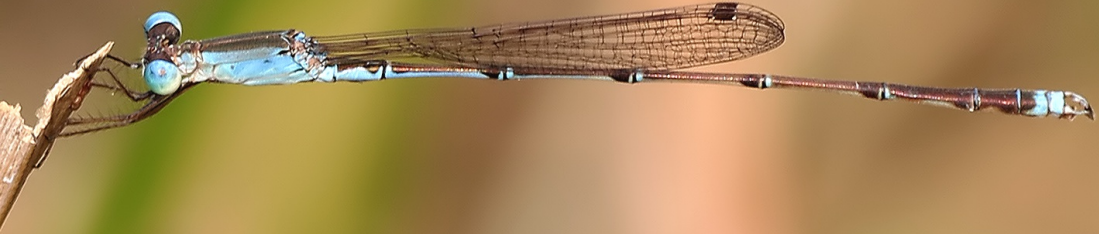


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Dennis Farrell & Noppadon Makbun

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**First records of three Lestidae species in Thailand,
with a checklist of the dragonflies known from Nam Nao National Park
and Phu Khieo Wildlife Sanctuary
(Odonata)**

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Abstract

Three lestid species, *Indolestes gracilis expressior* Kosterin, 2015, *Indolestes inflatus* (Fraser, 1933) and *Orolestes selysi* McLachlan, 1895, are reported from Thailand for the first time from records based mostly on photographs. The biology and habitats of the species are briefly discussed. A checklist of the Odonata recorded in Nam Nao National Park and Phu Khieo Wildlife Sanctuary is also presented for the first time.

Key words: *Indolestes*, *Orolestes*, damselfly, dragonfly, Odonata, new records, north-east, Thailand, checklist, Nam Nao National Park, Phu Khieo Wildlife Sanctuary

Introduction

Lestidae is a large family of damselflies distributed in almost every continent with 163 recognised species (Schorr & Paulson 2020). Ten species belonging to four genera (*Indolestes*, *Lestes*, *Orolestes*, *Platylestes*) have been recorded from Thailand (Hämäläinen & Pinratana 1999). Although new national and provincial records of Odonata have been published from Thailand (including Day et al. 2012; Makbun 2017a,b; Makbun & Fleck 2018; Sribal et al. 2018; Chainthong et al. 2020; Fleck 2020), none of these refer to any lestid species.

In this paper, new national records of three lestid species discovered in Nam Nao National Park and Phu Khieo Wildlife Sanctuary in Thailand are reported. These protected areas are situated in the Phetchabun Mountains and part of the Western Isaan Forest Complex, which covers 4,594 km² in four national parks and four wildlife sanctuaries in north-east Thailand (Fig.1). Nam Nao National Park was gazetted in 1972, covering 966 km² in Petchabun and Chaiyaphum provinces with an altitude ranging between 650 and 1,200 m asl. The park is a large mountainous forest comprising mainly hill evergreen forests, mixed deciduous forest, coniferous forest, deciduous dipterocarp forest, and some grassland areas with small streams and waterfalls. The annual average temperature is 25 °C (DNP 2020a). Phu Khieo Wildlife Sanctuary covers 1,560 km² in Chaiyaphum Province. The altitude ranges from 235 to 1,310 m asl. Phu Khieo Wildlife Sanctuary consists mainly of deciduous dipterocarp forest, coniferous forest and tropical

Fig. 1. Locations of Nam Nao National Park (red circle) and Phu Khieo Wildlife Sanctuary (yellow triangle).



grassland forest with lakes and small streams (DNP 2020b).

