Dragonflies and damselflies (Insecta: Odonata) of Jabalpur, Madhya Pradesh, India

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Abstract: The present study was carried out to reveal the odonate diversity in Jabalpur city and its surrounding area in Madhya Pradesh, central India. During the study period of 2008–2019 a total of 75 species of odonates belonging to two suborders and nine families were recorded. Twenty-one new species were recorded for Jabalpur district and four for Madhya Pradesh; 37% (28) species were abundant or very common, 19% (14) were common, 16% (12) were frequent, 24% (18) rare, and 4% (3) very rare. The maximum number of odonates were found in family Libellulidae (n=32), followed by Coenagrionidae (n=17), Gomphidae (n=09), Platyceridae (n=07), Libellulidae (n=05), Macromiidae (n=02), and Chlorocyphidae (n=01). Of 75 species recorded from Jabalpur city, 72 come under the IUCN Red List. Among them, Indothemis carnatica come under Near Threatened (NT) category, 65 species come under Least Concern (LC) Category, six species under Data Deficient (DD), and three species remain not assessed. The study supports the value of the city area in providing habitat for Odonata.

Keywords: Central India, checklist, conservation, distributional gaps, diversity, habitat, IUCN Red List, new records, Odonata.

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Author contributions: ADT and SVP designed the study, carried out the fieldwork, analyzed the data and prepared a draft; VS carried out the fieldwork and revised the final draft. ADT, SVP and VS helped with the preparation of the manuscript and revised the draft.

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INTRODUCTION

Odonates (damselflies and dragonflies) are an ancient insect order with origins in the Carboniferous era about 250 million years ago. They probably mark the first time that evolution experimented with the ability to hover in the air over an object of interest (Andrew et al. 2008). They are beautifully coloured, primarily aquatic in their pre-adult stages, and closely tied to freshwater ecosystems such as rivers, streams, lakes, marshes, and rice fields. Species are usually highly specific to habitats, but some have adapted to using man-made water bodies (Tiple & Chandra 2013). Odonates are important for water-rich habitats such as wetlands, lakes and rainforests, and they are also significant for habitats where water is scarce. Thus the Odonata are regarded as vital to the survival of life (Dijkstra 2007).

Odonates are economically significant and act as useful biocontrol agents, since adults prey on mosquitoes, flies, moths, aphids, termites, and small beetles, while larvae feed on mosquito larvae and other soft-bodied aquatic invertebrates. Odonata are reliable indicators of overall ecosystem health, since they are highly sensitive to environmental changes (Dijkstra & Lewington 2006; Andrew et al. 2008).

Globally, 6,356 species in 693 genera of odonates have been reported (Schorr & Paulson 2022), of which 498 species and 27 Subspecies in 154 genera and 18 families are known from India (Subramanian & Babu 2020; Joshi & Sawant 2020; Bedjanič et al. 2020; Payra et al. 2020, 2021; Dawn 2021). Fraser (1933–1936) published three volumes on Odonata in the 'Fauna of British India' and included 536 species and subspecies of Odonata from India, including Bangladesh, Bhutan, Myanmar, Nepal, Pakistan, and Sri Lanka and included many species from Madhya Pradesh. After Fraser’s work, some additions were made by Bhasin (1953), Prasad & Ghosh (1988), Mitra (1988, 1995), Srivastava & SuriBabu (1997), Prasad & Varshney (1995), and Mishra (2007). Many additions have been made to the fauna of Madhya Pradesh by Tiple et al. (2011, 2012) with the latest updated checklist being Tiple & Chandra (2013) revealing 106 species under 53 genera and 12 families with 14 new records from Madhya Pradesh and Chhattisgarh. Recently Tiple & Payra (2020) reported Epophthalmia frontalis as a new record for Madhya Pradesh. Though the diversity of Odonata had been well documented from Madhya Pradesh, no consolidated checklist of Odonata of Jabalpur city and its surrounding areas is available and hence the present one with an objective of exploring the diversity and abundance.

