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Alpha Diversity And Species Assemblage of Odonata from Different Habitats in Pune-Chindchwad Municipal Corporation (PCMC) Area, Pune, Maharashtra

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ABSTRACT

The present work is aimed to study diversity and abundance of dragonflies and damselflies of Pimpri-Chinchwad Municipality in Pune city of Maharashtra in Northern western Ghats. This study has been carried out for one year from June 2016 to March 2017. A total number of 32 species under 6 families was observed. The most abundant family was Libellulidae comprising 20 species followed by Coenagrionidae comprising 6 species, Chlorocyphidae comprising 2 species, Lestidae with 2 species, Aeshnidae and Platycnemidae comprising of 1species. Assemblage of different species in relation to their habitat diversity and diversity indices were also reported.

Keywords : Alpha Diversity, Species Assemblage, Bio-Indicators, Habitat Diversity

I. INTRODUCTION

Dragonflies and damselflies (Order – Odonata) are colorful predatory insects of freshwater habitat and characterized by their elongate body, extended wings and large eyes. These are carnivorous and a number of species are predators. They prefer to live in freshwater, non polluted and well oxygenated habitats. Therefore Dragonflies and Damselflies are precious bio-indicators for environmental contamination studies (Needham, et al., 2000).

Yet, there is no detailed report on Diversity and abundance of Dragonflies and Damselflies of PCMC area in Pune district of Maharashtra state. The present investigation was, therefore, done to put together the study on Diversity and abundance of Dragonflies and Damselflies of PCMC range in Pune district.

Biodiversity has number of function like maintaining balance of the ecosystems.; provisions of biological resources and food; social benefits; human health, cultural developement etc. Countries are facing threats due to activities like ruthless cutting of mangrove trees, overexploitation of fishery resources, ruthless mining of coral reefs, widespread degradation of habitats due to urbanization, industrialization, and increase in pollution level in estuaries, mangroves, backwaters and seas. During the last few years, the necessity for the conservation of biological resources and biodiversity assessment has promptly increased; taxonomic diversity studies are being encouraged now. Thus biodiversity and its measurement have a grave importance especially if we look into the present scenario.

Worldwide, 29 Orders of class Insecta occurs which comprise of 1,004,898 species (Foottit &Alder, 2009). It is still not known that how many insect species are there as many are still to be described. Currently, it is essential to improve taxonomic

knowledge on insect groups that would be truly beneficial for the point of conservation.

The Western Ghats is one of the world's most heavily populated biodiversity hotspot supporting about 400 million people through water, food and resources to sustain livelihood (Molur et al., 2011). Today these are being rapidly degraded due to various land use changes that have occurred in the recent past. Apart from the traditional impacts from farming, grazing and fire there are newer changes in land-use that are leading to biodiversity losses. This includes deforestation due to mining, construction of roads, dams, townships and industrialization. Urbanization and industrialization in Maharashtra, Gujarat and Goa has altered the natural ecological attributes over the last several decades. Thus there is a special requirements of sustainable development in areas that are ecologically fragile,

Maharashtra is one of the states of the Northern Western Ghats. The state of Maharashtra lies between 15°32' to 22°02' N latitude and 72°36' to 80°54' E longitude and is the third largest state of the country with an area of 3,07,714 sq km constituting 9.36% of India's total geographic area. The Ghats spread over 10 districts which includes 67 tehsils, Pune being one of them and covering a total of 527 km^2 (Jagtap and Singh, 2002).

According to the recent updated list, Odonata has a worldwide distribution of 5,952 species of which 474 species in 142 genera and 18 families exists in India (Subramanian, 2014). The Western Ghats is especially diverse with 174 species, comprising 56 endemics to the region (Subramanian et al. 2011). Based on morphology, the Order Odonata is divided into three groups, viz. damselflies (Zygoptera), Anisozygoptera and dragonflies (Anisoptera). The suborder Anisoptera consists of 7 families worldwide, suborder Zygoptera with 11 families and a single family under suborder Anisozygoptera.

