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Notes on intraspecific variation of some Gomphidae (Odonata) species in Cambodia

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Abstract

Specimens of *Burmagomphus asahinai* Kosterin, Makbun and Dawwrueng, 2012 and *Burmagomphus divaricatus* Lieftinck, 1964 from SW and NE Cambodia show differences in the development of the light pattern. One male of the latter species has unusual posterior spinules on posterior hamuli. Two males of *Orientogomphus minor* (Laidlaw, 1931) from the same locality in NE Cambodia have substantial differences in the thoracic and abdominal pattern. NE Cambodian specimens of *Gomphidia abbotti* Williamson, 1907 and *Lamelligomphus castor* (Lieftinck, 1941) have minor differences from data on these species from literature. Caution is necessary when composing and using keys for identification of the mentioned genera of gomphids.

Key words

Burmagomphus asahinai, Burmagomphus divaricatus, Orientogomphus minor, Gomphidia abbotti, Lamelligomphus castor, Cambodia, Thailand

Introduction

A preliminary checklist of Odonata species of Cambodia contained only nine identified gomphid species (Kosterin et al. 2012a). With exception of two *Ictinogomphus* spp., they all had been recorded in Cambodia in the south-western Koh Kong Province. In 2013, I visited the north-eastern Ratanakiri Province and found in total nine gomphid species, of which five were recorded for the first time in Cambodia (Kosterin 2014). Although not many specimens were collected from Cambodia, some species showed a substantial intraspecific variation referring to characters used in keys for species identification. In spite of the preliminary nature of these data, they are worth to be published to attract attention to this variation and to avoid misidentifications.

The focus of this publication set on two species of *Burmagomphus* Williamson, 1908 and one of *Orientogomphus* Chao et Xu, 1987. The genus *Burmagomphus* includes 25 described species ranging in E, SE and S Asia and Sundaland (Kosterin et al. 2012b) but only two of them have been known from Cambodia, both from Koh Kong Province: *B. asahinai* Kosterin, Makbun et Dawwrueng, 2012 (Kosterin 2010; 2012; Kosterin et al. 2012a,b) and *B. divaricatus* (Kosterin 2012; Kosterin et al., 2012a). Both are considered in this paper. The genus *Orientogomphus* includes six species, however validity of some of them is questionable because of scarcity of specimens. Fortunately, recently the four continental representatives of the genus were revised in detail by Wilson (2008).

Methods

Gomphidae were collected by net while walking along water courses and preserved on cotton layers with paper covers. Where possible, they were photographed in natural conditions and/or in hand using Olympus Camedia C8080 camera. The photos of specimen 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 software Helicon Focus 5.1 (http://www.photo-soft.ru/heliconfocus.html). Coordinates were recorded by Garmin eTrex H personal GPS navigator.

Localities

Cambodian specimens considered in this paper were collected at the following localities (Loc. 1 – 9). Names of places are used (including conventional ones) as in Kosterin (2014).

Koh Kong Province (SW Cambodia):

Loc. 1. 'Microgomphus River': a medium-sized river flowing among forested hills, partly at plantations; slow and shallow section at the bridge passing over to rapids downstream the bridge, 6.5 km SW Thma Bang village, 11°38'44-57'' N, 103°23'40-48'' E, 338-340 m (Kosterin 2010:54-55; 2012: 34).

Loc. 2. Thma Bang River rapids 6 km SW Thma Bang village [mistook for 'waterfall' in (Kosterin, 2011: 46-47, 82). 11°39'38-40'' N, 103°23'59'-24'00'' E (Kosterin 2012: 35)

Loc. 3. Thma Bang River wide and slow flowing reach 5 km SW Thma Bang village, 11°39'31'' N, 103°24'14'' E, 366 m. 15.04.2010 (Kosterin 2010: 55)

Loc. 4. - Capricornis rivulet', 25.5 km ENE Koh-Kong. 11°42'31'' N, 103°11'55'' E, 306 m (Kosterin 2012: 30)

Ratanakiri Province (NE Cambodia):

Loc. 5. O'Sieng Lei (O'Seng Eall, O Sin Laer) Waterfalls: a cascade of low waterfalls/rapids at a medium-sized river with red-brown water, 19 km SE of Ban Lung.

Loc. 5a - a slow reaches upstream the waterfalls, mostly knee-, locally to waist-deeps, with banks overgrown with bamboo. 13°35'38-40'' N, 107°05'09-19' E, 181-185 m.

Loc. 5b - rocky reaches with rapids downstream the waterfall, with some glide sections with a sandy bottom between rocks. 13°35'29-41'' N, 107°05'00-09' E, 160-178 m.

Loc. 6. 'Idionyx river": a small river surrounded by rubber and banana plantations with very scarce dipterocarp forest remnants at banks; a glide section of the river 9 km SSE of Ban Lung, 13°39'32-40'' N, 106°59'48-54' E, 216-223 m.

Loc. 7. Kachan Waterfall: a river with red-brown water downstream the high waterfall, below which it forms a large 'pond', then fast flowing among large boulders and bushes; the valley surrounded by very narrow stripes of remaining dipterocarp forest, 5 km S of Ban Lung, 13°41'31-33'' N, 106°59'20-22' E, 244-253 m.

Loc. 8. The river downstream Katieng Waterfall flowing over a stony bed with the banks shaded by broader forest stripes, 3 km downstream the same river as above, 8 km SSW of Ban Lung. 13°39'55-40'01'' N, 106°58'31-32' E, 200-203 m.

