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COMMUNICATION
ODONATA (INSECTA) DIVERSITY OF KULDIHA WILDLIFE SANCTUARY AND ITS ADJOINING AREAS, ODISHA, EASTERN INDIA

Subrat Debata & Kedar Kumar Swain

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Odonata (Insecta) diversity of Kuldiha Wildlife Sanctuary and its adjoining areas, Odisha, eastern India

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Abstract: A study was carried out to assess the Odonata fauna of Kuldiha Wildlife Sanctuary, Odisha, eastern India from November 2012 to October 2013. During the study a total of 54 species of odonates including 37 species of dragonflies (Anisoptera) and 17 species of damselflies (Zygoptera) were recorded. Among the dragonflies, the family Libellulidae was well represented with 30 species whereas among the damselflies, Coenagrionidae was well represented with seven species. Overall, the odonate fauna of Kuldiha Wildlife Sanctuary accounted for 49.09% of the odonate species known from Odisha and 10.73% of India. Therefore, further long-term studies on these lesser-known insect fauna in Kuldiha Wildlife Sanctuary will be useful in understanding their status over time.

Keywords: Anisoptera, Coenagrionidae, damselflies, dragonflies, Libellulidae, Zygoptera.

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Author Details: SUBRAT DEBATA is a wildlife researcher and naturalist with special interest on small mammals and waterbirds. KEDAR KUMAR SWAIN is presently working as Divisional Forest Officer in Chandaka Wildlife Division, Forest and Environment Department, Government of Odisha.

Author Contribution: Both the authors contributed equally in field work. SD designed and wrote the paper.

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INTRODUCTION

The order Odonata comprising both dragonflies and damselflies are believed to have evolved some 250 million years ago (Subramanian 2005). These aquatic insects being predators in both larval and adult stages are an important and widespread component of freshwater ecosystems (Adarsh et al. 2015) as well as valuable indicators of water quality and landscape disturbance (Watson et al. 1982; Castella 1987; Varghese et al. 2014). Globally around 5,952 species of odonates have been described; of which 503 species have been reported within the geographic limits of India so far (Joshi et al. 2017).

Odisha is one of the eastern coastal states of India and being situated along the amalgamation zone of Chhotanagpur Plateau, Eastern Ghats Highlands, Lower Gangetic Plain and the Eastern Coastal Plain’s biogeographic provinces (Ray 2005), represents a mixture of both Indo-Malayan and Afro-Mediterranean biodiversity elements (Das et al. 2015). Odonata research in Odisha dates back to the early 1900s when Laidlaw (1915) and Fraser & Dover (1922) studied the faunal diversity of Chilika Lake. Afterwards, as part of faunal expeditions, several collections were made from different parts of Odisha and the results of 58 species were documented in the state fauna series (Srivastava & Das 1987). Some of the recent published works from Odisha include: Mitra (2000) who reported 69 species of odonates throughout Odisha; Sethy & Siddiqi (2007) reported 16 species from Simlipal Biosphere Reserve; Das et al. (2010, 2011) reported 31 species from Baripada Forest Division, 26 species from Nandankanan Zoological Park and 58 species within the buffer area of Simlipal Tiger Reserve, respectively; Nair (2011) reported 110 species throughout Odisha and eastern India and 92 species from Simlipal Biosphere Reserve; Debata et al. (2013) reported 55 species from Hądgarh Wildlife Sanctuary; Payra et al. (2014) reported 56 species from Athagarh Forest Division; Sajan & Mohapatra (2014) reported the occurrence of Lesser Blue Wing (Rhyothemis triangularis Kirby, 1889) in Odisha from Kotgarh Wildlife Sanctuary and recently Pandey & Mohapatra (2017) reported 24 species from the Regional Institute of Education campus, Bhubaneswar. The vital information on diversity and distribution of odonates, however, is still missing from different parts of Odisha. Moreover, the increasing biotic pressure, deforestation and disappearance of wetlands are becoming major threats to odonates today. Therefore, documentation of Odonata from different geographic regions and habitats of Odisha is crucial for establishing baseline data for future comparison (Nair 2011). In this study, we summarize our findings of odonate fauna of Kuldiha Wildlife Sanctuary (KWS) in Odisha.

