International Journal of Ecology and Environmental Sciences 43 (2): 73-79, 2017
ISSN: 2320-5199 (Online)

Diversity of Odonate Fauna in Surajpur Lake: An Urban Wetland of Upper Gangetic Plain, Northern India

NASIM AHMAD ANSARI

Wildlife Institute of India, Post Box # 18 Chandrabani, Dehradun, Uttarakhand, India.
Email: dr.ansari.nasim@gmail.com

ABSTRACT

Surajpur Lake is a prominent urban wetland site in Upper Gangetic Plain, Northern India known for its rich avifaunal and other aquatic biodiversity. Present study was carried out to assess the odonate diversity from March 2010 to February 2013 by applying standard survey techniques. During the study period, a total of 36 species belonging to 29 genera and 5 families of odonate fauna were recorded. Dragonflies (Anisoptera) were represented by 25 species and damselflies (Zygoptera) by 11 species. Libellulidae was the dominant family among the dragonflies and Coenagrionidae among the damselflies. The relative abundance of odonates includes 14 species as common, 11 as very common, 7 were occasional, 3 were rare and one was very rare out of 36 species. The diversity of odonate fauna discussed in the light of results hitherto unreported.

Key Words: Dragonflies, Damselflies, Inventory, Surajpur Wetland

INTRODUCTION

Dragonflies and damselflies, collectively called odonates, are one of the most fascinating group of insects commonly flying over forest, fields, meadows, ponds and rivers (Subramanian 2005) and widely distributed in tropical and temperate freshwater ecosystems (Corbet 1999). Odonates are integral part of wetland ecosystems and are reliable indicators of its health (Subramanian 2009, Clark and Samways 1996). Odonates are good indicators of environmental changes as they are sensitive to changes in the habitats, atmospheric temperature and the weather conditions (Tiple et al. 2008). Being efficient predators both during their adult and larval stages, odonates play crucial role in controlling pest population and ecosystem functioning by keeping other insects including those harmful to humans (like mosquitoes, blood-sucking flies, etc.) under control (Nair 2011). Odonates are amongst the most attractive and ancient creatures on earth, the first to have conquered the aerial domain, yet we know very little of their diversity in India, indeed most of the species are yet to be described (Subramanian 2009). Wetlands are referred as "biological supermarkets" because they support all life forms through extensive food webs and biodiversity (Mitsch and Gosselink 1989). The Upper Gangetic Plains are scattered with several natural fresh water wetlands has the highest human density in India of 800-1200 people per km^2, which has thus resulted in high human impact on natural ecosystems. Surajpur Lake is one such wetland in urban surrounding in Upper Gangetic Plain. Through the ages, urban wetlands have been the lifeline of most cities in India. They provide multiple values for suburban and city dwellers (Castelle et al. 1994). Over the years, they have gradually depleted, leading to a number of problems in urban areas such as flooding, water scarcity and water logging.

Globally 5,952 species of odonates have been reported; of which 474 species belonging to 18 families i.e., 8% of the world's known species, are known from India (Subramanian 2014) and 164 species belong to Northern India (Sharma and Choudhary 2011). Odonata diversity is quite well known from the Central, Eastern and Southern India (Das et al. 2013, Dawn and Chandra

2014, Saha and Gaikwad 2015, Bharamal et al. 2014, Nair 2011, Boruah et al. 2015, Baruah and Saikia 2015, Adarsh et al. 2014) and very few studies from Northern India (Dayakrishna and Arya 2015, Singh and Banyal 2013, Kanaujia et al. 2015) is available. Although some studies have been done in the wild wetland habitats, but no such study on wetland surrounded by urban environment in the Northern India is available. In context of this, the study was conducted to explore the diversity of odonate fauna at Surajpur wetland in urban surrounding hitherto unreported.

