

## ***Macromidia donaldi pethiyagodai* subsp. nov. from Sri Lanka (Odonata: Corduliidae)**

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*Macromidia donaldi pethiyagodai* subsp. nov. (holotype ♂: Sri Lanka, Ratnapura District, near Kudawe, 6.26°N, 80.25°E, 03 July 2007; paratype ♀, same location, 17 April 2008, to be deposited in the Sri Lanka National Museum, Colombo) is described and figured. Its phenotype differs from that of *M. d. donaldi* from India. This is the first record of the genus *Macromidia* from Sri Lanka. The habitat characteristics and species behaviour are briefly outlined.

**Keywords:** Odonata; dragonfly; Corduliidae; *Macromidia*; new subspecies; Sri Lanka

### **Introduction**

The family Corduliidae as traditionally defined includes over 251 species in 38 genera that are distributed throughout the temperate and tropical world, especially Australia, North America, Europe, Africa, Asia, and China (Schorr & Paulson, 2012). The genus *Macromidia* (subfamily Idionychinae) is confined to eastern Asia ranging from Sri Lanka and India in the west to the Ryukyu Islands in the east, Zhejiang China in the north, and Sumatra in the south. Eleven species are presently known.

Most species of *Macromidia* are of very limited known distribution, having been reported from only one location. *Macromidia genialis* Laidlaw, 1923 (with two subspecies, *M. g. erratica* and *M. g. shanensis* in addition to the nominate one) is the most widespread and is reported from Malaysia, Sumatra, Burma and Thailand (Lieftinck, 1971; Wilson, 1996) while *M. rapida* Martin, 1907 is found in Hong Kong & Guangdong (China), Thailand and Vietnam (Wilson, 1996). *Macromidia atrovirens* Lieftinck, 1935 is endemic to the southwest of Sumatra and *M. fulva* Laidlaw, 1915 to North Borneo and Sarawak (Lieftinck, 1971). Two species are reported from the Philippines: *Macromidia asahinai* Lieftinck, 1971 from Palawan Island and *M. samal* Needham and Gyger, 1937 from Mindanao. *Macromidia ishidai* Asahina, 1964 is reported from Ryukyu Islands in Japan and from Taiwan (Yeh et al., 2006). China has three endemic species: *M. ellenae*

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Figure 1. *Macromidia donaldi pethiyagodai* subsp. nov., male, dorsal view.

Wilson, 1996 (Hong Kong), *M. kelloggi* Asahina, 1978 (Foochow [Fuzhou], Fujian Province, and Zhejiang) and *M. shiehae* Jiang, Li & Yu, 2008 (Jiangxi). *Macromidia donaldi* (Fraser, 1924) is found in the Western Ghats of peninsular India with which Sri Lanka is zoogeographically related. No species of *Macromidia* have been reported from Sri Lanka (Bedjanič et al., 2007; de Fonseka, 2000).

A new subspecies of *Macromidia donaldi* was found in the Ratnapura district in the southern part of Sri Lanka in 2007 and its description is provided here.

***Macromidia donaldi pethiyagodai* subsp. nov.**

(Figures 1–7)

*Etymology*

Noun in the genitive case, named in honour of Rohan Pethiyagoda, scientist, writer and founder of the non-profit organization, the Wildlife Heritage Trust (WHT) of Sri Lanka. The WHT published the first book dedicated to the dragonflies of Sri Lanka (*The Dragonflies of Sri Lanka* by Terence de Fonseka, 2000). Rohan personally oversaw the publication of this book, which presented up-to-date information on the odonates of Sri Lanka in a single source for the first time.

*Specimens studied*

Holotype male: Sri Lanka, Sabaragamuwa Province, Ratnapura district, near Kudawe, 6° 16''N, 80° 15'E, altitude 550 m asl, 3 July 2007, leg. NvdP; to be deposited at the Sri Lanka National Museum, Colombo. Paratypes: 1 ♂, same data as holotype; 1 ♀, same data but 17 April 2008 (♀ also to be deposited at the Sri Lanka National Museum, Colombo).

