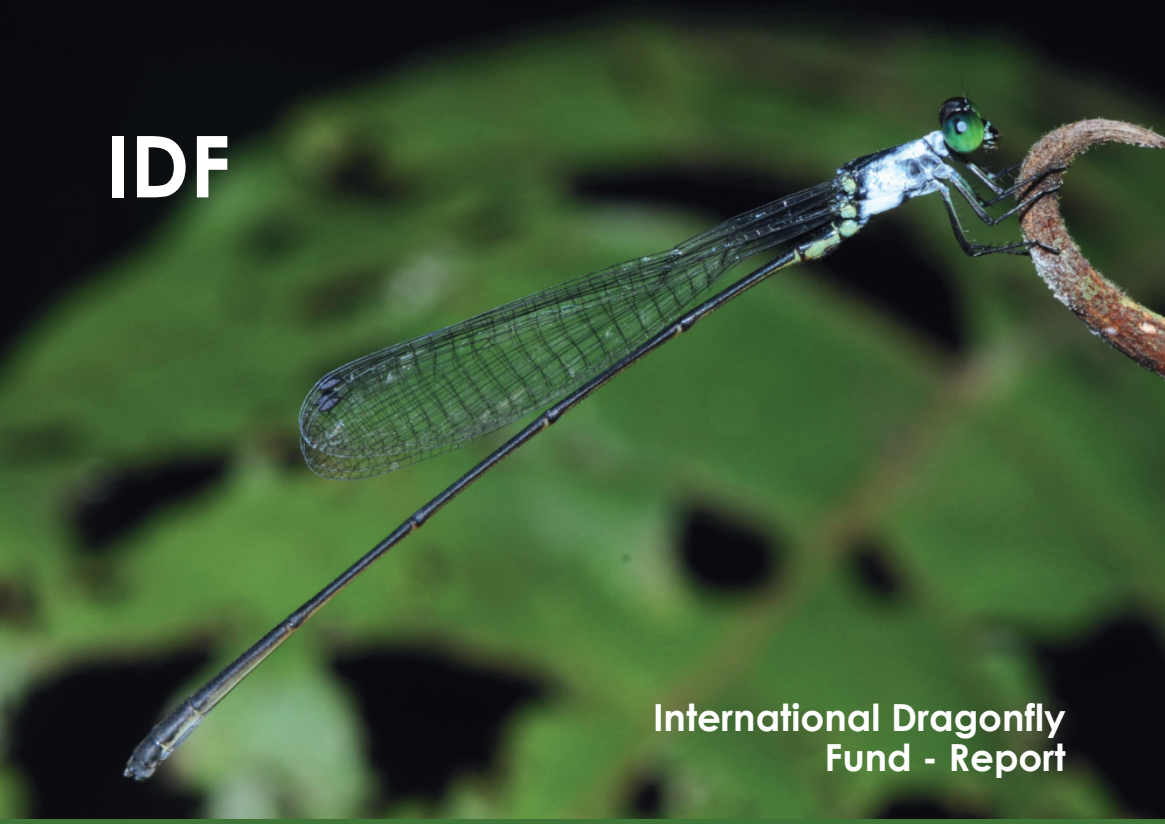

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Seven new species of *Teinobasis* Kirby from Papua New Guinea (Zygoptera: Coenagrionidae)

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Abstract

Damselflies of the genus *Teinobasis* Kirby, 1890 reach their greatest diversity on mainland New Guinea and adjacent islands. Here we describe seven new *Teinobasis* species from central and western Papua New Guinea (PNG): *Teinobasis aurantiaca* sp. nov., *T. caelestis* sp. nov., *T. fragillima* sp. nov. and *T. glossa* sp. nov. from the Purari River basin in southern PNG, *Teinobasis wau* sp. nov. and *T. marginata* sp. nov. from the Kikori and Fly-Strickland River basins respectively in southern PNG, and *Teinobasis livida* sp. nov. from the upper Sepik River basin in northwestern PNG. We also describe the hitherto unknown female of *T. debeauxi* Lieftinck, 1938 and a previously undescribed character that is useful for distinguishing males of *T. debeauxi* from similar congeners. Diagnostic characters of the males and females (if available) are illustrated, comparisons with similar congeners are presented, and habitat photos are provided.

Key words: Damselflies, New Guinea, rainforest, taxonomy, Zygoptera

Introduction

With 36 named species from the region (Theischinger & Richards 2017, 2020) *Teinobasis* is one of the most diverse genera of Zygoptera in New Guinea. These generally small, dull-coloured insects are an inconspicuous element of most odonate assemblages because of their tendency to perch motionless for long periods, often in shaded undergrowth, taking to the wing only when disturbed. The reproductive behaviour of *Teinobasis* species remains poorly known. *Teinobasis* cf. *nigrolutea* from Micronesia breeds in phytotelmata (Kalkman & Orr 2016) but it is likely that most species breed in 'normal' aquatic habitats because they are most frequently encountered adjacent to forest pools and slow-flowing streams (Kalkman & Orr 2013, 2016) and Lieftinck (1953) reported an unidentified *Teinobasis* species ovipositing in submerged root mats in a stream containing only isolated puddles filled with rainwater.

Teinobasis debeauxi Lieftinck, 1938 is a slender damselfly normally found perching in the undergrowth of lowland forest in southern New Guinea. It was described from the Astrolabe Range near Port Moresby (Lieftinck, 1938), but Lieftinck (1949) also reported the species from southern Papua Province in western Indonesia without providing precise locality data. Subsequently this species has been documented at numerous sites in Gulf Province

of south-central Papua New Guinea, at least partially filling the gap between the type locality and Lieftinck's (1949) record from western, formerly Dutch New Guinea (Richards et al. 2018).

While examining material of *Teinobasis* collected by SJR from both southern and northern mainland New Guinea it became apparent that some material previously identified as *T. debeauxi* represented species that were undescribed. Of the seven new taxa treated here, five have extensive yellow/orange coloration on the head and thorax. We describe, in alphabetic order, these species below, followed by two other novel *Teinobasis* species from the south and the north of New Guinea's Central Cordillera, bringing to 43 the number of *Teinobasis* species known from the region.

Material and methods

Descriptive terminology largely follows Chao (1953) and Watson & O'Farrell (1991). Coloration is given as discerned from live photographs and from the preserved material. All line illustrations were executed with the aid of a camera lucida and are not to scale. Coordinates are presented using the GPS datum WGS 84. Material is lodged in the collection of the South Australian Museum, Adelaide, Australia (SAMA). Abbreviation: S = abdominal segment/s.

We first provide new information on *Teinobasis debeauxi*, then describe the five species exhibiting yellow/orange coloration on the thorax and head. This is for convenience and does not imply that these species form a monophyletic group. Finally, we describe two species lacking extensive yellow/orange coloration.

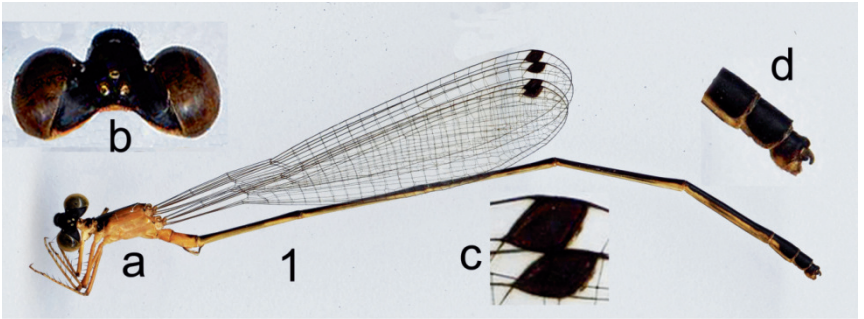
***Teinobasis debeauxi* Lieftinck, 1938**

Figures 1-4, 14-17

Teinobasis debeauxi Lieftinck, 1938. Nova Guinea (N.S.) 2: 113.

Material

All Papua New Guinea, Gulf Province. Purari River basin: 1♂ (SAMA 07-001702), Purari Site 1 (7.1464°S, 145.1408°E; 100 m a.s.l.), 21-i-2016, 1♀ (SAMA 07-001703), 1♂ (SAMA 07-001704), same data but 22-i-2016 and 24-i-2016 respectively; 1♂ (SAMA 07-001705), Purari Site 2 (7.2085°S, 145.1153°E; 95 m a.s.l, 28-i-2016; 3♂ (SAMA 07-001706-708), Purari Hydro Camp 7 (7.4502°S, 145.2829°E; 200 m a.s.l.), 22-23-ii-2012; 1♂ (SAMA 07-001709), Purari Hydro Camp 5, 12-x-2011, 2♂ (SAMA 07-001710-711), same details but collected 11-x-2011; 1♂ (SAMA 07-001712), Purari Hydro Camp 2 (6.8938 S, 144.9058 E; 90 m a.s.l.), 18-x-2011; 1♀ (SAMA 07-001713), Purari Hydro Camp 8 (6.9438 S, 145.1031 E; 90 m a.s.l.), 23-vi-2012, 1♀ (SAMA 07-001714), same details but 25-vi-2012, 1♂, 1♀ (SAMA 07-001715-716), same details but 26.vi.2012. Kikori River basin: 3♀ (SAMA 07-001717-719), Veiru (7.4692°S, 144.2280°E; 55 m a.s.l.), 30-iv-2017; 1♂ (SAMA 07-001720), Veimake Camp (7.4074°S, 144.2088°E; 15 m a.s.l.), ii-v-2017; 1♂, 1♀ (SAMA 07-001721-722), Wau Creek (7.1216°S, 144.3739°E; 20 m a.s.l.), 22-iv-2017, 1♀ (SAMA 07-001723), same details but 24-iv-2017, 2♂, 1♀, (SAMA 07-001724-726), same details but 25-iv-2017; all S.J. Richards, deposited in SAMA.



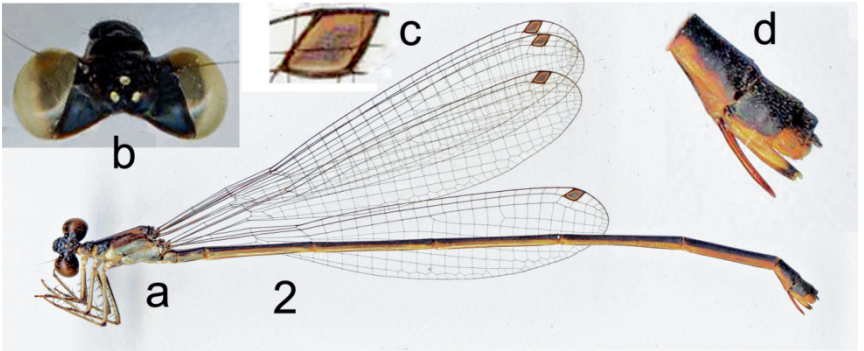


Fig. 1. ***Teinobasis debeauxi*** **Lieftinck, male, (a) habitus, with (b) head, (c) pterostigmata and (d) terminalia inset.**

Fig. 2. ***Teinobasis debeauxi*** **Lieftinck, female, (a) habitus, with (b) head, (c) pterostigma and (d) terminalia inset.**

Fig. 3. ***Teinobasis debeauxi*** **Lieftinck, male, photo by S.J. Richards.**

Fig. 4. *Teinobasis debeauxi* Lieftinck, female, photo by S.J. Richards.

Diagnosis

A large black and orange/yellow species with much of face and pronotum very dark and dorsum of synthorax orange with metallic greenish-black median band, narrow dorsally but broadly expanding laterally and ventrally so as to cover lower portion of mesanepisternum, most of mesokatepisternum and often part of mesepimeron. Pterostigma very close to rhomboidal but rounded. Abdomen largely black, in male only S1 and S2 largely and S1 of female, laterally, orange. The distinct synthoracic pattern described may be obscured by more expansive darkening in collected (dried or fixed) specimens (Fig. 2), but is usually clearly seen in life (Figs 3, 4).

