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A review of the *Teinobasis* of Sundaland, with the description of *Teinobasis cryptica* sp. nov. from Malaysia (Odonata: Coenagrionidae)

Rory A. Dow

Netherlands Centre for Biodiversity Naturalis, P.O. Box 9517, 2300 RA Leiden, The Netherlands.
<rory.dow230@yahoo.co.uk>

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Abstract

Teinobasis cryptica sp. nov. (holotype ♂: Borneo, Sarawak, Bahagian Samarahan, Kota Samarahan, old UNIMAS campus, disturbed peatswamp forest, 25 ii 2008, RMNH) from Malaysia is described from both sexes and compared with other *Teinobasis* species known to occur in Malaysia. The members of the genus known from Sundaland are reviewed. Records of *T. ruficollis* from Borneo are clarified. New records of other Bornean species are listed. The females of *T. laidlawi*, *T. rajah* and *T. ruficollis* are described for the first time. Keys are given to both sexes of all named species from the genus known from peninsular Malaysia, Singapore and the Greater Sunda Islands and the species are placed provisionally into two groups: the *laidlawi*-group and *ruficollis* -group. The former group also includes *T. rubricauda* from the Palawan region of the Philippines, which may be a junior synonym of *T. laidlawi*.

Introduction

The coenagrionid genus *Teinobasis* Kirby, 1890 is very diverse, with 66 species listed by Van Tol (2005), but far fewer species have been recorded in the Greater Sunda Islands or peninsular Malaysia. Three species of *Teinobasis* have generally been recognised as occurring on Borneo (Lieftinck 1954; Orr 2003): *T. rajah* Laidlaw, 1912, *T. laidlawi* Kimmins, 1936 and *T. suavis* Lieftinck, 1953. When the other Greater Sunda Islands and mainland Malaysia are considered, a further three species have been recorded: *T. ruficollis* (Selys, 1877) known from peninsular Malaysia, Singapore, Sumatra, the Riouw archipelago and Billiton (Lieftinck 1954), *T. kirbyi* Laidlaw, 1902, known only from two records from widely separated localities in peninsular Malaysia, and *T. euglena* Lieftinck, 1934, known from

Java, Sumatra and Engano (Lieftinck 1954). In fact *T. ruficollis* had already been recorded from Borneo (Lieftinck 1934a), but this record had been incorrectly dropped, as is discussed below.

In March 2005 the author collected a semi-teneral male of a previously unknown species of *Teinobasis* at Bako National Park in west Sarawak, Malaysian Borneo. Given its immature condition it was decided to wait until mature examples of both sexes became available before describing it. Additional specimens of both sexes were subsequently found at a number of locations across Sarawak, but it was only in February 2008 that fully mature males were collected. Additionally a female specimen from Pahang, peninsular Malaysia, previously identified as belonging to an *Amphicnemis* species (Hämäläinen 2000) was found in the collections of Naturalis, Leiden. This new species is extremely cryptic in behaviour and colouration, typically resting hanging from the underside of a leaf; it is described here as *T. cryptica* sp. nov. A review of the genus in Sundaland is given, including descriptions of previously undescribed females and keys to both sexes of all regional species.

Material and methods

Many of the specimens used in this paper were collected in Sarawak from 2005-2008 by G.T. Reels (GTR), me (RAD), and associates, and are currently in my collection (hereafter referred to as coll. RAD). Specimens from, or now in, the following institutions were also examined:
BMNH – The Natural History Museum, London;
CUMZ – Cambridge University Museum of Zoology;
RMNH – National Museum of Natural History Naturalis, Leiden, Netherlands.
Additionally the acronym UNIMAS for Universiti Malaysia Sarawak is used.

All specimens from Sarawak collected by RAD, GTR and associates from 2005-2008 and initially at least in coll. RAD have a reference code; this is only stated for type specimens and in instances where particular specimens are mentioned, e.g. where a description of a specimen is given. Specimens from coll. RAD were compared directly against specimens in the BMNH and RMNH.

All specimens were examined using stereomicroscopes. Measurements were made with the aid of a measuring eyepiece calibrated to a known scale. The illustrations were made with or with the aid of a Leica MZ16A equipped with a Leica DFC500 camera, motor focusing and LAS auto-imaging software at the RMNH, and with a Scanning Electron Microscope (SEM) at the RMNH.

Terminology used for wing venation follows that in Watson & O'Farrell (1991). The abbreviation Sg. for the Malay word Sungai, meaning stream, is used in locations.

Teinobasis of Sundaland

The *Teinobasis* species of Sundaland appear to fall into two or possibly three groups, based on wing venation, structure of the posterior lobe of the female pronotum and of the genital ligula. The first group, typified by *T. ruficollis*, is characterised by IR_3 arising separately from R_4, posterior pronotal lobe of females bearing low raised structures dorsally (Figs 3, 4) and genital ligula shaft without setae.

The second group, typified by *T. laidlawi*, is characterised by IR_3 arising directly from R_4, posterior pronotal lobe of female simple (Figs 2b, c) and genital ligula shaft with long setae (Figs 5c, e). *T. kirbyi* belongs in this group on the basis of wing venation and genital ligula structure, but its female is not known. The species of this group also share similar caudal appendages in the male (Figs 7a-c, 8a-d). The Palawan region species *T. rubricauda* Lieftinck, 1974 also belongs in this group. Lieftinck (1974) noted that *T. rubricauda* was unique amongst Philippine species of *Teinobasis* known at the time in the combination of characters Ac placed nearer Ax2 than Ax1 together with R_4 and IR_3 fused at origin. All species of the *laidlawi*-group share this combination of characters, but *T. euglena*, a *ruficollis*-group species, also has Ac placed nearer to Ax2 than Ax1. *T. rubricauda* is discussed further under *T. laidlawi*.

The position of *T. suavis* is not clear; IR_3 arises separately from R_4, and the posterior lobe of the female pronotum is slightly thickened centrally, but does not bear low raised structures. The only male specimen available is the holotype, and it has not been possible to examine the genital ligula of this specimen in sufficient detail to determine if the shaft bears setae. *T. suavis* has a very short vein 1A, which is atypical, although *T. cryptica* also has a short 1A, albeit not nearly as short as in *T. suavis*. Possibly *T. suavis* belongs in a separate species group; for this reason it is brought out separately from the other species in the keys.

The groups defined here should be considered as provisional. A thorough review of the entire genus is needed before the relationships within it can be soundly established.

Key

The female of *T. kirbyi* is unknown.

1. 1A very short, entering wing margin at level of first postquadrilateral antenodal cross vein in Fw and second in Hw ..... *T. suavis*
1'. 1A entering wing margin well distal to nodus in both wings 2
2. Upper branch of superior appendage of similar length to or longer than lower branch. IR_3 arising separately from R_4. Genital ligula shaft without setae. Female posterior pronotal lobe with raised structures dorsally (Fig. 3) ..... *ruficollis*-group 3

2'. Upper branch superior appendage much shorter than lower branch. IR_3 arising directly from R_4. Genital ligula shaft with long setae (Figs 5c, e). Female posterior pronotal lobe without raised structures dorsally (Figs 2b, c) ..... *laidlawi*-group 8

3. Males 4
3'. Females 6

4. Upper branch of superior appendage significantly longer than lower branch (Figs 8d, f) 5
4'. Upper branch of superior appendage of approximately the same length as lower branch (usually slightly shorter but can be slightly longer, as in Fig. 8e) ..... *T. rajah*

5. Lower branch superior appendage longer than inferior appendage (Fig. 8f) ..... *T. ruficollis*
5'. Lower branch superior appendage shorter than inferior appendage (Fig. 8d) ..... *T. euglena*

6. Posterior lobe of pronotum raised up from mesostigmal region of mesepisternum with upper surface at an angle to dorsal surface of median lobe (Fig. 4a) ..... *T. euglena*
6'. Posterior lobe of pronotum not raised up from mesostigmal region, upper surface almost in the same plane as upper surface of upper face of median lobe (e.g. Fig. 4b) 7

7. Free margin of posterior pronotal lobe simple (Fig. 3c) ..... *T. rajah*
7'. Free margin of posterior pronotal lobe with a central rectangular cleft with a central rectangular cleft (Fig. 3d) ..... *T. ruficollis*

8. Males 9
8'. Females 11

9. Synthorax and abdomen predominately pale. Caudal appendages as in Figures 7a, 8a ..... *T. cryptica* sp. nov.
9'. Synthorax dorsally and abdomen predominantly dark 10

10. Lower branch of superior appendage ca same length as inferior appendage (Figs 8c, d) ..... *T. laidlawi*
10'. Lower branch of superior appendage longer than inferior appendage (Fig. 8b) ..... *T. kirbyi*

11. Abdomen laterally very pale blue-green except for S8-10, contrast between these segments and the rest very strong (Plate IIa). Hw less than 23 mm ..... *T. cryptica* sp. nov.
11'. Abdomen less pale, brownish to brownish cream laterally, terminal segments darker, but contrast much less marked. Hw 23 mm or longer ..... *T. laidlawi*

Teinobasis cryptica sp. nov.
(Figs 1, 2a-b, 5a-c, 7a, 8a, Plate IIa)

Teinobasis ? new species. — Dow & Reels (2008: 3, Gunung Mulu National Park, Sarawak).
Teinobasis new species. — Dow (2008: 47-48, Samarakan, Sarawak).
Amphicnemis sp. — Hämäläinen (2000: 54, Krau Wildlife Reserve, Pahang).

Etymology

An adjective, from the Latin crypticus. Named for its cryptic colouration and behaviour.

