Journal of Threatened Taxa

Building evidence for conservation globally

www.threatenedtaxa.org

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

Note

Do predatory adult odonates estimate their adult prey odonates' body size and dispersal ability to proceed with a successful attack?

Tharaka Sudesh Priyadarshana

26 June 2021 | Vol. 13 | No. 7 | Pages: 18949–18952
DOI: 10.11609/jott.7198.13.7.18949-18952

Journal of Threatened Taxa | www.threatenedtaxa.org | 26 June 2021 | 13(7): 18949–18952
ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)
https://doi.org/10.11609/jott.7198.13.7.18949-18952
#7198 | Received 07 December 2020 | Final received 03 April 2021 | Finally accepted 09 June 2021
OPEN ACCESS

NOTE

Do predatory adult odonates estimate their adult prey odonates' body size and dispersal ability to proceed with a successful attack?

Tharaka Sudesh Priyadarshana

Asian School of the Environment, Nanyang Technological University, 50 Nanyang Avenue, 639798, Singapore.
tharakas001@e.ntu.edu.sg, tharakas.priyadarshana@gmail.com

The average body size and dispersal ability of a species significantly depends on its taxonomic order (Siemann et al. 1999). Indeed, there are significant body size and dispersal ability differences between predatory odonates and their typical prey items such as gnats, mayflies, flies, mosquitoes, and other small-sized flying insects. During one of my field visits in Sri Lanka in 2015, I observed an adult dragonfly (*Orthetrum sabina*) eating another species of dragonfly (*O. luzonicum*) (Image 1), and their average body sizes and dispersal abilities were similar. Similar observations were being circulated on Odonate-specialists' Facebook (FB) groups, suggesting that adult odonates feed on other species of odonates or even the same species (see Image 2). When predators prey upon members of the same taxonomic group, it is difficult to predict whether the predators still estimate the size and dispersal ability of their potential prey items to proceed with a successful attack (Woodward & Hildrew 2002). This, however, can be measured by using a robust statistical analysis and a precise dataset.

Even though adult odonates feed upon adult odonates, such records are uncommon. To build the dataset, I surveyed two private FB specialists' groups for such potential records. I manually checked every single post of the "*DragonflySouthAsia*" (https://www.facebook.com/groups/dragonflyindia) FB group between 2020 to 2016 and posts of the "*Dragonfly Interest Group of Sri Lanka*" (https://www.facebook.com/groups/256874097746055) FB group between 2020 to 2012. I also searched the "*Odonata of India*" (https://www.indianodonata.org/) website for more potential records. For most of those records, predator and prey species had been identified by experts within those groups. Prey odonates that could not be identified to species level due to predation were excluded from the final dataset. The records of mature predators preying upon juveniles were also excluded because that might result in some biases in the dataset as those individuals are immature. The final dataset included 67 records of adult predatory and prey odonate encounters from Sri Lanka (24) and India (43) — nine species of predators and 27 species of prey (see Table 1).

Morphometric trait measurement data related to body size and dispersal ability for each predator and prey odonate was extracted from the "Odonate Phenotypic Database" (OPD) at http://www.odonatephenotypicdatabase.org/ (Waller et al. 2019). When the data was not available in the OPD (only for eight species), the data was extracted from other published literature (see the Supplementary data for

Editor: Anonymity requested. **Date of publication:** 26 June 2021 (online & print)

Citation: Priyadarshana, T.S. (2021). Do predatory adult odonates estimate their adult prey odonates' body size and dispersal ability to proceed with a successful attack? *Journal of Threatened Taxa* 13(7): 18949–18952. https://doi.org/10.11609/jott.7198.13.7.18949-18952

Funding: Self-funded.

Competing interests: The author declares no competing interests.

Acknowledgements: I thank all those who shared their records and identified predatory and prey odonate species through cyberspace, Christos Mammides for his comments on the first draft, and Subramaniam Gopalakrishnan for the Image 2.

Table 1. Records of adult predator and prey odonate encounters from Sri Lanka (24) and India (43) from 2012 to 2020. Please see the supplementary data for additional information and references.

