

# Original Research Article

## Butterfly Diversity Of Navsari Agricultural University (Nau), Navsari, Gujarat, India

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**Aims:** The first systematic attempt to assess and document the butterflies richness on the lush green campus of Navsari Agricultural University (NAU) campus.

**Place and Duration of Study:** The study was conducted at the Navsari Agricultural University (NAU) was assessed over the duration from September 2020 to December 2022.

**Methodology:** The opportunistic survey was conducted on a monthly basis in the different pre-determined existing paths on the campus. Butterflies were sited, identified, and photographed during the survey. The identification of the species was carried out using field books and later confirmed by photographs taken during the survey referencing different available literature traditionally and online. The species identified were listed and classified into respective families.

**Results:** A total of 83 butterfly species belonging to 5 families were recorded at Navsari Agricultural University (NAU), Navsari, Gujarat between September 2020 to December 2022. 13 butterfly species recorded are protected under scheduled categories of Wildlife protection act, 1972. 4 species listed under the IUCN red list viz. *Euploea core* under the Least concerned category, *Hypolimnasmisippus* under the Least concerned category, *Junonia almana* under the Least concerned category, and *Castalius rosion* under the vulnerable category were recorded. Presence of suitable host plant for the butterfly determine the dominance in the campus.

**Conclusion:** From this study, it is evident that Navsari Agricultural University (NAU), Navsari, Gujarat has a very rich butterfly fauna.

*Keywords: Lepidoptera, red list, host plant, Campus*

## 1. INTRODUCTION

Butterflies are scaly winged insect of order Lepidoptera along with skippers and moths (Singh, 2011). India harbors 1,501 butterfly species, out of which 334 species are distributed in Western Ghats (Evans, 1932 and Kunte, 2000). Rich local flora influence the butterfly larval host relationship (Murphy and Wilcox, 1986).

Urban green spaces plays crucial role in combating the negative influence of urbanization on local biodiversity and often they end up in small, fragmented patches like urban parks, Gardens and educational institutes, Agricultural universities, etc. that may be isolated (Kuhn et al., 2022 and Sekarappa and Basavarajappa, 2016). Navsari districts of the southern Gujarat region falls under the northern tip of the Western Ghats with few studied on butterflies.

Recently very few studies are conducted in urban and semi-urban landscapes of India and Gujarat (Parasharya and Jani, 2007; Bhalodia et al., 2002; Shobana et al., 2012; Tiple, 2012; Kaneria et al., 2013; Kumar, 2013; Arya et al., 2014; Thangapandian et al., 2014; Mali et al., 2014; Gandhi et al., 2015; Priyamvada and Mohapatra, 2016; Gandhi and Kumar, 2016; Mukherjee et al., 2016; Bhatt and Nagar 2017 and Suthar et al., 2019), including in gardens, universities campuses, and urban parks, however, there was no specific work reported in urban landscapes of Navsari district. This is the first systematic attempt to assess and document the butterflies richness on the lush green campus of Navsari Agricultural University (NAU) campus.

## 2. MATERIAL AND METHODS

**2.1 Study area-** The Butterfly's diversity at the Navsari Agricultural University (NAU) was assessed over the duration from September 2020 to December 2022. The university (Lat-20.924660°, Long-72.907953°) sprawls over 3.45 km<sup>2</sup> in the Navsari district in Gujarat. This area comes under a heavy rainfall zone northernmost part of the Western Ghats. The unique location of the university allows the diversity of the different species to thrive well.

**2.2 Survey Methods**-The opportunistic survey was conducted on a monthly basis in the different pre-determined existing paths on the campus (Kasambe et al., 2018). Butterflies were sighted, identified, and photographed during the survey using the digital cameras (Canon EOS 3000D and Nikon D7200). The Identification of the species was carried out using field books and later confirmed by photographs taken during the survey referencing different available literature traditionally and online (Kunte et al., 2023; Kehimkar, 2016; Kunte, 2000; Gaonkar H., 1996; Varshney and Smetacek, 2015 and Evans, 1932). The species identified were listed and classified into respective families. Along with that occasional rare sightings were also considered to prepare the final checklist. The status was decided according to the number of sightings during the survey (Priyamvada and Mohapatra, 2016). Butterflies were also classified under the schedule list of India's Wildlife Protection Act, 1972 (Anon., 2006) for a better understanding of conservation strategies.

