BUTTERFLY FAUNA (INSECTA: LEPIDOPTERA: PAPILIONOIDEA) AND LARVAL HOST PLANT IN BONGAON TOWN, WEST BENGAL, INDIA

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ABSTRACT

An appraisal of butterfly species diversity was carried out in the suburban town of Bongaon, southern West Bengal, India whose butterfly faunal diversity remained undocumented. A total of 76 species of butterflies were recorded from October 2018 to October 2019. The highest number of butterflies were recorded belonging to the family Nymphalidae (27 species), followed by Lycaenidae (21 species), Hesperiidae (13 species), Pieridae (8 species) and Papilionidae (7 species). Among the 76 butterfly species that have been recorded, nine species come under the protection category as per the Indian Wildlife (Protection) Act, 1972. Over the study period, 54 species of larval host plants were also documented. This communication will be the first comprehensive work on butterflies of Bongaon town and serve as baseline data for future research on the butterfly.

Keywords: Butterfly fauna, checklist, diversity, larval host plant, Lepidoptera, Sub-urban ecosystem.

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INTRODUCTION

Butterflies are good pollinators (Dafni, 1992; Kearns & Inouye 1997), but at the same time, some of them are pest of crops (Nair et al., 2018) and fruits (Abbas et al., 2008). Although awareness of the increasing loss of butterfly biodiversity in the state is already present, several concerted efforts are being made to rescue the butterfly diversity of the state threatened by unplanned urban-tune and wetland as well as green patch reduction (Ganguli et al., 2016).

In West Bengal, as far back as 1866, F. Moore first contributed his butterfly knowledge through his publication (Moore, 1866). Later, de Nicéville (1885) worked on butterfly habits and their larval host plant. Such a fact-finding study on butterflies was followed by several scientists and amateur personnel, along with their life history stages, choice of food plants and related ecological documentation (Chowdhury, 2015). Judhajit Dasgupta (2010) compiled 452 species of butterflies through his Bengali literature book ‘Paschimbanger Prajapati’. Only in 2015, Mitra et al. (2015) listed 79 species of butterflies from Bibhutibhusan Wildlife Sanctuary, a protected area of West Bengal that falls under the Bongaon sub-division. However, no observation has been reported from the Bongaon town in particular. Hence, the data presented here is the first inventory of butterfly species diversity in the town that will act as the baseline data for similar studies in future.

The study was conducted in and around Bongaon (about 23.07°N; 88.82°E), a municipal town in the state of West Bengal, India (Fig. 1). The town is also a sub-divisional headquarter and situated in the vicinity of the India-Bangladesh border. River Ichhamati flows through it. The natural vegetation of the suburban town comprises scattered horticultural gardens, orchards, bamboo bushes, shrubs and herbs, and vast stretches of irrigated paddy fields intermingled with expanding human
settlements (Mukhopadhyay & Mazumdar, 2017). The area experiences a tropical monsoon climate. It has four distinct seasons viz., summer (March–May), monsoon (June–August), post-monsoon (September–November) and winter (December–February). The annual temperature ranges from 43 °C to 9 °C, and precipitation is 1,400 mm (Mitra et al., 2015). Relative humidity varies between 50% and 90% (Mukhopadhyay & Mazumdar, 2017).

Four sites were selected within a radius of 3 km of the Bongaon town area for the butterfly survey (Fig. 2). Site 1, 2 and 3 were rural habitats whereas Site 4 was urban habitat. Site 1 is a forested area with scattered horticulture gardens, orchards, bamboo bushes. Site 2 is a wetland area with scattered trees and bushes. Site 3 is dominated by agricultural fields with scattered trees and bushes. Site 4 is the highly populated municipal area with personal gardens and parks.

