

THREE NEW SPECIES OF GOMPHIDAE FROM VIETNAM (ANISOPTERA)

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Amphigomphus nakamurai sp. n. (holotype ♂: Vietnam, Binh Phuh prov., Mt Tamdao, 30-V-1993), *Merogomphus tamdaoensis* sp. n. (holotype ♂: Vietnam, Binh Phuh prov., Mt. Tamdao, 19/24-V-1993), and *Leptogomphus baolocensis* sp. n. (holotype ♂: Vietnam, 15 km from Baoloc to Ho-chi-minh, Lamdong prov., 16-VI-1996) are described, illustrated and their affinities are pointed out. Material is deposited in the author's institution.

INTRODUCTION

In recent years, many new insect species have been discovered in Vietnam. In 1993, I started a systematic research on the Vietnamese odonate fauna and I have already described several new species, viz. KARUBE (1995, 1999, 2000) and HÄMÄLÄINEN & KARUBE (2001). It is my objective to bring on record my entire collection, but here I describe separately several interesting new Gomphidae species.

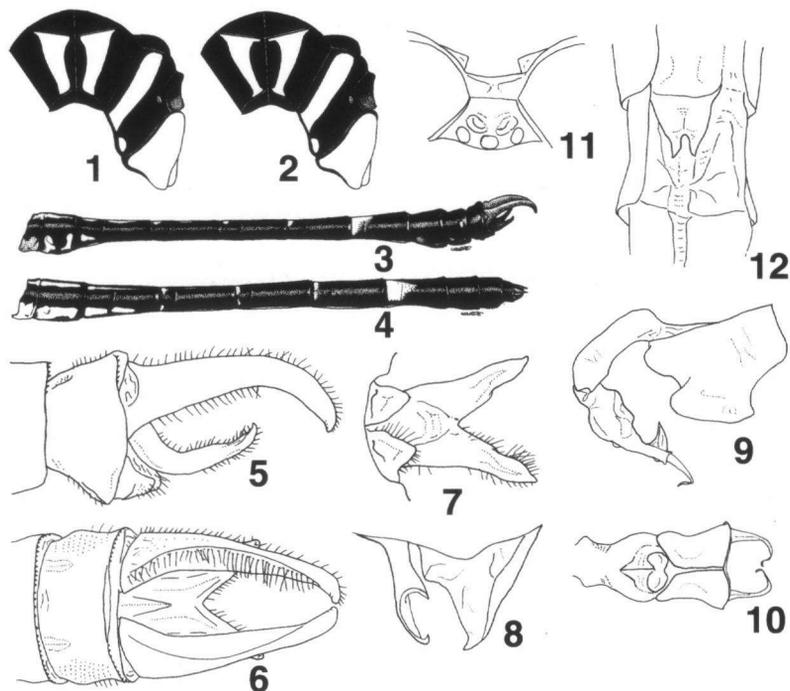
AMPHIGOMPHUS NAKAMURAI SP. NOV.

Figures 1-12

Material. — **Holotype** ♂: Vietnam, Binh Phuh prov., Mt Tamdao, 30-V-1993, S. Nakamura leg.; — **Paratypes**: 1 ♀: same locality as holotype, 29/31-V-1998, H. Karube leg.; — 1 ♂, same locality as holotype, 19/24-V-1993, H. Karube leg.; — 2 ♂: same locality as holotype, 31-V-1993, S. Nakamura leg.; — 2 ♂, 1 ♀, 24/26-V-1999, H. Karube leg. — The holotype is deposited in the Kanagawa Prefectural Museum of Natural History, Odawara.

Etymology. — The species name is dedicated to Mr Shin-ichi Nakamura, a butterfly researcher who usually helps in my studies.

MALE. — **Head** black with yellow markings: labium brownish yellow; labrum black; base of mandible with yellow patch; anteclypeus brown; postclypeus black;



Figs 1-12. *Amphigomphus nakamurai* sp. nov. (Figs 1, 3, 5-10: male; 2, 4, 11-12: female): (1-2) thorax; - (3-4) abdomen, oblique dorsal view; - (5) caudal appendages, lateral view; - (6) same, dorsal view; - (7) same, ventral view; - (8) accessory genitalia, lateral view; - (9) penis, lateral view; - (10) apical part of penis, ventral view; - (11) posterior part of head, dorsal view; - (12) valvular vulvae, ventral view.

frons largely yellow except for anterior and posterior margins; a pair of small rectangular swellings behind each lateral ocellus; occiput black with a small swelling in the middle, posterior margin raised.

