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Oleg E. Kosterin

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Gomphidae) from northern Cambodia

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***Burmagomphus williamsoni eddiei* subsp. nov. (Odonata, Gomphidae)  
from northern Cambodia**

Oleg E. Kosterin<sup>1,2</sup>

<sup>1</sup>Institute of Cytology & Genetics SB RAS, Acad. Lavrentyev ave. 10, Novosibirsk, 630090, Russia

<sup>2</sup>Novosibirsk State University, Pirogova str. 2, Novosibirsk, 630090, Russia

Email: kosterin@bionet.nsc.ru

**Abstract**

*Burmagomphus williamsoni eddiei* is described from northern Cambodia (holotype: Siem Reap Province, Sway Leu District, Phnom Kulen Mts, the waterfall 600 m NNW of Preah Ang Thom, 13.569°N, 104.108°E, 270 m a.s.l., 17.06.2018, RMNH), also occurring in Preah Vihear Province. The new subspecies differs from the nominotypical one by a very prominent subapical cercal tooth, the convex inner margin of the paraproct arms and a trapezoid incision between them, the antehumeral stripe finely separated from that on the metinfraepisternum in males and strong singular spines at the sides of the occipital plate in females.

**Keywords:** Odonata, Anisoptera, *Burmagomphus williamsoni* Förster, 1914, *Burmagomphus siamensis* Fraser, 1926, new subspecies, Cambodia, Phnom Kulen Mts, taxonomic notes

**Introduction**

*Burmagomphus williamsoni* Förster, 1914 (type locality: "Camp Jor, Wasserscheide zwischen Perak und Pahang (Inner Malakka)") (Förster 1914, Lieftinck 1964) has rather a complicated nomenclatorial history. It was described as the presumed Malayan subspecies ("Rasse") of *Burmagomphus vermicularis* (Martin, 1904). Later it was upgraded to a species (Fraser, 1926; Lieftinck (1940). Also Lieftinck (1940; 1964) synonymised to *B. williamsoni* three later described species: *Burmagomphus siamensis* Fraser, 1926 (for the type locality see below) (Fraser 1926), *Burmagomphus seimundi* (Laidlaw, 1931) (type locality: "Pahang. Malaya") (Laidlaw 1931) and *Burmagomphus javicus* Schmidt, 1934 (type locality: "W Java") (Schmidt, 1934), but Lieftinck (1964) retained the latter taxon as a subspecies (see below).

There is also a junior primary homonym *Burmagomphus williamsoni* Fraser, 1926, proposed by Fraser (1926) for the species described by Williamson (1907) under the name '*Burmagomphus vermiculatus* Martin' (sic), which, however, was not actually the same species as *Gomphus vermicularis* Martin, 1904. Both Williamson (1907) and Fraser (1926) assumed incorrect spelling '*vermiculatus*' for the species described by Martin (1904). For the junior homonym *B. williamsoni* Fraser, 1926 nec Förster, 1914, the new name *Burmagomphus arboreus* Lieftinck, 1940 was proposed by Lieftinck (1940), which

at present is considered as valid. However, *vermiculatus* and *vermicularis* are actually different names rather than homonyms (Williamson being the actual author of the former), so proposals of both the new name by Fraser (1926) and the replacement name for it by Liefstinck (1940) were not justified and the valid name for that species should be *Burmagomphus vermiculatus* Williamson, 1907, while *B. williamsoni* Fraser, 1926, nec Förster, 1914, and *B. arboreus* Liefstinck, 1940 are its junior objective synonyms.

The type locality of *B. siamensis*, described by the single female holotype, is another knot of confusion. It is mentioned in the original description as “Bangkok, Siam”, without the date and collector (Fraser 1926: 412). Liefstinck (1964: 37) and Kimmins (1966: 213) studied the holotype label and reported it as follows: “Don Chai, Siam, 5.XI.23, coll. S. Williamson. Type” (Liefstinck’s version provides 1923 in full and misses the word “Type”). Search for “Don Chai” resulted in two districts (tambons) and temples, Si Don Chai and O Don Chai, in Chiang Rai Province in North Thailand but nothing near Bangkok. Curiously, one year later Fraser (1927) published a description of a female of “*Burmagomphus vermiculatus* (Mart.)”, from the same collection by S. Williamson, with the following label: “Den Chai, N Siam, 5.XII.23”. Both descriptions have completely different wordings and approaches but leave little doubt they concerned the same specimen, in spite of the following differences (the 1926 vs 1927 paper): abdomen 26 vs 27 mm; hindwing nodal formula 8-9/9-8 vs 9-8/8-8; small black spines at the ends of occiput against eyes mentioned (but not seen in the drawing of fig. 1) vs not mentioned (while the yellow, long, prominent central spine mentioned in both papers); a fine middorsal stripe mentioned for S3-S4 vs only for S3. Besides, segments 8 and 9 in Fraser (1926) obviously referred to segments 9 and 10 (lapsus calami), correctly described in (1927). The holotype label of *B. siamensis* (Liefstinck 1964; Kimmins 1966) differed from that in Fraser (1927) in spelling “Don” vs “Den” and the month “xi” vs “XII”. Obviously the paper (Fraser 1927) was prepared still before (Fraser 1926), although published one year later. This is evidenced by the fact that Fraser (1927) still considered the Siamese specimens published by Williamson (1907) as ‘*B. vermiculatus*’ and the syntypes of *Gomphus vermicularis* from Tonkin (Martin 1904) as the same species, while Fraser (1926) already found them non-conspicuous and proposed a new name for the former (which was both preoccupied and unnecessary, see above). Hence we can conclude that *B. siamensis* was described not from Bangkok environs but from Chiang Rai Province of North Thailand.

