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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 Anisozygoptera 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 [10-13]. 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 Libelellulide (19 species) being dominant. This was followed by Gomphidae (2) and Aeshnidae (1). Among the 10 Zygoptera members, 6 belonged to the family Coenogrionidae followed by Platycnemididae (1) Calopterygidae (2) and Lestide (1).

The larger number of members of the sub order Anisoptera mighty 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 adjacence 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	Libelellulide	19
2	Gomphidae	2
3	Aeshnidae	1
4	Coenogrionidae	6
5	Platycnemididae	1
6	Calopterygidae	2
7	Lestide	1

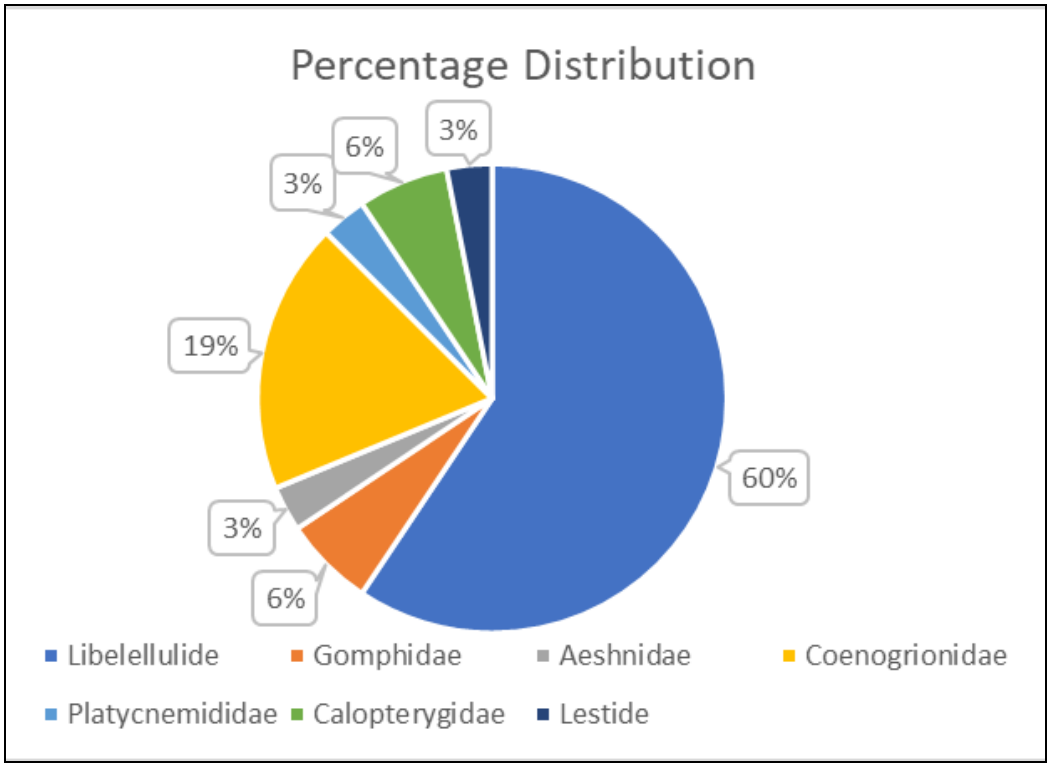

Fig 1: Percentage distribution among families

Table 2: List of dragonflies (Anisoptera) recorded in the study area

Family: Libellulidae		
Sl. No.	**Common name**	**Scientific name**
1	Trumpet-tail	*Acisoma panorpoides*
2	Crimson marsh glider	*Trithemis aurora*
3	Crimson tailed marsh hawk	*Orthetrum pruinosum*
4	Pigmy skimmer	*Tetrathemis platyptera*
5	Pied paddy skimmer	*Neurothemis tullia*
6	Fulvous 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	Wandering Glider	*Pantala flavescens*
12	Blue Ground Skimmer	*Diplacodes trivialis*
13	Red Marsh Trotter	*Tramea basilaris*
14	Scarlet Marsh Hawk	*Aethriamanta brevipennis*
15	Tri-coloured Marsh Hawk	*Orthetrum luzonicum*
16	Coral-Tailed Cloudwing	*Tholymis tillarga*
17	Brown-Backed Marsh Hawk	*Orthetrum chrysis*
18	Common Picturewing	*Rhyothemis variegata*
19	Long-Legged Marsh Glider	*Trithemis pallidinervis*
Family: Gomphidae		
20	Common Hook-Tail	*Paragomphus lineatus*
21	Indian Common Clubtail	*Ictinogomphus rapax*
Family: Aeshnidae		
22	Blue-tailed Green Darner	*Anax gutttus*

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

Family: Platycnemididae		
Sl. No.	**Common name**	**Scientific name**
1	Blue Bush Dart	*Copera vittata*
Family: Coenogrionidae		
2	Coromandel Marsh Dart	*Ceriagrion coromandelianum*
3	Indian Violet Dartlet	*Aciagrion approximans*
4	Orange-tailed Marsh Dart	*Ceriagrion cerinorubellum*
5	Western Golden Dartlet	*Ischnura rubilio*
6	Indian White Dartlet	*Agriocnemis pieris*
7	Pygmy Dartlet	*Agriocnemis pygmaea*
Family: Calopterygidae		
8	Black-tipped Forest Glory	*Vestalis apicalis*
9	Clear-winged Forest Glory	*Vestalis gracilis*
Family: Lestide		
10	Emerald Spreadwing	*Lestes elatus*

Major dragonflies recorded in the study

Family: Libellulidae

Trumpet-tail

Crimson Marsh Glider

Pigmy skimmer

Crimson tailed marsh hawk

Blue Ground Skimmer

Green marsh hawk

Pied Paddy Skimmer

Ditch Jewel

Blue-tailed Yellow Skimmer

Wandering Glider

Red Marsh Trotter

Scarlet Skimmer

Scarlet Marsh Hawk

Tri-coloured Marsh Hawk

Coral-Tailed Cloudwing

Brown-Backed Marsh Hawk

Common Picturewing

Long-Legged Marsh Glider

Family: Gomphidae

Fulvous Forest Skimmer

Family: Aeshnidae

Common Hook-Tail

Blue-tailed Green Darner

Fig 2: Major dragonflies recorded in the study

Family: Coenogrionidae

Orange-tailed Marsh Dart

Coromandel Marsh Dart

Western Golden Dartlet

Indian White Dartlet

Pygmy Dartlet

Indian Violet Dartlet

Family: Platycnemididae

Blue Bush Dart

Family: Calopterygidae

Black-tipped Forest Glory

Clear-winged Forest Glory

Emerald Spreadwing

Fig 3: Major damselflies recorded in the study

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 area and adjacent forests to get a clearer idea on the odonate population dynamics. The data provided here can be a baseline identifying the major species present in and around College of Forestry campus. This study calls for more rigorous and wider area explorations to be taken up in the region.

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