The odonate diversity of Nam Nao National Park and Phu Khieo Wildlife Sanctuary is still inadequately known. Three publications include records of Odonata of Nam Nao National Park. Day et al. (2012) included records of 33 species from this national park. Hämäläinen (2017: 9) added *Bayadera serrata* Davies & Yang, 1996 to the species list. Kosterin (2016) provided a record of *Onychargia priyda* Kosterin, 2015 from Nam Nao NP, photographed by Dennis Farrell. It is the same record, which was earlier published in Day et

al. (2012: 18) as '*Onychalgia atrocyana* (♂ with a highly pruinosed thorax)'. However, since this record was made '2 km S of Nam Nao town', a place not within the national park, *O. priyda* is not included in the species list of the national park (Table 1). *Rhinagrion hainanense* Wilson & Reels, 2001 was added to the list by Sribal et al. (2018). Phu Khieo Wildlife Sanctuary is a better studied area in terms of the number of species. Hämäläinen (1987) wrote a report on a dragonfly collecting trip in Thailand, which included a three-day stay at Phu Khieo Wildlife Sanctuary in June 1984. Only 24 out of more than 50 species were shown in the report without a complete checklist. Asahina (1990) recorded *Ceragrion indochinense* Asahina, 1967, *Gynacantha subinterrupta* Rambur, 1842, and *Epophthalmia vittigera bellicosa* Lieftinck, 1948. Asahina (1993) examined specimens from various locations and identified two species from this area: *Copera marginipes* (Rambur, 1842) and *Trithemis aurora* (Burmeister, 1839). Garrison & Garrison (1996) then found 45 species; of which, five species were identified at generic level.

Materials and Methods

The authors have surveyed dragonflies and damselflies in Nam Nao National Park and Phu Khieo Wildlife Sanctuary between 2009 and 2020 and their work has yielded impressive results. Besides the records of the three lestid novelties, a checklist of Odonata species known from these two protected areas is provided.

The new country records are based on the authors' high-quality photographs and voucher specimens collected. The photographer's name is given in parentheses at the end of the record. A checklist was made through the compilation of all available published records, as well as the authors' personal records. The checklist also includes unpublished records made in Phu Khieo by Amnuay Pinratana and/or his co-workers during several visits between 1981 and 1987 and by Matti Hämäläinen in 1984. The map was created with SimpleMappr (Shorthouse, 2010). The following abbreviations are used in this paper: mm = millimetre; m = metre; km² = square kilometre; asl = above sea level.

Results

New records for Thailand

Lestidae

1). *Indolestes gracilis expressior* Kosterin, 2015 (Fig. 2)

1♂, Thailand, Chaiyaphum province, Chaiyaphum, Thung Kramang lake, Phu Khieo Wildlife Sanctuary, 11-vii-2015 (Dennis Farrell); 1♂, same locality, 02-iv-2016 (Dennis Farrell).



Fig. 2. *Indolestes gracilis expressior* Kosterin, 2015. (a–b) male in life, 11-vii-2015, Phu Khieo Wildlife Sanctuary, Chaiyaphum province, Thailand, (a) lateral view, (b) oblique lateral. (c–d) male anal appendages, (c) lateral view, (d) top view. Photos: Dennis Farrell.

Indolestes gracilis consists of three subspecies: *I. g. gracilis* (Hagen in Selys, 1862) from Sri Lanka, *I. g. davenporti* Fraser, 1930 from South India, and *I. g. expressior* Kosterin, 2015 from Cambodia (Kosterin 2015). *Indolestes g. expressior* was described from Mondulkiri Province in eastern Cambodia. This subspecies can be differentiated from other subspecies by a combination of characters as follows: broad dark-bronze middorsal band with straight margin, the shape of the cerci with a foot-like apical portion and paraprocts bluntly round in dorsal view. The photographic records from Thailand fit well with the description, especially the shape of the cerci and paraprocts. It is clearly a rare species and only exists there in small numbers. This record extends its known range from Cambodia to Thailand.

2). *Indolestes inflatus* (Fraser, 1933) (Fig. 3)

1♂, Thailand, Petchabun province, Petchabun, 'Helicopter Pad' lake, Nam Nao National Park, 02-vii-2011 (Dennis Farrell); 1♂ 1♀, same locality, 09-vii-2011 (Dennis Farrell); 4♂♂, same locality, 16-vii-2011, Noppadon Makbun leg.; 1♂, same locality, 17-vii-2011, Noppadon Makbun leg.; 2♂♂ 1♀, same locality, 30-vi-2012 (Dennis Farrell); 1♂, same locality, 20-iii-2012 (Dennis Farrell). 1♂, Thailand, Petchabun province, Nam Nao National Park, tiny temporary pond, 28-viii-2012 (Dennis Farrell).

