

## Diversity and abundance of dragonflies in Sikar region, Rajasthan (India)

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### Abstract

Dragonfly survives in a particular range of climatic conditions. Its abundance and distribution depend on biotic and abiotic factors as in other insects. This research was undertaken to study the diversity and abundance of dragonflies in Sikar region from October 2019 to July 2024. A combination of random sampling, observation and opportunistic sighting methods were used to record different species of dragonflies. Among the 31 dragonfly species recorded, the most diverse family, Libellulidae was represented by 29 species, Gomphidae and Cordulegastridae were present each with one species. But only 6 species were most abundant. Documentation of Odonata has not been done earlier from Sikar region and our observations testify this region worthy of providing suitable habitats for Odonata.

**Keywords:** Abundance, conservation, diversity, dragonfly, species

### Introduction

Dragonfly is an organism that belongs to class Insecta of phylum Arthropoda. Habitat specificity of dragonfly makes them a good indicator of environmental health. Species abundance and diversity indicate sustainable balance in an ecosystem and more diverse an ecosystem, more is its productivity. Many species in the temperate region have shown a dramatic decline in distribution and abundance since the second half of the 20th century (Sahlén, 2001) [11]. This has been caused by habitat destruction, eutrophication, acidification and pollution of aquatic habitats in general, and the canalisation of streams and rivers. Most of the species have broad ranges and are hence, not under the threat of immediate extinction. Major threats for biodiversity result from land use change, such as urbanization and intensification of agricultural practices (Goertzen and Suhling, 2019) [4]. Koneri *et al.*, (2020) [7] studied the diversity and composition of dragonflies in the three types of habitats namely primary forest, secondary forest, and agricultural land that were used for sample and measured for temperature, altitude, humidity, vegetation, and coordinates. In Rajasthan state, Bishnoi & Dang, (2019) [2] studied Odonata diversity and distribution at four different areas of Kota which are Karanimata, C.V. Garden, Bhitariya Kund and Yatayat Park. The study reported the dominance of 3 species in four different survey areas of Kota. The dragonflies were present in all seasons, particularly in monsoon. Singh *et al.*, (2017) [12] examined dragonflies in Keoladeo National Park (Rajasthan). A combination of direct search, observation and opportunistic sighting methods were used to record 28 different species of dragonflies in which five were recorded for the first time from Rajasthan. Koli *et al.*, (2015) [6] studied odonates from 13 sites in south Rajasthan which contains different habitat gradient. Their study showed 45 species (84.90 %) under least concern (LC), seven species (13.20 %) under data deficient (DD) and one species i.e., *Indothemis carnatica* under near threatened (NT) category.

Diversity of dragonflies is influenced by climatic, physio-chemical and biological parameters of water and pollution level of environment. Some species are found in wide range of environmental conditions while some others are restricted

in narrow environmental factors. This study was important in documentation of dragonfly diversity in Sikar region, in desert, plains and foothills of Aravali, based upon observations made between 2019 and 2024.

### Material and methods

#### Study area

The study area was Sikar region which is located in the north eastern part of Rajasthan, India and extends between 27°07' N to 28°12' N and 74°41' E to 76°05' E. It forms about 2.25% of total area of the Rajasthan state. Mean annual rainfall of this region is 463.0 mm (1971-2011). Geo-morphologically, this region comprises the hilly area, plain and desert area. Main sampling sites for research in Sikar region were polluted water bodies of the region, crop fields, hill areas, urban and rural areas.

#### Collection

Collection and photography of various adult dragonflies was done from different locations of Sikar region. The localities chosen for the collection and photography comprises of water bodies of plains, agricultural land and the foothills of Aravali. The dragonfly collection was done in the morning hours, afternoon time and evening hours because dragonfly are usually active in day hours, especially shiny time.