T h o r a x. - Prothorax black. Pterothorax black, with symmetrically yellow marks as follows: humeral stripe broad, tapered to dorsal apex, joining the end of mesothoracic collar band; mesepimeron with a broad band; metepisternum with a spot at dorsal apex; metakatepisternum with a vestigial spot on posterior part; metepimeron largely yellow except for around the suture; poststernum yellow.

Legs rather short and black; outside of profemur yellow; each femur with many spines; each tibia with 9-10 very long spines.

Wings hyaline, with yellowish at the base; forewings with 13-16 antenodals and 18-20 postnodals, hindwings with 14-17 antenodals and 12-16 postnodals; pterostigma brown, slightly expanded at the centre, 3.9-4.1 mm in length in forewing, 4.1-4.3 mm in length in the hindwing; anal loop 2-celled; anal triangles 4-celled.

A b d o m e n. — Black with yellow markings, segments 8-10 expanded; 1st segment with ventral half band; longitudinal line runs on the dorsal carina from the anterior border of the 1st to the end of 4th segment, though interrupted in places; segment 2 with a pair of oblong patches, one being auricle to the ventral border, and the other to the post-ventral corner; 3rd with triangular spot at the base; 4th to 6th segments each with a small spot on dorsal base; 7th with a ring covering about the basal 1/3; 8th with a spot on ante-ventral corner; 9th with small spots at ante-ventral corner and medio-posterior border; 10th segment entirely black.

Caudal appendages rather robust, yellowish except for brownish at apices. Superior hooked, robust at the base, gently bent downwards at about apical 2/3 and also slightly curved inwards, apices nearly touching each other. Inferior appendages in lateral view: broad at the base, pointed to oblique-ventral, in about the apical half, sharp posterior curve right angled, becoming thinner in apical 1/5, with apex a little curved upwards; same in ventral view: V-shaped divarications, thinned at apical 3/5 and again near apex.

Genitalia. — Anterior hamule slender and curved posteriorly, with short branch at the middle; posterior hamule rather broad, pointed at apex. Sheath of penis developed, L-shaped, usually completely covering penis. Vesicle cup-shaped posteriorly; distal segment slender, with posterior lobe absent, and a pair of distinct spines at dorsal part near apex, cornua strongly curled inwards.

M e a s u r e m e n t s (in mm). — Length abdomen (incl. app.) 47.7-49.5; — hindwing 37.3-39.2.

FEMALE. — Maculate pattern similar to those of male. A pair of triangular projections behind eyes. Each apex of humeral stripe rather spread. Wings hyaline, with yellowish markings from base to triangles; forewings with 13-15 antenodals and 18-20 postnodals; hindwings with 14-17 antenodals and 13-15 postnodals; pterostigma brown, slightly expanded in the middle, 4.5 mm in length in forewing, 4.6 mm in hindwing.

Yellow markings of abdomen more developed, 3rd segments with medio-lateral edge markings, 8-10th segments black. 8th sternite with medio basal longitudinal ridge; 9th sternite with a pair of sclerites at the side, not sclerotized as in *Onychogomphus*. Valvular vulvae is about half length of 9th, divaricated at the tip, which is pointed outwards. Cerci about 1.3 time as long as 10th.

M e a s u r e m e n t s (in mm). — Length abdomen (incl. app.) 46.9-49.7; — hindwing 39.6-41.6 in length.

DISTRIBUTION. — Northern Vietnam.

NOTES. — The genus *Amphigomphus* was described by Chao in 1954, based on single male from Fujian, China, under the name of *A. hansonii*. In 1996, HAMALAINEN added a second smaller species, *A. somnuki* from northern Thailand. This new species is the third member of the genus and the first recorded from Vietnam. Judged by body markings and appendage structure, it seems closer to *somnuki* than to *hansonii*. It is easily distinguished from the other two species by the strongly bent superiors. The female of the new species is only the second one known in the genus. Compared with *somnuki*, the shape of the vulva is different: in

somnuki, the apex is not divaricated and not pointed outwards.

From these three species, this genus is characterized by (1) slender and biforked anterior hamule, – (2) absence of posterior lobe on distal penis segment, which is furnished with a pair of strong dorsal spines, – (3) broad antehumeral stripe confluent with mesothoracic collar, – (4) forked and rather opened inferior appendage, and by – (5) 2-celled anal triangles, A2 arising between Cua and inner side of subtriangles.

MEROGOMPHUS TAMDAOENSIS SP. NOV.