Specimens of *Macromidia d. donaldi* at NHM London: Male type (label: “Sampaji Ghat, Coorg, [India]. 7.vi.24. Coll. F.C. Fraser”); Male paratype (label: “Tamaracherry, S. Malabar, 10.v.29, S. India, F. C. Fraser”); Female allotype (label: “Tamaracherry, S. Malabar, nr. Calicut, 15.vii.28. Coll. F. C. Fraser”); Female paratypes: (label: “Tamaracherry, S. Malabar, 13.vi.28, Coll. Fraser”); (label: “R, Coorg, 14.??29, F. C. Fraser”). Specimen of *M. d. donaldi* at UMMZ Michigan: Male (label: “Tamaracherri, Malabar, 10.viii.28, From Fraser”).



Figure 2. *Macromidia donaldi pethiyagodai* subsp. nov., male, lateral view.

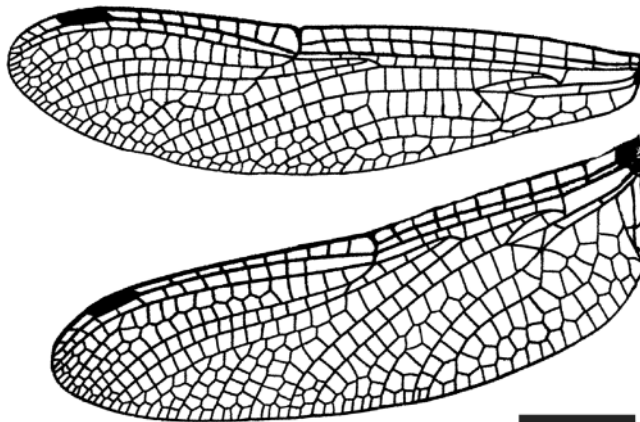


Figure 3. *Macromidia donaldi pethiyagodai* subsp. nov., male, wings (scale = 5 mm).

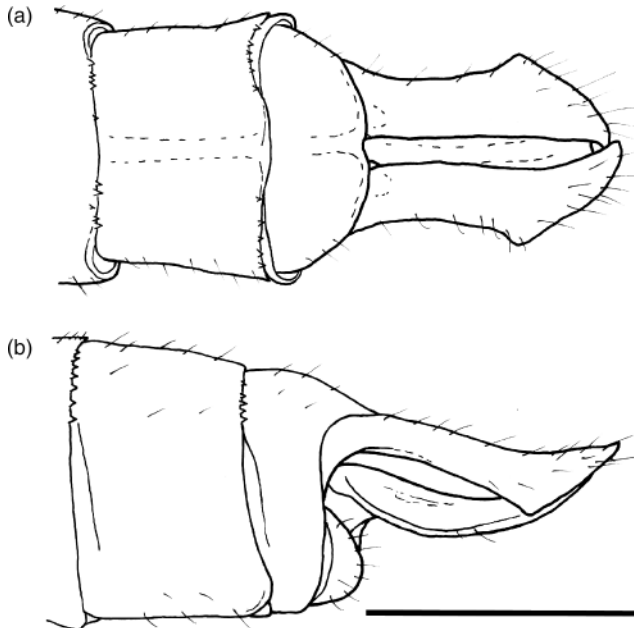


Figure 4. *Macromidia donaldi pethiyagodai* subsp. nov., male, anal appendages: (a) dorsal view; (b) lateral view (scale = 3 mm). This and following illustrations, except Figure 6, were traced from photographs; setae are indicated schematically and more sparsely than in reality.

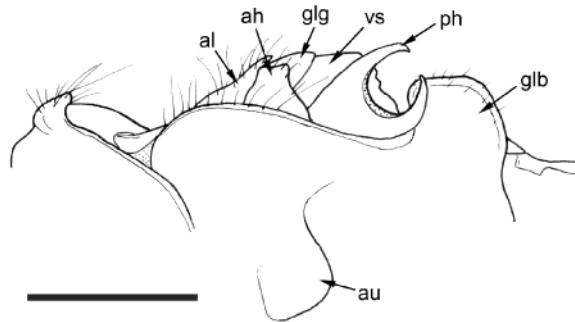


Figure 5. *Macromidia donaldi pethiyagodai* subsp. nov., male, secondary genitalia, lateral view; abbreviations are as follows: ah – anterior hamules, al – anterior lamina, au – auricle, glb – genital lobe, glg – genital ligula, ph – posterior hamules, vs – vesica seminalis (penis) terminal segment (scale = 1 mm).

*Description of holotype male (Figures 1, 2, 3, 4a, b, 5)*

**Head.** Labrum and mandibles blackish brown with green metallic reflections. Labium entirely bright yellow. Frons and postclypeus dark greenish black. Anteclypeus dull yellow. Occiput black. Eyes dark metallic green, yellowish below (Figure 1).