The first author noticed an unknown lestid species at the edge of a large, exposed and natural lake within Nam Nao National Park at approximately 850 m asl in 2011. Photographs were first sent to Matti Hämäläinen who then forwarded them to Rory Dow for identification. Individuals on the photographs were tentatively identified as *Indolestes inflatus* (Fraser, 1933), but specimens were needed before confirming its identity. A male specimen was later sent to Rory Dow

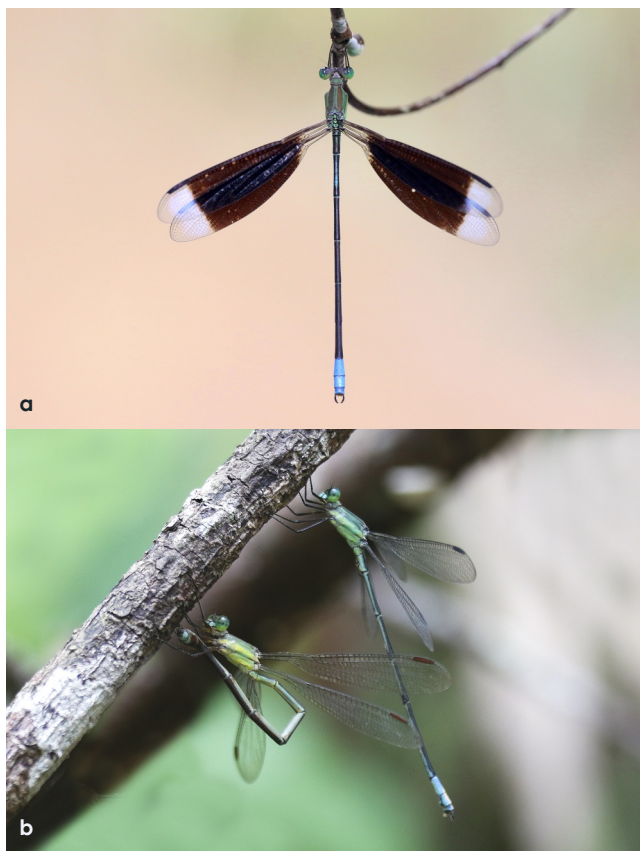


Fig. 3. *Indolestes inflatus* (Fraser, 1933) in life, 09-vii-2011, Nam Nao National Park, Petchabun province, Thailand. (a) male, (b) female. Photos: Dennis Farrell.

and he validated it as *I. inflatus*. Fraser (1933) described this species (as *Ceylonolestes inflata*) from a single male specimen collected in 1925 from Maymyo, northern Shan State, Burma (presently Myanmar). The strongly angulate cerci and brownish wings with bright rusty pterostigma separate it from other species in the genus (Fraser 1933). This record added north-east Thailand to its known range. So far, in Thailand, it has only been found at this location and in small numbers. The known flight season is between March and July.

3). *Orolestes selysi* McLachlan, 1895 (Fig.4)

1♂, Thailand, Chaiyaphum province, Phu Khieo Wildlife Sanctuary, unspecified date in March 2012 (Rapeepat Charoenpon); 3♂♂, same locality, 02-vii-2016 (Dennis Farrell); 4♂♂, same locality, 06-viii-2016 (Dennis Farrell); 1♂, 01-vii-2017, same locality (Andrew Pierce), 1♂, same locality, 22-vii-2017 (Dennis Farrell, Andrew Pierce); 1♂, same locality, 05-viii-2017 (Dennis Farrell); 2♂♂ 1♀, same locality, 21-vii-2018 (Dennis Farrell).



