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A review of the genus *Bornargiolestes* Kimmins, 1936 (Odonata: Zygoptera) with a description of two new species from Sarawak, Malaysia

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Abstract: The poorly known genus *Bornargiolestes* is reviewed and a fresh diagnosis is provided. Two new species, *Bornargiolestes fuscus* and *Bornargiolestes reelsi* are described. Illustrations, distribution maps and a key to the males of the genus are given.

Keywords: *Bornargiolestes*, Borneo, Indonesia, Kalimantan, Malaysia, new species, Odonata, Sarawak, Zygoptera.

Abstrak Bahasa Melayu: Genus Bormargiolestes yang kurang diketahui disemak semula dan satu diagnosis baru diberikan. Dua spesies baru, *Bornargiolestesfuscus* sp. nov. and *Bornargiolestes reelsi* sp. nov., diperihalkan. Ilustrasi, peta taburan dan kekunci bagi jantan genus ini diberikan.

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INTRODUCTION

The genus *Bornargiolestes* was erected by Kimmins (1936) for *B. nigra* Kimmins, 1936. *B. nigra* was known only from the holotype male, from Mount Dulit in Sarawak, and no other specimen from the genus was reported until Orr (2001) recorded a teneral male of a *Bornargiolestes* species, of uncertain status, from Brunei. Subsequently Dow & Reels (2009) recorded a *Bornargiolestes* species from Mount Dulit, which they considered a different species from *B. nigra*. The genus was also recorded from Kubah National Park in western Sarawak, and Lambir Hills National Park in northeastern Sarawak (Dow & Reels 2010), from Gunung Penrissen in western Sarawak Dow (2012), and from Mount Singgai, also in western Sarawak (Dow & Reels 2013). Additionally, V.J. Kalkman also found an old specimen from Kalimantan in the collections of the Naturalis Biodiversity Centre. However, all the recent material from Sarawak and Brunei belongs not to *B. nigra*, but to two previously undescribed species, with only the specimen from Kalimantan probably representing true *B. nigra*; this species appears to be an exceptionally elusive insect. The current family placement of the genus is uncertain, as it has traditionally been placed in the Megapodagrionidae, a family now considered polyphyletic (Dijkstra et al. 2013a). Dijkstra et al. (2013b) left *Bornargiolestes* as incertae sedis (the course followed here) but noted it could possibly be included in the Thaumatoneuridae.

The new species are described here as *Bornargiolestes fuscus* sp. nov. and *Bornargiolestes reelsi* sp. nov. With the material now available a better characterisation of the genus is possible; this is given below.

Terminology used here for wing venation and male abdominal terminalia follows that in Watson & O'Farrell (1991); other terminology mostly follows Westfall & May (1996). The acronyms BMNH and RMNH are used below for the Natural History Museum, London and the Naturalis Biodiversity Centre, Leiden. All material at least initially in the author's collection has been given a reference code which is stated here. All figures and images made by the author unless otherwise noted in the caption.

Bornargiolestes Kimmins

Bornargiolestes Kimmins, 1936: 86-87 (genus erected, genotype *B. nigra* Kimmins, 1936); – Orr (2001: 180); – Orr (2003: 12, 38, 43, 63); – Dijkstra, Kalkman et al. (2013: 20, 26, fig. 2B, fig. 3B).

Diagnosis

A genus of medium-sized, predominantly brown to black damselflies with short legs, distinguished from all genera presently or formerly placed in the Megapodagrionidae s.l. by the following combination of characters. Prothorax with middle pronotal lobe produced into spurs or projections in lateral posterior part and bearing a pair of dorsal depressions on either side. Posterior femur not reaching the first abdominal segment when folded back against the synthorax. Long wings (held closed in life) petiolate to beyond the base of the quadrilateral and the nodus situated at about one quarter of the length of the wing from the base. Arculus at or slightly distal to Ax 2. R_4 arising at or very close to Sn, IR_3 1-4 cells distal to Sn, quadrilateral long: in Hw anal-distal corner at or only slightly before level of nodus. Seminal vesicle inflated and flask shaped. Shaft of penis bearing long dense setae. Terminal segment of penis with pair of apical arms, directed dorsally and basally, the ends of these expanded and flattened. Superior anal appendages of male 2–3 times the length of S10, dorso-ventrally expanded at ca 1/3 to 1/2 length, at least weakly cleft at tip. Male inferior appendages broad at base but narrowing rapidly to a long slender tip about half the length of superior appendages.

Remarks

Kimmins (1936) emphasised wing venation characters in his description of *Bornargiolestes*, but omitted some other interesting structural characters. In all species the middle pronotal lobe has its lateral posterior parts produced into rounded projections bearing denticles (Images 3–5), and also has a pair of depressions on either side on its dorsal surface: one at the base of the lateral projection and the other more dorsally positioned (marked in Image 5). However both of these characters, especially the depressions, are less pronounced in the genotype than in the new species described here. Kimmins noted the similarity of *Bornargiolestes* to *Burmargiolestes* Kennedy, 1925, a genus which also has a pair of depressions on either side of the dorsum of the middle pronotal lobe, but lacks the lateral projections (Image 6 shows the prothorax of *Burmargiolestes laidlawi* Fraser, specimen from BMNH). The legs are missing in the holotype of *B. nigra*, so it is possible that they are longer than stated in the diagnosis above; in the teneral male from Kalimantan treated as *B. nigra* here they conform with the diagnosis.

Diagnostic features of the male anal appendages are best seen in lateral and ventral views, dorsal views are of little value in distinguishing species; for this reason only

lateral and ventral views are given in the illustrations. The reader is referred to Kimmins (1936: fig. 9B) for a dorsal view of the anal appendages of *B. nigra*. The branches defined by the cleft tips of the superior anal appendages are referred to as the subapical branch (the interior branch in ventral view) and the apical branch.