A voluminous literature contributed by several authors is being available relating to Odonata taxonomy and bio-ecology. Tillyard (1917) provided one of the earliest account of dragonfly biology, a book still of great value, since he emphasized functional morphology and anatomy. The biology, physiology and ecology of Odonates have also been well studied by Philip S. Corbet (1962) in his book "A Biology of Dragonflies". Prasad, (1996) studied Odonata from Maharashtra state and published in Records of Zoological Survey , where he presented a list of all the 83 species known from Maharashtra state till then. Koparde et al.,(2014) reports seven new records from Kolhapur district. However, very few studies have looked into Odonata fauna of North Western Ghats of Maharashtra (Fraser 1924, 1933, 1934, 1936; Kulkarni & Subramanian, 2013). Saha and Gaikwad, (2012) reported 27 species of Odonata from Tamhini, a sacred grove in Pune District. Saha and Gaikwad, (2014) studied the diversity and abundance of Odonates in parks and gardens of Pune city and recorded a total of 33 species. They also illustrated the importance of human-managed urban parks and gardens in supporting their diversity and abundance. Saha and Gaikwad, (2015) studied the Odonata assemblage at a very small marshy land in the heart of Pune city, which was documented to support 17 species of Odonata and thus can be considered as species rich diversity site in a purely urban backdrop. Though the Odonata of Pune District has been documented by some workers since the beginning of the 20th century (Fraser 1933–36; Prasad 1996), they were mostly species checklists without any details of habitat and seasonal distribution.

Odonata is sensitive to habitat structure and is an excellent indicator of changes in habitat structure (Clausnitzer, 2004). The group constitutes a valuable tool for various types of bio-assessment and bio-monitoring of aquatic habitats (Oertli, 2008). Odonates have been already in use as biomonitoring tools in countries like South Africa, U.S.A, Europe, Japan (Clark and Samways, 1996; Samways, 1996)

Therefore the importance of this group both ecological and economical. The current investigation aims at generating a baseline data on habitat distribution, seasonal variations and diversity of

Odonata of PCMC are in Pune district in Northern Western Ghats .

II. METHODS AND MATERIAL

1) Study area:

The area under Pimpri-Chinwchwad Municipal Corporation (PCMC) jurisdiction was selected as the study area. For selection of study sites, the center was geographically located, and the sampling was done from different localities. The selection of study sites was based on the availability of different habitat of odonates like urban and agricultural habitat. The urban habitat was again categorized based on the level of pollution. The highly polluted sites were specifically sampled. These sites are located at the vicinity of factories or dense human habitation. A total of localities were sampled during premonsoon and post monsoon seasons from July2016 to March 2017. Collection sites was mainly divided under three land-use categories which forms different habitats for Odonates. These are as follows:1)Agricultural habitat, 2)Polluted Urban habitat, 3) Non-polluted Urban habitat

Methodology:

The present study was done for one year from July 2016 to March 2017. Specimens of Dragonflies and damselflies were observed in field with careful note on their habitats. Repeated visits to field have been made in morning, afternoon and evening. For diversity and abundance, specimen number of each species has been counted by visual observations. The specimens were identified in the field by using field guides of Subramanian (2005, 2009) and the Handbook of Common Odonates of Central India by Andrew,et al (2009).

During survey standard Transect method was used. Different transects of 1 km length was drawn in different parts of the present area and the breadth of each transect was 20 feet. Results were recorded by visualizing the specimens through-out transect and after that summarization of all transects were done.

Preparation of data sheet:

In order to record systematically all the above-mentioned ecological details regarding the study sites and also about the species, data sheets were prepared. This data sheet helped to keep a systematic record of all the details for every species during every visit.

Diversity indices was measured using the data collected during repeated field visits.

