



A preliminary study on Odonate diversity in and around the campus area of Pt. Ravishankar Shukla University Raipur (C.G.) India

Sahu R¹ and Rai RK²

¹Department of Zoology, K.G. Arts and Science College, Raigarh C.G. India

²Department of Zoology, Govt. Mahamaya College Ratanpur, Bilaspur C.G. India

* Corresponding author: E. Mail. - rjm.mohan477@gmail.com | Mob. No. - 9752894675

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ABSTRACT

The climatic condition of campus area provides an optimal, favourable, healthy and natural environmental condition for Odonates (Insecta) diversity. An extensive study on identification and species richness of Odonatan diversity was conducted from April 2018 to March 2019. A checklist of 28 species of Odonates belonging to 19 genera representing for 3 families were recorded. The family Libellulidae with 18 species are found most dominant, Coenagrionidae family with 08 species are second dominant, Gomphidae having 02 and Aeshnidae family with 01 species is rare in count, were recorded in the present study. The observations also revealed the breeding and reproductive behavioural pattern of Odonate. The species richness in number is higher during post monsoon (September - October), their number in count is gradually declining from November to January and lowers in winter season (December to February). The present study provides a preliminary and baseline data of Odonatan diversity at central C. G. area for farmer, advanced research and conservational activities in this field.

Key words: Odonates, Diversity, Damselflies, Dragonflies

INTRODUCTION

Damselflies (Zygoptera) and Dragonflies (Anisoptera) are including in order Odonata under phylum Arthropoda. Odonates are one of the ancient, winged insects developed in Permian period (Kalkman et al. 2008). Odonates are worldwide distributed except Antarctica (Trueman, 2007).

Globally 5,952 extant species of Odonates with 31 family and 3 suborders are distributed in diverse ecological niche in all over the world, of these 474 species in 142 genera and 18 families have been

recorded in India and 106 species are labelled in M.P. and C.G. state. (Subramanian, 2009; Tiple and Chandra, 2013). 69 species are listed in the IUCN red list of threatened species and *Indothemis carnatica* comes near threatened condition (Tiple and Chandra, 2013).

Odonates are characterised by specific species and attractive body colouration along with flexible head (with large compound eyes), thorax (with distinct vented multi - coloured unequal wings, 3 pair walking legs), and a slender abdomen.

Dragonflies are larger and perch with their wings shed out to the side and damselflies have slender bodies and hold their wings over the body at rest. Damselflies are smaller and have equal size of wings. They hold their wings over the thorax and abdomen when the insect is resting.

The biological, ecological and bio topic significance of Odonates were discussed by various workers. Odonates are an agronomic significant species, their larva and adults act as a natural bio-controlling agent by controlling pest population (Khaliya, 2009). They play a vital role as indicator for good ecosystem functioning and also wetland health (Andrew et al. 2009), environmental changes (Tiple et al., 2009), good quality of biotopes and healthy ecosystem (Hart et al., 2014), good quality and terrestrial ecosystem condition (Martin 2016), freshwater ecosystem and river ecosystem, fresh water habitat (Clausnitzer, 2009; Kalkman et al., 2018). They also play a significant role as ideal surrogate taxa for identifying fresh water biodiversity hot spot for conservation (Hart et al., 2014). They are very sensitive to the alteration of their habitat as well as alteration of environmental changes viz. major landscape change, especially in the riparian zone. Their larvae are eaten in some part of the world. Tourist watched their behavioural and flying pattern as a hobby. It has also a potential for ecotourism.

Due to the biological and ecological significances of Odonates various workers conducted their work based on Odonatan diversity (Mitra, 1995; Prasad and Varshney, 1995; Srivastava and Suri babu, 1997; Kulkarni et al., 2002; Mishra, 2007; Tiple, 2013; Martin, 2016), Seasonal distribution (Khan, 2018; Tuhin, 2019) variation distribution pattern, species richness, morphology (Boudot and Kalkman, 2015). In India the work on odonatan species were conducted

by various workers (Subramanian, 2009; Nair, 2011; Kiran and Raju, 2019; Somwanshi et al., 2018).