MATERIALS AND METHODS

Study Area

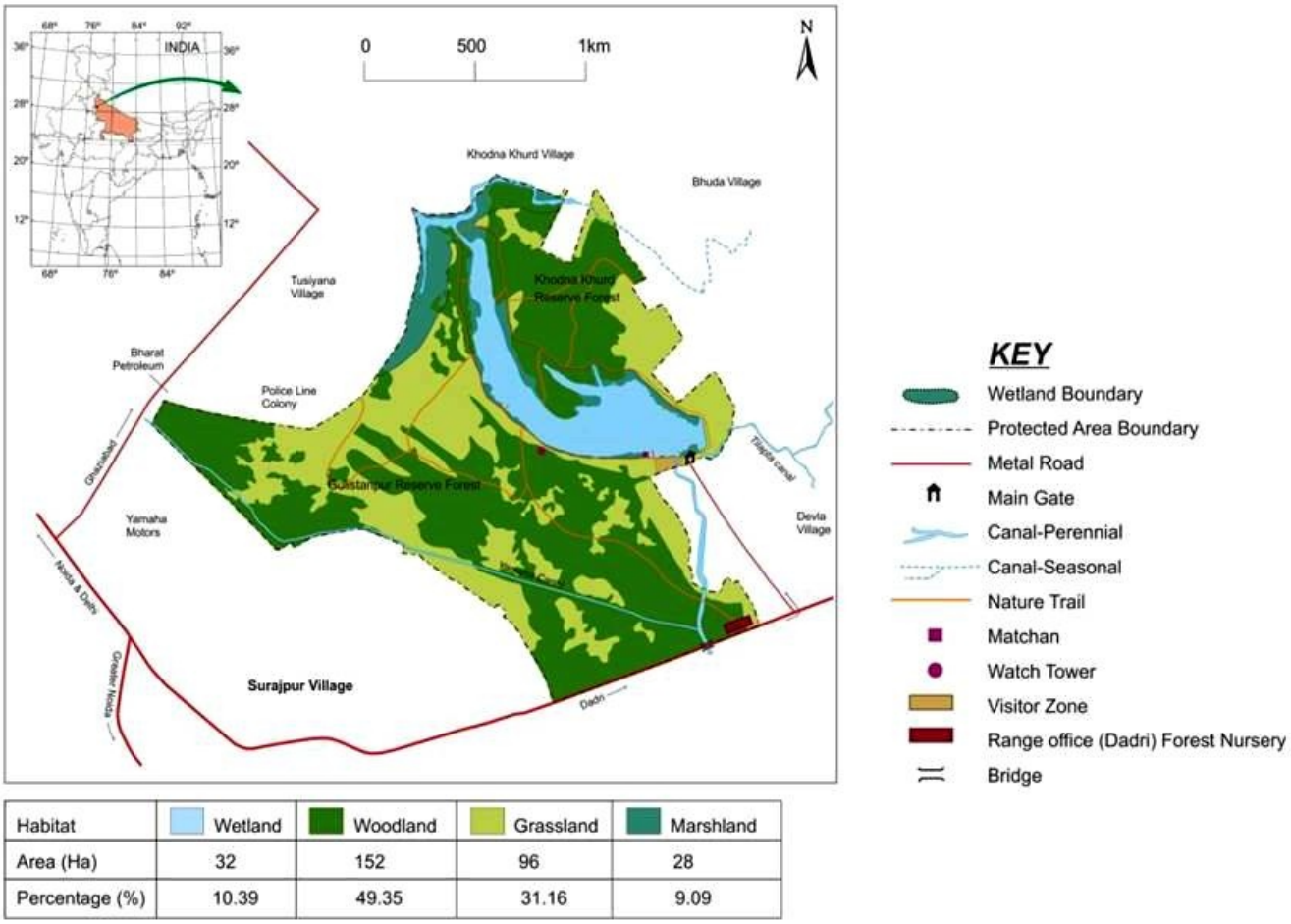
Surajpur Lake (28°31'425'N; 77°29'714'E) is an urban wetland located in district Gautam Budh Nagar, Uttar Pradesh falls under Upper Gangetic Plains biogeographic zone, Northern India, at an elevation of 184.7m above mean sea level (Figure 1). The landscape is characterized by fine alluvium and clay rich swamps, fertile soil and high water retention capacity (Manral et al. 2013). Surajpur Lake has been protected under Reserve Forest and spreads over an area of 308 hectare. The area is mainly rain-fed and other sources for water recharge are Hawaliya drain which is attached to Hindon River and Tilapta irrigation canal. The minimum and maximum temperatures ranged between 6.86C and 41.69C, and highest temperature was observed during June and the lowest during January.

