

An annotated checklist of butterflies and moths (Insecta: Lepidoptera) from the university of Rajasthan campus, Jaipur, India

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Abstract

The Lepidopterans are cosmopolitan, phytophagous, holometabolous, scale winged insects that comprises butterflies and moths. The Lepidopteran diversity of the University of Rajasthan campus that situated near Aravalli range, Rajasthan was accessed from March 2021 to February 2022, using random visual encounter method during morning hours of day. A total of 57 species of belonging to 45 genera of 11 families under 6 superfamilies of two suborders was observed. Out of these, 42 species belong from Rhopalocera, and remaining 15 were from Heterocera that constitutes 39.04% of total lepidopteran species. The Nymphalidae family was found richest in terms of the number of species and genera that are 14 and 10, respectively.

Keywords: Lepidoptera, Aravalli range, diversity, butterflies, moth

Introduction

The Lepidoptera is the most diverse order of the insects comprising scale winged beautiful butterflies and moth species. Lepidopteran fauna has much economic as well as ecological significance. They play a significant role in the terrestrial ecosystem, being pollinators of forest trees and agriculture crops, mineral recycling, and energy transformation up to succeeding trophic level into the forest food chain. The order Lepidoptera comprises 157,424 species belonging to 45 superfamilies, (Van Nieuwerkerken *et al.*, 2011) [33], and constitutes 10% of the total described species across globe (Mallet, 2007) [22]. There were 12000 lepidopteran species recorded from different parts of India (Chandra, 2007) [4]. Nevertheless, the recent studies suggest butterflies and moth species are declining in urban landscapes, which is alarming. It may be due to rapid urbanization, plant invasion, habitat degradation, artificial lightening, intensive agriculture practices, and lack of better conservation policies (Hallmann, 2020) [11]. A perusal of literature reveals that the lepidopteran fauna was explored in the different parts of the Rajasthan state by Macpherson (1927) [21], Kushwaha *et al.* (1963) [20], Varshney and Gupta (1966) [34], Thakur (1986) [1], Sharma (2014) [28], Sharma (2016) [29], Jangid *et al.* (2016) [16], Rajpurohit *et al.* (2017) [25], Choudhary *et al.* (2019) [5], Gupta and Dar and Jamal (2021) [7], Dar *et al.* (2021a) [6], Dar *et al.* (2021b) [8], Koli and Prajapati (2021) [19] Rajpurohit *et al.* (2017) [25], and Gehlot (2021) [9].

The literature surveys have not described any data available on the insect biodiversity of the campus. Hence, the finding of the present study underlines the importance of the preferred habitats of butterflies and moths at the foothills of Aravalli forest. This is quite significant and emphasizes the importance of University of Rajasthan, Jaipur campus in the biodiversity conservation scenario.

Study area

The main campus of the University of Rajasthan, Jaipur (UOR) is situated in the pediment plain in between the foothills of the north eastern portion of the Aravalli range in the Jaipur city of Rajasthan. Geographically it is located at 26.883225 N and 75.815436 E, with 444 meters average

elevation. The campus of University of Rajasthan, Jaipur is located very close to Jhalana Forest Reserve, and Nahargarh Wildlife Sanctuary, Jaipur. The climate represents 25.1°C mean temperature and 536 mm average rainfall with 35.1 mm rainfall days per year. This campus has a total area of 285.29 ha and the major habitat include a plant nursery, botanical garden, sports grounds, open grassland patches with the scattered shrubs and herbs (Fig- 1). The presence of semiarid habitat with tropical dry deciduous forest provides a home to a wide array of wildlife (Champion, and Seth 1968) [3]. In the account of flora *Acacia arabica*, *A. nilotica*, *A. leucophloea*, *A. senegal*, *Ficus religiosa*, *Boswellia serrata*, *Buteamonosperma*, *Madhuca indica*, *Anogeis suspendula*, *Zyziphus mauritiana*, *Z. nummularia*, etc. were dominant tree species, while *Lantana camera*, *Prosopis juliflora* are found invasive (Sharma, 2014) [28]. In the addition to the faunal account *Panthera pardus*, *Hyaena hyaena*, *Canis lupus*, *Rusa unicolor*, *Boselaphus tragocamelus*, *Semnopithecus entellus*, *Tetracerus quadricornis*, *Gazella bennettii*, etc., were dominating animal species of this landscape.

