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A Study on the Diversity of Butterfly Species in the Adjoining Natural Habitat of an Urbanized Locality of Sipajhar, Assam, India

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Abstract
Butterfly is considered as a flagship fauna. These are phytophagous in nature and they also contribute to pollination. Butterflies are sensitive to environmental changes including the fast rise of industries, intense use of fertilizers and insecticides, climate change, nitrogen pollution, mono-cropping, forest fires, fragmentation, and habitat degradation, all of which make them vulnerable to extinction. Change in land use pattern may lead to landscape changes that can reflect into change in butterfly diversity and distribution which makes butterflies also the umbrella species. In the present study, a total of 21 species of butterflies belonging to 16 genera in 6 families were recorded from the adjoining natural habitat of an urbanized locality of Sipajhar, Assam, India and the most of the species belonged to the family Nymphalidae. In this investigation, it was found that the recorded butterflies preferred white, purple, red and yellow flowers. The study results showed that the colour preferences of feeding flower is yellow in most of the cases. The decline and abundance of butterflies in any ecosystem may be directly related to the types and availability of plants in that particular area. So, a healthy ecosystem must be maintained for conservation of this beautiful species.

Keywords
Butterfly, Flower preferences, Habitat modification

INTRODUCTION

The biodiversity of insects is threatened worldwide and there has been a dramatic decline among Lepidopterans that may lead to the extinction of 40% of species over the next few decades (Sánchez-Bayo and Wyckhuys, 2019). Butterfly is considered as a flagship fauna (Tiple et al., 2005). Around 20,000 species of butterflies are recorded worldwide (Subedi et al., 2021) of which 1504 species are recorded from India (Kumar, 2021). This beautifully decorated insect have prominent ecological role as natural pollinator, proper indicator the ecological environment of a habitat having intimate relationship with faunal diversity of the habitat (Losey & Vaughan, 2006). Butterfly is classified into two super families namely Hesperioidea and Papilionoidea and the first one has a single while the second one has four families (Kehimkar, 2008).

Butterflies are phytophagous in nature and they also contribute to pollination (Mukherjee et al., 2015). Preference of flower depends upon colour of flower, necter concentration, quality and quantity, structure, size and shape of flower (Tiedge and Lohaus, 2017). Change even in a minor scale may lead to either migration or local extinction of butterfly (Kunte, 1997) as they are dependent on specific plant species (Bernays & Graham, 1988) and very sensitive to minor environmental changes (Stefanescu et. al., 2011).

The study area is situated at the edge of the capital city of Assam and recently been declared as a part of the urbanization program. Hence, along with the development, the pressure on the nature and natural resources has been increasing by degrees. Studies suggest that butterflies are sensitive to environmental changes (Stefanescu et al., 2011), including the fast rise of industries, intense use of fertilizers and insecticides, climate change, nitrogen pollution, mono-cropping, forest fires, fragmentation, and habitat degradation, all of which make them vulnerable to extinction. Change in

land use pattern may lead to landscape changes that can reflect into change in butterfly diversity and distribution which makes it a umbrella species, the species whose protection serves to protect many co-occurring species, for conservation planning and management (Fleishman et al., 2005; Betrus et al., 2005). The taxonomy, geographic distribution and status of many species of butterflies are relatively well known for which they are suitable for biodiversity studies and further they are considered as good biological indicators of habitat quality as well as general environmental health (Larsen, 1988; Kocher and Williams, 2000; Sawchik et al., 2005), as many species are strictly seasonal and prefer only particular set of habitats (Kunte, 1997). Human population in the world is increasing day by day resulting in anthropogenic changes impacting butterflies through both direct habitat loss as well as the loss of plant species on which butterflies depend (Hoyle and James, 2005).The studies on relationships between habitat modification and insect species in primary forests is an important prerequisite for understanding the process causing changes in distribution patterns and species composition of butterflies following anthropogenic disturbance (Kremen, 1992; Davis et al., 2001; Hamer et al., 2003).

MATERIALS AND METHODS

Study area

The study has been carried out at Sipajhar (Latitude-26.42995 N; Longitude-92.02095 E) which is situated around 50 Km away from Dispur, capital city of Assam. Topographically the area is plain and "Tropical Monsoon Rainforest Climate" persists in the area.