Key to males of *Bornargiolestes*

1 Mature males with white pruinosity on synthorax (Image 7). Abdominal S9 dorsum without pit. Superior anal appendage in lateral view with lower margin expanded ventrally as a deep heel with apex approximately a right angle (Fig. 8), subapical branch of cleft tip visible as a triangular shaped projection in lateral view ..... *B. nigra*

- Mature males never with pruinosity on synthorax. Abdominal S9 dorsum bearing a small, typically diamond shaped, pit (Images 8, 9). Superior anal appendage in lateral view with a much shallower and less distinct ventral heel (Figs. 7, 9), subapical branch of cleft tip either barely visible in lateral view, or rounded rather than triangular.....2

2 Superior anal appendages with subapical branch of cleft tip well developed (Fig. 10). Predominantly pale brown to reddish-brown or chestnut brown ..... ***B. fuscus* sp. nov.**

- Superior anal appendages with subapical branch of cleft tip barely developed (Fig. 12). Predominantly dark brown to black ..... ***B. reelsi* sp. nov**.

Bornargiolestes fuscus sp. nov. (Images 1,3,8,10; Figs. 5,7,10)

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Bornargiolestes species; – Orr (2001: 180, record Brunei); – Orr (2003: 63); – Dow & Reels (2009: 8, 13, record Mount Dulit); – Dow & Reels (2010: 15, 18, part, records Lambir Hills National Park and Gunung Mulu); – Dow, Reels & Butler (2013a: 10, 12–13).

Image 1. *Bornargiolestes fuscus* sp. nov. paratype male (SAR11_12_MEG2), semi-teneral, Lambir Hills

Material examined

Holotype: SAR07_8_MEG2 (Dow collection reference number), male, 5.i.2008, Borneo, Sarawak, Miri Division, Gunung Mulu National Park, Summit Trail, trailside at ca. 500m, leg. R.A. Dow. To be deposited in BMNH.

Paratypes: A total of five males, four females, all from Borneo, all leg. R.A. Dow and in collection R.A. Dow unless otherwise noted. – Malaysia, Sarawak: Female, SAR07_8_MEG3, in tandem with holotype male, data as holotype. Female, SAR07_8_MEG79, Gunung Mulu National Park, Summit Trail, on wet rock face at head of small stream at ca. 500m, 6.i.2008, leg. L. Southwell. Male, SAR07_8_MEG40 location as holotype, 11.ix.2008. Male, SAR07_8_MEG39, same trail, ca 350m, 13.ix.2008. Female, SAR07_8_MEG38, Miri Division, Lambir Hills National Park, Latak stream, wet cliff by waterfall, 23.viii.2008. Female, SAR11_12_MEG7, same area, at base of wet cliff in forest near main Latak waterfall, 21.iv.201. 3 males, SAR11_12_MEG2-3, SAR11_12_MEG6 (RMNH.INS.503853), same National Park, trailside on Oil Well Trail, 22.iv.2011, one in RMNH. – Brunei: Male, Temburong District, Kuala Belalong Field Studies Centre, "KBFSC Forest, near pondok tikus", ca 150m, 24.vi.1995, leg. A.G. Orr, in collection A.G. Orr.

Other material (all from Sarawak): Female, SAR07_8_MEG37, Miri Division, Tinjar basin, Mount Dulit, stream at ca. 850–880m, 30.viii.2008, leg. G.T. Reels. Female (teneral), SAR07_8_MEG1, Miri Division, mid Baram area, Gunung Kalulong, small wet rock face by small tributary, ca. 800–900 m, 18.xii.2007, leg. G.T. Reels. Female, SAR09_10_MEG41, same location, 8.x.2009. Female, SAR09_10_MEG25, RMNH.INS.501245, Miri Division, mid Baram area, Batu Uro', 15.vii.2010, leg. W. Kebing. Female, SAR13_14_MEG1, Kapit Division, Lanjak Entimau Wildlife Sanctuary, Nanga Bloh Field Station, seepage at Sungai Satap, 23.viii.2013, leg. R.A. Dow.

Etymology

Fuscus, a Latin adjective, meaning brown.

Diagnosis

A predominantly light brown to reddish or chestnut brown species, distinguished from *B. nigra* by the lack of pruinosity on the synthorax of mature males, lighter coloration and the much shallower ventral heel of the superior anal appendages. Distinguished from *B. reelsi* by coloration and the well-developed subapical branch of the cleft tip of the superior anal appendages; this is barely developed in *B. reelsi*.

Description of holotype male

Head: Labium pale. Labrum, mandible bases, genae and anteclypeus mostly whitish, postclypeus with central third brown, pale laterally. Frons, vertex and occiput black and dark brown, with a short yellowish streak reaching from each lateral ocellus towards the rear of, but not touching, the antenna sockets. A yellow streak on antenna bases, scape and pedicel pale and brown, flagella missing.

Thorax: Prothorax pale brown with indistinct darker areas. In dorsal view lateral posterior part of the middle pronotal lobe bulging outwards (as in Image 3, which shows a female paratype) rather abruptly as a sub-triangular blackish projection bearing denticles, protruding well beyond the propleuron, above this projection a shallow lateral depression and another depression placed dorsally. Synthorax brown (reddish-brown in life), becoming pale yellowish on lower part of metepimeron and on venter. Legs almost entirely pale brown. Posterior tibia approximately as long as the mesopleural suture measured from antealar carina to corner of mesinfraepisternum, posterior femur shorter, not reaching first abdominal segment. - Wings: hyaline, R_4 arising just distal to Sn, IR_3 2 cells distal. 20 Px in Fw, 18 (left) or 17 (right) Px in Hw. Pterostigma brown, with incomplete and poorly defined pale border, approximately trapezoidal, covering one central underlying cell and parts of the cell on either side. The anal side is thickened relative to the other sides and surrounding veins.

