

# Diversity of Odonata in Baby John Memorial Government College Campus Chavara Kollam, Kerala: A Preliminary Assessment and Conservation Implications

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## ABSTRACT

This study aimed to record and analyze the diversity of odonates in the BJM College campus, a 14-hectare area located in Chavara, Kollam, India. The research was conducted in the area where individual sightings were recognized and documented using suitable field guides. Eighteen odonate species were recorded in the study area, comprising 10 dragonflies and 8 damselflies from 3 families. Amid this diversity, a greater number of families Libellulidae and Coenagrionidae were observed in the orders Anisoptera and Zygoptera, respectively. The species richness (R), Shannon-Wiener diversity (H'), evenness (E), and Simpson's diversity (1/D) values calculated were 3.34, 2.48, 0.98, and 10.90 respectively, while the two groups exhibit vertical niche segregation. The baseline data presented here serve as the foundation for evidence-based conservation suggestions.

*Key words: Diversity, Ecosystem, Niche, Odonata*

## Introduction

Dragonflies and damselflies are aerial insects that significantly contribute to the stability of ecosystems by acting as natural predators of disease-carrying insects (Bybee *et al.*, 2016; CórdobaAguilar *et al.*, 2021). During their life cycle, from water-dwelling nymphs to flying adults, these insects consume various invertebrates, such as flies and mosquitoes, thus controlling their populations and reducing disease transmission (Mogi, 2007; Hershey *et al.*, 2010; Batzer & Boix, 2016). Dragonflies fulfil a dual function in ecosystems, acting as top predators that uphold food chain equilibrium and as delicate bio-indicators of ecological well-being (Kalkman *et al.*,

2018; Tang and Visconti, 2021; Dolny *et al.*, 2021). Odonate species encompassing dry and wet, as well as montane and lowland components, reside in various habitat types such as grasslands, riparian forest fragments, and both running and standing water wetlands. Nonetheless, the population and spread of Odonates may shift with alterations in land use caused by rising human activities and expected climate changes.

Despite a few surveys on the diversity of Odonate fauna in Kollam carried out during the last decades (Divya *et al.*, 2023), the lack of surveys remains one of the major obstacles to planning Odonate conservation in the Kollam district. In contrast to other groups like avifauna, there is a significant knowl-

edge gap regarding insects, primarily caused by insufficient sampling and taxonomic skills (Diniz-Filho and Hawkins 2010). Although various stages of Odonate nymphs indicate the ecological health of aquatic ecosystems (Farkas *et al.*, 2013), our understanding of Odonate larval stages is limited. Conservation strategies need data on the species richness, abundance, diversity, distribution, biogeography, ecology, and population dynamics of Odonate communities (Renner *et al.*, 2017). Consequently, conducting inventories to record current Odonate diversity is essential for their conservation efforts (Renner *et al.* 2017), as well as for setting biodiversity baselines for future observation. Thus, the current quick survey [e.g. (McCullough *et al.*, 2007; Clark *et al.*, 2012) sought to evaluate the Odonate species in Chavara Kollam and subsequently offer suggestions for their preservation in the region, as nearly no information exists on the taxa in this under-researched area experiencing rapid development. We accomplished the primary goal of the study by addressing three main objectives: (1) to catalog the Odonate fauna across various habitat types in BJM College Campus Chavara using a transect survey, (2) to analyze the endemism and conservation status of the Odonate fauna. These main goals account for most of our findings presented here, while providing the foundation for conservation suggestions

## Materials and Methods

### Study Site

The study area, Baby John Memorial Government College Campus, Chavara, is located in the Chavara Panchayat of Kollam District. The study was carried out from January to June 2024. It is situated between

9° 4' N, 76° 29' E and 8° 99' N, 76° 53' E. The total area is 10 acres. There are two semi-perennial streams within the campus, and a large area remains submerged during the monsoons. Apart from these, coconut plantations, bamboo groves, and garden patches are also present; two large gardens and fields dominated by grasses, herbs, and ferns provide excellent shelter and breeding habitat for the odonates. The climate of the area is characterized by a mean annual rainfall ranging from 1,875 to 2,500 mm and an average temperature of 28.3°C. The survey was conducted in five different habitat types that prominently cover much of the campus area, viz. lentic wetlands, lotic wetlands, patches of riparian forests, paddy-dominated agricultural habitats, and well-wooded home gardens, including most of the college campus premises (human settlements). We conducted the survey in five randomly selected sampling sites for each habitat type, representing the complexity of habitat features within each habitat type (Figure 1).

### Sampling Method

The survey was conducted from January 2025 to July 2025, and observations were mainly done at three sites within the campus. Photographs of the odonates were taken using a Canon PowerShot SX510 HS and a Canon EOS 1200D. In very few cases, the odonates were captured to take some close photographs and were released immediately; in no cases were these insects harmed or killed. Odonates were identified using the keys provided by Subramanian (2005), Nair (2011), Fraser (1933), Mitra (2002), and Subramanian *et al.*, 2017.

