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First report of Zygoptera and Anisoptera (Odonata: Insecta) near Johilla river at Umaria district (M.P.)

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Abstract
Odonates are potential biocontrol agents for many invertebrates, and biodiversity conservation and protection is a national and international agenda that is responsible for the long-term development of a region or country. The first report of Odonates from the Johilla River in Umaria District has been investigated. During the study 35 species of Odonata Belonging to 06 families of 02 Suborder were observed. Out of 35 species recorded, 17 species belonged to family Libellulidae (48%) making it the most specious and dominant family. Second most abundant family was Coenagrionidae (29%) which consisted of 10 species. This was followed by family Lestidae 03 Species (08%), Aeshnidae and Gomphidae both with 2 species (6%) each, Platycnemidiae with 1 species (3%). The Shannon's Index of odonata H=3.210710732 and Simpson C=0.049064332 was determined. For the first time, a comprehensive catalogue of odonates recorded from the Umaria district's Johila river area is presented. More research is needed to examine sources and a much wider geographic area.

Keywords: Odonata, johilla river, species diversity, bio control, first report

Introduction

Amazing insect species known as odonates have a great chance of surviving and thriving in perennial river systems with a diversity of habitat types. According to Ramesh *et al*. (2010) [16], measuring the diversity levels of ecosystem indicator groups should allow for the prediction of the presence of other taxa, emphasising the significance and suitability of utilising invertebrate groups as indicators (Oliver and Beattie, 1993; Pearson, 1994) [14, 15]. Odonata are found on all continents, though tropical forests are typically the richest in species (Kalkman *et al*., 2008) [10]. Odonates, an order of invertebrate insects that includes dragonflies and damselflies, are constantly alluring to people because of their wide range of colours, agile flight, and exceptional vision. Around 6000 different species of dragonflies were described by Silsby (2001). Though the real number of species may surpass 7,000, the Odonata has about 5,680 species globally. The current rate of new Odonata species descriptions is around 200 per decade (Kalkman *et al*., 2008) [10].

According to Subramaniam (2009), there are 470 species in 139 genera and 19 families in India. These species are important as markers of the health of the aquatic and terrestrial ecosystems and also play a crucial role as prey and predators in maintaining the balance of the tropic levels of the food chain. As top predators, they are also a significant and extensive part of freshwater ecosystems (Corbet, 1962) [5]. According to a recent study, around 10% of the world's dragonflies are probably vulnerable, while 35% have insufficient information. (Clausnitzer *et al*., 2009) [4]. Odonata spend their larval lives in aquatic environments and, as adults, make use of a variety of terrestrial habitats. The Johilla Valley area is bordered by a very diverse range of trees, a small hill, a wide grassland, and a mini-forest; these are the components for designing a suitable habitat for such species. Odonata have been recognised as excellent environmental health indicators and are an accessible category that may be utilised to evaluate the overall biodiversity of aquatic ecosystems (Kalkman *et al*., 2008, Corbet, 1999) [10].

Materials and methods

The present research will be carried out in the Johilla River Umaria district. Umaria District lies under Shahdol, division the surface of the district may be divided in to 4 different Physiographic regions, the shale, sandstone, plateaus and Pindaric basic. It is located between 22^0Latitude and $82^0$11'Longitude and is situated on the Vindhyan plateau at elevation of 330m. It is a tributary of the Son River, which itself is a tributary of the Ganges River. The Johila (23.645°N 81.236°E) originates at a place called Jwaleshwar in Maikal hills, 10 km from Amarkantak in Anuppur district of Madhya Pradesh. It merges with Son river in Manpur tehsil of Umaria district (Figure 01).