**Thorax.** Prothorax pale yellow, posterior lobe bright yellow. Synthorax metallic emerald green marked with yellow as follows: antealar sinus; stripe from trochanter of second leg to mesinfracpisternum; three lateral stripes – (1) on metepisternum from coxa of hind leg to just dorsal to spiracle; (2) on metepimeron vertically at mid-length from venter to metapleural suture; and (3) on metepimeron covering posterior 1/4 – all stripes continuing beneath the thorax to join with the corresponding stripes on the other side. Between stripes on sides and on lower part of dorsum

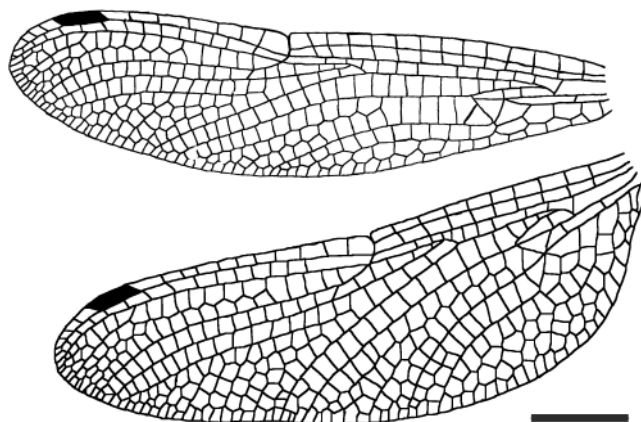


Figure 6. *Macromidia donaldi pethiyagodai* subsp. nov., female, wings (scale = 5 mm).

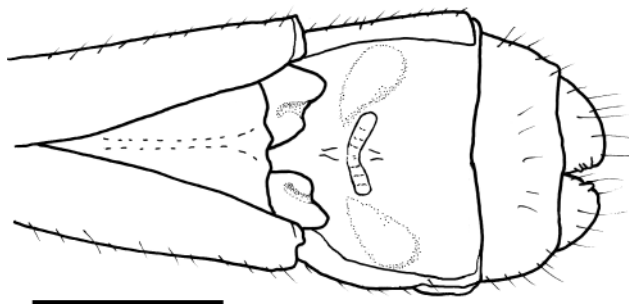


Figure 7. *Macromidia donaldi pethiyagodai* subsp. nov., female, valvula vulvae, ventral view (scale = 1 mm).

brownish red, below dark metallic blue. Legs black, coxae yellow, trochanter and proximal end of femora of the anterior pair yellow, trochanter of mid-pair yellow medially (Figures 1, 2). Wings: (Figure 3) hyaline, Fw: brownish yellow in costal space and subcostal space to nodus; Hw brownish yellow in costal and subcostal space and anal triangle; 1 cubital crossvein in Fw, 2 in Hw; supertriangle traversed 2 × in left Fw, 1 × in right Fw, 1 × in Hw; anal loop with 7 cells, discoidal field commencing with 8 rows of single cells in Fw, 4 in Hw, anal triangle 2 cells, Pt grayish black, covering 2 cells; membrane grayish white; Fw with 12 Ax, 7 Px; Hw 9 Ax; 9–10 Px.

**Abdomen.** Black, marked with yellow: S1 with thin apical ring ventrally; S2 with diamond-shaped dorsal spot at base extending in a thick line to the apical end, auricles yellow on inner surface and laterally joining with ventral elongated spot; S3–S6 with mid-dorsal stripe, sometimes faint, sometimes interrupted in the middle; S7 with mid-dorsal stripe slightly widened sub-basally; S8–S10 unmarked; ventrally yellow on edges of S3–S10. Abdomen slender, widest at S1–S2, tapering to base of S6, then widening to base of S8, base of S9 narrower than apex of S8, but S9 widening apically. Anal appendages black with fine hairs, cerci nearly as long as S9 and S10, pointed, subcylindrical, broadening about 1/3 distance from apex to form a robust lateral angulation (Figure 1); epiproct slightly shorter with apex curved upwards (Figures 4a, b). Secondary genitalia dark brown, anterior lamina and genital lobe moderately prominent and with long hairs; anterior hamules rather prominent, posterior hamules robust pincer-like curved hooks, slightly longer than lobe (Figure 5).