Methods

The present study was carried for the period of three years from March 2010 to February 2013 to explore the odonate diversity of Surajpur Lake. Data was collected in terrestrial and aquatic habitats of Surajpur Lake. The terrestrial habitat includes woodland (dominated with trees) and grassland (dominated with grasses) habitats, whereas aquatic habitat includes wetland and marshland habitats (Ansari 2015) (Figure 1). A total of 108 hours during 36 surveys were made with an average of 3 hours survey per month for 3 years were made by direct search technique (Sutherland 1996) between 10:00-16:00 h, because being ectotherms that is their peak time of activity in the study area (Das et al. 2013). Opportunistic sightings were also recorded. Odonates were identified directly in the field when sitting or were caught and brought to a laboratory to be later identified by taxonomists and referring to standard odonate taxonomic identification manuals such as, Fraser (1933-36); Subramanian (2009) and Nair (2011). The classification scheme follows Schorr et al. (2006). Family and species level classification follows Prasad and Varshney (1995). A Panasonic DMC FZ35 digital camera with close up mode was used to photograph the individual species, but we also used a dragonfly net to collect samples, which minimized the risk of erroneous identification (Das et al. 2013). The photographic records of all reported species were maintained and were submitted to WWF India. The abundance was determined by the number of individuals encountered during visual surveys along transects (Baruah and Saikia 2015). The odonate species were categorized into five relative abundance categories such as very common (VC), those which are sighted during 80-100% of the field days, common (C) (60-79%), occasional (O), (60-59%) and rare (R), (20-39%) and very rare (VR) for those that was sighted only less than 19% of the field days (Adarsh et al. 2014).

RESULTS AND DISCUSSION

During this survey we found 36 odonate species belonging to 29 general and 5 families (Table 1), representing over 7 percent of the Indian odonate fauna. Among the recorded species, dragonflies (Anisoptera) were represented by 25 species and damselflies (Zygoptera) by 11 species. among the dragonflies, Libellulidae was the dominant family represented by 20 species followed by Aeshnidae (3 species) and Gomphidae (2 species). Among damselflies, Coenagrionidae was the dominant family (10 species) followed by Platycnemididae (1 species). The relative abundance analysis showed that 14 species out of 36 were common, 11 were very common, 7 were occasional, 3 were rare and one was very rare. Among Anisoptera *Acisoma panorpoides* Rambur,1842, *Brachydiplax sobrina* (Rambur, 1842), *Brachythemis contaminata* (Fabricius, 1793), *Crocothemis servilia* (Drury, 1770), *Neurothemis tullia* (Drury, 1773), *Pantala flavescens* (Fabricius, 1798), *Rhyothemis variegata* (Linnaeus, 1763) and *Trithemis aurora* (Burmeister, 1839) were the most common species and among Zygoptera *Ceriagrion coromandelianum* (Fabricius, 1798), *Ischnura senegalensis* (Rambur, 1842) and *Pseudagrion decorum* (Rambur, 1842) were the most common species (Table 1). The photographic records of the most common species are presented in



Habitat	Wetland	Woodland	Grassland	Marshland
Area (Ha)	32	152	96	28
Percentage (%)	10.39	49.35	31.16	9.09

Figure 1. Map of the study area showing terrestrial and aquatic habitats

Figure 2 (A-L). Dragonflies were seen mostly in woodland and grassland habitats whereas damselflies were mostly recorded in marshland and wetland habitats. Each odonate species represents specific micro-habitat in various habitats types of the study area. Hook-tail and Club-tail belong to Gomphidae family found mostly in grasslands near the lake; Darners belong to Aeshnidae family found mostly in herbs and grasses near the lake, Skimmers, Trotters and Gliders belong to Libellulidae can be seen in all sorts of habitats of terrestrial and aquatic; Darts and Dartlets belong to Coenagrionidae mostly found in grassland and wetland periphery, Bush-Dart belong to Platycnemididae can be easily seen in rocky edges of the lake (Table 1). Fortunately, none of these species is threatened and all fall under 'Least Concern' of 'Low Risk Category' of IUCN Red List (IUCN 2015).