Methods

Survey was carried out in different spots within the study area including moist habitat, grassland and cropland from April to October, 2022 as it the time of harvesting and peak of greenery in this region (Wynter-Blyth, 1957). Data for both objectives were collected using the transect count method described by Pollard (1977). A total of 18 transects were arranged in a stratified and random manner at an interval of 90 m apart. Each transect was walked at a slow, constant pace and all butterflies within 5 m of the observer walking the transect (to either side, in front, and above) were counted and recorded. However, based on our observation, most individuals forage at the same patch for a long period and therefore most of the butterflies recorded were unique observations. Observation time was mostly from 6:00 am to 5:00 pm. Butterflies were identified in the field based on their behavioral and morphological characteristics following Smith and Majupuria (2006) and plants were identified based on leaf, floral and fruit characteristics following Storrs and Storrs (1990).

RESULTS AND DISCUSSION

In the present study, a total of 21 species of butterflies belonging to 16 genera in 6 families were recorded (Table 1) (Fig. 1). Among recorded, most number of species (Seven) belong to the family Nymphalidae (33.33%), which is followed by five species in the Pieridae (23.81%), three species in the Papilionidae (14.29%), three species in the Hesperiidae (14.29%), two species in the Lycaenidae (9.52%), and one species in the Riodinidae family (4.76%) (Fig. 2).

Table 1 Name and abundance of the selected organisms in the study area with their taxonomic status

S. No	Scientific Name	Family	Relative abundance	IUCN status
1	*Junonia atlites* (Linnaeus, 1763)	Nymphalidae	Very common	NE
2	*Zemeros flegyas* (Cramer, 1780)	Riodinidae	Rare	LC
3	*Delias pasithoe* (Linnaeus, 1767)	Pieridae	Common	LC
4	*Danaus chrysippus* (Linnaeus, 1758)	Nymphalidae	Common	LC
5	*Polyommatus Iphigenia* (Herrich-Schaffer, 1847)	Lycaenidae	Uncommon	NE
6	*Hesperia comma*(Linnaeus, 1758)	Hesperiidae	Uncommon	LC
7	*Lambrix salsala* (Moore, 1865)	Hesperiidae	Common	NE
8	*Papilio polytes* (Linnaeus, 1758)	Papilionidae	Common	LC
9	*Papilio helenus* (Linnaeus, 1758)	Papilionidae	Common	NE
10	*Pieris canidia* (Sparrman, 1768)	Pieridae	Very common	LC
11	*Elymnias hypermnestra* (Linnaeus, 1763)	Nymphalidae	Uncommon	NE
12	*Junonia lemonias* (Linnaeus, 1758)	Nymphalidae	Very common	NE
13	*Ypthima huebneri* (Kirby, 1871)	Nymphalidae	Very common	NE
14	*Junonia almanac* (Linnaeus, 1758)	Nymphalidae	Uncommon	LC
15	*Leptosia nina* (Fabricius, 1793)	Pieridae	Very common	NE
16	*Eurema hecabe* (Linnaeus, 1758)	Pieridae	Very common	NE
17	*Kricogonia lyside* (Godart, 1819)	Pieridae	Rare	NE
18	*Papilio demoleus* (Linnaeus, 1758)	Papilionidae	Uncommon	NE
19	*Asticopterus jama* (Felder, 1860)	Hesperiidae	Uncommon	NE
20	*Danaus genutia* (Cramer, 1779)	Nymphalidae	Common	NE
21	*Lapides boeticus* (Linnaeus, 1767)	Lycaenidae	Uncommon	LC