Odonates are basically an agronomic and biological significant species, but their number is gradually declining due to loss of their habitat, over expanding, uncontrolled and unorganized urbanization, waste disposal near Odonatan habitat, pollutants, grazing (Tiple and Khurad, 2007), Climatic changes and anthropogenic activities (Tiple et al., 2007).

The work based on Odonatan biology is quite well studied in the central India. The central Chhattisgarh is one of the main agro-forest areas of India. Central Chhattisgarh is also known as "Rice bowl" of the country. But the information and study on Odonatan diversity was scanty.

So an attempt is made to prepare a checklist and baseline data, population dynamics and seasonal pattern of Odonatan diversity found around the campus area of Pt. Ravishankar Shukla University, Raipur (C. G.) India.

MATERIALS AND METHODS

Study site

Odonatan diversity was studied in the campus area of Pt. Ravishankar Shukla University Raipur (C.G.) India. It is largest and oldest university of higher education. It was founded in 1964. The campus is located at the latitude 21^o.2469 N, longitude 81^o.5974 E. It is spreaded in 207 acres of land area. The sprawling campus is densely covered with herb shrubs and trees. Natural and manmade water bodies are also present around the university campus. The climatic conditions of the campus area provide an optimal natural environmental condition for the diversified Odonatan diversity to flourish.

We selected four sampling sites to observe Odonatan diversity.

Site No. 1. - The small pond area - located near university staff quarter.

Site No. 2. - Near guest house and boys hostel building area - marked by dense green plant area.

Site No. 3. - University main gate area - marked by dry patches of land and scattered vegetation.



Fig. 1 : Study Site- Campus area of Pt. Ravishankar Shukla University Raipur (C.G.) India.

Site No. 4. - Around the HRDC campus and behind the HRDC campus area - where natural pond (Dumar pond) is situated. The pond have full of vegetation.

Sampling design

The preliminarily study and observations were conducted throughout the campus area. Weekly and opportunistic visits were carried out to observe Odonatan diversity in the campus area. On the basis of Odonatan diversity richness we selected four study sites A, B, C, D (discussed above).

The study sites were surveyed by walking random, from 04.04.2018 to 17.03.2019 between 07.00 to 10.00 A. M. and 04.00 to 6.00 P.M.

Odonates are delicate insects and very shy in nature. To minimizing the destruction of Odonatan population, the photographs of adult male and female Odonates were taken. Some females and young individuals have created difficulty to identify in the field. So a butterfly net with dark coloured clothing is used to collect them. After identification and photography, the trapped Odonates were released. Only confusing Odonate species were collected by butterfly catching net and their specimens were prepared in 70% alcohol.

Additional specimens were also preserved at dry condition by following standard protocol.

A field guide note book was also prepared for recording information about Odonatan species (Subramanian, 2009).

The studies were conducted through direct observation, photography and extensive collection of Odonatan diversity at selected four study sites.

Identification of species

A detail sketch of the live insect with their body coloration and color pattern is prepared. The Odonatan species were identified with the help of taxonomic keys provided by - Fraser,1934, 1936; Subramanian, 2005; Mitra, 1995; Andrew et al., 2009) and the scientific names were followed by Subramanian, 2009; Prasad and Varshney, 1995.

RESULTS AND DISCUSSION

The observed Odonates were categorized on the basis of their abundance in the study sites and they were listed in Table no. 1.

