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Milen Marinov

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N. martina sp. nov. and *N. monika* sp. nov. (Odonata: Coenagrionidae)

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**On the Fijian endemic genus *Nesobasis* Selys, 1891
with introduction of *N. martina* sp. nov. and *N. monika* sp. nov.
(Odonata: Coenagrionidae)**

Milen Marinov

Biosecurity Surveillance & Incursion Investigation Plant Health Team, Ministry for
Primary Industries, 14 Sir William Pickering Drive, Christchurch 8544, New Zealand

Email: milen.marinov@mpi.govt.nz

Abstract

Two new congeneric species endemic to Fiji are introduced: *Nesobasis martina* sp. nov. [holotype female, Viti Levu Is] and *N. monika* sp. nov. [holotype male, Taveuni Is]. The species are placed in the *comosa*- and *erythro*s-groups respectively (grouping following Donnelly 1990). Diagnostic features are proposed, but not discussed. Further discussion is left for an ongoing revision of the genus (Donnelly & Marinov in prep.). The new species reported here are introduced ahead of this revision in a study which was made possible due to the International Dragonfly Fund (IDF) offering the opportunity to pick a new species' name for a donation.

Key words: Odonata, Viti Levu, Taveuni, Fiji, *Nesobasis*, new species

Introduction

Donnelly (1990) analysed the species diversity in the Fijian endemic genus *Nesobasis* Selys, 1891 from the islands of Viti Levu, Ovalau and Kadavu. He increased the species count to 20 and arranged them in three groups: *comosa*, *erythro*s, and *longistyla*. *Nesobasis brachycerca* Tillyard, 1924 was not included in this analysis because the species was known as an endemic to Vanua Levu Island. At the time Donnelly also had collections of specimens from islands in the northern part of the Fiji (Vanua Levu, Taveuni, Koro), however, those were not treated in this study.

Since then several other studies have been carried out resulting in several unnamed novel species reported (Van Gossum et al. 2006, 2007, 2008; Beatty et al. 2007, 2017) as well as other new species with descriptions pending (A. Cordero, C. Beatty, per. comm.).

At present, a large revision of the genus is underway (T. Donnelly & M. Marinov, pers. comm.) with the results expected to be published after introduction of the new to science species not collected by these two authors. Two new species are reported here ahead of the final revision.

Material and Methods

The material for this study was collected during Rapid Assessment Programmes organised and lead by the South Pacific Regional Herbarium (SUVA), University of South Pacific,

Suva, Fiji in Taveuni (04–14 October 2017) and Nadarivatu, Viti Levu (05–16 November 2018). Adult specimens were collected in separate vials and processed at the end of each sampling day. They were soaked in pure acetone overnight, dried and transferred to glassine envelopes. Some, not acetone treated, were preserved in 95% ethanol for molecular analysis.

Microscopic pictures for the figures were produced using the equipment of the Plant Health and Environment Laboratory, Christchurch, Ministry for Primary Industries, New Zealand. A series of images were taken under high power Nikon AZ100M microscope and stacked with Helicon Focus 6.7.1 software.

Morphological description follows Garrison et al. (2010), wing venation designation follows Riek & Kukulová Peck (1984).

The affiliation of the two species to the grouping proposed by Donnelly (1990) was based on the shape of the middle prothoracic lobe (Fig. 1), shape of terminal appendages (Fig. 2) and dentition of the ovipositor (Fig. 3).

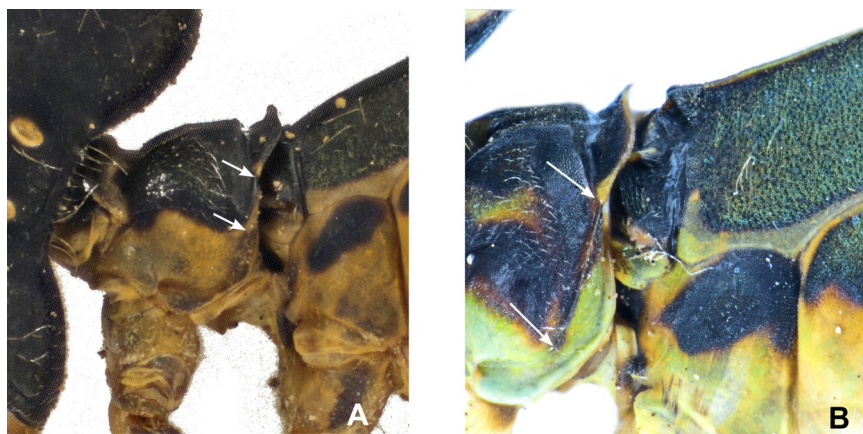


Figure 1. Comparison between the shape of the postero-lateral margin of median lobe of pronotum in: a) *comosa*-group, rounded, with a slightly raised rim, but not keeled, *N. comosa*, female; b) *erythrops*-group, generally produced laterally in a prominent keel, *N. monticola*, female.

