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Odonates of Gujarat: A comprehensive review with new record of *Selysiothemis nigra* (Van der Linden, 1825) from the Gujarat State, India

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Abstract

The significant ecological value of odonates makes them important for assessing disturbances or various environmental effects in the ecosystem. Odonate diversity was investigated from February 2022 to December 2022 at four different locations in north Gujarat State of India namely, Visnagar, Dharoi, Patan, and Balaram-Ambaji Wildlife Sanctuary (WLS), and the results were compared with past studies on the distribution and diversity of odonates in Gujarat. We recorded 44 species of odonates, including 32 species of Anisoptera (dragonflies) and 12 species of Zygoptera (damselflies). The highest species richness (19 dragonfly and 8 damselfly species) was observed in Visnagar. This was followed by Dharoi, Balaram-Ambaji WLS, and Patan, having 25, 23, and 20 species, respectively. In previous literature from the Gujarat State, a total of 18 studies from 2014 to 2021 have been carried out, and 80 species belonging to 50 genera, 9 families, and 2 suborders (25 species of Zygoptera and 55 species of Anisoptera) were recorded. Among these, 20 species of dragonflies and 9 species of damselflies are common in all five regions of Gujarat state. The Gujarat state is officially divided into five distinct regions; north Gujarat, central Gujarat, south Gujarat, Saurashtra and Kutch. Notably, *Selysiothemis nigra* (Van der Linden, 1825) is reported for the first time from Gujarat state. Odonates are reliable bioindicators because their diversity closely reflects habitat quality and ecosystem health. Although previous studies emphasize that habitat heterogeneity is essential for maintaining odonate diversity, many regions remain under-documented. Our data address this gap by providing updated diversity information and supporting a clearer understanding of habitat and odonate relationships.

Key words: Anisoptera, damselflies, dragonflies, species diversity, Zygoptera

Introduction

The stem group ancestors of modern Odonata, known as the Odonatoptera, were the dominant aerial predators during the Carboniferous and Permian periods, approximately 359–260 million years ago (Patel and Ghetiya, 2016). Along with mayflies (Ephemeroptera), these early forms are among the most ancient groups of winged insects, and their evolutionary success demonstrates the early diversification of flight in

terrestrial habitats (Grimaldi and Engel, 2005; Misof et al., 2014). Over time, these lineages gave rise to the modern odonates, represented today by the colorful wetland insects known as odonates, which include dragonflies and damselflies (Mitra, 2006). Generally, odonates are a primitive group of insects that play a crucial role in the ecosystem as top invertebrate predators in both their aquatic larval and terrestrial adult stages (Sharma et al., 2007; Koli et al., 2014), control other insects that are harmful to humans, and play an important role in biological control in agroforestry (Nair, 2011; Das et al., 2012). As sensitive bioindicators, odonates provide substantial information regarding the disturbance levels and health of terrestrial and aquatic habitats (Nair, 2011; Koli et al., 2014).

Globally, there are 6463 odonate species, classified into 688 genera and 48 families (Paulson et al., 2025). According to recent global assessments, the Indo-Malayan biogeographic realm hosts approximately 1,746 odonate species, representing more than one-fourth of the world's dragonfly and damselfly diversity. However, given that new species are continuously discovered, this number is likely underestimated (van Tol, 2012; Suhling et al., 2015; Beatty et al., 2022).

According to Prasad and Varshney (1995), as well as Subramanian (2014), Rohmare et al. (2015), and Rathod et al. (2016), Kalkman et al. (2020), India hosts 504 odonate species in 157 genera and 17 families out of 6463 species known globally. Fraser (1933; 1934; 1936) published the foundational literature titled *Fauna of British Indian Subcontinent and Abroad* in three volumes. Subsequently, numerous studies were carried out in India on the diversity and biology of Odonata. Fraser (1933; 1934; 1936); Prasad and Varsheny (1995); Emiliyamma and Radhakrishnan (2000); Subramanian (2005) and Subramanian et al. (2008) investigated the Western Ghats, while Mitra (2002) determined geographical distribution in eastern India. Kumar and Prasad (1981) investigated and published material on the western Himalayas and northern India. Lahiri (1979); Kumar and Mitra (1998); and Sharma and Joshi (2007) explored the diversity of odonates, whereas Tiple et al. (2011) and Das et al. (2013) contribute to their research of central India (Roy et al., 2022).

While the distribution of odonates is well documented in different parts of the Gujarat state, there is a need to review their diversity and identify under-surveyed areas to understand their role as biological indicators across different geographic regions. Thus, this study combines a literature review with original field data to compare the species diversity and distribution, aiming to establish a primary database for the state while specifically documenting the diversity of north Gujarat region.

Material and Methods

Study area

Due to the scarcity of data on odonate diversity in the literature, this study was conducted across four distinct locations in the north Gujarat region: Visnagar, Patan, Dharoi, and the Balaram-Ambaji Wildlife Sanctuary (Fig. 1) from February 2022 to December 2022. The study area lies within Biogeographic Zone 4, the semi-arid area of India and falls under the administrative division of north Gujarat, covering parts of the Banaskantha, Mehsana and Patan districts, and can be classified as a ravine thorn forest (6B/C2), characterised by dissected ravine terrain, sparse thorny vegetation and an overall dry climatic regime (Champion and Seth, 1968; Chaudhary et al., 2022; Rabari et al., 2022; Prajapati et al., 2023). The region experiences three distinct seasons, with temperature ranging from 5 °C in winter to 46 °C during the summer, and an annual rainfall of 600–750 mm. (Rabari et al., 2023). The terrain varies from semi-desert to Aravalli mountain range, with elevations ranging from 10 to 600 meters above mean sea level (amsl) (Mewada et al., 2019; Rabari et al., 2023). The study area map was prepared in QGIS 3.36 using the Gujarat district boundary layer, with the specific study sites indicated (Fig. 1).

Data collection

Data were collected from four locations in north Gujarat, including Visnagar in Mehsana District (27 species), Patan in Patan District (20 species), Dharoi in Sabarkantha District (25 species), and the Balaram–Ambaji Wildlife Sanctuary in Banaskantha District (23 species). Opportunistic surveys were conducted between 08:00 and 12:00. Odonates prefer this period to maintain their body temperature in sunlight (Das et al., 2013; Koli et al., 2014). For identification, we photographed from various angles using a Canon 550d with a 70–300 mm lens and identified species using standard field guides (Mitra, 2006; Subramanian, 2009). Nomenclature and classification followed the taxonomic revision by Dijkstra et al. (2013).

