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Previously unpublished Odonata records from Sarawak, Borneo, part VII: Odonata from Limbang Division

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Abstract

Records of Odonata from Limbang Division in Sarawak are presented, based on two surveys. The first survey was made in 2010 by the second author in the Paya Maga area at the border with Sabah. The second survey was made by the first author in 2020, mostly within the Ravenscourt Forest Management Unit, but with two days spent at Paya Maga. Fifty-four species are listed from these two surveys. Several species were recorded from Sarawak for the first time during the surveys reported on: *Devadatta tanduk* Dow, Hämäläinen & Stokvis, 2015 and two as-yet-unnamed species of *Coelliccia*; all of these species were previously known from Sabah. Many of the other records are firsts for Limbang Division. Other particularly significant records include *Indolestes dajakanus* (Liefstinck, 1948), *Protosticta joepani* Dow, Phan & Choong, 2020, *Telosticta ulubaram* Dow & Orr, 2012, *Euphaea basalis* (Laidlaw, 1915), *Rhinoneura caerulea* Kimmins, 1936, *Idionyx montana* Karsch, 1891, *Procordulia fusiformis* Liefstinck, 1977, *Hylaeothemis clementia* Ris, 1909 and *Orthetrum borneense* Kimmins, 1936. *Xiphiagrion cyanomelas* (form B as discussed in Dow et al. (2021)) is reported using surface tension to perch on the surface of a pond. The identity of the unidentified *Devadatta* species recorded from the Long Seridan area in Miri Division by Dow et al. (2021) is discussed further. With the records presented here 123 species of Odonata have now been recorded from Limbang Division and 312 from Sarawak as a whole.

Key words: Malaysia, Borneo, Sarawak, Limbangi Division, Odonata, new records

Introduction

This paper presents records of Odonata from Limbang Division, the northernmost Division in Sarawak. Unlike most of the previous papers in this series which listed records made on many separate trips into the areas which they covered, this paper only includes records from two trips. The first was made by the second author in 2010 to Paya Maga (a proposed totally protected area, currently considered to be a conservation area, alternatively spelled Payeh Mageh) on the border with Sabah as part of the Paya Maga Scientific Ex-

pedition 2010. The second was made by the first author in 2020, primarily to the Ravenscourt Forest Management Unit within the license areas of the Samling group of companies, but with two days spent at sites in the lower part of the Paya Maga Conservation Area (at lower altitudes than those sampled by the second author in 2010).

With an area of approximately 7,789 km² Limbang Division is the fourth largest of Sarawak's administrative divisions. It is divided into two districts, Lawas and Limbang. Limbang Division is relatively poorly known for Odonata, Dow (2021a) listed 93 species from the division, with one omission corrected in Dow (2021b) this figure became 94. However only a few records from the second author's sampling at Paya Maga were available at the time Dow (2021a) was submitted, which was also prior to the trip made by the first author in 2020. Paya Maga is in Lawas District. The Ravenscourt Forest Management Unit spans the border between Lawas and Limbang Districts but all our sampling sites there appear to lie within Limbang District.

There are published records of Odonata from Limbang Division in Cowley (1937), Dow (2010a, 2010b, 2016, 2020, 2021a, 2021b), Dow, Hämäläinen & Stokvis (2015), Dow & Morris (2021), Dow & Reels (2008), Dow, Stokvis & Ngiam (2017), Hämäläinen (1994), Hincks (1930), Kimmins (1936), Laidlaw (1912, 1913, 1920, 1931, 1934), Liefertinck (1954, 1968), Seehausen & Dow (2016), Steinhoff et al. (2019) and van Tol & Norma-Rashid (1995). The primary types of *Drepanosticta versicolor* (Laidlaw, 1913), *Coelliccia nemoricola* Laidlaw, 1912, *Prodasineura peramoena* (Laidlaw, 1913), *Amphicnemis remiger* Laidlaw, 1912, *Stenagrion dubium* (Laidlaw, 1912), *Teinobasis rajah* Laidlaw, 1912 and *Leptogomphus williamsoni* Laidlaw, 1912 are from locations within Limbang Division (all collected on expeditions made by the Sarawak Museum in the early part of the twentieth century, for instance see Moulton (1912)).

Locations

Fig. 1 shows an overview of our sampling sites in Limbang Division.

Paya Maga Conservation area

Figure 2 shows more detail of sampling locations at Paya Maga.

P1. A moderately high gradient stream system in disturbed forest, approximately 2 kms walk from the gate, sampled from ca. 730m a.s.l. (4.445N, 115.4991E) to ca. 775m a.s.l. (4.4463N, 115.5E).

P2. Two moderately high gradient forest stream systems with rocky substrates, higher up on the road leading from the gate, sampled from ca. 829m a.s.l. (4.4367N, 115.5142E) to ca. 946m a.s.l. (4.4396N, 115.5159E).

P3. Ponds, pools beside and along road leading from the gate:

- a. Open ponds near the point where the stream at P1 is crossed by the track.
- b. Pond just inside forest between the gate and P1, only sampled briefly late in the day.
- c. Pools along track or where track crosses small streams.
- d. Along track, not associated with water.

