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Butterfly (Lepidoptera: Rhopalocera) Fauna of East Calcutta Wetlands, West Bengal, India

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Abstract: East Calcutta Wetlands (ECW), lying east of the city of Kolkata (formerly Calcutta), West Bengal in India, demonstrates the usage of city sewage for traditional practices of fisheries and agriculture. As a Ramsar Site, the wetland demands exploration of its bioresources for better understanding and management of the ecosystem operating therein. Butterflies (Lepidoptera: Rhopalocera) being potent pollinators and ecological indicators, are examined in the present study. The diversity study, conducted for two consecutive years (Jan. 2007-Nov. 2009) in all the three seasons (pre-monsoon, monsoon and post-monsoon), revealed seventy-four species. As butterflies depend on preferred host and nectar plants during their larval and adult stages respectively, the lack of these sources in some parts of ECW indicate degraded habitats with low species richness. Ongoing unplanned anthropogenic activities like habitat modifications (conversion of wetlands to agricultural lands) are resulting in the loss of wetland biodiversity and hence ecosystem integrity in ECW.

Introduction

The East Calcutta Wetlands (ECW) is a complex of natural and man-made wetlands lying east of the city of Kolkata (formerly Calcutta), West Bengal in India. The wetlands cover 12,500 ha and comprise of intertidal marshes, including salt marshes and salt meadows, with significant waste water treatment areas like sewage farms, settling ponds, and oxidation basins. It is a perfect example of wise use of a wetland ecosystem where usage of city sewage for traditional practices of fisheries and agriculture is practiced by the local farmers who have mastered resource-recovery activities, making this the largest such area in the world. The ECW was designated a "Wetland of International Importance" under the Ramsar Convention on August 19, 2002 (Ramsar 2007). Biodiversity enumeration of such wetlands, especially in terms of ecologically sensitive species like butterflies (Lepidoptera: Rhopalocera) are important for estimating the general health as well as development of proper conservation plans for the entire ecosystem. Few studies have been done on butterfly diversity in Kolkata. Preliminary studies were carried out by L. de Nicéville (1885), D. G. Sevastopulo (1933; 1944a; 1944b; 1946) and D. F. Sanders (1944). In recent years, Chowdhury and Chowdhury (2006a; 2006b) and Chowdhury (2010) reported 96 species of butterflies in Chintamoni Kar Bird Sanctuary in suburban Kolkata. 33 species were documented from Mudiali Nature Park in urban Kolkata (Chowdhury and Chowdhury 2007). Chowdhury and Das (2007) reported 64 species from the Indian Botanic Garden in Howrah near Kolkata. As there are no previous studies on butterfly diversity in such an extensive wetland near Kolkata, the present work therefore demands importance for a better understanding of the health and integrity of the wetland ecosystem.

Materials and Methods

Study Site

East Calcutta Wetlands (22°25' – 22°40' N, 88°20' – 88°35' E) (Figure 1) is part of the mature delta of River Ganga. The wetlands here are the "interdistributary" marshes in the delta. Here, the streams – which were the tributaries, distributaries and re-distributaries of the Ganga – were once active. But with the shifting of the main river, the streams became inactive and some of them even died with consequent loss of headwaters while some of them were still building land on both sides. Between those raised tracts the land was comparatively depressed, being deprived of the annual deposition of silt. The ECW is located in such a low-lying region. It was once covered with salt-water marshes. Those salt-water marshes were between the River Hooghly to the west and the River Bidyadhari, a tidal channel, to the East. The mouths of some of the streams opened into the Bay of Bengal and were influenced by tidal action, which accounted for the tides and salinity of these salt-water lakes. These lakes were actually the spill-reservoirs of the tidal channel Bidyadhari which opened into the Bay of Bengal through the river Matla. At present the ECW encompasses 264 operating bheries (Shallow fresh or brackish waterbodies for pisciculture), including 46 in Bidhannagar, 37 in Bhangar, 104 in Sonarpur, and 77 in Tiljala. Of the 12,500 ha, approximately 45.93% comprises water bodies and 38.92% is agricultural land. The remaining portion is occupied by urban and rural settlements (10.42%) and sites for garbage disposal (4.73%).

The vegetation comprises primarily of 55 species of aquatic macrophytes, and 90 species of bank flora, including 41 species of herbs, 14 species of climbers, and 35 species of trees/shrubs (IWMED 2004). Moreover, in several parts of ECW area, 24 species of vegetable and crops, 5 species of fruit plants, and 10 species of ornamental plants are extensively cultivated by irrigating with sewage water (IWMED 2004). The wetland harbours a wide range of vertebrate fauna, of which fishes and birds

deserve a special mention. It hosts 40 species of fishes (De *et al.* 1989), 4 species of amphibians (IWMED 2004), 19 species of reptiles (IWMED 2004), about 135 species of birds (Personal Communication), and 16 species of mammals (IWMED 2004).

