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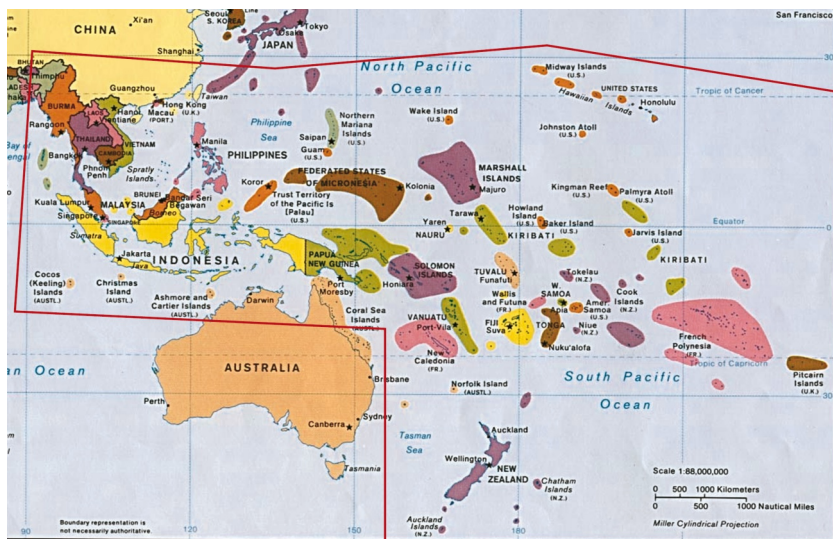
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## A contribution to the dragonfly fauna of Guadalcanal Island, Solomon Islands (Insecta: Odonata) with description of two new species

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### Abstract

New data on Odonata of the Guadalcanal Island, Solomon Islands are provided following a recently completed Rapid Biodiversity Assessment of the Tetena Haiaja ridge. Two new species, *Lieftinckia ulunorum* and *Procordulia vavehalo* are described. The first is a new member of the Solomon Islands endemic genus while the second is a new genus for the country and the second validated species from the Corduliidae family known from this Pacific archipelago. As *L. ulunorum* is found to be very closely related to formerly known *L. lairdi* Lieftinck, 1963, which was also collected during the field trip, both are described in detail based on mature adults and teneral specimens. Comparison with *L. salomonis* Kimmins, 1957 (investigated only from figures published in the original species description) and *Salomoncnemis gerdæ* Lieftinck, 1987 (also sampled during this study) were provided as well.

Additional morphological data is given on the following species: *Teinobasis bradleyi* Kimmins, 1957, female is illustrated here for the first time; *Anax* sp. cf. *gibbosulus*, second record of the genus for the country and *Gynacantha amphora* Marinov & Theischinger, 2012, originally described by a single male, here the description of the female is provided.

All other species collected during the field trip will be published separately in the final expedition report.

**Key words:** Odonata, Guadalcanal, Solomon Islands, new species, *Lieftinckia*, *Procordulia*, *Salomoncnemis*

### Introduction

Marinov & Pikacha (2013) summarised the existing literature on the Odonata fauna of the Solomon Islands and provided a complete updated species check list for the country. The study was a part of the ongoing research on the Pacific Odonata with scope outlined in Marinov & Doscher (2011). It is important to note that the Pacific Odonata research was initiated for the regions that at present remain outside of the global initiative for databasing and mapping Odonata distribution. Therefore, in their analysis Marinov & Pikacha (2013) focused on the country Solomon Islands and

excluded Bougainville Island as it is a territory of Papua New Guinea, hence subject to other studies (e.g. Kalkman & Orr 2013, Orr & Kalkman 2015).

Marinov & Pikacha (2013) compiled a list of 64 species that were reported for the country prior to their field study and added three more species which increased the total number to 67. That study was based on a small collection carried out in two and a half days of effective field work, including descriptions of two new species published separately by Marinov & Theischinger (2012), important additions to the fauna of the country and the whole archipelago as well as valuable taxonomic discussions. It highlighted the importance of more regular taxonomic and faunistic studies over the entire regions carried out all year around. At the present it is not possible for such programme to be implemented due to the lack of human resources and sufficient funds. However, any new data on this Pacific archipelago is welcomed and communication with the Pacific Odonata database manager (the author of this article) is encouraged as a valuable contribution towards understanding the species composition, extend of occurrence, trends and threats to local populations, all of which are highly needed for this remarkable part of the world.

The present paper provides a small contribution to this call for more intensive studies on the Solomon Islands Odonata. It builds on previous taxonomic discussions and provides new data for the country.

## **Material and Methods**

The material for this study was collected during an expedition for a Rapid Biodiversity Assessment of the Guadalcanal Watersheds. Guadalcanal Island was identified as one of the Key Biodiversity Areas under the ecosystem profile for the East Melanesian Islands. The expedition took place for a period of 11 days. Odonata were collected for a short time between 05-11 September 2015 only. The main focus of the expedition was Tetena Haiaja ridge, however a few more sites were added as they were sampled just before the field days in mountains.

Odonata species composition and distribution was the main focus of this study and therefore adults were mainly targeted. The biotope/habitat association was briefly recorded, but no detailed ecological studies carried out in the field. Adults were collected with an aerial net, killed in ethanol, air dried, transferred to paper envelopes and transported to the lab. Species identification was based largely on diagnostic keys provided in Michalski (2012) with the help of original species descriptions. Diagnostic images were taken using the methodology described in Marinov et al. (2013). Some specimens were badly damaged during the transportation to the lab and therefore for some species additional images were used to show the true colour as captured in the field soon after killing the specimens.

Exuviae with associated teneral and naiads were collected from several sites, however they will be treated in a separate analysis.

A complete species check-list will be prepared for the final expedition report. The goal of the current paper is only to provide clarification on some taxonomic issues encountered with the Solomon Islands Odonata. Therefore the information below



is related to those specific topics which are believed to help in future investigations of the Solomon Islands Odonata.

All specimens were collected by the author unless specified otherwise. They were all deposited at the New Zealand Arthropod Collection (NZAC), Auckland, New Zealand.

### Sampling localities

1. Valevahalo base camp: 9.6468°S, 160.0447°E; 810 m a.s.l. (08-11 September 2015).
2. Mbeambea River: 9.6470°S, 160.0501°E; 672 m a.s.l. (10 September 2015).
3. Stream and tributaries below Valevahalo base camp: 9.6464°S, 160.0443°E; 760 m a.s.l. (08, 09 September 2015).
4. Vulavula River: 9.6464°S, 160.040°E; 746 m a.s.l. (11 September 2015).
5. Light trap at Haviha Camp site: 9.6688°S, 160.0570°E; 1,221 m a.s.l. (16 September 2015). Tokasaya Curukivalenibula Cakacaka leg.

## Results

### Zygoptera

#### Coenagrionidae

*Teinobasis bradleyi* Kimmins, 1957

Localities: 1-4

So far only males have been figured in the literature (Kimmins 1957; Liefstinck 1987). During the present study both sexes were found in high numbers within the sampling sites. Diagnostic characters of females and males are illustrated in Figure 1. Important points to consider here are the pale hairs fringing the inner surface of the superior appendages of males and colour variants in females. The hairiness of male appendages are hinted on the figure of the holotype in Kimmins (1957). It is also specifically mentioned in the detailed description in Liefstinck (1987), but not well represented on the otherwise very accurate figure provided by that author.

Two different colour variants of the females were recorded. Figure 2 represent a tandem with one female colour variant only (provisionally named here as "orange" for the predominant colouration on the synthorax) which was found to be less common. The other colour variant was not photographed alive in the field.

#### Platycnemididae

*Liefstinckia lairdi* Liefstinck, 1963

Localities: 3 (08 September)-5

Eight specimens (six females and two males) were collected. The original species description was based on a teneral male (Fig. 3) and did not include illustrations of the female morphological features because Liefstinck (1963) found the allotype very

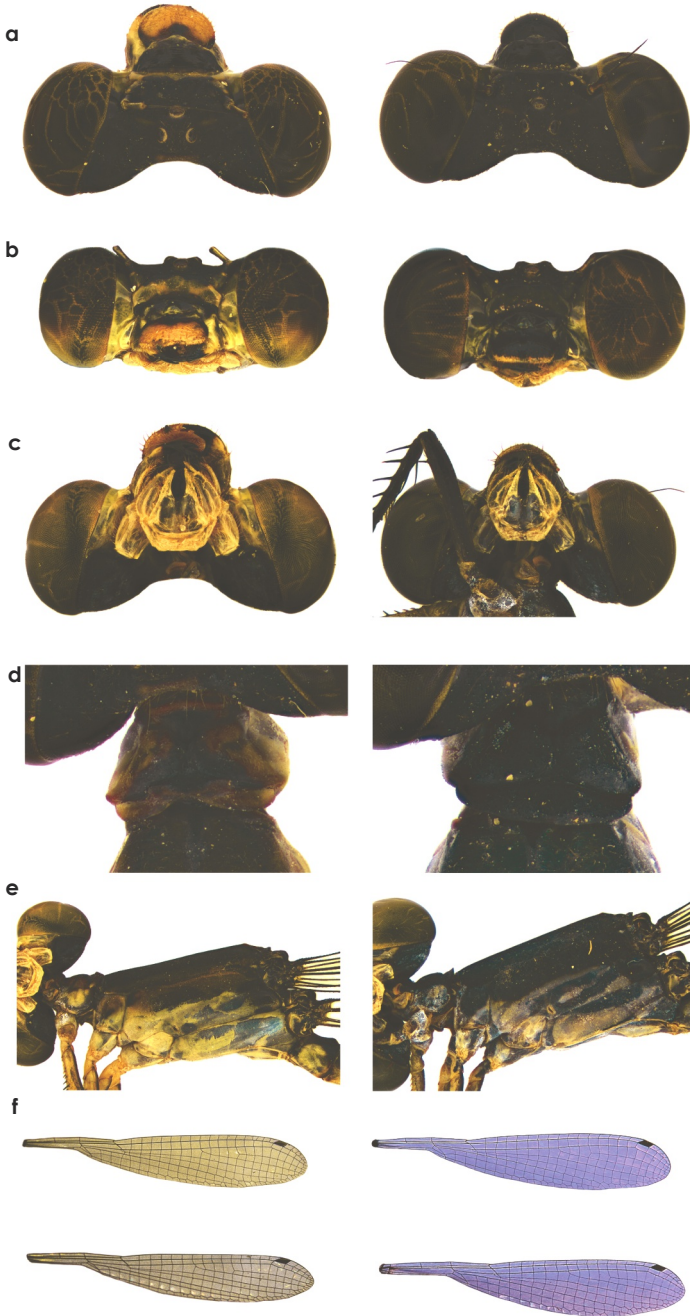
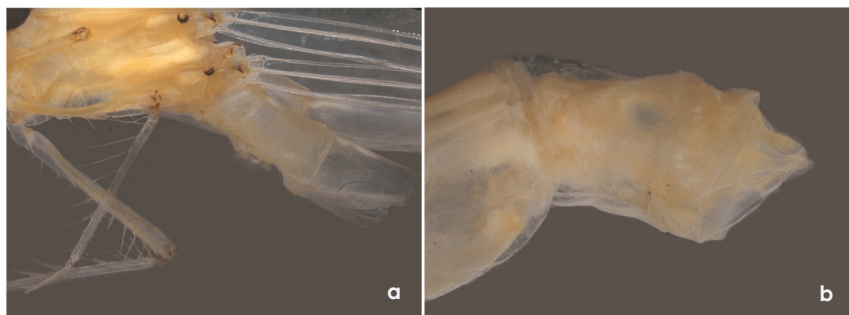




Figure 1. Comparison between the two sexes of *Teinobasis bradleyi* (left column female, right column male): a) head dorsal view, b) head frontal view, c) head ventral view, d) prothorax dorsal view, e) synthorax lateral view, f) wings, g) male appendages dorsal view, h) male appendages lateral view, i) male appendages posterior view, j) male appendages ventral view, k) female ovipositor.