Male (Figs 1, 3, 14-17)

Agrees well with Lieftinck's (1938) description of colour pattern and morphology. Postnodals 17-18/15-17. Terminalia (Figs 15-17) with anal tergite (Figs 16, 17), not figured by Lieftinck, trapezoidal, wider basally than apically, bilobed, lobes somewhat variable, widely triangular to rounded.

Measurements – Hindwing 28.0-31.1 mm, abdomen + anal appendages 46.1-52.7 mm.

Female (Figs 2, 4)

Head (Fig. 2) – Labium pale cream-coloured; face almost entirely black, except in some specimens variably intense yellow tending to pale bluish on anterior 1/3 of labrum, base of mandibles and genae to base of antennae, anteclypeus and thin line along anterior margin of postclypeus, a transverse elongate wedge-shaped mark each side on anterior frons, and small portion of face of antennal base, scape and pedicel. Tip of mandibles and antennal flagellum, vertex, postocular lobes and occiput black. Postgenae and post-occipital region cream-coloured.

Prothorax – Largely black, but pleura fading into bluish grey laterally and ventrally.

Synthorax (Fig. 2) – Pleura largely pale greyish brown, fading into greyish to dull yellow and even pale bluish particularly posterior to interpleural suture; dorsum of synthorax with black median band, narrow dorsally, widening continuously laterally, ventrally and posteriorly to cover most of mesokatepisternum and approximately ventral 1/6 of mesepimeron and radiating indistinctly along much of mesopleural suture; spiracular dorsum, antealar ridge and sinus, some narrow lines on and along subalar ridges and humeral plates also black or very dark. Older specimens much darker, with paler areas and patches described above less clear or not at all evident because of blackish grey covering anterior half of synthorax as far back as mesopleural suture; areas described above as black remain clear to see. Thoracic terga greyish yellow to greyish brown, postcoxae largely black and poststernum black and dull yellow. Coxae yellow with greyish brown to black posterobasal patch, trochanters yellow, femora pale to dark yellow, in some specimens distinctly darkened/black at knees, tibiae pale to dull yellow, lined black for most of length, tarsi and claws dull yellow and pale greyish brown, spines dark brown to black. Wings with membrane hyaline, venation blackish brown to black and pterostigma (Fig. 2) greyish brown, almost rhomboidal, less rounded than in male, with postero-proximal and antero-distal angles markedly narrower than antero-proximal and postero-distal angles, higher than adjacent costal cells and overlying single cell; postnodals 13-18/12-17.

Abdomen (Fig. 2, 4) – Largely black. Sides of S1 and S2 pale bluish in some preserved specimens, yellow in life. S3-S8 dorsally black, laterally dull yellow to pale greyish brown, this pale coloration slightly broader at the base of each segment; S7-S9 with intersegmental membrane dull yellow; tergite 9 and dorsal 1/2 of S10 black, sternite 9 and ventral 1/2 of S10 dark yellow to orange. Ovipositor (Fig. 2) reaching well beyond end of S10, outer valve dark to dull yellow with tip black, terebra long, straight, medium brown; anal appendages and supra-anal plate black; anal lamina pale yellow.

Measurements – Hindwing 26.4-32.5 mm, abdomen including ovipositor 37.0-50.1 mm.

Distribution

Our new records confirm that *T. debeauxi* has a broad distribution across southern Papua New Guinea, from the Port Moresby region in the east to at least the Kikori River basin in the west. The status of the *T. debeauxi* population in the former Dutch New Guinea (now Indonesia) reported by Lieftinck (1949) requires confirmation.

New species with extensive yellow/orange coloration on the thorax and face

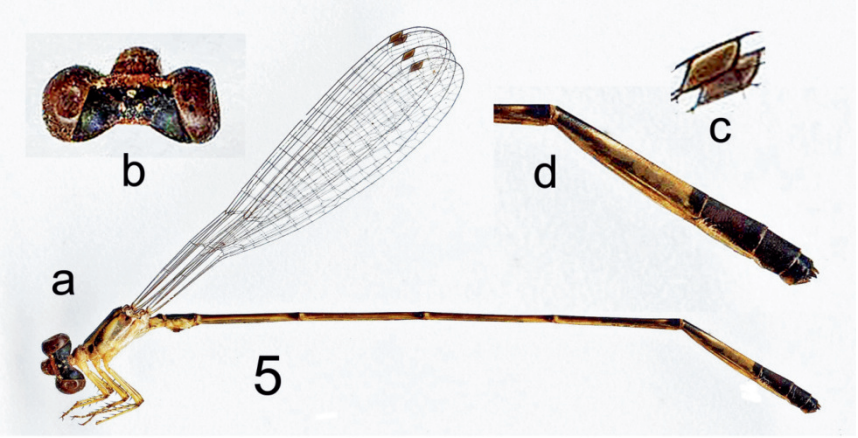
***Teinobasis aurantiaca* sp. nov**.

Figures 5-10

Material

Holotype ♂ (SAMA 07-001727): Papua New Guinea, Gulf Province. Purari River basin. Purari Site 5 (7.3126°S, 145.1378°E; 20 m a.s.l.), 1-vii-2016, S.J. Richards and P. Toko; deposited in SAMA.

Paratypes – All Papua New Guinea, Gulf Province. Purari River basin. 1♂, 1♀ (SAMA



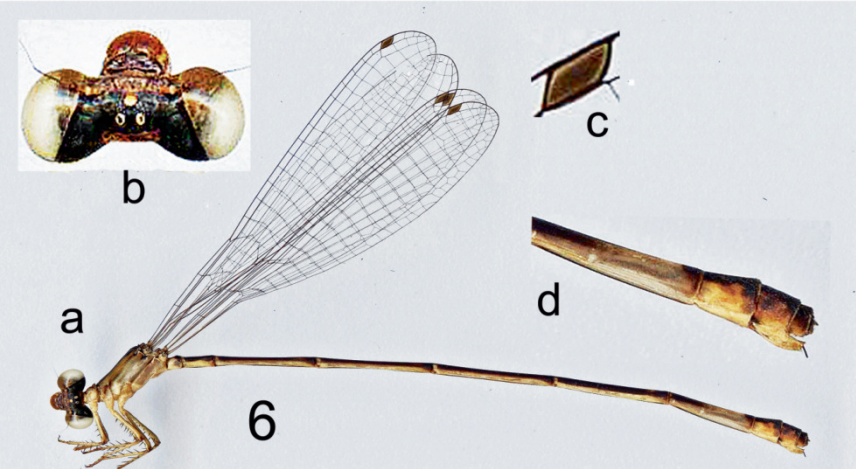
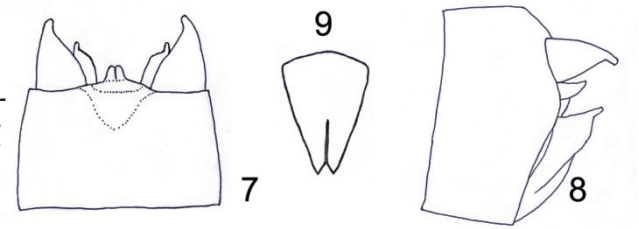


Fig. 5. ***Teinobasis aurantiaca*** **sp. nov., holotype male, (a) habitus, with (b) head, (c) pterostigmata and (d) terminalia inset.**

Fig. 6. ***Teinobasis aurantiaca*** **sp. nov., female, (a) habitus, with (b) head, (c) pterostigma and (d) terminalia inset.**



Figs 7-9. ***Teinobasis aurantiaca*** **sp. nov., holotype male: (7, 8) terminalia: (7 dorsal; (8) lateral; (9) anal tergite, caudal.**

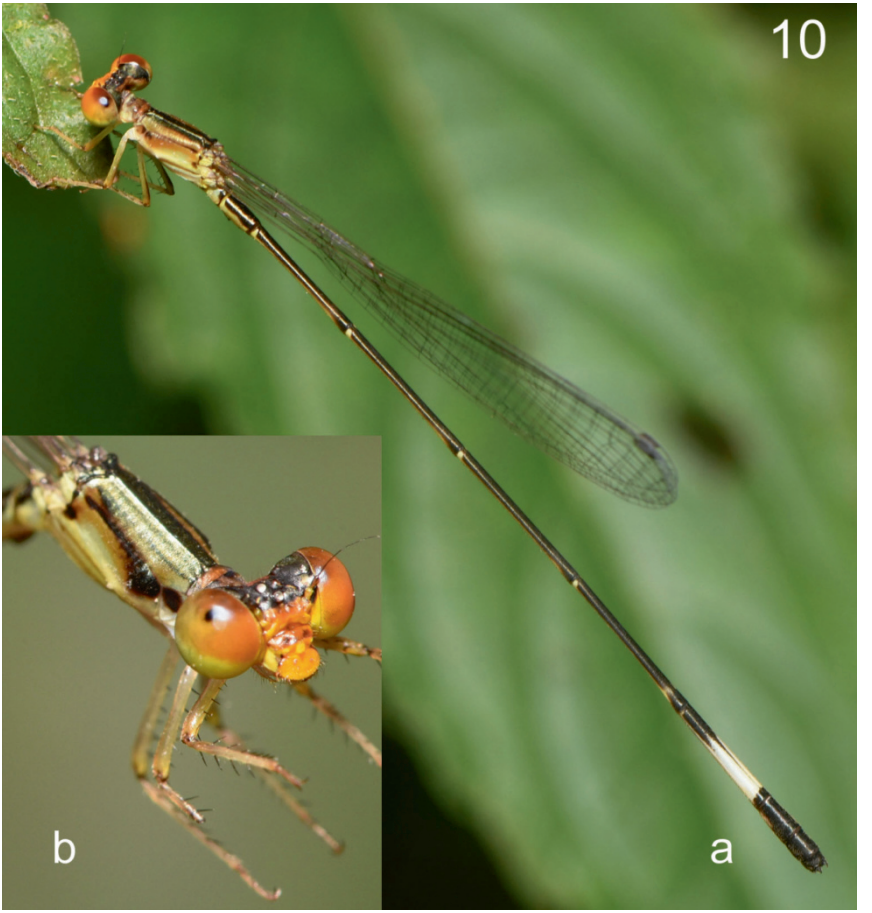


Fig. 10. *Teinobasis aurantiaca* sp. nov., male (a) dorsolateral view in life, (b) frontal view inset, photos by S.J. Richards.

07-001728-729), same details as holotype; 2♀ (SAMA 07-001730-731), same details as holotype but 22-vi-2016; 4♂, 4♀ (SAMA 07-001732-739), Purari Site 7 (7.6506°S, 145.2621°E; 45 m a.s.l.), 3-5-vii-2016; 1♂ (SAMA 07-001740), Purari Site 8a (7.7892°S, 145.2664°E; 5 m a.s.l.), 14-vii-2016. 1♀ (SAMA SAMA 07-001741), Purari Site 4 (7.3518°S, 145.1904°E; 30 m a.s.l.), 10-ii-2016. Kikori River basin. 1♀ (SAMA 07-001742), Veiru Creek (7.4692°S, 144.2280°E; 55 m a.s.l.), 2-v-2017; 2♀ (SAMA 07-001743-744), Wau Creek (7.1216°S, 144.3739°E; 20 m a.s.l.), 23-iv-2017; all S.J. Richards and P. Toko; deposited in SAMA.

Etymology

The species name is the Latin adjective *aurantiacus, -a, -um*, meaning orange, referring to the bright orange face and eyes of the male of the new species.

Diagnosis

A largely black and orange/yellow species, the male with face and much of eyes orange, at least in life, bi-coloured (orange and yellow) dorsum of synthorax, a dark (brown and black) humeral/posthumeral patch, extensive pale markings on S6 and particularly on S7, and terminalia with short conical upper branch of superior anal appendages/cerci distinctly longer than postero-dorsally directed, apically attenuated inferiors/paraprocts.

