–8; scale (b) Figure 4; scale (c) Figure 5.



Figures 9–14. *Mongolodiptomus dumonti* n. sp. Female. 9: Antenna. 10: Mandible. 11: Same, gnathal lobe. 12: Maxilliped. 13: Maxillula. 14: Maxilla.



Figures 15–18. *Mongolodiptomus dumonti* n. sp. Female. 15: P1. 16: P2. 17: P3. 18: P4.

Diagnosis

Female: Lateral wings of fifth pediger almost symmetrical. Each wing rounded and postero-laterally directed. Genital somite dilated at left proximal side just below the lateral wing, and armed with an extraordinary large, postero-laterally spine; right margin irregular with bulges on sub-proximal, mid-length, and distal regions, right genital spine much smaller than left one. P5: coxal spine of moderate size, sensory seta on basis about $3/4$ length of outer margin of first exopodite-segment. Third exopodite-segment small; inner spine with fine serrate margins and extending to about $2/3$ as long as terminal claw. Endopodite 2-segmented.

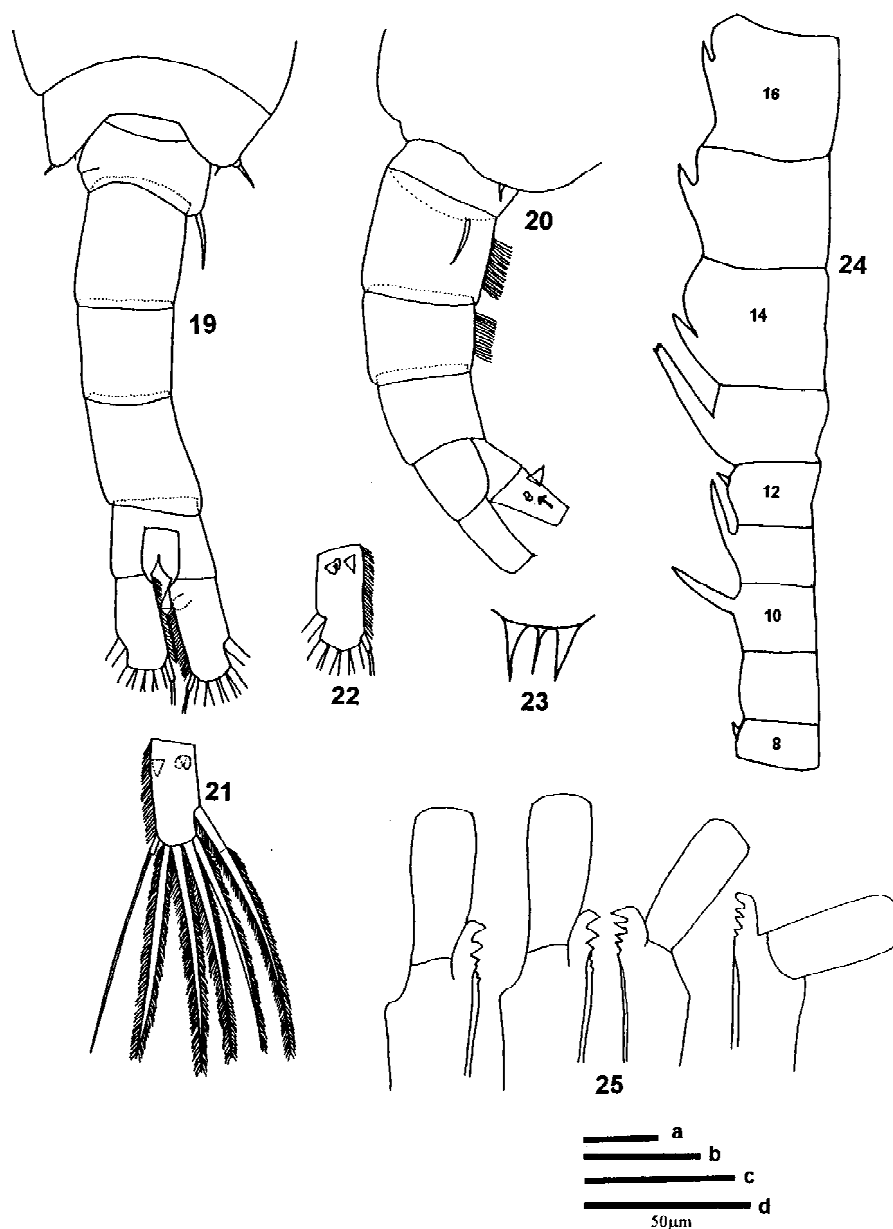
Male: Urosomites 2 and 3 with ventral hair-like setae. Right caudal ramus armed with 1 large triangle tooth and 1 bilobed knob on ventral aspect. Right antennule with spine on segment 8 and 10–16; spine on segment 8 and 12 rudimentary, spine on segment 13 longest; comb on antepenultimate segment relatively short. Right P5: coxal spine long. Basis squarish, with prominent spur-like process on mid-distal surface. First exopodite-segment without spinous process at distal outer corner. Second exopodite-segment with irregular outer margin, enlarged at proximal $1/3$, but narrowed at distal $2/3$, bearing 3 lateral spines of