Figure 2. A tandem of *Teinobasis bradleyi* with an "orange" female.



**Figure 3.** *Liefinckia lairdi* holotype male: a) synthorax lateral view, b) appendages lateral view.

similar to holotype male. Since *L. lairdi* is very closely related to *L. ulunorum* sp. nov. described below, and both inhabit the same habitats, both sexes of adult *L. lairdi* are described, illustrated and later compared to the new species. Teneral are included as well as some distinguishing features were noted from them too.

Male. – Head (Fig. 4a-c). – Labium pale orange, rest of the head uniformly orange darker than the ventral side and gradually darkening from labrum towards the occipital area; ocelli outlined with faint dark lines; only distal end of pedicel and flagellum distinctly dark red; rear part of head pale yellow; tips of mandibles deep red.

Thorax (Fig. 4d-h). – The whole of thorax almost uniformly orange, dark markings developed as follows: thick black line along the dorsal carina, faint traces across metepisternum posterior of metathoracic spiracle, black outline of the posterior border of mesepimeron, two black dots at the upper posterior end of metepimeron and posterior border of metasternum; legs almost uniformly orange slightly darker on the tibiae, faint traces of subapical bands on femora, thicker dark area at the apical annuli and tibial bases, darker apical ends of tarsal segments especially well pronounced on the last segment; wings finged with faint yellow, arculus distal to the second antenodal vein in fore wings and at the second antenodal vein in hind wings, Ac well proximal of the first antenodal vein, quadrilaterals trapezoidal and different in shape – fore wings have shorter costal edge thus looking smaller and wider, M3 at or very slightly proximal to subnodus in both fore wings and proximal to subnodus in hind wings, crossveins distal of the pterostigma: generally one row with extra veins forming one deep Y-shaped vein on fore left wings and one small Y-shaped vein in left hind wing, both right wings with complete rows of cells; nodal index 21-2 / 2-21 in fore wings, 20-2 / 2-19 in hind wings.

Abdomen (Fig. 4j-o). – Predominantly black with orange areas developed as follows: lateral on S1 meeting on the dorsum, lateral on S2 with its dorsal border descending posteriorly towards the ventral part of the segment not reaching intersegmental membrane, S3-5 small basal spot and smaller subapical spot weakly joined on S3 and gradually becoming completely separated towards the posterior end of the abdomen, these spots also decreasing in size, S6 basal spot only, S7-10 uniformly

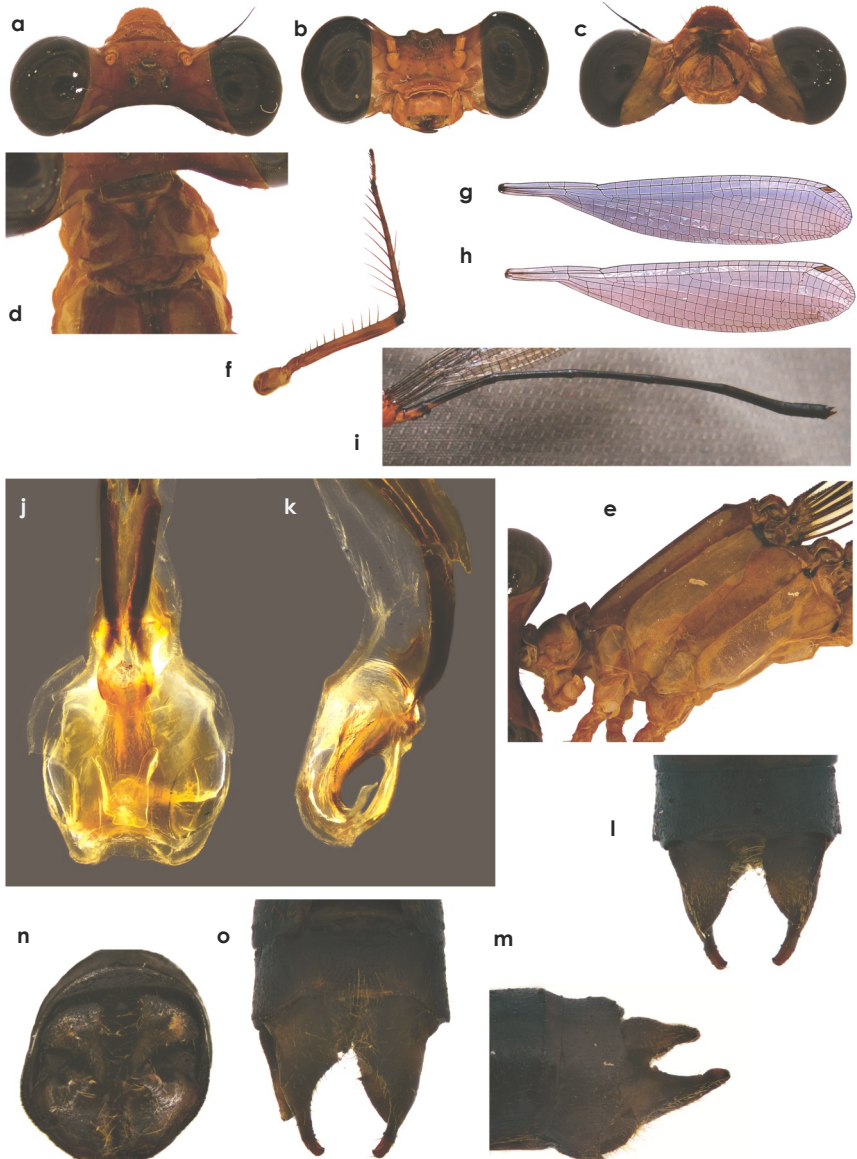


Figure 4. *Lieffinckia lairdi* male: a) head dorsal view, b) head frontal view, c) head ventral view, d) prothorax dorsal view, e) synthorax lateral view, f) hind leg, g) fore wing, h) hind wing, i) abdomen of a freshly killed specimen, j) penis ventral view, k) penis lateral view, l) appendages dorsal view, m) appendages lateral view, n) appendages posterior view, o) appendages ventral view.



black; anal appendages both dark with superior darker on dorsum and inferior appearing mottled. Penis in ventral view lateral flaps expanded considerably forming a roughly trapezoidal structure with a large and wide middle lobe, which expands in two very wide lateral flaps.

Measurements (in mm): total length (including appendages) 51.6; abdomen (including appendages) 42.9; hind wing 27.6.



**Figure 5.** *Lieffinckia lairdi* female: **a)** head dorsal view, **b)** head frontal view, **c)** head ventral view, **d)** prothorax dorsal view, **e)** synthorax lateral view, **f)** abdomen, **g)** ovipositor.

Female. – Head (Fig. 5a-c). – Labium yellow, mandibles yellow at the base with deep red apices; labrum darker with slightly paler anterior edge, dark marking continues up, diffused on the anteclypeus; postclypeus with a distinct semicircular dark spot; weak darkening above postclypeus; deep rusty colour between ocelli and the line at the occiput connecting the eyes at the posterior edges; antennae: scape yellow, pedicel rusty, flagellum dark red-brownish; rear part of head pale yellow.

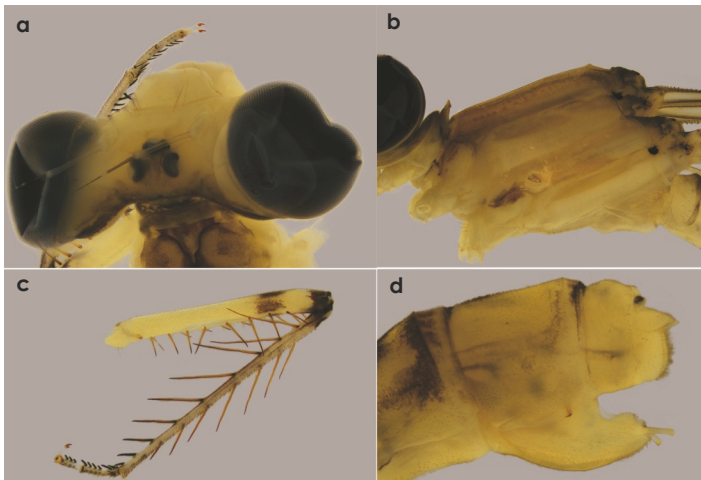
Thorax (Fig. 5d-e). – Prothorax clearly bicoloured with dark dorsal and pale yellow ventral part, posterior edge produced into two elevated bulging lobes with the



connecting edge appearing undulated between them; mesostigmal plate – outer edge elevated and slightly sticking out, curved posteriorly; synthorax uniformly dark rusty on mesepisternum descending down towards dorsal edge of mesinfraepisternum, across mesepimeron curving at the posterior end of metepisternum and produced as a transverse bar towards the metathoracic spiracle; two darker spots with the same rusty colour at the subapical edges of the mesopleural suture and on the metepisternum laying on the top of the metapleural suture; black lines and spots developed as follows: along the length of dorsal carina continuing on the alar ridges, alongside both posterior edges of mesepimeron and metepisternum, upper posterior end of metepimeron and posterior edge of metasternum; legs generally pale yellow with darker tibiae and traces of dark spots at the dorsal faces of second trochanters continuing on the extreme bases of the femora, subapical bands on all femora, apical on the annuli joined to the tibial bases and apical parts of tarsal segments; wings transparent, M3 in all wings proximal to subnodus, crossveins distal of the pterostigma: generally one row with some extra veins forming Y-shaped veins in three wings; hind wings with a complete row; nodal index 21-2 / 2-23 in fore wings, 19-2 / 2-19 in hind wings.