Holotype – Male (Figs 5, 7-9)

Head (Fig. 5) – Labium and postgenae yellow to intense orange; all of face just beyond and including antennal base and occipital edge light orange with mandibular base and genae tending to yellow, postclypeus and pedicel tending to brown; top of head, including most of frons, vertex, occiput and postocular lobes black except for small pale orange line laterally about halfway between antennal base and lateral ocellus.

Prothorax – Notum largely yellowish grey, blackish grey at posterior portion of median lobe, and in centre of posterior lobe which is widely convex to wide-angled postero-medially; pleura very pale yellow; legs pale yellowish with only femur very slightly darkened at knee, spines black.

Synthorax (Fig. 5) – Lateral pleura largely dull orange to pale yellow. Dorsum of synthorax with median metallic black stripe, somewhat wider than half of each mesanepisternum, including much of spiracular dorsum, subalar sinus and ridge and flanked laterally by substantial orange brown antehumeral patch, reaching from antealar ridge to brown lateral section of spiracular dorsum which it covers, and a black humeral line that widens in anterior/ventral half and nearly connects with black patch covering much of ventral portion of mesepimeron and most of mesokatepisternum; this black humeral patch merges through brown into overall pale orange-yellow covering almost all of remaining pleura; only small to tiny patches of black occur along and on subalar ridges, along small dorsal section of interpleural and metapleural sutures and along dorsal edge of metapostepimeron. Humeral plates dark brown, terga pale yellowish, postcoxae and poststernum pale to dull yellow. Legs much as for prothorax, coxae with indistinct patches of darker grey, metatibia somewhat lighter on inner face. Wing membrane hyaline, venation greyish to brownish black; pterostigma sepia, slightly sloping, approximately 1.5 times as long as wide and overlying one cell; postnodals 12/12.

Abdomen (Fig. 5) – S1 largely yellow, except black pear-shaped patch dorsally. S2-S6 largely blackish brown or black dorsally and laterally, but with posterior 1/10-1/8 of S3-S6 definitely black, latero-ventrally yellow, this pale coloration slightly widened at base of each segment and including a subapical lateral yellowish smudge on S6; S7 dorsally and laterally black for anterior slightly more than 1/3 and apical 1/10, in between and ventrally whitish yellow to dark yellow; S8-10 dorsally and laterally black, ventrally pale to bright yellow. Sternites generally greyish yellow. Terminalia (Figs 7-9): segment 10 with depressed caudo-medial area of dorsum rather indistinct, small; superior anal appendages brownish black to black, dorsal branch about twice as long as slightly upturned and hooked lower branch; inferiors about 2/3 length of superiors, with short attenuated tip, colour brownish yellow over brown to blackish brown at tip; anal tergite (Fig. 9) trapezoidal, split at about mid-length into two narrow parallel sided, pointed lobes.

Measurements – Hindwing 21.8 mm; abdomen (including anal appendages) 36.5 mm.

Female (Fig. 6), based on most mature specimen.

Head (Fig. 6) – Much as in male, but all pale areas tending to brown instead of yellow/orange, particularly labrum; postclypeus greyish to almost blackish brown. Antennal flagellum black.

Prothorax – Pronotum much as in male, but black posterior patch each side of median lobe and posterior lobe without median darkening, with posterior margin slightly and widely convex; pleura and leg much as in male, but femur indistinctly lined with brownish grey.

Synthorax (Fig. 6) – Much as in male but with median metallic black stripe somewhat narrower and framed each side by wider more substantial orange brown antehumeral stripe, the black humeral line vestigial, but black re-appearing as small patch at anterior/ventral end of mesepimeron and covering most of mesokatepisternum; black dots/patches and overall coloration of remaining pleura as well as terga and sterna much as in male. Legs much as in male, but femora lined with brownish grey. Wings much as in male, but with 12-13/12 postnodals.

Abdomen (Fig. 6) – S1-S7 much as in male, but pale yellow between black base and apex of S7; S8-10 largely black dorsally and dorso-laterally, merging without clear definition into dark to bright yellow ventro-laterally; sternites 3-7 yellowish- to brownish grey, sternite 8 largely yellow, black along midline. Ovipositor (Fig. 35) reaching to end of abdomen, valve dull yellow, terebra obscured. Supra-anal plate and anal appendages greyish brown to black, inferior anal lamina pale brown.

Measurements – Hindwing 25.4 mm, abdomen (including ovipositor) 38.8 mm.

Variability

The seven male and additional 10 female paratypes are less mature than the holotype and the most mature paratype picked for the description of the female. They differ from the descriptions above as follows: Face, occipital edge and pronotum very pale to pale greyish brown. Synthorax with black restricted to median stripe on dorsum and small marks along dorsal margin of lateral pleura; antehumeral and humeral/posthumeral region in varying shades of pale greyish brown. Remainder of synthorax generally yellowish white, in some specimens almost bluish white. Dark lining of female femora varies from hardly discernible to pale grey. Pterostigma in some specimens very pale brownish grey. Abdominal segments 1-6 dorsally and laterally largely greyish to blackish brown, the pale ventro-lateral coloration including expansion at segment bases, yellow in the holotype, paler yellow, smudge on S6 barely visible. Segment 7 brownish grey on anterior 1/4 to more than 1/2 of segment and on posterior 1/8 of segment. Anterior 3/4 of S8, S9 and S10 may be wholly whitish yellow, only laterally whitish or whitish yellow in ventral 1/4 with remainder greyish brown. There are 13-14/11-14 postnodals in males, 12-13/11-13 in females. Length of hindwing: male 20.7-24.5 mm, female 21.5-24.4 mm. Total length, including anal appendages/ovipositor: male 33.7-37.3 mm, female 31.8-39.0 mm.

Differential diagnosis

The male of *Teinobasis aurantiaca* shares an extensively yellow/orange thorax with the following congeners in the New Guinea region: *T. albula* Ris, 1915, *T. angusticlavia* Ris, 1913,

T. aquila Theischinger & Kalkman, 2014, *T. aurea* Lieftinck, 1938, *T. chrysea* Theischinger & Richards, 2013, *T. cuneata* Theischinger & Richards, 2015, *T. debeauxi* Lieftinck, 1938, *T. dominula* Lieftinck, 1937, *T. flavolineata* Theischinger & Richards, 2015, *T. fulgens* Lieftinck, 1949, *T. glossa* sp. nov., *T. lieftincki* Theischinger & Kalkman, 2014, *T. luciae* Lieftinck, 1937, *T. lutea* Theischinger & Richards, 2013, *T. marginata* sp. nov., *T. prothoracica* Selys, 1877, *T. rufithorax* Selys, 1877, *T. sjupp* Kalkman, 2008, *T. vincenti* Theischinger & Richards, 2017, *T. wallacei* Campion, 1924 and *T. wau* sp. nov. The male of *T. aurantiaca* can be distinguished from *T. albula*, *T. flavolineata*, *T. luciae* and *T. rufithorax* (with dorsum of synthorax completely yellow/orange) and *T. fragillima* sp. nov, *T. glossa*, *T. sjupp*, and *T. wallacei* (with dorsum of synthorax completely or almost completely black) by having a black median stripe on dorsum of the synthorax. It shares the black median stripe on the dorsum of synthorax with *T. angusticlavia*, *T. aurea*, *T. cuneata*, *T. chrysea*, *T. debeauxi*, *T. dominula*, *T. marginata* sp. nov., *T. prothoracica*, *T. vincenti*, and *T. wau* sp. nov. However, it differs from all of these species except *T. albula* and *T. cuneata* in its distinctly different terminalia which have a short conical upper branch of the superior anal appendages that is markedly longer than the slightly hooked, upturned lower branch and also longer than the postero-dorsally directed, apically attenuated inferiors/paraprocts (vs not this combination of characters). *Teinobasis albula* and *T. cuneata* also share with the new species a substantially pale (whitish to yellowish) S7 and a distinctly sloping pterostigma that is markedly longer than wide, and *T. cuneata* and the new species also share the black median stripe on the dorsum of the synthorax. *Teinobasis albula* can be distinguished from the new species by lacking a black median stripe on the dorsum of synthorax, and live males of both *T. albula* and *T. cuneata* have green eyes (versus orange eyes in the new species). *Teinobasis cuneata* further differs from *T. aurantiaca* sp. nov. by lacking (versus having) a dark humeral/posthumeral patch (Fig. 10, Fig. 33 left, and see Theischinger & Richards 2015, Figs 1-3).

Distribution and habitat

Teinobasis aurantiaca is known from scattered localities across the Kikori and Purari River basins in Gulf Province of south-central Papua New Guinea, where it occurs between about sea level and 55 m a.s.l. in very wet, lowland alluvial rainforest. Adults were normally found perched on low vegetation in areas where small pools had formed on the forest floor (Fig. 58), but small streams also dissect the forest habitats where it occurs, so the breeding habitat of this species remains uncertain. Some individuals were also encountered in forest clearings and along logging tracks through forest suggesting that this species can tolerate some degree of habitat disturbance.

***Teinobasis fragillima* sp. nov.**

Figures 11-13, 18

Material

Holotype ♂ (SAMA 07-001745): Papua New Guinea, Gulf Province, Purari River basin, Purari Site A, (7.3636°S, 145.2411°E; 75 m a.s.l.) 01-viii-2023, S. J. Richards and E. Nagombi.

Paratype: 1♂ (SAMA 07-001746), same data as holotype.

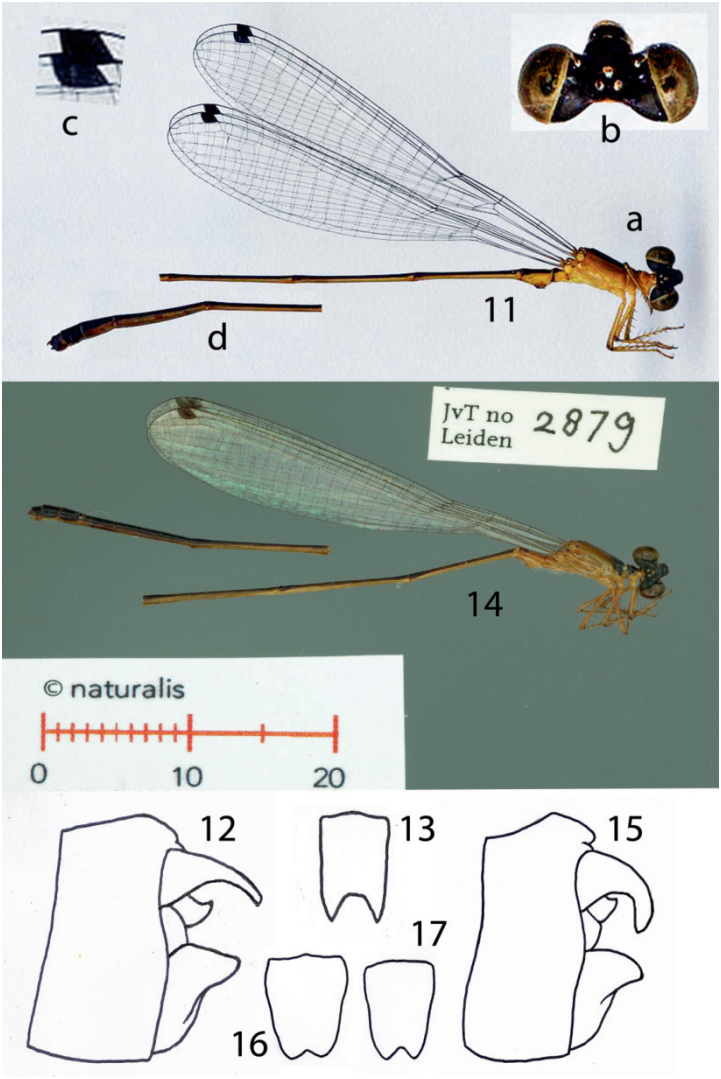


Fig. 11. ***Teinobasis fragillima*** **sp. nov., holotype male, (a, d) habitus, with (b) head and (c) pterostigmata inset.**

Figs 12, 13, ***Teinobasis fragillima*** **sp. nov., holotype male: (12) terminalia, lateral; (13) anal tergite, caudal.**

Fig. 14. ***Teinobasis debeauxi*** **Lieftinck, holotype male.**

Figs 15-17. ***Teinobasis debeauxi*** **Lieftinck, male: (15) terminalia, lateral; (16, 17) anal tergite, caudal.**

Fig. 18. *Teinobasis fragillima* sp. nov., male, photo by S.J. Richards.

