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An attempt to prepare a checklist of Odonata (Dragonflies and Damselflies) in Syangja District of mid-hills Nepal

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Abstract

Odonata are fascinating and widespread insects considered bioindicators of aquatic ecosystems. They are studied extensively worldwide. However, limited research has been conducted in various regions of Nepal on Odonata, and there has been no specific study in the Syangja District. Therefore, this study aimed to create a checklist of Odonata explored from Putalibazar and Waling Municipalities of the Syangja District of mid-hills Nepal. Data was collected through direct observation method; along diverse potential habitats such as water bodies, forests, settlements, and agricultural lands. The study documented a total of 33 species of Odonata from 25 genera and eight families. Among these, 20 species were Anisoptera (dragonflies), and 13 were Zygoptera (damselflies). The family Libellulidae had the maximum species richness (N=18), followed by Coenagrionidae (N=5). The study presented only a preliminary checklist of Odonata in the area, suggesting the need for further exploration of the region to discover more species.

Keywords: Anisoptera, bioindicator, damselfly, dragonfly, insect

1. Introduction

Odonata, an order of insects, comprises three sub-orders: Zygoptera (damselflies), Anisoptera (true dragonflies), and Anisozygoptera (mixed characteristics of dragonflies and damselflies) [1]. They are among the most ancient-winged insects, featuring two pairs of wings and compound eyes [2]. They are usually sighted flying over aquatic bodies (such as lakes, ponds, and streams) and terrestrial areas (like gardens, paddy fields, and forests). Odonata is distributed worldwide (except Antarctica); about 6,407 species of Odonata are recognized so far [3]. South Asian countries host about 588 taxa of Odonata [4], while Nepal hosts about 181 species [5].

The life cycle of Odonata is highly associated with water bodies [6], as their nymph is aquatic, and adult is terrestrial [7]. They are excellent bioindicators of water quality [8, 9], aquatic ecosystems [10, 11], and environmental change as they show a wide range of reactions to environmental stresses [12, 13]. They act as an umbrella species [14, 15] and play the role of both prey and predators in aquatic ecosystems [16, 17]. They are carnivorous and feed many pests in forests and agricultural ecosystems [6].

According to the recent global assessment of Odonata, about 16% out of 6,016 species (accessed) are threatened with extinction [18]. Habitat loss and degradation are major threats to Odonata, which are caused by water pollution, water extraction, eutrophication, acidification, urbanization, and tourism activities [19].

Odonates are extensively studied and explored worldwide [4, 20]. In Nepal's context, the Odonata study was pioneered by Selys and Hagen [21]. Since then, several pieces of research have been conducted focusing on Odonata in different parts of the country. The first checklist of Nepal's Odonata (including 172 species) was published by Vick [22]. The species number is still being revised and added [5, 23-25]. The study of Odonata at a local level is still limited although it is crucial to document local biodiversity for species conservation. No concrete research has been conducted focusing on Odonata in the Syangja District. Hence, this study aimed to prepare a preliminary checklist of Odonata sampled from two municipalities (Putalibazar and Waling) in the district. It will serve as baseline information for further research and conservation of Odonata and other insects in the area.

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2. Materials and Methods

2.1. Study area

The study was performed in Putalibazar Municipality (Latitude: 28.100°N, Longitude: 83.871°E, and area: 146.21 Km²) and Waling Municipality (Latitude: 28.32°N to 27.55°N, Longitude: 83.41°E to 83.50°E, and area: 128.58 Km²) of the Syangja District, mid-hills Nepal (Fig 1). The

study area lies in the sub-tropical region, including forests, water bodies, bare land, agricultural lands, and settlements. The vegetation of the area is dominated by *Casptanopsis indica* (Katus) and *Schima wallichii* (Chilaune). Neupane and Miya [26] have reported 180 species of butterflies from the Putalibazar municipality. The area has potential habitats for Odonata, unexplored, and is suitable for their study.

