

***Libellago corbeti* sp. nov. from Sri Lanka  
(Odonata: Chlorocyphidae)**

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**ABSTRACT**

*Libellago corbeti* sp. nov. (holotype ♂: Sri Lanka, Ratnapura District, near Kudawe, 6.26°N, 80.25°E, 03 vii 2007, to be deposited in the Sri Lanka National Museum, Colombo) is described and figured. Its phenotype does not resemble that of any other *Libellago* species. Habitat characteristics and species behaviour are briefly outlined. Keys to males and females of *Libellago* species in Sri Lanka are provided.

**INTRODUCTION**

The family Chlorocyphidae includes over 140 species in 19 genera that are distributed throughout tropical and subtropical Asia, Africa, and Australasia. The genus *Libellago* is confined to Asia ranging from Sri Lanka and India in the west to Sulawesi in the east and Fujian and Taiwan in the north; a total of 25 species is presently known (M. Hämäläinen pers. comm.). Recently Dow & Hämäläinen (2008) described a new species, *L. orri*, from Sarawak, Borneo, and van Tol (2007) described three new species from Sulawesi: *L. celebensis* with three subspecies, *L. daviesi*, and *L. manganitu*. Two species are found in peninsular India, with which Sri Lanka is zoogeographically related: *L. indica* (Fraser, 1928) and *L. lineata* (Burmeister, 1839).

Three species, all endemic, are found in the Andamans and Nicobar Islands (Hämäläinen 2002): *L. andamanensis* (Fraser, 1924) in the Andamans, and *L. balus* Hämäläinen, 2002 and *L. blanda* (Hagen in Selys, 1853) in the Nicobars. Four species have been reported from Sri Lanka in the literature (e.g. Fraser 1934; Liefertinck 1971; de Fonseka 2000; Bedjanič et al. 2007): *L. adami* Fraser, 1939, *L. finalis* (Hagen in Selys, 1869), *L. greeni* (Laidlaw, 1924), and *L. indica*. However, the Sri Lankan records of *L. indica* have proven to be incorrectly identified and this species was removed from the odonate list of Sri Lanka by Hämäläinen et al. (2009). Rather unexpectedly, a new *Libellago* species was found in the Ratnapura district in the southern part of Sri Lanka in 2007, and its description is provided here.

*Libellago corbeti* sp.nov.

Fig. 1, Plate V

## Etymology

Noun in the genitive case, named in honour of Philip S. Corbet who contributed immensely to the understanding of the Odonata and inspired many amateur and professional scientists.

## Specimens studied

Holotype ♂: Sri Lanka, Sabaragamuwa Province, Ratnapura District, near Kudawe (6.26°N, 80.25°E, alt. 550 m a.s.l.), 03 vii 2007, leg. NvdP; to be deposited at the Sri Lanka National Museum, Colombo. Paratypes: 1 ♂, same data as holotype; 2 ♀, same data but 17 iv 2008.

## Description of holotype male

**Head:** Labium, labrum, frons, clypeus, gena, and maxilla black. Rhinarium with flattened anterior facet between anteclypeus and basal portion of postclypeus; the flattened surface in life appears metallic green or purplish-blue depending on the angle of view (Pl. Va, b). Dorsally paired yellow spots just distad and posterior to the lateral ocelli. Eyes black, yellowish below; postgenae black with small, elongated citron yellow spots at level of occiput.

