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Study on the Diversity and Abundance of Butterfly Fauna in Pusa, Bihar

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Abstract
A study has been commenced to investigate the diversity of butterfly fauna in and around of Pusa. This study was carried out from the month February 2019 to March, 2020 to gather the activities of different genera. Throughout the study period a total of 52 butterfly species have been recorded which belongs to 5 families. Among all, Nymphalidae members were most frequently recorded accounting for 35.18 per cent (n = 19) belonging to 14 genera, followed by Lycaenidae of 28.84 per cent (n =15) belonging to 14 genera, Pieridae of 17.30 per cent (n = 9) belonging to 9 genera, Papilionidae of 11.53 per cent (n = 6) belonging to 3 genera and lowest species percentage was recorded for Hesperiidae as 5.76 per cent (n = 3) belonging to 3 genera. These results serve as a future reference material regarding the butterfly species richness in this region.

Keywords: Butterfly, species, diversity, Pusa

Introduction
Butterflies (Order: Lepidoptera) are highly colourful and have great aesthetic value. They are found all over the globe, except near the Poles and considered as good biological indicators because of their high diversity, short generation, good movement, host preference and sensitivity to environment changes (Lee *et al*., 2015) [7]. Since butterflies rely on unique host plants and have a complicated life cycle, they are vulnerable to human activities that threaten their habitat. Land, irrigation, fertilizer and pesticide applications and mechanisation have helped farmers achieve high productivity, but the survival of many butterflies and their biotopes has been threatened by these activities (Van der, 1987) [14].
Being potential pollinating agents of several wild and domesticated plant species depletion of their population could adversely affect the regeneration of plants they pollinate. Therefore, examination of butterfly fauna thus becomes significant in identifying and preserving potential habitats under threat (Nair *et al*., 2014) [9]. Globally about 45,000 species have been recorded and India has around 1,501species of butterflies (Jobiraj *et al*., 2020) [3]. Among all other biogeographic zones, Gangetic plain has less than 100 species of butterflies (Smetacek, 2017) [12]. So, the present study has been done to have an understanding of the diversity of butterflies found at Pusa, Bihar located in the Indo-Gangetic plain as the documentation on butterfly fauna in this region is very scanty. Eventually the entire study period gives an idea about the richness of butterfly fauna, their possible future exploration and conservation strategies in this area.

Materials and Methods
Study area
The study was done in and around Pusa with special attention in Dr. Rajendra Prasad Central Agricultural University, which is a home to various agricultural fields, Botanical garden and Biodiversity Park. It is located in the 'U' shaped southern and western bank of the river Burhi Gandak at 25° 59' 0" North latitude, 85° 41' 0" East longitude and 52.0 M above mean sea level (MSL). It falls in sub-humid, sub-tropical climate with moderate rainfall, cold winter and hot dry summer. The mean annual rainfall is about 1200 mm and the mean annual temperature varies from 24 to 26°C. The major types of vegetation covered were agricultural fields, grasslands, riverbank, roadside, shrubs and human habitations.

Butterfly survey
The observations were recorded on weekly basis from February 2019 to March, 2020 using Pollard Walk method (Pollard, 1977) and opportunistic sampling. The observations are taken between 8:00 AM to 10:00 AM and 3:00 PM to 5:00 PM. The butterflies were detected within 2.5 meters to the left and right side and five meters in front of the observer. The butterflies were documented either by direct observation or by capturing photographs and were identified later. Collecting live specimens were evaded during the study. The documentation of species was done with the help of field guides (Kehimkar, 2008; Kunte *et al*., 2011) [4, 6] and other relevant scientific sources from internet.

Fig 1: Satellite image of study area, Pusa

Results and Discussion

A total of 52 butterfly species have been documented during February 2019 to March, 2020 belonging to 5 Lepidopteron families as listed in table 1. Among these five families of butterfly species observed, members of Nymphalidae (19 species) were most frequently observed, which accounts for 35.18 per cent (n = 19) belonging to 14 genera, followed by Lycaenidae (15 species) 28.84 per cent (n =15) belonging to 14 genera, Pieridae (9 species) 17.30 per cent (n = 9) belonging to 9 genera, Papilionidae (6 species) 11.53 per cent (n = 6) belonging to 3 genera and lowest species percentage was recorded for Hesperiidae (3 species) as 5.76 per cent (n = 3) belonging to 3 genera.