Loc. 9. 'Asahinai brook' (the headwaters of the river of locs. 6-7), downstream the road, with stony bed and some pool sections with *Ludwigia* and *Marsilea* growing, partly shaded by trees, bordered by bush/herb thickets or small plantations, near Lake Yak Lom, 3 km ENE of Ban Lung.

Variation of characters and taxonomical notes

***Burmagomphus asahinai* Kosterin, Makbun et Davvrueng, 2012**

Material: Loc. 2, 25.08.2011 - 1 ♂ (the holotype); Loc. 3, 15.04.2010 - 3 ♀♀ (paratypes); Loc. 7, 1.06.2013 - 2 ♂♂, 1 ♀; Loc. 9, 6.06.2013 - 3 ♂♂ (+ 3 more ♂♂ photographed).

The species was described by a male and 3 females from Koh Kong Province of Cambodia, a male from North Thailand and 6 males and a female from Central Thailand (Kosterin et al. 2012b). In the original description, the following variation within the 8 males from the type series was mentioned (Ibid.):

- yellow stripe across the frons not interrupted in one specimen;
- presence of very narrow yellow streaks at S8 proximal margin in 4 specimens;

- in lateral view, ratio of epiproct branch length to cercus length varying from 1.00 to 1.28
- S9 distal margin pointed at middle in 2 specimens, not pointed in 8 (including the holotype)

Figure 1. Morphological details of *Burmagomphus asahinai* from Ratanakiri Province: a-b, d-e: males photographed (a-b) and collected (d-e) at 'Asahinai brook' (Loc. 9) on 6.06.2013; c, f, a female collected at Kachan Waterfall (Loc. 7) on 1.06.2013; a-b, general view on head and thorax; c, end of abdomen; d-f, head tops.

Figure 2. Males of *Burmagomphus asahinai* at 'Asahinai brook' (Loc. 9), Ratanakiri Province, 6.06.2013.

Variation in 4 female paratypes was not considered in Kosterin et al. (2012b) since 3 of them were teneral and 2 even not fully spread.

Specimens from Ratanakiri Province have some differences from the type series (Kosterin et al., 2012a):

- The antealar yellow spot on the mesepisternum is enlarged and triangular rather than round (Fig. 1a-b), while the antehumeral yellow stripe (not to confuse with the dorsal stripe) is more or less produced towards it. In one male from Loc. 9 they are connected by a narrow yellow line (Fig. 1b).
- A pair of tiny triangular sublateral spots are present at S8 (and also S10) hind margin in the only Ratanakiri female (Fig. 14c); there is no such spots in 2 females from the type series (2 more were still not coloured) and any so far known males.
- In males, a complete yellow dorsal streak is present along S2 (Fig. 1a, b; 2) but absent in the type series, while traces of such streaks on other abdominal segments are present in both series.
- In all Ratanakiri male specimens, S9 is pointed to a considerable spine (variable in the type series), and the S8 dorsum is also pointed (not so in the type series).
- All Ratanakiri specimens exhibit somewhat less sexual dimorphism in the occipital characters than the type series. In the female, the central yellow knob is smaller (Fig. 1f), while all but one (Fig. 1b) males have a more or less expressed yellow mark at the occiput centre, varying from a tiny dot to a considerable roundish spot (Fig. 1a, d-e). Only in one photographed male (Fig. 1b) the mark is absent and the occiput was entirely dark, as in the type series.

Other characters meet the original description well.

The fusion of the antealar spot to the antehumeral stripe in one male produces the condition of two parallel yellow stripes of the synthorax, which is observed in five *Burmagomphus* species forming "Group 3" by Kosterin et al. (2012b). In particular, the trend of their fusion makes the Ratanakiri specimens approaching to *Burmagomphus sowerbyi* Needham, 1930 by formal characters used in the key by Chao (1954). But in the latter species, the antehumeral stripe is much less constricted in its upper part (Zhang 2011; Asahina 1989: fig. 34), and lateral yellow spots are present on S8 and S9 (Needham 1930; Chao 1954; Zhang 2011). *B. asahinai* and *B. sowerbyi* are of course different and not so much related species: a complex of such important characters as the male appendages, secondary genitalia and penile organ, and the female valvular lamina, the occiput structure and face coloration of *B. asahinai* are quite different from those of *B. sowerbyi* as illustrated by Chao (1954: figs. 247-250) and, with some doubts in species identification, by Asahina (1976: fig. 14; 1989: figs. 35-37).

***Burmagomphus divaricatus* Lieftinck, 1964**

Material: Loc. 1, 23.08.2011 – 6 ♂♂ (+ 3 ♂♂ photographed), Loc. 2, 25.08.2011 – 1 ♂; Loc. 4, 14.08.2011 – 1 ♂; Loc. 6, 31.05.2013: 1 ♂; Loc. 7, 1.06.2013: 1 ♂ (+ 1 ♂ photographed).

Only males were collected. They correspond to the diagnostic characters of the species given by Lieftinck (1964):

- fused antehumeral+dorsal stripe of pterothorax not reaching metinfraepisternum;
- epiproct branches very long and slender, divaricate;
- long hairs along the anterior margin of the posterior hamulus (Fig. 3c-d; Fig. 4f);

They also show some characters indicated for Laotian and Thai males by Asahina (1977, 1986a) as differing from the Malaysian males depicted by Lieftinck (1964) and Asahina (1977):

- epiproct branches reach in caudal direction to the level of the cerci tips (Fig. 3a-b), as in Laotian (Fig. 4a) and Thai (Fig. 4b) males, versus slightly not reaching this level in males from Malaysia (Fig. 4c-d);
- cerci with both margins even as viewed dorsally (Fig. 3b) as in Laotian and Thai males (Fig. 4a-b), versus sinuous at outer margins in Malaysian males (Fig. 4c-d).