Dragonflies were collected using sweep net. The dragonflies were observed, captured and then photographed, later to be identified with the help of Identification keys provided by Mitra (2006) and Subramanian (2005) [13]. The opportunistic sightings made all throughout the day and during transect surveys.

To categorize the relative abundance of individual species, a quantitative approach was adopted based on the number of sightings. The abundance categories are labelled as VC-Very Common (> 25 sightings), C-Common (16-25 sightings), O-Occasional (9-15 sightings), R-Rare (5-8 sightings) and VR-Very Rare (< 5 sightings), as presented in Table 1. The use of this standardized approach allows for a clear and concise assessment of the abundance status of each species across different habitats.

**Results**

The survey of the diversity of dragonflies in Sikar region has revealed a total of 31 species (Table 1) from October 2019 to July 2024. Among the dragonfly species recorded,

the most diverse family observed was Libellulidae represented by 26 species and Cordulegastridae and Gomphidae were represented each with one species.

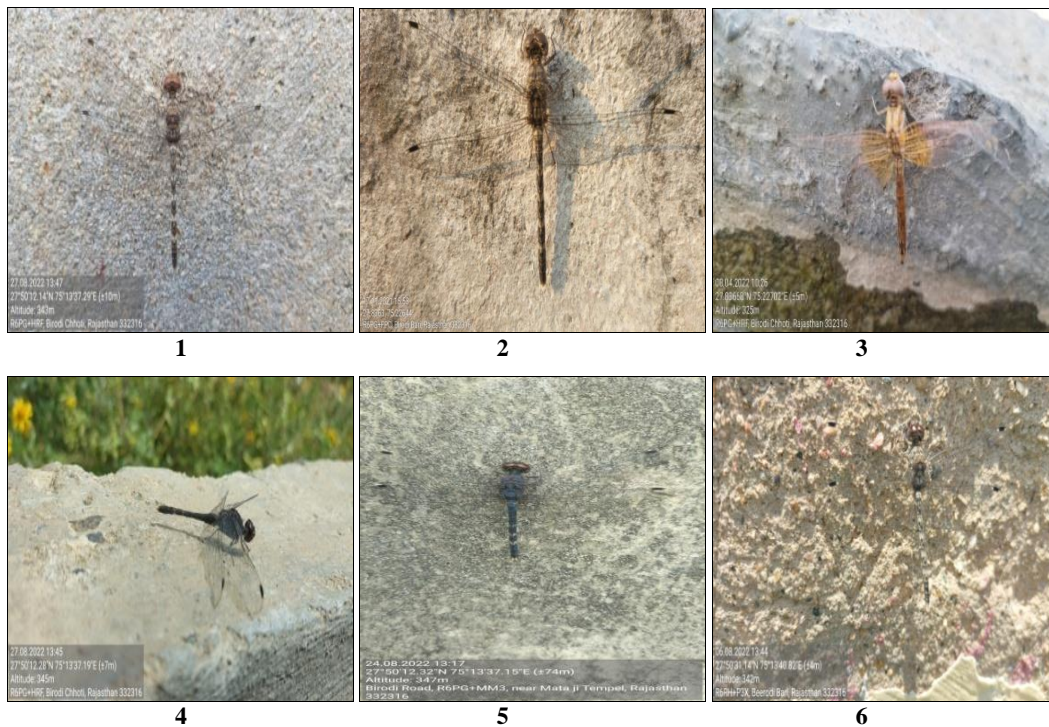
**Table 1:** Dragonfly diversity and abundance in Sikar region, Rajasthan, India