Guptha *et al*. (2012) [2] reported 50 butterfly species belonging to 5 families from Seshachalam Biosphere Reserve of Eastern Ghats Andhra Pradesh, India. Out of these, Nymphalidae family (20 species) was found to be most prevalent followed by Lycaenidae (12 species), Pieridae (11 species), Papilionidae (5 species) and Hesperiidae (2 species). Murugesan and Muthusamy (2011) [8] reported about 103 butterfly species during the survey conducted at eastern part of Western Ghats. They stated that Nymphalidae family was found to be most dominant having 32 species followed by family Pieridae (23 species), Hesperiidae (15 species) and Papilionidae (14 species). Patil (2014) [10] recorded a total of 52 butterfly species in Jnandweepa, VPM campus, Thane, Maharashtra. He reported that maximum diversity of species was shown by family Nymphalidae (22 species) followed by family Pieridae and Lycaenidae having 10 species each and family Papilionidae and Hesperiidae were found to have minimum species diversity as 7 and 3 species respectively. Tiple and Khurad (2009) [13] recorded 145 butterfly species at eight locations in and around the region of Nagpur City. He stated that butterflies belonging to the family Nymphalidae (51 species) were found to be highest, followed by Lycaenidae (46 species), Hesperiidae (22 species), Pieridae (17 species) and Papilionidae (9 species). Charn (2015) recorded 54 butterfly species belonging to 7 families around the forest strip of Punjab. Among those he reported Nymphalidae as the most dominant family during the study period as it had higher number of butterfly species. Bubesh *et al*. (2012) [1] listed a total of 50 species of butterflies belonging to 5 families. He reported that maximum diversity of butterfly species were found to be in the families of Nymphalidae and Lycaenidae.

Table 1: Checklist of butterfly species of different families and their abundance in Pusa

S. No	Common name	Scientific name	Number of individuals found	Occurrence
Nymphalidae				
1.	Plain Tiger	*Danaus chrysippus* (Linnaeus, 1758)	86	VC
2.	Stripped Tiger	*Danaus genutia* (Cramer, 1779)	74	C
3.	Glassy Tiger	*Parantica aglea* (Stoll, 1782)	67	C
4.	Common Evening Brown	*Melanitis leda* (Linnaeus, 1758)	66	C
5.	Common Crow	*Euploea core* (Cramer, 1780)	89	VC
6.	Common Leopard	*Phalanta phalantha* (Drury, 1773)	65	C
7.	Tawny Coster	*Acraea terpsicore* (Linnaeus, 1758)	19	R
8.	Common Castor	*Ariadne merione* (Cramer, 1779)	72	C
9.	Angled Castor	*Ariadne ariadne* (Linnaeus, 1763)	78	C
10.	Common Bush Brown	*Mycalesis perseus* (Fabricius, 1775)	76	C
11.	Painted Lady	*Vanessa cardui* (Linnaeus, 1758)	59	C
12.	Common Palm fly	*Elymnias hypermnestra* (Linnaeus, 1763)	17	R
13.	Peacock Pansy	*Junonia almanac* (Linnaeus, 1758)	77	C
14.	Chocolate Pansy	*Junonia iphita* (Cramer, 1779)	21	R