Figures. 13-22

Material. – **Holotype** ♂: Vietnam, Binh Phuh prov., Mt. Tamdao, 19/24-V-1993, H. Karube leg. – **Paratypes:** 2♀, same locality as holotype, 10-VII / 2-VIII-1990, S. Nagai leg.; – 6♂, 10♀, same locality as holotype, 19/24-V-1993, H. Karube leg.; – 4♂: same locality as holotype, 30/31-V-1993, S. Nakamura leg.; – 1♂, 6♀, same locality as holotype, 2/8-V-1994, S. & H. Karube and native collector leg.; – 2♀, same locality as holotype, 16/17-V-1997, native collector leg.; – 1♂, 1♀, same locality as holotype; – 29/31-V-1998, native collector leg.; – 1♂, 1♀, same locality as holotype, 24/26-V-1999, native collector leg. – The holotype is deposited in the Kanagawa Prefectural Museum of Natural History, Odawara.

Etymology. – “Tamdao” is the name of the type locality.

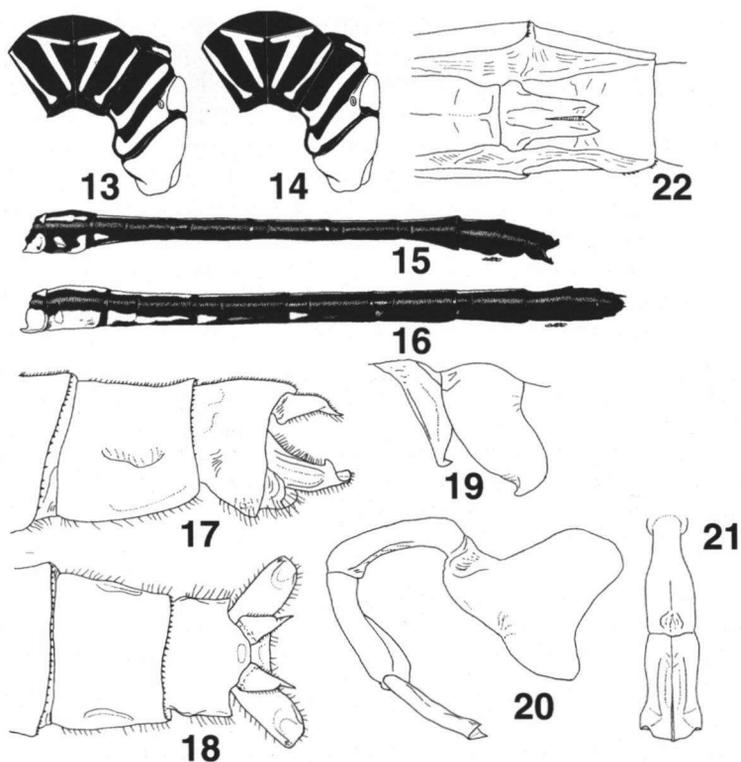
MALE. – Head black with yellow markings: base of mandible with yellow patch; frons with a pair of yellow rectangular spots at the crest; a pair of small swellings behind each lateral ocellus; occiput black slight swelling at the centre, with posterior margin rather raised.

Thorax. – Prothorax black. Pterothorax black, with symmetrically yellow marks as follows: antehumeral stripe slender and joining mesothoracic collar band to form T-marking; humeral stripe slender, a little curved anteriorly, expanded at the dorsal tip; mesokatepisternum with an oblong spot ventrally; mesepimeron with a median stripe with dorsal part spread anteriorly; metepisternum and metepimeron also largely yellow except for round the suture, the former connected with yellow metakatepisternum; poststernum yellow.

Legs long and black; each femur with many spines, with inner edges several strong spines; each tibia also with very long spines.

Wings hyaline, with yellowish spot at the base; forewings with 16-22 antenodals and 17-24 postnodals, hindwings with 15-19 antenodals and 11-17 postnodals; pterostigma brown, slightly expanded in the middle, 4.2-4.6 mm in length in forewing, 4.3-4.4 mm in length in hindwing.

Abdomen. – Expanded in the last four segments, black with greenish yellow markings; 1st segment with a ventral mark and a triangular spot at the dorso-posterior border; a longitudinal line runs on the dorsal carina from the anterior border of the 2nd to the end of the 8th segment, which is narrowed to the apex; segment 2 with a lateral mark at post-ventral corner, auricle yellow; 3rd with ante-ventral edge mark; remaining segments black, especially hairy on last three segments.



Figs 13-22. *Merogomphus tamdaoensis* sp. nov. (Figs 13, 15, 17-21: male; 14, 16, 22: female): (13-14) thorax; - (15-16) abdomen, oblique dorsal view; - (17) caudal appendages, lateral view; - (18) same, dorsal view; - (19) accessory genitalia, lateral view; - (20) penis, lateral view; - (21) apical part of penis, ventral view; - (22) valvular vulvae, ventral view.