Specimens examined

Holotype ♂ (SAR07_8_COE33), Borneo, East Malaysia, Sarawak, Bahagian Samarahan, Kota Samarahan, Old UNIMAS campus, disturbed peatswamp forest, 25 ii 2008, leg. RAD, to be deposited in RMNH (Leiden). — Paratypes, a total of 6 ♂, 8 ♀, all from Malaysia. — Sarawak: 1 ♂ (semi-teneral, SAR05_COE139), Bahagian Kuching, Bako National Park, trailside on Ulu Assam Trail, 22 iii 2005, leg. RAD; ♂ (SAR07_8_COE34), 1 ♀ (SAR07_8_COE35), data as holotype; 1 ♀ (SAR07_8_COE14), Bahagian Bintulu, Planted Forest Zone, Samarakan, Glen Forest, Sg. Philip, swampy area near stream, 27 ii 2008, leg. RAD; 1 ♀ (SAR06_COE148), Bahagian Bintulu, Planted Forest Zone, Bukit Sarang, disturbed alluvial forest, 01 iii 2006, leg. Supiandi; 1 ♀ (teneral, SAR06_COE249), Bahagian Miri, Gunung Mulu National Park, Park Headquarters area, by stream near Sg. Melinau, 09 ii 2006, leg. RAD; 1 ♀ (teneral, SAR06_COE529), same loc., by trail to Camp 5, 10 ii 2006, leg. J. Simun; 2 ♂ (teneral, SAR06_COE535, 536), same loc., park headquarters area, swamp on Night Walk Trail, 19 ii 2006, leg. RAD; 1 ♂ (teneral, SAR07_8_COE40), 1 ♀ (SAR07_8_COE41), same loc., 25 xii 2007, leg. RAD; 1 ♂ (teneral, SAR07_8_COE6), same loc., 29 xii 2007, leg. RAD; 1 ♀ (SAR07_8_COE2), same loc., 31 xii 2007, leg. RAD. —Peninsular Malaysia: 1 ♀, Pahang, Krau Wildlife Reserve, Kuala Lompat, 22-27 xi 1996, leg. M. Hämäläinen & H. Olsvik, in RMNH. Paratypes to be placed in the following collections: BMNH (London), RMNH (Leiden), and coll. RAD.

Diagnosis

An extremely slender and delicate *Teinobasis* species, predominately pale greenish coloured with the last three abdominal segments dark when mature. Easily distinguished from other *Teinobasis* species known to occur in Sundaland by the pale dorsum of the synthorax in both sexes, and details of the male terminal appendages.

Holotype male

Head: Occiput pale cream to pale yellow at rear. Labium pale except ends of hooks of labial palps, which are brown. Labrum pale cream except basally, where dark brown, this extended medially for a distance (Fig. 1a). Anteclypeus, mandible bases, genae and vertical face of frons very pale blue. Postclypeus black basally, anterior 2/3 dark brown with a central mark and lateral marks of same pale bluish colour as anteclypeus (Fig. 1a). Horizontal surface of frons bronzy black, with pale colour on genae extended narrowly beside eye margin to level of scape, a stripe of same colour running diagonally from angulation of frons up front surface of antenna base, and a spot of the same colour interior to antenna base. Antenna with scape and pedicel pale blue, pedicel brown at top, flagella missing. Rest of dorsum of head dark metallic green with a narrow pale yellow transverse stripe at extreme rear, not quite reaching the eye margins, and extended narrowly forwards at either end (Fig. 1a).
Thorax: Prothorax very pale greenish cream except for a black central band on the median lobe of the pronotum, extended onto the rear part of the anterior lobe centrally and the suture separating it from the middle lobe, forming a three branched pattern (Fig. 2a), and onto base of posterior lobe, where it expands laterally. Anterior margin of anterior lobe also black. Posterior pronotal lobe shallow, simple in form, hind margin gently curved. Synthorax almost entirely pale bluish green, slightly darker on mesepisternum, where there is a brownish tinge around the mid-dorsal carina and small narrow brown areas immediately anterior of antealar carina, which is pale blue; antealar triangles black. Venter of synthorax of similar colour to sides, but even paler. Legs short, pale cream except spines which are black, a fine dark line at lower margin of each femur and very small obscure dark marks on upper 1/2 of each tibia, claws brown. — Wings: hyaline, Fw with 11 Px, Hw with 10. Ac arising closer to Ax2 than Ax1. Fw quadrilateral long, with costal side ca half as long as anal side; Hw quadrilateral with costal side ca three-quarters anal side. R_4 arising distal to subnodus, IR_3 arising directly from R_4,

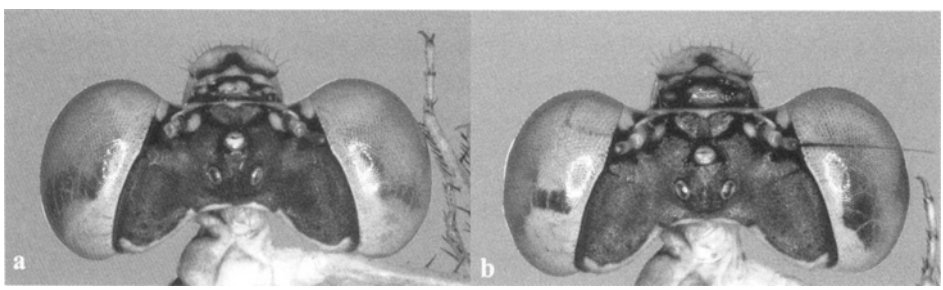


Figure 1: Head of *Teinobasis cryptica*, dorsal view — (a) holotype ♂; (b) ♀, Samarahan division, Sarawak, SAR07_8_COE35.

closer to Px1 than subnodus. 1A terminating at around level of Px4 in all wings, Pt dark brown, slightly oblique, parallel sided, covering one underlying cell, with narrow pale border inside black frame, this better defined in Hw, where whitish.
Abdomen: Very slender. S1-7 pale greyish blue-green laterally. S1 with posterior carina brown, this colouration extended dorsally and expanded on basal 3/4 of dorsum into a narrow triangle shaped mark. S2-7 with brown apical annulus. S2 dorsally with a brown mark running its length, darkest basally. S3-6 greyish brown dorsally, with narrow, medially interrupted pale basal annulus. S7 similar but dorsal brown very narrow and poorly defined on apical 1/3, a narrow black triangle, base on posterior carina, in apical 1/10. S8 almost entirely black, except for a small basal lateral blue area, S9-10 entirely black. S10 with dorsal hind margin deeply excised (Fig. 7a). — Caudal appendages: upper branches of superior appendages black, very short (ca 1/3 of lower branch), in dorsal view with inward directed projections (Fig. 7a), inner margin and tip folded downwards, leaving a hollowed area visible in lateral view (Fig. 8a). Lower branch ca as long as S10, brown with black tip that is directed slightly upwards. Inferior appendages ca same length as lower branches of superior appendages, brown, tips sharply pointed.
Measurements [mm]: Hw 19, abdomen 32 (excl. appendages), lower branch of superior appendage ca 0.4.

Female

The description is based on female SAR07_8_COE35. Very similar to male (Fig. 1b), differences noted below.
Thorax: Prothorax markings very similar to male, but differing slightly on posterior pronotal lobe (Fig. 2b).— Wings: Fw with 13 Px, Hw with 12 Px. 1A entering wing margin at around level of Px5 in Fw, Px3-4 in Hw. Pt on left in Hw pale.
Abdomen: Dorsum of S2 much paler than male, with just a brown tint, a pair of tiny basal brown spots and a poorly defined brown transverse stripe at ca 3/4 length. Brown on dorsum S3-8 paler than in male, pale basal annulus almost complete. S8 mostly dark brown, pale basally laterally and behind the posterior carina. S9 black dorsally, S10 and sides of S9 mottled brown. — Ovipositor with valves pale, anterior and posterior gonapophysis brown and visible through the valves, tip of ovipositor extending slightly beyond S10. Cerci short and thin, paraprocts rounded, featureless, nearly as long as superior appendages.
Measurements [mm]: Hw 21, abdomen without ovipositor or terminal appendages 31.5.

Genital ligula structure

The structure of the genital ligula (Figs 5a-c) was examined in three paratypes (SAR06_COE356, SAR07_8_COE6, SAR07_8_COE34). The distal part of the ter-

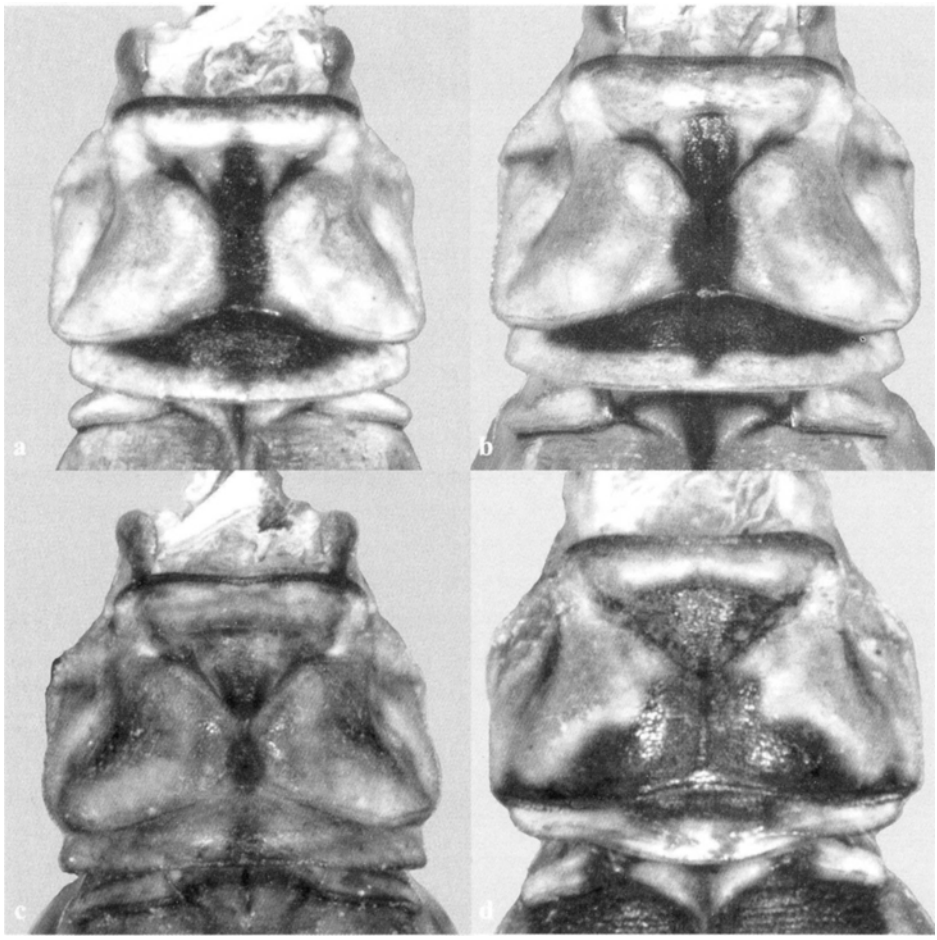


Figure 2: Prothorax of three *Teinobasis* species, dorsal view — (a) *T. cryptica* holotype ♂; (b) *T. cryptica* ♀, UNIMAS campus, Sarawak, SAR07_8_COE35; (c) *T. laidlawi* ♀, Mount Dulit, Sarawak; (d) *T. suavis* ♀, UNIMAS campus, Sarawak. — (a-c) *laidlawi*-group; (d) *suavis*-group.

minal segment is expanded laterally near its base, where it has rounded corners (Fig. 5a). There is a distinctive patch of minute spines on the basal part of the terminal segment (Figs 5a, b). The shaft bears relatively few setae (Fig. 5c, where the specimen is teneral and the terminal segment is in an atypical position).