Sr. No.	Name of species	Family	Abundance		Localities of species presence
			At sampling area	In Sikar region	
1	<i>Acisoma panorpoides</i>	Libellulidae	R	VR	Shakambhari hill area, Sikar region
2	<i>Acisoma variegatum</i>	Libellulidae	VR	VR	Hilly area of Jeenmata and forest area, Sikar region
3	<i>Aethriamanta brevipennis</i>	Libellulidae	R	VR	Near Udaipurwati area in Sikar region
4	<i>Brachydiplax sobrina</i>	Libellulidae	O	VR	Sakrai, Shakambhari hill area, Sikar region
5	<i>Brachythemis contaminata</i>	Libellulidae	VC	O	Bawaris (BaraTalab) of Sikar, near Rawasa at westage nala,
6	<i>Bradinopyga cornuta</i>	Libellulidae	O	R	Near Birodi Chhoti, Beedasar, Laxmangarh, Raiwasa, Fathepur areas, Beri, Dataramgarh tehsils villages, Neemkathana plain areas
7	<i>Bradinopyga geminata</i>	Libellulidae	VC	O	Near Birodi Chhoti, Beedasar, Laxmangarh
8	<i>Bradinopyga konkanensis</i>	Libellulidae	O	R	Near Birodi Chhoti, Beedasar, Laxmangarh, Raiwasa, Fathepur areas, Beri, Dataramgarh tehsils villages, Neemkathana plain areas
9	<i>Bradinopyga strachani</i>	Libellulidae	O	R	Near Birodi Chhoti, Beedasar, Laxmangarh, Raiwasa, Fathepur areas, Beri, Dataramgarh tehsils villages, Neemkathana plain areas
10	<i>Cordulegaster boltonii</i>	Cordulegastridae	VR	VR	Hill area of Sikar region
11	<i>Crocothemis erythraea</i>	Libellulidae	VR	VR	Raiwasa road in water effluent of village, Desert to open part
12	<i>Crocothemis servillia</i>	Libellulidae	O	VR	Raiwasa to Jeenmata areas
13	<i>Diplacodes trivialis</i>	Libellulidae	R	VR	Hill foot area of Sikar region
14	<i>Erythemis simplicicollis</i>	Libellulidae	VR	VR	In Bara Talab, Sikar; Shivesingpura weeded water body, near Pollution Control Board, Sikar
15	<i>Ictinogomphus rapax</i>	Gomphidae	VR	VR	Sakrai, Ragunarhgarh and Hill area of Sikar region
16	<i>Indothemis carnatica</i>	Libellulidae	VR	VR	In Bara Talab, Sikar; Shivesingpura weeded water body, near Pollution Control Board, Sikar, Khel of Birodi Chhoti, Laxmangarh Sikar
17	<i>Libellula saturata</i>	Libellulidae	VR	VR	Sakrai, Ragunarhgarh and Hill area of Sikar region
18	<i>Neurothemis intermedia</i>	Libellulidae	VR	VR	Hilly area of Sikar region
19	<i>Orthetrum glaucum</i>	Libellulidae	VR	VR	Sakrai, Ragunarhgarh and Hill area of Sikar region
20	<i>Orthetrum prunosum</i>	Libellulidae	O	VR	Raiwasa road in water effluent of village
21	<i>Orthetrum sabina</i>	Libellulidae	O	VR	Birodi Chhoti, Beedasar, Raiwasa, Fathepur areas
22	<i>Orthetrum taeniolatum</i>	Libellulidae	VR	VR	Sakrai, Khandela, Ragunarhgarh and Hill area of Sikar region
23	<i>Pantala flavescens</i>	Libellulidae	VC	O	Birodi Chhoti, Beedasar, Raiwasa, Fathepur areas, Beri, Dataramgarh tehsils villages, Neemkathana plain areas
24	<i>Rhodothemis rufa</i>	Libellulidae	O	VR	The wetlands of Aravalli hill of Sikar region
25	<i>Sympetrum striolatum</i>	Libellulidae	VR	VR	Hill foot area of Sikar region
26	<i>Tholymis tillarga</i>	Libellulidae	VR	VR	Wetland part of Sikar region
27	<i>Tramea basillaris</i>	Libellulidae	VR	VR	Hilly area of Jeenmata and forest area, Sikar region
28	<i>Trithemis annulata</i>	Libellulidae	VR	VR	Raiwasa area to desert part
29	<i>Trithemis aurora</i>	Libellulidae	O	VR	The wetlands of Aravalli hill of Sikar region
30	<i>Trithemis kirbyi</i>	Libellulidae	C	R	Birodi Chhoti, Beedasar, Raiwasa, Fathepur areas, Beri, Dataramgarh tehsils villages, Neemkathana plain areas
31	<i>Urothemis signata</i>	Libellulidae	VR	VR	Raiwasa road in water effluent of village

