

E-ISSN: 2708-0021  
P-ISSN: 2708-0013  
[www.actajournal.com](http://www.actajournal.com)  
AEZ 2021; 2(1): 12-18  
Received: 12-10-2020  
Accepted: 08-12-2020

**Agnes Deepa A**  
Unit of Conservation Biology,  
Department of Zoology,  
Bharathiyar University,  
Coimbatore, Tamil Nadu,  
India

**Selvarasu P**  
Bharathiyar Arts and Science  
and College for women,  
Deviyakurchi, Salem, Tamil  
Nadu, India

**Gunasekaran C**  
Bharathiyar Arts and Science  
and College for women,  
Deviyakurchi, Salem, Tamil  
Nadu, India

**Shobana G**  
Bharathiyar Arts and Science  
and College for women,  
Deviyakurchi, Salem, Tamil  
Nadu, India

**Corresponding Author:**  
**Agnes Deepa A**  
Unit of Conservation Biology,  
Department of Zoology,  
Bharathiyar University,  
Coimbatore, Tamil Nadu,  
India

## Odonata fauna in adjoining areas of Amirthi Zoological Park in Vellore District, Tamilnadu, India

**Agnes Deepa A, Selvarasu P, Gunasekaran C and Shobana G**

**DOI:** <https://doi.org/10.33545/27080013.2021.v2.i1a.24>

### Abstract

The objective of the present study is to explore the diversity of dragonflies and damselflies (Odonata) in Amirthi Forest Division, Vellore District. Dragonfly watching and recording has been done in each line transect during a week. A total of 37 species belonging to 29 genera and 6 families viz. Lestidae, Platycnemididae, Coenagrionidae (under suborder Zygoptera) and Coenagrionidae, Platycnemididae and Libellulidae (under suborder Anisozygoptera) were recorded. The maximum number of Odonates were found in Libellulidae (n=20), followed by Coenagrionidae (n=11 species), Aeshnidae (n=2 species), Lestidae (n=3 species), Platycnemididae (n=1 species) and Gomphidae (n=1 species). Out of the Site -1 Urban areas, Site -2 Agricultural areas, Site -3 wet land areas and Site - 4 Amirthi park areas are selected study sites, the highest number of Odonate species (28) was recorded in S3 and S2 ranked second with 24 species. Species richness was comparatively low in the remaining Study sites: S4 with 21 species and S1 with 18 species. The result of high species richness in the particular study sites (S3 and S2) may be due to the intensity and duration of longer surveys, rather than true ecological species richness. Among the selected Sites the diversity of dragonflies was high in Agricultural areas and wet land areas. Out of the 37 Odonates recorded from the district, 35 species come under the IUCN Red List of Threatened Category. Among them 37 species comes under Least Concern (LC) Category, one species under Data Deficient (DD) and three species is not evaluated. The present study is to encourages the wide range conservation of dragonfly species in the study area.

**Keywords:** Dragonfly, anisoptera, odonata, insecta, Amirthi Zoological Park

### Introduction

Dragonflies and damselflies (Order – Odonata) are multicolored predatory insects of freshwater habitat and characterized by their elongated body, extended wings and large eyes. The order Odonata is divided into three groups, they are damselflies (Zygoptera), Anisozygoptera, and dragonflies (Anisoptera) (Subramanian K.A., 2019). Odonates breeds are commonly found near aquatic bodies. During the breeding season, adult males generally establish their territories along with wetlands, and sexually mature and receptive females visit territories held by males. Their breeding habitats include both flowing and stagnant water bodies. Odonates have specific habitat requirements. They are also sensitive to changes in landscape and are reliable indicators of wetland health (Andrew, R.J., 2008) <sup>[1]</sup>. The rural areas have higher species richness as compared to urban areas (Willigalla C. and Fartmann T., 2012) <sup>[26]</sup>. Odonata, dragonflies and damselflies, constitute a small, well known order of insects that are widely distributed over the world (Tillyard RJ, 1917) <sup>[23]</sup>. Odonates can be found in almost all kinds of freshwater habitats, permanent running waters, lakes to small temporary rain pools. These are predaceous in nature as well as good indicators of water quality and ecosystem health (Andrew *et al.*, 2008; Tiple *et al.*, 2013) <sup>[1, 25]</sup>. Odonata larvae reside in aquatic habitats; require very specific environmental condition to survive as they have a narrow range for temperature, oxygen levels, vegetation cover, microhabitats and water quality (Clausnitzer *et al.*, 2009) <sup>[4]</sup>. These are observed near the ponds, lakes, rivers, ditches and all over the marshy places. Dragonflies (suborder- Anisoptera) have broad head with confluent separated eyes. Wings are dissimilar; hindwings are broadly dilated at base and differ in venation from fore-limbs.