**Figure 2.** Habitat of four survey sites in Bongaon town

**MATERIALS AND METHODS**

Field surveys were conducted weekly from October 2018 to October 2019. Field observations were carried out only on days with suitable weather conditions (i.e., in the absence of rain or strong wind) between 9:30 am to 11:30 am and 3:30 pm to 5:30 pm. A modified Pollard walk (Royer et al., 1998) method is used for data collection and butterfly species random sightings. Butterfly species were recorded and photographed using digital cameras (Nikon P600 & D7000). Occasionally an entomological net was used for Hesperiids photographs and the butterflies were released unharmed to their natural habitats. No butterfly species were collected, euthanized, or killed during the entire study. Photographs of all species were identified using Evans (1949), Kehimkar (2016) and Ek-Amnuay (2012). The systematic position (order and family), common name and scientific name of each species were assigned.
following the synoptic catalogue by Varshney & Smetacek (2015). The observed butterfly species were categorized into five categories based on their presence in the study area VC - very common (> 100 sightings), C - common (> 50–100 sightings), NR - not rare (> 15–50 sightings), R - rare (> 2–15 sightings), VR - very rare (1–2 sightings). Authors have followed the updated scientific name of the larval host plants which were photographed from the study site as per The Plant List (2013) and Prain (1903).

RESULTS

The study revealed the presence of 76 butterfly species belonging to 5 families in the study area (Table 1, Fig. 1). Nymphalidae was the richest family, comprising 27 species (35.52%), followed by Lycaenidae 21 species (27.63%), Hesperiidae 13 species (17.10%), Pieridae 8 species (10.52%) and Papilionidae 7 species (9.21%). Assessment of local abundance revealed that 19 species (25%) were very common, 27 species (35.52%) were common, 17 species (22.36%) were fairly common, and 5 species (10.52%) were rare. Eight butterfly species, namely Arhopala atrax (Hewitson, 1862), Venessa cardui (Linnaeus, 1758), Mahathala ameria (Hewitson, 1862), Discophora sondaica (Boisduval, 1836), Lethe europaea (Fabricius, 1775), Junonia orithya (Linnaeus, 1758), Junonia iphita (Linnaeus, 1758) and Baoris farri (Moore, 1878) were reported only once during the study period. 10 species have a protected status under the Indian Wildlife (Protection) Act (WPA), 1972 (Anonymous, 2010), including Discophora sondaica (Boisduval, 1836) under Schedule I, Anthene lycena (Felder, 1868), Baoris farri (Moore, 1878), Euthalia aconthea (Cramer, 1777), Lampides boeticus (Linnaeus, 1767), Euchrysops cnejus (Fabricius, 1798), Mahathala ameria (Hewitson, 1862), Rapala varuna (Horsfield, 1829) under Schedule II, and Euploea core (Cramer, 1758), Euploea klugii kollari (Felder & Felder, 1865) under Schedule IV.

| Subfamily | Binomial name | Status | WPA | Site 1 | Site 2 | Site 3 | Site 4 |
|-----------|---------------|--------|-----|--------|--------|--------|--------|
| Papilionidae (3 genera, 7 species) | | | | | | | |
| **Papilioninae** | | | | | | | |
| Graphium doson (Felder & Felder, 1864) | R | + | - | - | - |
| Graphium agamemnon (Linnaeus, 1758) | VC | + | + | - | + |
| Pachliopta aristolochiae (Fabricius, 1775) | NR | + | - | - | - |
| Papilio clytia (Linnaeus, 1758) | NR | + | + | + | - |
| Papilio polytes (Linnaeus, 1758) | VC | + | + | + | - |
| Papilio polymnestor (Cramer, 1775) | C | + | + | - | - |
| Papilio demoleus (Linnaeus, 1758) | C | + | + | + | - |
| Nymphalidae (18 genera, 27 species) | | | | | | | |
| **Danainae** | | | | | | | |
| Tirumala linctia (Cramer, 1775) | NR | + | + | + | - |
| Danaus genutia (Cramer, 1779) | C | + | + | + | - |
| Danaus chrysippus (Linnaeus, 1758) | VC | + | + | + | - |
| Euploea core (Cramer, 1758) | VC | + | + | + | - |
| Euploea klugii kollari (Felder & Felder, 1865) | NR | Sch.IV | + | + | - | + |
| **Morphinae** | | | | | | | |
| Discophora sondaica (Boisduval, 1836) | NR | Sch.IV | + | + | - | - |
| **Satyrinae** | | | | | | | |
| Elymnias hypermnestra (Drury, 1763) | VC | + | + | + | - |
| Melanitis leda (Linnaeus, 1758) | VC | + | + | + | - |
| Lethe europaea (Fabricius, 1775) | VR | + | - | - | - |
| Mycalesis sp. (Huebner, 1818) | VC | + | + | + | - |
| Ypthima baldus (Fabricius, 1775) | NR | + | + | - | - |
| Ypthima huebneri (Kirby, 1871) | VC | + | + | + | - |
| **Acraeinae** | | | | | | | |
| Acraea violae (Fabricius, 1775) | C | + | + | + | - |
| Phalantha phalantha (Drury, 1773) | C | + | + | - | - |