15.	Grey Pansy	*Junonia atlites* (Linnaeus, 1763)	56	C
16.	Yellow Pansy	*Junonia hierta* (Fabricius, 1798)	49	C
17.	Common Four Ring	*Ypthima huebneri* (Kerby, 1871)	58	C
18.	Great Egg fly	*Hypolimnas bolina* (Linnaeus, 1758)	63	C
19.	Common Sailor	*Neptis hylas* (Linnaeus, 1758)	22	R
Papilionidae				
1.	Common Rose	*Pachliopta aristolochiae* (Fabricius, 1775)	52	C
2.	Lemon Butterfly	*Papilio demoleus* (Linnaeus, 1758)	74	C
3.	Common Mormon	*Papilio polytes* (Linnaeus, 1758)	62	C
4.	Blue Mormon	*Papilio polymnestor* (Cramer, 1775)	01	VR
5.	Common Jay	*Graphium doson* (Felder & Felder, 1864)	69	C
6.	Tailed Jay	*Graphium agamemnon* (Linnaeus, 1758)	21	R
Pieridae				
1.	Common Grass Yellow	*Eurema hecabe* (Linnaeus, 1758)	124	VC
2.	Common Wanderer	*Pareronia valeria* (Cramer, 1776)	71	C
3.	Mottled Emigrant	*Catopsilia pyranthe* (Linnaeus, 1758)	116	VC
4.	Psyche Butterfly	*Leptosia nina* (Fabricius, 1793)	51	C
5.	Eastern Bath White	*Pontia edusa* (Fabricius, 1777)	12	R
6.	Cabbage Butterfly	*Pieris rapae* (Linnaeus, 1758)	106	VC
7.	Common Jezebel	*Delias eucharis* (Drury, 1773)	63	C
8.	Common Gull	*Cepora nerissa* (Fabricius, 1775)	67	C
9.	Pioneer	*Belenois aurota* (Fabricius, 1793)	76	C
Lycaenidae				
1.	Common Pierrot	*Castalius rosimon* (Fabricius, 1775)	54	C
2.	Rounded Pierrot	*Tarucus extricates* (Butler, 1886)	62	C
3.	Red Pierrot	*Talicada nyseus* (Guérin-Méneville, 1843)	10	R
3.	Common Silverline	*Cigaritis vulcanus* (Fabricius, 1775)	65	C
5.	Bright Babul Blue	*Azanus ubaldus* (Stoll, 1782)	55	C
6.	Common Grass Blue	*Zizina labradus* (Fabricius,1787)	58	C
7.	Dark Grass Blue	*Zizeeria karsandra* (Moore, 1865)	19	R
8.	Pale Grass Blue	*Pseudozizeeria maha* (Kollar,1844)	61	C
9.	Tiny Grass Blue	*Zizula hylax* (Fabricius, 1775)	66	C
10.	African Babool Blue	*Azanus jesous* (Guérin-Méneville, 1849)	59	C
11.	Cycad Blue	*Luthrodes pandava* (Horsfield, 1829)	56	C
12.	Pea Blue	*Lampides boeticus* (Linnaeus, 1767)	69	C
13.	Forget Me Not	*Catochrysops strabo* (Fabricius, 1793)	81	C
14.	Gram Blue	*Euchrysops cnejus* (Fabricius, 1798)	64	C
15.	Lime Blue	*Chilades lajus* (Stoll, 1780)	59	C
Hesperiidae				
1.	Rice Skipper	*Pelopidas mathias* (Fabricius, 1798)	62	C
2.	Beaven's Swift	*Borbo bevani* (Moore, 1878)	40	C
3.	Common Grass Demon	*Udaspes folus* (Cramer, 1775)	54	C