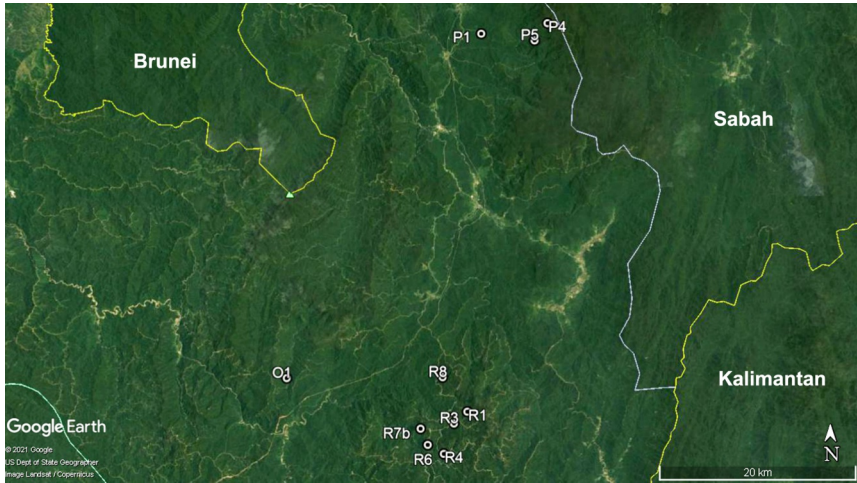


Figure 1. Overview of collecting locations in Limbang Division.

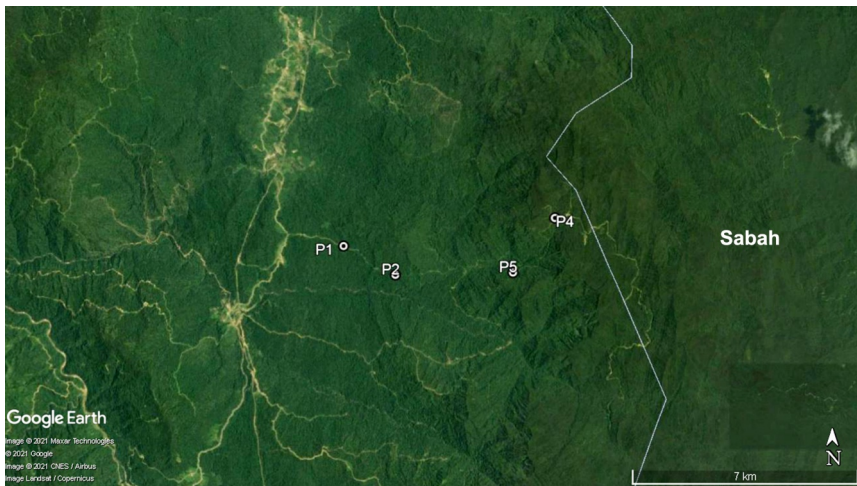


Figure 2. More detail of collecting locations at Paya Maga.

P4. Locations from the 2010 expedition (coordinates at the expedition campsite 4.4529N, 115.5595E):

- a. Waterfall, streams, streamlets and ponds around Paya Maga campsite at ca. 1,580m a.s.l.
- b. Forest swamp and streamlets approximately 1 km down from Paya Maga campsite at ca. 1,300m a.s.l.
- c. Streamlets and ponds approximately 1 km up from Paya Maga campsite at ca. 1,650m a.s.l. Figure 3 shows a small pond at this location.



Figure 3. A grassy pond at ca. 1650m a.s.l. at Paya Maga.



Figure 4. More detail of collecting locations in the Ravenscourt Forest Management Unit.

P5. Drains by logging road approximately 2 km up from Surveyor campsite (4.4375N, 115.5478E) at ca. 1,150m a.s.l.

Ravenscourt FMU camp area

Fig. 4 shows more detail of the locations in this area.

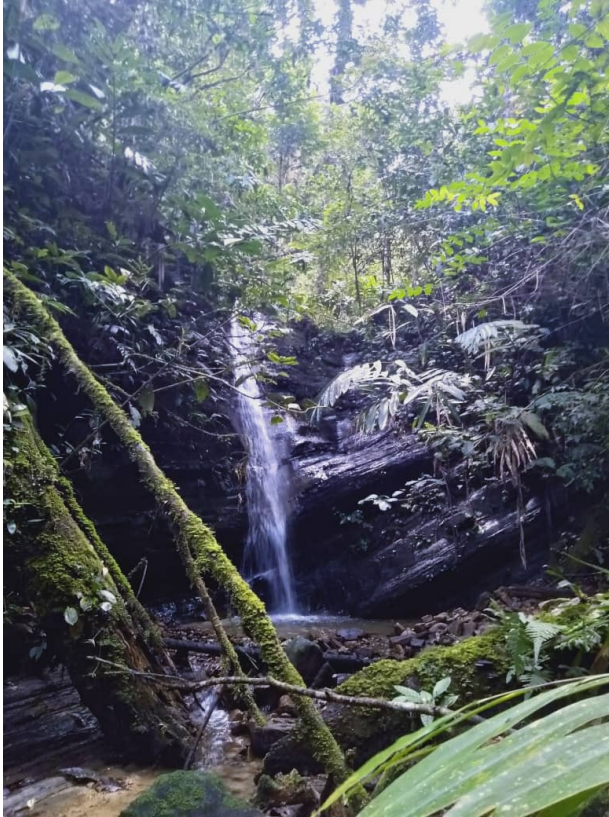


Figure 5. A small waterfall at location R1. Photo by Gregory Mering.