Record number	Country	Predator odonate species	Prey odonate species
Records of Anisoptera (dragonflies) preying upon Anisoptera (n= 40)			
1	Sri Lanka	*Orthetrum sabina*	*Neurothemis tullia*
2	Sri Lanka	*Orthetrum sabina*	*Neurothemis tullia*
3	Sri Lanka	*Orthetrum sabina*	*Diplacodes trivialis*
4	Sri Lanka	*Orthetrum sabina*	*Orthetrum pruinosum*
5	Sri Lanka	*Ictinogomphus rapax*	*Brachythemis contaminata*
6	Sri Lanka	*Orthetrum sabina*	*Brachythemis contaminata*
7	Sri Lanka	*Orthetrum sabina*	*Orthetrum luzonicum*
8	Sri Lanka	*Orthetrum sabina*	*Neurothemis tullia*
9	Sri Lanka	*Orthetrum sabina*	*Orthetrum luzonicum*
10	Sri Lanka	*Orthetrum sabina*	*Brachythemis contaminata*
11	Sri Lanka	*Orthetrum sabina*	*Orthetrum luzonicum*
12	Sri Lanka	*Orthetrum sabina*	*Orthetrum pruinosum*
13	India	*Orthetrum sabina*	*Neurothemis fulvia*
14	India	*Orthetrum sabina*	*Tetrathemis platyptera*
15	India	*Orthetrum sabina*	*Diplacodes trivialis*
16	India	*Orthetrum sabina*	*Potamarcha congener*
17	India	*Orthetrum sabina*	*Diplacodes trivialis*
18	India	*Orthetrum sabina*	*Orthetrum sabina*
19	India	*Orthetrum sabina*	*Diplacodes trivialis*
20	India	*Orthetrum sabina*	*Diplacodes trivialis*
21	India	*Orthetrum sabina*	*Orthetrum sabina*
22	India	*Orthetrum sabina*	*Orthetrum pruinosum*
23	India	*Rhodothemis rufa*	*Neurothemis tullia*
24	India	*Orthetrum sabina*	*Rhyothemis variegata*
25	India	*Orthetrum sabina*	*Orthetrum pruinosum*
26	India	*Orthetrum sabina*	*Potamarcha congener*
27	India	*Orthetrum sabina*	*Diplacodes trivialis*
28	India	*Orthetrum sabina*	*Orthetrum sabina*
29	India	*Orthetrum sabina*	*Orthetrum sabina*
30	India	*Orthetrum sabina*	*Crocothemis servilia*
31	India	*Orthetrum sabina*	*Trithemis aurora*
32	India	*Orthetrum sabina*	*Pantala flavescenes*
33	India	*Orthetrum sabina*	*Potamarcha congener*
34	India	*Orthetrum sabina*	*Diplacodes trivialis*
35	India	*Orthetrum sabina*	*Pantala flavescenes*
36	India	*Orthetrum sabina*	*Trithemis aurora*
37	India	*Orthetrum sabina*	*Tholymis tillarga*
38	India	*Acisoma panorpoides*	*Acisoma panorpoides*
39	India	*Orthetrum sabina*	*Orthetrum sabina*
40	India	*Orthetrum sabina*	*Paragomphus lineatus*
Records of Anisoptera (dragonflies) preying upon Zygoptera (damselflies) (n= 16)			
41	Sri Lanka	*Orthetrum sabina*	*Pseudagrion microcephalum*
42	Sri Lanka	*Acisoma panorpoides*	*Ceriagrion coromandelianum*
43	Sri Lanka	*Orthetrum sabina*	*Pseudagrion rubriceps*
44	Sri Lanka	*Orthetrum sabina*	*Pseudagrion microcephalum*
45	Sri Lanka	*Orthetrum sabina*	*Ceriagrion coromandelianum*
46	Sri Lanka	*Brachythemis contaminata*	*Pseudagrion rubriceps*
47	India	*Orthetrum sabina*	*Onychargia atrocyana*
48	India	*Orthetrum sabina*	*Lestes viridulus*
49	India	*Orthetrum sabina*	*Ischnura rubilio*
50	India	*Orthetrum sabina*	*Ischnura rubilio*
51	India	*Acisoma panorpoides*	*Ceriagrion coromandelianum*
52	India	*Acisoma panorpoides*	*Agriocnemis splendidissima*
53	India	*Brachythemis contaminata*	*Ischnura senegalensis*
54	India	*Brachythemis contaminata*	*Ischnura senegalensis*
55	India	*Orthetrum sabina*	*Ischnura senegalensis*
56	India	*Orthetrum sabina*	*Agriocnemis pygmaea*
Records of Zygoptera (damselflies) preying upon Zygoptera (n= 11)			
57	Sri Lanka	*Ceriagrion cerinorubellum*	*Ceriagrion coromandelianum*
58	Sri Lanka	*Ceriagrion coromandelianum*	*Agriocnemis pygmaea*
59	Sri Lanka	*Ceriagrion coromandelianum*	*Onychargia atrocyana*
60	Sri Lanka	*Ischnura senegalensis*	*Agriocnemis pygmaea*
61	Sri Lanka	*Ceriagrion coromandelianum*	*Pseudagrion microcephalum*
62	Sri Lanka	*Ischnura senegalensis*	*Agriocnemis pygmaea*
63	India	*Ceriagrion coromandelianum*	*Ceriagrion cerinorubellum*
64	India	*Ceriagrion coromandelianum*	*Ceriagrion cerinorubellum*
65	India	*Ischnura senegalensis*	*Agriocnemis pygmaea*
66	India	*Ceriagrion coromandelanium*	*Ischnura senegalensis*
67	India	*Ceriagrion coromandelanium*	*Agriocnemis pygmaea*

