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Butterfly diversity in Kolkata, India: An appraisal for conservation management

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ABSTRACT

An appraisal of butterfly species diversity was made using Kolkata, India as a model geographical area. Random sampling of rural, suburban, and urban sites in and around Kolkata metropolis revealed the presence of 96 butterfly species, dominated by Lycaenidae (31.25%) over Nymphalidae (28.13%), Hesperidae (18.75%), Pieridae (12.50%), and Papilionidae (9.38%). Suburban sites accounted for 96 species, followed by rural (81 species) and urban (53 species) over the study period. The relative abundance of the butterflies varied with the site, month, and family significantly. It is apparent that the urban areas of Kolkata can sustain diverse butterfly species which includes species of requiring conservation effort. Considering the landscape of Kolkata, steps to enhance urban greening should be adopted to maintain butterfly diversity and sustain the ecosystem services derived from them.

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Introduction

The study of biological diversity encompasses both the intrinsic and anthropocentric values associated with it. The values of the biological elements are recognized in correspondence to the perceived importance by the human being, which is realized in terms of the ecosystem services (Daily 1997; Millennium Ecosystem Assessment 2005; Baumgärtner 2007). Biological diversity is the base for upholding the ecosystems and the functional aspects of the species that provide goods and services for human well-being. Monitoring of species diversity of a region enables estimation of the prospective functional roles of the species. In urban ecosystems, monitoring species diversity can be used as a tool to reduce human mismanagement and pollution in urbanized, industrial, rural, and managed areas (Wilson 1997). Extending this view, studies on species diversity in urban ecosystems are

necessary to understand the effect of anthropocentric development on the integrity and sustenance of ecosystem.

The diversity of insects has been emphasized in many studies owing to their dominance in the terrestrial and aquatic ecosystems and provision of ecosystem services such as pollination, pest control, nutrient decomposition, and maintenance of ecosystem species (Losey and Vaughan 2006). Among insects, butterflies perform prominent roles in pollination and herbivores (Kunte 2000; Tiple et al 2006) bearing a history of long-term coevolution with plants (Ehrlich and Raven 1964). Adult butterflies are dependent on nectar and pollen as their food while the caterpillars are dependent on specific host plants for foliage (Nimbalkar et al 2011). Butterflies are considered as good indicators of the health of any specified terrestrial ecosystem (New 1991; Pollard and Yates 1993; Kunte 2000; Aluri and Rao 2002; Thomas 2005; Bonebrake et al 2010) as well as in reflection of human disturbance and habitat feature (Kunte et al 1999; Kocher and Williams 2000; Kunte 2000; Summerville and Crist 2001; Koh 2007) with greater sensitivity than many other taxonomic groups (Thomas et al 2004; Thomas 2005). Butterflies are therefore treated as an important model group in ecology and conservation (Watt and Boggs 2003; Ehrlich and Hanski 2004). The conservation of butterflies is necessary to

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Table 1. List of butterflies with their relative abundance (mean ± SE) in urban (U), suburban (Su) and rural (R) sites of Kolkata, India, recorded during study period.