R1. Ravenscourt camp water supply stream and tributaries. Sampled from entry point at ca. 1,560m a.s.l. (4.0978N, 115.4859E) just below the dam where the water enters the pipe to ca. 1,719m a.s.l. (4.1043 N, 115.4886E). This stream is one of the sources of the stream (Sungai Lawan according to people at the camp) that flows through part of the camp. Forest around stream with disturbance from past logging activities in places, pristine montane in uppermost part, stream mostly rocky with gravel sections, alternating high and moder-

ate gradient with many small waterfalls. Fig. 5 shows one of the many small waterfalls on this stream.

R2. A mostly rocky forest stream and its tributaries, crossed by the road leading to the water supply stream at ca. 1,388m a.s.l. (4.0887N, 115.4794E), sampled to ca. 1,480m a.s.l. (4.0934N, 115.4798E).

R3. Sungai Lawan and tributaries upstream of camp, a fairly large, mostly rocky, stream in disturbed forest, downstream of locations 4 and 5. Entered at ca. 1,345m a.s.l. (4.0865N, 115.4737E), sampled to ca. 1,391m a.s.l. (4.0834N, 115.4836E). Fig. 6 shows a section of this stream.

R4. A road leading out of the Ravenscourt camp, not currently maintained outside of the camp area with a bridge at (4.076N, 115.4616E) broken so that it is not possible to drive further; a stream system with a large pond at ca. 1,120m a.s.l. (4.058N, 115.4644E) beside the road:

- a. Steep streams in disturbed forest, sampled to ca. 1,193m a.s.l. (4.0605N, 115.4644E).
- b. Pond at road and marshy shady area beside it.



Figure 6. A section of Sungai Lawan (location R3). Photo by Gregory Mering.

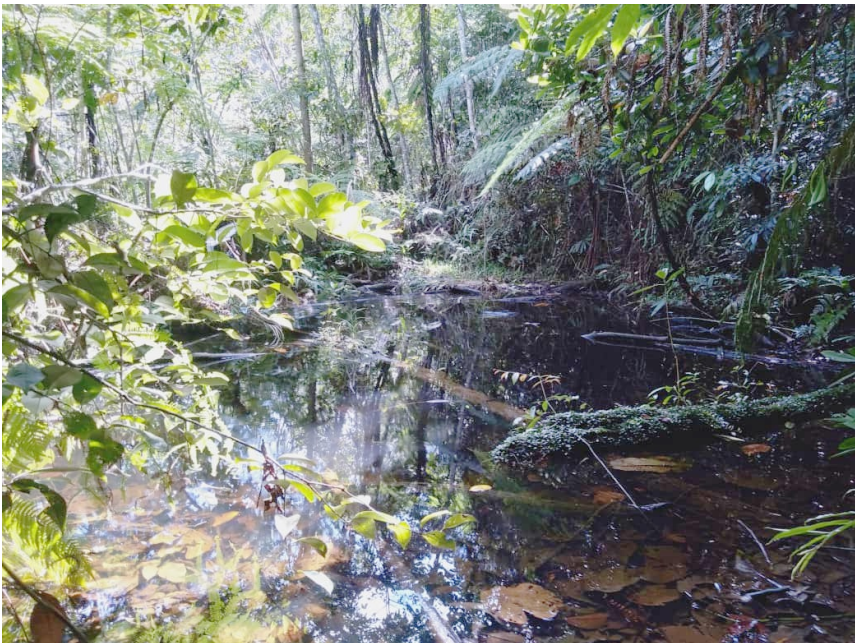


Figure 7. One of the ponds at location R7b. Photo by Gregory Mering.