Abdomen (Fig. 5f-g). – Predominantly dark rusty with pale yellow areas as follows: S1 lateral surfaces continuing on the dorsum; S2 basal and subapical areas with approximately the same size as is the dark posterior and slightly brighter brownish area descending from the dorsum forming a characteristic pattern of yellow-dark-yellow-dark areas starting from the anterior end of the segment, S4 similar to S3, but the pattern obscured and yellow areas hardly visible, S5 traces of yellow at the extreme base of the segment only, S6-10 appear uniformly dark slightly paler on S7-8; ovipositor ends before the end of the abdomen with styli not obviously sticking out from the end, but more or less aligned with the tips of the appendages.

Measurements (in mm): total length (including appendages) 48.6, abdomen (including appendages) 39.7, hind wing 28.6.



**Figure 6.**  
*Liefstinckia lairdi* female, teneral:  
a) head dorsal view,  
b) synthorax lateral view, c) leg,  
g) ovipositor.

Teneral (females only) (Fig. 6). – Front part of head clear of any dark spots or area except for a faint darkening just above postclypeus; dark markings on head restricted at the occipital area and between ocelli. Thorax darkening faintly and the contrast not well visible; metepisternal cross band well separated from ventral edge of dark area developed on mesepimeron, but it is very faint with darker area on metinfraepisternum; black spots at upper corners of mes- and metepisternum only and slightly on posterior end of metasternum; legs generally pale (slightly darker on tibiae) with dark areas developed as follows: subapical band, femoral annuli and extreme bases of tibiae. Abdomen with S3-7 with similar pattern light-dark-light-dark; S8 inverted T-shaped mark separated from the posterior dark ring; S9 one basal spear-like mark only and obscure posterior line; same posterior line on S10.

Variations in both sexes. Teneral specimens generally the same pattern of pale and dark areas on the body. Older females generally darker in all areas described above and the dark colouration extends over slightly larger areas; paler anterior edge of labrum still visible; darker on the postclypeus not as a semicircular spot, but as an area extending to the base of postclypeus; dark marking at the occiput extends forward towards level of median ocellus; dark marking on the thorax becoming orange while pale yellow much brighter thus the contrast between the dark and pale areas is slightly diffused; the dark areas on the thorax described above are the same and slightly enlarged with metepisternal band almost merged with the mesepimeron orange colouration; dark spots and black posterior edges of the same position, but slightly darker in intensity; legs – basal spots on the trochanter not visible otherwise the same as described above. A male almost identical to the one described above differs in occipital area of head much darker with better contrast between the paler frontal area; prothorax with a weak contrast between darker dorsal area and paler ventral; two dark subapical spots on synthorax at mesopleural suture (faint) and metepisternum bordering on the top of metapleural suture (dark); black posterior border of mesepimeron descending alongside posterior border of metepisternum almost touching the black spot at the upper corner of metepimeron, the latter extruded as a thin line towards the ventral area of the thorax. Wing venation (in both sexes): position of M3 generally at or slightly proximal to subnodus in fore wings and proximal in hind wings; origin of Rs in almost all specimens half way between subnodus and first postnodal crossvein except in one specimen in one wing closer to subnodus and not at the centre of the cell; great variations in the crossveins distal of pterostigma with overall one row of cells with extra cross/transverse veins forming various Y-shaped veins or false double rows for the length of one-two cells; nodal index in females varies between (21-22)-2 / 2-21 in fore wings and 20-2 / 2-(19-20) in hind wings, in males varies between (19-24)-2 / 2-(20-23) in fore wings and (17-21)-2 / 2-(17-21) in hind wings. No significant variations in the abdominal pattern observed. Measurements vary between: total length (including appendages) 45.2-52.5 (45.2-48.6 in females; 51.6-52.5 in males); abdomen (including appendages) 37.3-43.8 (37.3-39.7 in females; 42.9-43.8 in males); hind wing 26.3-28.6 (26.3-28.6 in females; 27.6-28.0 in males).

*Lieftinckia ulunorum* sp. nov.

Holotype ♂: Solomon Islands, Guadalcanal Island, Stream and tributaries below Valevahalo base camp (9.6468°S, 160.0447°E; 810 m a.s.l.; 08 September 2015), M. Marinov leg. Allotype ♀: same data as the holotype. Paratypes (collected by the author unless otherwise specified): two mature (one female and one male) specimens and one teneral male specimen same data as the holotype; one mature male: Vulavula River (9.6464°S, 160.040°E; 746 m a.s.l.; 11 September 2015); one mature male: Light trap at Haviha Camp site (9.6688°S, 160.0570°E; 1,221 m a.s.l.; 16 September 2015; T. Kakacaka leg.); three teneral (one female and two males) specimens: Mbeambea River (9.6470°S, 160.0501°E; 672 m a.s.l.; 10 September 2015). The holotype (NZAC04134322) and other specimens from the type series are deposited at the New Zealand Arthropod Collection, Auckland, New Zealand.

Etymology. The type specimens were collected within the area own by the Uluna tribe. People from the tribe hosted the research team and were very friendly and supportive in our activities. Therefore the new species is named after the members of Uluna tribe, latinised Uluni, the genitive of which is *ulunorum* [noun in the genitive plural].

Male (holotype). – Head (Fig. 7a-c). – Labium pale yellow continuing up on the mandibular bases, genae, lateral sides of postclypeus, across the frons just above postclypeus aligned with the ventral ends of antennal bases, along the eyes diffusing up at top of the head at the level between median ocellus and lateral ocelli; rest of head rusty with a bright yellow anterior bar of labrum and dark front edge of postclypeus; lateral ocelli outlined with darker near black colour; anteclypeus withdrawn under the postclypeus and hardly visible as a pale yellow strip; rear part of head pale yellow much paler than labium.

Thorax (Fig. 7d-h). – Prothorax with sharp contrast between dark rusty dorsal and bright yellow lateral parts. Synthorax almost uniformly dark rusty on the dorsum at the level of dorsal par of mesinfraepisternum continuing as a straight line across mesepimeron joining interpleural suture about 1/6 from its dorsal end, the rusty colour slightly brightens up as two parallel bars along both sides of dorsal carina; another dark rusty bar going transverse across the ventral area of metepisternum from metathoracic spiracle on the top of metapleural suture gradually tapering and diffusing towards the antennal bases joining a well defined dark spot, diffused rust colouration in front of metathoracic spiracle; additional deep dark spots/area as follows: alar ridges, dorsal edge of mesepimeron, spot on the metepimeron at the end of metapleural suture, posterior edge of metasternum and another weak spot at the tip of metasternum; rest of synthorax pale to bright yellow; legs yellow with traces of rusty bands on the femora (darker subapical and obscured basal), dark apical ends of femora continuing on the tibial bases; leg spines mostly destroyed best preserved on one hind leg: long with tibial as long as three times the distance between their bases with basal spines even longer; tarsal segments yellow with faint darkening at the apical end of last segment; wings slightly tinged with pale yellow; tips undulating strongly between R2-CuP veins; Ac situated posteriorly to the first antenodal cross vein; arculus well distal from the second antenodal cross

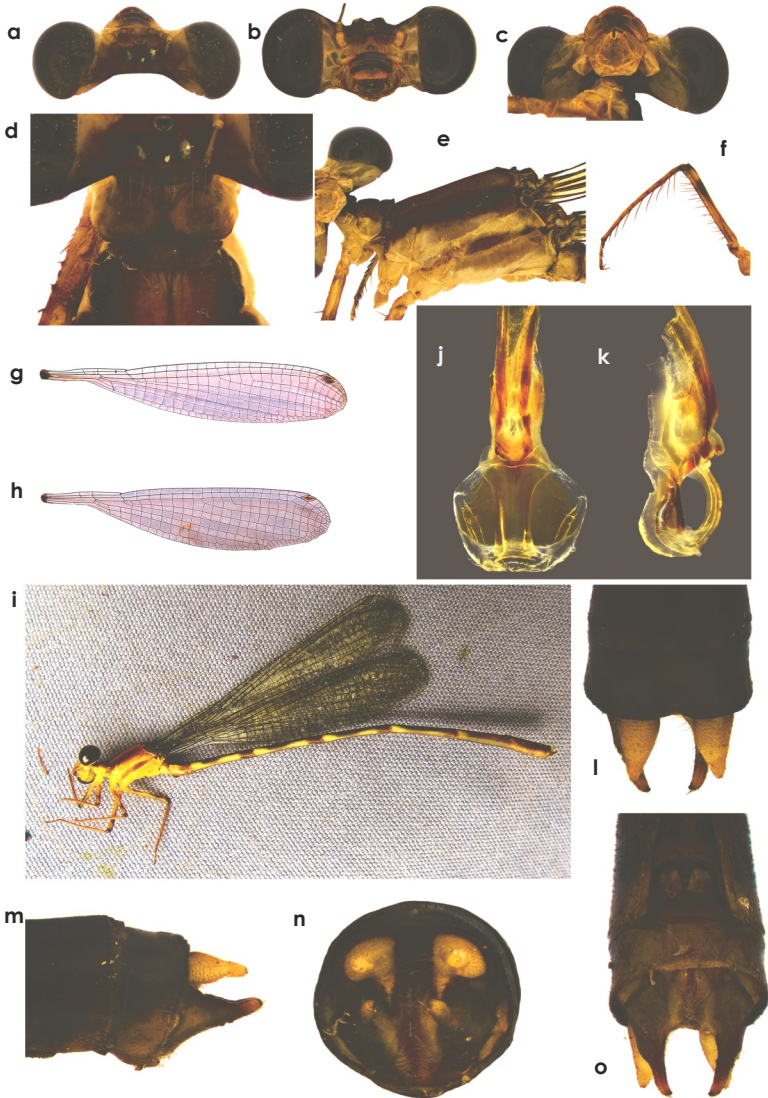


Figure 7. *Liefkinckia ulunorum* sp. nov., holotype male: a) head dorsal view, b) head frontal view, c) head ventral view, d) prothorax dorsal view, e) synthorax lateral view, f) hind leg, g) fore wing, h) hind wing, i) abdomen of a freshly killed specimen, j) penis ventral view, k) penis lateral view, l) appendages dorsal view, m) appendages lateral view, n) appendages posterior view, o) appendages ventral view.

vein; quadrilaterals trapezoidal and different in shape – fore wings have shorter costal edge thus looking smaller and wider; M3 situated at to slightly proximal to subnodus in fore wings to well proximal in hind wings; Rs at the middle of the first cell formed by the subnodus and the vein below the first postnodal cross vein; pterostigma pale yellow with a small invagination of the costal edge occupying one cell below it (one extra vein in fore left wing so pterostigma looks like occupying a cell and a half); generally one row of cells between costal edge and R1 after pterostigma with deep Y-shaped veins in both fore wings (one extra small Y-shaped vein in fore right wing) and right hind wing including two extra cells in hind left wing; nodal index: 19-2 / 2-20 in fore wings and 18-3 / 2-18 in hind wings.