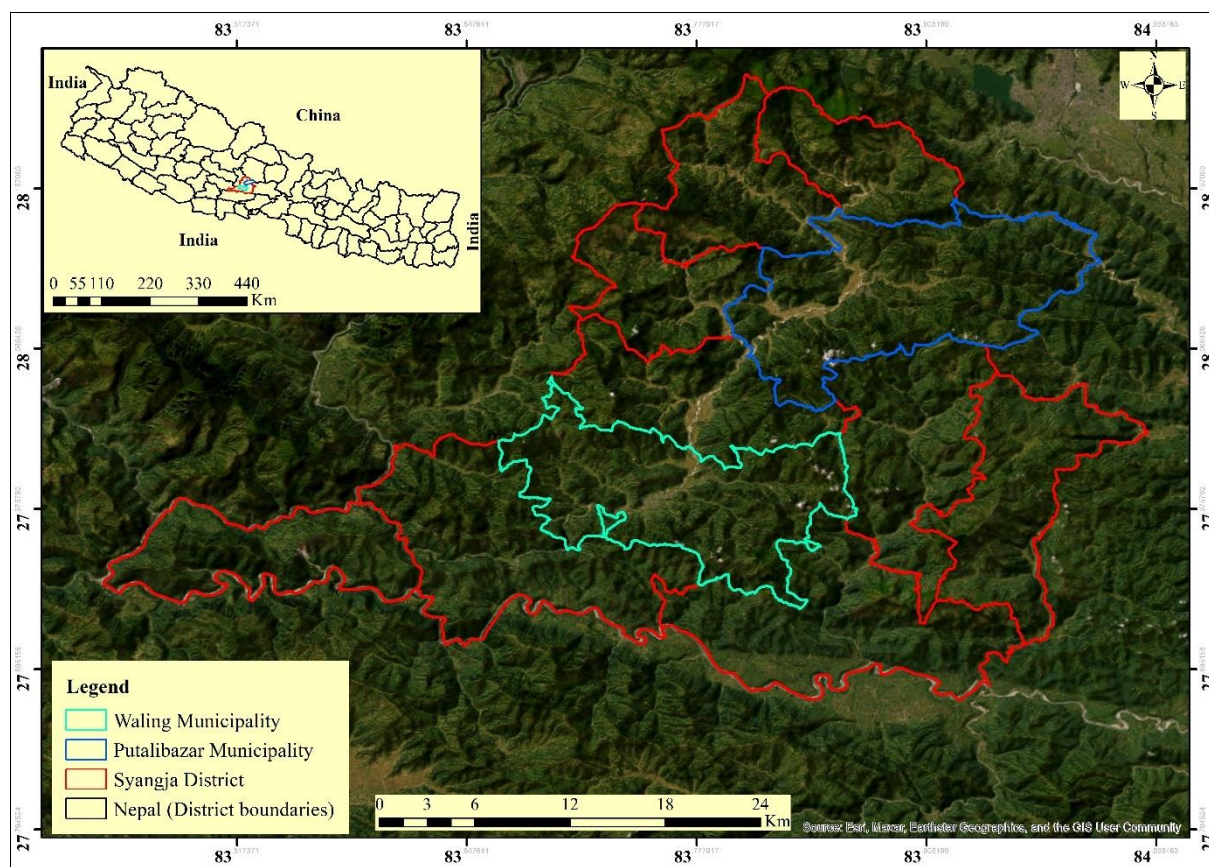


Fig 1: Study area map showing district boundaries of Nepal (top left) and Syangja District with Putalibazar Municipality and Waling Municipality

2.2. Data collection

Odonata was surveyed using the direct observation method (throughout 2021) along various potential habitats such as water bodies, forests, settlements, and agricultural lands [27]. The survey was conducted once a month during sunny days (10:00 am to 3:00 pm), as Odonata are active during the daytime [28, 29]. The species encountered were closely photographed using Smartphones, compared, and identified with the field guides [2, 6, 30] and internet references (<http://odonatanepal.blogspot.com>; <https://www.indianodonata.org>), and compiled to make a checklist. The species were also confirmed with the help of experts. No species were harmed or caught to photograph.

2.3. Data analysis

Data are presented in the tables and graphs. CorelDraw9 was used to create the image plates. The checklist is based on

taxonomy and systematic arrangement [4]. The IUCN status of Odonata was retrieved from the IUCN Red List of Threatened Species [31].