**Thorax:** Prothorax black with paired yellow dorsal spots on anterior lobe and paired yellow lateral spots on median lobe. Posterior lobe rounded with long setae. Synthorax black with citron yellowish-green markings (as in Fig. 1c) as follows: thin, pale greenish-yellow interrupted antehumeral stripe that runs from anterior border to  $\frac{3}{4}$  of distance to antealar sinus; small spot just proximal to antealar sinus; small spot on metepisternum just dorsal to hind leg; posterior to the latter, two elongated spots aligned with each other; small elongated spot on metepisternum at base of hindwing; one elongated spot on the metepimeron anterior to base of Hw. Legs black, with tibia yellowish-white on flexor surface, except at the basal  $\frac{1}{4}$ . — Wings: hyaline, slightly tinged with brown at base; Fw with a black tip (3 mm long on costal edge; 2 mm long on posterior edge), no Pt (as in Fig. 1e); Hw with tip slightly tinged with brown, Pt black; Fw 6 Ax; Hw 6 Ax; left Hw 12 Px, right HW 14 Px.

**Abdomen:** Black; faint reddish-brown streaks on underside of S4-7. Anal appendages black, cerci twice as long as S10, pointed, apices curved inward; paraprocts half the length of cerci.

**Measurements [mm]:** Total length 23.3; abdomen 14.5; cerci 0.8; Fw 19; Hw 18.

## Variation in paratype male

Paratype appears younger. Synthorax lacks the antehumeral stripe; spot proximal to antealar sinus absent; third spot on metepisternum reduced; elongated spot on metepimeron anterior to Hw reduced to two smaller spots. Wings: Fw 5 Ax; Hw 13 Px. Head: spots on postgenae larger; yellow spots that are located distad and posterior to lateral ocelli larger.