It is noteworthy that the original description of *B. siamensis*, based on the female holotype, mentioned only singular occipital lateral spines, as follows: “occiput yellow, raised into a long prominent median spine at its hinder border and with a smaller black spine at either end against the eyes but not quite on the free border” (Fraser 1926: 411). Liefstinck (1964: 37) re-examined the holotype and mentioned, in the addendum to his paper, the following: “The raised transverse processes, one on each side of the yellow central cone of the occiput”. In the main part of the paper, obviously written earlier, Liefstinck (1964) mentioned singular lateral occipital spines only for his *B. williamsoni austrosundanus* Liefstinck, 1964. Nevertheless he firmly synonymised *B. siamensis* to the nominotypical subspecies of *B. williamsoni williamsoni*, also in the addendum.

Dr. Benjamin Price at Natural History Museum, London (BMNH) made it possible to revise the details of the *B. siamensis* holotype (NHMUK 013384578) objectively by kindly providing its photographs (Figs 1-2). “Don Chai, Siam” is the correct spelling of

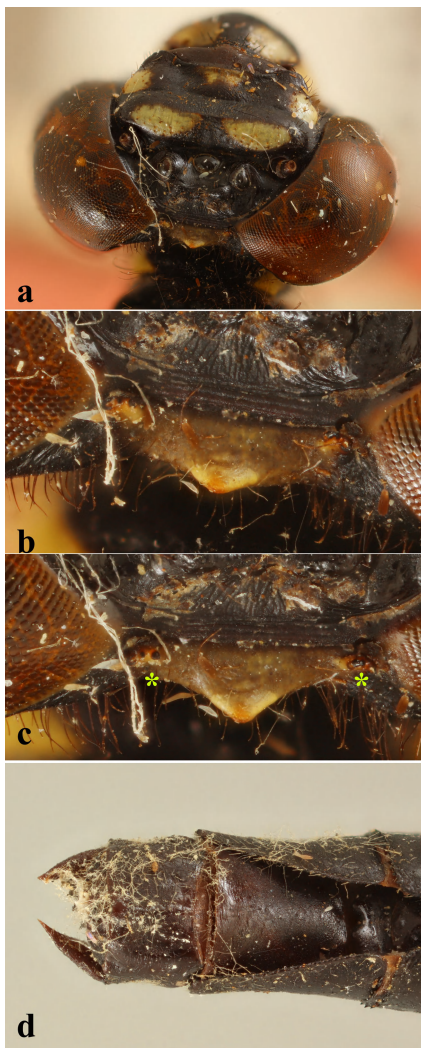


**Figure 1.** The habitus and labels of the holotype (female) of *Burmagomphus siamensis* Fraser, 1926 (a junior subjective synonym of *B. williamsoni* Förster, 1914) from Siam, Don Chai, 5.11.1923, S. Williamson leg. Photos by Benjamin Price, BMNH. <https://data.nhm.ac.uk/object/624a8753-d209-4474-9f42-705ad2d27d771-1630540800000>; retrieved 9.09.2021.

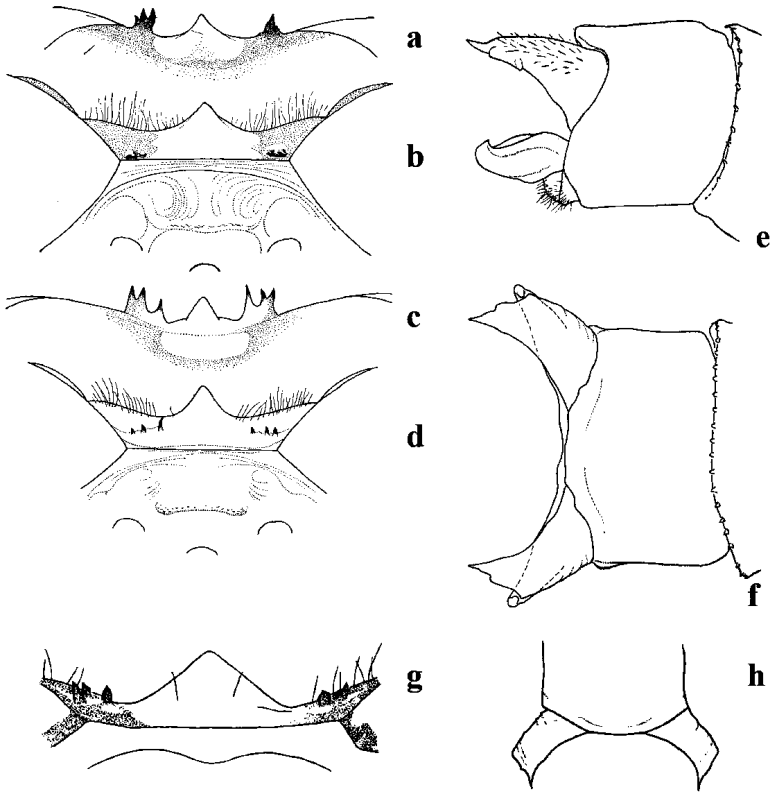
the type locality; hindwing nodal formula is 8-8/9-8 (not coinciding with that in both Fraser's descriptions); middorsal stripe is present on S3-S5 (Fig. 1). There are groups of small blunt sclerotised processes at the occipital plate sides against the eyes (as should be in *B. williamsoni*), three on the left side and two (maybe also three) on the right side (indicated with green asterisks in Fig. 2b-c), rather than singular spines as stated in the original description (Fraser, 1926). The synonymy of *B. siamensis* to *B. williamsoni* is indeed doubtless.

