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An assessment of the odonata fauna in and around the Goseindhara waterfall, Nabarangpur, Odisha

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Abstract
A study on the abundance of Odonates was conducted around the Goseindhara waterfall which is situated near the Nabarangpur district of Odisha and is a tourist spot due to its natural beauty. Our study duration was about 12 months and it revealed a total of 42 species of Odonates belonging to 31 genera and 8 families. More number of species were recorded under the sub-order Anisoptera (64.28%) in comparison to suborder Zygoptera (35.71%). The highest number of species were recorded under the family Libellulidae (47.61%) and the lowest number of species were recorded under the family Lestidae (2.38%). This is a first attempt to prepare a checklist for the Odonate population present in this area which could be referred for further studies in the future.

Keywords: odonata, dragonflies, damselflies, bio-indicator, Goseindhara

1. Introduction

Odonata is an order which is formed collectively by dragonflies (suborder: Anisoptera) and damselflies (suborder: Zygoptera). These are one of the one of the most common insects flying over forest, fields, meadows, ponds and rivers but they mainly depend on fresh water ecosystems for completion of their life cycle. The Odonates have always drawn human attention due to their beautiful colorations, transparent wings, strong vision and fast flight. They are ancient groups of insects which evolved during the Carboniferous era about 250 million years ago [1]. The adults are predators which feed on harmful insects like mosquitoes and also on their own kind while the larvae are carnivorous and voracious feeders. They are also important and widespread components of freshwater ecosystems, being top predators [2]. Odonates are ideal bio-indicators and are used as bio-monitoring models for the investigation of environmental warming and climate change due to their tropical evolutionary history and adaptations to temperate climates [3]. Odonates occupy almost all types of habitat ranging from permanent running waters and lakes to temporary rain pools [4]. The most number of species are found at places that provide a wide variety of microhabitats, though dragonflies tend to be much more sensitive to pollution than damselflies [5]. Even though most species of Odonates are highly specific to a habitat, some have adapted to urban areas and exploit man-made water bodies [6]. It is estimated that around 6000 extant species of odonata are present worldwide out of which about 500 known species are found in India. The state of Odisha has a very rich biodiversity and it's ecological landscapes provide an ideal habitat for a wide variety of organisms. Odonate research in Odisha dates back to early 1900s documenting the diversity of Chilika Lake and its adjoining areas [7, 8]. This was followed by reporting of 58 species of Odonate fauna by the Zoological Survey of India as part of faunal exploration [9]. Subsequently, various workers surveyed the Odonate diversity along different geographic regions of Odisha and a total of 110 species of odonates (representing 60 genera and 9 families) have been documented from the state [10-17]. Nair for the first time added 36 new species of Odonates in Odisha.

Thus from the above it can be concluded that few attempts have been made to study the odonate diversity in Odisha. The present study has been conducted around the Goseindhara waterfall which is a place of scenic beauty and tourist interest near the Nabarangpur district of Odisha. Our study is a first attempt to document the Odonate fauna present in this region and to prepare a checklist which would be helpful for future investigations.

2. Materials and Methods

The study has been conducted around Goseindhara (Latitude 19° 75′ 09.24″N and Longitude 82° 40′ 14.53″E) which is a natural waterfall situated at Jhargram block of Chacha Panchayat amidst deep forests which is about 82 Kms from Nabarangpur district of Odisha (Fig 1; Plate 1). This is a place of tourist attraction. The climate is sub-tropical to temperate. It is characterised by hot and dry summer, cool and humid monsoon and cold and dry winter. December is the coldest month with a mean daily average temperature of 23ºC which reaches to a maximum of up to 39ºC in May. The rainfall this area receives is mainly from the Southwest monsoons which lasts from June to October. The average annual rainfall varies from 1030.21 mm to 1569.50 mm. Two types of soils are mainly found in the area i.e., Red and Laterite soil. The soil pH is neutral to alkaline and its salinity is mainly normal. The flora of the study area is predominated by plants like Tamarind (*Tamarindus indica*), Kusum (*Schleichera oleosa*), Sal (*Shorea robusta*), Teak (*Tectona grandis*), Kendu (*Diospyros melanoxylon*), Kadamba (*Neolamarckia cadamba*), Amla (*Phyllanthus emblica*), Jamun (*Syzygium cumini*) and Bamboo (*Bambusa vulgaris*) etc.

