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***Macromidia genialis buusraensis* subspecies nova
(Odonata, Synthemistidae s.l.) from eastern Cambodia**

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Abstract

Macromidia genialis buusraensis subspecies nova is described from 10 males and 2 females from three localities of Mondulkiri Province, the eastern Cambodia (the type locality: a brook downstream Buu Sraa Waterfall 12°34' N 107°25' E). The new subspecies is close to *M. g. shanensis* Fraser, 1927 and differs from it by an additional, and the broadest, yellow spot on S7. It is partly syntopic with *Macromidia rapida* Martin, 1907. A brief overview of the current knowledge of the genus *Macromidia* Martin, 1907 is provided.

Key words: dragonfly, Corduliidae, Synthemistidae, Idionychinae, *Macromidia*, Odonata, Cambodia, new subspecies

Introduction

Macromidia Martin, 1907 (= *Indomacromia* Fraser, 1924) is rather a small Oriental genus of about dozen of species, some of which are known from one or few specimens only, and rather limited descriptions. The genus used to be included into the family Corduliidae until recent molecular studies showed that in the traditional sense this family is polyphyletic. Molecular data unequivocally evidenced that Gomphomacromiinae, Synthemistinae and Idionychinae form a monophyletic group, the so-called 'GSI clade' (Ware et al. 2007). However, the joint paper revising Odonata families according to molecular data (Dijkstra et al. 2013) very counter-traditionally left 18 genera (including *Macromidia*) as 'Libelluloidea incertae sedis', while at the same time so many families were reshuffled dramatically. The molecular evidence (although not covering all those 18 genera) is more than sufficient to attribute the GSI clade to Synthemistidae in the broad sense (the oldest available family group name) as it has been already done so by Schorr & Paulson (2018) in their World Odonata Species List.

A short overview of *Macromidia* spp. was published by Wilson (1996) but since that review important new data have appeared, so a new preliminary critical overview of the genus is presented below.

During an expedition aimed to study Odonata in Mondulkiri Province in the eastern Cambodia in June 2014, I collected a *Macromidia* which appeared to represent a new

subspecies close to *M. genialis shanensis* Fraser, 1927. More specimens were collected in June 2018.

A brief taxonomical overview of *Macromidia*

All known taxa of the genus *Macromidia* are listed below accompanied by references and taxonomic notes, including type localities, distribution and overt diagnostic features. The order of species below reflects their relatedness rather than the time of description or alphabetic position.

To exclude frequent misunderstanding resulting from the traditional wording 'a taxon is described', the following reservation is necessary. Some *Macromidia* species were originally described in insufficient detail, or by one sex, so additional descriptions were published by later authors. I would like to stress that according to International Code for Zoological Nomenclature (ICZN), a name proposition is a nomenclatorial act while a description is not a nomenclatorial act but only a condition which makes the proposed name available, if present as such or referenced in the publication proposing a name (ICZN Art. 12.1, 12.2, 13.1); this description is called 'original' (ICZN Glossary). That is, the word 'description' is used in the Code by its common sense rather than as a juridical term (ICZN Glossary). Hence one is free to use this word for any additional description of any additional specimen(s) made without nomenclatorial purpose. For instance, Frederic Charles Fraser (e.g. 1936) published detailed descriptions of all species included in his monograph 'Dragonflies of British India, including Ceylon and Burma', while Syoziro Asahina in his series 'A List of the Odonata of Thailand' (e.g. Asahina 1987) provided very useful detailed descriptions of Thai specimens for many earlier erected species. Also 'redescription' is not a nomenclatorial act, has no nomenclatorial sense and the word may be arbitrarily applied to any subsequent description which updates an insufficient original description.

1. *Macromidia fulva* Laidlaw, 1915

Described from a male collected in Borneo, Mt. Kinabalu, presently Malaysia, Sabah (Laidlaw 1915); later reported as widespread in Borneo (Liefinck 1954), e.g. recorded from many localities in Sarawak (Liefinck 1935; Dow 2012; Dow & Ngiam 2012, 2014, 2015; Dow & Reels 2010; Dow et al. 2015a, b).

Cerci sinuous, with a ventral tooth. Discoidal field on fore wing starts with two rows of cells. Wings enfumed, especially at costal sides. No yellow pattern, abdomen dark with lighter brown rings (Laidlaw 1915; Liefinck 1935).

2. *Macromidia rapida* Martin, 1907 (= *Macromia cantonensis* Tinkham, 1936).

The type species of the genus. Rather poorly described by Martin (1907) from 'Tonkin'; re-described from Hong Kong by Asahina (1988); then Wilson (1993; 1996) and Kosterin (2012) added more descriptive notes from Hong Kong and SW Cambodia, respectively. Wilson (1993) synonymised *Macromia kantonensis* with *Macromidia rapida*. Ranges in Vietnam (Do & Dang 2006), Hong Kong (Asahina 1988; Wilson 1993, 1996), continental Thailand (Hämäläinen & Pinratana 1999), throughout Laos (Yokoi & Souphanthong 2014) and Cambodia (Kosterin 2012; 2014). The fore wing discoidal field starts with two rows

of cells according to Lieftinck (1971), but in fact first several cells are disposed in one row, as stated by Lieftinck (1935), Wilson (1996) and Kosterin (2012).

Male cerci with a small ventral tooth, moderately sinuous and pointed in dorsal view, bicolorous, whitish or yellowish with dark base and apical part. Secondary genitalia resemble those of *M. fulva* (Wilson 1996). Fine dorsal stripe continuous or almost so to S7. The antehumeral spot is traditionally regarded as absent, but the broad reddish-brown area in the lower mesepisternum corresponds to the antehumeral spots in other species, just being darker and indistinct. Vulvar lamina deeply incised to two long, pointed lobes.

3. *Macromidia donaldi* (Fraser, 1924)

3a. *Macromidia donaldi donaldi* (Fraser, 1924)

Described as *Indomacromia donaldi* from India, Coorg, Sampaji Ghat (Fraser 1924), ranges in Western Ghats of Peninsular India (Fraser 1936).

Male cercus with strongly sinuous outer side and a blunt lateral tooth but with scarcely sinuous inner side, black. Vulvar scale moderately short, completely divided into two blunt parts. Antehumeral spot absent. Light fine dorsal stripe nearly continuous to S7, forming a conspicuous spot shaped as ace of clubs at that segment.

3b. *Macromidia donaldi pethiyagodai* van der Poorten, 2012

Described from Sri Lanka, Sabaragamuwa Province, Rattnapura District, near Kudawe (van der Poorten 2012) and recorded at more localities in the island interior (Bedjanič et al. 2014).

Slightly larger than the nominotypical subspecies, differs in the spot on S7 being narrow and details of yellow marking of the thorax and base of abdomen (van der Poorten 2012).

4. *Macromidia atrovirens* Lieftinck, 1935

Described by a single female from southern Sumatra, Benkoelen Residency, Boekit Itam (Lieftinck 1935). No further collections.

No light pattern on the body. Vulvar lamina short, with a deep triangular incision forming rounded lobes. *M. atrovirens* may happen to be conspecific to *M. genialis genialis* Laidlaw, 1923 (see below), known only by a male, although is larger, with venation enhanced accordingly.

5. *Macromidia genialis* Laidlaw, 1923

In the current treatment, this species consists of three subspecies which were described as independent species. They show marked differences in their body pattern, obscured by an obvious misidentification of a male from Penang Island by Lieftinck (1971) (see below). These differences would be enough to consider them as different species but I abstain from this because of their close morphological similarity.