Abdomen: Brown and yellowish. S1 yellowish-brown laterally, brown above. S2 mostly brown. S3 brown above, mostly yellowish laterally but entire apical sixth dark brown and the yellowish coloration intruding dorsally basally and subapically, the same pattern repeated on S4–6, with the brown becoming darker on successive segments. S7 without the subapical dorsal pale area, S8 dark brown except for yellow patches basal laterally and along the lower margin of the tergite. S9–10 entirely very dark brown or black. S9 expanded moderately from base in dorsal view, S10 maintaining the same width. In lateral view S8 and S9 expanded, reaching greatest height at the junction of the segments, narrowing quite abruptly from about 1/3 length S9. S9 with a basal diamond-shaped pit on the dorsal midline (Image 8). Penis (Fig. 5) typical for genus. Superior anal appendages shaped as in (Figs. 7, 10), mostly pale, with the subapical branch of the tip of the superior appendage well developed (Fig. 10). Inferior appendages mostly dark, with pale tips to the spine, which is slightly bulbous apically just before tip where it narrows rather abruptly to a point.

Measurements [mm]: Hw 27, abdomen 32 (excl. appendages), superior appendage ca 1.

Description of female paratype (SAR07_8_MEG3, as male except as noted)

Thorax: Wings: 3 Ax except right Fw where 2 Ax. 24 (left) or 21 (right) Px in Fw, 20 (left) or 21 (right) in Hw. R_4 arising at subnodus in right Fw. Wing margin contracted slightly at proximal end of pterostigma, which variably covering slightly less than two to parts of three underlying cells.

Abdomen: Colouration very similar to male. No depression or split in dorsum of S9. Superior anal appendages just longer than S10, conical and roundly pointed. Ovipositor brown, reaching ca the level of the tips of the superior anal appendages, valves with only minute teeth along lower edge.

Measurements [mm]: Hw 28.5, abdomen excluding anal appendages and ovipositor 33.

Variation: In some individuals, including all from Lambir Hills, the clypeus is entirely or almost entirely pale, but in the females from Dulit and the mid Baram the pale lateral marks on the postclypeus are darker and less distinct. One male from Gunung Mulu has a much darker thorax than any of the others, and dark tibae and tarsi; presumably this is a very mature individual. The pit on S9 of males varies in size but is present on all available specimens. Mature females from Dulit, the mid Baram and Lanjak Entimau in western Kapit have the mesepisternum and mesepimeron darker than in females from Lambir and Mulu. In both sexes R_4 variably arises slightly proximal, at, or slightly distal to Sn. In specimens from Mulu and the mid Baram IR_3 arises 2 cells distal to Sn, but in specimens from Lambir it typically arises 3 cells distal to Sn, occasionally 4 cells distal and in the female from Mount Dulit it arises 2.5–3 cells distal. In some individuals (e.g. the female described) there are 3 Ax in some wings. The colour of the pterostigma is darker in many individuals, but paler in teneral and semi-teneral specimens. In some individuals the wing margin is contracted slightly at the proximal end of the pterostigma (as in Figs 3, 4, which show a paratype of *B. reelsi*).

Measurements [mm]: Males: 18–20 Px in Fw, 15–20 in Hw. Hw 23.5–27, abdomen without anal appendages 29–32.5. Females: 20–24 Px in Fw, 18–20 in Hw. Hw 25–29, abdomen without anal appendages or ovipositor 29–33.5.

Remarks: The habitus of one of the paratypes is shown in Image 1. The upper part of the synthorax

of the holotype and the female taken in tandem with it were strongly red brown in life. Males from the mid Baram, Lanjak Entimau and in particular Mount Dulit, are lacking and there is a difference in the darkness of the upper part of the synthorax of females from these locations, but they agree more in wing venation and structure of the pronotum with *B. fuscus* sp. nov. males rather than with *B. nigra* and are considered to belong to the former species in the absence of more convincing evidence to the contrary.

Orr (2001) treated the male from Brunei as of "uncertain status". Later Orr (personal communication 2013) compared that specimen against the description and images of *B. fuscus* provided by this author and confirmed its identity.

Unfortunately, since the illustrations of the anal appendages of the holotype male were made, the subapical branch of the cleft tip of the right superior anal appendage has been broken off.

Bornargiolestes nigra Kimmins, 1936
(Images 4,7,11; Figs. 1,2,6,8,11)

Bornargiolestes nigra Kimmins 1936: 87-88, fig. 2 (original description male, Mount Dulit); – Lieftinck (1954: 27-28); – Kimmins (1970: 197, note on holotype); – van Tol (1992: 163, index to references to this species in Lieftinck's publications); – Orr (2003: 38, 63); – Dow & Reels (2009: 1, 13); – Dow, Reels & Butler (2013a: 10, 12-13).

Material examined

Holotype: male, BMNH, Borneo, Sarawak, Mount Dulit, 24.x.1932, leg. B.M. Hobby and A.H. Moore. Five labels on pin: "Type"; "Type" and "Bornargiolestes// nigra//male//Kimmins//det. DE. Kimmins"; "F.192"; "Oxford Univ. Exp.// B.M. Hobby & A.H. Moore//BM. 1933-254//A.J. Ford"; "SARAWAK:// Mt. Dulit//3000 ft//24.x.1932".

Additional material: male, RMNH, Borneo, Kalimantan, Kalimantan Barat, Nangaraun, Sungai Mandai Hills, Mount Liang Kubung, iv.1894, leg. J. Buttikofer.