Materials and Methods

A field survey and sampling was carried out at the campus of the University of Rajasthan, Jaipur from March 2021 to February 2022 by the direct sighting, visual observation method, random walk, and opportunistic sighting covering all habitats (Murugesan *et al.* 2013) [23]. The collection and observation was carried out using binoculars in the morning session from 07:00 AM to 11:00 AM once in a week. After the visual encounter, the photo documentation was prepared using Cannon Sx70Hs digital point and shoot camera. The collected and photographed specimens were identified using the photographic field guide (Rangnekar, 2007 and Kehimkar, 2008) [17, 26] and standard taxonomic keys and available literatures of insect order Lepidoptera provided by Hampson (1892-1896) [12, 13, 14, 15], Bell & Scot (1937) [2], Zimmerman (1978) [35], Barlow (1982) [1], Robinson *et al.* (1994) [27], Kendrick (2002) [18], Solovyev & Wit (2009) [30], Sondhi *et al.* (2018) [31], and Subhalaxmi (2018) [32]. The moths' classification at higher taxonomic levels was done based on Van Nieuwerkerken *et al.* (2011) [33].

Results

There was a total of 57 species of the order Lepidoptera were reported belonging to 45 genera of 11 families of 6 superfamilies of 2 suborders in the campus of the University of Rajasthan, Jaipur [Table-1]. Out of these, 42 species were reported belonging to the sub order Rhopalocera, and the remaining 15 species belong to Heterocera. A maximum number 17 species of family Nymphalidae was observed followed by the Lycaenidae (12 species), Pieridae (11 species), Noctuidae (7 species), Papilionidae (4 species), Crambidae (3 species), Sphingidae (2 species), Hesperidae (1 species), Nolidae (1 species), Plutellidae (1 species), and Pyralidae (1 species) [Fig-2]. The Gram Blue, *Euchrysops cnejus* (Fabricius, 1798), Pea blue, *Lampides boeticus* (Linnaeus, 1767), Common gull, *Cepora nerissa* (Fabricius, 1775), Common crow, *Euploea core* (Cramer, 1780) are protected under Indian Wildlife (Protection) Act, 1972.

The finding of the present study underlines the importance of the preferred habitats of butterflies and moths at the semi-

arid landscape of Aravalli range of mountains. The presence of scheduled species also indicates the importance of this landscape for moth, and butterflies conservation. The Common Grass Yellow, *Eurema hecabe* Linnaeus, 1758), Plain Tiger, *Danus chrysippus* (Linnaeus, 1758), Lemmon Pency, *Junonia lemonias* (Linnaeus, 1758), Yellow Pency, *Junonia hierta* (Fabricius, 1798), White Orange Tip, *Ixias Marianne* (Cramer, 1779), Small Orange Tip, *Colotis setrida* (Boisduval, 1836), Common Marmoon, *Papilio polytes* (Linnaeus, 1758), Tiny Grass Blue, *Zizula hylax* (Fabricius, 1775), Common Emigrant, *Catopsilla pomona* (Fabricius, 1775), Beet Webworm Moth, *Spoladea recurvalis* (Fabricius, 1775) were the common occurring species, while Blue Tiger, *Tirumala limniace* (Cramer, 1775), Common leopard, *Phalantapha lantha* Drury, 1773), Large Salmon Arab, *Colotis fausta* (Olivier, 1804), Common Crow, *Euploea core* (Cramer, 1780), Painted Lady, *Vanessa cardui* (Linnaeus, 1758), The Boronet, *Euthalia nais* (Forster, 1771) were rarely sighted.