All specimens were collected by the author.

All measurements are given in millimetres.

Abbreviations:

Morphology: AL – abdomen length (appendages excluded); HW – hind wing; HF – hind femur; MDBE – minimum distance between the eyes; P – pedicel; S – scape; S1–10 – abdominal segments 1 to 10.

Museum collections: MLBM – Bean Life Science Museum, Brigham Young University, USA; NZAC – New Zealand Arthropod Collection, Manaaki Whenua Landcare Research, Auckland, New Zealand; TND – Thomas (Nick) Donnelly Collection, USA

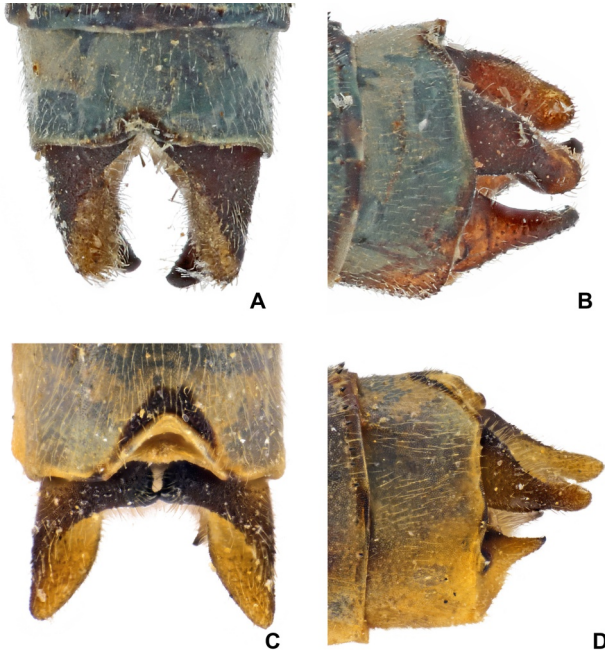


Figure 2. Comparison between the terminal appendages in: a-b) *comosa*-group, cerci generally almost as long as S10 and rounded, paraprocts subequal to cerci, *N. heteroneura*, male; c-d) *erythroths*-group, cerci L-shaped, paraprocts shorter than cerci, *N. flavifrons*, male.

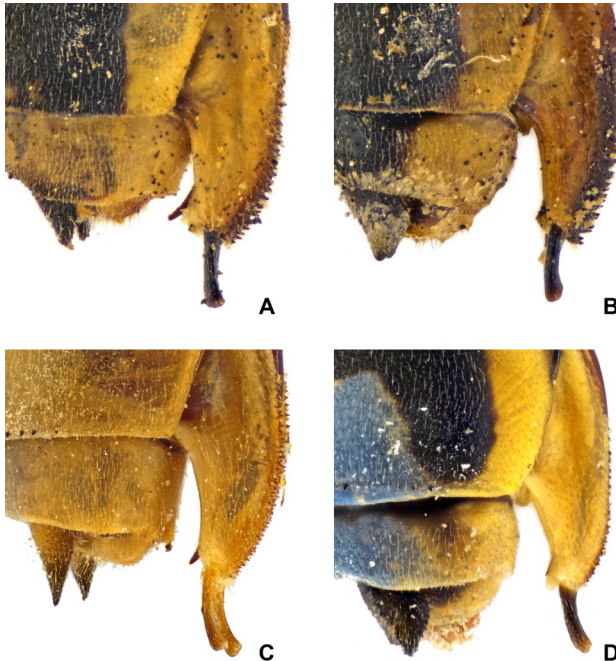


Figure 3. Comparison between the dentition of the ovipositors in: a-b) *comosa*-group, coarse (teeth often curved forward, distance between the tips usually equal to height of the tooth); c-d) *erythroths*-group, finely dentate (teeth usually not forwardly curved, distance between the tips usually longer than the height of the tooth); a) *N. heteroneura*, b) *N. martina*, c) *N. flavifrons*, d) *N. monika*.

Results

Nesobasis martina n. sp. (Figs 4-6, 8)

Holotype. Female (NZAC04230703, NZAC), VITI LEVU, a stretch of Wainavai stream about 3km East of Navai Village, Nabobuco District, Naitasiri Province, Viti Levu, 17.6172S, 177.9977E to 17.6188S, 178.0148E, 771–1,146 m a.s.l., 13 November 2018.

Etymology. The name, a noun in apposition, was selected by the German odonatologist Holger Hunger and refers to his wife, Martina Hunger. Holger wants to express his love and his gratitude to Martina for all of her support.

