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SHORT COMMUNICATION

A report on the butterfly (Lepidoptera: Rhopalocera) diversity of the Upper Ganga River Ramsar site in Uttar Pradesh, India

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Abstract: This study provides a primary inventory of the butterfly diversity of the Upper Ganga River Ramsar site in Uttar Pradesh, India. The study was carried out in two phases, first in March 2019 and then in November 2019. A total of 44 species of butterflies belonging to 34 genera and five families were seen in the area. The species observed in the study site belonged to the families Hesperiidae (4 genera, 4 species), Lycaenidae (4 genera, 4 species), Nymphalidae (18 genera, 24 species), Papilionidae (2 genera, 4 species), and Pieridae (6 genera, 8 species). Three of these species are legally protected under various schedules of the Indian Wildlife Protection Act (1972).

Keywords: Hesperiidae, Lycaenidae, Nymphalidae, Papilionidae, Pieridae, scheduled species, wetland.

There are a total of 42 wetlands in India covering a total of 1,081,438 ha of the country's geographic surface area that have been recognised as Ramsar sites (Ramsar Sites Information Service 2021). Since the life cycle of a terrestrial pollinator insect is not dependent on the aquatic ecosystem in most cases, it is assumed that their diversity in wetlands and riparian areas will always be low, but Begosh et al. (2020) observed that there was little difference in abundance and richness of pollinators between uplands and wetlands. However, there have been only a few studies on the butterfly diversity of Indian Ramsar sites. Trigunayat & Singh (1998) reported 35 butterfly species in Keoladeo National Park, Rajasthan and Palot & Soniya (2000; 2001) reported 40 species under seven families. Chowdhury & Soren (2011) reported the presence of 74 species of butterflies under six families from East Calcutta Wetlands, Kolkata. Thakur et al. (2010) reported the presence of 50 species of butterflies under eight families from the Ropar wetland, Punjab. Following that, Sharma et al. (2014) and Narender (2017) observed *Elymnias hypermnestra* and *Megisba malaya* in the Ropar wetland. Sarath et al. (2017) reported the presence of 50 species of butterflies under eight families from Kole Wetlands, Kerala. So far, no studies have been conducted to document the diversity of butterflies in the Upper Ganga River Ramsar

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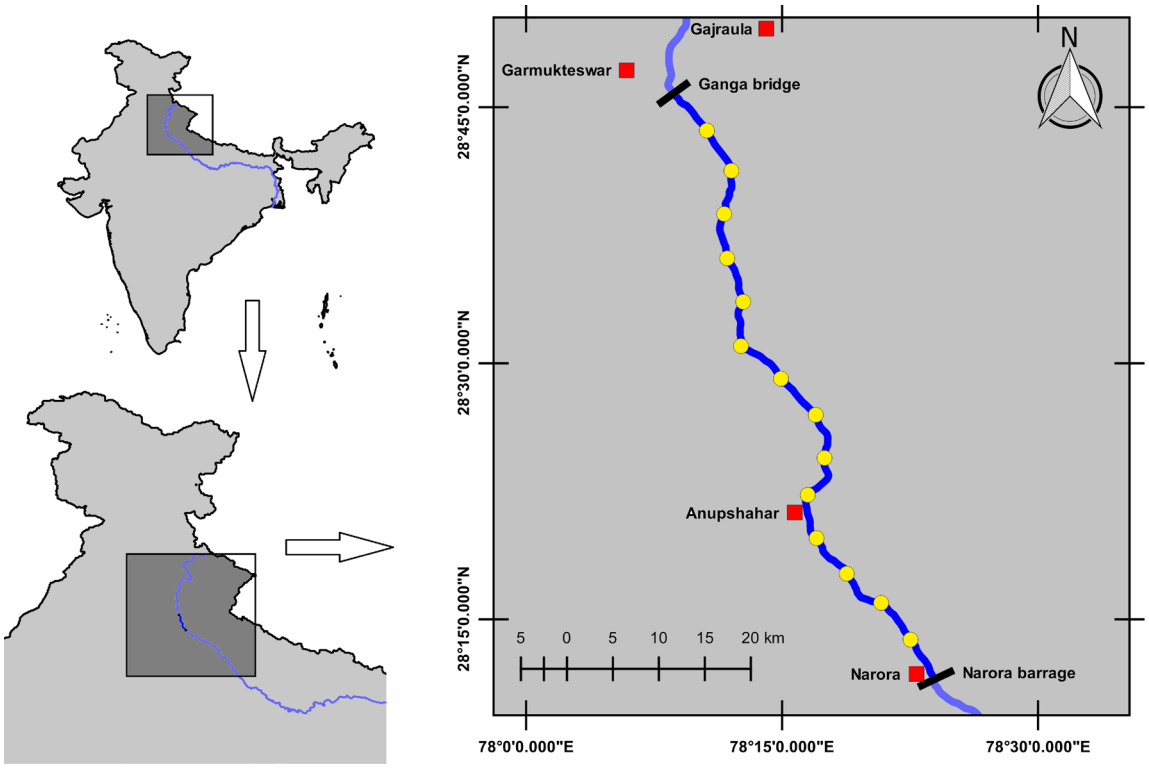