Globally 6256 species in 686 genera of odonates have been reported, of which India known to represent 487 species, 27 Subspecies in 152 genera under 18 families (Subramanian & Babu, 2017) <sup>[20, 21]</sup>. In Tamilnadu, (Kandibane *et al.*, 2005) <sup>[10]</sup> recorded 12 species in irrigated rice fields of Madurai.

(Gunathilagaraj *et al.*, 1999) <sup>[9]</sup> reported 16 species of Odonates in rice fields of Coimbatore, whereas, a recent study by Arulprakash and Gunathilagaraj *et al.*, (2010) <sup>[2]</sup> revealed twenty-one species of Odonata (14 species of Anisoptera and seven species of Zygoptera) belonging to 17 genera under four families were recorded from 13 temporary water bodies of Coimbatore and Salem districts in Tamil Nadu. Selvarasu *et al.*, (2019) <sup>[17]</sup> reported total 30 species were documented the suborder Anisoptera is represented by 2 families and 17 species and the suborder Zygoptera by 2 families and 13 species in vellore district. However, knowledge on the Odonata fauna of vellore District is very fewer. To the best knowledge of the authors, no diversity and habitat preference based research effort on Odonata carried out in Amirthi Zoological Park. Subsequently, the aim of the present investigation is to carry out the first comprehensive study on Odonates diversity and habitat preference in Amirthi Zoological Park. Henceforth, to provide baseline data and to upgrade the known Odonata fauna, present study was carried out in adjoining areas of Amirthi Zoological Park in Vellore.

### Materials and Methods

The present study carried out from December 2018 to September 2019.

### Study Area

Amirthi Zoological Park is situated 12.7322° N, 79.0566° E inside the Thellai Reserve Forest of Amirthi range with a semi-perennial falls nearby is the only Eco-tourism place present in Vellore Forest Division. It is geographically 25 Km away from the north east of Vellore head quarters. The climate of this area is tropical. During summer days (March-June) temperature of this region ranges from 25 °C – 36 °C and in winter (November-February) temperature ranges from 19 °C-25 °C. Average annual rainfall is about 795 mm.

### Study area in Adjoining Areas of Amirthi Zoological Park in Vellore District



Site 1: Urban Areas



Site 2: Agricultural Areas



Site 3: Wetland Areas



Site 4: Amirthi Park

### Study Design

Four sites were selected from all around the Amirthi Zoological Park. The sites were selected on the basis of different habitat, which may be important according to (Clark and Samway *et al.*, 1996) <sup>[3]</sup> in influencing the diversity of Odonates. Study area of North interior districts in Vellore was divided into following zones.

- Site -1 = Urban areas
- Site -2 = Agricultural areas
- Site -3 = wet land areas
- Site -4 = Amirthi park areas

### Data collection and identification

Dragonflies were collected by hand sweep net and random field sampling method was used to cover entire study area, the insects were pinned and photo documented by using Cannon power shot SX30 IS camera. Samplings were carried out from December 2018 to September 2019. Most of the sampling was done between 10 am to 2 pm, when odonates activities found in top most to control their body temperature in sunlight (Subramanian, 2009; Koli *et al.*, 2014) <sup>[19, 22, 11]</sup>. Identification of the Odonates was primarily made directly in the field. In critical condition specimens were collected only with handheld aerial sweep nets and subsequently released without harm. Photographs of the specimens were taken in the field from various angles and identified with the help of field identification guide (Andrew *et al.*, 2008; Nair, 2011; Subramanian, 2009) <sup>[1, 13, 19, 22]</sup>. Those specimens are difficult to identify in the field, were collected and preserved in 70% alcohol or Acetone and carried them to the laboratory for further identification with the help of taxonomic keys (Fraser 1933, 1934, 1936; Mitra 2002) <sup>[5, 6, 7, 12]</sup>. Systematic arrangement and scientific name of the species of the species follows Subramanian & Babu (2017) <sup>[20, 21]</sup>.