### Data Analysis

Data were analyzed statistically to determine spe-



Fig. 1. Different habitat at Study site

cies diversity, species richness, species abundance, and evenness. The data analysis discussed in this study includes the abundance of species (n), the richness of species (s), the diversity of species (H), and the evenness of species (E). The abundance of species is the number of individual species found at each sampling site, while the richness of species is based on the number of species present in each location of the study. Shannon diversity ( $H'$ ), evenness ( $e^H/S$ ), Margalef's species richness (d), and Fisher alpha diversity ( $\hat{\alpha}$ ) were computed using PAST software (Hammer *et al.*, 2001), and their interpretations followed Magurran (2004)

## Results and Discussion

### Composition of the Odonates fauna

When the transect survey is supplemented with opportunistic observations, we produced a checklist of 18 species of Odonates representing three families from BJM College Campus. They represent 10 species in two families of dragonflies and 8 species in one family of damselflies (Table 1). One species was found to be endemic to the Study site *Agriocnemis keralensis* including damselflies (Fig 2). Out of 18

Odonate species recorded, all species are least concern. No species were found under Vulnerable or Endangered categories. The Dragonfly family Libellulidae was found to be the most dominant with 9 species while the family Gomphidae was the least dominant representing only one species. The Damselfly family Coenagrionidae was the second largest represented by eight species. Dragonflies were found most diverse and predominant in four habitat types, lotic wetlands, lentic water bodies, paddy-dominated agricultural habitats, and human settlements except in the riparian forest patches where damselflies dominated. Among the 18 Odonate species recorded in the transect survey, 6 species were categorized as Common, 5 species as Fairly Common, 3 species as Uncommon, and 2 species as Rare. Notably, species like *Orthetrum sabina*, *Crocothemis servilia*, and *Neurothemis tullia* were frequently encountered and classified as Common, indicating their wide distribution and ecological adaptability. On the other hand, species such as *Agriocnemis keralensis* and *Ischnura rubilio* were marked as Rare, suggesting either habitat specificity or limited population density in the study area. These patterns of abundance reflect the ecological

**Table 1.** Checklist of the Odonates reported from Baby John Memorial Govt College Campus.

Sl. No.	Family	SCIENTIFIC NAME	Habitat Type				
			A	B	C	D	E
Sub order: Zygoptera							
1	Coenagrionidae	<i>Ceriagrion coromandelianum</i> (Brauer, 1865)	+	-	-	-	+
2	Coenagrionidae	<i>Ceriagrion cerinorubellum</i> (Fabricius, 1798)	+	+	-	-	+
3	Coenagrionidae	<i>Ischnura rubilio</i> (Selys, 1876)	+	+	-	-	-
4	Coenagrionidae	<i>Agriocnemis keralensis</i> (Peters, 1981)	+	+	-	+	+
5	Coenagrionidae	<i>Ischnura senegalensis</i> (Rambur, 1842)	+	+	-	-	-
6	Coenagrionidae	<i>Agriocnemis pygmaea</i> (Rambur, 1842)	+	+	-	+	+
7	Coenagrionidae	<i>Ischnura aurora</i> (Brauer, 1865)	+	+	-	-	-
8	Coenagrionidae	<i>Pseudagrion microcephalum</i> (Rambur, 1842)	+	+	-	-	-
Sub order: Anisoptera							
9	Libellulidae	<i>Diplacodes trivialis</i> (Rambur, 1842)	+	+	-	-	+
10	Libellulidae	<i>Aethriamanta brevipennis</i> (Rambur, 1842)	+	+	-	+	+
11	Libellulidae	<i>Rhyothemis variegata</i> (Linnaeus, 1763)	+	+	-	+	-
12	Libellulidae	<i>Neurothemis tullia</i> (Drury, 1773)	+	+	-	+	-
13	Libellulidae	<i>Acisoma panorpoides</i> (Rambur, 1842)	+	+	-	+	-
14	Libellulidae	<i>Trithemis aurora</i> (Burmeister, 1839)	+	-	+	+	+
15	Libellulidae	<i>Orthetrum sabina</i> (Drury, 1770)	+	+	+	+	+
16	Libellulidae	<i>Crocothemis servilia</i> (Drury, 1770)	+	+	+	+	+
17	Libellulidae	<i>Lathrecista asiatica</i> (Fabricius, 1798)	+	+	-	+	+
18	Gomphidae	<i>Ictinogomphus rapax</i> (Rambur, 1842)	+	+	-	-	-

**Habitat type:** A- Lentic wetland habitat; B - Lotic wetland habitats; C - Human settlements; D- Paddy dominated agricultural habitats; and E- Riparian Forest patches

+ indicates the presence of species - indicates the absence of species

preferences and habitat associations of each species, with Zygopteran species generally exhibiting localized distributions, while Anisopteran species such as *Diplacodes trivialis* and *Trithemis aurora* were more widespread and resilient to habitat variations (Table 1). The conservation status of least concern (LC) is a low-risk status, namely the status for species that are not endangered (Pradana *et al.*, 2019).