As given in table 1, diversity and abundance of dragonfly species were different in geographically diverse areas in Sikar region but most diverse dragonfly species were found between hill and desert areas of Sikar which includes foothill area, plain forest and crop fields. Out of these 31 species, only 6 species - *Brachythemis contaminata*, *Bradinopyga geminata*, *Orthetrum sabina*, *Pantala flavescens*, *Trithemis kirbyi* and *Bradinopyga cornuta* were

most abundant in this region. *Cordulegaster boltonii* was less abundant.

*Bradinopyga geminata*, *Brachythemis contaminata*, *Indothemis carnatica*, *Bradinopyga cornuta*, *Bradinopyga konkanensis* and *Bradinopyga strachani* were found near water bodies, such as khel (small water body for cattle), bawari, water taps, irrigation pipe joints, wells, tanks and containers with standing water. They are common in the both terrestrial and aquatic habitats of rural areas. (Plate-1).



**Plate 1:** Fig 1. *Bradinopyga geminata* Fig 2. *Bradinopyga cornuta* Fig 3. *Brachythemis contaminata* Fig 4. *Indothemis carnatica* Fig 5. *Bradinopyga konkanensis* and Fig 6. *Bradinopyga strachani*

In this study, the *Orthetrum sabina*, *Pantala flavescens* dragonfly species, which belong to the family Libellulidae, were observed in gardens and crop fields, outside water bodies. These species of dragonfly were observed perching motionless on shrubs and dry twigs for long periods of time. *Pantala flavescens*, a member of the Libellulidae family, was low in abundance throughout the year in the Sikar region, but numerous during the months of July to October where resting sites matched its preferences, particularly in Bajra (*Pennisetum glaucum*) crop fields. These dragonflies migrate in large numbers with the monsoon winds and

usually arrive with the first rain-making monsoon. *Trithemis kirbyi* is observed in the marshes, ponds, and lakes, and prefers to perch on exposed rocks, stones, dry areas, and boulders in khel and bawaris. This species favours open, arid and semi-arid landscapes, where it is found on a bare, stony or cemented plaster bottom and banks with little or no vegetation. These water bodies often dry out partially in summer. It is only present in hot areas even if the temperature is at 40 degrees celsius and is confined to low elevations (Plate 2).



**Plate 2:** Fig 1. *Orthetrum sabina* Fig 2. *Pantala flavescens* Fig 3. *Trithemis kirbyi*

Plate – 3 shows species of dragonflies, namely *Rhodothemis rufa*, *Trithemis aurora*, *Urothemis signata*, *Crocothemis erythraea*, *Tholymis tillarga*, *Trithemis annulata*, *Neurothemis intermedia*, *Cordulegaster boltonii*, *Diplacodes trivialis*, found only in Udaipura road-Raiwasa, gardens, crop fields, and Aravali hill areas. *Sympetrum striolatum*, *Acisoma variegatum*, *Erythemis simplicicollis*, and *Crocothemis servilia* were less abundant

throughout the year but become more numerous during the months of July to October and are highly localized (Plate - 4). *Aethriamanta brevipennis* was present near Udaipurwati area whereas *Ictinogomphus rapax*, *Orthetrum glaucum*, *Orthetrum taeniolatum* and *Libellula saturata* were present in Sakrai, Ragunargarh and Hill areas of Sikar region (Plate - 4).