The study was conducted from January 2018 to December 2018. Surveys were carried out during the light hours of the day from 08:00 am to 04:00 pm and most of the habitats were analysed around the waterfall. An entomological net was used to capture and identify the species without harming any specimen. The specimens were identified by

cross-checking with standard references and photographic guides of Fraser [18-20]. After identification the specimen was photographed using a camera (Nikon D3200) and then released back into it's habitat. The different species of Odonates recorded after the study were then systematically arranged into a checklist for future reference.

3. Results and Discussion

The present study revealed a total of 42 species of Odonates belonging to 31 genera and 8 families out of which sub-order Anisoptera (dragonflies) was represented by 27 species (64.28%) and sub-order Zygoptera (damselflies) was represented by 15 species (35.71%) (Table 1; Fig 2). Incase of sub-order Anisoptera (dragonflies) the most number of species were recorded under the family Libellulidae (47.61%) followed by Aeshnidae (11.9%) and Gomphidae (4.76%) (Fig 3). Incase of sub-order Zygoptera (damselflies) the most number of species were recorded under the family Coenagrionidae (19.04%) followed by Calopterygidae (4.76%), Chlorocyphidae (4.76%) and Platycnemididae (4.76%), the least number of species were recorded under the family Lestidae (2.38%) (Fig 4). Most of the species recorded during the study period were commonly seen in the study area and according to the IUCN are least concerned (LC = 80.95%), 4 species are data deficient (DD = 4.76%), 1 species is near threatened (NT = 2.38%) and 5 species are not assessed (NA = 11.9%) (Fig 5). Few species like *Anax guttatus*, *Anax imperator*, *Gynacantha dravida*, *Indothemis carnatica*, *Zygonyx iris*, *Zygonis torrida*, *Lestes umbrinus*, *Agriocnemis lecteola* and *Ischunara aurora* etc. were rarely observed during our study where as others were frequently encountered. The presence of Gomphids, Calopterygids, and Chlorocyphids indicates undisturbed and unpolluted water of Goseindhara.

This study is a preliminary attempt to record the various Odonate species present around the Goseindhara waterfall and although such studies have previously been carried out in other parts of Odisha no such study has ever been conducted in this area. It establishes the importance of such small unexplored eco-zones and also the need for further investigation around these parts. The study is for a short period of time and a limited area around the waterfall was taken in to account therefore it is highly possible that more species could be recorded and their diversity and species richness could be measured if subsequent studies in this area are conducted.

Fig 1: A satellite overview map showing the location of the study area.

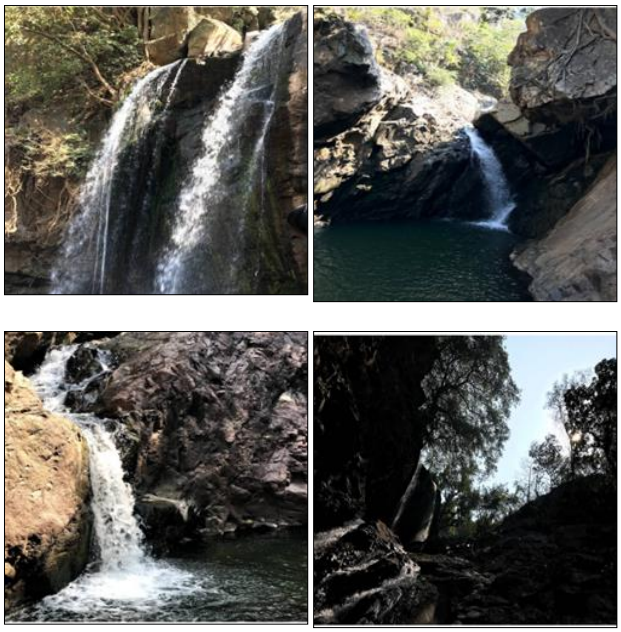

Plate 1: Photographs of the study sites around Goseindhara waterfall.

Table 1: Checlist of Odonates recorded in and around the Goseindhara waterfall.

