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Trainor & Malte Seehausen**

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New records of Odonata from the eastern Lesser Sunda Islands of Timor, Semau, Rote, and Alor, with discovery of *Hemicordulia eduardi* (Odonata: Corduliidae)

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Abstract

Eleven species of Odonata are reported for the first time from Timor and Semau Islands, 13 new records are reported for Rote Island and four new records for Alor Island. These records increase the checklists to 51 species for Timor (thereof 45 from Timor-Leste), 11 for Semau, 23 for Rote and 13 for Alor. An annotated listing is provided for these four islands.

Furthermore three species were rediscovered at Timor: *Indolestes lafaeci* Seehausen, 2017 for the first time since the type series collected in 1929, also the first photographs of living individuals and notes about the habitat are provided; *Diplacodes haematodes* (Burmeister, 1839) for the first time since 1935 and *Tamea loewii* Brauer, 1866 for the first time since an unspecific record published by Lieftinck (1953).

The identification of *Hemicordulia eduardi* Lieftinck, 1953, formerly supposed to be an endemic from Sumba Island, is discussed with reference to the holotype male. Also notes about the habitat and behaviour are given. Five taxa of the *Rhyothemis phyllis* (Sulzer, 1776) group were shortly discussed with respect to the individuals from Timor which are provisionally assigned to ssp. *ixias* Lieftinck, 1953. Illustrations of the face, labium and wings of the nominate subspecies as well as of ssp. *ixias*, ssp. *obscura* (Brauer, 1868), ssp. *snelleni* (Selys, 1878), and ssp. *chloe* (Kirby, 1894) are provided.

Key words: *Indolestes lafaeci*; *Rhyothemis phyllis ixias*; Indonesia; Timor-Leste

Introduction

The knowledge about the Odonata fauna from Timor Island has increased within the last several years. Seehausen (2017a) and Seehausen & Theislinger (2017) de-

scribed new species from Timor and Seehausen (2017b) gave the first updated overview including nine new records. Seehausen et al. (2018) provided new data and further reviews of historical records as well as descriptions of some Timorese habitats and landscapes. They reported four species new for Timor and increased the checklist to 40 species. Moreover, five new records for Rote Island and the first odonate record from Romang Island were provided.

In here, we provide further new and interesting records from Timor, Rote, and Alor Island and we provide the first odonate records for Semau Island. This small Indonesian island is about 3 km from the western shore of Timor and belongs to the Kupang Regency/West Timor. Semau has a flat landscape with the highest elevation of about 210 above sea level (a.s.l.). However, Alor covers an area of about 2800 km² with a rugged landscape. At 1765 m a.s.l., Mount Kolana is the highest location on the island; the lowlands are restricted to the Kalabahi City area.

Material and method

Our report is based on photographs taken by Rui Miguel da Silva Pinto (RMSP), Jafet Potenzo Lopes (JPL) as well as Colin Richard Trainor (CRT). Species identification and analysis of the photographs was accomplished by Malte Seehausen (MS). We focussed on first island records and provide further records of species not reported since 50 years ago. Our current database of Odonata from Timor comprises about 1840 data sets including records gleaned from the literature. Altitude data are approximated values. We also provide updated distribution maps (Appendix 2) for all species thus far known from Timor and surrounding islands.

Appendix 1 provides checklists for the Islands of Timor, Semau, Rote, and Alor including our new records and additionally checklists for the surrounding Islands of Pantar, Wetar, Kisar, and Romang based on pre-existing literature.

Appendix 2 provides updated distribution maps for each species recorded from Timor and surrounding islands.

Sampling locations

INDONESIA, EAST NUSA TENGGARA, ALOR ISLAND:

1. Coastal swamps south of Mali (Fig. 1; -8.153°N, 124.592°E; 11 m a.s.l.)
2. North of Apui, central Alor (-8.291°N, 124.720°E; 950 m a.s.l.)

INDONESIA, EAST NUSA TENGGARA, ROTE ISLAND:

3. Spring at rice field, northeast Rote (-10.598°N, 123.319°E; 11 m a.s.l.)
4. Lela plunge pool, central Rote (Fig. 2; -10.740°N, 123.121°E; 189-205 m a.s.l.)
5. Peto Area with spring, swamp forest and rice fields, central Rote (Figs 3-5; -10.752°N, 123.106°E; 124-169 m a.s.l.)
6. Daleholu Area with spring and stream, central Rote (-10.786°N, 123.160°E; 256-258 m a.s.l.)
7. Stream north east of Daleholu, central Rote (-10.744°N, 123.217°E; 167 m a.s.l.)
8. Danau-Tua Lake, southwest Rote (Figs 6-7; -10.853°N, 122.921°E; 72 m a.s.l.)

INDONESIA, EAST NUSA TENGGARA, SEMAU ISLAND:

9. Stream, north Semau (-10.175°N, 123.417°E; 38-41 m a.s.l.)
10. Stream, north Semau (-10.199°N, 123.417°E; 9 m a.s.l.)
11. Roadside dam, north Semau (Fig. 8; -10.168°N, 123.418°E; 60-61 m a.s.l.)
12. Uiasa spring, northeast Semau (Fig. 9; -10.154°N, 123.462°E; 31-37m a.s.l.)
13. Drain, north Semau (-10.195°N, 123.415°E; 12 m a.s.l.)
14. Wet rice field and surroundings, south Semau (-10.272°N, 123.348°E; 60-64 m a.s.l.)

TIMOR-LESTE

15. Aileu Municipality, coffee plantation near a small spring, around Tancae (-8.602°N, 125.603°E, 706 m a.s.l.)
16. Baucau Municipality, coastal pond, east of Vermasse (-8.470°N, 126.293°E; 3 m a.s.l.)
17. Dili and Aileu Municipality border, Manleu (-8.620°N, 125.542°E; 160 m a.s.l.)
18. Lautem Municipality, Mehara Ale Pala (-8.424°N, 127.192°E; 339 m a.s.l.)
19. Lautem Municipality, Lospalos (-8.514°N, 127.005°E; 382 m a.s.l.)
20. Lautem Municipality, Ou swamps, southwest of Lospalos (-8.539°N, 126.976°E; 434 m a.s.l.)
21. Lautem Municipality, Heler swamp (-8.516°N, 127.018°E; 371 m a.s.l.)
22. Lautem Municipality, Pulur Ira spring, east of Com (-8.374°N, 127.103°E; 128-135 m a.s.l.)
23. Lautem Municipality, southern area of the Lake Iralalalo (-8.471°N, 127.141°E; 337 m a.s.l.)
24. Lautem Municipality, Riviera Maluilada (-8.373°N, 126.885°E; 6 m a.s.l.)
25. Lautem Municipality, Mauninakoil, near Com (-8.361°N, 127.052°E; 80 m a.s.l.)
26. Lautem Municipality, Ocho-Lafai, along the coast east of Com (-8.366°N, 127.130°E; 11m a.s.l.)
27. Lautem Municipality, Arapmaku river, Nino Konis Santana National Park (-8.557°N, 127.134°E; 15 m a.s.l.)
28. Lautem Municipality, Jaco Island (-8.431°N, 127.324°E; 46 m a.s.l.)
29. Oecusse SAR, Pante Macassar Area (-9.204°N, 124.398°E; 222 m a.s.l.)
30. Oecusse SAR, Aosnak river environment, east of Pante Macassar (-9.185°N, 124.410°E; 22-33 m a.s.l.)
31. Oecusse SAR, Kolam-Xina environment, west of Pante Macassar (-9.201°N, 124.315°E; 7 m a.s.l.)
32. Oecusse SAR, Poto, near Oesilo (-9.361°N, 124.377°E; 439-440 m a.s.l.)
33. Oecusse SAR, Oebaha (-9.307°N, 124.353°E; 112 m a.s.l.)
34. Oecusse SAR, Kinat (-9.276°N, 124.413°E; 207 m a.s.l.)



Fig. 1. Alor Island, loc. 1. Photo: CRT.



Fig. 2. Rote Island, loc. 4. Photo: CRT.



Fig. 3. Rote Island, loc. 5, spring with stream. Photo: CRT.



Fig. 4. Rote Island, loc. 5, swamp forest. Photo: CRT.



Fig. 5. Rote Island, loc. 5, rice fields. Photo: CRT.



Fig. 6. Rote Island, loc. 8. Photo: CRT.



Fig. 7. Rote Island, loc. 8. Photo: CRT.



Fig. 8. Semau Island, loc. 11. Photo: CRT.



Fig. 9. Semau Island, loc. 12. Photo: CRT.

Annotated species list

Zygoptera

Coenagrionidae

1. *Agriocnemis femina* (Brauer, 1868)

INDONESIA, EAST NUSA TENGGARA, ROTE ISLAND: loc. 3, 22-ii-2019, males (CRT);
loc. 5, 14-ii-2019, male (CRT).

First records for Rote.

2. *Pseudagrion microcephalum* (Rambur, 1842)

INDONESIA, EAST NUSA TENGGARA, ALOR ISLAND: loc. 1, 27-i-2019, male (CRT).

First record for Alor.

3. *Pseudagrion pilidorsum deflexum* Lieftinck, 1936

INDONESIA, EAST NUSA TENGGARA, ROTE ISLAND: loc. 4, 21-ii-2019 and 23-ii-2019,
males (CRT); loc. 5, 17-ii-2019 and 21-ii-2019, males and female (CRT).

First records for Rote.

INDONESIA, EAST NUSA TENGGARA, SEMAU ISLAND: loc. 9, 26-ii-2019, male (CRT).

First record for Semau.

4. *Xiphiagrion cyanomelas* Selys, 1876

INDONESIA, EAST NUSA TENGGARA, ROTE ISLAND: loc. 4, 23-ii-2019, male (CRT).

First record for Rote.

INDONESIA, EAST NUSA TENGGARA, SEMAU ISLAND: loc. 11, 26-ii-2019, male (CRT).

First record for Semau and the Indonesian West Timor.

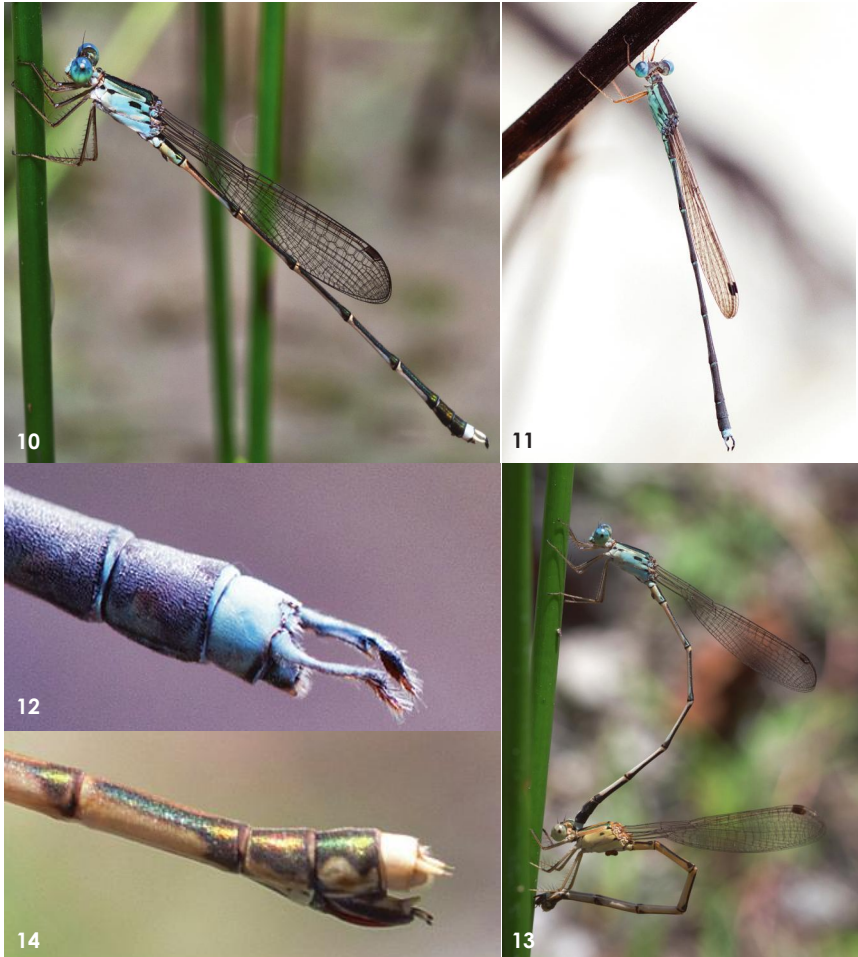


Fig. 10. *Indolestes lafaeci* male. Loc. 32, 18-ii-2020. Photo: RMSP.

Fig. 11. *Indolestes lafaeci* male. Loc. 32, 22-i-2020. Photo: RMSP.

Fig. 12. *Indolestes lafaeci* male appendages. Loc. 32, 25-i-2020. Photo: RMSP.

Fig. 13. *Indolestes lafaeci* tandem with female ovipositing. Loc. 32, 18-ii-2020. Photo: RMSP.

Fig. 14. *Indolestes lafaeci* female ovipositor. Loc. 32, 18-ii-2020. Photo: RMSP.

Lestidae

5. *Indolestes lafaeci* Seehausen, 2017

TIMOR-LESTE: loc. 32, 22-i-2020, 25-i-2020 and 18-ii-2020, males and females (RMSP, JPL; figs 10-14).



Fig. 15. Habitat of *Indolestes lafaeci* at loc. 32. Photo: RMSP.

First records since the original description (vi-1929 in Soe/South Central Timor Regency; cf. Seehausen 2017a). Photographs presented are the first showing living individuals of this species.

Notes: The Poto mud volcanoes are located within a small depression sloping towards the Ekatr river (Northwest of Poto). They are surrounded by *Casuarina junghuhniana* Miq. forest but few to no trees grow within the small depression where mud slurry extruded by 1-2 m high mud cones during the rainy season. They vary in size during the rainy season but are barely noticeable during the dry season. During the rainy season a series of white-coloured ponds are formed in the shallower depressions.

The pond (Fig. 15) where *I. lafaeci* was photographed is shallow with the deeper parts rarely exceeding 50 cm deep. Other species found here were *Ischnura senegalensis* (Rambur, 1842), *Crocothemis servilia* (Drury, 1773), *Diplacodes trivialis* (Rambur, 1842), *Neurothemis ramburii* (Brauer, 1866), *Orthetrum caledonicum* (Brauer, 1865), *Orthetrum sabina* (Drury, 1773), *Potamarcha congener* (Rambur, 1842), and *Tramea stenoloba* (Watson, 1992).

All individuals of *I. lafaeci* were either perching on the exposed *C. junghuhniana* roots, moss or small grass along the steep edges of the pond.



Fig. 16. *Lestes concinnus* male. Loc. 21, 23-vii-2019. Photo: JPL.

6. *Lestes concinnus* Hagen in Selys, 1862

TIMOR-LESTE: loc. 18, 25-iv-2020, females (JPL); loc. 21, 23-vii-2019, male and female (JPL; fig. 16).

First records for Timor.

7. *Lestes praemorsus* (Hagen in Selys, 1892)

TIMOR-LESTE: loc. 33, 7-iii-2019, males (RMSP; fig. 17).

First doubtless record of *Lestes praemorsus* from Timor. Lieftinck (1936) already mentioned larvae of this species from Timor but Seehausen (2017b) considered these records as not reliable. We could not positively assign the individuals to ssp. *decipiens* Kirby, 1890 and Dow & Sharma (2020) stated that the *Lestes praemorsus* taxa group needs a thorough revision.



Fig. 17. *Lestes praemorsus* male. Collected at loc. 33, 7-iii-2019. Photo: RMSP.

Platycnemididae

8. *Nososticta* sp.

INDONESIA, EAST NUSA TENGGARA, ROTE ISLAND: loc. 4, 21-ii-2019, male (CRT).

First record of a *Nososticta* species from Rote. Perhaps *N. impercepta* Seehausen & Theischinger, 2017 but unfortunately the photographs do not allow for a specific identification.

Anisoptera

Aeshnidae

9. *Anax guttatus* (Burmeister, 1839)

INDONESIA, EAST NUSA TENGGARA, SEMAU ISLAND: loc. 14, 10-ii-2019, female (CRT).

First record for Semau and Indonesian West Timor.

10. *Gynacantha bayadera* Selys, 1891

TIMOR-LESTE: loc. 33, 3-iii-2019, male, collected (RMSP; figs 18, 19a-b); loc. 32, 18-ii-2020, male and female (RMSP, JPL; fig. 20).

First records for Timor.

11. *Gynacantha* sp.

INDONESIA, EAST NUSA TENGGARA, ROTE ISLAND: loc. 5, 14-ii-2019, sex uncertain (CRT).

First record of member of the genus *Gynacantha* from Rote. Unfortunately the photo does not allow for a specific identification.



Fig. 18. *Gynacantha bayadera* male. Collected at loc. 33, 3-iii-2019. Photo: RMSP.