The above mentioned traits may be supposed as characteristic for all continental males of *B. divaricatus*.

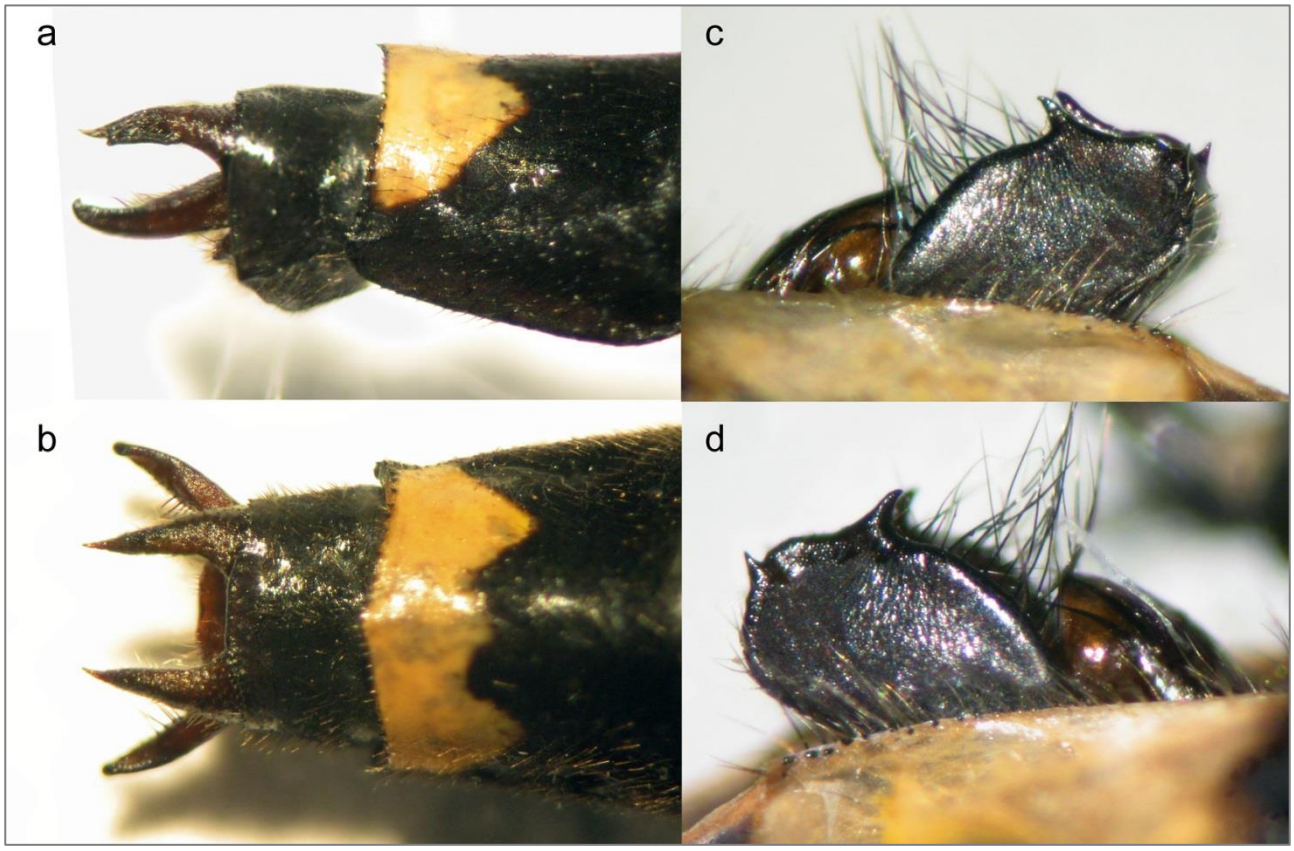

Figure 3. Morphological details of a male of *Burmagomphus divaricatus* collected at 'Idionyx River' (Loc. 6), Ratanakiri Province, 31.05.2013: a, end of abdomen, lateral view; b, ditto, dorsal view; c, hamuli (vesica removed), right laretal view; d, ditto, left lateral view.

