AGRION

NEWSLETTER OF THE WORLDWIDE DRAGONFLY ASSOCIATION

PATRON: Professor Edward O. Wilson FRS, FRSE

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Secretary and Treasurer: W. Peter Brown, Hill House, Flag Hill, Great Bentley, Colchester CO7 8RE. Email: wda.secretary@gmail.com.
Editors: Keith D.P. Wilson. 18 Chatsworth Road, Brighton, BN1 5DB, UK. Email: kdpwilson@gmail.com.
Graham T. Reels. 31 St Anne's Close, Badger Farm, Winchester, SO22 4LQ, Hants, UK. Email: gtreels@gmail.com.

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AGRION is the Worldwide Dragonfly Association's (WDA's) newsletter, which is normally published twice a year in January and July. Occasionally a special issue may be produced, as was the case in May 2020 when a special issue was published in response to the ongoing Covid-19 pandemic. The WDA aims to advance public education and awareness by the promotion of the study and conservation of dragonflies (Odonata) and their natural habitats in all parts of the world. *AGRION* covers all aspects of WDA's activities; it communicates facts and knowledge related to the study and conservation of dragonflies and is a forum for news and information exchange for members. *AGRION* is freely available for downloading from the WDA website at [https://worlddragonfly.org/about/agrion/]. WDA is a Registered Charity (Not-for-Profit Organization), Charity No. 1066039/0. A 'pdf' of the WDA's Constitution and byelaws can be found at its website link at [https://worlddragonfly.org/about/].

Editor's notes

Keith Wilson [kdpwilson@gmail.com]

WDA Membership

Control of the membership signing up and renewal process is now being handled by WDA directly from the WDA website. There are several kinds of WDA membership available, either single or family, with or without the WDA's journal (*The International Journal of Odonatology*) in electronic form or hard copy. There are also reduced membership categories for students (grade school, undergraduate, graduate, etc.) and anyone (student or not) residing in a developing nation. You can sign up for a membership using the WDA's website [https://worlddragonfly.org/membership-account/membership-levels/] or by contacting the WDA secretary directly [wda.secretary@gmail.com]. Sponsored memberships are also available for those who cannot afford the cost due to currency restrictions or other reasons.

Cover: Large Red Damselfly (*Pyrrhosoma nymphula*) illustrating the use of 'stacking' technique to deliver images with sharp subjects and good bokeh, garden pond, Brighton, 7 June 2020. Photo credit: Keith D.P. Wilson.

The front cover image of ***Pyrrhosoma nymphula*** illustrates the technique of 'stacking' using an Olympus OMD M1 Mark III camera and a 60 mm Olympus macro lens. The 'stacking' technique permits the use of a large aperture, in this case F 2.8, to isolate the subject from its relatively close background whilst retaining a high depth of field i.e. an image with a sharp subject and good 'bokeh'. The combination of a high depth of field and use of a large aperture is not normally possible without utilising the 'stacking' technique.

For the cover photo a series of eight handheld camera images were automatically taken by the camera in quick succession, each with a slightly different focused area achieved by successive movements of the camera's image sensor. The OMD M1's onboard post-processing software aligned all of the eight images to produce a final single focused image. The image processing took just under 10 seconds. The image's high depth of field has produced a sharp subject throughout its body length, including its legs and head, and the blurred background helps to isolate the damselfly, providing a pleasing aesthetic quality.

In the photo the green background colour is formed by the barely discernible leaves of Common Duckweed (*Lemna minor*) floating on the pond's surface just a few centimetres below the damselfly. Without the 'stacking' technique to produce a high depth of field and the use of a large aperture to blurr the background, isolating the subject, it would not be possible to take such a photo with the backdrop so close to the subject.

Keith D.P. Wilson

Conference & Meeting News

The International Congress of Odonatology ICO2021

The next ICO will be held in Paphos, Cyprus at the Neapolis University from 21st to 25th June 2021 and will be organised by The Cyprus Dragonfly Society and Terra Cypria. For further information consult the WDA website [Link] or contact David Sparrow, Chair of the Organising Committee [davidrospfo@hotmail.com].

European Congress on Odonatology (ECOO) 2020 postponed due to Covid-19

The 6th European Congress on damselflies and dragonflies, ECOO 2020, was scheduled to be held in Kamnik, Slovenia from 29 June to 2 July, 2020 with a post congress field trip. The meeting is now postponed and proposed to be held at the end of June 2022 for a similar period at the same location. Visit the ECOO 2020 website for more information and consult the ECOO2016 homepage web site for latest announcements at [https://ecoo2016.wordpress.com/].

Sociedad(e) de Odonatología Latinoamericana (SOL) 3rd annual meeting, 7-9 October 2020

The Sociedad(e) de Odonatología Latinoamericana is scheduled to hold its 3rd annual meeting in Cusco, Peru from 7-9 October 2020. There will be a post conference trip at the Manu Learning Centre, Peru from 10-13 October 2020. The conference venue is the Universidad San Antonio Abad de Cusco. Details of fees and submission deadlines are soon to be released via the SOL Facebook [facebook.com/OdonataSol] and the SOL website [http://www.odonatasol.org/].

Next issue of *AGRION*

For the next issue of *AGRION,* to be published at the beginning of January 2021, please send your contributions to Keith Wilson [kdpwilson@gmail.com] or Graham Reels [gtreels@gmail.com]. All articles, information and news items related to dragonflies or of interest to WDA members are most welcome and will be considered for publication. Please send all text and figure captions in a Word file by email. Please do not include artwork with the text but provide a separate file or files, ideally in a compressed format (e.g. 'tiff', 'jpeg' or 'gif'). Do not make up plates of multiple photos but send original photo images as separate files.

If you have an odonate photo illustrating any rarely observed aspect of dragonfly biology, or an unusual species, or simply a stunning dragonfly shot, please submit it for consideration for publication on the front cover of *AGRION*.

Big changes regarding *International Journal of Odonatology*

John C. Abbott [jabbott1@ua.edu]
Editor-in-Chief, International Journal of Odonatology

I am pleased to announce that the 2019 JCR (Journal Citation Reports) was recently released and the *International Journal of Odonatology* has seen its Impact Factor increase from 0.846 to 1.029. It has also moved up in the rankings and is now 59/101 in the Entomology JCR Category (previously 65/98 Entomology). This is fantastic news and a real testament to our authors, the manuscripts they have been submitting, and our great editorial board.

Additionally, I would like to let everyone know that after the current volume, IJO will no longer be published by Taylor & Francis. Starting January 2021, the journal will be published by Wachholtz Verlag. Along with this move, the journal will become online only and open access. We will continue to use Scholar One to accept and review submissions, so authors, reviewers and editors will see very little change on that side of things and the history of our previous manuscript reviews and editorial decisions will be retained. The transition should be quite smooth. I'm looking forward to these changes and continuing to build on the growth and momentum that we have with IJO.

Volunteer request for *Ceriagrion citrinum* Campion, 1914 monitoring and education project in Benin, West Africa

Séverin Tchibozo [s.tchibozo@crgbbj.org or tchisev@yahoo.fr]

The Research Center for Biodiversity Management (CRGB) is looking for a volunteer to assist with a *Ceriagrion citrinum* Campion, 1914 monitoring and education project in Benin, West Africa involving the making of a short report or documentary on the species and the collection of data in the field. *Ceriagrion citrinum* has been Red List assessed as Endangered (EN) by the SSC/IUCN [Link]. For further information see the French Society of Ecology and Evolution's web site [Link] and contact Séverin Tchibozo [s.tchibozo@crgbbj.org or tchisev@yahoo.fr], tel: (+229) 21031879/21353095/95063950. The closing date is 31 August 2020.

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ADDENDUM to "Phylogenetic implications of the pterothoracic sternites of Odonata nymphs"

Kenneth J. Tennessen
[ktennessen@centurytel.net]

In my paper in the May 2020 special Covid-19 issue of *AGRION*, I scored the nymphs of 30 families of Odonata for the presence or absence of a ventral transverse suture between the mesothorax and metathorax (Tennessen, 2020: 106, Table 1). Three "lestoid" families were included in the original study, but no specimens of Hemiphlebiidae and Synlestidae were available at that time. The evidence at hand raised the question of whether all Lestoidea lacked a ventral transverse suture. Since the publication of my article, Adolfo Cordero Rivera has kindly sent me data on *Hemiphlebia* and *Phylolestes*, along with photographs, revealing that these genera do not possess a transverse suture between the meso- and metathorax. In summary, it appears that all Lestoidea lack a ventral transverse suture, whereas all "non-lestoid" Zygoptera families have a suture. Therefore, the conclusions that I drew in my paper are substantiated.

Acknowledgements
I thank Adolfo Cordero Rivera (University of Vigo, Spain) for examining specimens and taking photos of the thoracic venter of *Hemiphlebia* and *Phylolestes* nymphs and for allowing me to use the data in this note.

Reference

Tennessen, K.J., **2020.** Phylogenetic implications of the pterothoracic sternites of Odonata nymphs. *Agrion* 24(2): 104-107.

Rumble in the stream: mating site preference in endemic *Euphaea aspasia* (Zygoptera: Euphaeidae)

Muhammad N. Janra[1]*, Henny Herwina[1] & David Gusman[2]
[1]*The Biology Department, Andalas University,
Jalan Kampus Unand Limau Manis Pauh,
Padang, West Sumatra 25163, Indonesia [mnjanra@sci.unand.ac.id]
[2]The Office of Environment and Forestry, Bengkulu Province,
Jl. Pembangunan Simpang Padang Harapan, Bengkulu City

Abstract
Euphaea aspasia, as with most of other members of the Oriental genus *Euphaea*, has poorly known reproductive biology. Here we report on a possible mating site for this species through observations of protracted agitation between two males over a prospective area, in addition to the subsequent guarding act from a male over the same area. The physical and environmental aspects of the prospective mating site are described.

Introduction

Breeding or reproductive cycle in the life of odonates demands sufficient resources such as food, good quality aquatic environment, suitable temperature and lighting exposure. While some odonates fondly welcome the congregating of many individuals around the mating site (known also as lekking, e.g. in Córdoba-Aguilar et al. 2008), others do not really share the resources when it comes to breeding matters. In general, males of odonates will tend to employ resource defense polygyny, in which they attempt to control female access to oviposition sites (Conrad & Pritchard, 1992).

Theoretically, males of odonates are able to assess the quality of an environment that provides sufficient resources for reproduction (De Marco & Resende 2004). Males instinctively defend the territories they perceive will be selected by females, as females may also be able to perceive appropriate habitats with abundant resources (Alcock 1987). By defending a certain area where females might possibly gather or be attracted by resource availability, a male can monopolize mating with any visiting female (Thornhill & Alcock 1983). It is therefore understandable if males fight in order to to occupy potential mating sites or to defend one they have established. Hence, fighting and the defence by males may be plausible indications to detect possible mating sites for many odonate species. In this paper, we assess the possibility of a mating site for the endemic *Euphaea aspasia* (Euphaeidae) indicated from observation of a lengthy fight between two males and subsequent site guarding by the probable winner.

Methodology

This observation was part of an odonate survey conducted once or twice a week at Biological Research and Educational Forest, Andalas University, West Sumatra, Indonesia from early October to late November 2019 (see map in Figure 1). The purpose of this survey was to make an inventory of the odonates in this forested area, especially within the primary and secondary coverage, as well as in human-affected areas.

A 100m transect was established following a small stream in primary forest while another 200 m transect was erected at the secondary environment to facilitate data collection. Each transect was surveyed from downstream up, in order to minimize possible disruption by the observers. Two to three observers were assigned in each observation session using Nikon Coolpix P900 for documenting odonate species and their activities, in which picture and video functions of the camera were deployed. The temperature was measured with alcohol thermometer and light intensity was scaled with Smart Luxmeter application installed in Vivo V9 smartphone.

Result and Discussion

The fighting and defence behavior

The *Euphaea aspasia* damselfly was found mainly at the rocky stream in the secondary forest. It mixed with many other zygopterans, mainly individuals from family Chlorophydae such as *Heliochypa angusta angusta* and *Libellago lineata*. A libellulid, *Trithemis festiva*, may also frequent the same habitat.

During our survey on 2 November 2019, around 15 meters from the starting point of the transect, we observed two male *Euphaea aspasia* in aerial agonistic interaction. They flew with rapid wing-beat, circling a cascading part of the stream. The flight of the two males was centered around the middle of the cascade, where they aerially gripped each other for a second or two in a sudden strike, before separating and flying away. This cycle of motion was repeated over and over, attracting our attention to record this 'fighting' for a couple of minutes before resuming the survey of the rest of transect.

After an hour and a half, upon completing data collection at the transect in this secondary forested area,

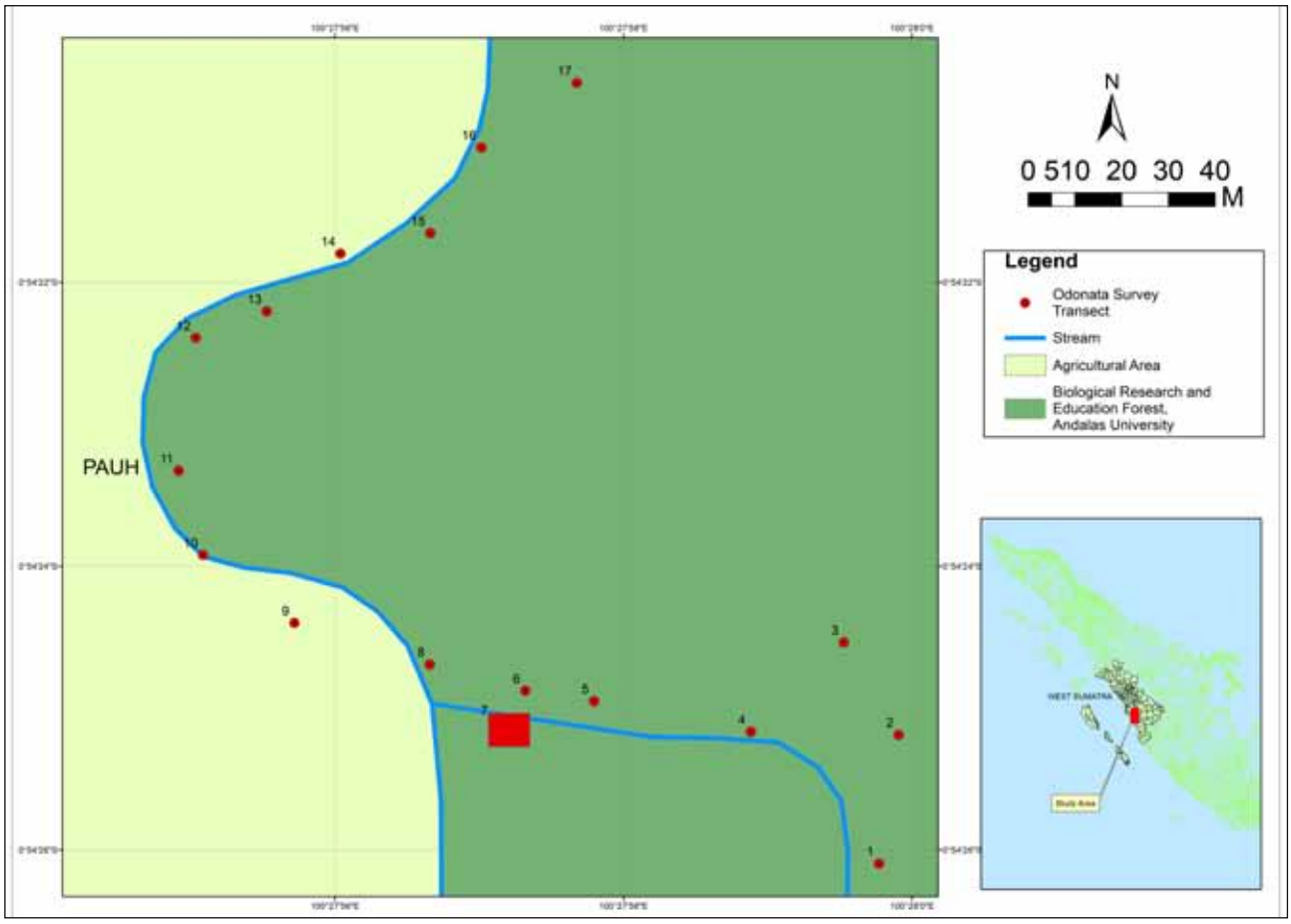

Figure 1. Map of survey site at Biological Research and Educational Forest, Andalas University, West Sumatra, Indonesia. Red square (no. 7) indicates the observed breeding site of *Euphaea aspasia*.

we returned to the 'fighting' site and found the two individuals were still in their intense aerial battle, in the way described above. The sound of flapping wings or possibly the physical contact between the two was sometimes audible over the sound of flowing water. We recorded the fighting for another couple of minutes. The cascade area, which we thought was the focal interest in this fighting, was also thoroughly inspected. Using the pictures and recorded video, we counted that the two individuals commenced around 20 strikes in a minute (see Plate 1 for fighting sequence).

Male to male contest is common among odonates. The main purposes include occupying a foraging site, dominating a potential mating site and defending the subsequently established mating site (Baird and May 1997, Baird and May 2003). The intensity of the fight may emphasize the importance of that site compared to other sites. The observed fight between the two male *E. aspasia* was believed to last for more than two hours (they had been fighting before we recognized it in our first observation up until we finished the survey an hour and a half later, and continued beyond).