MATERIALS AND METHODS

Opportunistic sampling and photo documentation were conducted in selected areas of Jabalpur city and its surrounding areas. Surveys were carried out from 2008 to 2019. Most of the samplings were done between 1000 h and 1400 h, when odonates control their body temperature in sunlight (Subramanian 2009; Koli et al. 2014; Payra & Tiple 2019). Identification of odonates was primarily made directly in the field from specimens collected with handheld aerial sweep nets and subsequently released without harm. Photographs of specimens taken from various angles aided their identification using field guides (Andrew et al. 2008; Subramanian 2009; Nair 2011). Specimens that were difficult to identify in the field were collected and preserved in 70% alcohol or acetone, and carried to the laboratory for further identification with the help of taxonomic keys (Fraser 1933, 1934, 1936; Mitra 2002). All scientific names follow Kalkman et al. (2020).

The species were categorized on the basis of number of sightings in the Jabalpur city as: VC very common (>100 sightings), C common (50–100 sightings), FC frequently common (15–50 sightings), R rare (2–15 sightings), VR very rare (<2 sightings) (Tiple et al. 2008).

Study area

Jabalpur is one of the largest and the most crowded cities in Madhya Pradesh, located in the north-center region of India at 23.16°10'7.57''N & 79.93°55'54.64''E. It is situated on the Deccan Plateau at an altitude of 411 m and is surrounded on all sides by ancient basalt rocks and forests. Jabalpur consists of a long, narrow plain running from south-west to north-east flanked by the Bhanrer and Kaimur ranges of the Vindhyan system on the west and the various hills of the Mahadeo range and Maikal range on the east. The Bhitrigarh range and a few subsidiary hills intrude upon in the middle of the district and practically join the Vindhyan and the Satpura systems, which together form the great central watershed of India. It lies in the catchment of the longest river of central India, the Narmada, along with its tributaries, Hiran, Gour, Ken, and Sone. Jabalpur city is surrounded by low, rocky, and barren hillocks, which include Kariapathar hillock to the north-east, SitaPahad and Kandhari hills to the east and Madan Mahal hills to the south-west (Chandra 2008; Flora et al. 2020).

Jabalpur city has a humid subtropical climate, having three main seasons: June/July wet monsoon and its aftermath from June till October, the cool dry winter from October/November to February/March and the...
hot dry season from April till the onset of rains. The temperature of the city ranges from minimum of 10–25 °C to maximum 30–45 °C with a relative humidity 10–15 % to 60–95 %. Annual precipitation is 1,386 mm.

Survey sites
All the study sites were within and around Jabalpur city within a radius of 20 km. Odonates were surveyed in Dumna Nature Reserve (includes Kakartala), Dhobi Reserve Forest, Lower Gaur Reserve Forest, City Gardens, Tropical Forest Research Institute (TFRI), Airport Road, Vijaynagar, Garha, Adhartal, Medical College Campus, Bhedaghat, Pariyat Tank, Narrai forest, Parashuram Kund, Madan Mahal Hills (includes Thakuratal, Pisanhaari Temple and SangramSagar), areas adjacent to River Narmada, Bargi dam, temporary and permanent flowing or still water bodies, and rivers (Figure 1).

RESULTS AND DISCUSSION
Seventy-five species of Odonata belongings to nine families were recorded. The present study adds 21 new species recorded for Jabalpur district, and four species for Madhya Pradesh. Of the total, 37% (28) species were abundant or very common, 19% (14) were common, 16% (12) were frequently common, 24% (18) rare and 4% (03) very rare (i.e., Aethriamanta brevipennis, Agrionemis pieris, Caconeura ramburi). The observed and identified species, their status in and around of Jabalpur city are listed in Table 1.