Variation in male paratypes

The colour of S8-10 becomes darker with age, as does the Pt. In teneral males the caudal appendages are cream coloured, with just the tip of the lower branch of the

superior appendage dark. There is considerable variation in the pale markings on the post clypeus, which are entirely absent on one male, reduced or more extensive on other specimens; this variation appears to be independent of age.
Measurements [mm]: Wings with 11 Px in Fw and 10-11 Px in the Hw. Hw 18-19, abdomen (excl. appendages) 29.5-32.

Variation in female paratypes

The variation in colouration of the female paratypes from Sarawak is the same as in the males. The female from Pahang is very similar to those from Sarawak, but the central black band on the median pronotal lobe is slightly narrower, there are obscure dark marks on the femora of all legs, 1A enters the wing margin at the level of Px4-5 in the Hw, and it is slightly larger than those from Sarawak.
Measurements [mm]: Wings with 11-14 Px in the Fw and 10-12 Px in the Hw in females. Hw 20-21.5 (Pahang 22), abdomen without appendages or ovipositor 30-32.5 (Pahang 33).

Remarks

T. cryptica is the fifth species of *Teinobasis* to be recorded from Borneo, the fourth from peninsular Malaysia and the seventh from Sundaland. It probably remained undetected because of its secretive habits and cryptic colouration. It can be separated from the other regional species by the characters given in the keys, in particular it is clearly separated from *T. laidlawi*, with which it occurs sympatrically, by colouration, size and build, and details of the upper branch of the male superior appendage. It is further separated from *T. laidlawi* by the small number of setae on the shaft of the genital ligula, the rounded rear corners of the distal part of the terminal segment and the patch of minute spines on the basal part, which is absent on *T. laidlawi*. The female from Pahang is so similar to those from Sarawak that it is treated as conspecific with the specimens from Sarawak with very few reservations

Biological notes

T. cryptica occupies a variety of lowland swamp forest habitats in Sarawak. The female from Pahang was collected in a "Pandanus-swamp in lowland forest" (Hämäläinen 2000). The author has observed females apparently ovipositing into vegetation just above the surface of swamp pools. At rest both sexes hang from the underside of leaves, this habit, together with their colouration, makes them very difficult to find; most specimens are teneral and were caught after being disturbed from low perches, their shiny wings and slow flight making them unusually conspicuous. This species is almost certainly under-recorded.

Distribution

Sarawak and Pahang. The specimens from Sarawak come from locations which together span the state; it can reasonably be assumed to occur throughout Sarawak wherever lowland swamp forest habitats occur. It should occur in Brunei and should be looked for in Kalimantan and Sabah as well. It is also likely to be more widespread in peninsular Malaysia than is currently known.

Teinobasis euglena Lieftinck, 1934
(Figs 3a, b, 4a, 6a, 7d, 8e)

Teinobasis euglena Lieftinck, 1934a: 8-11, fig. 3 (♂, ♀, Sumatra, Java). — Lieftinck (1934b: 398, Java); — Lieftinck (1935a: 10, Sumatra); — Lieftinck (1939: 50, habitat in Java); — Lieftinck (1948: 285, 291-292, Engano); — Lieftinck (1954: 62, distribution, habitat); — Lieftinck (1971: 87, note on types); — van Tol (1992: 95).

Teinobasis combusta nec Selys. — Krüger (1898: 120-121, ♀ Sumatra).

Specimens examined

All from Indonesia. — Sumatra: 1 ♂, south Sumatra, Oosthaven, 03 vi 1929, leg. F.C. Drescher; 1 ♀, south Sumatra, Lampongs, Kedaton, 150 m, 23 iii 1937, leg. J.v.d. Vecht; — Engano (unknown leg.): 1 ♂, 25 v 1936; 2 ♀, 03 vi 1936; 2 ♂, 5 ♀, 11 vi 1936; — Java: 1 ♂, 1 ♀, west Java, Oedjoengkoelon, Tjigenter, 09 ix 1942, forest brook, leg. M.A. Lieftinck; 04 ♂, 02 ♀, southwest Java, Genting Bay, Oedjoeng 26-29 iii 1937, leg. M.A. Lieftinck; 1 ♂, 1 ♀, mid Java, Koebangkangkoeng, 08 ii 1931, "#482", unknown leg.; 1 ♂, 1 ♀, 14 ii 1932, "#484", same loc., unknown leg.; 2 ♀, mid Java, Djeroeklegi, 01 iii 1931, leg. F.C. Drescher; — Panaitan (unknown leg.): 1 ♂, 01 vii 1955; 1 ♀, 02 vii 1955; 1 ♀, 03 vii 1955; 1 ♀, 23 vi 1958.

Remarks

In addition to the characters mentioned in the keys, mature individuals of *T. euglena* can easily be distinguished from those of *T. rajah* and *T. ruficollis* by their colouration. Mature males of *T. euglena* are largely black, with white pruinescence on the thorax, while mature females are noticeably less red than those of the other species in this group. However, immature individuals are largely red and closely similar in general appearance to those of the other regional red species.

There is considerable variation in the raised structures of the female pronotal posterior lobe (Figs 3a, b), which are almost parallel-sided in some individuals (Fig. 3a) but with sides almost convergent at the free margin of the lobe in others (Fig. 3b).

The genital ligula of *T. euglena* (Fig. 6a) is almost identical to that of *T. rajah*, with the corners of the rear margin of the distal part of the terminal segment produced into spatulate arms.

Distribution

Widely distributed in the Greater Sunda Islands apart from Borneo, with records from Java and Sumatra, as well as from their respective satellite islands Engano and Panitan.

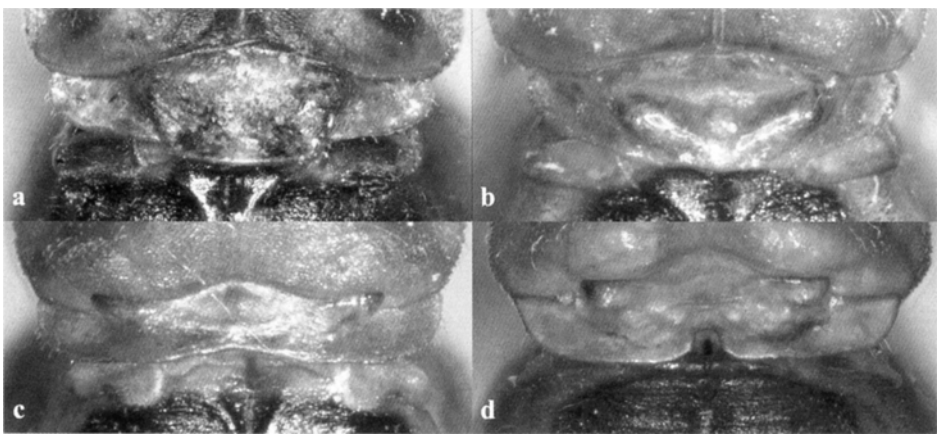


Figure 3: Pronotal posterior lobe of three *Teinobasis* species of the *ruficollis*-group, dorsal view — (a) *T. euglena* ♀, Oedjoengkoelon, W Java; (b) *T. euglena* ♀, Oedjoeng Genting Bay, SW Java; (c). *T. rajah* ♀, Maloewi, E Kalimantan; (d) *T. ruficollis* ♀, Bako National Park, Sarawak.

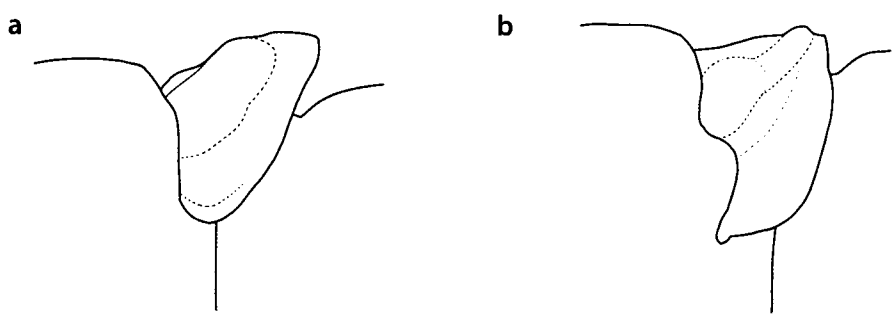


Figure 4: Pronotal posterior lobe of two *Teinobasis* species of the *ruficollis*-group, lateral view — (a) *T. euglena* ♀, Oedjoeng Genting Bay, SW Java; (b) *T. rajah* ♀; Maloewi, E Kalimantan.

