

Butterfly Diversity of Pune City along the Human Impact Gradient

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Introduction

India hosts 1,501 species of butterflies (Gaonkar 1996), of which peninsular India hosts 350, and the Western Ghats, 331. Pune falls in the relatively species-poor, drier region of the northern Western Ghats. Above literature on biogeographic distribution and habitat preference indicates that the Pune district may harbour about 170 species (Kunte, unpubl.), of which 103 are so far reported from Pune urban area within a 20 km radius. Remaining species are mostly forest dwellers and may not be found in the urban area. There is hardly any literature specific to Pune butterflies.

Methodology

While observations here are based on seasonal visits to many localities in and around Pune, the author explored six sites more intensely, given their contrasting vegetation types and levels of disturbance (Kunte, 1997). The sites include the moist deciduous forests at Sinhgad hills; forests and grasslands prone to fire and grazing, amidst deserted habitation around NDA; much drier, fire prone scrub and grasslands with little grazing, besides afforestation at Pachgaon, highly grazed but hardly burnt grasslands (so called 'barren land') at Malwadi; well-wooded campus of S.P. College with profusion of old, native trees, besides exotics ones, amidst a mosaic of concrete buildings, the marshes and scrub along the Mutha riverbank at Dattawadi. Besides noting relative abundance and even seasonal counts (Kunte, 1997), the author also recorded larval host plants and their phenology, be-

sides nectar plants, predators and early stages of butterflies.

Results And Discussion

Diversity and distribution : The annexure depicts the distribution patterns of 104 butterfly species recorded so far. Some butterfly species, which perhaps evaded detection or precise field identity, may include Lineblues, other Blues, Swifts and Skippers. Further survey may not record more than 120 species from the study area. Table 1 summarises the annexure in terms of habitatwise species richness and uniqueness. Over two thirds are found in denser forest habitats such as valleys of Sinhgad and Peacock Bay, 11 of which are found nowhere else. Scrub appears to be most species rich habitat frequented by three fourths of the species though only two of these were exclusive to it, seldom recorded elsewhere. Forest, on the other hand harboured a bit lower diversity with only two thirds the species, but highest level of uniqueness, with nearly a dozen species exclusive to it. Plantations also harboured two unique species, though low species richness. Agriculture and grassland harbour high and lowest species richness respectively though without any species being exclusive to them. Together, wilderness areas i.e. forest, scrub and grasslands harbour three fourths of the species, about a fourth of them being exclusive to wilderness zone. The plantations clinging the township, along with the agriculture represent more human impacted zone which harbours about two thirds of the total species recorded from Pune, but some of them have their larval food plants located in the wilderness zone. The habitat specialists

Table 1 Habitat-wise species richness

| | No. of total species | No. of Unique Species |
|-----------------|----------------------|-----------------------|
| Forest (F) | 68 | 11 |
| Scrub (S) | 76 | 2 |
| Grassland (G) | 38 | 0 |
| Plantations (P) | 57 | 2 |
| Agriculture (A) | 69 | 0 |
| Wild (F,S,G) | 80 | 20 |
| Impacted (P,A) | 70 | 0 |

include predominantly forest dwellers like the Bushbrown, few species of Yellows and Flats; while the Tailed Jay is a habitation specialist. The habitat generalists include Common Rose, Lime Butterfly, species of Grass Blues etc. found in a variety of habitat types.