### Results

A total of 37 species belonging to 29 genera and 6 families *viz.* Lestidae, Platynemididae, Coenagrionidae (under suborder Zygoptera) and Coenagrionidae, Platynemididae and Libellulidae (under suborder Anisozygoptera) were

recorded (Table 2). The maximum number of odonates were found in Libellulidae (number=20), followed by Coenagrionidae (number=10 species), Aeshnidae (number =2 species), Lestidae (number=3 species), Platycnemididae (number =1 species) and Gomphidae (number =1 species). Out of the 4 selected study sites, the highest number of Odonate species (28) was recorded in S3 sites and S2 ranked second with 24 species. Species richness was comparatively low in the remaining Study sites: S4 with 21 species and S1 with 18 species. (Table3). The result of high species richness in the particular study sites (S3 and S2) may be due to the intensity and duration of longer surveys, rather than true ecological species richness. During the study period we also found, some of the species were mainly restricted to particular sites, species like, *Mortonagrion aborense* (Laidlaw, 1914); *Anaciaeschna jaspidea* (Burmeister, 1839); were only recorded in S3. *Lestes umbrinus* (Selys, 1891) [18] and *Lestes viridulus* (Rambur, 1842) only found in S4, *Trithemis festiva* (Rambur, 1842), *Rhyothemis variegata* (Linnaeus, 1763) were only found in S2. According to following data we found that *Pantala flavescens* (Fabricius, 1798) was the most abundant species in Amirthi Zoological Park and *Brachydiplax sobrina*, *Brachydiplax contaminata*, *Crocothemis servilia* and *Orthetrum sabina* all four species were also abundant in study area. In case of sub order Anisoptera, family Libellulidae was the most dominant family; and in case sub order Zygoptera *Ceriagrion coromandelianum* (Fabricius,1798), *Agriocnemis pygmaea* (Rambur, 1842) and *Ceriagrion coromandelianum* (Fabricius,1798). Amid the 36 Odonates, recorded from vellore district 33 species comes under the IUCN Red List of Threatened Category. Among them 37 species come under Least Concern (LC) Category, one species under Data Deficient (DD) and three species is not evaluated.

## Discussion

In Vellore district first faunistic study on odonates was

carried out by selvarasu *et al.*, (2019) [17] while conduct the survey of the recorded. As a result, during the present study 37 species were recorded and with the addition of 22 species the number of known odonates from the vellore is increased to a total of 36 species (23 in the suborder Anisoptera and 14 in the suborder Zygoptera). Our studies were in perfect association with the above reports the species collected from our study areas belonged to the family of Coenagrionidae and Libellulidae. In relation to the above interpretation Rehn, 2003 [15] pointed out that almost all ubiquitous species belonging to Coenagrionidae and Libellulidae families dominate in unshared habitats with stagnant water. The reasons for their occurrence in the wetlands may be due to their shorter life cycle and widespread in distribution Norma-Rashid *et al.*, (2001) [14] and tolerant to wide range of habitats (Gentry *et al.* 1975; Samways 1989) [8, 16]. The diversity range of the dragonflies was high in the wetlands followed by the agricultural areas, amirthi stream and amirthi forest in terms of habitat preference.

This may be due to the possible reasons due to the presence of marginal vegetation and less shade cover areas in the amirthi zoological areas. Expansion of urbanization in such adjacent park areas is a matter of concern. As expansion of urbanization causing loss of natural and semi natural habitats of Odonates, as well as the residual habitat quality may have adversely affected by various forms of pollutants (Tiple *et al.*, 2013; Tiple & Koparde, 2015) [25]. Consequently, the necessity of increase the number of surveys from this area of Tamilnadu should be emphasized, considering that coastal habitats are in the state of fragmentation and degradation. Result of the present study shows, adjoining Park areas seems to have rich odonate diversity (36 species) and highlight the significance of the adjoining amirthi forest areas for Odonates conservation in northern parts of Tamilnadu, India. The study also provides baseline information for future quantitative work on the diversity of odonates in this particular study area.

**Table 1:** Zygoptera (damselflies) species in around the Amirthi Zoological Park, Tamilnadu. **Site -1** Urban areas, **Site -2** Agricultural areas, **Site -3** wet land areas, **Site - 4** Amirthi park areas.