Etymology

The specific name *fragillima* is the superlative of *fragilis, -e*, a Latin adjective meaning frail or brittle. It refers to the extremely thin delicate abdomen of the male.

Diagnosis

The male of *Teinobasis fragillima* sp. nov. can be distinguished from all congeners by the following combination of characters: labrum black and yellow; pronotum largely orange; dorsum of synthorax black except for very thin line along mesopleural suture; all abdominal segments dorsally black; superior anal appendages with upper branch slightly and evenly curved ventrad, about twice as long as upturned lower branch and slightly longer than blunt plump inferior appendages; anal tergite elongate, parallel sided with subtriangular incurved apical lobe each side, these separated by slightly rounded trapezoidal gap.

Holotype – Male (Figs 11-13)

Head (Fig. 11) – Labium pale cream-coloured; face almost all black except approximately anterior 1/3 of, and ill-defined narrow wedge along midline of, labrum, base of mandibles and genae to base of antennae and very narrowly to end of scape, approximately anterior 1/4 of postclypeus, small mark each side of, and an even tinier mark in middle of, base of anterior frons, face of scape and pedicel, spot in front of median ocellus and spot each side of occiput more or less intense yellow; tip of mandibles and antennal flagellum brown; vertex, postocular lobes and occiput black; postgenae and post-occipital region cream-coloured to yellow.

Prothorax – Largely dark yellow to orange with only first rim of anterior lobe, and postero-median region of median lobe and median region of posterior lobe of pronotum broadly black.

Synthorax (Fig. 11) – Largely dark yellow to orange with the following areas shining black: dorsum except for thin line along mesopleural suture; spiracular dorsum, antealar sinus and antealar ridge; spot at anterior end of subalar ridges; humeral plates. Thoracic terga, post-coxae and poststernum largely yellow. Legs with coxae and trochanters bright yellow, femora yellow, strongly darkened at knees, tibiae somewhat paler yellow with only protibia thinly lined black in proximal half, tarsi and claws dull yellow and brown, spines black. Wings with membrane hyaline, venation black; pterostigma (Fig. 11) black, posterior side slightly longer than others, higher than adjacent costal cells, overlying single cell; postnodals 13/12-13.

Abdomen (Fig. 11) – Largely black. S1 dark yellow with brownish black trapezoidal dorsal patch, wider posteriorly than anteriorly, and black posterior margin along dull yellowish inter-segmental membrane; S2 dark yellow with broad black pear-shaped dorsal patch; S3-S7 dorsally black, laterally pale to dull yellow, this pale band slightly widened at base of each segment, more distinctly in S3-4 than in S5-7; S6-S8 with black dorsal patch apically widened and S7-9 with intersegmental membrane dark yellow; tergite of S9 black, sternite dull to dark yellow; S10 largely black, fading into yellow ventrally. Terminalia (Figs 13, 14) with ventrally curving upper branch of largely greyish brown superior anal appendages approximately as long as S10, rather slender, about twice as long as upturned lower branch and somewhat longer than plump, blunt inferior appendages; anal tergite (Fig. 14) elongate, parallel sided with subtriangular incurved apical lobe each side, these separated by slightly rounded trapezoidal gap.

Measurements – Hindwing 23.2 mm, abdomen + anal appendages 37.8 mm.

Female – unknown.

Variability

The male paratype (photographed in life: Fig. 18) agrees very well with the holotype. However, there are no medial yellow marks/spots at base of anterior frons, in front of median ocellus and either side of occiput. There is a slight smudge of diffuse black on each side of median lobe of pronotum, a tiny brown spot on mesokatepisternum and a larger brown spot in dorsal 1/8 of mesepimeron. Postnodals 12-13/12. Hindwing 23.2 mm, abdomen + anal appendages 37.6 mm.

Differential diagnosis

Of the Papuan *Teinobasis* species that have the face and most of the synthorax orange/yellow, *Teinobasis fragillima* sp. nov. shares only with *T. debeauxi*, *T. glossa* sp. nov., *T. marginata* sp. nov. and *T. vincenti* male terminalia (Fig. 23) with upper branch of superior anal appendages down-curved, lower branch short, upturned with rather plump, not pointed or apically attenuated inferiors, and a short pterostigma. It can be distinguished from *T. debeauxi*, which has the most similar anal appendages (Figs 11-13 vs 14-17) and *T. glossa* by having pronotum largely yellow/orange vs largely black, from *T. debeauxi*, *T. vincenti* and *T. marginata* sp. nov. by having dorsum of synthorax almost completely black

vs yellow/orange with a narrow black median stripe, and from *T. debeauxi* by S1 and S2 dorsally largely black vs largely yellow/orange.

Distribution and habitat

Teinobasis fragillima sp. nov. is known only from the type locality in the Purari River basin in Gulf Province, south-central Papua New Guinea. Only two specimens are known; they were perched less than 3 m apart and less than 30 cm high, in the shade, on low foliage over a small seepage at the edge of a muddy forest trail in logged hill forest (Fig. 59).

***Teinobasis glossa* sp. nov.**

Figures 19, 21, 22

Material

Holotype ♂ (SAMA 07-001747): Papua New Guinea, Gulf Province, Purari Hydro Camp 8 (6.9438°S, 145.1031°E; 90 m a.s.l.), 25-vi-2012, S.J. Richards.

Etymology

The specific name, a noun in apposition, is based on the latinised Greek glossa, -es, meaning tongue, and refers to the shape of the anal tergite of the male.

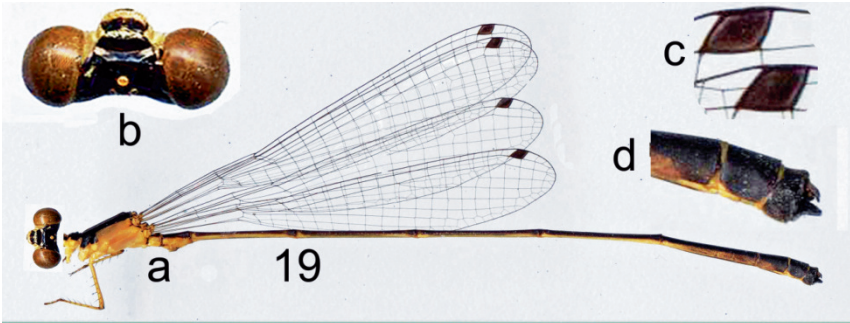
Diagnosis

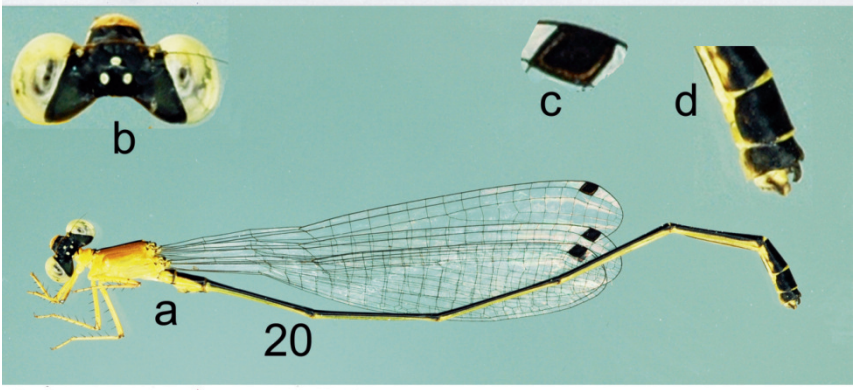
The male of *Teinobasis glossa* sp. nov. can be distinguished from all congeners by the following combination of characters: labrum black and yellow; pronotum largely black; dorsum of synthorax completely black, the black extending over large portion of mesokatepisternum and small portion of adjacent mesepimeron, sides of synthorax otherwise largely yellow/orange; all abdominal segments dorsally black; superior anal appendages with upper branch curved ventrad, markedly longer than upturned lower branch and markedly shorter than blunt inferior appendages; anal tergite tongue-shaped with apex evenly rounded (Fig. 22).

Holotype – Male (Figs 19, 21, 22)

Head (Fig. 19) – Labium yellow; face almost all black except anterior 1/3 and few tiny spots along midline of labrum, base of mandibles, genae beyond level of antennal base, anteclypeus, approximately anterior 1/3 of postclypeus, subtriangular mark each side of anterior frons, face of scape and small marks on pedicel intensive yellow; tips of mandibles blackish brown (antennal flagella missing); vertex, postocular lobes, occiput and postgenae adjacent to eyes black; reminder of postgenae also largely black, only post-occipital and ventral regions of genae dark yellow.

Prothorax – Pronotum largely shining black, only second rim of anterior lobe yellow and anteromedian region of median lobe forming broad intensive yellow triangle; propleura bright yellow. Legs with coxa, trochanter and what is left of one femur bright yellow (other segments absent).





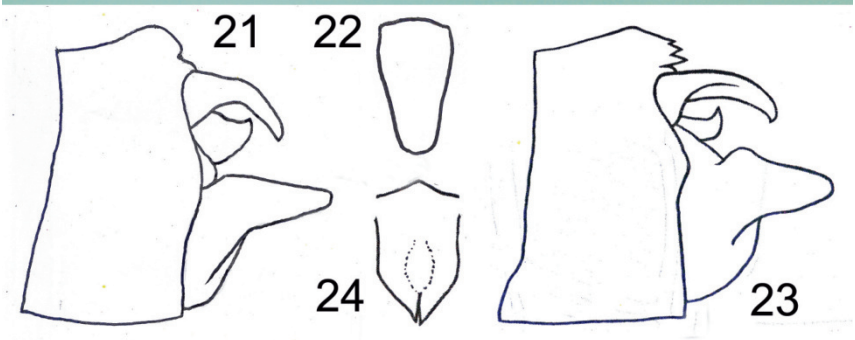


Fig. 19. ***Teinobasis glossa*** **sp. nov., holotype male, (a) habitus, with (b) head, (c) pterostigmata and (d) terminalia inset.**

Fig. 20. ***Teinobasis vincenti*** **Theischinger & Richards, holotype male, (a) habitus, with (b) head, (c) pterostigma and (d) terminalia inset.**

Figs 21, 22. ***Teinobasis glossa*** **sp. nov., holotype male: (21) terminalia, lateral; (22) anal tergite, caudal.**

Figs 23, 24. ***Teinobasis vincenti*** **Theischinger & Richards, holotype male: (23) terminalia, lateral; (24) anal tergite, caudal.**

Synthorax (Fig. 19) – Dorsum including spiracular dorsum, antealar sinus and antealar ridge, almost all of mesokatepisternum and adjacent approximately ventral 1/6 of mesepimeron, much of subalar ridges and humeral plates shining black, otherwise bright orange-yellow. Thoracic terga, postcoxae and poststernum largely yellow. Legs with coxae and trochanters bright yellow, femora yellow, somewhat darkened at knees, tibiae paler yellow, tarsi and claws dull yellow and brown, spines black. Wings with membrane hyaline, venation black and pterostigma (Fig. 19c) black, almost square, higher than adjacent costal cells and overlying single cell; postnodals 13-14/12-13.