Abdomen (Fig. 7j-o). Abdomen dark rusty on the dorsum and pale yellow on the ventrum especially at the base; S1 yellow goes upwards on the anterior part of the segment and appears as it joins on the dorsum; S2 yellow laterally for about 2/3 of the segment; S3-6 generally coloured following the pattern: yellow at the base, dark rust descending from the dorsum at about the middle, followed by yellow and dark posterior bands with variable widths creating a yellow-dark-yellow-dark pattern whose borders diffuse into each other, this pattern becomes less obvious towards the tip of the abdomen with S6 having one yellow basal area and obscured yellow at the level where the second yellow band is developed for the preceding segments; S7-10 almost completely dark rusty gradually becoming darker towards the tip of the abdomen; anal appendages – superior bright yellow, inferior appear slightly mottled with obscure yellow mixed up with diffused rusty; superior 0.8x the length of inferior. Penis in ventral view lateral flaps expanded considerably forming a roughly trapezoidal structure with a large extruded and narrow middle lobe, which in lateral view is strongly arched posteriorly and joins the main stem of the penis with a bifurcated end.

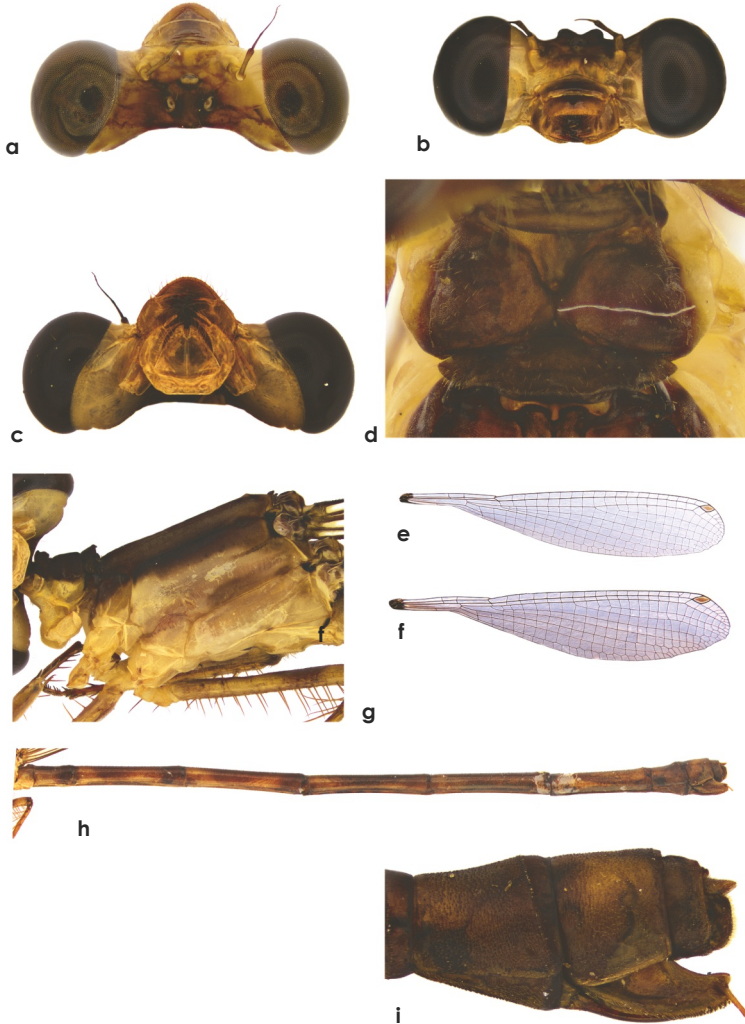
Measurements (mm): total length (including appendages) 47.1; abdomen (including appendages) 39.8; hind wing 25.9.

Female (allotype). – Generally same colour pattern as male, but paler. Head (Fig. 8a-c) dark rust colouration restricted mainly around the ocelli and diffused sideways; forehead almost completely yellow with traces of brownish rust at the centre of the labrum and posclypeus on the same areas as in males, but greatly reduced in intensity and area of occupation.

Thorax (Fig. 8d-g) same colouration as in male; posterior end of prothorax with two lateral lobes poorly defined and slightly erected, the edge connecting them almost straight with weak traces of undulation; mesostigmal plate low parallel sided; basal femoral spines as long as three to three and a half times the distance between them, more than four for the basal tibial spines; wing deeper tinged with yellow than holotype, venation identical to that observed in the male for the situation of the main veins given in the holotype; crossveins distal of the pterostigma with Y-shaped veins in both fore wings and additional transverse vein developed in left wing separating the adjacent cell in two, similar transverse cross vein separates the last cell in two in the right hind wing, left hind wing with one entire cell distal of the pterostigma followed by two rows with four (along the costal vein) and three (beneath) cells; nodal index 21-2 / 2-20 in fore wings and 18-2 / 2-18.

Abdomen (Fig. 8h-i) identical colouration to the holotype, but paler; ovipositor as long as the end of the abdomen with styli sticking slightly out.

Measurements (mm): total length (including appendages) 46.4; abdomen (including appendages) 37.8; hind wing 27.6.



**Figure 8.** *Lieffinckia ulunorum* sp. nov., allotype female: a) head dorsal view, b) head frontal view, c) head ventral view, d) prothorax dorsal view, e) synthorax lateral view, f) fore wing, g) hind wing, h) abdomen, i) ovipositor.



Teneral (male with exuvia) (Fig. 9). – Abdomen and wings still not fully expanded. Pale with dark colouration developed as follows: two basal spots on postclypeus, transverse bar above postclypeus separated from it by a pale area, dorsum of head around the ocelli connecting occiput between the eyes, with black semi-circles around all three of them, dorsal on the prothorax with posterior lobe almost entirely darkened, but paler compared to other dark areas, two parallel bars on the dorsum of the mesepisternum running along the mesopleural suture continuing anteriorly over the dorsal area of mesinfraepisternum and posteriorly ending around  $\frac{1}{4}$  of the length before the bases of the wings, weak traces on the mesepimeron at the level where the humeral bars end, metepisternal bar starkly distinct continuing over the dorsal area of metinfraepisternum and ending at the level of the humeral bar, black spots on the synthorax developed at the alar area at the bases of the wings around the upper posterior corners of both mes- and metepimeron; all legs with identical pattern: one dorsal spot on the second trochanter at the junction with the femur, two femoral bars one basal and one subapical increasing in intensity of the dark colouration from fore towards hind legs, tip of femora, weakly dark at the bases of tibiae; S1 dorsal posterior margin descending acutely along the border with S2, S2 with a solid, roughly inverted T-shaped area with a wider cross bar at the posterior end of the segment, S3-8 with similar pattern which could be explained as a modification of the inverted T-shaped area on S2 – wide transverse bar along the posterior end of the segment overarching along the junction with the succeeding segment partly to fully continuing on the intersegmental membrane and two roughly triangularly shaped spots finely separated with a yellow line along the dorsal carina of the segment becoming darker towards the anterior part of the segment and in S6-8 joining a dark rim-like line at the base of the segment, S9 posterior bar reduced to two small bars descending for a short distance on both lateral sides of the segment, dorsal dark area at the base of S9 with triangular shape orientated with its acute end towards the end of the segment; S10 with weak hardly visible dark patches at the area of the dorsal bars of S9. Other teneral males showed the same general body pattern with abdominal dark areas extended on the dorsum and decreased in intensity.



**Figure 9.** *Lieffinkia ulunorum* sp. nov., teneral male: a) head and thorax dorsal view, b) head and thorax lateral view, c) abdomen dorsal view.



**Figure 10.** *Lief-finckia ulunorum* sp. nov., teneral female: a) head dorsal view, b) synthorax dorsal view, c) synthorax lateral view, d) leg, e) ovipositor.

Teneral female (Fig. 10) appears darker than teneral males with dark areas developed in addition to that described for males as follows: elongated and thin triangular shaped lines on mesepisternum on both sides of the dorsal carina, humeral bars go to the end of mesepisternum joining the wing bases, bar on mesepimeron adjacent to humeral bars and running for about 2/3 of the length of mesepimeron, wider and longer bar on metepisternum weakly joining the wing bases as diffused traces, traces of dark areas on metepimeron below metepisternal bar separated by pale area, wider and much darker femoral bands almost joined at the inner surfaces of the hind legs; abdomen with the same pattern as for males throughout with dark posterior transverse bar darker as is the dorsal area running towards the anterior parts of the segments, S2 with an additional dark patches laterally; S10 with dark posterior ring like a bar.