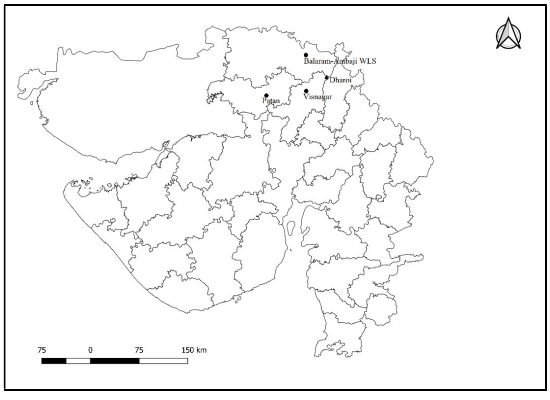

Figure 1: Map of the study area in north Gujarat, India, illustrating the four specific locations: Visnagar, Patan, Dharoi, and the Balaram–Ambaji Wildlife Sanctuary.

Literature survey

This study incorporates a review of previously published articles, reports, and documents documenting the diversity and distribution of odonates in Gujarat. To compile the available information, we conducted a systematic literature search in Google Scholar, ResearchGate, and other online academic databases. Keywords such as "odonate," "dragonfly," "damselfly," "odonate diversity," and "Gujarat odonates" were used individually and in combination. The review was limited to peer-reviewed publications, research papers, and accessible technical reports. Additional references were identified from the citation lists of earlier works. Data were categorized into five regions based on the state's administrative geographical divisions: north Gujarat, central Gujarat, south Gujarat, Saurashtra, and Kutch.

Results

During the study period, 44 species belonging to 27 genera, six families, and two suborders were recorded from four locations in north Gujarat. A total of 12 species of Zygoptera (damselflies) and 32 species of Anisoptera (dragonflies) were documented. In this study, three families of Zygoptera and three of Anisoptera were identified. Visnagar exhibited the highest diversity, with a total of 27 odonate species were found (19 dragonflies, 8 damselflies). Dharoi ranked second with 25 (19 dragonflies and 6 damselflies), followed by Balaram-Ambaji WLS (16 dragonflies and 7 damselflies) and Patan (13 dragonflies and 7 damselflies). Two species were prevalent across all four locations (Tables 1 and 2), *Pseudagrion microcephalum* (Rambur, 1842) and *Trithemis aurora* (Burmeister, 1839).

At least four damselfly species and 11 species of dragonfly were recorded in three locations, though their presence was not confirmed in the remaining areas, likely due to a limited sampling effort. Four dragonflies species were shared by Visnagar, Patan, and Dharoi, while *Crocothemis servilia* (Drury, 1770) was common to Patan, Dharoi, and the Balaram-Ambaji WLS. Two dragonflies and two damselfly species were recorded in Visnagar, Patan, and the Balaram-Ambaji WLS. Four dragonfly species and one damselfly (*Pseudagrion decorum* (Rambur, 1842)) were observed in Visnagar, Dharoi, and Balaram-Ambaji WLS (Table 1 and 2).

A total of 11 dragonflies and 6 damselflies were recorded only from two adjoining area. In Visnagar and Patan, *Ceriagrion olivaceum* was common. In Visnagar and Dharoi, four damselflies and two dragonflies were common. Two species of dragonflies (*Anax immaculifrons* and *Tramea limbata*) were common in Visnagar and Balaram-Ambaji WLS. Two species of damselfly and five species of dragonflies were common in Patan and Dharoi. *Agriocnemis pygmaea* were found common between Patan and Balaram-Ambaji WLS. *Orthetrum taeniolatum* and *Tramea basilaris* were recorded common between Dharoi and Balaram-Ambaji WLS (Table 1 and 2).

A total of two damselfly and seven dragonfly species was recorded from a single area. *Pseudagrion rubriceps*, *Disparoneura quadrimaculata*, *Anax guttatus*, *Orthetrum glaucum* and *Trithemis festiva* recorded only from the Balaram-Ambaji WLS. *Acisoma panorpoides*, *Potamarcha congener*, *S. nigra* and *Tetrathemis platyptera* recorded only from Visnagar (Table 1 and 2).

First time recorded species from the Gujarat

On June 2, 2022, *Selysiothemis nigra* (Van der Linden, 1825) was observed at In Dediyu Lake, Visnagar, Gujarat, (N 23.7043, E 72.5527). On June 6, 2022, a second observation and photo of the adult female of the same species was captured. Gerken and Sternberg (1999) identification keys and morphological traits were used to identify the species and Figure 2 confirms this identification.

Figure 2: *Selysiothemis nigra* (Van der Linden, 1825) observed at Dediyu Lake, Visnagar, Gujarat, India. Both photographs depict the same individual from different angles to aid identification. (Photo credit: Pavan Rana).

Table 1: Checklist of damselflies recorded from the north Gujarat, India along with their IUCN Red List conservation status (Least Concern - LC; Data Deficient - DD).

Serial No.	Family	Common name	Scientific name	IUCN	Visnagar	Patan	Dharoi	Balaram
1	Coenagrionidae	Pygmy dartlet	*Agriocnemis pygmaea*	LC	-	Y	-	Y
2	Coenagrionidae	Coromandel marsh dart	*Ceriagrion coromandelianum*	LC	Y	Y	-	Y
3	Coenagrionidae	Rusty marsh dart	*Ceriagrion olivaceum*	LC	Y	Y	-	-
4	Coenagrionidae	Golden dartlet	*Ischnura aurora*	LC	-	Y	Y	-
5	Coenagrionidae	Senegal golden dartlet	*Ischnura senegalensis*	LC	Y	-	Y	-
6	Coenagrionidae	Pixie dartlet	*Ischnura nursei*	LC	Y	Y	-	Y
7	Coenagrionidae	Malay lilly-squatter	*Paracercion melanotum*	LC	Y	-	Y	-
8	Coenagrionidae	Blue grass dartlet	*Pseudagrion microcephalum*	LC	Y	Y	Y	Y
9	Coenagrionidae	Three striped blue dart	*Pseudagrion decorum*	DD	Y	-	Y	Y
10	Coenagrionidae	Saffron-faced blue dart	*Pseudagrion rubriceps*	LC	-	-	-	Y
11	Lestidae	-	*Lestes concinnus*	LC	Y	Y	Y	-
12	Platycnemididae	Black-winged bambootail	*Disparoneura quadrimaculata*	LC	-	-	-	Y

Table 2: Checklist of dragonflies recorded from the north Gujarat, India along with their IUCN Red List conservation status (Least Concern - LC; Data Deficient - DD).