On the next survey on 7 November 2019, we observed only one male *E. aspasia* perching on rock or other surfaces within the proximity of the cascade (Figures 2a and 2b). We could not confirm if this male was one of the two we observed previously or one from any other contest that might have happened in between the two observations. This male, however, behaved defensively over other trespassing males of *E. aspasia*. It would chase any other males away from the cascade area. Despite this aggressiveness, the male did not show agitation with the presence of different odonate species. Individuals of *Heliocypha angusta angusta*, *Libellago lineata*, *Trithemis festiva* or sometimes *Zygonyx ida* perched in the proximity of the cascade without agitating the male. Unfortunately, during this second observation, we did not spot any female approaching the cascade for reproductive engagement. The video on the fragments of fighting and the guarding male were uploaded in Youtube Channel (https://youtu.be/DsIUIgdkQAQ and https://youtu.be/Mqf4Y93I4P4 respectively).

Description of possible mating site

The cascade guarded by the possible winning male was characterized by clear rapid torrent and 5-20 cm depth of water (in the dry season), with small rocks, gravel and sand as substrates. Its width and height were approximately

Figure 2. (A) The stream cascade which was presumed to be a breeding site for *E. aspasia*. Arrow indicates the mid portion of cascade. (B) Aerial fighting between two *Euphaea aspasia* males above cascade, 2 November 2019. (C) The presumed winner male *E. aspasia* perched on an in-stream rock, 7 November 2019. (D) The same male perching on nearby twig, 7 November 2019.

2 m and 0.5 m respectively (Figures 3a & b). The cascade 'wall' was constructed from the natural arrangement of small boulders and rocks, creating a rapid-flowing drop of around 0.5 m height. The bottom of the cascade was lined with organic materials, mostly twigs, leaf stalks and dead leaves fallen from surrounding vegetation. The characters of this site correspond to those mentioned by Reels and Dow (2006) as favourable mating and egg-depositing habitat for euphaeids. The fallen twigs and dead leaves may serve either as a holding surface for ovipositing females or as substrate for egg deposition. The rapid torrent supplies oxygen-rich water for the larvae, while gravel and small rocks provide gripping surfaces for nymphs.

Another prominent feature of the cascade was the prolonged exposure its sunlight (Table 1). The part of the stream where the cascade is located was somewhat open, with a flat river bank on its western side and no prominent tree to shade the afternoon sunshine. We measured this site with 797.67 foot-candle of light intensity, much higher than the average light intensity recorded along the secondary forest transect (468.57 foot-candle). On males of damselflies with bright (more often metallic) colour on their wings, the solar exposure helps them to cue their fitness and body quality, which in turn enhances their sexual recognition, as well as improving courtship intensity or other interspecific functions (Schultz and Fincke 2009, Tsubaki et al. 2010).

The temperature measured at this observed site was 28°C, above the average temperature across the transect (26.5°C) but slightly lower than the highest temperature recorded here (Table 1). This temperature was thought to result from the site exposure to sunlight as explained above. Body temperature in dragonflies results from exposure to environmental heat and will significantly affect their flight performance, increase manoeuverability, agility in catching prey and mating success (Samejima and Tsubaki 2010).

Future study

The observations and measurements above suggest the possible reproductive value of the observed cascade site for *E. aspasia*, which may explain the reason for males fighting over its occupancy. Confirmation of whether

Site #	Coverage	Light Intensity (foot-candle)	Temperature (°C)	Remark
1	Under canopy	138.98	25.5	
2	Open	262.27	27	
3	Open	752.61	26	
4	Under canopy	740.44	26	
5	Open	365.76	26	
6	Open	351.45	27	
7	Open	797.67	28	Possible mating site
8	Open	667.88	28.5	
9	Open	463.49	29	
10	Open	147.16	28	
11	Under canopy	334.08	26	
12	Under canopy	105.72	26	
13	Open	819.78	26	
14	Open	86.03	27	
15	Under canopy	485.88	24.5	
16	Under canopy	763.94	25	
17	Under canopy	682.56	25	
		$\dot{x} = 468.57$	$\dot{x} = 26.5$	

Table 1. Environmental factors along the transect at secondary forest in Biological Research and Educational Forest, Andalas University, West Sumatra, Indonesia, measured between 0900-1300 hours.

mating and oviposition take place in this presumed mating site is required. Not only is there no information on this aspect for *E. aspasia*, but for Euphaeidae in general the mating and oviposition behaviour are still poorly known. The knowledgeon reproductive behaviour in this genus comes from observations on several members. Five species are known to do submergence oviposition: *E. ameeka*, *E. Formosa*, *E. impar*, *E. decorata* and *E. subcostalis* (Thompson 1998, Wang 2000, Choong 2005, Reels and Dow 2006) and one, *E. ochracea*, with non-submergence egg-laying (Reels and Wilson 2009).

The indication of preferred mating site for *E. aspasia* indeed needs further confirmation through more observation either on the same site or over other similar sites. Recreating semi-artificial mating sites in other places that meet such environmental factors described above may provide an opportunity to prove this preliminary assumption as well. Furthermore, this observation opens plausible opportunity to study more on the reproductive behaviour of *E. aspasia* such as mating (copulation), oviposition, male role during oviposition, life cycle and other biological aspects.

Acknowledgment

The authors thank the members of organization KCA-LH Rafflesia FMIPA Unand for their help providing manpower, field equipment and logistics during field surveys. The authors also appreciate Irviandi Yonanta and Andalas University biology students in 2019 for their tremendous help during the field work. The authors also wish to acknowledge the financial assistance for Andalas University Odonata surveys provided by Directorate of Higher Education through the scheme of Bantuan Operasional Perguruan Tinggi Negeri (BOPTN) contract number T/15/UN.16.17/PT.01.03/RD-Inovasi Sains/2019 and Hibah Riset Dasar dan Riset Terapan Fakultas MIPA contract number 03/UN.16.03.D/PP/FMIPA/2020, both on behalf of Muhammad Nazri Janra.

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Additions to the Odonata fauna of Thailand (Aeshnidae, Devadattidae, Euphaeidae, Gomphidae, Libellulidae, Platycnemididae)

Noppawan Buppachat[1], Phasin Inkaew[2], Tosaporn Thitiarchagul[3], Chanachol Saengamorn[4], Narong Thepphibalsathit[5], Pithak Nurak[6], Satawan Atdhabhan[7], Surapon Chaychum[8], Udomsak Sribal[9], Wilawan Tangngekkee[10], Yingsak Paweenpermsuk[11], Dennis Farrell[12], Pattarawich Dawwrueng[13], Reinthong Ruangrong[14], Jamnongjit Ruangrong[15], Nathathai Thammasangwan[16], Sompong Tesring[17], Surachai Chanhong[18] & Noppadon Makbun[19]*

[1]290 Chermchomphol Rd., Si Racha, Chon Buri, 20110, Thailand [Noppawan.b1963@gmail.com]
[2]Doi Phu Kha National Park, Pua, Nan, 55120, Thailand. [phasin.ink@gmail.com]
[3]9/154 Pruksa Ville 8/2, Soi Waruwanaram 15, Don Muang, Bangkok, 10210, Thailand.
[4]99/2 Moo 2, Ban Mai, Tha Pha, Ko Kha, Lampang, 52130, Thailand. [Siroccogold_meri@hotmail.com]
[5]32/65 Butsaba 2 Village, Sukhumvit Rd., Pak Nam, Muang, Samut Prakan, 10270, Thailand. [bemcola@gmail.com]
[6]149/8 Moo 1, Thong Nian, Khanom, Nakhon Si Thammarat, 80210, Thailand. [Pithak1978@gmail.com]
[7]1 Provincial Electricity Authority, Betong, Yala, 95110, Thailand. [Oolah1205@gmail.com] [tosaporn78@yahoo.com]
[8]227 Moo 4, Soi 2C, Phraek Sa, Muang, Samut Prakan, 10280, Thailand. [chaychum@yahoo.com]
[9]90 Moo 15, Phra Kaeo, Sangkhla, Surin, 32150, Thailand [Jkong_udom@gmail.com]
[10]7/47 Phaholyotin 24, Chomphol, Chatuchak, Bangkok, 10900, Thailand. [wilawan4012@gmail.com]
[11]66/66 Moo 5, Thepharak Rd., Bang Muang, Muang, Samut Prakan, 10270, Thailand. [ae_iou_s@hotmail.com]
[12]9/756 Moo 11, Pimanthani Muang Gao, Glang Muang, Amphur Muang, Khon Kaen, 40000, Thailand. [thaiodonata@gmail.com]
[13]98 Moo 3, Khae Rai, Kra Tum Baen, Samut Sakhon, 74110, Thailand. [mapormail@hotmail.com]
[14]9/9 Moo 10, Lak Sam, Ban Phaeo, Samut Sakhon, 74120, Thailand. [reinthong22@gmail.com]
[15]9/9 Moo 10, Lak Sam, Ban Phaeo, Samut Sakhon, 74120, Thailand. [jammab@hotmail.com]
[16]64 Moo 7, Amphaeng, Ban Phaeo, Samut Sakhon, 74120, Thailand. [nathathai1990@gmail.com]
[17]80 Moo 2, Laksongsongsermvittaya School, Lak Song, Ban Phaeo, Samut Sakhon, 74120, Thailand. [pong@lak2.ac.th]
[18]79 Moo 4, Lak Sam, Ban Phaeo, Samut Sakhon, 74120, Thailand. [kroonueng@lak2.ac.th]
[19]211/5 Moo 4, Takhi, Nakhon Sawan, 60140, Thailand. [noppadon.makbun@gmail.com]
*Corresponding author

Abstract
Ten species of dragonflies and damselflies are reported for the first time from Thailand, based mostly on identifiable photographs: *Anisopleura pelecyphora* Zhang, Hämäläinen & Cai, 2014, *Cryptophaea yunnanensis* (Davies & Yang, 1996), *Devadatta yokoii* Phan, Sasamoto & Hayashi, 2015, *Euphaea decorata* Hagen in Selys, 1853, *Coeliccia hoanglienensis* Do, 2007, *Cephalaeschna asahinai* Karube, 2011, *Nychogomphus lui* Zhou, Zhou & Li, 2005, *Neurothemis ramburii* (Kaup in Brauer, 1866), *Orthetrum schneideri* Förster, 1903, and *Risiophlebia dohrni* (Krüger, 1902). The biology of some species is briefly discussed.

Key words: Odonata, dragonflies, damselflies, new records, Thailand

Introduction

Following the publication of the book "Atlas of the Dragonflies of Thailand: Distribution Maps by Provinces" by Hämäläinen & Pinratana in 1999, new records and species have been steadily reported. Sribul *et al.* (2018) enumerated and summarized all publications of new national records and new species subsequent to Hämäläinen & Pinratana (1999) and reported seven species new to the country: (*Podolestes orientalis* Selys, 1862, *Rhinagrion hainanense* Wilson & Reels, 2001, *Heliaeschna simplicia* (Karsch, 1891), *Atratothemis reelsi* Wilson, 2005, *Nannophyopsis clara* (Needham, 1930), *Risiophlebia guentheri* Kosterin, 2015, and *Zyxomma breviventre* (Martin, 1921)). Fleck (2020) then described a new subgenus and new species of *Onychogomphus*, *O. (Siriusonychogomphus) louissiriusi,* from Surat Thani province, Peninsular Thailand. More recently *Stylogomphus thongphaphumensis* Chainthong,

Sartori & Boonsoon, 2020 and *Stylogomphus malayanus* Sasamoto, 2001, a new species and a new national record, respectively, were added to the list (Chainthong, Sartori & Boonsoong 2020).

Here, we report ten additional species for Thailand based on photographs and specimens.

Material and methods

Most of these new records are from photos posted in the Facebook group "Dragonflies of Thailand" with the remainder from private collections. All records are given in alphabetical order of family under orders Zygoptera and Anisoptera, respectively. The collected and observed specimens are indicated unless based on photograph(s). Each photographer's name has been abbreviated to initials. If the abbreviated names are identical, the lowercase of the initial letter of the second syllable of the last name is added behind. The abbreviated name is in parentheses and added at the end of each photographic record. The classification of Odonata used in this paper follows Schorr & Paulson (2020). Abbreviations used throughout the text below are as follows: m: metre; mm: millimetre; a.s.l.: above sea level; Hw: hindwing; Ab+app: length of abdomen including anal appendages; S1-10: abdominal segments 1 to 10.

New records of Odonata from Thailand

ZYGOPTERA

Devadattidae

***Devadatta yokoii* Phan, Sasamoto & Hayashi, 2015 (Figure 1)**

1♂ (collected), Nan province, Bo Kluea, Khun Nan National Park, 19-v-2019, Noppadon Makbun leg.

Devadatta yokoii was described by Phan, Sasamoto & Hayashi (2015) from two male specimens collected from Vangvieng, Vientiane Province, Laos. The shape of the anal appendages, the dark markings on wing tips, and the synthoracic pattern of the Thai specimen match well with the original description of *D. yokoii*. Furthermore, the location where the Thai specimen was collected is only approximately 140 km from the type locality. However, the Thai specimen is somewhat larger (Hw: 36 mm and Ab+app: 40 mm) when compared to the type specimen and paratype (32–33 and 37.5–38.0 mm, respectively). This species was found perching on twigs along the dark ground areas of boulders near a partly-shaded shallow stream.

Euphaeidae

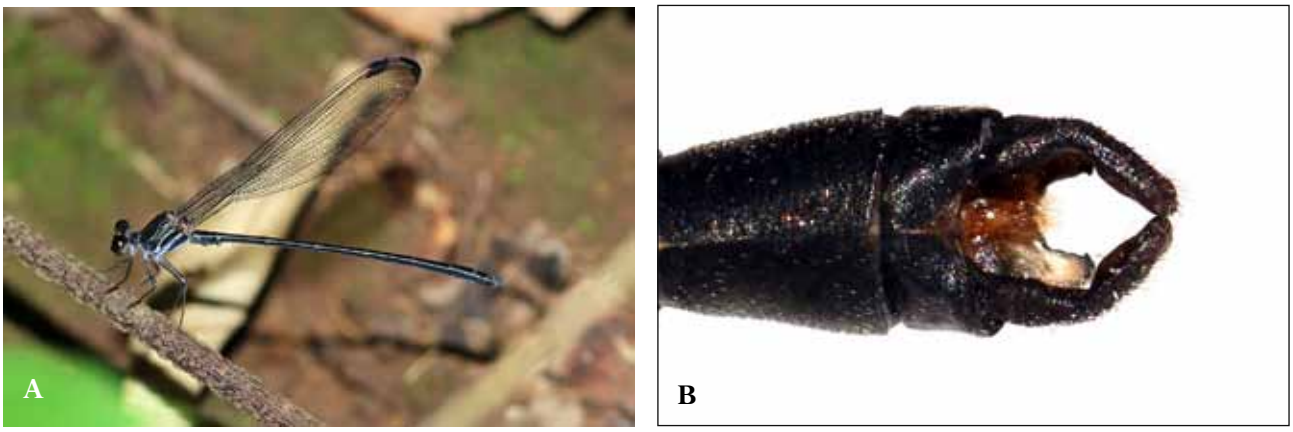

Figure 1. *Devadatta yokoii* Phan, Sasamoto & Hayashi, 2015. (A) Male, Khun Nan National Park, Nan province, 19-v-2019. (B) Male anal appendages, dorsal view. Photo credits: Noppadon Makbun.

***Anisopleura pelecyphora* Zhang, Hämäläinen & Cai, 2014 (Figure 2)**

1♂, Nan province, Doi Phu Kha National Park, 29-xi-2017 (DS); 2♂ (collected), same locality, 15-ix-2019, Noppadon Makbun leg.

Anisopleura Selys, 1853 is a small genus with eleven named species (Schorr & Paulson 2020). Members of this genus occupy montane and submontane streams in the Oriental region (Hämäläinen & Karube 2013). Three species are currently recorded from Thailand: *A. furcata* Selys, 1891, *A. subplatystyla* Fraser, 1927 and *A. trulla* Hämäläinen, 2003 (Hämäläinen & Pinratana, 1999, Hämäläinen 2003). The specimens from Nan province are different from the three species, and one specimen was sent to Dr Matti Hämäläinen, an expert who specialises in Caloptera, for examination. It was found that the shape of the anal appendages, the yellowish body colour and the hyaline wing bases match that of the type series of *A. pelecyphora* Zhang, Hämäläinen & Cai, 2014. Therefore, this is the fourth member of the genus recorded from Thailand and extends its known distribution from southwestern Yunnan, China to Thailand (Zhang, Hämäläinen & Cai 2014).