Description of holotype (Figs 4-6)

Head. Bright yellow-orange on frontal area up to almost level of median ocellus, darker orange to nearly reddish on labrum, anteclypeus, basal part of postclypeus, between antennal bases up to the border with black area, antennal segments up to apical end of pedicel, which is dark red to almost black on the flagellum, black marking as follows: spot at the mid-section of posterior edge of labrum, two spots at dorso-lateral corners of labrum, $\frac{3}{4}$ of anterior part of postclypeus, area behind antennal toruli projecting slightly on to frons, semilunar area ventral to median ocellus attached to black dorsal area of head with two nearly parallel bars on either side of median ocellus enclosing a roughly rectangular orange spot, rest of the dorsal part of head continuing on the rear of head and occupying most of it finishing as two broadly rounded projections reaching to the level of posterior edge of labium; yellow on the rear part of the head developed as two outward bars at the occipital foramen and area around the labium; eyes in life almost entirely red (dark red on the dorsum) except for yellow area ventrally.

Thorax. Prothorax almost entirely black on dorsum except for yellow oblique streaks on anterior lobe and very weak traces along posterior margin of posterior lobe, black descending on sides of the middle lobe and finishing in a wavy line, yellow for remaining $\frac{1}{3}$ – $\frac{1}{4}$ of the ventral area of middle lobe. Pterothorax pale green in life with black marking as follows: almost entire mesepisternum except for a yellow to orange line along border with mesopleural suture, almost entire dorsal half of mesinfraepisternum, connected to wide transverse bar which occupies between $\frac{2}{3}$ (anteriorly) to $\frac{1}{2}$ (posteriorly) of mesepimeron and tapers slightly to truncated posterior end finishing about at about $\frac{1}{9.5}$ before subalar ridge, triangular area on metepisternum attached with its base (projected ventrally to almost touch metapleural suture) to subalar ridge and continuing along interpleural suture for about half its length, spot sitting on metapleural suture at posterior end; additional darkening developed as fuscous areas on anterior ends of mesoepimeron, metaepisternum, metaepimeron, dorsal part of metinfraepisternum and almost entire ventral part of pterothorax. Mesostigmal plate (Fig. 4a) trapezoid with posterior carina, elevated ventral ends and raised tubercles at dorso-posterior corners; black with yellow ventral ends and prominent elevated tubercle at dorso-posterior corner. Legs yellow on anterior faces of coxae, trochanters and femora, fuscous to near black on posterior faces of tibiae, remaining areas dark with black reducing in intensity from fore to hind legs; tarsal segments fuscous to near black, claws dark orange.

Wings. Hyaline with black venation, red on alar sclerites; arculus at (FW) to slightly distal (HW) to Ax2, CuP almost half way between the two antenodal crossveins in fore wings and

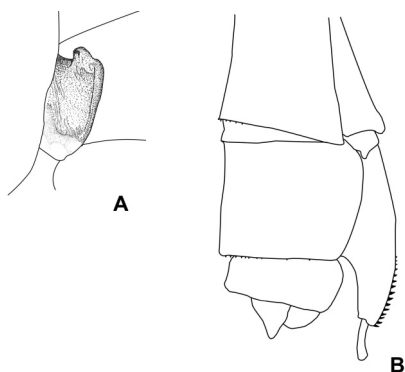


Figure 4. *Nesobasis martina*, holotype female: a) mesostigmal plate; b) ovipositor.

slightly distal to Ax2 in hind wings sitting on CuP&AA at a distance from origin of CuP&AA of about 1/3 length of CuP; pterostigma roughly rhomboid, fuscous with dark edges, FW: 19 Px, RP2 at 8–8.5th Px; HW: 16 Px, RP2 at 7th Px.

Abdomen. Overall dark on dorsum and pale laterally with the pale colour varying from red in life at the base to yellow towards the ventral parts of the segments, paleness more extensive at base where it occupies almost all of S1 laterally, continuing on to dorsum of S2 leaving small spear-like black marking at posterior end of segment, all antero-lateral areas at base and slightly on dorsum of S3 and descending to about half way up at posterior end of segment, S4–6 midline parallel to ventral edge descending slightly ventrally at about 1/9 before end of each segment, S7 straight line, S8 pale reduced to the ventral one third of the segment not reaching posterior end, S9 widely rounded anterior part of pale area outlined with dark at anterior end, S10 ventral half of segment; appendages black; ovipositor (Fig. 4b) slightly surpassing tip of S10, fuscous to slightly reddish for most of its surface and dark red along serration; sternite of S8 above ovipositor extruded with a pointed end, not developed as spine.

