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Odonata briefly observed on the islands of Bali and Lombok, Lesser Sundas, Indonesia, in the late February 2014

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Abstract

In the second half of February 2014, Odonata were searched for nine days on Bali and four days on Lombok, the western Lesser Sundas, Indonesia. One species, *Orthetrum chrysis* has been for the first time recorded for Bali and six species, *Nososticta emphyla*, *Idionyx murcia*, *Brachydiplax chalybea*, *Agrionoptera insignis*, *Neurothemis ramburii*, *Rhyothemis phyllis* have been for the first time recorded for Lombok. The previous literature concerning the two islands is analysed. To the moment, 55 Odonata species (3 unidentified) are known for Bali and 39 for Lombok, although the actual faunas of both islands are supposed to be equally rich, and further studies on Lombok are necessary. Odonata faunas of Bali and Lombok mirror each other in respect of high shares, 29 and 23%, of Odonata species ranging to the west and east of the two islands, respectively. Efficiency of Lombok Strait as a biogeographical boundary was estimated as high as 0.6, so Wallace Line is of importance for Odonata. Some diagnostic characters of *N. emphyla, N. ramburii, R. phyllis phyllis* and *Procordulia sambawana* and a taxonomical situation around *Prodasineura autumnalis* and *P. humeralis*, which is not justified biogeographically, are discussed. Short notes on habitats and assemblages of Odonata are added.

Keywords

Bali, Lombok, Indonesia, Lesser Sundas, biogeographical boundaries, Wallace Line, Sundaland, Wallacea, Lombok Strait, *Nososticta emphyla, Prodasineura autumnalis, Prodasineura humeralis, Idionyx murcia, Procordulia sambawana*, *Neurothemis ramburii, Neurothemis terminata*, *Rhyothemis phyllis* subspecies.

Introduction

The Sondaic Archipelago is an enormous set of islands of different size and geological origin situating in tropics, hence being among the world's main hotspots of terrestrial biodiversity. It had a complicated geological history (Hall 1998; 2001) and therefore exhibits a complicated biogeography (Heaney 1986; Turner et al. 2001; van Tol & Gassmann 2007). To recover the biogeographical structure of the archipelago with respect to any group of organisms, complete and precise data on occurrence of species at different islands is necessary. However, the numerous Sondaic islands are until now rather unevenly explored. Accumulation of faunistic data becomes especially important at present, because of a frightening tempo of disappearance of natural habitats throughout the tropics.

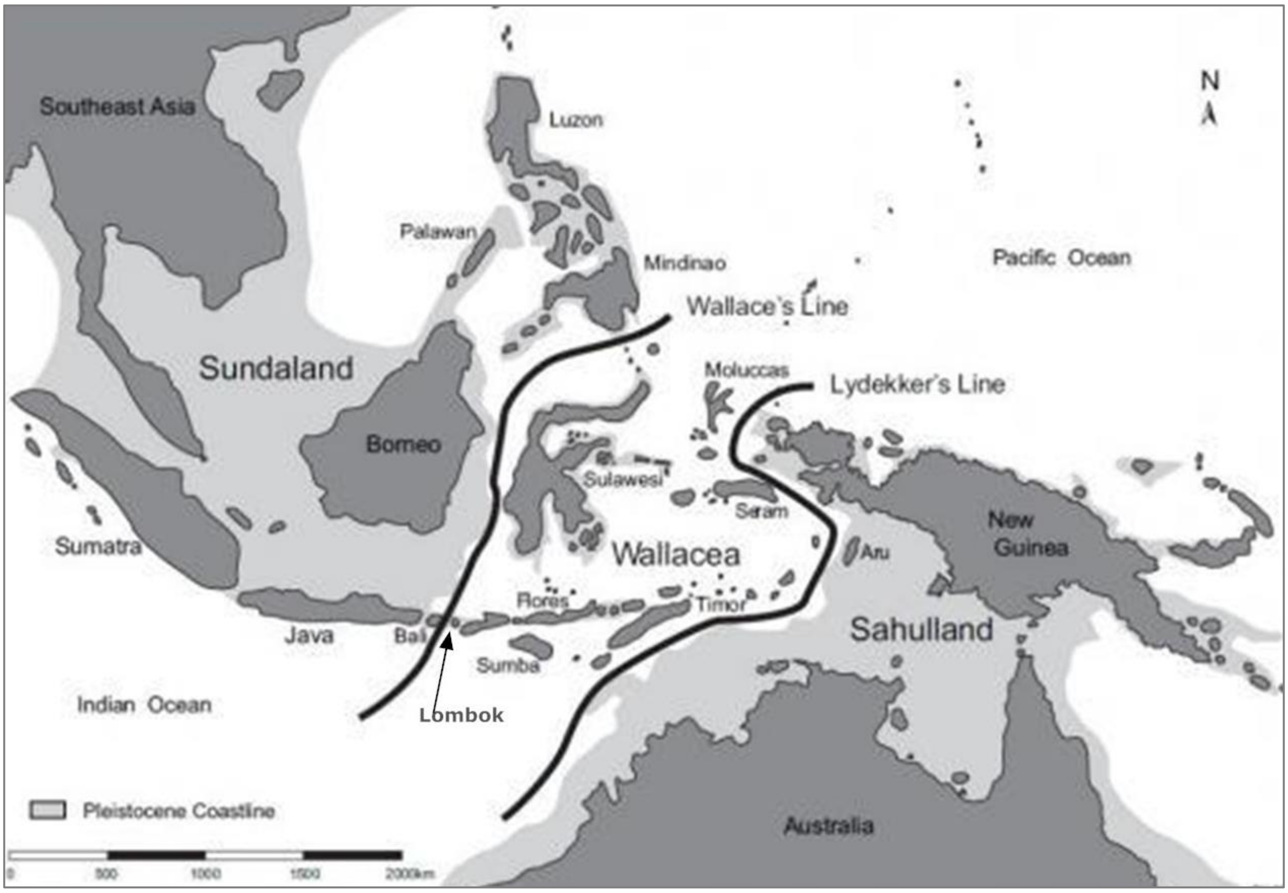

Figure 1: Biogeographic situation of Bali and Lombok (http://humanorigins.si.edu/sites/default-/files/Flores-WallaceAndLydekkerLines_lg_0.jpg; slightly modified).

The main biogeographical subdivision of the Sondaic Archipelago refers to three major landmasses into which the islands used to be merged: the continental shelves exposed the World Ocean level dropped due to glaciations in high latitudes: (i) the so-called Sundaland, merged to Asia, (ii) Wallacea (Fig. 1), never merged to anything, and (iii) Near Oceania, including the merged New Guinea and Australia; but this pattern is complicated by tectonic movements (Dickerson 1928; Keast 1973; Hall 1998; 2001). The so-called Wallace Line (or Wallace's Line) corresponding to deep, persistent straits between Sundaland and Wallacea (Audley-Charles 1981) is one of the oldest recognised (named by Huxley 1868 in recognition of pioneering works by Alfred Russel Wallace, see for instance Wallace 1859; 1880) and most famous biogeographical border separating the so-called Indomalaya and Australasia Ecozones (Keast 1973; Simpson 1977). It goes between the islands of Bali and Lombok, Borneo and Sulawesi and Mindanao and island groups of Sangihe and Talaud, although its exact position is not unequivocal (Mayr 1976; Simpson 1977). However, biogeographical subdivisions of Indonesia for different groups of organisms are not fully concordant, that makes accumulation of diverse faunistic data especially important.

Of the above mentioned islands, Bali and Lombok are relatively small islands of similar size belonging to the so-called Lesser Sundas and separated by Lombok strait which is just 33 km wide in the narrowest place but is as much as 250 m deep. The Odonata fauna of Lesser Sundas has been last summarised by Lieftinck (1953) who recognised 38 species for Bali and 27 species for Lombok. His Table II counts 26 species but the mark for Lombok was missed for *Orthetrum testaceum* (Burmeister, 1839) which was reported for this island in the text. (This miss caused a repeated report of this species as new for the island by Belle, 1994). More species have been reported for both islands by Belle (1994), Ruddek (1998) and Kishi (1999), namely:

- 16 taxa for Bali: *Prodasineura autumnalis* (Fraser, 1922); *Pseudagrion rubriceps* Selys, 1876; *Ictinogomphus decoratus* (Selys, 1954); *Gynacantha subinterrupta* Rambur, 1842; *Brachythemis contaminata* (Fabricius, 1793) by Belle (1994); *Libellago lineata* (Burmeister, 1839), *Pseudagrion pilidorsum* (Brauer, 1868), *Gynacantha bayadera* Selys, 1891, *G. musa* Karsch, 1892, *Idionyx* sp., *Macromia jucunda* Lieftinck, 1955, *Macromia* sp.A, *Macromia* sp.B, *Procordulia sambawana* (Förster, 1899), *Brachydiplax chalybea* Brauer, 1868, *Zyxomma petiolatum* Rambur, 1842 by Kishi (1999);
- 5 species for Lombok: *Pseudagrion pruinosum* (Burmeister, 1839), *P. rubriceps, B. contaminata, Pantala flavescens* (Fabricius, 1798) by Belle (1994); *Macrodiplax cora* (Brauer, 1867) by Ruddek (1998).

The latest published note devoted to the faunas of these islands (Belle 2001) actually added no species. The author claimed that he reported *Agriocnemis pygmaea* (Rambur, 1842) and *Tholymis tillarga* (Fabricius, 1798) for the first time for Bali, although both species were included into the checklist by Lieftinck (1953), with the data on the Balinese specimens of the former published in (Lieftinck 1936). Besides, Belle (2001) doubted the report of *M. cora*, *Orthetrum glaucum* (Brauer, 1865) and *Tramea eurybia* Selys, 1878 for Lombok by Ruddek (1998) because “the latter three species were only sighted and photographed” (Belle 2001: 94). Belle (2001) obviously understood Ruddek (1998) as if claiming to report *O. glaucum* and *T. eurybia* for the first time for Lombok: “I would maintain 31 as the number of the species known from Lombok - until the latter three species will have been actually collected there and identified under the microscope” Belle (2001: 94). However, Ruddek (1998) implied only *M. cora* as a new record for the islands, since *O. glaucum* and *T. eurybia* were listed for Lombok by Lieftinck (1953) (the paper which Belle (2001) has cited) and were in fact already counted among the mentioned 31 species.