5a. *Macromidia genialis genialis* Laidlaw, 1923

Described by a male from Malay Peninsula, presently Pahang State, Gunung Tahan Mt. (Laidlaw 1923). Male cerci scarcely sinuous in dorsal view (Fig. 1d). No antehumeral spot but anterior part of mesepisternum lighter brown. The yellow colour

is present on the abdomen only at the S2 ventral margin and genital lobe; the original description excludes any dorsal streak but Lieftinck (1948) claimed its presence at S2-3 in the holotype in the British Natural History Museum; no dorsal spot on S6.

Half a century later Lieftinck (1971) provided a redescription of this taxon by a male from Penang Island. However, its colour difference from the holotype were too profound to assume their con(sub)specificity: anterior brown oval spot on mesepisternum well defined rather than obscure, lateral yellow pattern on synthorax well defined versus obscure brown pattern and, most important, a lance-shaped yellow spot on S6 versus absence of any dorsal pattern there. At the same time there is little doubt that the Penang specimen belonged to the taxon *shanensis* Fraser, 1927 which fits as to all diagnostic characters (Fraser 1927; Asahina 1987; see below). Note that the illustration of *M. genialis* in the field guide by Orr (2005) referred to the Penang specimen rather than the type. In fact, there is still no record of *M. genialis genialis* sensu Laidlaw, 1923 non Lieftinck, 1971 other than the holotype.

5b. *Macromidia genialis shanensis* Fraser, 1927

Described as a species from a male and two females from Maymyo, Upper Burma (presently Pyin Oo Lwin, Myanmar) (Fraser 1927), later redescribed by Fraser (1936), then by Asahina (1987) from Thailand (and in fact by Lieftinck (1971) from Malaysia). Asahina (1987) downgraded the status of this taxon to a subspecies *M. genialis shanensis* because of the great similarity of its morphology and body pattern with those of the above mentioned Penang specimen redescribed by Lieftinck (1971) as *M. genialis genialis*. Actually it was not *genialis* s. str. but just a specimen of *shanensis*. (It is noteworthy that Asahina (1987) identified his specimen from Fraser Hills, Peninsular Malaysia, as *M. g. shanensis* rather than *M. g. genialis*). Ranges in Myanmar (Fraser 1927; Asahina 1970), continental Thailand (Asahina 1987; Hämäläinen & Pinratana 1999), northern Laos (Yokoi & Souphanthong 2014), Peninsular Malaysia (Lieftinck 1971 (here corrected); Asahina 1987), reported for central and southern Vietnam (Karube 2011; Phan & To 2018), Koh Kong Province in south-western Cambodia (Kosterin 2014).

Male cercus scarcely sinuous in dorsal view (Fig 1e-f), with a small ventral tooth (Fig 1h-i), black. Vulvar lamina moderately short, deeply bifid to a pair of pointed processes (Fig. 1k-l). Mesepisternum anterior part with a yellow or brown spot. Middorsal streak extends to S3-S5 while S6 with a conspicuous elongate spot.

5c. *Macromidia genialis erratica* Lieftinck, 1948

Described as a species from eight males and two females from southern Sumatra and southern Java, with the type locality was given as "S. Sumatra, Lampong distr., Giesting near Talangpadang, Wai tebu" (Lieftinck 1948: 274); recently reported from four localities in Borneo, Sarawak (Dow & Reels 2010; Dow et al. 2013, 2015b). Later Lieftinck (1971) downgraded this taxon to a subspecies of *M. genialis*, in spite of the strong differences in abdominal and thoracic coloration either from the holotype of *M. genialis*, which misses the middorsal line beyond S3 but has brown antehumeral spots (Laidlaw 1923; Lieftinck 1948), or from *M. genialis* sensu Lieftinck (1971) non Laidlaw (= *shanensis*), which has a conspicuous spot on S6 and

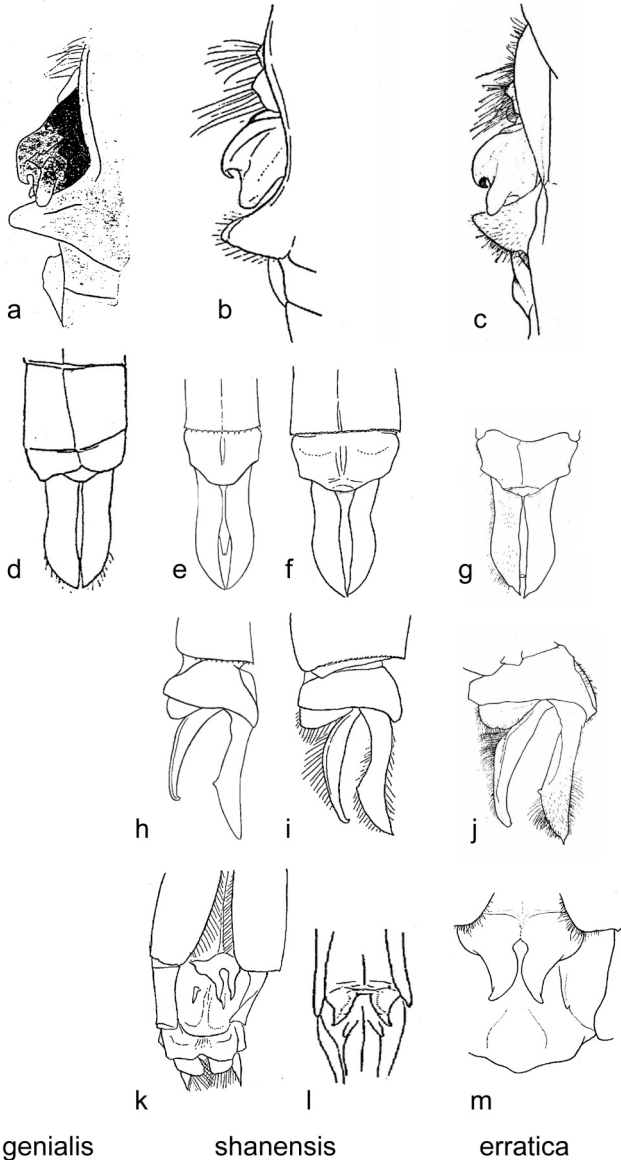


Figure 1. Structures of *Macromidia genialis* ssp. as depicted in literature: a-c – male secondary genitalia; d-g – male cerci in dorsal view; h-j – male anal appendages, lateral view; k-m – female vulvar lamina; a, d – *M. g. genialis* Laidlaw, 1923 from Laidlaw (1923: plate V); b, e-f, h-i – *M. g. shanensis* Fraser, 1927; e, h – from Fraser (1936: fig. 66); l – from Asahina (1970: fig. 52); b, f, i – from Asahina (1987: figs. 14-16, 19); c, g, j, m – *M. g. erratica* Liefstinck, 1948 from Liefstinck (1948: figs. 18-19). Not to scale; a and j mirrored.

again the antehumeral spots. Male cerci as in *shanensis* (Fig 1g, j). Vulvar lamina as in *shanensis* but shorter, with a narrower cleft and strongly diverging lobes (Fig. 1m). Mesepisternum fully metallic, without brown or yellow spots or areas. Antehumeral spots absent. Fine middorsal line extends to S7, not expanded at S6 (Fig. 2).