The present communication highlights the first significant record of odonates in Surajpur Lake surrounded by urban area in the district Gautam Budh Nagar, Upper Gangetic Plain region and also in the periphery of Delhi National Capital Region and thus, emphasizes the importance of this Lake in biodiversity conservation. The present study observed 36 odonate species, which is a significant increase to earlier studies done in Northern India. Dayakrishna and Arya (2015) reported 19 species from Corbett Tiger Reserve, Uttarakhand; Singh and Banyal (2013) documented 10 species from Khajjiar Lake, Himachal Pradesh and Kanaujia et al. (2015) documented 18 species from Nawabganj Bird Sanctuary, Uttar Pradesh, in Northern India. Odonate species *Acisoma panorpoides, Brachydiplax sobrina*, *Brachythemis contaminata*, *Crocothemis servilia*, *Neurothemis tullia*, *Pantala flavescens*, *Rhyothemis variegata* and *Trithemis aurora* belonging to family Libellulidae were the most common species in Anisoptera and *Ceriagrion coromandelianum*, *Ischnura senegalensis*, *Pseudagrion decorum* belonging to family

Table 1. List of odonates (Order Odonata) recorded in Surajpur wetland

Scientific Name and Family	Common Name	Abundance	Habitat Type
Sub-order: Anisoptera (Dragonflies)			
Family: Gomphidae			
Ictinogomphus rapax Rambur, 1842	Common Club-Tail	Common	Grassland near the lake
Paragomphus lineatus (Selys, 1850)	Common Hooktail	Occasional	Grassland near the lake
Family: Aeshnidae			
Anaciaeschna jaspidea (Burmeister,1839)	Rusty Darner	Common	Grasses in the edge of the lake
Anax guttatus (Burmeister, 1839)	Blue–tailed Green Darner	Common	Wet herbs and grasses in the lake
Anax immaculifrons Rambur, 1842	Blue Darner	Common	Dry herbs and grasses in the edge of the lake
Family: Libellulidae			
Acisoma panorpoides Rambur, 1842	Trumpet Tail	Very common	Grasses and rocky beds in the dried lake
Brachydiplax sobrina (Rambur, 1842)	Little Blue Marsh Hawk	Very common	Herbs and grasses in the edge of the lake
*Brachythemis contaminata (*Fabricius, 1793)	Ditch Jewel	Very common	Dry herbs and grasses in the edge of the lake
Bradinopyga geminata (Rambur,1842)	Granite Ghost	Occasional	Rocky edges of the lake
Crocothemis servilia (Drury, 1770)	Ruddy Marsh Skimmer	Very common	Herbs, grasses and rocky beds in the dry lake
Diplacodes trivialis (Rambur, 1842)	Ground Skimmer	Common	Grasses in the dried lake
Lathrecista asiatica (Fabricius, 1798)	Asiatic Blood tail	Rare	Dry twigs in the woodland
Neurothemis intermedia Rambur, 1842	Ruddy Meadow Skimmer	Common	Rocky edges of the lake
Neurothemis tullia (Drury, 1773)	Pied paddy Skimmer	Very common	Grasses in the grassland
Orthetrum sabina (Drury, 1770)	Green marsh hawk	Common	Dry twigs of grasses in the grassland
Palpopleura sexmaculata (Fabricius, 1787)	Blue-tailed Yellow Skimmer	Common	Dry twigs of grasses in the edge of the lake
Pantala flavescens (Fabricius, 1798)	Wandering Glider	Very common	Dry twigs of grassess in the grassland
Rhyothemis variegata Linnaeus, 1763	Common Picturewing	Very common	Dry twigs in the woodland
Tetrathemis platyptera Selys, 1878	Pigmy Skimmer	Rare	Dry twigs in the edge of the lake
Tholymis tillarga (Fabricius, 1798)	Coral-tailed Cloud Wings	Rare	Dry twigs in the woodland and grassland
Tramea basilaris Kirby,1889	Red Marsh Trotter	Occasional	Exposed twigs in the edge of the lake
Tramea limbata (Rambur,1842)	Black Marsh Trotter	Occasional	Exposed twigs in the edge of the lake
Trithemis aurora (Burmeister, 1839)	Crimson Marsh Glider	Very common	Dry twigs in the grassland
Trithemis pallidinervis Selys,1889	Long-Legged Marsh Glider	Common	Grasses in the edge of the lake
Urothemis signata (Rambur, 1842)	Greater Crimson Glider	Common	Dry twigs in the woodland
Sub-order: Zygoptera (Damselflies)			
Family: Coenagrionidae			
Aciagrion occidentale Laidlaw, 1919	Green-striped Slender Dartlet	Occasional	Herbs and grasses in the edge of the lake
Agriocnemis pygmaea Rambur, 1842	Pigmy Dartlet	Common	Herbs and grasses in the edge of the lake
Ceriagrion coromandelianum (Fabricius, 1798)	Coromandel Marsh Dart	Very common	Herbs and grasses in the edge of the lake
Ceriagrion cerinorubellum (Brauer, 1865)	Orange-Tailed Marsh Dart	Common	Herbs and grasses in the edge of the lake
Enallagma parvum Selys, 1876	Azure Dartlet	Occasional	Grassland near the lake
Ischnura aurora (Brauer, 1865)	Golden Dartless	Common	Grassland near the lake
Ischnura senegalensis (Rambur, 1842)	Senegal Golden Dartlet	Very common	Wet herbs and grasses in the lake
Pseudagrion decorum (Rambur, 1842)	Three-Lined Dart	Very common	Wet herbs and grasses in the lake
Pseudagrion microcephalum (Rambur, 1842)	Blue Grass Dartlet	Occasional	Grassland near the lake
Rhodischnura nursei Morton,1907	Pixie Dartlet	Very rare	Grasses in the dried lake
Family: Platycnemididae			
Copera marginipes (Rambur, 1842)	Yellow Bush-Dart	Common	Rocky edges of the lake