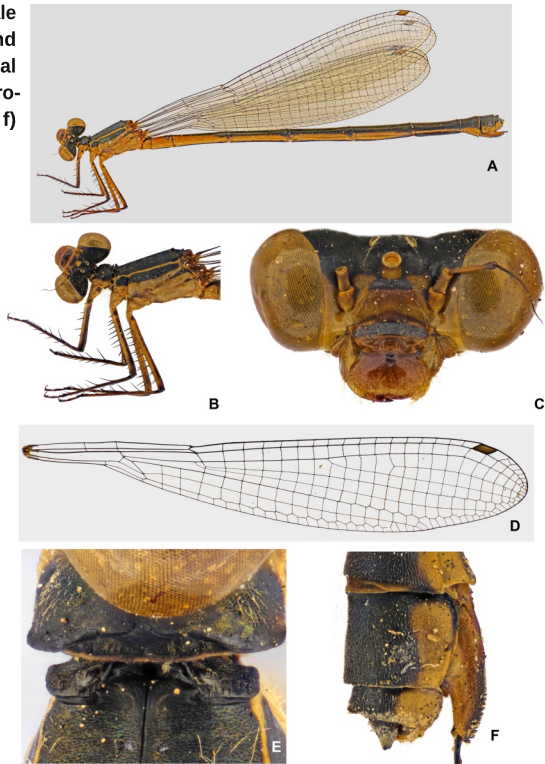
Measurements: AL 29; HW 24; HF 3.9; S 0.3; P 0.7; MDBE 1.8.

Differential diagnosis. *Nesobasis martina* is known only from one female which was very conspicuous in life owing to the reddish colour on the front of the head, bases of the wings and basal abdominal segments (Fig. 5). The specimen was assigned to the *comosa*-group because of its general resemblance to other females presently included in this species group: body proportions make the specimen stouter compared to female from *erythrospis*- and *longistyla*-groups, wings surpassing the middle of S7, long pedicel (length : width = 7), ovipositor coarsely dentate (cf. Fig. 3), hind femora surpassing the posterior end of poststernum, posterior edge of the middle prothoracic lobe rounded with rim present (Fig. 6). The latter is slightly more pronounced compared to the other females from *comosa*-group, however, this is visible only with direct inspection under a microscope of specimens from different species. The feature which was found to be unique for *N. martina* is the presence of a tubercle at the dorso-posterior corner of the mesostigmal plate. The reddish colour noted above is also unique for the known females from *comosa*-group. *Nesobasis aurantiaca* Tillyard, 1924 (Fig. 7) is the only other member of the group with a

Figure 5. *Nesobasis martina*, holotype female, two habitus views showing the eye colour (dorsal and ventral sides) and insert close up view to the eyes from frontal part.



Figure 6. *Nesobasis martina*, female diagnostic: a) habitus; b) head and thorax, lateral view; c) head, frontal view; d) HW; e) posterior lobe of prothorax and mesostigmal plate; f) ovipositor.



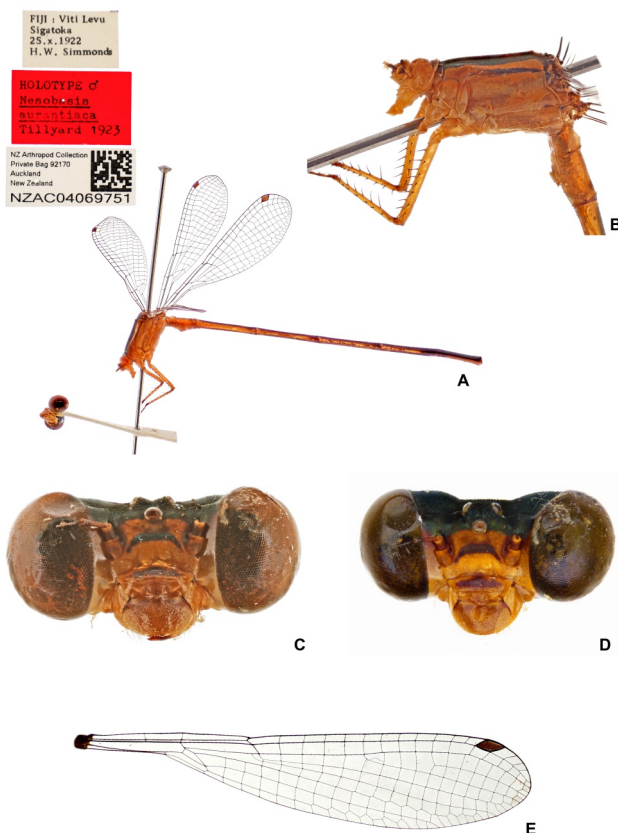


Figure 7. *Nesobasis aurantiaca*, holotype male: a) habitus; b) thorax, lateral view; c) head, frontal view; d) head, another frontal view showing the shape of the dark arched spot under the median ocellus and coloration on postclypeus, e) HW. Photos courtesy of Birgid Rhode, NZAC.

pale (orange) body which is probably reddish in life. However, this species is known from a single male from the description. Possible conspecificity of the female *N. martina* and the male *N. aurantica* was contemplated not only because of the reddish colour but also the shape of the dark marking on the postclypeus (cf. Figs 6c and 7c). For the moment they are kept as separate species because of the following structural and colour differences (*N. aurantica* in brackets): mesostigmal plate with projection (absent), sides of pterothorax pale green (orange), black triangular marking present on metepisternum (absent). This comparison was done with the assumption that overall body structure and coloration in both sexes in *Nesobasis* spp. exhibit comparable to almost identical patterns.