Figs 19. *Gynacantha bayadera* male appendages from dorsal (a) and lateral (b). Collected at loc. 33, 3-iii-2019. Photos: RMSP.



Fig. 20. *Gynacantha bayadera* female. Loc. 32, 18-ii-2020. Photo: RMSP.

Corduliidae

12. *Hemicordulia eduardi* Lieftinck, 1953

TIMOR-LESTE: loc. 29, 13-iii-2019 and 18-iii-2019, male and female, collected (RMSP; figs. 21, 23a-c, 24, 25a-b, 28a-d); loc. 15, 22-ix-2019, male (JPL; fig. 22).

First records for Timor.

Notes: RMSP noted *H. eduardi* as a fast flying species that seldomly perched. It had a relatively predictable flight pattern including hovering over the same place for 5-10 seconds rendering them easy to approach, but they kept some distance (0.6-1 m) making them easy to capture. They flew low over the water and all were found over pools below small waterfalls of 1-1.5 m (Figs 29-30), except for one caught at a pool with a medium sized waterfall (3-4 m). Flight activity was especially high over the pool's central area. Individuals patrolled the pool for 10-15 minutes, subsequently moving to other pools down- or upstream. Other odonate species found at the same locality were *Rhinocypha pagenstecheri timorana* Lieftinck, 1936, *Nososticta impercepta*, and *Pseudagrion pilidorsum deflexum*.



Fig. 21. *Hemicordulia eduardi* male in flight. The black S8-10 of the abdomen are good visible. Loc. 29, 22-iii-2019. Photo: RMSP.



Fig. 22. *Hemicordulia eduardi* male resting. Loc. 15, 22-ix-2019. Photo: JPL.



Fig. 23. *Hemicordulia eduardi* male from dorsal (a), lateral (b) and wings (c).



Fig. 24. *Hemicordulia eduardi* male secondary genitalia from lateral. Collected at loc. 29, 18-iii-2019. Photos: RMSP.

Fig. 25a, b. *Hemicordulia eduardi* male appendages from dorso-lateral (a) and appendages from ventral (b). Collected at loc. 29, 18-iii-2019. Photos: RMSP.

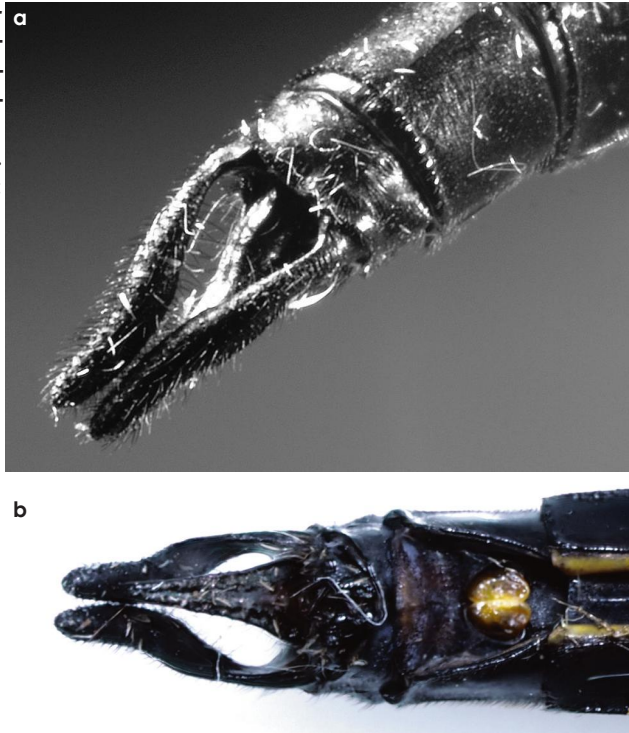


Fig. 26. Illustrations of *Hemicordulia eduardi* male from Lieftinck (1953: 187; figs 52-53).

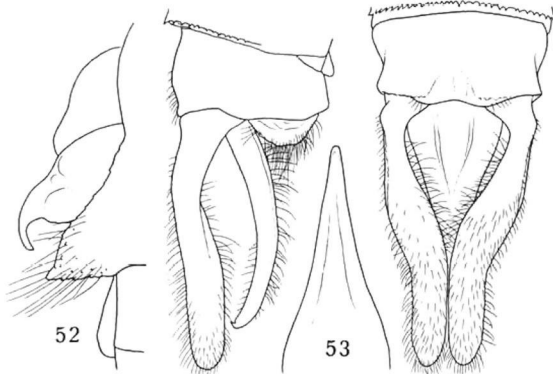


Fig. 52-53. *Hemicordulia eduardi*, sp. n., ♂ Sumba. Left lateral view of genitalia (52), right lateral and dorsal view of anal appendages, and ventral view of appendix inferior (53).



Fig. 27a-c. *Hemicordulia eduardi* holotype male from dorsal (a), lateral (b) and labels (c). Photos: Naturhistorisches Museum Basel.

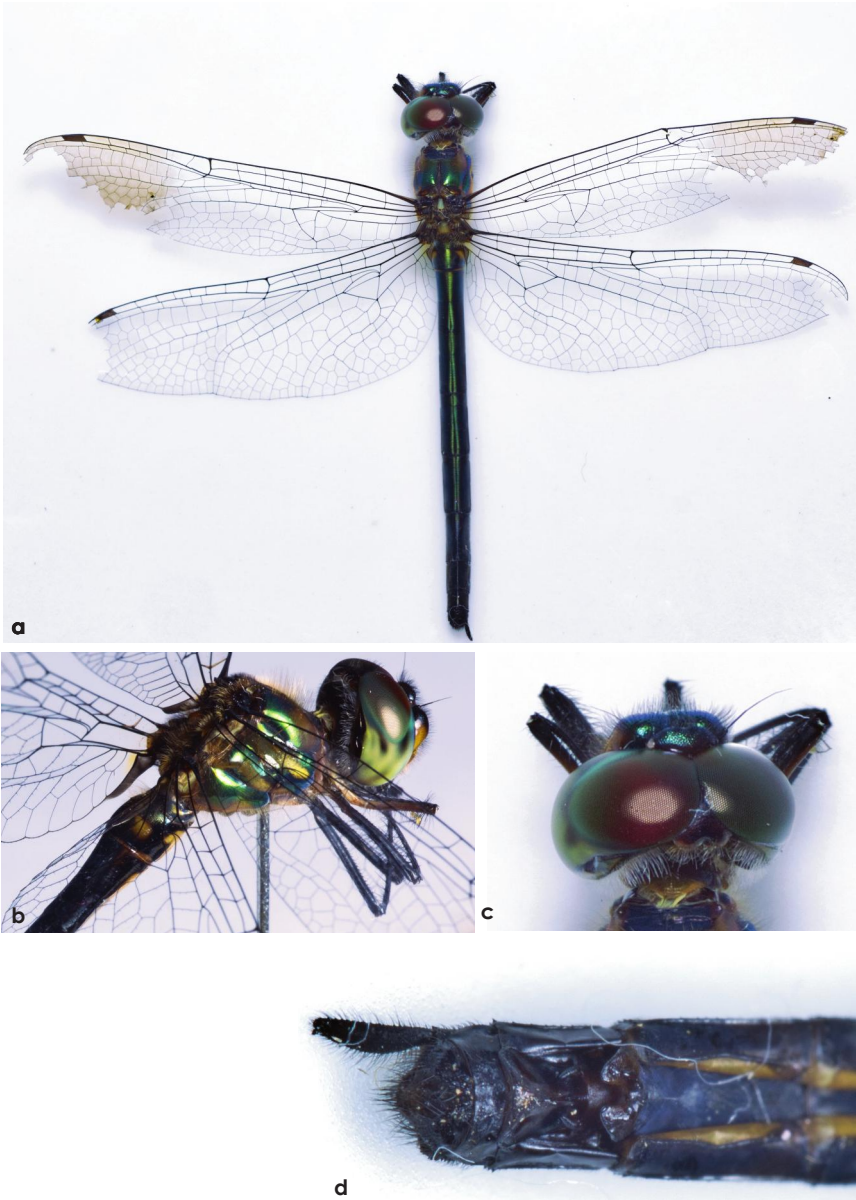


Fig. 28. *Hemicordulia eduardi* female from dorsal (a), head and thorax lateral (b), head dorsal (c) and vulvar lamina from ventral (d). Collected at loc. 29, 13-iii-2019. Photo: RMSP.



Fig. 29. Habitat of *Hemicordulia eduardi*. Pool with little water fall at loc. 29. Photo: RMSP.



Fig. 30. Habitat of *Hemicordulia eduardi*. Pool behind water fall at loc. 29. Photo: RMSP.

Libellulidae

13. *Acisoma panorpoides* Rambur, 1842

TIMOR-LESTE: loc. 20, 15-vii-2019, males and female (CRT, JPL); loc. 21, 23-vii-2019, female (JPL); loc. 22, 3-iv-2020, males (JPL); loc. 31, 25-ii-2020, male and female (JPL).

First records for Timor.

14. *Agrionoptera insignis* (Rambur, 1842)

INDONESIA, EAST NUSA TENGGARA, ALOR ISLAND: loc. 1, 27-i-2019, at least three males (CRT).

First record for Alor.

INDONESIA, EAST NUSA TENGGARA, ROTE ISLAND: loc. 5, 14-ii-2019, male (CRT).

First record for Rote.

TIMOR-LESTE: loc. 28, 9-iv-2020 and 10-iv-2020, males (JPL).

First records for Timor.

15. *Brachydiplax duivenbodei* (Brauer, 1866)

TIMOR-LESTE: loc. 22, 3-iv-2020, males and female (JPL; fig. 31).

First record for Timor.



Fig. 31. *Brachydiplax duivenbodei* female. Loc. 22, 3-iv-2020. Photo: JPL.

16. *Crocothemis servilia* (Drury, 1773)

INDONESIA, EAST NUSA TENGGARA, SEMAU ISLAND: loc. 14, 10-ii-2019, male (CRT).

First record for Semau.

17. *Diplacodes bipunctata* (Brauer, 1865)

TIMOR-LESTE: loc. 23, 22-vii-2019, males (CRT, JPL; fig. 32).

First record for Timor.



Fig. 32. *Diplacodes bipunctata* male. Loc. 23, 22-vii-2019. Photo: JPL.

18. *Diplacodes haematodes* (Burmeister, 1839)

TIMOR-LESTE: loc. 17, 2-v-2019, hundreds of males and females (RMSP, JPL; figs 33-34); loc. 30, 18-iv-2019 and 12-ii-2020, males (RMSP); loc. 34, 4-iv-2020 and 5-iv-2020, male and female (Inacia C.V. Pereira Teme).

First records since 1935 (cf. Lieftinck 1953).

19. *Diplacodes trivialis* (Rambur, 1842)

INDONESIA, EAST NUSA TENGGARA, ALOR ISLAND: loc. 1, 27-i-2019, males (CRT).

First record for Alor.

INDONESIA, EAST NUSA TENGGARA, SEMAU ISLAND: loc. 14, 10-ii-2019, males (CRT).

First record for Semau.



Fig. 33. *Diplacodes haematodes* male. Loc. 17, 2-v-2019. Photo: RMSP.



Fig. 34. *Diplacodes haematodes* female. Loc. 17, 2-v-2019. Photo: RMSF.

20. *Neurothemis ramburii* (Brauer, 1866)

INDONESIA, EAST NUSA TENGGARA, ROTE ISLAND: loc. 5, 14-ii-2019, male (CRT);
loc. 6, 15-ii-2019, male (CRT).

First records for Rote.

INDONESIA, EAST NUSA TENGGARA, SEMAU ISLAND: loc. 12, 9-i-2019, males (CRT).

First record for Semau.

21. *Orthetrum caledonicum* (Brauer, 1865)

INDONESIA, EAST NUSA TENGGARA, SEMAU ISLAND: loc. 11, 26-ii-2019, males (CRT);
loc. 14, 10-ii-2019, male (CRT).

First records for Semau.

22. *Orthetrum cf. glaucum* (Brauer, 1865)

INDONESIA, EAST NUSA TENGGARA, ALOR ISLAND: loc. 2, 26-i-2019, female (CRT).

First record for Alor.

23. *Orthetrum sabina* (Drury, 1773)

INDONESIA, EAST NUSA TENGGARA, SEMAU ISLAND: loc. 11, 26-ii-2019, male (CRT);
loc. 14, 10-ii-2019, males (CRT).

First records for Semau.

24. *Orthetrum testaceum* (Burmeister, 1839)

INDONESIA, EAST NUSA TENGGARA, ROTE ISLAND: loc. 4, 21-ii-2019 and 23-ii-2019, males (CRT); loc. 5, 14-ii-2019 and 21-ii-2019, males (CRT); loc. 6, 15-ii-2019, male (CRT).

First records for Rote.

25. *Pantala flavescens* (Fabricius, 1798)

INDONESIA, EAST NUSA TENGGARA, ALOR ISLAND: loc. 1, 27-i-2019, male (CRT).

First record for Alor.

26. *Potamarcha congener* (Rambur, 1842)

INDONESIA, EAST NUSA TENGGARA, SEMAU ISLAND: loc. 9, 26-ii-2019, male (CRT); loc. 11, 26-ii-2010, male (CRT); loc. 13, 26-ii-2019, male (CRT); loc. 14, 10-ii-2019, male (CRT).

First records for Semau.

27. *Rhodothemis* cf. *nigripes* Lohmann, 1984

TIMOR-LESTE: loc. 19, 15-vii-2019, teneral male (JPL; fig. 35).

First record for Timor.



Fig. 35. *Rhodothemis* cf. *nigripes* teneral male. Loc. 19, 15-vii-2019. Photo: JPL.

28. *Rhyothemis phyllis ixias* Lieftinck, 1953

TIMOR-LESTE: loc. 16, 15-ii-2019, male (JPL); loc. 22, 3-iv-2020, males (JPL); loc. 24, 19-ii-2019, male (JPL); loc. 25, 10-i-2020, male (JPL); loc. 28, 10-iv-2020, male (JPL); loc. 30, 28-iv-2019 and 16-iv-2020, males and females (RMSP; figs 39-40).

First records for Timor.

29. *Tholymis tillarga* (Fabricius, 1798)

INDONESIA, EAST NUSA TENGGARA, ROTE ISLAND: loc. 5, 14-ii-2019, female (CRT).
First record for Rote.

30. *Tamea loewii* Brauer, 1866

TIMOR-LESTE: loc. 26, 13-iv-2020, females (JPL; fig. 36).
First record since Lieftinck (1953; unspecified record of a female from Timor).



Fig. 36. *Tamea loewii* female. Loc. 26, 13-iv-2020. Photo: JPL.

31. *Tamea stenoloba* (Watson, 1962)

INDONESIA, EAST NUSA TENGGARA, ROTE ISLAND: loc. 8, 13-ii-2019, male (CRT).
First record for Rote.

INDONESIA, EAST NUSA TENGGARA, SEMAU ISLAND: loc. 11, 26-ii-2019, male (CRT).
First record for Semau.

32. *Trithemis aurora* (Burmeister, 1839)

INDONESIA, EAST NUSA TENGGARA, ROTE ISLAND: loc. 5, 14-ii-2019, male (CRT);
loc. 6, 15-ii-2019 and 21-ii-2019, males and female (CRT).

First records for Rote.

33. *Trithemis festiva* (Rambur, 1842)

INDONESIA, EAST NUSA TENGGARA, ROTE ISLAND: loc. 5, 14-ii-2019, male (CRT);
loc. 6, 15-ii-2019 and 21-ii-2019, males (CRT); loc. 7, 15-ii-2019, male (CRT).

First records for Rote.

INDONESIA, EAST NUSA TENGGARA, SEMAU ISLAND: loc. 9, 26-ii-2019, male (CRT);
loc. 12, 9-1-2019, male (CRT).

First records for Semau.

34. *Zygomma petiolatum* Rambur, 1842

INDONESIA, EAST NUSA TENGGARA, ROTE ISLAND: loc. 5, 14-ii-2019, 17-ii-2019
and 23-ii-2019, males (CRT; fig. 37).

First records for Rote.

TIMOR-LESTE: loc. 27, 20-vii-2019, male (JPL).

First record for Timor.



Fig. 37. *Zygomma petiolatum* male. Loc. 5 (swamp forest, cf. fig. 4), 17-ii-2019. Photo: CRT.

Discussion

This updated listing of the Odonata fauna of Timor and surrounding Islands augments the previously published list (Seehausen et al. 2018). We report 11 species for the first time from Timor, 13 species for the first time from Rote, four for the first time from Alor and provide the first published Odonata records of 11 species for Semau. Together, these records increase the checklist to 51 species for Timor (thereof 45 from Timor-Leste), 11 for Semau, 23 for Rote and 13 for Alor (Appendix 1). Most of the new records for these islands were not unexpected, but they had not been documented so far.