III. RESULTS AND DISCUSSION

Systematic account of Order Odonata.

Order Odonata Fabricius, 1793

Suborder Zygoptera Selys, 1854

I. Family: Lestidae Calvert, 1907

1. Genus: Lestes Leach, 1815

1. Lestes elatus Hagen in Selys, 1862
2. Lestes viridulus Rambur, 1842

Family: Chlorocyphidae Cowley, 1937

2. Genus: Heliocypha Fraser, 1949

3. Heliocypha bisignata (Hagen in Selys, 1853)

Superfamily Coenagrionidea Kirby, 1890

III. Family: Coenagrionidae Kirby, 1890

3.Genus: Agriocnemis Selys, 1877

4. Agriocnemis pygmaea (Rambur, 1842)

4. Genus**: Ceriagrion** Selys, 1876

5. Ceriagrion coromandelianum (Fabricius, 1798)

5. Genus:**Ischnura** Charpentier, 1840

6. Ischnura aurora (Brauer, 1865)
7. Ischnura senegalensis (Rambur, 1842)

6. Genus: **Pseudagrion** Selys, 1876

8. Pseudagrion decorum (Rambur, 1842)
9. Pseudagrion rubriceps Selys, 1876

Family: Platycnemididae Yakobson & Bainchi, 1905

7 . Genus: **Copera** Kirby, 1890

10. Copera vittata deccanensis Laidlaw, 1917

8. Genus: **Disparoneura** Selys, 1860

11. Disparoneura quadrimaculata (Rambur, 1842)

Suborder Anisoptera Selys, 1854

Superfamily Aeshnoidea Leach, 1815

III. Family: Aeshnidae Leach, 1815

9. Genus:**Anax** Leach, 1815

12. Anax immaculifrons Rambur, 184

Superfamily Libelluloidea Leach, 1815

IV. Family: Libellulidae Leach, 1815

10. Genus:**Acisoma** Rambur, 1842

13. Acisoma panorpoides Rambur, 1842

11. Genus:**Brachythemis** Brauer, 1868

14.Brachythemis contaminata (Fabricius,1793)

12. Genus:**Bradinopyga** Kirby, 1893

15. Bradinopyga geminata (Rambur, 1842)

13. Genus:**Crocothemis** Brauer, 1868

16. Crocothemis servilia (Drury, 1770)

14. Genus:**Diplacodes** Kirby, 1889

17. Diplacodes trivialis (Rambur,1842)

15. Genus:**Neurothemis** Brauer, 1867

18. Neurothemis intermedia intermedia (Rambur, 1842)

19. Neurothemis tullia (Drury, 1773)

16. Genus:**Orthetrum** Newman, 1833

20. Orthetrum luzonicum (Brauer, 1868)

21. Orthetrum pruinosum (Burmeister, 1839)

22. Orthetrum sabina (Drury, 1770)

23. Orthetrum taeniolatum (Schneider,1845)

17. Genus:**Pantala** Hagen, 1861

24. Pantala flavescens (Fabricius, 1798)

18. Genus:**Tholymis** Hagen, 1867

25. Tholymis tillarga (Fabricius, 1798)

19. Genus:**Tramea** Hagen, 1861

26. Tramea basilaris (Palisot de Beauvois, 1805)

27. Tramea limbata similata (Rambur, 1842)

20. Genus: Rhyothemis Hagen, 1867

28. Rhyothemis variegata (Linnaeus, 1763)

21. Genus:**Trithemis** Brauer, 1868

29. Trithemis aurora (Burmeister, 1839)

30. Trithemis festiva (Rambur, 1842)

31. Trithemis pallidinervis (Kirby, 1889

22. Genus: **Zyxomma Rambur, 1842**

32. Zyxomma petiolatum Rambur, 1842

Species Diversity in the study area:

In present investigation a total number of 363 individuals belonging to 32 species under 22 genera, 6 families and two suborders were recorded. The families are Libellulidae, Coenagrionidae, Ashnidae, Chlorocyphidae, Lestidae and Platycnemidae. The most dominant family in present study is Libellulidae which comprises 13 genera (61% of total genera) and 22 species (58.45% of total species).