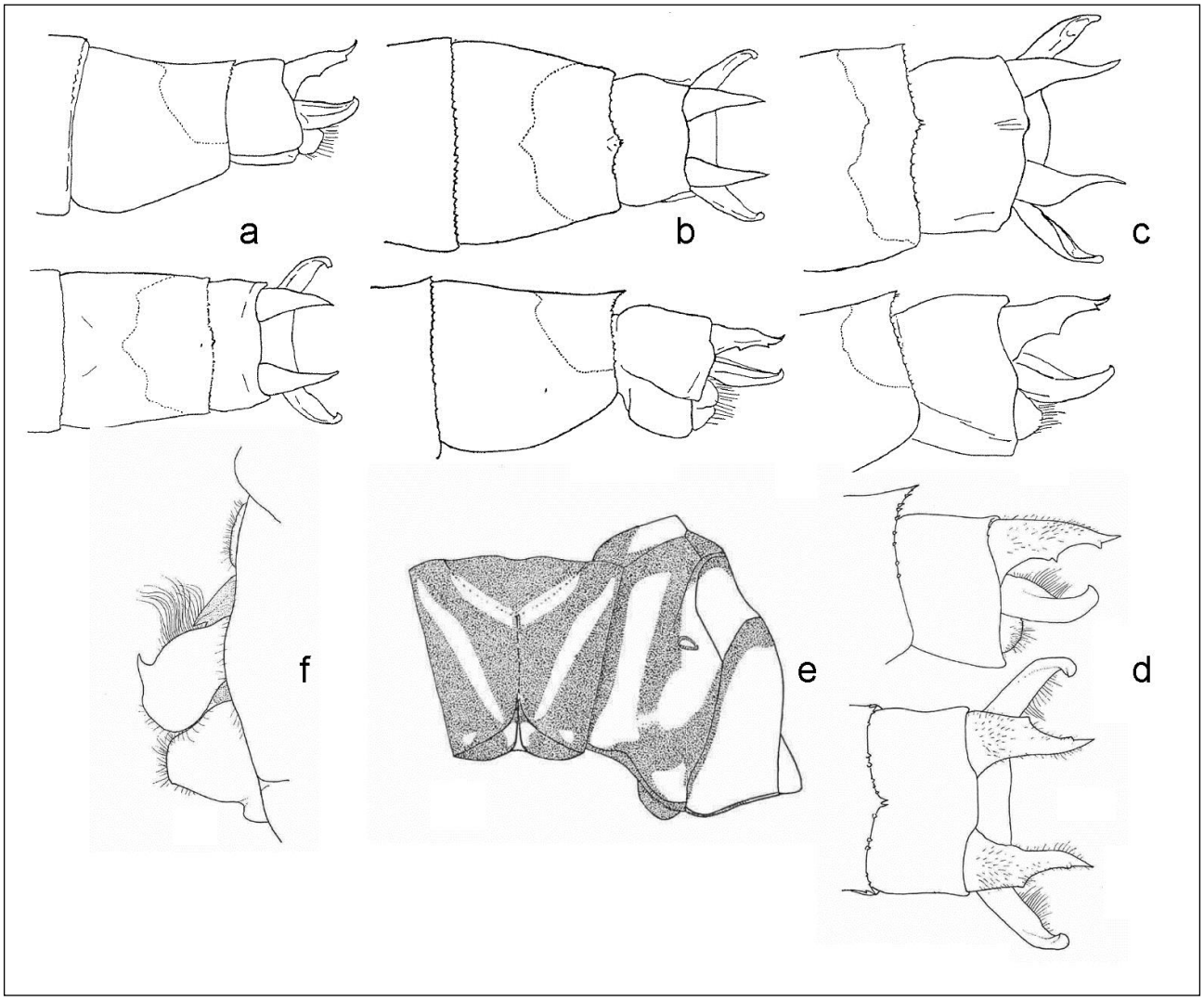

Figure 4. Details of *Burmagomphus divaricatus* from literature: a-d, caudal appendages; e, thorax coloration; f, secondary genitalia; a, Laos, Nammoh (Asahina 1977: figs 58-59); b, Thailand, Mae Sa (Asahina 1977: figs 60-61 = Asahina 1986a: figs 9-10); c, Malaysia, Kuala Lumpur (Asahina 1977: figs 62-63); d-f, holotype, Malaysia, Ulu Gombak, Selangor (Lieftinck 1964: figs 32-33 rotated and mirrored; 29 and 31).

One of 7 males from Koh Kong Province (see also Kosterin 2012) and both males from Ratanakiri Province demonstrate a feature common with the Laotian male characterised by Asahina (1977):

- S9 misses the terminal spine in the male from Loc. 7. It is pointed but not to a spine in male from Loc. 6. In Laotian male S9 was “scarcely developed” (Asahina 1977) (Fig. 4a). Note that the same character, once though to be diagnostic for species groups (Fraser 1926), appeared to be variable in the type series of *B. asahinai* (Kosterin et al 2012b) but not in the Ratanakiri specimens (see above).

In all Cambodian males, the occiput is black as in the original description of *B. divaricatus*, (Lieftinck, 1964), not yellowish as in the Laotian male by Asahina (1977).

Figure 5. Close-up view of perching males of *Burmagomphus divaricatus* at 'Microgomphus River' (Loc. 1), 23.08.2011 (above) and 'Thma Bang River' (Loc. 2), 25.08. 2011 (below). White arrowheads indicate the spots being remnants of the antehumeral stripe lower part. From Kosterin (2012: fig. 48).

Males from Koh Kong Province demonstrate a unique feature not observed elsewhere (Kosterin 2012): a diminished light thoracic pattern. The antehumeral light stripe has strongly reduced lower part which is either absent (in 3 males) or represented by a tiny isolated spot (in 5 males) (Fig. 5). The antealar spot on the mesepisternum is absent in 5 males and present in 3 males. Both the antehumeral stripe lower part and the antealar spot is present in 2 males, and both is absent in 2 males as well. The lateral thoracic pattern corresponds to that shown in Lieftinck (1964) (Fig. 4e) rather than in Asahina (1986a: fig. 8): the black anastomosis in the metepisternum upper part is complete and indistinctly fused with the black stripe along the mesepimeron/metepisternum seam, but all the lateral black stripes are broader.

This mentioned reduction of the thoracic light pattern is not observed in the two Ratanakiri males.