Indolestes lafaeci was rediscovered and we provide the first photographs of living individuals. The interesting habitat at ponds within the mud volcanos is the only known locality beside the type locality Soe/Indonesian West Timor (Seehausen 2017a). Additionally *Diplacodes haematodes* and *Tramea loewii* were rediscovered since the records published by Lieftinck (1953).

Completely unexpected were the records of *Hemicordulia eduardi*. Hitherto this species was only known from the holotype male from Sumba Island (Figs 26, 27a-c; Lieftinck 1953, Dow 2020). Our males exactly agree with the characters given by Lieftinck (1953) except that S8-10 of the abdomen are blackish in the Timorese individuals whereas Lieftinck (1953) stated only S9-10 to be black. However S8 of the Timorese specimen also has a slight green metallic lustre compared to the holotype and is not distinctly different. The female collected at loc. 29 is likely assignable to *H. eduardi* thus representing the first record of a female for this species. It has an almost identical coloration to the male, though S8-10 appear slightly darker with less of a green metallic lustre. The abdomen is parallel sided, the cercus is as long as S9, the apical third of the forewing is tinted brownish, the Pt in all wings is a dark reddish-brown, the occipital triangle is bilobate with long posteriorly directed greyish hair and a tuft of long erect black hairs as in the male (Figs 28a-c). The vulvar lamina is distinctly and almost angularly notched (Fig. 28a-c).

The measurements and wing venation of the male collected at loc. 29 are as follows (taken from photograph with scale): tot (incl. appendages) 43.5 mm; ab (without appendages) 29.5 mm; Pt Fw 1.5 mm; Pt Hw 1.3 mm; cercus 2.4 mm; Fw 7 antenodals/5 postnodals; Hw 5 antenodals/6-7 postnodals.

The specific search for crepuscular species yielded records of *Gynacantha bayadera*. This species was first reported from the Lesser Sunda Islands by Lieftinck (1953) who listed their occurrence on Sawu, Sumba and Java. Ris (1919) discussed the taxonomic problem of the type series comprising two species. However, our specimens agreed with the description of the species Ris called *bayadera nob.*, and also with figures provided by Asahina (1986).

Kalkman & Orr (2014) studied *Rhodothemis* from the Indo-Australian Archipelago and did not find *R. rufa* (Rambur, 1842) east of the Wallace Line, but did find *R. nigripes* Lohmann, 1984 (Lesser Sunda Islands, Sulawesi, Maluku, New Guinea); *R. lieftincki* Fraser, 1954 (Australia, New Guinea), and *R. mauritsi* Lohmann, 1984 (New Guinea) instead. Thus Timor is within the range of *R. nigripes* and perhaps also *R. lieftincki*. The number of spines on the hind femur of the photographed male agrees with *R. rufa* and *R. nigripes* (four long spines, about ten small spines; Kalkman & Orr 2014), but further identification is almost impossible in general individuals without collecting. However, for pragmatic reasons, we tentatively assign the *Rhodothemis* male to *R. nigripes*.

Seehausen et al. (2018) already discussed the *Rhyothemis phyllis* (Sulzer, 1776) taxa group with respect to ssp. *ixias*. Morphological studies of all taxa by MS did not lead to distinct results, the *R. phyllis* group is complex and the presence of twelve subspecies (Ris 1913a, Kimmins 1936, Lieftinck 1942, Lieftinck 1953; cf. fig. 38) appears doubtful. The main attributes for separation between the subspecies are the color of the face, labium and partly the extent of the wing color, but all these characters are variable

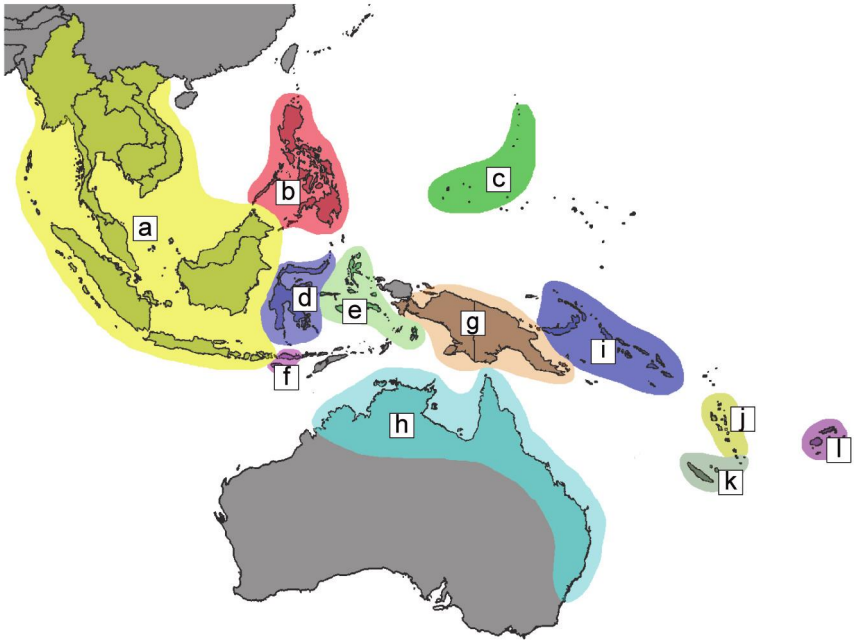


Fig. 38. Map of the *Rhythemis phyllis* taxa group: ssp. *phyllis* (a/yellow); ssp. *subphyllis* (b/red); ssp. *vitellina* (c/green); ssp. *snelleni* (d/violet); ssp. *obscura* (e/light green); ssp. *ixias* (f/magenta); ssp. *beatricis* (g/brown); ssp. *chloe* (h/turquoise); ssp. *marginata* (i/blue); ssp. *aequalis* (j/buff); ssp. *apicalis* (k/grey); ssp. *dispar* (l/lavender).

even within the same subspecies. We provide illustrations of these characters for four subspecies – ssp. *phyllis*, ssp. *ixias*, ssp. *snelleni* (Selys, 1878), ssp. *obscura* (Brauer, 1868), ssp. *chloe* (Kirby, 1894) – occurring within the Indo-Australian Archipelago around Timor (Figs 39a-v; the variability within the subspecies may be greater than illustrated). Most of the recent photographs from Timor neither show the face nor the color of the clypeus, but one photograph does and this male agreed with the dark color as in ssp. *ixias* (Fig. 40) whereas the face and labium would be more yellowish in the nominate subspecies and the Australian ssp. *chloe*. The wings of the Timorese individuals (Fig. 41) as well as of the female from Rote Island (Seehausen et al. 2018) agree with ssp. *phyllis* as well as ssp. *ixias* in extent of color at the wing base and the lack of extensive dark color at the nodus, costal and subcostal areas like it is in ssp. *snelleni* and ssp. *obscura*. However studies by MS show that there is in fact no distinct difference in the wing color between ssp. *phyllis* and ssp. *ixias* even in the type material. We provisionally assign the Timorese *R. phyllis* to ssp. *ixias* for pragmatic reasons and it seems likely that the individuals from Rote could also be assigned to this subspecies. However the status of all these taxa is in need of a full review including molecular studies.

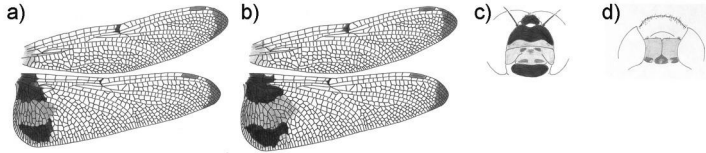
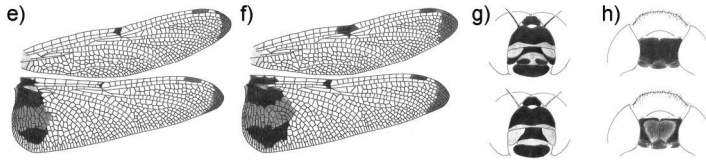
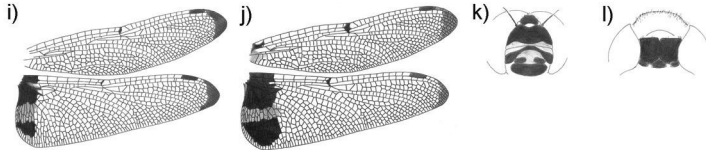
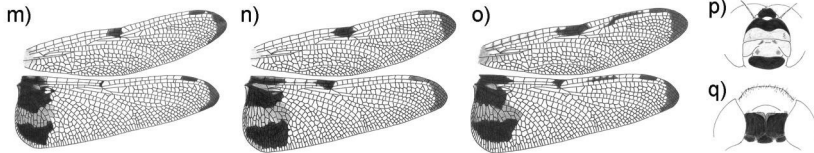
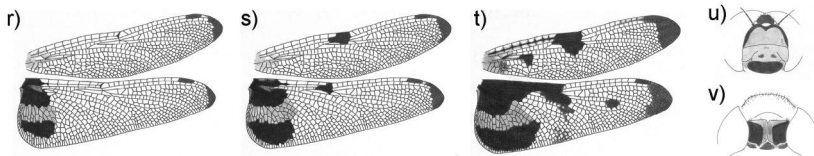
Rhyothemis phyllis phyllis*Rhyothemis phyllis ixias**Rhyothemis phyllis snelleni**Rhyothemis phyllis obscura**Rhyothemis phyllis chloe*

Fig. 39. Wings, face and labium of four members of the *Rhyothemis phyllis* taxa group of species: ssp. *phyllis* from western range (a-b: wings of male and female, c: face, d: labium), ssp. *ixias* from Sumba and Flores (e-f: wings of male and female, g: two variants of the face, h: two variants of the labium), ssp. *snelleni* from Sulawesi (i-j: wings of male and female, k: face, l: labium), ssp. *obscura* from Maluccu Islands (m-n: wings of male and female, o: wings of female; p: face, q: labium), ssp. *chloe* from Australia (r-s: wings of male and female, t: wings of female, u: face, v: labium). Illustrations: MS.



Fig. 40. *Rhyothemis phyllis ixias* male. The dark clypeus is clearly visible. Loc. 30, 28-iv-2020. Photo: RMSP.



Fig. 41. *Rhyothemis phyllis ixias* male. Loc. 30, 28-iv-2020. Photo: RMSP.

Acknowledgements

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Appendix 1

Appendix 1: Updated checklists of Odonata from Timor and surrounding islands. Species of the national list of Timor-Leste are marked with an asterisk. Records from the Islands of Pantar, Wetar, and Kisar refer to Lieffinck (1933, 1936, 1953) and Ris (1912), the record from Romang refers to Seehausen et al. (2018). The new island records published in this paper are marked with green.

| Species | Timor | Semau | Rofe | Pantar | Alor | Wetar | Kisar | Romang |
|--|-----------------|-----------|-----------|----------|-----------|----------|----------|----------|
| <i>Rhinocypha pagenstecheri timorana</i> | X* | | | | X | X | | |
| <i>Euphaea lara lombockensis</i> | | | | X | X | | | |
| <i>Indolestes lafaeci</i> | X* | | | | | | | |
| <i>Lestes concinnus</i> | X* | | | | | | | |
| <i>Lestes praemarsus</i> | X* | | | | | | | |
| <i>Nososticta impercepta</i> | X* | | | | | | | |
| <i>Nososticta</i> sp. | | | X | | | | | |
| <i>Agriocnemis femina</i> | X* | | X | | | | | |
| <i>Agriocnemis pygmaea</i> | X* | | | | | | | |
| <i>Austroallagma sagittiferum</i> | X | | | | | | | |
| <i>Ischnura aurora</i> | X* | | | | | | | |
| <i>Ischnura heterosticta</i> | X* | | | | | | | |
| <i>Ischnura senegalensis</i> | X* | | X | | | | | |
| <i>Pseudagrion microcephalum</i> | X* | | X | | X | | | |
| <i>Pseudagrion pilidorsum declaratum</i> | | | | | X | | | |
| <i>Pseudagrion pilidorsum deflexum</i> | X* | X | X | | | X | | |
| <i>Pseudagrion schmidtianum</i> | X | | | | | | | |
| <i>Xiphagrion cyanomelas</i> | X* | X | X | | | X | | |
| <i>Anax georgius</i> | X* | | | | | | | |
| <i>Anax guttatus</i> | X* | X | | | | X | X | |
| <i>Gynacantha bayadera</i> | X* | | | | | | | |
| <i>Gynacantha</i> sp. | | | X | | | | | |
| <i>Gynacantha</i> sp. cf. <i>dobsoni</i> | X* | | | | | | | |
| <i>Hemicordulia eduardi</i> | X* | | | | | | | |
| <i>Acisoma panorpoides</i> | X* | | | | | | | |
| <i>Agrioptera insignis</i> | X* | | X | | X | | | |
| <i>Brachydiplax duivenbodei</i> | X* | | | | | | | |
| <i>Brachythemis contaminata</i> | X* | | X | | | | | |
| <i>Camacina gigantea</i> | X* | | | | | | | |
| <i>Crocothemis servilla</i> | X* | X | X | | X | | | |
| <i>Diplacodes bipunctata</i> | X* | | | | | | | |
| <i>Diplacodes haematodes</i> | X* | | | | | | | |
| <i>Diplacodes trivialis</i> | X* | X | X | | X | X | | |
| <i>Macrodiplax cora</i> | X | | X | | | | | |
| <i>Neurothemis ramburii</i> | X* | X | X | | X | | | |
| <i>Orthetrum caledonicum</i> | X* | X | | | | | | |
| <i>Orthetrum glaucum</i> | X* | | | | | | | |
| <i>Orthetrum pruinosum schneideri</i> | X* | | | | | | | |
| <i>Orthetrum sabina</i> | X* | X | X | | X | | | |
| <i>Orthetrum testaceum testaceum</i> | X* | | X | | | | | |
| <i>Orthetrum testaceum soembanum</i> | | | | | X | X | | X |
| <i>Pantala flavescens</i> | X* | | X | | X | X | X | |
| <i>Potamarcha congener</i> | X* | X | X | | | | | |
| <i>Rhodothemis</i> cf. <i>nigripes</i> | X* | | | | | | | |
| <i>Rhyothemis graphiptera</i> | X | | | | | | | |
| <i>Rhyothemis phyllis</i> | X* | | X | | | | | |
| <i>Tetrathemis irregularis hyalina</i> | X | | | | | | | |
| <i>Tholymis tillarga</i> | X* | | X | | | | | |
| <i>Tramea loewii</i> | X* | | | | | | | |
| <i>Tramea stenoloba</i> | X* | X | X | | | | | |
| <i>Trithemis aurora</i> | X* | | X | | | | | |
| <i>Trithemis festiva</i> | X* | X | X | | X | | | |
| <i>Trithemis liacina</i> | X* | | | X | X | X | | |
| <i>Zygonyx ida</i> | X | | | | | | | |
| <i>Zyomma obtusum</i> | X* | | | | | | | |
| <i>Zyomma petiolatum</i> | X* | | X | | | | | |
| Total | 51 (45*) | 11 | 23 | 2 | 13 | 8 | 2 | 1 |

Appendix 2: Distribution maps

Explanation to the maps:

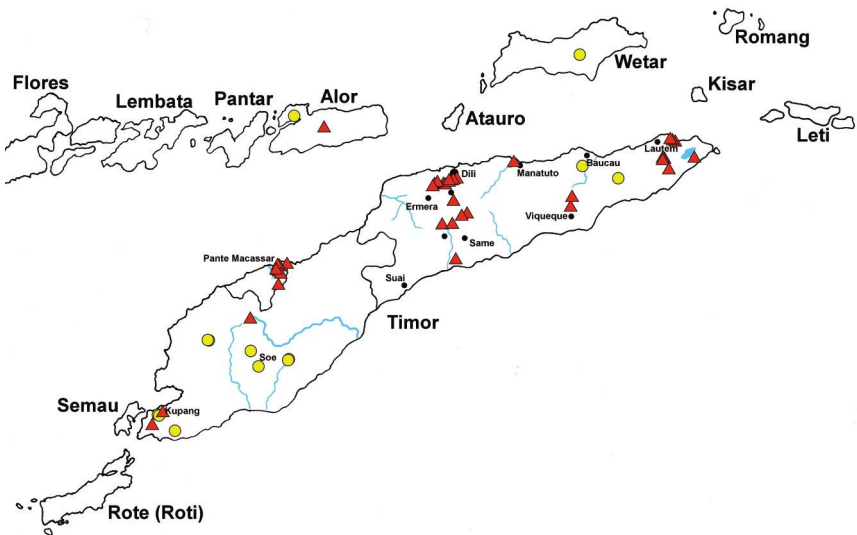
Red triangle – records published in this paper.

Green square – records since 2003 published by Polhemus & Helgen 2004, Seehausen 2017a, b and Seehausen & Theischinger 2017.