The abundance of sub-order Anisoptera was more in comparison to Zygoptera .since dragonflies are strong flier and can easily get adapted to environmental variation on the other hand damselflies are week fliers and more sensitive to environmental disturbances.

Species collected from agricultural area mainly comprised of Ceriagrion coromandelianum, Diplceodes trivialis, Neurothemis tullia, Crocothemis servillia, Trithemis aurora, Orthetrum sabina etc. They are predators for crop pests like moths and beetles.

Species observed in polluted urban area were Brachythemis contaminata, Pantala flavesance, Orthetrum sabina ,Trithemis festiva. The larvae of these species can tolerate a wide variation in pH, temparature and chemical constitute of water.

Species assemblage in non -polluted urban areas like well maintain park and garden river side etc. is dominated by Acisoma paneropoides, Orthetrum luzonicum, Trithemis pallinidervis, etc.

Heliocypha bisignata is particularly found in very clear streams since they are sensitive to pollutants.

Table 1. The diversity indices of Odonates from all the localities

Localities	Taxa_S	Individuals	Dominance_D	Simpson_1-D	Shannon_H	Margalef	Fisher_alpha
S1	22	55	0.0843	0.9157	2.762	5.24	13.59
S2	10	17	0.1349	0.8651	2.15	3.177	10.19
S3	14	34	0.0934	0.9066	2.484	3.687	8.902
S4	10	19	0.1191	0.8809	2.205	3.057	8.541
S5	11	22	0.1405	0.8595	2.158	3.235	8.755
S6	9	20	0.205	0.795	1.851	2.67	6.296
S7	11	20	0.145	0.855	2.181	3.338	10.03
S8	10	23	0.2628	0.7372	1.808	3.338	6.733
S9	7	27	0.2702	0.7298	1.566	1.82	3.066
S10	8	15	0.1911	0.8089	1.859	2.585	6.966
S11	11	26	0.1479	0.8521	2.138	3.069	7.193
S12	11	16	0.1094	0.8906	2.307	3.607	15.54
S13	9	17	0.1765	0.8235	1.952	2.824	7.753
S14	9	12	0.1667	0.8333	2.023	3.219	16.36
S15	6	9	0.2099	0.7901	1.677	2.276	7.867
S16	7	12	0.1944	0.8056	1.792	2.415	7.028
S71	12	21	0.1247	0.8753	2.281	2.415	11.64

Table 1 denotes the diversity indices of Odonates from all the localities. The site S1 (Hinjewadi) is a urban locality which shows highest diversity indices (2.762). This is due to the large pieces of marshy land that still exist. But the rapid urbanization is posing a great threat to this existing diversity. The least diverse sites are S15, S16 etc which are rather polluted due to presence of nearby factories or industries.