Teinobasis kirbyi Laidlaw, 1902
(Fig. 8b, Plate IIb)

Teinobasis kirbyi Laidlaw, 1902: 386-387 (♂ incomplete, Gunung Inas, Perak). — Laidlaw (1931a: 202); — Lieftinck (1934a: 11); — Kimmins (1936: 97, fig. 14, comparison *T. laidlawi*); — Lieftinck (1954: 62, distribution); — van Tol (1992: 133-134); — Orr (2005: 9); — Wilson & Gibert (2005: 28, record from Endau Rompin, Malaysia); — Wilson & Gibert (2006: 1, 4, 6, fig. 5, listed from Endau Rompin, photograph of male).

Specimens examined

Holotype ♂: Malaysia, Perak, Gunung Inas, Skeat Expedition, exact date of collection unclear, in CUMZ.

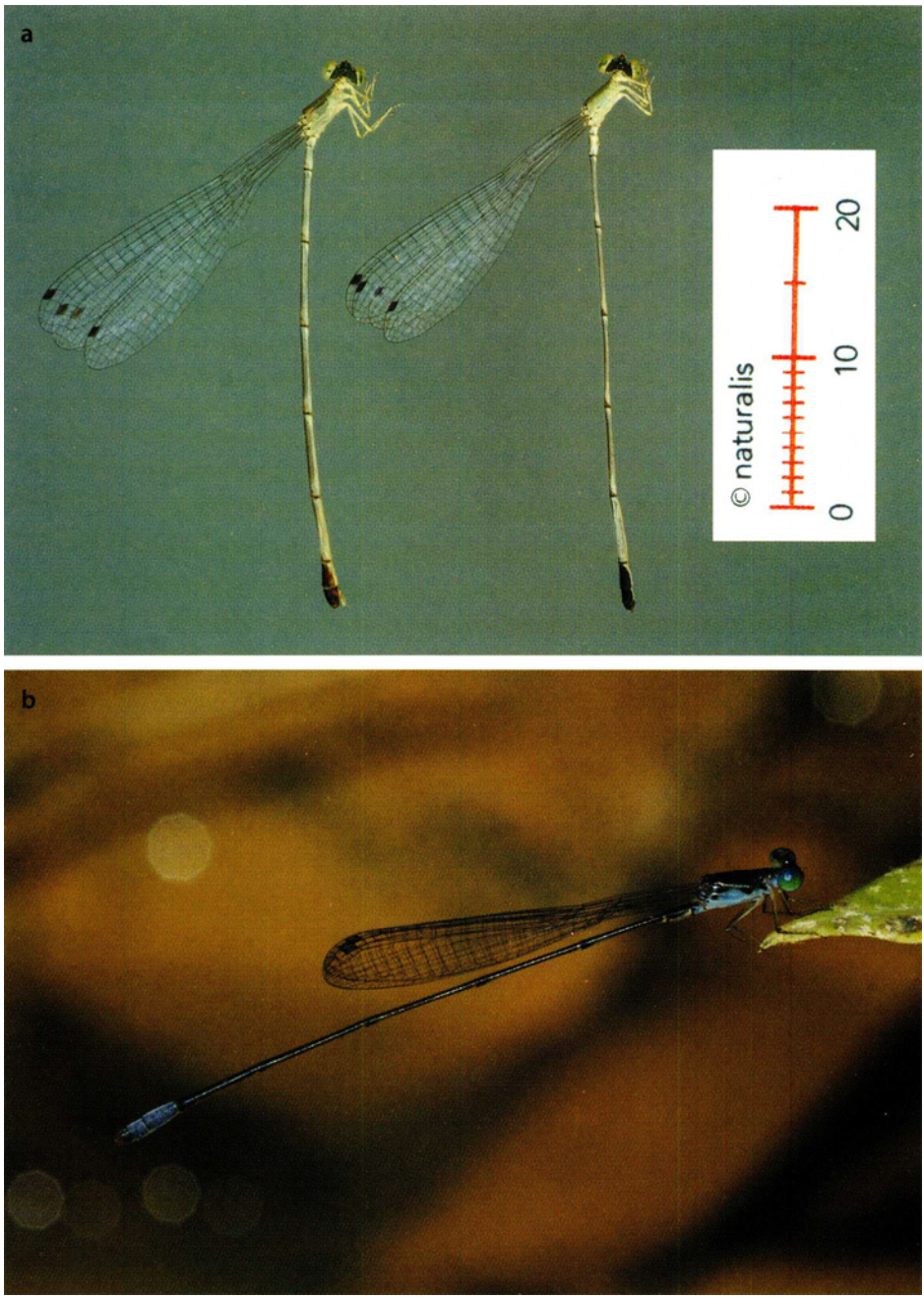
Remark

Until 2005 this species was known only from a single male, missing the terminal segments of the abdomen, collected more than a century ago. The condition of the specimen has deteriorated since the original description; the head and both Hw are now also missing. The colouration and wing venation of *T. kirbyi* are extremely similar to that of *T. laidlawi*. Kimmins (1936) considered the possibility that *T. kirbyi* and *T. laidlawi* are synonymous when he described *T. laidlawi*, but rejected it because of small differences in the markings of the synthorax, in the shape of the posterior lobe of the pronotum and in the genital ligula, as well as tiny and probably meaningless differences in wing venation. Kimmins' (1936) illustration of the genital ligula appears to show better-developed structures at the corners of the rear margin of the distal part of the terminal segment than in *T. laidlawi*. Unfortunately the genital ligula, already said to be "not in good condition" (Kimmins 1936), is now obscured by glue over its dorsal and much of its lateral surfaces, obscuring many features. However, as far as they are visible, the structures in question do appear to be longer, and possibly different in structure, compared with those of *T. laidlawi*. All other differences visible in the holotype of *T. kirbyi* could be considered likely to be the result of geographical intraspecific variation rather than interspecific variation.

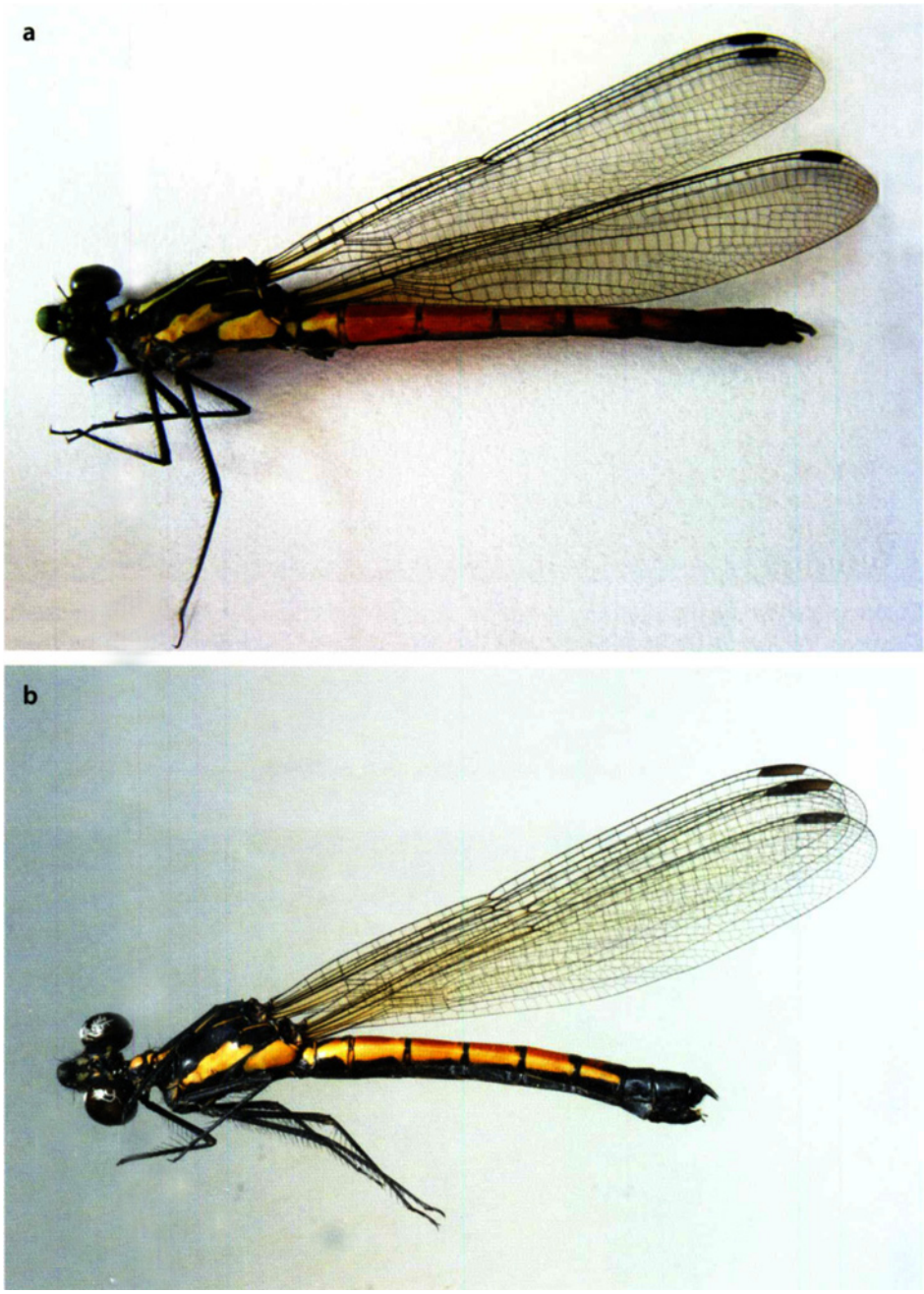
Wilson & Gibert (2005) recorded *T. kirbyi* from Endau Rompin National Park, Johor, Malaysia. This record was based on a single male (K.D.P. Wilson pers. comm.) collected on 10 i 2005. Unfortunately the specimen could not easily be located, but K.D.P. Wilson has provided sketches of the caudal appendages; the lateral view is reproduced in a slightly modified form here as Figure 8b, and a photograph in life (Plate IIb). The caudal appendages of the Endau Rompin speci-

Colour plate Ia: *Tetracanthagyna plagiata* F stadium female larva consuming a halfbeak fish, *Dermogenys pusilla*, before discarding head; 31 March 2010 in Singapore. Note specialised raptorial labial palps. Photo by TML.