Remarks

The male from Kalimantan Barat is teneral, but the ends of the superior anal appendages are intact and agree well with the holotype (shown in Figs. 17, 20). This specimen also agrees well with the holotype in size (Hw 28mm, abdomen without anal appendages 38.5mm), most details of wing venation, coloration of the labrum, clypeus and mandible bases, and the size and shape of the lateral projections on the rear part of the median pronotal lobe (Image 4). Overall the specimen is brown, and as it is teneral, it is likely to be substantially paler than it would be if mature. IR_3 arises two cells distal to Sn in all wings except the right Fw, where it arises one cell distal to Sn. The quadrilateral is short (compared to the two new species) in both wings, with the anal-distal angle falling short of the nodus; in the holotype this is the case in the Fw, but not in the Hw. A note on the pin indicates that Lieftinck had compared it with the type of *B. nigra* and considered it conspecific. I provisionally agree with Lieftinck's opinion, but see the discussion of the penis below.

The legs of the holotype of *B. nigra* were missing even when Kimmins wrote his description of it. The femur and tibia of four of the legs are still present in the Kalimantan male, the posterior femur is relatively longer than that of *B. fuscus* sp. nov. and *B. reelsi* but still not quite long enough to reach the first abdominal segment; the posterior tibia is significantly longer than the mesopleural suture measured from antealar carina to corner of mesinfraepisternum, in contrast to the other two species.

The penis of the holotype is mounted in Canada balsam on a card on the pin, but is hardly visible and appears compressed and damaged; it is not possible to check the accuracy of Kimmins' illustrations (Kimmins 1936: Fig. 9C, D). If Kimmins' illustrations (one of which is reproduced in slightly modified form in Fig. 6) is accurate, the penis of *B. nigra* has a broader terminal segment, with shorter apical arms, than either of the species described here. Given the fragile condition of the male from Kalimantan it was thought better not to attempt the extraction of its penis, however the penis is partly visible and appears to have a much narrower terminal segment than shown in Kimmins' illustration, creating some doubt over its status.

Both the holotype and the specimen from Kalimantan Barat lack the pit on the dorsum of S9 that is present on the males of the other two species.

Bornargiolestes reelsi sp. nov.
(Images 2,5,9,11; Figs. 3,4,9,12)

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Bornargiolestes species; – Dow & Reels (2010: 15, 18, part, record Kubah National Park); – Dow (2012: 5, records Gunung Pennrissen); – Dow & Reels (2013: 13, record Gunung Singgai); – Dow, Reels & Butler (2013b: 17, record Kubah National Park).

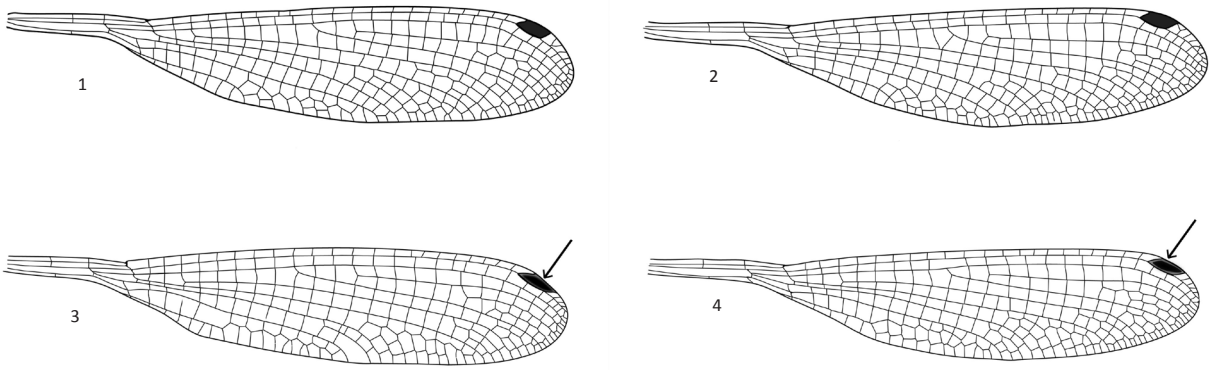
Image 2. *Bornargiolestes reelsi* sp. nov. paratype male (SAR11_12_MEG83), Gunung Penrissen.

Material examined

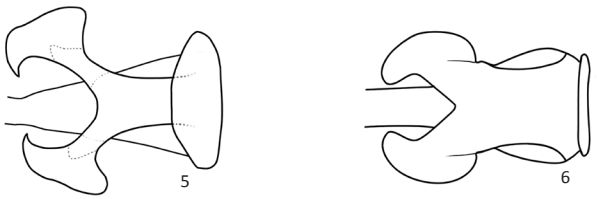
Holotype: RMNH.INS.506810 (Bearing Dow collection reference number SAR11_12_MEG81), 22.vii.2012, male, Borneo, Sarawak, Kuching Division, Gunung Penrissen, Borneo Highlands Resort, at wet cliff by trail in mixed dipterocarp forest, 1000–1100 m, leg. R.A. Dow. Deposited in RMNH.

Paratypes: A total of seven males, eight females, all from Malaysia, Sarawak, Kuching Division, all leg. R.A. Dow and in collection R.A. Dow unless otherwise noted. Two males, SAR06_MEG1-2, Kubah National Park, Waterfall Trail, by wet cliff in mixed dipterocarp forest, 13.iv.2006, in RMNH. Female, SAR06_MEG3, same location, 14.iv.2006, in RMNH. Teneral female (in ethanol), RMNH.INS.500005, same location, 21.viii.2008, leg. G.T. Reels, in RMNH. Female, same area, on wet, leaf litter covered rocks at side of rocky stream, 16.ix.2009, in the collection of the Sarawak Forestry Corporation, Semenggoh, Kuching. Female,

Images 3–6. Dorsal view of pronotum of *Bornargiolestes* and *Burmargiolestes*: (3) *Bornargiolestes fuscus* sp. nov. female paratype (SAR11_12_MEG7), Lambir Hills; (4) *Bornargiolestes nigra* male, Kalimantan; (5) *Bornargiolestes reelsi* sp. nov. holotype, d1, d2 – depressions of middle pronotal lobe; (6) *Burmargiolestes laidlawi* male, Mangpu, Darjeeling, India.