Orolestes selysi is known from India (Darjeeling), China (Yunnan, Guangxi, Hainan, Taiwan), Laos and Vietnam (Dow & Subramanian 2010; Zhang 2019). Therefore, it is no surprise that it has been recorded in the north-eastern part of Thailand. This species is easily separated from *O. octomaculatus* due to its solid black

Fig. 4. *Orolestes selysi* McLachlan, 1895 in life, Phu Khieo Wildlife Sanctuary, Chaiyaphum province, Thailand. (a) male, 02-vii-2016. (b) ovipositing female with hyaline-wing male, 21-vii-2018. Photos: Dennis Farrell.

wings with white tips. At Phu Khieo Wildlife Sanctuary, it tends to prefer hanging from tree branches that are either near or over small temporary ponds, especially in shaded areas. However, only one or two specimens are found at each pond. Interestingly, *O. selysi* co-exists with *O. octomaculatus* in the upper reaches of the sanctuary. However, though *O. octomaculatus* is found throughout the year, *O. selysi* only has a relatively short flight season from March to August. Currently, in Thailand, the species is only known from this location.

Checklist

As the Odonata faunistic data of Nam Nao National Park and Phu Khieo Wildlife Sanctuary was still lacking and somewhat scattered, as well as the fact that the two locations are in close proximity, the authors produced a combined checklist of Odonata from these two protected areas (Table 1). It was found that both protected areas were quite rich in dragonflies and damselflies with 144 species altogether. Libellulidae was the most dominant family (49 species), followed by Coenagrionidae (30 species) and Platycnemididae (14 species). Philogangidae, Philosinidae and Calopterygidae were the least recorded families with one, two and three species, respectively. 108 species (54 Anisoptera and 54 Zygoptera) were reported from Nam Nao National Park. Amongst these, 79 species (73.14%) are new for the Park (44 Anisoptera and 35 Zygoptera). Furthermore, 136 species (71 Anisoptera and 65 Zygoptera) were recorded from Phu Khieo Wildlife Sanctuary with 45 species (33.08%) known from the area for the first time. The new records comprise 20 species belonging to Anisoptera and 25 species belonging to Zygoptera.

Table 1. The checklist of Odonata of Nam Nao National Park and Phu Khieo Wildlife Sanctuary. The checklist is divided into Zygoptera and Anisoptera, respectively, and arranged alphabetically by families and species. Symbols are used as follows: x = present; ^ = new record for national park; * = new national record.

No.	Species	Nam Nao National Park	Phu Khieo Wildlife Sanctuary
ZYGOPTERA			
Family Calopterygidae			
1	<i>Neurobasis chinensis</i> (Linnaeus, 1758)	x^	x
2	<i>Vestalis gracilis</i> (Rambur, 1842)	x^	x
3	<i>Vestalaria smaragdina</i> (Selys, 1879)	x^	x
Family Chlorocyphidae			
4	<i>Aristocypha fenestrella</i> (Rambur, 1842)	x	x^
5	<i>Heliocypha biforata</i> (Selys, 1859)	x^	x
6	<i>Heliocypha perforata limbata</i> (Selys, 1879)	x^	x
7	<i>Libellago lineata</i> (Burmeister, 1839)	x^	x
Family Coenagrionidae			
8	<i>Aciaagrion approximans</i> (Selys, 1876)	x^	x^
9	<i>Aciaagrion borneense</i> Ris, 1911	x	x^
10	<i>Aciaagrion pallidum</i> Selys, 1891	x	x^
11	<i>Aciaagrion hisopa</i> (Selys, 1876)		x
12	<i>Aciaagrion</i> sp. (<i>occidentale?</i>)		x^