3. Results

The present study documented a total of 33 species of Odonata from 25 genera and eight families from the study area. Among them, 20 species were dragonflies (from two families), while 13 species were damselflies (from six families) (Table 1 and Table 2). Images of all the Odonata are presented in image plates (Images 1-24: Dragonflies and 25-39: Damselflies). The majority of species, comprising 32 in total, are classified under the Least Concern category, while one species, *Lestes umbrinus*, is listed as Data Deficient by the IUCN. The family-Libellulidae represented the maximum number of species (N=18), followed by Coenagrionidae (N=5), and so on (Fig 2).

Table 1: List of dragonflies recorded from Putalibazar and Waling Municipalities of Syangja District

S.N.	Scientific Name	Common Name	Family Name	IUCN Status
1.	<i>Acisoma panorpoides</i> Rambur, 1842	Asian Pintail	Libellulidae	LC
2.	<i>Anisogomphus occipitalis</i> (Selys, 1854)	Sivalik Clubtail	Gomphidae	LC
3.	<i>Brachythemis contaminata</i> (Fabricius, 1793)	Ditch Jewel	Libellulidae	LC
4.	<i>Bradinopyga geminata</i> (Rambur, 1842)	Granite Ghost	Libellulidae	LC
5.	<i>Crocothemis servilia</i> (Drury, 1770)	Scarlet Skimmer	Libellulidae	LC

6.	<i>Diplacodes trivialis</i> (Rambur, 1842)	Blue Ground Skimmer	Libellulidae	LC
7.	<i>Lamelligomphus biforceps</i> (Selys, 1878)	-	Gomphidae	LC
8.	<i>Lyriothemis bivittata</i> (Rambur, 1842)	-	Libellulidae	LC
9.	<i>Neurothemis fulvia</i> (Drury, 1773)	Fulvous Forest Skimmer	Libellulidae	LC
10.	<i>Neurothemis intermedia</i> (Rambur, 1842)	Paddy Field Parasol	Libellulidae	LC
11.	<i>Orthetrum glaucum</i> (Brauer, 1865)	Blue Marsh Hawk	Libellulidae	LC
12.	<i>Orthetrum luzonicum</i> (Brauer, 1868)	Tri- colored Marsh Hawk	Libellulidae	LC
13.	<i>Orthetrum pruinosum neglectum</i> (Burmeister, 1839)	Crimson-tailed Marsh Hawk	Libellulidae	LC
14.	<i>Orthetrum sabina</i> (Drury, 1773)	Green Marsh Hawk	Libellulidae	LC
15.	<i>Orthetrum triangulare</i> (Selys, 1878)	Blue-tailed Forest Hawk	Libellulidae	LC
16.	<i>Palpopleura sexmaculata</i> (Fabricius, 1787)	Blue-tailed Yellow Skimmer	Libellulidae	LC
17.	<i>Pantala flavescens</i> (Fabricius, 1798)	Wandering Glider	Libellulidae	LC
18.	<i>Rhyothemis variegata</i> (Linnaeus, 1763)	Common Picture Wing	Libellulidae	LC
19.	<i>Scalmogomphus bistrigatus</i> (Hagen, 1854)	-	Gomphidae	LC
20.	<i>Trithemis festiva</i> (Rambur, 1842)	Black Stream Glider	Libellulidae	LC

Table 2: List of damselflies recorded from Putalibazar and Waling Municipalities of Syangja

S.N.	Scientific Name	Common Name	Family Name	IUCN status
1.	<i>Aciagrion pallidum</i> Selys, 1891	Pale Slender Dartlet	Coenagrionidae	LC
2.	<i>Anisopleura lestoides</i> Selys, 1853	-	Euphaeidae	LC
3.	<i>Aristocypha quadrimaculata</i> Selys, 1853	Black Emperor	Chlorocyphidae	LC
4.	<i>Aristocypha trifasciata</i> Selys, 1853	Three-banded Emerald Jewel	Chlorocyphidae	LC
5.	<i>Bayadera indica</i> (Selys, 1853)	-	Euphaeidae	LC
6.	<i>Ceriagrion azureum</i> (Selys, 1891)	Azure Marsh Dart	Coenagrionidae	LC
7.	<i>Ceriagrion coromandelianum</i> (Fabricius, 1798)	Coromandel Marsh Dart	Coenagrionidae	LC
8.	<i>Coellicia renifera</i> (Selys, 1886)	-	Platycnemididae	LC
9.	<i>Ischnura forcipata</i> Morton, 1907	Forcipate Dartlet	Coenagrionidae	LC
10.	<i>Ischnura rubilio</i> Selys, 1876	Western Golden Dartlet	Coenagrionidae	LC
11.	<i>Lestes concinnus</i> Hegen, 1862	Brown Spreadwing	Lestidae	DD
12.	<i>Neurobasis chinensis</i> (Linnaeus, 1758)	Stream Glory	Calopterygidae	LC
13.	<i>Vestalis gracilis</i> (Rambur, 1842)	Clear-winged Forest Glory	Calopterygidae	LC