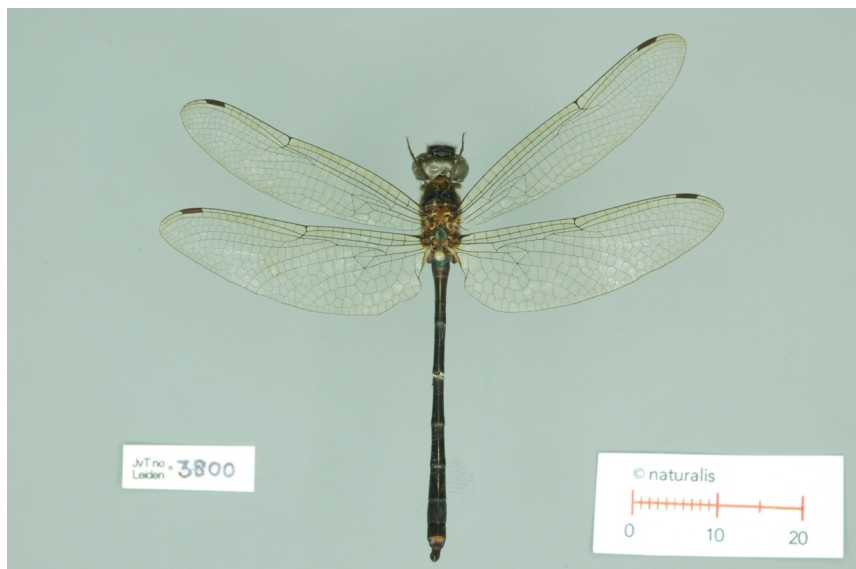


Figure 2. General habitus of the holotype of *Macromidia erratica* Lieftinck, 1948 at the collection of Naturalis Biodiversity Centre, Leiden, the Netherlands (RMNH). Photo by K.-D. Dijkstra (c) RMNH.

6. *Macromidia samal* Needham & Gyger, 1937

Described by a single female from Mindanao, Zamboanga Province, Kabasalan, (Needham & Gyger 1937). Vulvar lamina extremely short, with broad obtuse lobes. Middorsal streak extends to S9. Widespread in the Philippines according to Villanueva & Gil (2011) but the male has never been described.

7. *Macromidia ishidae* Asahina, 1964

Described from Iriomote and Ishigaki Islands of the Yaeyama Islands within Ryu Kyu Archipelago (Asahina 1964). Later reported for Taiwan by Yeh et al. (2006) who provided a description of the Taiwanese male and female. Male cerci very sinuous and pointed in dorsal view but rather blunt in a lateral view, with a ventral tooth, yellowish and largely black at base and tip. Vulvar lamina very short and broadly and deeply notched to two triangular lobes. Abdomen inflated apically. Antehumeral stripe well defined. Interrupted middorsal stripe extends to S8, with spots at S7 and S8 broader but that on S8 very short.

8. *Macromidia kelloggi* Asahina, 1978 (= *M. hangzhouensis* Zhou & Wei, 1979)

Described by a single female from Fohchow env., China, Fujan Province (Asahina 1978). *M. hangzhouensis* Zhou & Wei, 1979 was described by males from China, Zhejiang Province (Zhou & Wei 1979) and synonymised with *M. kelloggi* by Xu & Liu (2008). Later the species was found in Guandong (Wu 2012) and Bah Ma National Park, Thua

Thien Hue Province, Central Vietnam (Karube 2015). Male cerci sinuous, yellow with black base and extreme tip. Vulvar scale very short with a shallow incision. Antehumeral spot well defined. Interrupted middorsal stripe extends to S7, spot on S7 broader.

9. *Macromidia shiehae* Jiang, Li & Yu, 2008 (a dubious species)

Described by two males from China, Jiangxi Prov., Lushan Mt. (Haihui) (Jiang et al., 2008), as very close to "*M. hangzhouensis*" (that is *M. kelloggi*). The differences indicated were subtle, of which only presence of a yellow margin on the postclypeus and of four fine yellow streaks on the prothorax median lobe worth mentioning. Most probably a synonym of *M. kelloggi*.

10. *Macromidia ellenae* Wilson, 1996

Described by a male and two females from Hong Kong (Wilson 1996). Related to *M. kelloggi* but differing in quite peculiar and distinct yellow markings of the synthorax (which do not cover the spiracle). Male cerci rather straight, not sinuous, yellow with black base and extreme tip. Vulvar lamina very short with scarcely expressed incision. Antehumeral spot well defined, conspicuous. Interrupted middorsal stripe extends to S6 and indistinctly present at S7.

11. *Macromidia asahinai* Lieftinck, 1971

The species was erected by Lieftinck (1971) for a male described and illustrated from Palawan but misidentified as the unknown male of *Idionyx philippa* Ris, 1912 by Asahina (1968), but an own brief original description without illustration was proposed for this specimen by Lieftinck. No further records. Cerci sinuous in dorsal view, with pointed and incurved tips, no lateral or ventral tooth. No antehumeral pattern. Middorsal line on S2-S4, two curious round yellow dorsal spots on S7.

There is also at least one undescribed species in the Philippines (Villanueva & Gil 2011; Villanueva & Cahilog 2012). Yokoi & Souphanthong (2014) reported for Laos *Macromidia* sp1. along with *M. rapida* and *M. genialis shanensis*, but the illustrations provided (Yokoi & Souphanthong 2014: pl. 23, fig. 99) are insufficient to distinguish it from *shanensis*.

M. rapida and *M. fulva* are obviously related to each other judging from the shape of their secondary genitalia, cerci, venation and size (Lieftinck 1971), although they are quite differently coloured. *M. kelloggi*, *M. shiehae* (if bona species) and *M. ellenae* form another, 'northern' clade. *M. genialis* s.l. may represent a common clade with *M. samal* and *M. atrovirens*, but the males of the two latter taxa have not so far been described. *M. ishidai* looks intermediate between the *kelloggi* and *genialis* clades (the cerci coloured as in the former while the hamuli resembles those in the latter). *M. donaldi* and *M. asahinai* do not show proximity to other species with respect to their characters.

Nevertheless, at least males of the described taxa of *Macromidia* may be recognised by their colour markings, as follows:

- A. No dorsal markings on abdomen; cerci black: *M. fulva*, (?*M. atrovirens*);
- B. Middorsal line to S3; cerci black: *M. g. genialis*;

- C. Middorsal line to S4, two conspicuous rounded spots on S7, cerci black: *M. asahinai*.
 D. Middorsal line to S3-S5, a conspicuous spot on S6, cerci black: *M. g. shanensis*;
 E. Middorsal line to S3-S6, a conspicuous spot on S7, cerci black: *M. d. donaldi*;
 F. Middorsal line to S7 (or even S8), narrow, cerci black: *M. donaldi pethiyagodai*,
M. g. erratica;
 G. Middorsal line to S7, cerci bicolorous or mostly yellow:
 G1. Antehumeral spots replaced by brownish areas, apical black on cerci large:
M. rapida
 G2. Antehumeral spots well expressed, apical black only at extreme tips of
 cerci: *M. ishidai*, *M. kelloggi*, ?*M. shiehae*, *M. ellenae*.

Material and methods

Illustrations of morphological details were prepared from serial photographs obtained via lens Zeiss Stemi 2000-C with digital camera Canon PowerShot A640. Images with broad focus zones were obtained from serial photos with shifted focus using the program Helicon Focus 5.3.