No.	Species	Nam Nao National Park	Phu Khieo Wildlife Sanctuary
13	<i>Agriocnemis femina</i> (Brauer, 1868)	x [^]	x [^]
14	<i>Agriocnemis minima</i> Selys, 1877	x [^]	x
15	<i>Agriocnemis nana</i> Laidlaw, 1914	x	x
16	<i>Agriocnemis pygmaea</i> (Rambur, 1842)	x [^]	x
17	<i>Amphiallagma parvum</i> (Selys, 1876)	x	x
18	<i>Archibasis viola</i> Lieftinck, 1948		x [^]
19	<i>Argiocnemis rubescens rubeola</i> Selys, 1877	x	x
20	<i>Ceriagrion auranticum</i> Fraser, 1922		x [^]
21	<i>Ceriagrion azureum</i> (Selys, 1891)	x [^]	x
22	<i>Ceriagrion cerinorubellum</i> (Brauer, 1865)	x	x
23	<i>Ceriagrion chaoi</i> Schmidt, 1964	x [^]	x
24	<i>Ceriagrion indochinense</i> Asahina, 1967	x [^]	x
25	<i>Ceriagrion malaisei</i> Schmidt, 1964		x
26	<i>Ceriagrion olivaceum</i> Laidlaw, 1914	x [^]	x [^]
27	<i>Ceriagrion pallidum</i> Fraser, 1933		x
28	<i>Ceriagrion praetermissum</i> Lieftinck, 1929	x [^]	x [^]
29	<i>Ischnura aurora</i> Brauer, 1865	x	x [^]
30	<i>Ischnura senegalensis</i> (Rambur, 1842)	x [^]	x
31	<i>Mortonagrion aborense</i> (Laidlaw, 1914)	x [^]	x
32	<i>Paracercion malayanum</i> (Selys, 1876)		x
33	<i>Paracercion calamorum</i> (Ris, 1916)		x
34	<i>Pseudagrion australasiae</i> Selys, 1876	x	x
35	<i>Pseudagrion microcephalum</i> (Rambur, 1842)	x [^]	x
36	<i>Pseudagrion pruinatum</i> (Burmeister, 1839)	x [^]	x
37	<i>Pseudagrion rubriceps</i> Selys, 1876	x [^]	x
	Family Euphaeidae		
38	<i>Bayadera serrata</i> Davies & Yang, 1996	x	
39	<i>Dysphaea gloriosa</i> Fraser, 1938	x	x
40	<i>Euphaea masoni</i> Selys, 1879	x [^]	x
41	<i>Euphaea ochracea</i> Selys, 1859	x [^]	x
	Family Lestidae		
42	<i>Indolestes anomalus</i> Fraser, 1946	x	x [^]
43	<i>Indolestes gracilis expressior</i> Kosterin, 2015		x [^] *
44	<i>Indolestes inflatus</i> (Fraser, 1933)	x [^] *	
45	<i>Lestes concinnus</i> Hagen in Selys, 1862	x [^]	x [^]
46	<i>Lestes dorothea</i> Fraser, 1924	x [^]	x [^]
47	<i>Lestes elatus</i> Hagen in Selys, 1862	x [^]	x [^]
48	<i>Lestes praemorsus decipiens</i> Kirby, 1893	x [^]	x
49	<i>Platylestes platystylus</i> (Rambur, 1842)		x [^]
50	<i>Orolestes octomaculatus</i> Martin, 1902	x [^]	x
51	<i>Orolestes selysi</i> McLachlan, 1895		x [^] *
	Family Philogangidae		
52	<i>Philoganga loringae</i> Fraser, 1927		x
	Family Philosinidae		
53	<i>Rhinagrion hainanense</i> Wilson & Reels, 2001	x	
54	<i>Rhinagrion viridatum</i> Fraser, 1938	x [^]	x [^]
	Family Platycnemididae		
55	<i>Copera chantaburii</i> Asahina, 1984		x [^]
56	<i>Copera marginipes</i> (Rambur, 1842)	x [^]	x
57	<i>Copera vittata</i> (Selys, 1863)	x	x