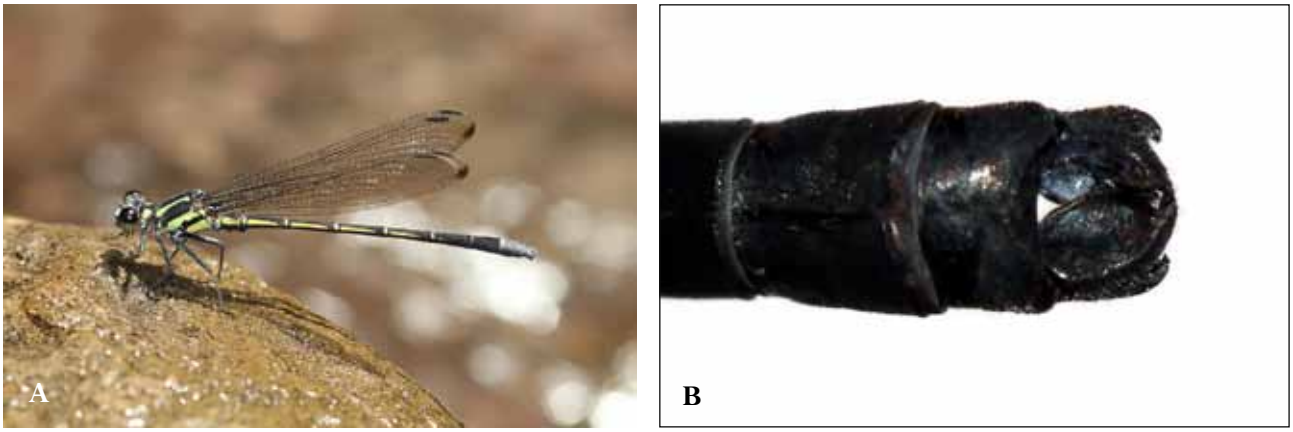

Figure 2. *Anisopleura pelecyphora* Zhang, Hämäläinen & Cai, 2014. (A) Male, Doi Phu Kha National Park, Nan province, 15-ix-2019. (B) Male anal appendages, dorsal view. Photo credits: Noppadon Makbun.

***Cryptophaea yunnanensis* (Davies & Yang, 1996) (Figure 3)**

1♂ (teneral) (collected), Nan province, Doi Phu Kha National Park, 7-iv-2019, Noppadon Makbun leg.; 1♂1♀, same locality, 18-v-2019 (PI); 1♂1♀ (collected), same locality, 18-v-2019, Noppadon Makbun leg.; 1♂, same locality, 20-v-2019, Noppadon Makbun leg.

The genus *Cryptophaea* was erected by Hämäläinen (2003) to accommodate *C. saukra* Hämäläinen, 2003, previously misidentified as *Schmidtiphaea schmidi* Asahina, 1978, from North Thailand. This small genus currently consists of three species: *C. saukra*, *C. vietnamensis* (van Tol & Rozendaal, 1995) and *C. yunnanensis* (Davies & Yang, 1996) (Schorr & Paulson 2020). The Thai specimens match well with *C. yunnanensis*, especially the size, the shape of the anal appendages and the thoracic pattern in the female. This is the second species in the genus *Cryptophaea* reported from Thailand. NM and NB observed the emergence of this species in April. This species seems to prefer resting on twigs in the shaded areas along small and shallow streams at approximately 1,100–1,300 m a.s.l. It should be noted that the synthorax of some females is black with blue pattern instead of yellow or orange, possibly due to the level of maturity.

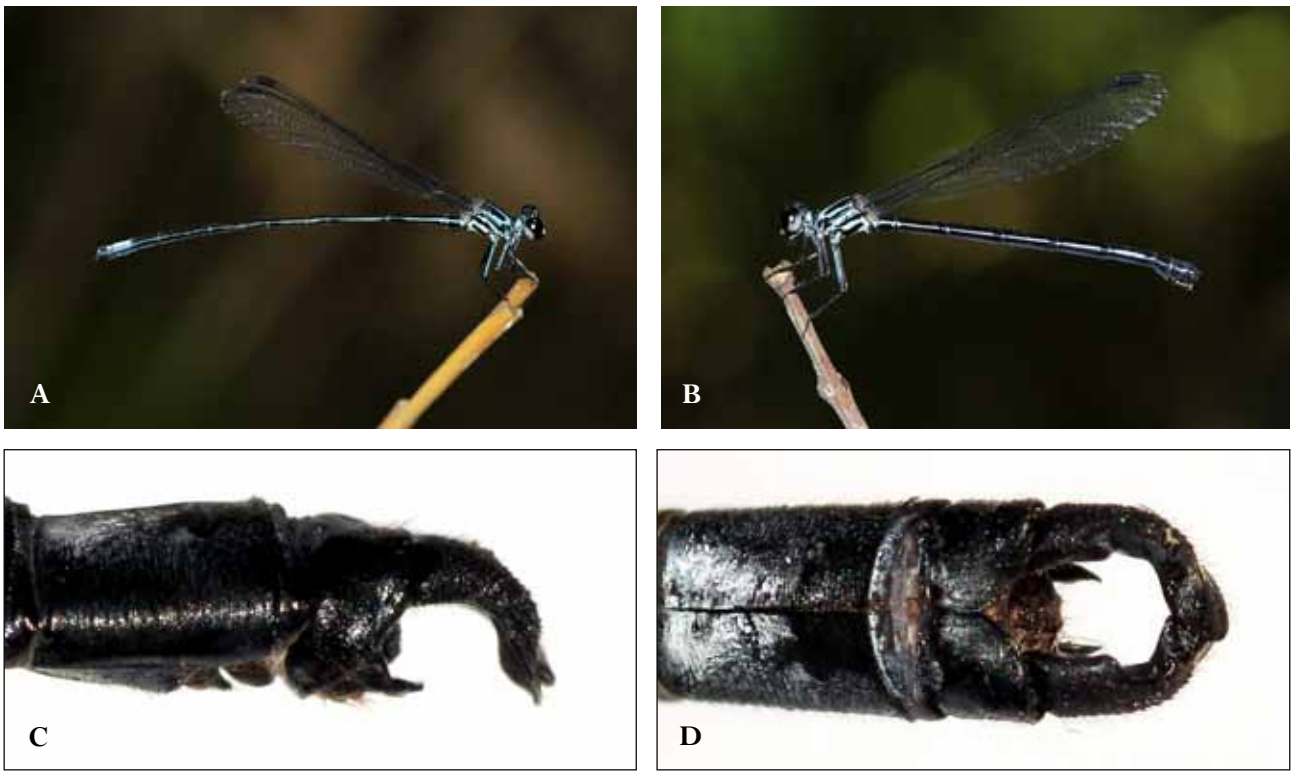

Figure 3. *Cryptophaea yunnanensis* (Davies & Yang, 1996), Doi Phu Kha National Park, Nan province, 18-v-2019. (A) Male. (B) Female. (C) Male anal appendages in lateral view. (D) Male appendages, dorsal view. Photo credits: Noppadon Makbun.

***Euphaea decorata* Hagen in Selys, 1853 (Figure 4)**

5♂1♀, Ubon Ratchathani province, Na Chaluai, Phu Chong–Na Yoi National Park, Huay Luang waterfall, 1-v-2018 (ST, RR, JR, NTm); 2♂, Si Sa Ket province, Khun Han, Samrongkiat Waterfall, 1-v-2018 (ST, JR)

Euphaea decorata is characterised by its black body and abdomen with broad black band for about three-fifths of the wing distal to the nodus on the male hindwings (Phan *et al.* 2018). This characteristic is unique among all *Euphaea* species known from Thailand (*E. impar* Selys, 1859, *E. masoni* Selys, 1879, *E. ochracea* Selys, 1859 and *E. pahyapi* Hämäläinen, 1985). Discovery of this species in Thai territory expands its distribution from China, Hong Kong and Vietnam to Thailand (Tam *et al.* 2011, Phan *et al.* 2018).

Figure 4. *Euphaea decorata* Hagen in Selys, 1853, Huay Luang waterfall, Phu Chong–Na Yoi National Park, Ubon Ratchathani province, 1-v-2018 (A) Male. Photo credit: Sompong Tesring. (B) Female. Photo credit: Nathathai Thammasangwan.

Platycnemididae

***Coeliccia hoanglienensis* Do, 2007 (Figure 5)**

1♂, Nan province, Doi Phu Kha National Park, 29-xi-2017 (PI); 1♂ (collected), same locality, 28-v-2019, Pattarawich Dawwrueng leg.

Do (2007) described a new *Coeliccia* species, *C. hoanglienensis*, from two males collected from Hoang Lien National Park, Lao Cai province, North Vietnam. A remarkable green stripe on the dorsum of the synthorax separates it from all known Vietnamese species. This species was later recorded from Laos (Yokoi & Souphanthong 2014). A single male specimen from Thailand agrees with the description of *C. hoanglienensis*, although its anal appendages are not entirely black, perhaps due to maturity. Its habitat is partially shaded, small and shallow streams at 1,200–1,300 m a.s.l.

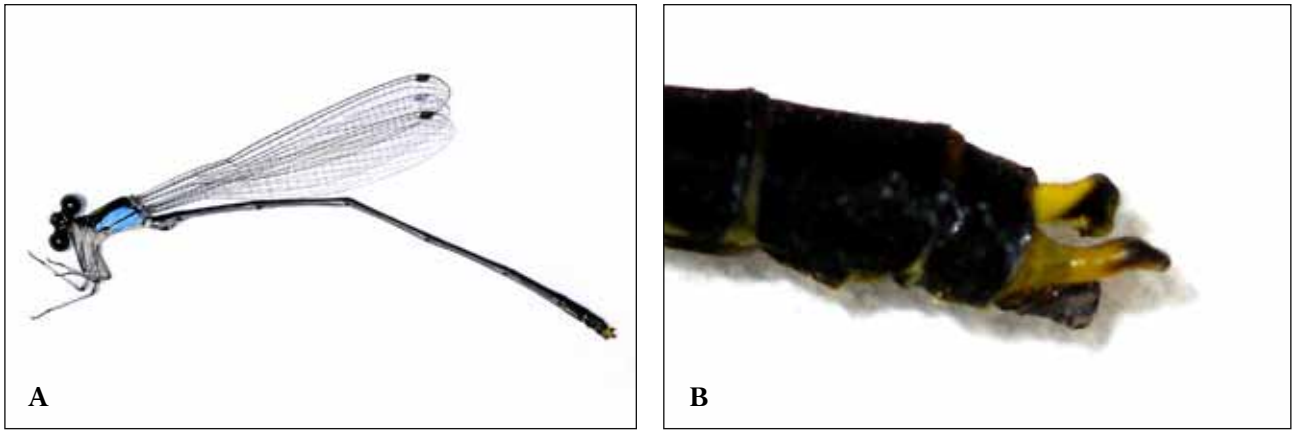

Figure 5. *Coeliccia hoanglienensis* Do, 2007 by Pattarawich Dawwrueng, 28-v-2019, Doi Phu Kha National Park, Nan province. (A) Male, habitus. (B) Male anal appendages in lateral view.

ANISOPTERA

Aeshnidae

***Cephalaeschna asahinai* Karube, 2011 (Figure 6)**

1♀, Chiang Mai province, Chom Thong, Doi Inthanon NP, Siriphume waterfall, 6-v-2016 (TT); 1♂ (collected), same locality, 10-v-2016, Noppadon Makbun leg.

In the World list of Odonata, 27 recognised species belong to the genus *Cephalaeschna* Selys, 1883. This genus ranges from the Himalayas in the west to China, and to Laos and Vietnam in the south (Karube 2003, Yokoi & Souphanthong 2014, Schorr & Paulson 2020). The shape of the anal appendages and the synthoracic pattern of the Thai specimen agrees well with the description of *C. asahinai* from Vietnam (Karube 2011). However, the Thai specimen is smaller in size (Hw: 40.0 mm and Ab+app: 50.5 mm). Hence, this is a new genus and species for Thailand.

Figure 6. *Cephalaeschna asahinai* Karube, 2011 male, Siriphume waterfall, Doi Inthanon National Park, Chiang Mai province, 6-v-2016. Photio credit: Noppadon Makbun.

Gomphidae

***Nychogomphus lui* Zhou, Zhou & Li, 2005 (Figure 7)**

3♂, Sakon Nakhon province, Ban Muang, Ban Na Kha, 30-ix-2019; 1♂, same locality, 15-vi-2016; 1♂, same locality, 31-vii-2016; 1♂ (teneral), same locality, 2-viii-2016 (YP); 1♀, same locality, 22-vi-2016 (YP, NM, PD). 1♂, Bueng Kan province, Muang, Hin San Wan, 4-vii-2019 (CS); 1♂, Seka, Chet Si waterfall, 20-vii-2019 (DF); 3♂, same locality, 29-ix-2019 (US). 1♂3♀, Bueng Kan province, Bung Khla, 19-vii-2019 (DF); 1♂, Kalasin province, Phu Phan National Park, 24-v-2019 (YP)

Nychogomphus lui was first described from specimens from Yunnan, China (Zhou, Zhou & Li 2005). Later, it was recorded from Vietnam (Kompier 2016) and Laos (Seehausen 2018). The photographs from northeast Thailand fit well with characters of *N. lui*, especially the synthoracic pattern and shape of anal appendages with one tooth on the paraprocts (Zhou, Zhou & Li, 2005, Kompier 2016, Seehausen 2018). This species is found in sparse forest and rubber tree plantations near rivers or streams. It is the second species of the genus recorded from Thailand.

Figure 7. *Nychogomphus lui* Zhou, Zhou & Li, 2005, Ban Muang, Sakon Nakhon province, 30-ix-2019. Photo credit: Yingsak Paweenpermsuk.

Libellulidae

***Neurothemis ramburii* (Kaup in Brauer, 1866) (Figure 8)**

2♀(collected), Krabi province, Muang, Sai Thai, 1-viii-2018, Noppadon Makbun leg.

1♂, Kanchanaburi province, Sai Yok, Sai Yok Yai National Park, unknown date in 2010 (RR); 1♂, same locality, 21-v-2016; 6♂, same locality, 14-iv-2018; 1♂, same locality, 19-iv-2018 (TT); 10♂1♀, Si Sawat, Tha Kradan, Erawan waterfall, 15-xi-2014 (TT); 1♂, Thungyai Naresuan Wildlife Sanctuary, forest swamp, 24-ii-2019; 1♂, same locality, 9-iv-2019 (Pranuch Pumipuk); Si Sawat, Khuean Srinagarindra National Park, Huay Mae Khamin Waterfall, ♂ (numerous), 8-ii-2018 (RR, JR). 1♂, Petchaburi province, Kaeng Krachan National Park, 4-ii-2011 (RR, JR); 1♂, same locality, 24-vi-2017 (RR, JR, NTm, ST); 1♂, same locality, 23-i-2017; 1♂, same locality, 9-vii-2017 (NM, RR, JR, NTm, ST); 1♂, same locality, 28-vii-2017 (RR, JR, NTm, ST); 2♂, same locality, 7-8-i-2018 (NB); 2♂, same locality, 12-13-i-2018 (NM, RR, JR, NTm, ST); 5♂, same locality, 25-iii-2018 (RR, JR, NTm, ST); ♂♀(numerous), same locality, 1-iv-2018 (NTp, SCc, NTm, ST, TT); 8♂2♀, same locality, 10-iv-2018; 12♂, same locality, 3-vi-2018 (RR, JR); 3♂, same locality, 12-iv-2018 (US); 9-10♂, same locality, 23-vi-

2018 (RR, JR, NTm, ST), 8♂, same locality, 24-xi-2019 (NB, NM, ST, NTm). 1♂ Mae Hong Son province, Sop Moei, Mae Sam Laep, near Salween river (CS). 2♂, Ratchaburi province, Suan Phueng, Kaeng Som Maew Queen Sirikit Forest Park, 6-iv-2018 (RR, JR, SCh). 2♂, Prachuap Khiri Khan province, Pran Buri, Nong Ta Taem, 15-x-2018 (NB); 1♀, Bang Sapan, 13-xii-2019 (Virayuth Lauhachinda). 3♂, Nakhon Si Thammarat province, Khanom, Hat Khanom-Mu Ko Thale Tai National Park, Had Thong Yi, 7-x-2018; 6♂, same locality, 29-x-2018; 4♂, same locality, 19-xii-2019; 1♂, same locality, 29-iii-2020 (PN).

Identification of the 'reddish-brown-winged' group of *Neurothemis* had been confusing. This taxonomic confusion was later resolved by the work of Seehausen & Dow (2016). *Neurothemis ramburii* is distributed from the Andaman and Nicobar Islands across Sumatra, Borneo, Java, Sumba and north to the Philippines (Seehausen & Dow 2016). *N. ramburii* is divided into three subspecies: *N. ramburii ramburii*, *N. ramburii martini*, and *N. ramburii oceanis*. The photos from Thailand show characters that match with the diagnostic characters of *N. ramburii*, especially the single crossvein in the cubito-anal space of the hindwing, the shape of wing maculation in both wings in both sexes, and the pattern on the abdomen. *N. ramburii* from Thailand falls into the nominated subspecies. The males have wings with fringe maculation and the females have two patterns: isochrome females with maculation to the nodus and main isochrome females. The Thai records extend the known distribution of this taxon northward to mainland Southeast Asia. At Kaeng Krachan National Park, Petchaburi province, it occurs in a pond at which *N. fulvia* and the smaller *N. fluctuans* are both present.

Figure 8. *Neurothemis ramburii* (Kaup in Brauer, 1866). (A) Male, Kaeng Krachan National Park, Petchaburi province, 24-xi-2019. (B) Isochrome female with maculation to the nodus, Muang, Krabi province, 1-viii-2018. Photo credits: Noppadon Makbun.