Serial No.	Family	Common name	Scientific name	IUCN	Visnagar	Patan	Dharoi	Balaram
1	Aeshnidae	Vagrant emperor	*Anax ephippiger*	LC	-	Y	Y	-
2	Aeshnidae	Blue-tailed green darner	*Anax guttatus*	LC	-	-	-	Y
3	Aeshnidae	Magnificent emperor	*Anax immaculifrons*	LC	Y	-	-	Y
4	Aeshnidae	Lesser emperor	*Anax parthenope*	LC	-	Y	Y	-
5	Gomphidae	Common clubtail	*Ictinogomphus rapax*	LC	Y	-	Y	Y
6	Gomphidae	Lined hooktail	*Paragomphus lineatus*	LC	Y	Y	Y	-
7	Libellulidae	Trumpet tail	*Acisoma panorpoides*	LC	Y	-	-	-
8	Libellulidae	Scrlet marsh hawk	*Aethriamanta brevipennis*	LC	Y	-	Y	Y
9	Libellulidae	Little blue marsh hawk	*Brachydiplax sobrina*	LC	-	-	-	-
10	Libellulidae	Ditch jewel	*Brachythemis contaminate*	LC	Y	Y	Y	-
11	Libellulidae	Granite ghost	*Bradinopyga geminate*	LC	Y	Y	-	Y
12	Libellulidae	Ruddy marsh skimmer	*Crocothemis servilia*	LC	-	Y	Y	Y
13	Libellulidae	Black ground skimmer	*Diplacodes lefebvrii*	DD	-	-	Y	Y
14	Libellulidae	Ground skimmer	*Diplacodes trivialis*	LC	-	Y	Y	-
15	Libellulidae	Pied paddy skimmer	*Neurothemis tullia*	LC	Y	-	Y	-
16	Libellulidae	Blue marsh hawk	*Orthetrum glaucum*	LC	-	-	-	Y
17	Libellulidae	Tricoloured marsh hawk	*Orthetrum luzonicum*	LC	Y	Y	Y	-
18	Libellulidae	Crimson-tailed marsh hawk	*Orthetrum pruinosum*	DD	-	Y	-	-
19	Libellulidae	Green marsh hawk	*Orthetrum sabina*	LC	Y	Y	Y	-
20	Libellulidae	Small skimmer	*Orthetrum taeniolatum*	LC	-	-	Y	Y
21	Libellulidae	Wandering glider	*Pantala flavescens*	LC	-	Y	Y	-
22	Libellulidae	Yellow-tailed ashy skimmer	*Potamarcha congener*	LC	Y	-	-	-
23	Libellulidae	Common picture wing	*Rhyothemis variegata*	LC	Y	-	Y	Y
24	Libellulidae	Black pennant	*Selysiothemis nigra*	LC	Y	-	-	-
25	Libellulidae	Pigmy skimmer	*Tetrathemis platyptera*	LC	Y	-	-	-
26	Libellulidae	Coral-tailed Cloud Wing	*Tholymis tillarga*	LC	Y	-	Y	Y
27	Libellulidae	Red marsh trotter	*Tramea basilaris*	LC	-	-	Y	Y
28	Libellulidae	Black marsh trotter	*Tramea limbata*	LC	Y	-	-	Y
29	Libellulidae	Crimson marsh glider	*Trithemis aurora*	LC	Y	Y	Y	Y
30	Libellulidae	Black stream glider	*Trithemis festiva*	LC	-	-	-	Y
31	Libellulidae	Scarlet rock glider	*Trithemis kirbyi*	LC	Y	-	Y	-
32	Libellulidae	Long-legged marsh glider	*Trithemis pallidinervis*	DD	Y	Y	-	Y

The thorax of the adult females is distinctly brownish-black. The abdomen was very short, compressed, and subcylindrical. Legs were greenish-white in color. Pterostigma is colorless and heavily bordered by thick black veins; wings hyaline and colorless, including neuration (Fraser, 1936).

From 2015 to 2021, a total of 18 studies were conducted in Gujarat, recording 80 species belonging to 37 genera, across nine families, and two suborders (Table 4 and 5). A total of 25 species of Zygoptera (damselflies) and 55 species of Anisoptera (dragonflies) were recorded. Out of nine families, five belong to Zygoptera and four to Anisoptera. The Libellulidae was most species-rich family with 41 species, followed by the Coenagrionidae with 16 species. The Gomphidae family was represented by six genera and seven species, while the Macromiidae, Chlorocyphidae and Euphaeidae were represebted by a single genus and species each (Fig. 3).

A total of 20 species of dragonfly species were recorded acrossall five regions of Gujarat state. Four dragonfly species were found only in central Gujarat, *Orthetrum triangulare* was recorded only in Saurashtra region while 13 species were recorded from south Gujarat. Nine damselfly species were found throughout Gujarat. *Enallagma cyathigerum* was found from central Gujarat only, *Libellago lineata* was found solely in Saurashtra region while three species were recorded only from the south Gujarat (Table 4 and 5).

Table 3: Checklist of damselflies recorded from the Gujarat compared with our study along with their IUCN Red List conservation status (Least Concern - LC; Data Deficient - DD).