MATERIALS AND METHODS

Study Area

The KWS (Fig. 1) is situated along the tropic zone between 21.333–21.500°N and 86.500–86.750°E covering an area of 272.75km² in northern Odisha region. The landscape is characterized by undulating terrain and altitude ranges between 169–682 m. The climate is seasonal, with summer season between March to
June, monsoon (July–October) and winter (November–February). The area receives an annual average rainfall of 1,460mm from the south-west monsoon and the temperatures range from 8°C in December to 42°C in June. Vegetation is mostly mixed deciduous type (Champion & Seth 1968). There are numerous perennial and seasonal hill streams and water bodies in and around KWS, which are habitats preferred by odonates.

**Methods**

While carrying out a biodiversity survey in KWS from November 2012 to October 2013, odonates were observed along hill streams, water bodies and temporary water logged areas. Whenever a species was encountered, its close up photographs were taken and later identified following the keys provided by Subramanian (2009) and Nair (2011); however, the species with confirmed identification were only taken under consideration for the checklist. The taxonomy and nomenclature of all the identified species followed Subramanian (2014). Based on the encounter rate of different species, we categorized them into five different groups such as very common (species encountered during 81–100 % of the survey days), common (61–80 %), occasional (41–60 %), rare (20–41 %) and very rare (less than 20%). To understand the significant difference in species richness between different months and seasons, a Chi-square test ($\chi^2$) was performed.

**RESULTS AND DISCUSSION**

During the survey, 54 species of odonates (Images 1–53) including 37 species of Anisoptera (dragonflies) and 17 species of Zygoptera (damselflies) were recorded from KWS (Table 1). In Anisoptera, the family Libellulidae was well represented by 31 species followed by Aeshnidae and Gomphidae (3 species each). Likewise, in Zygoptera Coenagrionidae was dominated by seven species followed by Calopterygidae and Protonuridae (3 species each), Chlorocyphidae (2 species), and Platycnemididae and Lestidae with a single species each (Fig. 2). Our observations on family wise species richness are more or less similar with the earlier studies from different protected areas of Odisha (Sethy & Siddiqi 2007; Das et al. 2011; Nair 2011; Debata et al. 2013) and elsewhere in India (Varghese et al. 2014; Adarsh et al. 2015).

During the study period, a maximum of 51 species were encountered during the months of April and a minimum of 12 species during the month of January (Fig. 3) and the observed species richness varied significantly between the months ($\chi^2 = 80.49, df = 11, p < 0.05$). Similarly during seasonal analysis, a maximum of 51 species were recorded during summer and a minimum of 16 during monsoon (Fig. 3) and it also varied significantly between the seasons ($\chi^2 = 18.76, df = 2, p < 0.05$). In terms of species encounter rate, a majority of 16 species were found to be occasional followed by 15 species as very common, 13 species as common, nine species as rare and one species as very rare (Table 1; Fig. 4). Species like *Ictinogomphus rapex* and *Paragomphus lineatus* were more commonly sighted inside the sanctuary indicating unpolluted water sources and good habitat quality where as *Brachythemis contaminata* was frequently sighted at the peripheral zones indicating presence of polluted water within anthropogenic habitats (Nair 2011). Referring to IUCN Red List classification, 45 species from our study area are classified under Least Concern and one species under Data Deficient categories (Table 1). The rest of the species have not yet been assessed.
Table 1. Checklist of odonates recorded in Kuldiha Wildlife Sanctuary, Odisha during November 2012 to October 2013

