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# Checklist and seasonal distribution of odonata (Insecta) of Khulna University campus, Bangladesh

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#### Abstract

An extensive survey of odonates were conducted in Khulna University Campus from August 2014 to August 2018. In total 40 species belonging to 24 genera and 4 families of odonates were recorded. Anisoptera contributed with 25 species belonged to 17 genera and two families and Zygoptera contributed with 15 species of 7 genera and two families. Libellulidae found most dominant family of odonates by contributing 24 species over Coenagrionidae, Platycnemididae, and Gomphidae. Species richness increased in monsoon and 95% of the total species count were recorded in June-October. In winter, species richness declined at lowest number.

Keywords: Dragonflies, damselflies, diversity, seasonal distribution, Khulna University, Bangladesh

# Introduction

With 5680 species, 31 families and three suborder, Odonates are one of the smallest and oldest insect order <sup>[1]</sup>. Still, we had very limited studies about their ecology and distribution <sup>[2, 3]</sup>. It has a vital role in ecosystem functioning and a good indicator of aquatic and terrestrial ecosystem condition <sup>[4, 5, 6]</sup>. Last two decades, study of odontates become very popular and several studies were conducted for describing distribution pattern, species richness and morphology <sup>[7]</sup>. Somehow, it also play a central role in the conservation of freshwater habitats, especially in Europe <sup>[8, 9]</sup>.

Odonate diversity varies in different climatic zones <sup>[10]</sup>. Like other insecta, odonates are distributed abundantly in tropics rather than other regions <sup>[1, 11]</sup>. Especially in monotonous areas of tropical forests inhabit the largest number odonates <sup>[12, 13]</sup>. Indo-Malayan is one of the most diversified habitat for odonates and home of a number of endangered odonates <sup>[8]</sup>.

In Bangladesh, first attempt of listing odonates starts with listing of 96 species from eastern region by Chowdhury and Mohiuddin in 2011 <sup>[14]</sup>. In 2015, Khan updated the checklist by listing 75 species from this region <sup>[15]</sup>. From northeastern region, Khan reported 76 species with several new records and described 108 species from the country <sup>[16, 17]</sup>. Biswas *et al.* took the first approach to annotate the odonates of southwestern region by listing odonates of Bagerhat <sup>[18]</sup>. Furthermore, Tuhin and Khan updated the list of odonates of South-western Bangladesh with 50 species and 25 species from the Sundarbans <sup>[19]</sup>. So, the actual species content of this country is still unknown to us. This study is conducted to identify the species and their occurrence pattern in a public university campus.

# 2. Materials and Methods

# 2.1 Study Site

The study site (Khulna University Campus) lies between 22°47′57″ N to 22°48′18″ N and 89°31′38″ E to 89°32′21″ E with an area of 106.75 acres (Fig 1). Climatic condition of this area is typically tropical with a mild winter from October to March, hot and humid summer in March to June and humid, warm rainy monsoon in June to October. Average annual precipitation was around 368 mm and reaches highest in July and August with 393mm rainfall. Maximum and minimum temperature is variable all the year round ca. 12-15 °C (minimum) and reaches up to 41-45 °C (maximum) <sup>[20]</sup>.

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Fig 1: Map of the study area

# 2.2 Sampling design

The study was carried out throughout a reputed public university campus of Bangladesh (Khulna University Camus) from August 2014 to August 2018. Weekly opportunistic visits were carried out to address the identification of odonata of the study site. The area were surveyed by walking through all possible habitats present at the study site from 8:00 am-17:00 hr. <sup>[15, 16, 19]</sup>. For minimizing the destruction of odonata population the specimens were photographed by Nikon-3200D camera with Nikkor 18-55mm AF-S DX, Nikkor 55-300mm AF-S DX and Micro-Nikkor 105 mm FX AF lenses. Only confusing specimens were collected by insect catching net from the site for proper identification. Identification were done with the help of taxonomic keys provided by Fraser (1933, 1934, 1936), Asahina (1967), Lahiri (1987), Mitra (2002), Subramanian (2005), and Nair (2011) <sup>[21-28]</sup>.