(Abbreviation used: LC = Least Concern, DD= Data Deficient)

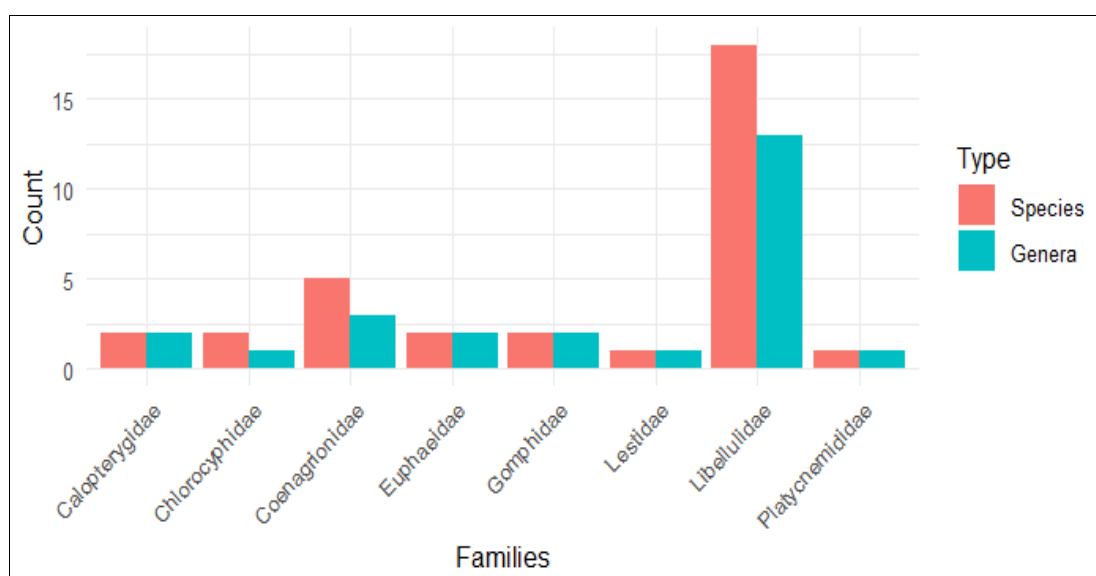


Fig 2: Family-wise composition of Odonata recorded from the study area

4. Discussion

This study provided a list of 33 species of Odonata from the Putalibazar and Waling Municipalities of Syangja. It comprises 18.23% of the total Odonata species (N=181) reported from Nepal [5]. Odonata are well-known bioindicators of freshwater ecosystems [10, 11]. The presence of a diverse Odonata suggests that the water bodies in Putalibazar and Waling Municipalities probably support a healthy aquatic ecosystem. Among the Odonata, Anisoptera comprised more species than Zygoptera. Zygoptera has limited dispersal ability, which might be the reason for the lower species number compared to Anisoptera in the study

area [32]. Zygoptera, with limited dispersal capacity, are more sensitive to habitat fragmentation and may require more connected and contiguous habitats for their viability in the area.