### Diversity indices of Odonates Fauna

Diversity indices for different habitat types (Table 3) lentic water bodies received the highest scores (R - 3.34, H' - 2.48, E - 0.97, and 1/D - 10.99) whereas human settlements scored the least (R - 1.16, H' - 1.06, E - 0.66, and 1/D - 2.19). The scores for riparian forest patches (R - 1.67, H' - 1.76, E - 0.83, and 1/D - 3.44) were also noteworthy. The diversity indices for different habitat types revealed that lentic water bodies contribute to the highest species richness and the diversity opposed to the least values for human settlements. The loss of natural microhabitats including sites for perching, breeding, predator refuge, and less availability of food resources could be the reasons for low species richness, Shannon-Wiener diversity, evenness, and Simpson's diversity in human settlements. In contrast, higher values in lentic habitats are presumed to be influenced by the availability of open water for mating, maintaining breeding and foraging territories, and direct pen-

etration of sunlight which affects them to regulate their body temperature. The BJM College campus is a suitable location for the natural habitat of various types of dragonflies. This is due to the existence of stagnant aquatic ecosystems (swamp and pond) where various types of dragonflies are used to continue their life cycle, namely by laying eggs and becoming larvae in the waters. This is in accordance with (Laily *et al.*, 2018), who reported that the egg and nymph phases of dragonflies live in water. As a result, adult dragonflies are rarely far from the water (Paulson, 2009; Pumungkas & Ridwan, 2015; Samways, 2008). Most of the life stages of dragonflies are in the water, so most types of dragonflies have their main habitat type in the aquatic ecosystem

### Threats faced by Odonate fauna in BJM College Campus and conservation recommendations

Odonates play an essential ecological role and uniquely contribute to biodiversity, making them valuable indicator species for the conservation of aquatic and terrestrial habitats, thereby preserving overall biodiversity. Therefore, these species may serve as an effective means for identifying key regions for conservation (Renner *et al.*, 2017). The findings of this survey would offer important insights into Odonate species, their habitat needs, and how shifts in environmental conditions will impact their populations. Additionally, the key threats to Odonates in the region, including the fragmentation of existing patches for agriculture, removal of riparian vegetation, landscape changes from unregulated development and human habitation, pesticide runoff in farming, rising natural pollution, and waterway contamination from detergents and solid waste, particularly plastics and polythene, must be carefully addressed in the sustainable management of this human-influenced landscape. Consequently, creating a conservation plan based on evidence for the region to offer scientific backing for biodiversity



*Lathrecista asiatica*

*Pseudagrion microcephalum*

Fig. 2. Photographs of Odonates in study site

Table 3. Diversity indices of odonates recorded in study site

Habitat Type	Species Richness (R)	Shannon -wiener Diversity (H)	Species Evenness (E)	Simpson Diversity(1/D)
Lotic wetland	2.24	1.88	0.58	5.43
Lentic wetland	3.34	2.48	0.97	10.99
Agricultural area	2.56	2.26	0.94	6.58
Human area	1.16	1.06	0.66	2.19
Riperian area	1.67	1.76	0,83	3.44

management is an urgent necessity. While the present survey was conducted in only five common habitat types in the area, our findings suggested that Odonate diversity in the broader landscapes is significantly greater, even in disturbed and fragmented environments. Therefore, the primary aim of a conservation strategy for the landscape should maintain the Odonate community while safeguarding the overall biodiversity and reducing local extinctions. The slow human-driven development within the Campus area will unavoidably include new infrastructure, alter the natural scenery, and eliminate certain existing areas of native vegetation. It is crucial to enhance the link between current habitat patches by creating corridors and buffer areas. Moreover, creating small ponds and/or artificial wetlands with macrophyte plants, alongside ongoing maintenance of increased habitat diversity, will offer microhabitats for the Odonate species. Additionally, it will enhance the connectivity of habitats. These artificial lentic habitats often draw effective dispersers, offering sanctuaries for locally uncommon species and enabling quicker adaptation to changes in the environment. Removal of riparian vegetation leads to a decline in habitat diversity and integrity (De paiva Silva *et al.*, 2010). Additionally, the elimination of riparian vegetation influences the community structure of Odonates, substituting specialist species with generalist ones (Da Silva Monteiro Júnior *et al.*, 2013). Creating small reserves near water bodies on private properties, preserving live fences, and maintaining wet marshlands around agricultural areas, along with the rehabilitation and restoration of damaged habitats through planting appropriate species, is also advised.

## Conclusion

Findings of this survey revealed that different habitat types of the BJM College Campus area have a rich diversity of Odonates comprising 18 species belonging to three families, while they are complementary to each other in terms of their Odonate assemblages. The maximum number of Odonates was recorded during the rainy season. Further, the study revealed that the family Libellulidae was the most specious and diverse. Further, the checklist of Odonates in BJM College Campus presented here could be used as a baseline for future updates and monitoring of Odonates in the area. In addition, these findings support the importance of maintaining di-

versified habitat patches, lentic and lotic wetlands, agricultural lands including grasslands, riparian vegetation, etc. in the environment with an appropriate canopy cover and habitat complexity to conserve the rich diversity of Odonates.

**Conflict of Interest - None**

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