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Studies on Butterfly (Lepidoptera: Papilionoidea) Diversity in the Thar Desert of Rajasthan (India)

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ABSTRACT: Butterflies (Superfamily Papilionoidea) belong to the Insect Order Lepidoptera (*lepidos* = scale and *pteron* = wing) which also consists of moths. Butterflies serve as both pollinators and food for birds and other insectivorous animals, making them vital members of the food chain and markers of an environment in good health. The Thar Desert in Rajasthan comprises a significant portion (70%) of the Great Indian Desert. The Thar Desert is recognized for its rich and diversified flora and fauna. The majority of the flowers bloom during the monsoon months with just a moderate quantity of rain. The present study includes a thorough checklist of butterflies from Rajasthan's Thar Desert, including species found in the databases of the Zoological Survey of India, Desert Regional Centre, Jodhpur, and species that have already been documented in the literature. The present study revealed 98 species of butterflies, spread across 54 genera and 6 families, were found in the study region. With 34 species under 18 genera, the family Nymphalidae dominated, followed by Pieridae (28 species under 13 genera), Lycaenidae (21 species under 15 genera), Papilionidae (9 species under 3 genera), Hesperidae (5 species under 4 genera), and Riodinidae (1 species under 1 genus), respectively. There might be some other additions to the butterfly fauna of the Thar Desert of Rajasthan if thorough surveys are to be made. In the studied area, a butterfly species known as the Indian Pierrot, *Tarucus indica* Evans, 1932, has been found for the first time.

KEYWORDS: Butterfly, Fauna, Lepidoptera, Rajasthan, Thar-desert.

I. INTRODUCTION

Butterflies are the most attractive and fascinating insects belonging to the Insect Order Lepidoptera (scaly-winged) which also consists of moths. Butterflies are indicators of a healthy ecosystem and an important part of the food chain because they are food for birds and other insectivores and also act as pollinators. The butterfly fauna of the Thar Desert was earlier worked out by Nurse (1899), Macpherson (1927), Talbot (1939, 1947), Pruthi and Bhatia (1952), Mathur and Champakavalli (1961), Gupta and Thakur (1986), Varshney and Gupta (1996), Parihar and Singh (1993), Kazmi et al. (2003), Haldhar et al. (2013), Bhati & Srivastava (2016, 2016a), Rajpurohit et al. (2017), Sharma (2013 & 2018), Kaur et al. (2020), Gehlot et al. (2021), Meena et al. (2021), Mukherjee et al. (2021), Prajapat et al. (2021), and Chandra et al. (2021). In the current research, 98 species and subspecies of butterflies are reported from the Thar Desert of Rajasthan (Table 1) belonging to 54 genera and 6 families.

The classification of butterflies (Lepidoptera: Papilionoidea) has been followed by van Nieuwerkerken et al. (2011). For convenience, the common names of butterflies followed by Kunte et al. (2022) and other sources have also been provided in Table 1 with their scientific names.

The Thar Desert is classified as State 3A in the Indian Biogeographic Classification (Rodgers et al. (2000). The Thar Desert or Great Indian Desert is the 10th largest desert in the world, forming most of western India, and covers an area of about 2,78,330 sq. km., of that, 1,96,150 sq. km. (70%) is in Rajasthan, 62,180 sq. km. (23%) is in Gujarat, about 20,000 sq. km. (7%) Punjab and Haryana (Sharma, 2018). The climate of the Thar Desert is hot and dry, receives less than 25 cm or 10 inches of precipitation falls per year and the rate of evaporation is twice that of precipitation. The Thar Desert is recognized for its rich and diversified flora and fauna. The majority of the flowers bloom during the monsoon months with just a moderate quantity of rain. The Thar Desert of Rajasthan is encircled by the Sutlej River in the northwest, the Aravalli mountains in the east and the salty marshland of the Rann of Kutch (Gujarat) in the south, and the Indus River in the west. The Thar Desert of Rajasthan is predominantly characterized by three landforms-the sandy stretches of the Thar with sand dunes, plains, and hills. The present study only focused on the Thar Desert of Rajasthan which covers almost 13 districts out of 33 districts of the state.