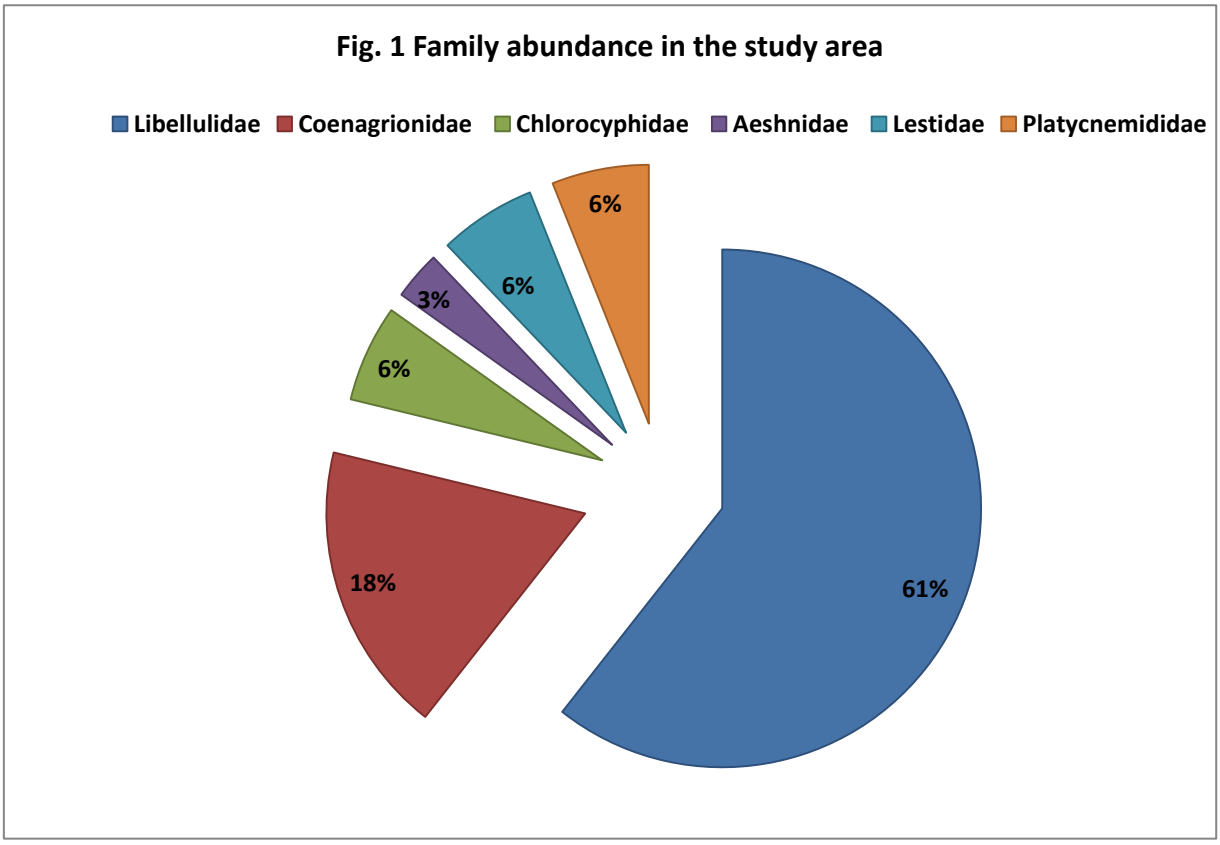
