Preliminary checklist of butterfly (Insecta, Lepidoptera, Papilionoidea) species around Haringhata dairy farm, Nadia district, West Bengal including range extension of Prosotas bhutea (de Niceville, [1884]) for southern West Bengal, India.

Catálogo preliminar de las especies de mariposas (Insecta, Lepidoptera, Papilionoidea) de los alrededores de la granja lechera de Haringhata, distrito de Nadia, Bengala Occidental, incluida la ampliación del área de distribución conocida de Prosotas bhutea (de Niceville, [1884]) para el sur de Bengala Occidental, India.

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ABSTRACT

The aim of this paper is to investigate and produce an updated and exhaustive checklist of butterfly species recorded around Haringhata Dairy Farm till December 2020. This list is intended to serve as a basis to prepare conservation strategies and generate awareness among the local people. The checklist comprises a total of 106 butterfly species belonging to 06 families, 19 subfamilies, and 74 genera. It includes the range extension of Prosotas bhutea into the lower Gangetic plains of South Bengal.

Key words: Insect; Biodiversity; Checklist; Barajaguli; Prosotas bhutea.

RESUMEN

El objetivo de este documento es investigar y producir una lista de verificación actualizada y exhaustiva de las especies de mariposas registradas alrededor de la granja lechera Haringhata hasta diciembre de 2020. Esta lista tiene el propósito de servir de base para para preparar estrategias de conservación y generar concienciación entre la población local. La lista de verificación comprende un total de 106 especies de mariposas pertenecientes a 06 familias, 19 subfamilias y 74 géneros. Incluye la extensión del rango de Prosotas bhutea en las llanuras del Ganges inferior de Bengala del Sur.

Palabras clave: Insecta; Biodiversidad; Catálogo; Barajaguli; Prosotas bhutea.
INTRODUCTION

Butterflies are flying beauty which act as climate change indicators and are sensitive to environmental degradation (Kehimkar, 2008). Around us, many of the butterfly species are cryptically coloured (Noort & Stone, 1999). Some of the species are pests of agricultural crops and economically important plants (Nair et al., 2018). India has one of the richest and most diverse butterfly faunas in the world. Due to their attractiveness and omnipresence, they have acquired a niche in the prose and poetry of various cultures (Kunte, 2000). India has 1,501 species, of which 321 are Skippers, 107 Swallowtails, 109 Whites and Yellows, 521 Brush-footed, and 443 Blues (Kehimkar, 2008). In the state of West Bengal, 452 species of butterflies (Dasgupta, 2010) are recorded. Several studies on butterflies have been conducted throughout the state to date (Moore, 1882; De Niceville, 1885; Sanders, 1944; Ghosh and Siddique, 2005; Chowdhury and Chowdhury, 2006; Chowdhury and Das, 2007; Chowdhury and Soren, 2011; Roy, 2011; Chowdhury, 2014; Nair et al., 2014; Sengupta et al., 2014; Dwari and Mandal, 2015,2020; Mukherjee et al., 2015; Mitra et al., 2015; Mukhopadhaya and Chattopadhyaya, 2015; Mukherjee et al., 2016; Biswas et al., 2016; Ghosh and Saha, 2016; Dey et al., 2017; Dwari et al., 2017; Samanta et al., 2017; Das et al., 2019; Sinha et al., 2019; Mukherjee and Mondal, 2020). Dey and Ghosh (2016) and Chakraborty et al., (2018) compiled 33 species and 26 species of butterflies respectively from Nadia district. There is no previously published checklist of butterfly species from Haringhata. Hence the present work was initiated. Nadia is situated between 22°53’ and 24°11’ North Latitude and 88°09’ & 88°48’ East Longitude, this district is longitudinal in shape with an orientation of North-South. The tropic of cancer (23.5° N) divides the district into two parts.

STUDY SITE

The present study was conducted in area adjacent to the Haringhata Dairy Farm (HDF), situated in the lower Gangetic plains at an altitude of 13 m. Also known as Haringhata Butterflying Zone (22.949533° N and 88.541389° E) (Fig.1), this site in Barajaguli (also simply known as Jaguli), is located around 48 kilometres north of Kolkata, in the southernmost fringe of Nadia district in West Bengal, India. In 1950-51, the Government of West Bengal had installed the dairy plant (HDF), the first of its kind in the state, with vision of urban milk supply schemes. To develop fodder for the animal resources, various species of grasses were planted in the study site. The invasive trees on the grassland’s habitat have forming marshes in and around HDF. The climate is characterized by hot summer, high humidity, and well-distributed rainfall (annual average rainfall 1419 mm). The average daily temperature is 31.8°C, and the minimum temperature is 21.3°C. January is the coldest month when the minimum temperature often drops to 6-7°C. The study area is thus in a hot humid zone where summer starting from March to June, monsoon from July to October, and winter come from November to February. In the summer season, the maximum temperature generally varies from 28°C to 35°C. On a sunny day, the temperature may go up to 40°C.