II. MATERIAL AND METHODS

Study Area:

Rajasthan is located in northwestern India, between 23°30' and 30°11' North latitude and between 69°29' and 78°17' East longitude, and covers an area of 342,239 sq. km. Almost diagonally, the Aravalli chain divides Rajasthan into its two climatic zones viz., the arid zone i.e., the Thar Desert in the west and the semi-arid to sub-humid zone in the east and southeast of Rajasthan. The present study only focused on the Thar Desert of Rajasthan which covers almost 13 districts out of 33 districts of the state (Ghosh et al., 1996).



Fig.: Map of the study area



Fig.: Distribution of the Indian Thar Desert

The present study on the butterfly diversity in the Thar Desert of Rajasthan includes a thorough checklist of butterflies from Rajasthan's Thar Desert, incorporating species found in the databases of the Zoological Survey of India (ZSI), Desert Regional Centre (DRC), Jodhpur, and species that have already been documented in the published literature.

SYSTEMATIC LIST OF SPECIES
 Class INSECTA
 Order LEPIDOPTERA Linnaeus, 1758
 Super family PAPILIONOIDEA Latreille, 1802



Table 1: Checklist of Butterfly species reported from the Thar Desert of Rajasthan

Sl. No.	Family	Scientific name	Common name
1	Papilionidae	<i>Papilio polymnestor</i> Cramer, [1775]	Blue Mormon
2		<i>Papilio polytes</i> (Linnaeus, 1758)	Common Mormon
3		<i>Papilio polytes romulus</i> Cramer, 1776	Indian Common Mormon
4		<i>Papilio demoleus</i> Linnaeus, 1758	Lime Butterfly
5		<i>Pachliopta aristolochiae</i> (Fabricius, 1775)	Common Rose
6		<i>Pachliopta hector</i> (Linnaeus, 1758)	Crimson Rose
7		<i>Graphium doson</i> (C. & R. Felder, 1864)	Common Jay
8		<i>Graphium nomius</i> (Esper, 1799)	Spot Swordtail
9		<i>Graphium agamemnon menides</i> (Fruhstorfer, 1904)	Dakhan Tailed Jay
10	Pieridae	<i>Delias eucharis</i> (Drury, 1773)	Indian Jezebel
11		<i>Colotis danae</i> (Fabricius, 1775)	Crimson Tip
12		<i>Colotis etrida</i> (Boisduval, 1836)	Little Orange Tip
13		<i>Colotis eucharis</i> Fabricius, 1775	Plain Orange Tip

14		<i>Colotis fausta</i> (Olivier, 1804)	Large Salmon Arab
15		<i>Coloits fausta faustina</i> (C & Felder, [1865])	Punjabi Large Salmon Arab
16		<i>Colotis amata</i> (Fabricius, 1775)	Small Salmon Arab
17		<i>Colotis phisadia</i> (Godart, 1819)	Blue-Spotted Arab
18		<i>Colotis protractus</i> (Butler, 1876)	--
19		<i>Colotis vestalis</i> (Butler, 1876)	White Arab