***NE** = Not evaluated, **LC** = Least concern

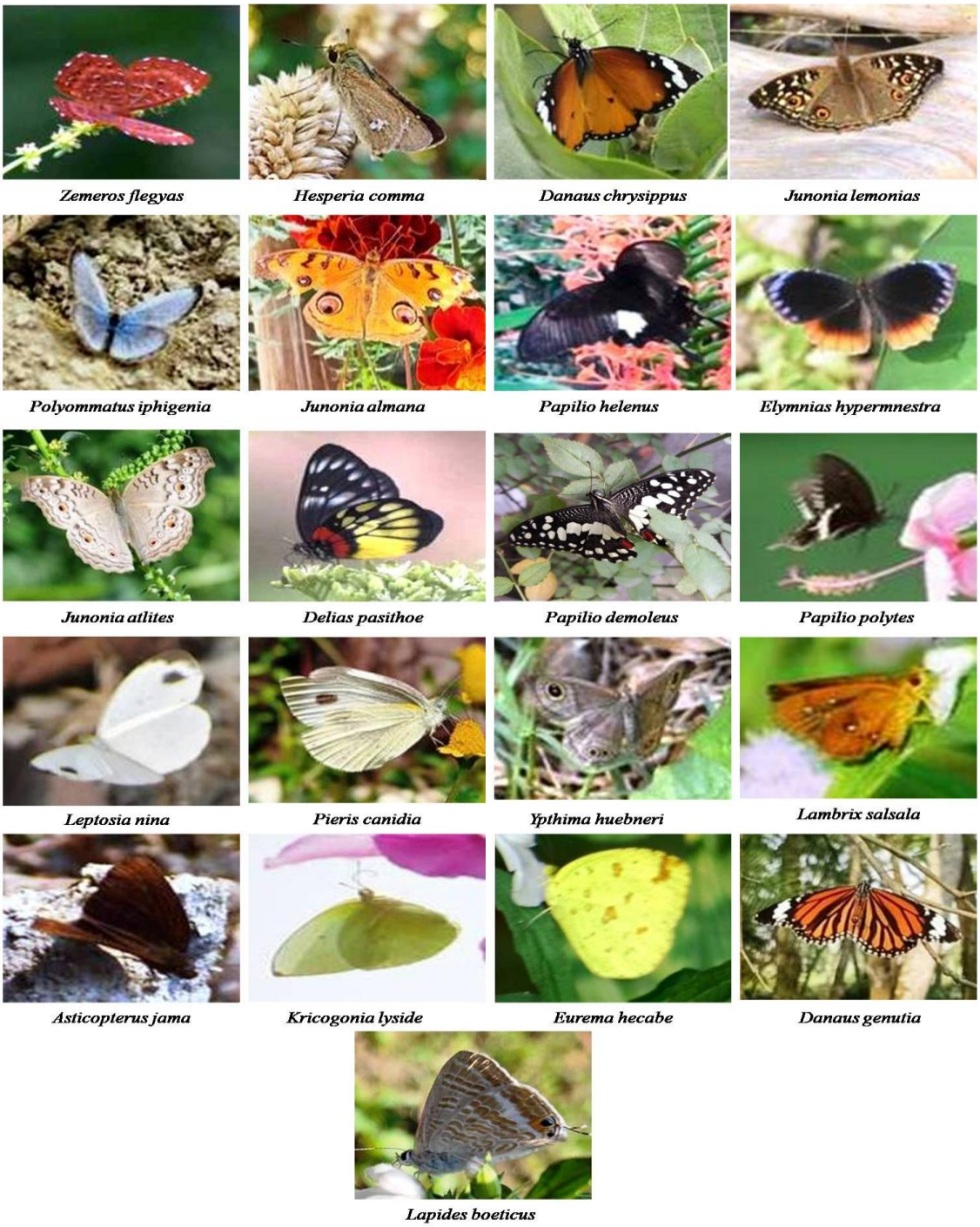

Fig. 1 Photograph of Butterflies from Sipajhar Area

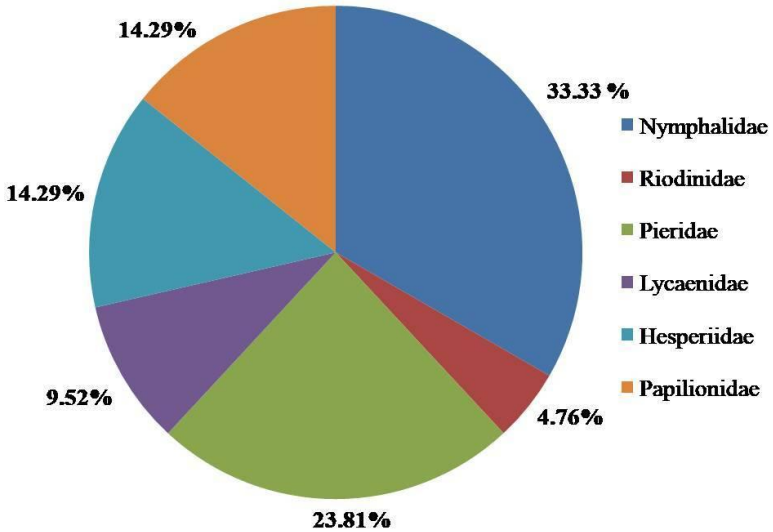

Fig. 2 Families of Butterflies with % of species

The distribution and abundance of butterfly species mostly depend on the availability of the feeder plant. In this investigation, it was found that the recorded butterflies preferred white, purple, red and yellow flowers. The study results showed that the colour preferences of feeding flower is yellow in most of the cases (Table 2).