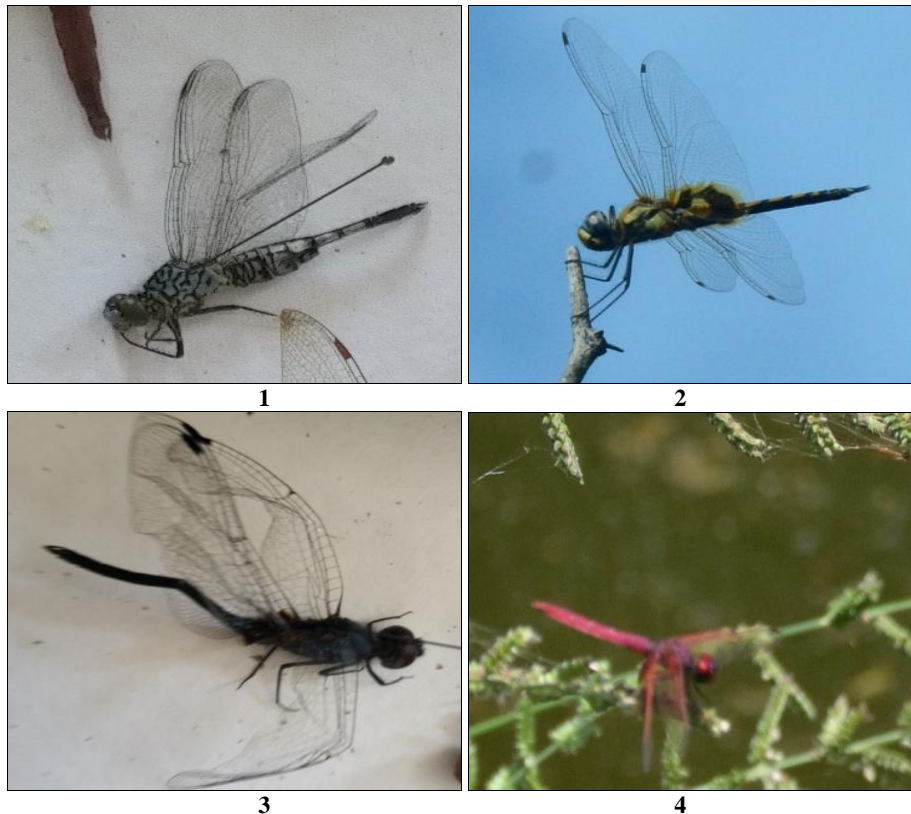


**Plate 3:** Dragonfly species Fig 1. *Rhodothemis rufa* Fig 2. *Trithemis aurora* Fig 3. *Urothemis signata* Fig 4. *Crocothemis erythraea* Fig 5. *Tholymis tillarga* Fig 6. *Trithemis annulata* Fig 7. *Neurothemis intermedia* Fig 8. *Cordulegaster boltonii* Fig 9. *Diplacodes trivialis*





**Plate 4:** Fig 1. *Sympetrum striolatum* Fig 2. *Acisoma variegatum* Fig 3. *Erthemis simplicicolis* Fig 4. *Crocothemis servilia* Fig 5. *Ictinogomphus rapax* Fig 6. *Orthetrum glaucum* Fig 7. *Orthetrum taeniolatum* Fig 8. *Aethriamanta brevipennis* Fig 9. *Libellula saturata*



**Plate 5:** Fig 1. *Acisoma panorpoides* Fig 2. *Tramea basillaris* Fig 3. *Brachydiplax sobrina* Fig 4. *Orthetrum pruinatum*

Only four species namely, *Acisoma panorpoides*, *Brachydiplax sobrina*, *Orthetrum pruinatum* and *Tramea basillaris* were restricted to the hilly part (Plate 5). *Acisoma panorpoides* occurred in areas of Shakambhari, Sakrai and other hilly areas, only in rainy season. *Brachydiplax sobrina* occurrence was at Shakambhari hill areas (sampled at Sakrai). *Orthetrum pruinatum* was sampled at Raiwasa road in water effluent of village of Sikar district. *Tramea basillaris* was seen in forest area of Harsh hill and hilly forest areas.