Both males from Ratanakiri Province also show a feature not observed elsewhere:

- in cerci, the central ventral tooth is weakly expressed and scarcely seen in lateral view while the subapical one is well expressed (Fig. 3a). Both teeth are seen well in Lieftinck (1964) and Asahina (1977; 1986a) (Fig. 4a-d) and more or less well in specimens from Koh Kong Province (not shown).

At last, the male from Loc. 6 has a feature very unusual for the species:

- in the posterior hamuli, in addition to the common strong anteriorily directed apical spine, there are smaller spines on the posterior margin: two on the right one (Fig. 3c) and one on the left one (Fig. 3d). Such 1 or 2 small spines are a feature of the related species *Burmagomphus arboreus* Lieftinck, 1940 described from Burma and illustrated well by Lieftinck (1964). However, *B. arboreus* misses the long and dense hairs on the anterior margin of the posterior hamulus (a very characteristic feature of *B. divaricatus*); and the appendages in *B. arboreus* are thick and robust (Lieftinck 1964), with the epiproct arms not so long and delicate as characteristic for *B. divaricatus* and in both our males (Fig. 3a-b).

***Orientogomphus minor* (Laidlaw, 1931)**

Material: Loc. 5a, 2.06.2013 - 1 ♂ (male 1); Loc. 5b, 2.06.2013: 1 ♂ (male 2).

Wilson (2008) made a revision of known *Orientogophus* specimens from North Myanmar, Thailand, North Vietnam and S China, recognising four bona species: *O. circularis* (Selys, 1894), *O. minor, O. naninus* (Förster, 1905) and *O. armatus* Chao et Xu, 1987, occurring in the mentioned regions respectively. In a distributional map provided by Wilson (2008: fig. 32), the closest known record to Ratanakiri Province of Cambodia (ca 550 km) is that for *O. minor* in Sakon Nakhon Province of Thailand (Wilson 2008; Hämäläinen & Pinratana 1999).

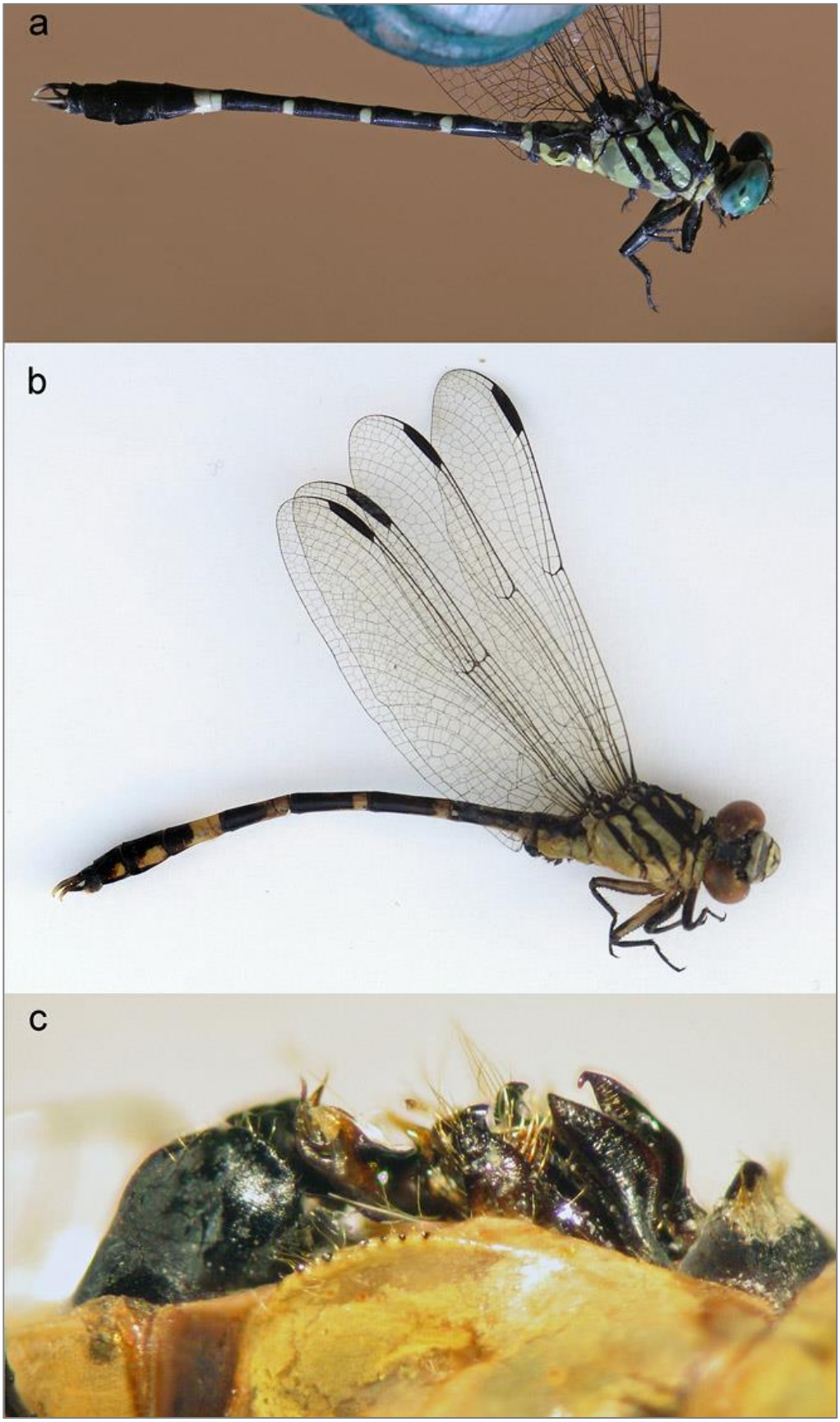

Figure 6. Two males of *Orientogomphus minor* collected at O'Sieng Lei Waterfalls (Loc. 5), Ratanakiri Province, on 02.06. 2013: a, male 1; b-c, male 2; a-b, general habitus, c, secondary genitalia.