Bali has been densely populated for millennia and presently is very popular in cultural and recreational respects, hence it is intensively visited and, as a consequence, well studied (note 54 hitherto known odonate species, compared to 32 known for Lombok). Lombok received much less attention, yet its popularity among tourists is growing rapidly. I happened to be one of those as visiting the two islands with my family on the February 2014 for a holiday. Nevertheless, I made efforts to register as much Odonata as possible and so obtained some faunistic data, including the reported below as new to the islands: six species to Lombok and one species to Bali.

Materials and Methods

Methods

Odonata were sought for while walking, mostly along rivers and lakes. Well recognisable common species were recorded by sight, others were captured by a hand net. Some voucher specimens were collected and preserved on cotton layers with paper covers. Coordinates were recorded by Garmine eTrex H personal GPS navigator, their ranges for the actually examined areas and elevations were adjusted using Google-Earth. Odonata were photographed by Olympus Camedia C8080 camera. Illustrations of morphological details were prepared from serial photographs obtained via lens Zeiss Stemi 2000-C with digital camera Canon PowerShot A640 at the Institute of Cytology and Genetics of Siberian Branch of Russian Academy of Sciences, Novosibirsk. Images with broad focus zones were produced from serial photos with shifted focus using the program Helicon Focus 5.3 (http://www.photo-soft.ru/heliconfocus.html).

Localities examined

The locality names were coded with a prefix latter “B” or “L” referring to Bali and Lombok, respectively, followed by an ordinal number.

Bali:

B1 – Sanur Beach: house estates, hotels with gardens and swimming pools, sandy beach with some trees, patches of ruderal vegetation, rarely with tiny pools. 08°40'05''-42'42” S, 115°15'14”-16'01'' E, 3-10 m a.s.l., 15-19 and 24-27.02.2014.

B2 – a pasture N of Sanur Beach: mouths of two small dirty rivulets connected with a muddy ditch with temporal water depending on tides behind the paved passage along the coast, a degraded pasture behind the ditch, bordered with some fields and plantations, 08°39'45''-40'01” S, 115°15'38”-44'' E, 3 m a.s.l., 20.02.2014.

B3 – Ruins of a resort just N of Sanur Beach (Fig. 2): a deep pond with tiled banks, a tiled ditch with very shallow muddy water, dense trees and bushes at banks, 08°39'19-22'' S, 115°16'00''-02'' E, 3-4 m a.s.l., 20.02.2014.

Figure 2. A tiled ditch at ruins of a resort just N of Sanur Beach, Bali (B3); a habitat of *Gynacantha subinterrupta, Neurothemis terminata, Tholymis tillarga, Zyxomma obtusum*.

B4 – Mambal, a large river with a woody left bank and concrete channel at the right bank, 08°32'49''-55'' S, 115°12'57''-60'' E, 118-127 m a.s.l., 17.02.2014.

B5 – Sacred Monkey Forest Sanctuary, Padangtegal, Ubud (Fig. 3): a patch of natural forest along a deep gorge of a rapidous river, 08°31'03''-14'' S, 115°15'19''-34'' E, 170-192 m a.s.l., 16.02.2014.

B6 – Unda River near the mouth: a broad major river with shingle/muddy bed and broad valley, 26.02.2014.

B6a – a grassy right bank with bushes and some trees, also a deep bay without noticeable current covered with water hyacinth (*Eichhornia crassipes* (Mart.) Solins) (Fig. 4, left), 08°33'31''-46'' S, 115°25'21''-25'' E, 8-12 m a.s.l.

B6b – shallow swamps of the left floodplain, completely covered with a carpet of water hyacinth, water lettuce (*Pistia stratiotes* L.) and some Poaceae and thickets of cattail (*Typha* sp.) (Fig. 4, right), 08°33'34'' S, 115°25'30'' E, 10 m a.s.l.

Figure 3. A river in a gorge at Sacred Monkey Forest Sanctuary, Padangtegal, Ubud, Bali (B5); a habitat of *Heliocypha fenestrata, Pseudagrion pruinosum, Copera marginipes, Prodasineura autumnalis*.

Figure 4. The Unda River near its mouth, Bali: left - the right bank with a deep bay overgrown with water hyacinth (L6a), a habitat of *Pseudagrion microcephalum, P. pruinosum, Crocothemis servilia, Brachythemis contaminata, Neurothemis terminata, Orthetrum sabina*; right - a shallow swamp covered with a carpet of water hyacinth, water lettuce and grasses (L6b), a habitat of *Agriocnemis femina, Acisoma panorpoides, Brachydiplax chalybaea, O. sabina*.

B7 – Tegenungan Waterfall, Gianyar Regency (Fig. 5): a deep valley with grassy and stony bottom and slopes covered with a secondary forest just downstream a medium waterfall, 08°34'31-34'' S, 115°17'21''-25'' E, 60-70 m a.s.l., 26.02.2014.

Figure 5. Tegenungal Waterfall, Bali (B7); a habitat of *Heliocypha fenestrata, Libellago* ? *lineata, Copera marginipes, Prodasineura autumnalis, Diplacodes trivialis, Orthetrum sabina, O. testaceum, Pantala flavescens, Potamarcha congener*.

B8 – Batur Volcano caldera:

B8a – Lake Batur: a large (7,0 x 2.4 km) lake in the Batur Volcano caldera (Fig. 6): a flat and shallow S bank with emergent grass (*Bidens* sp., *Cyperus* sp.), also shaded herbage at a grove nearby, 08°16'52'' S, 115°23'13'' E, 1040 m a.s.l., 16.02.2014.

Figure 6. Lake Batur S bank, Bali (B8a); a habitat of *Ischnura senegalensis, Pseudagrion microcephalum, Brachythemis contaminata, Crocothemis servilia, Orthetrum sabina, Pantala flavescens*.

B8b – old lava at the volcano SE foot, very dry, with scarce grass and ferns and sparse pine and *Melaleuca* trees.

B9 – Lake Bratan, S bank at Bendugul (Fig. 7): a large (2.3 x 2.5 km) caldera lake with a zone of emergent *Cyperus* sp. grass with some round floating leaves (?*Nymphoides* sp.), examined at a grassy hotel territory and a high bank covered with primary forest, 08°16'44''-17'01'' S, 115°09'54''-10'13'' E, 1253 m a.s.l., 17.02.2014.

B10 – Lake Tamblingan (Fig. 8): a large (2 x 0.9 km) lake in the same caldera as above, surrounded by primary forest as protected within the Buyan-Tamblingan Wildlife Sanctuary.

B10a - SW bank at Gobleg-Banyar village (Fig. 8, bottom): flat and grassy, with a broad zone of emerging *Cyperus* sp., *Ludwigia* sp. and ?*Nymphoides* sp., then high, covered with primary forest, 08°15'33''-50'' S, 115°05'25''-30'' E, 1233 m a.s.l., 18.02.2014.

B10b - NE bank: rocky, forested and rather steep, 08°14'56'' S, 115°06'03'' E, 1233 m a.s.l., 17.02.2014.

Figure 7. Lake Bratan S bank at Bendugul, Bali (B9); a habitat of *Ischnura senegalensis, Diplacodes trivialis, Orthetrum sabina, Pantala flavescens*.

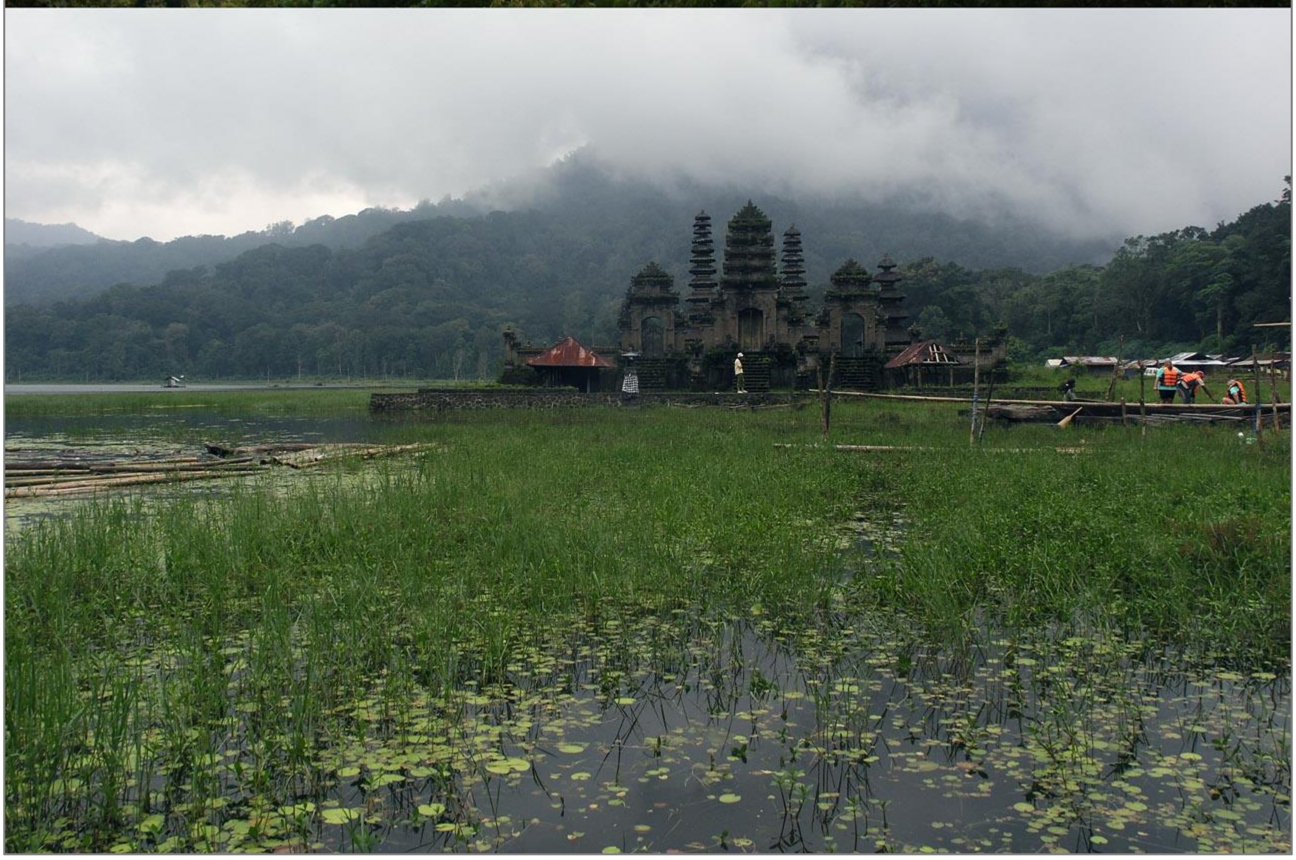

Figure 8. Lake Tamblingan, Bali (B10): top - general view; bottom - SW bank at Gobleg-Banyar village; a habitat of *Heliocypha fenestrata, Agriocnemis femina, Ischnura senegalensis, Orthetrum sabina, Pantala flavescens*.