Odonata sampling was carried out over a seven-month period, from July 2022 to January 2023. The sites are visited early in the morning from 5-10am, and in the evening from 4-7pm, to record the maximum number of dragonfly species and their activities (Sampling one visit in a week). The current study is based on the population of dragonflies and damselflies. Observations are made by walking a large area of the site with binoculars and digital cameras. The Fauna of British India by Fraser, F.C. (1933, 1934, and 1936) [7, 8, 9], Mitra, T.R. (2006) [13], Subramanian, K.A. (2005 and 2009) [20, 21, 2, 9], Andrew *et al*., (2009) [2], taxonomic keys were used for identification. According to Tiple *et al*., 2008 Protocols, the Odonates were classified based on their abundance in Johilla, which was shortened as VC - Very Common (51-100Sp), C - Common (26-50Sp), R - Rare (11-25Sp), VR - Very Rare (01-10Sp). The Shannon-Weiner diversity index (H) was calculated using Mangurran, A. (1988) Shannon-Weiner equation, and the Simpson index (C) was calculated using Sklar, F.H. (1985) [17].

Fig 1

Results and discussion

The current study was conducted for the first time in Umaria district from July 2022 to January 2023 to explore the diversification of Odonata-Insecta in the vicinity of the Johila river. So, Overall during the sampling total 1190 individual (601 Zygoptera and 589Anisoptera specimen) were observed. During the study 35 species of Odonata (14 Zygoptera and 21 Anisoptera species) Belonging to 06 family of 02 Suborder were observed from the study sites. Family wise distribution, Relative Status and Statistical analysis shown in Table 01. During the present investigation, the suborder Anisoptera is found to be abundant in comparison to Zygoptera. A total of 21 species has been recorded under Anisoptera which constitute 60% of the total recorded species. Suborder Zygoptera accounts for the remaining 40% with a total of 14 species. Out of 35 species recorded, 17 species belonged to family Libellulidae (48%) making it the most specious and dominant family. Second most abundant family was Coenagrionidae (29%) which consist of 10 species.This was followed by family Lestidae 03 Species (08%), Aeshnidae and Gomphidae both with 2 species (6%) each, Platycnemidiae with 1 species (3%).

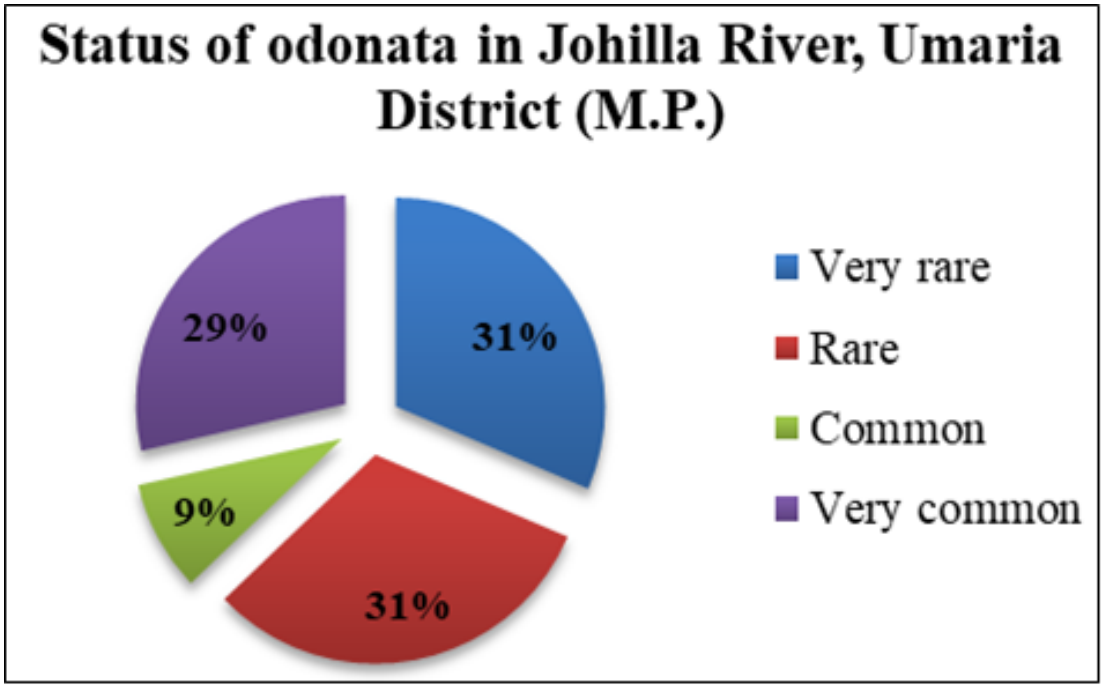
Table 1: Individual Record of Odonata From Johilla River Umaria District, Madhya Pradesh, India From 2022-23.