*Burmagomphus williamsoni* Förster, 1914 nec Fraser, 1926, was redescribed in detail by Liefstinck (1964). He acknowledged the taxon *javicus* Schmidt, 1934 as the subspecies *Burmagomphus williamsoni javicus* and also described the subspecies *Burmagomphus williamsoni austrosundanus* (type locality: "E Sumba, Laluku"). Liefstinck (1964: 19-20) evaluated his notion of subspecies in *B. williamsoni* as follows: "The distinguished features of these subspecies ... are slight, not easily paraphrased, and based on average characters of size and extent of body markings. It is worthy of note that the females are more easily held apart than the males". Liefstinck (1964) did not provide separate differential diagnoses

but scattered some comparative remarks along the redescription and description of the respective taxa. Those on markings are not easy to follow since the differences are not always stressed and so should be inferred from comparing detailed descriptions, anyway they are slight and not so important since they are known to exhibit intra-species variation in *Burmagomphus* (Kosterin 2014). More important structural differences concerned only females and were claimed as follows. In the vulvar lamina of ssp. *williamsoni*, “on the whole the triangular lobes are a trifle longer, more approximated, with the emargination more triangular in outline, than in *javicus*”, while in ssp. *austrosundanus* “vulvar lamina trapezoidal, even shorter than in *javicus*, the apical emargination and lobes scarcely indicated” (Liefertinck 1964: 20, 23, 36). The occiput was characterised as follows: ssp. *williamsoni*: “erect spine-like process on each side at the base of the occipital plate usually placed transversally and ending in two or three (rarely four) fine spines” (Fig. 3a-d, as reproduced from Liefertinck 1964: figs 19-23); ssp. *javicus*: “erect spine-like process at base of occipital plate less broad at base, uni- or bispinose, rarely tridentate, in some specimens not at all differing in shape and length from typical *williamsoni*”; ssp. *austrosundanus*: “conical tubercle in middle of occiput slightly less prominent than in *javicus*, the erect processes near eye-margin either bidentate or undivided, in the form of slender conical spikes” (Liefertinck 1964: 20, 23, 36). The size is reported to change in the row of subspecies *javicus* – *williamsoni* – *austrosundanus* as follows (mm): male: abd.+apps. 28.5-29.0 – 27.3 – 25.5-26.0; hindwing 23.0-23.5 – 21.8 – 22.0; female: abd.+apps. 29.0-32.0 – 27.0-28.0 – 27.0-28.0; hindwing 25.0-26.0 – 23.3 – 24.0 – 23.5-25.5. All these differences claimed as subspecific by no means look convincing, nevertheless the current notion is still that the nomino-



**Figure 2. Details of the holotype (female) of *Burmagomphus siamensis* Fraser, 1926: a – head, oblique dorsofrontal view; b – occiput, oblique dorsofrontal view; c – occiput, dorsal view; d – end of abdomen, ventral view. The processes at the occipital plate sides are indicated with green asterisks. Photos by Benjamin Price, BMNH.**



**Figure 3. Female occiput (a, c – posterior view; b, d, g – anteriodorsal view) and male anal appendages (e – lateral view; f, h – dorsal view) of *Burmagomphus williamsoni williamsoni* as depicted in Lieftinck (1964: figs 19-23) from specimens from Peninsular Malaysia, Camp Jor (a-b, e-f – the lectotype of the species) and Sungai Chemor (c-d), and in Katatani et al. (2010) from specimens from either Nan or Phrae Province of Thailand (g, h). Not to scale.**

typical subspecies occurs on the continent including Malay Peninsula while two other subspecies are insular.

Beyond the Malay Peninsula, *B. williamsoni* was reported from the north, west, south and south-east of continental Thailand, namely the provinces of Chiang Rai (Fraser 1926; Katatani et al. 2004), Kanchanaburi (Lieftinck 1964), Chiang Mai, Phrae, Chanthaburi (Hämäläinen & Pinratana 1999; note this source does not mention Chiang Rai), Nan (Katatani et al. 2010), Ratchaburi and Phetchaburi (Day et al. 2012), and also from Yunnan Province of China (Zhang et al. 2015). It looks rather unnatural that the specimens from such a long, longitudinally stretched range in the mainland, biogeographically quite distinct from Sundaland where the species was described from, have been so far attributed to

the nominotypical subspecies (Lieftinck 1964; Katanani et al. 2004; 2010), while two weakly differing subspecies (*williamsoni* and *javicus*) are recognised within Sundaland (plus ssp. *austrosundanum* in Wallacea).

Along with the holotype of *B. siamensis*, Lieftinck examined a male specimen from “19 km N. of Ban Kao” in Kanchanaburi Province in western Thailand and stated that it “fits our description and figures in every respect” (Lieftinck 1964: 38). Katatani et al. (2010: figs 5-8) depicted a photo of the habitus of both sexes, a drawing of the male cerci (Fig. 3h), a photo of the female face and a drawing of the female occiput (Fig. 3g) of *B. williamsoni williamsoni* from either Nan or Phrae Province of Thailand (the species was collected in both, the figures are not associated to localities; the description is overall of the specimens collected). The drawing of the female occiput by Katatani et al. (2010: fig. 8) (Fig. 3g) shows three small teeth on the right side and two ones at the left side.