Serial No.	Scientific name	Common name	IUCN category	North Gujarat	Central Gujarat	South Gujarat	Saurashtra	Kutch	Our	Authors
					Suborder Zygoptera					
					Family Chlorocyphidae					
1	*Libellago lineata* (Burmeister, 1839)	River heliodor	LC				Y			Rathod et. al., 2021
					Family Coenagrionidae					
2	*Agriocnemis pygmaea* (Rambur, 1842)	Pigmy dartlet	LC	Y	Y	Y	Y	Y	Y	Rathod et al., 2015; Rohmare et al., 2015; Patel and Ghetiya, 2016; Patel et al., 2016; Rathod et al., 2016a, b; Rohmare et al., 2016; Mokaria and Jethva, 2018; Patel et al., 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Sharma and Kumar, 2020; Rathod et al., 2021
3	*Agriocnemis splendidissima* Laidlaw, 1919	Splendid dartlet	LC			Y				Rathod et al., 2016a, b; Rathod et al., 2021
4	*Amphiallagma parvum* (Selys, 1876)	Little blue	LC			Y	Y	Y		Patel et al., 2016; Rathod et al., 2016b; Rathod et al., 2021
5	*Ceriagrion coromandelianum* (Fabricius, 1798)	Coromandel marsh dart	LC	Y	Y	Y	Y	Y	Y	Mokaria, 2015; Rathod et al., 2015; Rohmare et al., 2015; Patel and Ghetiya, 2016; Patel et al., 2016; Rathod et al., 2016a; Rohmare et al., 2016; Mokaria and Jethva, 2018; Patel et al., 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Sharma and Kumar, 2020; Rathod et al., 2021
6	*Ceriagrion azureum* (Selys, 1891)	Rusty marsh dart	LC				Y		Y	Patel et al., 2016
7	*Enallagma cyathigerum* (Charpentier, 1840)	Common bluet	LC		Y					Rohmare et al., 2015; Patel et al., 2016; Rohmare et al., 2016; Mokaria and Jethva, 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Sharma and Kumar, 2020; Rathod et al., 2021
8	*Ischnura aurora* (Brauer, 1865)	Golden dartlet	LC	Y	Y	Y	Y	Y	Y	Mokaria, 2015; Rathod et al., 2015, Rohmare et al., 2015; Patel and Ghetiya, 2016; Patel et al., 2016; Rathod et al., 2016a, b; Rohmare et al., 2016; Mokaria and Jethva, 2018; Patel et al., 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Sharma and Kumar, 2020; Rathod et al., 2021
9	*Ischnura elegans* (Vander Linden, 1820)	Common bluetail	LC		Y	Y				Rohmare et al., 2015; Rathod et al., 2016a, b; Rohmare et al., 2016
10	*Ischnura nursei* Morton, 1907	Pixie dartlet	LC	Y	Y	Y	Y	Y	Y	Mokaria, 2015; Rathod et al., 2015; Patel et al., 2016; Rathod et al., 2016a, b; Rohmare et al., 2016; Mokaria and Jethva, 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Sharma and Kumar, 2020; Rathod et al., 2021
11	*Ischnura senegalensis* (Rambur, 1842)	Senegal golden dartlet	LC	Y	Y	Y	Y	Y	Y	Mokaria, 2015, Rathod et al., 2015; Rohmare et al., 2015; Patel and Ghetiya, 2016; Patel et al., 2016; Rathod et al., 2016a, b; Mokaria and Jethva, 2018; Patel et al., 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Sharma and Kumar, 2020; Rathod et al., 2021;
12	*Paracercion melanotum* (Selys, 1876)	Malayan lilly-squatter	LC	Y	Y	Y	Y	Y	Y	Rathod et al., 2016a, b; Rohmare et al., 2016; Rathod and Parasharya, 2018; Rathod et al., 2021

Table 3: (Continued).

Serial No.	Scientific name	Common name	IUCN category	North Gujarat	Central Gujarat	South Gujarat	Saurashtra	Kutch	Our	Authors
13	*Pseudagrion decorum* (Rambur, 1842)	Three striped blue dart	DD	Y	Y	Y	Y	Y	Y	Mokaria, 2015; Rathod et al., 2015; Rohmare et al., 2015; Patel and Ghetiya, 2016; Patel et al., 2016; Rathod et al., 2016a, b; Rohmare et al., 2016; Mokaria and Jethva, 2018; Patel et al., 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Sharma and Kumar, 2020; Rathod et al., 2021
14	*Pseudagrion hypermelas* Selys, 1876	Lavender sprite	LC		Y	Y	Y			Rohmare et al., 2015; Rathod et al., 2016a, b; Rohmare et al., 2016; Rathod and Parasharya, 2018; Rathod et al., 2021
15	*Pseudagrion microcephalum* (Rambur, 1842)	Blue grass dartlet	LC	Y	Y	Y	Y		Y	Rathod et al., 2015; Rohmare et al., 2015; Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Rohmare et al., 2016; Mokaria and Jethva, 2018; Patel et al., 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Sharma and Kumar, 2020; Rathod et al., 2021
16	*Pseudagrion rubriceps* Selys, 1876	Saffron-faced blue dart	LC		Y	Y	Y		Y	Rathod et al., 2015; Rohmare et al., 2015; Rathod et al., 2016a, b; Rohmare et al., 2016; Rathod and Parasharya, 2018; Sharma and Kumar, 2020; Rathod et al., 2021
17	*Pseudagrion spencei* Fraser, 1922	Yellow-striped sprite	LC			Y				Rathod et al., 2016a, b
Family Euphaeidae										
18	*Dysphaea ethela* Fraser, 1924	Black torrent dart	LC			Y				Rathod et al., 2016a, b
Family Lestidae										
19	*Lestes concinnus* Hagen in Selys, 1862		LC	Y	Y	Y	Y	Y	Y	Mokaria, 2015; Rathod et al., 2015; Rohmare et al., 2015; Patel and Ghetiya, 2016; Rathod et. al., 2016a, b; Rohmare et al., 2016; Patel et al., 2018; Rathod and Parasharya, 2018; Sharma and Kumar, 2020; Rathod et al., 2021
20	*Lestes elatus* Hagen in Selys, 1862	Emerald spread wing	LC	Y	Y	Y	Y	Y		Rathod et Al., 2016a, b
21	*Lestes viridulus* Rambur, 1842	Emerald-striped spread wing	LC		Y	Y				Rohmare et al., 2015; Rathod et al., 2016a, b; Rohmare et al., 2016; Sharma and Kumar, 2020; Rathod et al., 2021
Family Platycnemididae										
22	*Copera marginipes* (Rambur, 1842)	Yellow bush dart	LC		Y	Y	Y			Rohmare et al., 2015; Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Rohmare et al., 2016; Patel et al., 2018; Rathod and Parasharya, 2018; Sharma and Kumar, 2020; Rathod et al., 2021
23	*Disparoneura quadrimaculata* (Rambur, 1842)	Black-winged bambootail	LC		Y	Y	Y		Y	Rohmare et al., 2015; Patel and Ghetiya, 2016; Patel et al., 2016; Rathod et al., 2016a, b; Patel et al., 2018; Sharma and Kumar, 2020; Rathod et al., 2021
24	*Elattoneura nigerrima* (Laidlaw, 1917)		DD		Y	Y	Y			Rathod et al., 2016a, b; Rohmare et al., 2016; Rathod and Parasharya, 2018; Rathod et al., 2021

Table 4: Checklist of dragonflies recorded from the Gujarat compared with our study along with their IUCN Red List conservation status (Least Concern - LC; Data Deficient - DD; Near Threatened - NT)