### 3. RESULTS AND DISCUSSION

A total of 83 butterfly species belonging to 5 families, namely, hesperiidae (6 species), papilionidae (6 species), peiridae (20 species), lycaenidae (23 species), and nymphalidae (28 species) were documented during the study period (Table 1, plate i, ii, iii and iv). A total of 13 butterfly species are protected under scheduled categories of wildlife protection act, 1972, i.e. *Castaliusrosimonrosimon* (fabricius, 1775) and *Danaus genutiagenutia* (cramer, [1779]) are under schedule-i, *Hypolimnasmisippus* (linnaeus, 1764) under schedule i as well as ii, *Anthenelycaeninalycaenina* (r. Felder, 1868), *Ceporanerissaphryne* (fabricius, 1775), *Charaxes solon solon* (fabricius, 1793), *Euchrysops snejuscnejus* (fabricius, 1798), *Euthalia acontheameridionalis* (fruhstorfer, 1906), *Kallima horsfieldii* (kollar, 1844), *Lampides boeticus* (linnaeus, 1767), *Prosotasnoraardates* (moore, 1875), *Spindasiselimalima* (moore, 1877), under schedule ii and *Appiaslibythea* (fabricius, 1775) is under sched iv of WPA 1972 (anon., 2006). Ecological inventories are important to maintain baseline data for future research to evaluate the shifts in species composition due urbanization or other anthropogenic pressure (trivedi et al., 2022).

**Table 1. List of butterfly species of Navsari Agricultural University, Navsari, Gujarat**

No. #	Common Name	Zoological Name	WPA Status	Status*
<b>(A) Family: Nymphalidae</b>				
1	Baronet	<i>Symphaedranais</i> (Forster, 1771)	NA	UC
2	Chinese Lemon Pansy	<i>Junonialemoniaslemonias</i> (Linnaeus, 1758)	NA	VC
3	Common Four-ring	<i>Ypthimahuebneri</i> (Kirby, 1871)	NA	C
4	Coromandel Glassy Tiger	<i>Paranticaagleaaglea</i> (Stoll, 1782)	NA	UC
5	Dakhan Common Baron	<i>Euthalia acontheameridionalis</i> (Fruhstorfer, 1906)	Sched II	R
6	Dakhan Common Bush brown	<i>Mycalesisperseustabitha</i> (Fabricius, 1793)	NA	C
7	Dakhan Common Castor	<i>Ariadne merionemerione</i> (Cramer, 1777)	NA	R
8	Danaid Eggfly	<i>Hypolimnasmisippus</i> (Linnaeus, 1764)	Sched I & II	VC
9	Himalayan Common Palmfly	<i>Elymniashypermnestraundularis</i> (Drury, 1773)	NA	R
10	Indian Common Crow	<i>Euploea core core</i> (Cramer, 1780)	NA	VC
11	Indian Common Sailer	<i>Neptishylasvarmona</i> (Moore, 1872)	NA	C
12	Oriental Blue Tiger	<i>Tirumala limniaceexoticus</i> (Gmelin, 1790)	NA	R
13	Oriental Chocolate Pansy	<i>Junoniaiphitaiphita</i> (Cramer, 1779)	NA	VC
14	Oriental Commander	<i>Moduzaprocrisprocris</i> (Cramer, 1777)	NA	UC
15	Oriental Common Evening Brown	<i>Melanitisledaleda</i> (Linnaeus, 1758)	NA	C
16	Oriental Common Leopard	<i>Phalantaphalanthaphalanth</i> (Drury, 1773)	NA	C
17	Oriental Great Eggfly	<i>Hypolimnasmisippus</i> (Linnaeus, 1764)	NA	VC
18	Oriental Grey Pansy	<i>Junoniaatlitesatlites</i> (Linnaeus, 1763)	NA	VC
19	Oriental Peacock Pansy	<i>Junoniaalmanaalmana</i> (Linnaeus, 1758)	NA	VC
20	Oriental Plain Tiger	<i>Danaus chrysippuschrysippus</i> (Linnaeus, 1758)	NA	VC
21	Oriental Striped Tiger	<i>Danaus genutiagenutia</i> (Cramer, [1779])	Sched I	VC
22	Oriental Yellow Pansy	<i>Junoniahiertahierta</i> (Fabricius, 1798)	NA	R