***Orthetrum schneideri* Förster, 1903 (Figure 9)**

3♂, Narathiwat province, Sukhirin, Hala-Bala Wildlife Sanctuary, 1-2-iii-2018 (NB). 1♂1♀ (copula), Yala province, Betong, 6-i-2018 (WT); 6♂, same locality, 1-ii-2018; 1♂, same locality, 16-iii-2019 (SA); 1♂, same locality, 20-ii-2020 (WT, SA).

Orthetrum pruinosum neglectum (Rambur, 1842) is a dragonfly species found throughout the country. The photographs from the deep south of Thailand, however, show S1–3 have a bluish pruinescence. This is a diagnostic character of *O. p. schneideri* (Förster, 1903), which has a distribution range extending through Peninsular Malaysia, Sumatra, Borneo and Timor (Sharma 2010, Seehausen 2017). Although many research articles and other literature treated it as a subspecies of *O. pruinosum*, it gained full species status through the result of molecular study (Yong *et al.* 2014). Nevertheless, the taxonomic status of this species still needs further study (Seehausen 2017).

Figure 9. *Orthetrum schneideri* Förster, 1903 male, Hala-Bala Wildlife Sanctuary, Sukhirin, Narathiwat province, 1-2-iii-2018. Photo credit: Noppawan Buppachat.

***Risiophlebia dohrni* (Krüger, 1902) (Figure 10)**

2♂ (collected), Surat Thani province, Tha Chana, Khan Thuli, Khan Thuli swamp forest, 19-vii-2019, Noppadon Makbun leg.; 1♂1♀ (copula), same locality, 20-vii-2019, Noppadon Makbun leg.; 1♂ (collected), same date and

locality, Noppadon Makbun leg.

Risiophlebia dohrni is a small dragonfly species that inhabits small pools or sluggish channels in Borneo, Sumatra, Banka, Belitung (Billiton), Singapore and Peninsular Malaysia (Kosterin 2015, Orr 2005). This is the second species of the genus recorded from Thailand after the discovery of *R. guentheri* Kosterin, 2015 in Khao Khao Khitchakut National Park, Chantaburi province, East Thailand (Sribul *et al.* 2018). The Thai male specimens show the diagnostic characters of *R. dohrni*: hamulus with raised "heel" and relative epiproct length less than 0.7 (0.64–0.67) and its size is smaller than that of *R. guentheri* (hindwing: 19–21 mm and abdomen including anal appendages: 20–22 mm). However, their size and number of antenodal crossveins in the forewing and hindwing (8–9 and 8–9, respectively) are larger and more than those of *R. dohrni* in Kosterin (2015). In Thailand, this species was found resting on sunspots over swamp forest at approximately 20–30 m a.s.l.

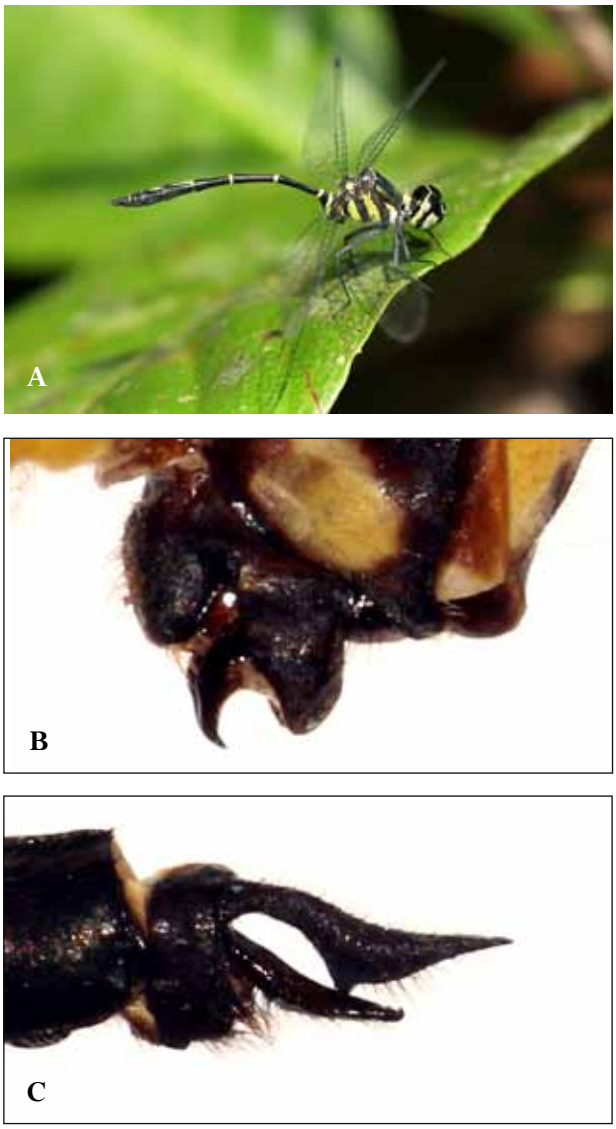

Figure 10. *Risiophlebia dohrni* Kruger, 1902. (A) Male, Khan Thuli swamp forest, Surat Thani province, 19-vii-2019. (B) Accessory genitalia, lateral. (C) Male anal appendages, lateral. Photo credits: Noppadon Makbun.

Discussion

We report here ten records new to Thailand based on photographic records from the Facebook group 'Dragonflies of Thailand' and specimens. Among them, one genus, *Cephalaeschna*, is recorded for the first time from the country. Although most records are from protected areas, one species is worrisome. The swamp forest that *R. dohrni* inhabits is surrounded by fruit and rubber tree plantations. Worryingly, it appears that the habitat is slowly reducing through the expansion of these plantations. Nevertheless, these records are very meaningful and underline the importance of citizen science. These new records emphasize the need for further intensive surveys both in studied and unstudied areas for more understanding of the Odonata fauna of Thailand.

Acknowledgements

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More lockdown odonatology – ten weeks of observations at a garden pond

Albert Orr [agorr@bigpond.com]

In the recent Covid -19 special issue of *Agrion*, I described my garden pond in subtropical Queensland, Australia and its dragonfly fauna (Orr 2020), indicating my intention to study this microcosm while in 'lockdown'. Since writing that article, I continued detailed daily 1-2 hour long observations, weather permitting, from 20/3/2020 (the autumnal equinox) to 31/5/2020 (the last day of autumn). I report here the daily counts of each species as well as notes on general behaviour and other observations. The period makes for an interesting study as it starts at a time of high diversity and abundance, and follows the decline of all odonates with the approach of winter. During this period day length ranged from 12h 05m to 10h 35m, and average daily temperatures dropped from 23°C to 19°C, although unusually low temperatures, 5°C below normal, occurred during mid May of 2020.

General methods and results

The method of counting was to record the maximum number of distinct individuals of each species observed at the pond and in nearby vegetation each day. These figures were condensed into total weekly counts (Fig. 1), meaning that many individuals would have been recorded several times. On the other hand, fairly regular rainy or overcast days suppressed weekly counts. The overall trend was very clear, with numbers peaking in early April, then declining sharply throughout May, with no records at all after 27/5/2020, despite warm sunny conditions on the last four days of observation. The daily activity period also contracted for all species as the season advanced. At the start of observations in March odonates were present around the pond from about 0900h to 1600h. From late April onwards the period of activity contracted sharply until by mid May almost all activity took place between 1100h and 1330h. This was a dramatic effect given that day length was only about 90 minutes shorter and daytime temperatures were still well over 20°C on most days.

Throughout the observation period, given suitable weather, four species were almost always present at the pond in the middle of the day: *Orthetrum villosovittatum*, *Ceriagrion aeruginosum*, *Agriocnemis pygmaea* and *Ischnura aurora*. Two others, *Diplacodes bipunctata* and *Agrionoptera insignis* appeared irregularly most weeks, and exhibited some oviposition behaviour. The phenology and relative abundance of these six species is summarised in Figure 2. Seven other species appeared once or twice only and were not recorded breeding.

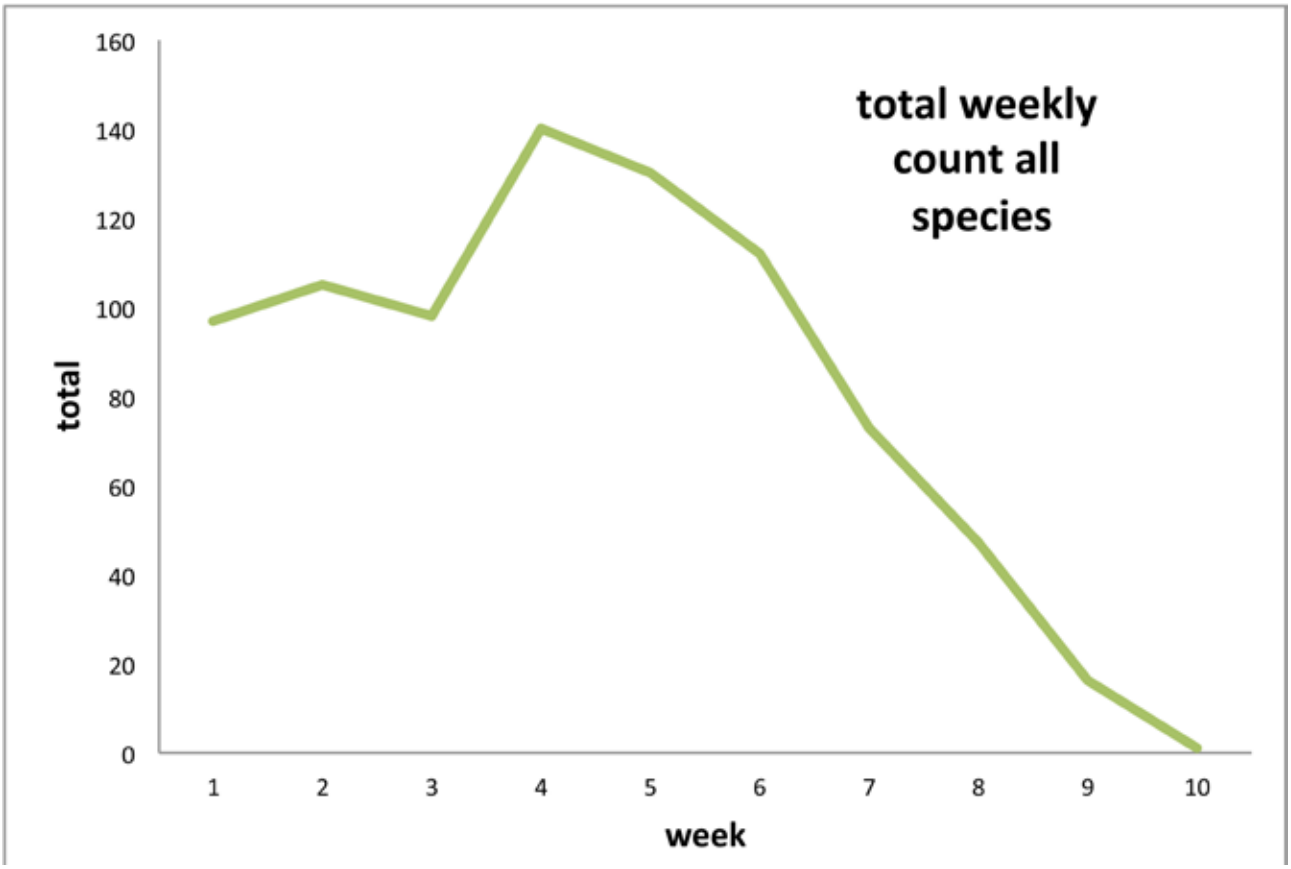

Figure 1. Weekly counts of all Odonata at the pond during the study period.

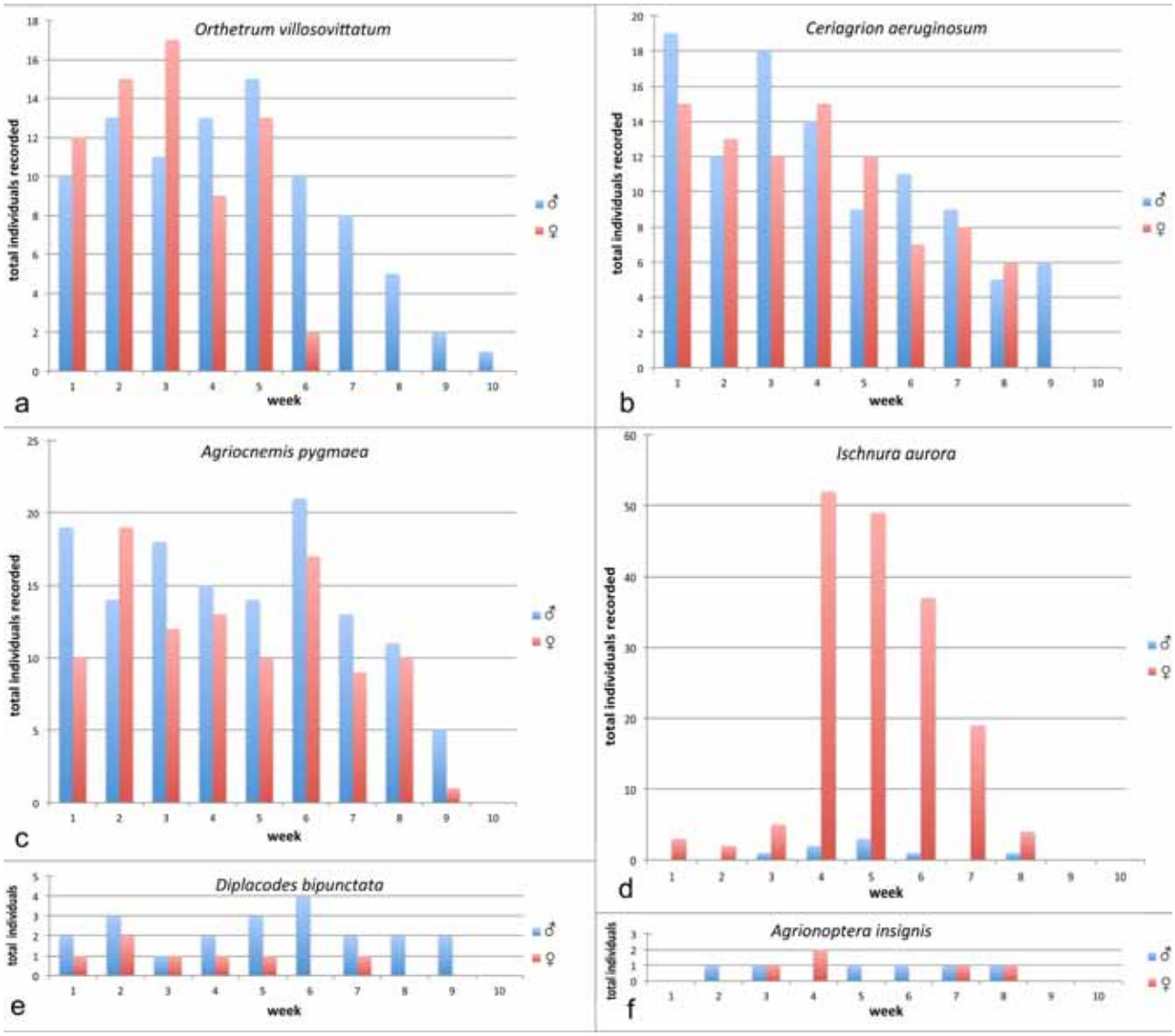

Figure 2. Weekly counts of male and females of six species at the pond during the study period: (a) *Orthetrum villosovittatum*, (b) *Ceriagrion aeruginosum*, (c) *Agriocnemis pygmaea*, (d) *Ischnura aurora*, (e) *Diplacodes bipunctata*, (f) *Agrionoptera insignis*.

Species accounts

Orthetrum villosovittatum (Figure 3)

This species only visited the pond for reproduction and foraged elsewhere. When observations began, it was usual for a male *O. villosovittatum* to be perched in full sunlight about 30 cm above the water on the blades of the Mat-rush *Lomandra longifolia* at the western end of the pond from ca 0900h until 1530h. This is a sunny part of the pond and commands a good view of the entire front garden helping them to intercept incoming females. Territorial disputes with other males sometimes occurred with up to four males fighting at once. Occasionally a second male perched at the other end of the pond but I never saw one maintain this position for more than ten minutes; for most of the time there was just one resident male mating with all arriving females. Brief altercations also occurred between the resident *O. villosovittatum* male and males of the smaller red libellulids *Diplacodes bipunctata* and *Agrionoptera insignis*. However conflict was largely avoided by the different perching habits of these two less common species.

Figure 3. *Orthetrum villosovittatum* male.

Females began arriving around 1000h and were typically mated several times between bouts of non-contact guarded oviposition. Unguarded oviposition occurred mainly when the male was occupied with another female. Up to three females were recorded in an hour on any given day, but if the weather was overcast they tended not to appear, whereas there was normally a male on station unless it was actually raining.

O. villosovittatum showed a normal abundance pattern (Figure 2a) but oviposition activity almost ceased at the end of April and hence almost no females were recorded in May. The very last record of any species for the year was a male that flew over the pond briefly without perching, on May 27th.