Seasonality : Table 2 presents the number of total species recorded along transects at four localities (Kunte, 1997) across seasons. This excludes species with unreliably low abundances and the plantation fauna. Kunte (1997) describes in detail the seasonality patterns, technically termed flight periods, of species and groups, including factors affecting it. Butterflies in all habitats have distinct flight periods. Almost all butterflies have very short seasonal peaks, and they are either absent or rare in other seasons. However, their interesting patterns probably reflect phenophases of their host plants. Some species occur throughout the year with a short population peak in a specific season, and some species occur only for a few months, such as the Spotless Grass Yellow and the Common Hedge Blue, respectively (at Sinhagad). A few species have a single, short flight period such as Lineblues (at Sinhagad) whereas some have two short peaks (e.g. Common Five-ring at Sinhagad). Yet others have just one, but fairly long flight period (e.g. Chocolate Pansy

at Sinhagad). Although with little fluctuations, a few species (e.g. Common Evening Brown at Sinhagad) have similar abundance throughout the year. Most butterflies, in terms of number of individuals and number of species, fly in Pune during late monsoon and winter. The populations are low in spring and summer, probably due to fires at Peacock Bay and Pachgaon, and scarcity of water and ground flora at Malwadi and Sinhagad. Usually at all the sites, the populations start building from early monsoon and show the first peak in late monsoon, followed by a second peak in winter.

Fire and grazing impacts : Certain hillocks in Pune are grazed by migratory herds of sheep and resident livestock. Some are annually burned in uncontrolled and artificial fires. Intense grazing seriously alters the composition of ground flora in grasslands. Cattle up-root grasses while feeding on them, and therefore decrease their density, promote unpalatable herbs, at the cost of tall grasses such as at Malwadi. On the other hand, the fire-afflicted site of Pachgaon hosts tall grasses but herbs are rare. Given these difference in larval and adult food resources, the butterfly fauna of Malwadi grasslands differs from the Pachgaon grasslands. For instance, species such as Grass Blues, Grass Jewel, Joker and Blue Pansy are much more common mainly at the fire-free site of Malwadi than Pachgaon, especially during winter. Since larval as well as imaginal stages of these butterfly species inhabit extremely disturbed vegetation, it is possible that they have evolved in secondary, disturbed grasslands. Fire can occur naturally or be initiated by human beings. It plays a very important role since it affects the vegetation directly. However, despite affecting species composition, fire does not seem to affect the species richness (Table 2). Butterflies such as common evening brown, plains cupid, spotless grass yellow, blue pansy, lemon pansy, painted lady and leopard were found at fire-free as well as at fire-afflicted sites. These species had more intense peaks at fire-afflicted areas with highly seasonal occurrence.

Table 2 Seasonal variation in species richness at the four sites

| | Feb.-Mar. | Apr.-May | Jun.-Jul. | Aug.-Sep. | Oct.-Nov. | Dec.-Jan. |
|-------------|-----------|----------|-----------|-----------|-----------|-----------|
| Sinhagad | 8 | 7 | 17 | 19 | 16 | 14 |
| Peacock Bay | 6 | 6 | 7 | 14 | 19 | 12 |
| Pachgaon | 4 | 3 | 14 | 25 | 18 | 21 |
| Malwadi | 14 | 8 | 10 | 14 | 18 | 12 |

On the other hand, in the fire-free areas their occurrence was less seasonal and spread across more seasons. Control of annual fires will be a singular, and perhaps the most important, effort at conserving butterflies in Pune.

Population changes : In the absence of earlier studies, it is impossible to quantify if certain butterfly population have increased or decreased over the last decades. It is obvious that loss of the habitat and the increased use of the inorganic pesticides in recent decades have adversely affected many butterfly species. Yet, no species might have gone locally extinct in Pune, given the long history of modification of the land in this region. In contrast, populations of at least two butterflies, evergreen and semi-evergreen forest dwellers viz. Blue Mormon and the Plain Puffin have increased prominently in the last 10 years, thanks to the home gardens that host their larval host plants viz. *Citrus spp.* and *Drypetes roxburghii* respectively. Common Albatross and the Plain Puffin both feed on *D. roxburghii* and co-occur at the probable source population, in Bheemashankar in the Western Ghats. But so far only the Plain Puffin has been successful in establishing in the drier east of Pune while only the Common Albatross has established itself in parts of moister, western Mumbai city. Populations of the Tailed Jay and the Common Mormon from the evergreen and deciduous forests respectively seem increasing, benefiting from the avenue and homestead plantation of larval host trees such as *Polyalthia longifolia* and *Citrus spp.* The plants apparently helped in widening the habitat preference of butterflies.