Table 1: A checklist of Odonatan species found at Pt. Ravishankar Shukla University Campus area Raipur (C.G.) India

S. No.	Genus and Species	Family	Occurrences in				Fig. No.
			Site 1	Site 2	Site 3	Site 4	
1.	<i>Acisoma panorpoides</i>	Libellulidae	Y	N	N	Y	2.
2.	<i>Brachythemis contaminata</i>	Libellulidae	Y	Y	Y	Y	3.
3.	<i>Brachydiplax chalybea</i>	Libellulidae	Y	N	N	Y	4.
4.	<i>Brachydiplax sobrina</i>	Libellulidae	N	N	N	Y	5.
5.	<i>Bradinopyga geminata</i>	Libellulidae	N	Y	Y	N	6.
6.	<i>Crocothemis servilia</i>	Libellulidae	Y	Y	N	Y	7.
7.	<i>Diplocodes nebulosa</i>	Libellulidae	N	N	N	Y	8.
8.	<i>Diplocodes trivilis</i>	Libellulidae	Y	Y	Y	Y	9.
9.	<i>Orthetrum pruinosum</i>	Libellulidae	Y	N	N	Y	10.
10.	<i>Orthetrum sabina</i>	Libellulidae	Y	Y	N	Y	11.
11.	<i>Pantala flavescens</i>	Libellulidae	Y	Y	Y	Y	12.
12.	<i>Potamarch congener</i>	Libellulidae	N	Y	Y	Y	13.
13.	<i>Rhyothemis variegata</i>	Libellulidae	Y	Y	N	Y	14.
14.	<i>Tramea basilaris</i>	Libellulidae	N	N	N	Y	15.
15.	<i>Tramea limbata</i>	Libellulidae	N	N	N	Y	16.
16.	<i>Trithemis aurora</i>	Libellulidae	Y	Y	Y	Y	17.
17.	<i>Trithemis pallidinervis</i>	Libellulidae	Y	Y	N	Y	18.
18.	<i>Ictinogomphus rapax</i>	Gomphidae	Y	N	N	Y	19.
19.	<i>Paragomphus lineatus</i>	Gomphidae	N	N	N	Y	20.
20.	<i>Rhionaeschna multicolor</i>	Aeshnidae	N	N	N	Y	21.
21.	<i>Agriocnemis femina</i>	Coenagrionidae	N	N	N	Y	22.
22.	<i>Agriocnemis pygmaea</i>	Coenagrionidae	Y	N	N	Y	23.
23.	<i>Ceriagrion coromandelianum</i>	Coenagrionidae	Y	Y	Y	Y	24.
24.	<i>Ischnura aurora</i>	Coenagrionidae	Y	N	Y	Y	25.
25.	<i>Ischnura senegalensis</i>	Coenagrionidae	Y	Y	N	Y	26.
26.	<i>Pseudagrion decorum</i>	Coenagrionidae	Y	N	N	Y	27.
27.	<i>Pseudagrion microcephalum</i>	Coenagrionidae	N	N	N	Y	28.
28.	<i>Pseudagrion rubriceps</i>	Coenagrionidae	Y	N	N	Y	29.