Table 1. List of Butterflies found in and around the Bongaon Municipality area
| Subfamily | Binomial name | Status | WPA | Site 1 | Site 2 | Site 3 | Site 4 |
|-----------|---------------|--------|-----|--------|--------|--------|--------|
| Limenitae | Moduza procris (Cramer, 1777) | R | + | + | + | + | |
|           | Neptis hylas (Linnaeus, 1758) | C | + | - | - | + | |
|           | Neptis jambha (Moore, 1858) | NR | + | + | - | - | |
|           | Ethalia acontha (Cramer, 1777) | C | Sch. II | + | + | + | + |
| Biblidinae | Ariadne Ariadne (Linnaeus, 1763) | VC | + | + | + | + | |
|           | Ariadne merione (Cramer, 1777) | C | + | - | - | + | |
| Nymphalinae | Venessa cardui (Linnaeus, 1758) | VR | - | + | - | - | |
|           | Junonia orithya (Linnaeus, 1758) | VR | - | - | + | - | |
|           | Junonia iphita (Cramer, 1779) | VR | + | - | - | - | |
|           | Junonia alitites (Linnaeus, 1763) | VC | + | + | + | + | |
|           | Junonia almana (Linnaeus, 1758) | C | + | + | + | + | |
|           | Junonia lemonias (Linnaeus, 1758) | VC | + | + | + | + | |
| Pieridae (7 genera, 8 species) | Eurema hecabe (Linnaeus, 1758) | VC | + | + | + | + | |
|           | Catopsilia pomona (Fabricius, 1775) | VC | + | + | + | + | |
|           | Catopsilia pyranthe (Linnaeus, 1758) | VC | + | + | + | + | |
|           | Pareronia valeria (Cramer, 1776) | C | + | + | - | - | |
|           | Appias olferna (Swinhoe, 1890) | C | - | + | + | - | |
|           | Cepora nerissa (Fabricius, 1775) | C | + | + | + | + | |
|           | Delias eucharis (Drury, 1773) | C | + | + | + | + | |
|           | Hypolimnas bolina (Linnaeus, 1758) | C | + | + | + | + | |
| Coliadinae | Eurema hecabe (Linnaeus, 1758) | VC | + | + | + | + | |
|           | Catopsilia pomona (Fabricius, 1775) | VC | + | + | + | + | |
|           | Catopsilia pyranthe (Linnaeus, 1758) | VC | + | + | + | + | |
|           | Pareronia valeria (Cramer, 1776) | C | + | + | - | - | |
|           | Appias olferna (Swinhoe, 1890) | C | - | + | + | - | |
|           | Cepora nerissa (Fabricius, 1775) | C | + | + | + | + | |
|           | Delias eucharis (Drury, 1773) | C | + | + | + | + | |
|           | Hypolimnas bolina (Linnaeus, 1758) | C | + | + | + | + | |
| Lycaenidae (18 genera, 21 species) | Anthene emolus (Godart, 1824) | NR | + | - | - | + | |
|           | Anthene lycaenina (Fielder, 1868) | NR | Sch. II | + | - | - | - | |
|           | Catohrysops strabo (Fabricius, 1793) | C | + | + | - | - | |
|           | Lampides boeticus (Linnaeus, 1767) | R | Sch. II | - | + | - | - | |
|           | Castalium rosimon (Fabricius, 1775) | VC | + | + | - | - | |
|           | Tarucus balkanicus (Freyer, 1844) | NR | + | + | + | - | |
|           | Zicera karsandra (Moore, 1865) | NR | + | + | + | - | |
|           | Pseudozicera maha (Kollar, 1844) | C | + | + | + | - | |
|           | Zizula hylas (Fabricius, 1775) | NR | - | + | + | - | |
|           | Nepithecops zalmora (Butler, 1870) | C | + | + | + | + | |
