A preliminary study on diversity status of Odonates in and around college of forestry Campus, Uttara Kannada, Karnataka, India

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Abstract
Odonata is an insect order with two sub orders, Zygoptera and Anisoptera. They are an amazing insect group with an amphibious life cycle. This makes them an important component of freshwater ecosystems and indicators of ecosystem health. The present study was an attempt made to document and analyse the odonate diversity of College of Forestry Sirsi campus, a 14-ha site in Sirsi, Karnataka, India. The study was done in the field where individual observations were identified and recorded with the help of appropriate field guides. A total of 32 odonate species, i.e., 22 dragonflies and 10 damselflies belonging to 7 families were observed in the study area. Within this diversity, a higher proportion of families Libellulidae and Coenagrionidae within orders Anisoptera and Zygoptera respectively was found. This presence of generalists more than specialists might be due to higher proportion of anthropogenic disturbances in the study site.

Keywords: Odonata, diversity, zygoptera, anisoptera

Introduction
The insect order Odonata is a group of flying insects divided into three sub orders i.e. Zygoptera, Anisoptera and Anisogzyoptera of which Anisoptera (dragonflies) and Zygoptera (damselflies) are the main sub orders [1, 2]. Dragonflies are generally larger and alight with wings held in horizontal plane at rest while the latter are smaller and slender bodied with their wings held over the abdomen [1]. Having evolved during the carboniferous period, with their short lifespan and amphibious life history, odonates are a much interesting group of insects [3, 4]. The amphibious life makes them an integral part of freshwater ecosystems. There are 5952 species of odonates around the globe and the number can still increase with nearly a 1000 more species expected to be still discovered [2-5]. India is home to 474 species in 142 genera and 18 families of which Western Ghats have 174 species of odonates with 69 endemics [7, 8]. Their peculiar ecology makes them susceptible to the subtle changes in ecosystems. Odonata forms a flagship taxon of freshwater ecosystems [9]. Anthropogenic disturbances are today causing damage to ecosystem health and odonate populations, numerous studies have shown the impact of human induces changes on odonate populations making them the perfect model of indicator groups for ecological surveys [10-12]. This study attempts to understand the odonate diversity in College of Forestry Campus, located in Uttara Kannada district of Karnataka, India and to derive possible inferences on the ecosystem health of the locality.

Materials and Methods
Study area
The study site, College of Forestry Sirsi campus is 14 ha of land surrounded by tropical moist deciduous forests, *Acacia auriculiformis* plantations and human habitat areas. Located at an elevation of 600 m above mean sea level, the area is a fragmented landscape of tree lots, paddy fields and small ponds. The presence of ponds, paddy fields and adjoining forests are expected to influence the presence and diversity of odonates in the campus. The campus is located at coordinates 14.61°95’N 74.83°54’E and receives annual rainfall between 200 and 250 cm, primarily from the southwest monsoon winds.
Methodology
Observations were made and recorded by direct encounter through regular survey of the campus covering all habitat types. The observed individuals were photographed and species identifications were done with the help of standard field guides, references and identification keys [8, 14, 15]. The observations were made for the duration of five months from August to December 2019. Each individual observation was recorded to give an idea of the odonate community. The species records were cross checked with available literature on odonate diversity to understand the significance of our data in an ecological perspective.

Results and Discussion
A total of 32 odonate species, i.e., 22 dragonflies and 10 damselflies belonging to 7 families were observed in the study area. Anisoptera (dragonflies) accounted for highest number of species (22) with the family Libellulidae (19 species) being dominant. This was followed by Gomphidae (2) and Aeshnidae (1). Among the 10 Zygoptera members, 6 belonged to the family Coenagrionidae followed by Platycnemididae (1) Calopterygidae (2) and Lestide (1). The larger number of members of the sub order Anisoptera might be due to larger number of generalist species within this group. The ratio of Libellulidae/other Anisoptera and Coenagrionidae/other Zygoptera is found to be large in the study. This is an indicator of ecosystem disturbance [16]. Literature shows that, for tropical ecosystems, the higher number of Libellulidae and Coenagrionidae can be attributed to a higher amount of anthropogenic ecosystem disturbance. The presence of different institutions and adjacency to human settlement might are the causes of disturbance in the area. There is no availability of specific bench line data on previous odonate diversity in the particular area to analyse any diversity changes due to human interference. But this study can provide preliminary reference data for future exploration of diversity of the taxa in the region and adjoining forests.