unequal sizes; proximal spine denticle-like, principal spine strong, point toward posterolateral direction and located distal to middle of outer margin, distal spine smaller than proximal spine and arising from caudal surface close to outer margin. Left P5 reaching proximal third of second exopodite-segment of right P5. Basis rectangular, inner margin fringed with narrow hyaline lamella and dilated distally in lateral angle. Second exopodite-segment relatively slender, proximal inner margin fringed with a field of spinules.

Description

Adult female (Figs 1–18 and 31–39)

Total length exclusive of caudal setae 1.19–1.63 mm, mean 1.40 mm ($n = 20$). Rostral spines as in Figures 4 and 36. Body widest at posterior border of first pediger. Cephalosome gradually attenuating anteriorly; anterior end broadly rounded. Fourth and fifth pedigers fused, but indented laterally; dorsal or lateral spinules absent. Lateral wings of fifth pediger (Figs 1 and 31) moderately developed, almost symmetrical, partially overlapping proximal and lateral margins of genital somite. Each wing (Fig. 1) rounded, postero-

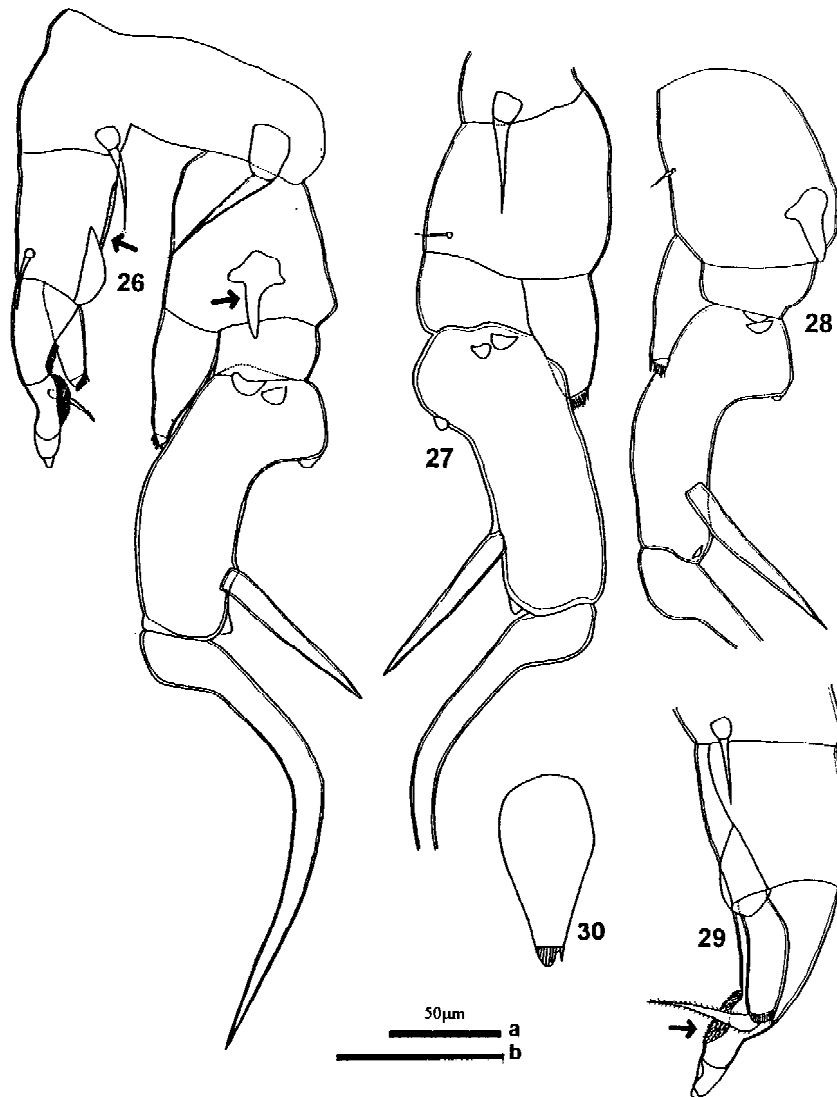


Figures 19–25. *Mongolodiptomus dumonti* n. sp. Male. **19**: Pedigers 4, 5 and urosome, dorsal. **20**: Same, lateral (arrow points to chitinous teeth on right caudal ramus). **21**: Right caudal ramus, dorsal. **22**: Same, ventral. **23**: Rostral spines. **24**: Right antennule, segments 8–16. **25**: Same, combs on antepenultimate segment. Scale bar (a) Figures 19–22; scale (b) Figure 24; scale (c) Figure 23; scale (d) Figure 25.

laterally directed and armed with 1 posterior and 1 inner spine; spines on both wings almost equal in size.

Urosome of 3 somites; percentage length of these somites and caudal rami as follows: 69: 11: 19: 21. Genital somite asymmetrical, longer than the rest of urosome including caudal rami; right margin irregular with bulges on sub-proximal, mid-length, and distal regions; left margin proximally produced into rounded

lobe, carrying extremely large, postero-laterally directed spine (Figs 1, 31 and 32) and lying over dorsal aspect of lobe; right side spine smaller than left one, both spines occurring opposite to each other. Clasping site (Fig. 32) of genital somite relatively wide, shallow, mid-dorsal in position and not fully extending to left margin. Second urosomite smallest with its proximal third telescoped into genital somite. Anal somite



Figures 26–30. *Mongolodiptomus dumonti* n. sp. Male. 26: P5, posterior (arrow points to hyaline lamella on left basis). 27: Same, anterior. 28: Same, lateral. 29: Left P5, exo- and endopodites, anterior (arrow points to field of spinules). 30: Right P5, endopodite. Scale bar (a) Figures 26–28, 30; scale (b) Figure 29.