Table 1: An Annotated checklist of Lepidopteran species of campus of University of Rajasthan, Jaipur

S. No	Suborder	Superfamily	Family	Species	Common Name	
1	Rhopalocera	Papilionoidea	Lycaenidae	<i>Taracus nara</i> (Kollar, 1848)	Strippted Pierrot	
2				<i>Taracus callinara</i> (Butler, 1886)	Spotted Pierrot	
3				<i>Taracus extricatus</i> (Butler, 1886)	Rounded Pierrot	
4				<i>Zizula hylax</i> (Fabricius, 1775)	Tiny Grass Blue	
5				<i>Chilades parrhasius</i> (Fabricius, 1793)	Small Cupid Butterfly	
6				<i>Leptotes plinius</i> (Fabricius, 1793)	Zebra Blue	
7				<i>Freyeria putli</i> (Kollar, 1844)	Oriental Grass Jewel	
8				<i>Azanus ubaldus</i> (Stoll, 1782)	Bright Babool Blue	
9				<i>Luthrodes pandava</i> (Horsfield, 1829)	The Plain Cupid	
10				<i>Lampides boeticus</i> (Linnaeus, 1767)*	Pea Blue	
11				<i>Zizina</i> sp.	Lesser Grass Blue	
12				<i>Euchrysops cnejus</i> (Fabricius, 1798)*	The Gram Blue	
13			Hesperidae	<i>Pelopidas mathias</i> (Fabricius, 1798)	Small Branded Swift	
14			Nymphalidae	<i>Hypolimnas bolina</i> (Linnaeus, 1758)	Great Egg fly	
15				<i>Danus chrysippus</i> (Linnaeus, 1758)	Plain Tiger	
16				<i>Danus genutia</i> (Cramer, 1779)	Stripped Tiger	
17				<i>Melanitis leda</i> (Linnaeus, 1758)	Common Evening Brown	
18				<i>Junonia lemonias</i> (Linnaeus, 1758)	Lemon Pency	
19				<i>Junonia hierta</i> (Fabricius, 1798)	Yellow Pency	
20				<i>Junonia orithya</i> (Linnaeus, 1758)	Blue Pency	
21				<i>Ypthima asterope</i> (Klug, 1832)	Common Three Ring	
22				<i>Phalanta phalantha</i> (Drury, 1773)	Common Leopard	
23				<i>Junonia almana</i> (Linnaeus, 1758)	Peacock Pansy	
24				<i>Tirumala limniace</i> (Cramer, 1775)	Blue Tiger	
25				<i>Euploea core</i> (Cramer, 1780)*	Common Crow	
26				<i>Vanessa cardui</i> (Linnaeus, 1758)	Painted Lady	
27				<i>Euthalia nais</i> (Forster, 1771)	The Boronet	
28				Papilionidae	<i>Papilio polytes</i> (Linnaeus, 1758)	Common Marmoon
29					<i>Pachliopta aristolochiae</i> (Fabricius, 1775)	Common Rose
30					<i>Papilio demoleus</i> (Linnaeus, 1758)	Lime Butterfly
31			<i>Graphium nomius</i> (Esper, 1793)		The Spot Swardtail	
32			Pieridae	<i>Eurema hecabe</i> (Linnaeus, 1758)	Common Grass Yellow	
33				<i>Ixias marianne</i> (Cramer, 1779)	White Orange Tip	
34				<i>Ixias pyrene</i> (Linnaeus, 1764)	Yellow Orange Tip	
35				<i>Colotis etrida</i> (Boisduval, 1836)	Small Orange Tip	
36				<i>Catopsilla pomona</i> (Fabricius, 1775)	Common Emigrant	
37				<i>Catopsilla pyranthe</i> (Linnaeus, 1758)	Mottled Emigrant	
38				<i>Delias eucharis</i> (Drury, 1773)	Common Jezebel	
39				<i>Belenois aurota</i> (Fabricius, 1758)	Caper White	
40				<i>Cepora nerissa</i> (Fabricius, 1775)*	Common Gull	
41				<i>Eurema brigitta</i> (Cramer, 1780)	Small Grass Yellow	
42				<i>Colotis fausta</i> (Olivier, 1804)	Large Salmon Arab	
43	Heterocera	Noctuoidea	Noctuidae	<i>Spodoptera litura</i> (Fabricius, 1775)	Tobacco cutworm	