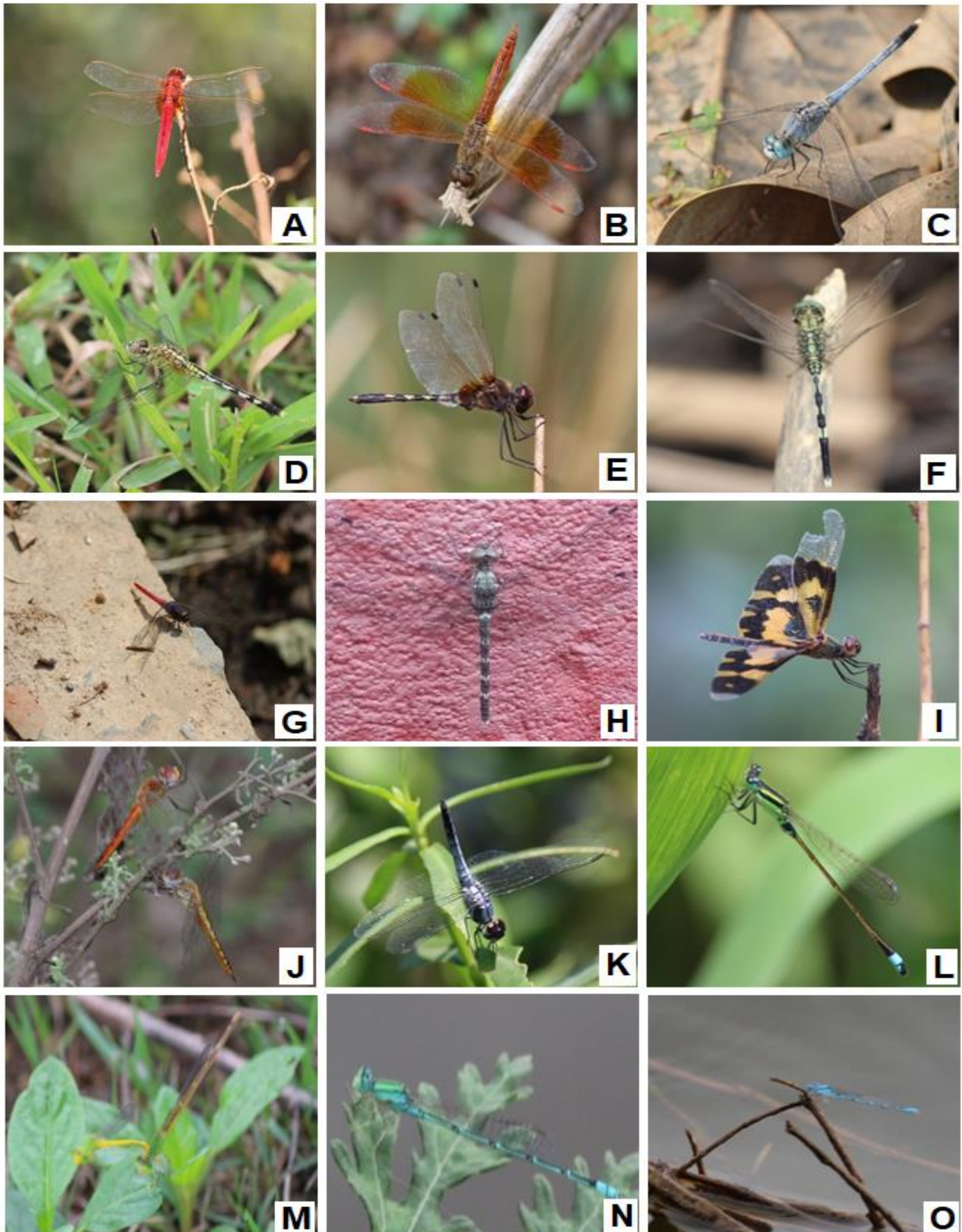


Fig. 2 : A: *Crocothemis servilia*,
 D: *Diplocodes trivialis*(female)
 G: *Orthetrum pruinosum*,
 J: *Pantala flavescens*,
 M: *Ceriagrion coromandelianum*,

B: *Brachythemis contaminata*,
 E: *Trithemis palliverdis*
 H: *Bradinopyga geminata*,
 K: *Brachydiplax sorbina*,
 N: *Pseudagrion decorum*,

C: *Diplocodes trivialis* (male),
 F: *Orthetrum sabina*,
 I: *Rhyothemis variegata*,
 L: *Ischnura senegalensis*,
 O: *Pseudagrion microcephalum*