The dates are provided in dd.mm.year system.

Macromidia genialis buusraensis subsp. nov.

Figures 3-4, 5a, c, e, g, i, 6-10

Holotype ♂ (fragmented specimen: left fore and mid legs, abdominal S5-6 and S7-S10 detached) (Fig. 3; 4a, 5a, c, e, g, i), Cambodia, Monduliri Province, 27 km NE of Sen Monorom, 'Loringae brook', the left tributary of the main river downstream Buu Sraa Waterfall, 12°34'01"-19" N 107°24'50"-25'03" E, 416-490 m a.s.l., 15.06.2014, O. Kosterin leg.; deposited in Naturalis Biodiversity Centre, Leiden, the Netherlands (RMNH).

Paratypes: ♀ (incomplete specimen missing the end of abdomen starting from S7) (Fig. 4c), the same data as the holotype. ♂ (Fig 4b, 6a), Cambodia, Monduliri Province, 12.8 km NE of Sen Monorom, lower reaches of a brook being the right tributary of Pulung (?) River 12°31'16.3" N 107°17'38.2" E, 530 m a.s.l., 25.06.2018, O. Kosterin leg. 7 ♂♂ (Figs. 7-8), 1 ♀ (Figs. 4d, 6b, 9-10), Cambodia, Monduliri Province, 15.8 km NNE of Sen Monorom, a river (temporary a weak brook), 12°35'04.5" N 107°15'14.8" E, 414 m a.s.l., 26.06.2018, O. Kosterin leg. ♂, the same place, 27 VI 2018, O. Kosterin leg. (in RMNH, Nature History Museum, London (BMNH) and the author's collection).

Etymology.

The new subspecific name is a Latin geographical adjective referring to Buu Sraa Waterfall near the type locality. This toponym sounds too ridiculously to miss an opportunity to derive a Latin name from it.

Male holotype (Figs. 3, 4a, 5a, c, e, g, i)

Head. Labium entirely bright yellow (Fig. 3b). Mandibles brown. Labrum brownish-black, with lighter brown areas at the centre of its anterior and posterior parts. Ante-

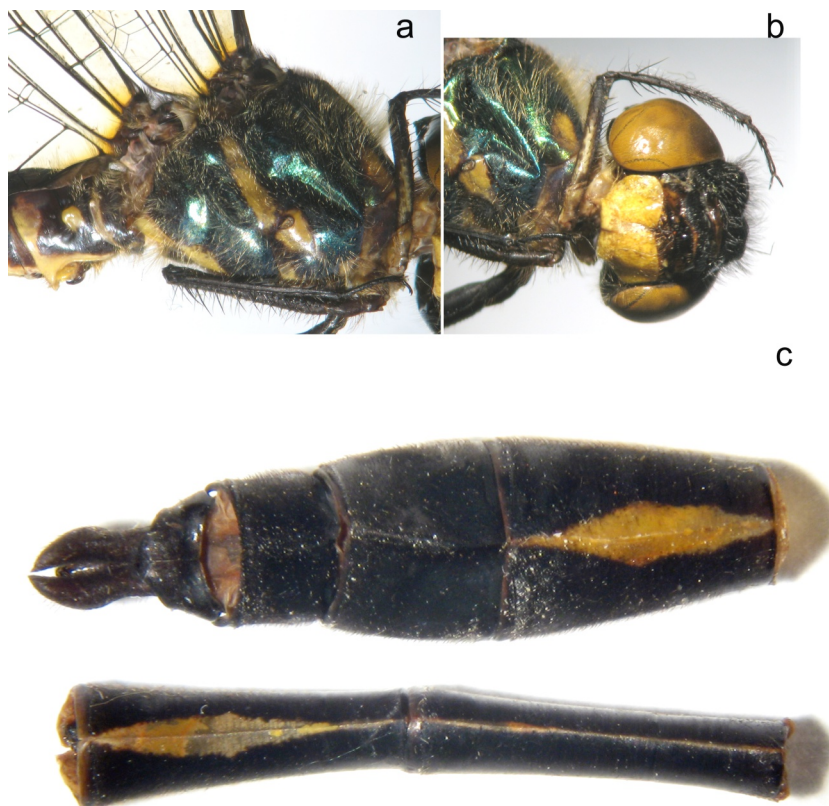


Figure 3. Details of the holotype male of *Macromidia genialis buusraensis* ssp. nov.: a – thorax, lateral view; b – ventral part of head and fore part of thorax; c – abdominal S7-S10 with appendages, dorsal view; h – abdominal S5-S6, dorsal view. Not to scale.

clypeus anterior part brown. Rear part of head behind eyes glossy black. The rest of head metallic dark-emerald. Head densely set with dark hairs, shorter and sparser on labium. Eyes bright emerald green when alive, brown in dried specimen.

Thorax (Fig. 3a-b). Prothorax light yellow with a brownish transversal stripe. Synthorax metallic emerald with the following yellow markings on each side:

- a well defined oval antehumeral spot at anterior part of mesepisternum, occupying about 1/3 of its length and width;
- a midlateral stripe with its lower part divided between mesepimeron and metepisternum and its upper part above spiracle going along anterior margin of metepisternum; its anterior margin has a strong kink above spiracle to almost medial suture, its posterior margin straight, extending from ventro-posterior corner of met-

episternum to about middle of its dorsal margin but the stripe ends rounded about 1 mm before dorsal margin; there is an obscure short dark-brown patch over otherwise yellow stripe connecting spiracle and metepisternum posterior margin;

- a stripe at lower margin of metepimeron, those of either side meeting at middle of ventral margin;
- ventral and dorsal corners of inframesepisternum yellow, smoothly transiting through brown to its emerald centre;
- posterior half of imframetepisternum yellow with an indistinct border to brown, with a trace of emerald, anterior half.

Antealar sinus greyish-white. Synthorax densely set with golden hairs, especially dense and long on metepisterna.

Poststernum anterior part brownish, posterior part yellow.

Coxae anterior parts brownish, posterior parts yellow.

Fore protrochanters, trochanters and femora brownish with yellowish ventral side (for 2/3 length of profemur), rest of fore leg brownish black. Mid protrochanter and trochanter brown, femur black with brown outer side, rest black, but tibial keel yellowish. Hind legs black with femur outer side somewhat brownish, tibial keel yellowish. Tibial keel extends for about distal 40% of fore tibia, half of mid tibia and 80% of hind tibia. Hind femora extend to hamuli.