A. List of Dragonflies (Sub-order Anisoptera)				
Sl. No.	**Family**	**Common Name**	**Scientific Name**	**IUCN Status**
1.	Gomphidae	Common Clubtail	*Ictinogomphus rapax* (Rambur,1942)	LC
2.		Common Hooktail	*Paragomphus lineatus* (Selys,1850)	LC
3.	Aeshnidae	Lesser Green Emperor	*Anax guttatus* (Burmeister, 1839)	LC
4.		Blue Darner	*Anax immaculifrons* (Rambur,1842)	LC
5.		Emperor Darner	*Anax imperator* (Leach,1815)	LC
6.		Parakeet Darner	*Gyanacantha bayadra* (Selys,1891)	LC
7.		Brown Darner	*Gyanacantha dravida* (lieftinck,1960)	DD
8.	Libellulidae	Trumpet Tail	*Acisoma panorpoides* (Rambur,1842)	LC
9.		Black Tailed Dasher	*Brachydiplax farinose* (Kruger,1902)	LC
10.		Granite Ghost	*Bradynopyga geminate* (Rambur,1842)	NA
11.		Giant Forest Skimmer	*Camacinia gigantean* (Brauer,1867)	LC
12.		Scarlet Skimmer	*Crocothemis servilia* (Drury,1770)	LC
13.		Black-tipped Ground Skimmer	*Diplacodes nebulosa* (Fabricius,1793)	LC
14.		Ground Skimmer	*Diplacodes trivialis* (Rambur, 1842)	LC
15.		Black Marsh Skimmer	*Indothemis carnatica* (Fabricius,1798)	NT
16.		Fulvous Forest Skimmer	*Neurothemis fulvia* (Drury,1773)	LC
17.		Pied Paddy Skimmer	*Neurothemis tullia* (Drury,1773)	LC
18.		Blue Marsh Hawk	*Orthetrum glaucaum* (Brauer,1865)	LC
19.		Green Marsh Hawk	*Orthetrum Sabina* (Drury,1770)	LC

20.		Wandering Glider	*Pantala flavescens* (Fabricius,1798)	LC
21.		Rufous Marsh glider	*Rhodothemis rufa* (Rambur,1842)	LC
22.		Coral Tailed Cloud-wing	*Thydmis tillagra* (Fabricius,1798)	LC
23.		Crimson Marsh Glider	*Trithemis aurora* (Burmeister,1839)	LC
24.		Pygmy Skimmer	*Tetrathemis platyptana* (Selys,1878)	LC
25.		Greater Crimson Glider	*Urothemis signata* (Rambur,1842)	LC
26.		Iridiscent Stream Glider	*Zygonyx iris* (Selys,1869)	LC
27.		Torrent Glider	*Zygonyx torrida* (Kirby,1889)	LC
B. List of Damselflies (Sub-order Zygoptera)				
28.	Lestidae	Brown Spread-wing	*Lestes umbrinus* (Selys,1891)	DD
29.	Calopterygidae	Stream Glory	*Neurobasic chinensis* (Linnaeus,1758)	LC
30.		Clear-winged Forest Glory	*Vestalis gracilis* (Rambur,1842)	LC
31.	Chlorocyphidae	Stream Ruby	*Heliocypha bisignata* (Selys,1853)	LC
32.		River Heliodor	*Libellago lineata* (Burmeister,1839)	NA
33.	Platycnemididae	Yellow Bush Dart	*Copera marginipes* (Rambur,1842)	LC
34.		Blue Bush Dart	*Copera vittata* (Selys,1863)	LC
35.	Coenagrionidae	Pygmy Dartlet	*Agriocnemis pygmaea* (Rambur,1842)	LC
36.		Splendid Dartlet	*Agriocnemis splendidissima* (Laidlaw,1919)	NA
37.		Milky Dartlet	*Agriocnemis lecteola* (Selys,1877)	NA
38.		Orange Marsh Dart	*Ceriagrion rubiae* (Laidlaw,1916)	LC
39.		Coramandel Marsh Dart	*Ceriagrion coramandelium* (Fabricius,1798)	NA
40.		Little Blue Dartlet	*Enallgma parvum* (Selys,1876)	LC
41.		Golden Dartlet	*Ischnura aurora* (Brauer,1865)	LC
42.		Blue River Damsel	*Pseudogrion microcephalum* (Rambur,1842)	LC

DD = Data Defecient, LC = Least Concern, NT = Near Threatened and NA = Not Assessed.