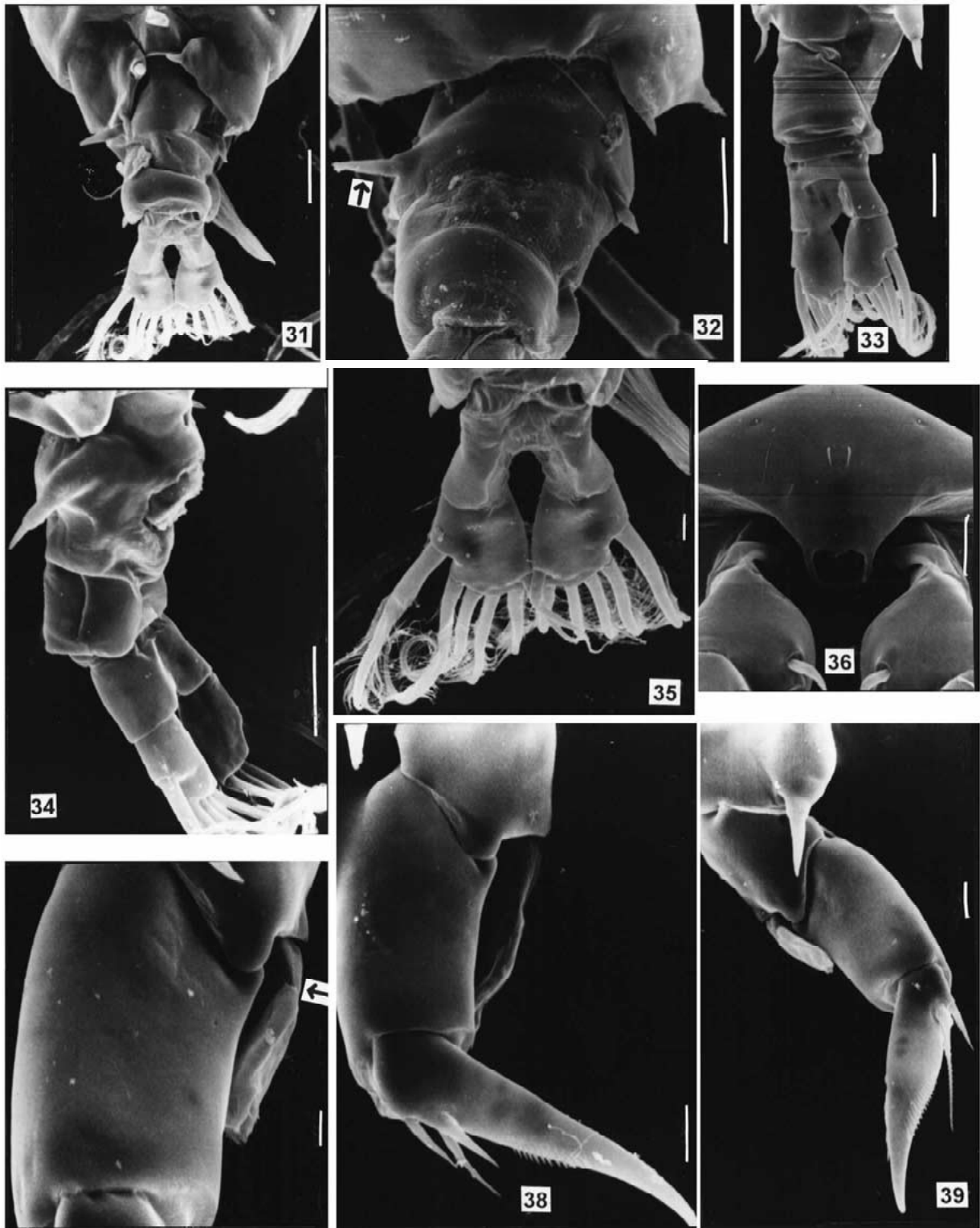
almost as long as caudal rami, with concave lateral margins. Caudal rami parallel, symmetrical, 1.6 times as long as wide, with hairy outer and inner margins (Figs 3, 33 and 35). Lateral seta on either ramus somewhat stouter than other setae and proximally