Figure 1. Location of Upper Ganga river Ramsar site (dark blue line) between Ganga bridge at Garmukteswar and Narora barrage. Red squares represent nereast major towns and yellow circles reresent sampling lications.

site. The current study was carried out in order to create a primary inventory of butterflies of the Upper Ganga River Ramsar site.

Materials and Methods

The study was carried out first in March 2019 and then again in November 2019 along an 85-km stretch of the Ganga River in Uttar Pradesh, from Brijghat to Narora (Figure 1). This section of the river was designated as a Ramsar site in 2005 (Ramsar site no. 1574). It is India's only Ramsar site in the lotic (river) wetland category (Murthy et al. 2013). This stretch is shallow with deep water pools that are home to many conservation-worthy species such as Gangetic River Dolphins, Gharials, crocodiles, six species of turtles, otters, 82 species of fish, and hundreds of bird species (Ramsar Sites Information Service 2021). Agriculture is the most important land use in this region (Prasad et al. 2021). A total of 14 study sites were selected at 5-km intervals along the left bank of the river. A 100-m stretch was chosen at each site to record butterfly species. Sampling was conducted at each study site between 0930 h and 1330 h.

The opportunistic sampling method was used to visually record the species with binoculars. Butterflies that could not be identified in flight were captured with a butterfly net, identified, and safely released. The butterflies were identified in the field using field guides (Evans 1932; Wynter–Blyth, 1957; Kunte 2000; Kehimkar 2008). For further confirmation, a photograph of the documented species was taken during the survey using a DSLR camera. Scientific names of butterflies were followed as per Varshne & Smetacek (2015).

Results

A total of 44 species of butterflies belonging to 34 genera and five families (Hesperiidae, Lycaenidae, Nymphalidae, Papilionidae, and Pieridae) were found in the study area (Table 1). The butterflies under the family Nymphalidae was most abundant with 24 species (54.545 % of total species) and 18 genera (52.941 % of total genera), followed by family Pieridae with eight species (18.182 % of total species) and six genera (17.647 % of total genera), family Lycaenidae with four species (9.091 % of total species) and four genera (11.765 % of total genera), family Hesperiidae with four species (9.091 % of total species) and four genera (11.765 % of total genera), and family Papilionidae with four species (9.091 % of total species) and two genera (5.882 % of total genera) (Figure 2).

Among these butterflies, three species are listed in

Table 1. List of butterflies reported from the Upper Ganga River Ramsar site.