It is noteworthy that Chiang Rai Province, from where *B. siamensis* was described, is in the same North Thailand as Nan and Phrae Provinces from where specimens by Katatani et al. (2010) originated, so that the distance between the places of their origin hardly exceeded 150 km. Thus, the so far examined diagnostic structures of *B. williamsoni* specimens from North Thailand, that is the holotype of *B. siamensis* (Figs 1-2) and illustrations in Katatani et al. (2010) (Fig. 3h,g), appeared nearly identical to those depicted by Lieftinck (1964) for the specimens from Malay Peninsula (Fig. 3a-d,e-f). This is impressive bearing in mind the distance of almost two thousand km. It may be supposed that *B. williamsoni* ranges in the mainland along Burma Plate (a geological entity), from the Malay Peninsula through Kanchanaburi to the northern Thailand. Which subspecies inhabits Chatthaburi Province in SE Thailand is still to be revealed.

At the same time, while studying the Odonata fauna of NW (Kosterin & Smith 2020) and N (Kosterin 2020) Cambodia I came across a *Burmagomphus* with a degree of differences from *B. williamsoni* somewhat intermediate between what is usually considered sufficient for different species and different subspecies (Kosterin & Smith 2020). To remain on the safe side, I prefer to describe this taxon here as a Cambodian subspecies of *B. williamsoni*, differing from the nominotypical one stronger than the above mentioned insular subspecies.

### ***Burmagomphus williamsoni eddiei* subsp. nov.**

(Figs. 4-8)

#### **Type material**

Holotype: ♂ (Figs 4, 5a,c, 6), Cambodia, Siem Reap Province, Sway Leu District, Phnom Kulen Mts, the waterfall 600 m NNW of Preah Ang Thom, 13.569°N, 104.108°E, 270 m a.s.l., 17.06.2018, O. Kosterin leg. (RMNH).

Paratypes: 1 ♀, the same place, date and collector as the holotype (Figs 5b,d, 7); 2 ♂♂, the same place and collector, 30.06.2018; 1 ♀, Cambodia, Preah Vihear Province, Chey Saen District, Chrach Commune, a river in Pramoll Phdom village, 13.611-612°N, 105.363-364°E, 80 m a.s.l., 21.06.2018, O. Kosterin leg.

Additional data: 1 ♂ collected, examined in hands with a lens and missed, the same place as the holotype 12.06.2018; 1 ♂ (Fig. 8b), 1 ♀ (Fig. 8a) photographed in nature, the



same place, 17.06.2018. 1 ♂ photographed in nature by Eddie Smith, Cambodia, Siem Reap Province, Sway Leu District, Phnom Kulen Mts, 500 m NE of Anlong Thom village, the O'Dar River, 13.541–542°N, 71 104.168–170°E, 336–340 m a.s.l., 15.05.2019; 1 ♂ (Fig. 8d) photographed in nature by Eddie Smith, Cambodia, Siem Reap Province, Banteay Srei District, 2.5 km SE of Khum village, the Siem Reap River at the first bridge 5.5 km downstream of its leaving the Phnom Kulen Mts, 13.619–620°N, 104.006–007°E, 60 m a.s.l., 15.05.2019.

### Etymology

The subspecies is named in honour of Eddie Smith, a pilot and eager nature photographer from Siem Reap.



**Figure 4.** General habitus of the holotype (male) of *Burmagomphus williamsoni eddiei* subsp. nov. from Cambodia, Siem Reap Province, Sway Leu District, Phnom Kulen Mts, the waterfall 600 m NNW of Preah Ang Thom, 17.06.2018. Photo by the author.

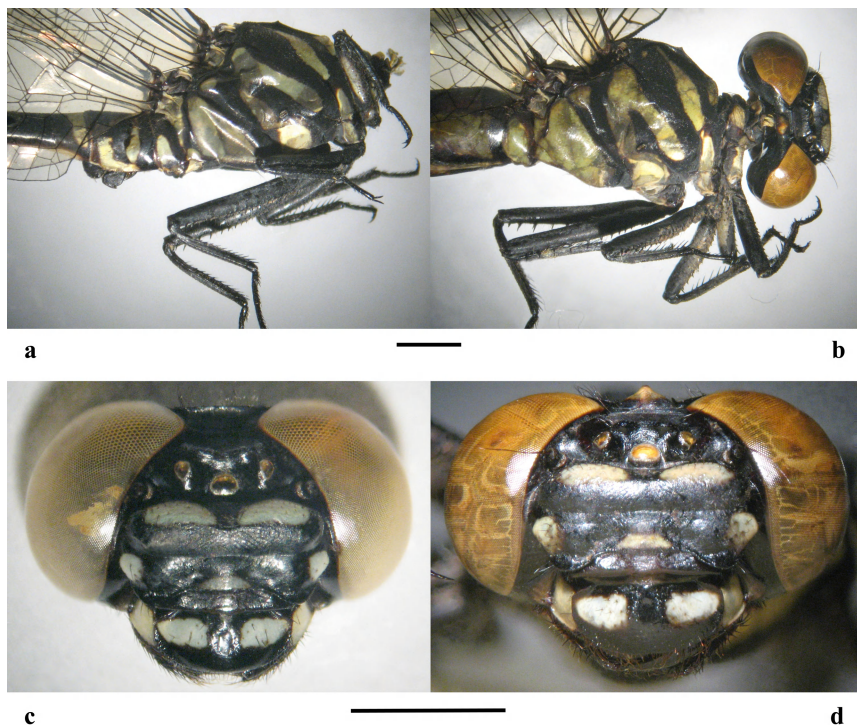
### Diagnosis

Holotype (Figs 4, 5a,c, 6) – male. Coloration usual for *Burmagomphus*, black with dull greenish-yellow marking.