Sl. No	Scientific Name	Common Name	IUCN STATUS	Study Sites (Present study)
<b>Suborder Zygoptera (Selys, 1854)</b>				
<b>Family: Coenagrionidae Kirby, 1890</b>				
1	<i>Aciagrion pallidum</i> (Selys, 1891)	Pale slender Dartlet	LC	S2, S3, S4
2	<i>Agriocnemis femina</i> (Brauer, 1868)	Pruinosed Dartlet	LC	S3, S4
3	<i>Agriocnemis lacteola</i> (Selys, 1877)	Milky Dartlet	NA	S2, S3
4	<i>Agriocnemis pygmaea</i> (Rambur, 1842)	Pygmy Dartlet	LC	S2, S3, S4
5	<i>Ceriagrion cerinobellum</i> (Brauer, 1865)	Orange-tailed Marsh Dart	LC	S2, S3, S4
6	<i>Ceriagrion coromandelianum</i> (Fabricius, 1798)	Coromandel Marsh Dart	LC	S1, S2, S3, S4
7	<i>Ceriagrion fallax</i> (Ris, 1914)	Black-tailed Marsh Dart	LC	S2, S3, S4
8	<i>Ischnura aurora</i> (Brauer, 1865)	Golden Dartlet	LC	S2, S3, S4
9	<i>Mortonagrion aborense</i> (Laidlaw, 1914)	Not available	LC	S1, S2
10	<i>Pseudagrion rubriceps</i> (Selys, 1877)	Saffron-faced blue dart	LC	S1, S3, S4
<b>Family: Platycnemididae (Yakobson &amp; Bainchi, 1905)</b>				
11	<i>Copera vittata</i> (Selys, 1863)	Blue Bush Dart	LC	S1,S2,S3
<b>Family: Lestidae Calvert, 1907</b>				
12	<i>Lestes elatus</i> (Selys, 1862)	Emerald Spreadwing	LC	S1, S2, S3
13	<i>Lestes umbrinus</i> (Selys, 1891)-	Brown spreadwing	DD	S1, S3, S4
14	<i>Lestes viridulus</i> (Rambur, 1842)	Emerald-Striped Spreadwing	LC	S1, S2, S3, S4

Families-03; Species- 14



**Table 2:** Anisoptera (Dragonflies) species of adjoining in Amirthi Zoological Park, Tamilnadu.

Sl. No	Scientific Name	Common Name	IUCN STATUS	Study Sites (Present study)
<b>Suborder: Anisoptera (Dragonflies) - Hanlirsch, 1906</b>				
<b>Family: Libellulidae (Leach, 1815)</b>				
1	<i>Acisoma panorpoides</i> (Rambur, 1842)	Trumpet Tail	LC	S2, S3, S4
2	<i>Brachidiplax chalybea</i> (Brauer, 1868)	Rufous-backed Marsh Hawk	LC	S1, S2, S3,
3	<i>Brachidiplax sobrina</i> (Rambur, 1842)	Little Blue Marsh Hawk	LC	S1, S3, S4
4	<i>Brachythemis contaminata</i> (Fabricius, 1793)	Ditch Jewel	LC	S1, S2, S3, S4
5	<i>Bradinyopyga geminata</i> (Rambur, 1842)	Granite Ghost	NA	S1, S2, S3,S4
6	<i>Crocothemis servilia</i>	Ruddy Marsh Skimmer	LC	S1, S2, S3, S4
7	<i>Diplacodes trivialis</i> (Rambur,1842)	Ground Skimmer	NA	S1, S2, S3, S4
8	<i>Neurothemis fulvia</i> (Drury, 1773)	Fulvous Forest Skimmer	LC	S1, S2, S3, S4
9	<i>Neurothemis intermedia</i> (Rambur, 1842)	Ruddy Meadow Skimmer	LC	S1, S2, S3
10	<i>Neurothemis tullia</i> (Drury, 1773)	Pied-paddy Skimmer	LC	S2, S3, S4
11	<i>Orthetrum chrysis</i> (Selys, 1892)	Brown-Backed Red Marsh Hawk	LC	S1, S2, S4
12	<i>Orthetrum pruinosum</i> (Rambur, 1842)	Crimson Tailed Marsh Hawk	LC	S1, S2, S3
13	<i>Orthetrum sabina</i> (Drury, 1770)	Green Marsh Hawk	LC	S1, S2, S3, S4
14	<i>Orthetrum taeniolatum</i> (Schneider, 1845)	Taeniolate Marsh Hawk	LC	S2, S3, S4
15	<i>Pantala flavescens</i> (Fabricius, 1798)	Wandering Glider	LC	S1, S2, S3, S4
16	<i>Rhyothemis variegata</i> (Linnaeus, 1763)	Common Picturewing	LC	S1, S2, S3,
17	<i>Rhodothemis rufa</i> (Rambur, 1842)	Rufous Marsh Glider	LC	S2, S3, S4
18	<i>Trithemis festiva</i> (Rambur, 1842)	Black Marsh Glider	LC	S1, S3, S4
19	<i>Trithemis pallidinervis</i> (Kirby, 1889)	Long-Legged Marsh Skimmer	LC	S1, S2, S3
20	<i>Tramea limbata</i> (Desjardins, 1832)	Black marsh trotter	LC	S1, S3, S4
<b>Family: Gomphidae</b>				
21	<i>Ictinogomphus rapax</i> (Rambur, 1842)	Common Clubtail	LC	S1, S3, S4
<b>Family: Aeshnidae (Leach,1815)</b>				
22	<i>Anaciaeschna jaspidea</i> (Burmeister, 1839)	Rusty darnier	LC	S1, S2, S3,
23	<i>Anax guttatus</i> (Burmeister, 1839)	Lesser green emperor	LC	S2, S3,