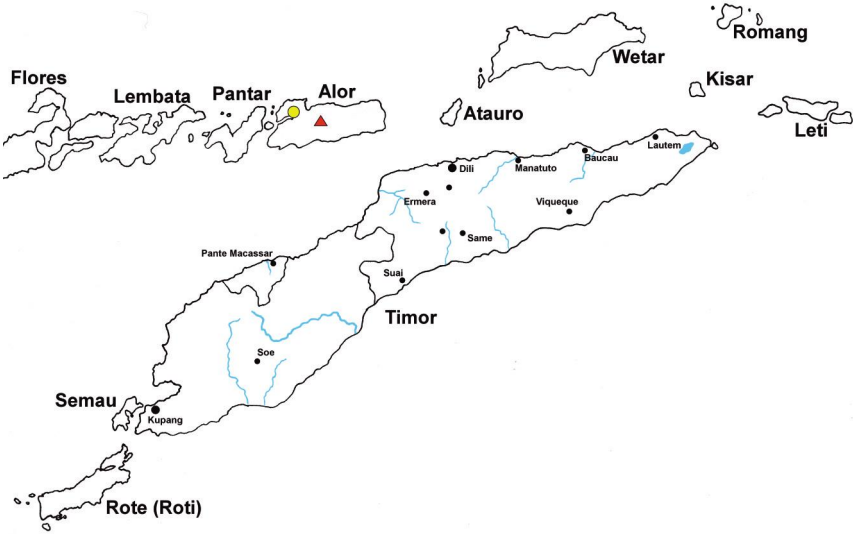
Yellow circles and oval – historical records published by Hagen (1863, 1869), Asahina (1990), Lieftinck (1931, 1933, 1936, 1953), Ris (1913a, b, 1916), Seehausen (2017a, b) and Seehausen & Theischinger (2017).

Shaded grey – further range basing on Lieftinck (1936, 1953).

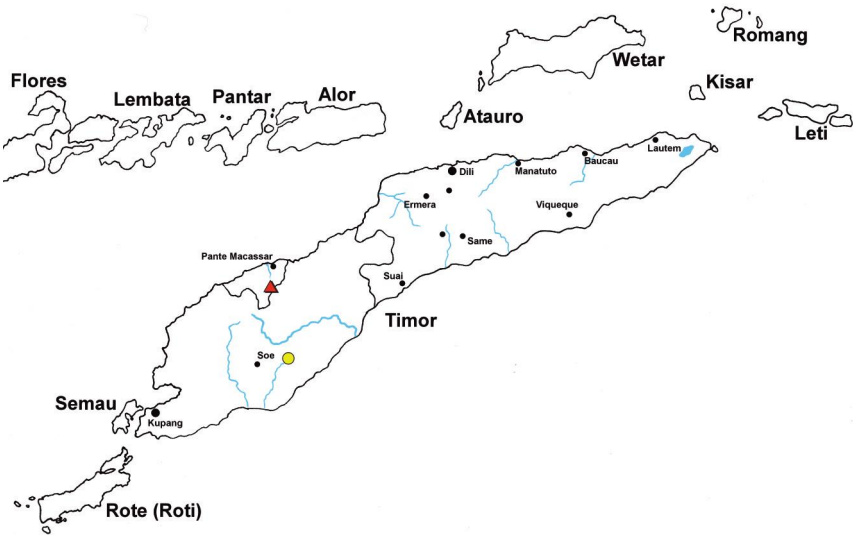
Question mark – unspecified historical records published by Ris (1909a, 1912) and Lieftinck (1953).



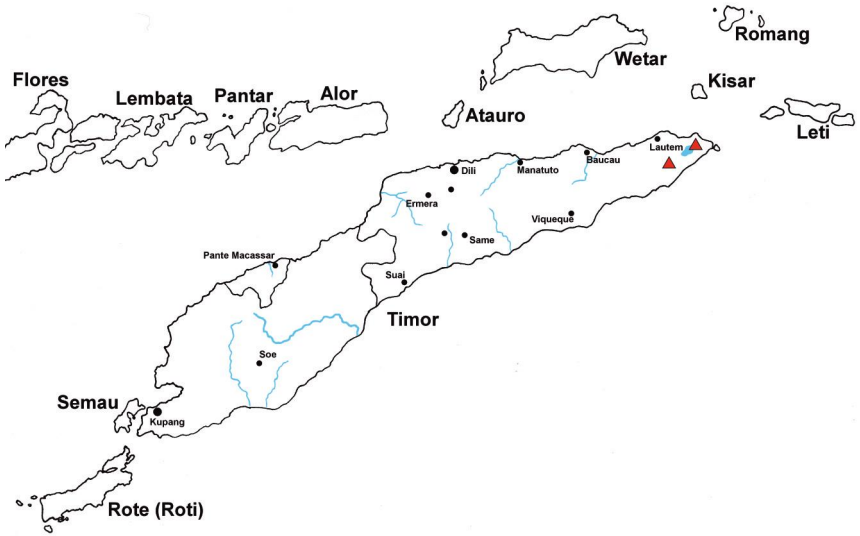
Map 1: *Rhinocypha pagenstecheri timorana* Lieftinck, 1936



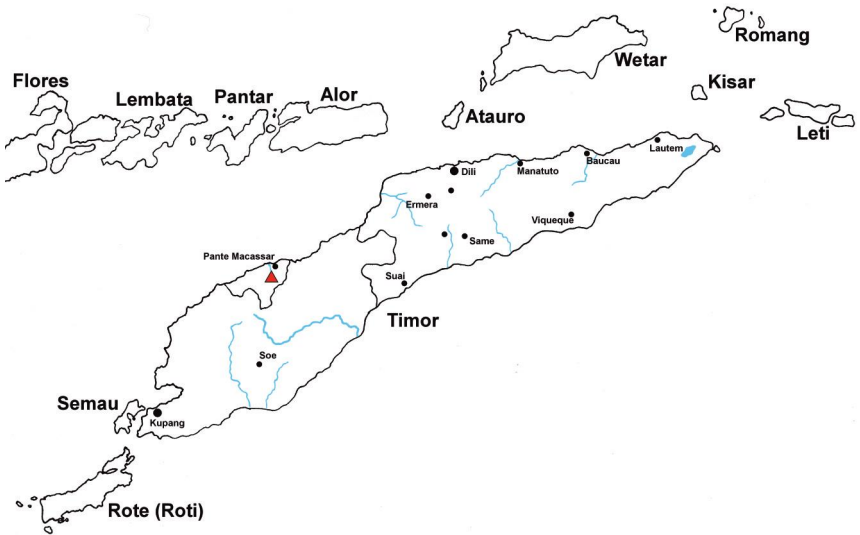
Map 2: *Euphaea lara lombockensis* (McLachlan, 1898)



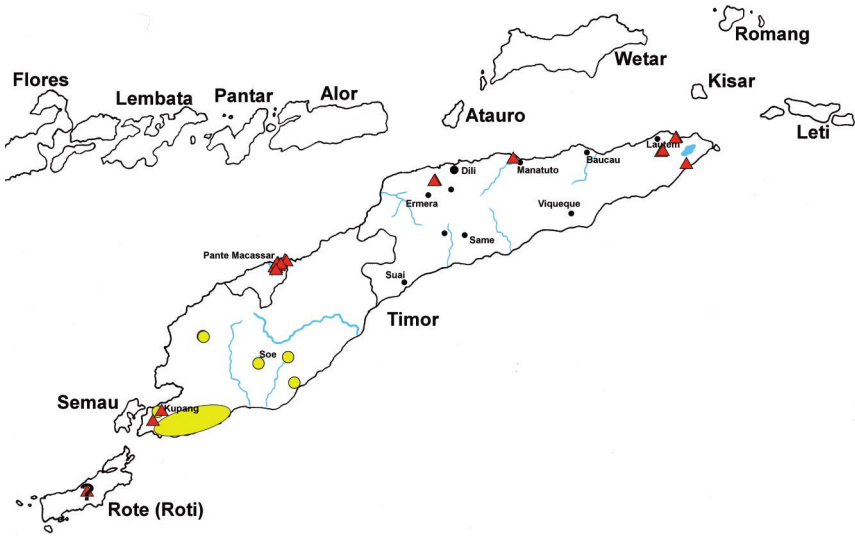
Map 3: *Indolestes lafaeci* Seehausen, 2017



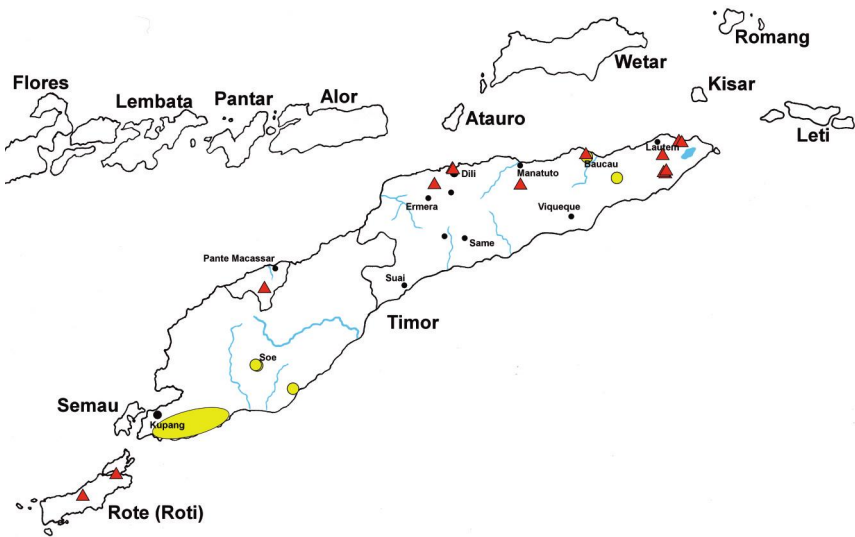
Map 4: *Lestes concinnus* Hagen in Selys, 1862



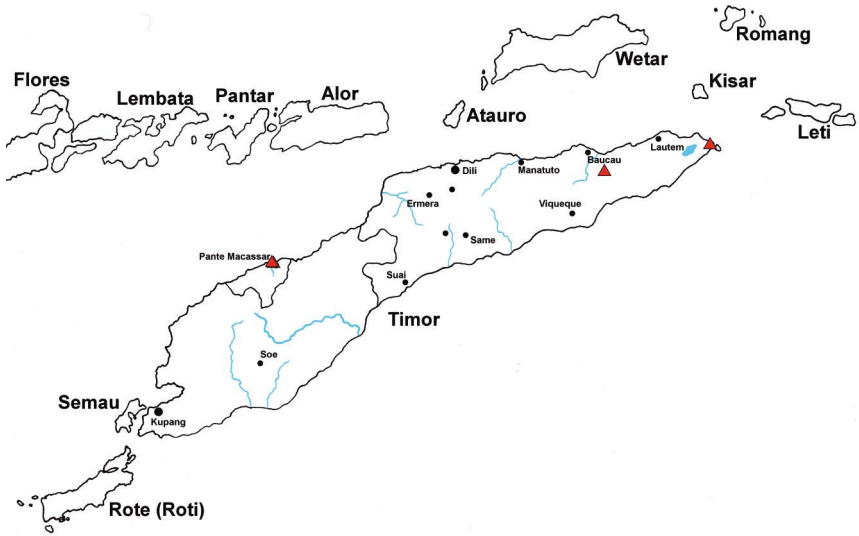
Map 5: *Lestes praemorsus* (Hagen in Selys, 1892)



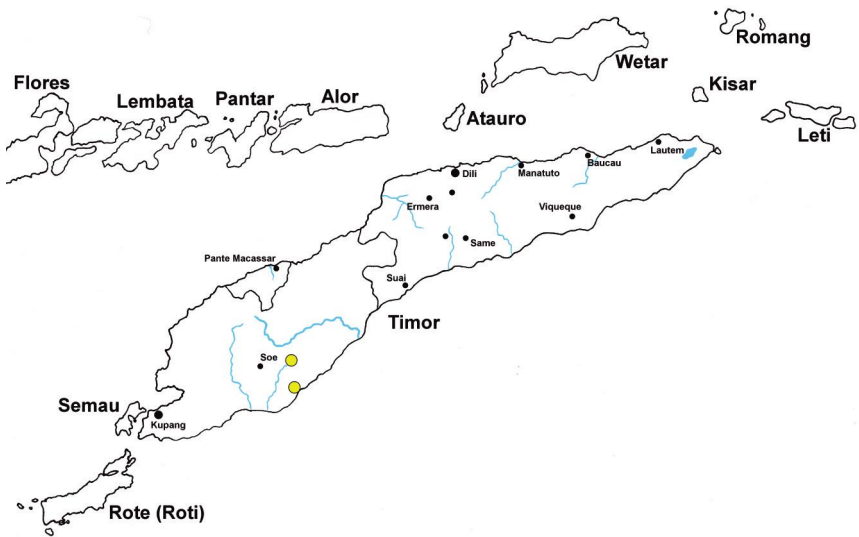
Map 6: *Nososticta impercepta* Seehausen & Theischinger, 2017



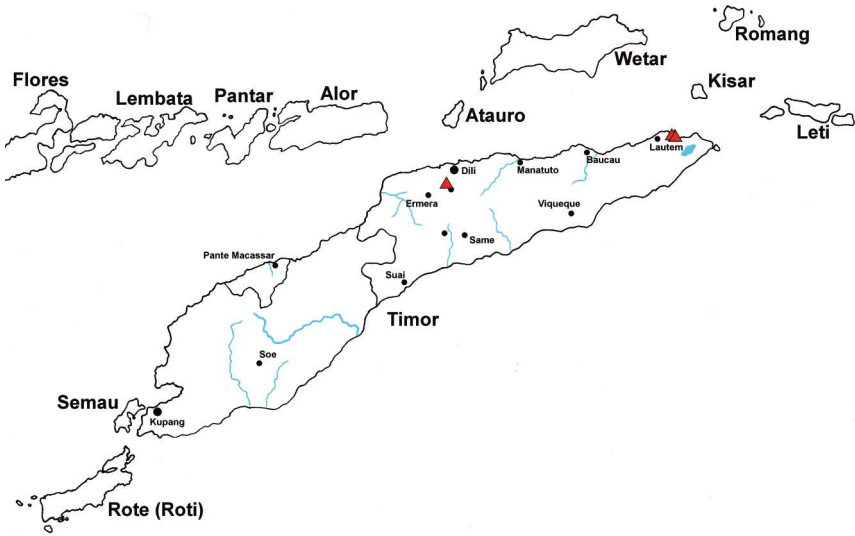
Map 7: *Agriocnemis femina* (Brauer, 1868)



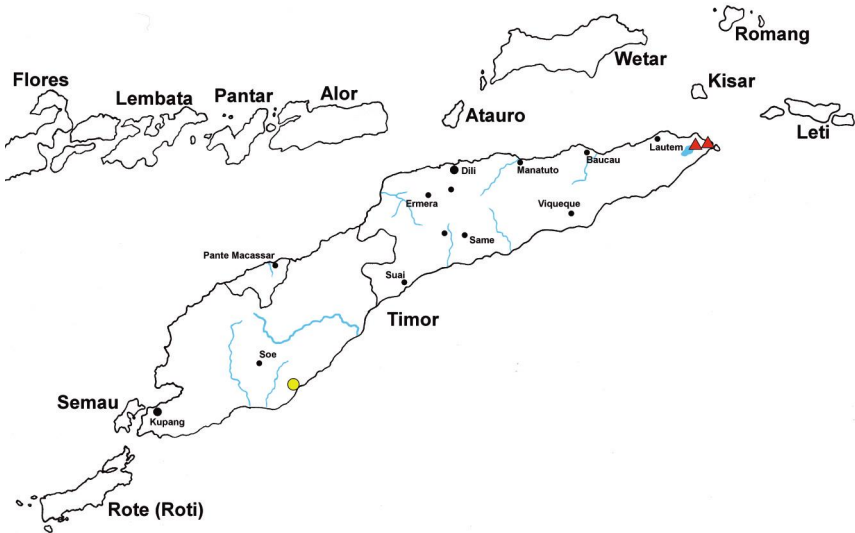
Map 8: *Agriocnemis pygmaea* Rambur (1842)



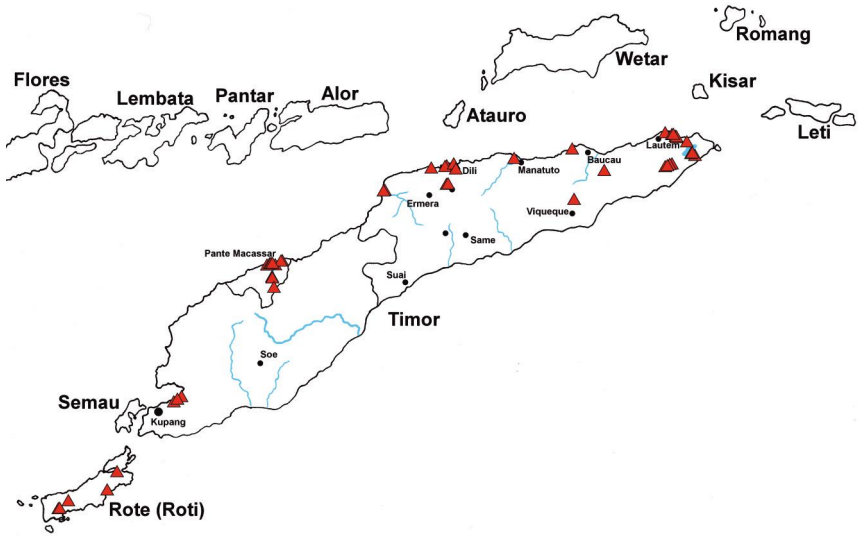
Map 9: *Austroallagma sagittiferum* (Lieftinck, 1949)