**Measurements [mm]:** Total length 22; abdomen 13.5; Fw 19.5; Hw 19.

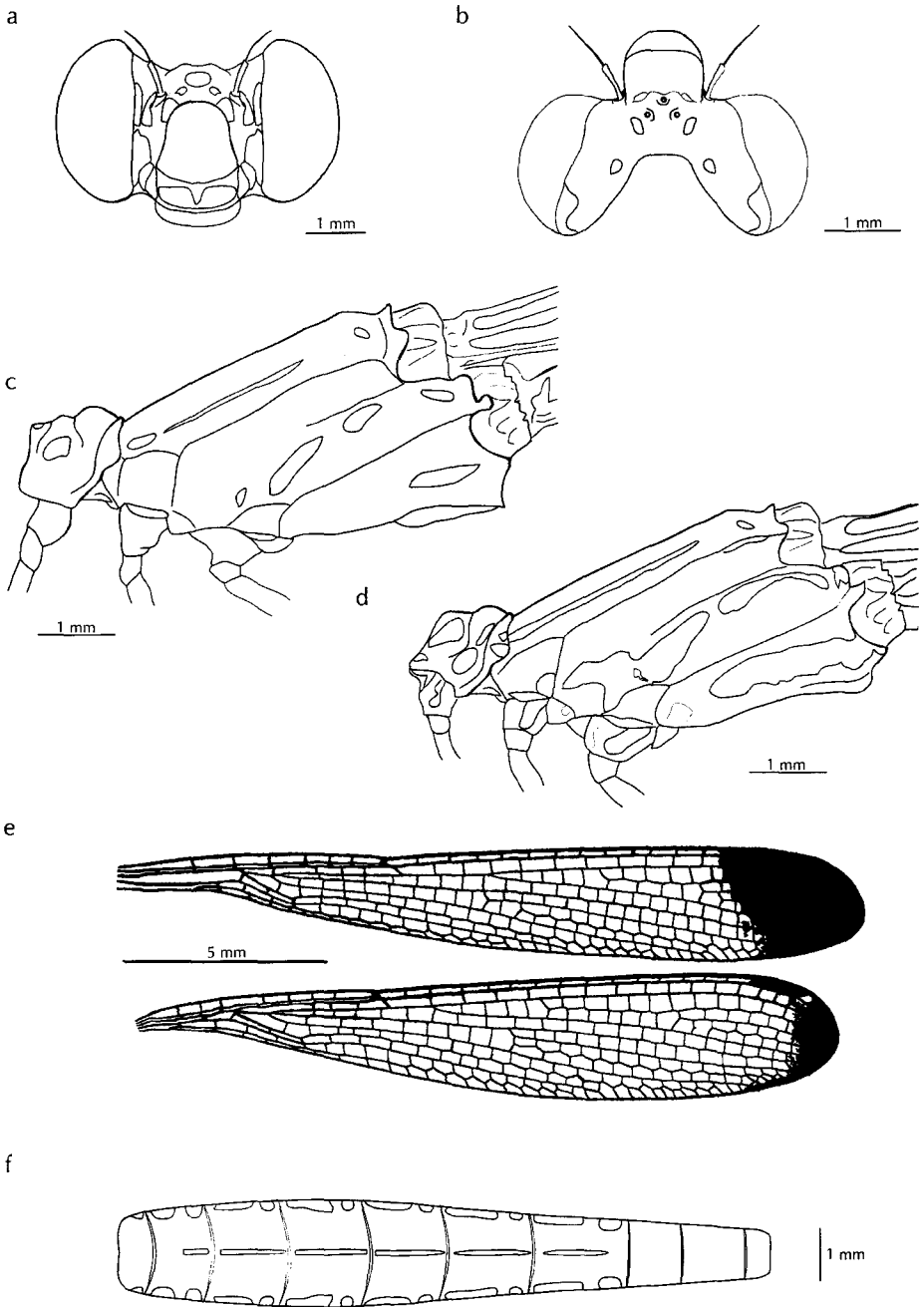


Figure 1: *Libellago corbeti* sp. nov. — (a) female paratype head, frontal view; (b) female paratype head, dorsal view; (c) male holotype thorax, lateral view; (d) female paratype thorax, lateral view; (e) male holotype wings; (f) female paratype abdomen, dorsal view.

Table 1. Comparison of males of all recorded species of *Libellago* from Sri Lanka.

<i>L. adami</i>	<i>L. corbeti</i>	<i>L. finalis</i>	<i>L. greeni</i>
<b>Prothoracic anterior lobe</b> Black with narrow citron-yellow marking on anterior collar	Black with paired yellow dorsal	Black with yellow marking on anterior collar	Black with yellow marking on anterior collar
<b>Prothoracic median lobe</b> Black with three pairs of yellow spots	Black with one pair of lateral spots	Black with two pairs of yellow spots	Black with two pairs of yellow spots
<b>Prothoracic posterior lobe</b> Black with large, oval yellow median spot	Black	Black with medium-sized yellow median spot	Black with medium-sized yellow median spot
<b>Antehumeral stripe</b> Long	Thin and interrupted, or absent	Long	Long
<b>Humeral stripe</b> Long	Absent	Short	Short
<b>Mid-dorsal carina</b> With yellow stripe	Black	With yellow stripe	With yellow stripe
<b>Fw Ax</b> 5-6	5-6	6-7	6
<b>Hw Ax</b> 5-6	6	6-7	6
<b>Hw Px</b> 10-12	12-14	10	10-12
<b>Hw length [mm]</b> 18-19	18-19	21-22	17-19
<b>Abdomen length [mm]</b> 14-15	14-15	16-19	14
<b>Abdomen</b> Black with dorso-lateral markings, grass green dorsally, yellow laterally, on S1-7 ( S8)	Black with faint reddish-brown ventral markings	Black with yellow dorso-lateral markings on S1-6 ( S7, 8)	Black with yellow, orange or red dorso-lateral markings on each segment

Key to *Libellago* males from Sri Lanka

1. Dorsum of abdomen entirely black ..... *L. corbeti* sp. nov.
- 1'. Dorsum of abdomen with yellow, green or red markings ..... 2
2. Dorsal markings on abdomen yellow, orange, and red; all segments marked ..... *L. greeni*
- 2'. Dorsal markings on abdomen yellow or green; S9-10 entirely black ..... 3
3. Humeral stripe on thorax very short, less than  $\frac{1}{4}$  length of thorax; markings on abdomen yellow; abdomen 16 mm or longer; Hw 21 mm or longer ..... *L. finalis*
- 3'. Humeral stripe on thorax long, almost  $\frac{3}{4}$  length of thorax; markings on abdomen green dorsally and yellow laterally; abdomen 15 mm or less; Hw 19 mm or less ..... *L. adami*

Table 2. Comparison of females of all recorded species of *Libellago* from Sri Lanka.