Caudal appendages black. Superiors short and conical, with small ventral projection at the base, spiny in apical 1/4. Inferior appendages with opened divarications, in dorsal view roundly truncate at apex; in lateral view gently narrowed towards apex, and with dorsal broad spines at the outer corner, rounded at inner apex.

Genitalia. - Anterior hamule broad at the base, suddenly narrowed towards apex, with apex strongly hooked posteriorly; posterior hamule robust, with apex hooked anteriorly. Vesicle triangularly protruded downwards and cup-shaped ventro-posteriorly; stem slender; median segment rather flat and tapered to basal apex; posterior lobe degenerated, visible small median longitudinal rise; distal segment broad and depressed, very simple structure, slightly narrowed at the median sides, with median longitudinal groove ventrally, with apex truncated and broadly protruded as small lobe ventrally.

Measurements (in mm). — Length abdomen 50.3-52.3 (incl. app.); — hindwing 42.1-46.0.

FEMALE. — Pattern of markings very similar to those of the male. Each tibia and femur more densely spined. Wings tinged with light golden yellow, yellowish at the base; forewings with 16-22 antenodals and 21-25 postnodals, hindwings with 17-21 antenodals and 13-17 postnodals; pterostigma brown, slightly expanded in the middle, 4.7-5.0 mm in length in forewing, 4.8-5.2 mm in length in the hindwing.

Yellow markings of abdomen more developed. Ventral 2/3 of 1st to 2nd segment with yellow band, 3-5th each with edge-shaped lateral markings at the base and with a yellow stripe medio-ventrally, but in mature specimens these stripes difficult to recognize; 6th-8th with faintly recognizable basal spots, 9th and 10th black. Valvular vulvae is about 3/5 length of 9th, lobed with divaricate tip. Cerci about same length as 10th.

Measurements (in mm). — Length abdomen 50.1-55.7 (incl. app.); — hindwing 46.4-50.5.

DISTRIBUTION. — Northern Vietnam.

NOTES. — The new species is similar to *M. chaoi*, described from Yunnan, China, but distinguished by (1) larger body size, — (2) smaller and more slender superior appendages, — (3) outer apex of inferior appendages with broad spines, and by — (4) strongly hooked anterior hamuli.

LEPTOGOMPHUS BAOLOCENSIS SP. NOV.

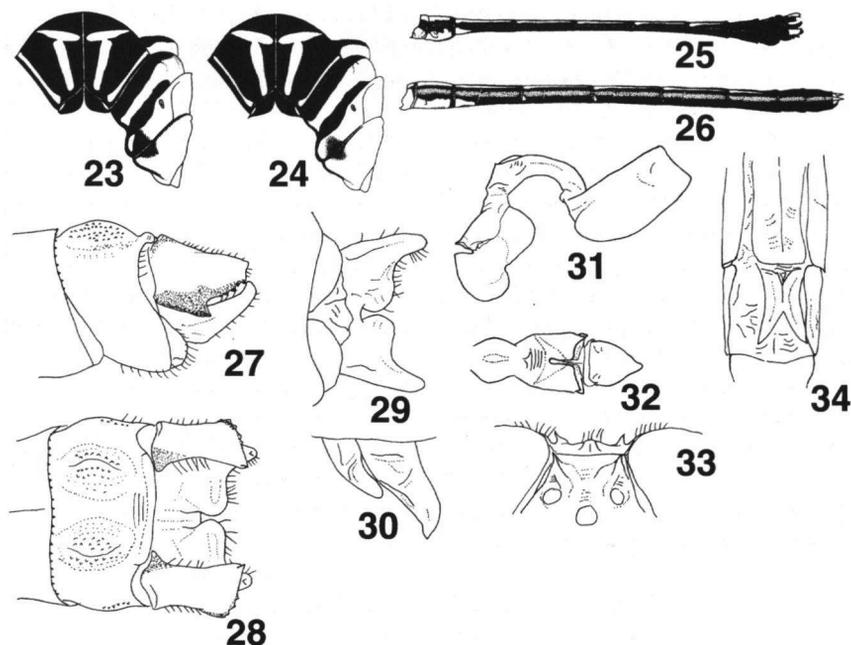
Figures 23-33

Material. — **Holotype** ♂: Vietnam, Lamdong prov., 15 km from Baoloc to Hochiminh, 16-VI-1996, H. Karube leg. — **Paratypes**: 1 ♀: same date as holotype, — 1 ♂ (immature), 18 km from Baoloc to Hochiminh, 6-V-1997, H. Karube leg. — The holotype is deposited in the Kanagawa Prefectural Museum of Natural History, Odawara.