R5. First stream system after the broken bridge on the same road as location 7, sampled from ca. 1,161m a.s.l. (4.0741N, 115.4622E) to 1,262m a.s.l. (4.0736N, 115.4657E):

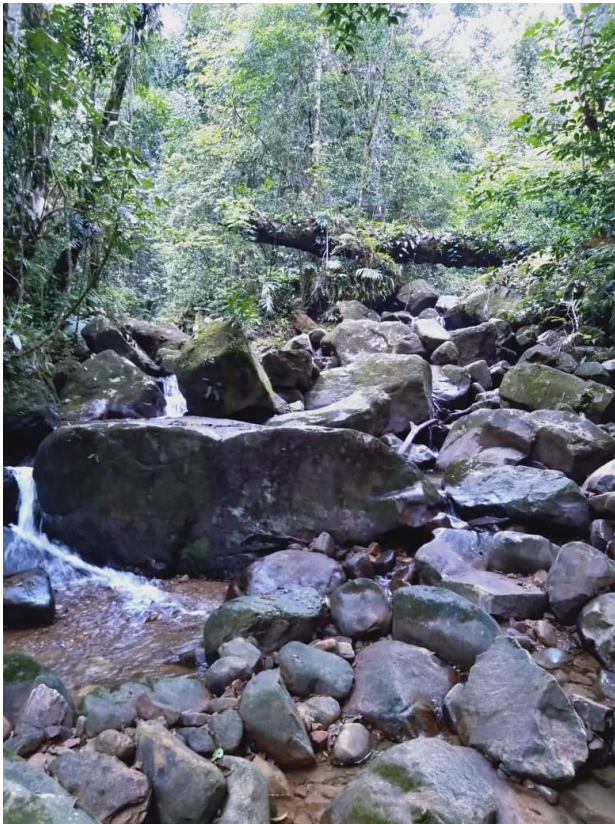
- a. Main stream, moderately high gradient, rocky, disturbed forest.
- b. Small steep tributary.

R6. Junction from the road of locations 7 and 8, steep stream system in disturbed forest reached by cutting down from an old skid path, sampled from ca. 1,052m a.s.l. (4.0661N, 115.4496E) down to ca. 1,030m a.s.l. (4.0654N, 115.4498E).

R7. An area reached from the same junction as location R6:

- a. Mostly steep stream system in disturbed forest, sampled from ca. 1,130m a.s.l. (4.0791N, 115.4405E) down to ca. 1,082m a.s.l. (4.0777N, 115.4414E).
- b. Ponds just inside disturbed and second growth forest, ca 1,175m a.s.l. (4.0813N, 115.443E). Fig. 7 shows one of the ponds.

R8. A moderately high gradient, with many boulders, stream system in disturbed forest on the main road leading to the Ravenscourt camp, sampled from ca. 1,016m a.s.l. (4.1284N, 115.4633E) to ca. 1,071m a.s.l. (4.1268N, 115.4645E). Fig. 8 shows a section of this stream.



R9. Various ponds and pools by logging roads, and beside roads.

Other

O1. A rocky, low gradient stream in disturbed forest, sampled briefly at ca. 457m a.s.l. (4.1266N, 115.3185E) on way back from the Ravenscourt FMU.

Figure 8. Part of the stream at location R8. Photo by Gregory Mering.

List of species recorded

The family level taxonomy used here follows that adopted by Paulson & Schorr (2021) after the publication of Bybee et al. (2021). Note that trinomial names are only given in cases where the subspecies recorded is not the nominate subspecies, in other cases it should be understood that the nominate subspecies is being referred to. A species recorded from Limbang Division for the first time is indicated by a * after the authority, a ** in the same position indicates a first record from Sarawak. The authors' names are abbreviated as RD, CYC below; GM is Gregory Mering.

Zygoptera

Lestidae

1. *Indolestes dajakanus* (Lieftinck, 1948)

Recorded for the first time since its description at Paya Maga in 2010, a male was found perching in foliage overhanging a grassy pond at ca. 1,650m a.s.l., the habitat is shown in Fig. 3, the male in Fig. 9.

P4c – ♂, 30.ix.2010, CYC.

2. *Orolestes wallacei* (Kirby, 1889)*

R7b – ♂, 20.vii.2020, RD; ♂, 20.vii.2020, GM.



Figure 9. Male of *Indolestes dajakanus* at Paya Maga, the same as on cover. Photo by RD.

Platystictidae

3. *Drepanosticta actaeon* Laidlaw, 1934*

Originally described from Mount Kinabalu in Sabah, *D. actaeon* now appears to be common in the mountainous interior parts of Sarawak and was the most common member of the Platystictidae in the sampled part of the Ravenscourt FMU. The form found in Limbang Division is the red-eyed form reported from Miri Division (see Dow (2017)).