Colour plate Ib, c: *Crenigomphus kavangoensis* sp. nov. — (b) mature male, 19 December 2004; (c) mature female, 29 November 2006 – both at N'Kwazi Lodge near Rundu, Okavango River, Namibia. Photos by FS.



Colour plate II: Two *Teinobasis* species — (a) *T. cryptica* sp. nov., holotype ♂ (right) and paratype ♀ (UNIMAS campus, Sarawak, SAR07_8_COE35); (b) *T. kirbyi* ♂, Endau Rompin National Park, Johor Bahru, Malaysia. Photos by Klaas-Douwe Dijkstra (a) and Keith Wilson (b).



Colour plate III: *Indocypha catopta* sp. nov. — (a) holotype male; (b) paratype female. Both were collected on a fast flowing rocky stream in the Maolan National Nature Reserve, Guizhou Province, China, in July 2008.

Colour plate IVa: *Zygonyx torridus*, a typical migrant and colonizer; Wadi Sidi Harazem, Morocco, 23 July 2010. Patrolling males are powerful and swift fliers. Photo by Jean-Pierre Boudot.

Colour plate IVb: *Ophiogomphus spinicornis* ♂, a species confined to eastern Central Asia, at the Erzin River (loc. 53), Tuva, Siberia, 12 July 2000. Photo by OK.

men are very similar to those of *T. laidlawi*, but the lower branch of the superior appendage is significantly longer. In dorsal view the upper branches of the superior appendages and shape of the lower branches are virtually identical to those of Sarawak *T. laidlawi* (Fig. 7c). Additionally the caudal appendages of the Endau Rompin specimen are distinctly reddish apart from at the tips; *T. laidlawi* from Sarawak often have slightly reddish caudal appendages, but apparently this colouration is not as strong as in the Endau Rompin specimen, and the dark tips are better defined. Given the differences in the genital ligula of the holotype, and the superior appendages of the Endau Rompin specimen, it appears best to maintain *T. kirbyi* and *T. laidlawi* as distinct species, although they are clearly very closely related. Some doubt must remain as to whether the Endau Rompin specimen is the true *T. kirbyi*; however, given the condition of the holotype, some doubts would remain even if fresh specimens from the type locality become available.

Biological notes

The Endau Rompin specimen was collected at a small shady forest pool. This habitat is identical to that in which *T. laidlawi* is typically found.

Distribution

T. kirbyi is known only from peninsular Malaysia (Johor and Perak). It should also be looked for in southern Thailand and southern Myanmar.

Teinobasis laidlawi Kimmins, 1936

(Figs 2c, 5d, e, 7b, c, 8c, d)

Teinobasis laidlawi Kimmins, 1936: 95-97, figs 13, 14 (holotype and paratype ♂, Malaysia, Sabah, Bettotan, paratype ♂, Malaysia, Sarawak, Lio Matu). — Lieftinck (1954: 62 and footnote 1 on same page, distribution, habitat, record SE Borneo); — Kimmins (1970: 187, note on holotype); — Lieftinck (1974: 131, comparison with *T. rubricauda*); — van Tol (1992: 135); — Orr (2003: 39, 88, plate 9a)
Teinobasis superba nec Selys.— Laidlaw (1918: 231, ♂, Sarawak).
Teinobasis kirbyi nec Laidlaw.— Laidlaw (1920: 237-238, fig. 4, ♂, Sarawak).
Teinobasis species. — Laidlaw (1931b: 249, Sabah).

Specimens examined

Type specimens: (all in BMNH) Holotype ♂, Malaysia, Sabah, Sandakan Bay area, Bettotan, 23 vii - 17 viii 1927, leg. C. Boden Kloss, H.M. Pendlebury; 1 para-

type ♂, Malaysia, Sarawak, Bahagian Miri, Upper Baram area, Lio Matu, 04 xi 1914, leg. J.C. Moulton. — **Other specimens:** Malaysia, Sarawak, in coll. RAD unless noted otherwise: 2 ♂, Bahagian Sri Aman, Batang Ai National Park, branch of Bebiong Mit Trail leading to Sg. Bebiong Besar, forest pool, 04 xii 2007, leg. RAD; 1 ♂, same area, Bebiong Mit Trail, small forest pool, 07 xii 2007, leg. RAD, in ethanol in RMNH (RMNH_INS_228949); 1 ♂, same loc. and date, leg. GTR; 2 ♂, 1 ♀ (one pair in tandem), Bahagian Miri, Mount Dulit, small pool in clearing on lower slopes, 28 iii 2006, leg. RAD; 3 ♂, 1 ♀ (one pair in tandem), same mountain, small pools in disturbed forest at ca 300 m, 01 ix 2008, leg. RAD; 1 ♂, Bahagian Miri, Gunung Mulu National Park, Summit Trail between plankwalk and Sg. Melinau Paku ford, muddy pool in lowland forest, 11 i 2008, leg. RAD; 2 ♂, same loc., 10 ix 2008, leg. RAD. — Malaysia, Sabah: 3 ♂, loc. as holotype, 31 vii 1927, in BMNH; Sandakan area, 1 ♂, Sepilok, 31 ix 1957, leg. J.L. Gressitt, in RMNH; 1 ♂, Danum Valley, lotus pond, 150 m, 23-28 iv 1994, leg. M. Hämäläinen, in RMNH; 1 ♂, 1 ♀, Quoin Hill, Tawau, 09-20 vii 1962, leg. Y. Hiroihima, in RMNH. — Indonesia, Kalimantan, all in RMNH: 1 ♂, 1 ♀, SE Kalimantan, Sangkoelirang area, Kariorang, v 1937, leg. J.W. Quarles de Quarles; 7 ♂, 2 ♀, same loc., iv 1937, leg. M.E. Walsh; 5 ♂, 2 ♀, same data but vi 1937; 2 ♀, same area, Pelawan besar, v 1937, leg. M.E. Walsh; 1 ♂, 1 ♀, same area, Maloewi, v 1937, leg. M.E. Walsh; 4 ♂, SE Kalimantan, Sg. Mentawir, 01-26 x 1950, unknown leg.; 1 ♀ S Kalimantan, Tanggarong, Mount Pandjung, 02 vii 1937, leg. M.E. Walsh.

Female

The description is based on female SAR07_8_COE185, Sarawak, Mount Dulit, 01 ix 2008.

Head: Labium pale except end hooks of labial palps, which are brown. Labrum orange-brown with a black central basal mark and black border except at free margin. Genae and mandible bases pale. Anteclypeus largely pale with a pair of poorly defined brown patches. Postclypeus black with poorly defined pale brown marks in a transverse central row. Vertical face of frons pale. Horizontal face of frons and most of rest of dorsum bronzy black; frons with pale marks around antennae base as in *T. cryptica* female. Pale colour from genae extended narrowly along eye margin as in *T. cryptica*. Scape dark brown with pale annulus at top; pedicel brown except to rear away from top, where pale grey; flagellum (missing on left) dark brown. Occiput pale, yellowish cream beneath genae, becoming pale orange-brown to rear, this extended narrowly onto dorsum at rear as a transverse band, shaped as in *T. cryptica* female, but with shallow forward pointing extensions near eye margins slightly wider.

Thorax: Prothorax with pronotum mottled pale greyish brown, with anterior carina of anterior lobe black and poorly defined black patches laterally on the median lobe and centrally on rear part of all lobes. Propleuron dirty cream. Synthorax

with mesepisternum orange-brown with obscure greyish areas (possibly artefacts of preservation) and mid-dorsal carina and most of antealar triangles very dark brown. Colour of mesepisternum continued onto lateral synthorax, but becoming paler further down, dirty cream on metepimeron and venter. Legs coloured very like those of *T. cryptica*, but with a narrow dark stripe along lower half of extensor surface of all femora, and on the outer extensor surface of all tibiae, this broadest and best defined on anterior tibia. — Wings: part of rear margin of right Fw missing. Fw with 15 Px, Hw with 13 Px. Ac much nearer to Ax2 than Ax1. Quadrilateral long, especially in Hw, with costal side slightly less than ½ of anal side in Fw and ca 2/3 of anal side in Hw. R_4 arising distal to subnodus; IR_3 arising directly from R_4, closer to Px1 than subnodus. 1A entering wing margin at level of Px10 in left Fw, at Px8-9 in Hw. Pt orange-brown with paler border, proximal side entering wing margin at acute angle, distal side gently curved and entering wing margin at a slightly obtuse angle, covering one underlying cell.