Ceriagrion aeruginosum (Figures 4, 5)

C. aeruginosum mainly utilised the pond for breeding (Fig. 4). They mostly foraged in nearby undergrowth, generally within about 30 m of the pond. Late in the season when reproductive activity had almost ceased both sexes foraged over the pond, taking various small Diptera,which were very numerous, and sometimes other damselflies such as *Ischnura aurora* (Fig. 5). At the start of the observation period adults were active from about 0800 to 1400h and a great deal of reproductive behaviour was observed. At times up to four tandem pairs were ovipositing into hydrophytes, especially water lilies, at any one time. The more shaded parts of the pond were preferred and couples tolerated each other. Males awaiting the arrival of receptive females also perched within one metre of each other without apparent conflict.

The abundance of both sexes declined steadily with the approach of winter (Fig. 2b). By mid May oviposition had ceased but a few females were still present foraging over the pond. Late in the season males seldom appeared before 1200h and usually had departed by 1400h. In the second last week there was only ever a single male perched about 20-40 cm above the water and no individuals of either sex were seen in the last week.

Agriocnemis pygmaea (Figures 6, 7, 8)

Mature adults of this tiny species spent almost all their time on or at the margins of the pond where they foraged, mated and oviposited. Both sexes perched on emergent stalks of vegetation a few centimetres above the water. They showed no preference for any particular part of the pond. Typically, in the early part of the study, there were two to four males maintaining territories and a similar number of females. These numbers gradually dwindled during May (Fig. 2c), with none observed in the last week. Towards the end of the study males were distinctly darker than normal (Fig. 6), but whether this is age related or a seasonal effect is unclear.

Males were quite aggressive to each other, vigorously attacking any conspecific intruder that came within about a metre of their perch. On one occasion a male *Ischnura aurora* that perched on a low twig in the

Figure 4. *Ceriagrion aeruginosum* in the wheel.

Figure 5. *Ceriagrion aeruginosum* female eating a female *Ischnura aurora*.

Figure 6. *Agriocnemis pygmaea* male, in early May, showing dark coloration.

Figure 7. *Lispe* sp. (?*sydneyensis*) scavenging a dead male *Agriocnmis pygmaea*.

centre of the pond was driven off by repeated attacks from a nearby *A. pygmaea* that was perched half a metre away. On another occasion a male attempted to mate with a female *I. aurora*. On encountering a perched female conspecific a male typically hovered about 10 cm in front of her for a few seconds and then suddenly pounced on her. I observed this behaviour on at least 12 occasions and only once did it result in a mating. Once a female, in trying to escape a male, flew into the web of a small unidentified spider; she managed to break free but the next day a female, probably the same individual, was found dead in the web. Relatively few copulations were seen and while oviposition was observed at least 15 times, it was more common to see females perched; both sexes were regularly observed catching and eating small Diptera around the margins of the pond.

Throughout the study, especially in May, dead individuals were found floating in the water or spread-eagled on the top of lily pads. One dead male (Fig. 7) was scavenged by a muscid fly (*Lispe ?sydneyensis*) which were numerous at the pond. Flies of this genus specialise in preying on other small insects or feeding on invertebrate carrion. It is unlikely in this case that the fly would have been able to capture and kill the damselfly unless it was already moribund.

Freshly emerged individuals, which continued to appear as late as the first week of May, flew a few metres from the pond and remained in nearby undergrowth and shrubbery for some days (Fig. 8). Nevertheless it is likely that for this species, following maturity the pond is the centre of all activity until death.

Ischnura aurora (Figures 9, 10, 11)

Only females of this species were regularly seen at the pond. Males (Fig. 9) occasionally foraged in undergrowth around the pond but more commonly spent their time in a patch of high shrubbery some metres distant where they maintained small territories; during disputes they hovered face to face about 5-10 cm apart and flicked up the terminal blue spot on their abdomen in a clear agonistic display. It was here too that mating occurred, typically before noon. Few matings were observed, partly because the main area of sexual activity was removed from my observation post, but it is likely that females mate infrequently and briefly, given the dearth of observations. On the other hand several instances of males and females feeding on small Diptera in this peripheral shrubbery were recorded.

The phenology of *I. aurora* in 2020 differed from other species in that only low numbers were present in March, but this was followed by a strong surge in mid to late April tapering away in May (Fig. 2d). Females spent long periods ovipositing into hydrophytes at or just under the surface of the water (Fig. 10). At times up to 15 individuals were present simultaneously scattered over the whole pond and these oviposition bouts lasted up to an hour. Females only occasionally perched by the pond and were never seen foraging there, but in

Figure 8. Immature female *Agriocnemis pygmaea* in nearby shrubbery.

Figure 9. Male *Ischnura aurora* in shrubbery.

Figure 10. Female *Ischnura aurora* ovipositing.

Figure 11. *Dolomedes facetus* spider preying on female *Ischnura aurora* captured while ovipositing.

the last week perched females were more common in the cooler weather. During April some females were on the pond from about 1000-1500h, but by mid May this activity period had contracted to 1200-1300h.

Ovipositing females were vulnerable to predation, by *Ceriagrion aeruginosum* (Fig. 4) and by *Dolomedes facetus* (Fig. 11). Nevertheless it was remarkable given the high density of both *D. facetus* and ovipositing *I. aurora* that only one instance of predation was witnessed. Perhaps this was because there was an abundance of slow moving emerging froglets on which the spiders also fed.

Diplacodes bipunctata (Figures 12, 13)
D. bipunctata males were sometimes present at the pond where they perched low on lily pads in full sunlight, typically staying several hours (Fig. 12), and in a nearby driveway 20 m away where they foraged. Females occasionally visited, perching (Fig. 13) and ovipositing. No matings were observed and oviposition took place unguarded. Overall numbers were low (Fig. 2e).

Agrionoptera insignis (Figures 14, 15)
A. insignis males tended to perch high, in shade or semi-shade (Fig. 14), and seldom stayed more than an hour. Females (Fig. 15) also occasionally visited and oviposited but rarely were males and females present at the same time. No matings were observed and oviposition took place unguarded. It was surprising that this mainly northern species was present in low numbers even in May (Fig. 2f).

Other species
The other species recorded were *Austrolestes leda* (both sexes), *Austroagrion watsoni* (male), *Argiocnemis rubescens* (male - Fig. 16), *Ischnura heterosticta* (female androchrome - Fig. 17), *Anax papuensis*, *Diplacodes melanopsis* (male) and *Orthetrum sabina*. It was notable that these species tended to appear immediately after rain, perhaps because they were stimulated to search for new temporary water habitats. The abundance of regular visitors such as *O. villosovittatum* and *I. aurora* tended to increase at these times as well.

Appearences ranged from very ephemeral visits of a few seconds (*A. papuensis*, *O. sabina*) to a three day vigil by *A. rubescens*. This species was not recorded in my previous article (Orr, 2020) but that was an oversight – it has been seen at the pond before. In this case a single male appeared on 28/4 at about 1400h and remained until 1700 h. It returned on the next two days, always perching in quite deep shadow at the western end of the pond, arriving as early as 0900h and remaining until 1600h or later.

Further observations
At present (16th June) all activity is ceased and it is unlikely there will be any sightings of adult Odonata until September. Next season I hope to resume systematic counting to obtain a full year's results.

Figure 12. Male *Diplacodes bipunctata* perching on lily pads.

Figure 13. Female *Diplacodes bipunctata*.

Figure 14. Male *Agrionoptera insignis* perched high in semi-shade.

Figure 15. Female *Agrionoptera insignis* perched after oviposition.

Figure 16. Male *Argiocnemis rubescens* perched in shady spot.

Figure 17. Female androchrome *Ischnura heterosticta*.

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In memoriam: Venelin Beschovski (1933–2019)

Milen Marinov[1]*, Alexi Popov[2] & Toshko Ljubomirov[3]

[1]Biosecurity Surveillance & Incursion Investigation Plant Health Team, Ministry for Primary Industries, 14 Sir William Pickering Drive, Christchurch 8544, New Zealand [milen.marinov@mpi.govt.nz]
[2]National Museum of Natural History, Bulgarian Academy of Sciences, 1 Tsar Osvoboditel Blvd, BG-1000 Sofia, Bulgaria [alpopov@nmnhs.com]
[3]Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, 1 Tsar Osvoboditel Blvd, BG-1000 Sofia, Bulgaria [toshkoljubomirov@gmail.com]
***Corresponding author: [milen.marinov@mpi.govt.nz]**

The 2nd of December, 2019 brought tragic news to the Bulgarian entomologists and world experts in the insects groups of Diptera and Odonata about the sudden departure of Prof. Venelin Lazarov Beschovski. A distinguished mentor and friend to a large majority of the contemporary generation of Bulgarian entomologists, Prof. Beschovski is honoured by his students and colleagues as an extremely passionate researcher, endless optimist and strikingly humble personality. The legacy left behind is measured in six books (four monographs and two popular books) and 167 articles (149 scientific and 18 popular papers). What is unmeasurable is in our memories and discussions in the office, field trips and friendly talks with one of the most prominent Bulgarian entomologists.

Figure 1. Professor Venelin Beschovski in 2018 aged 85.

Venelin Beschovski (Fig. 1) made remarkable progress in his profession: Deputy Director of the Institute of Zoology; Head of the Department of Taxonomy, Faunistics and Zoogeography of the Institute; Chairman of the Scientific Council on Zoology and Ecology; member of the editorial boards of several scientific journals. His academic career was similarly distinguished: Doctor of Philosophy (1973), Associate Professor (1975), Doctor of Science (1984) and Professor (1986). During this time he described four new genera and subgenera and 36 new species of Diptera from Europe, North Africa and West Asia. He reported as new for Bulgaria 16 families, several subfamilies, a number of genera and 560 species. Some of these genera and species are new to the Balkan Peninsula or Europe. A bibliography of Prof. Beschovski's most important contributions to the study of the Bulgarian Odonata fauna follows this article.

Venelin Beschovski was born on 4th April 1933 in Knezha, north Bulgaria. His earliest studies on the Bulgarian dragonflies were influenced by Prof. Alexandar Valkanov, Head of Department of Hydrobiology in St. Kliment Ohridski University of Sofia. Venelin Beschovski, then a young student, began his research with one of the most attractive insect groups which, unfortunately, had been neglected by the majority of the Bulgarian entomologists at the time – 1960s. With the exception of a single paper published more than 40 years previously, information on the Odonata fauna in the Bulgarian literature had been scattered in short notes in mainly regional faunistic studies. There was virtually no information on the distribution of taxa within the country, ecology and pre-imaginal stages. All these gaps have been gradually filled by the publications of V. Beschovski, starting with his first contribution on the high mountain glacial lakes and bogs of the Rila Mountains, based on the material collected by Prof. A. Valkanov.

Prof. Valkanov played a significant role in the scientific career of the young V. Beschovski, employing him first as an assistant in what is now the Institute of Fish Resources, Varna. In this new job V. Beschovski continued to investigate the main subject of his thesis from the graduation from the University of Sofia - Odonata nymphs

(Figs 2–3) - until a few years later when he was assigned to the study of the Diptera fauna of the saline habitats along the Bulgarian Black Sea coast. During this time (more than 10 years) he published several very important contributions on the distribution and ecology of the Bulgarian dragonflies. They were dedicated to the fauna of the Bulgarian Black Sea coast (33 species), North (36 species) and South Bulgaria (47 species) and included both imago and nymphs. Six species were recorded as new to Bulgaria as well. Among the most significant discoveries during this period was the record of the new to the country family Euphaeidae with *Epallage fatime* penetrating the Balkan Peninsula along the Black Sea coast. Other new genera included *Caliaeschna* from the northern section of the Bulgarian Black Sea coast and *Cordulia* from Srebarna Reserve, near the Danube River. New to the country species were: *Erythromma najas* from Rabisha Lake (NW Bulgaria), *Coenagrion scitulum* from South Bulgarian Black Sea coast and *Aeshna cyanea* from Smolyan lakes (Rhodopes Mountains).

The intensive field collections and detailed studies of V. Beschovski resulted in the first in depth ecological analysis of the Odonata nymphs and their adaptations for life in running and standing waters in Bulgaria. Lentic water (limnophilous) inhabitants were found to be more numerous than lotic ones (rheophilous). Both major groups of nymphs were further split into epiphytic (phytophilous) and benthic. Rheophilous nymphs were found to inhabit a wide variety of coenoses: lithophilous, pelophilous, psammophilous and rarely argilophilous, whereas the limnophilous benthic species were discovered in the pelophilous coenosis only. Limnophilous nymphs were found to inhabit both temporary and permanent water bodies. As one can expect, the nymph stage in temporary waters is shortened to only 3–4 months.

Figure 2. Rhodopes Mountains, Chudnite Mostove, 1961; from left to right: Bulgarian zoologists Venelin Beschovski, Dimo Bozhkov and Wesselin Naidenow.

Venelin Beschovski's analysis revealed that rheophilous nymphs (in contrast to limnophilous ones) have certain adaptations for their life in running waters: more dorso-ventrally flattened body, enlarged ventral body surface for better adhering to the substrate, enlargement of a particular antennal segment, reduced swimming ability and in Zygoptera lengthening and hardening of the caudal lamellae. These general character states are better pronounced in benthic than epiphytic species. Another analysis was made on the shape of the mask, body hairiness, presence/absence of extra spurs for digging, and numbers of the tarsal segments.

Figure 3. Pirin Mountains, First Georgiisko Lake, 1963.

After these considerable contributions to the ecology of the Odonata nymphs, Venelin Beschovski got more involved in studies on Diptera along the Black Sea coast. He gradually expanded the scope of his research and gained a reputation as one of the prominent European taxonomists in these insects. About 20 years later in his career, as a professor, he returned to the dragonflies and, without entirely giving up on Diptera, he embarked on the very ambitious task of reviewing and summarising the knowledge on the Bulgarian Odonata. A faunistic list of the known species and subspecies was published. It was based on a critical review of the literature which resulted in removal of seven species and one subspecies from the Bulgarian list. Prof. Beschovski was critical not only of earlier twentieth century studies but of his own publications and he excluded the following species proposed by him: *Calopteryx haemorrhoidalis*, *Aeshna grandis*, *Cordulegaster annulatus* and *Somatochlora alpestris*. This way the number of species was reduced from 71 to 64, which were included in the Fauna of Bulgaria, vol. 23, Odonata – the pinnacle of Prof. Beschovski's odonatological studies of Bulgaria. It is a richly illustrated monograph with figures of morphological features, descriptions and keys to both imagoes and nymphs. The distribution of all 64

Figure 4. Venelin Beschovski collecting Odonata in the Rila Mountains, above Rila Monastery, 1997.

species (24 Zygoptera and 40 Anisoptera) was mapped for the first time. The key also included species which might be found in Bulgaria. This volume is unique in being the only one from the series which treats imago and pre-imaginal stages of any insect order equally in Bulgaria. Later, Prof. Beschovski authored two more volumes of Fauna of Bulgaria on Diptera. He also added later another genus and species to the list of Odonata, *Selysiothemis nigra* from southwestern Bulgaria.

Later published odonatological studies of Prof. Beschovski were mainly dedicated to preparing the National Strategy for Conservation of Bulgaria's Biodiversity, regional faunistic investigations crucial for the development of management plans for two of the Bulgaria biodiversity hot spots (Central Balkan and Rila, Fig. 4) and a chapter on Odonata in a monograph on biogeography and ecology of Bulgaria.

The last active work on Odonata was in 2014 when Prof. Beschovski identified about 800 imagoes of at least 45 dragonfly species collected from all over the country in relation to the work on NATURA 2000.

Prof. Beschovski's life time collections are presently held at the Institute of Biodiversity and Ecosystem Research. These are two very rich depositions of imagoes of more than 80 species from Bulgaria, Malaysia and Morocco as well as nymphs of at least 40 Bulgarian species.

Prof. Venelin Beschovski remains in our memories not only from the compilations of studies on his two favourite insect groups. He was undoubtedly one of Bulgaria's leading taxonomists but despite his scientific titles and high rank in his job, Prof. Beschovski remained the humble and ever shy person we knew from the first years in his scientific career. In field studies, he was one of the first from the scientific team to get out in the morning and start collecting, always worrying about successful completion of the job until the final publication. The dedication to study was a defining character of Prof. Beschovski. The determination to achieve whatever the task would be was not just easy to see but also feel from his strong handshake, which was in strange contrast with the flushing redness on his face – so easily provoked. The smile was always on his face – when chairing the Scientific Council or even when at the age of 64 climbing steep slopes of the Central Balkan for collecting insects. His laugh was contagious because it came with rhythmic waves of his shoulders and sudden back tilts of his head.

Prof. Beschovski was a caring mentor to all of his co-workers and visitors to his office. His busy schedule as a responsible head and organiser of the life in the Institute of Zoology was never an obstacle to receiving a colleague and having a chat on entomology related issues, giving encouraging advice on future research ideas related to filling the gaps in our understanding of the diverse entomofauna of Bulgaria. His guidance and great experience will be missed but never forgotten.

