

AN OBSERVATION ON DIVERSITY AND DISTRIBUTION OF ODONATES IN THE SELECTED SITE OF KANNUR AND WAYANAD DISTRICT, KERALA, INDIA

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Abstract: Odonata are the bioindicators of freshwater ecosystem health and is recognized as an excellent 'flagship' group among insects. The present study was carried out in the selected sites of Kannur and Wayanad district of Kerala, India during October 2020 to January 2021. A total of 16 species of odonates belonging to 12 genera and 5 families were recorded from the study area. From the results obtained it could be seen that, Family Libellulidae was dominated with 8 species. Following Libellulidae, Coenagrionidae consisted of 4 species. Family Casopterygidae, Euphaedae, Lestidae and Protonureidae comprised of one species each. In the present study 8 species were spotted commonly, 5 species showed occasional appearance and 3 species showed rare sightings. Almost similar number of species was identified from both the sites.

Index Terms - Odonata, Dragonflies, Species Diversity, Bioindicator, Habitat.

I. INTRODUCTION

One of the most important and popular groups of insects is the order Odonata. Dragonflies and damselflies both are together known as Odonata. A small, well known order of insects that are widely distributed over the world is Odonata, dragonflies and damselflies (Tillyard, 1917). The order Odonata are divided into three groups based on morphology, viz. damselflies (Zygoptera), Anisozygoptera and dragonflies (Anisoptera). The suborder Anisozygoptera is known as a living fossil which comprises of two species, of which *Epiophlebia laidlawi* is known from Darjeeling. The life history of odonates is closely linked with water bodies. The odonates make use of wide range of stagnant and flowing water bodies. Most species of odonates are highly specific to a habitat, but some make use of man-made water bodies and are adapted to urban areas. Habitat specificity plays an important role on the distribution and ecology of odonates (Subramanian, 2005).

Odonates are denizens of many aquatic ecosystems and their distribution covers a great deal of continuum from temporary to permanent water bodies (Corbet, 1999). Odonates are excellent biological indicators of environmental condition as they sensitivity to environmental condition (Brown, 1991). Odonata lives in almost all kinds of habitats starting from stagnant water bodies to running water bodies and dry deciduous forest to evergreen forest. Odonate assembles in areas that represent sensitive indicators of environmental conditions that include the water environment and forest structure. Odonates are the most dominant invertebrate predator in any ecosystem. They play a very significant role in the ecosystem as they act as predators both at nymph and adult stages. They occur almost all over the globe in different habitats (Silsby, 2011).

Evolved around 250 million years ago (Subramanian, 2005), these magnificent groups of flying insects are sharing a long cultural relationship with humans as well as an important species in the ecosystem, being key indicator of water quality and fluvial ecosystem disturbance (Castella, 1987). Odonates lay their eggs up on a wide range of aquatic habitats, from damp soil to waterfalls. Mainly based on the physical characters such as the length of the shoreline, females will select the egg-laying site. Species, breeding in rivers will select water bodies that are either slow flowing or fast flowing depending on the capability of their larvae to adjust with moving water. It is usually seen that long straight shores of lakes are often occupied by riverine species (Subramanian, 2005).

Adult odonates often emerge during late evening or early morning. Emerged odonates colonize landscape surrounding the wetland. Male odonates are generally more beautiful and are brightly coloured than females. Adult odonate catches insects such as small mosquitoes, butterflies, flies and other small odonates in flight. Some species of dragonflies like the Wandering Glider (*Pantala flavescens*) migrate with monsoon winds across the Indian subcontinent (Andrew *et al.*, 2009). Dragonflies and Damselflies are considered to be the prominent and colourful insects of the tropical landscapes that are considered as a crucial component of the freshwater ecosystem as well as good indicators of ecosystem health (Adarsh, *et al.*, 2014).

II. MATERIALS AND METHODS

The present study aims on studying the diversity and distribution of Odonates in the selected sites of Kannur and Wayanad districts (Madayipara and Mananthavady) of Kerala, India.

Madayipara is a beautiful flat topped hillock that overlooks Payangadi town on the northern bank of Kuppam river and is located in Madayi village, at latitude 12°2' N and longitude 75°16'E, about 21 km north of Kannur town, in Kerala. Mananthavady is a municipality and taluk in the Wayanad district of Kerala, India located at 11.8014° N, 76.0044° E. Mananthavady is the largest City in Wayanad District and is also the largest municipality of Kerala in terms of area.

2.1 Sampling method

The study was carried out during the time period from October 2020 to January 2021. The selected two localities were flourished with good environment which made it a suitable breeding place for many varieties of odonates. Odonates were collected from the human dwellings of two selected localities. Sampling were made between 09:00 am and 01:00 pm when insects were most active.