B11 – Banyar Hot Springs, 18.02.2014.

B11a - a medium-sized fast river with rocky bed in quite a deep gorge, with some clayey bluffs and an outlet of the hot springs (Fig. 9, right), 08°12'38''-42'' S, 114°58'01''-06'' E, 77-80 m a.s.l.,

B11b - a small shady channel with fast but smooth flow, between a slope with secondary forest and plantation (Fig. 9, left), 08°12'40''-42'' S, 114°58'02''-05'' E, 80-83 m a.s.l.,

Figure 9. At Banyar Hot Springs, Bali: left - a small shady channel (B11a), a habitat of *Pseudagrion pilidorsum, P. pruinosum, Prodasineura autumnalis*; right - the main river (B11b), a habitat of *Heliocypha fenestrata, Copera marginipes, P. autumnalis*.

Lombok:

L1 – Sinaru env. at Rinjan Volcano N foot: a gorge (Fig. 10) of a large rapidous river leading to the Sindana Gila and Tiu Kelep Waterfalls, with a large Dutch channel (Fig. 11) with fast flow, the slopes clad with primary forest and some clearings at right side, 08°18'05''-43'' S, 116°24'15''-30'' E, 490-530 m a.s.l., 24.02.2014.

L2 – Pusok Hill (Fig. 12): alternating plantations, forest edges and open grassy crests, 08°27''-29' S, 116°04'49''-50'' E, 350-570 m a.s.l., 23.02.2014.

Figure 10. A gorge at Sinaru, Rinjan Volcano N foot, Lombok (L1), a habitat of *Heliocypha fenestrata, Idionyx murcia, Procordulia sambawana, Orthetrum testaceum, Pantala flavescens, Trithemis festiva.*

Figure 11. An old Dutch channel at Sinaru, Rinjan Volcano N foot, Lombok (L1), a habitat of *Idionyx murcia, Trithemis festiva*.

Figure 12. Pusok Hill, Lombok (L2); top - a place where a female of *Trithemis lilacina* was found; bottom - a place where a female of *Idionyx murcia* was found.

L3 – Batu Bolong, Senggigi Beach:

L3a - Batu Bolong Cottages Resort: pools of tiny fountains, a swimming pool, road-side ditches, beach, 08°30'18''-23'' S, 116°03'16''-20'' E, 4-10 m a.s.l., 21-25.02.2014.

L3b - the river at mouth: rather small, medium-fast, with sandy/gravel/shingle banks with a lot of rubbish, some trees, a pasture 08°30'25''-27'' S, 116°03'27''-29'' E, 12-17 m a.s.l., 22.02.2014

Figure 13. The Batu Bolong River middle reaches, Lombok (L3c), a habitat of *Euphaea lara, Pseudagrion pilidorsum, Nososticta emphyla, Agrionoptera insignis, Orthetrum glaucum, O. sabina, P. testaceum, Pantala flavescens, Rhyothemis phyllis, Trithemis festiva, T. lilacina*.

L3c - the river middle flow (Fig. 13): fast, locally rapidous, with rocky/stony bed, medium narrow valley clad with forest which incorporates plantations, 08°29'42''-53'' S, 116°04'05''-17'' E, 90-175 m a.s.l., 21-23.02.2014.

L4 – shallow ponds clad with lotus (*Nelumbo nucifera* L.) with tiny muddy pools at banks, 7 km NW Mataram (Fig. 14), 08°31'54''-58'' S, 116°04'11''-15'' E, 6 m a.s.l., 22.02.2014.

Figure 14. A lotus pond near Mataram, Lombok (L4), a habitat of *Agriocnemis femina, Ischnura senegalensis, Crocothemis servilia, Brachydiplax chalybea, Diplacodes trivialis, Neurothemis terminata, Rhyothemis phyllis, Orthetrum sabina, Rhyothemis phyllis*.

Results

Species registered

The list of species recorded, with enumeration of localities and rough estimation of abundance are presented in Table 1.

Table 1. Odonata species recorded in the second half of February, 2014 in the islands of Bali (localities B1-B11) and Lombok (localities L1-L4). For designation of localities see the text. After each locality, a rough estimation of abundance (sometimes separately for sexes) is given in parenthesis as encoded as follows: s – single; f – few, m – many, v – very numerous. New records for specific or both islands are highlighted in bold red letters.

	Species (subspecies)	Bali	Lombok
1.	*Heliocypha fenestrata cornelii* (Lieftinck, 1947) (Fig. 15)	B4(s♂), B5(f♂♀), B7(s♂), B10a(s♂♀), B10b(s♂), B11a (s♂)	-
2.	*Libellago* sp. (?*L. lineata* Burmeister, 1839)) (Fig. 16)	B7(s♀)	-
3.	*Euphaea lara lombokensis* McLachlan, 1898 (Fig. 17)	-	L1(s♂), L3b (s♂), L3c(v♂f♀)
4.	*Agriocnemis femina femina* (Brauer, 1868)	B2(f♂), B6b(m♂♀), B10a(f♂♀)	L4(f♂♀)
5.	*Ischnura senegalensis* (Rambur, 1842)	B1(f), B2(s♂), B3(s♂), B8a (v♂♀), B9(s♀), B10a(f♂♀)	L4(f♂♀)
6.	*Pseudagrion microcephalum* (Rambur, 1842) (Fig. 18)	B6a(f♂), B8a(s♂♀ androchromic)	-
7.	*Pseudagrion pruinosum pruinosum* (Burmeister, 1839) (Fig. 19)	B5(f♂), B6a(s♂), B11b(f♂s♀)	-
8.	*Pseudagrion pilidorsum declaratum* Lieftinck, 1936 (Fig. 20)	B11b(f♂)	L3b(f♂), L3c (f♂s♀)
9.	*Copera marginipes* (Rambur, 1842) (Fig. 21)	B5(f♂♀), B6a(s♂), B7(s♂), B11a(f♂)	-
10.	*Prodasineura autumnalis* (Fraser, 1922)	B5(f♂♀), B7(f♂), B11a (s♂), B11b(f♂♀)	-
11.	***Nososticta emphyla* (Lieftinck, 1936)**	-	**L3c(s♂)**
12.	12. *Gynacantha subinterrupta* Rambur, 1842	B1(s♂), B3(s♀)	-
13.	***Idionyx murcia* Lieftinck, 1971**	-	**L1(f♂s♀), L2(s♀)**
14.	14. *Procordulia sambawana* (Förster, 1899)	-	L1(f♂)
15.	*Acisoma panorpoides* Rambur, 1842	B6b(v♂♀),	-
16.	*Agrionoptera insignis insignis* (Rambur, 1842)	-	**L3c(s♂)**

	Species (subspecies)	Bali	Lombok
17.	*Brachydiplax chalybea chalybea* (Brauer, 1868)	B6b(s♀)	**L3a(f♀), L4(f♂)**
18.	*Brachydiplax contaminata* (Fabricius, 1793)	B8a(v♂♀)	-
19.	*Crocothemis servilia servilia* (Drury, 1770)	B1(f♂♀), B8a(s♂)	L4(f♂)
20.	*Diplacodes trivialis* (Rambur, 1842)	B1(f), B4(1♂), B6a(f), B7(f), B9(f)	L1(f♂), L2(f♂), L4(s♀)
21.	*Neurothemis ramburii ramburii* (Kaup in Brauer, 1866)	-	**L3a(f♂f♀)**
22.	*Neurothemis terminata* Ris, 1911 (Fig. 22)	B1(s♂), B5(f♂♀), B6a(f♂),	L3b(f♂ f♀), L3b (f♂♀), L4(f♂)
23.	***Orthetrum chrysis* (Selys, 1891)**	**B11a(s♂)**	-
24.	*Orthetrum glaucum* (Brauer, 1865) (Fig. 23)	B11a(s♂)	L3c(m♂)
25.	*Orthetrum sabina* (Drury, 1770) (Fig. 24)	B1(m), B4(m), B5(f), B6a(m), B6b(m), B7(f), B8a(f), B8b (s♂), B9(f), B10a(s), B11a(f)	L1(f), L2(f), L3b(f), L3c(f), L4(f♂)
26.	a. *Orthetrum testaceum testaceum* (Burmeister, 1839) (Fig. 25, top)	B9(s♀), B7(f♂)	-
27.	b. *Orthetrum testaceum soembanum* Förster, 1903 (Fig. 25, bottom)	-	L1(s♀), L3a (s♂), L3b(f♂), L3c(m♂)
28.	*Pantala flavescens* (Fabricius, 1798) (Fig. 26)	B1(v), B7(m), B8b(f), B9(v), B10a(f)	L1(m), L2(f), L3a(f), L3c(f)
29.	*Potamarcha congener* (Rambur, 1842)	B7(s♀)	-
30.	***Rhyothemis phyllis phyllis* (Sulzer, 1776)**	-	**L3b(f♂s♀), L3c(f), L4(f)**
31.	*Tramea eurybia eurybia* Selys, 1878	**?B1(s♂)** (species uncertain)	L3a(f♂)
32.	*Tholymus tillarga* (Fabricius, 1798)	B3(s♂s♀)	-
33.	*Trithemis festiva* (Rambur, 1842) (Fig. 27)	-	L1(s♂), L3b (s♂), L3c(m♂)
34.	*Trithemis lilacina Förster, 1899 (Fig. 28)*	-	L2(s♀), L3c(f♂)
35.	*Zyxomma obtusum* (Albarda, 1881)	B1(s♀), B3(f♂1♀oviposit.)	L3a(f♂)