A. Common Picture-wing
(Female) *Rhyothemis variegate*

B. Common Picture-wing
(Male) *Rhyothemis variegate*

C. Coromandel Marsh Dart
Ceriagrion coromandelianum

D. Ditch Jewel
Brachythemis contaminata

E. Little Blue Marsh Hawk
Brachydiplax sobrina

F. Orange-Tailed Marsh Dart
Ceriagrion cerinorubellum

G. Pied Paddy Skimmer
Neurothemis tullia

H. Rusty Darner
Anaciaeschna jaspidea

I. Senegal Golden Dartlet
Ischnura senegalensis

J. Three-Lined Dart
Pseudagrion decorum

K. Trumpet Tail
(Female) *Acisoma panorpoides*

L. Trumpet Tail
(Male) *Acisoma panorpoides*

Figure 2 (A-L). Odonates recorded from Surajpur Lake

Coenagrionidae were the most common in Zygoptera in the study area. Family Libellulidae and Coenagrionidae were the most common, numerous, abundant and speciose families in the study area are also reported by several authors (Emiliyamma et al. 2005, Das et al. 2013, Adarsh et al. 2014, Calvao et al. 2014, Dawn and Chandra 2014, Boruah et al. 2015, Kanaujia et al. 2015, Saha and Gaikwad 2015). Libellulidae was the most speciose family, possibly due to high dispersal and thermo-regulatory abilities (Corbet 1999, May 1979). Coenagrionidae was the most abundant family, probably due to endophytic oviposition and climbing behavior of larvae (Fulan and Henry 2007). The water present in the study site is perennial in nature and covered with floating macrophytes, providing a habitat for various types of dragonflies and damselflies in the area (Saha and Gaikwad 2015).

Surajpur wetland area is very important to biodiversity conservation as it provides an opportunity to conserve and preserve the native flora, fauna and biodiversity amidst a densely populated urban area without hindering the development of social and economical structures (Bura et al. 2013). The urban and industrial development across the Greater Noida city which is resulting in habitat destruction of odonates is a matter of great concern. This small piece of marshy land with stagnant water has a very rich diversity of odonates creating a small biodiversity hotspot. This area should therefore be conserved and kept pollution free across the city limits as they support a good congregation of aquatic/semi aquatic insects. Further investigations are necessary for utilizing this group of insect as indicator species for the management of various habitats in the study area.