Abdomen (Fig. 19) – Largely black. S1 yellow with brownish black trapezoidal dorsal patch, wider posteriorly than anteriorly, with black posterior margin along dull yellowish intersegmental membrane; S2 paler yellow with broad black pear-shaped/trapezoidal dorsal patch; S3-S6 dorsally black, laterally pale to dull yellow, this pale band slightly widened at base of each segment, more distinctly so in S3-4 than in S5-6; S7 similar to S6 but with black dorsal patch apically widened and with intersegmental membrane dark yellow; S8-S10 largely black, S8 and S9 with intersegmental membrane yellow; S8 lateroventrally margined greyish to brownish yellow for approximately 2/3 of its length, S9 margined bright yellow only in basal 1/3; S10 largely black, ventrally merging into dark yellowish brown. Inner corner of apical margin of S10 on both sides of medio-dorsal cavity produced as very slight digital lobes. Terminalia (Figs 21, 22): ventrally downturned upper branch of largely brown superior anal appendages approximately as long as S10, rather slender, markedly longer than rather plump apically upturned lower branch, markedly shorter than long tapered black inferiors; anal tergite (Fig. 22) pale brown, tongue-shaped with apex evenly rounded.

Measurements – Hindwing 23.5 mm, abdomen + appendages 38.8 mm.

Female – unknown.

Differential diagnosis

Of the Papuan *Teinobasis* species that have the face and most of the synthorax orange/yellow, *T. glossa* sp. nov. shares with only *T. debeauxi*, *T. fragillima* sp. nov., *T. marginata* sp. nov. and *T. vincenti* male terminalia with upper branch of the superior anal appendages downcurved, lower branch short and upturned and with inferiors that are not pointed or apically attenuated, and a short pterostigma. *Teinobasis glossa* sp. nov. can be distinguished from these four species by its tongue-shaped anal tergite and further from *T. fragillima* sp. nov., *T. marginata* sp. nov., and *T. vincenti* by having the pronotum largely black vs largely yellow/orange, from *T. debeauxi*, *T. marginata* sp. nov. and *T. vincenti* by the dorsum of synthorax completely black versus yellow/orange with a black median stripe, and from *T. debeauxi* by having S1 and S2 dorsally largely black versus largely yellow/orange.

Distribution and habitat

Teinobasis glossa sp. nov. is known from a single specimen collected in lowland forest in the Purari River basin in south-central Papua New Guinea. Numerous small clear-flowing streams dissected the forest floor at the type locality (Fig. 60) but the species was not observed breeding and nothing else is known about its ecology.

***Teinobasis marginata* sp. nov.**

Figures 25-30

Material

Holotype ♂ (SAMA 07-001748): Papua New Guinea, Western Province, upper Fly-Strickland catchment, P'nyang Camp 4 (5.9079°S, 141.8462°E; 125 m a.s.l.), 1-viii-2013, S.J. Richards.

Paratypes: 1 ♀ (SAMA 07-001749), same data as holotype; 1 ♀ (SAMA 07-001750), same details as holotype but 5-viii-2013, both S.J. Richards.

Etymology

The specific name is the perfect participle of the Latin verb margino, -are, meaning to put a border on. It declines as an adjective. It refers to the distinct pale margin along the sides of the pterostigma.

Diagnosis

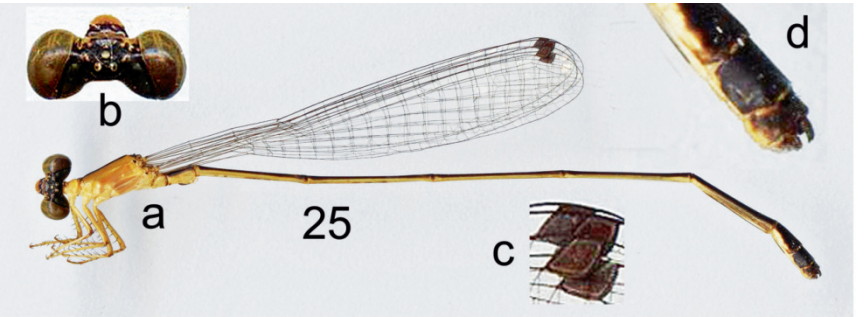
The male of *Teinobasis marginata* sp. nov. can be distinguished from all congeners by the following combination of characters: labrum largely pale, postclypeus largely black, synthorax orange with black median stripe restricted to dorsum; superior anal appendages slightly curved ventrally, subequal in length to plump, apically bluntly rounded inferiors, apex of lower branch of superior anal appendages upturned. Female pterostigma grey with very distinct pale margin along sides, costal side distinctly shorter than other three sides, higher than adjacent costal cells; ovipositor reaching well beyond end of S10.

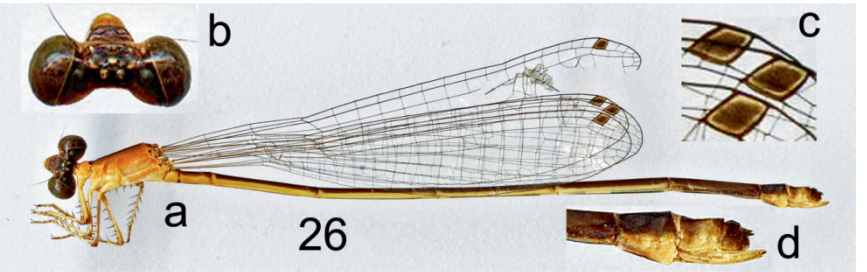
Holotype – Male (Figs 25, 27-29)

Head (Fig. 25) – Labium pale cream; almost all of labrum bright to dark orange-yellow, except base of lateral margins black merging into brown; base of mandibles, genae beyond level of antennae, anteclypeus, anterior frons, almost all of antennal base, a frontal line of scape, outer face of pedicel, most of postgenae and postocciput and small mark laterally between lateral ocellus and scape of antenna dark to dull yellow; tips of mandibles brown; antennal flagella missing; postclypeus largely brownish black with anteromedial yellow patch; most of scape and pedicel, top of frons, vertex, postocular lobes and top of postgenae adjacent to eyes black.

Prothorax – Largely bright orange, except anterior margin of anterior lobe of pronotum, posteromedian triangle of median lobe and approximately median third of widely and rather evenly convex posterior lobe black.

Synthorax (Fig. 25) – Largely bright to dark yellow and orange except middorsal carina with fine black line running parallel along either side, antealar ridge and sinus, and spot on subalar ridge just posterior to dorsal end of mesopleural and metapleural sutures black; extreme dorsal edge of metapostepimeron and sclerites at wing bases with greyish brown spot. Black middorsal line at base of antealar sinus terminating in distinct yellow spot. Thoracic terga largely yellow to orange; postcoxae yellow; poststernum pale yellow. Legs yellow with only femora somewhat darkened at knees, spines black. Wings with membrane hyaline, venation black, pterostigma black with distinct pale margin along sides, costal side





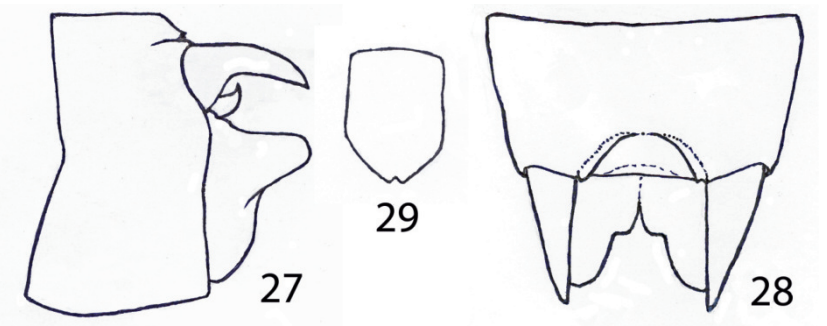


Fig. 25. *Teinobasis marginata* sp. nov., holotype male, (a) habitus, with (b) head, (c) pterostigmata and (d) terminalia inset.

Fig. 26. *Teinobasis marginata* sp. nov., paratype female, (a) habitus, with (b) head, (c) pterostigmata and (d) terminalia inset.

Figs 27-29. *Teinobasis marginata* sp. nov., holotype male: (27, 28) terminalia: (27) lateral; (28) dorsal; (29) anal tergite, caudal.

distinctly shorter than other three sides, higher than adjacent costal cells, overlying single cell; postnodals 14/13.

Abdomen (Fig. 25) – Largely black. S1 yellow with black trapezoidal dorsal patch covering less than apical half, wider posteriorly than anteriorly, black posterior margin along dull

Fig. 30. *Teinobasis marginata* sp. nov., (top) male, (bottom) female; photos by S.J. Richards.

yellowish intersegmental membrane; S2 yellow with narrow black subrectangular dorsal patch; S3-S6 dorsally black, laterally yellow, this pale band slightly widened at base and apex of each segment; S7 similar to S6 but with black dorsal patch apically more widened and with intersegmental membrane dark yellow; S8-S10 largely black, S8 and S9 with intersegmental membrane yellow and lateroventrally margined yellow; S10 largely black, only ventrally yellow. All abdominal sternites grey to dull yellow. Terminalia (Figs 27-29): ventrally curved upper branch of largely blackish brown superior anal appendages approximately as long as S10, rather slender, markedly longer than also rather slender apically upturned

lower branch; inferior anal appendages blackish brown and yellow, almost exactly as long as superiors, plump, with base medially thickened, apex produced narrowly but blunt; anal tergite (Fig. 29) pale yellow, widely tongueshaped with apex medially notched, lobes very short, subtriangular.

Measurements – Hindwing 24.6 mm, abdomen + anal appendages 38.9 mm.

Female (Fig. 26, 30 bottom)

Head (Fig. 26) – Much as in male, yellow mark between lateral ocellus and scape of antenna slightly larger; antennal flagellum blackish brown.

Prothorax – Much as in male, but black on posterior lobe of pronotum may extend closer to lateral margin.

Synthorax (Fig. 26) – Much as in male but may be somewhat darker. Yellow spot on mid-dorsal line may be less distinct or extend on to inner area of antealar sinus. Legs much as in male but with fine greyish lining on parts of femora and tibiae, tarsi and claws yellowish tending to light greyish. Wings much as in male, but pterostigma (Fig. 26) largely pale grey to dark grey; postnodals 12-15/13-15.

Abdomen (Fig. 26) – Largely black. S1 yellow on anterior half, dorsally brownish black on posterior half; S2-S7 dorsally black, laterally pale to dark or dull yellow, this pale band slightly widened at base of each segment, most distinctly widened on S3; S7-S9 with intersegmental membrane yellow; tergites 8 and 9 largely black, ventro-laterally bright yellow; S10 dorsally and laterally largely black fading into yellow ventro-laterally and yellow ventrally. Terminalia (Fig. 26): ovipositor reaching well beyond end of S10; outer valve dark to dull yellow, orange or pale greyish brown with tip black; terebra long, straight, medium brown; anal appendages and supra-anal plate black; anal lamina greyish yellow.

Measurements – Hindwing 24.8-25.0 mm, abdomen including ovipositor 35.9-36.8 mm.

Differential diagnosis

Of the Papuan *Teinobasis* species that have the face and most of the synthorax orange/yellow, *T. marginata* sp. nov. exhibits similarities in structure of the male terminalia only with *T. debeauxi, T. fragillima* sp. nov., *T. glossa* sp. nov. and *T. vincenti*, all of which have the upper branch of the superior anal appendages short, widened basally with rather long, ventrally curved apical lobe and inferiors that are not pointed or apically attenuated. These five species also share a short pterostigma. Within this group *T. marginata* sp. nov. and *T. vincenti* share a black median stripe restricted to orange dorsum of synthorax, vs this stripe extending into mesokatepisternum and part of mesepimeron in *T. debeauxi* and vs a completely or almost completely black dorsum of synthorax in *T. glossa* sp. nov. and *T. fragillima* sp. nov. *Teinobasis marginata* sp. nov. (Fig. 25, 27-29) is most similar to *T. vincenti* (Fig. 20, 23, 24) from which it is further distinguished by its much shorter inferior anal appendages in relation to the superiors.