Odonata bibliography of Professor Venelin Beschovski (1933–2019)

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Odonata assemblages in Akure Forest Reserve, southwestern Nigeria

[1*]Adu, B.W, and [2]Ogbogu, S.S

[1]Department of Biology,Federal University of Technology, Akure,
Ondo State, Nigeria. E-mail: [williamsadubabs@yahoo.com, bwadu@futa.edu.ng]
[2]Department of Zoology, Obafemi Awolowo University, Ile-Ife 220005, Osun State,
Nigeria. E-mail: [slyd58@yahoo.com, sogbogu@oauife.edu.ng]
*corresponding author

Abstract
A survey of adult dragonflies and damselflies of Rivers Alatori, Aponmu and Owena in Akure Forest Reserve was undertaken with the aim of determining the species assemblage patterns in them. A total of 517 individuals of dragonflies (339) and damselflies (178) was collected, representing 48 species in three families of dragonfly and five families of damselfly. *Trithemis arteriosa* was the dominant dragonfly and well represented in the rivers. *Chlorocypha curta* dominated the damselflies with 21 individuals. Species diversity in River Owena was the richest (Margalef index d = 6.267, Simpson's dominance index = 0.7419, and Shannon Wiener H` = 2.446). The distribution of species was best in River Alatori (Evenness E = 0.3511 and Equitability = 0.6787). Simpson diversity t-test indicated that there was no significant difference in the species diversity among the three rivers studied in Akure Forest Reserve at $p < 0.05$ (P1: p-value 0.89592, P 2: p-value 0.89497, P 3: p-value 0.99972). Although the forest is under considerable human disturbance the ecosystem is still conducive for a fairly large number of species of Odonata. Species of some interesting genera such as *Gynacantha*, *Sapho, Umma* and *Chlorocypha* were also encountered in the forest. However, a large percentage of species sampled at the forest are ubiquitous, indicating the effect of disturbed environment with altered ecosystem integrity.

Keywords: Akure Forest Reserve, rivers, human disturbance, biodiversity, biotic indices.

Introduction
Freshwater bodies around the world are drying up due to overexploitation (Akindele *et al.*, 2014) in spite of increasing ecosystem conservation awareness (Fernández-Díaz, 2008). It is obvious that freshwater ecosystems are under threat especially from human population increase and climate change. Dudgeon *et al*. (2006) grouped the main threats under five interacting categories: over-exploitation, water pollution, flow modification, destruction or degradation of habitat and invasion by exotic species. Apart from loss in size of freshwater bodies, there is corresponding loss of aquatic biota. For instance, Odonata (dragonfly and damselfly) exhibit differential tolerance to changes in environmental conditions hence they readily indicate the levels of ecosystem stress. The varying tolerance to pollution and other ecosystem stress exhibited by different species of Odonata is responsible for their functional role as a tool for monitoring water quality. This study attempts to assess odonate species assemblages with the overall aim of having an insight into the ecological integrity of Rivers Alatori, Aponmu and Owena in Akure Forest Reserve. Since the rivers are affected by varying degrees of human activities, it is hypothesized that there will be differences in the diversity of their odonate species.

Apart from the works of Adu *et. al*, (2015), studies targeted at assessing freshwater ecosystem integrity have focused mainly on the use of macroinvertebrates or physico-chemical water quality (e.g. Ikomi and Arimoro, 2008). However, the use of a single taxonomic group such as Odonata in water quality assessment of rivers tends to provide a more accurate picture.

Study area
Akure Forest Reserve covers an area of 69.93 km^2 and is located between Owena and Aponmu villages along Ondo-Akure road, about 20 km south of Akure, extending to part of Osun State, along Ile-Ife - Benin express road (07°11.94′ N to 07° 13.57′N and 005° 01.12′E to 005° 02.92′ E) (Figure 1). The forest is managed by the Federal Ministry of Environment in conjunction with Ondo State Ministry of Agriculture and Natural Resources The water bodies in the forest include Rivers Owena, Aponmu, Apurere, Aro, and Alatori. Others include Elemo stream and Ago-Store pond. Rivers Owena, Aponmu and Alatori are the major ones.

The human activities associated with the water bodies include laundry, palm oil, cassava and rice processing, as well as recreation activities (Figure 2A and 2B). Other human activities at the forest include deforestation (Figure 2C), irrigation, agrochemicals in run-offs from the farms, and dumping of domestic waste into the water channels. Human excreta were also seen littering the rock at the banks of the rivers, especially at Rivers Aponmu and Owena.

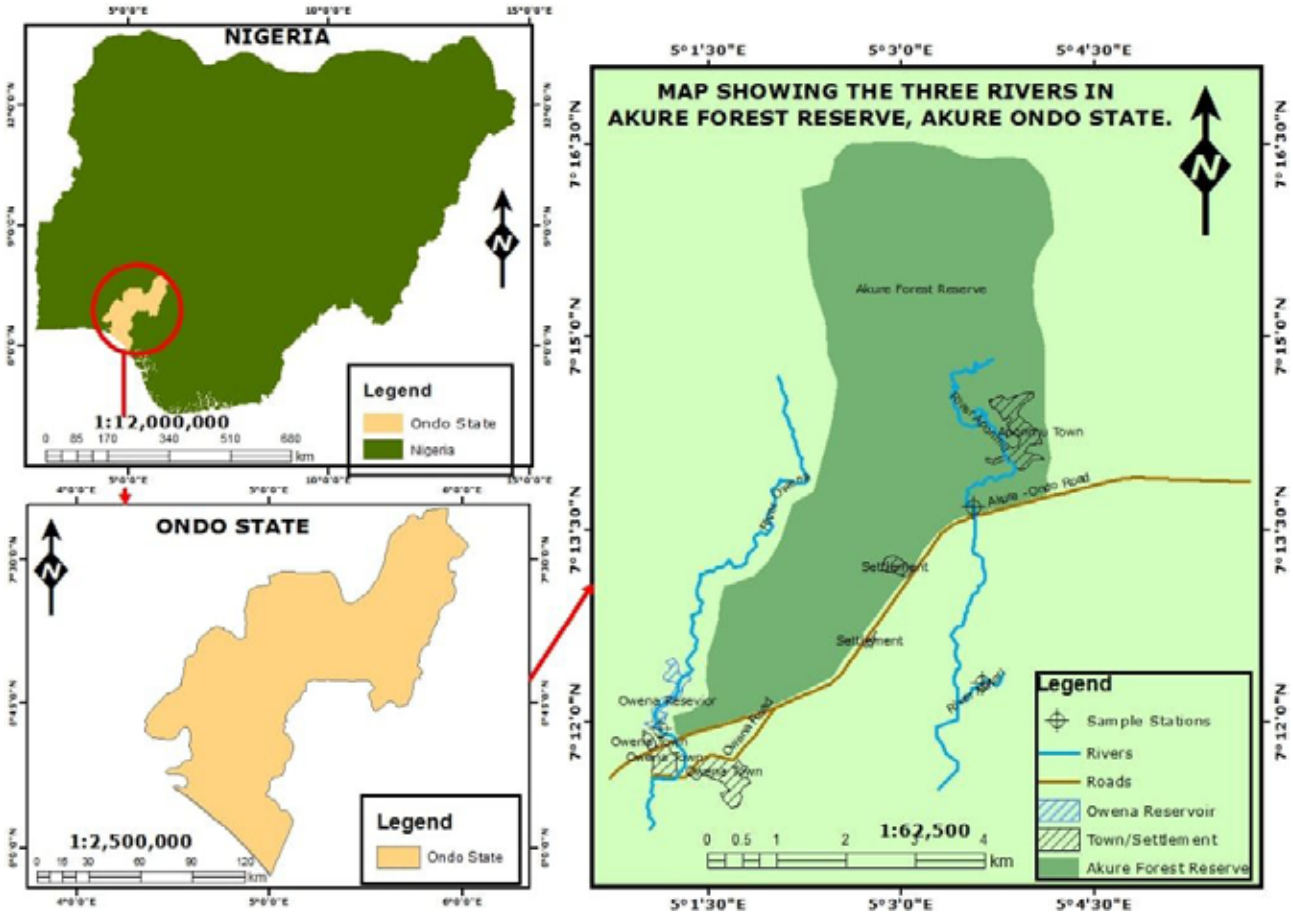

Figure 1. Maps of Rivers Alatori, Aponmu and Owena in Akure Forest Reserve.

Figure 2. (A) Domestic waste at the bank of River Aponmu by Aponmu village. (B) Palm oil pulp pressing trench at bank of River Aponmu in Aponmu village. (C) Harvested logs of wood between Aponmu and Owena in Akure Forest Reserve. (D) A section of River Alatori in Akure Forest Reserve, Akure.

Methods

Sampling procedures

Sampling of specimens at the study sites was carried out once a month for six months at the littoral portions of the rivers using sweep net, between 9.00 am and 4.00 pm on sampling days. This period was chosen because most dragonflies and damselflies are photophilic. The sampling methodology is consistent with Kipping *et al*. (2018). All specimens collected were taken to the laboratory for identification

Data analysis

To determine the species diversity at each site, Simpson's dominance index, Shannon-Wiener diversity index (H') and Evenness (E) were used (Watanabe *et al*., 2004). The higher the value of H', the greater the diversity and the cleaner the environment (Ameilia *et al*., 2006). Mean comparison of the species diversity of species collected at the three study sites were carried out in order to determine the similarities in the occurrence of species at the study sites. Diversity of odonates at the rivers was compared using Simpon's diversity index t-test. This was done in order to determine the similarity and dissimilarity in the community structure of the fauna at the rivers.

Result and Discussion

Odonate composition at the three rivers

A total of 517 individuals of dragonflies (339) and damselflies (178) was collected at the three rivers, representing 48 species in three families of dragonfly and five of damselfly (Table 1). All the eight families were found present at the three rivers except Gomphidae which was not collected at River Alatori. River Owena had the largest number (215) of individuals while Alatori (101) had the least. The dominant species in this study was *Trithemis arteriosa* which was well represented at all the rivers. *Chlorocypha curta* dominated the damselflies with 21 individuals. Two dragonflies, *Dilpacodes lefebvrii* and *Hadrothemis infesta* were the least collected species, with only two individuals of each.

Given its high adaptation potential, *Trithemis* can be found in any kind of water (Damm *et al*, 2010) hence species of the genus are known to be widespread all over Africa. They are generally grouped into red-vein and dark-vein based on the colour of the wing venation (Ameilia et al 2006, Samways 2008, Damm et al 2010, Dijkstra and Clausnitzer 2015). *Trithemis arteriosa* belongs to the red-vein group, associated with open landscape and cosmopolitan in distribution. This species was found in abundance at the reaches of all the rivers despite the prevailing human activities along the banks of the water. *Chlorocypha curta* was the dominant damselfly collected in this study. The species occurred more in River Alatori and can be seen flying along the banks of the rivers on sunny days. *Chlorocypha curta* usually appeared dull when the weather was cold, and brightly coloured on sunny days. This changes in colour is physiological and known as reversible temperature-induced colour change (RTCC) (Corbet 2004). The genus *Chlorocypha* is usually beautifully coloured (especially the males) and commonly found in running waters in the forest. The young adults and the females are not as attractive as the males. Adetunji and Parr (1974) also observed this colour change in some other odonates. *Diplacodes lefebvrii* was scarce at three rivers; it prefers open marsh habitats (Dijkstra and Clausnitzer 2014). More of this species were expected to be found in parts of the rivers that were marshy. *Hadrothemis infesta* is another scarce odonate in this study. It is a forest species, but has preference for standing water which could be the reason why it was scarce at the three rivers ((Dijkstra and Clausnitzer 2014). Lestidae was the least represented family in this study. Only a single species (*Lestes virgatus)* was sampled out of over 80 species known worldwide, which could be due to the types of water bodies sampled (Dijkstra and Clausnitzer 2014). According to Dijkstra and Clausnitzer (2014), members of the family thrive in standing water. Their scarcity could be attributed to their choice of habitat.

Community structure and diversity assessment of odonates at the three rivers

The diversity of Odonata at the three rivers was fairly close considering values of diversity indices obtained (Table 2). The t-test of species diversity revealed that River Owena was the richest (Margalef index d = 6.267, Simpson's dominance index = 0.7419, and Shannon Wiener H` = 2.446). The values for the evenness and equitability revealed a spread (even distribution) of the species among the three rivers, but the spread was best at River Alatori (Evenness E = 0.3511 and Equitability = 0.6787).

Generally, Simpson index is used to assess dominance, the values obtained in this study revealed that Aponmu and Owena have the same dominance value (0.7419) with Alatori having the minimum value (0.7365). The Shanonn-Wiener index (H`) values for the three rivers ranged between 2.211 (Alatori) and 2.446 (Owena). According to Stub *et al.* (1970), values above 3.00 are indicative of stable environmental condition. The highest H' obtained at Owena is not up to 3.00 and cannot be said to a stable environmental condition. All the H' obtained in this study are above 2.00 which Stud *et al* (1970) considers a moderately polluted condition. Therefore Akure Forest Reserve cannot be said to be unpolluted.

Table 1. Odonata of Rivers Alatori, Aponmu and Owena in Akure Forest Reserve

Taxa	Alatori	Aponmu	Owena	Total
ANISOPTERA				
Aeshnidae				
Gynacantha bullata Karsch, 1891	0	5	0	5
Gynacantha nigeriensis (Gambles, 1956)	0	7	6	13
Gynacantha sextans McLachlan, 1896	5	8	7	20
Heliaeshna sembe Pinhey, 1962	3	8	9	20
Gynacanthan mandericaa Gruenberg, 1902	0	6	0	6
Gomphidae				
Ictinogomphus ferox (Ramur, 1942)	0	8	9	17
Lestinogomphus angustus Martins, 1911	0	0	8	8
Libellulidae				
Acisoma panorpoides Rambur, 1842	2	6	9	17
Acisoma trifidum Kirby, 1889	0	0	6	6
Brachythemis lacustris (Kirby,1889)	0	8	0	8
Brachythemis leucosticte (Burmeister,1839)	3	5	7	15
Crocothemis erythraea (Brulle,1832)	7	7	9	23
Diplacodes lefebvrii (Rambur,1842)	0	0	2	2
Neodythemis klingi (Karsch,1890	0	0	2	2
Hadrothemis infesta (Karsch,1891)	0	0	7	7
Nesciothemis farinosa (Forster,1898)	0	0	5	5
Orthetrum brachiale (Palisot de Beauvois,1817)	0	3	0	3
Orthetrum chrysostigma (Burmeister,1839)	0	0	8	8
Orthetrum julia Kirby,1900	0	0	9	9
Orthetrum stemmale (Burmeister,1839)	0	2	2	4
Chalcostephia flavifrons Kirby,1889	0	9	4	13
Palpopleura portia (Drury,1773)	0	5	4	9
Palpopleura lucia (Drury,1773)	4	8	5	17
Rhyothemis semihyalina (Desjardins,1832)	0	0	3	3
Sympetrum fonscolombii (Selys,1840)	0	7	0	7
Thermochoria equivocata Kirby,1889	0	7	6	13
Trithemis arteriosa (Burmeister,1839)	7	8	9	24
Trithemis annulata (Palisot de Beauvoi,1805)	3	8	9	20
Urothemis edwardsii (Selys, 1849	0	6	0	6
Urothemis assignata (Selys, 1872)	4	6	8	18
Zygonyx torridus (Kirby, 1889)	0	4	7	11
ZYGOPTERA				
Calopterygidae				
Phaon iridipennis (Burmeister, 1839)	5	2	3	10
Sapho bicolor Selys 1853	2	5	1	8
Umma cincta (Hagen in Sélys, 1853)	7	1	0	8
Chlorocyphidae				
Chlorocypha cancellata (Selys, 1879)	7	5	0	12
Chlorocypha victorae (Förster, 1914)	7	3	1	11
Chlorocypha curta (Hagen in Selys, 1853)	9	8	4	21
Platycypha lacustris (Forster,1914)	6	0	0	6
Coenagrionidae				
Aciagrion gracile (Sjöstedt,1909)	1	0	6	7
Agriocnemis maclachlani Selys, 1877	1	3	0	4
Ceriagrion glabrum (Burmeister, 1839	1	0	8	9
Pseudagrion kersteni (Gerstäcker, 1869)	6	3	9	18
Pseudagrion sublacteum (Karsch, 1893)	1	2	2	5
Lestidae				
Lestes virgatus (Burmeister, 1839)	1	3	2	6
Platycnemididae				
Mesocnemis singularis Karsch, 1891	2	7	5	14
Chlorocnemis nigripes Selys, 1886	0	7	6	13
Elattoneura nigra Kimmins 1938	4	3	1	8
Elattoneura vrijdaghi Fraser, 1954	3	8	7	18
Total	**101**	**201**	**215**	**517**

Table 2. Odonata diversity at three water bodies in Akure Forest Reserve

Diversity	Alatori	Aponmu	Owena
Species	26	37	39
Individuals	202	402	430
Simpson_1-D	0.7365	0.7419	0.7419
Shannon_H	2.211	2.439	2.446
Evenness_e^H/S	0.3511	0.3099	0.296
Margalef	4.71	6.004	6.267
Equitability_J	0.6787	0.6756	0.6677

Simpson diversity t-test

The diversity of species at the rivers was compared based on the hypothesis that there will be difference in diversity of species of the three rivers. Simpson diversity t-test were conducted on pairs of the three study sites: The first pair = P1 (Alatori and Aponmu), second pair = P2 (Alatori and Owena), and the third pair = P3 (Aponmu and Owena). The findings from the analysis indicated that there was no significant difference in the species diversity among the rivers in Akure Forest Reserve at $p < 0.05$ (P1: p-value 0.89592, P2: p-value 0.89497, P3: p-value 0.99972); see Table 3. With this result the null hypothesis is rejected.

