

## **Alpha-diversity of Odonates (Insecta: Odonata) at Dhebar Lake (Salumbar, Rajasthan) in Breeding Season**

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### **Abstract**

This study was performed to assess the diversity of odonates in Dhebar Lake during breeding season of odonates. In current study, total 19 species under 13 genera and 5 families are reported, out of which 11 species under 8 genera and 3 families reported as dragonflies (Anisoptera) and 8 species under 5 genera and 2 families reported in damselflies (Zygoptera). All families were found almost in equal proportions except Aeshnidae which was reported lesser in number.

**Keywords:** Anisoptera, Zygoptera, Odonata, Libellulidae, Coenagrionidae

### **Introduction**

Alpha diversity measures the different species within a specific area or habitat. Odonates usually known as dragonflies and damselflies. Odonata is the oldest group of winged and flying insect (Corbet, 1999; Grimaldi & Engel, 2005). Odonates get its name because of toothed mandibles. It is a cosmopolitan group found globally except poles. It inhabits both lentic and lotic freshwater habitats including both temporary and permanent water bodies (Subramanian, 2005). Damselflies (Zygoptera) have similar fore and hind wings and when rest, wings folded parallel to the body while dragonflies (Anisoptera) have dissimilar fore and hind wings and when rest, wing spread perpendicular to the body. Odonates show incomplete metamorphosis (hemimetaboly) means pupal stage is absent in their life cycle (Bechly, 2007). Larvae are aquatic while adults are terrestrial. Odonata spent most of its life as larval forms while adults live only for few months. Odonates are good fliers, have direct flight muscles, have well developed wings (Mischiati et al., 2015) and predatory biting mouthparts (Mitra, 2006). They catch and eat live prey using interception (Olberg et al., 2007). Odonates are major link in the food webs of freshwater aquatic ecosystem. Authentic record of odonates is approximately more than 6400 species worldwide.

India has 504 recorded species with 175 endemic species. Rajasthan has 51 recorded species with one endemic species of odonates (Subramanian and Babu, 2024).

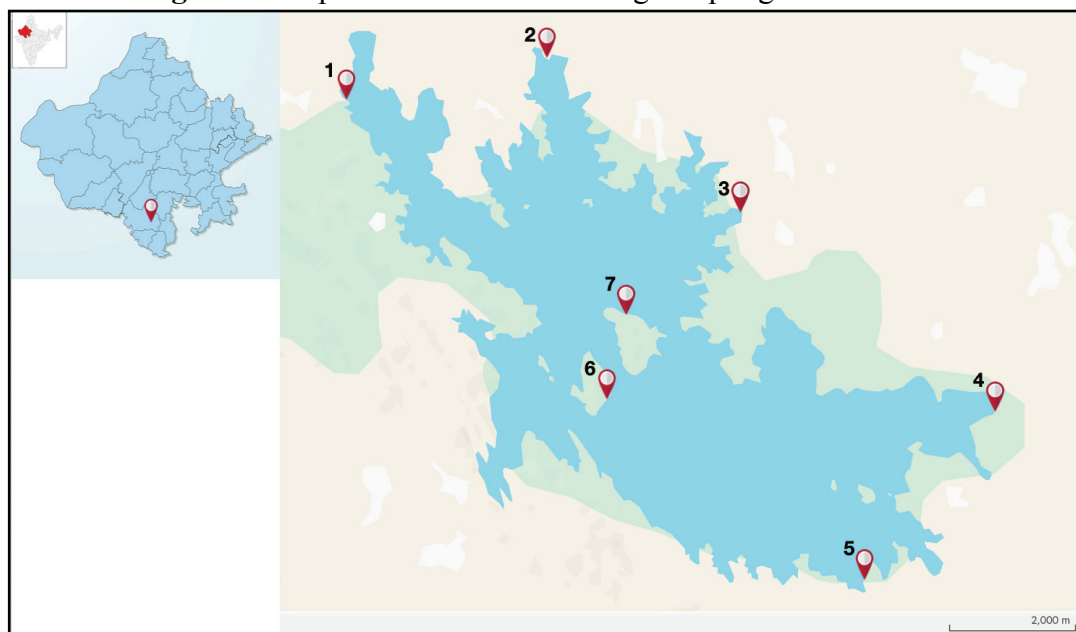
### Material and Methods

Preliminary survey was done for the assessment of feasibility of research. After survey seven sampling sites were selected for random sampling covering whole lake. Sampling was done in breeding season of odonates (Jul-Sept, 2024). Sampling on each site was done using transect method (225m<sup>2</sup>) along shoreline. Photographs on site were taken using Nikon Coolpix p1000 digital camera. Sample were collected using aerial net. Identification was done further in Laboratory using field guide and taxonomic keys (Subramanian, 2014; Singh, 2022).