Head (Fig. 5c) – Eyes green while alive. Face black with the following pale pattern: a pair of large broadly lunular pale spots at frons upper surface; postclypeus with a small trapezoid central spot at lower margin and a pair of lateral spots at sides; a pair of large, broadly separated spots at labrum; mandible bases pale; prementum brownish-pale, labial palpi pale with black margins; mentum black with a pair of large roundish spots with indistinct margins at base. Occiput margin straight, with slight knobs at its sides near eyes. Ocellar tubercle moderate, in frontal view like two low semicircular humps; behind it vertex surface flat.

Thorax (Figs 4, 5a).

Prothorax – black with bright yellow anterior lobe (hind border of this colour wavy), a pair of large lateroposterior spots at middle lobe and a pair of smaller anteroventral



**Figure 5.** Thorax (a-b, lateral view) and head (c-d, frontal view) of the male holotype (a, c) and a female collected at the same place and date (b, d) of *Burmagomphus williamsoni eddiei* subsp. nov. Scale bar 2 mm. Photo by the author.

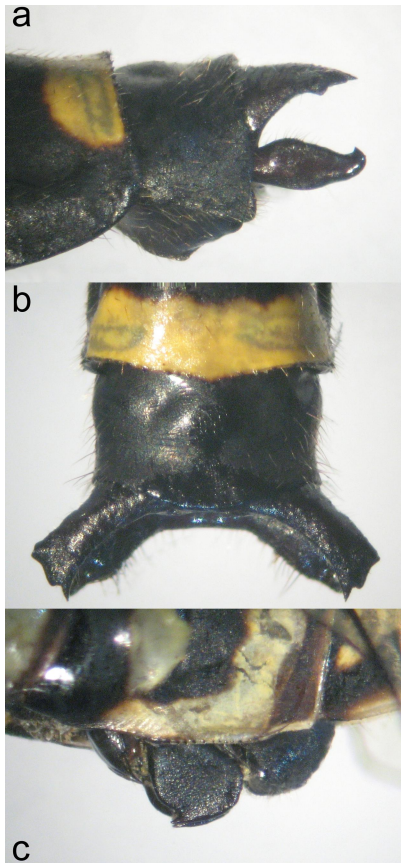
spots at sides. Posterior lobe in dorsal view slightly and rather evenly convex, very finely outlined with yellow.

Pterothorax — Collar stripes evenly broad, very narrowly interrupted by black middorsal ridge. Antealar sinus yellow at middle; antealar spots small, round. Antehumeral stripes broadened and kinked at lower 1/3 of their length, at lower ends rounded and isolated from pale colour at mesinfraepisternum, lower half of which occupied with a broad pale stripe, twice as long as gap between it and antehumeral stripe. Mesepimeron and metepisternum with broad pale stripes broadly fusing above (where reaching alar ridge) and enclosing a black foot-like area with a narrow 'ankle' and broadly rounded apex, enclosing spiracle at its 'heel'. Dorso-posterior corner of metepisternum with a rounded subtriangular pale spot. Metinfraepisternum mostly pale, with black anterior and posterior margins. Metepimeron pale with a broad black border at metapleural seam and a narrowly black alar ridge. Main poststernum area black, contrasting to its pale caudal plate.

Coxae — with broad pale outer stripes. Legs black but ventral side of profemur and prochanter pale.

Wings — hyaline with a very slight brownish tint becoming more noticeable towards base, venation black. In left wings, 12 antenodals (1st and 5th primary) and 9 postnodals in fore wing and 9 antenodals and 7 postnodals in hind wing; in right wings the numbers are less for one except for the same 7 hind wing postnodals. Three crossveins between Arc and R1-R4 junction above Rs and two below it on fore wing, one at both sides or RS in hind wing. Anal loop one celled. Anal triangle 2-celled. Tornus about rectangular but rounded, membranula very narrow, grey. Pterostigma brown, with black bordering veins, covering below ca 3.5 cells in fore wing and 4.5 cells in hind wing.

Abdomen (Fig. 4) — very thin at S3-S6, S7 expanding, S8-S10 rather thick. Pale markings as follows: S1 with large and broad vertical spot on either side; S2 with a yellow ring including auricle and, behind it, on either side with a broad vertical stripe occupying about half of tergite height and protruding anteriorly along its ventral margin with a longitudinal stripe. S3-S7 with broad semi-rings at anterior margins, that on S3 extending at middle while that on S7 incised at middle. S9 with a broad trapezoid stripe at posterior margin. This margin forms a very blunt angle but not pointed, that of S10 slightly convex. Ventral tergite margins (on the lower side of abdomen) with a very narrow pale streak, near which black ground colour turns to lighter brown.



Cerci and epiproct arms (Fig. 6a-b) — of exactly the same length and direction so that the latter scarcely seen below the former when viewed from above (Fig. 6a). In this view, inner margins of cerci form a very even broad curve and end with a strong spine; their outer margins, with coarse outline, scarcely curved so that the cerci slightly expand to a strong subapical angulation where they are truncated at a blunt angle; there is additional blunt projection between the angulation and spine so that the truncated subapical side of each cercus has in sum three projections (Fig. 6a). Epiproct margin between arms straight, inner sides of arms strongly convex, outer sides evenly convex, apices slightly attenuated but rounded (Fig. 6a).