**Families-03; Species- 23**



*Brachythemis contaminata* (Ditch Jewel Male)



*Crocothemis servilia* (juvenile male)



*Brachythemis contaminata* (Ditch Jewel Female)



*Neurothemis intermedia* (Ruddy Meadow Skimmer)



*Tramea limbata* (Black marsh trotter) female



*Anax guttatus* (Lesser green emperor female)



*Pantala flavescens* (globe skimmer)



*Acisoma panorpoides* (Trumpet tail, female)



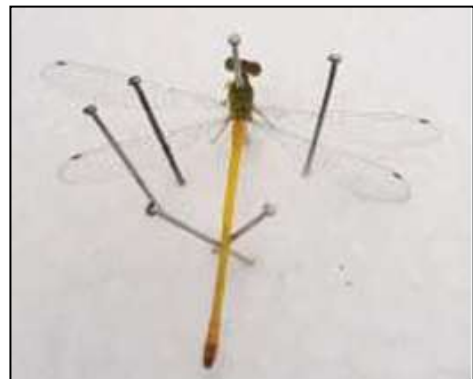
*Diplacodes trivialis* (ground skimmer)



*Crocothemis servilia* (adult male)



*Crocothemis servilia* (scarlet skimmer)



*Ceriagrion cerinobellum* (Coromandel Marsh Dart)



*Aciagrion pallidum* (pale slender dartlet ) female



*Ischnura aurora* (Golden dartlet)



*Agriocnemis femina* (Pruinosed Dartlet)



*Aciagrion pallidum*



*Lestes umbrinus*



*Lestes viridulus*

## Conclusion

In the current study altogether 35 species of dragonflies and damselflies were reported from the four study sites of the Vellore district. The checklist of Odonate species shows remarkable dragonfly diversity and distribution in the Vellore district of Tamil Nadu. The present study proves that the malfunctioning and other activities results the degradation of Odonate species in particular sites, To overcome this problem, the people has to advised not to use such highly polluted things in agriculture fields and requisition may send to all small scale industry people to avoid pollution in particular area.

## Acknowledgements

Special sincere thanks to Department of Zoology, Bharathiyar University for their valuable suggestions during the study period. We would like to thank Dr. K.A. Subramanian (Zoological Survey of India, Kolkata) for species identification.