Data of the present study was collected by direct search technique (Sutherland, 1996) at the important habitats of odonates. For this date collection, 10–15 minutes halts were made at each search locations that are chosen at random. During the course of the present survey that has been carried out, odonates observed in the field were identified by using field guides. For observation visual encounter method (Heyer *et al.*, 1994) was followed in transect. Data on sampling time, date, type of habitat and surroundings were recorded.

2.2 Identification

Most of them were observed by random observations as well as opportunistic sampling during walking through near the fresh water bodies, and the day today observations were noted in the field book. The odonates are photographed and primarily identified directly in the field. In some cases the adults were collected, photographed and after recording the morphological features it is freed to conserve biodiversity. The photographed specimens were identified by using field identification keys provided by Subramanian (2005 and 2009), Fraser (1933 and 1934) and Kiran and Raju (2013) and the identification of species with the help of the photographic field guide of dragonflies and damselflies of Kerala. Identification was done by observing wing venation, color pattern, and genitalia described in standard taxonomic literature and field guides.

In some difficult states the odonates were collected by using butterfly nets. For collection butterfly nets with dark coloured clothing is used. Net consists of 2 ft long handle with ring of about 25 cm diameter with open mesh net. The odonates were transferred to plastic bottle and then brought back to home for detailed identification. Odonates were very delicate insect so that the collection is very difficult (Subramanian, 2005). So in handpicking method the odonates were collected by holding the tough wings inside the fingers for short time. The collected Odonata species were identified using the keys given by Subramanian (2009). Publications and different literatures were also referred during the study which also helped in identification.

III. RESULTS AND DISCUSSION

Baseline knowledge on the diversity and distribution of odonates over spatiotemporal scale is the key to biodiversity conservation. The present work aims at studying the diversity and distribution of Odonates in the selected sites of Kannur and Wayanad districts such as Madayipara and Mananthavady. Results of Odonates diversity are given in Table 1 & Fig 1 to 16.

Table 1: Diversity of Odonates in the Study Sites

Sl. No	Scientific name	Common name	Family
1	<i>Diplacodes trivalis</i>	Blue Ground skimmer	Libellulidae
2	<i>Neurothemis fulvia</i>	Fulvous forest skimmer	Libellulidae
3	<i>Neurothemis tullia</i>	Pied paddy skimmer	Libellulidae
4	<i>Orthetrum chrysis</i>	Spine tufted skimmer	Libellulidae
5	<i>Orthetrum sabina</i>	Green marsh hawk	Libellulidae
6	<i>Rhodothermis rufa</i>	Rofous marsh glider	Libellulidae
7	<i>Rhyothemis variegata</i>	Common picture wing	Libellulidae
8	<i>Tholymis tillagra</i>	Coral-tailed cloud wing	Libellulidae
9	<i>Aciagrion palladium</i>	Rusty dart	Coenagrionidae
10	<i>Agriocnemis pygmaea</i>	Pigmy dartlet	Coenagrionidae
11	<i>Ceriagrioncerino rubellum</i>	Orange tailed marsh dart	Coenagrionidae
12	<i>Ceriagrion coromandelianum</i>	Coromandal marsh dart	Coenagrionidae
13	<i>Vestalis gracilis</i>	Clear-winged forest glory	Casopterygidae
14	<i>Euphaea dispar</i>	Nilgiritorent dart	Euphaeidae
15	<i>Lestes elatus</i>	Emerald spreadwing	Lestidae
16	<i>Prodasineura verticalis</i>	Red-striped black bambootail	Protoneuridae

A total of 16 species of odonates belonging to 12 genera and 5 families were recorded from the study area. From the results obtained from the present study, Family Libellulidae was dominant among the 5 families with 8 species. The species were *Diplacodes trivalis*, *Neurothemis fulvia*, *Neurothemis tullia*, *Orthetrum chrysis*, *Orthetrum Sabina*, *Rhodothermis rufa*, *Rhyothemis variegata*, *Tholymis tillagra*.

Following Libellulidae family was family Coenagrionidae which comprised of 4 species viz., *Aciagrion palladium*, *Agriocnemis pygmaea*, *Ceriagrion cerinorubellum*, *Ceriagrion coromandelianum*. Family Casopterygidae (*Vestalis gracilis*), Family Euphaeidae (*Euphaea dispar*), Family Lesidae (*Lestes elatus*) and Family Protoneuridae (*Prodasineura verticalis*) comprised of one species each.

Libellulidae and Coenagrionidae were the more frequently sighted groups during the study. Status of all species was categorized depending on the direct sighting during the study. In the present study 8 species (*Neurothemis fulvia*, *Neurothemis tullia*, *Orthetrum chrysis*, *Orthetrum sabina*, *Rhodothermis rufa*, *Rhyothemis variegata*, *Tholymis tillagra*, *Ceriagrion cerinorubellum*) were spotted commonly, 5 species (*Diplacode trivalis*, *Agriocnemis pygmaea*, *Ceriagrion coromandelianum*, *Aciagrion palladium*, *Agriocnemis pygmaea*) showed occasional appearance and 3 species (*Vestalis gracilis*, *Euphaea dispar*, *Lestes elatus*) showed rare sightings.