|           | Euchrysops cnejus (Fabricius, 1798) | C | Sch. II | + | + | + | + | |
|           | Chilades pandava (Horsfield, 1829) | VC | + | + | + | + | |
|           | Chilades lajas (Stoll, 1780) | VC | + | + | + | + | |
| Miletinae | Spalgis epius (Westwood, 1851) | NR | + | - | - | - | |
| Aphnaeinae | Spindasis vulcanus (Fabricius, 1775) | C | + | + | + | + | |
| Polyommatinae | Anthene emolus (Godart, 1824) | NR | + | - | + | - | |
|           | Anthene lycaenina (Fielder, 1868) | NR | Sch. II | + | - | - | - | |
|           | Catohrysops strabo (Fabricius, 1793) | C | + | + | - | - | |
|           | Lampides boeticus (Linnaeus, 1767) | R | Sch. II | - | + | - | - | |
|           | Castalium rosimon (Fabricius, 1775) | VC | + | + | - | - | |
|           | Tarucus balkanicus (Freyer, 1844) | NR | + | + | + | - | |
|           | Zicera karsandra (Moore, 1865) | NR | + | + | + | - | |
|           | Pseudozicera maha (Kollar, 1844) | C | + | + | + | - | |
|           | Zizula hylas (Fabricius, 1775) | NR | - | + | + | - | |
|           | Nepithecops zalmora (Butler, 1870) | C | + | + | + | + | |
|           | Euchrysops cnejus (Fabricius, 1798) | C | Sch. II | + | + | + | + | |
|           | Chilades pandava (Horsfield, 1829) | VC | + | + | + | + | |
|           | Chilades lajas (Stoll, 1780) | VC | + | + | + | + | |
| Theclinae | Arhopala atrax (Hewitson, 1862) | VR | + | - | - | - | |
|           | Mahathala ameria (Hewitson, 1862) | VR | Sch. II | + | - | - | - | |
|           | Loxura atymnus (Stoll, 1780) | NR | + | - | + | - | |
|           | Rathinda amor (Fabricius, 1775) | C | + | + | - | - | |
|           | Rapala manea (Hewitson, 1863) | C | + | + | + | + | |
|           | Rapala varuna (Horsfield, 1829) | R | Sch. II | - | - | + | - | |
| Hesperiidae (12 genera, 13 species) | Tagiades japetus (Stoll, 1781) | NR | + | + | - | - | |
| Pyrginae | Tambrix salisala (Moore, 1866) | VC | + | + | - | - | |
| Hesperiinae | Suastus greius (Fabricius, 1798) | C | + | + | + | - | |
|           | Matapa aria (Moore, 1866) | NR | + | + | - | - | |
|           | Parnara bada (Moore, 1878) | C | + | - | - | - | |
Authors have recorded 70 species of butterflies from Site 1, 60 species from Site 2, 46 species from Site 3 and 41 species from site 4 (Fig. 3). Chi-square goodness of fit test was performed using R statistical software to compare the species richness across sites. The result showed a significant difference (Chi value = 9.6728, df = 3, p-value = 0.02) across sites. A pairwise comparison using the chi-square test identified a significant difference (p-value = 0.03) of species richness between Site 1 and Site 4. In the course of the study, a total of 54 plant species belonging to 28 families and 51 genera were found to use by the butterfly larvae of this town as host plants (Table 2). Poaceae (8 species) and Fabaceae (6 species) were the most dominant families of host plants in this area. Six species of caterpillars feed on the plant *Cassia fistula*, whereas *Capparis zeylanica* exclusively supports the growth of four species of caterpillars.