MATERIALS AND METHODS

Author regularly carried out extensive field survey in the different landscape elements like remnants of secondary deciduous forest, shrubs, paddy fields, and marshes region from January 2014 to December 2020. The field visits were conducted randomly, with a frequency of at least twice a month in the area. This survey compiles data from observations studied through walking for approximately four hours (8:30 AM to 12:30 PM) on each field visit. Based on their relative abundances, the species were ranked into four categories, i.e. Very Frequent (VF) = More than 100 days of sightings, Frequent (F) = 50-100 days of sightings, Infrequent (IF) = 10-50 days of sightings and Rare (R) = 1 to 10 days of sightings. Days of sightings means the number of days during the entire study periods in which the particular species was observed on field trips. Identification of the photographs taken in the field was done with the help of Evans (1949); Kehimkar (2016);
Figure 1: Study area map showing around Haringhata Dairy Farm green zone.
and Ek-Amnuay (2012). All scientific and English common names follow the catalogue by Varshney & Smetacek (2015). Photographic documentation was done by the author using DSLR camera (model no. Nikon D7000) with 18-55 mm VR II kit and 70-300 mm VR ED lens (Nikkor make) for capturing the maximum species image.

**RESULTS**

This study reports 106 species belonging to 74 genera distributed in 6 families (Table 2). Lycaenidae was the most diverse family (35 species under 27 genera and averaging 33.02% species richness), followed by Nymphalidae (30 species, 17 genera; 28.30%) (Table 1).

| Family       | Subfamily | Genera | Species |
|--------------|-----------|--------|---------|
| Papilionidae | 01 (5.26%)| 03 (4.05%) | 09 (8.49%) |
| Nymphalidae  | 08 (42.11%)| 17 (22.97%) | 30 (28.30%) |
| Pieridae     | 01 (5.26%)| 09 (12.16%) | 12 (11.32%) |
| Lycaenidae   | 05 (26.32%)| 27 (36.49%) | 35 (33.02%) |
| Hesperiidae  | 03 (15.79%)| 17 (22.98%) | 19 (17.92%) |
| Riodinidae   | 01 (5.26%)| 01 (1.35%) | 01 (0.94%) |
| Total: 06    | 19 (100%)  | 74 (100%) | 106 (100%) |

Table 1: Overview of the taxonomic diversity of butterfly species of survey area:

It was interesting to note the presence of *Proso- tas bhuta* two times in the study site (23.XI.2018 and 25.XII.2018). The taxon was first sighted and photographed from this area, as well as South Bengal in January 2015 (Anonymous, 2020). *Megisba malaya thwaitesi, Megisba malaya sikkima, Zesius chrysomallus,* and *Pieris canidia* were also recorded, which can be considered as uncommon species to the lower Gangetic plains (southern part of the West Bengal state). Out of the 106 butterfly species reported from around HDF, 16 species are protected under the Wildlife (Protection) Act, 1972 enacted in India (Table 2). Among those sixteen, three species are protected under Schedule I, 10 species under Schedule II, and three species under Schedule IV. (Table 2). However, it is also pleasing to note that King Crow, Striped Albatross, Common Gull and Pointed Ciliate Blue were observed frequently (F) (between 50 and 100 sightings). Another three species namely Common Mime, Common Lineblue and Common Pierrot are also scheduled under this Wildlife (Protection) act but are very common in this area (VF) (Table 2)
| Sl. No. | Subfamily | Common name         | Bionomial name                        | FO  | WPA schedule |
|--------|-----------|---------------------|--------------------------------------|-----|--------------|
|        | Papilionidae (03 genera, 09 species) |                |                                      |     |              |
| 1.     | Papilioninae | Common Jay          | Graphium doson (C. & R. Felder, 1864) | F   |              |
| 2.     | Papilioninae | Tailed Jay          | Graphium agamemnon (Linnaeus, 1758)  | VF  |              |
| 3.     | Papilioninae | Spot Swordtail      | Graphium nomius (Esper, 1799)        | R   |              |
| 4.     | Papilioninae | Common Rose         | Pachliopta aristolochiae (Fabricius, 1775) | F |              |
| 5.     | Papilioninae | Common Mime         | Papilio clytia (Linnaeus, 1758)      | VF  | I            |
| 6.     | Papilioninae | Common Mormon       | Papilio polytes (Linnaeus, 1758)     | VF  |              |
| 7.     | Nymphalidae (17 genera, 30 species) | Blue Mormon       | Papilio polymnestor (Cramer, 1775)   | F   |              |
| 8.     | Nymphalidae | Common Lime         | Papilio demoleus (Linnaeus, 1758)    | F   |              |
| 9.     | Nymphalidae | Common Banded Peacock | Papilio crino (Fabricius, 1793)     | IF  |              |
| 10.    | Danainae   | Blue Tiger          | Tirumala limniace (Cramer, 1775)     | F   |              |
| 11.    | Danainae   | Common Tiger        | Danaus genutia (Cramer, 1779)        | F   |              |
| 12.    | Danainae   | Plain Tiger         | Danaus chrysippus (Linnaeus, 1758)   | VF  |              |
| 13.    | Danainae   | Common Crow         | Euploea core (Cramer, 1758)          | VF  |              |
| 14.    | Danainae   | King Crow           | Euploea klugii kollari (C. & R. Felder, 1865) | F | IV          |
| 15.    | Charaxinae | Black Rajah         | Charaxes solon (Fabricius, 1793)     | F   |              |
| 16.    | Satyrinae  | Common Palmfly      | Elymnias hypermnestra (Linnaeus, 1763) | F |              |
| 17.    | Satyrinae  | Common Evening Brown | Melanitis leda (Linnaeus, 1758) | F   |              |
| No. | Family | Species Name | Common Name | Reference |
|-----|--------|--------------|-------------|-----------|
| 18. | Cuadernos de Biodiversidad 61 (2021) | Mycalesis perseus | Common Bushbrown | (Fabricius, 1775) |
| 19. | Cuadernos de Biodiversidad 61 (2021) | Mycalesis mineus | Dark-brand Bushbrown | (Linnaeus, 1758) |
| 20. | Cuadernos de Biodiversidad 61 (2021) | Mycalesis visala | Long-brand Bushbrown | (Moore, 1857) |
| 21. | Cuadernos de Biodiversidad 61 (2021) | Ypthima baldus | Common Fivering | (Fabricius, 1775) |
| 22. | Cuadernos de Biodiversidad 61 (2021) | Ypthima huebneri | Common Fouring | (Kirby, 1871) |
| 23. | Acraeinae | Acraea violae | Tawny Coster | (Fabricius, 1793) |
| 24. | Heliconinae | Phalanta phalantha | Common Leopard | (Drury, 1773) |
| 25. | Limenitinae | Moduza procris | Commander | (Cramer, 1777) |
| 26. | Limenitinae | Neptis hylas | Common Sailer | (Linnaeus, 1758) |
| 27. | Limenitinae | Neptis jumbah | Chestnut-streaked Sailer | (Moore, 1858) |
| 28. | Limenitinae | Euthalia aconthea | Common Baron | (Cramer, 1777) |
| 29. | Biblidinae | Ariadne Ariadne | Common Castor | (Linnaeus, 1763) |
| 30. | Biblidinae | Ariadne merione | Angled Castor | (Cramer, 1777) |
| 31. | Biblidinae | Vanessa cardui | Painted Lady | (Linnaeus, 1758) |
| 32. | Nymphalinae | Junonia orithya | Blue Pansy | (Linnaeus, 1758) |
| 33. | Nymphalinae | Junonia iphita | Chocolate Pansy | (Cramer, 1779) |
| 34. | Nymphalinae | Junonia atlites | Grey Pansy | (Linnaeus, 1763) |
| 35. | Nymphalinae | Junonia almana | Peacock Pansy | (Linnaeus, 1758) |
| 36. | Nymphalinae | Junonia lemonias | Lemon Pansy | (Linnaeus, 1758) |
| 37. | Nymphalinae | Junonia hierta | Yellow Pansy | (Fabricius, 1798) |
| 38. | Nymphalinae | Hypolimnas bolina | Great Eggfly | (Linnaeus, 1758) |
| 39. | Nymphalinae | Hypolimnas misippus | Danaid Eggfly | (Linnaeus, 1764) |
### Pieridae (09 genera, 12 species)