Wings (Fig. 4a) hyaline but with a noticeable even yellowish-brown enfumation, extreme wing bases with some amber. Pterostigmata brownish-black with lighter narrow brown rim. Antenodals: 16 (right)-18 (left) on fore wings, 11 (right)-12 (left) on hind wings; postnodals 8 on fore wings, 11 on hind wings. Cubital veins: 2 on fore wing,

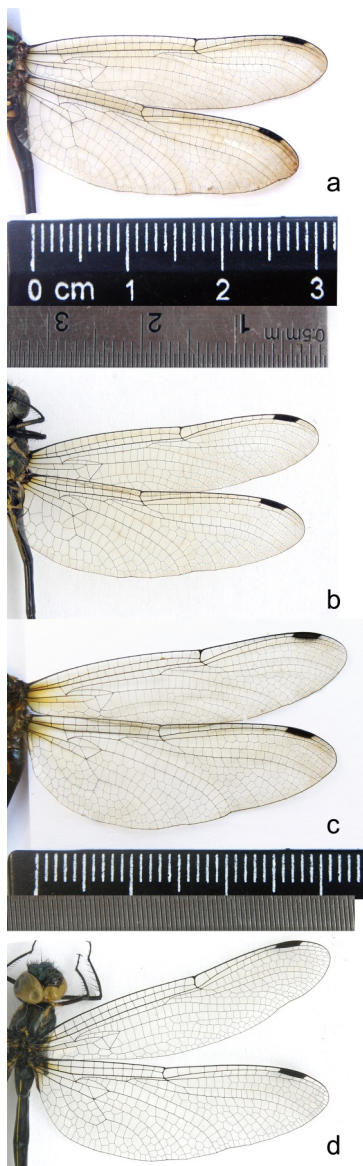


Figure 4. Wings of *Macromidia genialis buusraensis* ssp. nov.: a-b – males; c-d – females; a – the holotype; b – the male paratype collected 12 km NE from Sen Monorom on 25.06.2018; c – the female paratype collected at the type locality on 12.06.2014; d – the female paratype collected 15.8 km NNE of Sen Monorom on 26.06.2018.

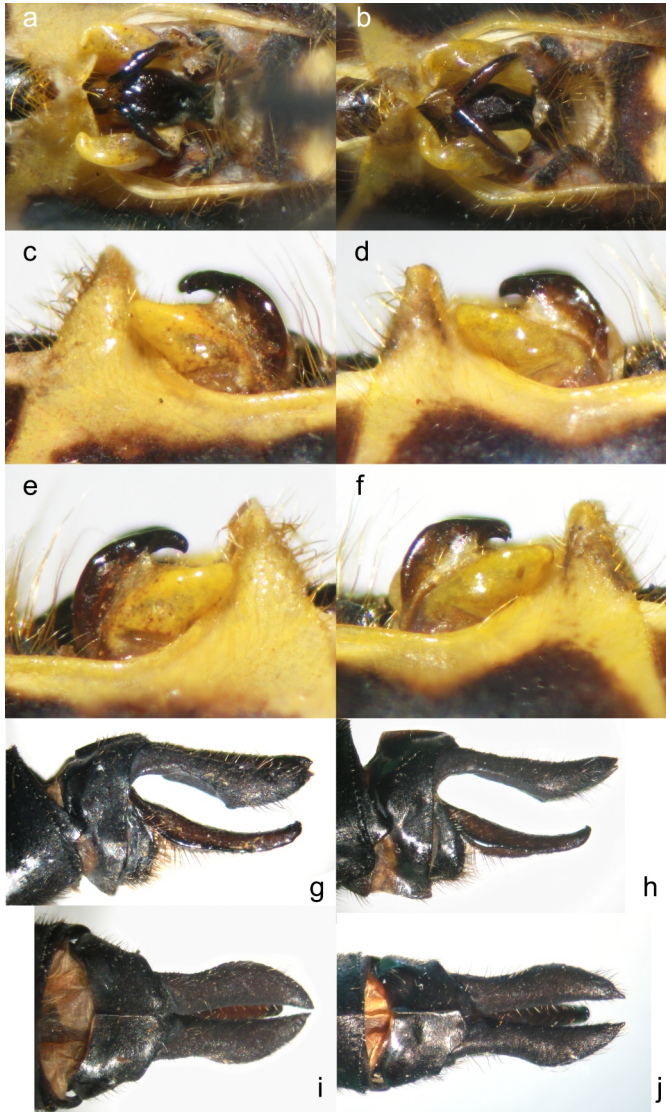


Figure 5. Comparison of the secondary genitalia (a-f) and anal appendages (g-j) of males of *Macromidia genialis buusraensis* ssp. nov., represented by the holotype (a, c, e, g, i), and *M. genialis shanensis*, represented by a male from Cambodia, Koh Kong Province, 10 km E of Koh Kong, 25.05.2013: a-b – secondary genitalia in ventral view; c-d – left posterior hamulus in lateral view; e-f – right posterior hamulus in lateral view; g-h, S10 and anal appendages in lateral view; i-j, S10 and cerci in dorsal view. Not to scale.

4 on hind wing. Discoidal field commencing with 7 (left)-8 (right) cells in one row on fore wing, with 4 (left)-5 (right) cells on hind wing. Anal loop 8-celled. Pterostigma dark-brown.

Abdomen smoothly narrowing at S4-S5 and expanding at S7-S8. Abdomen ground colour glossy brownish-black, with traces of emerald on S2 dorsum. Posterior margins of S1 yellow, those of S2 with drop-like yellow stripes at their lower 2/3 (Fig. 3a), posterior margins of other segments with indistinct narrow brownish rings. Auricles yellow. Ventral margins of tergites 2-9 yellow, rather broadly at S2-S3 and S7-S8. S2 with a narrow oval dorsal streak occupying its distal half; S3-S5 with a finest yellow dorsal streak, not interrupted although further narrowing to segment margins. On S6 this streak widens to a diamond-shaped spot about 8 times as narrow as long and extending all over segment length (Fig. 3c). S7 with a wider such spot, about 3.5 times as narrow as long, rather shield-like than diamond-shaped, since its sides have two lateral projections (Fig. 3c). S8-10 unmarked.

Cerci brownish-black, twice as long as S10, in dorsal views their outer sides sinuous, inner sides slightly concave, ends converging and pointed (Fig. 5i). In lateral view their dorsal side almost straight, ventral side sinuous so that cerci narrow at proximal 1/3 and expanding to a small ventral tooth disposed at distal 1/3 behind which ventral side slightly convex; apex ends with a very small tooth (Fig. 5g). Distinct lateral ridges extend to about level of ventral tooth. Epiproct dorsal side in lateral view smoothly concave, ventral side convex with the maximum breadth at proximal quarter (Fig. 5g).

Genital lobe yellow, triangularly processed. Posterior branches of posterior hamuli light-yellow, in lateral view rounded and slightly extended behind genital lobe anterior side (Fig. 5c, e), in ventral view hooked inside (Fig. 5a). Anterior branches brown to black apically, in lateral view more or less rounded, but with margins becoming straighter distally, and end with robust hooks (Fig. 5c, e), in ventral view straight, converging at 45° (Fig. 5a). Anterior hamuli small, set with very long yellowish setae, in lateral view scarcely seen, pointed, in ventral view nearly straight, oriented at 45° to each other (Fig. 5a). Anterior lobe almost not expressed, set with similar setae.

Measurements [mm] – hw 30.5; abd. 35 with apps and 33.5 without apps; total length 45; pterostigma along costa 2.50 on fw, 2.65 on hw.

Variation in male paratypes

The holotype (Fig. 3) and all male paratypes are uniform with respect to their yellow body pattern (Figs. 6a, 7-8). The width of the lateral yellow thoracic stripe and the expression of its kink above the spiracle somewhat vary (Fig. 8). The degree of wing membrane brown enfumation varies from none to considerable.

Venation characters vary as follows: antenodals: 14-17 on fore wings, 9-11 on hind wings; postnodals 7-9 on fore wings, 9-12 on hind wings. Cubital veins: 2, rarely 3 (3 cases) on fore wing, 3, in one case 4 on hind wing. Discoidal field commencing with 5-9 cells in one row on fore wing, with 2-5 cells on hind wing. Anal loop 6-9-celled. The degree of the curvature of the outer posterior hamulus outer branch in the ventral view is somewhat variable; this variation is obscured by slight differences of the view aspect.