**Discussion**

Odonates are significant organisms as they are the best indicators of biodiversity and ecosystem quality. The dragonfly biotic index is an important tool in monitoring the water quality of an ecosystem. They are effective monitoring agents of environmental health and conditions of the ecosystems, caused by human activities (Kehimkar, 2016) [5]. The distribution and occurrence of odonates are known to be linked with their associated habitat including different vegetation life-forms and landscape (Balzan, 2012)

[1]. Sikar region of Rajasthan state has varied habitat types where odonate populations are seen to thrive. The plain areas, considerably high hill peaks of the North-Eastern Aravali range and forested areas have a hot and humid climate in summers and the rainfall is mainly confined to the rainy season. The region’s diverse habitats create optimal environment for odonate insects.

In our sampling, family Libellulidae was represented by highest number of species (29), but only one species was found from the family Gomphidae. Tiple and Koparde, (2014) [14] surveyed Odonata in Maharashtra, India. A checklist of 134 species of Odonata belonging to 70 genera representing 11 families was prepared in this study. The largest numbers of species were recorded from the families Libellulidae (48 species) and Gomphidae (22 species). The number of species in family Gomphidae is lesser than family Libellulidae but the abundance of local dragonfly population is dependent on the adult habitat site selection and the spatial heterogeneity of larval survival (Remsburg, 2011) [9]. Gain & Kulkarni, (2024) studied the diversity along with thermal sensitivity of Odonata fauna of Lohara

Lake of district Chandrapur (M.S), India. They documented 8 species of dragonflies from family Libellulidae and 4 species from family Coenagrionidae with minimum and maximum temperatures at the site being 16°C and 44°C, respectively.

D'Souza and Pai, (2019) <sup>[3]</sup> conducted comparative study on dragonfly diversity on a plateau and an agro-ecosystem in Goa, India. A total of 28 species of dragonflies were encountered belonging to 18 genera but only 12 species of dragonflies belonging to 18 genera were common to both ecosystems. Plateau region diversity was higher possibly due to the greater plant diversity in the region. Mokaria and Jethva, (2019) <sup>[8]</sup> conducted an evaluation of community composition of dragonflies (Order: Odonata) in Nalsarovar Bird Sanctuary, Gujarat, India. In this study, the most abundant species encountered was *Pantala flavescens*. Although, the density of dragonfly species namely *Trithemis pallidinervis* was highest followed by *Pantala flavescens*. In our study too, *Pantala flavescens* was the most common in abundance along with *Brachythemis contaminata* and *Bradinopyga geminata*.

*Rhodothemis rufa* is restricted to the wetlands of Aravali hills of Sikar region and is seen only occasionally, which could indicate a loss of diversity in the Sikar region. *Trithemis aurora* has been assessed for The IUCN Red List of Threatened Species in 2010 and was listed as Least Concern, but in Sikar region, it is of greater concern due to its localized and low abundance.

During the droughts, dragonflies search ponds and such optimal habitats and dissipate across landscapes. Habitat-specialist species are exposed to local extinction resulting due to swift climate change (Samways MJ, 2024) <sup>[10]</sup>.

### Conclusion

This study provides worthwhile record of dragonfly diversity in the Sikar region. The most diverse family is Libellulidae but more concern is about their abundance because most species showed only rainy seasonal presence. The findings of this study suggest that the rapid development and resource consumption by the growing population in Sikar region, combined with the scarcity of pure water sources lead to the loss of many dragonfly species. This information can be used as of prime concern in conservation efforts and to develop effective approach for the protection and preservation of dragonfly populations in the Sikar region.

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