jointed (Fig. 35); dorsal setae longer than principal ones.

Antennule (Fig. 6–8) 25-segmented, extending beyond caudal setae by last 2 segments; armature normal.

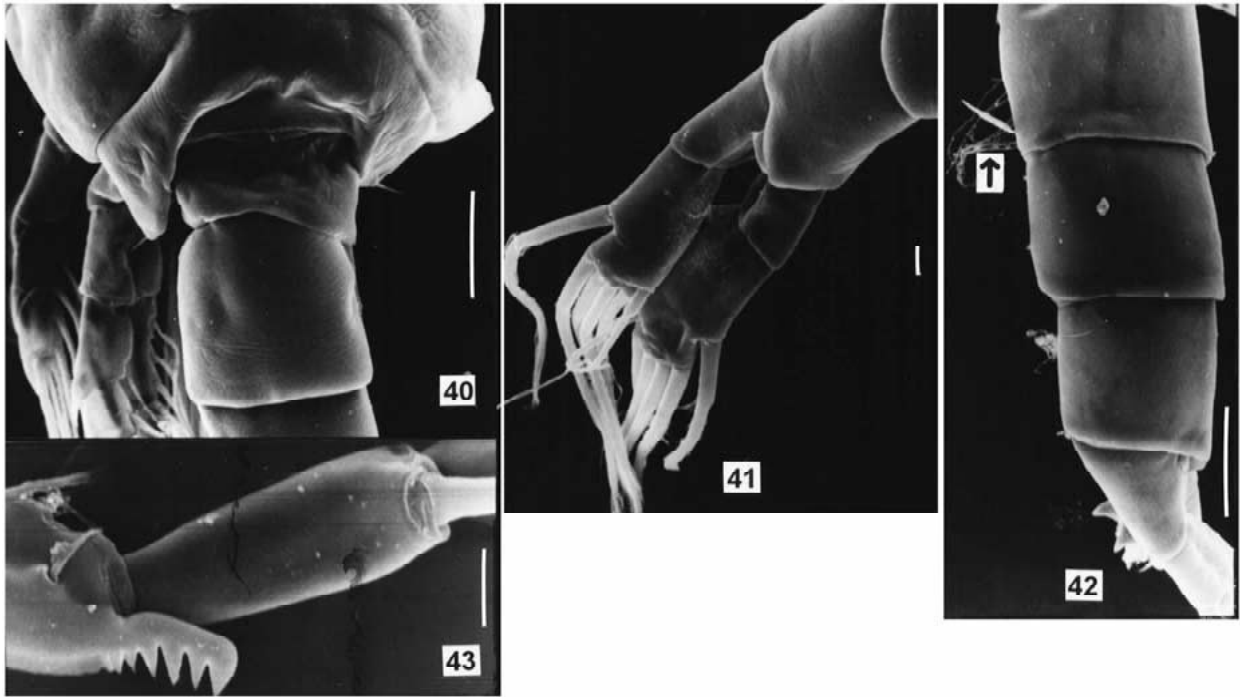
Antenna, mandibular palp and blade, maxillula, maxilla, and maxilliped as in Figures 9–14.