# 3. Results

A total of 40 species of odonates belonging to 25 genera and 4 families were recorded (Table 1). Anisoptera found more dominant with 17 genera and 25 species than Zygoptera with 7 genera and 15 species. For sub-order Anisoptera as well as for total, Libellulidae was the most dominant family of the study area with 24 species and Coenagrionidae found next dominant family with 13 species (Fig 2). Among total 25 genera, Agriocnemis was counted 4 species and become highest in species content than Orthetrum (3), Mortonagrion (2), Brachydiplax (2), Diplacodes (2), Neurothemis (2), Rhodothemis (2), Trithemis (2), Ceriagrion (2), Ischnura (2), Pseudagrion (2), Copera (2) and others (Fig. 3). Diplacodes trivialis. Crocothemis servilia, Orthetrum Sahina Agriocnemis pygmaea and Pantala flavescens found more dominant species both in number and occurrence.



Fig 2: Species richness in sub-order and families

Occurrence of all odonates were not homogenous in the study area. In monsoon the occurrence of the species found highest. In the months of June-September on average over 30 (77%) species were listed from this area. August identified as the most suitable time for odonatan survey in this region because of the occurrence of 37 (91%) species. During December to April the occurrence of odonates became lowest with contribution of less than 10 species per month. The trend of odonates occurrence gradually increasing from January to august and decreasing from august to December (Fig. 3). *Onychargia atrocyana* and *Aethriamanta brevipennis* occurred in only two months of the study area of the year and identified as the rarest taxa of all. One extremely rare taxa *Mortonagrion varalli* cited once from the study site.



Fig 3: Seasonal occurrence of Odonates at study site.

## 4. Discussion

In the current study we have found 40 species of odonates belonging to 25 genera and 4 families, where Libellulidae found most dominant family similar to previous studies <sup>[14-16, 19, 29, 30]</sup>. Educational institutions like university areas could be a vital place for odonatan conservation which could be supplemented with this study, 45 species listing from SUST campus <sup>[16]</sup> and 25 species from Chittagong University Campus <sup>[30]</sup>.

Population of all odonates were not homogenous and equally visible at the study site. Among 40 species, 14 species found very common and easily cited at the study area. 10 species found moderately common and 10 species odonates found. Meanwhile, 5 of them found extremely rare and cited only a few times at the study period.

Listed species differs with habitat associations e.g. *Agriocnemis kalinga*, *Copera ciliata*, *Copera marginipes*, *Mortonagrion aborense*, *Zyxomma petiolatum* and *Mortonagrion varalli* were observed only at lake side of the study area which could be restricted to their habitats. Whereas, *Pseudagrion spp.* found only in the ponds and lakes of the area. *Agriocnemis femina*, *Agriocnemis pygmaea* were restricted to the grasslands. *Brachydiplax spp.* found abundant at the compact canopy of tree stands with low light intensity areas like previous study done by Khan (2015)<sup>[16]</sup>.

All odonates larvae need an aquatic environment for their development and become areal at maturity <sup>[31]</sup>. So, freshwater diversity and moisture content is vital for their habitat choice and diversity <sup>[9]</sup>. In the study, the occurrence of odonates found variable in seasons and most of the odonates (94%) found in monsoon, which is similar to Kulkarni and Subramanian (2013) <sup>[32]</sup>. Rainfall and temperature found vital for diversity of odonates of the study area. At winter, with dropping temperature, species richness declines significantly and dropped at 5 in January and February.

| Table 1: Checklist of odonates of Khulna | University campus (VC=Very | Common; MC=Moderately Common; | R=Rare; ER=Extremely Rare). |
|--|----------------------------|-------------------------------|-----------------------------|
|  |                            |                               |                             |