Conclusion : Nearly half the species are recorded in the city, including various kinds of plantations of trees and shrubs in the home gardens, public gardens, avenues etc. However, all of them may not survive if the natural vegetation like forest and grasslands surrounding the city vanish. For, some of the species seen around human habitation have their food plants or source populations in such wilderness zones skirting the city. Together, a fifth of the species are recorded primarily from such wilderness, rarely encountered in the city. These are thus most vulnerable to any further destruction of wilderness areas. This can be minimised by promoting these food plants (Kunte, 2000),

whether herbs or climbers, rather than planting exotic trees. Controlling hill fires is also a pressing need.

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Annexure : Distribution and abundance of butterflies in the Pune urban area

Habitats : F-forest, S-Scrub, G-Grassland, P-Plantations, A-Agriculture

ABD (Abundance) : A-Abundant, C-common, O-Occasional, R-rare, S-Stray

Remarks : LC- Law College, PU- Pune University

The common names are adopted from Evans (1932) and Winter Blythe (1957). For scientific nomenclature, consult Gaonkar (1996).

| Sr.no. | Common Name | ABD | Habitats | Remarks |
|----------------------------|-------------------------|-----|----------|------------------|
| Family Papilionidae | | | | |
| 1 | Common Rose | C | FSGPA | |
| 2 | Crimson Rose | O | FSPGA | |
| 3 | Tailed Jay | C | P | |
| 4 | Common Mime | S | | source at 40 km? |
| 5 | Lime | A | FSGPA | |
| 7 | Common Mormon | C | FP | |
| 8 | Blue Mormon | O | FP | increasing |
| Family Pieridae | | | | |
| 9 | Common Emigrant | A | FSPA | |
| 10 | Mottled Emigrant | A | SGPA | |
| 11 | Small Grass Yellow | C | FSGPA | |
| 12 | Spotless Grass Yellow | A | FSGPA | Seasonal forms |
| 13 | Common Grass Yellow | A | FSGPA | |
| 14 | Three-Spot Grass Yellow | ? | F | rare, Sinhagad |
| 15 | Common Jezebel | C | FP | |
| 16 | Psyche | C | FSPA | |
| 17 | Common Gull | A | FSGPA | |
| 18 | Pioneer Or Caper White | A | SGPA | |
| 19 | Plain Puffin | O | P | fresh arrival |
| 20 | Striped Albatross | R | SGA | sporadic |
| 21 | Small Salmon Arab | S | SA | |
| 22 | Small Orange Tip | C | SGA | |
| 23 | Plain Orange Tip | R | SGA | |
| 24 | Crimson Tip | R | SGA | only PU & LC |
| 25 | Large Salmon Arab | R | SGA | LC hill |
| 26 | White Orange Tip | O | FSPA | |
| 27 | Yellow Orange Tip | S | FS | |
| 28 | Common Wanderer | C | FSPA | |
| Family Nymphalidae | | | | |
| 29 | Common Evening Brown | A | FSGPA | |
| 30 | Common Treebrown | R | FS | |
| 31 | Common Bushbrown | O | F | |
| 32 | Common Threering | C | FSGA | |
| 33 | Common Fivering | C | FS | |
| 34 | Common Nawab | R | FPA | winter |
| 35 | Black Rajah | R | FSPA | winter |
| 36 | Tawny Coster | C | SGPA | |
| 37 | Common Leopard | C | FSA | |