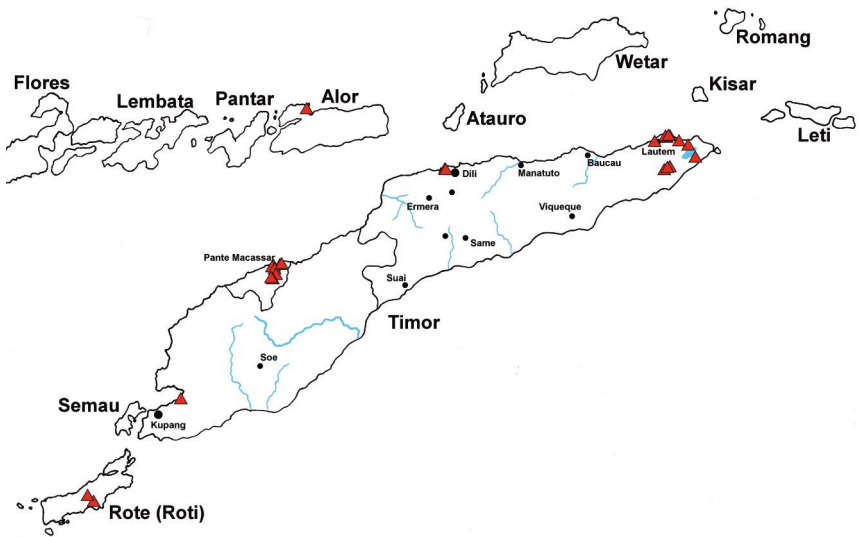
Map 10: *Ischnura aurora* (Brauer, 1865)



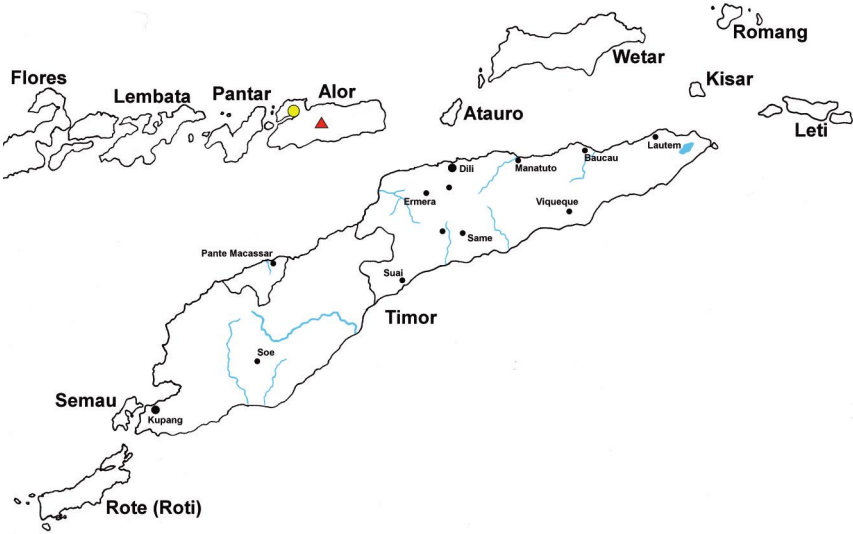
Map 11: *Ischnura heterosticta* (Burmeister, 1839)



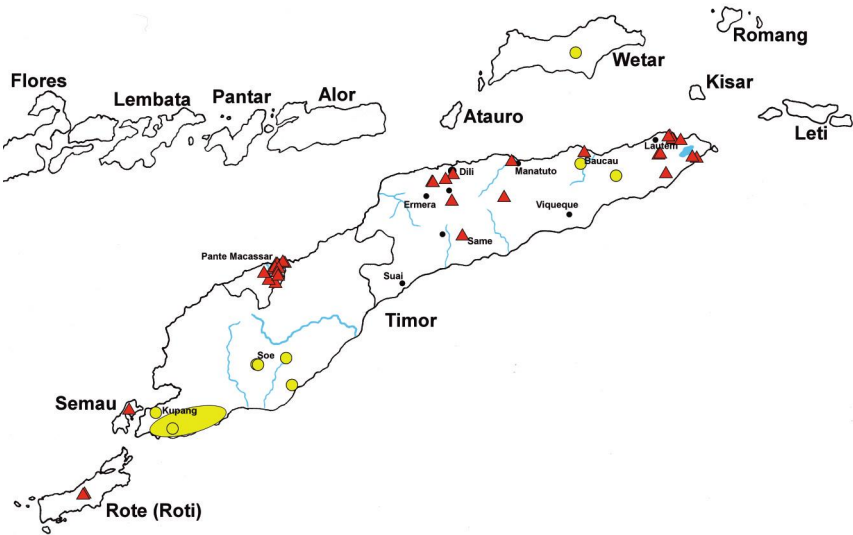
Map 12: *Ischnura senegalensis* (Rambur, 1842)



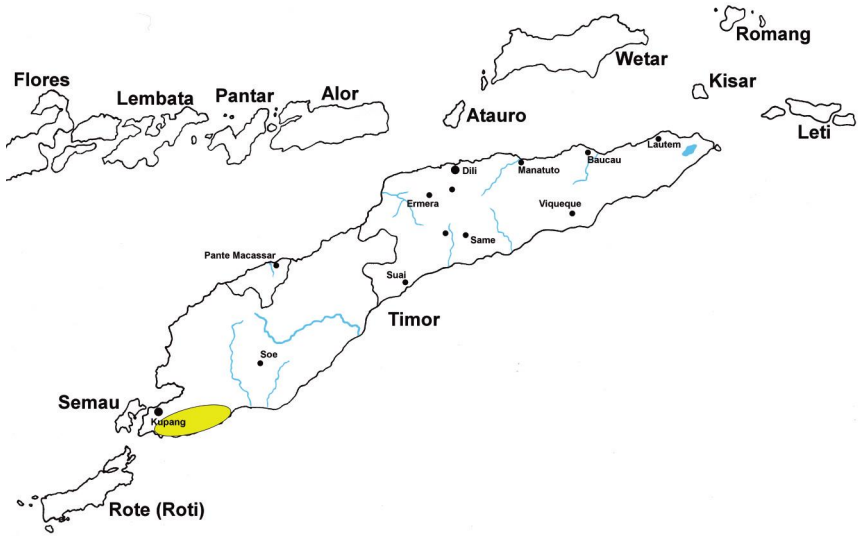
Map 13: *Pseudagrion microcephalum* (Rambur, 1842)



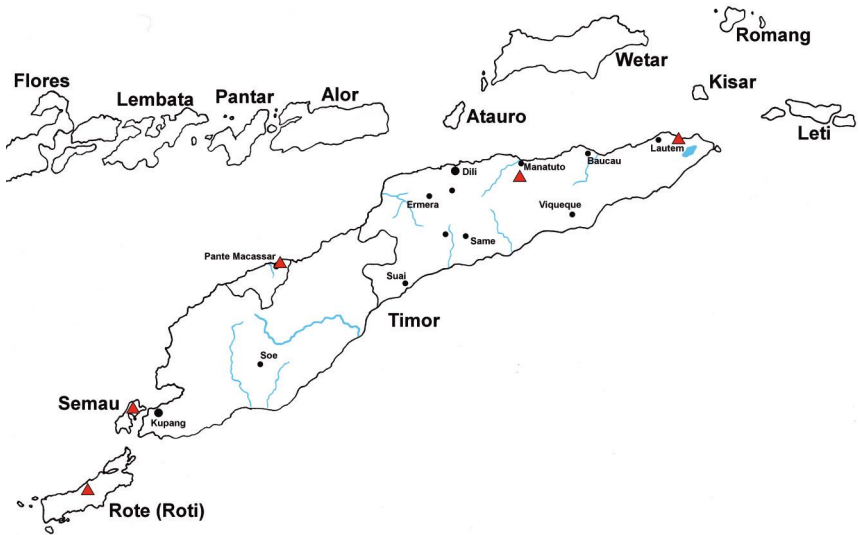
Map 14: *Pseudagrion pilidorsum declaratum* (Liefkinck, 1936)



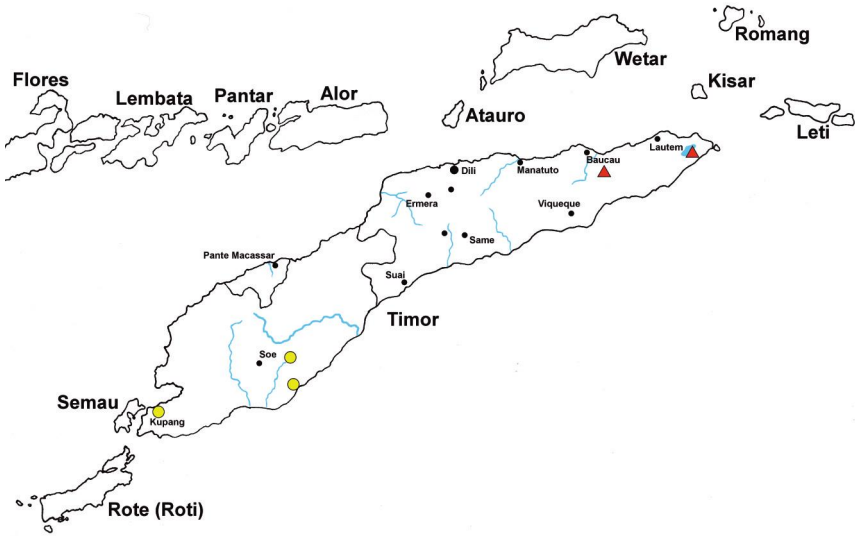
Map 15: *Pseudagrion pilidorsum deflexum* Liefkinck, 1936



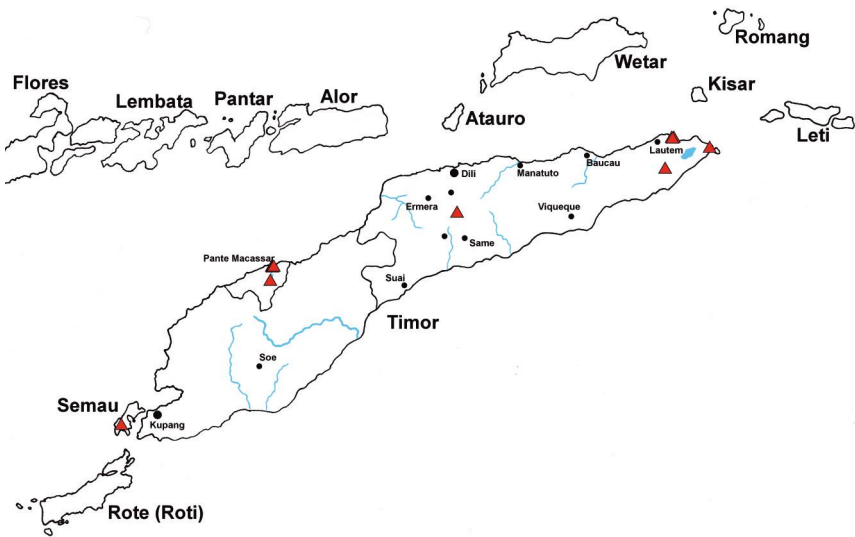
Map 16: *Pseudagrion schmidianum* Liefinck, 1936



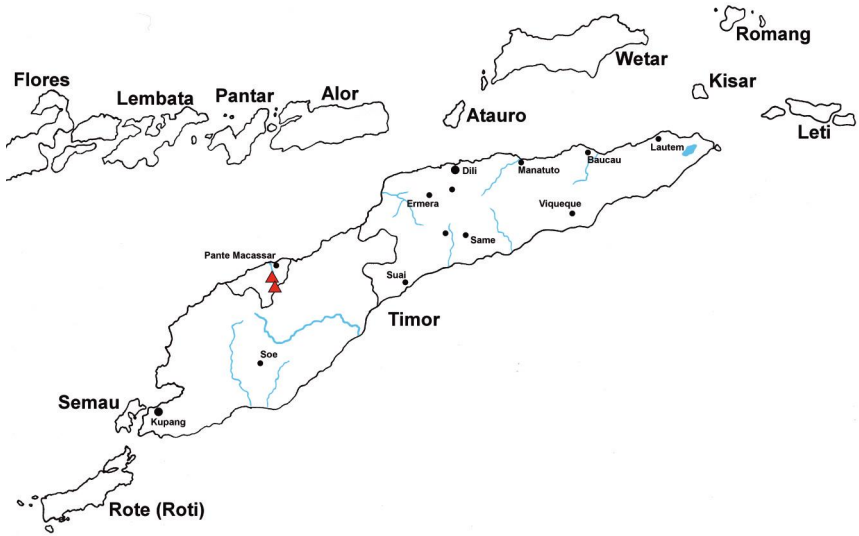
Map 17: *Xiphiagrion cyanomelas* Selys, 1876



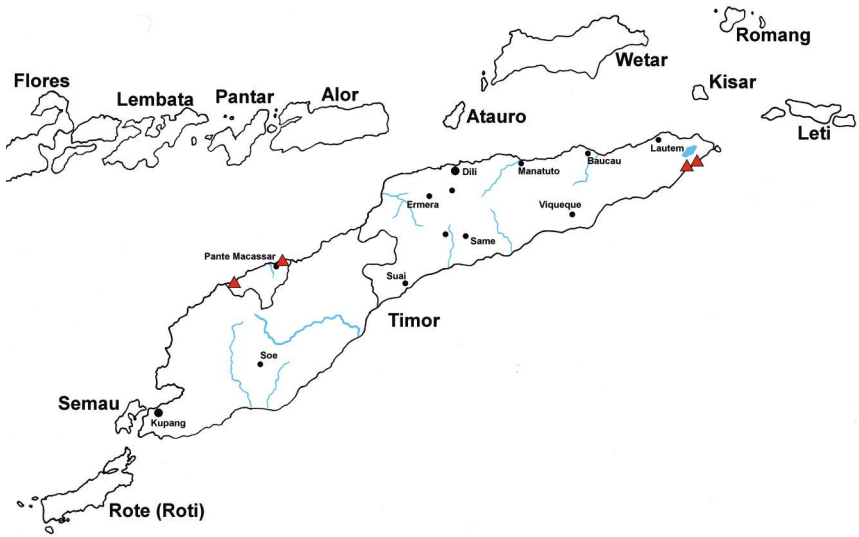
Map 18: *Anax georgius* Selys, 1872



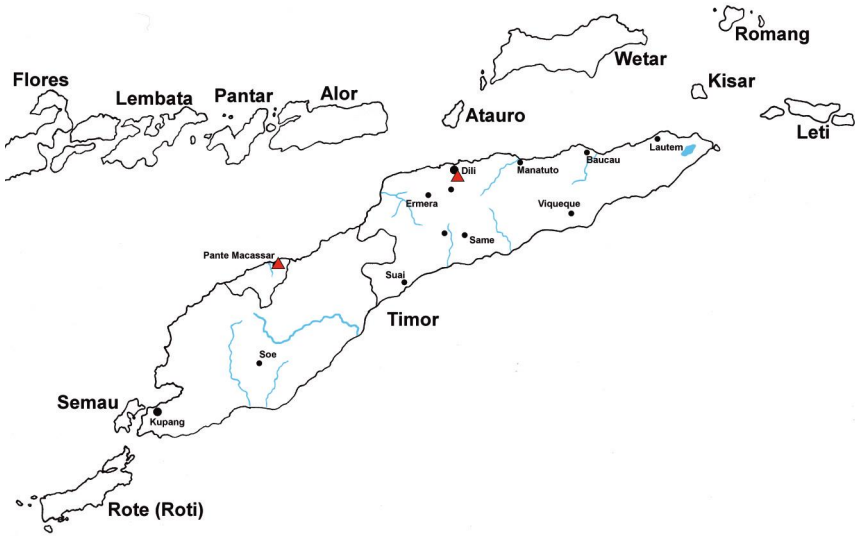
Map 19: *Anax guttatus* (Burmeister, 1839)