- R2** – ♀ (teneral), 22.vii.2020, RD; ♂♂, 22.vii.2020, GM. **R3** – ♀, 18.vii.2020, RD. **R4a** – ♂♂, 19.vii.2020, RD; ♂♂, 19.vii.2020, GM. **R5a** – ♂, 26.vii.2020, RD; ♂♂, 26.vii.2020, GM. **R6** – ♂♂, 16.vii.2020, RD; ♂, 16.vii.2020, GM. **R7a** – ♂♂, ♀, 20.vii.2020, RD; ♂♂, ♀, 20.vii.2020, GM. **R8** – ♂♂, ♀, 23.vii.2020, RD; ♂♂, 23.vii.2020, GM.
4. *Drepanosticta rufostigma* (Selys, 1886)
P1 – ♂♂ (one teneral), 17.vii.2020, RD. **R6** – ♂♂, 16.vii.2020, RD; ♂, 16.vii.2020, GM. **R7a** – ♂♂, 20.vii.2020, RD; ♂, 20.vii.2020, GM. **R8** – ♂, 23.vii.2020, RD.
5. *Protosticta joepani* Dow, Phan & Choong, 2020*
 A female collected in the highest part of location **R1** reached (above 1,700m a.s.l.) and one from location P4a (ca. 1,580m a.s.l.) and included under *P. joepani* here show some differences from typical examples and might eventually prove to be a different species.
P1 – ♂, 17.vii.2020, RD. **P4a** – ♀, 30.ix.2010, CYC. **R1** – ♀, 25.vii.2020, RD. **R5a** – ♂, 26.vii.2020, GM. **R7a** – ♀, 20.vii.2020, GM. **R8** – ♂, 23.vii.2020, GM.
6. *Telosticta ?berawan* Dow & Orr, 2012*
P2 – ♀, 21.vii.2020, RD.
7. *Telosticta ulubaram* Dow & Orr, 2012*
 Quite common at the Ravenscourt FMU but always found at low densities there. In the Ravenscourt area it was found in forest that had been disturbed by logging, most observations of this species before had been from pristine areas or areas only effected by more gradual forms of disturbance than large scale commercial logging.
R2 – ♂ (in steep tributary), 22.vii.2020, RD. **R4a** – ♀, 19.vii.2020, RD. **R5b** – ♂♂, 26.vii.2020, RD. **R6** – ♂, 16.vii.2020, RD. **R7a** – ♂♂, 20.vii.2020, RD.

Euphaeidae

8. *Dysphaea ulu* Hämäläinen, Dow & Stokvis, 2015
O1 – ♂, 27.vii.2020, RD.
9. *Euphaea basalis* (Laidlaw, 1915)*
R1 – ♂, 15.vii.2020, RD; ♂, 15.vii.2020, GM; ♂, 25.vii.2020, RD.
10. *Euphaea subcostalis* Selys, 1873
P1 – ♂♂, 17.vii.2020, RD; ♂♂, 17.vii.2020, GM. **O1** – ♂, 27.vii.2020, RD.
11. *Euphaea subnodalis* (Laidlaw, 1915)*
R3 – ♂♂, 18.vii.2020, RD.

Devadattidae

12. *Devadatta aran* Dow, Hämäläinen & Stokvis, 2015*
 A very common species in the Ravenscourt FMU.
P1 – ♀, 17.vii.2020, RD. **P2** – ♀, 21.vii.2020, RD. **P4b** – ♂, 3.x.2010, CYC. **R1** – ♂♂, 15.vii.2020, RD; ♂♂, 25.iii.2020, RD; ♀, 25.iii.2020, GM. **R2** – ♂♂, 22.vii.2020, RD; ♂♂, 22.vii.2020, GM. **R3** – ♂♂ (in tributary), 18.vii.2020, RD. **R4a** – ♂♂, 19.vii.2020,

RD; ♂♂, 19.vii.2020, GM. **R5a** – ♂, 26.vii.2020, GM. **R5b** – ♂, ♀, 26.vii.2020, RD. **R6** – ♂♂, 16.vii.2020, RD. **R7a** – ♂♂, 20.vii.2020, RD; ♂♂, 20.vii.2020, GM. **R8** – ♂, 23.vii.2020, RD; ♂, 23.vii.2020, GM.

13. *Devadatta clavicauda* Dow, Hämäläinen & Stokvis, 2015

P1 – ♀, 17.vii.2020, RD. **P2** – ♀, 21.vii.2020, RD.

14. *Devadatta tanduk* Dow, Hämäläinen & Stokvis, 2015**

This species, described from Sabah, is recorded from Sarawak for the first time here.

P1 – ♂, 17.vii.2020, RD; ♂, 17.vii.2020, GM. **P2** – ♂♂, 21.vii.2020, RD; ♂♂, ♀, 21.vii.2020, GM.

Argiolestidae

15. *Podolestes* sp.*

A large sized form allied to *P. orientalis* Selys, 1862 and also known from Batang Ai National Park (Dow, Reels, Ngiam 2015a), the Lanjak Entimau Wildlife Sanctuary (Dow et al. 2019), the Ulu Moh area (Dow & Ngiam 2015) and the Usun Apau plateau (Dow, Reels, Ngiam 2015b). See Note 14 in Dow (2021a) for a discussion of the status of this taxon.

R7b – ♂♂, ♀, 20.vii.2020, RD; ♂, 20.vii.2020, GM.

Calopterygidae

16. *Matronoides cyaneipennis* Förster, 1897

R1 – ♂, 15.vii.2020, RD; ♀, 15.vii.2020, GM; ♀♀, 24.vii.2020, GM. **R2** – ♂♂, 22.vii.2020, RD; ♀♀, 22.vii.2020, GM.