Abdomen: All segments very dark brown to black dorsally. S1-7 laterally cream (S1-2) to brownish cream (S7); S3-5 with a grey streak along the basal 1/2 to 2/3 of the segment except at extreme base. Posterior carina of S1 largely black. S2-6 with a brown apical annulus, but this less well defined on successive segments. S8 laterally brown, with black from dorsum extending onto side in apical half, dirty cream behind posterior carina. S9 largely black at side, but with a poorly defined

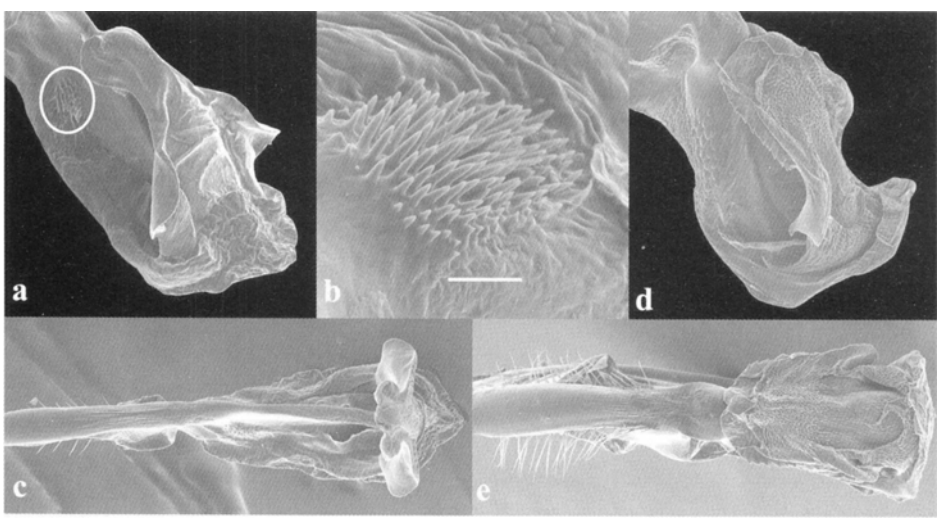


Figure 5: Genital ligula of two species of the *laidlawi*-group — (a) *T. cryptica*: patch of minute spines circled, ventro-lateral view, SAR07_8_COE6 from Gunung Mulu National Park, Sarawak; (b) same: detail of spines on basal part of terminal segment, SAR07_8_COE34 from UNIMAS campus, scale bar 20 µm; (c) same: ventral view, SAR06_COE536 from Gunung Mulu National Park, Sarawak; (d) *T. laidlawi*: ventro-lateral view, Kariorang, E Kalimantan; (e) same: ventral view.

central brown mark. S10 almost entirely black, except narrowly at sides along apical margin, where brown. — Cerci and paraprocts brown, similar to those of *T. cryptica*. Ovipositor rich brown, tip at ca level of tips of cerci.
Measurements [mm]: Hw 25, abdomen without appendages or ovipositor 36.5.

Remarks

Kimmins (1936) omitted the shape of the pterostigma from his description of male *T. laidlawi*. In all specimens examined the pterostigma is shaped as in the female described above, in contrast to the other species known from Sundaland, where it is typically parallel-sided. Kimmins already noted the variability in the extent of black markings laterally on the synthorax of the male, but failed to note that there is variation in the profile of S10 of the abdomen (Figs 8c, d) and the dorsal view of the upper branch of the superior appendage (Figs 7b, c). In the known populations from Sarawak, and some eastern populations S10 and the cerci are as shown in Figs 7c, 8d, but in other eastern populations they are as shown in Figures 7b, 8b.

Mature eastern females, especially those from Kalimantan, have much more extensive dark markings on the pronotum, and on the mesepisternum, than in the female described above.

The genital ligula of *T. laidlawi* bears many setae on the shaft (Fig. 5e), and has the corners of the rear margin of the distal part of the terminal segment not rounded but angulated and slightly produced to the rear (Fig. 5d).

As was noted by Lieftinck (1974), *T. laidlawi* is closely allied to *T. rubricauda* from the Palawan region of the Philippines, with records from Palawan and Dumaran (Hämäläinen & Müller 1997), from which it differs in colouration. Lieftinck stated that *T. rubricauda* also differs in the structure of the male caudal appendages, but these are identical to those of males from Sarawak and some eastern populations. The genital ligula of *T. rubricauda* appears to be identical to that of *T. laidlawi*, as does the wing venation.

Biological notes

T. laidlawi appears to be a rather local species, occurring at pools in lowland forest in flat terrain, but perhaps more commonly in hilly terrain. It is easily overlooked as it flies low in shady situations; it is likely to be under-recorded.

Distribution

This species appears to be confined to Borneo (but see remarks above on *T. rubricauda*), where there are now records from east Sabah, Sarawak east of the Lupar River and east and southeast Kalimantan.

Teinobasis rajah Laidlaw, 1912
(Figs 3c, 4b, 6b, 7e, 8f)

Teinobasis rajah Laidlaw, 1912: 97 (♂, Sarawak). — Laidlaw (1920: 338); — Laidlaw (1931b: 249, Sabah); — Lieftinck (1935b: 248, footnote 1 on same page); — Lieftinck (1954: 63, distribution, habitat); — Kimmins (1970: 191, lectotype designated); — van Tol (1992: 191); — Norma-Rashid et al. (2001: 142, Tasek Bera, Pahang); — Orr (2001: 186, Brunei); — Orr (2003: 39, 88, fig. 128); — Orr (2005: 9, 41, illus. ♂ appendages lateral).

Teinobasis leonorae Lieftinck, 1937: 97-99, fig. 22, ♂, Penang (?); junior synonym (Lieftinck 1954: 63, footnote 2).

Specimens examined

Type specimens: Lectotype ♂, Malaysia, Sarawak, Bahagian Limbang, 22 vi 1911, leg. J.C. Moulton, in BMNH. — **Other specimens:** Malaysia, Sarawak, in coll. RAD except where noted: 1 ♂, Bahagian Bintulu, Planted Forest Zone, Samarakan, stream in highly disturbed forest at acacia nursery, 05 iii 2006, leg. RAD; 1 ♂, same area, Glen Forest, disturbed backwater of Sg. Philip, 07 iii 2006; 2 ♂ (one in ethanol in coll. RMNH, RMNH_INS_229075), same area, swampy area adjacent to Sg. Philip, 27 ii 2008; 3 ♂, same loc. and date, leg. R. Ragai; 1 ♀, same area, Sg. Gagak (stream in acacia plantation), 03 iii 2008, leg. RAD; 1 ♂, Bahagian Bintulu, Planted Forest Zone, Bukit Sarang, disturbed alluvial forest, 15 x 2008, leg. RAD; 3 ♂, Bahagian Miri, Niah National Park, Trail to Sg. Tangas Longhouse, seasonal swamp forest, 08 v 2005, leg. RAD; 3 ♂, Bahagian Miri, Bakong River, Sg. Balansai (second order tributary of Bakong), 08 iv 2005, leg. RAD; 2 ♂, Bahagian Miri, Loagan Bunut National Park, Hydrology Trail, disturbed peatswamp forest, 4 iv 2008, leg. RAD. — Malaysia, Sabah: 2 ♂, Jesselton, 24 vii and 20 xi 1966, leg. P. Roch, in BMNH. — Indonesia, SE Kalimantan, all in coll. RMNH except where noted: 15 ♂, 4 ♀, Sangkoelirang area, Kariorang, vi 1937, leg. M.E. Walsh; 1 ♂, 1 ♀, same area, Maloewi, v 1937, leg. M.E. Walsh; 4 ♂, 5 ♀, same area, Pelawan besar, v 1937, leg. M.E. Walsh; 1 ♂, same loc., vi 1937, leg. M.E. Walsh; 4 ♂, same area, Sampajan, v 1937, leg. M.E. Walsh; 2 ♂, same loc., 09 vi 1937, leg. M.E. Walsh; 9 ♂, Sg. Mentawir, 7-23 x 1950, unknown leg.; 3 ♂, same loc., 07-21 x 1950, unknown leg., in BMNH.

Female

The description is based on a female from E Kalimantan, Sangkoelirang, Maloewi, v 1937.

Head: Labium entirely pale. Labrum, clypeus and vertical face of frons orange, mandible bases slightly paler orange, genae cream coloured. Dorsal surface of

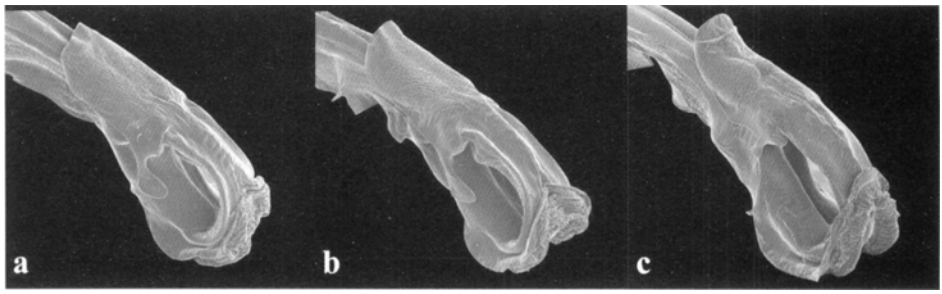


Figure 6: Genital ligula of three *Teinobasis* species of the *ruficollis*-group, ventro-lateral view of terminal segment — (a) *T. euglena*, Oedjoengkoelon, W Java; (b) *T. rajah*, Samarakan, Sarawak; (c) *T. ruficollis*, Samarahan division, Sarawak.

head mostly dark metallic green, metallic black to front, with much of the horizontal face of the frons, between the level of the antenna bases, orange, but with an anterior black spot centrally. Narrow orange stripes from front of lateral ocelli towards rear of antennae, not reaching level of antennae. A narrow orange transverse band along the occipital ridge behind the ocelli. Antenna with scape and pedicel orange, flagellum brown. Occiput largely black, except below genae, where cream.

Thorax: Prothorax entirely orange. Posterior pronotal lobe narrow, bearing a transverse raised structure occupying the central ca 2/3 of the lobe seen dorsally, its lateral extremities well defined, acutely pointed, pressed up against the middle lobe, its rear margin gently curved, the whole widest centrally where it is only narrowly separated from the free margin of the lobe (Fig. 3c). Free margin of posterior pronotal lobe simple. Synthorax with mesotigmal plates with rear edge slightly raised up centrally (visible in Fig. 3c). Most of mesepisternum occupied by a broad, brilliant metallic dark greenish blue band, extending to the antealar carina, and occupying ca 5/6 of the width for most of its length. Antealar triangles orange, their frame largely black. Rest of synthorax orange, becoming paler and more yellowish lower on the sides. Legs entirely orange cream except for brown spines. Tarsal claws with a tiny rudimentary tooth. — Wings with 13 Px in Fw, 12 Px in Hw. Ac nearer to Ax1 than Ax2, Fw quadrilateral with costal side very short, ca 1/4 of anal side. Hw quadrilateral with costal side slightly more than half length of the anal side. 1A entering wing margin at level of Px8, CuP at level of Px10. Pt covering slightly less than one underlying cell, pale orange-brown, almost parallel sided.