Fig 1: *Diplacodes trivalis*

Fig 2: *Neurothemis fulvia*

Fig 3: *Neurothemis tullia*

Fig 4: *Orthetrum chrysis*



Fig 5: *Orthetrum sabina*

Fig 6: *Rhodothemis rufa*

Fig 7: *Rhodothemis variegata*

Fig 8: *Tholymis tillagra*



Fig 9: *Aciagrion palladium*

Fig 10: *Agriocnemis pygmaea*

Fig 11: *Ceriagrion cerinorubellum*

Fig 12: *Ceriagrion coromandelianum*



Fig 13: *Vestalis gracilis*

Fig 14: *Euphaea disper*

Fig 15: *Lestus elatus*

Fig 16: *Prodasineura verticalis*

Similar study was conducted by Harisha (2016) in that they evaluated status and diversity of Odonates of Kondajji Lake in Kondajji Village of Davanagere District, Karnataka, India. From the results, a total of 34 species of Odonates in 24 genera belonging to 6 families have been reported. The family Libellulidae dominated with 20 species among the Anisoptera followed by the Aeshnidae with 3 and Gomphidae with 2. Among the Zygoptera, Coenagrionidae

was found to be the dominant family with 6 species followed by the Platycnemididae with 2 and Lestidae with 1 of total odonates recorded from the study area. In accordance to this, in the present study we have found out twelve species from Madayipara site. Family Libellulidae showed dominant number of species in the site. Family Libellulidae comprised of eight species followed by family Coenagrionidae which comprised of two species.

3.1 Diversity of Odonata Species in Site 1 - Madayipara

The Madayipara hills in Kannur District of Kerala, is perhaps one of the remarkable laterite hillocks of North Malabar. The results of Odonates diversity in the site Madayipara is presented in the Table 2. In site Madayipara all together 12 species belonging to 4 different families were recorded.

Table 2: List of Species in Site 1- Madayipara

Sl. No	Scientific name	Family
1	<i>Diplacodes trivalis</i>	Libellulidae
2	<i>Neurothemis fulvia</i>	Libellulidae
3	<i>Neurothemis tullia</i>	Libellulidae
4	<i>Orthetrum chrysis</i>	Libellulidae
5	<i>Orthetrum sabina</i>	Libellulidae
6	<i>Rhodothemis rufa</i>	Libellulidae
7	<i>Rhyothemis variegata</i>	Libellulidae
8	<i>Tholymis tillagra</i>	Libellulidae
9	<i>Aciagrion palladium</i>	Coenagrionidae
10	<i>Ceriagrioncerino rubellum</i>	Coenagrionidae
11	<i>Vestalis gracilis</i>	Casopterygidae
12	<i>Lestes elatus</i>	Lestidae

In the present study we have found out twelve species from Madayipara. Family Libellulidae showed dominant number of species in the site Madayipara. Family Libellulidae comprised of eight species followed by family Coenagrionidae which comprised of two species. The different species belonging to the family Libellulidae that were found in the site Madayipara were *Diplacodes trivalis*, *Neurothemis fulvia*, *Neurothemis tullia*, *Orthetrum chrysis*, *Orthetrum sabina*, *Rhodothemis rufa*, *Rhyothemis variegata* and *Tholymis tillagra*.

Following that was the family Coenagrionidae that comprised of the species viz., *Aciagrion palladium*, *Ceriagrioncerino rubellum*. Family Casopterygidae and family Lestidae comprised of one species each such as *Vestalis gracilis*, *Lestes elatus* respectively.

A study similar to present study was carried out by (Deepa, Selvarasu, Gunasekaran, & Shobana, 2021). That recorded a total of 37 species belonging to 29 genera and 6 families. The maximum number of odonates was found in Libellulida, followed by Coenagrionidae. The present study also stated that Libellulida was dominated than other families. In accordance to the above statement Rehn (2003) noted 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, Mohd-Sofian, & Zakaria-Ismail, 2001) and tolerant to wide range of habitats (Gentry, Garten, Howell, & Smith, 1975). The species diversity of the dragonflies was found to be high in the wetlands which were followed by the agricultural areas, Amirthi stream and Amirthi forest in terms of habitat preference.

3.2 Diversity of Odonata Species in Site 2 – Mananthavady

Mananthavady is a municipality and taluk in the Wayanad District of Kerala. The results of Odonates diversity in the site Mananthavady is presented in the Table 3. In site Mananthavady all together 13 species belonging to 5 different families were reported.