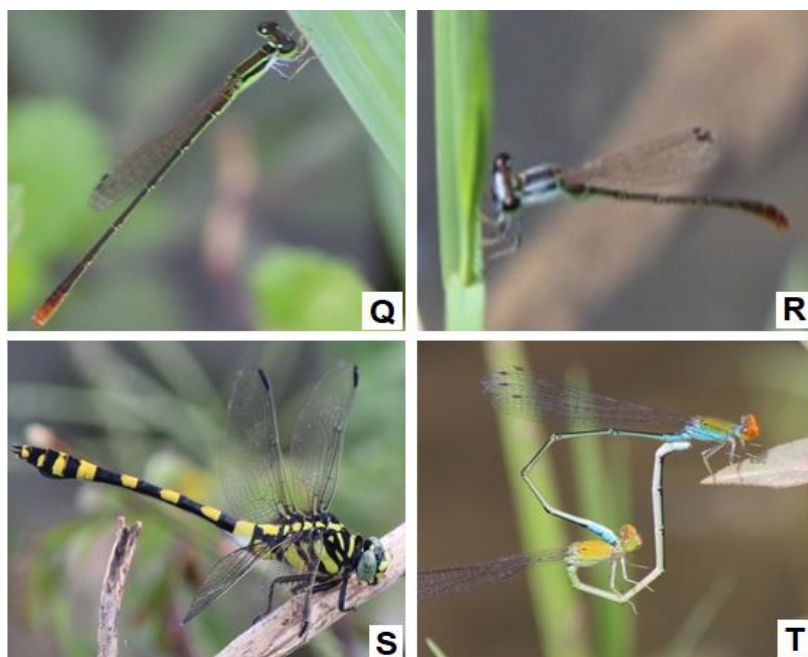


Fig. 2: Q : *Agronemis pygmea*,
S : *Ictinogomphus rapax*,

R: *Agriocnemis femina*,
T: *Pseudagrion rubriceps* (Mating Pair)

Our observations also showed that the Odonate (*Pseudagrion rubriceps*) has showing a special type of breeding behavior. Simple aggressive courtship behavior was showed during breeding process at flying condition. Male acquire bright coloration and become mature earlier than female. The sexually mature male reaches the breeding habit and holds a territory (Subramanian, 2009). During flying condition, a receptive female become stagnant and adopt a characteristic posture in front of a potential male and display their abdomen by doing up and down. Male holds a special angled position just 20 - 25 cm. distances behind a receptive female. Pairing between both sexes follows immediately during flying condition. Male holds the abdomen of female. The clasper of male fits exactly in to the special harpoon shaped accessory genitalia, located at second abdomen of female.

After this lock and key mechanism, the paired abdomens of both sexes take a characteristics heart wheel Shape structure. Then the flying female with paired male was settled down into any appropriate holding place.

Observations also showed that the species richness in number is higher during post monsoon (September - October) and their number in count is gradually

decline from November to January and lower in winter (December - March) season.

The present study which was conducted in four study sites of Pt. Ravishankar Shukla University Raipur C. G. (India) resulted in listing the 28 Odonatan species, which are more than 5.9% of the Indian Odonatan species.

Among these 28 odonatan species are belonging to three families and 19 genera. The family Libellulidae is most dominant family in number having 17 species, Family Coenagrionidae is second dominant family having 8 species, family Gomphidae having 2 species and Aeshnidae having only one species. Family Libellulidae comprises 60.71%, Family Coenagrionidae comprises 28.57% and Family Gomphidae comprises 7.14 and Aeshnidae comprises 3.57 % of the total observed Odonatan species.

The Libellulidae is the most common and Aeshnidae is least abundant family found in the campus area. The *Pseudagrion rubriceps* is showing special simple aggressive courtship behavior.

The Odonata were showing seasonal variation according to their occurrence in relation with seasonal changes.