Common name	Scientific name	U	Su	R
Family: Papilionidae				
Common jay	<i>Graphium doson</i> (Felder & Felder, 1864)	7 ± 2.24	7.66 ± 3.04	3.16 ± 1.64
Tailed jay	<i>Graphium agamemnon</i> (Linnaeus, 1758)	8 ± 2.69	12.33 ± 4.71	5 ± 2.08
Common mormon	<i>Papilio polytes</i> (Linnaeus, 1758)	5 ± 1.76	20.16 ± 5.34	20.41 ± 4.94
Lime butterfly	<i>Papilio demoleus</i> (Linnaeus, 1758)	6 ± 1.78	23.08 ± 5.84	16 ± 3.98
Common mime	<i>Chilasa clytia</i> (Linnaeus, 1758)	0.16 ± 0.17	11.08 ± 3.06	3.25 ± 1.12
Blue mormon	<i>Papilio polymnestor</i> (Cramer, 1775)	0	0.5 ± 0.23	0
Common rose	<i>Pachliopta aristolochiae</i> (Fabricius, 1775)	0.91 ± 0.36	13.58 ± 3.06	5.16 ± 1.32
Crimson rose	<i>Pachliopta hector</i> (Linnaeus, 1758)	0.00	0.41 ± 0.26	0
Spot-swordtail	<i>Graphium nomius</i> (Esper, 1798)	0.00	0.33 ± 0.26	0
Family: Pieridae				
Small grass yellow	<i>Eurema brigitta</i> (Stoll, 1780)	0	5.25 ± 2.40	1.91 ± 0.73
Three-spot grass yellow	<i>Eurema blanda</i> (Boisduval, 1836)	0.41 ± 0.23	9 ± 4.22	3 ± 1.32
Common grass yellow	<i>Eurema hecabe</i> (Linnaeus, 1758)	4.91 ± 2.67	35.91 ± 13.74	10 ± 3.81
Common emigrant	<i>Catopsilia pomona</i> (Fabricius, 1775)	9.83 ± 2.29	55.16 ± 16.33	10.16 ± 2.8
Mottled emigrant	<i>Catopsilia pyranthe</i> (Linnaeus, 1758)	9.1 ± 2.33	62 ± 17.18	16.66 ± 3.68
Yellow orange-tip	<i>Ixias pyrene</i> (Linnaeus, 1764)	0	3.25 ± 1.37	0.5 ± 0.34
Common wanderer	<i>Pareronia valeria</i> (Cramer, 1776)	0.66 ± 0.38	11.08 ± 3.28	4 ± 1.24
Striped albatross	<i>Appias libythea</i> (Fabricius, 1775)	4.5 ± 1.40	15.25 ± 4.91	4.16 ± 1.13
Common gull	<i>Cepora nerissa</i> (Fabricius, 1775)	4.75 ± 1.69	26.83 ± 7.30	4.58 ± 1.57
Common jezebel	<i>Delias eucharis</i> (Drury, 1773)	2.91 ± 1.34	31.33 ± 15.24	3.25 ± 1.36
Psyche	<i>Leptosia nina</i> (Fabricius, 1793)	8.08 ± 1.94	13.08 ± 3.33	4.83 ± 1.57
Pioneer	<i>Belenois aurota</i> (Fabricius, 1793)	0	0.25 ± 0.18	0
Family: Nymphalidae				
Blue tiger	<i>Tirumala limniace</i> (Cramer, 1775)	1.41 ± 0.65	13.41 ± 4.18	4.91 ± 4.40
Striped tiger	<i>Danaus genutia</i> (Cramer, 1779)	2 ± 0.99	15.083 ± 5.86	3.41 ± 1.65
Plain tiger	<i>Danaus chrysippus</i> (Linnaeus, 1758)	4.83 ± 2.27	24.25 ± 8.85	3.83 ± 1.77
Brown king crow	<i>Euploea klugii</i> (Moore & Horsfield, 1857)	0	1.08 ± 0.47	0
Common crow -	<i>Euploea core</i> (Cramer, 1780)	3.58 ± 1.71	16.83 ± 5.18	2.66 ± 1.01
Common evening brown	<i>Melanitis leda</i> (Linnaeus, 1758)	6.75 ± 2.27	41.91 ± 19.55	9.333 ± 3.59
Bamboo treebrown	<i>Lethe europa</i> (Fabricius, 1775)	0	1 ± 0.72	1.41 ± 1
Common palmfly	<i>Elymnias hypermnestra</i> (Linnaeus, 1763)	1.58 ± 0.83	11.5 ± 3.18	7.5 ± 2.32
Common bushbrown	<i>Mycalasis perseus</i> (Fabricius, 1775)	2 ± 0.89	15.5 ± 6.25	3.5 ± 1.16
Dark brand bushbrown	<i>Mycalasis mineus</i> (Linnaeus, 1858)	0.00	15.5 ± 6.87	1.75 ± 0.94
Common three-ring	<i>Ypthima asterope</i> (Klug, 1832)	0.08 ± 0.08	0.08 ± 0.08	0
Common five-ring	<i>Ypthima baldus</i> (Fabricius, 1775)	0.83 ± 0.46	12.08 ± 4.96	2.16 ± 0.89
Common four-ring	<i>Ypthima huebneri</i> (Kirby, 1871)	0.33 ± 0.22	11.16 ± 4.59	1 ± 0.56