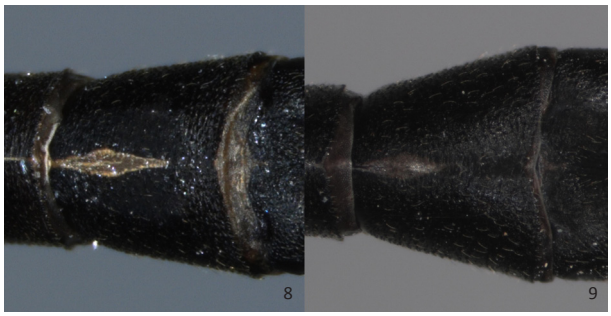


Figures 1-4. Wings of *Bornargiolestes* species: (1) *B. nigra* holotype right Fw; (2) *B. nigra* holotype right Hw; (3) *B. reelsi* sp. nov. paratype (SAR06_MEG1) right Fw; (4) *B. reelsi* sp. nov. paratype (SAR06_MEG1) right Hw. The arrow in (10) and (11) indicates the slight contraction at pterostigma. Figures 1–2 based on photographs made by B. Price.



Figures 5–6. Penis of (5) *Bornargiolestes fuscus* sp. nov. holotype; (6) *Bornargiolestes nigra* holotype, adapted from Kimmins (1936: Fig. 9D).

Image 7. Lateral view of thorax of *Bornargiolestes nigra* holotype. Photograph by B. Price.



Images 8–9. Abdominal segment 9 of male *Bornargiolestes*, dorsal view: (8) *Bornargiolestes fuscus* sp. nov. holotype; (9) *Bornargiolestes reelsi* sp. nov. holotype.

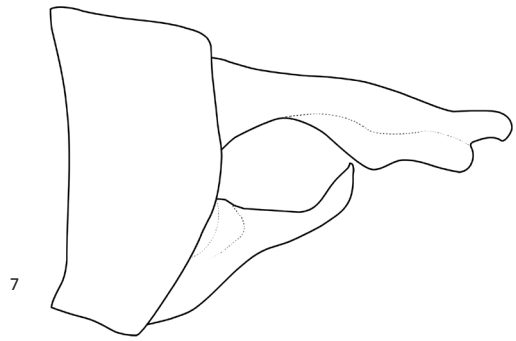
SAR09_10_MEG5, same national park, seepage area at side of small rocky stream near road up Gunung Serapi, ca. 440m, 7.ix.2009. Female, SAR07_8_MEG41, trailside on Gunung Singgai above Catholic church, 2.x.2008. two males, SAR11_12_MEG86, 87, female, SAR11_12_MEG82; RMNH.INS.506811, data as holotype, in RMNH. Male, SAR11_12_MEG83, same location, 25.vii.2012. Male, SAR11_12_MEG84, same area, trailside in mixed dipterocarp forest, ca. 800-900m, 25.vii.2012. Male, SAR11_12_MEG97, two females, SAR11_12_MEG80 (RMNH.INS.506821), SAR11_12_MEG 98, same area, below peak of Gunung Penrissen, in forest and at steep tiny trickles adjacent to a small waterfall, 26.vii.2012. One male paratype to be deposited in BMNH.

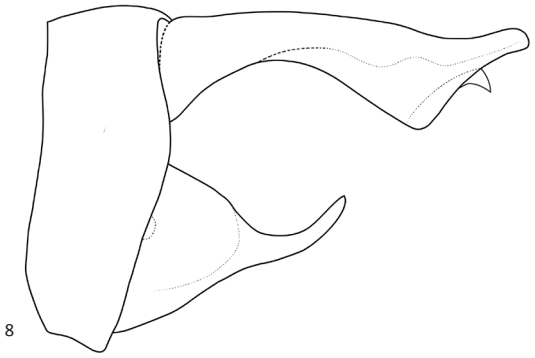
Etymology

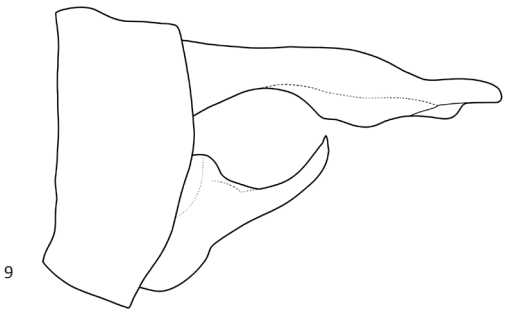
Reelsi, a noun in the genitive case; named for my friend Graham Reels, who collected part of the type series, in recognition of his contributions to our knowledge of the Odonata of Sarawak.

Diagnosis

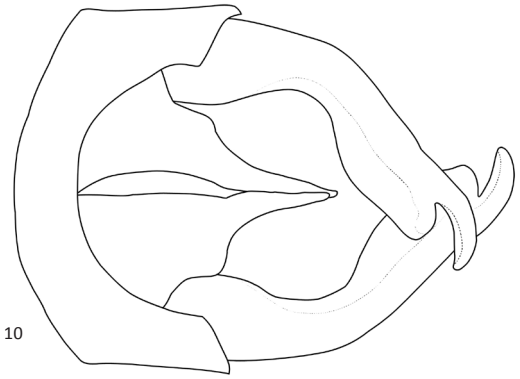
A predominantly dark brown to black species, distinguished from *B. nigra* by the lack of pruinosity on the synthorax of mature males and the subapical branch of the cleft tip of the superior anal appendages barely visible in lateral view. Distinguished from *B. fuscus* sp. nov. by darker coloration and the poorly developed subapical branch of the cleft tip of the superior anal appendages; this is well developed in *B. fuscus* sp. nov.