Natatory legs (P1–P4) (Figs 15–18). P1 typical of the subfamily Diaptominae with 1 outer spine on third exopodite-segment. Third endopodite-segment of P2–P4 carrying full complement of 7 setae.

P5 (Figs 5 and 37–39). Symmetrical except for terminal claw of right P5 being relatively smaller than that of the left one. Coxal spine of moderate size, conical and pointed. Sensory seta on basis reaching about 3/4 length of outer margin of first exopodite-segment. First exopodite-segment about 2.2 as long as wide, with convex outer margin and almost straight inner margin. Lateral spine on second



Figures 31–39. SEMs of *Mongolodiptomus dumonti* n. sp. Female. **31:** Last pedigers, urosome and caudal rami, dorsal. **32:** Genital somite, dorsal (arrow points to postero-lateral spine on left margin). **33:** Genital somite and caudal rami, dorsal. **34:** Same, lateral. **35:** Anal somite and caudal rami, dorsal. **36:** Rostral spines, frontal view. **37:** P5, first exopodite-segment and endopodite, anterior (arrow points to septum on endopodite). **38–39:** Same, posterior. Scale: 50 μm , Figures 31–34; scale: 10 μm , Figures 35–39.



Figures 40–43. SEMs of *Mongolodiptomus dumonti* n. sp. Male. **40**: Last pedigers, genital somite and second urosomite, dorsal. **41**: Fourth urosomite, anal somite and caudal rami, dorsal. **42**: Urosome (genital somite not shown), lateral (arrows point to hair-like setae on ventral surface). **43**: Right antennule, comb-like process on antepenultimate segment. Scale: 50 μ m, Figures 40, 42; scale: 10 μ m, Figures 41, 43.

exopodite-segment slightly smaller than outer spine on third exopodite-segment. Terminal claw nearly straight; lateral margins with fine spinules. Third exopodite-segment small, but distinct; inner setiform spine with fine serrate margins and extending to about 2/3 as long as terminal claw. Endopodite 2-segmented (Figs 37–39), and 2/3 as long as inner margin of first exopodite-segment; apex rounded and provided with row of spinules.

Ovigerous females carrying 10–12 eggs in spherical egg sac.