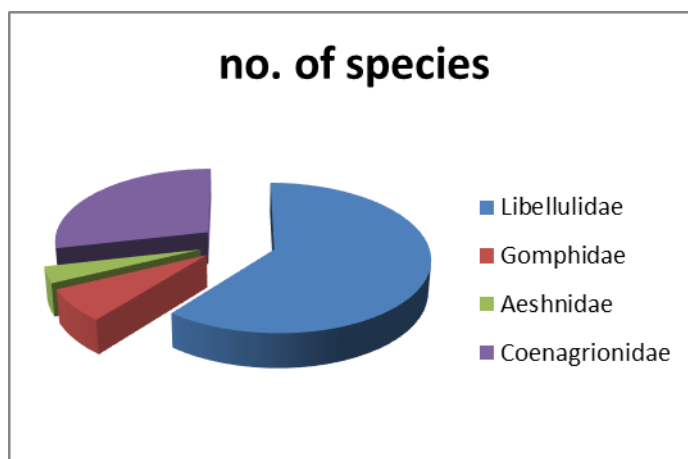


Fig. 3 : Chart showing abundance status and species richness of Odonata in the study site.

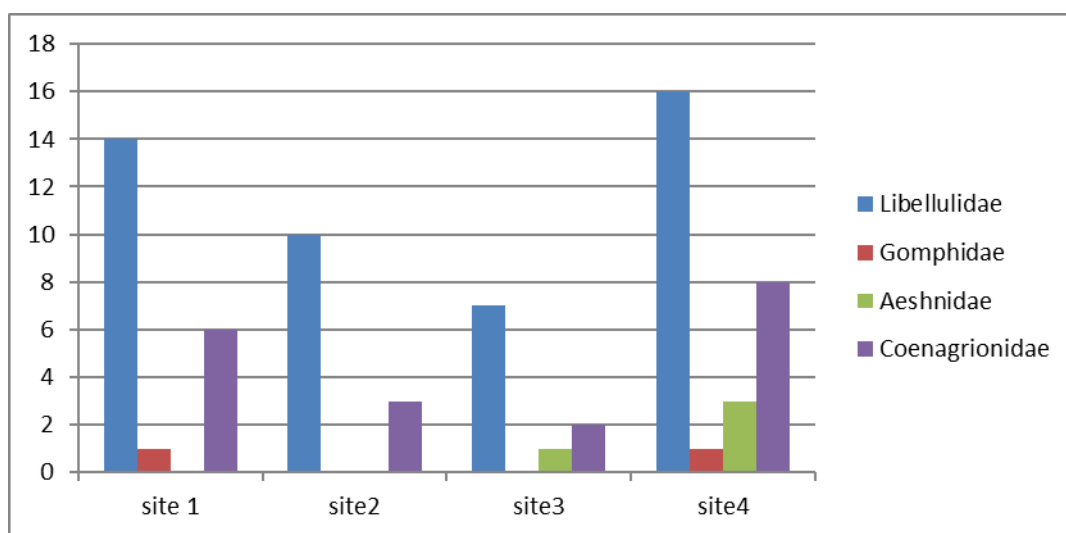


Fig. 4 : Chart showing no. of Odonata species from different families identified during the study.

DISCUSSION

India harbors diversified animal diversity. Odonates play an important role in agronomy and also as a biological indicator. The environmental conditions with dense vegetation, grassland areas and water bodies at Pt. Ravishankar Shukla University Raipur C. G. (India) provide an optimal natural environmental condition for Odonatan diversity. These conditions also initiate to prepare a checklist and study on seasonal variation of Odonatan diversity.

The prepared checklist and study on seasonal variation on Odonatan diversity in the central Chhattisgarh area is the first of its kind. The observations showed the presence of remarkable diversity and distribution of Odonatan at dense vegetation, grassland and wetland around the campus

area. The observed Odonatan diversity has a taxonomic significance.

The findings of the present study prepare a baseline data, showing seasonal variation on their distribution and also underline the importance of Odonatan diversity. The study also suggests a preferred abode for Odonata.

Further conservational strategies, continuous study on both larva and adult stage and continuous exploration of Odonatan species in the remote area of whole Chhattisgarh may enrich the species list of Odonata.

The present study promotes and increase the research interest based on Odonatan diversity as well as in taxonomy-based research activities.

CONFLICT OF INTEREST:

The Authors declare no conflict of interest.

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