### Study Area:

Dhebar lake (24.2667°N, 74.0000°E) also known as Jaisamand lake is a largest artificial lake of India. Altitude of this lake is 587 meter asl. It was built by Maharana Jai Singh. It gets water from Gomati River. It is surrounded by Jaisamand wildlife sanctuary. Dhebar Lake is a mesotrophic permanent water body. It has two larger islands. It has shoreline length of 81 km and covers surface area of 48 km<sup>2</sup>. Shoreline development index of this lake is 3.29414 (Rawal and Verma, 2021).

**Figure 1:** Map of Dhebar lake showing sampling sites.



### Results and Discussion

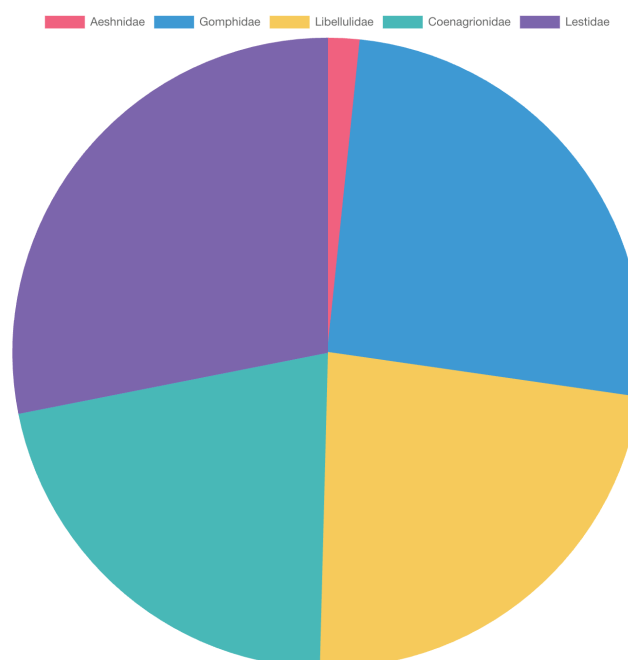
In current study, 234 individuals of adult odonates were collected, out of which 115 individuals were reported under suborder Anisoptera (dragonflies) and 119

individuals were reported under Zygoptera (damselflies). Total 19 species under 13 genera and 5 families (Aeshnidae, Gomphidae, Libellulidae, Coenagrionidae and Lestidae) were reported, out of which 11 species and 8 genera reported under 3 families and 8 species and 5 genera were reported under 2 families. 14 individuals were not identified below suborder. Current 5 families were also reported previously in vicinity (Koli et al., 2014). Dominant species reported was *Aciagrion occidentale* under family Coenagrionidae, *Lestes viridulus* under family Lestidae, *Orthetrum pruinatum* under family Libellulidae and *Acisoma panorpoides* under family Gomphidae. Despite of its abundance and greater impact on aquatic ecosystem, very few studies are done on odonates of water bodies of Rajasthan. Most studies on odonates done on adults, however they spent most of their life in larval forms so future studies must focus on larval stages. Researcher ignore their study due to its lesser impact on humans. Most odonates have conservation status of all species is Least Concern (LC) except *Orolestes durga* which is Data Deficient (DD) under IUCN red list category and also endemic to India (Babu et al., 2013). Further it is non invasive and not listed under CITES. It does not mean its conservation is not important but enough data is not available. More data on their population dynamics and cataloguing are required.

**Table 1.** Data of odonate diversity in Dhebar Lake.

Suborder	Family	Species	n	IUCN redlist category
Anisoptera Selys, 1854	Aeshnidae Leach, 1815	<i>Anax guttatus</i> Burmeister, 1839	2	LC (Dow, 2017)
	Gomphidae Rambur, 1842	<i>Ictinogomphus rapax</i> Rambur, 1842	15	LC (Mitra, 2010a)
		<i>Acisoma panorpoides</i> Rambur, 1842	16	LC (Clausnitzer et al., 2018)
	Libellulidae Leach, 1815	<i>Brachythemis contaminata</i> Fabricius, 1793	4	LC (Sharma, 2010a)
		<i>Crocothemis erythraea</i> Brulle, 1832	19	LC (Clausnitzer, 2016)
		<i>Indothemis carnatica</i> Fabricius, 1798	1	LC (Dow, 2019)
		<i>Orthetrum pruinatum</i> Burmeister, 1839	22	LC (Sharma, 2010b)
		<i>Orthetrum sabina</i> Drury, 1770	11	LC (Mitra, 2020)