Size was recognised by Wilson (2008) among the characters differentiating *O. minor* (abd. + apps. 35.0-36.5 mm, hw 25.0-27.0 mm) from *O. circularis* (male abd. 41 mm, hw 32 mm), *O. naninus* (abd. + apps. 43 mm, hw 32.5 mm) and *O. armatus*.

Wilson (2008) described and discussed morphological variation in *O. minor*. The two Cambodian *Orientogomphus* males fall into this variation but yet in some respects nearly represent its opposite extremes.

Their respective measures are 33 mm, 26 mm in male 1 and 33.5 mm, 27 mm in male 2, which corresponds to *O. minor*. The hind wing veins 1A and CuP are divergent at the wing margin as in *O. minor* (and *O. naninus* as well; parallel in *O. circularis*). A less extended yellow pattern was indicated as the third (and last) difference of *O. minor* from *O. circularis*, of which the interrupted versus just indented yellow stripe across the frons was mentioned. However, Wilson (2008) did not illustrate this feature in male *O. circularis* while the drawing reproduced from Asahina (1986b: fig. 67) and identified as *O. minor* in (Wilson 2008: fig. 19) show the stripe rather indented than interrupted. This stripe is just slightly indented in both O'Sieng Lei specimens. These, as well as Thai specimens, have slightly curved arms of the epiproct: a difference from *O. armatus* in which they are straight (Wilson 2008).

The two males show strong difference in the development of black versus yellow pattern of the thorax and abdomen (but not of the head), with the slightly larger male 2 (Fig. 6b) being 'more yellow' than male 1 (Fig. 6a). These differences are summarised in Table 1.

Table 1. The pattern differences in the two males of *Orientogomphus minor* from O'Sieng Lei Waterfalls

Character	**male 1 (Fig. 6a)**	**male 2 (Fig. 6b)**
pterothorax dorsal suture	with a yellow dot	with a yellow streak
black stripe along 1st lateral suture	broadly connected to humeral black by the ventral border of mesepimeron, as in Fig. 7b adopted from Asahina (1986a)[1]	disconnected to it, hence mesepimeron ventral margin yellow, as in Fig. 7a,c adopted from Wilson (2009)
outer surface of metafemur	black for the distal 1/3 of its length	almost entirely yellow
S2 dorsal black	with a ventrad projection behind the auricle	without the projection
dorsal yellow spots	on S2-S5 (a tiny dot on S5)	on S2-S6 (that on S5 considerable, that on S6 fused to anterior yellow ring)
fine black dorsal line crossing broad yellow ring of S6-S7	complete	reduced to traces
S8	with a pair of very small slanting yellow marks	with large trapezoid yellow lateral spots occupying 3/4 of segment length

[1]but the inframesepisternum pattern look unnatural in that figure; in both my males inframesepimeron is largerly yellow but with a black dorsal part