| No. | Subfamily | Common Name | Scientific Name | Year | Status |
|-----|-----------|-------------|-----------------|------|--------|
| 40. | Coliadinae | Common Grass Yellow | *Eurema hecabe* (Linnaeus, 1758) | VF |
| 41. | Coliadinae | Three-spot Grass Yellow | *Eurema blanda* (Boisduval, 1836) | F |
| 42. | Coliadinae | Common Emigrant | *Catopsilia pomona* (Fabricius, 1775) | VF |
| 43. | Coliadinae | Mottled Emigrant | *Catopsilia pyrene* (Linnaeus, 1758) | VF |
| 44. | Coliadinae | Yellow Orange Tip | *Ixias pyrene* (Linnaeus, 1764) | IF |
| 45. | Coliadinae | Common Wanderer | *Pereronia valeria* (Cramer, 1776) | F |
| 46. | Coliadinae | Striped Albatross | *Appias libythea* (Fabricius, 1775) | F IV |
| 47. | Coliadinae | Common Albatross | *Appias albina* (Boisduval, 1836) | R II |
| 48. | Coliadinae | Indian Cabbage White | *Pieris canidia* (Linnaeus, 1768) | R |
| 49. | Coliadinae | Common Gull | *Cepora nerissa* (Fabricius, 1775) | F II |
| 50. | Coliadinae | Common Jezebel | *Delias eucharis* (Drury, 1773) | F |
| 51. | Coliadinae | Psyche | *Leptosia nina* (Fabricius, 1793) | VF |

### Lycaenidae (27 genera, 35 species)

| No. | Subfamily | Common Name | Scientific Name | Year | Status |
|-----|-----------|-------------|-----------------|------|--------|
| 52. | Curetinae | Indian Sunbeam | *Curetis thetis* (Drury, 1773) | F |
| 53. | Mileitinae | Apefly | *Spalgis epius* (Westwood, 1852) | F |
| 54. | Aphnaeinae | Common Silverline | *Spindasis vulcanus* (Fabricius, 1775) | F |
| 55. | Aphnaeinae | Scarce-shot Silverline | *Spindasis elima* (Moore, 1877) | IF II |
| 56. | Polyommatinae | Ciliate Blue | *Anthene emolus* (Godart, 1824) | F |
| 57. | Polyommatinae | Pointed Ciliate Blue | *Anthene lycaenina* (Felder, 1868) | F II |
| 58. | Polyommatinae | Common Lineblue | *Prosotas nora* (C. Felder, 1860) | VF II |
| 59. | Polyommatinae | Bhutya Lineblue | *Prosotas bhutea* (de Niceville, 1884) | R |
| No.  | Name                      | Scientific Name                          | Publication                | Category |
|------|---------------------------|------------------------------------------|-----------------------------|----------|
| 60.  | Tailless Lineblue         | *Prosotas dubiosa* (Semper, 1879)        | VF                          |          |
| 61.  | Dark Cerulean             | *Jamides bochus* (Stoll, 1782)           | F                           |          |
| 62.  | Common Cerulean           | *Jamides celeno* (Cramer, 1775)          | F                           |          |
| 63.  | Forget me not             | *Catochrysops Strabo* (Fabricius, 1793)  | F                           |          |
| 64.  | Pea blue                  | *Lampides boeticus* (Linnaeus, 1767)     | IF, II                     |          |
| 65.  | Zebra Blue                | *Leptotes plinius* (Fabricius, 1793)     | IF                          |          |
| 66.  | Common Pierrot            | *Castalius rosimon* (Fabricius, 1775)    | VF, I                      |          |
| 67.  | Black-spotted Pierrot     | *Tarucus balkanicus* (Freyer, 1844)      | IF                          |          |
| 68.  | Striped Pierrot           | *Tarucus nara* (Kollar, 1848)            | F                           |          |
| 69.  | Dark Grass Blue           | *Zizeeria karsandra* (Moore, 1865)       | F                           |          |
| 70.  | Lesser Grass Blue         | *Zizina otis* (Fabricius, 1787)          | F                           |          |
| 71.  | Pale Grass Blue           | *Pseudozizeeria maha* (Kollar, 1844)     | VF                          |          |
| 72.  | Tiny Grass Blue           | *Zizula hylax* (Fabricius, 1775)         | F                           |          |
| 73.  | Quaker                    | *Neopithecops zalmora* (Butler, 1870)    | VF                          |          |
| 74.  | Malayan                   | *Megisba malaya* (Horsfield, 1828)       | F, II                      |          |
| 75.  | Gram Blue                 | *Euchrysops cnejus* (Fabricius, 1798)    | F, II                      |          |
| 76.  | Plains Cupid              | *Chilades pandava* (Horsfield, 1829)     | IF                         |          |
| 77.  | Lime Blue                 | *Chilades lajus* (Stoll, 1780)           | F                          |          |
| 78.  | Theclinae                 | *Mahathala ameria* (Hewiston, 1862)      | F, II                      |          |
| 79.  | Redspot                   | *Zesius chrysomallus* (Hubner, 1819)     | R                          |          |
| 80.  | Peacock Royal             | *Tajuria cippus* (Fabricius, 1798)       | IF, II                     |          |
| 81.  | Broadtail Royal           | *Creon cleobis* (Godart, 1824)           | R                          |          |
| No. | Group         | Species                                      | Description          | Status |
|-----|---------------|----------------------------------------------|----------------------|--------|
| 82. | Yamfly        | *Loxura atymnus* (Stoll, 1780)               | IF                   |
| 83. | Monkey Puzzle | *Rathinda amor* (Fabricius, 1775)            | F                    |
| 84. | Common Guava Blue | *Virachola isocrates* (Fabricius, 1793) | R                    |
| 85. | Slate Flash   | *Rapala manea* (Hewitson, 1863)              | VF                   |
| 86. | Red Flash     | *Rapala iarbus* (Fabricius, 1787)           | F                    |