The region has a hot and humid monsoonal climate, with average annual rainfall of about 1,600 mm (mainly in the monsoon months from mid June to mid October). The summer temperature ranges between 30.4 - 40.2 °C, while winter temperature varies between13.6-14.2 °C.

Data Collection

The ECW was surveyed from January 2007 to November 2009 to assess the diversity of butterflies. Yearly survey was categorized into three seasonal durations, viz. the Premonsoon (March – May), Monsoon (June – October), and Postmonsoon (November – February). The survey was carried out in both human-inhabited and uninhabited wetland areas in all the four blocks of Bidhannagar, Bhangar, Sonarpur, and Tiljala.

Pollard Walk Method (Pollard 1977; Pollard and Yates 1993) was followed for recording the butterflies while walking along fixed paths in the wetland areas. The observation width was limited to about 3 m. Butterflies were observed throughout the day (n=24) from 08:00 h to 04:00 h, quarterly in three seasons for two consecutive years (2008, 2009). They were identified in the field using field guides by Evans (1932), Wynter-Blyth (1957), and Kehimkar (2008). Classification was followed after Heppner (1998).

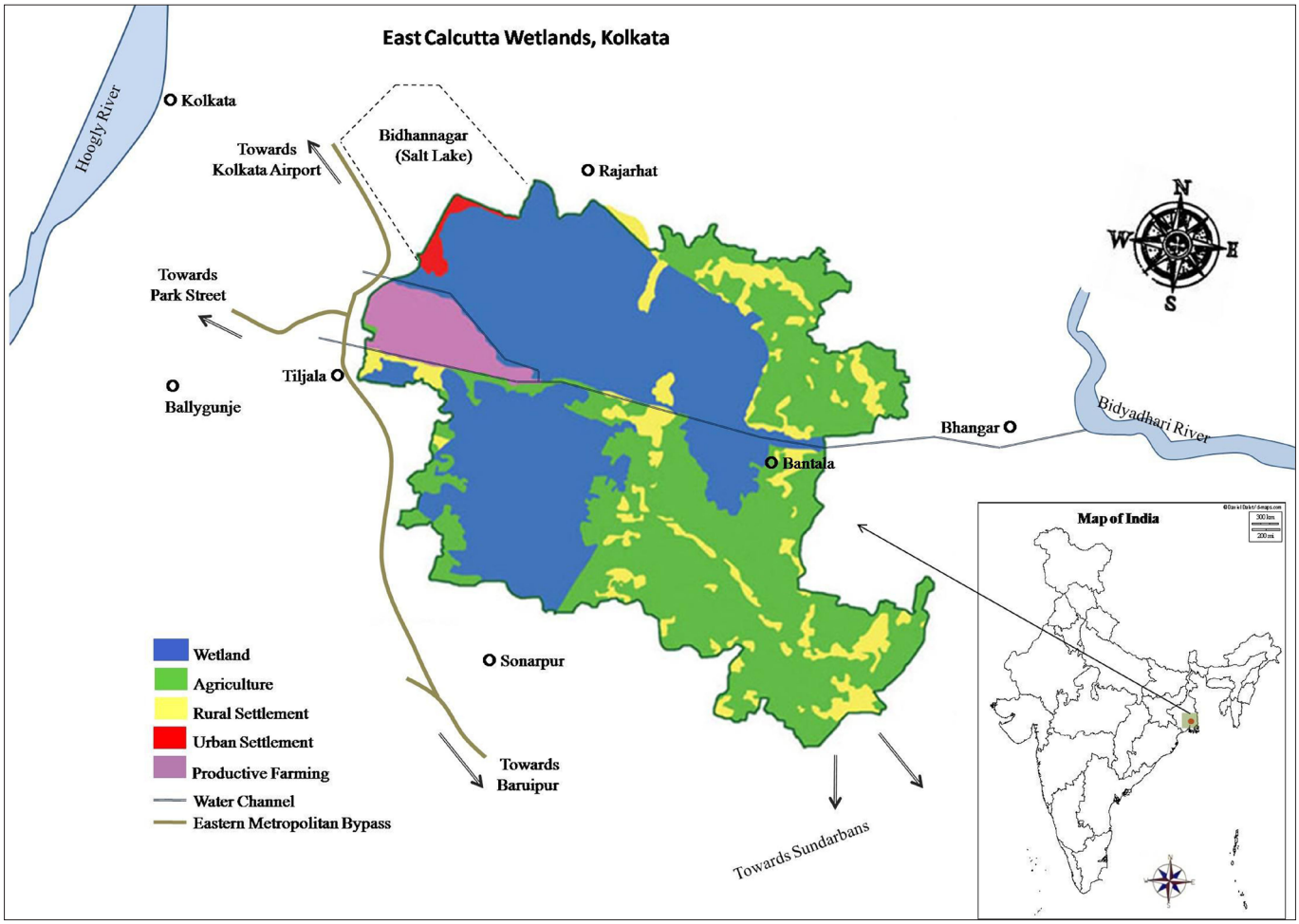

Figure 1. Map of East Calcutta Wetlands (ECW), Kolkata [Inset showing the location of ECW as a small part in Kolkata, represented by the box on map of India].

Results and Discussion

Although ECW attains primary concern for its rich piscine and avian resources, the area shows a rich assemblage of butterflies. Seventy-four species of butterflies representing six families have been recorded during the study. Nymphalidae showed the maximum species richness, comprising of 24 species (32%), followed by Lycaenidae (18 species, 24%), Hesperiidae (12 species, 16%), Pieridae (11 species, 15%), Papilionidae (8 species, 11%), and Riodinidae (1 species, 2%).