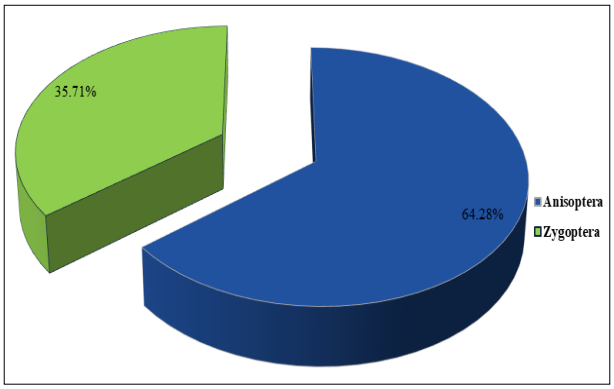

Fig 2: Percentage occurrence of Anisoptera and Zygoptera.

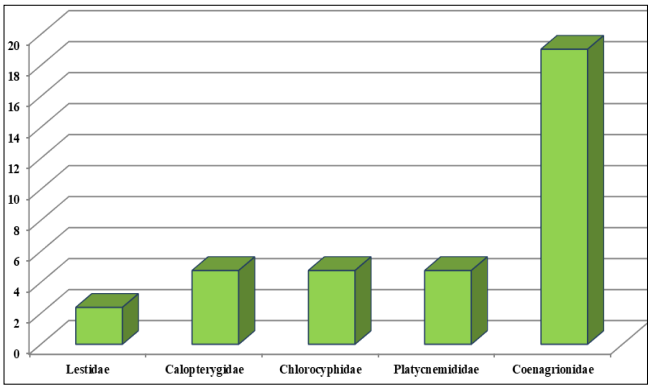

Fig 4: Percentage occurrence of Zygoptera in different families.

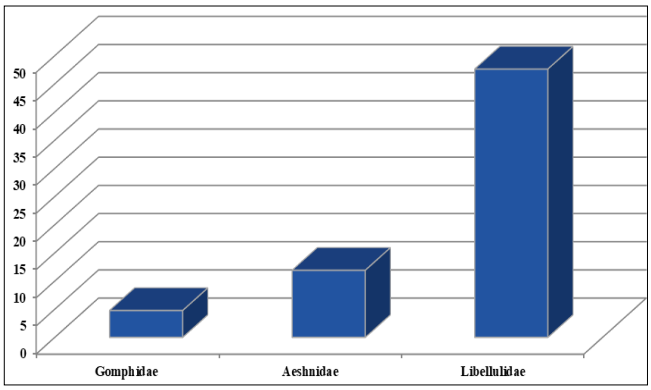

Fig 3: Percentage occurrence of Anisoptera in different families.

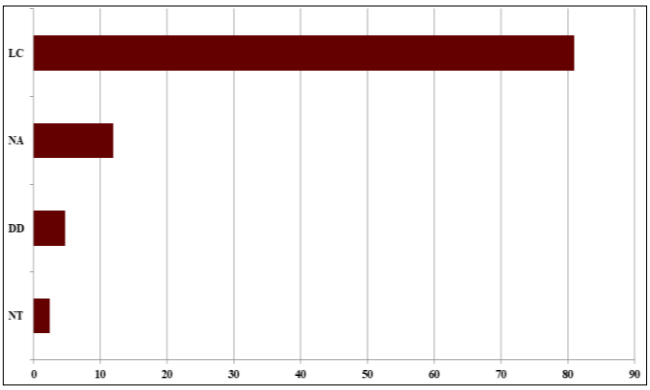

Fig 5: Percentage occurrence of Odonates according to IUCN status.