Table 2 Table showing the distribution and feeder plant of the respective butterfly species in the study area

S. No.	Scientific Name	Latitude	Longitude	Feeder plant
1	*Junonia atlites*	26.397121°	91.898029°	*Asteracantha longifolia* (Family: Acanthaceae)
2	*Zemeros flegyas*	26.497019°	91.810962°	*Festuca ovina* (Family : Poaceae)
3	*Delias pasithoe*	26.395015°	91.893244°	*Asteracantha longifolia* (Family: Acanthaceae)
4	*Danaus chrysippus*	26.36365°	91.905622°	*Asclepias curassavica* (Family: Oleander)
5	*Polyommatus iphigenia*	26.39697°	91.89672°	*Onobrychis Montana* (Family: Fabaceae)
6	*Hesperia comma*	26.327463°	91.920153°	*Festuca ovina* (Family : Poaceae)
7	*Lambrix salsala*	26.363134°	91.903727°	*Brassica rapa* (Family: Brassicaceae)
8	*Papilio polytes*	26.497019°	91.810962°	*Citrus limon* (Family: Rutaceae)
9	*Papilio helenus*	26.397121°	91.898029°	*Deutzia crenata* (Family: Hydrangeaceae)
10	*Pieris canidia*	26.361573°	91.899237°	*Brassica rapa* (Family: Brassicaceae)
11	*Elymnias hypermnestra*	26.398549°	91.902956°	*Abrus precatorius* (Family: Fabaceae)
12	*Junonia lemonias*	26.39697°	91.89672°	*Citrus limon* (Family: Rutaceae)
13	*Ypthima huebneri*	26.361567°	91.89929°	*Asclepias curassavica* (Family: Apocynaceae)
14	*Junonia almana*	26.398549°	91.902956°	*Hygrophila auriculata* (Family: Acantheaeae)
15	*Leptosia nina*	26.397121°	91.898029°	*Abrus precatorius* (Family: Fabaceae)
16	*Eurema hecabe*	26.361567°	91.89929°	*Abrus precatorius* (Family: Fabaceae)
17	*Kricogonia lyside*	26.395015°	91.893244°	*Guaiacum sanctum* (Family: Zygophyllaceae)
18	*Papilio demoleus*	26.361567°	91.89929°	*Brassica rapa* (Family: Brassicaceae)
19	*Asticopterus jama*	26.363682°	91.905595°	*Miscanthus sinensis* (Family: Poaceae)
20	*Danaus genutia*	26.327463°	91.920153°	*Asclepias curassavica* (Family: Apocynaceae)
21	*Lapides boeticus*	26.390646°	91.893807°	*Brassica rapa* (Family: Brassicaceae)

It is observed that Nymphalidae family is dominant in the study area which resembles to the studies where it was recorded with the highest species richness (Kunte, 1997; Prajapati et al., 2000; Shrestha et al., 2018). Saikia, 2014 in her study at the Gauhati University Campus, Jalukbari, Assam recorded butterflies belonging to the families of Papilionidae, Nymphalidae, Hesperiidae and Pieridae which supports our findings. The overall flower preferences of the butterflies were partly resembled with the findings of Santhosh & Basavarajappa (2016) and Tiple et al. (2005). The butterflies under the family Nymphalidae and Pieridae (having the highest number of recorded species in this study) were found to be attracted mainly to the yellow coloured flowers which resembles to the findings of Omura and Honda (2005) and Zhang et al. (2018).

CONCLUSION

Butterflies are very sensitive and easily affected by changes and variations of environment. The most worrying causes of extinction of butterfly species are destruction, degradation or fragmentation of biotopes. Therefore, control of exploitation of natural biotopes for butterflies would help to increase its number. The decline and abundance of butterflies in any ecosystem may be directly related to the types and availability of plants in that particular area. So, to maintain a healthy ecosystem, a detailed study and proper strategies must be adopted to conserve this flagship organism.

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DECLARATION OF CONFLICT

The author declares that they have no known competing financial interest or personal relationships that could have appeared to influence the work reported in this paper.

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