Suborder	Family	Species	n	IUCN redlist category
		<i>Trithemis aurora</i> Burmeister, 1839	8	LC (Subramanian & Dow, 2010)
		<i>Trithemis kirbyi</i> Selys, 1891	8	LC (Boudot, 2016)
		<i>Trithemis pallidinervis</i> Kirby, 1889	3	LC (Subramanian, 2010)
		Not identified	6	
Zygoptera Selys, 1854	Coenagrionidae Kirby, 1890	<i>Aciagrion occidentale</i> Laidlaw, 1919	24	LC (Mitra, 2010b)
		<i>Agriocnemis femina</i> Brauer, 1868	12	LC (Dow, 2020)
		<i>Agriocnemis pygmaea</i> Rambur, 1842	4	LC (Subramanian, 2020)
		<i>Ceriagrion olivaceum</i> Laidlaw, 1914	7	LC (Mitra, 2010c)
		<i>Ischnura senegalensis</i> Rambur, 1842	9	LC (Sharma & Clausnitzer, 2016)
		<i>Pseudagrion decorum</i> Rambur, 1842	21	LC (Mitra, 2013)
	Lestidae Calvert, 1907	<i>Lestes viridulus</i> Rambur, 1842	23	LC (Dow, 2010)
		<i>Orolestes durga</i> Lahiri, 1987	11	DD (Dow, 2009)
		Not identified	8	

**Graph 1.** Relative abundance of odonate families.

### Conclusion

Total 19 species of odonates under 5 families are reported. Total odonate species found in this lake were 3.76% of total odonate species recorded in India and 37.25% of total odonate species recorded in Rajasthan. Most common dragonfly family was reported Libellulidae and most common damselfly family was reported Coenagrionidae. Population of dragonflies (n=115) and damselflies (n=119) were found almost equal. Highest number of dragonfly individuals were reported from species *Orthetrum pruinosum* (n=22) and damselfly individuals were reported from species *Aciagrion occidentale* (n=24). Dhebar Lake may be hotspot of odonate diversity. Odonates are the perfect organism for perfect ecosystem.

### References

- [1] Babu, R., Subramanian, K.A. and Nandy, S. 2013. Endemic odonates of India. Records of Zoological Survey of India, Occasional Paper, 347: 1-60.
- Bechly, G. 2007. Phylogenetic systematics of Odonata. Zygote, 2: 1-16.
- [2] Boudot, J.-P., Clausnitzer, V., Samraoui, B., Suhling, F., Dijkstra, K.-D.B. & Schneider, W. 2016. *Trithemis kirbyi*. The IUCN Red List of Threatened Species 2016: e.T60062A83875068. <https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T60062A83875068.en>.

- [3] Clausnitzer, V. 2016. *Crocothemis erythraea*. The IUCN Red List of Threatened Species 2016: e.T59859A83846274. <https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T59859A83846274.en>.
- [4] Clausnitzer, V., Suhling, F. & Dow, R.A. 2018. *Acisoma panorpoides*. The IUCN Red List of Threatened Species 2018: e.T56259873A56260502. <https://dx.doi.org/10.2305/IUCN.UK.2018-1.RLTS.T56259873A56260502.en>.
- [5] Corbet, P. S. 1999. Dragonflies: behaviour and ecology of Odonata. Cornell University Press.
- [6] Dheerendra, S. 2022. Field Guide to the Dragonflies & Damselflies of Northwest India. M/s Bishen Singh Mahendra Pal Singh, India.
- [7] Dow, R.A. 2009. *Orolestes durga*. The IUCN Red List of Threatened Species 2009: e.T163628A5626542. <https://dx.doi.org/10.2305/IUCN.UK.2009-2.RLTS.T163628A5626542.en>.
- [8] Dow, R.A. 2010. *Lestes viridulus*. The IUCN Red List of Threatened Species 2010: e.T167318A6328220. <https://dx.doi.org/10.2305/IUCN.UK.2010-4.RLTS.T167318A6328220.en>.
- [9] Dow, R.A. 2017. *Anax guttatus*. The IUCN Red List of Threatened Species 2017: e.T167337A48635356. <https://dx.doi.org/10.2305/IUCN.UK.2017-1.RLTS.T167337A48635356.en>.
- [10] Dow, R.A. 2019. *Indothemis carnatica*. The IUCN Red List of Threatened Species 2019: e.T163674A123027708. <https://dx.doi.org/10.2305/IUCN.UK.2019-2.RLTS.T163674A123027708.en>.
- [11] Dow, R.A. 2020. *Agriocnemis femina* (errata version published in 2020). The IUCN Red List of Threatened Species 2020: e.T167208A179263659. <https://dx.doi.org/10.2305/IUCN.UK.2020-1.RLTS.T167208A179263659.en>.
- [12] Grimaldi, D. and Engel, M. S. 2005. Evolution of the Insects. Cambridge University Press, Cambridge.
- [13] Koli, V. K., Bhatnagar, C., and Shekhawat, D. S. 2014. Diversity and Species Composition of Odonates in Southern Rajasthan, India. Proceedings of the Zoological Society, 68: 202-211.
- [14] Mischianti, M., Lin, H. T., Herold, P., Imler, E., Olberg, R. and Leonardo, A. 2015. Internal models direct dragonfly interception steering. Nature, 517: 333-338.
- [15] Mitra, A. 2013. *Pseudagrion decorum*. The IUCN Red List of Threatened Species 2013: e.T167269A17536286. <https://dx.doi.org/10.2305/IUCN.UK.2013-1.RLTS.T167269A17536286.en>.
- [16] Mitra, T.R. 2006. Handbook on common Indian dragonflies (Insect: Odonata). Kolkata: Zoological Survey of India.
- [17] Mitra, A. 2010a. *Ictinogomphus rapax*. The IUCN Red List of Threatened Species 2010: e.T167365A6334728. <https://dx.doi.org/10.2305/IUCN.UK.2010-4.RLTS.T167365A6334728.en>.