Tawny coster	<i>Acraea violae</i> (Fabricius, 1775)	2.75 ± 1.21	6.75 ± 2.89	5.75 ± 2.41
Common leopard -	<i>Phalanta phalantha</i> (Drury, 1773)	0.25 ± 0.18	17 ± 6.98	4.91 ± 2.50
Commander	<i>Moduza procris</i> (Cramer, 1777)	0	1.75 ± 0.79	1.08 ± 0.67
Chestnut-streaked sailer	<i>Neptis jumbah</i> (Moore, 1857)	0	2.75 ± 1.08	0.25 ± 0.25
Common baron	<i>Euthalia aconthea</i> (Cramer, 1779)	0	2.16 ± 1.42	0.58 ± 0.40
Gaudy baron	<i>Euthalia lubentina</i> (Cramer, 1779)	0	0.5 ± 0.26	0
Angled castor	<i>Ariadne ariadne</i> (Linnaeus, 1763)	4.33 ± 1.26	14.08 ± 4.50	4.75 ± 1.56
Common castor	<i>Ariadne merione</i> (Cramer, 1779)	4 ± 1.56	10.33 ± 2.94	4.08 ± 1.25
Peacock pansy	<i>Junonia almana</i> (Linnaeus, 1758)	7.6 ± 1.96	33.25 ± 5.98	5.75 ± 2.15
Grey pansy	<i>Junonia atlites</i> (Linnaeus, 1763)	9.08 ± 1.99	30.5 ± 6.22	11.5 ± 2.63
Lemon pansy	<i>Junonia lemonias</i> (Linnaeus, 1758)	0.91 ± 0.57	6.75 ± 2.48	2.83 ± 1.18
Blue pansy	<i>Junonia orithya</i> (Linnaeus, 1764)	0	0.08 ± 0.08	0
Great eggfly	<i>Hypolimnas bolina</i> (Linnaeus, 1758)	3.08 ± 0.71	17.83 ± 4.43	3.66 ± 1.28
Danaid eggfly	<i>Hypolimnas misippus</i> (Linnaeus, 1764)	0	1.75 ± 0.73	0.41 ± 0.29
Family: Lycaenidae				
Apefly	<i>Spalgis nubilus</i> (Moore, 1883)	0	0.25 ± 0.18	0.41 ± 0.29
Indian sunbeam	<i>Curetis thetis</i> (Drury, 1773)	0	1.25 ± 0.66	0.58 ± 0.34
Falcate oak blue	<i>Mahathala ameria</i> (Hewitson, 1862)	0	5 ± 2.56	0.25 ± 0.25
Silverstreak blue	<i>Iraota timoleon</i> (Stoll, 1790)	0	0.25 ± 0.25	0.16 ± 0.17
Yamfly	<i>Loxura atymnus</i> (Cramer, 1780)	0	6.58 ± 2.59	2.5 ± 1.76
Monkey puzzle	<i>Rathinda amor</i> (Fabricius, 1775)	0	1.91 ± 1.12	0
Guava blue	<i>Virachola isocrates</i> (Fabricius, 1793)	0	0.41 ± 0.29	0.25 ± 0.25
Slate flash	<i>Rapala manea</i> (Hewitson, 1863)	0.08 ± 0.08	0.33 ± 0.14	0.5 ± 0.34
Indigo flash	<i>Rapala varuna</i> (Horsfield, 1829)	0	0.58 ± 0.31	0
Common silverline	<i>Spindasis vulcanus</i> (Fabricius, 1775)	0.25 ± 0.13	14.83 ± 3.46	2.75 ± 0.88
Common ciliate blue	<i>Anthene emolus</i> (Godart, 1824)	0.08 ± 0.08	6.25 ± 2.38	3.33 ± 1.51
Pointed ciliate blue	<i>Anthene lycaenina</i> (Felder, 1868)	0	4.66 ± 2.12	3.66 ± 1.39
Common pierrot	<i>Castalius rosimon</i> (Fabricius, 1775)	2.33 ± 0.69	24 ± 5.84	4.08 ± 1.17
Red pierrot	<i>Talicauda nyseus</i> (Guérin-Ménéville, 1843)	0.08 ± 0.08	0.16 ± 0.11	0
Striped pierrot	<i>Tarucus nara</i> (Kollar, 1848)	0.5 ± 0.36	21.83 ± 5.34	1.75 ± 0.78
Zebra blue	<i>Tarucus plinius</i> (Fabricius, 1793)	0.08 ± 0.08	5.583 ± 1.82	0.83 ± 0.53
Common lineblue	<i>Prosotas nora</i> (Felder, 1860)	0	0.33 ± 0.26	0.41 ± 0.29
Tailless line blue	<i>Prosotas dubiosa</i> (Semper, 1879)	0	1.08 ± 0.58	0.33 ± 0.26
Dark cerulean	<i>Jamides bochus</i> (Stoll, 1782)	0	0.75 ± 0.41	0
Common cerulean	<i>Jamides celeno</i> (Cramer, 1775)	0	0.66 ± 0.31	0.08 ± 0.08
Forget-me-not	<i>Catochrysops strabo</i> (Fabricius, 1793)	0	0.41 ± 0.29	0.33 ± 0.26
Pea blue	<i>Lampides boeticus</i> (Linnaeus, 1767)	0	0.83 ± 0.51	0

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