| Table 1: Number of individual species observed among different families |
|-----------------|-----------------|-----------------|
| Sl. No. | Family | Species number |
| 1 | Libellulida | 19 |
| 2 | Gomphidae | 2 |
| 3 | Aeshnidae | 1 |
| 4 | Coenagrionidae | 6 |
| 5 | Platycnemididae | 1 |
| 6 | Calopterygidae | 2 |
| 7 | Lestide | 1 |

Fig 1: Percentage distribution among families
Table 2: List of dragonflies (Anisoptera) recorded in the study area

| Sl. No. | Common name       | Scientific name             |
|---------|-------------------|------------------------------|
| 1       | Trumpet-tail      | Acisoma panorpoides         |
| 2       | Crimson marsh glider | Trithemis aurora            |
| 3       | Crimson-tailed marsh hawk | Orthetrum pruinorum       |
| 4       | Pigmy skimmer     | Tetrathemis platyptera      |
| 5       | Pied paddy skimmer | Neurothemis tullia          |
| 6       | Pulvous forest skimmer | Neurothemis fulvia       |
| 7       | Green marsh hawk  | Orthetrum sabina            |
| 8       | Yellow-tailed Ashy Skimmer | Potamarcha congener  |
| 9       | Ditch Jewel       | Brachythemis contaminata    |
| 10      | Blue-tailed Yellow Skimmer | Palpopleura sexmaculata   |
| 11      | Evening Gomphid | Pantala flavescens          |
| 12      | Blue Ground Skimmer | Diplacodes trivialis     |
| 13      | Red Marsh Trotter | Tramea basilis              |
| 14      | Scarlet Marsh Hawk | Aethriamania brevipennis    |
| 15      | Tri-colored Marsh Hawk | Orthetrum lucinum         |
| 16      | Coral-Tailed Cloudwing | Tholymis tillarga       |
| 17      | Brown-Backed Marsh Hawk | Orthetrum chrysis       |
| 18      | Common Picturewing | Rhyothemis variagata       |
| 19      | Long-Legged Marsh Glider | Trithemis pallidinervis   |

Family: Gomphidae

| Sl. No. | Common name         | Scientific name             |
|---------|---------------------|------------------------------|
| 20      | Common Hook-Tail    | Paragomphus lineatus        |
| 21      | Indian Common Clubtail | Ictinogomphus rapax       |

Family: Aeshnidae

| Sl. No. | Common name       | Scientific name             |
|---------|-------------------|------------------------------|
| 22      | Blue-tailed Green Darner | Anax guttatus |

Table 3: List of damselflies (Zygoptera) recorded in study area

| Sl. No. | Common name             | Scientific name             |
|---------|-------------------------|------------------------------|
| 1       | Blue Bush Dart          | Copera vittata               |

Family: Platycnemididae

Family: Coenogriionidae

| Sl. No. | Common name             | Scientific name             |
|---------|-------------------------|------------------------------|
| 2       | Coromandel Marsh Dart   | Ceriagrion coromandelianum   |
| 3       | Indian Violet Dartlet   | Ceriagrion approximans      |
| 4       | Orange-tailed Marsh Dart | Ceriagrion cerinorubellum   |
| 5       | Western Golden Dartlet  | Ischnura rubilio             |
| 6       | Indian White Dartlet    | Agriocnemis piers            |
| 7       | Pygmy Dartlet           | Agriocnemis pygmaea          |

Family: Calopterygidae

| Sl. No. | Common name             | Scientific name             |
|---------|-------------------------|------------------------------|
| 8       | Black-tipped Forest Glory | Vestalis apicalis           |
| 9       | Clear-winged Forest Glory | Vestalis gracilis           |

Family: Lestida

| Sl. No. | Common name             | Scientific name             |
|---------|-------------------------|------------------------------|
| 10      | Emerald Spreadwing      | Lestes elatus                |

Major dragonflies recorded in the study

Family: Libellulidae

|                |                        |
|----------------|------------------------|
| Trumpet-tail   | Crimson Marsh Glider   |
|                | Pigmy skimmer          |
Long-Legged Marsh Glider

Family: Gomphidae

Fulvous Forest Skimmer

Family: Aeshnidae

Common Hook-Tail

Blue-tailed Green Darter

Fig 2: Major dragonflies recorded in the study

Family: Coenagrionidae

Orange-tailed Marsh Dart

Coromandel Marsh Dart

Western Golden Dartlet

Indian White Dartlet

Pygmy Dartlet

Indian Violet Dartlet
**Conclusion**

The species that were observed in the study indicates the in-situ diversity of the study site with multiple habitat types that can house varied variety of odonates. It can be seen that the population structure observed indicates the amount of disturbance that the ecosystem is experiencing. This is evident from the fact that there is a larger number of generalists than specialists. Specialists can thrive under multiple habitats conditions and hence can buffer environmental disturbances to a larger limit in comparison to specialists. Odonata is a perfect indicator group of ecosystem health. We suggest that more rigorous and temporally wider studies are necessary in the region.

