

Assessment of butterfly diversity status and conservation issues in Agartala urban localities of Tripura, North East, India

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ABSTRACT

Urbanization leads to a great impact on biodiversity and butterflies (Lepidoptera) are commonly used as a bioindicator species for impact assessment throughout the globe. In order to attain the present status knowledge and conservation issues of butterflies in different impact zones across natural and semi-natural vegetation types, ecopark, residential area, commercial hub etc. in different urban localities of Agartala city, Tripura a random field study was conducted for two years. A total of 76 butterfly species belonging to 6 families and 51 genera were recorded with seasonal variation in their abundance. The family Nymphalidae was dominant in terms of species composition with 28 species and Riodinidae was least one with only single representative. This is the first urban butterfly study in Tripura highlighting present diversity status with some conservation issues like anthropogenic stress, mitigation measures etc. The present report may be useful for environmental impact assessment study in future developmental activities in the study area.

Key words : Butterflies, Nymphalidae, Urbanization, Conservation, Agartala, Tripura

Introduction

Changes in habitat quality and quantity associated with urbanization have negative influences on biodiversity. Due to the hazards imposed by urbanization to butterflies and the heterogeneity of urban areas throughout the globe, it is crucial to increase the number of ecological studies in a larger array of urban scenarios considering their geographic location, demography and urban management activities etc. (MacGregor-Fors and Ortega-Álvarez, 2013). The speed and intensity at which urbanization is taking place requires the use of bioindicators groups that provide a rapid and precise response; butterflies adhere to both requirements (Rouquette *et al.*, 2013; Lee *et al.*, 2015; Sing *et al.* 2016; Tam and Bonebrake, 2016; Das, 2020). Butterflies are a poten-

tial bio-indicator because of quick response to a minute level of environmental changes and receive much attention of common people for their color beauty. Global biodiversity loss is well known and bioindicator species provide a means for monitoring changes (Defra, 2016).

Urban biodiversity provides important cultural ecosystem service and may contribute towards human well-being. The negative ecological impact of urbanization on butterflies have been documented in many countries including India (Blair, 1999; Jones and Leather, 2012; Mukherjee *et al.*, 2016; Paul and Sultana, 2020). There are several research observations on butterflies in Tripura province of northeastern part of India, an Indo-burma biodiversity hotspot (Mondal *et al.*, 2002; Lodh and Agarwala, 2015; Lodh and Agarwala, 2016; Agarwala *et al.*,

2010; Majumder *et al.*, 2012; Majumder *et al.*, 2013; Das, 2017; Nair *et al.*, 2018; Bhowmik *et al.*, 2020; Agarwala and Majumder, 2020; Bhowmik, 2021) but as to date, there is no study report in relation to urban area landscape. So, the present study was designed to undertake for the first time in Agartala urban area, which is known as 'Agartala Smart City' since 2016 considering the second most populous city among north east state of India after Gauhati, Assam with current population size of 595,000 (2021) and its tremendous economic growth parameters.

Materials and Methods

Agartala is positioned at 23°50' 9.78''N (Latitude) and 91° 16' 45.80''E (Longitude) and covers an area of 76.51 square kilometers. In the present study 8(eight) sites were intensely explored covering of different vegetation types and level of disturbance. The sites include 1. College tila 2. Gurkabasti 3.Laxminarayan temple lake 4. Ramnagar 5.Badharghat 6. Radhanagar 7. Chandrapur 8. City Centre. Some of the sites having prominent green spaces like College tila, Gurkabasti and a few water bodies such as College tila lake, Laxminarayan temple lake. The survey was made for April, 2019 to May, 2021 in different seasons (pre monsoon, monsoon and post monsoon) and across different habitat like ecopark, lake, road side, commercial area, residential area, home garden etc. The butterflies were documented by random walks and opportunistic sighting. Photographic record was done with the help of high resolution digital camera (NIKKON COOPIX P610) and ASUS ZENFONE 3 MAX for the taxonomic purpose. The information regarding habitat characteristics and nectar plant sources were noted down. Identification at the species level was confirmed by following field guides (Kunte, 2000; Kehimkar, 2008; Kunte *et al.*, 2020). The abundance status of each species was determined based on sighting frequency in each sampling visit during the study period (Rare: 1-15 %; Not Rare:16-30 %; Uncommon: 31-60 %; Common:61-80 %; Very Common: > 80 %).