**Figure 6.** Anal appendages (a - lateral view; b - dorsal view) and the secondary genitalia (c - lateral view) of the male holotype of *Burmagomphus williamsoni eddiei* subsp. nov. Scale bar 1 mm. Photo by the author.

Accessory genitalia (Fig. 6c) — black. Anterior hamulus very narrow and pointed, appressed to vesica seminalis head. Posterior hamulus with anterior margin strongly convex below a strong, anteriorly directed terminal hook, posterior margin with a blunt angulation at base, here with several strong hairs not forming a bunch, then narrow curving to terminal hook; no additional denticles. Vesica seminalis base about the same size as posterior hamulus, in lateral view roundish but skewed anteriorly, with anterior margin slightly angled; cleft occupies ca half of its length.

Measurements (mm) — Hind wing 20, abdomen without appendages 20, total body length 30.5.

### Variation in male paratypes.

In both male paratypes the mentum is pale at base (not as two spots). One of them seems to be immature as having the ground colour brownish–black; it has narrow yellow stripes at S8 anterior margin, interrupted at middle. The other male paratype is mature and its pale marking is not extended, however its occipital plate is pale with distinct black margins. Antenodals 11-12 in fore wings, 8-9 in hind wings, postnodals 7-8 in all wings.

Measurements (mm) — abdomen with appendages 36–41; hindwing 22–25; total 44–48.

### Female (mature one from the type locality) (Figs 5b,d, 7).

Resembles male but somewhat larger. Below only the differences are outlined.

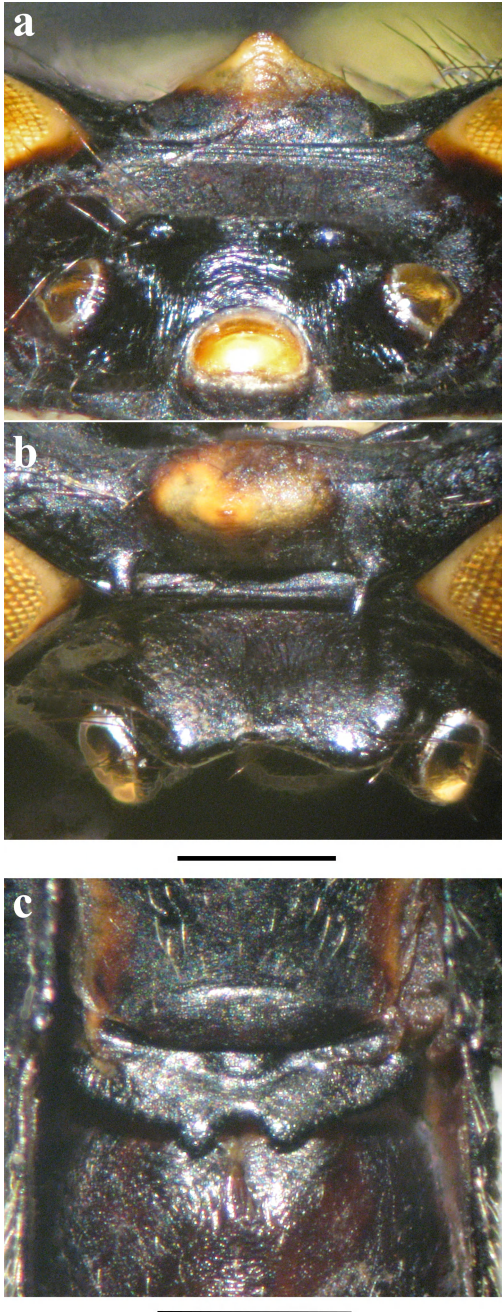
Head (Figs 5d; 7a-b) — Occiput with a large prominence, subtriangular in frontal view (Fig. 7a), slightly rounded rather than sharply pointed at tip, as wide as about 2/3 of space between eyes; most of its surface yellow, with indistinct brownish border to black. Margins of occipital plate at both sides of it incline towards it and bear long hairs (Fig. 7a). There is a pair of strong, long, singular spines at lower seam of occipital plate at its sides near eyes (about 5-fold closer to eyes than to midpoint); in the specimen considered the left one is pointed while the right rather blunt (Fig. 7a-b). They are directed mostly forward but somewhat skewed up and toward each other. Their position and direction makes them scarcely noticeable in frontal view (Fig. 7a) and they are better seen in dorsoposterior oblique view (Fig. 7b). Bipartite ridge between lateral ocelli more prominent and better defined than in male, vertex surface above it concave. There are also short ridges along inner side of lateral ocelli (Figs 5d, 7a). Mentum pale with a very broad black anterior border.

Thorax (Fig. 5c) — As in male, but antehumeral pale stripe almost fused to that at mesinfraepisternum, separated only by very narrow black line along suture. The latter stripe, however, has at that suture a strong but indistinct incision of brownish colour.

Wings — with a slightly stronger brown suffusion, more noticeable at costal margins. Antenodals: 13 in right fore wing, 12 in left fore wing, 9 in hind wings; postnodals: 8 in fore wings, 7 in right hind wing, 9 in left hind wing. Two antefurcal crossveins above and below RS in fore wing (but one above it vestigial in right fore wing); one antefurcal crossvein at both sides of RS in hind wing. Pterostigma light brownish, covers below 4.5 or 5 cells below in both fore and hind wings.

Abdomen — evenly cylindrical, very scarcely expanding at S8-S9.