## References

1. Andrew RJ, Subramaniam KA, Tiple AD. Common Odonates of Central India. E-book for The 18th International Symposium of Odonatology, Hislop College, Nagpur, India 2008, pp 55.
2. Arulprakash R, Gunathilagaraj K. Abundance and diversity of Odonata in temporary water bodies of Coimbatore and Salem districts in Tamil Nadu. Journal of Threatened Taxa 2010;2(8):1099-1102.
3. Clark TE, Samwys MJ. Dragonflies (Odonata) indicators of biotic quality in Kruger National Park, South Africa. J. Applied Eco 1996;3:96-102.
4. Clausnitzer V, Kalkman VJ, Ram M, Collen B, Baillie JE, Bedjanič M, *et al.* Odonata enter the biodiversity crisis debate: the first global assessment of an insect group. Biological Conservation 2009;142(8):1864-1869.
5. Fraser FC. Fauna of British India Odonata 1. Taylor and Francis Ltd. London 1933, 423 pp.
6. Fraser FC. Fauna of British India Odonata 2. Taylor and Francis Ltd. London 1934, 398 pp.
7. Fraser FC. Fauna of British India Odonata 3. Taylor and Francis Ltd. London 1936, 461 pp.
8. Gentry JB, Garten CT, Howell FG, Smith MH. Thermal ecology of dragonflies in habitats receiving reactor effluent. In: Environmental Effect of Cooling Systems at Nuclear Power Plants. International Atomic Energy Agency, Vienna 1975, 563-574.
9. Gunathilagaraj K, Soundarajan RP, Chitra N, Swamiappan M. Odonata in the rice fields of Coimbatore. Zoos' Print Journal 1999;14(6):43-44.
10. Kandibane M, Raguraman S, Ganapathy N. Relative abundance and diversity of Odonata in an irrigated rice field of Madurai, Tamil Nadu. Zoos' Print Journal 2005;20(11):2051-2052.
11. Koli VK, Bhatnagar C, Shekhawat DS. Diversity and Species Composition of Odonates in Southern Rajasthan, India. Proceedings of the Zoological Society 2014;68:202-211.
12. Mitra TR. Geographical distribution of Odonata (Insecta) of Eastern India. Memoirs of the Zoological Survey of India 2002;19(1):1-208.
13. Nair MV. Dragonflies & Damselflies of Orissa and Eastern India. Wildlife Organization, Forest &

- Environment Department, Government of Orissa 2011, 252.
14. Norma-Rashid Y, Mohd-Sofian A, Zakaria-Ismail M. Diversity and distribution of odonata (dragonflies and damselflies) in the fresh water swamp lake, Tasek Bera, Malaysia. *Journal of Hydrobiologia* 2001;459:135-146.
  15. Rehn AC. Phylogenetic analysis of higher-level relationships of Odonata. *Journal of Systematic Entomology* 2003;28:181-239.
  16. Samways MJ. Insect conservation and the disturbance landscape. *Agric., Ecosys. Environ* 1989;27:183-94.
  17. Selvarasu P, Gunasekaran C, Agnes Deepa A, Mohana P, Raj Kumar V, Chinnaraj P, *et al.* Diversity of Odonates (Insecta: Odonata) in Different Habitats of Vellore District, *International Journal of Recent Scientific Research* 2019;10:04(G):32127-32130.
  18. Selys L. Odonates in 'Viaggio Di Leonardo Fea in Birmania e Regional Vicine. *Annali del Museo civico di storia naturale Giacomo Doria* 1891;2(10):433-518.
  19. Selys Longchamps ME. de Synopsis des Agrionines, Seconde legion: *Lestes*. *Bulletins de l'Academie royale de Belgique* 1862a;2(13):288-388.
  20. Selys Longchamps ME. de Synopsis des Agrionines, Troisieme legion: Podagrion. *Bulletins de l'Academie royale de Belgique* 1862b;2(14):5-44.
  21. Selys Longchamps ME. de Synopsis des Agrionines, Quatrieme legion: Platycnemis. *Bulletins de l'Academie royale de Belgique* 1863;2(16):147-176.
  22. Subramanian KA. Dragonflies of India-A Field Guide. Vigyan Prasar Department of Science and Technology. A50, Institutional Area, Sector-62 NOIDA 201 307 (Uttar Pradesh), India 2009.
  23. Subramanian KA, Babu R. Checklist of Odonata (Insecta) of India. Version 3.0. [www.zsi.gov.in](http://www.zsi.gov.in). 2017, 1-54.
  24. Subramanian KA, Babu R. Checklist of Odonata (Insecta) of India. Version 3.0. [www.zsi.gov.in](http://www.zsi.gov.in). 2017, 1-54.
  25. Subramanian KA. Dragonflies of India - A Field Guide. *Vigyan prasar*, New Delhi 2009.
  26. Tillyard RJ. *The Biology of Dragonflies*. Cambridge University Press, Cambridge 1917, 396.
  27. Tillyard RJ. *The Biology of Dragonflies*. *Cambridge University Press*, Cambridge, 396. Tiple A. D., Andrew, R. J., Subramanian, K. A. & Talmale, (2013). Odonata of Vidarbha region Maharashtra state, central India. *Odonatologica* 1917;42:237-245.
  28. Tiple AD, Koparde P. Odonata of Maharashtra, India with notes on species distribution. *Journal of Insect Science* 2015;15:1-10.
  29. Willigalla C, Fartmann T. Patterns in the diversity of dragonflies (Odonata) in cities across Central Europe, *Eur. J. Entomol* 2012;109:235-245.