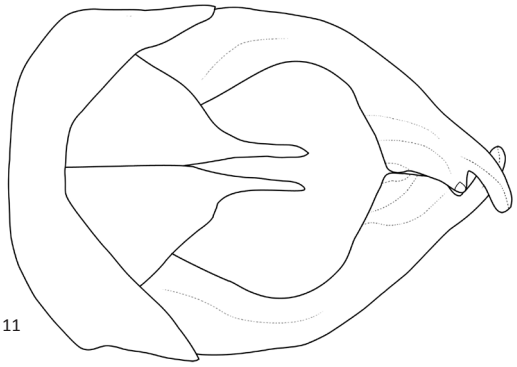


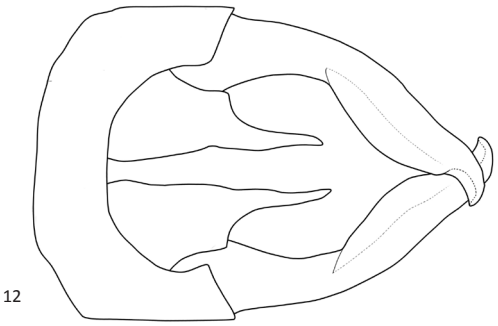




Figures 7–9. Lateral view of male anal appendages: (7) *B. fuscus* sp. nov. holotype; (8) *B. nigra* holotype; (9) *B. reelsi* sp. nov. holotype.







Figures 10–12. Ventral view of male anal appendages: (10) *B. fuscus* sp. nov. holotype; (11) *B. nigra* holotype; (12) *B. reelsi* sp. nov. holotype.

Description of holotype male

Head: Labium mostly pale, except laterally and around free edge of post mentum. Labrum bluish. Mandible bases mostly pale. Anteclypeus mostly dark brown. Genae mostly black, except immediately adjacent to mandible bases. Postclypeus, frons, vertex and occiput black, with a yellowish streak reaching from each lateral ocellus towards, but not touching, the antenna sockets. Antennae with scape brown, pale at top, pedicel brown, flagellum black.

Thorax: Pronotum with anterior lobe brown, dark laterally and on anterior carina, middle and posterior lobes black. Lateral posterior part of the middle lobe produced outwards (Image 5) as a rounded projection bearing a few denticles, protruding well beyond the propleuron in dorsal view, above this projection a small depression and another larger depression placed more dorsally (Image 5). Propleuron black. Synthorax almost entirely black, except venter which is pale, and some brown patches near the antealar carina and the coxae. A distinct peak is present on the antealar