23	Painted Lady	<i>Vanessa cardui</i> (Linnaeus, 1758)	NA	R
24	Pale Black Rajah	<i>Charaxes solon solon</i> (Fabricius, 1793)	Sched II	R
25	Pale Blue Pansy	<i>Junoniaorithya</i> (Linnaeus, 1758)	NA	UC
26	Sahyadri Blue Oakleaf	<i>Kallima horsfieldii</i> (Kollar, 1844)	Sched II	R
27	Sri Lankan Club Beak	<i>Libytheamyrrharama</i> (Moore, 1872)	NA	R
28	Tawny Coster	<i>Acraea terpsicore</i> (Linnaeus, 1758)	NA	VC

**(B) Family: Lycaenidae**

29	Asian Zebra Blue	<i>Leptotespliniusplinius</i> (Fabricius, 1793)	NA	VC
30	Assam Opaque Six-Lineblue	<i>Nacadubaberoegythion</i> (Fruhstorfer, 1916)	NA	UC
31	Continental Common Pierrot	<i>Castaliusrosimonrosimon</i> (Fabricius, 1775)	Sched I	VC
32	Dakhan Orange-crowned Cupid	<i>Evereslacturnussyntala</i> (Cantlie, 1963)	NA	VC
33	Dakhan Pointed Ciliate Blue	<i>Anthenelycaeninalycaenina</i> (R. Felder, 1868)	Sched II	VC
34	Indian Common Lineblue	<i>Prosotasnoraardates</i> (Moore, 1875)	Sched II	VC
35	Indian Common Shot Silverline	<i>Spindasisictisictis</i> (Hewitson, 1865)	NA	R
36	Indian Common Silverline	<i>Spindasisvulcanusvulcanus</i> (Fabricius, 1775)	NA	R
37	Indian Dark Cerulean	<i>Jamidesbochusbochus</i> (Stoll, 1782)	NA	R
38	Indian lesser grass blue	<i>Zizinaotis indica</i> (Murray, 1874)	NA	VC
39	Indian Lime Blue	<i>Chiladeslajuslajus</i> (Stoll, 1780)	NA	C
40	Indian Red Pierrot	<i>Talicedanyseusnyseus</i> (Guérin-Méneville, 1843)	NA	UC
41	Indian Scarce Shot Silverline	<i>Spindasiselimaelima</i> (Moore, 1877)	Sched II	R
42	Indian Sunbeam	<i>Curetis thetis</i> (Drury, 1773)	NA	R
43	Indian Tiny Grass Blue	<i>Zizulahylaxhylax</i> (Fabricius, 1775)	NA	UC
44	Lankan Large Oakblue	<i>Arhopalaamantesamantes</i> (Hewitson, 1862)	NA	R
45	Oriental Common cerulean	<i>Jamides celeno celeno</i> (Cramer, 1775)	NA	C
46	Oriental Forget-me-not	<i>Catochrysopsstrabostrabo</i> (Fabricius, 1793)	NA	VC
47	Oriental Gram Blue	<i>Euchrysopsnejusnejus</i> (Fabricius, 1798)	Sched II	VC
48	Oriental Lesser Grass Blue	<i>Zizinaotisotis</i> (Fabricius, 1787)	NA	UC
49	Oriental Plains Cupid	<i>Chiladespandavapandava</i> (Horsfield, 1829)	NA	VC
50	Pea Blue	<i>Lampidesboeticus</i> (Linnaeus, 1767)	Sched II	VC
51	Tamil Large Guava Blue	<i>Virachola perse ghela</i> (Fruhstorfer, 1912)	NA	UC

**(C) Family: Peiridae**

52	Dakhan Common Gull	<i>Ceporanerissaphryne</i> (Fabricius, 1775)	Sched II	UC
53	Dakhan Large Salmon Arab	<i>Colotisfaustafulvia</i> (Wallace, 1867)	NA	UC
54	Dakhan Yellow Orange-tip	<i>Ixias pyrene sesia</i> (Fabricius, 1777)	NA	VC
55	Desert Small Salmon Arab	<i>Colotisamataamata</i> (Fabricius, 1775)	NA	UC
56	Indian Crimson-tip	<i>Colotisdanaedanae</i> (Fabricius, 1775)	NA	R
57	Indian Jezebel	<i>Delias eucharis</i> (Drury, 1773)	NA	VC
58	Indian Little Orange-tip	<i>Colotisetridaetrida</i> (Boisduval, 1836)	NA	VC
59	Indian Pioneer	<i>Belenois aurotaaurota</i> (Fabricius, 1793)	NA	VC
60	Indian Spotless Grass Yellow	<i>Euremalaetalaeta</i> (Boisduval, 1836)	NA	VC
61	Indian Wanderer	<i>Pareroniahippia</i> (Fabricius, 1787)	NA	VC
62	Oriental Common Grass Yellow	<i>Euremahecabehecabe</i> (Linnaeus, 1758)	NA	VC
63	Oriental Lemon Emigrant	<i>Catopsiliapomonapomona</i> (Fabricius, 1775)	NA	VC
64	Oriental Mottled Emigrant	<i>Catopsiliapyranthepyranthe</i> (Linnaeus, 1758)	NA	VC
65	Oriental Psyche	<i>Leptosianinanina</i> (Fabricius, 1793)	NA	C