| Sub Order / Family / Scientific name | Common name | Image number | Season | Abundance | IUCN status |
|--------------------------------------|-------------|--------------|--------|-----------|-------------|
| **Sub Order: Anisoptera (Dragonflies)** |
| **Family: Aeshnidae (Darners)** |
| 1. Anax guttatus (Burmeister, 1839) | Blue-tailed Green Darter | 1 | S, M | O | LC |
| 2. Gomphus belladona Selys, 1873 | Parakeet Darter | 2 | S, M | R | LC |
| 3. Gomphus flavescens (Rambur, 1842) | Brown Darter | 3 | M | C | DD |
| **Family: Gomphidae (Clubtails)** |
| 4. Ictinogomphus rapax (Rambur, 1842) | Common Club Tail | 4 | S, M, W | C | NA |
| 5. Macrogomphus annulatus (Selys, 1854) | Deccan Bow Tail | 5 | S, M | R | NA |
| 6. Paragomphus lineatus (Selys, 1850) | Common hook Tail | 6 | S, M | O | LC |
| **Family: Libellulidae (Skimmers)** |
| 7. Acisoma panorpoides (Rambur, 1842) | Trumpet Tail | 7 | S, M | C | LC |
| 8. Brachydiplax sobrina (Rambur, 1842) | Little Blue Marsh Hawk | 8 | S, M | VC | LC |
| 9. Brachythemis contaminata (Fabricius, 1793) | Ditch Jewel | 9 | S, M, W | VC | LC |
| 10. Bradynysyga geminate (Rambur, 1842) | Granite Ghost | 10 | S, M, W | C | NA |
| 11. Crocophtheis servilia (Drury, 1770) | Ruddy Marsh Skimmer | 11 | S, M, W | O | LC |
| 12. Diplacodes nebulosa (Fabricius, 1793) | Black-tipped ground Skimmer | 12 | S, M | O | LC |
| 13. Diplacodes trivialis (Rambur, 1842) | Ground Skimmer | 13 | S, M, W | VC | NA |
| 14. Lathrecista asiatica (Fabricius, 1798) | Asian Bloodtail | 14 | S | R | LC |
| 15. Neurothemis fulvia (Drury, 1773) | Fulvous Forest Skimmer | 15 | S, M | VC | LC |
| 16. Neurothemis intermedia (Rambur, 1842) | Ruddy Meadow Skimmer | 16 | S, M, W | O | LC |
| 17. Neurothemis tullia (Drury, 1773) | Pied Paddy Skimmer | 17 | S, M, W | R | LC |
| 18. Orthetrum glaucum (Brauer, 1865) | Blue Marsh Hawk | 18 | S | R | NA |
| 19. Orthetrum luzonicum (Brauer, 1868) | Tricoloured Marsh Hawk | 19 | S | R | LC |
| 20. Orthetrum prunorum (Burmeister, 1839) | Crimson Tailed Marsh Hawk | 20 | S, M, W | VC | LC |
| 21. Orthetrum sabina (Drury, 1770) | Green Marsh Hawk | 21 | S, M, W | VC | LC |
| 22. Orthetrum taeniolatum (Schneider, 1845) | Taeniolata Marsh Hawk | 22 | S | VC | LC |
| 23. Orthetrum triangulare (Selys, 1878) | Blue tailed forest Hawk | 23 | S, M | O | LC |
| 24. Polioppeura sexmaculata (Fabricius, 1787) | Blue Tailed Yellow Skimmer | 24 | S | O | LC |
| 25. Pantala flavescens (Fabricius, 1798) | Wandering Glider | 25 | S, M, W | VC | LC |
| 26. Pantomarca congner (Rambur, 1842) | Yellow-tailed Ashy Skimmer | 26 | S, M | C | LC |
| 27. Rhodochromis rufa (Rambur, 1842) | Rufous Marsh Glider | 27 | S, M, W | O | LC |
| 28. Rhythemis vaniegata (Linnaeus, 1763) | Common Picture Wing | 28 | S, M, W | VC | LC |
| 29. Tetrathemis platyptera Selys, 1878 | Pygmy Skimmer | 29 | S, M | R | LC |
| 30. Thalismis tillarga (Fabricius, 1798) | Coral-tailed Cloud Wing | 30 | S, M | VR | LC |
| 31. Tramea basilaris (Palisot de Beauvois, 1805) | Red Marsh Trotter | 31 | M | O | LC |
| 32. Tramea limbatia (Desjardins, 1832) | Black Marsh Trotter | 32 | S, M | C | LC |
| 33. Trithemis aurora (Burmeister, 1839) | Crimson Marsh Glider | 33 | S, M, W | C | LC |
| 34. Trithemis festiva (Rambur, 1842) | Black Stream Glider | 34 | S, M | VC | LC |
| 35. Trithemis pallidinervis (Kirby, 1889) | Long-legged Marsh Glider | 35 | S, M | C | LC |
| 36. Urothorix signata (Rambur, 1842) | Greater Crimson Glider | 36 | S, M | O | LC |
| 37. Zyxomma petiolatum (Rambur, 1842) | Brown Dusk Hawk | 37 | S, M | VC | LC |