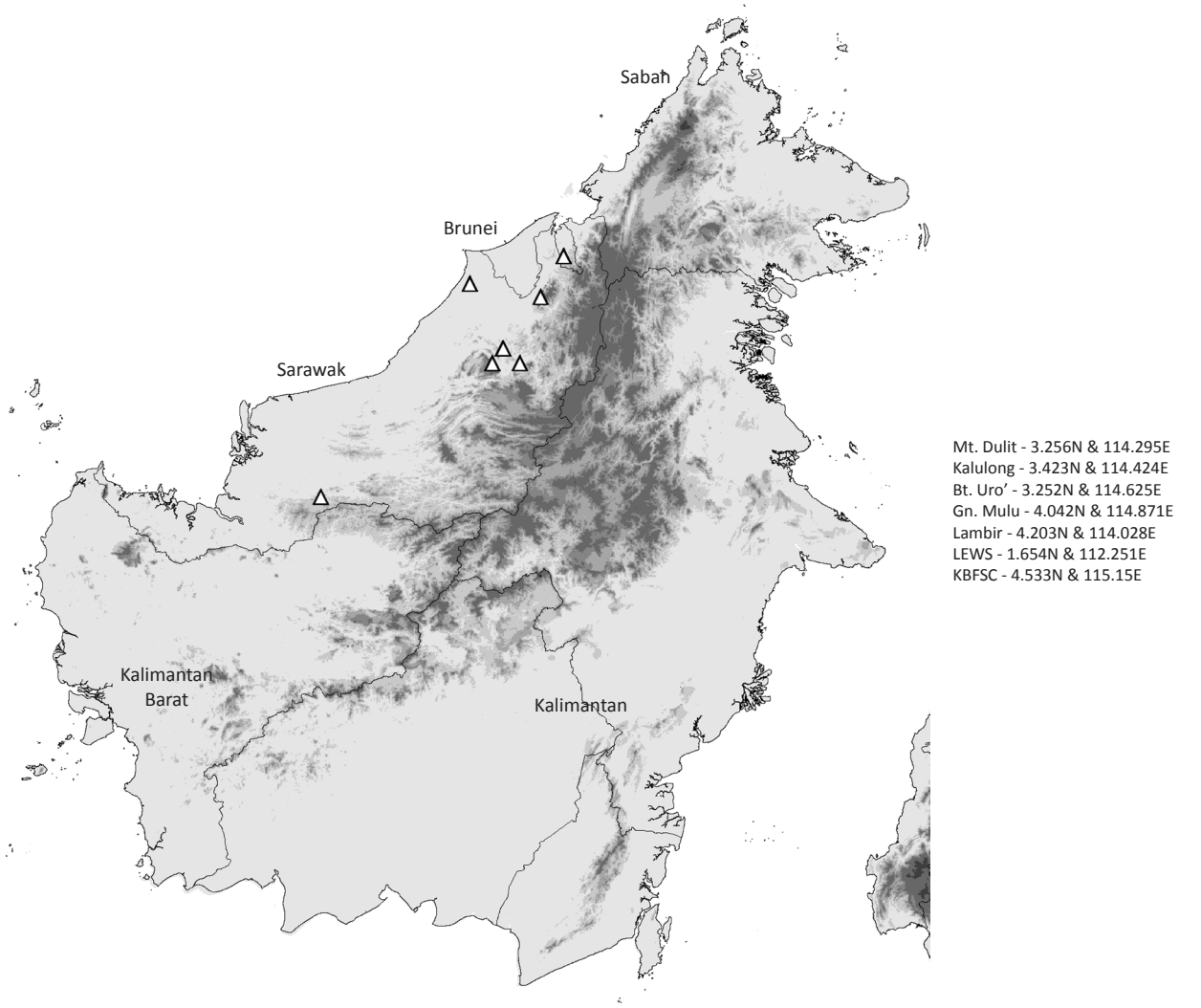


Image 10. Distribution of *Bornargiolestes fuscus* sp. nov. Coordinates given to three decimal places. Location names (west to east): LEWS - Lanjak Entimau Wildlife Sanctuary; Lambir - Lambir Hills National Park; Dulit - Mount Dulit; Kalulong - Gunung Kalulong; Bt. Uro' - Batu Uro'; Gn. Mulu - Gunung Mulu in Gunung Mulu National Park; KBFSC – Kuala Belalong Field Studies Centre.

carina at the apex of the antealar triangle. Legs with coxa brown and cream, femur pale brown with a grey stripe along extensor surface, tibia and tarsus mostly dark. Posterior tibia approximately as long as the mesopleural suture measured from antealar carina to corner of mesinfraepisternum, posterior femur shorter, not long enough to reach the first abdominal segment. Wings (very similar to Figs. 3, 4 which show those of a paratype): hyaline. R_4 arising slightly proximal to Sn, IR_3 3 cells distal. 24 (right) or 25 (left) Px in Fw, 23 (left) or 22 (right) Px in Hw. Pterostigma greyish brown, with incomplete pale border, approximately trapezoidal, covering one central underlying cell and parts of the cell on either side. The anal side is thickened relative to the other sides and surrounding veins. The wing margin is slightly contracted at the proximal end of the pterostigma (as in Figs. 3–4, which show a paratype).

Abdomen: Mostly black. S2-7 with a narrow incomplete pale basal annulus expanded on the lower lateral part of the tergite, where continued narrowly along the margin for most of the length. S8 almost entirely black, S9–10 black. In dorsal view S9 expanded from base, S10 maintaining the same width, S9 with a small, shallow basal diamond shaped pit on the midline (Image 9). Penis very similar to that of *B. fuscus* sp. nov. Superior anal appendages shaped as in (Figs. 9, 12), black basally, pale on the upper and internal surfaces distally, the subapical branch of the cleft tip barely developed, so hardly visible in ventral view (Fig. 12). Inferior appendages mostly black.