S. N	Name of Species	Common Name	Total No. of Observed Species (n i)	Pi = (n i / N)	log Pi = ln (n i/N)	H = Pi x log Pi	C = Pi^2	Species Status
Suborder: Zygoptera Selys, 1854 Superfamily: Coenagrionidea Kirby, 1890 Family: Coenagrionoidae Kirby, 1890 Genus: Agriocnemis Selys, 1877								
1	Agriocnemis femina (Brauer, 1868)	Pruinosed Dartlet	59	0.049579832	-3.004171142	-0.1489463	0.00245816	Very Common
2	Agriocnemis pieris (Laidlaw, 1919)	White Dartlet	24	0.020168067	-3.903654756	-0.078729172	0.000406751	Rare
3	Agriocnemis pygmaea (Rambur, 1842)	Pygmy Dartlet	68	0.057142857	-2.862200881	-0.163554336	0.003265306	Very Common
4	Agriocnemis splendidissima (Laidlaw, 1919)	Splendid Dartlet	23	0.019327731	-3.94621437	-0.07627137	0.000373561	Rare
Genus: Ceriagrion Selys, 1876								
5	Ceriagrion coromandelianum (Fabricius, 1798)	Coromandel Marsh Dart	75	0.06302521	-2.764220473	-0.174215576	0.003972177	Very Common
Genus: Ischnura Charpentier, 1840								
6	Ischnura aurora (Brauer, 1868)	Golden Dartlet	78	0.065546218	-2.724999759	-0.17861343	0.004296307	Very Common
7	Ischnura nursei (Morton, 1907)	Pixie Dartlet	72	0.060504202	-2.805042467	-0.169716855	0.003660758	Very Common
8	Ischnura senegalensis (Rambur, 1842)	Senegal Golden Dartlet	79	0.066386555	-2.712260734	-0.180057645	0.004407175	Very Common
Genus: Pseudagrion Selys, 1876								
9	Pseudagrion rubriceps (Selys, 1876)	Saffron-faced Blue Dart	48	0.040336134	-3.210507575	-0.129499465	0.001627004	Common
10	Pseudagrion spencei (Fraser,1922)	Brook Sprite	44	0.03697479	-3.297518952	-0.121925071	0.001367135	Common
Family: Platycnemidiae Yakobson & Bainchi, 1905 Genus: Copera Kirby, 1890								
11	Copera marginipes (Rambur, 1842)	Yellow Bush Dart	8	0.006722689	-5.002267044	-0.033628686	4.51945E-05	Very Rare
Superfamily: Lestoidea Calvert, 1901 Family: Lestidae Calvert, 1907 Genus: Lestes Leach, 1815								
12	Lestes elatus (Hagen in Selys, 1862)	Emerald Spreadwing	6	0.005042017	-5.289949117	-0.026672012	2.54219E-05	Very Rare
13	Lestes umbrinus (Selys, 1891)	Brown Spreadwing	8	0.006722689	-5.002267044	-0.033628686	4.51945E-05	Very Rare
14	Lestes viridulus (Rambur, 1842)	Emerald-Striped Spreadwing	9	0.007563025	-4.884484009	-0.036941476	5.71994E-05	Very Rare
Suborder: Anisoptera Selys, 1854 Superfamily: Aeshnoidea Leach, 1815 Family: Aeshnidae Leach, 1815 Genus: Anax Leach, 1815								
15	Anax guttatus (Burmeister, 1839)	Blue-tailed Green Darner	10	0.008403361	-4.779123493	-0.040160702	7.06165E-05	Very Rare
16	Anax immaculifrons (Rambur, 1842)	Blue Darner	16	0.013445378	-4.309119864	-0.057937746	0.000180778	Rare
Superfamily - Gomphoidea Rambur, 1842 Family: Gomphidae Rambur, 1842 Genus: Ictinogomphus Cowley, 1934								
17	Ictinogomphus rapax (Rambur, 1842)	Common Clubtail	19	0.015966387	-4.137269607	-0.066057246	0.000254925	Rare
Genus Paragomphus Cowley, 1934								
18	Paragomphus lineatus (Selys, 1850)	Common Hooktail	20	0.016806723	-4.085976313	-0.068671871	0.000282466	Rare
Superfamily: Libelluloidea Leach, 1815 Family: Libellulidae Leach, 1815								
19	Acisoma panorpoides (Rambur, 1842)	Trumpet Tail	24	0.020168067	-3.903654756	-0.078729172	0.000406751	Rare
Genus: Brachythemis Brauer, 1868								
20	Brachythemis contaminata (Fabricius,1793)	Ditch Jewel	88	0.07394958	-2.604371772	-0.192592198	0.00546854	Very Common
Genus: Bradinopyga Kirby, 1893								
21	Bradinopyga geminate (Rambur, 1842)	Granite Ghost	28	0.023529412	-3.749504076	-0.088223625	0.000553633	Common
Genus: Crocothemis Brauer, 1868								
22	Crocothemis servilia (Drury, 1770)	Ruddy Marsh Skimmer	22	0.018487395	-3.990666133	-0.073777021	0.000341784	Rare
Genus: Diplacodes Kirby, 1889								
23	Diplacodes trivialis (Rambur, 1842)	Ground Skimmer	15	0.012605042	-4.373658385	-0.055130148	0.000158887	Rare
Genus: Lathrecista Kirby, 1889								
24	Lathrecita asiatica asiatica (Fabricius, 1798)	Asiatic Bloodtail	5	0.004201681	-5.472270674	-0.022992734	1.76541E-05	Very Rare
Genus: Neurothemis Brauer, 1867								
25	Neurothemis tullia (Drury, 1773)	Pied Paddy Skimmer	8	0.006722689	-5.002267044	-0.033628686	4.51945E-05	Very Rare
Genus: Orthetrum Newman, 1833								
26	Orthetrum glaucum (Brauer, 1865)	Blue Marsh Hawk	10	0.008403361	-4.779123493	-0.040160702	7.06165E-05	Very Rare
27	Orthetrum taeniolatum (Schneider, 1845)	Taeniolate Marsh Hawk	9	0.007563025	-4.884484009	-0.036941476	5.71994E-05	Very Rare