**Sub Order: Zygoptera (Damsselflies)** |

| Sub Order: Zygoptera (Damsselflies) |
|--------------------------------------|
| 38. Neurobasis chinensis (Linnaeus, 1758) | Stream Glory | 38 | S, M | O | LC |
| 39. Vestalis apicola Selys, 1873 | Black-tipped Forest Glory | 39 | S, M | O | NA |
| 40. Vestalis gracilo (Rambur, 1842) | Clear-winged Forest Glory | 40 | S | C | LC |
| **Family: Chlorocyphidae (Stream Jewels)** |
| 41. Libellula lineata (Burmeister, 1839) | River Helider | 41 | S | R | LC |
| 42. Rhinocypha bisignata Hagen in Selys, 1853 | Stream Ruby | 42 | S, M | C | LC |
### Odonates of Kuldiha Wildlife Sanctuary

**Debata & Swain**

#### Sub Order / Family / Scientific name

| Image number | Season | Abundance | IUCN status |
|---------------|--------|-----------|-------------|
| **Family: Coenagrionidae (Marsh Darts)** |
| 43. | Agriocnemis lecteola Selys, 1877 | Milky Dartlet | 42 | S, M | VC | NA |
| 44. | Agriocnemis pygmaea (Rambur, 1842) | Pygmy Dartlet | 43 | S, M, W | VC | LC |
| 45. | Amphaiagluma parvum (Selys, 1876) | Azure Dartlet | 44 | S | O | LC |
| 46. | Ceriagrion coromandelium (Fabricius, 1798) | Coromandal Marshdart | 45 | S, M, W | VC | NA |
| 47. | Ischnura aurora (Brauer, 1865) | Golden Dartlet | 46 | S, M, W | C | LC |
| 48. | Pseudagrion decorum (Rambur, 1842) | Three lined Dart | 47 | S | R | LC |
| 49. | Pseudagrion rubriceps Selys, 1876 | Saffron Faced Blue Dart | 48 | S | C | LC |
| **Family: Lestidae (Spread Wings)** |
| 50. | Lestes viridulus Rambur, 1842 | Emerald Striped Spreadwing | 49 | M | O | LC |
| **Family: Platycnemididae (Bush Darts)** |
| 51. | Copera vittata Selys, 1863 | Blue Bush Dart | 50 | S, M | O | LC |
| **Family: Protoneuridae (Bamboo Tails)** |
| 52. | Cacconeura ramburi (Fraser, 1922) | Coorg Bambootail | 51 | S | M | VC | DD |
| 53. | Disparoneura quadrimaculata (Rambur, 1842) | Black-winged Bambootail | 52 | S, M | O | LC |
| 54. | Prodasineura verticalis (Selys, 1860) | Black Bambootail | 53 | S, M | C | LC |

S - Summer; M - Monsoon; W - Winter; VC - Very Common; C - Common; O - Occasional; R - Rare; VR - Very Rare; LC - Least Concern; DD - Data Deficient; NT - Near Threatened; NA - Not Assessed

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**Figure 4.** Observed encountered rate of different Odonata species in Kuldiha Wildlife Sanctuary, Odisha from November 2012 to October 2013

Although KWS represents around 0.17 % of the total geographic area and 3.31 % of the total protected areas network of Odisha, it contributes around 49.09 % of the Odonata species richness of the state and 10.73 % of India. Yet, the present study gives a preliminary observation on Odonata fauna of KWS as part of multi taxa inventory. Therefore, more detailed and targeted long term studies on these lesser-known insect fauna will be useful in understanding their status and monitoring the change over time in the study area.
Image 13. *Diplocodes trivialis* Female