The highest number of odonates belonged to the family Libellulidae (32 species) with 10 new records (i.e., Aethriamanta brevipennis, Diplacodes lefebvreii, Diplacodes nebulosa, Indothemis carnatica, Neurothemis fulvia, Orthetrum chrysis, Rhodothemis rufa, Tramea limbata, Rhyothemis triangularis, Urothemis signata), followed by Coenagrionidae (17 species) with one new record (Pseudagrion hypermelas), Gomphidae (09 species) with five new records (i.e., Cyclogomphus ypsilon, Cyclogomphus wilkinsi, Ictinogomphus distinctus, Ictinogomphus angulosus, Microgomphus torquatus), Platycenemididae (06 species) with three new records (i.e., Caconeura ramburi, Elattoneura nigerrima, Onychargia atrocyana), Aeshnidae (05 species) with one new record (Anax indicus), Lestidae (03 species), Macromiidae (02 species) with one new record (Macromia cingulata) and Chlorocyphidae (1 species) (see Figure 2). Ictinogomphus distinctus, Rhyothemis triangularis, Onychargia atrocyana, and Anax indicus are recorded for the first time in Madhya Pradesh. I. distinctus has been reported from Santragachi, Howrah, West Bengal (Image 1). R. triangularis a widely distributed species; it was recorded only from Assam, Karnataka, Kerala, Tamil Nadu states (Dow & Sharma 2010) (Image 4). O. atrocyana is a widely distributed

Figure 1. Map of the surveyed localities of Jabalpur City. Source: Google Earth
| Scientific name                      | OS      | TS      |
|--------------------------------------|---------|---------|
| **Suborder: Anisoptera** (Dragonflies)**
| Family: Libellulidae (32)            |         |         |
| 1 Pseudagrion rubriceps               | C       | LC      |
| 2 Anax immaculifrons (Rambur, 1842)  | C       | LC      |
| 3 Anax indicus Lichtenk. (1942)*      | R       | LC      |
| 4 Anax ephippiger (Burmeister, 1839) | C       | LC      |
| 5 Gynacantha bayadera Selys, 1891     | C       | LC      |
| | **Family: Gomphidae (09)**           |         |         |
| 6 Burmagomphus pyramidalis Laidlaw, 1922 |  R   | NA      |
| 7 Cyclogomphus ypsilon Selys, 1854*   | R       | NA      |
| 8 Cyclogomphus wilkinsi Fraser, 1926* | R       | DD      |
| 9 Ictinogomphus distinctus Ram. 1985* | R       | DD      |
| 10 Ictinogomphus angulosus (Selys,1854)* | R   | LC      |
| 11 Ictinogomphus rapax (Rambur, 1842)| VC      | LC      |
| 12 Macrochroa annulatus (Selys,1854)  | FC      | DD      |
| 13 Microgomphus tarsatus Selys, 1854* | R       | DD      |
| 14 Paragomphus lineatus (Selys,1850)  | C       | LC      |
| **Family: Libellulidae (32)**         |         |         |
| 15 Aciagrion panorpoides Rambur, 1842 | C       | LC      |
| 16 Aethriamantis abrepicens Rambur, 1842* | R   | LC      |
| 17 Brachydiplax sobrina (Rambur, 1842)| FC      | LC      |
| 18 Brachythemis contaminata (Fabricius, 1793) | VC | LC      |
| 19 Bradinopyga geminate (Rambur, 1842)| VC      | LC      |
| 20 Crocothemis servilia (Drury, 1770) | VC      | LC      |
| 21 Diplacodes lefeburi Rambur,1842)*  | R       | LC      |
| 22 Diplacodes nebulosa (Fabricius, 1793)* | R   | LC      |
| 23 Diplacodes trivialis Rambur,1842)  | VC      | LC      |
| 24 Indotheus carnatica (Fabricius, 1798)* | R       | NT      |
| 25 Neurothemis fulvia (Drury, 1773)*  | C       | LC      |
| 26 Neurothemis intermedia (Rambur, 1842)| VC   | LC      |
| 27 Neurothemis tullia (Drury, 1773)   | C       | LC      |
| 28 Orthetrum Sabina (Drury, 1773)     | VC      | LC      |
| 29 Orthetrum chrysis (Selys, 1891)    | VC      | LC      |
| 30 Orthetrum glaucum (Brauer, 1865)   | VC      | LC      |
| 31 Orthetrum luzonicum (Brauer, 1868) | VC      | LC      |
| 32 Orthetrum pruinorum (Burmeister, 1839)| VC | LC      |
| 33 Orthetrum tenuilamum (Schneider,1845)| VC   | LC      |
| 34 Pantala flavescens(Fabricius, 1798)| VC      | LC      |
| 35 Potamarcha congner (Rambur, 1842)  | VC      | LC      |
| 36 Rhodothemis rufa (Rambur, 1842)*   | R       | LC      |
| 37 Rhyothemis variagata (Linnaeus, 1763) | VC  | LC      |
| 38 Rhyothemis triangularis Kirby, 1889*# | R   | LC      |
| 39 Tholymis tilarga (Fabricius, 1798) | C       | LC      |