17. *Vestalis amnicola* Lieftinck, 1965

P1 – ♂♂, 17.vii.2020, RD; ♂♂, 17.vii.2020, GM. **P2** – ♂, 21.vii.2020, GM. **R1** – ♀, 15.vii.2020, GM. **R2** – ♂, ♂+♀, 22.vii.2020, RD; ♂♂, ♀♀, 22.vii.2020, GM. **R3** – ♂♂, 18.vii.2020, RD; ♂♂, 18.vii.2020, GM. **R5a** – ♂, 26.vii.2020, RD; ♂♂, ♀♀, 26.vii.2020, GM. **R8** – ♂♂, ♀, 23.vii.2020, GM.

18. *Vestalis beryllae* Laidlaw, 1915*

R4a – ♂, 19.vii.2020, RD. **R7a** – ♂♂, 20.vii.2020, GM.

Chlorocyphidae

19. *Rhinocypha spinifer* Laidlaw, 1931

R2 – ♂♂, 22.vii.2020, RD; ♂♂, 22.vii.2020, GM. **R3** – ♂♂, ♀, 18.vii.2020, RD; ♂♂, 18.vii.2020, GM. **R5a** – ♂, 26.vii.2020, RD; ♂♂, 26.vii.2020, GM. **R8** – ♂, 23.vii.2020, RD.

20. *Rhinocypha* sp. cf. *spinifer* Laidlaw, 1931*

P2 – ♀, 21.vii.2020, RD. **R7a** – ♀, 20.vii.2020, RD.

21. *Rhinoneura caerulea* Kimmins, 1936*

Found at very low densities above 1,600m a.s.l. in lower gradient sections of the water supply stream at Ravenscourt Camp, including in parts that had been disturbed by

logging in the past; the comment made about *Telosticta ulubaram* above also applies to this species.

R1 – ♂♂, 15.vii.2020, RD; ♂, 25.vii.2020, RD.

Platycnemididae

22. *Coeliccia borneensis* (Selys, 1886)

R4a – ♂, 19.vii.2020, GM. **R6** – ♂ (in seepage), 16.vii.2020, RD.

23. *Coeliccia campioni* Laidlaw, 1918*

P1 – ♀, 17.vii.2020, RD. **P2** – ♂, 21.vii.2020, RD; ♂, 21.vii.2020, GM. **R6** – ♂♂, ♀, ♂+♀, 16.vii.2020, RD; ♂♂, 16.vii.2020, GM. **R8** – ♂, 23.vii.2020, RD.

24. *Coeliccia cyaneothorax* Kimmins, 1936*

R3 – ♂, 18.vii.2020, RD. **R8** – ♂, 23.vii.2020, RD.

25. *Coeliccia nemoricola* Laidlaw, 1912

P4a – ♂♂, 29.ix.2010, CYC. **P4b** – ♂♂, 1.x.2010, CYC. **P5** – ♂♂, 28.ix.2010, CYC. **R1** – ♂♂ (one in tiny tributary), 15.vii.2020, RD; ♂, 25.vii.2020, RD. **R2** – ♂♂, 22.vii.2020, RD; ♂♂, 22.vii.2020, GM. **R3** – ♂, 18.vii.2020, RD. **R4a** – ♂♂, 19.vii.2020, RD. **R5a** – ♂♂, 26.vii.2020, RD. **R5b** – ♂+♀, 26.vii.2020, RD. **R7a** – ♂, 20.vii.2020, RD. **R8** – ♂, 23.vii.2020, RD; ♂, 23.vii.2020, GM.

26. *Coeliccia* new sp. cf *nemoricola* Laidlaw, 1912 A

Descriptions of this and the next two species are in progress (Dow, Choong & Price in preparation). Details of specimens collected will be given with the descriptions. Locations R4a, R6 and R7a.

27. *Coeliccia* new sp. cf *nemoricola* Laidlaw, 1912 B**

This unnamed species, and the next, were known from Sabah but are recorded from Sarawak for the first time here, both at Paya Maga. Locations P1, P2 and P5.

28. *Coeliccia* new sp. cf *nemoricola* Laidlaw, 1912 C**

Locations **P4a** and **P4c**.

29. *Coeliccia nigrohamata* Laidlaw, 1918

P2 – ♂♂, ♀, 21.vii.2020, GM. **R6** – ♂♂, 16.vii.2020, RD. **R7a** – ♂♂, ♂+♀ (all in low gradient seepage), 20.vii.2020, RD; ♂♂, 20.vii.2020, GM. **R8** – ♂, ♂+♀, 23.vii.2020, RD.

Coenagrionidae

30. *Agriocnemis femina* (Brauer, 1868)*

P4a – ♂, 2.x.2010, CYC.

31. *Ceriagrion bellona* Laidlaw, 1915

P3c – ♂+♀, 21.vii.2020, RD. **P4a** – ♂, ♀, 30.ix.2010, CYC. **P4c** – ♂, ♂♂+♀♀, 30.ix.2010, CYC. **R4b** – ♀, 19.vii.2020, GM. **R7b** – ♂+♀, 20.vii.2020, RD; ♀, 20.vii.2020, GM. **R9** – ♂♂, 16.vii.2020, RD;

32. *Stenagrion dubium* (Laidlaw, 1912)

P2 – ♂, ♂+♀, 21.vii.2020, RD. **R2** – ♂, 22.vii.2020, RD. **R3** – ♂♂, 18.vii.2020, RD. **R4a** – ♂, 19.vii.2020, GM. **R5a** – ♂, 26.vii.2020, RD. **R6** – ♂ (in seepage), 16.vii.2020, RD. **R7a** – ♀, 20.vii.2020, RD. **R8** – ♂, 23.vii.2020, RD.