No.	Species	Nam Nao National Park	Phu Khieo Wildlife Sanctuary
58	<i>Coeliccia chromothorax</i> (Selys, 1891)	x	x
59	<i>Coeliccia didyma</i> (Selys, 1863)	x	x
60	<i>Coeliccia poungyi</i> Fraser, 1924	x	x
61	<i>Coeliccia</i> sp. (loogali?)	x^	x^
62	<i>Indocnemis orang</i> (Förster in Laidlaw, 1907)	x^	x^
63	<i>Onychargia atrociana</i> Selys, 1865	x^	x
64	<i>Prodasineura autumnalis</i> (Fraser, 1922)	x^	x
65	<i>Prodasineura auricolor</i> (Fraser, 1927)	x	x^
66	<i>Prodasineura doisuthepensis</i> Hoess, 2007	x	x^
67	<i>Prodasineura</i> sp.		x^
68	<i>Pseudocopera ciliata</i> (Selys, 1863)	x^	x
ANISOPTERA			
Family Aeshnidae			
69	<i>Anaciaeschna jaspidea</i> (Burmeister, 1839)	x	
70	<i>Anax guttatus</i> (Burmeister, 1839)	x^	x
71	<i>Anax indicus</i> Lieftinck, 1942		x^
72	<i>Gynacantha basiguttata</i> Selys, 1882		x^
73	<i>Gynacantha saltatrix</i> Martin, 1909	x^	x^
74	<i>Gynacantha subinterrupta</i> Rambur, 1842	x^	x
75	<i>Polycanthagyna erythromelas</i> (McLachlan, 1896)		x^
76	<i>Polycanthagyna ornithocephala</i> (McLachlan, 1896)	x^	
Family Gomphidae			
77	<i>Burmagomphus asahinai</i> Kosterin, Makbun & Dawwrueng, 2012	x^	
78	<i>Burmagomphus divaricatus</i> Lieftinck, 1964		x
79	<i>Euthygomphus yunnanensis</i> (Zhou & Wu, 1992)	x^	x^
80	<i>Gomphidia abbotti</i> Williamson, 1907		x
81	<i>Gomphidia kruegeri</i> Martin, 1904	x^	x
82	<i>Gomphidictinus perakensis</i> (Laidlaw, 1902)	x^	x^
83	<i>Ictinogomphus decoratus melaenops</i> (Selys, 1858)	x^	x
84	<i>Macrogomphus albardae</i> Selys, 1878		x
85	<i>Macrogomphus kerri</i> Fraser, 1932		x
86	<i>Merogomphus pavici</i> Martin, 1904	x	x^
87	<i>Microgomphus svihleri</i> (Asahina, 1970)		x^
Family Libellulidae			
88	<i>Acisoma panorpoides</i> Rambur, 1842	x^	x
89	<i>Aethriamanta aethra</i> Ris, 1912		x
90	<i>Aethriamanta brevipennis</i> (Rambur, 1842)	x^	x
91	<i>Aethriamanta gracilis</i> (Brauer, 1878)	x^	x^
92	<i>Agrionoptera insignis</i> (Rambur, 1842)	x^	x^
93	<i>Amphithemis curvistyla</i> Selys, 1891		x
94	<i>Brachydiplax chalybea</i> Brauer, 1868	x^	x^
95	<i>Brachydiplax farinosa</i> Krüger, 1902	x^	x
96	<i>Brachythemis contaminata</i> (Fabricius, 1793)	x^	x
97	<i>Camacina gigantea</i> (Brauer, 1867)		x
98	<i>Cratilla lineata calverii</i> Förster, 1903	x^	x
99	<i>Crocothemis servilla</i> (Drury, 1773)	x^	x
100	<i>Diplacodes nebulosa</i> (Fabricius, 1793)	x^	x^
101	<i>Diplacodes trivialis</i> (Rambur, 1842)	x	x