Table 1. Checklist of Odonata of Jabalpur city: OS—Occurrence status | TS—Threat status as assigned from IUCN (2014). NA—Not available | LC—Least concern | DD—Data deficient | VU—Vulnerable | NT—Near Threatened. The species recorded for the first time from the Jabalpur city are asterisked by (*), and those which were previously unrecorded in the Madhya Pradesh state are marked by #.
species; it was recorded only from forested areas of Western Ghats, Bengal, and northeastern states (Image 3). These species are recorded for the first time in central India. *A. indicus* is a widely distributed species in India. There are gaps in its known distribution but these are likely to be due to under sampling and misidentification as the closely related *A. guttatus*, with which it has been frequently confused (Image 2).

Among the 75 odonates recorded from Jabalpur city, 72 species are listed in the IUCN Red List of Threatened Species. Among them *Indothemis carnatica* is ‘Near Threatened’, 65 species are ‘Least Concern’, the six species are ‘Data Deficient’ (*Cyclogomphus wilkinsi*, *Ictinogomphus distinctus*, *Macrogomphus annulatus*, *Microgomphus torquatus*, *Caconeura ramburi*, and *Elattoneura nigerrima*), and three not listed. The family Gomphidae is also represented by the highest number of Data Deficient species (Table 1). The members of this family are fast moving insects and may have crepuscular habits. These insects are difficult to observe or collect. Many gomphids are already rare. Therefore, there are high chances of not detecting them during surveys (Tiple & Koparde 2015).

During monsoon and post-monsoon seasons, *Pantala flavescens* is very abundant, as a result of mass emergence and migration. However, species like *Aethriamanta brevipennis*, *Agriocnemis pieris*, *Caconeura ramburi*, *Onychargia atrocyana*, *Elattoneura nigerrima*, *Ictinogomphus angulosus*, and *Rhyothemis triangularis* were rarely encountered. Abundance of *Brachythemis contaminata*, *Orthetrum Sabina*, and *Diplacodes trivialis* was high in contaminated water bodies. Species of Gomphidae, Macromiidae, Chlorocyphidae, and Platycnemididae were not found in contaminated water but found to occur in unpolluted
wetlands. Odonates are an indicator group and conservation activities must be acknowledged, especially for tropical odonates (Samways & Steytler 1996; Suhling et al. 2004). Zones in and around urban regions which consist of rivers, lakes, dams, rainwater puddles, marshes, urban parks, and gardens are excellent and rich sites of Odonata, and thus should be conserved and kept pollution free. Emerging urbanization affects odonate populations because of destruction and contamination of their natural habitats. Regions like the Narmada River and Bargi dam, which are home to large numbers of migratory birds, should be monitored and kept pollution free. Thorough analyses of their population in these habitats may act as role model for the evaluation of environmental health and quality. Observations from the present investigation may end up being significant as a reference for biodiversity managers in assessing changes in environmental conditions in the study area.

To conserve the suitable habitats of these ecologically important insects, public awareness is required. Anthropogenic activities (cutting logs, expansion of agricultural fields in lake surroundings), siltation, and eutrophication are among the major causes for increasing deterioration rate of the suitable habitats of odonates. However, presence of forest streams, waterfalls, rivers, lakes, and temporary & permanent flowing or still water bodies with dense shrubs & tree vegetation are most likely the major attractions for the Odonata. The observations recorded in the present study may prove valuable as a reference for assessing the changes due to the environmental conditions in the locality in the future.