Distribution and habitat

Teinobasis marginata is known only from the type locality in the upper Fly-Strickland rivers catchment of southwestern Papua New Guinea. All of the specimens were perching on low

foliage in shady positions in lowland rainforest (Fig. 61). Although numerous small streams dissected the forest floor at the type locality, none of the specimens encountered were immediately adjacent to aquatic habitats. Nothing else is known about this species' ecology.

***Teinobasis wau* sp. nov.**

Figures 31, 32, 34-39

Material

Holotype (SAMA 07-001751): ♂, Papua New Guinea, Gulf Province, Wau Creek, (7.1216°S, 144.3739°E; 20 m a.s.l.), 26-iv-2017, S.J. Richards and P. Toko; deposited in SAMA.

Paratypes – Papua New Guinea, same locality as holotype: 1 ♂ (SAMA 07-001752), 24-iv-2017, 1 ♂ (SAMA 07-001753), 26-iv-2017, 1 ♀ (SAMA 07-001754), 23-iv-2017, 1 ♀ (SAMA 07-001755), 25-iv-2017, all S.J. Richards and P. Toko; all deposited in SAMA.

Other material – 2 ♂, Papua New Guinea, Gulf Province, Kikori River basin, c. 3km upstream of Dark End Lumber Camp near Wau Creek (7.1482°S, 144.3822°E, ~ 55 m a.s.l.) on 7-x-1999 by S.J. Richards are assigned to this species but because of their poor condition (fractured, incomplete) they are not included as paratypes. They will be deposited in SAMA.

Etymology

The specific name is based on Wau Creek, the name of the type locality, used as a noun in apposition to the generic name.

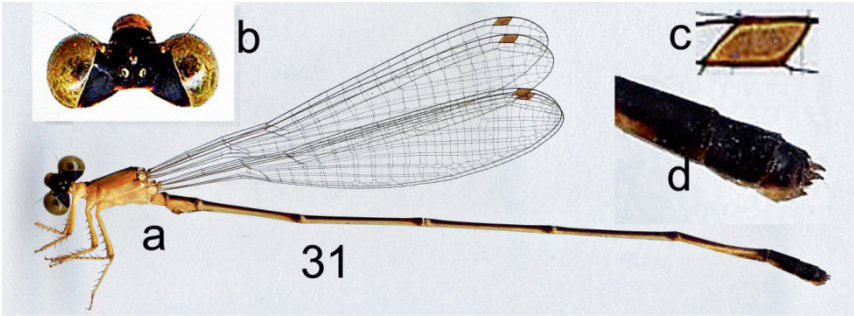
Diagnosis

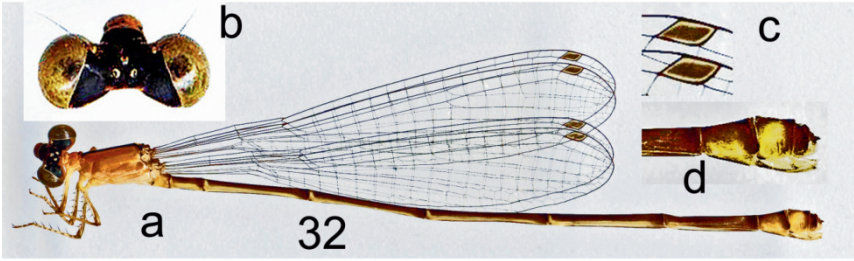
The male of *Teinobasis wau* sp. nov. can be distinguished from all congeners by the following combination of characters: labrum orange, postclypeus black, synthorax orange with black median stripe largely restricted to close to median carina; pterostigma short, skewed; abdominal segment 7 paler than 2-6. Upper branch of superior anal appendages with long base and short tip, overall much longer than barely hooked lower branch; inferiors slightly shorter than upper branch of superiors and rather stout. Anal tergite widely subtriangular with narrow divided apex, cleft to about 4/5 from apex, the two lobes closely adpressed.

Holotype – Male (Figs 31, 34-37)

Head (Fig. 31) – Labium pale yellow; labrum, base of mandibles, genae, anteclypeus, and anterior frons largely orange; a black spot each side at base of labrum and widely triangular brown patch along epistomal suture in front median ocellus; postclypeus jet-black; tips of mandibles brownish black; top of frons, vertex, antennae, post-ocular lobes and top of postgenae black, most of postgenae and three spots along occipital edge orange; scape and pedicel orange and dark brown; antennal flagellum black.

Prothorax – Dull yellow except median half of posterior lobe of notum (Fig. 34) black and slightly more strongly arched than sides.





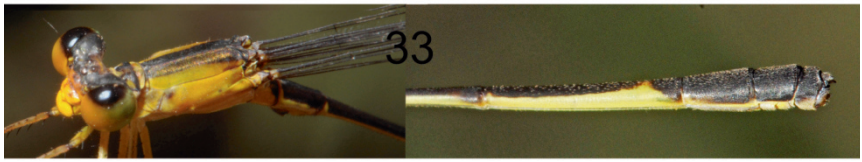
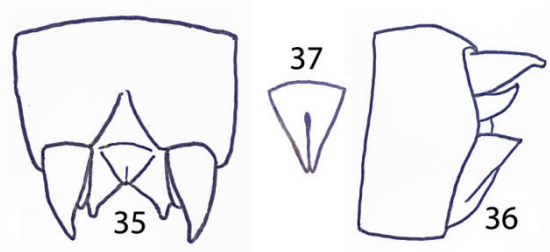


Fig. 31. ***Teinobasis wau*** **sp. nov., holotype male, (a) habitus, with (b) head, (c) pterostigma and (d) terminalia inset.**

Fig. 32. ***Teinobasis wau*** **sp. nov., female, (a) habitus, with (b) head, (c) pterostigma and (d) terminalia inset.**

Fig. 33. ***Teinobasis cuneata*** **Theischinger & Richards: (left) head and thorax; (right) part of abdomen, lateral.**



Figs 34-38. ***Teinobasis wau*** **sp. nov.: (34-37) male: (34) posterior lobe of pronotum, dorsal; (35-37) terminalia: (35) dorsal; (36) lateral; (37) anal tergite, caudal; (38) female, posterior lobe of pronotum, dorsal.**

Synthorax (Fig. 31) – Largely pale orange except black mid-dorsal carina, inner 1/3 to almost 1/2 of mesanepisternum, antealar ridge and sinus and spiracular dorsum, small line/spot on subalar ridges between dorsal end of humeral and interpleural suture and at dorsal end of metapleural suture, and extreme dorsal edge of metapostepimeron. Thoracic terga and sclerites at wing base brown and yellow. Postcoxae and poststernum pale orange. Legs yellow with only extreme tip of femora very slightly darkened, spines black. Wing membrane hyaline, venation black; pterostigma (Fig. 5) greyish brown with yellowish margin, nearly 1.5 times as long as wide, strongly slanting, overlying one cell; postnodals 14/13.

Abdomen (Fig. 31) – Largely black. S1 yellow with short grey wedge-shaped dorsal mark; dorsal face of S7 also grey; much of sides of S2 and ventral edge of S3-7 yellow, this pale coloration slightly widened at base of segments; S8-10 largely black, ventrally yellow. Terminalia (Figs 34-37) – Superior anal appendages brownish black, upper branch much longer than barely hooked lower branch; inferiors rather stout with acute ascending tip, slightly shorter than upper branch of superiors. Anal tergite (Fig. 37) grey, widely subtriangular with narrow apex, divided ca 4/5th of its length, the two lobes closely adpressed.

Measurements – Hind wing 24.1 mm; abdomen including anal appendages 40.0 mm.

Female (Figs 32, 38)

Head (Fig. 32) – Much as in male, but without brown triangular patch, instead antennal base, narrow bow in front of median ocellus, and stripe along occipital edge and posterior margin of postocular lobes orange, small linear patch each side between lateral ocellus and antennal base dull yellow.

Prothorax – Much as in male but with posterior lobe medially widely angulate and laterally more strongly arched (Fig. 32), blackish or with black spot each side.

Synthorax (Fig. 32) – Much as in male but median black stripe covering at most 1/3 width of each mesanepisternum; antealar sinus black or black and orange, lateral portions of spiracular dorsum yellow. Legs and wings much as in male; postnodals 15/13.

Abdomen (Fig. 32) – Much as in male, but S7 dorsally dark to pale grey, S8 and 9 largely yellow, merging into blackish anteriorly and posteriorly, and S10 black. Terminalia (Fig. 32) – Ovipositor extending slightly beyond end of S10; outer valve dark to dull yellow; anal appendages and supra-anal plate brown; anal lamina greyish yellow.

Measurements – Hindwing 26.7-27.5 mm, abdomen including ovipositor 39.7-40.5 mm.

Variability

Both male paratypes agree well with the holotype but one is slightly paler and both have the three orange patches along the occipital edge less clearly defined. As opposed to the holotype one paratype has an ill-defined yellow patch in the middle of the black section of the posterior lobe of pronotum, while the other has no yellow central patch but the black section is slightly longer than 1/2 of the width of the posterior lobe. The black median stripe along dorsal carina on the front of the synthorax of both paratypes is slightly narrower than in the holotype. Postnodals 13-14/12-13. Hindwings 23.7-24.0 mm; abdomen including anal appendages 38.5-39.8 mm.

Fig. 39. *Teinobasis wau* sp. nov., male, photo by S.J. Richards.

Differential diagnosis

Teinobasis wau sp. nov. shares a black median stripe on the yellow/orange dorsum of synthorax with the following *Teinobasis* species in the New Guinea region with an extensively yellow/orange synthorax: *T. angusticlavia*, *T. aurantiaca* sp. nov., *T. aurea*, *T. cuneata*, *T. chrysea*, *T. debeauxi*, *T. dominula*, *T. fulgens*, *T. marginata* sp. nov., *T. prothoracica*, and *T. vincenti*. It differs from *T. aurea*, *T. chrysea*, *T. debeauxi*, *T. prothoracica* and *T. wallacei* by having the lobes of the anal tergite long, slim and adjacent to each other vs lobes short with significant gap between them; from *T. marginata* and *T. vincenti* in having the upper branch of the appendages with long basal section and short lobe/tip vs short basal section and long lobe; from *T. fulgens* and *T. cuneata* by having a jet-black postclypeus vs face all yellow or orange; from *T. angusticlavia* by lacking blue-powdered (Lieftinck 1935) spots on pronotum and front of synthorax and from *T. dominula* by having S10 not postero-dorsally extended. Its most similar congener is *T. cuneata*, from which it can be distinguished by its black postclypeus, pale median lobe and black-patched posterior lobe of pronotum, shorter pterostigma, S7 without distinct pale spots (Fig. 31, 39) and stouter anal appendages vs completely pale face, black median lobe and pale posterior lobe of pronotum (Fig. 33 left), longer pterostigma and distinct pale spots on S7 (Fig. 33 right), and slimmer anal appendages.

Distribution and habitat

Teinobasis wau sp. nov. is known only from Wau Creek and from forest in the nearby Dark End Lumber block, an old logging concession. Both of these sites are on tributaries of the Kikori River. Wau Creek is a proposed conservation area and includes a patch of primary, unlogged lowland forest where *T. wau* sp. nov. was found perched on low foliage in shade or dappled sun. The forest at Wau Creek is bisected by numerous small, clear-flowing streams (Figs 62, 63) and it is likely that this species breeds in them but this has yet to be confirmed.

Species lacking extensive yellow/orange coloration on the thorax and face.

Teinobasis caelestis sp. nov.