**Riodinidae (01 genera, 01 species)**

| No. | Subfamily     | Species                                      | Description          |
|-----|---------------|----------------------------------------------|----------------------|
| 87. | Riodininae    | *Abisara bifasciata* (Moore, 1877)           | R                    |

**Hesperiidae (17 genera, 18 species)**

| No. | Subfamily     | Species                                      | Description          |
|-----|---------------|----------------------------------------------|----------------------|
| 88. | Coeliadinae   | *Hasora chromus* (Cramer, 1780)              | IF                   |
| 89. | Pyrginae      | *Tagiades japetus* (Stoll, 1781)             | F                    |
| 90. |              | *Spialia galba* (Fabricius, 1793)            | VF                   |
| 91. | Hesperiinae   | *Ampittia dioscorides* (Fabricius, 1793)     | F                    |
| 92. |              | *Halpe porus* (Mabille, 1877)                | R                    |
| 93. |              | *Iambrix salsala* (Moore, 1866)              | VF                   |
| 94. |              | *Suastus gremius* (Fabricius, 1798)          | F                    |
| 95. |              | *Hyarotis adrastus* (Stoll, 1780)            | IF IV                |
| 96. |              | *Matapa aria* (Moore, 1866)                  | F                    |
| 97. |              | *Parnara bada* (Moore, 1878)                 | VF                   |
| 98. |              | *Parnara ganga* (Evans, 1937)                | R                    |
| 99. |              | *Borbo cinnara* (Wallace, 1866)              | VF                   |
| 100.|              | *Pelopidas agna* (Moore, 1866)               | VF                   |
| 101.|              | *Pelopidas mathias* (Fabricius, 1798)        | IF                   |
| Number | Species                               | Scientific Name                  | Species Name         |
|--------|---------------------------------------|----------------------------------|----------------------|
| 102.   | Common Grass Dart                     | *Taractrocera maevius* (Fabricius, 1793) | R                    |
| 103.   | Common Dartlet                        | *Oriens gola* (Moore, 1877)       | VF                   |
| 104.   | Dark Palm Dart                         | *Telicota bambusae* (Moore, 1878) | F                    |
| 105.   | Plain Palm Dart                        | *Cephrenes acalle* (Hopffer, 1874) | IF                   |
| 106.   | Grass Demon                            | *Udaspes folus* (Cramer, 1775)    | F                    |

Figure 2: The number on the left of each photograph correspond to the numbering on the species in Table 2.
DISCUSSION

The aforementioned data indicate that this study area is a butterfly hotspot. But this area is increasingly threatened by demographic pressure and the establishment of transport godown, garbage dumping, seasonal picnic, fuel wood extraction, unplanned urbanization which are destroying the biological balance at a very rapid pace. The range extension of *Prosotas bhutea* into southern part of West Bengal highlights the importance of this kind of extensive surveys at un-explored sites. Since the study area harbours several protected species and *Prosotas bhutea*, the importance of conserving the butterfly fauna of this area is highlighted. Also, this species checklist may be used as an ecological indicator of this area.

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