66	Plain Orange Tip	<i>Colotis aurora</i> (Cramer, 1780)	NA	VC
67	Red-line Small Grass Yellow	<i>Euremabrigitta rubella</i> (Wallace, 1867)	NA	C
68	Sahyadri One-spot Grass Yellow	<i>Eurema andersonii shimai</i> (Yata & Gaonkar, 1999)	NA	C
69	Sylhet Three-spot Grass Yellow	<i>Euremablandasilhetana</i> (Wallace, 1867)	NA	C
70	Western Striped Albatross	<i>Appiaslibythea</i> (Fabricius, 1775)	SchedIV	C
71	White Orange-tip	<i>Ixias marianne</i> (Cramer, 1779)	NA	C

**(D) Family: Hesperiiidae**

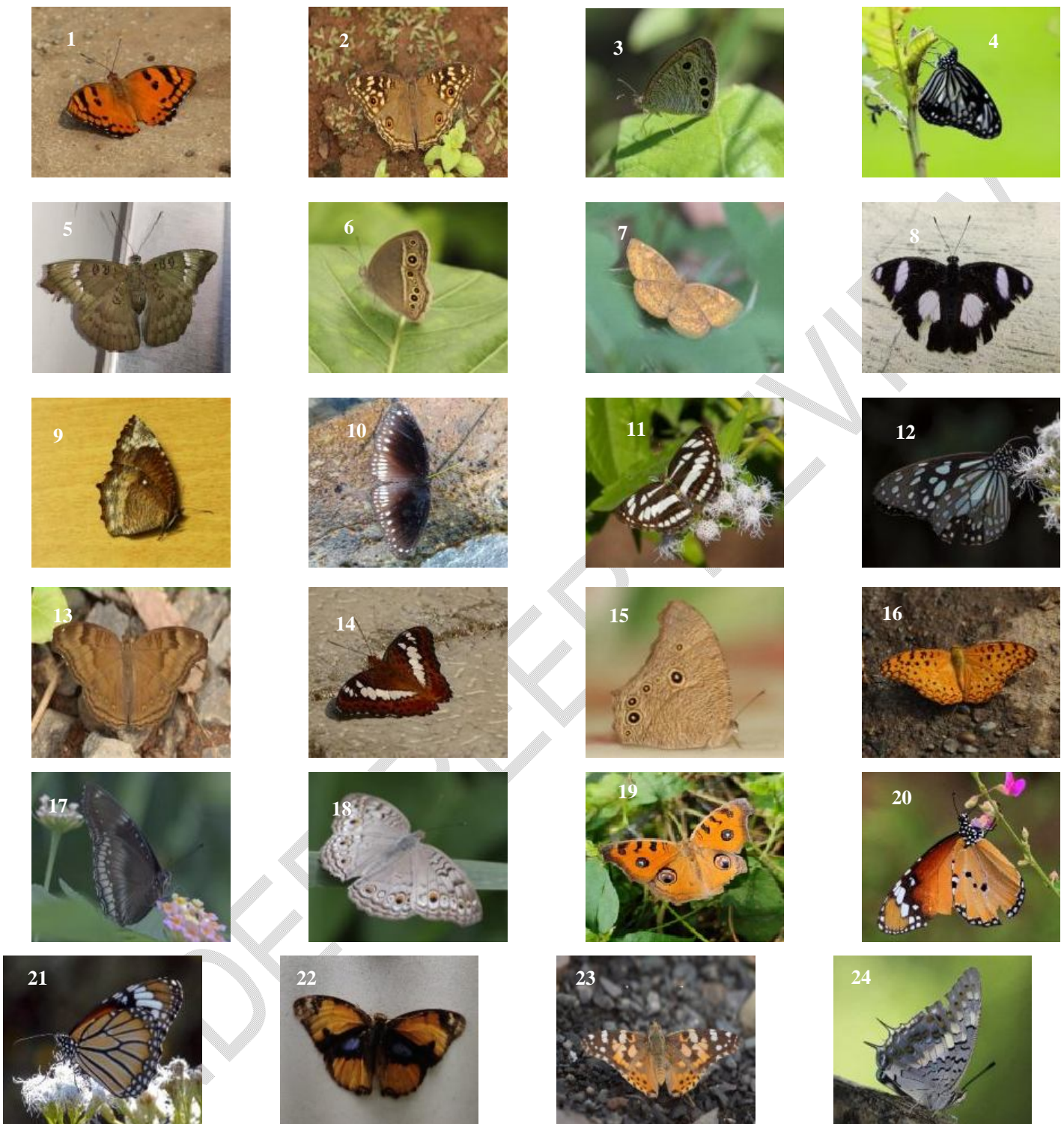
72	Common Branded Redeye	<i>Matapa aria</i> (Moore, 1866)	NA	R
73	Grass Demon	<i>Udaspesfolus</i> (Cramer, 1775)	NA	R
74	Indian Grizzled Skipper	<i>Spialialagalbagalba</i> (Fabricius, 1793)	NA	VC
75	Indian Palm Bob	<i>Suastusgremiusgremius</i> (Fabricius, 1798)	NA	VC
76	Oriental Dark Palm-Dart	<i>Telicotabambusaebambusae</i> (Moore, 1878)	NA	UC
77	Rice Swift	<i>Borbocinnara</i> (Wallace, 1866)	NA	VC