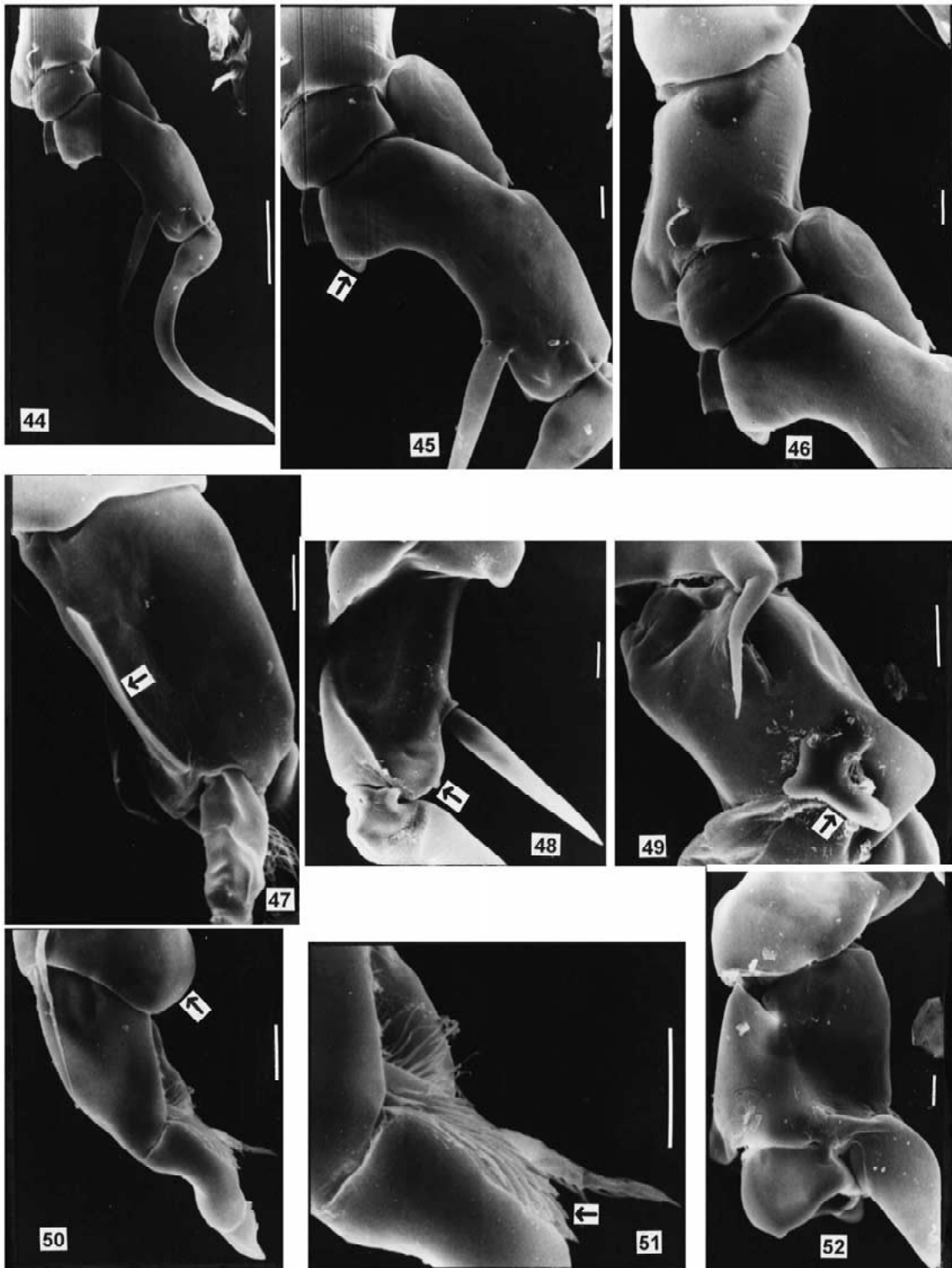
Adult males (Figs 19–30 and 40–52)

Total length (exclusive of caudal setae) 1.05–1.43 mm, mean 1.28 mm ($n = 20$). Rostral spines (Fig. 23) as in females, but slightly smaller. Fourth and fifth pedigers completely separated by septum (Figs 19 and 40), no dorsal or lateral spinules discernible. Lateral wings of fifth pediger moderately in size, asymmetrical; right wing slightly larger than left wing and with somewhat strong postero-lateral spine and 1 minute inner spine; spines on left wing much reduced in size.

Urosome of 5 somites and bent to the right side. Genital somite (Figs 19 and 40) wider than long,

asymmetrical, right margin slightly dilated distally. Genital spine slightly larger than postero-lateral spine on right wing. Second and third urosomites with relatively long hair-like setae on ventral margin (Figs 20 and 42). Fourth urosomite asymmetrical, posterior border produced on right side into small lobe. Caudal rami asymmetrical, right ramus slightly longer than left ramus (Figs 19 and 41), either ramus about twice as long as wide and with delicate hairs on inner margins, outer margins bare. Right ramus (Fig. 22) armed with 2 dissimilar, chitinous teeth; 1 large triangle tooth, projecting laterally from proximal outer margin and arising from lobed structure, and 1 bilobed tooth, lying at proximal mid-ventral surface, clearly visible in lateral view (Fig. 20). Lateral caudal setae stouter than other setae, vaguely jointed proximally and postero-laterally directed (Fig. 41). Dorsal jointed seta almost as long as innermost seta (Fig. 21).