Image 1

Image 2

Image 3

Image 4

Image 5

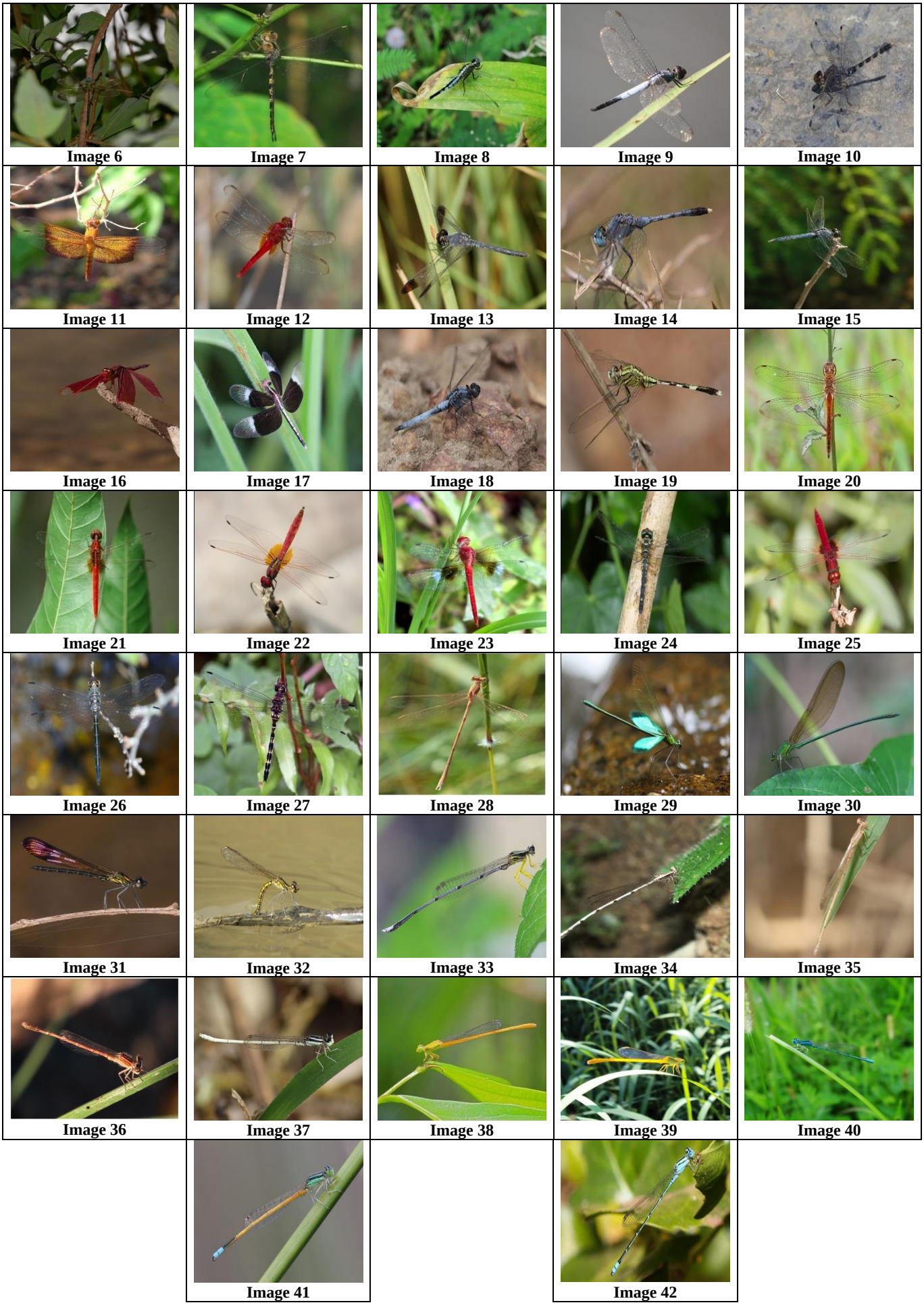

Plate 2: Photographs of the odonates observed at Goseindhara waterfall. (See Table 1 for the corresponding names).

4. Conclusion

The present study revealed 42 species of Odonates around the Goseindhara waterfall and it reflects a moderately healthy overall biodiversity for the study location. The Goseindhara waterfall provides a favourable habitat to many types of organisms like butterflies, fishes, reptiles and birds apart from the Odonates. The underlying importance of such unexplored areas cannot be over-ruled if we consider wildlife conservation seriously. These types of habitats are ideal for bio-monitoring and to study the effect of human intervention and relationship between humans and wildlife. Odonates are an important link in the food chain as they help to keep the population of harmful insects in check and also act as a food source to other organisms. They are very susceptible to even the slightest changes in the environment and therefore they are used as bio-indicators. The present study is a first attempt to prepare a checklist of various Odonate species present in this area which will be helpful for their conservation and further studies in future.

5. Acknowledgement

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