| Sr.no. | Common Name | ABD | Habitats | Remarks |
|--------------------------|-------------------------------|-----|----------|--------------------|
| 38 | Common Sailer | C | FS | source at Sinhgad? |
| 39 | Common Baron | C | FPA | winter |
| 40 | Baronet Or Red Baron | R | FS | frequents Malwadi |
| 41 | Joker | O | SGA | localized |
| 42 | Angled Castor | R | SA | |
| 43 | Common Castor | A | FSPA | |
| 44 | Yellow Pansy | C | FSGPA | |
| 45 | Blue Pansy | C | SGPA | |
| 46 | Lemon Pansy | A | FSGPA | |
| 47 | Peacock Pansy | C | FSPA | Waterbodies |
| 48 | Grey Pansy | C | FSPA | Waterbodies |
| 49 | Chocolate Pansy | C | F | |
| 50 | Painted Lady | O | SGA | highly seasonal |
| 51 | Great Eggfly | O | FSPA | |
| 52 | Danaid Eggfly | O | FSPA | |
| 53 | South Indian Blue Oakleaf | R | F | |
| 54 | Glassy Tiger | O | FSPA | |
| 55 | Blue Tiger | C | FSPA | |
| 56 | Plain Tiger | A | SGPA | |
| 57 | Striped Or Common Tiger | O | FSPA | |
| 58 | Common Indian Crow | A | FSGPA | |
| Family Lycaenidae | | | | |
| 59 | Plum Judy | O | F | highly seasonal |
| 60 | Apefly | S | | |
| 61 | Common Pierrot | C | FSPA | |
| 62 | Angled Pierrot | O | F | highly seasonal |
| 63 | Rounded/Rusty/Striped Pierrot | O | SPA | |
| 64 | Zebra Blue | C | FSPA | |
| 65 | Bright Babul Blue | O | FSA | |
| 66 | Dull Babul Blue | O | FSA | |
| 67 | African Babul Blue | C | SA | |
| 68 | Common Hedge Blue | O | F | highly seasonal |
| 69 | Pale Grass Blue | C | SGPA | |
| 70 | Dark Grass Blue | C | SGPA | |
| 71 | Lesser Grass Blue | C | SGPA | |
| 72 | Tiny Grass Blue | C | FSGPA | |
| 73 | Lime Blue | O | PA | |
| 74 | Small Cupid | S? | SGA | |
| 75 | Plains Cupid | C | SGPA | |
| 76 | Grass Jewel | C | SGA | highly seasonal |
| 77 | Gram Blue | A | FSGPA | |
| 78 | Forget-Me-Not | O | F | |
| 79 | Pea Blue | C | FSGPA | |
| 80 | Dark Cerulean | O | FA | |
| 81 | Common Cerulean | A | FPA | |
| 82 | Common Line Blue | O | FS | |
| 83 | Red Pierrot | C | SPA | localized |
| 84 | Common Silverline | R | FPA | |

BUTTERFLY DIVERSITY OF PUNE CITY ALONG THE HUMAN IMPACT GRADIENT

| Sr.no. | Common Name | ABD | Habitats | Remarks |
|--------|--------------------------------|-----|----------|-----------------|
| 85 | Shot Silverline | S? | S | |
| 86 | Scarce Shot Silverline | S? | S | |
| 87 | Peacock Royal | O | FA | |
| 88 | Indian Red Flash | O | FS | |
| 89 | Slate Flash | O | FS | |
| 90 | Indian Sunbeam | O | FSPA | |
| | Family Hesperiiidae | | | |
| 91 | Common Banded Awl | A | FSPA | highly seasonal |
| 92 | Brown Awl | O | F | |
| 93 | Common Spotted Flat | R | F | |
| 94 | Malabar Spotted Flat | R | F | |
| 95 | Common Small Flat | R | SG | |
| 96 | Spotted Small Flat | R | SG | |
| 97 | Indian Grizzled/Indian Skipper | O | SGPA | |
| 98 | Grass Demon | C | FP | |
| 99 | Indian Palm Bob | O | PA | |
| 100 | Pale Palm Dart | O | FS | |
| 101 | Dark Palm Dart | O | FS | |
| 102 | Rice Swift | C | FSPA | |
| 103 | Bevan's Swift | C | FSGPA | |