Figure 6. General habitus of *Macromidia genialis buusraensis* ssp. nov. paratypes, dorsal view: a – male collected 12 km NE from Sen Monorom on 25.06.2018; b – female collected 15.8 km NNE of Sen Monorom on 26.06.2018.

Measurements of the paratypes [mm] – hw 28.5-31; abd. without apps 28-33.5 mm; total length 42-45.

Female (Figs. 4c-d, 6b, 9-10)

The complete paratype of 26.06.2018 is described (Fig. 4d, 6b, 9-10).

Resembles the male (Figs 6b, 9-10). Anteclypeus dark-brown with a yellow anterior margin (Fig. 10a). Antehumeral yellow spots broader than in male, occupying ca 40% of mesepisternum width (Fig. 9). Fore coxae entirely and ventral side of other coxae yellow; fore protochanter and trochanter brown with yellow ventral side, fore femur brown with ventral side yellow in proximal half; ventral side of midleg protochanters and trochanters brownish-yellow. No tibial keels. Antalar sinus bright-yellow (Figs 9, 10b).

Hind wing broader than in male due to more expanded anal area, with an evenly convex anal margin. Wings (Fig. 4d) hyaline; their bases with amber gradually fading to the first antenodal and, on hind wing, to end of membranula. Membranula grey, darker to its apex. Antenodals 15 (right)-17 (left) on fore wing, 9 (right)-10 (left) on hind wing; postnodals 7 (left)-8 (right) on fore wing, 9 (left)-10 (right) 11 on hind wing. The discoidal field starts with 6 (left)-8 (right) cells in one row on fore wing, 1 (left)-2(right) cells on hind wing. Cubital veins 2(right)-3 (left) on fore wing, 3 (left)-4 (right) on hind wing, anal loop 12 (left)-13 (right)-celled. Pterostigma brownish-black; membranula pale grey.

Abdominal S2 with round yellow spots corresponding to male's auricles, spots at S2 posterior margin much longer, as a curved triangular directed with their apices to the

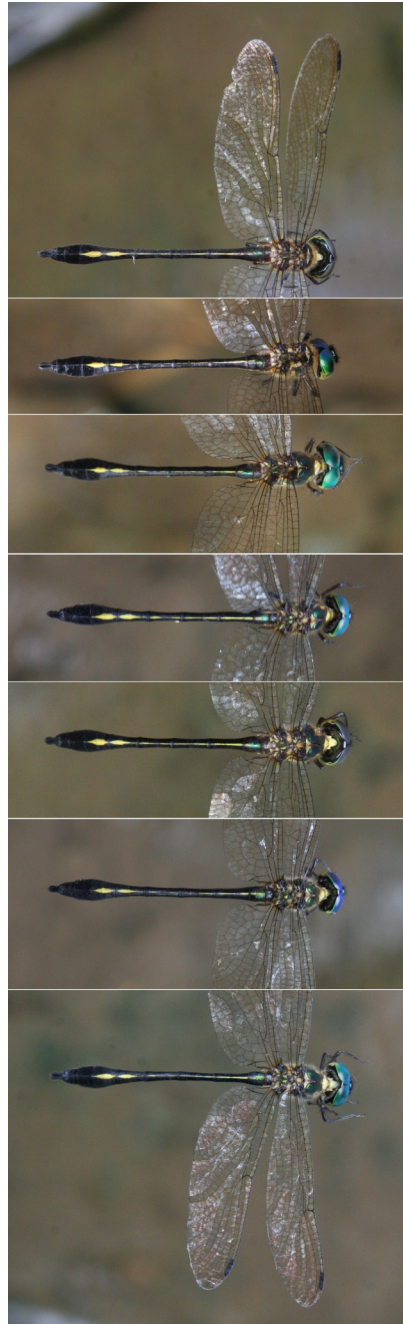


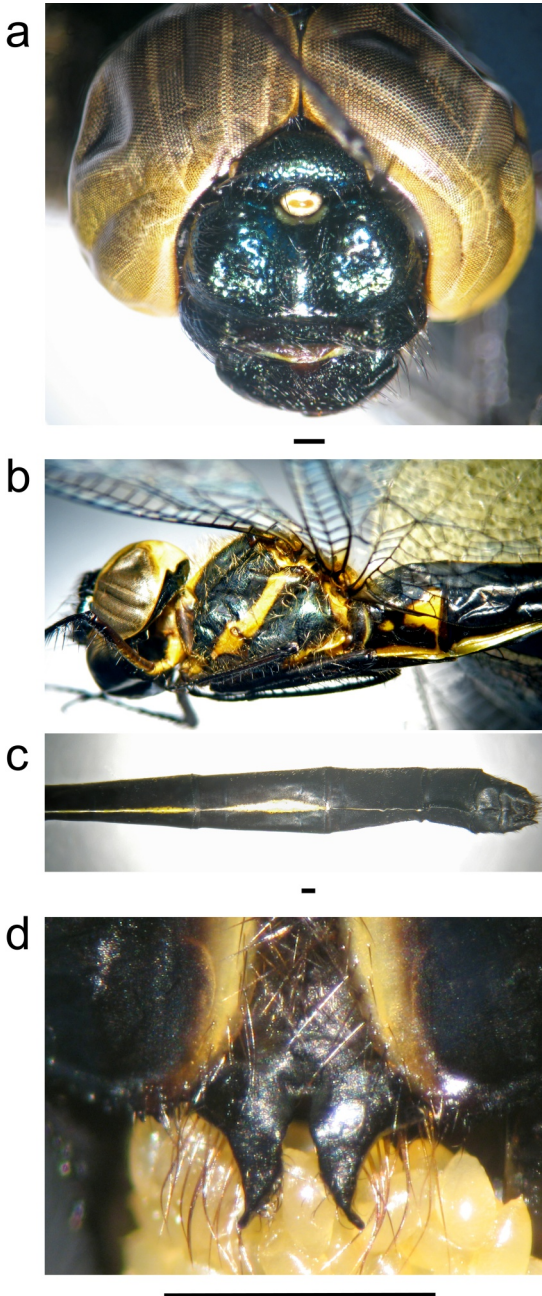
Figure 7. Seven male paratypes of *Macro-midia genialis buusraensis* ssp. nov. collected 15.8 km NNE of Sen Monorom on 26.06.2018 in live colours, dorsal view.



Figure 8. Four male paratypes of *Macromidia genialis buusraensis* ssp. nov. collected 15.8 km NNE of Sen Monorom on 26.06.2018 in live colours, lateral view.



Figure 9. The female *Macromidia genialis buusraensis* ssp. nov. paratype collected 15.8 km NNE of Sen Monorom on 26.06.2018 in live colours.



rounded spots (Figs 9, 10b). Broad yellow stripes along ventral sides of all tergites (Fig. 9). Dorsal yellow stripe narrow and contiguous, its starts at the middle of S2 and continues to the end of S6, slightly broadening at S2, S5 and especially S6; dorsal ridge of S7 with a trace of a yellow streak (Figs 6b, 9, 10c). Vulvar lamina with a deep and broad, rounded cleft; lateral lobes attenuated, pointed and curved to diverge from each other (Fig. 10d).

Measurement [mm] – hw 32, abd. 32, total length 43.5.