The preference of butterflies for particular habitats is often linked with the larval or adult food source. The rich diversity of butterflies, especially the nymphalids and lycaenids in ECW indicates a varied assemblage of floral species, particularly among the bank vegetation. Occurrence of some rare species like the Black Rajah (*Charaxes solon* Fabricius, 1793) in the wetlands under Sonarpur Block, hosting its food plant *Derris indica* (Lam.) Bennett (1972) have been reported by Chowdhury and Sarkar (2007). The presence of this butterfly along with the occurrence of other butterflies listed indicates the potential of this wetland area to harbor varied environmental conditions that in turn can support further bioresources. Lack of preferred nectar source as well as larval host plants in several patches of the ECW indicate degraded site, with low butterfly richness. Several

anthropogenic activities including intense encroachment stress from urban expansion, alterations of wetland habitats to agricultural lands, and discharge of untreated waste water effluent from several industries to the recently laid sewers emptying into the eastward flowing city outfall channels, are presently acting as potential threats in ECW. Restoration of wetlands for butterflies should concentrate on planting of host plants and propagation of conspicuous patches of the preferred nectar plant.

Being potential pollinating agents of their nectar plants as well as indicators of the health and quality of their host plants and the ecosystem as a whole, exploration of butterfly fauna thus becomes important in identifying and preserving critical wetland habitats under threat. More detailed studies regarding the role of butterflies in the wetland ecosystem and their mode of assessment of the habitat quality should be carried out for better management and conservation of ECW resources.

Table 1. Butterfly Checklist of East Calcutta Wetlands, Kolkata.