**(E) Family: Papilionidae**

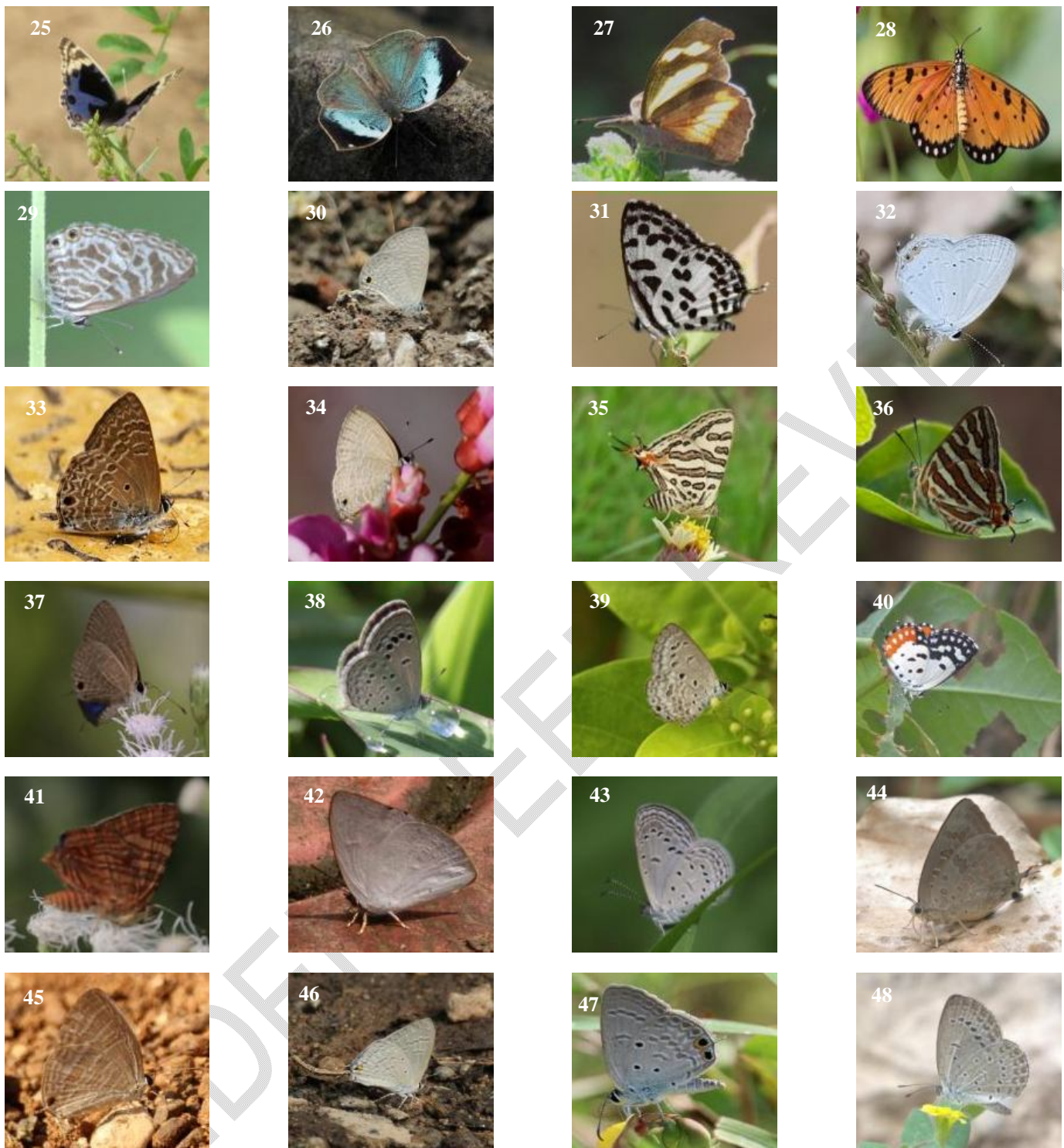
78	Dakhan Common Jay	<i>Graphiumdosoneleius</i> (Fruhstorfer, 1907)	NA	C
79	Dakhan Tailed Jay	<i>Graphiumagamemnonmenides</i> (Fruhstorfer, 1904)	NA	UC
80	Indian Common Mormon	<i>Papilio polytesromulus</i> (Cramer, 1775)	NA	VC
81	Indian spot Swordtail	<i>Graphiumnomiusnomius</i> (Esper, 1799)	NA	R
82	Northern Lime Swallowtail.	<i>Papilio demoleusdemoleus</i> (Linnaeus, 1758)	NA	VC
83	Oriental Common Bluebottle	<i>Graphiumsarpedonsarpedon</i> (Linnaeus, 1758)	NA	R