#### Variations in paratypes

One mature male preserved in ethanol for months before examination had the colouration almost identical to holotype. It is believed to be more mature than the holotype because was overall bright yellow with sharp contrast of the dark colouration

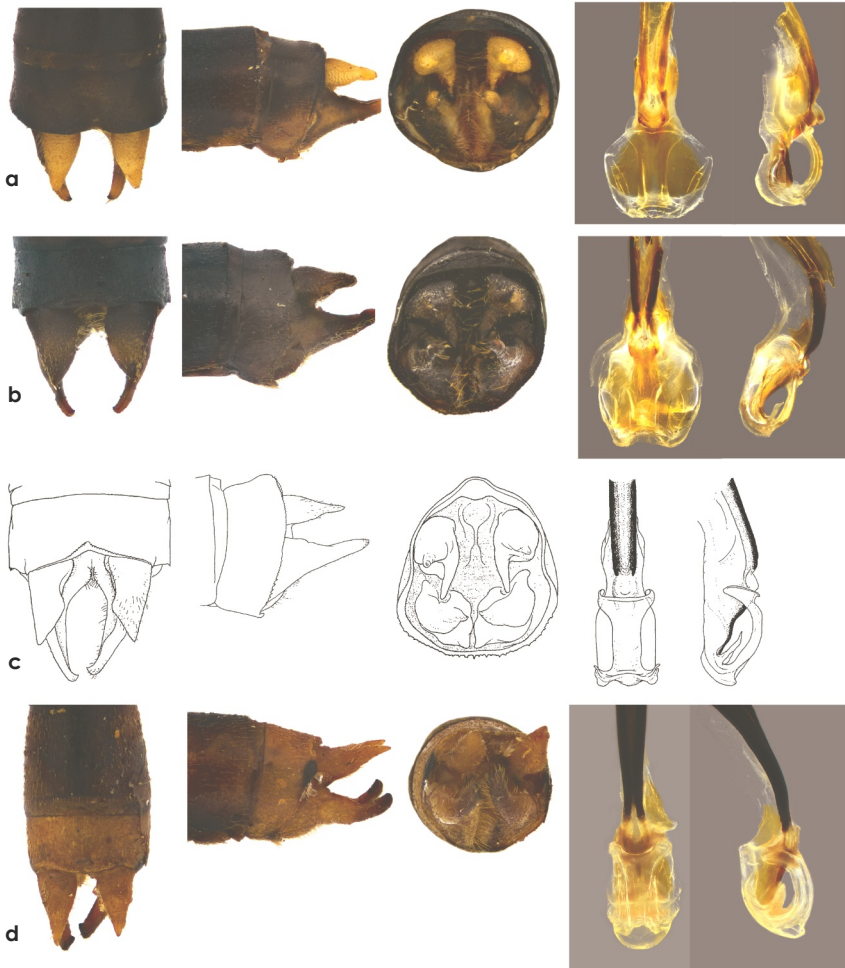
on the dorsum of the thorax and darker abdomen. It differed in the generally slightly darker body especially on: mandibular bases, rust on the frons descending down to the border with postclypeus, anteclypeus visible yellow with two dark spots on both sides of the central yellow area; basal and subapical bars on legs clearly visible. The specimen had the same paler area alongside dorsal carina; abdomen – stark contrast between dorsal dark and ventral yellow areas; S1 completely dark on the dorsum, S2 half dark half yellow laterally, S3 lateral darker area much larger than holotype almost occupying the lateral side of the segment, S4 lateral yellow at the base, but posterior yellow very faint, S5-S8 yellow at the base not joined on the dorsum and dark towards the end of the segment, S9-10 dark with very faint pale mark towards the ventral side, posterior edge of S10 with two faint yellowish spots around the bases of the appendages; superior appendages bright yellow and inferior mottled with more yellow than in holotype.

One female identical to the allotype with the following observed slight variations: S1 more rust on the dorsum at the base; ovipositor sticking out of S10 not just the styli. Other variations observed were the intensity of the pigmentation of the wing membrane



**Figure 11.** *Lieftinckia ulunorum* sp. nov., teneral male with exuvia, c) seepage as a habitat of *L. ulunorum*, d) fast flowing river as a habitat of *L. ulunorum*. Note – the metepisternal bar is well visible in all photos of teneral individuals; two femoral rings also showing on the male individual in a).

and greater inconsistency between the number of Y-shaped and transversely crossing veins in the area distal from the pterostigma. M3 in all wings generally almost always slightly to clearly proximal to subnodus; nodal index in females varies between (18-21)-2 / 2-(19-20) in fore wings and (18-19)-2 / 2-(17-18) in hind wings, in males varies between (17-21)-2 / 2-(17-22) in fore wings and (17-20)-2 / 2-(17-19) in hind wings. No significant variations in the abdominal pattern were observed. Measurements vary between: total length (including appendages) 45.5-50.7 (46.4-47.4 in females; 45.5-50.7 in males); abdomen (including appendages) 37.6-42.3 (37.8-39.3 in females; 37.6-42.3 in males); hind wing 25.7-27.6 (26.8-27.6 in females; 25.7-27.4 in males).

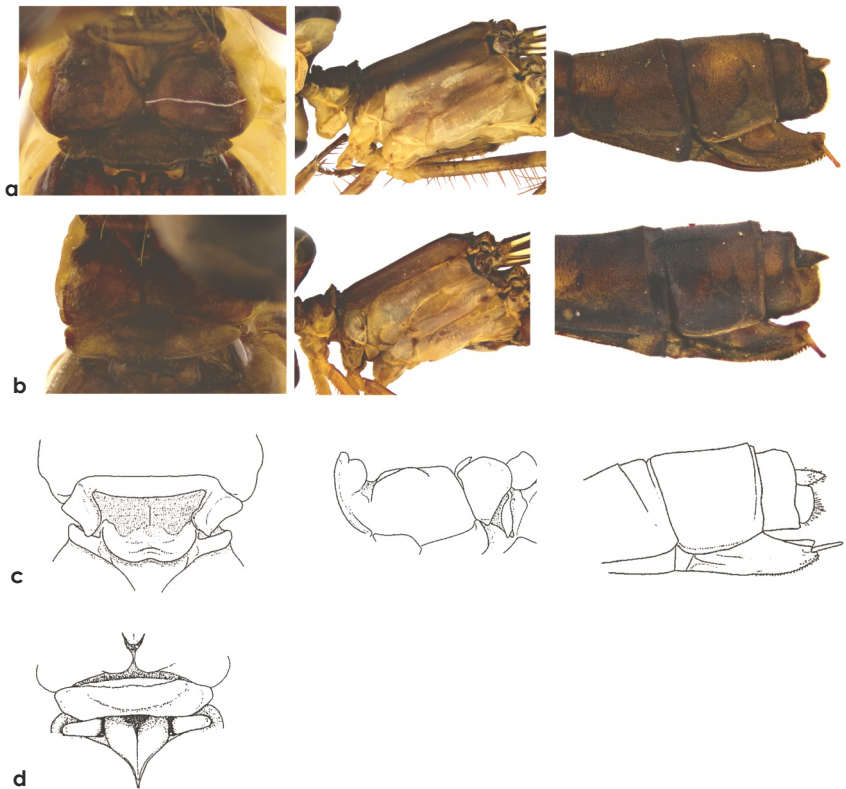


**Figure 12.** Comparison between the male appendages and penes of: a) *Lieffinckia ulunorum*, b) *L. lairdi*, c) *L. salomonis*, d) *Salomoncnemis gerdae*.



Habitat: Inhabits running water in the mountain areas. Teneral (Fig. 11a-b) have been observed in heavily shaded seepages flowing down on rocks (Fig. 11c) and large fast flowing rivers with large exposed boulders (Fig. 11d). A teneral male was collected with its exuvia (Fig. 11a-b), however no description of the naiad is provided here. It will be included in another paper dealing with naiads of several species recorded during this field trip. Adults were collected from the vegetation immediately surrounding the stream banks. No mating or feeding behaviour was observed.

Differential diagnostic. Figure 12 compares the males (appendages and penes) of *L. ulunorum* sp. nov. to *L. lairdi* and *Salomoncnemis gerdae* Lieftinck, 1987 collected during this study and *L. salomonis* Kimmins, 1957 from reprinted figures published in Lieftinck (1963). Males of all four species have similar shaped anal appendages which could be described as generally triangular in the superior in both dorsal and lateral views and which are shorter than the inferior; the latter having elongated and tapering posterior tips which are slightly inwardly curved at the very end (visible only in dorsal



**Figure 13. Comparison between the female prothorax and ovipositor of: a) *Lieftinckia ulunorum*, b) *L. lairdi*, c) *L. salomonis*, d) *Salomoncnemis gerdae*.**

**Table 1. Comparison between the superior appendages of: a) *Lieftinckia ulunorum*, b) *L. lairdi*, c) *L. salomonis*, d) *Salomoncnemis gerdae*.**

Feature	<i>ulunorum</i>	<i>lairdi</i>	<i>salomonis</i>	<i>gerdae</i>
superior appendages - end tips	blunt to round	broadly rounded	acute	acute
superior appendages - shape	elongated triangle	broad triangle	narrow triangle	narrow and elongated triangle
inferior appendages - shape at the tips	stout	narrow	narrow	stout

**Table 2. Comparison between the posterior lobes of the prothorax and ovipositor of: a) *Lieftinckia ulunorum*, b) *L. lairdi*, c) *L. salomonis*, d) *Salomoncnemis gerdae*.**

Feature	<i>ulunorum</i>	<i>lairdi</i>	<i>salomonis</i>	<i>gerdae</i>
prothorax - dorsal view	weak undulation	sharp undulation	sharp undulation	weak undulation
prothorax - lateral view	weakly raised	greatly raised	greatly raised	–
ovipositor	at the tip of the abdomen	shorter than the tip of the abdomen	at the tip of the abdomen	–

view). The differences are very minute and explained in Table 1. One must bear in mind that all those differences make sense only when comparing the four species together.

Penes of the four species are distinct. The lateral flaps of *lairdi* and *ulunorum* are wide and have the roughly trapezoidal shape described above while in *salomonis* and *gerdae* this structure is narrow and parallel sided. The ligula is strongly curved in *ulunorum* and *gerdae*, less pronounced in *salomonis* to almost straight in *lairdi*. The last-named has a ligula head of a characteristic wide and laterally expanded shape with flanges that overlap a large portion of the trapezoidal base of the lateral flaps, while the other three species have their ligula heads narrow ending in a clearly bifurcated tip in *ulunorum* and *gerdae* and nearly straight edge in *salomonis* (ventral views).

Important diagnostic features of females are illustrated in Figure 13 and described in Table 2. No females of *S. gerdae* have been collected and only a single figure published with the species description is used here. The taxonomic value of those features is evident in direct examination of specimens from different species. The differences in the posterior lobe of the prothorax are small, but consistent between *ulunorum* and *lairdi* investigated in direct comparison. The length of the ovipositor relative to the tip of the abdomen is a more reliable diagnostic. It is clearly shorter in *lairdi* and aligned with the end of the abdomen in *ulunorum* in both mature and teneral females. More data is necessary for *salomonis* and *gerdae* in order to be incorporated in a detailed analysis, however it seems that based on the shape of



the posterior end of the prothorax *salomonis* is closer to *lairdi* while the length of ovipositor is similar to *ulunorum*.