Table 3. Comparison of Odonata community structure of the three rivers in Akure Forest Reserve

	P1		P2		P3	
	Alatori	**Aponmu**	**Alatori**	**Owena**	**Aponmu**	**Owena**
Taxa Size	26	37	26	39	37	39
Simpson index	0.26345	0.25806	0.26345	0.25807	0.25806	0.25807
Variance	0.001113	0.000583	0.001113	0.000545	0.000583	0.000545
t value	0.1309		0.1321		-0.0003487	
df	412.33		402.98		828.23	
p-value	0.89592		0.89497		0.99972	

In conclusion, some challenges were encountered in the field which include lack of cooperation of the locals who thought the study was for profit making, and the problem with religious and traditional voodoo people who were there to do some religious rituals affected our sampling duration. The activities of the ritualists contributed to the contamination of the water through the dropping of fetish materials used for their sacrifice. Although the forest ecosystem is under the influence of regular human disturbance which affects Odonata assemblages, it is still conducive for a fairly large number of species. Some interesting species of *Gynacantha*, *Sapho, Umma* and *Chlorocypha* were found inhabiting the forest. However, a large percentage of species sampled at the forest were ubiquitous types which are usually associated with disturbed environment. Simpson diversity t-test which compared the three rivers in pairs revealed that there is similarity in the assemblages of Odonata at the rivers. However, River Owena was the richest in terms of species diversity, while River Alatori had the best species distribution. Finally, the forest and its water bodies which are rich in natural resources should be protected so as to prevent loss of viable natural resources.

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Annual meeting of Japanese Society for Odonatology 2019

Hide Natsume [romluna@y4.dion.ne.jp]

The 62nd. annual meeting of Japanese Society for Odonatology (JSO) was held at Kanagawa Prefectural Museum of Natural History at Odawara city, Kanagawa prefecture on November 16-17, 2019. This was the 6th time that this museum has hosted a JSO annual meeting.

I joined this event as a member of executive committees for JSO2019. Executive committee members started preparation in January of this year and held meetings in March, September and early-November besides frequent email meetings. Odawara is close to Tokyo so naturally most executive committees were members of Tokyo Odonatological Society.

The weather was fine on the morning of the third Saturday of November 2019 when committee members got together at the venue early to finish the last preparation for the meetings. Besides ordinary programmes this year we have specially arranged huge photo/painting sessions as well as displays of odonatan specimens from different parts of the world. We had to finish photo panels as well as final arrangements of displays of Odonata specimens. Most of them had already been brought into the museum before the itinerary but setting of each panel is really time consuming so a number of museum staff helped us to set up the exhibition corners in advance.

Beautiful photos of Japanese dragonflies and damselflies were finally displayed at the specially arranged exhibition room. This room was opened to the public through this weekend. Photographers were Akira Ozono, Hideto Kita, Masaki Yui and Isao Tsuji. Shigeru Kimura brought miniatures of Japanese *Aeshnidae*. Toshiyuki Teramoto, Kazutaka Ikeda, Haruki Karube and Sadayuki Ugai exhibited world-wide Odonata specimens from their personal collections.

On Saturday afternoon November 16, 2019 more than 80 members got together and registered to join the 62nd JSO annual meeting.

The committees of nature conservation were the main events of the first day and followed by general meetings, and the annual auction at the dinner party was conducted by Haruki Karube with his humorous and thoughtful talks as usual. The dinner party was held at the local restaurant "Erenna Gosso" famous for traditional Japanese fish cakes.

On Sunday November 17 seven articles and seven poster presentations were carried out, and a special seminar about "Interspecific hybrid of Odonata and latest outcome of DNA analysis" was performed by Ryo Futahashi. Latest analysis shows that *Mnais* of Izu peninsula (Shizuoka pref.) is different from both *Mnais costalis* and *Mnais pruinose*.

Out of articles Akihiro Tamada of Tohoku University gave a very interesting report about the Japanese endemic damselfly *Platycnemis echigoana*.

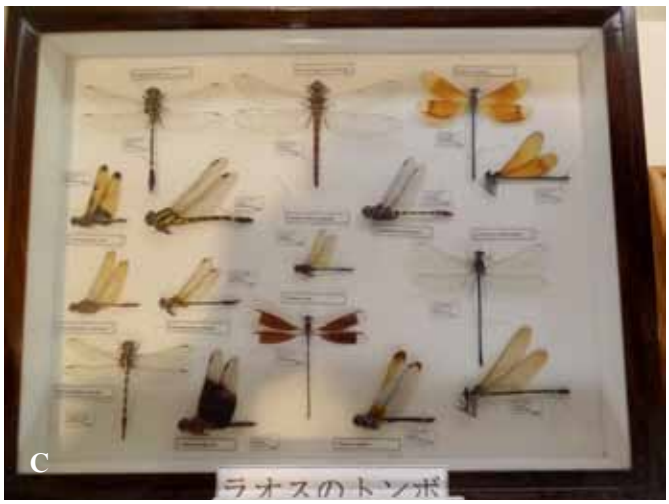

Figure 1. (A) Kanagawa Prefectural Museum of Natural History at Iriuda, Odawara. View from nearest railway station. ICO2012 was also held at this museum. (B) Photo exhibition room. More than 100 beautiful photos of dragonflies and damselflies were exhibited during the meeting. (C) Many rare Odonata specimens from Laos exhibited by Toshiyuki Teramoto.

This beautiful damselfly has long been believed as a typical lentic species and known habitats are mostly deep and large lakes in deep forests. He found two lotic habitats in Yamagata prefecture and both circumstances are quite similar to the habitat of the congeneric *Platycnemis foliacea* although there is no place where both species could be observed at the same time.

Hiroshi Jinguji gave an interesting presentation on *Pantala flavescens*. He conducted elemental analysis by microanalyzer of this species collected at various areas/countries and tried to infer where the adults originally came from. *Pantala flavescens* is one of the commonest dragonflies in most parts of Japan in summer but they are unable to survive in winter even in larvae or in egg stages.

Akio Muraki made a presentation of several interesting *Macromia* collected in Laos and Vietnam. He also discussed *Macromia muraki* and its status by DNA analysis.

Figure 2. (A) Odonata specimens from New Caledonia by Kazutaka Ikeda. (B) Odonata specimens from Hawaii, U.S.A. by Kazutaka Ikeda. (C) Miniature of 13 Japanese Aeshnidae painted by Shigeru Kimura. (D) Auction at restaurant 'Erenna Gosso' (means various delicacies). Standing with a cap and microphone is Kazuhiro Hiratsuka who is showing a dragonfly ornament brought from Sapporo. (E) Restaurant 'Erenna Gosso' has been exclusively booked for JSO members this evening. They served three different local beers brewed by the restaurant owner. (F) Bungo Kagimoto from Hiroshima holds the picture and gives an explanation about *Meganeura*.

Sadayuki Ugai gave a report about Malaysian *Aeshnids*. Most of them are not so familiar to Japanese dragonfly lovers so many attendees, especially younger generations who do not have much experience of overseas fauna, were excited to see new species to them.

Naoji Katatani presented a detailed report about a dragonfly recently collected by him in Laos. According to his close investigations this dragonfly has a typical venation of *Pseudotramea* which is originally described from Darjeeling, India

In a poster presentation Takuya Kiyoshi released data of comparison between *Cryptophaea saukra* and his own latest collection from Kaya, Myanmar.

Motoharu Fukui gave a detailed report about variations of wing color and patterns of *Ryothemis fuliginosa* This report was made from a huge analysis conducted in Shizuoka, Kikukawa, Iwata and Hamamatsu city through 2018 to 2019.

Toshinobu Nakamura and Sinichi Suda reported the latest status of *Stylurus oculatus* in Nagano prefecture. This gomphid is endemic to Japan and they say there might be an unknown oviposition site near Lake Suwa judging from observed numbers of adults near several points around the lake Suwa and rivers draining into it.

Kazuhiro Hiratsuka gave a presentation of subspecies *Sympetrum risi yosico* in Hokkaido. A certain number of *Sympetrum risi yosico* are difficult to divide from *Sympetrum risi risi* according to his investigations.

Haruki Karube made a report about *Aciagrion migratum* and *Ictinogomphus pertinax* in Kanagawa prefecture. *Ictinogomphus pertinax* is a southern species and is gradually spreading its territories to the north and east. *Aciagrion migratum* was not so common there but it is spreading its territories quickly and widely.

One open symposium about "Neonicotinoid pesticides" was organized in the afternoon and Yutaka Kameda of Chiba university of Technology was invited to progress this symposium. This special program was open to the public and nearly 500 participates were gathered in the big conference theater.

During the two-day program the bookshop Roppon-ashi (six legs) opened an outlet in the meeting room and several JSO members also made sales corners for their publications.

JSO 2019 annual meeting was carried out successfully by many Japanese dragonfly enthusiasts. Chairman of the executive committee Sadayuki Ugai made a closing speech. Haruki Karube will take over as the chairman of JSO and he appointed Sinichi Suda as vice-chairman. This was approved and announced by the directors' board. JSO 2020 will be held at Osaka.

Figure 3. (A) Seminar about 'Interspecific hybrid of Odonata and latest outcome of DNA analysis' given at the lecture theater. (B) Akihiro Tamada's presentation where he found a new habitat of *Platycnemis echigoana* at Tennou River in Yamagata prefecture. This circumstance is totally different from known habitats. (C) Motoharu Fukui's poster presentation about variations of wing color and patterns of *Ryothemis fuliginosa*.

Figure 4. (A) Poster presentation by Takuya Kiyoshi showing the details of damselflies he collected in Myanmar. (B) Hide Natsume (left) and Sadayuki Ugai (right) beside announcement board of JSO 2020 at the entrance of the museum. (C) Chairman Kenichi Watanabe (far left) made a closing speech and introduced new directors of JSO from 2020 onwards. Haruki Karube (second from left) will be the chairman.

The 3rd Indonesian Dragonfly Jamboree

Nanang Kamaludin [kamaludin.nanang@yahoo.com]
Indonesia Dragonfly Society

Not so many cities or areas in Indonesia shows a close relationship with dragonflies culturally or ecologically. But, it's different for Banyuwangi, a city in the easternmost tip of Java. The Using people (also known as Osing, the indigenous people of Banyuwangi regency) have a specific knowledge system of dragonflies. They have local names for each dragonfly based on its color or distinct species characteristics. For example they call *Zyxomma obtusum dhudhuk putih* (dhudhuk = dragonfly, putih = white) because of the species color. Not only that, the Using people also use dragonflies as symbolism in their art as captured in their song, *Untring-untring.*

With that interesting background, it's clear that Banyuwangi is the perfect place to hold the third Indonesian Dragonfly Jamboree. With the theme, "Dragonflies for Conservation and Cultural Preservation', the jamboree was held for two days (26-27th of July) in the city of Banyuwangi. There were a hundred participants from various regions in Indonesia who joined this national event. The first day of jamboree took place in 17 August 1945 University and started with seminars about 'The role of Dragonflies in Banyuwangi Culture', 'Dragonflies and Agriculture', and 'Dragonfly and Climate Change'. After the seminars, the participants continued the discussion in Kemiren village (Using tourist village). They presented and shared the results of their dragonfly observations in different cities in Indonesia.

On the second day, the participants took part in field observations in the Kalongan Forest. They also joined the Dragonfly Race and Photography Competition. The Dragonfly race is the first race about dragonflies in Indonesia where participants observe, draw and describe the dragonflies (especially the key species) they found. There are key species there such as *Amphiaeschna ampla* and *Drepanostica sundana.* In the afternoon, participants discussed the database of dragonflies in Indonesia including the distribution and preferred habitat. The participants also talked about the location of the next jamboree.

We are glad that the third Indonesian Dragonfly Jamboree can be held as an effort to strengthen the togetherness of Indonesian dragonfly enthusiasts and to develop the dragonfly database in Indonesia. A huge thanks to 17 August 1945 University and Indonesia Dragonfly Society who organized the jamboree and to all the partners who collaborated, Thanks to Bayu Catur for all photos and Tabita Makitan for editing this article.

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Figure 1. (A) The Gandrung dance welcomed all the jamboree participants. (B) Presenters on the seminar sessions. (C) amboree participants are taking photographs of dragonflies. (D) All Indonesian Dragonfly Jamboree participants.

Report on the 10th South Asian Dragonfly Meeting and Symposium 2018

Raymond J. Andrew[1], Ashish D. Tiple[2], Neha Mujumdar[3], Pankaj Koparde[4*]
[1]Centre for Higher learning and research in Zoology, Hislop College, Civil Lines, Nagpur, Maharashtra, India
[2]Department of Zoology, Vidyabharti College Seloo, Maharashtra, India
[3]Bombay Natural History Society, Hornbill House, Opp. Lion Gate, Shaheed Bhagat Singh Road, Colaba, Mumbai, Maharashtra, India
[4]School of Ecology & Environmental Management, Faculty of Sustainability Studies, MIT World Peace University, Kothrud, Pune, Maharashtra, India
***corresponding author: [pankajkoparde@gmail.com]**

The 10th South Asian Dragonfly Meet and Symposium 2018 was organized by Hislop College, in association with South Asian Council of Odonatology, DragonflySouthAsia, and Maharashtra State Forest Department (Melghat Tiger Conservation Foundation) from 3 to 6 October 2018 at Hislop College, Nagpur, India, including a three-day workshop at Melghat Tiger Reserve (Semadoh), Amravati, India. Mr Nitin Kakodkar, Additional Principal Chief Conservator of Forest (Maharashtra State), was the chief guest of the inaugural function which was presided over by Prof. D. B. Tembhare, past President, South Asian Council of Odonatology and ex-head, PGD Zoology, RTM Nagpur University. The dais was shared by the Principal of Hislop College, Dr Dipti Christian and Conveners of the Symposium, Dr K. A. Subramanian (Zoological Survey of India, Chennai) and Dr R. J. Andrew. The welcome address was followed by the release of the souvenir (in CD format). Dr R.J. Andrew, President, South Asian Council of Odonatology, and Convener of the Symposium spoke about various symposia and conferences of Odonatology organized by the South Asian Council of Odonatology held at different places in India, including the fifth, seventh and eighth at Nagpur under his leadership and also the 18th International Symposium of Odonatology which was organized by Hislop College in 2008. Dr Dipti Christian, Principal of Hislop College, lauded the efforts taken by the Department of Zoology in organizing such academic activities. She focused on the need for conservation of biodiversity and habitats. The chief guest Mr Nitin Kakodkar spoke about the similarity between tiger and dragonfly in its own biotope. He further added that the potential of the odonates is yet to be understood as they have a definite role to play in maintaining ecology in a given ecosystem, and the biodiversity to be protected. Prof. D. B. Tembhare was felicitated for his forty years of research in odonatology and being the perfect role-model teacher for his students. He informed delegates about the work undertaken by the South Asian Council of Odonatology, and the role undertaken by Hislop College in organizing various programs for the council. During the vote of thanks, Dr Andrew felicitated the persons who have helped him in organizing various odonatology symposia for the last 25 years. The list included Dr Manu Thomas (Madras Christian College, Tambaram, Chennai), Dr Gurinder Kaur Walia (Punjabi University, Patiala), Dr D.D. Barsagade, Dr S.S. Bakare, Dr S.S. Shrikhande, Dr Avinash Upadhyay, Dr Ashish Tiple, Dr Deepa Jamwal and Dr Anjali Andrew. The whole-hearted cooperation rendered by Mr M. Srinivasa Reddy, Chief Conservator of Forest and Field Director, Melghat Tiger Project, Amravati in the organization of the workshop at Semadoh, was appreciated and acknowledged.

After the address of the guests, the first session started with the Keynote address by Dr K. A. Subramanian (Odonata of the Himalayan region), followed by a plenary talk on dragonflies of Kerala by Mr Balachandran V. (General Secretary, Indian Dragonfly Society). In the second session, Mr David Raju (naturalist and author) presented a talk on the Biodiversity of Central India followed by an academic presentation by Dr Anulin Christudhas on *in silico* analysis of dragonfly defensin for its antibacterial activity. Post-lunch the participants departed for Melghat for the workshop session which was arranged at the Semadoh area of Melghat forest (21.4458 N, 77.1972 E, 564 m asl). The idea of the workshop was to provide a platform for researchers and amateurs working on odonates across India, to conduct field surveys, and to meet, interact and discuss their work. As soon as the participants reached Semadoh, Dr Ashish Tiple (Head, Dept. of Zoology, Vidhyabharati College, Selu) briefed them on the workshop schedule, activities to be undertaken and the general agenda of the workshop.

On 4th October morning, a field trip was arranged to Sipana River and Jawahar Kund waterfall in Melghat Tiger Reserve. The trip was led by Dr Ashish Tiple, Dr Gaurav Sharma (Zoological Survey of India, Solan) and Mr Shantanu Joshi (National Centre for Biological Sciences, Bangalore). Nineteen species of odonates were sighted during the trip. The field trip was followed by talks on understanding Odonata and Odonata behavioral biology by Neha Majumdar (Bombay Natural History Society, Mumbai), followed by a presentation on the taxonomy of Odonata by Mr Amila Sumanapala (Butterfly Conservation Society of Sri Lanka). Both these audio-visual lectures provided participants with basic knowledge on the identification of common odonates of the region. This session was followed by student participant presentations.

Figure 1. The 10th South Asian Dragonfly Meet and Symposium – 2018: Inauguration, keynote address, and guest speakers, 3rd October 2018.