Image 1. A mature adult of *Orthetrum sabina* preying upon a mature adult of *O. luzonicum* at Sinharaja rain forest in Sri Lanka, 2015.

Image 2. A mature adult of *Orthetrum sabina* preying upon a mature adult of *O. sabina* at Tirupur, Tamil Nadu in India, 2018.

Table 2. Differences in body size (average body length in mm) and dispersal ability (hind-wing length in mm) between predator and prey odonates when both groups belong to Anisoptera (dragonflies) suborder (n= 40). SD indicates standard deviations, and L-95% and U-95% indicate 95% credible interval (lower and upper, respectively).

	Mean	SD	L-95%	U-95%
Body size of predator odonates	46.500	0.001	46.498	46.502
Body size of prey odonates	39.992	2.415	35.208	44.530
Body size differences between predator and prey odonates	6.507	2.415	6.492	6.522
Dispersal ability of predator odonates	30.500	0.0006	30.498	30.501
Dispersal ability of prey odonates	28.251	1.482	25.287	31.027
Dispersal ability differences between predator and prey odonates	2.248	1.482	2.239	2.257

Table 3. Differences in body size (average body length in mm) and dispersal ability (hind-wing length in mm) between predator and prey odonates when predators belong to Anisoptera (dragonflies) and prey belong to Zygoptera (damselflies) suborder (n= 16). SD indicates standard deviations, and L-95% and U-95% indicate 95% credible interval (lower and upper, respectively).

	Mean	SD	L-95%	U-95%
Body size of predator odonates	45.749	2.037	40.313	46.533
Body size of prey odonates	32.808	1.235	30.371	35.155
Body size differences between predator and prey odonates	12.941	2.252	12.926	12.955
Dispersal ability of predator odonates	30.499	0.003	30.494	30.505
Dispersal ability of prey odonates	18.624	0.871	16.797	20.221
Dispersal ability differences between predator and prey odonates	11.875	0.871	11.869	11.881

Table 4. Differences in body size (average body length in mm) and dispersal ability (hind-wing length in mm) between predator and prey odonates when both groups belong to Zygoptera (damselflies) suborder (n= 11). SD indicates standard deviations, and L-95% and U-95% indicate 95% credible interval (lower and upper, respectively).