Family	Scientific name	Authority	Common name	WPA status
Hesperiidae	*Matapa aria*	(Moore, [1866])	Common Branded Redeye	
Hesperiidae	*Parnara* sp.			
Hesperiidae	*Pelopidas* sp.			
Hesperiidae	*Udaspes folus*	(Cramer, [1775])	Grass Demon	
Lycaenidae	*Euchrysops cnejus*	(Fabricius, 1798)	Gram Blue	Schedule II (Part II)
Lycaenidae	*Chilades lajus*	(Stoll, [1780])	Lime Blue	
Lycaenidae	*Tarucus balkanica nigra*	Bethune-Baker, [1918]	Black-spotted Pierrot	
Lycaenidae	*Zizeeria karsandra*	(Moore, 1865)	Dark Grass Blue	
Nymphalidae	*Acraea terpsicore*	(Linnaeus, 1758)	Tawny Coster	
Nymphalidae	*Ariadne merione*	(Cramer, [1777])	Common Castor	
Nymphalidae	*Cupha erymanthis*	(Drury, [1773])	Rustic	
Nymphalidae	*Cyrestis thyodamas*	Doyère, [1840]	Map Butterfly	
Nymphalidae	*Danaus chrysippus*	(Linnaeus, 1758)	Plain Tiger	
Nymphalidae	*Danaus genutia*	(Cramer, [1779])	Striped Tiger	
Nymphalidae	*Euploea mulciber*	(Cramer, [1777])	Striped Blue Crow	Schedule IV
Nymphalidae	*Hypolimnas bolina*	(Linnaeus, 1758)	Great Eggfly	
Nymphalidae	*Hypolimnas misippus*	(Linnaeus, 1764)	Danaid Eggfly	Schedule II (Part II)
Nymphalidae	*Junonia almana*	(Linnaeus, 1758)	Peacock Pansy	
Nymphalidae	*Junonia atlites*	(Linnaeus, 1763)	Grey Pansy	
Nymphalidae	*Junonia iphita*	(Cramer, [1779])	Chocolate Pansy	
Nymphalidae	*Junonia lemonias*	(Linnaeus, 1758)	Lemon Pansy	
Nymphalidae	*Junonia orithya*	(Linnaeus, 1758)	Blue Pansy	
Nymphalidae	*Kaniska canace*	(Linnaeus, 1763)	Blue Admiral	
Nymphalidae	*Libythea myrrha*	Godart, 1819	Club Beak	
Nymphalidae	*Melanitis leda*	(Linnaeus, 1758)	Common Evening Brown	
Nymphalidae	*Mycalesis* sp.			
Nymphalidae	*Neptis soma*	Moore, 1858	Creamy Sailer	
Nymphalidae	*Parantica aglea*	(Stoll, [1782])	Glassy Tiger	
Nymphalidae	*Phalanta phalantha*	(Drury, [1773])	Common Leopard	
Nymphalidae	*Symbrenthia lilaea*	(Hewitson, 1864)	Common Jester	
Nymphalidae	*Vanessa cardui*	(Linnaeus, 1758)	Painted Lady	
Nymphalidae	*Ypthima huebneri*	Kirby, 1871	Common Four-ring	
Papilionidae	*Pachliopta aristolochiae*	(Fabricius, 1775)	Common Rose	
Papilionidae	*Papilio demoleus*	(Linnaeus, 1758)	Lime Swallowtail	
Papilionidae	*Papilio polymnestor*	Cramer, 1775	Blue Mormon	
Papilionidae	*Papilio polytes*	Linnaeus, 1758	Common Mormon	
Pieridae	*Cepora nerissa*	(Fabricius, 1775)	Common Gull	
Pieridae	*Catopsilia pyranthe*	(Linnaeus, 1758)	Mottled Emigrant	
Pieridae	*Delias eucharis*	(Drury, 1773)	Common Jezebel	
Pieridae	*Ixias marianne*	(Cramer, [1779])	White Orange Tip	
Pieridae	*Ixias pyrene*	(Linnaeus, 1764)	Yellow Orange Tip	
Pieridae	*Pareronia hippia*	(Fabricius, 1787)	Indian Wanderer	
Pieridae	*Pieris brassicae*	(Linnaeus, 1758)	Large Cabbage White	
Pieridae	*Pieris canidia*	Sparrman, 1768	Asian Cabbage White	

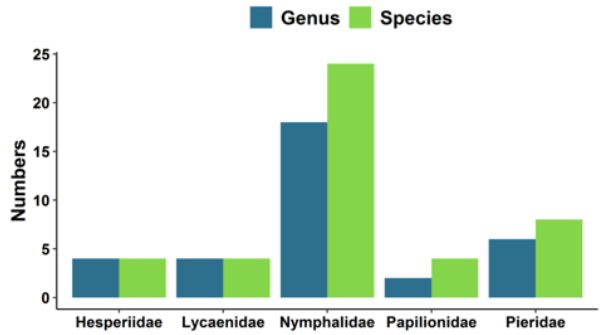

Figure 2. Comparative accountof numbers of genus and species of butterflies under five families found from the Upper Ganga River Ramsar site

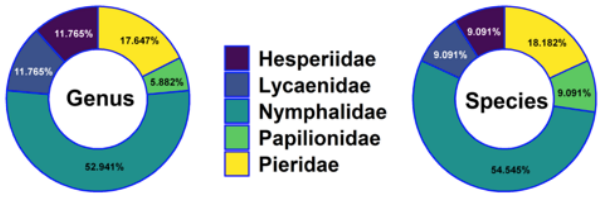

Figure 3. Percentage of genus and species of butterflies under five families found from the Upper Ganga River Ramsar site.

the schedules of the Wildlife Protection Act (WPA), 1972. Among these three species one species: *Euchrysops cnejus* (Fabricius, 1798) belongs to the family Lycaenidae and two species: *Euploea mulciber* (Cramer, [1777]) and *Hypolimnas misippus* (Linnaeus, 1764) belong to the family Nymphalidae.