Serial No.	Scientific name	Common name	IUCN category	North Gujarat	Central Gujarat	South Gujarat	Saurashtra	Kutch	Our	Authors
					Suborder Anisoptera					
					Family Aeshnidae					
1	*Anaciaeschna jaspidea* (Burmeister, 1839)	Rusty darner	LC		Y					Rohmare et al., 2015
2	*Anax ephippiger* (Burmeister, 1839)	Vagrant emperor	LC	Y	Y	Y	Y	Y	Y	Mokaria and Jethva, 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Rathod et al., 2021
3	*Anax guttatus* (Burmeister, 1839)	Blue-tailed green darner	LC	Y	Y	Y	Y	Y	Y	Rathod et al., 2015; Rohmare et al., 2015; Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Rohmare et al., 2016; Mokaria and Jethva, 2018; Patel et al., 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Sharma and Kumar, 2020; Rathod et al., 2021
4	*Anax immaculifrons* Rambur, 1842	Magnificent emperor	LC	Y	Y	Y	Y	Y	Y	Rathod et al., 2015; Rohmare et al., 2015; Rathod et al., 2016a, b; Rohmare et al., 2016; Rathod and Parasharya, 2018; Rathod et al., 2021
5	*Anax parthenope* (Selys, 1839)	Lesser emperor	LC	Y	Y		Y	Y	Y	Shukla et al., 2014; Rathod and Parasharya 2018; Rathod et. al., 2021
6	*Gynacantha bayadera* Selys, 1891	Parakeet darner	LC		Y					Rathod et al., 2021
7	*Gynacantha dravida* Lieftinck, 1960	Brown darner	DD			Y				Patel et al., 2018
					Family Gomphidae					
8	*Burmagomphus laidlawi* Fraser, 1924	Sprayed clubtail	DD			Y				Rathod et al., 2016a, b; Rathod et al., 2021
9	*Cyclogomphus ypsilon* Selys, 1854					Y				Rathod et al., 2016a, b; Rathod et al., 2021
10	*Ictinogomphus rapax* (Rambur, 1842)	Common clubtail	LC	Y	Y	Y	Y	Y	Y	Shukla et al., 2014; Mokaria, 2015; Rathod et al., 2015; Rohmare et al., 2015; Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Rohmare et al., 2016; Mokaria and Jethva, 2018; Patel et al., 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Sharma and Kumar, 2020; Rathod et al., 2021
11	*Macrogomphus annulatus* (Selys, 1854)	Keiser's forktail	DD			Y				Rathod et al., 2021
12	*Microgomphus torquatus* (Selys, 1854)		DD			Y				Rathod et al., 2016a, b
13	*Melligomphus acinaces* (Laidlaw, 1922)		DD			Y				Rathod et al., 2016a, b; Rathod et al., 2021
14	*Paragomphus lineatus* (Selys, 1850)	Lined hooktail	LC	Y	Y	Y	Y		Y	Mokaria, 2015; Rohmare et al., 2015; Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Patel et al., 2018; Rathod and Parasharya, 2018; Sharma and Kumar, 2020; Rathod et al., 2021
					Family Libellulidae					
15	*Acisoma panorpoides* Rambur, 1842	Trumpet tail	LC	Y	Y	Y	Y	Y	Y	Shukla et al., 2014; Rathod et al., 2015; Rohmare et al., 2015; Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Rohmare et al., 2016; Mokaria and Jethva, 2018; Patel et al., 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Sharma and Kumar, 2020; Rathod et al., 2021

Table 4: (Continued).

Serial No.	Scientific name	Common name	IUCN category	North Gujarat	Central Gujarat	South Gujarat	Saurashtra	Kutch	Our	Authors
16	*Aethriamanta brevipennis* (Rambur, 1842)	Scarlet marsh hawk	LC			Y			Y	Rathod et al., 2016b
17	*Brachydiplax sobrina* (Rambur, 1842)	Little blue marsh hawk	LC	Y	Y	Y	Y		Y	Shukla et al., 2014; Rathod et al., 2015; Rohmare et al., 2015; Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Rohmare et al., 2016; Mokaria and Jethva, 2018; Patel et al., 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Sharma and Kumar, 2020; Rathod et al., 2021
18	*Brachythemis contaminata* (Fabricius, 1793)	Ditch jewel	LC	Y	Y	Y	Y	Y	Y	Shukla et al., 2014; Mokaria, 2015; Rathod et al., 2015; Rohmare et al., 2015; Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Rohmare et al., 2016; Mokaria and Jethva, 2018; Patel et al., 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Sharma and Kumar, 2020; Rathod et al., 2021
19	*Bradinopyga geminata* (Rambur, 1842)	Granite ghost	LC	Y	Y	Y	Y	Y	Y	Shukla et al., 2014; Mokaria, 2015; Rathod et al., 2015; Rohmare et al., 2015; Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Mokaria and Jethva, 2018; Patel et al., 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Sharma and Kumar, 2020; Rathod et al., 2021
20	*Cratilla lineata* (Brauer, 1878)	Emerald-banded skimmer	LC			Y				Rathod et al., 2021
21	*Crocothemis servilia* (Drury, 1770)	Ruddy marsh skimmer	LC	Y	Y	Y	Y	Y	Y	Shukla et al., 2014; Mokaria, 2015; Rathod et al., 2015; Rohmare et al., 2015; Rathod et al., 2016a, b; Rohmare et al., 2016; Mokaria and Jethva, 2018; Patel et al., 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Sharma and Kumar, 2020; Rathod et al., 2021
22	*Crocothemis servilia servilia* (Drury, 1770)	Greater red skimmer				Y				Patel and Ghetiya 2016
23	*Diplacodes lefebvrii* (Rambur, 1842)	Black ground skimmer	DD	Y	Y	Y	Y	Y	Y	Mokaria, 2015; Rathod et al., 2015; Rohmare et al., 2015; Rathod et al., 2016a, b; Mokaria and Jethva, 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Sharma and Kumar, 2020; Rathod et.al., 2021
24	*Diplacodes trivialis* (Rambur, 1842)	Ground skimmer	LC	Y	Y	Y	Y		Y	Shukla et al., 2014; Mokaria, 2015; Rathod et al., 2015; Rohmare et al., 2015; Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Rohmare et al., 2016; Mokaria and Jethva, 2018; Patel et al., 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Sharma and Kumar, 2020; Rathod et al., 2021
25	*Diplacodes nebulosa* (Fabricius, 1793)	Black-tipped grounnd skimmer	LC	Y	Y	Y	Y	Y		Rathod and Parasharya, 2018; Sharma and Kumar, 2020; Rathod et al., 2021
26	*Hylaeothemis apicalis* Fraser, 1924	Blue hawklet	DD			Y				Rathod et al., 2016a, b
27	*Indothemis carnatica* (Fabricius, 1798)	Blue ground skimmer	NT		Y	Y				Mokaria and Jethva, 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Sharma and Kumar, 2020; Rathod et al., 2021
28	*Lathrecista asiatica* (Fabricius, 1798)	Asiatic blood-tail	LC			Y				Rathod et al., 2016a, b; Rathod et al., 2021

Table 4: (Continued).