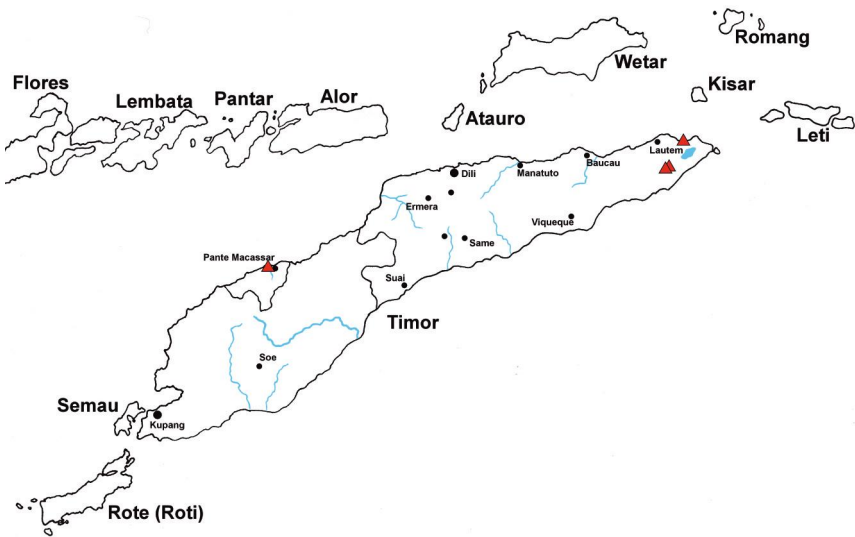
Map 20: *Gynacantha bayadera* Selys, 1891



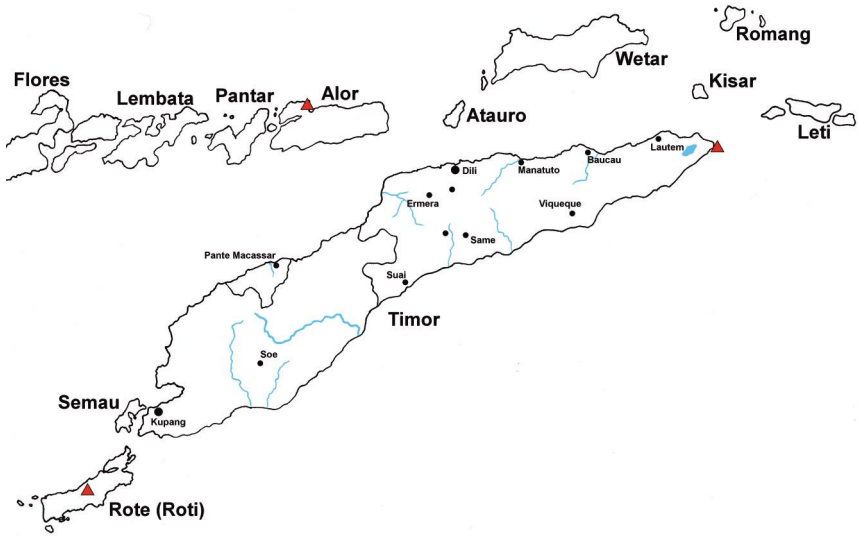
Map 21: *Gynacantha* sp. cf. *dobsoni* Fraser, 1951



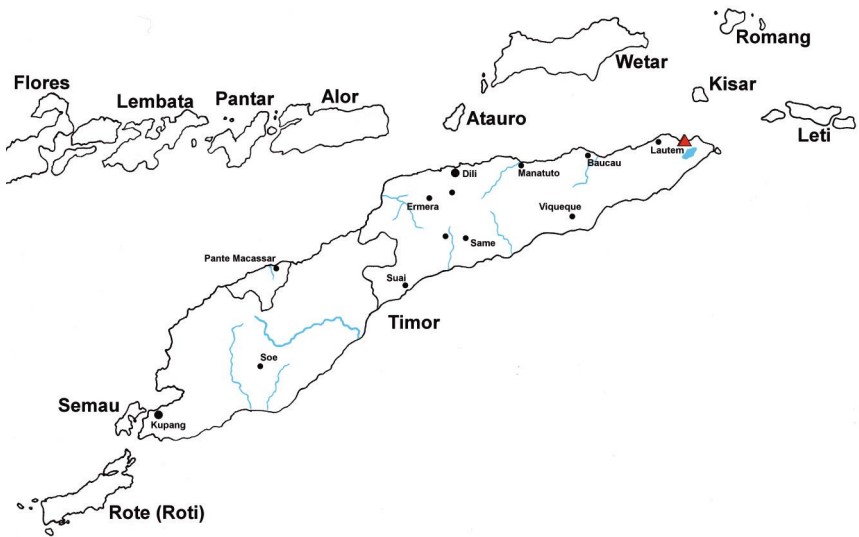
Map 22: *Hemicordulia eduardi* Lieffinck, 1953



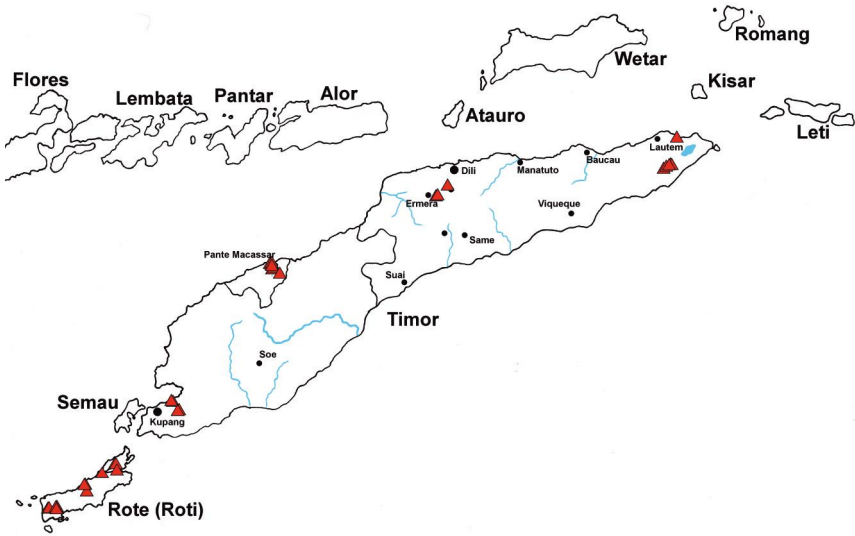
Map 23: *Acisoma panorpoides* Rambur, 1842



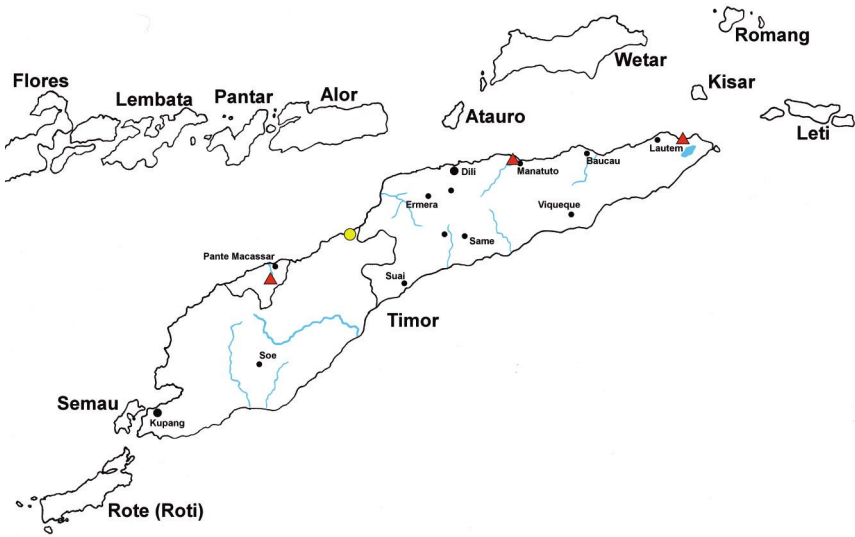
Map 24: *Agrionoptera insignis* (Rambur, 1842)



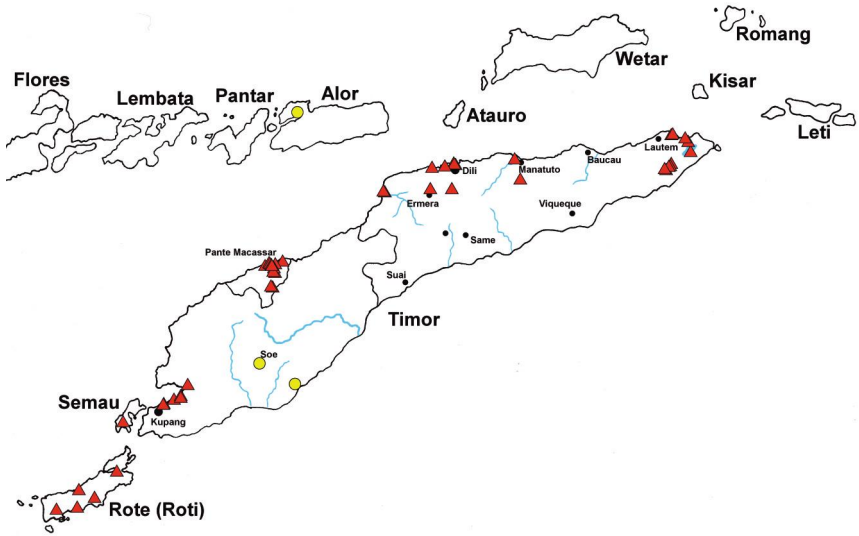
Map 25: *Brachydiplax duivenbodei* (Brauer, 1866)



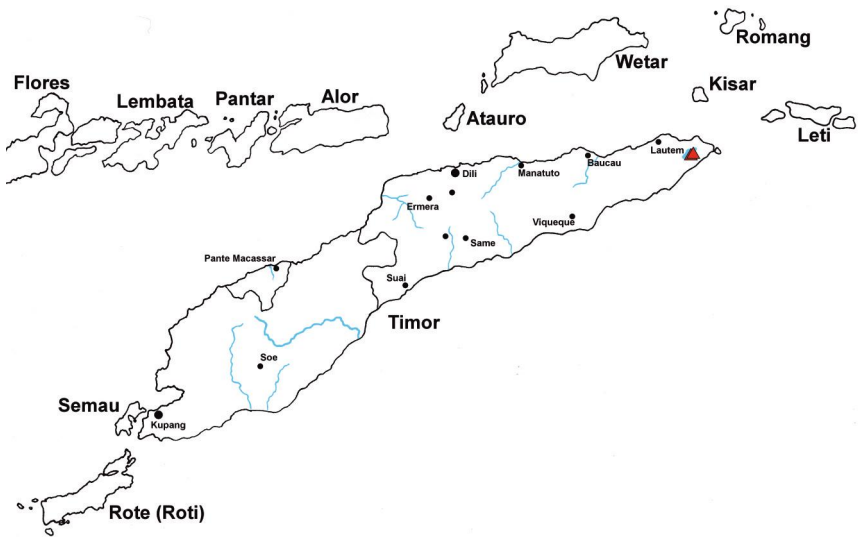
Map 26: *Brachythemis contaminata* (Fabricius, 1793)



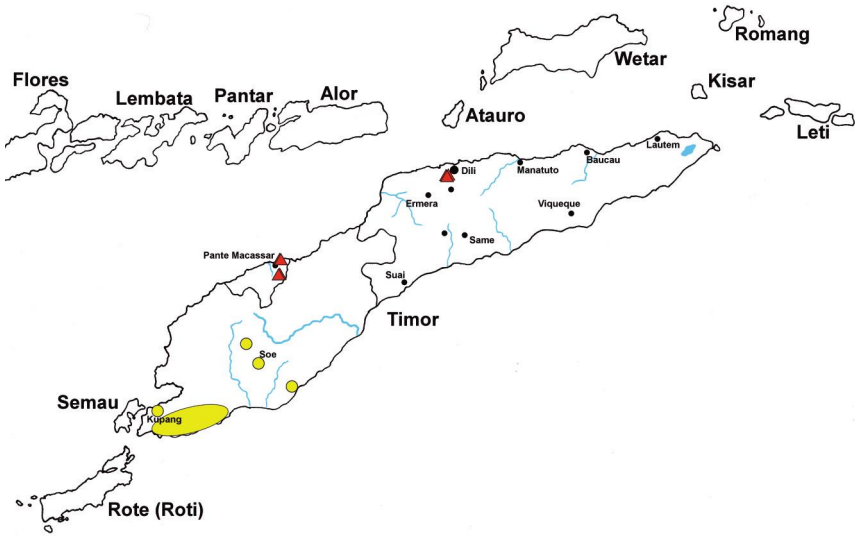
Map 27: *Camacinia gigantea* (Brauer, 1867)



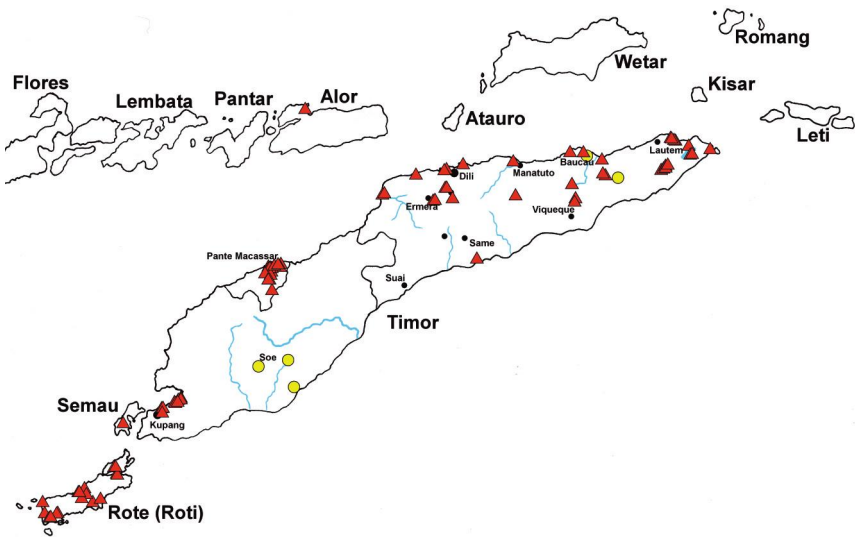
Map 28: *Crocothemis servilia* (Drury, 1773)



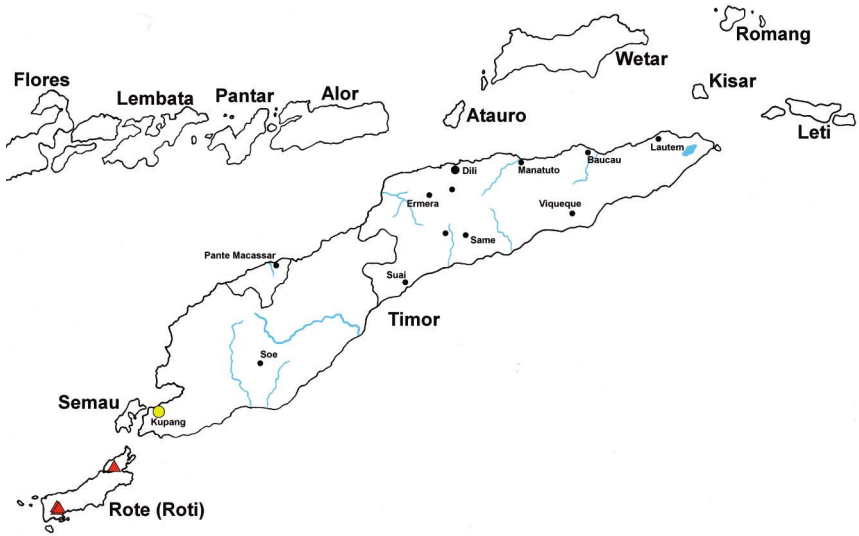
Map 29: *Diplacodes bipunctata* (Brauer, 1865)



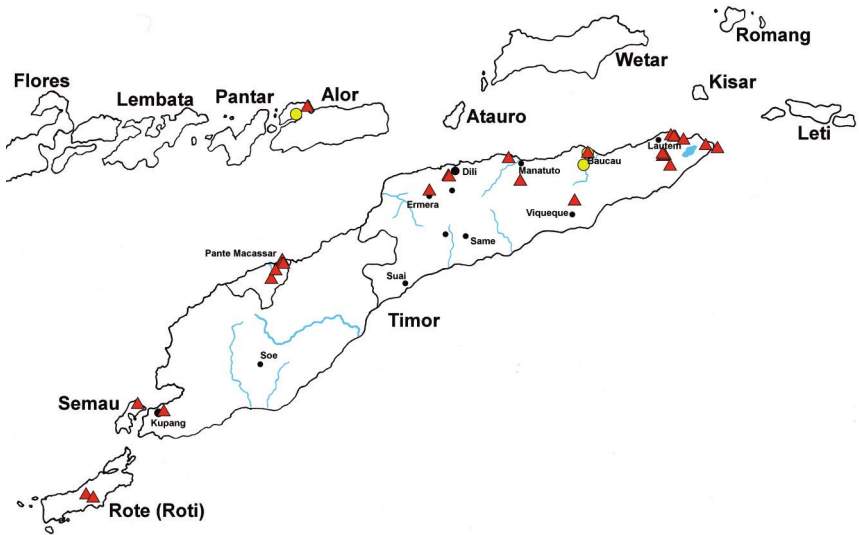
Map 30: *Diplacodes haematodes* (Burmeister, 1839)