![Figure 3](image)

**Figure 3.** Family wise species richness of butterflies in four different locations of the study area

| Subfamily | Binomial name | Status | WPA | Site 1 | Site 2 | Site 3 | Site 4 |
|-----------|---------------|--------|-----|--------|--------|--------|--------|
|           | *Borbo cinnara* (Wallace, 1866) | C | + | + | + | + | + |
|           | *Pelopidas* sp. (Walker, 1870) | C | + | + | + | + | + |
|           | *Baoris farri* (Moore, 1878) | VR | Sch. II | + | - | - | - |
|           | *Oriens gola* (Moore, 1877) | C | + | + | + | - | - |
|           | *Telicota colon* (Fabricius, 1775) | C | + | + | - | - | - |
|           | *Telicota bambusae* (Moore, 1878) | NR | + | + | - | - | - |
|           | *Cephrenes acalle* (Hopffer, 1874) | R | + | - | - | - | - |
|           | *Udaspes folus* (Cramer, 1775) | NR | + | + | - | - | + |

*Abbreviations: VC - Very Common (> 100 sightings); C - Common (> 50–100 sightings); NR - Not Rare (> 15–50 sightings); R - Rare (> 2–15 sightings); VR - Very Rare (1–2 sightings); +: Present; -: Absent*

| Family | Larval host plant | Butterfly species | References |
|--------|------------------|------------------|------------|
| Fabaceae | *Senna tora* (L.) Roxb. | *Eurema hecabe* | Nitin et al., 2018 |
|         | *Senna occidentalis* (L.) Link | *Catopsilia pomona* | Kunte et al., 2021 |
|         | *Cassia fistula* L. | *Catopsilia pyranthe* | Robinson et al., 2010 |
|         | | *Eurema hecabe* | Robinson et al., 2010 |
|         | | *Catopsilia pomona* | Robinson et al., 2010 |
|         | | *Catopsilia pyranthe* | Robinson et al., 2010 |
|         | | *Spindasis vulcanus* | Nitin et al., 2018 |
|         | | *Anthene emolus* | Robinson et al., 2010 |
|         | | *Graphium agamemnon* | Robinson et al., 2010 |
|         | | *Tamarindus indica* L. | *Suastus gremius* | Robinson et al., 2010 |
|         | | *Lablab purpureus* (L.) Sweet | *Euchrysops cnejus* | Robinson et al., 2010 |
|         | | *Cajanus cajan* (L.) Millsp. | *Lampides boeticus* | Robinson et al., 2010 |
|         | | | *Catochrysops strabo* | Robinson et al., 2010 |
| Rutaceae | *Aegle marmelos* (L.) Corrêa | *Papilio demoleus* | Robinson et al., 2010 |
|         | | *Papilio polytes* | Robinson et al., 2010 |
|         | | *Glycosmis pentaphylla* (Retz.) DC. | *Neopithecops zalmora* | Robinson et al., 2010 |
|         | | | *Papilio polytes* | Robinson et al., 2010 |
|         | | *Citrus sp.* | *Papilio polytes* | Robinson et al., 2010 |
| Family         | Larval host plant | Butterfly species | References       |
|---------------|-------------------|-------------------|------------------|
| Oxalidaceae   | Oxalis corniculata L. | Pseudozizeeria maha | Robinson et al., 2010 |
| Mimosaceae    | Flacourtia indica (Burm.f.) Merr. | Pseudoselasia phalantha | Robinson et al., 2010 |
| Sapindaceae   | Litchi chinensis Sonn. | Anthene emolus | Robinson et al., 2010 |
| Annonaceae    | Polyalthia longifolia (Sonn.) Thwaites | Graphium agamemnon | Robinson et al., 2010 |
| Lauraceae     | Litsea glutinosa (Lour.) C. B. Rob. | Papilio clytia | Robinson et al., 2010 |
| Rubiaceae     | Neolamarckia cadamba (Roxb.) Bosser | Monasa procris | Kunte et al., 2021 |
| Anacardiaceae | Mangifera indica L. | Rathinda amor | Robinson et al., 2010 |
| Euphorbiaceae | Ricinus communis L. | Ariadne merione | Kunte et al., 2021 |
| Verbenaceae   | Lantana camara L. | Zizia hylax | Robinson et al., 2010 |
| Areaceae      | Phoenix sylvestris (L.) Roxb. | Elymnias hypermnestra | Kunte et al., 2021 |
|               | Rhapis humilis Blume | Elymnias hypermnestra | Robinson et al., 2010 |
|               | Areca catechu L. | Elymnias hypermnestra | Kunte et al., 2021 |
| Apocynaceae   | Catalpa gigantea (L.) Dryand. | Danaus genuttia | Robinson et al., 2010 |
| Malvaceae     | Sida rhombifolia L. | Spialia galba | Robinson et al., 2010 |
| Capparaceae   | Capparis zeylanica L. | Cepora nerissa | Kunte et al., 2021; Robinson et al., 2010 |
| Brassicaceae  | Sinapis arvensis L. | Pseudozizeeria maha | Robinson et al., 2010 |
| Rhamnaceae    | Ziziphus jujuba Mill. | Castalia rosmon | Kunte et al., 2021 |
| Lamiaceae     | Clerodendrum infortunatum L. | Rapala maneia | Kunte et al., 2021 |
| Mimosaceae    | Mimosa pudica L. | Prosthas dubiosa | Kunte et al., 2021 |
| Oxalidaceae   | Oxalis corniculata L. | Pseudozizeeria maha | Robinson et al., 2010 |
DISCUSSION

