NOTE

DO PREDATORY ADULT ODONATES ESTIMATE THEIR ADULT PREY ODONATES’ BODY SIZE AND DISPERAL 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
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...
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 |
|---------------|---------|--------------------------|----------------------|
| 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 pruinum |
| 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 pruinum |
| 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 sabina |
| 23            | India    | Orthetrum sabina | Rhodothemis rufa |
| 24            | India    | Orthetrum sabina | Rhyothemis variegata |
| 25            | India    | Orthetrum sabina | Orthetrum pruinum |
| 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 flavescens |
| 33            | India    | Orthetrum sabina | Potamarcha congener |
| 34            | India    | Orthetrum sabina | Diplacodes trivialis |
| 35            | India    | Orthetrum sabina | Pantala flavescens |
| 36            | India    | Orthetrum sabina | Trithemis aurora |
| 37            | India    | Orthetrum sabina | Thaliomya tillaria |
| 38            | India    | Acisoma panorpoides | Acisoma panorpoides |

| Record number | Country | Predator odonate species | Prey odonate species |
|---------------|---------|--------------------------|----------------------|
| 39            | India    | Orthetrum sabina | Orthetrum sabina |
| 40            | India    | Orthetrum sabina | Paragomphus lineatus |

| Record number | Country | Predator odonate species | Prey odonate species |
|---------------|---------|--------------------------|----------------------|
| 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 viridisul |
| 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 |

| Record number | Country | Predator odonate species | Prey odonate species |
|---------------|---------|--------------------------|----------------------|
| 57            | Sri Lanka | Ceriagrion coromandelianum | 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 coromandelianum |
| 64            | India    | Ceriagrion coromandelianum | Ceriagrion coromandelianum |
| 65            | India    | Ischnura senegalensis | Agriocnemis pygmaea |
| 66            | India    | Ceriagrion coromandelianum | Ischnura senegalensis |
| 67            | India    | Ceriagrion coromandelianum | Agriocnemis pygmaea |
Predatory adult odonates and their adult prey odonates

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  | 2.568  | 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.
Communications

Persistence of Trachypityches geel (Mammalia: Primates: Cercopithecidae) in a rubber plantation in Assam, India — Joydeep Shil, Jihosuo Biswas, Sudipta Naq & Houknival N. Kumara, Pp. 18679–18866

Population assessment of the endangered Western Hoolock Gibbon Hoolock hoolock Harlan, 1834 at Sheikh Jamal Inani National Park, Bangladesh, and conservation significance of this site for threatened wildlife species — M. Tarik Kabir, M. Farid Ahsan, Susan M. Cheyne, Shahrul Anuar Mohd Sah, Susan Lappan, Thad Q. Bartlett & Nadine Ruppert, Pp. 18687–18694

Assessment of changes over a decade in the patterns of livestock depredation by the Himalayan Brown Bear in Ladakh, India — Aishwarya Maheshwari, A. Arun Kumar & Sambandam Sathyakumar, Pp. 18695–18702

Habitat selection of Himalayan Musk Deer Moschus moschiferus (Mammalia: Artiodactyla: Moschidae) with respect to biophysical attributes in Annapurna Conservation Area of Nepal — Bijaya Neupane, Nar Bahadur Chhetri & Bijaya Dhami, Pp. 18703–18712

Sero-diagnosis of tuberculosis in elephants in Maharashtra, India — Utkarsh Rajhans, Gayatri Wankhede, Balaji Ambore, Sandeep Chaudhari, Navnath Nighet, Vitthal Dhyagude & Chhaya Sonekar, Pp. 18713–18718

Avian species richness in traditional rice ecosystems: a case study from upper Myanmar — Steven G. Platt, Myo Min Win, Naing Lin, Swann Het Naing Aung, Ashish John & Thomas R. Rainwater, Pp. 18719–18737

Conservation status, feeding guilds, and diversity of birds in Daroji Sloth Bear Sanctuary, Karnataka, India — M.N. Hanifi, K.S. Abdul Samad & B.B. Hosetti, Pp. 18738–18751

Birds of Surat-Dangs: a consolidated checklist of 50 years (1944–2020) with special emphasis on noteworthy bird records and bird hotspots from northern Western Ghats of Gujarat, India — Nikunj Jambu & Kaushal G. Patel, Pp. 18752–18780

Identification of a unique barb from the dorsal body contour feathers of the Indian Pitta Pitta brochymena (Aves: Passeriformes: Pittidae) — Prateek Dey, Swapna Devi Ray, Sanjeev Kumar Sharma, Padmanabhan Pramod & Ram Pratap Singh, Pp. 18781–18791

Underestimated diversity of Cnemaspis Strauch, 1887 (Sauria: Gekkonidae) on karst landscapes in Sarawak, Eastern Malaysia, Borneo — Izzniel Nasriq & Indraneil Das, Pp. 18803–18809

The tribe Cnodalonini (Coleoptera: Tenebrionidae: Stenchiinae) from Maharashtra with two new species of the genus Smerinthinae) from India: a notable range extension for the genus Laothoe Eitschberger et al., 1998 (Sphingidae: Laothoe witti) distribution in the western Himalaya, India — Carlos Otávio Araujo Gussoni & Marco Aurélio Galvão da Silva, Pp. 18810–18814

Notes

Photographic record of the Rusty-spotted Cat Prionailurus rubiginosus (L. Geoffroy Saint-Hilaire, 1831) (Mammalia: Carnivora: Felidae) in southern Western Ghats, India — Devika Sangamthirai & P.O. Nameer, Pp. 18925–18933

Natural history notes on the highly threatened Pinto’s Chachalaca Ortalis picta (Aves: Cracidae) — Carlos Otavio Araujo Gussoni & Marco Aurélio Galvão da Silva, Pp. 18934–18938

First record of the Afghan Poplar Hawkmoth Eupsilia intermedia (Balfour-Browne, 1917) (Lepidoptera: Sphingidae) in southern Western Ghats, India — Devika Sangamthirai & P.O. Nameer, Pp. 18949–18956

The tribe Cnodalonini (Coleoptera: Tenebrionidae: Stenchiinae) from India with two new species of the genus Smerinthinae) from India: a notable range extension for the genus Laothoe Eitschberger et al., 1998 (Sphingidae: Laothoe witti) distribution in the western Himalaya, India — Carlos Otávio Araujo Gussoni & Marco Aurélio Galvão da Silva, Pp. 18934–18938

Redescription of Ophirhizra incanata C.E.C. Fisch. (Rubiaceae) from the Western Ghats of India after a lapse of 83 years — Perumal Murugan & Prabakar Ravi, Pp. 18949–18952

Response

Comments on the “A checklist of mammals with historical records from Darjeeling-Sikkim Himalaya landscape, India” — P.O. Nameer, Pp. 18956–18958