Wing venation is difficult to assess because *salomonis* has been investigated from figures published in Liefstinck (1963) and Michalski (2012). Both *lairdi* and *ulunorum* were found to be indistinguishable based on wing venation. Nodal indexes are overlapping in both species with *lairdi* generally having slightly higher cross vein numbers in both sexes which was attributed to overall larger sizes observed in the investigated specimens. The double rows of cells distal to the pterostigmata seem to be the best character to differentiate *salomonis* from *lairdi* and *ulunorum*. The last two species have extra vertical and transverse veins that appear to divide single cells into two thus making two rows of cells for a short distance, however, none of the investigated specimens had a clearly double cells-rowed structure in all four wings. There was always at least one cell undivided immediately adjacent to the pterostigma. The positions of M3 and Rs are probably another feature to consider in future morphological analyses. In *lairdi* and *ulunorum* they are always clearly separated with M3 usually at or proximal to the subnodus while in *salomonis* it seems to be at or slightly distal. Rs in *lairdi* and *ulunorum* originates midway between subnodus and first postnodal cross vein while in *salomonis* it looks as if it is merged with the origin of M3.

Differences in body colouration cannot be evaluated because *salomonis* was not available for assessment. Based on the description given in Liefstinck (1963) it appears that *salomonis* has a general body pattern closer to *lairdi* than to *ulunorum* in having a black dorsal carina on the mesepisternum well visible in both live individuals and preserved in dead specimens (Fig. 14), faint stripe on the metepisternum and one



**Figure 14. Comparison between the colouration of the dorsal carina in both live and dead specimens of: a) *L. ulunorum*, b) *L. lairdi*.**

subapical diffused ring on the femora. In *ulunorum* the contrast between the stripes is sharper in both teneral and mature specimens, the black dorsal carina is missing and femora have an extra basal ring very well visible in tenerals. Abdominal patterns in all three species seem to be very similar. No diagnostic features could be proposed now as there were age related differences observed in the investigated specimens for both *lairdi* and *ulunorum*.

## Anisoptera

### Aeshnidae

*Anax* sp. cf *gibbosulus* Rambur, 1842

Locality: 1 (10 September)

One female was collected only. Due to the poor state of preservation the identification was difficult even under the microscope. The thoracic and abdominal patterns had vanished and were unreliable for identification. Other diagnostic features were sought in comparison with two widely distributed species within the Pacific: *A. gibbosulus* specimens collected from New Caledonia and *A. guttatus* sampled from many parts of the Pacific Ocean islands. Figures of Papuan *Anax* species presented in Michalski (2012) were used too. Figure 15 compares male specimens from the two species to the female reported here. The female was found to be closer to *gibbosulus* by the presence of several characters that collectively are believed to be useful diagnostics: large T-shaped mark on the dorsum of the frons (absent in *guttatus*), black occipital triangle (yellow in *guttatus*), large apical transverse bar on the labrum (smaller in *guttatus*), larger dark areas on the apical section of the middle lobe of the



Figure 15. Comparison between male *Anax guttatus* and *A. gibbosulus* to the female *Anax*

reported here: a) *A. guttatus*, male, b) *A. gibbosulus* male, c) *A. gibbosulus*, female.

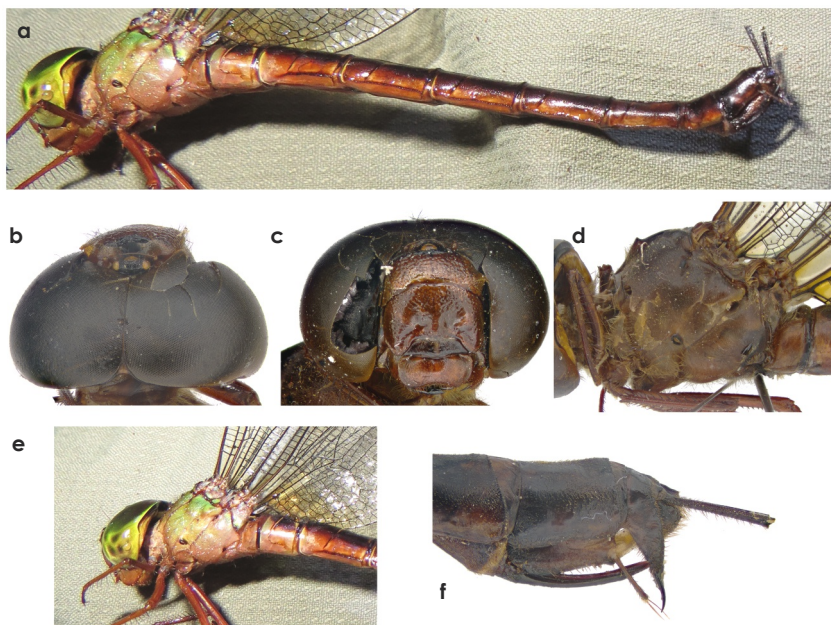
labium (brighter yellow in *guttatus*) and the brighter yellow area on the rear part of the head (darker yellow in *guttatus* and occupying lesser area). However, the final identification was still uncertain for the following: overall bad state of preservation with no markings visible on the abdomen, T-shaped mark thicker than usual and body size differences compared to other *Anax* species known from the Papuan region as reported in Michalski (2012).

*Gynacantha amphora* Marinov & Theischinger, 2012 (by supposition)

Locality: 1 (11 September)

One female was collected only. It is identified as *G. amphora* by supposition based on the general resemblance to the holotype male. The female specimen was partly destroyed during transportation and the colouration completely vanished. Therefore, field photos of the colouration shortly after euthanizing the specimen were used for the description provided below.

Head (Fig. 16a-c). – Labium dark orange; mandibles dark orange at the base with dark reddish tips; almost the entire forehead of the face dark orange which spreads onto the labrum, postclypeus and fore part of the frons; anteclypeus darker reddish; dorsal part of frons broken, but predominantly same colour as forehead with traces of a very thick-stemmed black T-shaped mark; antennae light brown; vertex dark

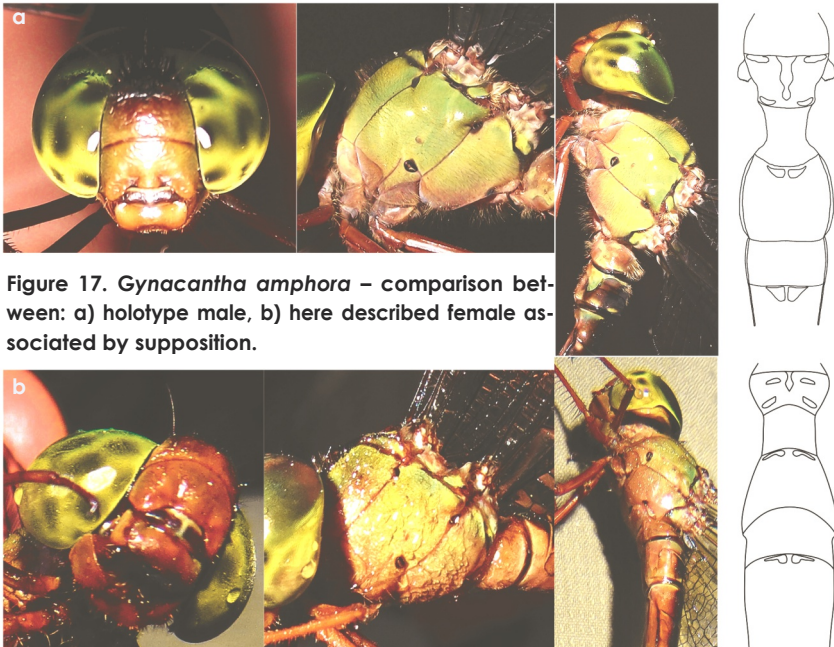


**Figure 16.** *Gynacantha amphora*, female: a) lateral view of the whole body of freshly killed specimen showing the true colouration, b) head dorsal view, c) head frontal view, d) synthorax lateral view (dead specimen), e) synthorax lateral view (freshly killed specimen), f) ovipositor.

almost entirely black; occipital triangle yellow; rear part of head bright yellow with dark red arch-like area along the eyes wider around the rear side of occipital triangle and tapering to acutely pointed near the eye seam; another red area (slightly lighter) developed towards the foramen.

Thorax (Fig. 16a, d-g). – Prothorax dark yellow to pale brown towards posterior lobe. Synthorax (colour on the dead specimen completely vanished) in life pale green on the dorsal area becoming light brownish towards the ventral part; with two dark spots at the dorsal ends of both mesopleural and metapleural sutures just before the bases of the wings and another dark spot at the posterior edge of metepimeron anterior of the metasternum; black rim around the metastigma. Legs uniformly reddish brown with coxae paler than the rest and darker spines. Wings hyaline tinged with light yellow at the bases: fore wings with light streaks in the cubital space, hind wings with a wider area almost reaching anal loop; venation pale brown proximally and along the leading costal edge becoming darker to black towards the posterior edge of the wing membrane; pterostigma dark yellow overlaying  $4\frac{1}{2}$  (fore wings) and  $3\frac{1}{2}$  (hind wings) cells; nodal index 26-30 / 31-25 in fore wings and 27-21 / 23-27 in hind wings; triangles comprising 7-8 (fore wings) and 6 (hind wing) cells; anal loop made up of 17 cells.

Abdomen (Fig. 16a, i): colour of the dead specimen completely vanished with no traces of any markings visible. Generally dark brown to black on the dorsum and pale brown on the ventral area. Yellow markings developed as follows: pairs of mid dorsal spots adjacent and posterior to supplementary transverse carina with



**Figure 17. *Gynacantha amphora* – comparison between: a) holotype male, b) here described female associated by supposition.**

roughly triangular shape to boomerang shaped on at least S3-7 (end of the body not visible from the photo of the freshly killed specimen); thin ring-like line at the anterior end of S3-6; obscure areas on the lateral sides most of the segments better pronounced on basal segments. First abdominal segments with faint greenish areas as well.

Measurements (mm). Total length (with appendages) 78.1; abdomen (with appendages) 60.8; fore wing 52.5; hind wing 52.3; pterostigma (costal edge of hind wing) 3.8.

Differential diagnostic. The female described here is believed to be associated with the male *G. amphora* for the general similarity in the holotype male observed in colouration of the head (identical in both sexes), thorax (almost identical with more vivid green in male), abdominal pattern (broader dorsal yellow spots at the supplementary transverse carina in male), nodal index (up to four cross veins more in female) and general measurements (female slightly larger). Figure 17 illustrates the similarity in these body features. The female abdominal pattern was redrawn from a photograph of a freshly killed specimen. Unfortunately it was not verified with a preserved specimen because of the poor state of body colour which is indistinguishable. Therefore, the illustration on the Figure 17 must be considered as approximate and was prepared to show the general similarity to the male *G. amphora*.

## **Corduliidae**

*Procordulia vavevahalo* sp. nov.