The incomplete 2014 paratype has the same coloration of head, thorax and proximal part of abdomen. The anteclypeus anterior margin without a distinct yellow margin. Fore wing membrane without enfumation, hind wing membrane with a very light one, but wing bases with indistinct brownish-yellow areas

Figure 10. Details of the female *Macromidia genialis buusraensis* ssp. nov. paratype collected 15.8 km NNE of Sen Monorom on 26.06.2018: a – face, frontal view; b – head, thorax and proximal part of abdomen, lateral view; c – distal part of abdomen, dorsal view; d – vulvar lamina, ventral view. Scale bar 0.5 mm.

extending to slightly behind arculus and to ends of membranula. This paratype (Fig. 4c) has 15 (right)-16 (left) antenodals on fore wings and 10 (left)-11 (right) on hind wings, 9 postnodals on fore wings and 11 (right)-12 (left) on hind wings; discoidal field starts with 8 cells in one row on fore wings and 1 (right)-2 (left) cells on hind wings; 2 cubital veins on fore wings and 4 on hind wings; anal loop 14 (right)-15 (left)-celled. Hindwing 33 mm, pterostigmata 3 mm.

Short diagnosis

A *Macromidia* with the fore wing discoidal field commencing from many (5-9) cells in single row, black male cerci with a ventral tooth, well defined yellow antehumeral spots and dorsal yellow line on S2-S7, in males with spots on S6-S7 expanded, that on S7 being the broadest; in females that on S6 expanded while that on S7 as a fine line; female vulvar lamina with a broad rounded cleft and diverging lobes.

Differential diagnosis and remarks

Males of the new taxon closely resembles *M. g. shanensis* and differs from it by an additional, conspicuous, broad dorsal yellow spot on S7 (Figs. 3c, 6a, 7), while in *shanensis* the conspicuous, broad dorsal spot is located on S6. All published illustrations and descriptions of *shanensis* (Fraser 1927, 1936; Asahina 1987), also as *M. genialis* sensu Lieftinck 1971 nec Laidlaw, 1923 (Lieftinck 1971; Orr 2005) show S7 unmarked while S6 with a large conspicuous spot. At the site <http://www.allodonata.com> there is a photo identified as *M. g. shanensis* from Thaiprachan National Park, Ratchaburi Province, Thailand uploaded by Reingthong Ruangrong in which a fine dorsal streak is seen on S7, but the S6 spot is normally broad and conspicuous as it should be in this subspecies. (Note that three more photos of this taxon by the same author from different localities show S7 unmarked.).

For a direct comparison I have at my disposal a specimen of *M. g. shanensis* from SW Cambodia (Koh Kong Province, 'Macromidia rivulet', 10 km E of Koh Kong, 11°36'03"-06" N, 103°04'15" E, 114-123 m a.s.l., 25.05.2013, O. Kosterin leg.) (Kosterin 2014). It corresponds well to the description of Thai males provided by Asahina (1987); in relation to the thoracic markings it fits the therein depicted mature Thai male (compare Kosterin 2014: fig. 4b and Asahina 1987: fig. 11).

From *M. g. erratica* the new subspecies differs by the presence of well defined oval antehumeral spots (Figs. 3a-b, 8, 9) (no spots in *erratica*, see Fig.2) and by inflated yellow spots on S6 and, especially S7 in males (Fig. 3c, 6a, 7) (an uniform fine streak in *erratica*, see Fig.2).

By the abdominal pattern, especially a broad spot on S7, the new subspecies resembles *M. donaldi donaldi* (but not *M. d. pethygodai*) but differs from it by the presence of well defined yellow antehumeral spots and absence of an additional synthoracic yellow stripe at the anterior margin of the metepimeron. There is an important difference from *M. donaldi* in the shape of cerci, which are expanded ventrally rather than laterally and bear the ventral rather than a lateral tooth (compare Fraser 1936: fig. 65). The cerci shape of the new subspecies is similar to *M. g. shanensis* (Figs. 1e-f, h-i, 4g, i) and *M. g. erratica* (Fig. 1g, j) but the cercus is thicker in lateral view, ending rather bluntly

but furnished with a small apical spinulet. For the holotype of *M. g. genialis* the cerci are illustrated as somewhat more robust and less sinuous in dorsal view (Fig. 1d). The shape of the posterior hamulus (Fig. 5c, e) differs markedly from that of *M. donaldi* (see van der Poorten 2012: fig. 5) but resembles that in *M. genialis* spp. (Fig. 1a-c).

Quite a variation in the structure of the posterior hamulus can be noticed over the taxa currently attributed to *M. genialis*, namely *genialis* s. str., *shanensis*, *erratica*, and the new subspecies. However, this variation, as inferred from the sources available, does not reveal any regular pattern. Illustrations provided for the holotypes of *genialis* (Fig. 1a) and *erratica* (Fig. 1c) by their authors show rather a narrow posterior branch of the posterior hamulus, while in the new subspecies and *shanensis* as illustrated by Asahina (1987) for a specimen from Thailand (Fig. 1b) and in this paper for a specimen from NW Cambodia (Fig. 4d, f), the posterior branch is thicker. The anterior branch, as depicted, differs strongly in *M. g. genialis* and *M. g. erratica* in its outline in lateral view. In *erratica* it is almost evenly rounded (Fig. 1c) while in the holotype of *genialis* its dorsal margin looks nearly straight (Fig. 1a). In the Thai specimen of *shanensis* illustrated by Asahina (1987) (Fig. 1b), the dorsal outline is rounded while in the Cambodian specimen of *shanensis* it is almost straight (Fig. 4d, f). In the new taxon it is rather rounded but still straighter in the distal part (Fig. 4c, e), its curvature somewhat variable among the paratypes. The terminal hook of the anterior branch is shown very thick but rather short for *erratica* (Fig. 1c), robust and longer for the holotype of *genialis* (Fig. 1a), very short for *shanensis* by Asahina (Fig. 1b) while in the Cambodian specimens of both *shanensis* (Fig. 5d, f) and the new subspecies (Fig. 4c, e) the hook is rather long (these differences may be artifacts of fine differences in the aspect of the point of view). More specimens of different taxa are to be examined to reveal validity of characters of the shape of the posterior hamulus.

In *buusraensis*, the dorsal keel of S10 is substantially lower (Fig. 5g) than in males of *shanensis* (Figs. 1h, 4h) (the drawing by Fraser (1936), see Fig. 1i, is too schematic and does not show the keel at all). However, this keel is slightly better expressed than illustrated for *erratica* (Fig. 1j).

The distal part of abdomen is more inflated in *buusraensis* than in the Cambodian male of *shanensis*, however relevance of this characters is unclear.

The female vulvar lamina of *M. g. buusraensis* (Fig. 10d) resembles that of *M. g. erratica* (Fig. 1m) by the diverging lateral lobes but in the Lieffinck's figure the cleft is shown so narrow that the lobes almost touch each other with their inner margins (Fig. 1m) while in the only complete female of the new taxon available the cleft is broad (Fig. 10d). The dorsal yellow markings of the female of the new subspecies resembles that of *M. g. shanensis* (see Asahina 1987: fig. 18) but the dorsal yellow spot on S6 is not so expanded and there is a fine dorsal streak on S7 (Figs. 6b, 9, 10c) (note a strong difference from the male pattern where the S7 dorsal spot is the broadest). On the other hand, the abdominal dorsal streak is better expressed than in *M. g. erratica*. Hence, the female of the new subspecies has an appearance somewhat intermediate between *M. g. erratica* and *M. g. shanensis* (the female of *M. g. genialis* is still unknown).