Most of lower part of S1 sides pale; most of S2 sides occupied by large quadrangular spots. Sides of F3 with a broad pale stripe almost throughout its length, narrowing and



ending just before hind margin; this stripe is interrupted with a narrow black line along medial suture. S4-S6 with narrow pale semirings at anterior margin, fused to broad lateral stripes starting at anterior margin and rounding and ending before medial suture; behind medial seam there is an additional pale stripe rounded at both ends, decreasing in length posteriorly as occupying ca 2/3 of the length of the segment part behind the suture in S4, ca 1/2 of it in S5 and ca 1/4 in S6. S7 with a broad semiring with rounded angles, divided for 4/5 of its width with a triangular incision at midline. S8 with narrow stripes at sides along anterior margin. S9 with a semiring divided by a central incision almost to base. Posterior margins of S7-S9 finely marked with yellow lines. Cerci black.

Vulvar scale broad and short, with a central rounded incision with two short blunt processes at its sides (Fig. 7d).

Measurements (mm) — hind wing 23, abdomen 26; total length 35.

The female from Preah Vihear Province was captured in maiden flight still discoloured and acquired coloration in captivity. It is very similar to the above described one in all respects but being rather deformed and having the body ground colour

**Figure 7.** Occiput in anterior (a) and dorsoposterior (b) views and vulvar lamina (c) of the female of *Burmagomphus williamsoni eddiei* collected along with the holotype. Scale bar 0.5 mm. Photo by the author.

and venation still brownish. Antenodals 11-12 on FW, 9 in hind wings; behind the nodes the wings are damaged.

### Differential diagnosis

The following male characters suggest belonging of these specimens to *B. williamsoni* according to Lieftinck (1953; 1964): the posterior hamulus very broad with an anteriorly directed hook and without additional denticles or long hairs (Fig. 6c), the epiproct arms in line with the cerci when viewed above, the tooth of the cercus occupying a subapical position; the antehumeral and dorsal stripes fused into a broad kinked stripe (Fig. 6a). However, a number of structural and maculation characters of males differ from all the three known subspecies of *B. williamsoni*:

- (i) the subapical cercal tooth very prominent, forming almost a right angle and well seen in lateral view (Fig. 6a);
- (ii) the paraproct arms as long as (rather than shorter than) the cerci and with their inner margins distinctly convex (Fig. 6a), as in *Burmagomphus vermicularis* (Martin, 1904) (Do 2011: figs 2g-h, 3d), however the incision between them is not U-shaped as in the last mentioned species and other subspecies of *B. williamsoni* but trapezoid-shaped, with a straight central section.
- (iii) S9 has no dorsoapical tooth (Fig. 6a) - a character variable in some other species of the genus (Kosterin et al. 2012; Kosterin 2014).
- (iv) the antehumeral pale stripe is separated from that on the mesinfraepisternum with black (Fig. 4, 5a) (not so in female).

The female occiput has a prominent yellow conical projection (Fig. 7a), but, unlike the so far known subspecies of *B. williamsoni* (Lieftinck 1953: fig. 40; 1964: fig. 20-22), at its sides there is a pair of robust but singular spines (Fig. 7a-b) rather than of triple or double small spines or processes (Figs 2b-c, 3a-g) or of weak singular spines (the occiput of *B. vermicularis* is simple, straight, see Lieftinck 1953: fig. 41). Note an error in my notes on this species in Kosterin & Smith (2020: 48) stating the absence of any tubercles, which were overlooked on preliminary examination because of their forward direction.

### Habitat and habits

These dragonflies were rather common at a big and deep river broadening under the well-known waterfall in the Phnom Kulen Mts. They appeared at around 9:30 a.m., rested on big boulders by the water (Fig. 8a,c) (but far beyond the reach of the waterfall spray) (Kosterin & Smith 202: fig. 6; Loc. 8 therein), rarely on shrubs growing on rocks (Fig. 8b), or fly low over the water surface, sometimes chasing other males. Also found upstream and downstream the same river (bearing the alternative names Prey Thom, O'Dar and Siem Reap), respectively 7.3 km SE and 12.7 km NW from the type locality. At the former site the river flows shallowly over a sandstone bed by a big open glade in ever-green forest remnants and a cashew plantation (Loc. 19 in Kosterin & Smith 202). In the latter site the river has already left the mountains 5.5 km easterly and produces sunny reaches, ankle to waist deep, bordered by 'walls' of thick bushes and trees at banks (see Kosterin & Smith 202: fig. 27; Loc. 25 therein) and surrounded by arable land, plantation



Figure 8. Female (a) and males (b-c) of *Burmagomphus williamsoni eddiei*: a-b – at the type locality, Phnom Kulen waterfall, 17.06.2018, photo by the author; c – at the Siem Reap River at the first bridge after its leaving the mountains, 15.05.2019, photo by Eddie Smith. The same as Fig. 48 in Kosterin & Smith (2020).

and forest remnants around. On the plain of Preah Vihear Province (80 m a.s.l.) a general female was startled from a deep reach, bordered with trees, of a medium-sized clear river (Loc. in Kosterin 2020). So far these dragonflies were observed in May-June.

### Distribution

The new subspecies is known only from northern Cambodia, namely the low, forested plateau of the Phnom Kulen Mts in Siem Reap Province and the deforested plain to the east, in Preah Vihear Province.

## Discussion

The description of *B. siamensis* by Fraser (1926) just mentioned (but did not depict) the spines at the occipital plate spines and could be understood so that they were singular rather than double or triple, which inspired a question if the holotype was similar to the here described female specimens. This motivated the investigation of the *B. siamensis* holotype, which has shown that it has triple/double small processes (Fig. 2b-c) at the occipital plate sides and hence corresponds to the nominotypical *B. williamsoni williamsonii* (Fig. 3a-g) (see 'Introduction'), rather than to the new subspecies.