Besides, I received the following small collection of Odonata from Lombok by Peter Ustjuzhanin (Novosibirsk): *Rhinocypha pagenstecheri pagenstecheri* Förster, 1897 – 1 ♀, Pusok Keli River, 16.08.2013; *Euphaea lara lombokensis* McLachlan, 1898 – 3 ♂♂,

Figure 15. ***Heliocypha fenestrata cornelii*****; a, b – mature male, c – a teneral male, all at Sacred Monkey Forest Sanctuary, Padangtegal, Ubud, Bali (B5), d – a female at Tegenungal Waterfall, Bali (B7).**

Figure 16. ***Libellago* ?*lineata,* a female at Tegenungal Waterfall, Bali (B7), photographed at the same rope as that of *Heliocypha fenestrata* in Fig. 14d.**

the same label; *O. testaceum* – ♀, the same label; *Diplacodes trivialis* (Rambur, 1842) – 2 ♂♂, 1 ♀, the same label; 2 ♂♂, Kerandagan, 18.08.2013; 1 ♂, 1 ♀, Senggigi Beach, 10.08.2013; *Potamarcha congener* (Rambur, 1842) – 2 ♂♂, 1 ♀, Senggigi Beach, 10.08.2013; *Neurothemis ramburii ramburii* (Kaup in Brauer, 1866) – 3 ♂♂, - the same label.

Figure 17. *Euphaea lara lombokensis* at the Batu-Bolong River, Lombok (L3c); left – males, right – a female.

Figure 18. *Pseudagrion microcephalum,* a male, at a bay of the Unda River lower reach, Bali (L6A).

Figure 19. ***Pseudagrion pruinosum pruinosum*****, males; left – at a shall channel at Banyar Hot Springs, Bali (B11b); right - at a bay of the Unda River lower reach, Bali (L6a).**

Figure 20. ***Pseudagrion pilidorsum declaratum;*** **left – males at a shall channel at Banyar Hot Springs, Bali (B11b); right – an ovipositing tandem at the Batu Bolong River middle reaches, Lombok (L3c).**

Figure 21. ***Copera marginipes,*** **males; left – at Sacred Monkey Forest Sanctuary, Padanngtegal, Ubud, Bali (B5); right – at Tegenungan Waterfall, Bali (B7).**

Figure 22. ***Neurothemis termina,*** **a female at Sacred Monkey Forest Sanctuary, Padanngtegal, Ubud, Bali (B5).**

Figure 23. ***Orthetrum glaucum,*** **males; left – at an outlet of Banyar Hot Springs, Bali (B11a); right – at the Batu Bolong River middle reaches, Lombok (L3c).**

Figure 24. ***Orthetrum sabina,*** **a male, and** ***Junonia hedonia*** **(Linnaeus, 1758) at Sanur Beach, Bali (B1).**

Figure 25. ***Orthetrum testaceum,*** **males; above –** ***O. t. testaceum*** **at Tegenungan Waterfall, Bali (B7); below –** ***O. t. soembanum*** **at the Batu Bolong River at its mouth, Lombok (L3b).**

Figure 26. ***Pantala flavescens,*** **a male at Tegenungan Waterfall, Bali (B7).**

Figure 27. ***Trithemis festiva,*** **male at the Batu Bolong River middle reaches, Lombok (L3c).**

Figure 28. ***Trithemis lilacina*; top - a male at the Batu Bolong River middle reaches, Lombok (L3c); bottom – a female on Pusok Hill (L2), at a place depicted in Fig. 11, bottom.**

Species new to Bali

Orthetrum chrysis (Selys, 1891)

On 18.02.2014, a male of this species (Fig. 29), and also a male of *O. glaucum*, perched on stones amidst a short seepage of warm water being the outflow from a basin of Banyar Hot Springs to the nearby river (B11a). I did not capture the *O. chrysis* male because was unaware of this common species (known from Java and Lombok adjacent to Bali from west and east, respectively) being a new island record. However, the dark purplish-red, rather crimson than scarlet, tint of the abdomen, darker thorax and the abdomen more slender, gradually tapering rather than evenly broad to S7 (Fig. 29), well distinguished it from *O. testaceum*.

Figure 29. *Orthetrum chrysis,* a male at an outlet of Banyar Hot Springs, Bali (B11a).

Tramea sp.

At hot midday on 19.02.2014, a male appeared above the Griya Sanur Hotel swimming pool (within B1), made several circles above it and disappeared. The generic attribution was doubtless and it looked quite as *T. eurybia* Selys, 1878, but the male neither was captured nor its wingspot size was recognised. For some reason, no representative of this widespread genus has been reported for Bali up to date.

Species new to Lombok

Nososticta emphyla (Lieftinck, 1936)

Specimen: L3c, 22.02.2014 – 1 ♂ (Fig. 30).

Remarks. *N. emphyla* was described by a teneral male from Flores (Lieftinck 1936). Later Lieftinck (1953) redescribed mature specimens of both sexes from the same island. Differences concerned the colour of the light pattern: bluish-white with greenish and yellowish hues in the teneral holotype, but deep reddish-purple on the head, violet, ventrally gradually turning to citron-yellow on the thorax, violet on S1-3 and brilliant cobalt-blue on S8-10 in mature males. The male from Lombok had all the pattern dark-violet (Fig. 30, left), that may indicate its being old.

For Lombok and Sumbawa, Lieftinck (1953) expected *N. selysi* (Förster, 1896), known from Flores, Sumba and Timor, but for some reasons not *N. emphyla*.

Habitat: The male hovered low above a slow pool in a rocky river.

Figure 30. *Nososticta emphyla*; a male at the Batu Bolong River middle reaches, Lombok (L3c), 22.02.2014; left – general habitus; right – the abdomen end with appendages in lateral view.

Idionyx murcia Lieftinck, 1971

Specimens: L1, 24.02.2014 -3 ♂♂ (Fig. 31d, 31); L2, 23.02.2014 – 1 ♀ (Fig. 31a-c).

Remarks. This clear-cut species, quite well differing from its congeners, was described from the neighbouring island of Sumbawa and hence could be expected on Lombok. The specimens fitted the detailed description by Lieftinck (1971) in all details (Fig. 31, 32) but one: in both sexes, the characteristic yellow oval antehumeral spot on the anterior part of the mesepisternum (designated by a red asterisk in Fig. 32c), absent in other species, is smaller as occupying not more than 1/3 of the mesepisternum (2/5 in the description), is isolated from their continuation on the inframesepisternum (continuous in the description) and has somewhat indistinct borders (clear-cut in the description). Importantly, our specimens exactly fitted the description in structural respect. Unfortunately, *Idionyx* sp. reported for Bali by Kishi (1999) was neither identified nor illustrated in detail.