20		<i>Colias fieldii</i> Menetries, 1855	Dark Clouded Yellow
21		<i>Cepora nerissa</i> Fabricius, 1775	Common Gull
22		<i>Ixias pyrene</i> (Linnaeus, 1764)	Yellow Orange-Tip
23		<i>Ixias marianne</i> (Cramer, 1779)	White Orange-Tip
24		<i>Belenois aurota</i> (Fabricius, 1793)	Pioneer
25		<i>Leptosia nina</i> (Fabricius, 1793)	Psyche
26		<i>Eurema hecabe</i> (Linnaeus, 1758)	Common Grass Yellow
27		<i>Eurema blanda</i> (Boisduval, 1836)	Three Spot Grass Yellow
28		<i>Eurema brigitta rubella</i> (Wallace, 1867)	Small Grass Yellow
29		<i>Eurema laeta</i> (Boisduval, 1836)	Spotless Grass Yellow
30		<i>Hebomoia glaucippe</i> (Linnaeus, 1758)	Great Orange-tip
31		<i>Pareronia valeria</i> (Cramer, 1776)	Common Wanderer
32		<i>Pieris brassicae</i> (Linnaeus, 1758)	Large Cabbage White
33		<i>Pieris canidia</i> (Sparrman, 1768)	Indian Cabbage White
34		<i>Pontia glauconome</i> (Klug, 1829)	Desert Bath White Butterfly
35		<i>Catopsilia pomona</i> (Fabricius, 1775)	Lemon Emigrant
36		<i>Catopsilia pyranthe</i> (Linnaeus, 1758)	Mottled Emigrant
37	Nymphalidae	<i>Acraea violae</i> (Fabricius, 1758)	Tawny Coster
38		<i>Argynnis hyperbius</i> (Linnaeus, 1763)	Indian Fritillary
39		<i>Charaxes bernardus</i> (Fabricius, 1793)	Tawny Rajah
40		<i>Danaus chrysippus</i> (Linnaeus, 1758)	Plain Tiger
41		<i>Danaus genutia</i> (Cramer, 1779)	Striped Tiger
42		<i>Euploea core</i> (Cramer, 1780)	Common Crow
43		<i>Tirumala limniace</i> (Cramer, 1775)	Blue Tiger



44		<i>Tirumala limniace leopardus</i> (Butler)	--
45		<i>Tirumala septentrionis</i> (Butler, 1874)	Dark Blue Tiger
46		<i>Melanitis leda</i> Linnaeus, 1758	Common Evening Brown
47		<i>Melanitis leda ismene</i> (Cramer, 1775)	--
48		<i>Mycalesis mineus</i> (Linnaeus, 1758)	Dark-Brand Bushbrown
49		<i>Ypthima baldus</i> (Fabricius, 1775)	Common Five-Ring
50		<i>Ypthima asterope</i> (Klug, 1832)	Common Three-ring
51		<i>Ypthima huebneri</i> Kirby, 1871	Common Four-ring
52		<i>Phalanta phalantha</i> (Drury, 1773)	Common Leopard
53		<i>Junonia atlites</i> (Linnaeus, 1763)	Grey Pansy
54		<i>Junonia almana</i> (Linnaeus, 1758)	Peacock Pansy
55		<i>Junonia hierta</i> (Fabricius, 1798)	Yellow Pansy
56		<i>Junonia iphita</i> (Cramer, 1779)	Chocolate Pansy

57		<i>Junonia lemonias</i> (Linnaeus, 1758)	Lemon Pansy
58		<i>Junonia lemonias vaisya</i> (Fruhstorfer, 1912)	--
59		<i>Junonia orithya</i> (Linnaeus, 1758)	Blue Pansy
60		<i>Junonia orithya swinhoei</i> Butler, 1885	Pale Blue Pansy
61		<i>Hypolimnas bolina</i> (Linnaeus, 1758)	Great Eggfly
62		<i>Hypolimnas misippus</i> (Linnaeus, 1764)	Danaid Eggfly
63		<i>Vanessa cardui</i> (Linnaeus, 1758)	Painted Lady
64		<i>Neptis hylas</i> (Linnaeus, 1758)	Common Sailor
65		<i>Neptis hylas astola</i> (Moore, 1872)	--