Figures 40, 42, 45, 46

Material

Holotype ♂ (SAMA 07-001756): Papua New Guinea, Gulf Province, Purari River basin, Purari Site B (7.3711°S, 145.2231°E; 65 m a.s.l.), 31-vii-2023, S.J. Richards and E. Nagombi.

Paratypes: 3♂ (SAMA 07-001757-759): Papua New Guinea, Gulf Province, Purari Site 1 (7.1464°S, 145.1408°E; 100 m a.s.l.), 2-i-2016, S.J. Richards.

Etymology

The specific name, formed from the Latin adjective *caelestis, -e,* meaning heavenly, refers to the sky-blue coloration on much of the head, thorax and abdomen of the male.

Diagnosis

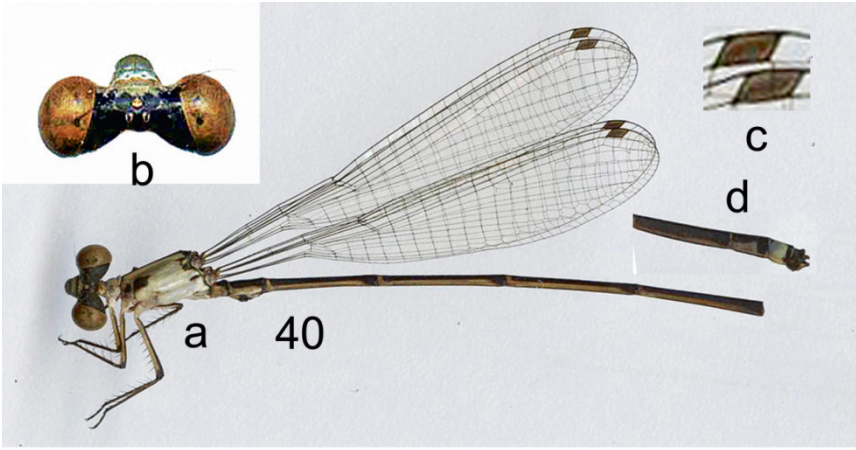
The male of *Teinobasis caelestis* sp. nov. can be distinguished from all congeners by the following combination of characters: face, synthorax and S9 largely pale blue; down-curved upper branch of superior anal appendages shorter than S10 and markedly shorter than almost straight apically hooked lower branch as well as the rather slender inferiors.

Holotype – Male (Figs 40, 46)

Head (Fig. 40) – Labium pale cream; face including labrum, base of mandibles, genae slightly beyond end of scape, anteclypeus, postclypeus, anterior frons, much of top of frons anterior to median ocellus, face of antennal base and scape, fine line on face of pedicel and small comma-shaped mark each side of vertex pale blue; ill-defined fractured line along back of occiput dull yellow; tip of mandibles blackish brown; antennal flagellum, vertex, postocular lobes, occiput and most of postgenae black; ventral and inner region of postgenae pale bluish merging into yellowish.

Prothorax – Pronotum largely pale to dull blue, darkened to brown and black along much of transverse furrows, a C-shaped black mark along part of border notum/pleura; propleura pale blue.

Synthorax (Fig. 40) – Largely pale blue except spiracular dorsum, narrow slightly wedge-shaped stripe covering dorsal carina and adjacent 1/4 anteriorly to more than 1/2 posteriorly of each mesanepisternum, antealar sinus and antealar ridge, an ill-defined mark over about 1/2 of mesokatepisternum and another over approximately ventral 1/3 of mesepimeron shining black. Also black humeral plates and small patches and lines on and along subalar ridges and connected to them larger patches over approximately 1/8 of the thorax depth, trapezoidal along top of both mesopleural and interpleural sutures and semicircular along top of metapleural suture, these three narrowly connected to each other as well as to the black stripe on the dorsum of synthorax. Terga, postcoxae and poststernum largely pale blue. Legs with coxae and trochanters pale blue, femora and tibiae pale blue fading into pale yellow, longitudinally lined black and darkened/black at knees, spines black, tarsi and



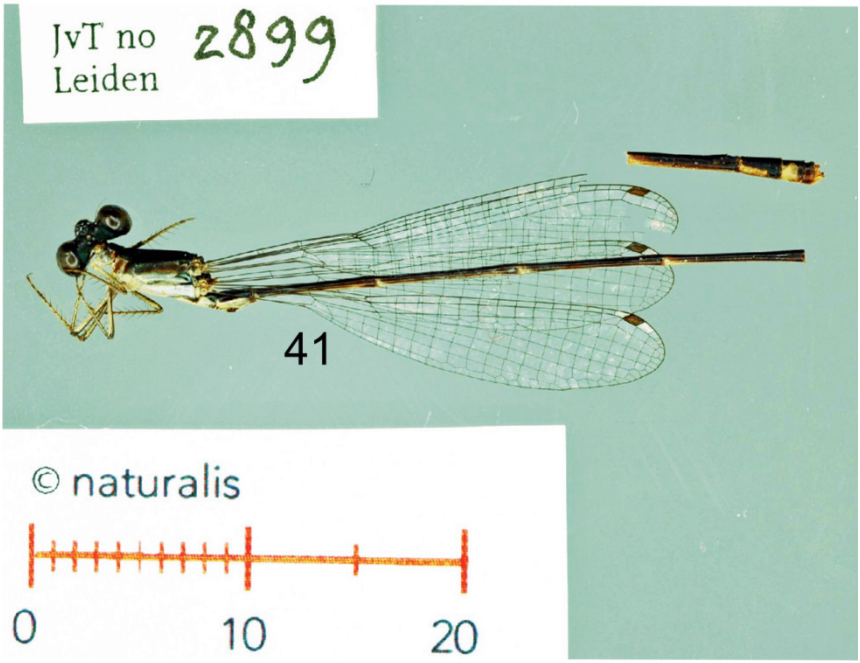


Fig. 40. *Teinobasis caelestis* sp. nov., holotype male, (a, d) habitus, with (b) head and (c) pterostigmata inset.

Fig. 41. *Teinobasis scintillans* Lieftinck, holotype male.

claws brownish black. Wings with membrane hyaline, venation black and pterostigma (Fig. 40c) brownish grey, skewed, almost 50% longer than high, slightly higher than adjacent costal cells and overlying a single cell; postnodals 15-16/13-14.

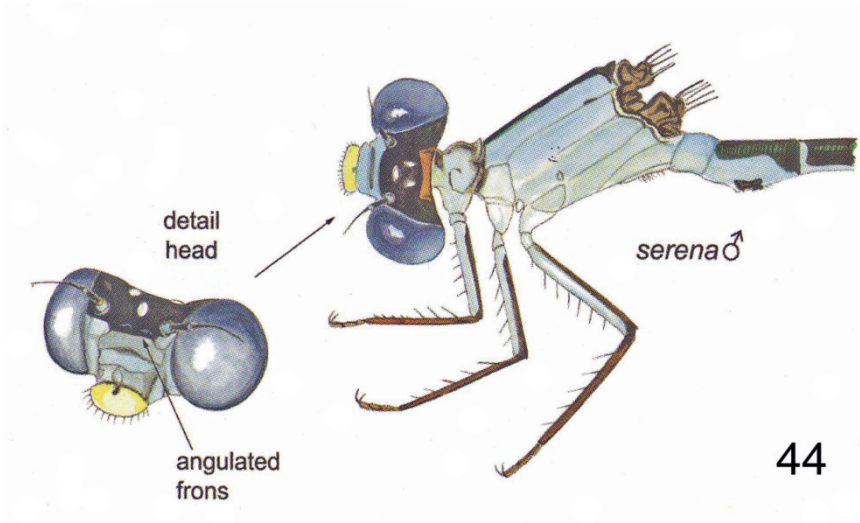


Fig. 42. *Teinobasis caelestis* sp. nov., male, in life, photo by S.J. Richards.

Fig. 43. *Teinobasis scintillans* Lieftinck, male, photo by S.J. Richards.

Fig. 44. *Teinobasis serena* Lieftinck, male, head, thorax and anterior abdominal segments, modified from Kalkman & Orr (2013).

Abdomen (Fig. 40) – Largely black. S1 dull pale blue with brownish black trapezoidal dorsal patch, wider posteriorly than anteriorly, and black posterior margin along dull bluish to yellowish intersegmental membrane; S2 paler dull blue with broad black subrectangular

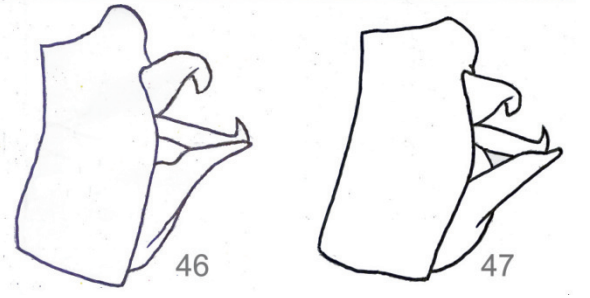


Fig. 45. ***Teinobasis caelestis*** **sp. nov., male, details, photo by S.J. Richards.**

Fig. 46. ***Teinobasis caelestis*** **sp. nov., holotype male, terminalia, lateral.**

Fig. 47. ***Teinobasis scintillans*** **Lieftinck, male, terminalia, lateral.**

dorsal patch; S3-S7 dorsally black, laterally dull yellow to greyish brown, this pale band widened at base of each segment; S7-S9 with intersegmental membrane pale blue; S8 with dorsal black patch much narrower in anterior 2/3 than in apical 1/3, remaining lateral area blue, S9 blue, narrowly margined with black anteriorly, black margin markedly wider posteriorly; S10 largely black, merging over brown into yellow mid-ventrally. Abdominal sternites 3-8 largely brownish grey, sternite 9 paler brownish grey anteriorly, yellow in posterior 1/2. Terminalia (Fig. 46): down- and in-curved, dark greyish brown, upper branch of superior anal appendages shorter than S10 and markedly shorter than black, almost straight apically hooked lower branch as well as rather slender greyish to brownish yellow inferiors.

Measurements – Hindwing 23.3 mm, abdomen + anal appendages 37.2 mm.

Female – unknown.

Variability

The paratype males agree very well with the holotype. However, they are older specimens and the bright blue (Fig. 42) (pale blue in the preserved holotype) is paler and more yellowish in the paratypes. The comma-shaped marks each side of the vertex are less clear to hardly discernible. The occipital line fractions are replaced by a tiny ill-defined brownish spot each end in one paratype, while nothing is evident in two paratypes. The two black patches at the top of mesopleural and interpleural sutures are slightly more rounded than in the holotype, and in one paratype the black mesepimeral mark is slightly larger than in the holotype. Postnodals 13-15/12-15. Hindwing 22.7-24.4 mm, abdomen + anal appendages 36.0-40.0 mm.

Differential diagnosis

Teinobasis caelestis sp. nov. can be distinguished from almost all congeners from New Guinea and its adjacent islands by having much of its face and most of its thorax pale blue (Figs 40, 42, 45). It can be separated from the only known species that shares this character, *T. serena* (Fig. 44) as illustrated in Kalkman & Orr (2013), by S1 being bicolored (brownish black and blue) vs uniformly blue (Lieftinck 1932) and by the lower branch of the superior anal appendages and the inferiors being markedly longer than the upper branch of the superiors vs the upper branch of the superiors much longer than the lower branch and the inferiors (Lieftinck 1935). In the structure of the terminalia *Teinobasis caelestis* sp. nov. (Fig. 46) is most similar to *T. scintillans* Lieftinck, 1932 (Fig. 47) and *T. kiautai* Theischinger & Richards, 2007, but these species differ in having a much darker head and thorax, which is largely metallic black (Figs 41, 43) vs largely pale blue (Figs 40, 42, 45).

Distribution and habitat

Teinobasis caelestis sp. nov. is known only from two localities in foothill forest in the Purari River basin in south-central Papua New Guinea. All known specimens were found perching on low twigs and foliage over forest pools in both logged and unlogged forest (Fig. 64). They were never observed near flowing water. Nothing else is known about this species' ecology.