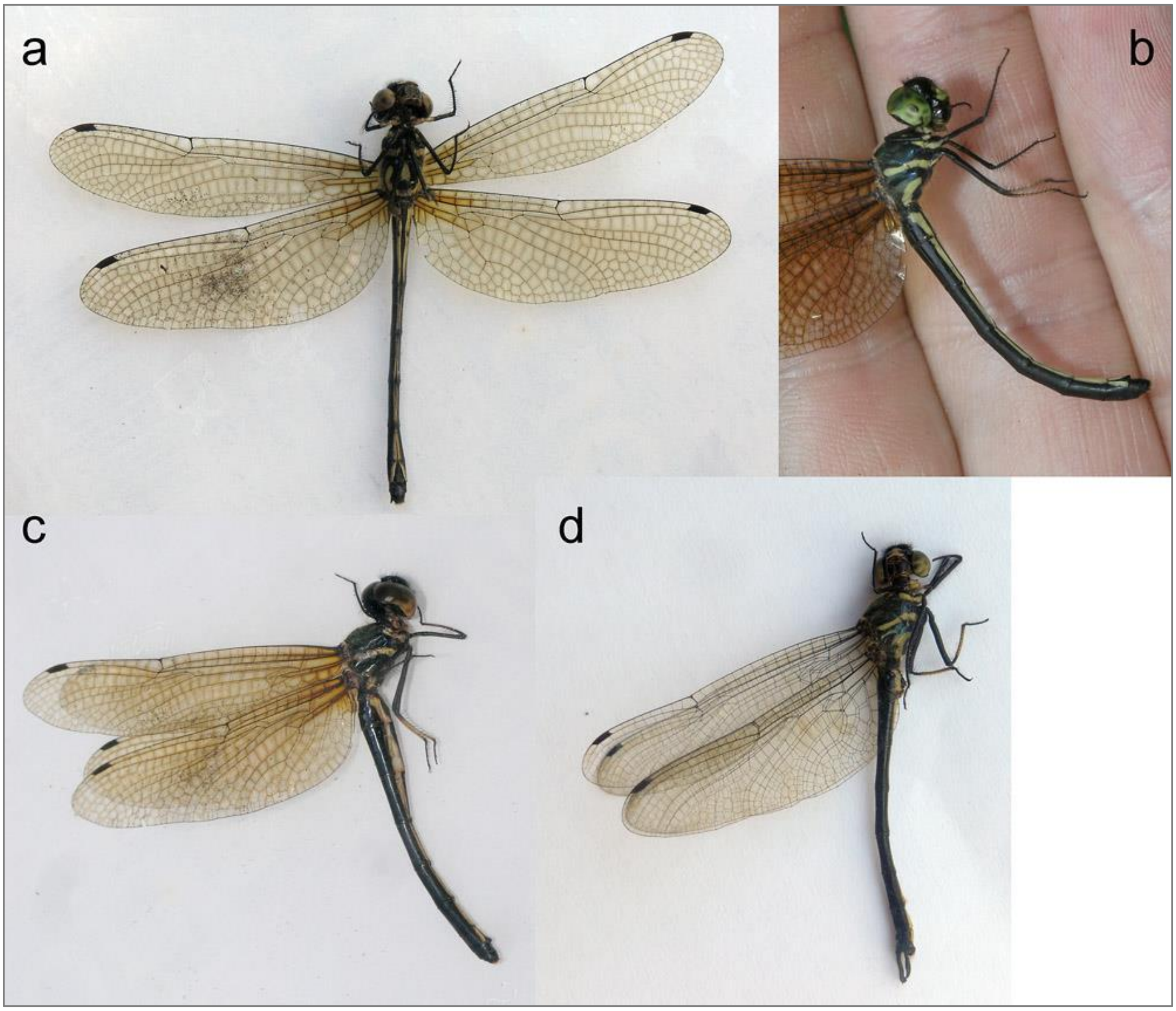

Figure 31. ***Idionyx murcia*; general habit: a-c - a female from Pusok Hill, Lombok (L2), at a place shown in Fig. 12, 23.02.2014; d – a male from Sinaru env., Rinjan Volcano N foot, Lombok (L1), 24.02.2014.**

Habitat and behaviour. Behaviour of both sexes was typical for the genus: fluttering to and fro between trees or bushes at about 1-2 m above the ground at overcast, humid, misty weather. The female at Pusok Hill (L2) flew alone at 8:50 a.m., while all but one individuals at Sinaru (L1) for some reasons were restricted to the same small grassy patch between low trees at a paved pathway (Fig. 33), but absent in other analogous places. I found them there both before a strong rain at 11:00 a.m. (three males: one captured, two disappeared) and after it, at 1:10 p.m. (a male descended to the grass, grasped a female and flew away) and at 2:15 p.m. (again three males). Curiously, in the third case there was also a male of *P. sambawana* (see below). One more male at L1 was spotted above a channel with fast running water, that is not so typical of *Idionyx*.

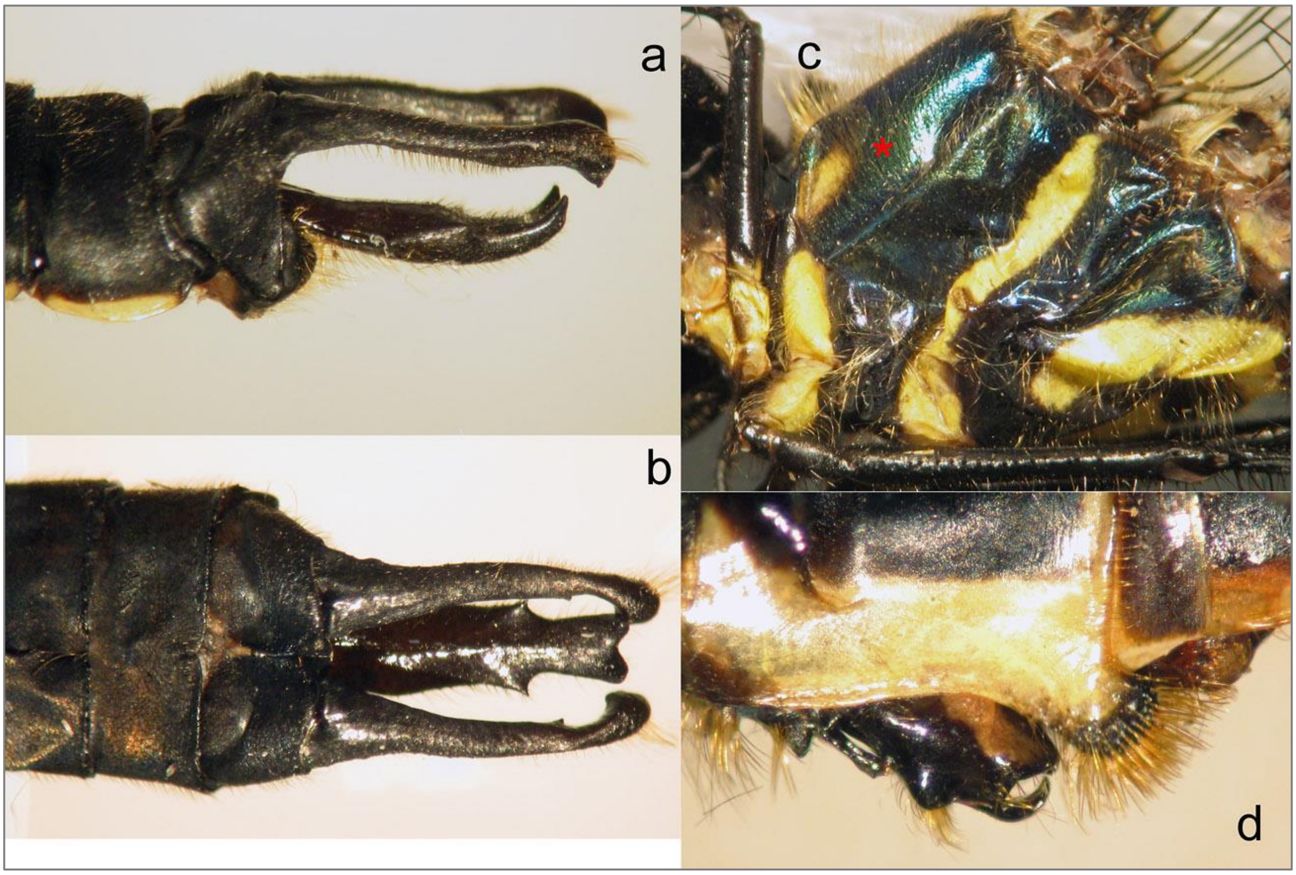

Figure 32. ***Idionyx murcia*****; details of males from Sinaru env., Rinjan Volcano N foot, Lombok (L1), 24.02.2014: a - anal appendages in lateral view; b – anal appendages of another specimen in dorsal view; c – thorax, lateral view; d – secondary genitalia, lateral view. The red asterisk indicates the antehumeral yellow spot.**

Figure 33. A grassy patch between low trees at a paved pathway at a valley slope at the Sinaru env, Rinjan Volcano N foot, Lombok (L1), to which several individuals of *Idionyx murcia* were repeatedly found to be restricted and were a male of *Procordulia sambawana* was captured on 24.02.2014.

Agrionoptera insignis insignis (Rambur, 1842)

On 22.02.2014, a male of this quite expectable species was observed perching on a bamboo stick at quite a large stagnant pool, shaded by a tall bamboo bunch, near the Batu Bolong River. It was not collected but unmistakable, as proved by a photo (Fig. 34).

Figure 34. *Agrionoptera insignis insignis,* a male at a shaded pool in the Batu Bolong River valleyaches, Lombok (L3c).

Brachydiplax chalybea chalybea (Brauer, 1868)

Specimens: L3a, 21.02.2014 - 1♀; L4, 22.02.2014 – 1 ♂, 1 ♀.

Neurothemis ramburii ramburii (Kaup in Brauer, 1866) (Fig. 35a-c, 36)

Specimens: L3b, 22.02.2014 – 1 ♂ (Fig. 34c), 1 ♀; Senggigi Beach Hotel, 10.08.2013 – 3 ♂♂ (P. Ustjuzhanin leg.) (Fig. 35a-b)

Taxonomic remark. This species was quite abundant at decorative pools at Batu Bolong Cottages (L3a). All three males collected (Fig. 44a-c) and several photographed (Fig., 35) at Senggigi Beach possessed the diagnostic characters of the species: one Cux on the hind wing; the wing transparent tip started at the costa at the pterostigma proximal end (better to say 1 cell before it), and its margin on the hind wing strongly inclined posteriorly towards base (Orr 2005). Unfortunately, not many specimens were checked. So, I found 'pure' representatives of *N. ramburii* seemingly predominating at Senggigi Beach, while only *N. terminata* has been earlier reported for Lombok in literature (Lieftinck 1953), and I found it as well (see below).