Right antennule (Figs 24, 25 and 43), with spine on segment 8 and 10–16; spine on segment 8 rudimentary like that on segment 12; spine on segment 11 sharply bent backward and as long as that on segment 10; spine on segment 13 largest, bent over next segment and with incised tip; relative lengths of all spines in



Figures 44–52. SEMs of *Mongolodiptomus dumonti* n. sp. Male. 44: Right P5 (in part), anterior. 45: Same, first and second exopodite-segments (arrow points to proximal accessory spine), and endopodite, anterior. 46: Same, basis, first exopodite and proximal part of second exopodite-segments, and endopodite. 47: Left P5 (in part), anterior (arrow points to hyaline lamella on basis). 48: Right P5, second exopodite-segment, posterior (arrow points to distal accessory spine). 49: Same, basis, posterior (arrow points to spur-like process). 50: Left P5, distal part of basis (arrow points to dilated margin), first and second exopodite-segments, and its terminal process, lateral. 51: Same, second exopodite-segment (arrow points to field of spinules). 52: Right P5 (in part), anterior. Scale: 50 μm , Figure 44; scale: 10 μm , Figures 45–52.

Table 1. List of localities sampled for *Mongolodiptomus dumonti* n. sp. with dates, environmental variables and co-occurrence of with other diaptomid copepods

| Locality | Sampling dates | Environmental variables | | | Co-occurrence with other diaptomid copepods |
|---|----------------|-------------------------|-----|---------------------------------|--|
| | | Temp. (°C) | pH | Cond. ($\mu\text{S cm}^{-1}$) | |
| Temporary pond, Nong Bua Lam Phu Province | 06-06-93 | 34 | 8.0 | 200 | <i>Mongolodiptomus rarus</i> , <i>Phyllodiptomus praedictus</i> |
| Chee River, Muang district, Khon Kaen Province | 12-08-93 | 28 | 8.3 | 440 | <i>Mongolodiptomus botulifer</i> , <i>Phyllodiptomus praedictus</i> |
| Hui Jote canal, Ubolrat district, Khon Kaen Province | 12-08-93 | 34 | 7.9 | 1800 | <i>Mongolodiptomus botulifer</i> |
| Sapan Kao pond, Khon Kaen University campus, Muang district, Khon Kaen Province | 13-08-93 | 31 | 7.1 | 170 | <i>Mongolodiptomus calcarus</i> , <i>Mongolodiptomus botulifer</i> |
| Roadside canal, Nong Rua district, Khon Kaen Province | 04-08-94 | 27 | 7.8 | 65 | <i>Mongolodiptomus malaindosinensis</i> |
| Lam Nang Rong reservoir, Non Din Daeng district, Buriram Province | 06-12-98 | 27 | 7.1 | 140 | <i>Mongolodiptomus malaindosinensis</i> |
| Nong Sam Rong swamp, Khu Muang district, Buriram Province | 07-12-98 | 26 | 6.8 | 290 | No other species present |

decreasing order as follows: $13 > 11 \geq 10 > 14 > 15 \geq 16 > 12 \geq 8$; spinous process on antepenultimate segment short, comb-like, with 4–6 teeth (Figs 25 and 43), below which the segment is lined with narrow hyaline membrane. Armature of left antennule generally as in female.

Structure and armature of antennae, oral parts, and natatory legs as in female.

Right P5 (Figs 26–28, 30, 44–46, 48, 49 and 52). Coxa much wider than long and without any outgrowth at distal inner corner; spine long, arising from more or less rectangular lobe at distal outer corner on caudal surface. Basis squarish in outline (Figs 46 and 52), about 1.1 as long as wide and with prominent spur-like process on mid-distal surface margin (Figs 26 and 49); spur slightly variable and fringed with hyaline lamella on outer; inner margin without any hyaline structure; sensory seta at distomedial corner short. First exopodite-segment rather small, wider than long and unproduced at distal outer corner. Second exopodite-segment (Fig. 44) about 1.6 times as long

as wide, with smooth convex inner margin and irregular outer margin; enlarged at proximal 1/3, bearing a denticle-like proximal spine (Fig. 45) at the outer distal projection and narrowed at distal 2/3, bearing 2 lateral spines of unequal sizes, principal lateral spine strong, about 0.7 times as long as its segment, straight, point toward posterolateral direction and located posterior to mid-length of outer margin; distal spine smaller than proximal spine and arising from caudal surface close to outer margin (Fig. 48). End claw slender, 1.4 times as long as exopodite; smoothly curved and gradually tapering to acuminate tip; inner margin covered with narrowed hyaline membrane. Endopodite 1-segmented, sturdy, conical, surpassing proximal third of second exopodite-segment, tip rounded, with subapical row of spinules (Fig. 30).