*Measurements* (mm). Total length 40; abdomen 27; cerci 2.5; Fw 26; Hw 27.

*Variation in paratype male*

Wings: supertriangle traversed 1× in left Fw, 2× in right Fw; Fw 12, 13 Ax; 7, 8 Px.

*Description of paratype female (Figures 6, 7)*

*Head.* Labrum and mandibles blackish brown with green metallic reflections. Labium bright yellow, bordered with brown. Frons and postclypeus dark greenish black. Anteclypeus dull yellow. Occiput black. Eyes dark metallic green, yellowish below.

*Thorax.* Coloration nearly identical to male. Wings (Figure 6): hyaline, Fw: brownish yellow in costal space for 3 cells, in the subcostal space to nodus and in cubital space; Hw brownish yellow in costal space for 3 cells, in subcostal space halfway to nodus, in cubital space and anal triangle; cubital nervures 1 in Fw, 2 in Hw; supertriangle traversed 1× in left Fw, 2× in right Fw, 2× in left Hw, 1× in right Hw; anal loop 9 cells including one central cell, discoidal field commencing with a row of single cells (6 in Fw and 2 in Hw), anal triangle 3 cells, Pt grayish black, covering 2½ cells; membrane grayish white; Fw 13 Ax, 6 Px; Hw 9 Ax, 10 Px (Figure 6).

*Abdomen.* Black, marked with yellow as follows: S1 all black; S2 as in male; S3–S6 with mid-dorsal stripe, sometimes faint basally, sometimes interrupted in the middle; S7 mid-dorsal stripe slightly widened sub-basally; S8–S10 unmarked; ventrally yellow on edges of S2–S8. S3–S5 constricted at the middle; S6 constricted subbasally; S7–S9 widest apically; abdomen slender, tapering from the base of S2 to S7, then widening to the apex of S9, then narrowing again. Cerci black, pointed, slightly longer than S10. Valvula vulvae very short (one-fifth the length of S9), completely divided to form two obtusely pointed blades, each of which has a deep invagination one-third the way from the centre (Figure 7).

*Measurements* (mm). Total length 39; abdomen 28.5; cerci 0.5; Fw 32; Hw 32.

*Diagnosis*

The male of *M. donaldi pethiyagodai* differs from the male of *M. d. donaldi* as follows:

*M. d. donaldi* larger (abd + app 34 mm, Hw 30 mm), labium narrowly bordered with brown, postclypeus black with bluish metallic reflections, prothorax entirely pale yellow, yellow thoracic stripes longer, trochanter of all legs yellow, additional yellow rays in cubital and anal triangle, S1 with broad yellow lateral spot and minute basodorsal one, S2 dorsal spot rectangular, S7 with broad subbasal spot shaped like ace of clubs with its stalk tapering to the apical border, abdomen of uniform width from S1 to base of S7, then widest at S8 (which is uniform along its length), tapering to S10, S3–S6 bordered finely with yellow ventrolaterally.

The secondary genitalia of *M. d. donaldi* have not been figured nor were they described when the species was first erected as a new genus *Indomacromia* (Fraser, 1924). Martin (1906) did not describe the secondary genitalia of *Macromidia* when he first erected the genus. Fraser (1936) did not describe the secondary genitalia of *M. d. donaldi* though he described the secondary genitalia for the genus as: “lamina depressed; hamules robust curved hooks with broad foliate base; lobe small, triangular, projecting”. Lieftinck (1971) wrote of the genus *Macromidia* when comparing it with *Idionyx*: “Outer branch of male posterior genital hamule longer, thinner and incurved, projecting much beyond hook-shaped inner branch”. However, these general descriptions do not apply to all members of the genus, many of which have been described since 1971.

Though the type specimen of *M. donaldi* and photographs of a specimen from UMMZ were examined, it was difficult to clearly discern what the secondary genitalia looked like as the specimens (in particular, the type specimen) were not in good condition. However, they appear to be similar to those of *M. donaldi pethiyagodai*.