Abdomen: Dark brown to black in upper half, brownish cream below on S1-7, the boundary of the two shades well defined, paler lateral colour extended upwards as a narrow medially interrupted basal annulus. S8-10 with dorsum black, sides brown. Cerci shorter than S10, paraprocts rounded and featureless. Ovipositor

yellowish brown, styli brown, tip extending to beyond S10, just before level of tips of cerci.

Measurements [mm]: Hw 19, abdomen without appendages or ovipositor 28.5.

Remarks

The only published records of *T. rajah* from outside of Borneo are that of the holotype of the synonymous *T. leonorae*, a specimen bought from Staudinger, labelled as collected in Penang (Lieftinck 1937: 97), and that in Norma-Rashid et al. (2001) of a single specimen from Tasek Bera in Pahang; the sex of this specimen is not stated. I have been unable to find any representative of *T. rajah* from peninsular Malaysia in either the BMNH or RMNH, and C.Y. Choong (pers. comm.) has not collected this species in more than four years of fieldwork in Malaysia. It appears that *T. rajah* is at best a scarce species in peninsular Malaysia, and some doubts must remain about its occurrence there unless fresh specimens are collected.

The genital ligula of *T. rajah* (Fig. 6b) is almost identical to that of *T. euglena*.

Distribution

Sabah and Sarawak east of the Lupar River, Brunei, south and south-east Kalimantan, peninsular Malaysia (Penang and Pahang).

Teinobasis ruficollis (Selys, 1877)

(Figs 3d, 6c, 7f, 8g)

Telebasis ruficollis Selys, 1877: 113, 119-120 (♂, Singapore).— Laidlaw (1902: 387); — Ris (1927: 25, Sumatra); — Laidlaw (1931a: 202); — Lieftinck (1934a: 11, Borneo, Singapore, Riouw Archipelago, Sumatra); — Lieftinck (1935a: 10, Durian Island, Riouw Archipelago) — Lieftinck (1954: 63, Billiton added to distribution); — van Tol (1992: 198); — Murphy (1997: 338, 344, Singapore); — Orr (2005: 9, 41, illus ♂ lateral, dorsal thorax and head and lateral terminal appendages); — Norma-Rashid et al. (2008: 5, Singapore).

Specimens examined

Malaysia, Pahang, all in RMNH: 1 ♂, Krau Wildlife Reserve, Kuala Lompat, 31 i 1996, leg. M. Hämäläinen; 7 ♂, same loc., 22-27 ii 1996, leg. M. Hämäläinen, H. Olsvi. — Malaysia, Sarawak, in coll. RAD unless noted: 1 ♂, Bahagian Kuching, Lundu, in toilet at petrol station, 19 ii 2008, leg. J. Allcock; 1 ♂, Bahagian Kuching, Kuching, Sama Jaya Nature Reserve, in forest, 22 ii 2008, leg. RAD; 1 ♂, Bahagian

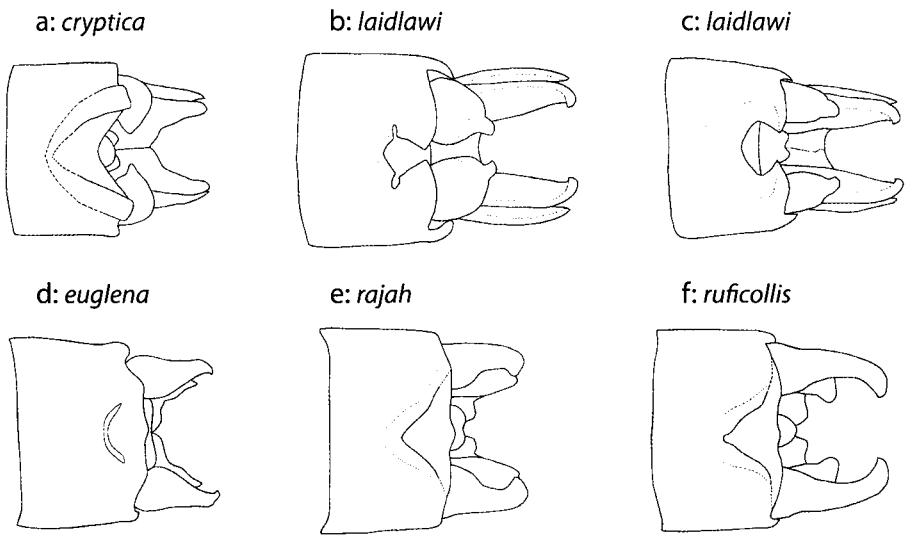


Figure 7: S10 and caudal appendages of males of five *Teinobasis* species, dorsal view — (a) *T. cryptica* holotype; (b) *T. laidlawi*, Kariorang, E Kalimantan; (c); *T. laidlawi*, Mount Dulit, Sarawak; (d) *T. euglena*, after Lieftinck (1934a: fig. 3); (e) *T. rajah*, Niah National Park, Sarawak; (f) *T. ruficollis*, Bako National Park, Sarawak. — (a-c) *laidlawi*-group; (d-f) *ruficollis*-group.

Kuching, Bako National Park, flooded area near park accommodation, 20 iii 2005, leg. RAD; 1 ♂, 1 ♀ (in tandem), same national park, low pH swamp forest at start of Tanjong Sapi Trail, 24 v 2005; 2 ♂ (one now in coll. UNIMAS), Bahagian Samarahan, Kota Samarahan area, brackish highly disturbed swamp forest to rear of mangrove, 20 iii 2005, leg. RAD; 2 ♂, same area, Sg. Semawang, by stream in strip of highly disturbed forest, 20 iii 2005, leg. RAD; 1 ♂, same area, old UNIMAS campus, disturbed peatswamp forest, 30 v 2005, leg. RAD; 1 ♂, same location, 24 i 2006, leg. RAD; 3 ♂ (one in ethanol in coll. RMNH, RMNH_INS_229072), 25 ii 2008, leg. RAD. — 1 ♂, Indonesia, W Kalimantan, Singkawang, in house, 09 ii 1933, leg. L. Coomans de Ruiter, in RMNH. — Indonesia, Billiton, all leg. F.J. Kuiper, all in RMNH: 1 ♂, Mendanan island, 04 ii 1936; 1 ♂, Tandjong Pandan, 21 xii 1936; 2 ♂, same location, 27 i 1937.

Female

The description is based on female SAR05_COE46, Sarawak, Bako National Park, 20 iii 2005. Very similar to that of *T. rajah*, differences noted below.

Head: Horizontal face of frons orange, without anterior black spot.

Thorax: Posterior lobe of pronotum shallow, but deeper centrally than that of *T. rajah* female, with a similar raised transverse structure, but with free margin

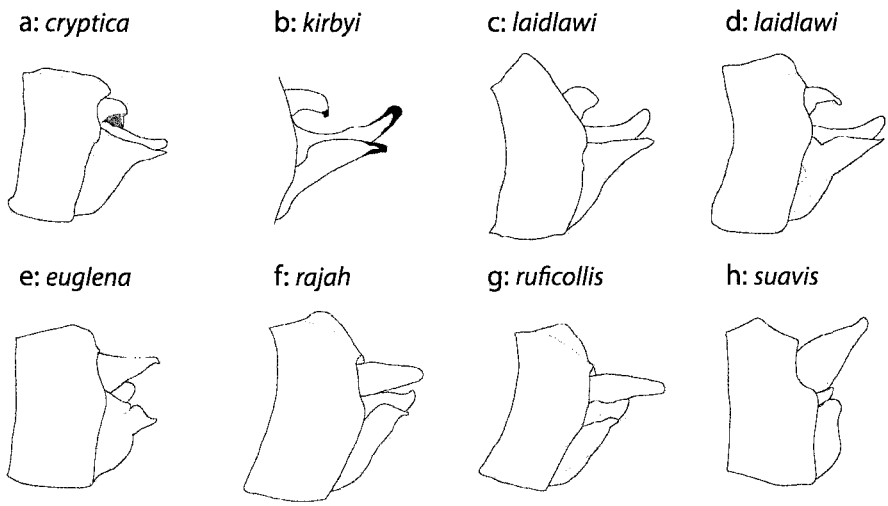


Figure 8: S10 and caudal appendages of males of five *Teinobasis* species, lateral view — (a) *T. cryptica* holotype; (b) *T. kirbyi* Endau Rompin, adapted from a sketch made by K.D.P. Wilson (unpubl.)); (c) *T. laidlawi*, Kariorang, E Kalimantan; (d) *T. laidlawi*, Mount Dulit, Sarawak; (e) *T. euglena*, after Lieftinck (1934a: fig. 3); (f) *T. rajah*, Niah National Park, Sarawak; (g) *T. ruficollis*, Bako National Park, Sarawak; (h) *T. suavis* holotype, after Lieftinck (1953: fig. 5). — (a-d) *laidlawi*-group; (e-g) *ruficollis*-group.

of lobe with a deep and narrow (ca 1/16 of width) central rectangular excision (Fig. 3d). Mesostigmal plates with rear margin not raised. Mesepisternum with dark central band coloured as in *T. rajah* and occupying ca 2/3 of the width for most of its length. — Wings with 13 Px. Fw quadrilateral with costal side short, ca 1/3 of anal side. Hw quadrilateral with costal slightly more than half of the anal side. 1A entering wing margin at level of Px7 in Fw, Px8 in Hw; this part of wing margin missing on right.

Abdomen: S8 with a broad black band occupying most of dorsum, sides orange, S9-10 almost entirely orange, with just a narrow and poorly defined dark streak mid dorsally from ca 1/5-3/5 segment length and a very narrow basal dorsal transverse stripe. Cerci only slighter shorter than S10 measured along dorsal surface.

Measurements [mm]: Hw 21, abdomen without appendages or ovipositor 32.