<i>L. adami</i>	<i>L. corbeti</i>	<i>L. finalis</i>	<i>L. greeni</i>
<b>Rhinarium</b>			
Broadly marked with yellow	Black	Small spot of yellow on each facet	Small spot of yellow on each facet
<b>Antehumeral stripe</b>			
Broad, tapering caudad	Narrow	Broad, tapering caudad	Broad, tapering caudad
<b>Humeral stripe</b>			
Long (ca ¾ length)	Absent	Very short (<¼ length)	Medium (ca ½ length)
<b>Mid-dorsal carina</b>			
With yellow line	Black	With yellow line	With yellow line
<b>Fw Ax</b>			
5-6	6-7	6-7	5-6
<b>Fw Px</b>			
10-11	13-14	11-13	11-12
<b>Hw Ax</b>			
5-6	6-7	5-7	5-6
<b>Hw Px</b>			
10	13-14	11-14	10-12
<b>Hw length [mm]</b>			
19-21	19-20	25	19-20
<b>Abdomen length [mm]</b>			
13-14	13-14	16	12-13
<b>S2, dorso-lateral markings</b>			
Elongated spot that covers entire segment	Basal and apical lateral spots	Elongated spot that covers entire segment	Elongated spot that covers entire segment
<b>S3-7, dorso-lateral markings</b>			
Elongated broad spot that covers entire length of segment	Basal elongated stripe and apical spot	Elongated narrow spot that covers entire length of segment	Elongated narrow spot that covers entire length of segment

Key to *Libellago* females from Sri Lanka

1. Humeral stripe absent; two dorso-lateral markings on S2-7 ... *L. corbeti* sp. nov.
- 1'. Humeral stripe present; single, elongated dorso-lateral spot on S2-7 ..... 2
2. Humeral stripe long, almost ¾ length of thorax; yellow markings on abdomen broad; rhinarium broadly marked with yellow ..... *L. adami*
- 2'. Humeral stripe short, less than ½ length of thorax, sometimes interrupted; yellow markings on abdomen narrower; rhinarium with small yellow markings ..... 3
3. Abdomen 15 mm or longer, Hw 25 mm or longer; Fw 6-7 Ax ..... *L. finalis*
- 3'. Abdomen shorter than 15 mm; Hw less than 20 mm; Fw 5-6 Ax ..... *L. greeni*

## Description of paratype females

**Head:** Labium black; labrum black with yellow spots laterally and yellow stripe mid-anteriorly; frons black with lateral yellow spot (Fig. 1a). Rhinarium black with flattened anterior facet between the anteclypeus and the basal portion of postclypeus. Maxilla black with traces of yellow; two small yellow spots between antennae, faint in one specimen; paired yellow spots located distad and posterior to lateral ocelli (Fig. 1b); yellow spot on gena. Eyes black, yellowish below, with yellow marking on posterior edge; postgena black with citron yellow spot at level of occiput.

**Thorax:** Prothorax black with yellow markings of variable size as follows: transverse stripe along entire length of anterior lobe, lateral spot on median lobe; transverse dorsal line and lateral spot on posterior lobe; spot just above coxa of anterior leg. Synthorax black with citron yellow-green markings as follows: thin antehumeral stripe that reaches  $\frac{3}{4}$  distance to base of wing; thin short stripe just proximal to base of wing: spot anterior to antehumeral stripe; spot just above second coxa; interrupted, undulating median stripe crossing the stigma; metepimeron with elongated spot starting  $\frac{1}{4}$  distance from anterior edge and reaching to base of wing (Fig. 1d). Legs black, coxa and basal  $\frac{1}{3}$  of inner surface of femur with yellow markings. — Wings with pale brownish tint except at base, Pt dark brown, 1.5 mm, covering 3-4 cells; Fw 6-7 Ax, 13-14 Px; Hw 6-7 Ax, 13-14 Px.