# serial number corresponds with the figure numbers of plate for individual species, \*VC-Very Common ( $\geq 50$  individuals), C-Common (30-50 individuals), UC-Uncommon (5-30 individuals), R-Rare ( $\leq 5$  individuals); WPA- Indian Wildlife Protection Act, 1972 (Anon., 2006)

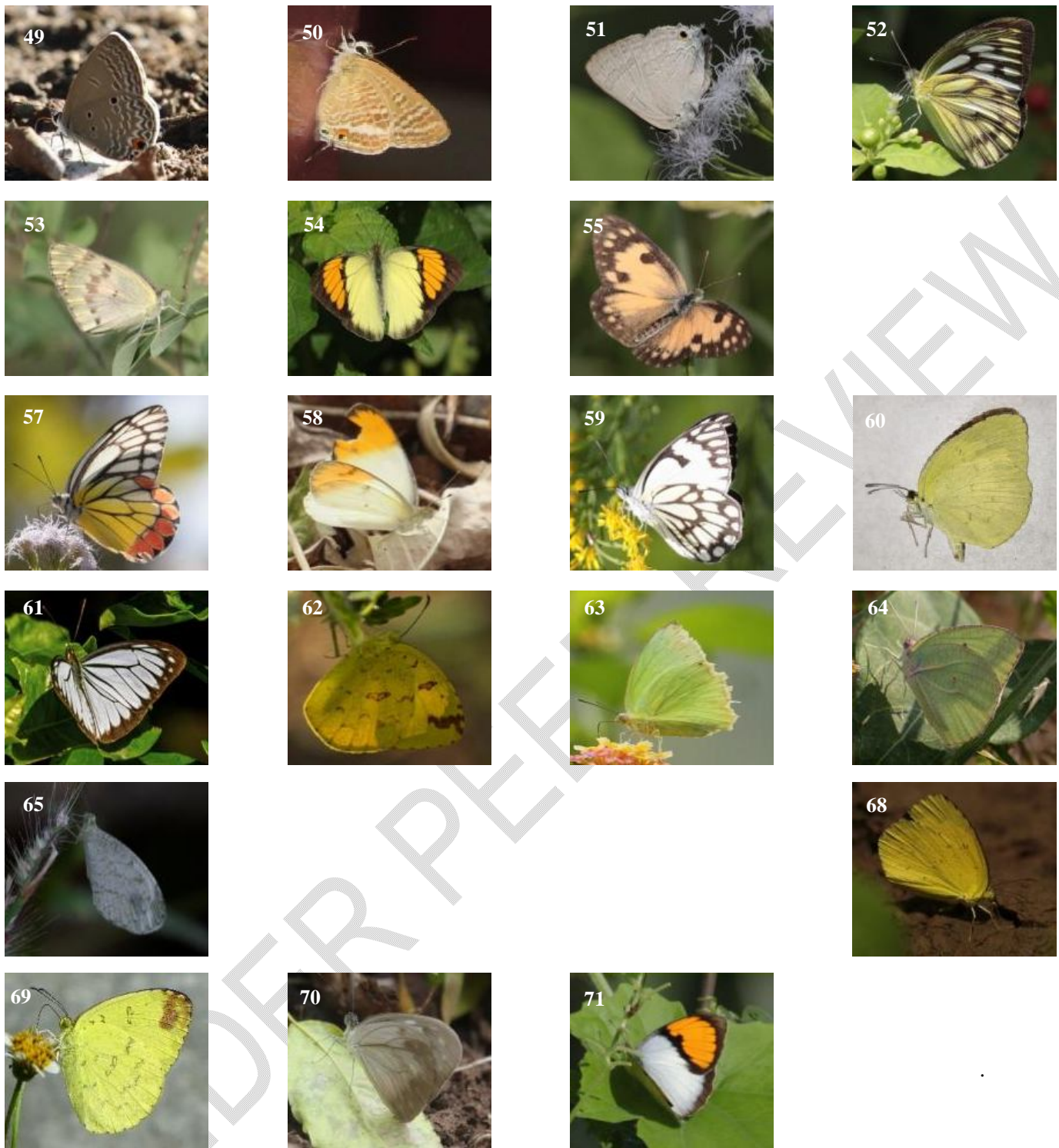
In the surveyed area, as per the IUCN threat category 4 species are listed under the red list viz. *Euploea core*, *Hypolimnasmisippus*, and *Junoniaalmana* are under the Least Concerned category, and *Castaliusrosimon* under the Vulnerable category. As per the sightings of the butterflies, 42% were very common (35), 17% common (14), 17% uncommon (14), and 24% were categorized rare (20) in the Navsari Agricultural University. *Graphiumnomius* a summer visitor in Gujarat is also found in NAU. Total of 45 species of butterflies has been reported from the Regional Institute of Education campus, Bhubaneswar (Priyamvada and Mohapatra, 2016).