Results and Discussion

During the entire course of study in the urban localities of Agartala a total of 76 species of butterflies were documented belonging to 51 genera and 6

families. Out of the total 76 species observed, 26 species were very common, 18 species were common, 16 species were uncommon, 9 species were not rare and 7 species were being rare (Table 1). Among the families, the most dominant family was Nymphalidae representing by 18 genera with 28 species (36.8%) followed by Lycaenidae with 15 species (19.7%) and Riodinidae was represent by only single species (Figure 1, 2). Photographic record of all the documented species in the study area were placed in Photo plat 1, 2, 3. The availability of species were vary according to season and habitat structure. One of the key finding was that most of the highly-managed green spaces are very poor places for butterflies. Many of the parks surveyed in the study area like Heritage park, Nehru park had very low diversity of butterflies, especially those butterflies which depend on having native wild-flowers and specific caterpillar food plants nearby. A striking finding was that species like Mandarin Blue, Peacock Royal, Indian Nawab are absent from much of the densely populated area in city, clinging on only in a few spots. One more interesting finding of the present study is that, most of the butterfly

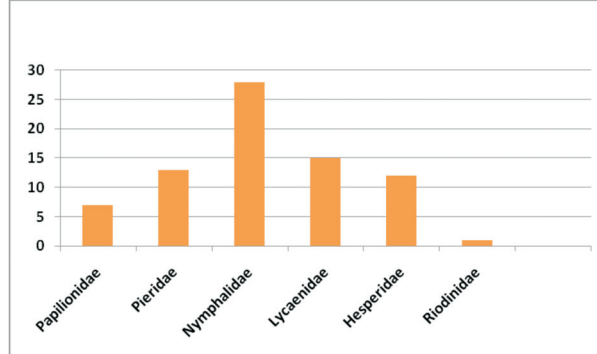


Fig. 1. Representation of family-wise species composition in the study area

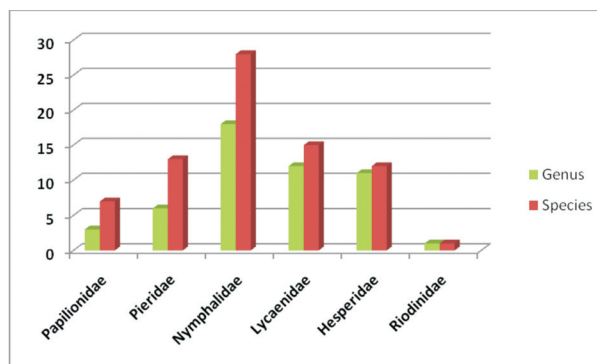


Fig. 2. Representation of Genus and Species-wise diversity among the family

Table 1. Butterfly species status in urban vicinity of Agartala with its abundance and seasonal occurrence

Sl. No.	Common Name	Scientific Name	Abundance	Pre-monsoon	Monsoon	Post-monsoon
Family: Papilionidae						
1	Common Rose	<i>Pachliopta aristolochiae</i>	Uncommon	+	+	+
2	Lime Swallowtail	<i>Papilio demoleus</i>	Very Common	+	+	+
3	Red Helen	<i>Papilio helenus</i>	Uncommon	+	+	-
4	Great Mormon	<i>Papilio memnon</i>	Very Common	+	+	+
5	Common Mormon	<i>Papilio polytes</i>	Very Common	+	+	+
6	Yellow Helen	<i>Papilio nephelus</i>	Common	-	+	+
7	Common Birdwing	<i>Troides helena</i>	Not Rare	+	+	-
Family: Pieridae						
8	Common Grass Yellow	<i>Eurema blanda</i>	Very Common	+	+	+
9	Lemon Emigrant	<i>Catopsilia pomona</i>	Very Common	+	+	+
10	Mottled Emigrant	<i>Catopsilia pyranthe</i>	Very Common	+	+	+
11	One-spot Grass Yellow	<i>Eurema andersoni</i>	Very Common	+	+	+
12	Three-spot Grass Yellow	<i>Eurema blanda</i>	Very Common	-	+	+
13	Red-base Jezebel	<i>Delias pasithoe</i>	Common	-	+	+
14	Psyche	<i>Leptosia nina</i>	Very Common	+	+	+
15	Red-spot Jezebel	<i>Delias descombesi</i>	Very Common	-	+	+
16	Painted Jezebel	<i>Delias hyparete</i>	Uncommon	-	-	+
17	Indian Cabbage White	<i>Pieris canidia</i>	Common	+	+	-
18	Common Albatross	<i>Appias albina</i>	Not Rare	-	+	+
19	Chocolate Albatross	<i>Appias lyncida</i>	Rare	+	-	-
20	Striped Albatross	<i>Appias libythea</i>	Uncommon	-	+	+
Family: Nymphalidae						
21	Common Castor	<i>Ariadne merione</i>	Rare	+	+	+
22	Indian Nawab	<i>Charaxes bharata</i>	Rare	-	-	+
23	Striped Tiger	<i>Danaus genutia</i>	Very Common	+	+	+
24	Plain Tiger	<i>Danaus chrysippus</i>	Very Common	+	+	+
25	Common Iascar	<i>Pantoporia hordonia</i>	Common	+	+	-
26	Knight	<i>Lebadea martha</i>	Uncommon	-	+	+
27	Common Crow	<i>Euploea core</i>	Very Common	+	+	+
28	Common Five-ring	<i>Ypthima baldus</i>	Very Common	-	+	+
29	Common Four-ring	<i>Ypthima huebneri</i>	Common	-	+	+
30	Nigger	<i>Orsotriaena medus</i>	Very Common	+	+	+
31	Common sergeant	<i>Athyma perius</i>	Rare	-	-	+
32	Common Palmfly	<i>Elymnias hypermnestra</i>	Very Common	+	+	+
33	Spotted Palmfly	<i>Elymnias malelas</i>	Common	+	+	+
34	Studded Sergeant	<i>Athyma asura</i>	Uncommon	+	+	-
35	Colour Sergeant	<i>Athyma inara</i>	Common	+	+	-
36	Common Red Forester	<i>Lethe mekara</i>	Uncommon	-	+	+
37	Blackvein Sergeant	<i>Athyma ranga</i>	Uncommon	+	-	-
38	Common Evening Brown	<i>Melanitis leda</i>	Very Common	+	+	+
39	Peacock Pansy	<i>Junonia almana</i>	Uncommon	+	+	-
40	Grey Pansy	<i>Junonia atlites</i>	Very Common	+	+	+
41	Yellow Pansy	<i>Junonia hierta</i>	Uncommon	-	+	+
42	Common Leopard	<i>Phalanta phalantha</i>	Common	+	-	-
43	Glassy Tiger	<i>Parantica aglea</i>	Rare	-	+	-
44	Great Eggfly	<i>Hypolimnas bolina</i>	Not Rare	+	-	-
45	Chocolate Pansy	<i>Junonia iphita</i>	Common	+	+	+
46	Lemon Pansy	<i>Junonia lemonias</i>	Very Common	+	+	+
47	Common Sailer	<i>Neptis hylas</i>	Common	+	+	+
48	Grey Count	<i>Tanaecia lepidea</i>	Common	+	+	+