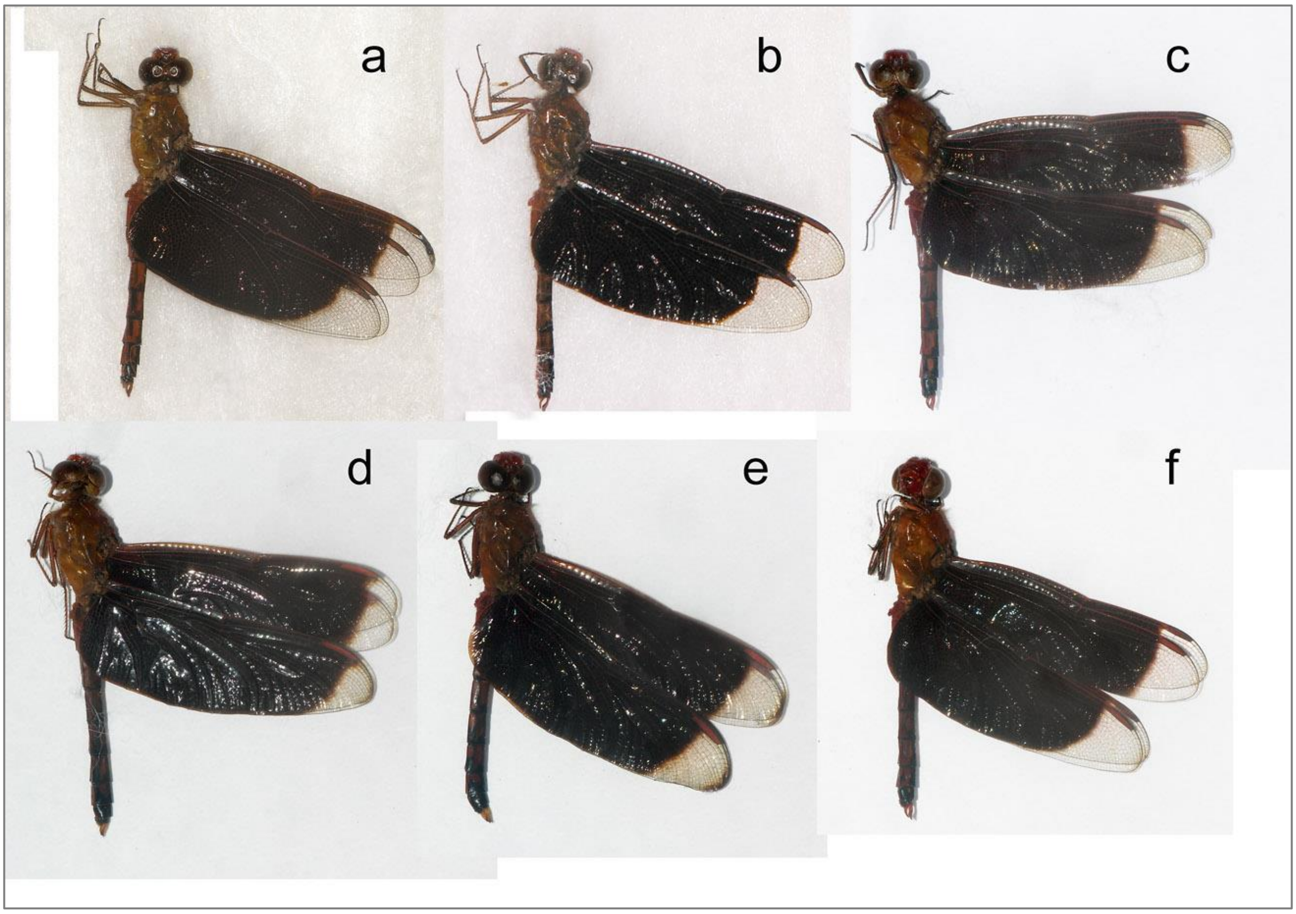

Figure 35. Males of *Neurothemis ramburii* (a-c) and *N. terminata* (d-f). a-b – Senggigi Beach Hotel, 10.08.2013; P. Ustjuzhanin leg.; c – pools at Batu Bolong Cottages, 21.02.2014 (L3a), d – the Batu Bolong River valley at its mouth, 22.02.2014 (L3b); e-f – at pools near the lotos pons at Mataram, 22.02.2014 (L4). Note that e has the wing coloration pattern transitory to *N. ramburii* and f as in *N. ramburii.* Images a and b are mirror-flipped.

Rhyothemis phyllis phyllis (Sulzer, 1776)

Specimens: L3b, 22.02.2014 - 1♂, 1♀ (Fig. 37)

Remarks. The original description of *R. phyllis ixias* from Sumba, with some paratypes also from Flores, is overloaded with details (Lieftinck 1953), but no straight-forward diagnostic characters were mentioned. Instead many characters were described, using terms 'more' or 'less', to be just intermediate between *R. phyllis phyllis* (Sulzer, 1776) and *R. phyllis obscura* Selys, 1878 from Halmahera, so here we have a case when a weak, "intermediate" subspecies was introduced, its transitory characters challenging the validity of both above mentioned subspecies. Besides, specimens of *R. p. ixias* from Flores were noted to somewhat differing from those from Sumba. It seems that

Figure 36. ***Neurothemis ramburii*** **at pools at Batu Bolong Cottages, Lombok (L3a): top – a mature male; middle – an immature male; bottom – a female.**

the saturated yellow ground colour but without brownish tingle could serve as the most noticeable feature, as the subspecies name chosen “is an allusion to the orange-, black- and yellow-winged members of the Pierid genus *Ixias*” (Lieftinck 1953: 223). I would not say that in my pair of specimens from Bali the wing membrane was more yellowish than in specimens from e.g. Indochina (Fig. 36). Besides, in both sexes, the labium, clypeus and anterior part of the frons were yellow, as in *R. phyllis phyllis* and Lieftinck’s Floresian specimens of *R. phyllis ixias*, while the typical *R. phyllis ixias* from Sumba has the face strongly darkened. So I identify my specimens as the nominotypical subspecies *R. phyllis phyllis*. Note that (i) Lieftinck (1954) reported *R. phyllis phyllis* for Java, and (ii) the species has not been yet recorded for Bali.

Figure 37. *Rhyothemis p. phyllis* collected at the Batu Bolong River at its mouth, Lombok (L3b) on 22. 02.2014: top – a male; bottom – a female.

Habitat: Loose but aggregated groups of several individuals of this species were observed along the Batu Bolong River valley (L3b and L3c) as well over a meadow at the bank of a large lotus pond (L4). The species looked numerous and common over the Senggigi area.

Remarks on other species

Prodasineura autumnalis Fraser, 1922 – probably an invalid species composed of two melanised subspecies of *P. humeralis* (Selys, 1860).

Specimens: B5, 16.02.2014 - 1♂, 1♀; B7, 26.02.2014 - 1♂, B11b, 18.02.2014 - 1♂, 1♀; published records: Belle 1994 (Bali: Banyar Hot Springs, Gitgit Waterfall); Kishi 1999 (Bali: Ubud Gianyar, Mas Gianyar, Kuwum Badung, Legian Badung, Batasbr Celuk Badung, Batukau Tabanan, Negara Jembrana).

Figure 38. *Prodasineura autumnalis*: top – a female at Sacred Monkey Forest Sanctuary, Padangtegal, Ubud, Bali (B5), bottom – a male at Tegenungal Waterfall, Bali (B7).

The nearly fully blackened head and thorax in mature males (Fig. 38, bottom) is considered the most conspicuous character of this species. The range of *P. autumnalis* (type locality: Shillong, Meghalaya, East India), as presently accepted, is not justified biogeographically: the continental tropical Asia, including India, Nepal, Myanmar, Thailand, Indochina, South China, and then Sumatra, Java and Bali (Lieftinck 1954; Asahina 1983), with a huge gap in Peninsular Malaysia. This gap is, however, 'filled' by *Prodasineura humeralis* (Selys, 1860) (type locality: Malacca) which in fact differs from *P. autumnalis* only in less thorax melanisation with age in males, with the antehumeral and lateral brownish-yellow stripes remaining in mature males (they are present and identical in young males in both taxa). Note that this feature works only if one has in hand a mature male with the synthorax entirely black above, which is to be identified as *P. autumnalis*. At the same time each male with the mentioned stripes cannot be identified as either of the two species, as it can happen to be insufficiently mature. This provided a ridiculous situation when a border of states putatively serves as a presumed border of species. Of these two species,

- Hämäläinen & Pinratana (1999: 61 and 125) mentioned for Thailand only *P. autumnalis* and showed its range to spread south to the very border with Malaysia (their map 67), with a note "There exist some geographical variation (also inside Thailand) with populations presently linked to this taxon", while
- Orr (2005: 51) mentioned for Peninsular Malaysia only *P. humeralis* as "widespread", with a note "Previously listed from Peninsular Malaysia both as *P. verticalis* or *autumnalis*".

This situation was additionally obscured by Lieftinck (1954) who did not recognise differences of *P. humeralis* and *P. verticalis* (Selys, 1860) (type locality: Borneo) and suspected them to be the same species: "I am deliberately of opinion that *humeralis* is not specifically distinct from *verticalis* and that it can probably not even be ranked as a subspecies" (Lieftinck 1954: 43). This statement is strange in view of the fact that females of these species well differ in the prothorax morphology. For this reason, specimens from Peninsular Malaysia used to be variably identified in the past as *P. humeralis*, *P. verticalis*, or *P. autumnalis* (Orr 2005; Tang et al. 2010).

Tang et al. (2010) supposed that *P. autumnalis* may be the same species as *P. humeralis*. This is a very reasonable supposition since just a degree of thorax melanisation with age can hardly be a basis for recognition of different species and the only diagnostic character. No doubt this trait can change in evolution very easily and independently in different populations. The island populations with the thorax totally blackening above in males can be decisive in this respect. Biogeographically they cannot be closest relatives to similar continental populations. One has to assume that either a stronger melanisation with age was acquired by continental and island populations independently and is hence a homoplasy (this option implies a less melanised common ancestor), or was lost by peninsular populations (this implies a more melanised common ancestor).

Lieftinck (1930) described *Caconeura corvina* Lieftinck, 1930 from Java, Jeroeklegi. The most conspicuous feature of this species was nearly complete thorax blackening in mature males, with small patches of brownish-yellow pattern left only at the metepimeron and inframetepisternum. Later Lieftinck (1934) acknowledged its practical identity and hence synonymy to the continental *P. autumnalis* (see also Asahina 1983; Davis et al 1984; Bridges 1994; Tsuda 2000). The name *corvina* Lieftinck, 1930 is, nevertheless, available for the taxon from Sumatra, Java and Bali if it were recognised as valid.

This above outlined situation would be best interpreted taxonomically in terms of three subspecies, which would receive the following valid names:

- *Prodasineura humeralis autumnalis* (Fraser, 1922): the continent;
- *Prodasineura humeralis humeralis* (Selys, 1860): Malay Peninsula;
- *Prodasineura humeralis corvina* (Lieftinck, 1930): islands;

probably with a transitional zone between *P. h. autumnalis* and *P. h. humeralis* in the Kra Isthmus, and without known diagnostic characters beyond provenance allowing to distinguish *P. h. autumnalis* and *P. h. corvina*. The latter circumstance does not contradict the current concept of subspecies as entities of geographical variation. However, some diagnostic characters will probably be found by comparing large series of specimens.