FAMILY	COMMON NAME	SCIENTIFIC NAME
Papilionidae	Jay, Common	*Graphium doson* (C. and R. Felder, 1864)
	Jay, Tailed	*Graphium agamemnon* (Linnaeus, 1758)
	Lime	*Papilio demoleus* (Linnaeus, 1758)
	Mime, Common	*Papilio clytia* (Linnaeus, 1758)
	Mormon, Blue	*Papilio polymnestor* (Cramer, 1775)
	Mormon, Common	*Papilio polytes* (Linnaeus, 1758)
	Rose, Common	*Pachliopta aristolochiae* (Fabricius, 1775)
	Rose, Crimson	*Pachliopta hector* (Linnaeus, 1758)
Pieridae	Albatross, Common	*Appias albina (*Boisduval, 1836)
	Albatross, Striped	*Appias libythea* (Fabricius, 1775)
	Emigrant, Common	*Catopsilia pomona* (Fabricius, 1775)
	Emigrant, Mottled	*Catopsilia pyranthe* (Linnaeus, 1758)
	Grass Yellow, Common	*Eurema hecabe* (Linnaeus, 1758)
	Grass Yellow, Three-spot	*Eurema blanda* (Boisduval, 1836)
	Gull, Common	*Cepora nerissa* (Fabricius, 1775)
	Jezebel, Common	*Delias eucharis* (Drury, 1773)
	Pioneer	*Anaphaeis aurota* (Fabricius, 1775)
	Psyche	*Leptosia nina* (Fabricius, 1793)
	Wanderer, Common	*Pareronia valeria* (Cramer, 1776)
Nymphalidae	Baron, Common	*Euthalea aconthea* (Cramer, 1777)
	Bushbrown, Common	*Mycalesis perseus* (Fabricius, 1775)
	Bushbrown, Dark-Brand	*Mycalesis mineus* (Linnaeus, 1758)
	Castor, Angled	*Ariadne ariadne* (Linnaeus, 1758)
	Castor, Common	*Ariadne merione* (Cramer, 1779)
	Commander	*Moduza procris* (Cramer, 1777)
	Crow, Brown King	*Euploea klugii* (Moore, 1858)
	Crow, Common Indian	*Euploea core* (Cramer, 1780)
	Eggfly, Danaid	*Hypolimnas misippus* (Linnaeus, 1758)
	Eggfly, Great	*Hypolimnas bolina* (Linnaeus, 1758)
	Evening Brown, Common	*Melanitis leda* (Linnaeus, 1758)
	Leopard, Common	*Phalanta phalantha* (Drury, 1773)
	Palmfly, Common	*Elymnias hypermenstra* (Linnaeus, 1758)
	Pansy, Grey	*Junonia atlites* (Linnaeus, 1763)
	Pansy, Lemon	*Junonia lemonias* (Linnaeus, 1758)
	Pansy, Peacock	*Junonia almana* (Linnaeus, 1758)
	Rajah, Black	*Charaxes solon* (Fabricius, 1793)
	Ring, Common Five	*Ypthima baldus* (Fabricius, 1775)
	Ring, Common Four	*Ypthima huebneri* (Kirby, 1871)
	Sailer, Chestnut-streaked	*Neptis jumbah* (Moore, 1857)
	Sailer, Common	*Neptis hylas* (Moore, 1758)
Nymphalidae	Tiger, Blue	*Tirumala limniace* (Cramer, 1775)
	Tiger, Plain	*Danaus chrysippus* (Linnaeus, 1758)
	Tiger, Striped	*Danaus genutia* (Cramer, 1779)
Lycaenidae	Blue, Gram	*Euchrysops cnejus* (Fabricius, 1798)
	Cerulean, Common	*Jamides celeno* (Cramer, 1775)
	Blue, Ciliate	*Anthene emolus* (Godart, 1824)
	Cupid, Plains	*Euchrysops pandava* (Horsfield, 1829)
	Flash, Slate	*Rapala manea* (Hewitson, 1863)
	Forget-me-not	*Catochrysops strabo* (Fabricius, 1793)

Table 1. *Continued.*

FAMILY	COMMON NAME	SCIENTIFIC NAME
Lycaenidae	Grass Blue, Dark	*Zizeeria karsandra* (Moore, 1865)
	Grass Blue, Pale	*Pseudozizeeria maha* (Kollar, 1848)
	Grass Blue, Tiny	*Zizula hylax* (Fabricius, 1775)
	Blue, Lime	*Chilades laius* (Stoll, 1780)
	Lineblue, Common	*Prosotas nora* (C. and R. Felder, 1860)
	Monkey Puzzle	*Rathinda amor* (Fabricius, 1775)
	Pierrot, Common	*Castalius rosimon* (Fabricius, 1775)
	Pierrot, Striped	*Tarucus nara* (Kollar, 1848)
	Quaker	*Neopithecops zalmora* (Butler, 1870)
	Silverline, Common	*Spindasis vulcanus* (Fabricius, 1775)
	Sunbeam, Indian	*Curetis thetis* (Drury, 1773)
	Yamfly	*Loxura atymnus* (Stoll, 1780)
Riodinidae	Judy, Plum	*Abisara echerius* (Stoll, 1790)
Hesperiidae	Bob, Chestnut	*Iambrix salsala* (Moore, 1866)
	Bob, Indian Palm	*Suastus gremius* (Fabricius, 1798)
	Dart, Dark Palm	*Telicota ancilla* (Herrich-Schäffer, 1869)
	Dartlet, Ceylon	*Oriens goloides* (Moore, 1881)
	Dartlet, Common	*Oriens gola* (Moore, 1877)
	Demon, Grass	*Udaspes folus* (Cramer, 1775)
	Hopper, Bush	*Ampittia dioscorides* (Fabricius, 1793)
	Red Eye, Common	*Matapa aria* (Moore, 1866)
	Snow Flat, Common	*Tagiades japetus* (Stoll, 1781)
	Swift, Dark Branded	*Pelopidas agna* (Moore, 1866)
	Swift, Rice	*Borbo cinnara* (Wallace, 1866)
	Swift, Small Branded	*Pelopidas mathias* (Fabricius, 1798)

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