| Sl. No         | Species                                      | Flight Time | Occurrence |  |  |
|----------------|--|-------------|------------|--|--|
| Anisoptera     |  |             |            |  |  |
|                | Gomphidae                                    |             |            |  |  |
| 1              | Ictinogomphus rapax Rambur, 1842             | Jul-Sept    | ER         |  |  |
| Libellulidae   |  |             |            |  |  |
| 2              | Acisoma panorpoides Rambur, 1842             | Jul-Sept    | R          |  |  |
| 3              | Aethriamanta brevipennis Rambur, 1842        | Jul-Aug     | ER         |  |  |
| 4              | Brachydiplax chalybea Brauer, 1868           | Jun-Oct     | VC         |  |  |
| 5              | Brachydiplax farinosa Krüger, 1902           | Jun-Sept    | VC         |  |  |
| 6              | Bradinopyga sobrina Rambur, 1842             | Jun-Sept    | R          |  |  |
| 7              | Crocothemis servilia Drury, 1773             | Year round  | VC         |  |  |
| 8              | Diplacodes nebulosa Fabricius, 1793          | Jun-Jan     | MC         |  |  |
| 9              | Diplacodes trivialis Rambur, 1842            | Year round  | VC         |  |  |
| 10             | Macrodiplax cora, Brauer, 1867               | Year round  | VC         |  |  |
| 11             | Neurothemis fulvia Drury, 1773               | Jun-Aug     | VC         |  |  |
| 12             | Neurothemis tullia Drury, 1773               | May-Sept    | MC         |  |  |
| 13             | Orthetrum chrysis Selys, 1891                | May-Aug     | R          |  |  |
| 14             | Orthetrum glaucum Brauer, 1865               | May-Jul     | ER         |  |  |
| 15             | Orthetrum sabina Drury, 1773                 | Year round  | VC         |  |  |
| 16             | Pantala flavescens Fabricius, 1798           | Jun-Feb     | VC         |  |  |
| 17             | Potamarcha congener Rambur, 1842             | May-Sept    | R          |  |  |
| 18             | Rhodothemis rufa Rambur, 1842                | Jul-Oct     | MC         |  |  |
| 19             | Rhyothemis variegata Linnaeus, 1763          | Jun-Oct     | MC         |  |  |
| 20             | Tholymis tillarga Fabricius, 1798            | Jun-Aug     | R          |  |  |
| 21             | Tramea basilaris burmeisteri Kirby,1889      | Jun-Sept    | R          |  |  |
| 22             | Trithemis festiva Rambur, 1842               | Apr-Aug     | MC         |  |  |
| 23             | Trithemis pallidinervis Kirby, 1889          | Jun-Aug     | MC         |  |  |
| 24             | Urothemis signata Rambur, 1842               | Feb-Nov     | VC         |  |  |
| 25             | Zyxomma petiolatum Rambur, 1842              | May-Dec     | MC         |  |  |
|                | Zygoptera                                    |             |            |  |  |
| Coenagrionidae |  |             |            |  |  |
| 26             | Agriocnemis femina Brauer, 1868              | May-Sept    | R          |  |  |
| 27             | Agriocnemis kalinga Nair & Subramanian, 2015 | Aug-Oct     | MC         |  |  |
| 28             | Agriocnemis lacteola Selys, 1877             | June-Sept   | R          |  |  |
| 29             | Agriocnemis pygmaea Rambur, 1842             | Feb-Dec     | VC         |  |  |
| 30             | Ceriagrion cerinorubellum Brauer, 1865       | Mar-Nov     | VC         |  |  |
| 31             | Ceriagrion coromandelianum Fabricius, 1798   | May-Oct     | VC         |  |  |
| 32             | Ischnura aurora Brauer, 1865                 | Jul-Sept    | ER         |  |  |

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| 33              | Ischnura senegalensis Rambur, 1842     | May-Nov  | VC |
|-----------------|--|----------|----|
| 34              | Mortonagrion aborense Laidlaw, 1914    | Aug-Oct  | R  |
| 35              | Mortonagrion varalli Fraser, 1920      | Sep-Oct  | ER |
| 36              | Onychargia atrocyana Sélys, 1865       | Jul-Aug  | R  |
| 37              | Pseudagrion microcephalum Rambur, 1842 | May-Dec  | VC |
| 38              | Pseudagrion rubriceps Selys, 1876      | Jul-Nov  | MC |
| Platycnemididae |  |          |    |
| 39              | Copera ciliata Selys, 1863             | May-Sept | VC |
| 40              | Copera marginipes Rambur, 1842         | Aug-Sept | MC |



Fig 4: Images of some Odonates found in Khulna University Campus; A= Agriocnemis Kalinga; B= A. Pygmaea; C= A. lacteola: D= mortonagrion aborense E = M. varali; F= Copera marginipes; G= Pseudagrion microcephalum; H= Ischnura senegalensis: I = Diplacodes trivialis: J = Macrodiplax cora; K= Neurothemis tullia:, L = Crocothemis servilia: M= Ictinogomphus rapax: N= Trithem is pallidnervis: O = Urothemis sigata

#### 5. Conclusion

Odonata is a vital indicator to study aquatic habitat condition. Hence, odonata study in under inventory phase in Bangladesh. We have very little knowledge about their distribution and ecology. Current study is a small contribution of documentation and distribution pattern of odonata of this country.

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