- [18] Mitra, A. 2010b. *Aciagrion occidentale*. The IUCN Red List of Threatened Species 2010: e.T167267A6320067. <https://dx.doi.org/10.2305/IUCN.UK.2010-4.RLTS.T167267A6320067.en>.
- [19] Mitra, A. 2010c. *Ceriagrion olivaceum*. The IUCN Red List of Threatened Species 2010: e.T167147A6308337. <https://dx.doi.org/10.2305/IUCN.UK.2010-4.RLTS.T167147A6308337.en>.
- [20] Mitra, A. 2020. *Orthetrum sabina*. The IUCN Red List of Threatened Species 2020: e.T165470A83377025. <https://dx.doi.org/10.2305/IUCN.UK.2020-1.RLTS.T165470A83377025.en>.
- [21] Olberg, R. M., Worthington, A. H. and Venator, K. R. 2007. Prey pursuit and interception in dragonflies. *Journal of Comparative Physiology A*, 186: 155-162.
- [22] Paulson, D. and Schorr, M. 2024. The World Odonata List. <https://www.odonatacentral.org/app/#/wol/>
- [23] Rawal, D. and Verma, H. 2021. Biodiversity analysis of chironomids (Diptera: Chironomidae) in Jaisamand Lake (Udaipur, Rajasthan). *International Journal of Entomology Research*, 6: 135-139.
- [24] Sharma, G. 2010a. *Brachythemis contaminata*. The IUCN Red List of Threatened Species 2010: e.T167368A6335347. <https://dx.doi.org/10.2305/IUCN.UK.2010-4.RLTS.T167368A6335347.en>.
- [25] Sharma, G. 2010b. *Orthetrum pruinsum*. The IUCN Red List of Threatened Species 2010: e.T167097A6301540. <https://dx.doi.org/10.2305/IUCN.UK.2010-4.RLTS.T167097A6301540.en>.
- [26] Sharma, G. and Clausnitzer, V. 2016. *Ischnura senegalensis*. The IUCN Red List of Threatened Species 2016: e.T59897A75436136. <https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T59897A75436136.en>.
- [27] Subramanian, K. A. 2005. Dragonflies and Damselflies of Peninsular India-A Field Guide. E-Book of Project Lifescape. Centre for Ecological Sciences, Indian Institute of Science and Indian Academy of Sciences, Bangalore, India.
- [28] Subramanian, K. A. 2010. *Trithemis pallidinervis*. The IUCN Red List of Threatened Species 2010: e.T167370A6336121. <https://dx.doi.org/10.2305/IUCN.UK.2010-4.RLTS.T167370A6336121.en>.
- [29] Subramanian, K. A. 2014. Dragonflies and Damselflies of Peninsular India - A Field Guide. *Indian Academy of Sciences*, Bangalore.
- [30] Subramanian, K. A. 2020. *Agriocnemis pygmaea*. The IUCN Red List of Threatened Species 2020: e.T167280A83374189. <https://dx.doi.org/10.2305/IUCN.UK.2020-1.RLTS.T167280A83374189.en>.
- [31] Subramanian, K. A and Babu, R. 2024. Fauna of India Checklist: Arthropoda: Insecta: Odonata. Version 1.0. Zoological Survey of India. <https://doi.org/10.26515/Fauna/1/2023/Arthropoda:Insecta:Odonata>
- [32] Subramanian, K. A. & Dow, R.A. 2010. *Trithemis aurora*. The IUCN Red List of Threatened Species 2010: e.T167395A6341159. <https://dx.doi.org/10.2305/IUCN.UK.2010-4.RLTS.T167395A6341159.en>.