Notes

This species is known from Viti Levu only (Fig. 8). One female individual was collected in the field which was immediately recognised as a possible new species and possible member of *comosa*-group due to its habitus (appearing stouter compared to the females of other two

Figure 8. Distribution of *Nesobasis martina*.



groups and wings reaching as far as mid-S7) and the reddish colour. Another red-looking damselfly was seen but not collected during the same trip less than 5 km straight line from the *N. martina* type locality – a stretch of Nadala Reserve creek, -17.5854, 177.9808 to -17.5808, 177.9837E; 779-839 m a.s.l.; 08 November. The single individual descended from the top of the trees, landed on the top of a bedrock and took off almost immediately to the canopy on the opposite side of the stream.

***Nesobasis monika* sp. nov.** (Figs 9-16)

Holotype. Male (NZAC04230715; NZAC), TAVEUNI, Naibili River, about 4 km SE of Somosomo village, Cakaudrove District, Cakaudrove Province, Taveuni, 16.7910S, 179.9332W, 671 m a.s.l., 12 October 2017.

Paratypes. TAVEUNI, TND: 3 ♂♂, Naibili River, 16.7910S, 179.9332W, 671 m a.s.l., 12 October 2017; 1 ♂, unnamed stream about 2 km NW of Vidawa Village, Wainikeli District, Cakaudrove Province, 16.8096S, 179.8839W, 139 m a.s.l., 8 October 2017; MLBM: 1 ♂, Naibili River, 16.7910S, 179.9332W; 671 m a.s.l., 12 October 2017.

Allotype. Female (NZAC04230716, NZAC), TAVEUNI, unnamed stream above Vidawa Village, 16.8096S, 179.8839W, 139 m a.s.l., 8 October 2017.

Etymology. The name, a noun in apposition, was selected by the German odonatologist Reinhard Jödicke and refers to his wife, the late Monika Jödicke (4th December 1944 - 4th April 2019) who admired the beauty of dragonflies and always supported the odonatological work of her husband.

Description of holotype (Fig. 9)

Head. Labium bright yellow, paler on middle lobe around median cleft; yellow on ventral area of gena gradually diffusing into blue-green on anterior part of face along eyes and reaching dorsal end of scape; same blue-green colour developed on most of face continuing on dorsum of postfrons saved for black transverse bars on basal part of labrum and anterior bar on postclypeus where it forms a T-shape figure connecting to faint dark line at

base of postfrons; antennae: scape same blue-green colour as frontal part of head, pedicel pale brown, flagellum dark; dorsal part of head almost entirely dark except for a small spot anterior to median ocellus; eyes in life bicoloured – dark on dorsum and green all over remainder transitioning to greenish yellow ventrally.

Thorax (Fig. 9a). Prothorax almost completely black on dorsal surface except yellow-green line running along entire posterior edge of posterior lobe, black surface interrupted laterally on middle lobe by club-shaped yellow-green markings on both sides, ventrolateral areas yellow-green. Pterothorax with two small tubercles anterodorsally close to dorsal edge of mesostigmal plates; black with slight copper sheen on dorsum and yellow-green laterally; additional yellow-green spots developed as follows: bar starting from anteroventral corners of mesepisternum running dorsally on mesopleural suture acutely tapering and ending slightly posterior of midlength of mesopleural suture, both ventral and dorsal corners of mesostigmal plate, dorsal carina, prealar ridges; black on lateral side as follows: bar starting very close to anterior edge of mesinfraepisternum continuing posteriorly into mesepimeron ending in a roughly round head before it reaches end of segment, black spot on metepisternum at dorsal edge of metapleural suture and at posterior edge of poststernum; mesostigmal plate flat slightly tapering towards ventral side (Fig. 9b). Legs predominantly yellow, coxae with slight bluish hue, posterior faces of femora dark, rest of femora, tibiae and tarsi appear spotted because of dark areas around bases of all hairs, claws yellow with dark red tips.