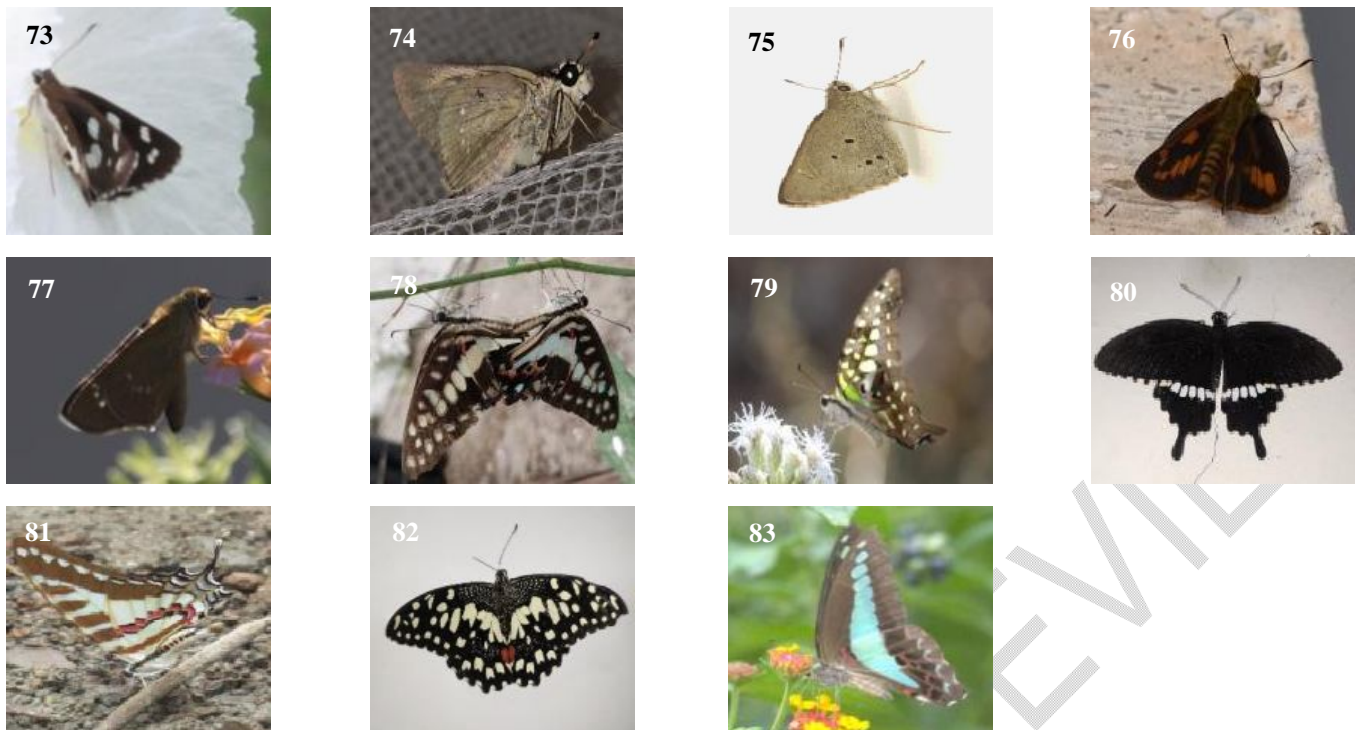
**Fig. 1-24. Butterflies of the Navsari Agricultural University** (1. Baronet, 2. Chinese Lemon Pansy, 3. Common Four-ring, 4. Coromandel Glassy Tiger, 5. Dakhan Common Baron, 6. Dakhan Common Bush Brown, 7. Dakhan Common Castor, 8. Danaid Eggfly, 9. Himalayan Common Palmfly, 10. Indian Common Crow, 11. Indian Common Sailer, 12. Oriental Blue Tiger 13. Oriental Chocolate Pansy, 14. Oriental Commander, 15. Oriental Common Evening Brown, 16. Oriental Common Leopard, 17. Oriental Great Eggfly, 18. Oriental Grey Pansy, 19. Oriental Peacock Pansy, 20. Oriental Plain Tiger, 21. Oriental Striped Tiger, 22. Oriental Yellow Pansy, 23. Painted Lady, 24. Pale Black Rajah)