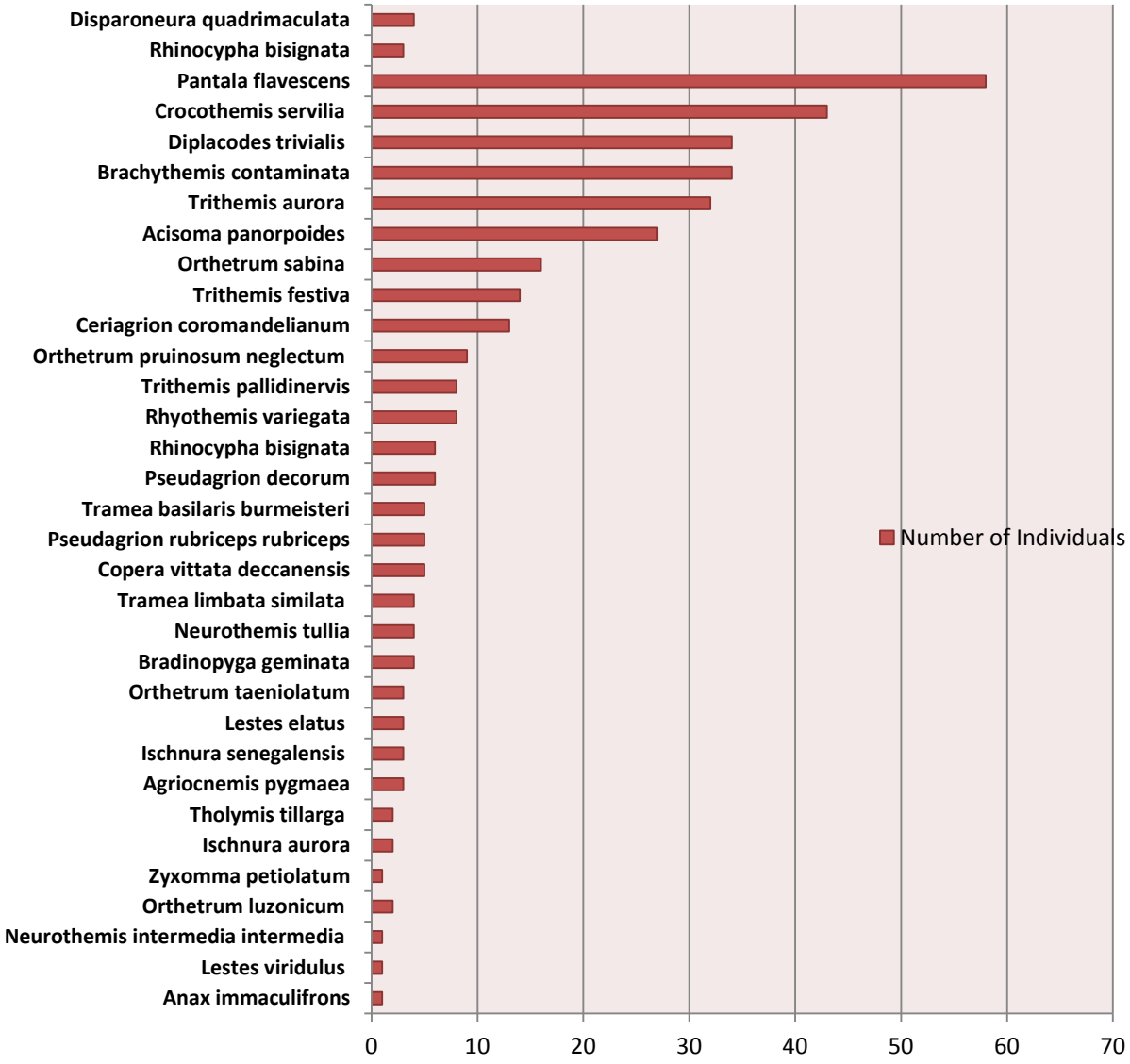