The female of *M. donaldi pethiyagodai* differs from the female of *M. d. donaldi* as follows: *M. d. donaldi* with longer abdomen but shorter wings (abd 31 mm, Hw 28–30 mm), frons and postclypeus black with bluish metallic reflections, prothorax pale yellow, thoracic stripes extending closer to bases of wings, trochanter of all legs yellow, yellow rays at base of both wings but more restricted in spread along the wing, supertriangle traversed 2× in all wings, anal loop with 6–8 cells without a central cell, S1 with broad lateral yellow spot and minute basodorsal one, S7 with broad subbasal spot shaped like ace of clubs, its stalk tapering to the apical border and onto S8, abdomen narrowest at apex of S4 and widest at S8 (which is of a uniform width along its length), tapering again in S9–S10. Though Fraser (1936) stated that the valvula vulvae were “as for the genus: triangular, ending in two robust divergent spines and half the length of S9”, this was not borne out by an examination of the specimen of the allotype female. Though this specimen was not in good condition, the valvula vulvae appeared to be similar to those of *M. donaldi pethiyagodai* and not as Fraser described them. Though the shape of the abdomen of *M. donaldi* and *M. donaldi pethiyagodai* appear to be significantly different, it is possible that the abdomens of the Indian specimens are distorted.

### Biological notes

*M. donaldi pethiyagodai* was found in the wet zone (annual rainfall 3000–6000 mm) of the southwest of the island within a semi-disturbed, hilly dipterocarp forest with bamboo and tree ferns. The habitat was a small, perennial, slow-moving stream with marshy land on one side and a forested hillside on the other. The edges of both sides of the stream were densely covered with vegetation. At the height of the rains the stream reached a maximum depth of 1 m and overflowed into the adjoining marshy area. Further down, the stream descended a steep slope and the water ran much faster. The edges of this part of the stream were covered by tall trees but the undergrowth was less dense. The type male was seen hawking along the trail near the opening to a small pool in the stream. Its flight was extraordinarily fast and about 1 m from the ground. Another male was seen along the trail further away from the stream. A third male was observed inside the room of a tourist inn near the steep section of the stream. The female was seen in the marshy area adjoining the stream.

### Discussion

*Macromidia* is widespread across Asia but is poorly represented in the Indian subcontinent, of which Sri Lanka is zoogeographically a part. Only one species, *M. donaldi*, is found in continental India and its distribution is restricted to the Western Ghats (Fraser 1936). Lieftinck (1971) believed that *Macromidia* was a bridge between *Macromia* and *Idionyx* because of the many characters that the three genera shared – in particular, the venation of *Macromidia* resembled that of *Macromia* though the more rounded wings and less sinuous primary veins resembled *Idionyx*. However, Ware et al. (2007) reported that the subfamily Idionychinae (family Gomphomacromiidae) (which comprises only *Idionyx* and *Macromidia*) formed a monophyletic group. *Macromia* belongs to the family Macromiidae which is a separate monophyletic clade from Corduliidae. There are two species of *Macromia* in Sri Lanka, both of which are endemic (*M. zeylanica* Fraser, 1927 and *M. flinti* Lieftinck, 1977). Laidlaw (1951) considered *M. zeylanica* to be from the same stock as

the Indian species of which there are 14. No species of *Idionyx* occur in Sri Lanka though there are 13 species in India (Subramanian, 2009).

It is possible that *M. donaldi pethiyagodai* represents a new species and is not a subspecies of *M. donaldi*. However, this cannot be proven until certain aspects of *M. d. donaldi* are described more fully and accurately and until the variation within the species is documented. In the male, the secondary genitalia, the shape and markings of the abdomen, the yellow tinting on the wings and wing venation need to be fully documented. In the female, the shape and markings of the abdomen, the yellow tinting on the wings, the composition of the anal loop, and the shape of the valvula vulvae need to be fully documented. Unfortunately, *M. d. donaldi* appears to be a scarce insect in India and has not been reported in recent times (K. Subramanian, personal communication).

A study of the molecular phylogeny of the genus would be helpful in elucidating the relationship of *M. donaldi pethiyagodai* to *M. d. donaldi* and to the other species.

Although Sri Lanka is geographically and zoogeographically considered part of the Indian sub-continent, it has several characteristics that distinguish it from the Western Ghats and south India with which it is often grouped. Of the 118 species of odonates reported from the island, 46 species are endemic at the species level (five of them described within the past three years), while eight are endemic at the subspecies level. This is an exceptionally high level of endemism that matches that of Borneo and Sulawesi (Kalkman et al. 2008). Although a taxonomic revision of some species is necessary, there are additional endemic species in the process of description (M. Bedjanič, personal communication; K. Conniff, personal communication). This new subspecies of *Macromidia* further adds to the distinctive character of the odonate fauna of the island.

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