Image 14. *Lathrecista asiatica* Female

Image 15. *Neurothemis fulvia* Male

Image 16. *Neurothemis intermedia* Female

Image 17. *Neurothemis tullia* Male

Image 18. *Orthetrum glaucum* Male

Image 19. *Orthetrum luzonicum* Male

Image 20. *Orthetrum pruinosum* Mating

Image 21. *Orthetrum sabina* Male

Image 22. *Orthetrum toeniolatum* Male

Image 23. *Orthetrum triangulare* Male

Image 24. *Palpopleura sexmaculata* Male
Odonates of Kuldiha Wildlife Sanctuary

Image 25. *Pantala flavescens* Male

Image 26. *Potamarcha congener* Male

Image 27. *Rhodothemis rufa* Male

Image 28. *Rhyothemis variegata* Male

Image 29. *Tetraphemis platyptera*

Image 30. *Tholymis tillarga* Male

Image 31. *Tramea basiliris* Male

Image 32. *Tramea limbata*

Image 33. *Trithemis aurora* Male

Image 34. *Trithemis festiva* Male

Image 35. *Trithemis pallidinervis* Male

Image 36. *Urothemis signata* Male
Odonates of Kuldiha Wildlife Sanctuary

Debata & Swain

Image 49. Lestes viridulus Male

Image 50. Copera vittata Male

Image 52. Disparoneura quadrivinculata Male

Image 53. Prodasineura verticalis Male

Image 51. Caconeura ramburi Mating

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Odonata (Insecta) diversity of Kuldia Wildlife Sanctuary and its adjoining areas, Odisha, eastern India
-- Subrat Debata & Kedar Kumar Swain, Pp. 12969–12978

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-- Pedro Nacib Jorge-Neto, Cristiane Schilbich Pizzutto, Gedienson Ribeiro de Araujo, Thyara de Deco-Souza, Leanes Cruz da Silva, Jorge Aparecido Salomão Jr. & Hernan Baldassare, Pp. 12933–12939

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-- Subrat Debata & Kedar Kumar Swain, Pp. 12969–12978

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**Notes**

The identification of Takin *Budorcas taxicolor* (Mammalia: Bovidae) through dorsal guard hair
-- Manokaran Kamalakannan, Pp. 13014–13016

Photographic evidence of Striped Hyena *Hyaena hyaena* (Mammalia: Carnivora: Hyaenidae) in Ramnagar forest division, Uttarakhand, India
-- VIPul Maurya, Jai Pratap Singh, Khalikashan Naseem, Surender Mehra, Parag M. Dhakate, Neha Verma & A.G. Ansari, Pp. 13017–13019

Range extension of the Least Leaf-nosed Bat *Hipposideros cinereus* Blyth, 1853 (Mammalia: Chiroptera: Hipposideridae): to central India
-- M. Kamalakannan, C. Venkatraman, Tauseef Hamid Dar & Kailash Chandra, Pp. 13020–13023

A report on the possible interbreeding between Grizzled Giant Squirrel *Ratufa macroura* and Indian Giant Squirrel *Ratufa indica* from Chinnar Wildlife Sanctuary in the southern Western Ghats, India
-- Kiran Thomas, D.K. Vinodkumar, Jomsals Mathews John, M. Shaji & P.O. Nameer, Pp. 13024–13028

*Ischnura fontaineae* (Insecta: Odonata: Zygoptera) in Oman, eastern Arabia
-- Elaine Mary Cowan & Peter John Cowan, Pp. 13029–13031

First report of *Leptogenys hysterica* Forel, 1900 (Hymenoptera: Formicidae: Ponerinae) from Pakistan
-- Muhammad Tariq Rasheed, Imran Bodlah, Aamna Gull e Fareen & Xiaolei Huang, Pp. 13032–13036

First report of darkling beetle *Blaps orientalis* Solier, 1848 (Coleoptera: Tenebrionidae) from India
-- V.D. Hegde, D. Vasanthakumar & S.V. Manthen, Pp. 13037–13038

Notes on the occurrence of orchids *Bulbophyllum medioximum*, *Herminium edgeworthii* and *H. macrophyllum* (Orchidaceae) in Arunachal Pradesh, India
-- Krishna Chowlu, Avishek Bhattacharjee & Pankaj Kumar, Pp. 13039–13043

Lectotypification of two names in the genus *Gymnostachyum* (Acanthaceae)
-- M.C. Shameer & V.K. Sreenivas, Pp. 13044–13045

**Miscellaneous**

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