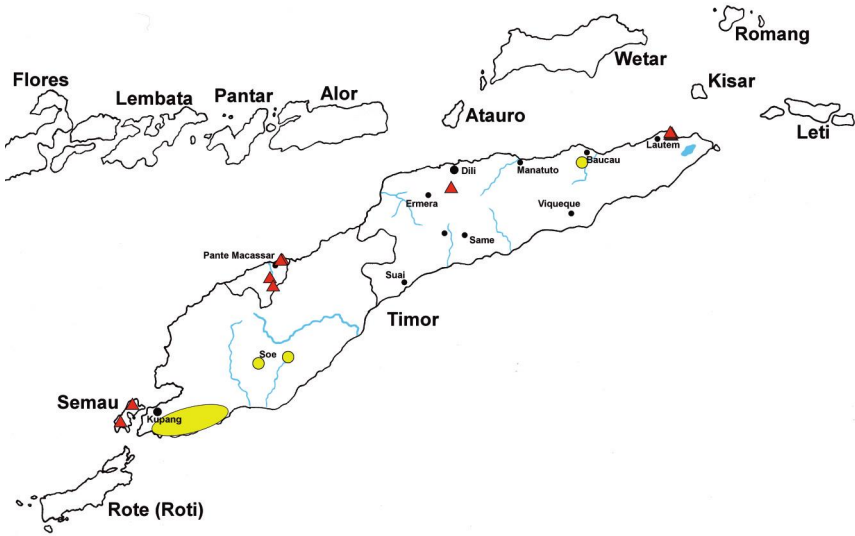
Map 31: *Diplacodes trivialis* (Rambur, 1842)



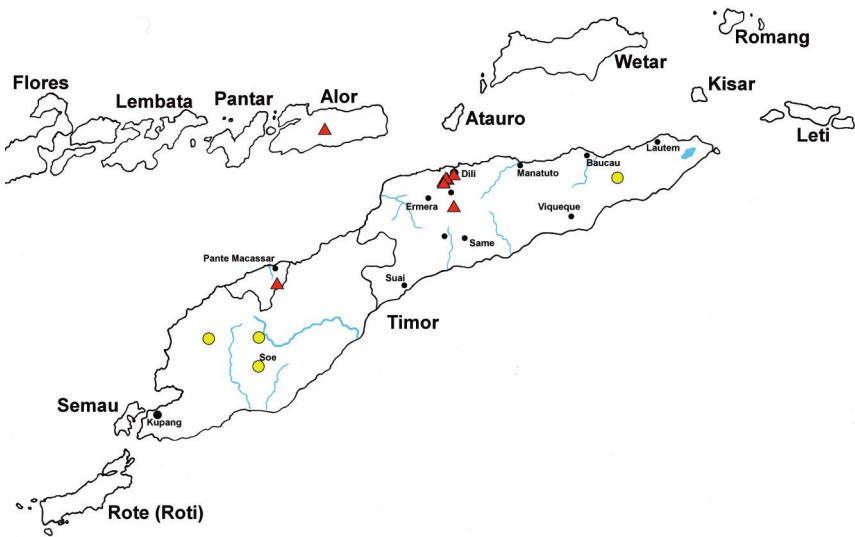
Map 32: *Macrodiplax cora* (Brauer, 1867)



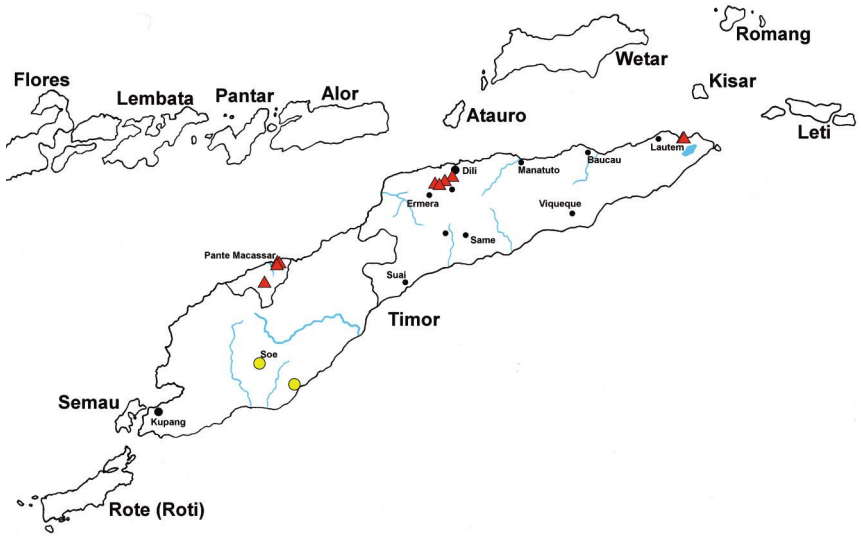
Map 33: *Neurothemis ramburii* (Brauer, 1866)



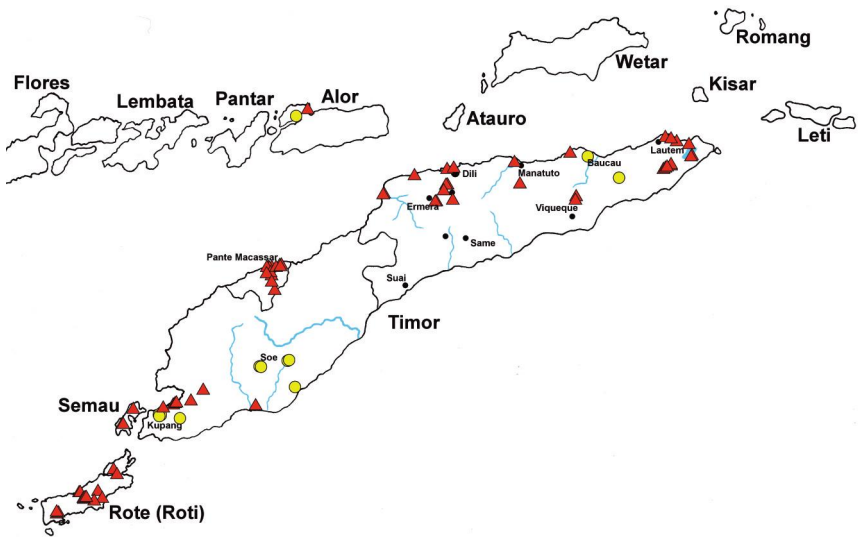
Map 34: *Orthetrum caledonicum* (Brauer, 1865)



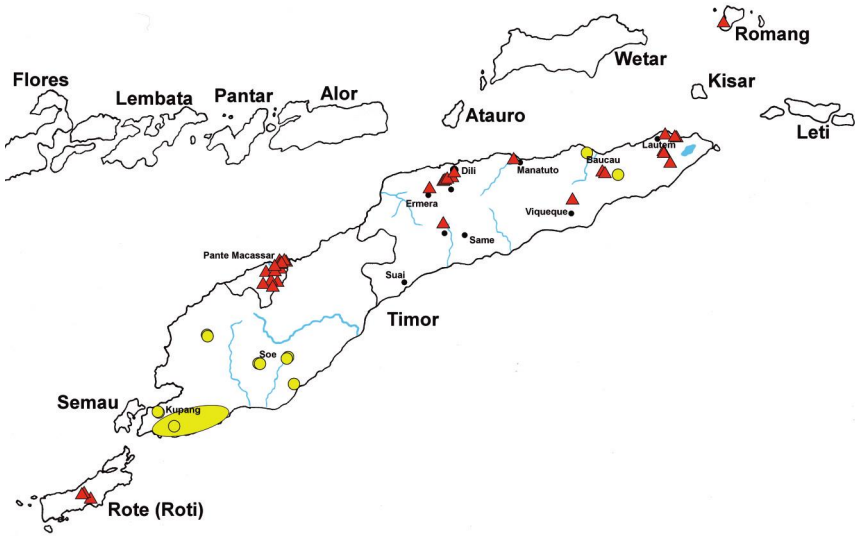
Map 35: *Orthetrum glaucum* (Brauer, 1865)



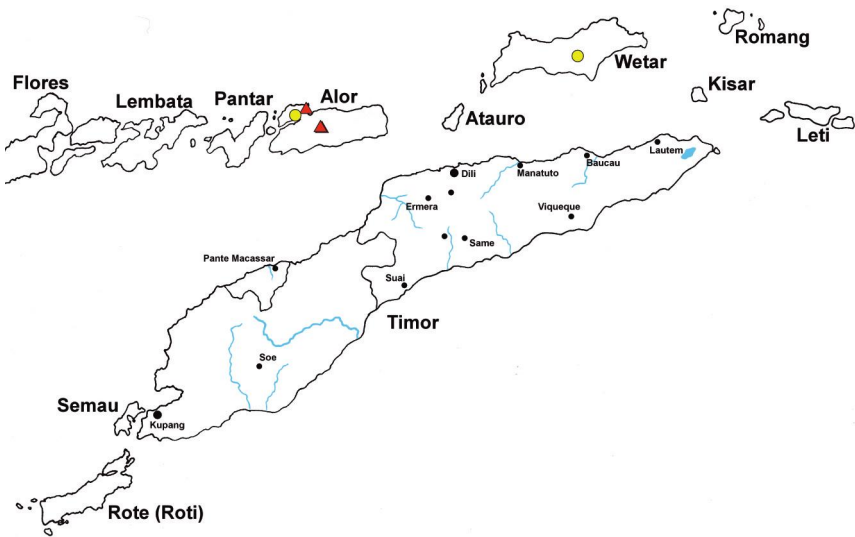
Map 36: *Orthetrum pruinatum schneideri* Förster, 1903



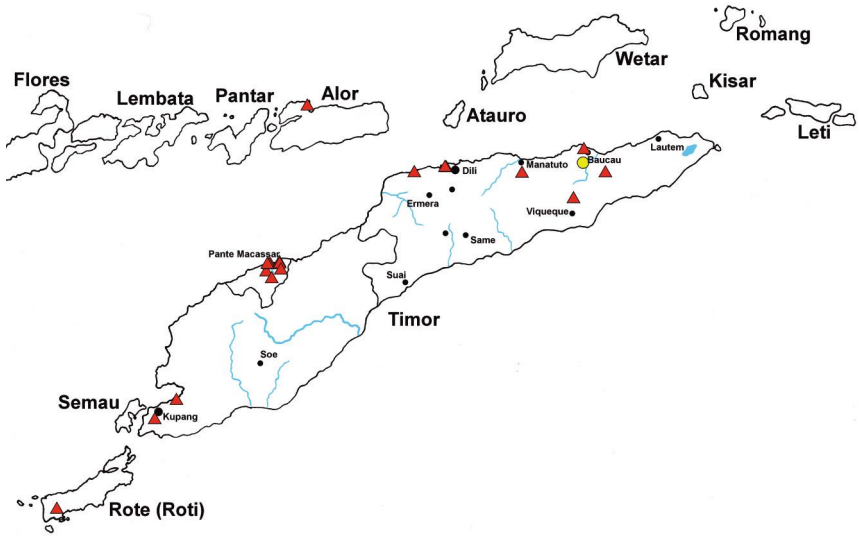
Map 37: *Orthetrum sabina* (Drury, 1773)



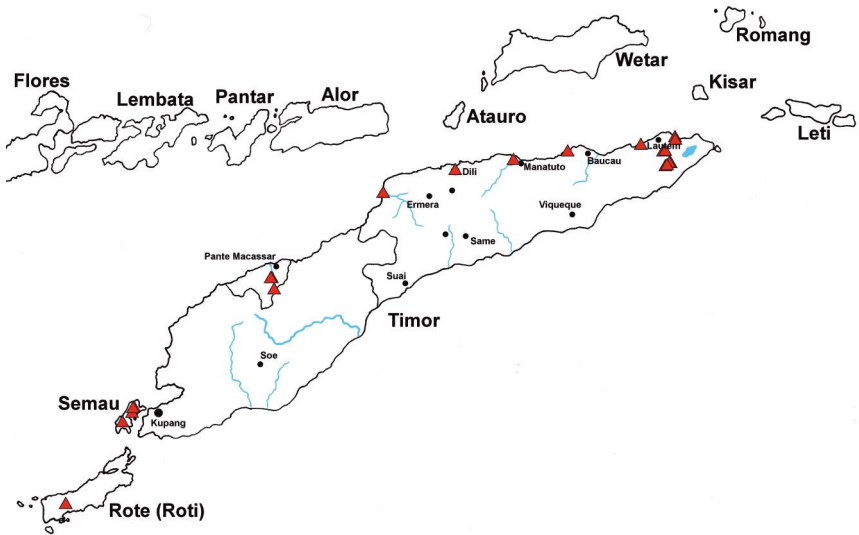
Map 38: *Orthertrum testaceum* (Burmeister, 1839)



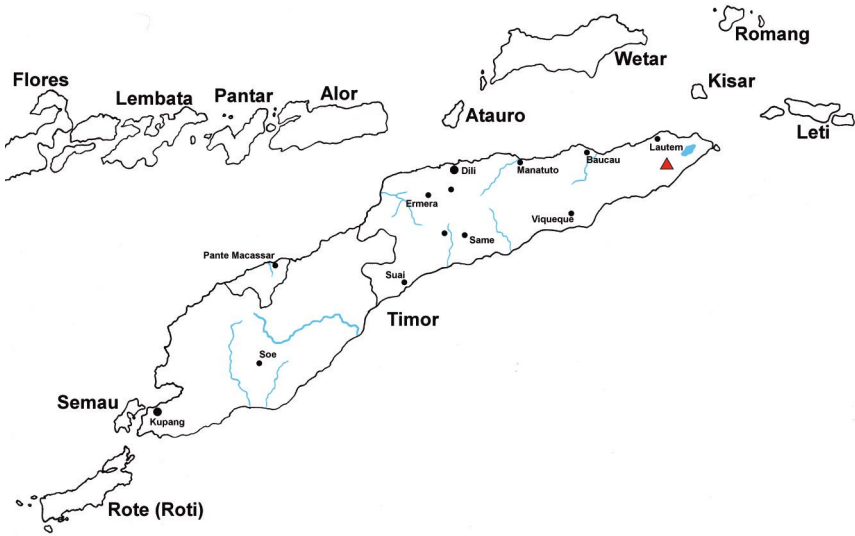
Map 39: *Orthertrum testaceum soembanum* (Förster, 1903)



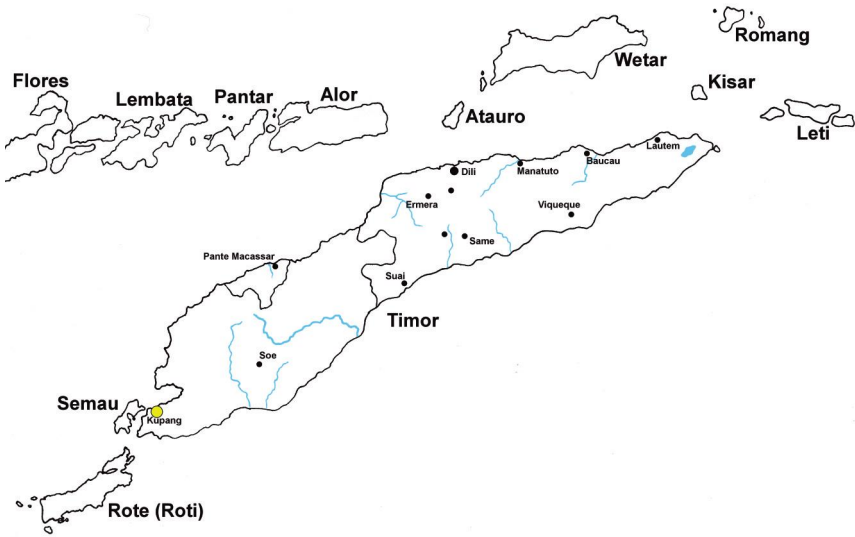
Map 40: *Pantala flavescens* (Fabricius, 1798)