No.	Species	Nam Nao National Park	Phu Khieo Wildlife Sanctuary
102	<i>Hydrobasileus croceus</i> (Brauer, 1867)	x [^]	x
103	<i>Indothemis carnatica</i> (Fabricius, 1798)	x [^]	x
104	<i>Indothemis limbata</i> (Selys, 1891)	x	x
105	<i>Lathrecista asiatica</i> (Fabricius, 1798)	x [^]	x [^]
106	<i>Lyriothemis elegantissima</i> Selys, 1883		x [^]
107	<i>Nannophya pygmaea</i> Rambur, 1842		x [^]
108	<i>Neurothemis fulvia</i> (Drury, 1773)	x [^]	x
109	<i>Neurothemis intermedia atalanta</i> Ris, 1919	x	x [^]
110	<i>Neurothemis tullia</i> (Drury, 1773)	x [^]	x
111	<i>Onychothemis testacea</i> Laidlaw, 1902		x
112	<i>Orthetrum chrysis</i> (Selys, 1891)	x [^]	x
113	<i>Orthetrum glaucum</i> (Brauer, 1865)	x [^]	x [^]
114	<i>Orthetrum luzonicum</i> (Brauer, 1868)	x [^]	x
115	<i>Orthetrum pruinusum neglectum</i> (Rambur, 1842)	x [^]	x
116	<i>Orthetrum sabina</i> (Drury, 1770)	x [^]	x
117	<i>Orthetrum triangulare</i> (Selys, 1878)		x
118	<i>Palpopleura sexmaculata</i> (Fabricius, 1787)	x	x [^]
119	<i>Pantala flavescens</i> (Fabricius, 1798)	x [^]	x
120	<i>Potamarcha congener</i> (Rambur, 1842)	x [^]	x
121	<i>Pseudothemis jorina</i> Förster, 1904	x	x
122	<i>Rhodothemis rufa</i> (Rambur, 1842)	x [^]	x
123	<i>Rhyothemis obsolescens</i> Kirby, 1889		x
124	<i>Rhyothemis phyllis</i> (Sulzer, 1776)	x [^]	x
125	<i>Rhyothemis plutonia</i> Selys, 1883	x	x
126	<i>Rhyothemis triangularis</i> Kirby, 1889	x	x
127	<i>Rhyothemis variegata</i> (Linnaeus, 1763)	x [^]	x
128	<i>Tetrathemis platyptera</i> Selys, 1878	x	x
129	<i>Tholymis tillarga</i> (Fabricius, 1798)	x [^]	x
130	<i>Tramea transmarina euryale</i> Selys, 1878		x [^]
131	<i>Trithemis aurora</i> (Burmeister, 1839)	x [^]	x
132	<i>Trithemis festiva</i> (Rambur, 1842)	x [^]	x
133	<i>Trithemis pallidinervis</i> (Kirby, 1889)	x [^]	x
134	<i>Urothemis signata</i> (Rambur, 1842)	x [^]	x
135	<i>Zygonyx iris malayana</i> (Laidlaw, 1902)	x [^]	x
136	<i>Zyomma petiolatum</i> Rambur, 1842	x [^]	x
	Family Macromiidae		
137	<i>Epophthalmia frontalis</i> Selys, 1871		x
138	<i>Epophthalmia vittigera bellicosa</i> Lieftinck, 1948		x
139	<i>Macromia chaiyaphumensis</i> Hämäläinen, 1985		x
140	<i>Macromia cupricincta</i> Fraser, 1924		x
141	<i>Macromia</i> sp.	x [^]	
	Family Synthemiidae		
142	<i>Idionyx</i> sp.	x [^]	
143	<i>Macromidia genialis shanensis</i> Fraser, 1927	x [^]	x [^]
144	<i>Macromidia rapida</i> Martin, 1907		x
	Total new records (including new national records)	79	45
	Total number of records	108	136

Discussion

With more than 350 species currently known from Thailand (Hämäläinen 2017), the number of odonate species recorded from Nam Nao National Park and Phu Khieo Wildlife Sanctuary has accounted for 30.85% and 38.85%, respectively. The percentage of new records from these two protected areas (73.14 and 33.08, respectively) suggests that the faunistic data on Odonata in many areas of Thailand is still lacking and is in need of more intensive surveys and specimen collection. However, it is difficult to obtain a permit in order to collect odonates from protected areas throughout Thailand, leading to an increased reliance on high-quality photos to record the known species range in Thailand. However, as voucher specimens are key to true identification, obtaining a permit more easily through the right channels is imperative to accelerating and improving the study of Thai dragonflies and damselflies.

Although many new species and records have been published, this paper demonstrates that there are many more species awaiting discovery, not only in these two protected areas, but also in other locations throughout the country.

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