Discussion

In comparison to other ecological elements, the terrestrial arthropod fauna of wetlands has received little attention from researchers (Batzer & Wu 2020). Butterflies are a major herbivore group in terrestrial ecosystems but they are also common in riparian ecosystems because they actively use riparian habitats for nectar and larval food, and they can be used as an indicator group for riparian ecosystem assessment (An & Choi 2021).

Since butterflies are pollinators of their nectar plants as well as indicators of the health and quality of their host plants (Tiple et al. 2006) and the ecosystem as a whole, exploration of butterfly fauna is important in identifying and preserving potential habitats under threat. The presence of the Upper Ganga River Ramsar site, a wetland of international significance and India's only riverine Ramsar site, it is practically equivalent to the presence of a 'spring in a desert'. The river Ganga experiences different anthropogenic dangers throughout its course causing habitat degradation, which makes the preservation of a Ramsar site even more critical for species survival that cause the natural habitat of several aquatic and riparian biota to decline, however this region secures them.

Despite its immense ecological importance, the entomofauna of the Upper Ganga River Ramsar site is poorly documented. From this area, De et al. (2021) reported presence of 29 species of aquatic insects, including three species of Coleoptera, four species of Hemiptera, and 22 species of Odonata. For the first time, this study found 44 species of butterflies from 34 genera and five families in this area. Because the butterfly fauna of Indian Ramsar wetlands is largely unknown, the findings of this study contribute to our understanding of butterfly biodiversity in them.

The current list of butterfly species is non–exhaustive, and further detailed studies encompassing all seasons, variety of host and nectar plants, and other influential factors is recommended for creating favourable environments to sustain butterfly diversity in this wetland ecosystems.

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Image 1. Butterfly reported from the Upper Ganga River Ramsar site: 1—*Matapa aria* (Moore, [1866]) | 2—*Parnara* sp. | 3—*Pelopidas* sp. | 4—*Udaspes folus* (Cramer, [1775]) | 5—*Euchrysops cnejus* (Fabricius, 1798) | 6—*Chilades lajus* (Stoll, [1780]) | 7—*Tarucus balkanica nigra* Bethune-Baker, [1918] | 8—*Zizeeria karsandra* (Moore, 1865) | 9—*Acraea terpsicore* (Linnaeus, 1758).

Image 2. Butterfly reported from the Upper Ganga River Ramsar site: 10—*Ariadne merione* (Cramer, [1777]) | 11—*Cupha erymanthis* (Drury, [1773]) | 12—*Cyrestis thyodamas* Doyère, [1840] | 13—*Danaus chrysippus* (Linnaeus, 1758) | 14—*Danaus genutia* (Cramer, [1779]) | 15—*Euploea mulciber* (Cramer, [1777]) | 16—*Hypolimnas bolina* (Linnaeus, 1758) | 17—*Hypolimnas misippus* (Linnaeus, 1764) | 18—*Junonia almana* (Linnaeus, 1758).

Image 3. Butterfly reported from the Upper Ganga River Ramsar site: 19—*Junonia atlites* (Linnaeus, 1763) | 20—*Junonia iphita* (Cramer, [1779]) | 21—*Junonia lemonias* (Linnaeus, 1758) | 22—*Junonia orithya* (Linnaeus, 1758) | 23—*Kaniska canace* (Linnaeus, 1763) | 24—*Libythea myrrha* Godart, 1819 | 25—*Melanitis leda* (Linnaeus, 1758) | 26—*Mycalesis* sp. | 27—*Neptis soma* Moore, 1858.

Image 4. Butterfly reported from the Upper Ganga river Ramsar site: 28—*Parantica aglea* (Stoll, [1782]) | 29—*Phalanta phalantha* (Drury, [1773]) | 30—*Symbrenthia lilaea* (Hewitson, 1864) | 31—*Vanessa cardui* (Linnaeus, 1758) | 32—*Ypthima huebneri* Kirby, 1871 | 33—*Pachliopta aristolochiae* (Fabricius, 1775) | 34—*Papilio demoleus* (Linnaeus, 1758) | 35—*Papilio polymnestor* Cramer, 1775 | 36—*Papilio polytes* Linnaeus, 1758.

Image 5. Butterfly reported from the Upper Ganga river Ramsar site: 37—*Cepora nerissa* (Fabricius, 1775) | 38—*Catopsilia pyranthe* (Linnaeus, 1758) | 39—*Delias eucharis* (Drury, 1773) | 40—*Ixias marianne* (Cramer, [1779]) | 41—*Ixias pyrene* (Linnaeus, 1764) | 42—*Pareronia hippia* (Fabricius, 1787) | 43—*Pieris brassicae* (Linnaeus, 1758) | 44—*Pieris canidia* Sparrman, 1768.

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