Remarks

Lieftinck (1934a) includes Borneo in the range of this species, stating "I have seen specimens ... from W. Borneo, ..." Lieftinck made no mention of this species from Borneo again, and the island was not included in the distribution of the species as stated in the Handlist of Malaysian Odonata (Lieftinck 1954). It has not been recorded from Borneo again until the records listed above, nor has it

been recognised as occurring in Borneo, e.g. it is omitted from the list of Bornean species in Orr (2003). There is one male *T. ruficollis* from west Kalimantan, collected in 1933, in the RMNH collections, this is presumably the, or one of the, specimen(s) to which Lieftinck (1934) was referring.

The genital ligula of *T. ruficollis* (Fig. 6c) is similar to that of *T. euglena* and *T. rajah*, with the most significant difference being the smaller and differently orientated process at the rear corners of the distal part of the terminal segment. The transverse ridge on the distal part of the terminal segment visible in Figure 6c may be an artefact or have been rendered easier to see by the coating process prior to making the SEM image. It is difficult to tell if such a structure is present or not on other specimens examined with a stereomicroscope; in these circumstances it cannot be considered to be a reliable diagnostic character.

Distribution

Northwest Kalimantan, Sarawak west of the Lupar River, Sumatra and Durian Island in the Riouw Archipelago, Singapore, peninsular Malaysia (Pahang).

Teinobasis suavis Lieftinck, 1953

(Figs 2d, 8h)

Teinobasis suavis Lieftinck, 1953: 244-246, fig. 5 (♂, ♀, Kalimantan). — Lieftinck (1954: 63, distribution); — Lieftinck (1971: 115, note on types); — van Tol (1992: 215); — Orr (2003: 39, 88).

Specimens examined

Type specimens: Holotype ♂: Indonesia, southeast Kalimantan, Ampah, 11 v 1948, leg. L.S. Liong. Paratypes: 2 ♀, same loc. and collector as holotype, 29 iv 1948; 2 ♀, same data but 03 v 1948; 1 ♀, same area and collector, Ranamun, 21 v 1948. All in RMNH. — **Other specimens:** 1 ♀, Malaysia, Sarawak, Bahagian Samarahan, Kota Samarahan area, old UNIMAS campus, disturbed peatswamp forest, 25 ii 2008, leg. RAD, in coll. RAD.

Remark

This species stands somewhat apart from the other species known from Sundaland in its small size and extremely reduced vein 1A. The female from Sarawak is referred here with some reservations, although it agrees with the type series in most regards, it does differ in some small details of colouration, and is smaller:

abdomen without appendages 26 mm, Hw 16 mm compared with 26.5-28 mm and 17.5-18.5 mm respectively in the female paratypes. These differences probably represent minor variation, but at least until males are found at the same location, the possibility that the female is that of an unnamed species cannot be ruled out. The female illustrated in Figure 2d is that from Sarawak, the prothorax of the female paratypes differ in that the dark markings on the pronotum are less extensive.

The posterior pronotal lobe of *T. suavis* differs in structure from all other species considered here: the central part is slightly thickened, but without distinct raised structures as seen in *ruficollis*-group species.

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References

Dow, R.A., 2008. Odonata of the "Glen Forest" at Samarakan, Bintulu Division, Sarawak, Malaysian Borneo. Agrion 12: 46-48.

Dow, R.A. & G.T. Reels, 2008. List of species recorded at Gunung Mulu National Park, Sarawak, Malaysian Borneo in 2005-2006. Echo 5: 2-3.

Hämäläinen, M., 2000. Ten species added to the list of Peninsular Malaysian Odonata. Notulae Odonatologicae 5: 53-55.

Hämäläinen, M. & R.A. Müller, 1997. Synopsis of the Philippine Odonata, with lists of species recorded from forty islands. Odonatologica 26: 249-315.

Kimmins, D.E., 1936. The Odonata of the Oxford University Sarawak expedition. Journal of the Federated Malay States Museum 18: 65-108.

Kimmins, D.E., 1970. A list of the type-specimens of Odonata in the British Museum (Natural History). Part III. Bulletin of the British Museum (Natural History), Entomological Series 24: 173-205.

Krüger, L., 1898. Die Odonaten von Sumatra. I. Theil. Familie Agrioniden. Stettiner Entomologische Zeitung 59: 64-139.

Laidlaw, F.F., 1902. On a collection of dragonflies made by members of the Skeat expedition in the Malay Peninsula in 1899-1900. Part II. Coenagrioninae. Proceedings of the Zoological Society of London 1902: 381-389.

Laidlaw, F.F., 1912. List of the Odonata taken on an expedition to Mt. Batu Lawi together with descriptions of supposed new species. Journal of the Straits Branch of the Royal Asiatic Society 63: 92-99, 1 pl.

Laidlaw, F.F., 1918. Some additions to the known dragonfly fauna of Borneo, with an account of new species of the genus *Coeliccia*. Proceedings of the Zoological Society of London 1918: 223-232.

Laidlaw, F.F., 1920. Contributions to the study of the dragonfly fauna of Borneo. Part IV. A list of species known to occur in the island. Proceedings of the Zoological Society of London 1920: 311-342.

Laidlaw, F.F., 1931a. Dragonflies of the Malay Peninsula with descriptions of new species. Journal of the Federated Malay States Museums 16: 175-233.

Laidlaw, F.F., 1931b. Revised list of the dragonflies of Borneo. Journal of the Federated Malay States Museums 16: 234-250.

Lieftinck, M.A., 1934a. Descriptions of five new species of Agrionidae from Java (Odonata). Stylops 3: 6-17.

Lieftinck, M.A., 1934b. An annotated list of the Odonata of Java, with notes on their distribution, habits and life-history. Treubia 14: 377-462.

Lieftinck, M.A., 1935a. A synopsis of the Odonata (Dragonflies) of Sumatra. Miscellanea Zoologica Sumatrana 92/93: 1-23.

Lieftinck, M.A., 1935b. The dragonflies (Odonata) of New Guinea and neighbouring islands. Part III. Descriptions of new and little known species of the families Megapodagrionidae, Agrionidae and Libellulidae (Genera Podopteryx, Argiolestes, Papuagrion, Teinobasis, Huonia, Synthemis, and Procordulia). Nova Guinea 17: 203-300, figs 1-50.

Lieftinck, M.A., 1937. Descriptions and records of South-east Asiatic Odonata. Treubia 16: 55-119.

Lieftinck, M.A., 1939. On the true position of the genus *Orolestes* McLach., with notes on *O. wallacei* (Kirby), its habits and life-history (Odon., Lestid.). Treubia 17: 45-61.

Lieftinck, M.A., 1948. The Odonata of Engano with a survey of the dragonfly-fauna of the West Sumatra chain of islands. Treubia 19: 279-304.

Lieftinck, M.A., 1953. Additions to the odonate fauna of the Indo-Australian archipelago. Treubia 22: 233-269.

Lieftinck, M.A., 1954. Handlist of Malaysian Odonata. A catalogue of the dragonflies of the Malay Peninsula, Sumatra, Java and Borneo, including the adjacent small islands. Treubia (Supplement) 22: i-xiii, 1-202.

Lieftinck, M.A., 1971. A catalogue of type-specimens of Odonata preserved in The Netherlands, with a supplementary list of the Odonata types described by Dutch scientists deposited in foreign institutional collections. Tijdschrift voor Entomologie 114: 65-139.

Lieftinck, M.A., 1974. Dragonflies collected by the Noona Dan Expedition in the southwestern Philippine Islands (Insecta, Odonata). Steenstrupia 3: 111-147.

Murphy, D.H., 1997. Odonata biodiversity in the nature reserves of Singapore. Garden's Bulletin, Singapore 49: 333-352.

Norma-Rashid, Y., A. Mohd-Sofian & M. Zakaria-Ismail., 2001. Diversity and distribution of Odonata (dragonflies and damselflies) in the freshwater swamp lake Tasek Bera, Malaysia. Hydrobiologica 459: 135-146.

Norma-Rashid, Y., L.F. Cheong, H.K. Lua & D.H. Murphy, 2008. The dragonflies (Odonata) of Singapore: current status records and collections of the Raffles Museum of Biodiversity Research, Singapore, 21 pp. Available from: <http://rmbr.nus.edu.sg/raffles_museum_pub/Dragonfly_of_Singapore.pdf>. [Accessed 7 November 2008].

Orr, A.G., 2001. An annotated checklist of the Odonata of Brunei with ecological notes and descriptions of hitherto unknown males and larvae. International Journal of Odonatology 4: 167-220.

Orr, A.G., 2003. A guide to the dragonflies of Borneo: their identification and biology. Natural History Publications (Borneo), Kota Kinabalu.

Orr, A.G., 2005. Dragonflies of Peninsular Malaysia and Singapore. Natural History Publications (Borneo), Kota Kinabalu.

Ris, F., 1927. Odonaten von Sumatra, gesammelt von Edward Jacobson. Zoologische Mededeelingen 10: 1-49.

Selys Longchamps, E. de, 1877. Synopsis des Agrionines, 5^{me} legion: *Agrion* (suite et fin). Les genres *Telebasis*, *Argiocnemis* et *Hemiphlebia*. Bulletins de l'Académie Royale de Belgique (2nd Séries) 43: 97-159.

van Tol, J., 1992. An annotated index to names of Odonata used in publications by M.A. Lieftinck. Zoologische Verhandelingen 279: 1-263.

van Tol, J., 2005. Global Species Database Odonata. Available from: <http://www.odonata.info.> [Accessed 24 November 2009].

Watson, J.A.L. & A.F. O'Farrell, 1991. Odonata (dragonflies and damselflies). In: Naumann, I.D., P.B. Carne, J.F. Lawrence, E.S. Nielsen, J.P. Spradbery, R.W. Taylor, M.J. Whitten & M.J. Littlejohn (eds) "The insects of Australia", 2nd Edition, Melbourne University Press, Melbourne, pp. 294-310.

Wilson, K.D.P. & E. Gibert, 2005. Endau-Rompin 20-24 July '04. Echo 3: 26-28.

Wilson, K.D.P. & E. Gibert, 2006. Survey of Odonata at Endau-Rompin, Peninsular Malaysia. Report submitted to Johor National Parks Corporation and Malaysian Nature Society (MNS Johor Branch).