The main objective of the study was to prepare a comprehensive list of butterfly species, determine which species were most abundant during the time of sampling, and document the available host and feeding plants in suburban Bongaon town. Our study confirms the presence of a wide variety of butterflies in the suburban town despite a large influx of human population and anthropogenic disturbances. The highest number of butterflies was recorded in Site 1 with the least human interferences and dense vegetation among the other sites. The availability of larval host plants and adult nectar plants could be one reason for its dominance (Murugesan et al., 2013). The least number of species were recorded from Site 4. High anthropogenic disturbance and the least vegetation might be a reason for this (Samal et al., 2021). The highest similar species assemblage was observed between Site 1 and Site 2 possibly due to their close proximity and the lowest similarity of species was recorded between Site 3 and Site 4 due to heterogeneity in habitat types (Table 3). Butterflies in high frequency were seen nectaring on flowering plants (Lantana camara, Nerium oleander, Ixora sp. etc.), planted by Bongaon Municipality to beautify the roads. The parks of the town, personal gardens also serve as potential resource sites for butterflies. However, seasonal slash and burn of vegetation poses a threat to the availability of both the host and feeding plants in the study area (Cleary & Genner, 2004). The presence of ten species listed under the Indian Wildlife (Protection) Act, 1972 demands necessary conservation measures to avoid regional extirpation.

Table 3. Sorensen’s similarity index of butterfly species recorded in the study sites

| Site 1 | Site 2 | Site 3 | Site 4 |
|-------|-------|-------|-------|
| Site 1 | 0.86  | 0.76  | 0.70  |
| Site 2 | 0.81  | 0.73  | 0.69  |
| Site 3 |       |       |       |
| Site 4 |       |       |       |
Figure 4. Some butterflies recorded from the study site
1. Loxura atymnus; 2. Lampides boeticus; 3. Anthene lycaenina; 4. Castalus rosimon; 5. Spalgis epius; 6. Anthene emolus; 7. Zizeeria karsandra; 8. Mahathala ameria; 9. Chilades lajus; 10. Chilades pandava; 11. Zizula hylax; 12. Mycalesis sp.; 13. Moduza procris; 14. Ypthima baldus; 15. Junonia aitites; 16. Junonia lemonias; 17. Danaus chrysippus; 18. Venessa cardui; 19. Phalanta phalantha; 20. Pachliopta aristolochiae; 21. Papilio clyta; 22. Papilio polytes; 23. Graphium doson; 24. Eurema hecabe; 25. Pereronia valeria; 26. Iambris salsula; 27. Oriens gola; 28. Borbo cinnara; 29. Suastus gremius; 30. Matapa aria
Species like Pieris canidia, Charaxes solon (Dey, 2021), Iraota timoleon (Sourabh Biswas observed from IISER Kolkata Campus, Nadia, West Bengal) were reported within 40 km radius of Bongaon. The host plants of these three species i.e., Sinapis arvensis, Tamarindus indica, Ficus bengalensis respectively were present in abundance at the study site. Further exploration might reveal the presence of these butterflies in the area. As the study provides a checklist of butterfly species, their feeding and larval host plants available in the area, it can be regarded as the maiden step towards forming a butterfly garden. Research and systematic monitoring will be helpful to better understand the influence of different landscape elements on butterfly community structure and their conservation needs.
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