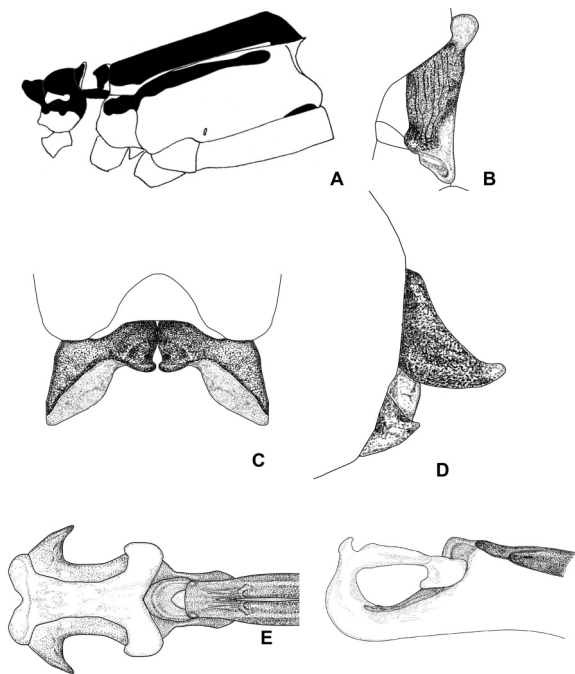


Figure 9. *Nesobasis monika*, holotype male: a) thorax, lateral view; b) mesostigmal plate; c–d) appendages, dorsal and lateral views; e–f) penis, ventral and lateral views. Note – the penis was damaged when extracted, photographed and consequently lost. The drawings were made tracing the images of the microscopic pictures. However, the lateral view is not an exact representation of the structure of the distal lobe, which was split transversely on the flap. The drawing is made by supposition following the outlines of the opposite lobe from the ventral view.

Wings. Hyaline with mostly dark venation paler proximally and yellow on sclerites at joins with thorax; arculus distal to 2Ax in all wings, CuP slightly proximal to middle between two antenodal crossveins in both wings, CuP&AA originating proximally to base of CuP, pterostigma white rhomboid with thickened outlines, slightly skewed distally diminishing size of neighbouring cell reducing its costal margin to nearly half length of posterior margin especially in left HW, same cell in all wings with irregular dark brownish incrustation along costal margin, first crossvein distal to pterostigma thickened at anterior part tapering to an acute end posteriorly to RA; FW: 12/13 Px, RP2 at 6/6.5th Px; HW: 11/12 Px, RP2 at 5/5.5th Px.

Abdomen. Predominantly black on dorsum, bright on lateral and ventral tergites; dark dorsal areas slightly lighter (pale brownish) on discal regions of S3–6; S9–10 with blue markings as follows: posterior half of S9 and kidney-shaped lateral spots on S10; lateral bright area on abdomen yellow-green anteriorly on S1–2 to about half way of S3, bright yellow for rest apart of bluish areas on S9–10 especially around gonopore; terminal appendages (Fig. 9c–d): cercus shorter than S10 dark brown with lighter tips, L-shaped from dorsal view with arms diverging, arms appear round with a roughly sickle shape viewed laterally; paraproct very short hardly projecting from tip of S10, predominantly yellow broadly rounded at tips and dentate tubercles on outer surfaces; penis (Fig. 9e–f). Measurements: AL 31; HW 20; HF (missing); S 0.2; P 0.4; MDBE 1.4.

Description of allotype (Fig. 10)

Head. Labium bright yellow; labrum dark blue with yellow anterior edge and pale brown developed as median spot and two lateral areas along posterior margin; anteclypeus mostly dark blue with yellow streaks; postclypeus dark blue with a transverse dark bar at anterior edge; rest of frons bluish reaching to about midlength of scape, blue transforms to yellow ventrally towards gena; mandibular bases mostly yellow with weak bluish streaks; scape and pedicel pale especially on anterior faces; dorsum of head black except for a small bright mark in front of median ocellus.

Thorax. Similar to holotype in general pattern with colour on lateral sides of pterothorax blue to metapleural suture and descending to posterior area of metepimeron diffusing to yellow anteriorly on same segment; mesostigmal plate (Fig. 10a). Legs similar to holotype much paler yellow with spots at bases of hairs.

Wings similar to holotype main difference being lack of thickened crossveins distal to pterostigma and lack of brown incrustation along costal edge of first cell distally to pterostigma; FW: 13/14 Px, RP2 at 6th Px; HW: 11/12 Px, RP2 at 5/just proximal to 6th Px.

Abdomen. Almost completely dark on dorsum except surfaces of S9–10 (first half blue and second almost completely blue) pale laterally and on ventral side with pale being almost entirely bright yellow except bluish marking at sides of S1–2 and very base of S3, ovipositor (Fig. 10b) very slightly projecting beyond tip of S10, terminal appendages black roughly triangular from dorsal view strongly tapering from lateral view.

Measurements (in mm): AL 26; HW 19; HF 2.5; S 0.2; P 0.34; MDBE 1.3.

Variations in paratypes. All resemble the holotype very closely in morphological features, specimens differ in: shape of transverse dark bar on mesepimeron (Fig. 11) varying from

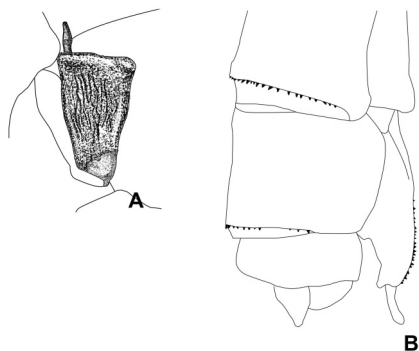


Figure 10. *Nesobasis monika*, allotype female: a) mesostigmal plate, b) ovipositor.