Serial No.	Scientific name	Common name	IUCN category	North Gujarat	Central Gujarat	South Gujarat	Saurashtra	Kutch	Our	Authors
29	*Macrodiplax cora* (Brauer, 1867)	Estuarine skimmer	LC		Y					Mokaria and Jethva, 2018; Mokaria and Jethva, 2019
30	*Neurothemis intermedia* (Rambur, 1842)	Paddyfield parasol	LC			Y				Rathod et al., 2016a, b
31	*Neurothemis tullia* (Drury, 1773)	Pied paddy skimmer	LC	Y	Y	Y	Y		Y	Rathod et al., 2015; Rohmare et al., 2015; Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Rohmare et al., 2016; Patel et al., 2018; Rathod and Parasharya, 2018; Sharma and Kumar, 2020; Rathod et al., 2021
32	*Orthetrum glaucum* (Brauer, 1865)	Blue marsh hawk	LC		Y	Y	Y		Y	Shukla et al., 2014; Mokaria, 2015; Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Mokaria and Jethva, 2018; Patel et al., 2018; Mokaria and Jethva, 2019
33	*Orthetrum luzonicum* (Brauer, 1868)	Tricolored marsh hawk	LC	Y	Y	Y	Y		Y	Rohmare et al., 2015; Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Rohmare et al., 2016; Patel et al., 2018; Rathod and Parasharya, 2018; Rathod et al., 2021
34	*Orthetrum pruinosum* (Burmeister, 1839)	Crimson-tailed marsh hawk	DD	Y	Y	Y	Y		Y	Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Patel et al., 2018; Rathod and Parasharya, 2018; Sharma and Kumar, 2020; Rathod et al., 2021
35	*Orthetrum pruinosum neglectum* (Rambur, 1842)	Crimson-tailed marsh hawk	LC		Y					Rohmare et al., 2015; Rohmare et al., 2016
36	*Orthetrum sabina* (Drury, 1773)	Green marsh hawk	LC	Y	Y	Y	Y	Y	Y	Shukla et al., 2014; Mokaria, 2015; Rathod et al., 2015; Rohmare et al., 2015; Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Rohmare et al., 2016; Mokaria and Jethva, 2018; Patel et al., 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Sharma and Kumar, 2020; Rathod et al., 2021
37	*Orthetrum taeniolatum* (Schneider, 1845)	Small skimmer	LC	Y	Y	Y	Y	Y	Y	Mokaria, 2015; Rohmare et al., 2015; Rathod et al., 2016a, b; Rohmare et al., 2016; Rathod and Parasharya, 2018; Sharma and Kumar, 2020; Rathod et al., 2021
38	*Orthetrum triangulare* (Selys, 1878)	Blue-tailed forest hawk	LC				Y			Shukla et al., 2014
39	*Pantala flavescens* (Fabricius, 1798)	Wandering glider	LC	Y	Y	Y	Y	Y	Y	Shukla et al., 2014; Mokaria, 2015; Rathod et al., 2015; Rohmare et al., 2015; Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Rohmare et al., 2016; Mokaria and Jethva, 2018; Patel et al., 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Sharma and Kumar, 2020; Rathod et al., 2021
40	*Potamarcha congener* (Rambur, 1842)	Yellow-tailed ashy skimmer	LC	Y	Y	Y	Y		Y	Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Patel et al., 2018; Rathod and Parasharya, 2018; Rathod et al., 2021;
41	*Rhodothemis rufa* (Rambur, 1842)	Rufous marsh glider	LC			Y		Y		Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Patel et al., 2018; Rathod et al., 2021
42	*Rhyothemis variegata* (Linnaeus, 1763)	Common picture wing	LC	Y	Y	Y	Y	Y	Y	Shukla et al., 2014; Mokaria, 2015; Rathod et al., 2015; Rohmare et al., 2015; Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Rohmare et al., 2016; Mokaria and Jethva, 2018; Patel et al., 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Sharma and Kumar, 2020; Rathod et al., 2021
43	*Selysiothemis nigra* (Van der Linden, 1825)	Black pennant							Y	
44	*Tetrathemis platyptera* Selys, 1878	Pigmy skimmer	LC			Y			Y	Rathod et al., 2016a, b

Table 4: (Continued).

Serial No.	Scientific name	Common name	IUCN category	North Gujarat	Central Gujarat	South Gujarat	Saurashtra	Kutch	Our	Authors
45	*Tholymis tillarga* (Fabricius, 1798)	Coral-tailed cloudwing	LC	Y	Y	Y	Y	Y	Y	Rathod et al., 2015; Rohmare et al., 2015; Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Rohmare et al., 2016; Patel et al., 2018; Rathod and Parasharya, 2018; Sharma and Kumar, 2020; Rathod et al., 2021;
46	*Tramea basilaris* (Palisot de Beauvois, 1817)	Red marsh trotter	LC	Y	Y	Y	Y	Y	Y	Mokaria, 2015; Rathod et al., 2015; Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Patel et al., 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Rathod et al., 2021
47	*Tramea basilaris burmeisteri* (Kirby, 1889)	Keyhole glider	LC		Y					Rohmare et al., 2015; Rohmare et al., 2016
48	*Tramea limbata* (Desjardins, 1835)	Black marsh trotter	LC	Y	Y	Y	Y	Y	Y	Shukla et al., 2014; Mokaria, 2015; Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Mokaria and Jethva, 2018; Patel et al., 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Rathod et al., 2021
49	*Trithemis aurora* (Burmeister, 1839)	Crimson marsh glider	LC	Y	Y	Y	Y	Y	Y	Shukla et al., 2014; Mokaria, 2015; Rathod et al., 2015; Rohmare et al., 2015; Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Rohmare et al., 2016; Patel et al., 2018; Rathod and Parasharya, 2018; Sharma and Kumar, 2020; Rathod et al., 2021
50	*Trithemis festiva* (Rambur, 1842)	Black stream glider	LC	Y	Y	Y	Y		Y	Shukla et al., 2014; Rohmare et al., 2015; Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Mokaria and Jethva, 2018; Patel et al., 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Sharma and Kumar, 2020; Rathod et al., 2021
51	*Trithemis kirbyi* Selys, 1891	Scarlet rock glider	LC	Y	Y	Y	Y	Y	Y	Mokaria, 2015; Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Mokaria and Jethva, 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Sharma and Kumar, 2020; Rathod et al., 2021
52	*Trithemis pallidinervis* (Kirby, 1889)	Dancing dropwing	DD	Y	Y	Y	Y	Y	Y	Shukla et al., 2014; Mokaria, 2015; Rathod et al., 2015; Rohmare et al., 2015; Patel and Ghetiya, 2016; Rohmare et al., 2016a, b; Mokaria and Jethva, 2018; Patel et al., 2018; Rathod and Parasharya, 2018; Mokaria and Jethva, 2019; Sharma and Kumar, 2020; Rathod et al., 2021
53	*Urothemis signata* (Rambur, 1842)	Greater crimson glider	LC		Y	Y				Rathod et al., 2015; Rohmare et al., 2015; Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Rohmare et al., 2016; Patel et al., 2018; Rathod and Parasharya, 2018; Rathod et al., 2021
54	*Zyxomma petiolatum* Rambur, 1842	Brown dusk hawk	LC		Y	Y	Y			Rathod et al., 2015; Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Rohmare et al., 2016; Patel et al., 2018; Rathod and Parasharya, 2018; Rathod et. al., 2021
Family Macromiidae										
55	*Epophthalmia vittata* Burmeister, 1839	Common torrent hawk	LC		Y	Y				Rohmare et al., 2015; Patel and Ghetiya, 2016; Rathod et al., 2016a, b; Patel et al., 2018; Rathod et al., 2021