Table 3: List of Species in Site 2- Mananthavady

Sl. No	Scientific name	Family
1	<i>Neurothemis fulvia</i>	Libellulidae
2	<i>Neurothemis tullia</i>	Libellulidae
3	<i>Orthetrum chrysis</i>	Libellulidae
4	<i>Rhodothemis rufa</i>	Libellulidae
5	<i>Rhyothemis variegata</i>	Libellulidae
6	<i>Tholymis tillagra</i>	Libellulidae
7	<i>Aciagrion palladium</i>	Coenagrionidae
8	<i>Agriocnemis pygmaea</i>	Coenagrionidae
9	<i>Ceriagrioncerino rubellum</i>	Coenagrionidae
10	<i>Ceriagrion coromandelianum</i>	Coenagrionidae
11	<i>Vestalis gracilis</i>	Casopterygidae
12	<i>Euphaea dispar</i>	Euphaeidae
13	<i>Prodasineura verticalis</i>	Protoneuridae

In the present study at the site Mananthavady thirteen species from five different families wererecorded. Family Libellulidae comprised of six species followed by family Coenagrionidae which comprised of four species. The different

species belonging to the family Libellulidae that were found in the site Mananthavady were *Neurothemis fulvia*, *Neurothemis tullia*, *Orthetrum chrysis*, *Rhodothemis rufa*, *Rhyothermis variegata* and *Tholymis tillagra*.

Family Coenagrionidae showed the presence of four species viz., *Aciagrion palladium*, *Agriocnemis pygmaea*, *Ceriagrioncerino rubellum* and *Ceriagrion coromandelianum*. The families Casopterygidae, Euphaeidae and Protoneuridae comprised of one species each such as *Vestalis gracilis*, *Euphaea dispar* and *Prodasineura verticalis* respectively.

Similar study was conducted by Susanth and Anooj (2020) that prepared a checklist of Odonata on Wayanad District, Kerala. The results study documented a total of 59 species of 40 genera and 7 families, of these twenty four belonged to the suborder Zygoptera and thirty five belonged to Anisoptera. Libellulidae was the most diverse family with 31 species followed by Coenagrionidae with 11 species. Platynemididae was represented by five species, Gomphidae by four species, Calopterygidae and Euphaeidae by three species each and Chlorocyphidae by two species. In the current study carried out at Mananthavady, Wayanad District a total of thirteen species from five different families was recorded. In the present study and above mentioned study Libellulidae was the most dominant family followed by Coenagrionidae.

The study conducted by Boruah *et al.* (2015) has reported total number of 51 species of odonates in Padmatola wetland. The sub order Anisoptera contributed 33 species followed by Libellulidae 28, Gomphidae 3, Aeshnidae 1 and Macromiidae 1. The sub order Zygoptera contributed 18 species followed by Coenagrionidae 15, Platynemididae 2 and Lestidae 1. Results in parallel to this is found in the present study which also reported 3 similar families, Libellulidae 8, Coenagrionidae 4, Lestidae 1. From the both study Libellulidae is dominated followed by Coenagrionidae.

Odonates are prominent predator of serious pests in both terrestrial and aquatic ecosystem. They food of odonates are noxious flies, aphids, jassids, bollworms, mosquitoes (Fraser, 1933) and black flies (Subramanian, 2005). The maximum diversity of Odonates might be observed due to their larger size, diverse habitat and presence of permanent and temporary water bodies. The size of the water bodies (temporary or permanent) also becomes an important factor to determine the species richness and diversity of Odonates (Carchini, Solimni, & Ruggiero, 2005; Suh and Samways, 2005).

Many species in the temperate region have shown a dramatic decline in distribution and abundance since the second half of the 20th century (Westfall and May, 1996; Sahle'n, Bernard, Rivera, Ketelaar, & Suhling, 2004; Inoue, 2004). This has been caused by habitat destruction, eutrophication, acidification and pollution of aquatic habitats in general, and the canalisation of streams and rivers. Major threats to odonates diversity may be due to over pollution, destruction of wetlands and their natural habitats. The present study reveals important information on odonate diversity of the study region which will certainly be helpful for future researchers to study on the group.

IV. CONCLUSION

Madayipara and Mananthavady in Kannur and Wayanad seems to be an important source of support for insects like Odonates with this investigation which records 16 species belongs to 12 genera. The abundance and species richness tend to increase with increase in the presence of and perennial water sources, good aquatic vegetation etc. In all season odonates are widely distributed, mostly in monsoon. But in other season the distribution is not so much affected due to available water sources throughout the year. Odonates are mainly aquatic insect and their part of lifecycle completed through aquatic environment. From the current study the less dominance of some species may be due to their habitat destruction, pollution and other anthropogenic activities. Present short-term investigation on diversity of odonates will serve as the baseline data for the future researchers and investigators for the conservation of odonate species.

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