Holotype ♂: Solomon Islands, Guadalcanal Island, light trap at Haviha Camp site (9.6688°S, 160.0570°E; 1,221 m a.s.l.; 16 September 2015), T. Cakacaka leg. Allotype ♀: 11 September 2015, Vulavula River (9.6483°S, 160.0370°E; 710 m a.s.l. 11 September 2015), M. Marinov leg. The holotype (NZAC04139934) and allotype are deposited at the New Zealand Arthropod Collection, Auckland, New Zealand.

**Etymology.** The species is named after the name of the old village Vavevahalo [noun in apposition] from where the type specimens were collected.

**Male (holotype).** – Head (Fig. 18a-b). – Labium white, lateral lobes fringed with yellow hairs, median lobe covered with long white hairs; mandibles hidden and partly visible, their apices dark red, bases appear white; labrum dark purple to nearly black with two symmetrical longitudinal depressions running parallel for about 3/4 from the base towards the anterior edge; anteclypeus yellow save for light brown side lobes which also have triangular inner projections at their bases; postclypeus almost entirely unicoloured light brown with weak brighter patches and streaks at the median area; frons laterally same colour as postclypeus going upwards and reaching the bases of the antennae, yellow transverse bar bordering the suture between the frons and postclypeus outlined with darker orange line at the dorsal edge; dorsal area of frons and vertex metallic green with deep purple iridescence; almost entire front part of the head covered with black hairs which are stouter and denser on the dorsal area especially on the vertex; antennae dark red with scape and pedicel almost black and flagellum slightly paler; occipital triangle light brown with strongly erect very dense hairs slightly bent forwards, rear area continues to paler almost dirty yellow with hairs at the border line which are finer, blackish on the light brownish area



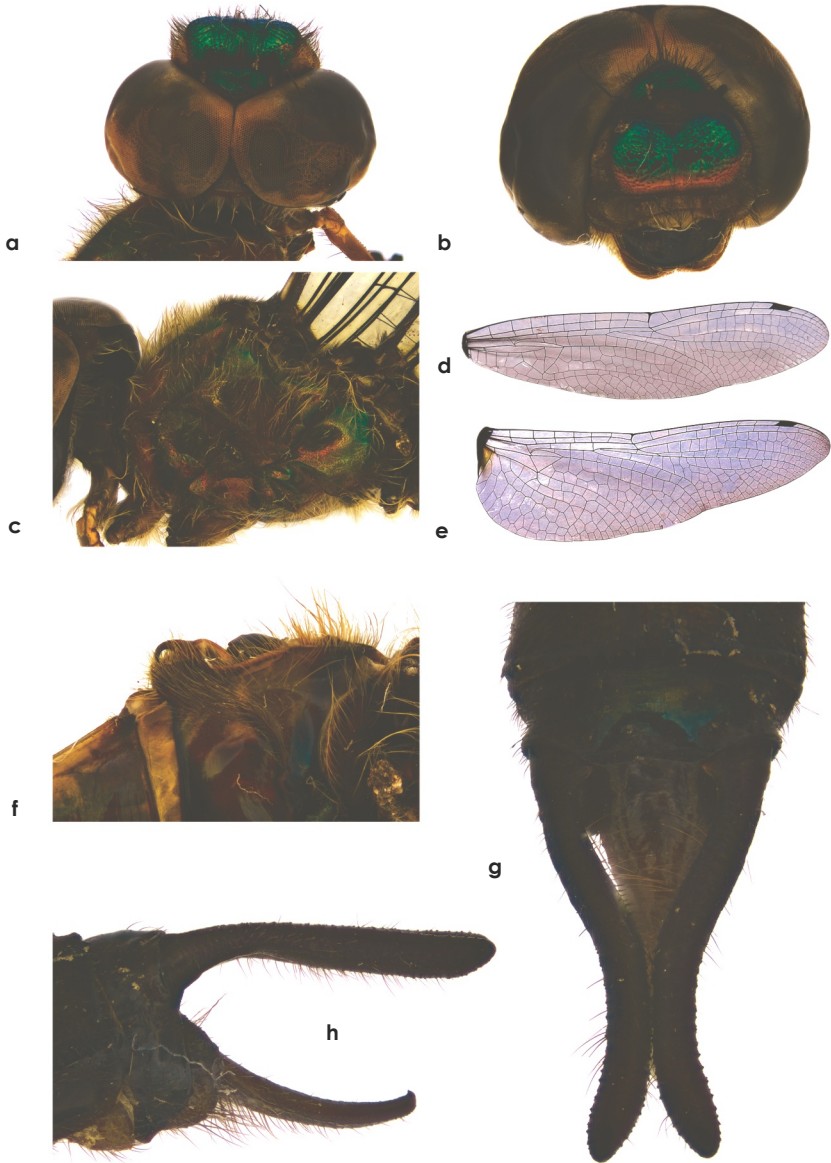


Figure 18. *Procordulia vavehalo* sp. nov., holotype male: a) head dorsal view, b) head frontal view, c) synthorax lateral view, d) fore wing, e) hind wing, f) secondary genitalia, g) appendages dorsal view, h) appendages lateral view.



and very long and white on the dirty yellow area. Entire occipital area of head black with a dense fringe of white hairs.

Thorax (Fig. 18c-e). – Prothorax mostly dark, anterior lobe erect with bright yellow apical part, dorsal area of middle lobe dark orange continuing to dark brown (almost black) laterally and dark yellow above the fore coxae; posterior lobe dark yellow, flat with transversely truncated posterior end; hairs – very small and white on the elevated posterior area of anterior lobe, longer whitish on the anterior edge of middle lobe and very dense long hair on posterior lobe which are mostly white on the dorsal area and yellowish at the posterior end. Synthorax overall metallic green with dark yellow colouration developed on mesinfraepisternum, ventral one third part of mesepisternum at the lower outer lobes ascending as a thin line alongside the mesopleural suture, dorsal half of metinfraepisternum, area just above the metastigma spreading out onto mesepimeron and metepisternum on both sides of intersegmental suture ascending alongside the metapleural suture up to the wing bases, almost entire ventral side of metepimeron and continuing up and anteriorly as two round lobes fading around the edges, metasternum; metastigma outlined with a black rim with the dark area going towards and up along the intersegmental suture; violet sheen developed around the edges of the synthoracic segments especially close to the sutures; almost entire surface of synthorax covered with long and dense whitish hairs especially more densely developed on the mesepisternum.; legs coxae predominantly dark yellow with dark areas developed on the anterior surfaces of all three pairs as follows: front – an obscure bar on the outer edge, middle – entire anterior face, hind – around the ventral surface at the joint to the trochanter fading upwards at the posterior face; rest of the legs almost black with the dark yellow colouration developed on front legs up to just before the distal corner of the femora, very obscure area on the inner surfaces of the middle legs up to about one quarter before the distal end of the femora and proximal areas including trochanters of the hind femora; claws dark red with bidentate apices; tibial keels developed as follows: slightly longer than half on the front legs and most of the hind where they stop at about one ninth before the proximal end. Wings transparent with very faint yellow infumation; venation black except the proximal corners of the costal veins for a short distance at the bases only and a slight tinge of yellow on first antenodal cross veins; pterostigmata deep dark red; arculus situated half way between first and second antenodal veins in both wings; triangles crossed by one transverse vein in fore wing and free in hind wing; three-celled subtriangle in forewings; nodal index 7-8 / 9-7 for forewings and 8-6 / 6-7 for hind wings.

Abdomen (Fig. 18f-h): S1 dark yellow with obscured dark areas on the lateral surfaces; the rest of the abdomen predominantly metallic green with dark yellow areas developed on the ventral two thirds of S2, S3 and the intersegmental membrane between them continuing on the ventral surface for almost the entire length interrupted by black areas (outlined with dark red) at: posterior half of S3, entire S4-5 alongside the supplementary transverse carina fading towards the sternites, small streaks at the anterior corners and large roughly triangular spots at the posterior ends of S6-8, almost entire areas on S9-10 saved for dark yellow around the genital pore; bright yellow bars developed dorsally on the supplementary transverse carina of S5-8 for

about four fifth/sixth of the length of the segment; S5 bar like a very faint yellow line, S6 parallel sided, S7 higher at the anterior end and roughly rounded at the posterior, S8 truncated to acutely pointed towards the posterior end; metallic sheen on the dorsal surface of S9 obscured. S10 black. Anal appendages black, superior long about five times longer than S10, converging at around the middle, parallel sided and divergent at the tips; distal ends rounded. Inferior as long as four fifth of the superior.

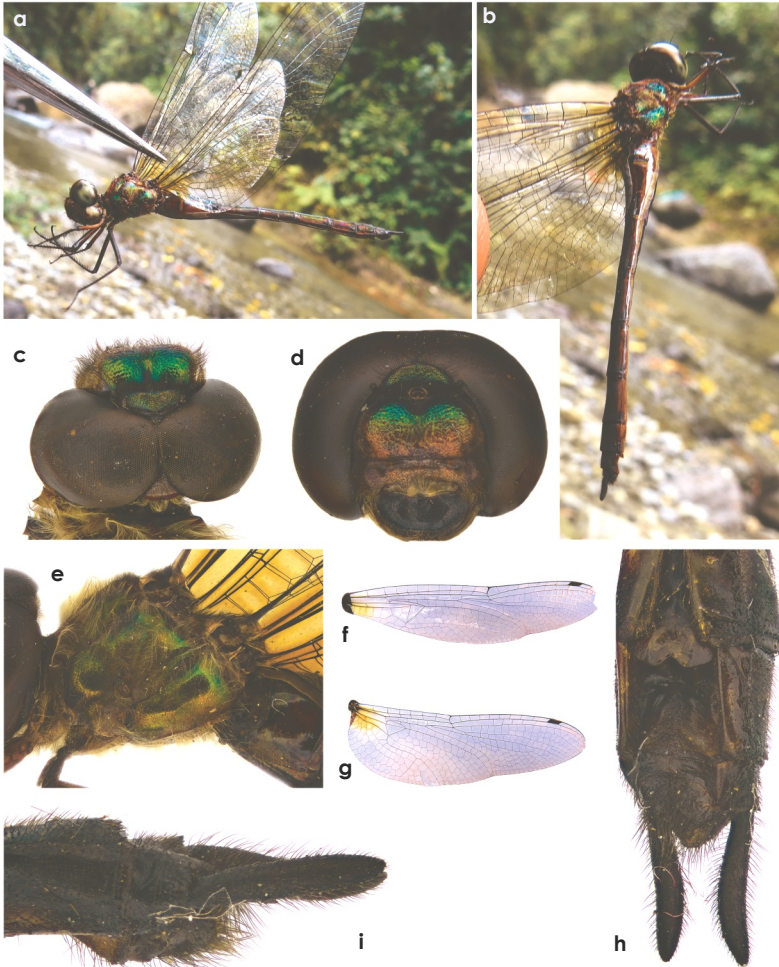


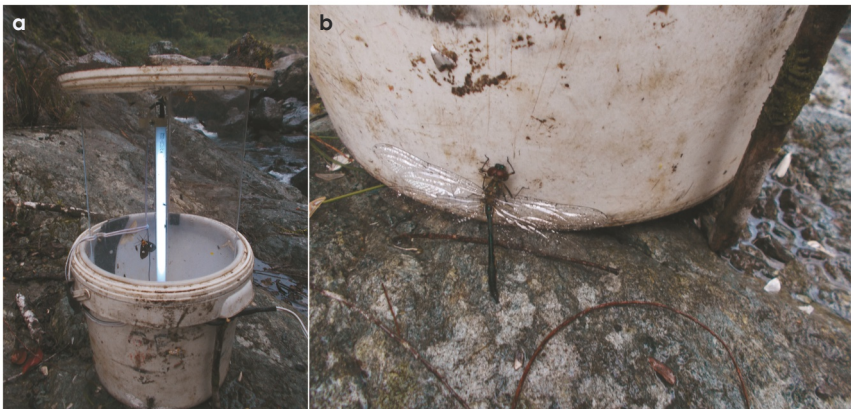
Figure 19. *Procordulia vavahalo* sp. nov., allotype female: a)-b) lateral views of the whole body of freshly killed specimen showing the true colouration, c) head dorsal view, d) head frontal view, e) synthorax lateral view, f) fore wing, g) hind wing, h) appendages lateral view, i) vulvar scale.