The new subspecies differs from the nominotypical one much stronger than the currently recognised insular subspecies *B. w. javicus* and *B. w. austrosundanus* (see the Introduction). It is not excluded that it will be raised to the species level with more information accumulated on the characters of *B. williamsoni* in the neighbouring Thailand, from where very few specimens exist in collections. *Burmagomphus williamsoni* was reported for Chanthaburi Province in SE Thailand but not for the large Korat Plateau in the east of that country (Hämäläinen & Pinratana 1999), which borders the Cambodian Lowland (in which the Phnom Kulen Mts stands as an 'island') from the north. The Korat Plateau is relatively dry as compared to the evergreen forest of Phnom Kulen, so it is unclear if the species has not been found yet or actually absent from there. In case it will be found there the specimens should be checked for resemblance to the here described subspecies.

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## References

- Day, L., Farrell, D., Günther, A., Hämäläinen, M., Klimsa, E., Korshunov, A., Kosterin, O., Makbun, N., Pelegrin, A., Roeder, U., Ruangrong, R. & Vikhrev, N. (2012). New provincial records of Odonata from Thailand mostly based on photographs. *Agrion* 16: 16–24.
- Do, M.C. 2011. *Burmagomphus schneideri* sp. nov., a new dragonfly from the south of Vietnam (Odonata: Gomphidae). *International Journal of Odonatology* 14(3): 223–231.
- Förster, F. 1914. Beiträge zu den Gattungen und Arten der Libellen (N. III). 3. Archiv für Naturgeschichte 80 A(2): 59–83.
- Fraser, F.C. 1926. Indian dragonflies, part XXIV-2. *Journal of Bombay Natural History Society* 31: 408–426.
- Fraser, F.C. 1927. Notes on a collection of dragonflies (Odonata) from Siam. *Journal of Siam Society, Natural History Supplement* 7: 83–92.
- Hämäläinen, M. & Pinratana, A. 1999. Atlas of the Dragonflies of Thailand. Distribution maps by provinces. Brothers of St. Gabriel in Thailand, Bangkok.



- Katatani, N., Kitagawa, K., Muraki, A. & Matuzawa, T. 2004. Notes on Thai Odonata, Part 3. Odonata of Chiang Rai. *Aeschna* 41: 59–70.
- Katatani, N., Kitagawa, K., Muraki, A., Katoh K. & Masaki N. 2010. Notes on Thai Odonata, Part 5. The Odonata from Nan and Phrae. *Aeschna* 46: 45–58.
- Kimmins, D.E. 1966. A list of the Odonata types described by F. C. Fraser, now in the British Museum (Natural History). *Bulletin of the British Museum (Natural History), Entomology* 18(6): 173–227.
- Kosterin, O.E. 2014. Notes on infraspecific variation of some Gomphidae (Odonata) species in Cambodia. *International Dragonfly Fund Report* 68: 1-16.
- Kosterin, O.E. 2020. First data on Odonata of Prey Long forest in Cambodian Lowland. *International Dragonfly Fund Report* 54: 1-28.
- Kosterin, O.E., Makbun N. & Dawwrueng P. 2012. *Burmagomphus asahinai* sp. nov., a new species from Cambodia and Thailand, with a description of the male of *B. gratiosus* Chao, 1954. *International Journal of Odonatology* 15: 275-292.
- Kosterin, O.E. & Smith, E. 2020. Odonata of Phnom Kulen Mts, Cambodia: a preliminary checklist. *International Dragonfly Fund Report* 54: 99-184
- Laidlaw, F.F. 1931. A list of the dragonflies (Odonata) of the Malay Peninsula with descriptions of new species. *Journal of the Federated Malay States Museum* 16: 175–233.
- Lieftinck, M.A. 1940. On some Odonata collected in Ceylon, with description of new species and larvae. *Ceylon Journal of Science* 22: 117.
- Lieftinck, M.A. 1953. The Odonata of the island Sumba with a survey of the dragonfly fauna of the Lesser Sunda islands. *Verhandlungen der Naturforschenden Gesellschaft in Basel* 64(1): 118-228.
- Lieftinck, M.A. 1964. Some Gomphidae and their larvae, chiefly from the Malay Peninsula (Odonata). *Zoologische Verhandelingen* 69: 3-38.
- Martin, R. 1904. Liste des Névroptères de l'Indo-Chine. In: *Misson Pavie Indo-Chine 1879-1895. Études diverses. III. Recherches sur l'histoire naturelle de l'Indo-Chine orientale*, Emest Leroux, Paris, pp. 204-221.
- Schmidt, E. 1934. Odonata der Deutschen Limnologischen Sunda-Expedition. 1. Imagines. Mit Beschreibungen zweier neuer *Ictinus* aus Celebes und Neu-Guinea. *Archiv für Hydrobiologie, Supplement-Band XIII*: 316–397.
- Williamson, E.B. 1907 [1908]. The dragonflies (Odonata) of Burma and Lower Siam – II. Subfamilies Cordulegasterinae, Chlorogomphinae, and Gomphinae. *Proceedings of the United States National Museum* 33: 267-317.
- Zhang H.-m., Kosterin, O.E., Cai C.-h. 2015. New species and records of *Burmagomphus* Williamson, 1907 (Odonata, Gomphidae) from China. *Zootaxa* 3999(1): 62-78.



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