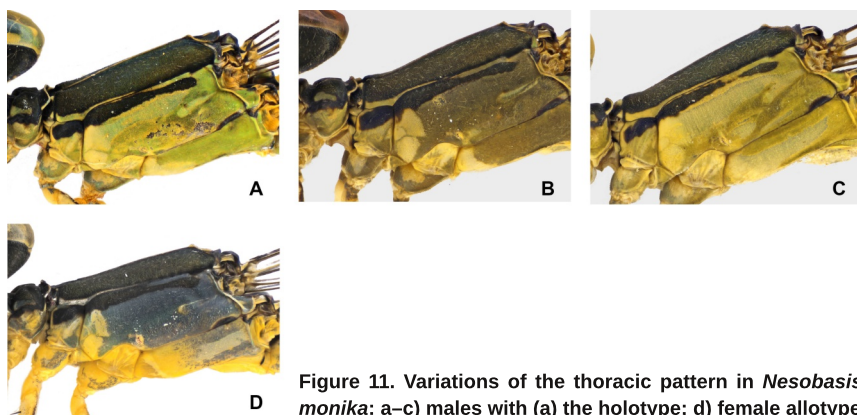


Figure 11. Variations of the thoracic pattern in *Nesobasis monika*: a–c) males with (a) the holotype; d) female allotype.

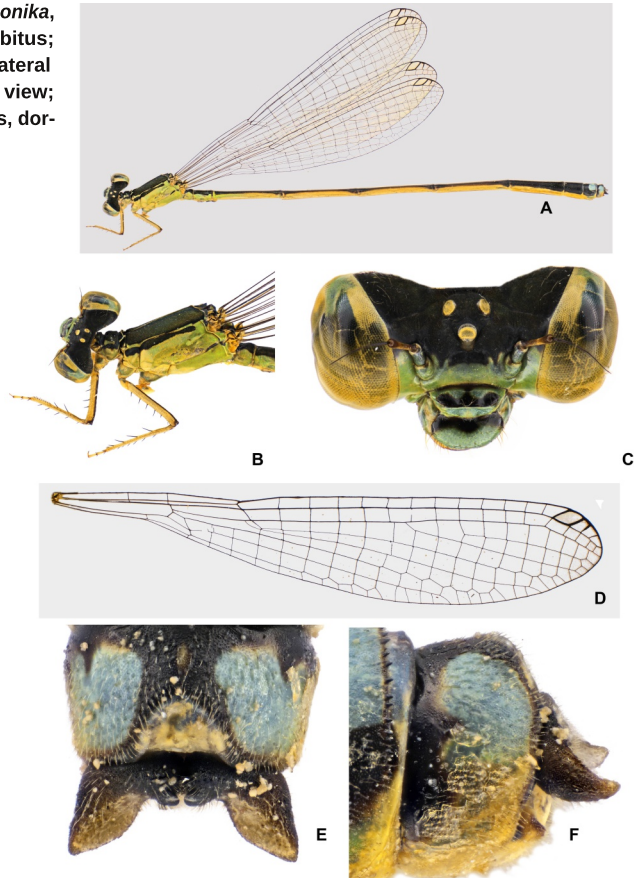
strongly constricted/interrupted to very expanded at middle joining dark area on mesepisternum, and blue spots at tip of abdomen with kidney-shaped on S10 reduced to almost circular or expanded to connect at dorsum; nodal index (11–13) –2 / 2– (11–12) in FW, (10–12) –2 / 2– (10–11) in HW.

Measurements (in mm): AL 28–28.5, HW 18.5–20.5.

Differential diagnosis

This is one of the smallest *Nesobasis* spp. characterised by an overall green body and pale pterostigmata which is white in males and pale yellow in females (Figs 12a, 13a). The structure of the middle prothoracic lobe, shape of cerci and dentition of ovipositor place *N. monika* in the *erythropros*-group. Terminal male appendages resemble most closely *N. rufostigma* Donnelly, 1990 in the reduced size of the paraprocts (Fig. 14). This is due to the lateral projections, which in *N. rufostigma* barely surpass the tip of the paraproct, but are still visible in the shape typical for other members of this group; however in *N. monika* these are missing and paraprocts appear rounded with small lateral tubercles, which is a unique feature within the group. Penis morphology places *N. monika* closer to *N. angulicollis* (Fig. 15) which was so far the only species in the group with a T-shaped distal

Figure 12. *Nesobasis monika*, male diagnostic: a) habitus; b) head and thorax, lateral view; c) head, frontal view; d) HW; e–f) appendages, dorsal and lateral views.



lobe as pointed out by Donnelly (1990). *Nesobasis monika* can be separated from *N. angulicollis* even in the field by the overall body coloration; shape of the terminal male appendages is explained above as a diagnostic feature and illustrated in Figs 12-13.