28	Orthetrum pruinosum (Burmeister, 1839)	Crimson Tailed Marsh Hawk	7	0.005882353	-5.135798437	-0.030210579	3.46021E-05	Very Rare
29	Orthetrum sabina (Drury,1773)	Green Marsh Hawk	78	0.065546218	-2.724999759	-0.17861343	0.004296307	Very Common
Genus: Pantala Hagen, 1861								
30	Pantala flavescens (Fabricius, 1798)	Wandering Glider	5	0.004201681	-5.472270674	-0.022992734	1.76541E-05	Very Rare
Genus: Potamarcha Karsch, 1890								
31	Potamarcha congener (Rambur, 1842)	Yellow Tailed Ashy Skimmer	16	0.013445378	-4.309119864	-0.057937746	0.000180778	Rare
Genus: Rhyothemis Hagen, 1867								
32	Rhyothemis variegata (Linnaeus, 1763)	Common Picture Wing	18	0.01512605	-4.191336828	-0.063398372	0.000228797	Rare
Genus: Tholymis Hagen, 1867								
33	Tholymis tillarga (Fabricius, 1798)	Coral-tailed Cloud Wing	23	0.019327731	-3.94621437	-0.07627137	0.000373561	Rare
Genus: Trithemis Brauer, 1868								
34	Trithemis aurora (Burmeister, 1839)	Crimson Marsh Glider	78	0.065546218	-2.724999759	-0.17861343	0.004296307	Very Common
35	Trithemis festiva (Rambur, 1842)	Black Stream Glider	90	0.075630252	-2.581898916	-0.195269666	0.005719935	Very Common
		Grand Total	1190			-3.210710732	0.049064332	