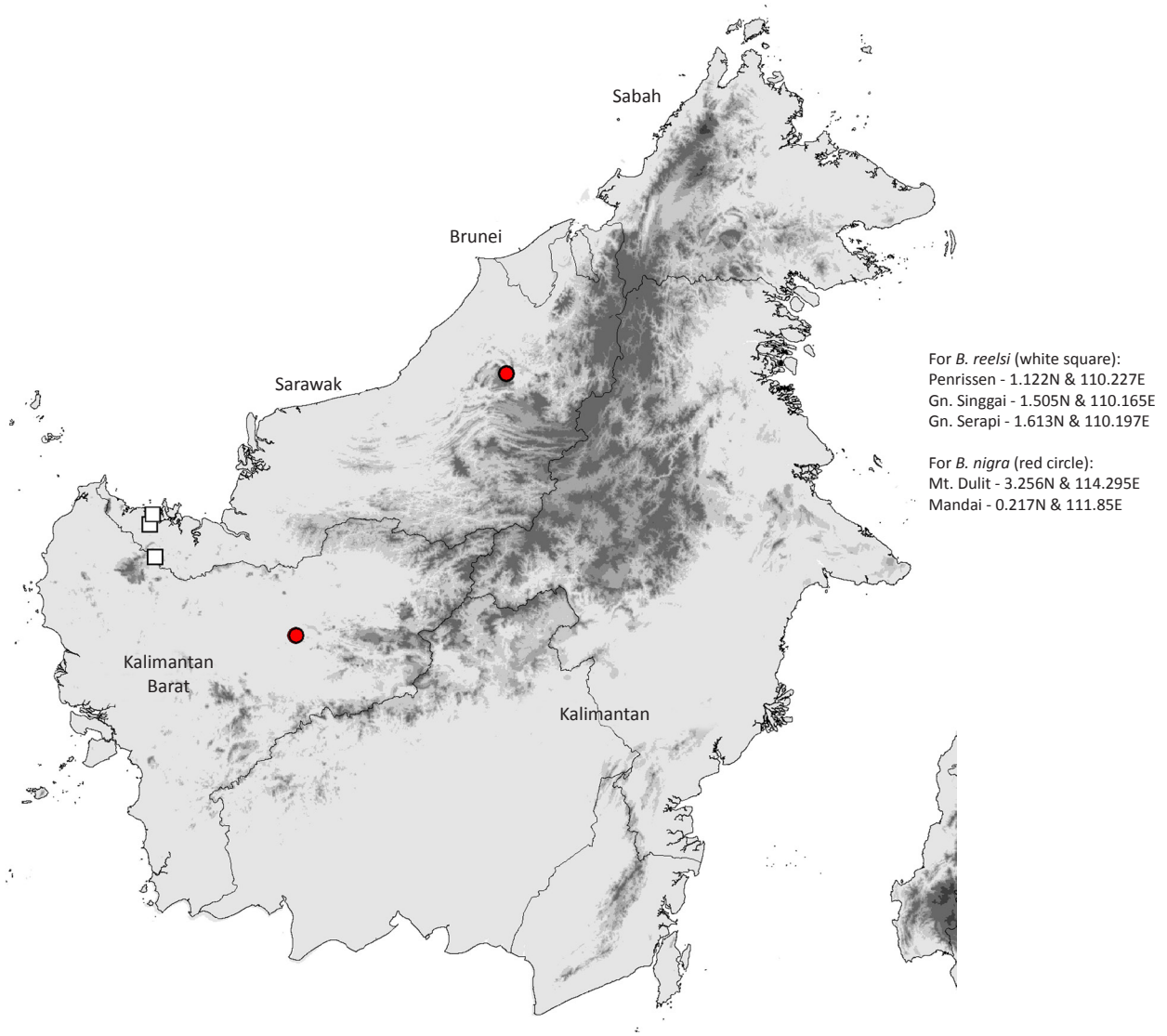


Image 11. Distributions of *Bornargiolestes* species. Red circle - *B. nigra*; white square - *B. reelsi*. Coordinates given to three decimal places. Location names (south to north): Mandai - Sungai Mandai Hills; Penrissen - Gunung Penrissen; Singgai - Gunung Singgai; Serapi - Gunung Serapi in Kubah National Park; Dulit - Mount Dulit.

Measurements [mm]: Hw 27, abdomen 32.5 (excl. appendages), superior appendage ca 1.25.

Description of female paratype (SAR06_MEG3, as male except as noted)

Head: Labium pale, labrum greyish, pale dirty yellow along free margin, mandible bases greyish, clypeus dark brown.

Thorax: Prothorax marked like male but paler brown. Synthorax brown, paler than male, becoming pale yellowish on metepimeron. Mesostigmal plates short and erect, yellowish. Legs with coxa and trochanter entirely pale yellowish, dark stripe on extensor surface present on anterior pair, faded on middle and posterior pair, tibia greyish. Wings: R_4 arising slightly proximal to Sn, IR_3 3 cells distal. 21 (left) to 22 (right) Px in Fw, 20 (left) or 19 (right) in Hw. Contraction of wing margin at pterostigma slightly more pronounced than in male, pale border of pterostigma better defined and more complete than in male, pterostigma covering one central cell and parts of the two on either side in the Fw, two underlying cells in Hw.

Abdomen: Lighter brown than male, S7 with a well-developed, broad yellowish basal annulus, no depression or split in the dorsum of S9. Superior anal appendages just longer than S10, conical and roundly pointed. Ovipositor brown, reaching about the level of tips of superior anal appendages, valves with only minute teeth along lower edge.

Measurements [mm]: Hw 25.5, abdomen excluding

anal appendages and ovipositor 30.5.

Variation in paratypes: Immature individuals are paler than the holotype and described female paratype. In both sexes R_4 typically arises at or slightly proximal to Sn, but occasionally arises very slightly distal to it, IR_3 arises 2–3 cells distal to Sn. The pit on the dorsum of S9 is present in all males examined, but is very small in some individuals.

Measurements [mm]: Males: 22–25 Px in Fw, 19–23 in Hw. Hw 24–28, abdomen without anal appendages 30–34. Females: 20–25 Px in Fw, 19–23 in Hw. Hw 25–29.5, abdomen without anal appendages or ovipositor 28.5–34.

Remark: The habitus of one of the paratypes is shown in Image 2. The contrasting coloration of femur and tibia (Image 2) in mature males of *B. reelsi* sp. nov., with femur pale and tibia dark is readily apparent in specimens and should certainly assist in distinguishing them from superficially similar looking *Devadatta* species, with which it can co-occur, in the field. However, the coloration of femur and tibia appears much more similar in immature males and females, so limiting the value of this character.

DISCUSSION

The two species described here, *B. fuscus* sp. nov. and *B. reelsi* sp. nov., appear more closely related to each other than to *B. nigra*. They share greater development of the structures of the middle pronotal lobe than *B. nigra*, very similar wing venation and penis structure and both bear pits on the dorsum of abdominal S9, lacking in *B. nigra*. Judging from the specimen from Kalimantan Barat provisionally considered as *B. nigra*, the two new species also have shorter legs.

Bornargiolestes remains a poorly known and elusive genus, its habitats are barely understood, its larva is unknown and the type species is still known only from two old specimens. The genus is associated with steep forested terrain, where a substantial proportion of the available specimens of *B. fuscus* sp. nov. and *B. reelsi* sp. nov. have been taken on trails. Where the individuals have been found at water, they have often been found at permanently wet cliff faces deep in forest, or at very small trickles and seepages beside small streams. These habitats are characterised by having only the barest amount of water running above the leaf litter; in some cases no flow was visible above the leaf litter. Nothing whatsoever has been recorded on the habitat of *B. nigra*, but the type was collected on the Tinjar (eastern) face of Mount Dulit, which is almost entirely steep to extremely steep. Attempts to find the larva of *B. fuscus* sp. nov. and *B. reelsi* sp. nov. at sites where freshly emerged individuals have been found have so far yielded no results. *B. fuscus* sp. nov. has been found at altitudes from close to sea-level up to at least 900m; *B. reelsi* sp. nov. has been found from close to sea-level up to ca. 1100m. The type of *B. nigra* was collected at around 900m; the altitude at which the specimen from Kalimantan Barat was collected is not given on the labels, and the height of Mount Liang Kubung is unclear. Most locations where *B. fuscus* has been found are intact primary forest, but the habitats in the mid Baram area and on Mount Dulit have been disturbed by logging. Similarly, some of the habitat on Gunung Penrissen where *B. reelsi* has been found has been disturbed by logging in the past. Habitats such as described above are common over much of Borneo, but *Bornargiolestes* has been found only at a small percentage of apparently suitable sites surveyed; clearly the species of this genus are very local in occurrence and our understanding of their habitat requirements is inadequate.

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