Table 1. Continued ...

Sl. No.	Common Name	Scientific Name	Abundance	Pre-monsoon	Monsoon	Post-monsoon
Family: Lycaenidae						
49	Yamfly	<i>Loxura atymnus</i>	Not Rare	+	-	-
50	Common Tit	<i>Hypolycaena eryllus</i>	Uncommon	-	+	+
51	Mandarin blue	<i>Charana mandarinus</i>	Rare	-	-	+
52	Common Red Flash	<i>Rapala iarbus</i>	Common	-	+	+
53	Slate Flash	<i>Rapala manea</i>	Vey Common	+	+	+
54	Common Cerulean	<i>Jamides celeno</i>	Not Rare	+	-	+
55	Copper Flash	<i>Rapala pheretima</i>	Very Common	+	+	+
56	Purple Sapphire	<i>Heliophorus epicles</i>	Uncommon	+	-	-
57	Common Ciliate Blue	<i>Anthene emolus</i>	Very Common	-	+	+
58	Common Pierrot	<i>Castalius rosimon</i>	Very Common	+	+	+
59	Peacock Royal	<i>Tajuria cippus</i>	Rare	-	-	+
60	Lesser Grass blue	<i>Zizina otis</i>	Common	+	+	+
61	Pale Grass Blue	<i>Pseudozizeeria maha</i>	Very Common	+	+	+
62	Common Gem	<i>Poritia hewitsoni</i>	Uncommon	+	+	-
63	Forget-me-not	<i>Catochrysops strabo</i>	Common	+	-	-
Family: Hesperidae						
64	Common snow flat	<i>Tagiades japetus</i>	Common	-	+	+
65	Dark Velvet Bob	<i>Koruthaialos butleri</i>	Uncommon	-	+	+
66	Light Straw Ace	<i>Pithauria stramineipennis</i>	Not Rare	+	+	-
67	Chestnut bob	<i>Iambrix salsala</i>	Very Common	+	+	+
68	Black Paint-brush Swift	<i>Baoris unicolor</i>	Uncommon	-	+	+
69	Obscure Branded Swift	<i>Pelopidas agna</i>	Uncommon	+	+	-
70	Continental Swift	<i>Parnara ganga</i>	Not Rare	-	+	+
71	Great Swift	<i>Pelopidas assamensis</i>	Common	-	+	+
72	Smaller Dartlet	<i>Oriens goloides</i>	Not Rare	-	-	+
73	Grass Demon	<i>Udaspes folus</i>	Common	+	+	-
74	Dark Palm Dart	<i>Telicota bambusae</i>	Common	+	+	+
75	Common Branded Redeye	<i>Matapa aria</i>	Not Rare	+	+	-
Family: Riodinidae						
76	Punchinello	<i>Zemeros flegyas</i>	Very Common	+	+	+

species visit to *Chromolaena odorata*, an invasive shrub to meet the requirement for nectar particularly in the dry season. The surveys revealed that there is a relation between water bodies or semi-natural areas and butterfly diversity.