66		<i>Ariadne merione</i> (Cramer, 1777)	Common Castor
67		<i>Ariadne ariadne</i> (Linnaeus, 1763)	Angled Castor
68		<i>Moduza procris</i> (Cramer, 1777)	Commander
69		<i>Kallima paralekta</i> (Horsfield, [1829])	Indian Leaf wing
70		<i>Euthalia aconthea</i> (Cramer,[1777])	Common Baron
71		<i>Euthalia nais</i> (Forster, 1771)	Baronet
72	Lycaenidae	<i>Azanus ubaldus</i> (Stoll, 1782)	Desert Babul Blue
73		<i>Azanus uranus</i> Butler, 1886	Dull Babul Blue
74		<i>Catochrysops strabo</i> (Fabricius, 1793)	Forget-Me-Not
75		<i>Castalius rosimon</i> (Fabricius, 1775)	Common Pierrot
76		<i>Chilades lajus</i> (Stoll, (1780)	Lime Blue
77		<i>Chilades pandava</i> (Horsefield, 1829)	Plainstt Cupid
78		<i>Deudorix isocrates</i> (Fabricius, 1793)	Common Guava Blue
79		<i>Freyeria putli</i> (Kollar, 1844)	Black spotted Grass Jewel
80		<i>Freyeria trochylus</i> (Freyer, 1845)	Orange-spotted Grass Jewel
81		<i>Jamides bochus</i> (Stoll, 1782)	Dark Cerulean
82		<i>Tarucus extricatus</i> Butler, 1886	Rounded Pierrot
83		<i>Tarucus indica</i> Evans, 1932*	Indian Pierrot
84		<i>Tarucus callinara</i> Butler, 1886	Spotted Pierrot
85		<i>Tarucus theophrastus</i> (Fabricius, 1793)	Pointed Pierrot
86		<i>Euchrysops cnejus</i> (Fabricius, 1798)	Gram Blue
87		<i>Leptotes plinius</i> (Fabricius, 1793)	Zebra Blue
88		<i>Lampides boeticus</i> (Linnaeus, 1767)	Pea Blue
89	<i>Pseudozizeeria maha</i> (Kollar, 1844)	Pale Grass Blue	



90		<i>Prosotas nora</i> (Felder, 1860)	Common Lineblue
91		<i>Zizula hylax</i> (Fabricius, 1775)	Tiny Grass Blue
92		<i>Zizeeria karsandra</i> (Moore, 1865)	Dark Grass Blue
93	Riodinidae	<i>Dodona durga</i> (Kollar & Redtenbacher, 1844)	Common Punch
94	Hesperiidae	<i>Hesperilla ornata</i> (Leach, 1815)	Spotted Sedge-Skipper
95		<i>Parnara guttatus</i> (Bremer and Grey, 1853)	Common Straight Swift
96		<i>Pelopidas mathias</i> (Fabricius, 1798)	Small Branded Swift
97		<i>Spialia doris evanida</i> Butler, 1880	Desert Grizzled Skipper
98		<i>Spialia galba</i> (Fabricius, 1793)	Indian Grizzled Skipper

III. RESULT AND DISCUSSION

The present study revealed altogether 98 species/subspecies of butterflies distributed over 54 genera and 6 families recorded from the Thar Desert of Rajasthan. The Family Nymphalidae has been found dominating with 34 species under 18 genera followed by Pieridae 28 species under 13 genera, Lycaenidae 21 species under 15 genera, Papilionidae 9 species under 3 genera, Hesperidae 5 species under 4 genera, and Riodinidae 1 species under 1 genus respectively. There might be some other additions to the butterfly fauna of the Thar Desert of Rajasthan if thorough surveys are to be made. In the studied area, a butterfly species known as the Indian Pierrot, *Tarucus indica* Evans, 1932 marked with an asterisk (*), has been found for the first time. In this study, we also found that there may be more species of butterfly that are yet to be documented from this region because of its vast dry grasslands and less explored butterfly fauna.