The family - Libellulidae showed the greatest number of species among all the families. The maximum number of species from Libellulidae may be due to their higher dispersal ability [32] as well as tolerance to the wide range of habitats [33]. The wide range of distribution of Libellulidae is also favored by the large and bulky body size [34]. This finding indicates a variety of habitats and microhabitats suitable for Libellulidae and their tolerance and adaptability within the

study area. Our result is similar to Sharma *et al.* [35], who reported Libellulidae as the dominant family (N=28) among 11 families comprising 61 species of Odonata in Western Nepal. Similarly, Sajan and Gurung [24] found Libellulidae to be the dominant family in Dipang Lake, Kaski, where they recorded 17 species of Libellulidae out of the 28 species from six families. Likewise, Miya *et al.* [36] noted 12 species of Libellulidae out of 26 species of Odonata in the Tanahun district. Moreover, our finding supports the findings of other scholars who mentioned Libellulidae as the dominant family in their studies [37-41].

Our research highlights the diverse Odonata from the study area supported by various ecological richness and habitat variety. This study lays the groundwork for future ecological and conservation research in the area. Continuous monitoring of these species can facilitate the identification of changes in ecosystem health and the effects of environmental stressors over time. The study was conducted randomly using the direct observation method, so the abundance of species could not be determined. It only provided a preliminary checklist of the Odonata in the study area therefore, we recommend a systematic and detailed survey.



Fig 1-20: 1 - *Acisoma panorpoides* ♂ © K Neupane | 2 - *Anisogomphus occipitalis* ♂ © K Neupane | 3 - *Brachythemis contaminata* ♂ © MS Miya | 4 - *Bradinopyga geminata* ♀ © MS Miya | 5 - *Crocothemis servilia* ♂ © K Neupane | 6 - *Diplacodes trivialis* ♂ © K Neupane | 7 - *Diplacodes trivialis* ♀ © K Neupane | 8 - *Lamelligomphus biforceps* ♀ © K Neupane | 9 - *Lyriothemis bivittata* ♂ © K Neupane | 10 - *Neurothemis fulvia* ♂ © K Neupane | 11 - *Neurothemis fulvia* ♀ © K Neupane | 12 - *Neurothemis intermedia* ♂ © K Neupane | 13 - *Orthetrum glaucum* ♀ © K Neupane | 14 - *Orthetrum luzonicum* ♀ © K Neupane | 15 - *Orthetrum pruinosum neglectum* ♂ © K Neupane | 16 - *Orthetrum pruinosum neglectum* ♀ © K Neupane | 17 - *Orthetrum sabina* ♂ © K Neupane | 18 - *Orthetrum triangulare* ♂ © K Neupane | 19 - *Palpopleura sexmaculata* ♂ © K Neupane | 20 - *Palpopleura sexmaculata* ♀ © K Neupane



Fig 21-39: 21 - *Pantala flavescens* ♀ © K Neupane | 22 - *Rhyothemis variegata* ♂ © K Neupane | 23 - *Scalmogomphus bistrigatus* ♂ © K Neupane | 24 - *Trithemis festiva* ♂ © K Neupane | 25 - *Aciagrion pallidum* ♀ © K Neupane | 26 - *Anisopleura lestoides* ♂ © K Neupane | 27 - *Anisopleura lestoides* ♀ © K Neupane | 28 - *Aristocypha quadrimaculata* ♂ © K Neupane | 29 - *Aristocypha trifasciata* ♂ © K Neupane | 30 - *Bayadera indica* ♂ © K Neupane | 31 - *Ceriagrion azureum* ♂♀ © K Neupane | 32 - *Ceriagrion coromandelianum* ♂ © K Neupane | 33 - *Coeliccia renifera* ♂ © K Neupane | 34 - *Coeliccia renifera* ♀ © K Neupane | 35 - *Ischnura forcipata* ♂ © K Neupane | 36 - *Ischnura rubilio* ♂ © K Neupane | 37 - *Lestes concinnus* ♂ © K Neupane | 38 - *Neurobasis chinensis* ♀ © K Neupane | 39 - *Vestalis gracilis* ♀ © K Neupane

5. Conclusion

Altogether 33 species of Odonata (including 20 dragonflies and 13 damselflies) were recorded from the study area. Anisoptera comprised more species than Zygoptera. Among all the families, the Libellulidae family comprised the maximum number of species. The present study infers that the Syangja district is rich in Odonata species. A further systematic study is suggested to explore more species in the district.

6. Author contributions

KN and MSM designed the study. KN collected the data. KN, RS, and MSM wrote the draft and finalized the manuscript.

All authors contributed to revising, editing, and approving the manuscript.

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