Etymology. — “Baoloc” is the name of the type locality.

MALE. — **Head** black with yellow markings: labium whitish yellow; labrum black with a pair of rectangular dorsal spots; anteclypeus and postclypeus black; antefrons largely yellow except for ventral 1/4 and lateral to dorsal border; vertex rather protruded above median ocellus as a pair of small swellings; occiput black, triangularly raised at median part, which is yellowish.

Thorax. — Prothorax yellowish with black marks as follows: anterior and posterior lobe largely yellow, median lobe with X-shaped central mark. Pterothorax black, with symmetrical yellow marks as follows: antehumeral stripe tapered towards dorsal apex, narrowly joining with the end of mesothoracic collar, making T-shaped marks; humeral stripe thin, slightly expanded at the dorsal apex, and connected with a yellow spot on the mesokatepisternum; mesepimeron with a median band, broadened to ventrad; metepisternum largely yellow, tapered to dorsal apex, which is connected with yellow metakatepisternum, with very pale blackish marks near dorsal apex; metepimeron also largely yellow except for dorsal half along metapleural suture and edge of post-dorsal part; poststernum yellow; outsides of



Figs 23-34. *Leptogomphus baolocensis* sp. nov. (Figs 23, 25, 27-32: male; 24, 26, 32, 33: female): (23-24) thorax; - (25-26) abdomen, oblique dorsal view; - (27) caudal appendages, lateral view; - (28) same, dorsal view; - (29) same, ventral view; - (30) accessory genitalia, lateral view; - (31) penis, lateral view; - (32) apical part of penis, ventral view; - (33) posterior part of head, dorsal view; - (34) valvular vulvae, ventral view.

coxae yellowish.

Legs rather long, brownish black, with many spines on each femur and several long spines on each tibia.

Wings hyaline; forewings with 11-12 antenodals 14-16 postnodals, hindwings with 11-12 antenodals and 11-12 postnodals; pterostigma brown, slightly expanded at the middle, 2.8-3.0 mm in length in forewing, 3.3-3.4 mm in length in the hindwing.

A b d o m e n. - Black, with yellow markings; 1st segment yellow except for remaining black area at dorsum; segment 2 with yellow ventral band; 3rd with triangular spot at antero-ventral part; 4th with a small vestigial spot at antero-ventral; with longitudinal line running along the dorsal carina from the anterior border of segments 1 to 2, which stops before the posterior border, and starts again from 3rd to 7th; 8-10th segments entirely black, 10th with a pair of tubercles dorsally.

Caudal appendages slender. Superiors whitish, except for a brownish inner and ventral side, conical, widely separated, with strong ventral spines along the basal

1/3, with 6 ventral teeth lined up apical 2/5, inner apex pointed. Inferior appendages black, slender; in lateral view curved upwards and tapered along the apical half; in dorsal view broadly bilobed with prolonged outer apex, each lobe with inner circular projections which are nearly touching.

Genitalia. — Anterior hamule billed, rounded at the apex; posterior hamule rather broad, pointed at apex. Vesicle with a V-shaped median notch at the anterior area; stem armed, expanded apically; middle segment broad, bell-shaped in dorsal view; distal segment a depressed hemisphere, protruded ventrad; posterior lobe expanded, with posterior half clear; cornua vestigial, very short.

Measurements (in mm). — Length abdomen (incl. app.) 42.4; — hindwing 31.9-32.1.

FEMALE. — Markings very similar to those in male. Head behind each lateral ocellus horned; from median part of occiput to posterior border a hemispherical swelling, of which the top to occiput yellowish; each side of occipital swelling with a distinct vertical horn. Legs brownish, each tibia and femur with long spines.

Wings hyaline; forewings with 11-13 antenodals and 15-17 postnodals, hindwings with 11 antenodals and 11-12 postnodals; pterostigma light brown, slightly expanded centrally, 3.2 mm in length in forewing, 3.6 mm in hindwing.

Abdominal markings similar as in male, but 4-8th segments with very small latero-basal spots. 9th and 10th black. Valvular vulvae long, rather shorter than 9th segment, divaricated for about half the length and the divarications slightly curved outwards. Cerci white, about same length as 10th. Supra-anal plate white.

Measurements (in mm). — Length abdomen (incl. app.) 34.0; — hindwing 39.8.

DISTRIBUTION. — Southern Vietnam.

NOTES. — The new species is similar to *L. perforatus* Ris from China, from which it is easily distinguished by (1) smaller body size, — (2) different shape of antehumeral stripes, — (3) more slender inferior appendage and with outer projections, — (4) more developed distal segment of penis, and by — (5) long valvular vulvae.

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