**Abdomen:** Black with grass green and dark yellow markings (Fig. 1f). S1 with yellow lateral spot and yellow ventral spot. S2 with two grass green lateral spots, a faint dark yellow marking on ventral edge, and a short yellow line apically along mid-dorsum. S3 with dorsolateral marking broken into two grass green spots: basal spot elongate and apical spot rounded; a dark yellow elongated ventral spot, and a yellow line along mid-dorsum. S4-7 same as S3 but basal spots progressively thinner and apical spots progressively smaller. S8 with two grass green lateral elongated spots or one long stripe. S9 with one small yellow apical lateral spot. S10 entirely black. Cerci black, pointed, twice as long as S10. Ovipositor valves extend to level of paraproct.

**Measurements** [mm,  $n = 2$ ]: Total length 22-23.6; abdomen 12.8-13.5; cerci 0.9-1.1; Fw 20; Hw 19.5-20.

## Diagnosis

The male of *L. corbeti* differs from its Sri Lankan congeners by its colour pattern: the markings on the thorax are greatly reduced; the abdomen is black without any pale dorsal markings and with only faint reddish-brown streaks on the underside (Tab. 1). The female differs from its Sri Lankan congeners by the black mid-dorsal carina, the lack of a humeral stripe, and by the distinctive pattern of yellow basal and apical dorso-lateral markings on S2-7 (Tab. 2).

## Biological notes

*L. corbeti* was found in the wet zone (annual rainfall 3,000-6,000 mm, 550 m) of the south-west 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. The young, but already mature males were seen perched at a height of ca 1 m above the water. The females were seen further down the same stream beside a forest path perching on bare twigs at a height of 3-6 m above the ground.

## DISCUSSION

The new species described here belongs to the genus *Libellago* because it presents the characters defining this genus: sectors of the arc arising from a common point, Fw of male without a pterostigma, and epistome greatly projecting so that there is a deep fissure between frons and nasus. Liefinck (1950) noted differences in the configuration of the rhinarium in *Libellago* species. In some species (e.g. *L. adami*, *L. greeni*, *L. indica*, and *L. lineata*), the anterior facet between the anteclypeus and the basal portion of the postclypeus is distinctly flattened in both sexes. In a few other species, the facet is absent. In other species (e.g. *L. finalis*), the facet is not distinctly flattened. *L. corbeti* has a distinctly flattened anterior facet in both sexes.

*Libellago* is widespread across Asia but is poorly represented in the Indian subcontinent. Only two taxa are found in continental India, viz. *L. indica* and *L. lineata*, which different authors rank either as subspecies or species. By contrast, Sri Lanka and the Andaman and Nicobar Islands have a rich *Libellago* fauna: the Andaman and Nicobar Islands have three species, all endemic, and Sri Lanka has four species, all endemic. Three of the Sri Lankan species, *L. adami*, *L. finalis*, and *L. greeni*, are at least locally common, but *L. corbeti* appears to be rare. No other species of *Libellago* have been reported from the immediate vicinity of the type locality of *L. corbeti*, though *L. greeni* has been reported (Bedjanič 2002) from a fast-flowing river several km away in a similar habitat at a lower elevation of 400 m. No interaction between males and females was observed, nor were they observed doing anything other than perching. In all species of *Libellago* that have been studied so far, the male raises his abdomen during courtship to display the pale spots on its dorsal surface. Since the male of *L. corbeti* has no dorsal pale spots, it is unlikely that it displays in this manner and its courtship may be unusual (A.G. Orr pers. comm.).

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