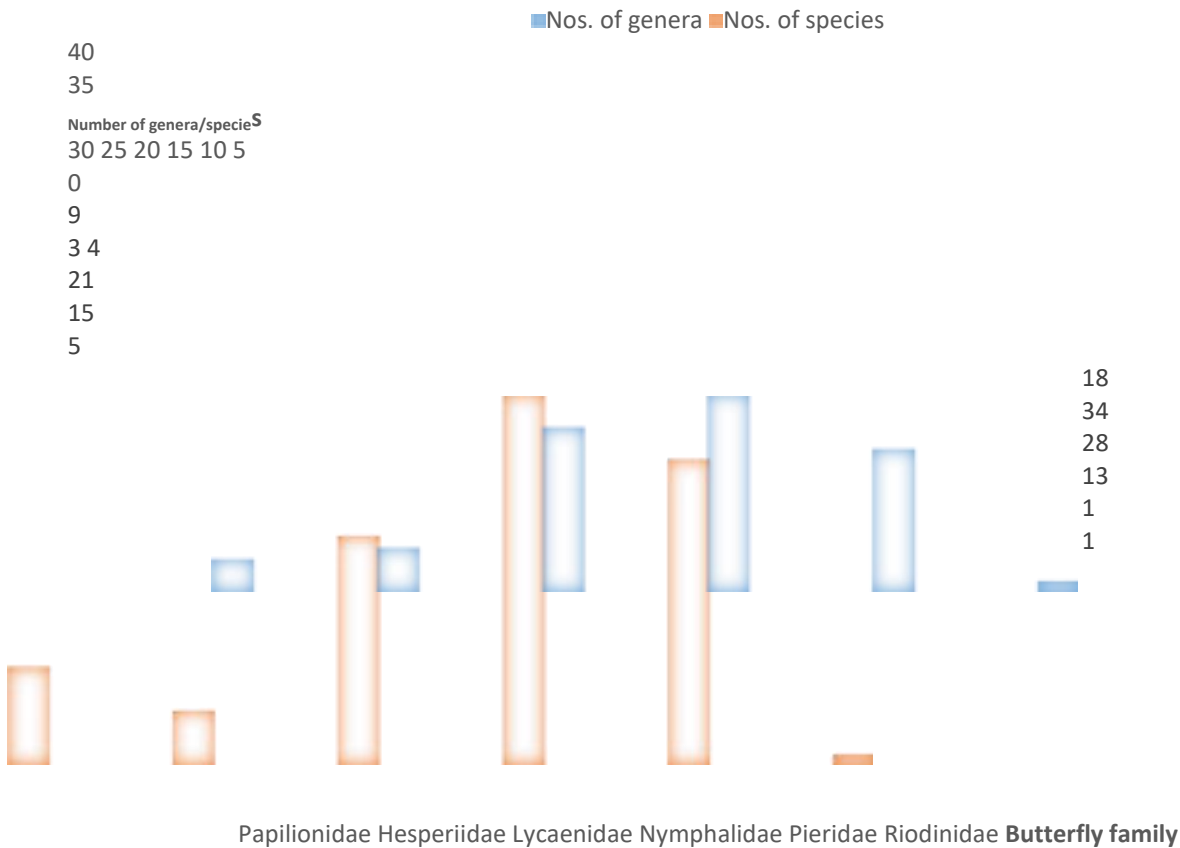


Fig.: Family-wise number of genera and species of butterfly recorded from the Thar Desert of Rajasthan.

Threats:

- The introduction of the Indira Gandhi Nahar Canal Pariyojna (IGNP) has converted more than 11% of uninhabitable desert grasslands to fertile or agricultural land, devoid of butterfly habitat and host plants.
- Large-scale irrigation projects are turning desert grasslands into agricultural land, threatening native biodiversity (xeric element).
- The loss of biodiversity is another effect of the mining of rocks, minerals, and other natural resources, whether or not it is being monitored.
- The rapid expansion of the livestock population has also put an inordinate amount of strain on the butterfly habitats in the grasslands.

Conservation measures:

- Although their primary objective is to preserve the significant species of animals that dwell there, the government has previously established a number of protected areas, such as the Desert National Park WLS, Talchhapar WLS, Gajner WLS and Sundha Mata Conservation Reserve in the Thar Desert region.
- Under the Indian Wildlife (Protection) Act of 1972, the Government of India protected 452 species of butterflies in three schedules (out of six), including 128 species in Schedule I, Part IV, 305 species in Schedule II, and 19 species in Schedule IV (Secs. 2, 8, 9, 11, and 61). (Anon., 2003).
- Export of butterflies (dead or alive) and ornaments made from butterflies is prohibited.
- People love butterflies, but unknowingly dislike their immature stages (caterpillars) for various reasons.
- The importance of butterflies and their habitats should be made known to the general public.



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