Reported from Taveuni only (Fig. 16).

Discussion

Nesobasis is one of the most speciose genera in the Pacific Odonata (Marinov 2015) with 21 recognised species and at least 17 more under revision (Donnelly & Marinov, in prep.).

The study presented here reports on two of these new species published ahead of the revision. It was made possible due to the International Dragonfly Fund (IDF) offering the opportunity to pick new species' name for a donation. This is one way of improving the very

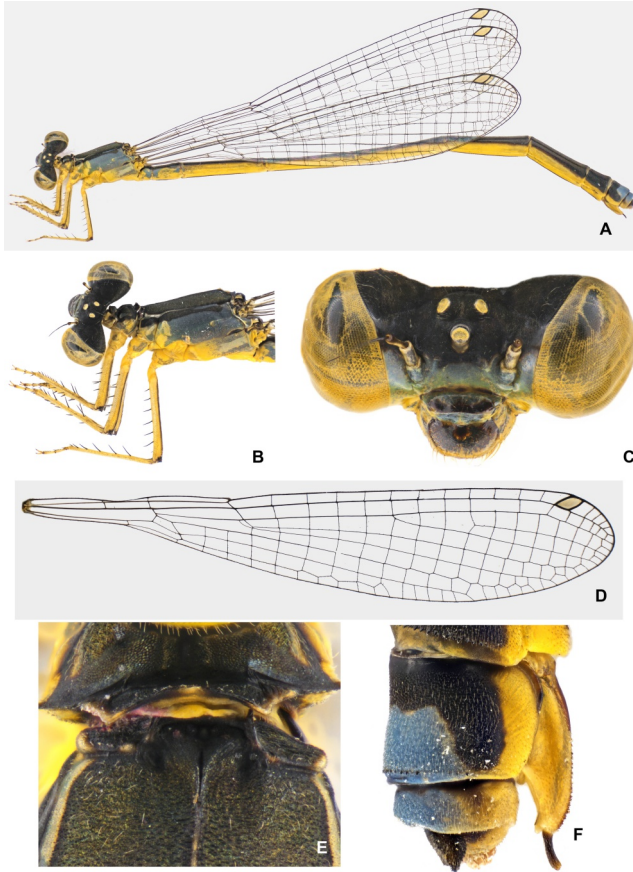


Figure 13. *Nesobasis monika*, female diagnostic: a) habitus; b) head and thorax, lateral view; c) head, frontal view; d) HW; e) posterior end of prothorax and mesostigmal plate; f) ovipositor.

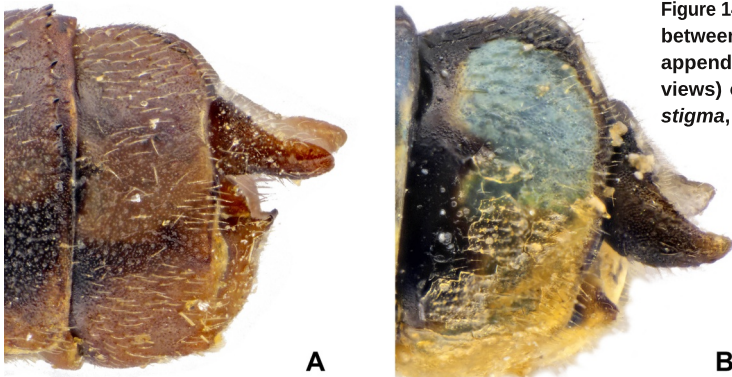


Figure 14. Comparison between the terminal appendages (lateral views) of: a) *N. rufostigma*, b) *N. monika*.

Figure 15. Comparison between the peneses (ventral views) of: a) *N. angulicollis* (figure taken from Donnelly, 1990), b) *N. monika*.

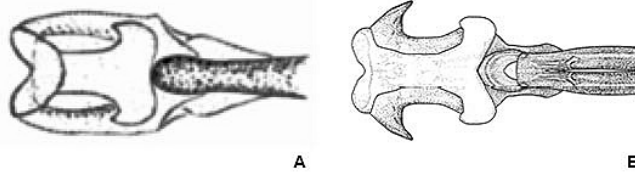


Figure 16. Distribution of *Nesobasis monika*.



difficult funding of projects with the aim of cataloguing (and preserving!) the world's species. Further discussion on the representatives of the genus will be saved for the revision.

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The material for this paper was collected during the two assessments of the Fijian biodiversity of particular regions of Viti Levu and Taveuni. I was very fortunate to be invited to join the research teams of both expeditions and am extremely grateful to the staff of the Herbarium of the University of South Pacific, Suva.

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