	Mean	SD	L-95%	U-95%
Body size of predator odonates	32.984	0.938	31.117	34.820
Body size of prey odonates	28.387	2.477	23.564	33.450
Body size differences between predator and prey odonates	4.597	2.658	4.581	4.614
Dispersal ability of predator odonates	18.600	1.010	16.606	20.324
Dispersal ability of prey odonates	14.359	1.718	10.919	17.829
Dispersal ability differences between predator and prey odonates	4.241	2.009	4.228	4.253

references). The average body length of each predator and prey species considered as the body size and potential dispersal ability was measured with the hind-wing length (only males in mm) for each species (Moretti et al. 2017). To measure whether there is a significant difference in body size and dispersal ability between predatory and prey odonates, I performed a Bayesian t-test using the "BEST" package with flat priors (Kruschke & Meredith 2020). Due to available replicates and data distribution, the Bayesian t-test approach provides a more robust way of estimating posterior probabilities of group differences (Kruschke 2013; Kruschke & Meredith 2020). All the statistical analyses were performed in R version 4.0.3 (www.r-project.org/).

The final dataset showed three types of predation behaviors between the two suborders of Odonata, i.e., (i) Anisoptera (dragonflies) prey upon Anisoptera (60 %, n= 40), (ii) Anisoptera prey upon Zygoptera (damselflies) (24 % of n= 16), and (iii) Zygoptera prey upon Zygoptera (16 %, n= 11), but there was no record of Zygoptera preying upon Anisoptera. Therefore, three separate analyses were performed for each type of predation to estimate the body size and dispersal ability differences between adult predatory and prey odonates. Since each suborder was separately analyzed, the hind-wing length measurements were not scaled relative to body length.

The results of the analysis showed strong evidence that the predatory odonates performing the attack had larger body size and greater hind-wing length than their prey odonates across all three predation types (see Table 2–4). This indicates that predatory adult odonates may estimate the body size and dispersal ability of the adult prey odonates to execute a successful attack even when both groups belong to the same taxonomic group. *Orthetrum sabina* had the highest percentage with 70 % (n= 47) of attacks on both Anisoptera and Zygoptera species, including *O. sabina-O. sabina* attacks (Image 2). It is also important to note that the attacks of the predatory odonates were mostly on the head or thorax of their prey odonates.

Data accessibility: Supplementary data for this study is available at, https://github.com/Tharaka18/Predatory-adult-odonates-and-their-adult-prey-odonates

References

Kruschke, J.K. (2013). Bayesian estimation supersedes the t test. *Journal of Experimental Psychology: General* 142(2): 573–603. https://doi.org/10.1037/a0029146

Kruschke, J.K. & M. Meredith (2020). BEST: Bayesian estimation supersedes the t test. R package version 0.5.1

Moretti, M., A.T.C. Dias, F. de Bello, F. Altermatt, S.L. Chown, F.M. Azcárate, J.R. Bell, B. Fournier, M. Hedde, J. Hortal, S. Ibanez, E. Öckinger, J.P. Sousa, J. Ellers & M.P. Berg (2017). Handbook of protocols for standardized measurement of terrestrial invertebrate functional traits. *Functional Ecology* 31(3): 558–567. https://doi.org/10.1111/1365-2435.12776

Siemann, E., D. Tilman & J. Haarstad (1999). Abundance, diversity and body size: patterns from a grassland arthropod community. *Journal of Animal Ecology* 68(4): 824–835. https://doi.org/10.1046/j.1365-2656.1999.00326.x

Waller, J.T., B. Willink, M. Tschol & E.I. Svensson (2019). The odonate phenotypic database, a new open data resource for comparative studies of an old insect order. *Scientific Data* 6(1): 316. https://doi.org/10.1038/s41597-019-0318-9

Woodward, G. & A.G. Hildrew (2002). Body-size determinants of niche overlap and intraguild predation within a complex food web. *Journal of Animal Ecology* 71(6): 1063–1074. https://doi.org/10.1046/j.1365-2656.2002.00669.x

Zhang, H. (2019). *Dragonflies and damselflies of China*. Chongqing University Press, Chongqing, China, xiv+1460pp.

Journal of Threatened Taxa

www.threatenedtaxa.org

OPEN ACCESS

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

June 2021 | Vol. 13 | No. 7 | Pages: 18679–18958
Date of Publication: 26 June 2021 (Online & Print)
DOI: 10.11609/jott.2021.13.7.18679-18958

Publisher & Host

WILD ZOOREACH
Threatened Taxa