44				<i>Spodoptera exigua</i> (Hubner, 1808)	Beet Armyworm
45				<i>Agrotis ipsilon</i> (Hufnagel, 1766)	Dark Sward-Grass
46				<i>Helicoverpa armigera</i> (Hubner, 1808)	Cotton Ballworm
47				<i>Mythimna seprata</i> (Walker, 1865)	Oriental Armyworm
48				<i>Chrysodeixis sp.</i>	Tomato Looper
49				<i>Thysanoplusia orichalcea</i> (Fabricius, 1775)	Slender burnished brass
50		Nolidae		<i>Earias insulana</i> (Boisduval, 1833)	Egyptian Stem borer
51	Yponomeutoidea	Plutellidae		<i>Plutella xylostella</i> (Linnaeus, 1758)	Diamondback Moth
52	Pyraloidea	Pyralidae		<i>Etiella zinckenella</i> (Treitschke, 1832)	Pulse Pod Borer Moth
53	Bombycoidea	Sphingidae		<i>Agrius convolvuli</i> (Linnaeus, 1758)	Convolvulus Hawk-moth
54				<i>Acherontia styx</i> (Westwood, 1847)	Death's Head Hawkmoth
55	Pyraloidea	Crambidae		<i>Diaphania indica</i> (Saunders, 1851)	Cucumber Moth
56				<i>Spoladea recurvalis</i> (Fabricius, 1775)	Beet Webworm Moth
57				<i>Hellula undalis</i> (Fabricius, 1794)	The Cabbage Webworm