***Teinobasis livida* sp. nov.**

Figures 48, 50, 51 54, 55

Material

Holotype ♂ (SAMA 07-001760): Papua New Guinea, West Sepik Province, 'Construction Camp' (4.6473°S, 141.7979°E; 290 m a.s.l.), 6-ii-2010, S.J. Richards. Paratypes: 2♂ (SAMA 07-001693-694): Papua New Guinea, West Sepik Province, Ok Binai 1 Camp (4.7011°S, 141.8420°E; 125 m a.s.l.), 12-iii-2011, S.J. Richards.

Etymology

The specific name derives from the Latin adjective *lividus, -a, -um*, meaning black and blue, and refers to the coloration on much of head, thorax and abdomen of the male.

Diagnosis

The male of *Teinobasis livida* sp. nov. can be distinguished from all congeners by the following combination of characters: face largely black, anterior frons blue; prothorax largely blue; synthorax blue with black stripe across median carina and adjacent portion of mesanepisterna, but antealar sinus, humeral plates and wing bases blue; abdomen largely black except for S1 which appears bluish to yellowish. Upper branch of superior anal appendages sub-conical, shorter than S10, but much longer than the upturned, not distinctly hooked lower branch, and markedly longer than the inferior appendages.

Holotype – Male (Figs 48, 50, 51)

Head (Fig. 48) – Labium pale cream-coloured; labrum black with dark yellow anterior margin; base of mandibles, genae slightly beyond end of scape, much of anteclypeus, anterior frons, face of antennal base, a small comma-shaped mark each side between antenna and lateral ocellus and three spots along occipital margin pale to bright blue; an ill-defined patch each side between the middle and lateral portion of anteclypeus, tip of mandibles, postclypeus, scape and pedicel largely black; antennal flagella missing; vertex and postocular lobes black; postgenae dorsally black, merging into yellowish below.

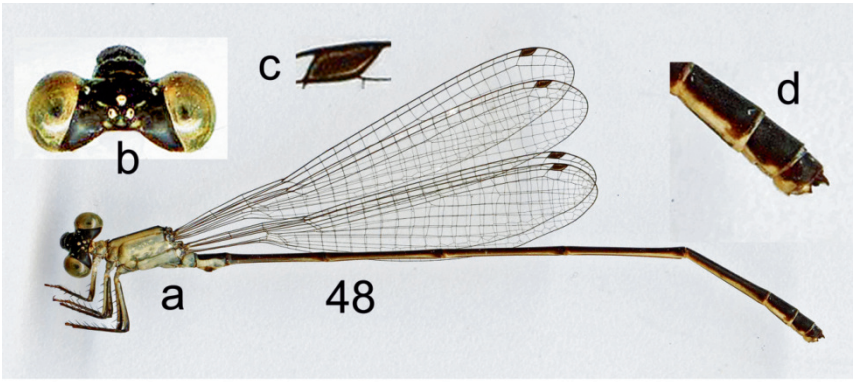
Prothorax – Pronotum pale to dull bluish to pale and dull yellowish, somewhat darker along furrows, most of posterior margin of posterior lobe darkened to brownish black; propleura pale bluish to yellowish.

Synthorax (Fig. 48) – Largely pale bluish to yellowish. Antealar sinus, humeral plates, wing bases and much of terga blue; most of spiracular dorsum; an approximately parallel sided median stripe covering dorsal carina and adjacent slightly more than 1/3 the width of each mesanepisternum, antealar ridge, anterior portion of subalar ridges and dorsal margin of metapostepimeron, black. Postcoxae and poststernum largely pale bluish to yellowish. Legs with coxae and trochanters pale blue, femora pale blue fading into pale yellow, lined broadly black with black stripe widening at knees; tibiae and spines black, tarsi and claws brownish black. Wings with membrane hyaline, venation black and pterostigma dark brownish grey, pterostigmata distinctly skewed, not quite 50% longer than high, slightly higher than adjacent costal cells and overlying single cell; postnodals 17/15-16.

Abdomen (Fig. 48) – Largely black. S1 dull pale blue; S2-7 dorsally and laterally largely black, latero-ventrally pale to dull yellow, this pale coloration broadest at base of each segment; S7 with intersegmental membrane dull yellow to greyish yellow; S8-9 dorsally and laterally black, latero-ventrally pale yellow with intersegmental membrane pale blue; S10 dorsally and laterally black, ventrally pale yellow. Sternites 3-7 largely pale brownish grey, sternite 8 pale yellow, dark greyish brown along midline; sternite 9 pale yellow. Terminalia (Figs 50, 51): Upper branch of brownish black superior anal appendages sub-conical, shorter than S10, but much longer than upturned, not distinctly hooked lower branch, and markedly longer than yellow-based, black-tipped inferior appendages. Anal tergite (Fig. 51) greyish brown, with short triangular lobe each side of wide U-shaped notch.

Measurements – Hindwing 28.1 mm, abdomen + anal appendages 45.4 mm.

Female – unknown.



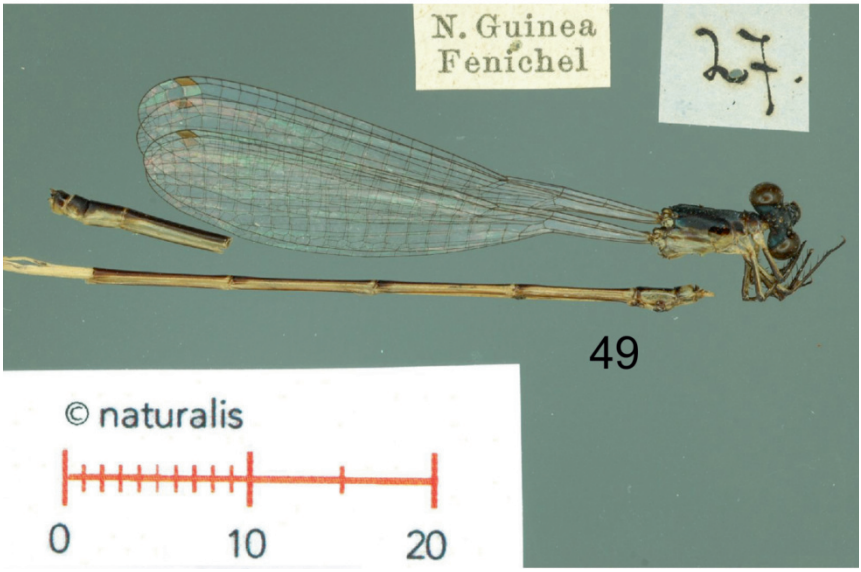
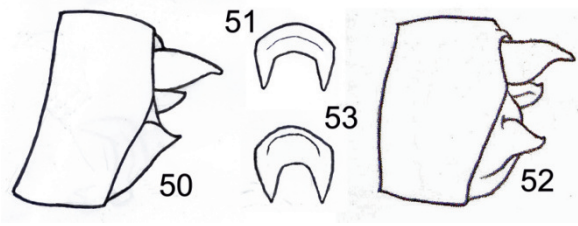


Fig. 48. ***Teinobasis livida*** **sp. nov., holotype male, (a) habitus, with (b) head, (c) pterostigmata and (d) terminalia inset.**

Fig. 49. ***Teinobasis metallica*** **Förster, holotype male.**



Figs 50, 51. ***Teinobasis livida*** **sp. nov., holotype male, terminalia: (50) lateral; (51) anal tergite, caudal.**

Figs 52, 53. ***Teinobasis metallica*** **Förster, male, terminalia: (52) lateral; (53) anal tergite, caudal.**

Fig. 54. *Teinobasis livida* sp. nov., male, photo by S.J. Richards.

Fig. 55. *Teinobasis livida* sp. nov., male, detail, photo by S.J. Richards.

Variability

The two paratype males agree rather well with the holotype. However, in both specimens the small comma-shaped mark between antenna and lateral ocellus and several ill-defined spots discernible along occipital margin paler than in holotype, and abdominal segment 1 tending to yellowish (vs pale blue). Black median stripe on dorsum of synthorax covers approximately 1/2 width of each mesanepisternum in one specimen and 3/4 width of each mesanepisternum in the other, this darker specimen also with small, ill-defined irregular blackish patch at base of each mesepimeron vs absent in holotype. Postnodals 15/14. Hindwing 25.5-27.3 mm, abdomen + anal appendages 41.6-44.0 mm.

Differential diagnosis

Teinobasis livida sp. nov. can be distinguished from all congeners from New Guinea and its adjacent islands except *T. caelestis* sp. nov. (Figs 40, 42, 45, 46) and *T. serena* (Fig. 44) by its largely pale blue thorax and black abdomen. It differs further from *T. caelestis* sp. nov. by having a completely pale (bluish/yellowish) S1 (vs S1 dull pale blue with brownish black trapezoidal dorsal patch), and from *T. serena* by its largely black vs blue face and blue vs black antelar sinus and humeral plates. In the structure of its terminalia (Figs 50, 51) the new species is most similar to *T. metallica* Förster, 1898 (Figs 52, 53) and may be closely related to that species. The male of the new species can be distinguished from *T. metallica* by its completely blue versus black anterior frons with large elongate blue or yellow patch each side, blue vs black antelar sinus and humeral plates, largely pale (bluish/

Fig. 56. *Teinobasis metallica* Förster, male, photo by S.J. Richards.
Fig. 57. *Teinobasis metallica* Förster, male, detail, photo by S.J. Richards.

Fig. 58. Very wet lowland rainforest habitat at the type locality of *Teinobasis aurantiaca* sp. nov., photo by S.J. Richards.

Fig. 59. Muddy trail through logged rainforest at the type locality of *Teinobasis fragillima* sp. nov. The types were collected from a seepage flowing onto this trail at the left background of the photo.

yellowish) vs largely black, sometimes even pruinescent, thorax and a completely pale (bluish/yellowish) vs dorsally black S1. It should be noted that specimens from subadult to very mature of *T. metallica* were available for comparison with *Teinobasis livida* sp. nov.

Distribution and habitat

Teinobasis livida sp. nov. is known only from two locations less than 8 km apart on the northern fringe of New Guinea's central cordillera in West Sepik Province. All specimens were perched on low foliage in shady locations in hill forest criss-crossed by numerous small, clear-flowing streams (Fig. 65). Nothing else is known about this species' ecology.

Discussion

Five of the seven species described in this paper have extensive yellow/orange coloration on the thorax and face. They seem to include two distinct subgroups, each containing species with remarkably similar morphologies. The first of these subgroups comprises *Teinobasis fragillima* sp. nov., *T. glossa* sp. nov. and *T. marginata* sp. nov. which share with each other and with *T. debeauxi* and *T. vincenti* a number of characters that are pointed out

Fig. 60. A small, slow-flowing stream in lowland rainforest at the type locality of *Teinobasis glossa* sp. nov.

Fig. 61. Lowland rainforest habitat at the type locality of *Teinobasis marginata* sp. nov. Specimens were perched on low foliage such as this, often some distance from water.

and used in the diagnoses of the novelties. The second subgroup comprises *Teinobasis aurantiaca* sp. nov. and *T. wau* sp. nov. and these species are very similar to *T. cuneata*.

Figs 62, 63. Clear-flowing forest streams at Wau Creek, the type locality of *Teinobasis wau* sp. nov. Several specimens were obtained in close proximity to these two streams.

Genetic studies are required to better understand the relationships among and between the species in these subgroups, and among other similar but little known *Teinobasis* with yellow/orange colouration on the thorax and face.

Fig. 64. Forest pool in logged hill forest, habitat of *Teinobasis caelestis* sp. nov. at the type locality. The holotype perched on low emergent twigs and vegetation, usually over deeper water.

Acknowledgements

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Fig. 65. Shallow, slow-flowing stream at the type locality of *Teinobasis livida* sp. nov.

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