Fig. 2. Abandance of Odonates in the study area



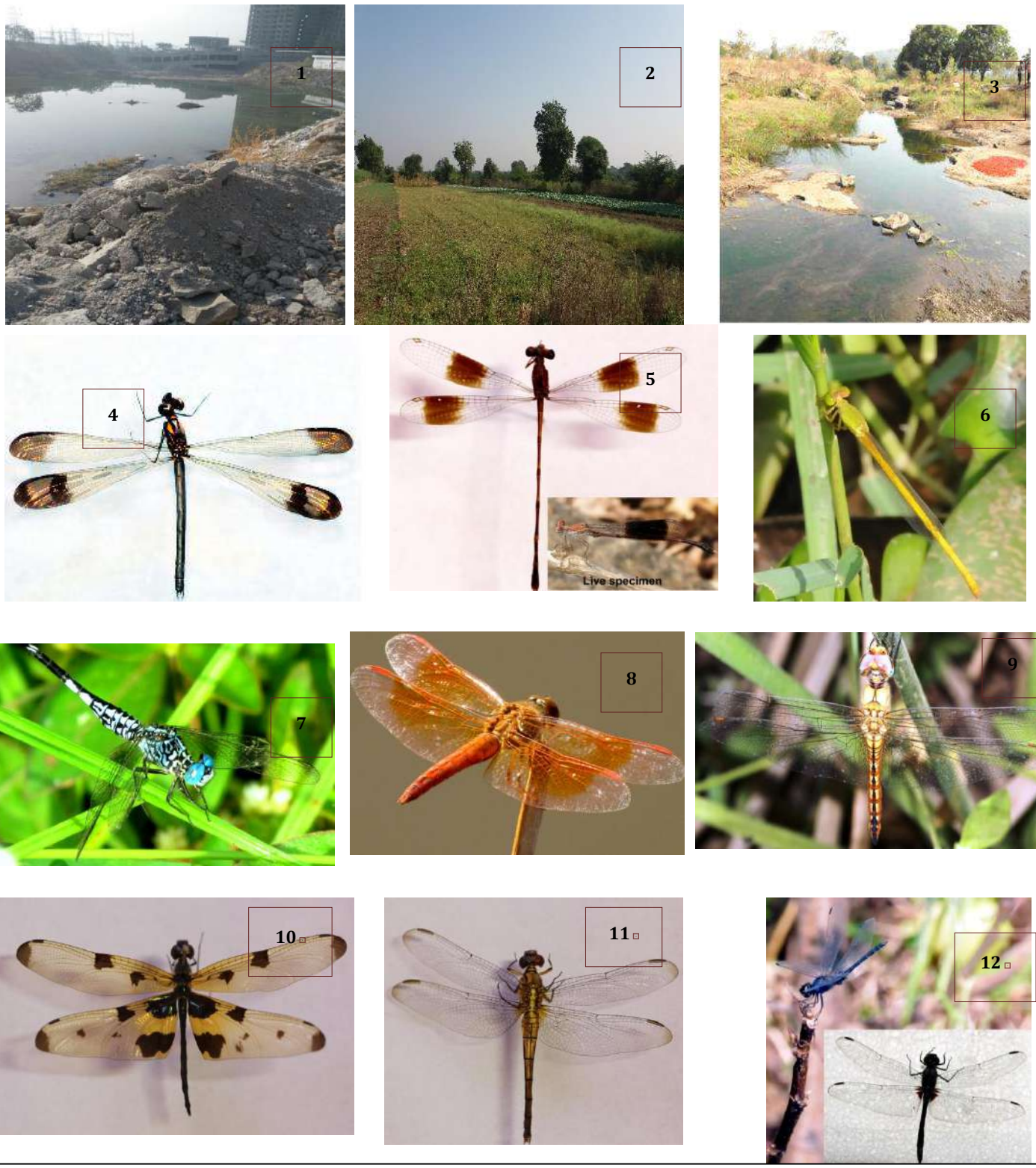


Fig. 1. Site (polluted-urban) 2. Site (agricultural) 3. Site (unpolluted urban). 4. *Heliocypha bisignata* (Hagen in Selys, 1853) 5. *Disparoneura quadrimaculata* (Rambur, 1842) 6. *Ceriagrion coromandelianum* (Fabricius, 1798) 7. *Acisoma panorpoides* Rambur, 1842 8. *Brachythemis contaminata* (Fabricius,1793) 9. *Pantala flavescens* (Fabricius, 1798) 10. *Rhyothemis variegata* (Linnaeus, 1763) 11. *Orthetrum luzonicum* (Brauer, 1868) 12. *Trithemis festiva* (Rambur, 1842)

IV.CONCLUSION

This study highlights how the different types of habitat influence Odonate assemblage and the threatening effect of pollution because of urbanization and industrialization on the same. Similar type of species assemblages were recorded from specific habitats. Information on diversity and distribution of various taxa and their habitat is the key to diversity conservation. In this context, the present study on Odonate diversity, abundance and distribution in Pune district of Maharashtra which falls under Northern Western part has been initiated to fill in the above mentioned lacunae.

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