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**References**

1. Bybee S, Cordoba-Aguilar A, Duryea MC et al. Odonata (dragonflies and damselflies) as a bridge between ecology and evolutionary genomics. Front Zool 2016;13(1):1-20. doi:10.1186/s12983-016-0176-7
2. Dijkstra K-DB, Bechly G, Bybee SM et al. The classification and diversity of dragonflies and damselflies (Odonata). In: Zhang, Z.-Q. (Ed.) Animal Biodiversity: An Outline of Higher-level Classification and Survey of Taxonomic Richness (Addenda 2013). Zootaxa 2013;3703(1):36. doi:10.11646/zootaxa.3703.1.9
3. Remsburg AJ, Turner MG. Aquatic and terrestrial drivers of dragonfly (Odonata) assemblages within and among north-temperate lakes. J North Am Benthol Soc 2009;28(1):44-56. doi:10.1899/08-004.1
4. Misof B, Liu S, Meusemann K et al. Phylogenomics resolves the timing and pattern of insect evolution. Science (80) 2014;346(6210):763-767. doi:10.1126/science.1257570
5. Kalkman VJ, Clausnitzer V, Dijkstra KDB, Orr AG, Paulson DR, Van Tol J. Global diversity of dragonflies (Odonata) in freshwater. Hydrobiologia 2008;595(1):351-363. doi:10.1007/s10750-007-9029-x
6. Subramanian KA. A Checklist of Odonata (Insecta) of India. Zoological Survey of India, Pune 2009;1:37
7. Subramanian KA. The status and distribution of dragonflies and damselflies (Odonata) of the Western Ghats. In: Molur S, Smith KG, Daniel BA, Darwall WRT, eds. The status and distribution of freshwater biodiversity in the western ghats, India. The IUCN Red List of Threatened Species ™. IUCN, Cambridge, UK and Gland, Switzerland and Zoo outreach organization, Coimbatore, India 2011, 63-71.
8. Subramanian KA. A Checklist of Odonata (Insecta) of India. Zoological Survey of India, Kolkata 2017;3:54.
9. Nagy HB, Laszlo Z, Szabo F, Szocs L, Dévai G, Tothmeresz B. Landscape-scale terrestrial factors are also vital in shaping Odonata assemblages of watercourses. Sci Rep 2019;9(1):1-8. doi:10.1038/s41598-019-54628-7
10. Villalobos-Jiménez G, Dunn AM, Hassall C. Dragonflies and damselflies (Odonata) in urban ecosystems: A review. Eur J Entomol 2016;113(1):217-232. doi:10.14411/eje.2016.027
11. Uke SHL, Dow RA, Bu HEN, TI ER, SE et al. The impacts of habitat disturbance on adult and larval dragonflies (Odonata) in rainforest streams in Sabah, Malaysian Borneo 2017. doi:10.1111/fwb.12880
12. Simaika JP, Samways MJ. Comparative assessment of indices of freshwater habitat conditions using different invertebrate taxon sets. Ecol Indic 2011;11(2):370-378. doi:10.1016/j.ecolind.2010.06.005
13. Burrows MT, Schoeman DS, Richardson AJ et al. Geographical limits to species-range shifts are suggested by climate velocity. Nature 2014;507:492-495. doi:10.1038/nature12976
14. Ranjan Mitra T. Endemic odonata of India. Rec. zool. Surv. India 2002;100(3-4):189-199.
15. Walia GK, Devi M. Cytogenetic data of subfamily Disparoneurinae (Odonata: Zygoptera: Platycnemididae) based on localization of C-heterochromatin, AgNOR’s and AT-GC regions. International Journal of Entomology Research. 2020;5(2):70-3.
16. Fraser FC. The Fauna of British India, Ceylon and Burma 1934, 2.
17. Hana S, Jan S. A novel approach involving the use of Odonata as indicators of tropical forest degradation: When family matters. Ecol Indic 2019;104:229-236. doi:10.1016/j.ecolind.2019.05.001