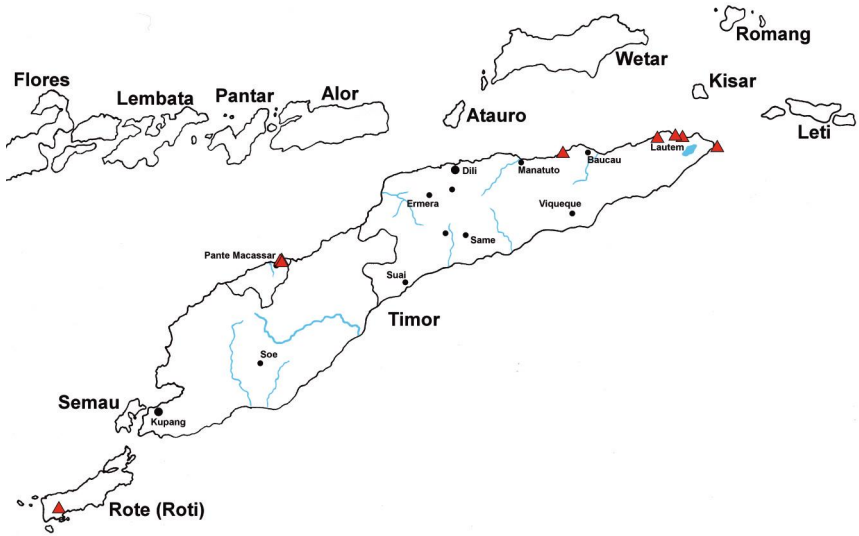
Map 41: *Potomarcha congener* (Rambur, 1842)



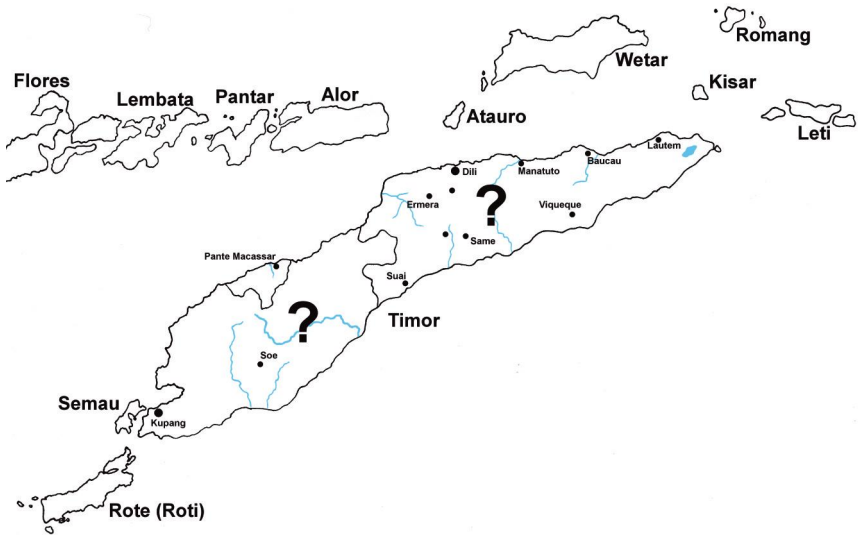
Map 42: *Rhodothemis cf. nigripes* Lohmann, 1984



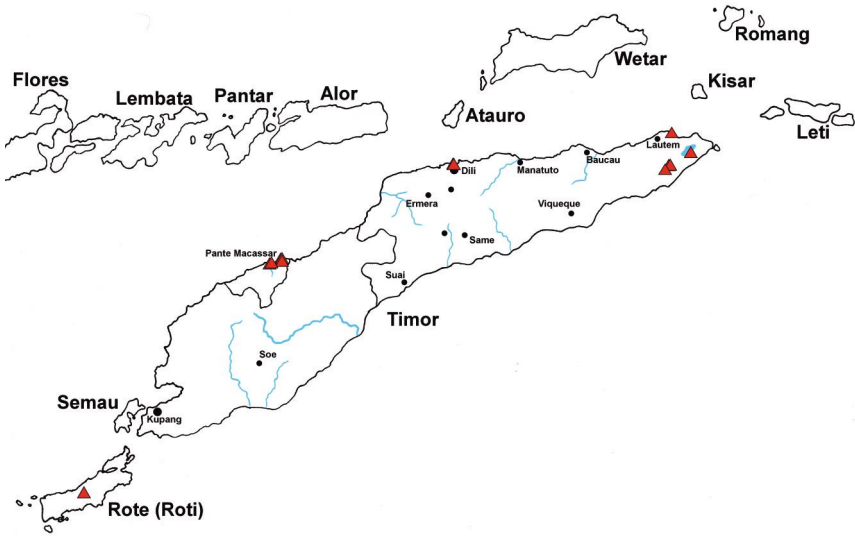
Map 43: *Rhyothemis graphiptera* (Rambur, 1842)



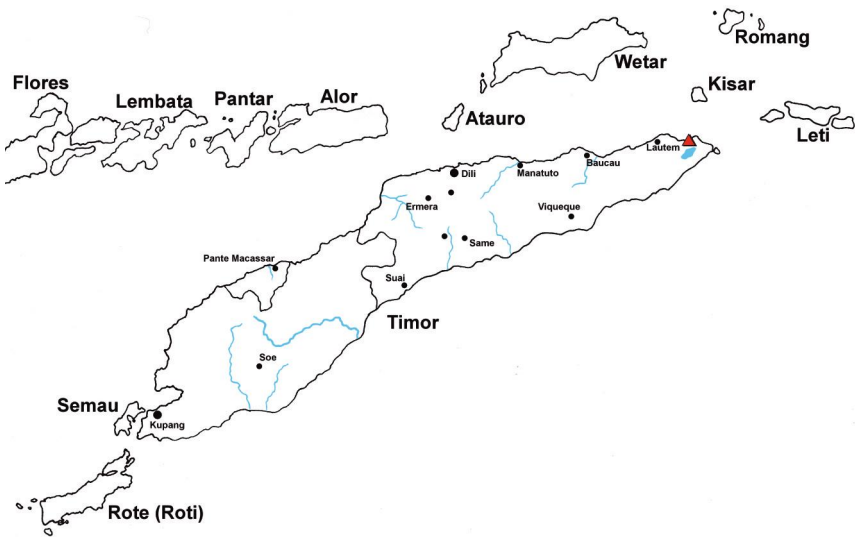
Map 44: *Rhyothemis phyllis ixias* (Liefinck, 1953)



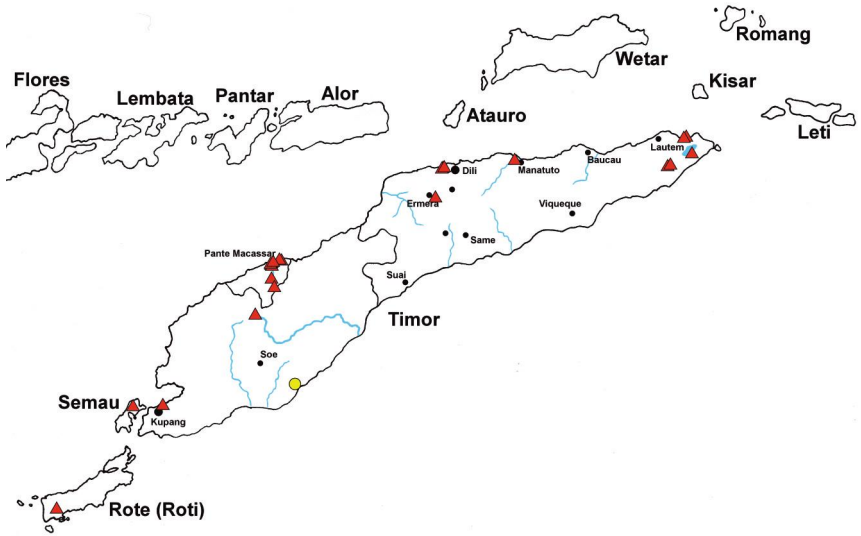
Map 45: *Tetrathemis irregularis hyalina* Kirby, 1889



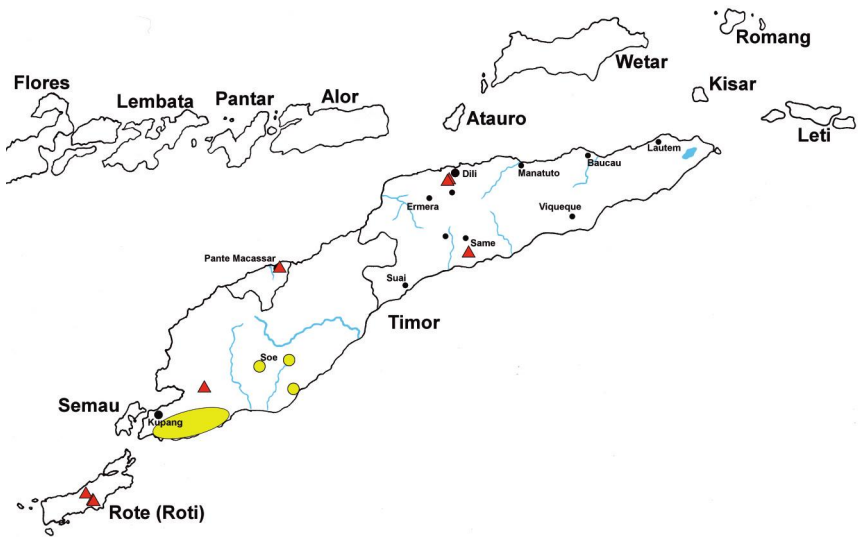
Map 46: *Tholymis tillarga* (Fabricius, 1798)



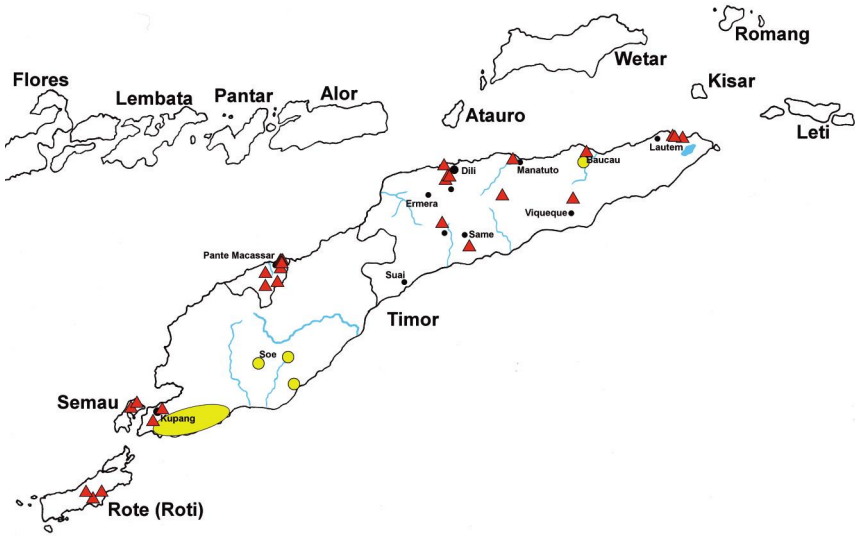
Map 47: *Tramea loewii* (Brauer, 1866)



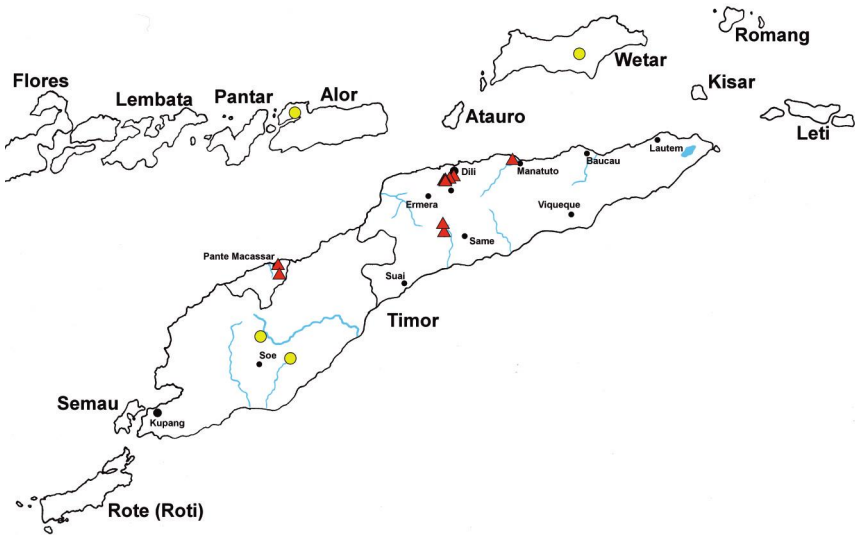
Map 48: *Tramea stenoloba* (Watson, 1962)



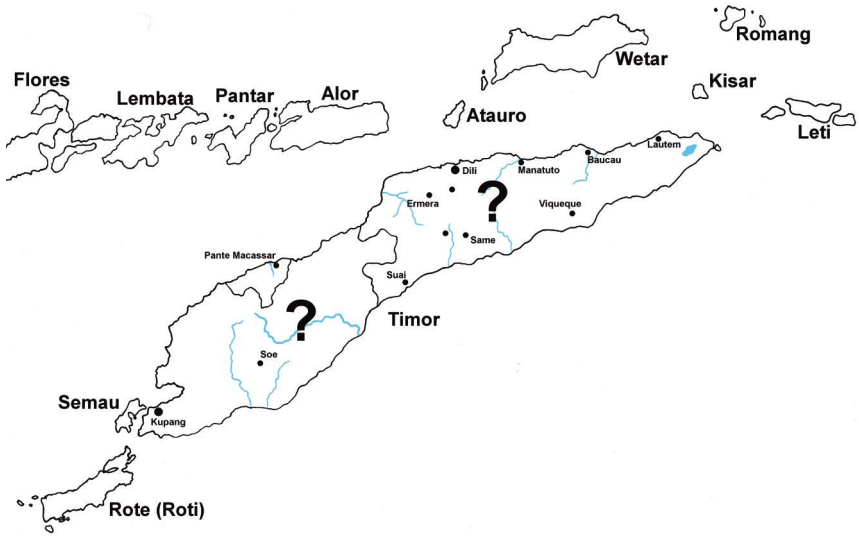
Map 49: *Trithemis aurora* (Brauer, 1865)



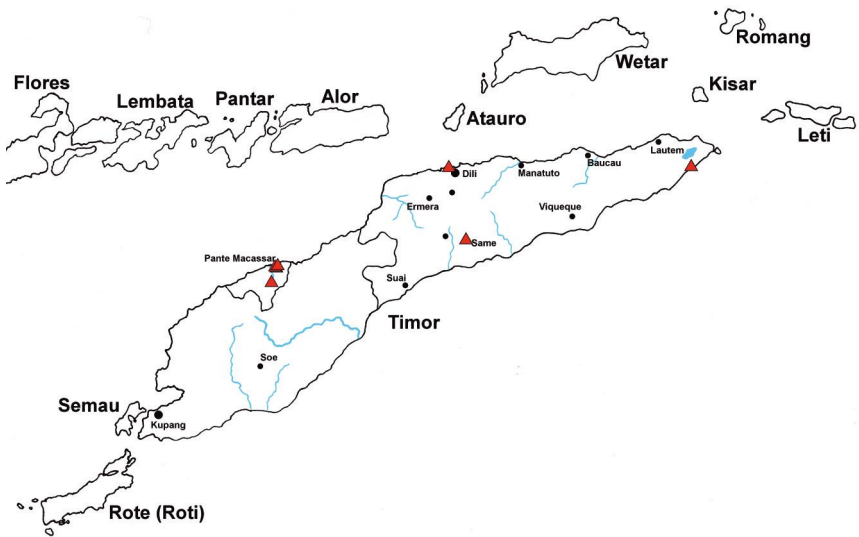
Map 50: *Trithemis festiva* (Rambur, 1842)



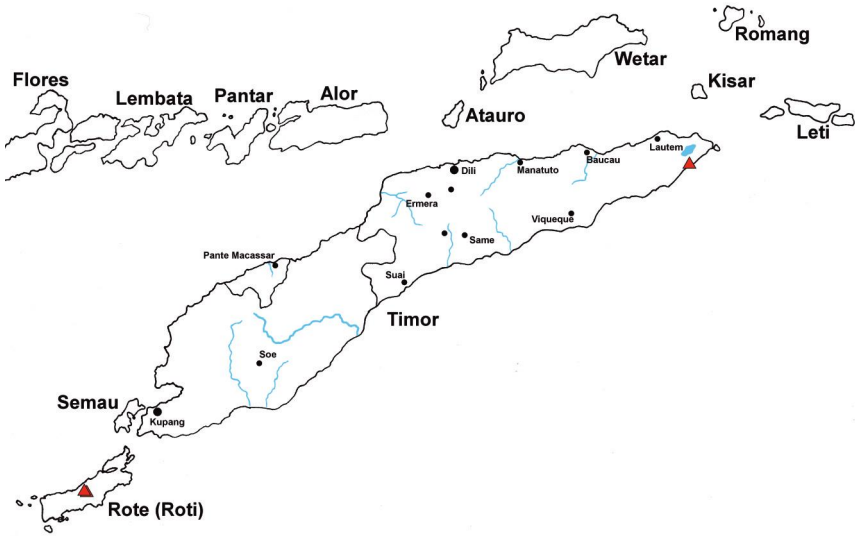
Map 51: *Trithemis lilacina* Förster, 1899



Map 52: *Zygonyx ida* Selys, 1869



Map 53: *Zyxomma obtusum* Albarda, 1881



Map 54: *Zyxomma petiolatum* Rambur (1842)

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