At present there seems to be no sound argument for *P. autumnalis* being bona species. Yet I do not introduce here the above trinomens as valid for the three supposed subspecies since it demands a special study. No doubt, a thorough revision of variation in large series is necessary to prove conspecificity between *P. humeralis* and *P. autumnalis*, which would be much more fruitful than studying of type specimens as soon as an age-related character is mainly concerned.

Procordulia sambawana (Förster, 1899)

Specimens: L1, 24.02.2014 - 1♂ (Figure 38); published record: Lieftinck 1953 (Lombok: Sapit).

Remarks. Van Tol (1997: 135) stated that males of this species have “two Cux in hind wing, the distal Cux forming an infratriangle”. Therefore it is noteworthy that in the male from L1 the distal Cux is absent from the left hind wing, although its small ‘stump’ (anlage) is seen (indicated by the red asterisk in Fig. 39, right). That on the right hind wing is present but it can hardly be said to form an infratriangle since it is situated at some distance proximally of the triangle.

Habitat and behaviour. Lieftinck (1953: 193) noted that this species “is never encountered below approximately 800 metres above sea-level”, but at the Rinjan Volcano foot at Sinaru I found it at about 500 m. Individuals were observed before and after strong rain, flying very low above the ground or pathways, alternating hovering and

Figure 39. ***Procordulia sambawana,*** **a males from Sinaru env., Rinjan Volcano N foot, Lombok (L1), 24.02.2014: top – wing bases; bottom – general habitus. The red asterisk indicates the second Cux on the right hind wing and its anlage on the left hind wing.**

fast movement and very hard to see in shade. However, the male collected was captured as ranging to and fro at about 2.5 m above a pathway, at the same place to which several individuals of *I. murcia* were restricted (Fig. 32).

Neurothemis terminata Ris, 1911 (Fig. 35d-f)

Specimens: L3b, 22.02.2014 – 1 ♂ (Fig. 35c), 1 ♀; L4, 22.02.2013 – 2 ♂♂ (Fig. 35a-b)

Taxonomic remarks. A male collected at the lowest reaches of the Batu Bolong River (L3b) had all diagnostic characters of *N. terminata* (Orr, 2005): two Cux on the hind wing (the second forming the infratriangle) and the transparent areas of both wings starting at about the end of pterostigma (Fig. 35d). Two males collected at the lotus pond 3.2 km south-east (L4) also had two Cux on the hind wing, while the border of the wing transparent area varied as to its position: in one at the middle of pterostigma (Fig. 35e), in the other as in *N. ramburii* (Fig. 35f). In all these three males, the border was skewed proximally on the hind wing, but in the two former not as strong as in *N. ramburii*. I preliminary identify them as *N. terminata*, although the two latter specimens may be products of genetic introgression between the two discussed species. Obviously, there should be some hybridisation between *N. ramburii* and *N. terminata* on Lombok, as it occurs elsewhere (Lieftinck 1954; Orr 2005).

I did not investigate intergradation of the two species on Bali, for which both species has been reported (Lieftinck 1953), but few specimens I collected and photographed at different localities were all *N. terminata*.

Faunal Discussion

I made only one new finding for Bali, plus an observation of an unidentified *Tramea* sp.: for some reason this widespread genus has not been recorded there. At the same time, just three and half days spent on Lombok provided as many as six species not hitherto reported for this island: *N. emphyla, I. murcia, B. chalybea, A. insignis, N. ramburii* and *R. phyllis*. Noteworthy that all these genera but *Neurothemis* are hence also recorded for Lombok for the first time. *A. insignis, N. ramburii* and *B. chalybea* were known from Bali (Kishi 1999) and *I. murcia* and *R. phyllis* were known from Sumbawa Island (Lieftinck 1953), the closest of the Lesser Sundas to Lombok in the east. Three large libellulids, *A. inignis, N. ramburii* and *R. phyllis*, were quite expectable on Lombok as good fliers able of crossing straits. *B. chalybea* is not yet known easterly of the two islands considered. It is a common dweller of small ponds and it is not excluded that its spread, in egg stage, was facilitated by humans or birds and could be quite recent. *N. emphyla* was thought to be endemic of Flores; now one has to expect it for Sumbawa. The narrow and shallow Alas Strait which repeatedly dried out in the Pleistocene could hardly serve as a biogeographical barrier even for such weakly flying stenotopic Odonata as *Idionyx* and *Nososticta*.

The six species new for Lombok registered for so few days of exploring the island evidence how insufficiently studied its Odonata fauna still is. No doubt that more regular studies are necessary, which will most probably provide more species presently known from the more easterly islands of Sumbawa and Flores, the sister to Lombok members of the former Wallacea.

In spite of our knowledge of Lombok fauna being still too incomplete but in view of the considerable recent update for Bali (see the introduction), it is worth to attempt the next, after Lieftinck (1953), preliminary summation of Odonata of Bali and Lombok, that is made in Table 2.

In total 67 taxa are presently known from both islands (during my trip I observed half of them, 34 species), 14 of which were added (Belle 1994; Ruddek 1998; Kishi 1999; this paper) after Lieftinck (1953). On Bali, 55 species have been recorded, and 39 on Lombok.

In the text below and Table 2, I will classify ranges of species mentioned as to their position with respect to Bali and Lombok and use the following codes: w – for species ranging to the west of Bali and Lombok, at least present in Java; e - for species ranging in the more easterly islands, t - for species ranging through the two islands, from islands west of Bali to those east of Lombok, en – for endemic species (information chiefly from Lieftinck 1953; 1954) , u – for unidentified species.

It follows from the last, summarising line of Table 2 that the Lombok Strait section of Wallace Line does serve as a strong biogeographical boundary for Odonata. For as many as 29.1% of species so far known for Bali (encoded with ‘w’), this is their easternmost record. The fraction of eastern species for which Bali is their westernmost record, that is they do pass Lombok Strait from the east but do not pass the next, shallow Bali Strait westerly (encoded with ‘e’), comprises 3.6% (just two species, P. pilidorsum and H. australiae, most probably they will later turn to be ‘t’ species). On Lombok, the percentage of eastern species at their westernmost location, which do not pass Lombok Strait from the east (‘e’), is 23.1 %; and the number of western species which pass Lombok Strait from the west but do not pass the next, shallow Alas Strait (‘w’) is 5.1%. That is, percentages of species for which Lombok Strait serves a range border are very similar on Bali and Lombok, 29 and 23%, respectively; and percentages of species which pass Lombok Strait from the west and from the east but stop at the next strait are also similar but much smaller: 3.6 and 5.1% (2 species in both cases), respectively. This means that the shallow Bali and Alas Straits are much weaker biogeographical boundaries than the deep Lombok Strait. Lastly, percentages of species which range throughout Bali and Lombok at least from Java to Sumbawa (marked with ‘t’) are similar as well: 60.0% and 69.2%, respectively. We may conclude that Odonata faunas of Bali and Lombok mirror each other as having equally strong western and eastern aspect, respectively. (Note that among the latter considered category ‘t’ there are species of both western and eastern main range and origin, but general distribution of species is beyond our concern here.)

Note that of the nine species of Table 2 marked with ‘e’, that is not extending west of the two islands considered, six are strictly Wallacean, that is not crossing Lydekker Line, and only two species (*Anax gibbosulus* Rambur, 1842 and *T. eurybia*) enter Oceania (New Guinea, Australia and Polynesia), and one (*P. pilidorsum* Brauer, 1868) extending more easterly northwards to the Philippines (belonging to Sundaland) and even Taiwan and Ryukyu Islands.

Efficiency *E* of a biogeographical boundary, Lombok Strait in our case, may be evaluated as the ratio of the number of species which do not pass it, as found only at one its side (in our case either on Bali or Lombok), to the total number of species found in both areas compared (both on Bali and Lombok) (Sergeev 1986; Kosterin & Zaika 2010). The value of *E* calculated from actual data of Table 2, regardless ‘w’, ‘e’ and ‘t’ codes (for instance, a ‘t’ species found at only one of the two islands is counted as not passing the boundary), is 40/67=0.60. This is a high value: the boundary appeared impermeable for more than half of species, illustrating a great importance of Wallace Line for Odonata.

Note that $E = 1 – J$, where J is Jaccard coefficient (the ratio of the number species occurring in both regions to the total number of species occurring in both or either of the two regions) being a simple measure of similarity of two faunas; its value in our case being 27/67=0.40.

Partial efficiency of the boundary with respect to direction, e.g. as the eastern border for western species E_{w-e}, may be evaluated as the ratio of species not passing it from one side to the other (in our case from west to east, from Bali to Lombok) to the number of species occurring at the first side (in our case on Bali). In our case the value of E_{w-e} is 28/55= 0.51. The value of the partial efficiency in the opposite direction, E_{e-w}, is 12/39=0.31. (Note that E_{w-e} x E_{e-w} = E^2.) The latter partial efficiency is noticeably smaller than the former, that seems to contradict to the above conclusion of symmetry of the two islands with respect to the respective proportion of ‘w’ and ‘e’ species. This resulted from Lombok still being insufficiently studied, namely because quite a number of ‘t’ species, with wide ranges, are still not found there although highly expected (producing ‘t | -’ lines in the Table 2 columns 2 and 3). Such a result is the best motivation to proceed search for Odonata on Lombok. This no doubt will make more elegant the figures which presently are too preliminary, most probably by somewhat lowering the values of E_{w-e} and, to less extent, E.

Table 2. The present day species checklists of the Odonata fauna of Bali and Lombok (authorities and subspecies omitted). Presence of each species is reflected by either of the following codes: w – for species ranging to the west of Bali and Lombok, at least present in Java; e - for species ranging in the more easterly islands, t - for species ranging through Bali and/or Lombok from west to east, en – for endemic species (information chiefly from Lieftinck 1953; 1954), u – for unidentified species. Records after Lieftinck (1953) by Belle (1994), Kishi (1999), Ruddek (1998), and this paper are highlighted with bold red letters.