Discussion

Previous studies on odonates from neighboring states provide useful biogeographic context for Gujarat. Rajasthan supports a mixture of desert-adapted and generalist odonate species typical of arid landscapes (Prasad and Thakur, 1981; Thakur, 1985; Prasad, 2004; Koli et al., 2014). In contrast, Maharashtra and Madhya Pradesh support species associated with moist deciduous and semi-evergreen habitats (Mitra, 1988; Prasad, 1996; Mishra, 2007; Kulkarni and Subramanian, 2013; Koparde et al., 2014), Additional studies have been conducted in other parts of India, such as Assam (Baruah and Saikia, 2015), Odisha (Das et al., 2012; Debata et al., 2013; Palita et al., 2016), South India (Palot et al., 2005; Sharma et al., 2007; Adarsh et al., 2015; Kannagi et al., 2016).

In contrast, earlier work from Gujarat indicates a comparatively lower but ecologically distinct diversity. The earliest records come from Asana and Makino (1935), followed by Shull and Nadkerny (1967), who published limited data. Later, Prasad (2004) documented 48 species as a faunistic survey by the Zoological Survey of India (ZSI). More recently, Sharma et al. (2009) reported 58 species from the arid and semi-arid regions of Gujarat based on museum specimens, and Rathod et al. (2016) also noted that published information on the state's odonate diversity remains scarce.

According to Rathod et al. (2016), the study of odonates in Gujarat has received limited attention. Most studies have focused on the central Gujarat, particularly around Nal Sarovar Bird Sanctuary (a Ramsar site) and in the Ratanmahal WLS and Jambughoda WLS, conducted by Rathod et al. (2015), Rohmare et al. (2015), Rohmare et al. (2016), Rathod and Parashariya (2018), Mokaria and Jethva (2018), Mokaria and Jethva (2019), Sharma and Kumar (2020), Rathod et al. (2021).

In the south Gujarat, multiple studies have focused on Vansda National Park (NP), Shoolpaneshwar WLS and Purna WLS by Patel and Ghetiya (2016), Rathod et al. (2016a), Rathod et al. (2016b), Patel et al. (2018), Rathod et al. (2021).

In the Saurashtra region, major studies in Bhavnagar district are conducted by Shukla et al. (2014), Mokaria (2015), and Patel et al. (2016). Additionally, Rathod et al. (2021) surveyed protected areas including Khijadiya Bird Sanctuary, Porbandar Bird Sanctuary, Black buck National park, Gir Wildlife Sanctuary and Gir National Park.

By contrast, north Gujarat and Kutch remain the least explored regions of Gujarat state. In north Gujarat, available work is limited to studies at Thol Bird Sanctuary and Jessore Sloth bear Sanctuary conducted by Mokaria (2015) and Rathod et al. (2021) Similarly, Kutch's odonate diversity is represented by a single study carried out by the Rathod et al. (2021) in the Kutch Desert Wildlife Sanctuary highlighting a major knowledge gap for these ecologically unique parts of the state.

The results of this study demonstrate notable species richness in the study area, substantially increasing our understanding of odonate diversity in north Gujarat. A total of 44 species in all, including 32 species of Anisoptera (dragonflies) and 12 species of Zygoptera (damselflies), were recorded from four sites: Visnagar, Patan, Dharoi, and Balaram-Ambaji Wildlife Sanctuary. This study emphasizes north Gujarat's potential as an odonate biodiversity hotspot and is consistent with other research demonstrating the enormous diversity of the region (Rathod et al., 2021).

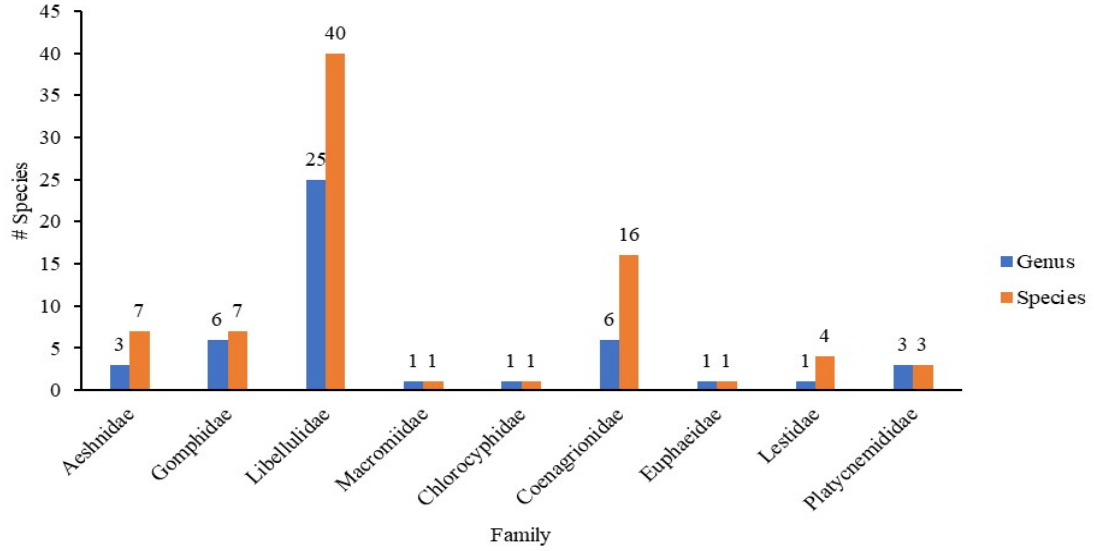

Figure 3: Family-level species richness of odonates in Gujarat state, India.

Pseudagrion microcephalum and *T. aurora* are widely distributed throughout all research locations, indicating that these species possess broad ecological tolerances and are adaptable to the typical climatic conditions characteristic of north Gujarat. This finding is consistent with the ecological adaptability of these species, which have been documented in a variety of habitats across Gujarat state (Patel and Ghetiya, 2016; Rathod et. al., 2016a; Rohmare et al., 2016; Patel et al., 2018; Rathod and Parasharya, 2018; Rathod et. al., 2021). The activity period of *S. nigra* (May to August or September) aligns with observations from European populations (Dijkstra and Lewington, 2020). There is insufficient information on phenology of *S. nigra* in India to ascertain whether the species exhibits a similar pattern or a unique regional activity schedule, despite the fact that the species was observed in Gujarat in early June corresponds to the early phase of that European window. This species was previously recorded in Jammu and Kashmir (Carfi et al., 1983); Rajasthan (Jodhpur) (Prasad, 1996); and Thar Desert National Park (Prasad, 2004).