The suborder Anisoptera was abundant in comparison to Zygoptera, and found in all the water bodies that were sampled. This corroborates the findings of earlier reports (Williams 1997; Lawler 2001; Suhling et al. 2004). Our findings agree with Keize & Kalkman (2009), who concluded that Coenagrionidae and Libellulidae are the dominant Odonata fauna in standing water worldwide. Tiple (2008) studied the Odonata fauna of Nagpur city and observed that the Libellulidae dominated with 30 species followed by Coenagrionidae (16 species). In central India too, odonate fauna is mostly dominated by the Libellulidae and Coenagrionidae (Tiple & Chandra 2013). Andrew (2013) observed similar findings with the Odonata of Chatri Lake in Amravati (Tiple & Chandra 2013). Andrew (2013) observed similar findings with the Odonata of Chatri Lake in Amravati (Tiple & Chandra 2013). Andrew (2013) observed similar findings with the Odonata of Chatri Lake in Amravati

REFERENCES

Andrew, R.J. (2013). Odonates of Zilpi Lake of Nagpur (India) with a note on the emergence of the Libellulidae dragonfly, Trithemis pallidenervis. Journal of New Biological Report 2: 177–187.

Andrew, R.J., K.A. Subramaniam, & A.D. Tiple (2008). A Handbook on Common Odonates of Central India. South Asian Council of Odonatology, 65 pp.

Bedjanić, M., V. Kalkman & K.A. Subramanian (2020) A new species of Orthetrum Newman, 1833 (Odonata: Libellulidae) from the Andaman Islands, India. Zootaxa 4779(1): 91–100.

Bhasin, G.D. (1953). A systematic catalogue of main identified collection at Forest Research Institute, Dehra Durn. Pt. 12. Order Odonata. Indian Forest Leaflet 121(3): 63–78.

Chandra, K. (2008). Faunal Diversity of Jabalpur District, Madhya Pradesh. Zoological Survey of India, Kolkata, 417 pp.

Dawn, P. (2021). A new species of Cephaelemacna Selys, 1883 (Odonata: Anisoptera: Aeshnidae) from Neora Valley National Park, West Bengal, India, with notes on C. acanthifrons Joshi & Kunte, 2017 and C. viridifrons (Fraser, 1922). Zootaxa 4949(2): 371–380.

Dijkstra, K.D.B. (2007). Gone with the wind: westward dispersal across the Indian Ocean and island speciation in Hemicordulia dragonflies (Odonata: Corduliidae). Zootaxa 1438: 27–48.

Dijkstra, K.D.B. & R. Lewington (2006). Field Guide to the Dragonflies of Britain and Europe. British Wildlife Publishing, 320 pp.

Dow, R.A. & G. Sharma (2010). Rhynothemis triangularis. The IUCN Red List of Threatened Species 2010: e.T169123A6570098. https://doi.org/10.2305/IUCN.UK.2010-4.RLTS.T169123A6570098.en

Flora, J.S., A.D. Tiple, A. Sengupta & S.V. Padwad (2020). Butterfly (Lepidoptera: Rhyothemis) fauna of Jabalpur City, Madhya Pradesh, India. Journal of Threatened Taxa 12(11): 16607–16613. https://doi.org/10.11609/jott.4168.11.16607-16613

Fraser, F.C. (1913). Fauna of British India Odonata 2. Taylor and Francis Ltd. London, 398 pp.

Fraser, F.C. (1934). Fauna of British India Odonata 1. Taylor and Francis Ltd. London, 423 pp.

Fraser, F.C. (1933). Field Guide to the Dragonflies of Britain and Europe. British Wildlife Publishing, 320 pp.

Joshi, S. & D. Sawant (2020). Description of Bradinopygna konkanensis.
Journal of Threatened Taxa | www.threatenedtaxa.org | 26 March 2022 | 14(3): 20740–20746

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sp. nov. (Odonata: Anisoptera: Libellulidae) from the coastal region of Maharashtra, India. Zootaxa 4779(1): 65–78.

Kalkman, V.J., R. Babu, M. Bedjanič, K. Conniff, T. Gyeltshen, M.K. Khan, K.A. Subramanian, A. Zia & A.G. Orr (2020). Checklist of the dragonflies and damselflies (Insecta: Odonata) of Bangladesh, Bhutan, India, Nepal, Pakistan and Sri Lanka. Zootaxa 4849(1): 1–84.