*Scheduled species

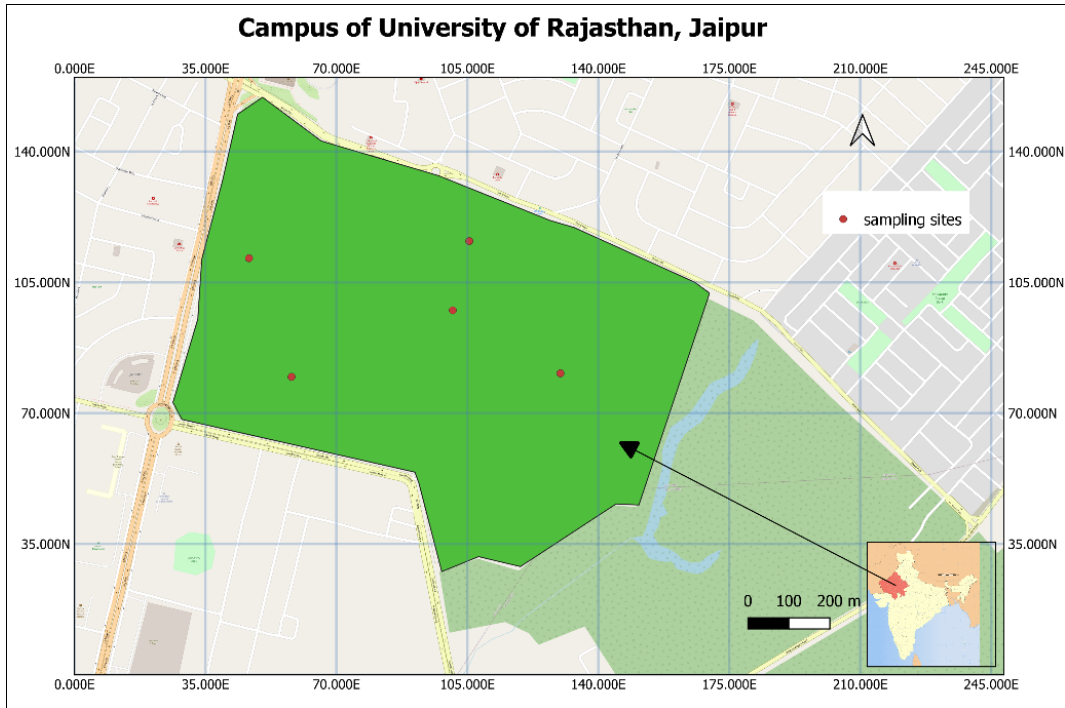


Fig 1: The Campus of University of Rajasthan, Jaipur showing sampling sites

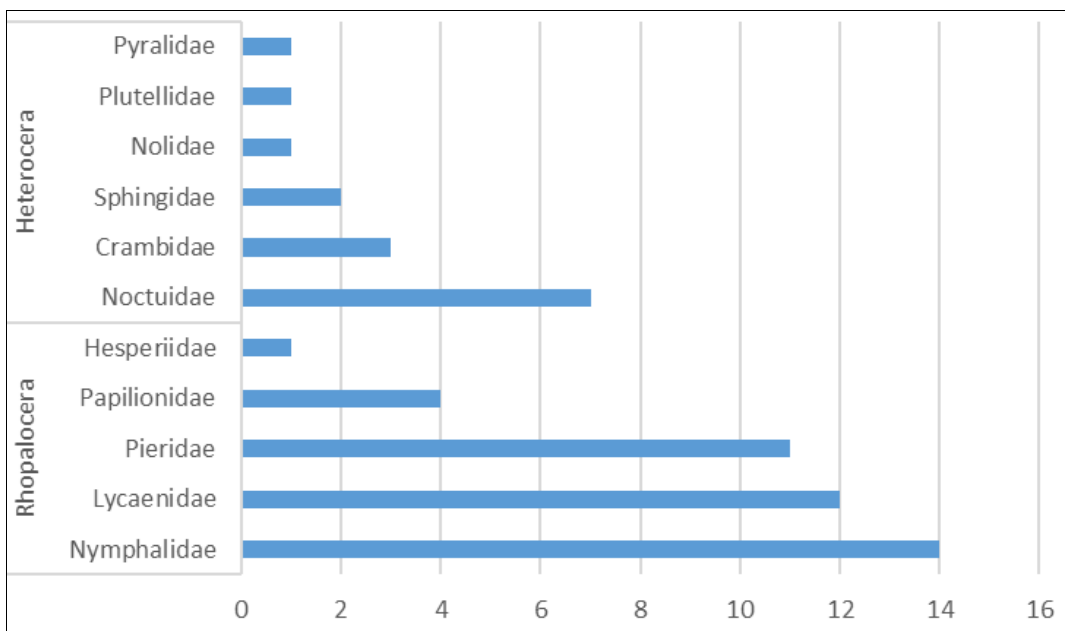
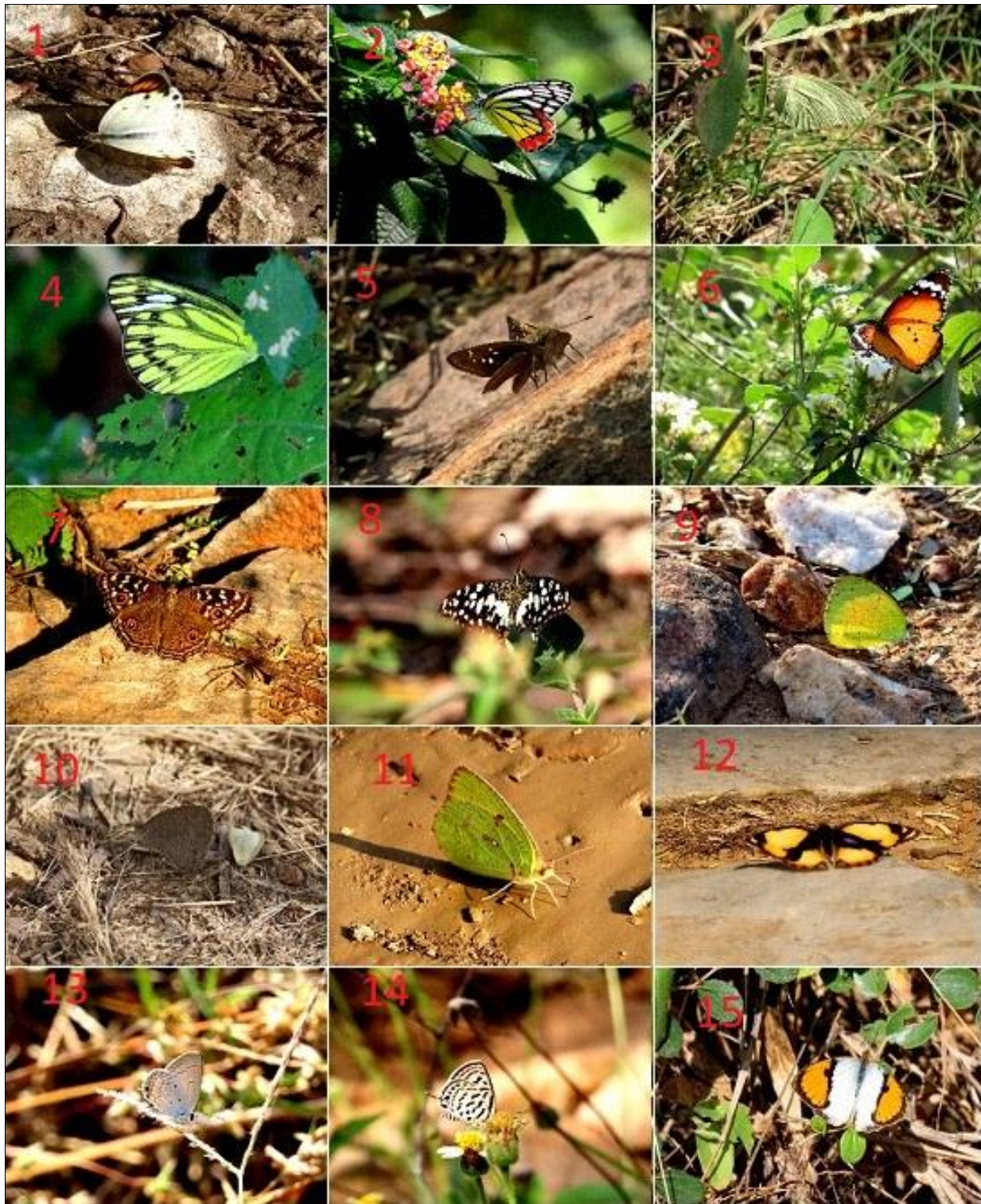