33. *Teinobasis laidlawi* Kimmins, 1936***R7b** – ♂, 20.vii.2020, GM.34. *Xiphiagrion cyanomelas* Selys, 1876 B*

See Dow et al. (2021) on the division of *Xiphiagrion cyanomelas* into forms A and B, only the latter was found at the locations considered here. At location P4 at Paya Maga CYC observed males using surface tension to stand on the water surface at grassy ponds. This act was normally performed with the middle and hind legs touching the water surface while the fore legs were lifted close to the head (Fig. 10). The anal appendages are also touching the water surface in Fig. 10. When wind blew across the pond, males drifted smoothly across the surface. In 2021 RD observed a male of form A perform the same action for a short time at a lowland pond in Kuching Division, Sarawak, so this behaviour is not limited to form B, but it may be more common in form B, which certainly seems to carry it out for longer periods.

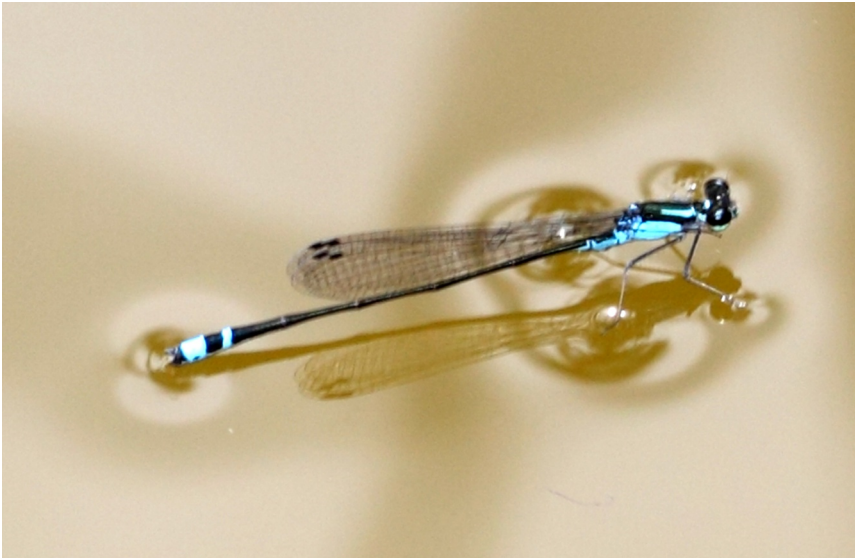
P4a – ♂♂, 30.ix.2010, CYC; ♂, ♀, 3.x.2010, CYC. **P4c** – ♂♂, ♂♂+♀♀, 30.ix.2010, CYC.**R7b** – ♂♂+♀♀, 20.vii.2020, RD. **R9** – ♂♂, ♂♂+♀♀, 16.vii.2020, RD.

Figure 10. Male of *Xiphiagrion cyanomelas* B using surface tension to perch on the water surface at a pond at Paya Maga. Photo by CYC.

Anisoptera**Macromiidae**35. *Macromia westwoodii* Selys, 1874***P4c** – ♂, 30.ix.2010, CYC. **R1** – ♀, 15.vii.2020, GM; ♀, 25.vii.2020, RD.

Synthemistidae

36. *Idionyx montana* Karsch, 1891*

P2 – ♀, 21.vii.2020, RD.

37. *Idionyx* sp. cf. *yolanda* Selys, 1871*

P2 – ♀, 21.vii.2020, GM.

Corduliidae

38. *Procordulia fusiformis* Liefinck, 1977

We have typically only encountered single individuals or occasionally two of this species at a single place and time, but it was quite common at the large pond at R4b, where males patrolled sections of the pond margin, occasionally clashing with each other.

P4c – ♀, 30.ix.2010, CYC. **R4b** – ♂♂, 19.vii.2020, RD; ♂, 19.vii.2020, GM.

Libellulidae

39. *Camacina gigantea* (Brauer, 1867)*

P3b – ♂♂, 21.vii.2020, RD.

40. *Cratilla lineata* (Brauer, 1878)*

P3d – ♂, 21.vii.2020, RD.

41. *Cratilla metallica* (Brauer, 1878)

R9 – ♂, 20.vii.2020, RD.

42. *Diplacodes trivialis* (Rambur, 1842)*

P4a – ♂, 30.ix.2010, CYC. **R9** – ♀, 19.vii.2020, RD.

43. *Hylaeothemis clementia* Ris, 1909

P4b – ♂, 1.x.2010, CYC. **R9** – ♀, 16.vii.2020, RD; ♀ (teneral), 20.vii.2020, GM.