The current findings provide valuable context when compared to previous studies conducted in Gujarat between 2015 and 2021, which documented 79 species; the zone-wise distribution is depicted in Figure 4. The dominance of the Libellulidae family reflects global trends, as this family is frequently dominant due to the ability of its members to tolerate a wide variety of environments (Subramanian and Gadgil, 2009). The distribution of species varies by region, with certain species being exclusive to central Gujarat (*Anaciaeschna jaspidea* (Burmeister, 1839); *Gynacantha bayadera* Selys, 1891; *Macrodiplax cora* (Brauer, 1867); *Orthetrum pruinosum* (Rambur, 1842); *T. basilaris* (Kirby, 1889); *Enallagma cyathigerum* (Charpentier, 1840)), southern Gujarat (*Agriocnemis splendidissima* Laidlaw, 1919; *P. spencei* Fraser, 1922; *Dysphaea ethela* Fraser, 1924; *Gynacantha dravida* Lieftinck, 1960; *Burmagomphus laidlawi* Fraser, 1924; *Cyclogomphus ypsilon* Selys, 1854; *Macrogomphus annulatus* (Selys, 1854); *Hylaeothemis apicalis* Fraser, 1924; *Lathrecista asiatica* (Fabricius, 1798); *Neurothemis intermedia* (Rambur, 1842); *T. platyptera* Selys, 1878), Saurashtra (*L. lineata* (Burmeister, 1839); *O. triangulare* (Selys, 1878)). This underscores the influence of habitat heterogeneity on odonate diversity. These results indicate that odonate communities are significantly shaped by local environmental conditions, including prey availability, habitat structure, and water quality (Sharma et al., 2007; Koli et al., 2014).

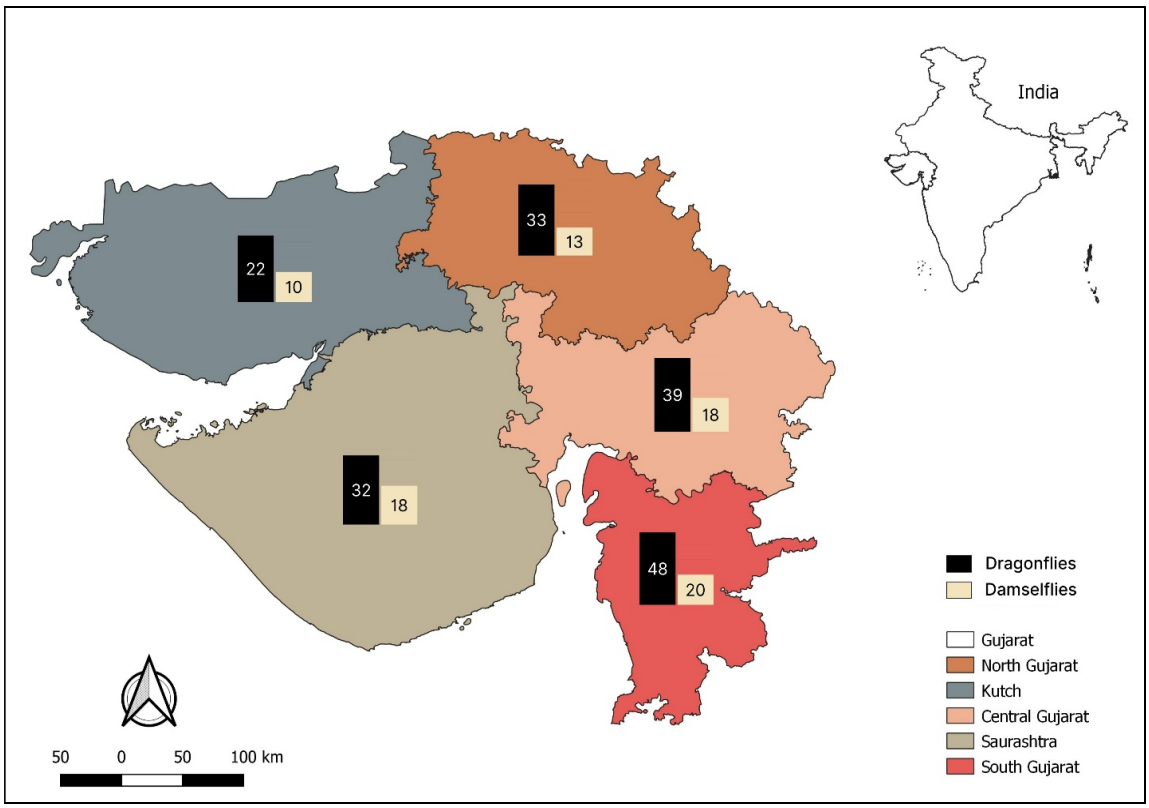

Figure 4: Map of Gujarat showing the region wise distribution of odonate diversity.

The diversity and distribution of odonates provide important insights into the ecosystem health, making them as reliable bioindicators. The diversity of odonate species found in north Gujarat's habitats supports their utility in monitoring environmental quality and identifying habitat alterations (Nair, 2011; Koli et al., 2014; Šigutová et al., 2023). The presence of habitat specialists restricted to specific areas highlights the need to protect a variety of habitats to preserve overall odonate diversity (Sandamini et al., 2019). These species are vital to conservation efforts as they act as sensitive markers of alterations in the ecosystem.

Conclusion

This study provides an updated overview of odonate diversity in north Gujarat and highlights the significance of this semi-arid landscape for dragonflies and damselflies. The presence of both widespread generalist species and regionally important taxa underscores the ecological heterogeneity of the area. The record of *S. nigra* further emphasizes the need for more intensive surveys in underexplored habitats. Overall, the findings reinforce the value of odonates as bioindicators and demonstrate the importance of conserving a mosaic of wetland and forest habitats to sustain their populations. Continued long-term monitoring will be crucial for understanding species responses to habitat change and for guiding conservation strategies in Gujarat.

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Author contributions

PD, SC, NP, and PR collected data from the field and online sources. PD and ND designed the methods and supervised the work. PD and SC wrote the first draft. PD and SC analyzed the data and worked on the second draft. PD, SC, NP, PR and ND reviewed and edited the final manuscript.

Conflict of interest

All authors declare there are no conflicting issues regarding this research article.

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