Fig 2: The Bar graph showing insect diversity in family wise manner



Images 1-15: 1. *Colotis etrida* (Boisduval, 1836) 2. *Delias eucharis* (Drury, 1773) 3. *Catopsilla pomona* (Fabricius, 1775) 4. *Cepora nerissa* (Fabricius, 1775) 5. *Pelopidas mathias* (Fabricius, 1798) 6. *Danus chrysippus* (Linnaeus, 1758) 7. *Junonia lemonias* (Linnaeus, 1758) 8. *Papilio demoleus* (Linnaeus, 1758) 9. *Eurema hecabe* (Linnaeus, 1758) 10. *Ypthima asterope* (Klug, 1832) 11. *Catopsilla pyranthe* (Linnaeus, 1758) 12. *Junonia hierta* (Fabricius, 1798) 13. *Luthrodes pandava* (Horsfield, 1829) 14. *Taracus nara* (Kollar, 1848), 15. *Ixias marianne* (Cramer, 1779).

Discussion

Rajasthan state has various types of ecoregions viz., Aravalli, Western great Thar Desert, plateau, eastern plain and there is no complete data base availability regarding Lepidoptera fauna of the whole state. Sharma (2014) [28] reported 146 species Lepidopteran belonging to 17 families at different parts of the Aravalli landscape, Rajasthan. The present study on the Lepidopteran fauna of the main campus of UOR, Jaipur revealed 57 species, which contributes

39.04% of the total species recorded from Aravalli of the State. Dar and Jamal (2021) studied different protected areas of the Aravalli landscape, and described 79 species of moth (Heterocera) belonging to 63 genera from all over the state. There were 14 species found similar to recorded species, and only *Chrsodeixis sp.* was found different. Jangid *et al.* (2016) [16] registered 77 species of butterfly at central Aravalli region at Ajmer district, which covers 40 species that recorded in our study.

The three butterfly families, Nymphalidae, Lycaenidae, and Pieridae were noticed most diversified. The higher species diversity of Lepidoptera in UOR, Jaipur campus may be attributed to the diverse habitats and rich vegetation. The study also reported four scheduled species under Indian Wildlife (Protection) Act, 1972 such as *Euchrysops cnejus* (Fabricius, 1798), *Lampides boeticus* (Linnaeus, 1767), *Cepora nerissa* (Fabricius, 1775), and *Euploea core* (Cramer, 1780). Paul and Sultana (2020) [24] reported that butterfly diversity varies in the different urban habitats, it may be due to this lesser number of species has been reported in our study.

The present study highlights the crucial role of the University of Rajasthan's Jaipur campus in conserving the insect biodiversity of the region, making it a pioneering effort in biodiversity assessment. This study is especially significant as it underscores the campus's importance within the broader context of biodiversity conservation efforts.

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