Left P5 (Figs 26, 29, 47, 50 and 51) reaching proximal half of second exopodite-segment of right P5. Coxa squarish, armed with relatively long spine, arising from small lobe near distal inner corner. Basis rectangular, about 1.3 times as long as wide; lat-

eral outer margin nearly straight, inner margin fringed with narrow hyaline lamella (Figs 26 and 47), and somewhat dilated distally in lateral angle (Fig. 50); sensory seta longer than its counterpart on right leg. First exopodite-segment conical, about 1.3 times as long as second segment and with hairy lobe near inner margin. Second exopodite-segment relatively slender; proximal inner margin fringed with a field of spinules (Fig. 51). Apical process on second exopodite-segment digitiform, about half as long as its segment and tipped with minute hyaline lobe. Seta slender, longer than apical process and covered with fine spinules. Endopodite rectangular, nearly as long as first exopodite-segment; with truncate apex and a row of spinules.

Etymology

The new species is named after Prof. Dr Henri Dumont, in recognition of his significant contribution to the Thai copepods.

Ecology and distribution

Mongolodiaptomus dumonti n. sp. is rather rare in occurrence and has so far been found only in the northeast of Thailand. It occurs in swamps, ponds, reservoirs, canals and rivers, and usually co-exists with 1–2 other diaptomid species (Table 1). The new species is the sixth *Mongolodiaptomus* recorded in Thailand and might be endemic to this country.

Differential diagnosis and relationships

According to the typical armature of the second exopodite-segment of the male right P5, the new species is placed accurately in the genus *Mongolodiaptomus*. Amongst its 10 known congeners (see Reddy et al., 2000), *M. dumonti* n. sp. has closest affinities to *M. calcarus*, *M. gladiolus* and *M. rarus*. Thus, the new species together with these three congeners constitute a distinct group, namely *gladiolus*-group. In fact, the general structure of the second exopodite-segment of the new species displays closest similarity to that of *M. gladiolus* (see Reddy, 1994), but the other several features are more resembling to those of *M. calcarus*. In the male, *M. dumonti* n. sp. and *M. calcarus* share

the following characters: (1) the second and third urosomites have hair-like setae on ventral margin, (2) the caudal rami asymmetrical and the right ramus is armed with 2 dissimilar teeth on ventral side, (3) the inner margin of basis of left P5 is fringed with a narrow hyaline lamella and (4) the basis of the right P5 has a spur-like process on mid-distal surface. Likewise, *M. rarus* also shares the last feature but it has only one tooth on ventral side of the right ramus. Additional characters of the *gladiolus*-group, which can be diagnostic in the male are: (1) the antepenultimate segment of the right antennule is comb-like, (2) the inner margin of basis of the right P5 is naked, and (3) the first exopodite-segment of the right P5 is not produced at distal outer corner.

The unique character of *M. dumonti* n. sp., however, is evident, *inter alia*, by having an extraordinary large postero-laterally spine at left proximal margin of genital somite of the female. It is markedly different from *M. calcarus* in various other characters in the male. On the right P5, the coxal spine and spur-like process on basis are different between the two taxa in shape and size. Whereas the second exopodite-segment of the right P5 in *M. dumonti* n. sp. is relatively slender with long and straight principal lateral spine, it is thick with short and bent spine in *M. calcarus*. The end claw on the right P5 is relatively slender and elongate in *M. dumonti* n. sp. Moreover, the second exopodite-segment of the left P5 in *M. calcarus* has prominent serrate inner margin.

In comparison with *M. gladiolus*, the female of the new species has different morphological details in the lateral wings of fifth pediger and the genital somite (see Figure 164, in Reddy, 1994). Concerning the female P5, the endopodite is 2-segmented in *M. dumonti* n. sp., whereas it is 1-segmented in *M. gladiolus*; the sensory seta on the basis is comparatively long in the new species. In the male, the principal lateral spine of second exopodite-segment of the right P5 in the new species is long, reaching 1/3 length of the end claw, whereas it is short, reaching just the proximal end of the end claw.

Acknowledgements

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