On 5th October, field trips were arranged at Pili River, Kolkas, and Semadoh Streams of Melghat Tiger Reserve. The trips were led by Dr Ashish Tiple, Mr Shantanu Joshi and Mr Amila Sumanapala. Fifteen species of odonates were sighted during the trip. The workshop session started with a presentation by Dr Gaurav Sharma on the odonates of India. This was followed by a talk by Mr Shantanu Joshi, on Odonata biology. Later Neha Mujumdar and Dr Asani Baduri delivered a talk on citizen science in Odonata research and dragonfly identification android mobile app. Dr Gurinder Kaur Walia gave a presentation on the distribution of C-Heterochromatin, AgNORs and AT-GC-rich regions in six species of genus *Orthetrum* from India. This session was followed by presentations of student participants.

On 6th October, field trips were arranged at streams near Ghatang Village and the Walgaon River of Melghat forest. Seventeen species of odonates were sighted and identified. The participants left the Melghat Tiger Reserve and reached Nagpur at 5 pm. The workshop session ended with a talk by the Convener, Dr R. J. Andrew, who summarized the workshop activities and discussed the future plan to be undertaken by the South Asian Council of Odonatology.

During this three days field trip, 32 species of odonates were sighted from Semadoh region of Melghat Tiger Reserve forest of Central India (Table 1): 20 Anisoptera (two Aeshnidae, two Gomphidae, 16 Libellulidae), ; and 12 Zygoptera (nine Coenagrionidae, three Platycnemididae) .

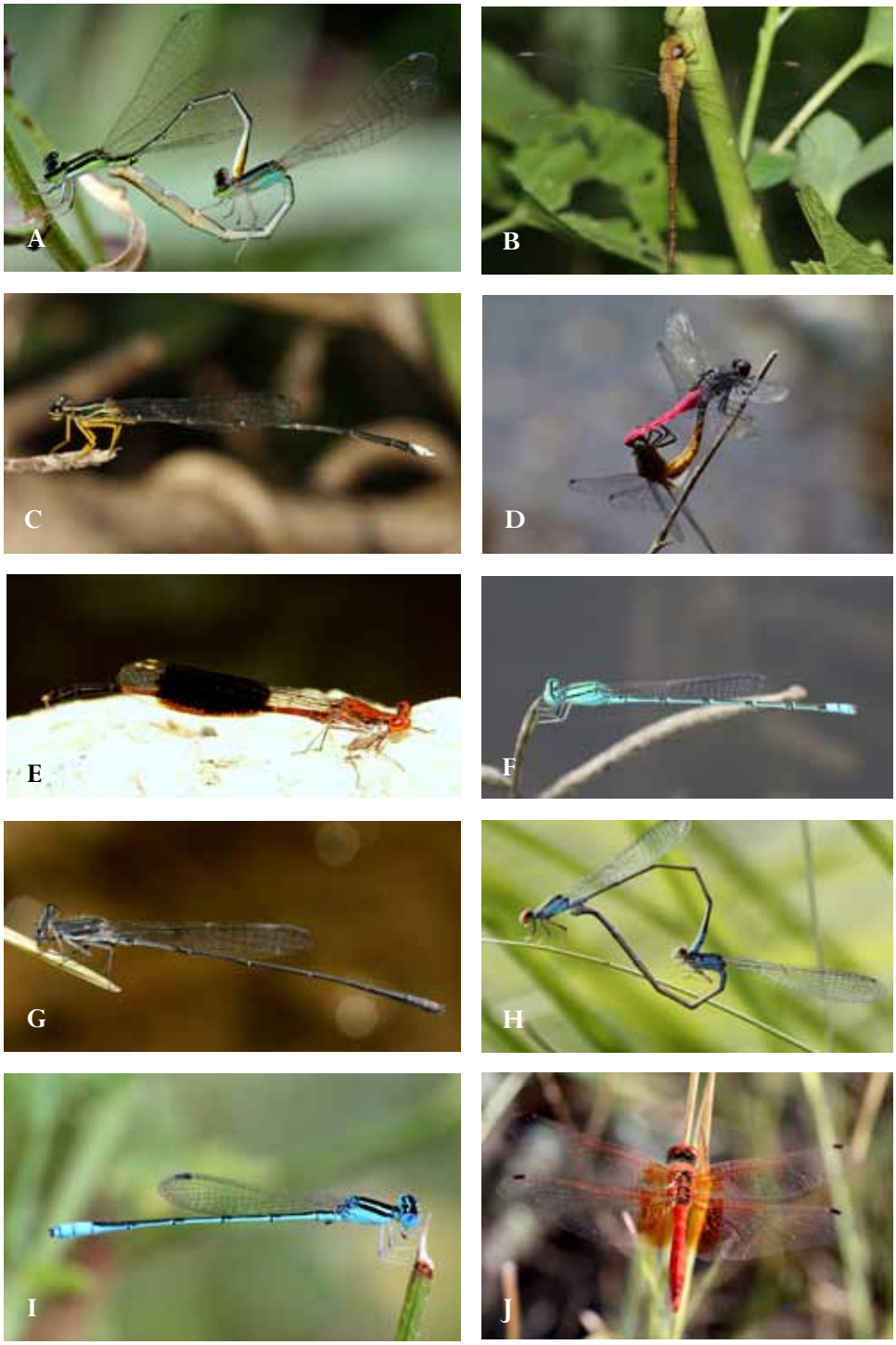


Figure 2. Some of the species sighted during the field trips at Melghat Tiger Reserve. (A) ***Agriocnemis pygmaea.*** **(B)** ***Gynacantha bayadera.*** **(C)** ***Copera marginip.*** **(D)** ***Orthetrum pruinosum.*** **(E)** ***Disparoneura quadrimaculata.*** **(F)** ***Pseudagrion decorum.*** **(G)** ***Elattoneura nigerrima.*** **(H)** ***Pseudagrion rubriceps.*** **(I)** ***Enallagma parvum.*** **(J)** ***Trithemis kirbyi.***








Table 1. The list of species observed during the three days workshop at Melghat Tiger Reserve (SR: Sipana River, JK: Jawahar Kund, PR & K: Pili River and Kolkas, SS: Semadoh Streams, GS: Ghatang Streams, WR: Walgaon River). X: Presence.

Sr. No	Scientific name	SR	JK	PR&K	SS	GS	WR
Suborder: Anisoptera (Dragonflies)							
Family: Aeshnidae							
	Anax immaculifrons (Rambur, 1842)		X				
	Anax indicus Lieftinck, 1942						X
	Gynacantha bayadera (Selys, 1891)	X	X				
Family: Gomphidae							
	Paragomphus lineatus (Selys,1850)	X	X				X
Family: Libellulidae							
	Acisoma panorpoides Rambur, 1842	X					X
	Brachythemis contaminata (Fabricius,1793)	X	X	X	X		X
	Bradinopyga geminata (Rambur, 1842)	X					X
	Crocothemis servilia (Drury, 1770)	X	X	X	X	X	X
	Diplacodes trivialis (Rambur,1842)	X	X	X	X	X	X
	Orthetrum sabina (Drury, 1773)	X	X	X	X	X	X
	Orthetrum pruinosum (Burmeister, 1839)	X	X	X	X	X	X
	Orthetrum taeniolatum (Schneider,1845)	X	X	X		X	X
	Pantala flavescens (Fabricius, 1798)	X	X	X	X	X	X
	Rhyothemis variegata (Linnaeus, 1763)						X
	Tramea limbata (Desjardins, 1832)						X
	Trithemis aurora (Burmeister, 1839)	X	X	X	X	X	X
	Trithemis festiva (Rambur, 1842)	X	X	X	X	X	X
	Trithemis kirbyi Selys, 1891	X	X	X			
	Trithemis pallidinervis (Kirby, 1889)	X					X
Suborder: Zygoptera (Damselflies)							
Family: Coenagrionidae							
	Agriocnemis splendidissima Laidlaw, 1919	X					
	Agriocnemis pygmaea (Rambur, 1842)	X	X	X	X	X	X
	Ceriagrion coromandelianum (Fabricius, 1798)	X	X	X	X	X	X
	Enallagma parvum (Selys, 1876)						X
	Ischnura aurora (Brauer, 1865)	X	X	X	X	X	X
	Ischnura senegalensis (Rambur, 1842)	X	X	X	X	X	X
	Pseudagrion spencei Fraser, 1922						X
	Pseudagrion decorum (Rambur, 1842)	X		X			X
	Pseudagrion hypermelas (Selys,1876)	X	X				X
	Pseudagrion rubriceps (Selys, 1876b)	X	X	X	X	X	X
Family: Platycnemididae							
	Copera marginipes (Rambur, 1842)	X	X	X		X	X
	Disparoneura quadrimaculata (Rambur,1842)	X	X	X	X		X
	Elattoneura nigerrima (Laidlaw, 1917)		X				

Figure 3 (p. 216). Snaps from the workshop at the Melghat Tiger Reserve (Semadoh) (4-6th October 2018).

GEODE

Geneology and Ecology of Odonata

Announcing GEODE: Genealogy and Ecology of Odonata: the first resolved evolutionary history and global biogeography of an entire insect order

Seth Bybee[1], John Abbott[2], Paul Frandsen[2], Robert Guralnick[3], Vincent Kalkman[4], Jessica Ware[5]
[1]Brigham Young University, [2]University of Alabama, [3]University of Florida, [4]Naturalis Biodiversity Center, [5]American Museum of Natural History

We are at the beginning of an exciting new dragonfly and damselfly project, that has been funded by the US National Science Foundation, which aims to comprehensively sample across Odonata for genomics, ecology, and morphology. This is a chance for us as a community to organize all current knowledge into an evolutionary context all while setting up for more focused targeted research. We strongly feel that this grant will further unite our odonate community by providing us with a foundation upon which we can all work to better understand these remarkable species well into the future.

We are excited to work with each of you. We'll be in contact with more details in the near future as we begin to build the infrastructure to generate, gather and share data. We expect to have an update for the next issue of this newsletter to describe in a more extended format the goals and details of this project.

In the meantime, we wanted to let you know that over the next two years we will be seeking both PhD students and postdocs to join this effort. We also are working on a framework where students from around the world can propose phylogenetic and/or trait based projects that focus on systematic, evolutionary, and ecological questions at the species level of small to moderate sized Odonata groups (e.g., families, genera, etc). We hope that such an approach will grow the odonate community around the world and spur an exceptional amount of growth in terms of taxonomic, ecological and morphological expertise.

Again, we are thrilled about the potential of this project for our community and hope you will join us to bring it to fruition. We view this as a truly collaborative effort, and we look forward to working with you on dragonfly and damselfly biology over the next few years and beyond!

Dr. Jessica L. Ware
[jware@amnh.org]
American Museum of Natural History

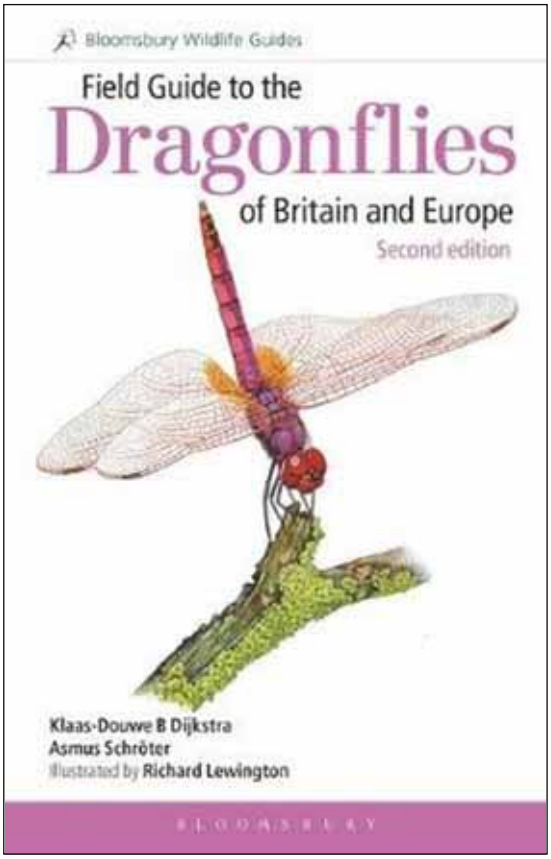
New Books
Field Guide to the Dragonflies of Britain and Europe
Second edition

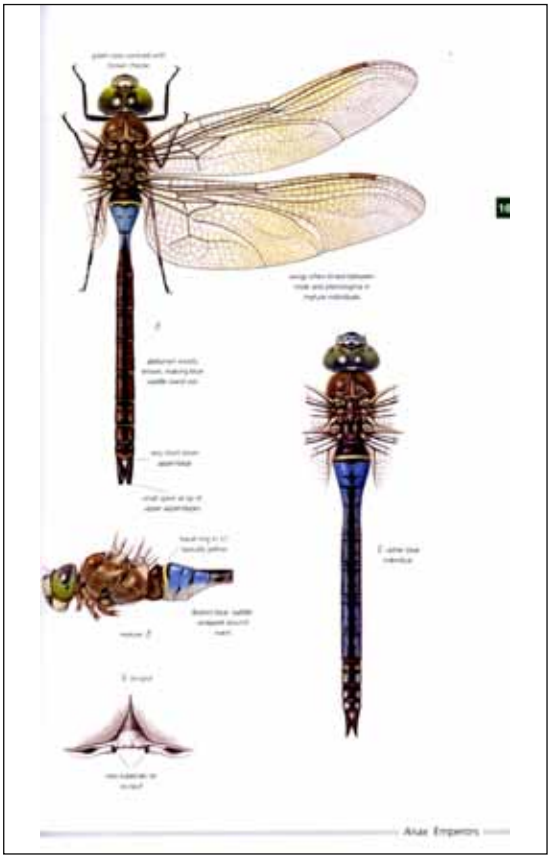
Authors: K-D Dijkstra (Author) & Asmus Schröter (Author)
Illustrator: Richard Lewington

Publication date 20 August 2020
Paperback & hardback 336 pp
ca. 1,000 illustrations, line drawings & photos
Publisher: Bloomsbury Wildlife Guides, Bloomsbury Publishing PLC, London, UK
ISBN10 1472943953 & ISBN13 9781472943958

Available: Book Depository (paperback) £22.38, US$27.60, €24,61 [Link]
Amazon (hardback) £40, ((paperback) £22 [Link]
NHBS (paperback) £19.99 + p&p, (hardback) £32.99 + p&p

The first edition of the Field Guide to the Dragonflies of Britain and Europe was a ground-breaking identification guide that led to an increase in Odonata recording across Europe. The second edition includes fully revised regional guides and identification texts, updated distribution maps and conservation statuses, illustrated accounts for five species that have been discovered in the region since the first edition, updated checklists and taxonomy, new photographs throughout, as well as an introduction to larvae identification. Each species is lavishly illustrated with artworks of males, females and variations, as well as close-ups of important characters.





Europe's Dragonflies:
A field guide to the damselflies and dragonflies

Authors: Dave Smallshire & Andy Swash

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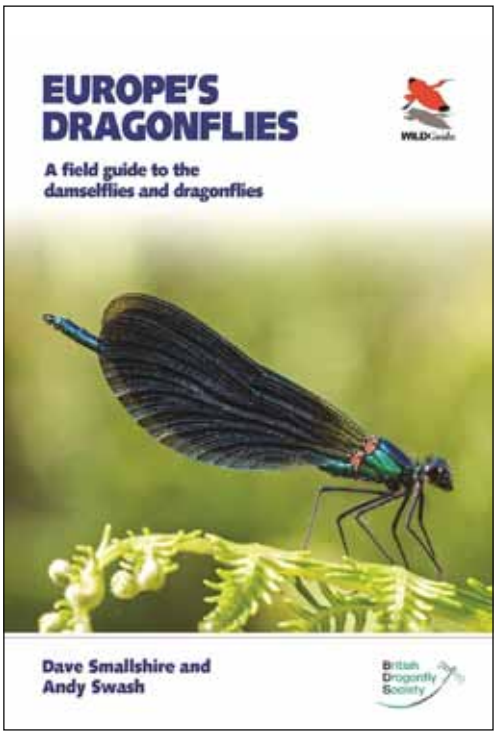
NHBS (paperback) £19.99 + p&p [Link]
Princeton University Press (paperback & ebook) US$29.95 [Link]; Amazon £18.99 [Link]

The go-to photographic guide to all the damselflies and dragonflies recorded in Europe, including the Macaronesian Islands and western Turkey

Europe's Dragonflies is a comprehensive, lavishly illustrated and beautifully designed photographic field guide to the damselflies and dragonflies of Europe. Written by two well-travelled experts, the book covers all 140 resident and vagrant species recorded, focussing on the field identification of adult insects. Concise species profiles highlight key identification features and provide information on behaviour, habitat preferences, distribution, flight periods, status and conservation. Other sections cover identification tips, conservation status and legislation. Presenting an unsurpassed selection of images of the highest quality, this is the go-to guide for anyone wishing to know more about these amazing and fascinating insects.



- Comprehensive coverage of every species of damselfly and dragonfly recorded in Europe
- Stunning colour plates showing males, females, immatures, colour forms, subspecies and typical habitat for every species
- Over 1,200 superb photographs, supplemented with illustrations of fine details
- Detailed profiles for the 140 resident and vagrant species
- Unique comparison plates for difficult groups
- Easy to use by beginners and experts alike, avoiding technical terms