44. *Lyriothemis biappendiculata* (Selys, 1878)

R7a – ♂, (in low gradient seepage), 20.vii.2020, RD.

45. *Neurothemis fluctuans* (Fabricius, 1793)

P3c – ♂, 17.vii.2020, RD; ♂♂, 21.vii.2020, GM. **R9** – ♀, 20.vii.2020, RD; ♂, 20.vii.2020, GM.

46. *Neurothemis terminata* Ris, 1911

P3a – ♂, 17.vii.2020, RD. **P3b** – ♂, 17.vii.2020, GM. **P3d** – ♀, 21.vii.2020, GM. **P4a** – ♂, 30.ix.2010, CYC.

47. *Orthetrum chrysis* (Selys, 1891)

R9 – ♂, 20.vii.2020, RD.

48. *Orthetrum borneense* Kimmins, 1936

This seldom encountered montane species was moderately common at higher altitudes at Paya Maga, where it was found in rather open habitats, including old logging roads. Fig. 11 shows a male perched on a logging road at Paya Maga.

P4a – ♂, 29.ix.2010, CYC; ♂♂, 30.ix.2010, CYC.



Figure 11. Male of *Orthetrum borneense* perched on an old logging road at Paya Maga. Photo by CYC.

49. *Orthetrum glaucum* (Brauer, 1865)

P4a – ♂, 30.ix.2010, CYC. **R3** – ♀, 18.vii.2020, GM. **R9** – ♀, 16.vii.2020, RD; ♀, 16.vii.2020, GM; ♂♂, 19.vii.2020, GM; ♂♂, 20.vii.2020, GM; ♂, 26.vii.2020, GM.

50. *Orthetrum pruinoseum schneideri* Förster, 1903

P3a – ♂, 17.vii.2020, GM. **P4a** – ♂, 1.x.2010, CYC. **R4b** – ♂, 19.vii.2020, GM. **R9** – ♂, 16.vii.2020, RD; ♂, 20.vii.2020, RD; ♂, 20.vii.2020, GM.

51. *Orthetrum testaceum* (Burmeister, 1839)

P3c – ♂, 17.vii.2020, RD; ♂, 17.vii.2020, GM.

52. *Tramea transmarina euryale* Selys, 1878*

P3a – ♂, 17.vii.2020, GM.

53. *Trithemis aurora* (Burmeister, 1839)*

R4b – ♂, 19.vii.2020, RD; ♂♂, 19.vii.2020, GM.

54. *Trithemis festiva* (Rambur, 1842)*

O1 – ♂, 27.vii.2020, RD.

Discussion

With the records presented here 123 species of Odonata have now been recorded from Limbang Division. Three species (two still unnamed), all previously known from Sabah and all found at Paya Maga on the Sabah-Sarawak border, are recorded from Sarawak for the first time here. This raises the number of species known from Sarawak to 312. The number of new records, both for Limbang Division and for Sarawak as a whole, demonstrates that there is much still to learn about the odonate fauna of the division. It should be noted that since the surveys reported on here were made entirely above 700m a.s.l., even short surveys at lower altitudes are likely to result in similar increases

to the number of species known from Limbang Division. Two species not yet recorded in Sarawak (*Rhinocypha humeralis* Selys, 1873 and *Mortonagrion alycone* (Laidlaw, 1931)) that occur on the eastern side of Borneo in Sabah and Kalimantan have small populations in Brunei and are therefore particularly likely candidates for future discovery in Limbang Division.

Dow et al. (2021) recorded a *Devadatta* species from the Long Seridan area in Miri Division (not far from the border with Limbang Division), noting that the specimens (all male) appeared intermediate between *D. aran* and *D. tanduk* but might be *D. aran*. The reader is referred to the comments in Dow et al. (2021) and Dow, Hämäläinen & Stokvis (2015) on character displacement in Bornean *Devadatta* species and issues with identification of *D. aran*, *D. somoh* Dow, Hämäläinen & Stokvis, 2015 and *D. tanduk* without molecular data in areas where only one of the three occurs. The discovery of definite *D. tanduk* on the Sarawak side of the Sabah-Sarawak border makes an alternative possibility more likely than it might have appeared previously – that the Long Seridan species is *D. tanduk*. The closest location to Long Seridan from which Dow, Hämäläinen & Stokvis (2015) recorded *D. aran*, and also *D. somoh*, is Gunong Mulu National Park. Only a single female of *D. aran* has been recorded at Gunong Mulu National Park but a number of males of *D. somoh* have been found there. No molecular data from the Gunong Mulu National Park populations of either species is available so it is possible that only one of these species actually occurs there, with the associated identification problems, in which case it is perhaps more likely that the single female of *D. aran* from that location is a mis-identification of *D. somoh* (or possibly *D. tanduk*) than vice versa. However these issues are only likely to be resolved satisfactorily by using molecular data from the Long Seridan and Gunong Mulu National Park populations (at present not practical for several reasons). The situation where molecular data is needed for identification is frustrating, but seemingly unavoidable in this case.

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