All of the previous study of butterfly in Tripura either limited to protected area (Lodh and Agarwala, 2016; Majumder *et al.*, 2012; Agarwala and Majumder, 2020) or natural forest area (Das, 2020; Bhowmik, 2021). But, this present study in the Agartala city is the first time attempt to explore the diversity status in any urban area of Tripura. The diverse habitats and topography are the major influence on the butterfly availability in Eastern Himalayan region (Mani, 1986). Butterflies are commonly found in the forest, and it is interesting to note that in the present study 76 species of butterflies were documented. In the present urban butterfly explora-

tion efforts the family Nymphalidae has dominated in terms of species and genera, a common trend in the previous study report in different protected and natural forest area of Tripura. Biodiversity in urban area decreases due to the increase of area such as residential area, industrial area, and commercial area associated with the decrease of natural environment (Alberti *et al.*, 2003; Kuussaari *et al.*, 2021). During the study period the important anthropogenic activities like illegal filled-up of water bodies, cutting of fodder plants, unscientific construction work etc. were noticed. So, it is important to rejuvenate the butterfly preferred food plants in different patches of the city and establishment of dedicated butterfly garden in urban parks, factory sites etc. in order to increase biodiversity in the study area. The present butterfly diversity study within Agartala urban area have generated a comprehensive



Photoplate 1: 1. *Pachliopta aristolochiae*; 2. *Papilio demoleus*; 3. *Papilio helenus*; 4. *Papilio memnon*; 5. *Papilio polytes*; 6. *Papilio nephelus*; 7. *Troides Helena*; 8. *Eurema blanda*; 9. *Catopsilia Pomona*; 10. *Catopsilia pyranthe*; 11. *Eurema andersoni*; 12. *Eurema blanda*; 13. *Delias pasithoe*; 14. *Leptosia nina*; 15. *Delias descombesi*; 16. *Delias hyparete*; 17. *Pieris canidia*; 18. *Appias albino*; 19. *Appias lycinda*; 20. *Appias libythea*; 21. *Ariadne merione*; 22. *Charaxes bharata*; 23. *Danaus genutia*; 24. *Danaus chrysippus*



Photoplate 2: 25. *Pantoporia hordonia*; 26. *Lebaea Martha*; 27. *Euploea core*; 28. *Ypthima baldus*; 29. *Ypthima huebneri*; 30. *Orsotriaena medus*; 31. *Athyma perius*; 32. *Elymnias hypermnestra*; 33. *Elymnias malelas*; 34. *Athyma asura*; 35. *Athyma inara*; 36. *Lethe mekara*; 37. *Athyma rangia*; 38. *Melanitis leda*; 39. *Junonia almana*; 40. *Junonia atlites*; 41. *Junonia hierta*; 42. *Phalanta phalantha*; 43. *Parantica aglea*; 44. *Hypolimnas bolina*; 45. *Junonia iphita*; 46. *Junonia lemonias*; 47. *Neptis hylas*; 48. *Tanaecia lepidea*



Photoplate 3:49. *Loxura atymnus*; 50. *Hypolycaena erylus*; 51. *Charana mandarinus*; 52. *Rapala airbus*; 53. *Rapala manea*; 54. *Jamides celeno*; 55. *Rapala pheretima*; 56. *Heliophorus epicles*; 57. *Anthene emolus*; 58. *Castalius rosimon*; 59. *Tajuria cippus*; 60. *Zizina otis*; 61. *Poritia hewitsoni*; 62. *Poritia hewitsoni*; 63. *Catochrysops Strabo*; 64. *Tagiades japetus*; 65. *Koruthaialos butleri*; 66. *Pithauria stramineipennis*; 67. *Iambrix salsala*; 68. *Baoris unicolor*; 69. *Pelopidas agna*; 70. *Parnara ganga*; 71. *Pelopidas assamensis*; 72. *Oriens goloides*; 73. *Udaspes folus*; 74. *Telicota bambusae*; 75. *Matapa aria*; 76. *Zemerus flegyas*

baseline data, which will help in future assessment of biodiversity and any impact on the habitat of the present study area.

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Conflict of interest

The author declares no conflict of interest.

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