No	Species	Bali	Lombok
1	*Vestalis luctuosa*	w	-
2	*Heliocypha fenestrata*	w	-
3	***Libellago lineata***	**w**	-
4	*Rhinocypha pagenstecheri*	-	e
5	*Euphaea lara*	-[1]	e
6	*Euphaea variegata*	w	-
7	*Drepanosticta berlandi*	-	en
8	*Agriocnemis femina*	t	t
9	*Agriocnemis pygmaea*	t	-
10	*Ischnura senegalensis*	t	t
11	*Pseudagrion microcephalum*	t	-
12	*Pseudagrion pilidorsum*	**e**	e
13	*Pseudagrion pruinosum*	w	**w**
14	***Pseudagrion rubriceps***	t	t
15	*Copera marginipes*	t	-
16	*Prodasineura humeralis*	w	-
17	***Nososticta emphyla***	-	**e**
18	*Nososticta insignis*	w	-
19	*Anaciaeschna jaspidea*	t	t
20	*Anax gibbosulus*	-	e
21	*Anax guttatus*	t	-
22	*Anax panybeus*	w	-
23	***Gynacantha bayadera***	**t**	-
24	*Gynacantha musa*	**t**	t
25	*Gynacantha subinterrupta*	**t**	t
26	***Ictinogomphus decoratus***	**w**	-
27	*Onychogomphus fruhstorferi*	w	-
28	*Paragomphus reinwardtii*	w	-
29	*Paragomphus flavohamatus*	-	e
30	*Epophthalmia vittigera*	w	-
31	*Hemicordulia australiae*	e	-
32	***Idionyx murcia***	**-**	**e**

No	Species	Bali	Lombok
33	***Idionyx sp.***	**u**	-
34	***Macromia jucunda***	**w**	-
35	***Macromia* sp A.**	**u**	-
36	***Macromia* sp B.**	**u**	-
37	*Procordulia sambawana*	**t**	t
38	*Acisoma panorpoides*	t	t
39	*Agrionoptera insignis*	t	**t**
40	*Brachydiplax chalybea*	w	**w**
41	***Brachydiplax contaminata***	**t**	**t**
42	*Camacinia gigantea*	-	t
43	*Cratilla lineata*	w	-
44	*Crocothemis servilia*	t	t
45	*Diplacodes trivialis*	t	t
46	***Macrodiplax cora***	-	**t**
47	*Lathrecista asiatica*	t	-
48	*Neurothemis ramburii*	t	**t**
49	*Neurothemis terminata*	t	t
50	*Onychothemis culminicola*	w	-
51	***Orthetrum chrysis***	**t**	-
52	*Orthetrum glaucum*	t	t
53	*Orthetrum pruinosum*	t	t
54	*Orthetrum sabina*	t	t
55	*Orthetrum testaceum*	t	t
56	*Pantala flavescens*	t	**t**
57	*Potamarcha congener*	t	t
58	***Rhyothemis phyllis***	-	**t**
59	*Tetrathemis irregularis*	t	-
60	*Tramea eurybia*	?[2]	e
61	*Tholymus tillarga*	t	t
62	*Trithemis aurora*	t	-
63	*Trithemis festiva*	t	t
64	*Trithemis lilacina*	-	e

No	Species	Bali	Lombok
65	*Zygonyx ida*	t	t
66	*Zyxomma obtusum*	t	t
67	***Zyxomma petiolatum***	**t**	-
	Total	55 (16 w, 2 e, 34 t, 3 u)	39 (2 w, 9 e, 27 t, 1 en)

[1]Lieftinck (1953) reasonably doubted that the type of *E. lara balica* McLachlan, 1898 originated from Bali. Since nobody has confirmed presence of the conspicuous species *E. lara* on Bali for the following half a century, I exclude it from the Bali checklist.

[2]The male of *Tramea* sp. observed by me on Bali remained unidentified but it would not be reasonable to count it separately for most probably it was *T. eurybia* as well.

Notes on the Odonata habitats and assemblages

The parts of Bali and Lombok which I saw contrasted to each other like the hell and paradise, respectively. The central area of Bali, from south to north, is entirely settled and looks like a continuous city, from the beaches to volcanic calderas. You may cross the island and see few places where a road, always with heavy traffic, goes for a short distance through just rice fields or plantation and is not bordered by infinite walls and houses, nearly each third of which being a temple. Scarce remnants of nature were tiny and visiting them should have been planned specially. Most rivers flow in deep and narrow crevices, dug in soft volcanic soils or rocks. They can be recognised just by stripes of trees hiding under them some black abyss where the water cannot be seen, crossed by short bridges. The coast of the western and northern Lombok is a chain of bays, with sparse cottages or desolate, with deep azure blue sea, greyish-white beaches, palm groves and green coastal hill offering gentle rivulet valleys. These hills and valleys are clad with plantations of coconut palms, bananas etc., finely incorporated into the forest remnants so that they little changed the structure of the forest community and left sunny rivulets with stone and rocky beds nearly undisturbed. (The East Bali looks similar but I did not examine it). To complete the contrast, such an entomologist's pest as sandbur grass (*Cenchrus* sp.), with its phoretic spiny paniculi making net sweeping hardly possible, filled any ruderal place on Bali but was absent at all from Lombok.

I spent only nine days on Bali and four on Lombok, yet these my short comparative observations, made nearly simultaneously in the second half of the rainy season, may be of some value. The assemblage of riverine odonates, as I observed them, differed strongly between the two islands. First it concerned demoiselles: all examined rivers on Bali abounded with *Aristocypha fenestrata cornelii* Lieftinck, 1947, while at the two rivers I examined on Lombok I found only *E. lara lombokensis* (extremely numerous at

Batu-Bolong). The former represented Chlorocyphidae while the latter Euphaeidae, and although both families are present in both islands (see Table 2), I failed to meet representatives of the former on Lombok and the latter on Bali during my trip. In addition, while processing my photos I was struck to find out the second chlorocyphid from Bali, *Libellago ? lineata*: a female appeared to be photographed at Tegenungan Waterfall, see Fig. 15, together with a female of *R. fenestrata cornelii* sitting on the same rope of a small sacral place, see Fig 14d. Of Platycnemididae in its present broad sense, *Copera marginipes* (Rambur, 1842) was found in several places on Bali, kept to shady bluffs (while in Indochina I observed it preferring more opened habitats) and in southern, eastern and northern Bali I found numerous *P. autumnalis*, while on Lombok only single male of *N. emphyla* was found. The riverine Coenagrionidae were represented on Bali by *P. pruinosum* (frequent) and *P. pilidorsum* (scarce), both preferring small calm streams or reaches, while on Lombok I found only the latter but abundant. *Pseudagrion microcephalum* (Rambur, 1842) appeared only at nearly lotic shallows of the large and flat Unda River on Bali. *Trithemis festiva* (Rambur, 1842) was abundant (males perching on stones and sticks) and *T. lilacina* Förster, 1899 (the endemic of Lesser Sundas not crossing the Lombok Strait to the west; males preferred larger boulders and rocks than the former species) was common at the Batu Bolong River on Lombok. I failed to find this genus on Bali. *Orthetrum* and *Neurothemis* spp. were common without observable regularity. None Gomphidae was found.

I examined lowland lotic habitats on both islands and the only quite surprising thing was that I failed to find a single individual of *Anax* spp,, although three species are known in total for the two islands. *Zyxomma obtusum* Albarda, 1881 was observed in both islands, active in the dusk and down (observation of one male on Lombok) at tiny shallow and shaded pools. At such a place on Bali, I at once observed ovipositing females of this species, *Tholymis tillarga* (Fabricius, 1798) (into very shallow water full of pond scum and tadpoles) and *Gynacantha subinterrupta* (Rambur, 1842) (into a muddy bank).

Large lakes in volcanic calderas situated above 1,000 m a.s.l. on Bali appeared to be quite different from each other with respect to Odonata. They all had shallow banks with stripes of inundated grass. At Lake Batur, there were enormous quantities of *Ischnura senegalensis* (Rambur, 1842), very numerous *B. contaminata* and scarce *P. microcephalum*. At the same time, Lakes Bratan and Tamblingan, situating in another caldera, were nearly empty in this respect. I examined their banks both at settlements (just a tiny village at Tamblingan) and at undisturbed sections bordered by lush primary forest. They were quite lively, with frogs and birds, yet at Bratan, with much effort, I managed to sweep out only a single female of *I. senegalensis* while at Tamblingan I got several individuals of this species and also of *Agriocnemis femina* (Brauer, 1868) (besides, some *Pantala flavescens* (Fabricius, 1798) and *Orthetrum sabina* (Drury, 1770) were found at both lakes as elsewhere throughout the islands).

Interestingly, at each of NE and SW sides of Lake Tamblingan I encountered a male of *A. fenestrata cornelii*, a lotic demoiselle. The reason of this poverty of two so nice lakes in the same caldera remained unclear and may have a chemical nature.

The caldera lake of the Rinjan volcano on Lombok (the second high in Indonesia) was closed for visiting in rainy season for the danger of too slippery paths. And indeed, in the elsewhere nice day when we visited its forested northern foot at Sinaru we got under a prolonged rain. Before and after it I was happy to find *I. murcia* and *P. sambawana*, and also single males of *E. lara lombokensis* and *T. festiva*, although the powerful river with rapids and stony Dutch channels with smoothly flowing water looked extremely favourable for more diverse lotic odonates.

Three most common libellulids could be found virtually at any open place on both islands: *O. sabina, D. trivialis* and *P. flavescens*, here ordered from the most to least abundant. I have to say *O. sabina* may be ten times more numerous than I used to observe it in Thailand or Cambodia.

Curious observation

For the first time in my odonatological practice I happened to get a specimen of a rather scarce damselfly, a male of *Pseudagrion pilidorsum declaratum* Lieftinck, 1936, by taking it from a large water strider (Gerridae) who carried it as a prey, at L3c on 23.03. 2014.

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