ACKNOWLEDGEMENTS

I would like to thank Uttar Pradesh Forest Department for granting the permission to carry out this study. I also express our sincere gratitude to World Wide Fund for Nature-India for supporting the study and the anonymous referees for reviewing the manuscript.

REFERENCES

Adarsh, C.K.; Aneesh, K.S. and Nameer, P.O. 2014. A preliminary checklist of odonates in Kerala Agricultural University (KAU) campus, Thrissur District, Kerala, southern India. Journal of Threatened Taxa 6(8): 6127–6137. doi: http://dx.doi.org/10.11609/jott.o3491.6127-37

Ansari, N.A. 2015. A Study on Bird Communities and its Relationship with Habitat Structure in Surajpur Wetland, Uttar Pradesh, India. Ph.D. Thesis, Department of Forestry and Environmental Sciences, Kumaun University, Uttarakhand, India. 288 pages.

Baruah, C. and Saikia, P.K. 2015. New records of odonata from Barpeta district, Assam, India. Journal of Global Biosciences 4 (9): 3335-3343.

Bharamal, D.L.; Koli, Y.J.; Korgaonkar, D.S. and Bhawane, G.P. 2014. Odonata fauna of Sindhudurg district, Maharashtra, India. International Journal of Current Microbiology and Applied Science 3 (9): 98-104.

Boruah, B.; Payra, A.; Das, G.N.; Misra, R.K.; Rout, S.D. and Sahu, H.K. 2015. Diversity of Odonata (Insecta) in Padmatola wetland, Balasore, Odisha, India. Asian Journal of Conservation Biology 4 (1): 92-97.

Bura, P.; Ansari, N.A. and Nawab, A. 2013. Ecological assessment, conservation and management of Surajpur wetland, Greater Noida, Uttar Pradesh. Pages 95-103, In: Kumar, P.; Singh, P. and Srivastava, R..J (Editors) Proceedings of International Conference on Water and Biodiversity, Uttar Pradesh State Biodiversity Board, Lucknow, Uttar Pradesh.

Calvão, L.B.; Júnior, P.D.M. and Batista, J.D. 2014. Odonata (Insecta) from Nova Xavantina, Mato Grosso, Central Brazil: Information on species distribution and new records. Check List 10 (2): 299–307. http://dx.doi.org/10.15560/8670

Castelle, A.J.; Johnson, A.W. and Conolly, C. 1994. Wetland and stream buffer size requirements: A review. Journal of Environmental Quality 23 (5): 878-882. http://dx.doi.org/10.2134/jeq1994.00472425002300050004x

Clark, T.E. and Samways, M.J. 1996. Dragonflies (Odonata) as indicators of biotope quality in the Kruger National Park, South Africa. Journal of Applied Ecology 33: 1001-1012.

Corbet, P.S. 1999. Dragonflies: Behavior and Ecology of Odonata. Harley Books, Great Horkesley, Colchester. 830 pages.

Das, S.K.; Sahoo, P.K.; Dash, N.; Marathe, S.; Mahato, S.; Dashahare, A.; Mishra, P.S.; Prasad, A. and Rana, R. 2013. Odonates of three selected tiger reserves of Madhya Pradesh, Central India. Check List 9 (3): 528-532. http://dx.doi.org/10.15560/9.3.528

Dawn, P. and Chandra, K. 2014. Dragonflies and damselflies (Insecta: Odonata) of Chhattisgarh, India. Check List 10 (5): 1104–1109. http://dx.doi.org/10.15560/10.5.1104

Dayakrishna and Arya, M.K. 2015. Study on the abundance and diversity of dragonflies and damselflies (Insecta: Odonata) of Corbett Tiger Reserve, Uttarakhand, India. Journal of Entomology and Zoology Studies 3 (4): 467-472.

Emiliyamma, K.G.; Radhakrishnan, C. and Palot, M.J. 2005. Pictorial Handbook on Common Dragonflies and Damselflies of Kerala. Zoological Survey of India, Kolkata. 67 pages.

Fraser, F.C. 1933. The Fauna of British India, including Ceylon and Burma: Odonata 1. Taylor and Francis, London. 436 pages.