Shannon's Index (H) = - Pi * Log Pi = (-3.210710732) = 3.210710732

Simpson's Index (C) = (Pi)2 = 0.049064332

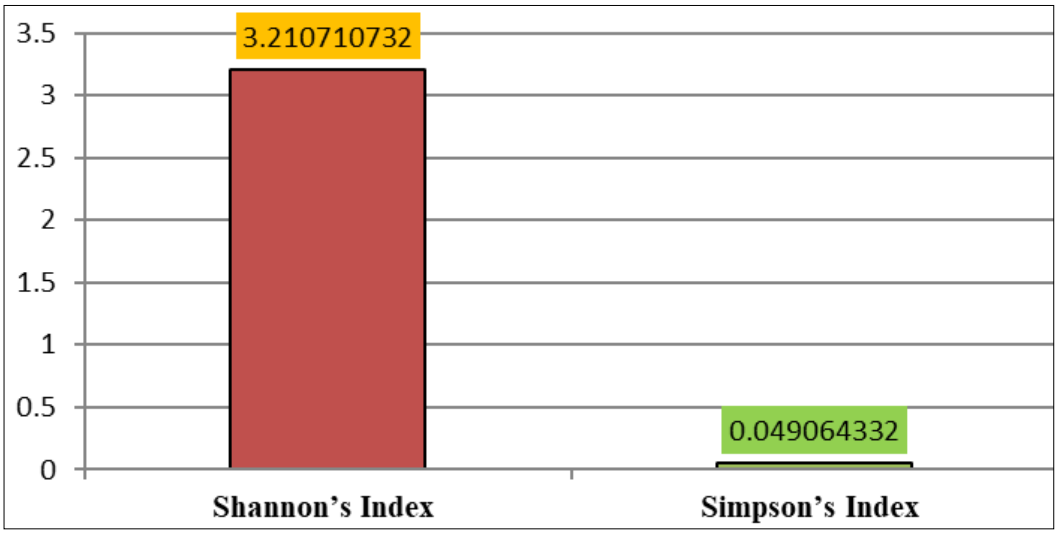


Graph 1: Status of Odonata in River Johilla at Umaria District (2022-23)

The relative abundance revealed that among the 35 Odonata species recorded, 10 were observed to be very common (06Z + 04A), 03 were common (02Z + 01A), 11 were rare (02Z + 09A), and 11 were very rare (04Z + 07A) in the study areas shown in Table 01. These 34% of Odonata species from the study area were designated as rare, and 31% as very rare, indicating the need for prescriptive conservation (Graph 01).

Because it assumes all species are represented in a sample and are randomly sampled, the Shannon - wiener is a metadata statistic index (gives more weight to common or dominant species). A few rare species with only a few representatives will have no effect on diversity in this case. The Shannon-Wiener index (H) was observed to be an average of 3.210710732 in the current study of Odonata species diversity in the Johilla River from 2022 to 2023, indicating high diversity in the studied area (Table 1). The Simpson Index (C) computation revealed that the value of the species dominance index ranged from 0.049064332. The values of the Simpson index increased as Shannon diversity decreased, indicating that dominance shows a negative association with diversity in Graph 02; a similar conclusion was presented by Al-Nemraw (2005) [1]. According to Subramanian (2009) [20, 21, 2], there are 11 dragonfly families worldwide, with 972 species belonging to the Libellulidae and 958 species belonging to the Gomphidae, followed by 436 species belonging to the Aeshnidae, 249 species belonging to the Corduliidae, and 123 species belonging to the Macromiidae. Manwar *et al*.

(2012) [11] discovered 22 species of dragonflies and damselflies from four families and 17 genera in Maharashtra (India), with 50% of the species belonging to the Libellulidae family.



Graph 2: Diversity indices in 2022-23.

Conclusion

The overview gives details on the diversity and status of Odonata. The aforementioned facts are similar to the current observations in that most species of the Libellulidae family are amphibious insects found in all freshwater bodies, and dragonflies are. Although odonates have limited economic worth, they are consumed locally as food and as a source of magic or medicine, and they may have an undetermined impact on populations of disease vectors. They are frequently used as environmental protection and conservation management indicators, and they have a significant function in nature management.

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