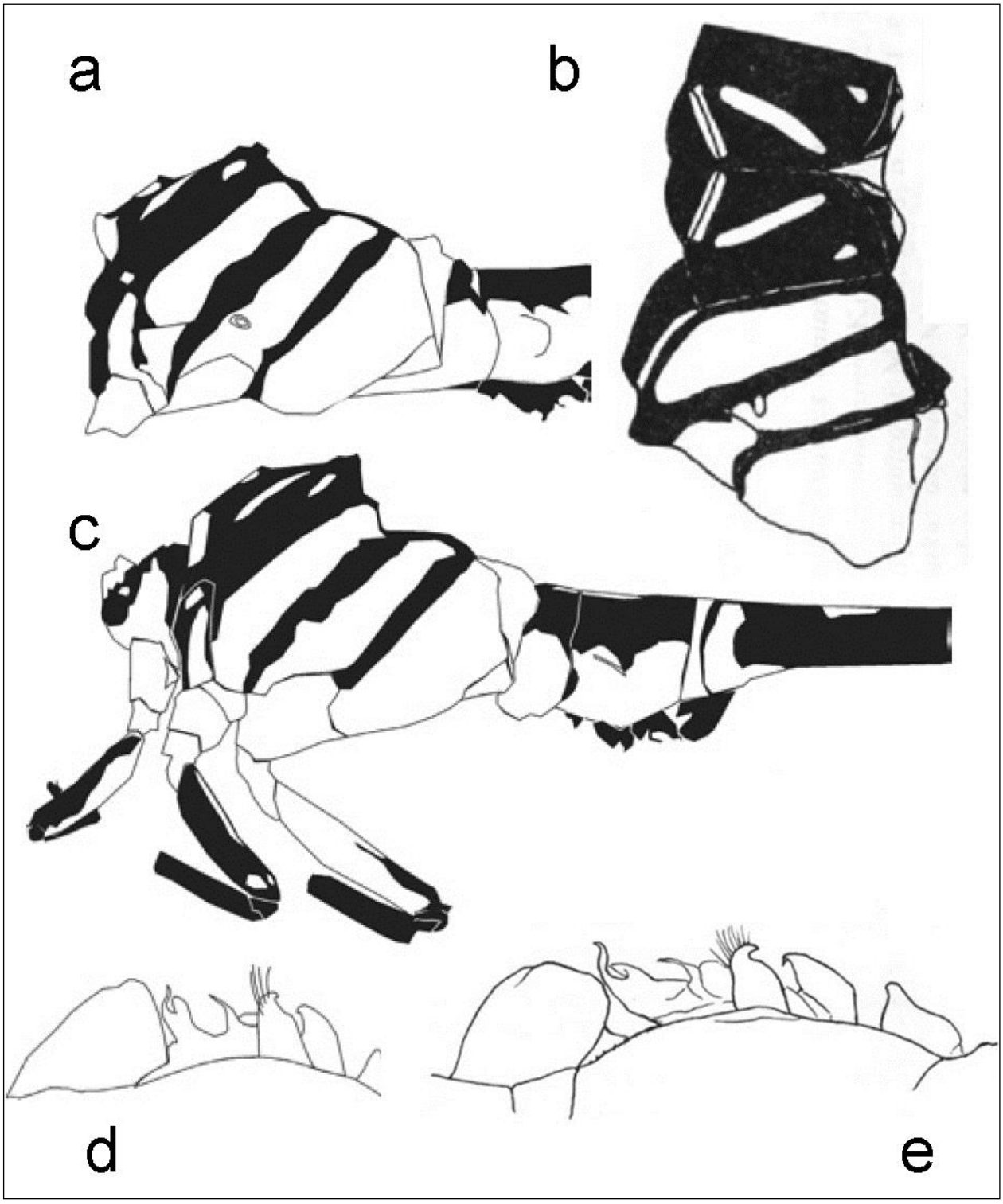

Figure 7: Details of males of *Orientogomphus minor* from Wilson (2008): a-c, thorax pattern; d-e, secondary genitalia; a, d, lectotype, Malaysia, Kuala Lumpur (loc. cit.: figs 8, 11); b, Thailand, Krabi, Khao Phanon Bencha National Park (loc. cit.: fig. 14); c, Thailand, (loc, cit.: fig. 20, rotated and mirrored, 25 = Asahina 1986b: figs 68, 73, as *O. circularis*)

In contrast to the differences in melanisation of the thorax and abdomen, the appendages of the two males are similarly coloured: epiproct black, cerci yellow outside and brownish to the proximal 2/3 and yellowish to the distal 1/3, with a gradual transition, inside.

The anal loop is two-celled in male 1 and one celled in the larger (!) male 2, both cases being observed in *O. minor* (Wilson 2008: figs 18 and 12, respectively). The number of cells in many wing areas are of little importance, and this seems to be so in the anal loop; yet in our case, one versus two large cells make the anal loop looking conspicuously different in shape. The anal triangles are three-celled.

The secondary genitalia (Fig. 6c) are as shown for *O. minor* in Wilson (2008) (Fig. 7d-e) rather than for *O. naninus* (Wilson 2008: fig. 30-31): the anterior hamulus is only slightly hooked and the posterior one does not bend caudad; but the anterior one is as high as the posterior one (lower in all the mentioned figures).

In spite of differences between the two O'Sieng Lei males, both fall within the variation of O. minor as reported by Wilson (2008) and meet all the diagnostic characters of this species specified in loc. cit., and it is safe to identify them so (if all the mentioned taxa are indeed *bona species*).

***Gomphidia abbotti* Williamson, 1907**

Material: Loc. 7, 1.06.2013 - 1 ♂; Loc. 9, 6.06 – 1 ♀.

Asahina (1986b) recognised two very distinct "forms" of this species, A and B, with respect to the degree of development of the yellow pattern. The nature of these forms is still unclear. They could be bona species, subspecies or just alternative colour morphs. However, nobody reported both forms for the same locality. This could mean that they exclude one another, so the option of colour morphs is rather unlikely. Both male and female from NE Cambodia belong to the B form (to which the species type also belongs) with a wider light pattern (Fig. 6 a-c). However, in the male collected, the head light pattern is diminished a little bit: the labrum is mostly black, with a pair of transversal yellow patches, as in Wilson & Reels (2001: fig. 24). Besides, the uppermost margin of the anteclypeus is also black, while the anteclypeus was shown entirely yellow in Asahina (1986b: fig. 136). The dorsal seam of the pterothorax is marked with a yellow line (not shown in the loc. cit.).

***Lamelligomphus castor* (Lieftinck, 1941)**

Material: Loc. 5b, 2.06.2013 - 1 ♀; Loc. 7, 1.06.2013 - 1 ♂; Loc. 8, 1.06.2013 - - 1 ♂.

In the two males, the head light pattern is extended as compared to that described and depicted by Asahina (1986b):

- the light areas on the labrum occupy most of its area rather than "very small"(Ibid.);
- there are lateral light spots on the postclypeus, which Asahina (1986b) characterised as "entirely black" but depicted the outlines of these spots in loc. cit.: fig. 82.
- the dorsal row between the mesepisterna is marked with yellow; the row of denticles at the cercus inner margin is continued by weak denticles (not men-

tioned and scarcely depicted in loc. cit.) to some distance distally of several strong ones.