Measurements (mm). Total length (with appendages) 48.2; abdomen (with appendages) 34.3; fore wing 37.1; hind wing 36.2.

Female (allotype). – (Fig. 19). – Similar to male in colouration and hairiness, but differs in the following points: dorsal area of frons and vertex lack the deep dark purple iridescence and are predominantly metallic green; hairs on the dorsal surface of the occipital triangle less dense; no fibial keels developed; colouration on the abdomen faded, but generally looks darker green than male with weak purple sheen and obscured dark yellow areas on first three segments only, arranged similarly to the male; wings with darker infumation, bright yellow basal areas developed on both pairs and larger areas reaching just before or almost to the arculus in fore and hind wings respectively, arculus closer to second antenodal cross vein, other characters such as the number of cross veins and cells between major longitudinal veins were considered minor and probably will be found variable should more specimens be discovered; nodal index 7-10 / 10-6 for forewings and 8-6 / 6-8 for hind wings; vulvar scale more than three times as wide as long, deeply incised to about half the length.

Measurements (mm). Total length (with appendages) 54.5; abdomen (with appendages) 41.6; fore wing 40.5; hind wing 39.6.

Habitat: The holotype was collected from a light trap (Fig. 20) and no information on the habitat could be provided. The allotype was found in a 5 to over 10 m wide river with shallow water and exposed bed rocks. At the locality the slope of the bottom was gentle to nearly flat allowing for river water to run without making fast rapids. The banks of the river were heavily vegetated with tall trees. Dead trunks with variously long branched were anchored at the river banks creating perching places for other odonates, but *P. valevahalo* was not observed sitting on the any of those branches. The sole female was collected in flight close to the river bank just above the water surface.



**Figure 20.** *Procordulia valevahalo* sp. nov., holotype male by the light trap: a) the trap set up with *P. valevahalo* partly visible at the bottom, b) *P. valevahalo* at the light trap.

## Discussion

*Teinobasis bradleyi* was described from only two males. Females were unavailable until Lieftinck (1987) described one adult from Bougainville Island which was collected with the male and corresponded closely with it. The diagnostic features of males (anal appendages) were illustrated twice in Kimmins (1957) and Lieftinck (1987) with the latter being reprinted in Michalski (2012). Kimmins (1957) also provided a schematic drawing of the thoracic pattern. The female, however, has never been illustrated and therefore special attention was paid here to this species. It appears that females of *T. bradleyi* come in two different colour variants. Both have been detected in copulation tandems with males within the same localities. However, at this stage it is unclear if they have to be regarded as two different forms. Two provisional names are suggested here – “blue” for the more common variant and “orange” for the less frequently encountered one.

Three Platycnemididae species (*Salomoncnemis gerdae*; *Lieftinckia lairdi*; *L. ulunorum*) were found similar in general body colouration in the field. *S. gerdae* was identified based on diagnostic features provided in Lieftinck (1987) although the figure of the penis in the original description differs slightly in the shape of the ligula head in ventral view from what was observed and illustrated here for the specimens collected during the trip. However, other morphological features (including lateral view of the penis) were found to be identical to *S. gerdae*. Lieftinck (1987) established the monotypical genus *Salomoncnemis* for differences (compared to *Lieftinckia*) observed mostly in: broader head with bulging eyes, shorter and stouter legs with little shorter spines and more open wing venation. However, in the general shape of the male anal appendages *S. gerdae* is much closer to *L. lairdi*, *L. salomonis* and *L. ulunorum* than all three are to other congeneric species, like *L. isabellae* Lieftinck, 1987, *L. kimminsi* Lieftinck, 1963 and *L. ramosa* Lieftinck, 1987. Anal appendages of the last representative of the genus *L. malaitae* Lieftinck, 1987 have never been illustrated (Michalski 2012) and therefore not included in this comparison. The taxonomic position of *S. gerdae* seems to require further consideration and the sole representative will probably need to be included under the genus *Lieftinckia*. It is not considered here that there is sufficient material for such a review, moreover the whole genus and its correct taxonomic place requires thorough work as both Kimmins (1957) and Lieftinck (1963) considered it to be an aberrant Platycnemididae.

The described here as *L. ulunorum* was found to be very closely related to *L. lairdi*. In fact all specimens collected during this field trip were initially assigned to *L. lairdi* with the differences observed in the body colouration (colouration of the anterior part of the head, transverse dark bar on the metepimeron and bright yellow superior appendages) considered to be age-related morphological differences. The femoral bands were not considered to be of any importance until close investigation of the teneral specimens in both species was done. The striking differences in the structure of the penis was what initiated the more detailed morphological analyses of all closely related specimens. *L. ulunorum* is believed to be a good species based on the features explained in detail in the description above (cf. Differential diagnostic).

Donnelly (1987) reported *Anax* sp. cf. *gibbosulus* which was the first record of the genus for the Solomon Islands. No precise identification was provided as the sampled spec-

imen was found to have thinner appendages than the typical *gibbosulus*. Species identification of the here reported female was not possible for some morphological uncertainties explained in the Results. The affiliation with *A. gibbosulus* is very likely because generally the female was closer to this known species based on morphological (cf. Results) and ecological evidence. It was sampled from a high mountain area which is found to be typical of the species from other parts of the Pacific (Donnelly 1986). For the moment no precise species identification can be provided because the possibility of this female belonging to another species, not considered here, is not to be excluded. This conclusion is based not only on the slight morphological discrepancies, but also considering the results in Donnelly (1987) on the specimen sampled by him which was also left without a final species identification.

*Gynacantha amphora* was described based on a single male collected by hand on a bush leaf during the night (Marinov & Theischinger 2012). The female described here is believed to be associated with the male *G. amphora* for the general similarity in the holotype male observed in body shape and colouration. However, *Gynacantha* is a widespread genus throughout the tropics of both the Old and New World (Orr & Kalkman 2015) with 12 species given for the Papuan region (Michalski 2012) and at least one more described by Marinov & Theischinger (2012) from the Solomon Islands. Therefore, the possibility of discovering new species from this part of the world is not to be excluded and the correct species affiliation needs to be validated with further field studies.

The newly described *Procordulia vavehalo* is the third representative of the family Corduliidae known from the Solomon Islands. To date *Guadalca insularis* Kimmins, 1957 was the only validated species described from Guadalcanal Island. This is also an endemic monotypic genus, so far additionally reported from Malaita Island only (Donnelly 1987). Kimmins (1959) reported *Hemicordulia* ? *oceanica* as an inhabitant of the Solomon Islands based on a single female specimen collected by a British Expedition in 1953 to Rennell Island. Lieftinck (1968) recalled this finding in an account of the Odonata fauna of Rennell Island. Marinov & Pikacha (2013) questioned the validity of this species on the grounds of uncertainties of the correct affiliations of all Pacific *Hemicordulia* species reported prior to Lieftinck (1975) when he associated most of the older records from Fiji, Tonga and Samoa to the newly erected species *H. hilaris* Lieftinck, 1975. Lieftinck (1975) also excluded *H. oceanica* Selys, 1871 from Bougainville Island believing that species' main distribution was within the Society Islands, French Polynesia. However, Marinov & Pikacha (2013) left *H. oceanica* for the Solomon Islands species check list because the Rennell Island specimen has never been investigated since Kimmins (1959). Lieftinck (1968) stated that he had "... no reason to call this identification in question", but it is unclear if he actually examined the specimen himself. Orr & Kalkman (2015) reported *H. hilaris* as occurring on New Britain. Having in mind the wide species range occurring on all Pacific islands between New Caledonia and the Cook Islands (Marinov 2012) and its overall morphological similarity to *H. oceanica* (Lieftinck 1975), it is possible that the Rennell Island *Hemicordulia* female was in fact another *H. hilaris*. If this statement is validated it will link the distribution range given in Marinov (2012) to the record from New Britain published in Orr & Kalkman (2015). Probably the species inhabits other islands within the Solomon Islands archipelago.



*Procordulia vavehahalo* adds also a new genus for the country. *Procordulia* extends from Malaysia and the Philippines through Indonesia and New Guinea to New Zealand and Fiji (Theischinger & Hawking 2006). The genus badly needs a revision because all past attempts failed to understand its systematics and phylogeny (van Tol 1997). Rowe (1987) claims that the New Zealand '*Procordulia*' *grayi* (Selys, 1871) is almost certainly not congeneric with the other member of the genus present in the country – *P. smithii* (White, 846). *P. irregularis* Martin, 1907 is so far the only one species recorded from the two largest islands of Fiji (Viti Levu and Vanua Levu), but there is probably another species from the genus inhabiting Kadavu Island (Marinov, per. observ.). Three species (*P. astridae* Lieftinck, 1935; *P. leopoldi* Fraser, 1932; *P. sylvia* Lieftinck, 1935) are so far the closest known to Guadalcanal Island. They all are reported as inhabitants of mountainous regions of New Guinea. *P. vavehahalo* was also established from areas at and above 700 m a.s.l. which emphasises the importance of carrying more studies at the higher mountainous zones of this Pacific archipelago.

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