Keizer, J. and V. Kalkman (2009). Records of dragonflies from Kabupaten Merauke, Papua, Indonesia collected in 2007 and 2008 (Odonata). Suara Serangga Papua 4(2): 40–45.

Koli, V.K., C. Bhatnagar & D.S. Shekhawat (2014). Diversity and species composition of odonates in southern Rajasthan, India. Proceedings of the Zoological Society 68: 202–211.

Lawler, S.P. (2001). Rice fields as temporary wetlands: a review. Israel Journal of Zoology 47: 513–528.

Mishra, S.K. (2007). Fauna of Madhayapardesh (Odonata: Insecta). State Fauna Series, Zoological Survey of India, Kolkata 15(1): 245–272.

Mitra, T.R. (1995). Geographical distribution of Odonata (Insecta) in India. Memoirs of the Zoological Survey of India 19(1): 1–208.

Nair, M.V. (2011). Dragonflies & Damselflies of Orissa and Eastern India. Wildlife Organization, Forest & Environment Department, Government of Orissa, 252 pp.

Payra, A., R.J. Andrew, K.A. Subramanian & S.S. Talmale (2013). Dragonflies and Damselflies (Insecta, Odonata) of Madhya Pradesh and Chhattisgarh States, India. Indian Insects Diversity and Science. CRC Press, Taylor & Francis.

Prasad, M. & A. Singh (1995). Fauna of conservation areas series 5. Rajaji National Park: Odonata. Records of the Zoological Survey of India 195–215.

Samways, M.J. & N.S. Steytler (1996). Dragonfly (Odonata) distribution patterns in urban and forest landscapes, and recommendations for riparian management. Biological Conservation 78: 279–288.

Schorr, M. & D. Paulson (2021) World Odonata List. https://www.worldodonatalist.org/

Srivastava, V.K. & B. SurilBabu (1997). Annotiations on the Damselfly collection from Sagar, Central India. Fraseria 4: 13–15.

Subramanian, K.A. (2009). Dragonflies and Damselflies of Peninsular India - A Field Guide. VigyanPrasar, Noida, India, 168 pp.

Subramanian, K.A. & R. Babu (2020). Dragonflies and damselflies (Insecta: Odonata) of India, pp. 29–45. In: Ramani, S., M. Prarashanth & H.M. Yeshwanath (eds.). Indian Insects Diversity and Science. CRC Press, Taylor & Francis.

Suhling, F., K. Schenk, T. Padefkte & A. Martens (2004). A field study of larval development in a dragonfly assemblage in African desert ponds (Odonata). Hydrobiologia 528: 75–85

Tiple A.D. & A. Payra (2020) First Record of Epophthalmia frontalis from Central India (Insecta: Odonata: Macromiidae). Travaux du Muséum National d’Histoire Naturelle “Grigore Antipa” 63(2): 127–130. https://doi.org/10.3897/travaux.63.e52897

Tiple, A.D. & P. Koparde (2015). Diversity of Odonata, India with Notes on Species Distribution. Journal of Insect Science 15(1): 1–10. https://doi.org/10.1093/jisesa/iev028

Tiple, A.D. & K. Chandra (2013) Dragonflies and Damselflies (Insecta, Odonata) of Madhya Pradesh and Chhattisgarh States, India. Core4Nature 1(1): 2–11.

Tiple, A.D., N. Kulkarni & K.C. Joshi (2011). Diversity of Odonata in Kanha National Park, Madhya Pradesh, India. Indian Journal of Forestry 34(3): 329–332.

Tiple, A.D., R.J. Andrew, K.A. Subramanian & S.S. Talmale (2013). Dragonflies of Vidarbha region, Maharashtra state, central India. Odonatologica 42: 237–245.

Tiple, A.D., S. Paunikar & S.S. Talmale (2012). Dragonflies and Damselflies (Odonata: Insecta) of Tropical Forest Research Institute, Jabalpur, Madhya Pradesh, central India. Journal of Threatened Taxa 4(4): 2529–2533. https://doi.org/10.1609/JoTT.o2657.2529-33

Williams, D.D. (1997). Temporary ponds and their invertebrate communities. Aquatic Conservation: Marine and Freshwater Ecosystems 7: 105–117.
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