Distribution

The subspecies is so far known only from Mondulhiri Province in eastern Cambodia but is surely expected from southern Vietnam, the border of which lies in just 17 km east from the type locality.

Habitat and behaviour

At the first discovery on 15.06.2014, these dragonflies were found near a forest brook at the left slope of the Buu Sraa valley. The *Macromidia* males cruised ranged swiftly and straight-forwardly about 1-1.5 m above the ground over territories of several metres (faster and lower than males of *Idionyx thailandica* Hämäläinen, 1985 in the same place and time) at openings among bamboo thickets at overcast weather at noon. My 2018 experience suggested that this was behaviour of *Macromidia* dragonflies disturbed from resting on bamboo rather than male reproductive behaviour, nevertheless one of such males was obviously attracted by an ovipositing female of *I. thailandica*. The female oviposited at tiny shady pools at the brook, after a missing net stroke it re-appeared at the same place after ca 5 min..

The same place was then revisited on 3-4.08.2016 and 24.06.2018 in search of more specimens. No *Macromidia* were found there in 2016. On 24.06.2018, eight hours (9 a.m. to 5 p.m.) of walking along the course of the 'Loringae brook' provided four males of *Macromidia* (at ca 10 a.m., 1-2 and 5 p.m.), all of which, however, appeared *M. rapida*. Their behaviour was as described above. Observation of *M. rapida* in the type locality of *M. g. buusraensis* rises doubts that all *Macromidia* individuals observed on 15.06.2014 belonged to the new taxon.

On 25.06.2018, a brook of similar size but flowing through a flat terrain with open deciduous dipterocarp forest, 12.8 km NE of Sen Monorom, was examined at 11:30 a.m. – 2:50 p.m. *Macromidia* appeared in the overcast afternoon (with remote thunder being permanently heard) from 1 p.m. and were on the wing until the end of observation. Some ranged at ca 1.5 m as disturbed from rest, but most were males exhibiting obvious reproductive behaviour: they quickly ranged to and fro in few cm over two 'peninsulas' of wet reddish-brown gravel ca 1 × 1 (Fig. 11 below) and 1 × 2 m in size and 12 m from each other, at a very shallow reach with moderate current, half-shaded by bamboo (Fig. 11 above). Each male appeared over a 'peninsula', ranged for several minutes, disappeared somewhere and re-appeared again; sometimes they ranged for longer distance over the stream; sometimes two flew simultaneously over the same 'peninsula' without agonistic behaviour. With such a flight mode, obscure colours and a shady habitat, they were very difficult to follow by sight. Once a female ovipositing at a 'peninsula' was noticed. Of four males collected (beyond numerous missing net strokes) three were *M. rapida* and one *M. g. buusraensis* ssp. nov. Two days later two more *Macromidia* males, both *M. rapida*, were captured at the same place (and the same weather) examined at 4:15 – 5 p.m.

On 26.06.2018, at 10:20 a.m. – 3:45 p.m., a river was examined 15.8 km NNE of Sen Monorom, a considerable stony valley of which, with frequent stones of a porous igneous rock, did not correspond to a weak brook (sometimes disappearing in the ground) flowing through, which connected some considerable deep pools (maybe



Figure 11. Habitat of *Macromidia rapida* (predominating) and *Macromidia genialis buusraensis* ssp. nov. (inferior in number) 12 km NE from Sen Monorom, 25.06.2018. Below a 'peninsula' 1 × 1 m of wet reddish-brown gravel is shown being the focus of the reproductive activity of *Macromidia* males.



Figure 12. Habitat of *Macromidia genialis buusraaensis* ssp. nov. 15.8 km NNE of Sen Monorom, 26.06.2018. The white asterisk indicates a gravel bank being the focus of the male reproductive activity and female oviposition.

the river was dammed upstream). The first *Macromidia* appeared at 2:09 p.m. when the sun disappeared, and many were active until the end of observation; all this time thunder of a slowly approaching storm was heard. All were observed over a brook stretch similar to that described above, very shallow and moderately fast, but there was less wet gravel between large stones (Fig. 12). Their behaviour was similar to that described above: they cruised over that stretch for a distance of 5-7 m but preferred a particular small shady pool with gravel banks (indicated by the white asterisk in Fig. 12), over which they spent more time. For one and half hour seven males and one female were collected (female the last); surprisingly all they were *M. g. buusraaensis* ssp. nov. I collected them one by one and after a while the next one appeared, and the interval did not seem to increase while a considerable number of specimens were removed. This looked like many males hid in the surrounding vegetation (mostly bamboo) 'in a queue' and descended to their preferred brook stretch when they found it free. Next day, the same place was examined twice; again, there were no *Macromidia* at the sunny midday (11:40 a.m. – 1 p.m.) while in the overcast afternoon

(2:50-3:20 p.m., this time no storm approaching) one more male of *M. g. buusraensis* was collected (at 3:05 p.m.). No *M. rapida* was recorded in this place.

Discussion

The three earlier described taxa presently considered as subspecies of *M. genialis*, namely *M. g. genialis*, *M. g. shanensis* and *M. g. erratica*, as well as the one described here, differ enough from each other by the coloration pattern to be considered good species. Nevertheless, their great morphological similarity votes for their subspecific rank, although it is quite probable that the new taxon is in fact a good species ranging in the Annamese Mts.

The pale pattern against the black ground colour no doubt serves *Macromidia* dragonflies an important visual cue for recognition of conspecific mates, especially taking into account their activity only in deep shade. The pattern of the three previously known subspecies of *M. genialis* differ quite drastically and enough for bona species. An expanded last yellow spot of the abdomen is a common feature of *M. g. shanensis* and *M. g. buusraensis* and no doubt an excellent cue, by the way equally expressed by both sexes of *M. shanensis* (Fraser 1927, 1936; Asahina 1987: figs. 13, 18). It is, however, unclear if a dragonfly can tell such a spot located at S6 or S7, that is if the dragonflies of *shanensis* and *buusraensis* would be able to recognise consubspecific mates if they were sympatric.

Genetic distance would aid to a final solution but cannot be decisive in allopatry. Although no sympatry has been recorded, there are two countries in which two subspecies of *M. genialis* are found: Peninsular Malaysia with *M. g. genialis* at Taman Negara and *M. g. shanensis* in Fraser Hills (Asahina 1987) and Penang Island (Lieftinck 1971, here corrected) and Cambodia with *M. g. shanensis* in the Cardamom foothills and *M. g. buusraensis* at the foothills of the Annamense Mts.

Here reported is the second case when two *Macromidia* species were recorded in the same habitats, in addition to co-existence of *M. rapida* and *M. ellenae* at the same woodland streams in Hong Kong (K.D.P. Wilson pers. comm.). In Monduliri Province of Cambodia, the new taxon *M. g. buusraensis* shares at least part of its habitats (2 of 3 known) with its congener *M. rapida*, both taxa having identical behaviour, habitats and even a 'favourite' small reproduction site.

The type locality of *M. g. buusraensis*, the 'Loringae brook' below the Buu Sraa Waterfall, is also the type locality of *Asiagomphus reinhardtii* Kosterin & Yokoi 2016 (Kosterin & Yokoi 2016), *Coelliccia poungyi dasha* Kosterin+2016 (Kosterin 2016) and *Coelliccia rolendorum* Kosterin & Kompier, 2017 (Kosterin & Kompier 2016).

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