Fraser, F.C. 1934. The Fauna of British India, including Ceylon and Burma, Odonata 2. Taylor and Francis, London. 442 pages.

Fraser, F.C. 1936. The fauna of British India, including Ceylon and Burma, Odonata 3. Taylor and Francis, London. 448 pages.

Fulan, J.A. and Henry, R. 2007. Temporal distribution of immature Odonata (Insecta) on *Eichhornia azurea* (Kunth) stands in the

Camargo Lake, Paranapanema River, Sao Paulo. Revista Brasileira de Entomologia 51: 224–227.

IUCN. 2015. The IUCN Red List of Threatened Species. Version 2015-4. <www.iucnredlist.org>. 13th June 2016.

Kanaujia, A.; Kumar, A.; Kushwaha, S. and Kumar, A. 2015. Diversity of odonates (dragonflies and damselflies) and lepidopteran (butterflies) fauna of Nawabganj Bird Sanctuary, Unnao District, Uttar Pradesh, India. Advances in Bioresearch 6 (2): 72-78.

Manral, U.; Raha, A.; Solanki, R.; Hussain, S.A.; Babu, M.M.; Mohan, D.; Veeraswami, G.G.; Sivakumar, K. and Talukdar, G. 2013. Plant species of Okhla Bird Sanctuary: A wetland of Upper Gangetic Plains, India. Check List 9 (2): 263–274. http://dx.doi.org/10.15560/9.2.263

May, M..L. 1979. Insect thermoregulation. Annual Review of Entomology 24: 313–349.

Mitsch, W.J. and Gosselink, J.G. 1989. Wetlands. Van Nostrand Reinhold , New York. 920 pages.

Nair, M.V. 2011. Dragonflies and Damselflies of Orissa and Eastern India. Wildlife Organisation, Forest and Environment Department, Government of Orissa, Bhubaneswar. 249 pages.

Prasad, M. and Varshney, R.K. 1995. A checklist of the Odonata of India including data on larval studies. Oriental Insects 29: 385-428. http://dx.doi.org/10.1080/00305316.1995.10433748

Saha, P.D. and Gaikwad, S.M. 2015. Odonata assemblage at a small marshy land in Khadki (Pune city) – An assessment. Journal of Entomology and Zoology Studies 3 (1): 53-64.

Schorr, M.; Lindeboom, M. and Paulson, D. 2006. World Odonata (Insecta) Checklist. http://www.pugetsound.edu/academics/academic-resources/slater-museum/biodiversity-resources/dragonflies/world-odonata-list2/, Accessed on 3 May 2011.

Sharma, G. and Choudhary, M.S. 2011. Status of damselflies and dragonflies (Odonata: Insecta) in North India with a note on the swarms of *Pantala flavescens* (Fabricius) in Rajasthan, India. In: Abstracts of National seminar on Biodiversity and Intangible Natural Heritage: 10-11. Desert Regional Centre, Zoological Survey of India, Jodhpur.

Singh, V. and Banyal, H.S. 2013. Odonate fauna of Khajjiar Lake (mini Switzertland) of Chamba district of Himachal Pradesh, India. Bioscan 8 (1): 281-287.

Subramanian, K.A. 2005. Dragonflies and Damselflies of Peninsular India- A Field Guide. E-Book of Project Lifescape. Centre for Ecological Sciences, Indian Institute of Science and Indian Academy of Sciences, Bangalore, India. 118 pages.

Subramanian, K.A. 2009. Dragonflies of India- A Field Guide. Vigyan Prasar, India Offset Press, New Delhi. 168 pages.

Subramanian, K.A. 2014. A Checklist of Odonata of India. Zoological Survey of India, Kolkata. 31 pages.

Sutherland, W.J. 1996. Ecological Census Techniques. Cambridge University Press, Cambridge. 450 pages.

Tiple, A.D.; Khurad, A.M. and Andrew, R.J. 2008. Species Diversity of Odonata in and around Nagpur City, Central India. Fraseria (Proceedings of the 18th International Symposium of Odonatology, Nagpur) 7: 41-45.

Received 9 January 2017
Accepted 25 June 2017