*VC- Very Common, C- Common, R- Rare and VR- Very Rare

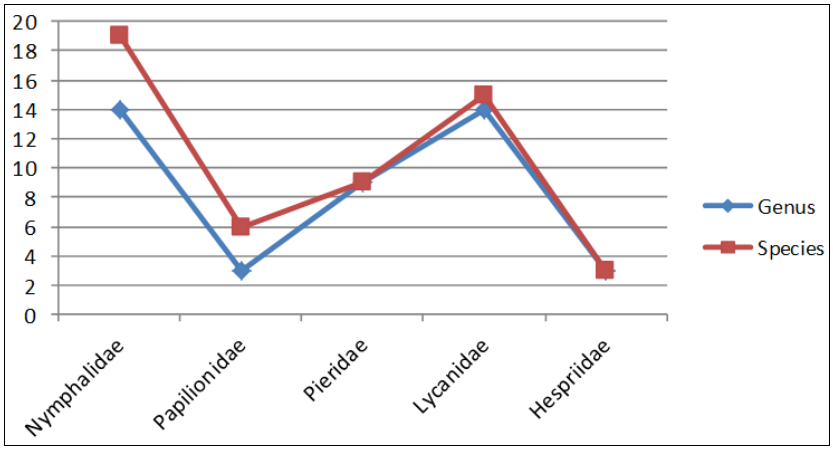


Fig 2: Distribution of genera and species of different families

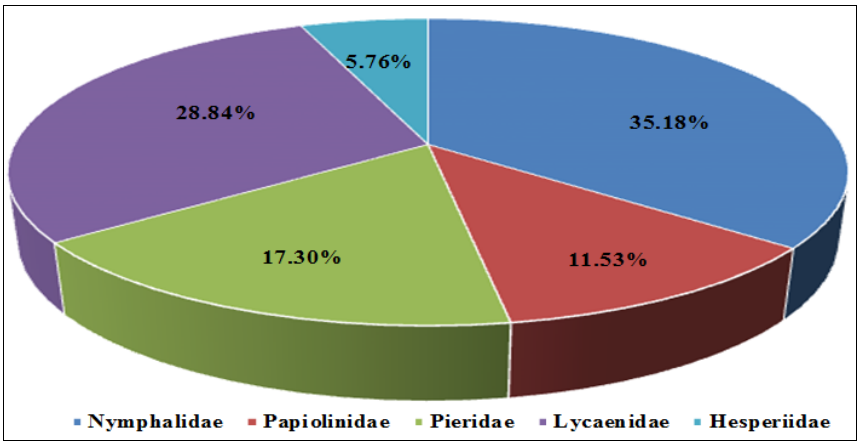
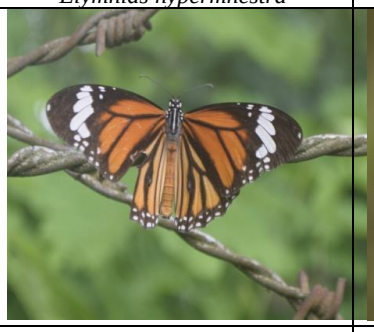
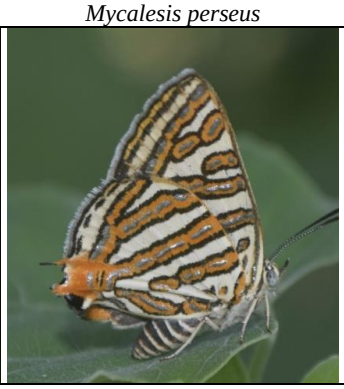
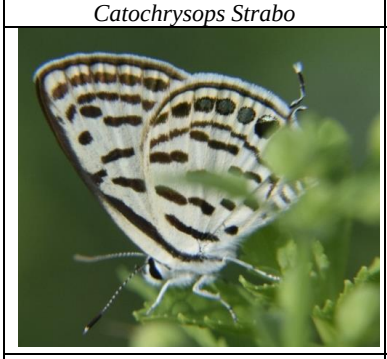
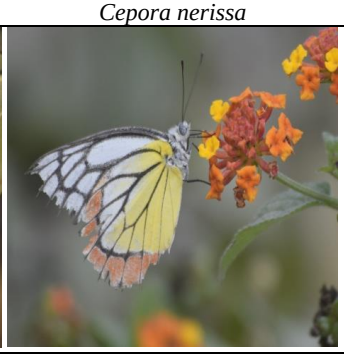


Fig 3: Percentage composition of different families

			
Great Eggfly *Hypolimnas bolina*	Grey Pansy *Junonia atlites*	Common Four Rings *Ypthima huebneri*	Common Leopard *Phalantha phalantha*
			
Peacock Pansy *Junonia almana*	Common Palmfly *Elymnias hypermnestra*	Painted Lady *Vanessa cardui*	Chocolate Pansy *Junonia iphita*
			
Common Castor *Ariadne merione*	Common Tiger *Danaus genutia*	Plain Tiger *Danaus chrysippus*	Common Crow *Euploea core*

			
Common Sailer *Neptis hylas*	Common Evening Brown *Melantis leda*	Common Bush Brown *Mycalesis perseus*	Bright Babul Blue *Azanus ubaldus*
			
Forget-me-not *Catochrysops Strabo*	Common Pierrote *Castalius rosimon*	Common Silverline *Cigaritis vulcanus*	Tiny Grass Blue *Zizula hylax*
			
Rounded Pierrote *Tarucus extricates*	Psyche Butterfly *Leptosia nina*	Common Gull *Cepora nerissa*	Eastern Bath White *Pontia edusa*
			
Common Grass Yellow *Eurema hecabe*	Common Wanderer *Pareronia valeria*	Common Jezebel *Delias eucharis*	Common Mormon *Papilio polytes*

Common Rose *Atrophaneura aristolochiae*	Citrus Butterfly *Papilio demoleus*	Common Grass Demon *Udaspes folus*	Bevans Swift *Pseudobarbo bevani*

Fig 4: Certain photographs of the butterflies observed in Pusa

Conclusion

The present work has systematically studied the butterfly diversity for first time in Pusa region and prepared a checklist in the study site. Among all, family-Nymphalidae carries the maximum number of species 19 (35.18%) followed by Lycaenidae 15 (28.84%), Pieridae 9 (17.30%), Papiolinidae 6 (11.53%) Hesperiidae 3 (5.76). This study provides baseline information of the diversity of butterflies and for future taxonomic work on Lepidoptera in the study area.

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