Discussion

The hereby reported intraspecific variation within *B. asahinai* and *B. divaricatus* appeared to be greater than could be expected from literature. The extention of thoracic yellow pattern (as well as lateral spots on S8 in the female), makes some specimens of *B. asahinai* from NE Cambodia looking as if approaching *B. sowerbyi*. The additional spines on the hamuli in a male of *B. divaricatus* are the same as thought to be diagnostic for B. arboreus. Yet other diagnostic characters evidence for identifications of these problematic specimens as *B. asahinai* and *B. divaricatus*, respectively. Thus, identification of Burmagomphus spp. should rely on a complex of characters and caution is necessary when using formal keys, such as in Chao (1954). More specimens from more localities are necessary to reveal the pattern of this intraspecific variation in both species considered. Most probably it will show geographical trends, such as the yellow pattern extention from Thailand to NE Cambodia in *B. asahinai*, or reduction of the S9 spine and non-sinuous cerci in the dorsal view in continental representatives of *B. divaricatus*. The status of the diminished thoracic light pattern in specimens of the latter species from the Cardamoms (SW Cambodia) is to be revealed as well. These trends may either be of a clinal nature or demonstrate some discontinuity so motivating subspecies descriptions. Clarification of this matter is an aim for future research.

Wilson (2008: 15) reported a rare in gomphids crepuscular activity of *O. minor* in Krabi Province of Thailand, with males “patrolling sections of the stream and hovering over gravel riffles for short periods” until dark. Both my specimens were collected hovering over the O’Sieng Lei River (male 1 at a calm reach and male 2 at a reach with rapids) at daytime.

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Nr.	Jahr	geförderte Person bzw. Körperschaft	Fördergegenstand
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78	2010	Villanueva, Reagan, Philippinen	Stereomikroskop
79	2010	Villanueva, Reagan, Philippinen	Odonata of the Diomabok-Lake region south of Davao, The Philippines Follow-up
80	2011	Villanueva, Reagan, Philippinen	Odonata of the Catanduanes-Island, The Philippines
81	2012	Villanueva, Reagan, Philippinen	Odonata of Dinapique, The Philippines
82	2012	Dow, Rory, UK/The Netherlands	Odonata of Kalimantan, Borneo, Malaysia
83	2012	Marinov, Milen, Christchurch	Odonata species diversity of the "Eua Island, Kingdom of Tonga"
84		Marinov, Milen, Christchurch	Odonata of Solomon Islands
85	2012	Villanueva, Reagan, Philippinen	Odonata from Talaingod, Davao del Norte, Mindanao Island, Philippines
86	2012	Do Manh, Cuong, Hanoi, Vietnam	Mau Son Mountain Odonata, Vietnam
87	2012/13	Villanueva, Reagan, Philippinen	Odonata fauna Mt. Lomot and Mt. Sumagaya, The Philippines
88	2013	Anna Rychla, Ukraine	Vorkommen der Arktischen Smaragdlibelle *Somatochlora arctica* (Zetterstedt, 1840) in Planregenmooren der polnischen Ostseeküste (*S. arctica* in bogs along the coast of Polish Baltic Sea)
89	2013	Vincent Kalkman/A.B. Orr, The Netherlands/Australia	Field guide New Guinea Zygoptera
90	2013	Oleg Kosterin, Russia	Progress study Cambodia 2013
91	2013	Dejan Kulijer, Bosia & Herzegovina	Odonata fauna of karst streams and rivers of South Herzegovina (Bosnia and Herzegovina, West Balkan)
92	2013	Saeed, Muhammad & Fazlullah Gujjar, Haripur, Pakistan	Distribution and diversity of Odonata with emphasis on Gomphidae and Cordulegastridae in the border region of Pakistan and Afghanistan
93	2013	Villanueva, Reagan, Philippinen	Odonata from Balabac Islands, Palawan, Philippines
94	2013	Villanueva, Reagan, Philippinen	Fieldwork to survey the odonatologically unstudied islands of Balut and Sarangani (The Philippines) and Talaud (Indonesia)"
95	2013	Garrison, Rosser/von Ellenrieder, Natalia, Sacramento, USA	The genus Argia in Costa Rica
96	2013	Villanueva, Reagan, Philippinen	Odonata of Surigao del Sur, Philippines
97	2014	Dawn, Prosenjit, Kolkata, India	Rheophilous Odonata diversity of protected areas of Chhattisgarh, India
98	2014	Dow, Rory, UK/The Netherlands	Sarawak Odonata – documenting the status quo Odonata diversity prior logging"
99	2014	Xu, Xin, Nankai University, Tianjin, China	Odonata of Mt Dabieshan in centre of eastern China
100	2014	Rychla, Anna, Polen	Untersuchung der Libellen von westpolnischen Mooren.
101	2014	Dow, Rory, UK/The Netherlands	Naming an Onychogomphus from Malaysia
102	2014	Vincent Kalkman/A.B. Orr, The Netherlands/Australia	Field guide New Guinea Anisoptera
103	2014	Marinov, Milen, Christchurch, New Zealand	Odonata of Samoa, revisiting the localities from Fraser 1925, 1926, 1927, 1953 and 1956
104	2014	Ahmed Zia, Pakistan	Zygoptera in eastern Pakistan
105	2014	Saeed, Muhammad & Fazlullah Gujjar, Haripur, Pakistan	Progress study: Distribution and diversity of Odonata with emphasis on Gomphidae and Cordulegastridae in the border region of Pakistan and Afghanistan and China