**Fig. 25-48. Butterflies of the Navsari Agricultural University** (25. Pale Blue Pansy, 26. Sahyadri Blue Oakleaf, 27. Sri Lankan Club Beak, 28. Tawny Coster, 29. Asian Zebra Blue, 30. Assam Opaque Six-Lineblue, 31. Continental Common Pierrot, 32. Dakhan Orange-crowned Cupid, 33. Dakhan Pointed Ciliate Blue, 34. Indian Common Lineblue, 35. Indian Common Shot Silverline, 36. Indian Common Silverline, 37. Indian Dark Cerulean, 38. Indian lesser grass blue, 39. Indian Lime Blue, 40. Indian Red Pierrot, 41. Indian Scarce Shot Silverline, 42. Indian Sunbeam, 43. Indian Tiny Grass Blue, 44. Lankan Large Oakblue, 45. Oriental Common cerulean, 46. Oriental Forget-me-not, 47. Oriental Gram Blue, 48. Oriental Lesser Grass Blue)



**Fig. 49-72. Butterflies of the Navsari Agricultural University** (49. Oriental Plains Cupid, 50. Pea Blue, 51. Tamil Large Guava Blue, 52. Dakhan Common Gull, 52. Dakhan Large Salmon Arab, 53. Dakhan Yellow Orange-tip, 55. Desert Small Salmon Arab, 56. Indian Crimson-tip, 57. Indian Jezebel, 58. Indian Little Orange-tip, 59. Indian Pioneer, 60. Indian Spotless Grass Yellow, 61. Indian Wanderer, 62. Oriental Common Grass Yellow, 63. Oriental Lemon Emigrant, 64. Oriental Mottled Emigrant, 65. Oriental Psyche, 66. Plain Orange Tip, 67. Red-line Small Grass Yellow, 68. Sahyadri One-spot Grass Yellow, 69. Sylhet Three-spot Grass Yellow, 70. Western Striped Albatross, 71. White Orange-tip, 72. Common Branded Redeye)



**Fig. 73-83. Butterflies of the Navsari Agricultural University** 73. Grass Demon, 74. Indian Grizzled Skipper, 75. Indian Palm Bob, 76. Oriental Dark Palm-Dart, 77. Rice Swift, 78. Dakhan Common Jay, 79. Dakhan Tailed Jay, 80. Indian Common Mormon, 81. Indian spot Swordtail, 82. Northern Lime Swallowtail, 83. Oriental Common Bluebottle.

#### 4. CONCLUSION

The urban greenscape of Agricultural University forms a manmade modified habitat that helps restore the native diversity of butterflies with limited resources. The butterfly study clearly depicts that diverse phyto-resources play a significant role in maintaining diversity (Gandhi et al., 2015).

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