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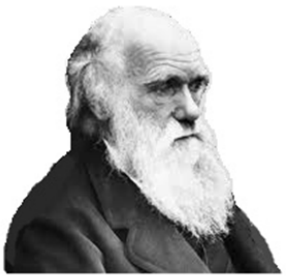

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Preliminary checklist of Moths (Insecta: Lepidoptera) and their role in maintenance of trophic chain of birds in Ecopark, West Bengal, India

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ABSTRACT

Ecopark Kolkata is a protected urban park of Kolkata West Bengal, having an area of approximately 480 acres. The study was conducted from May 2020 to April 2022. This study provides baseline data of moths in Ecopark, Kolkata. This is the first documentation and evaluation of the role of moths in the food web maintenance in birds, specially focused on an urban park in Kolkata. A total of 37 species under 12 families were reported in this present Survey. Of these, Crambidae shares maximum species 12 followed by Erebidae with 9 species; Noctuidae with 4 species; Zygaenidae, Sphingidae, Pyralidae each with 2 species and Uraniidae, Pterophoridae, Euteliidae, Geometridae, Nolidae, Limacodidae each with 1 species. The maximum number of the caterpillars of moth was found on *Crotalaria retusa, Hymenocallis littoralis, Hiptage benghalensis, Ziziphus ziziphus, Moringa oleifera, Pithecellobium dulce, Lantana camara* etc. Preference of food in between the resident birds also were found to be variable based on the bird species and the life stage of the moth and that in an urban park where vegetation and associated diversity is limited, moths can serve as a good supplementary food source for birds.

***Keywords*:** Moth, Ecopark, Urban Park, Diversity, Crambidae, Food source, Birds

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1. INTRODUCTION

Like other insects, moths are a valuable category to study in terms of ecology and conservation. As most moth species are nocturnal and easily drawn to light traps, it is possible to estimate relative abundance and identify the species richness easily [1]. Moths respond to anthropogenic disturbances and succession processes and are bio-indicators of habitat quality [2]. Although some environmental changes do not affect all groups of moths, vulnerability varies among taxa [3]. A loss of endemic host plants results in a corresponding loss of specialized moth fauna [4]. Moths are good environmental indicator. They play an important role in the maintenance of food chain balance especially in birds. Around 400-500 million metric tons of insects were documented to consumed by birds including the moths [5]. Birds favoured bigger insects to smaller insects, but preferred moths over butterflies. The coloration of several moths throughout the adult and larval stages is quite unattractive to birds [6]. The wing area/body size ratio was a significant factor influencing the attractiveness of diverse lepidopteron prey [7]. A single clutch of *Carolina chickadee* was reported to consume above 9000 caterpillars, before fledging [8].

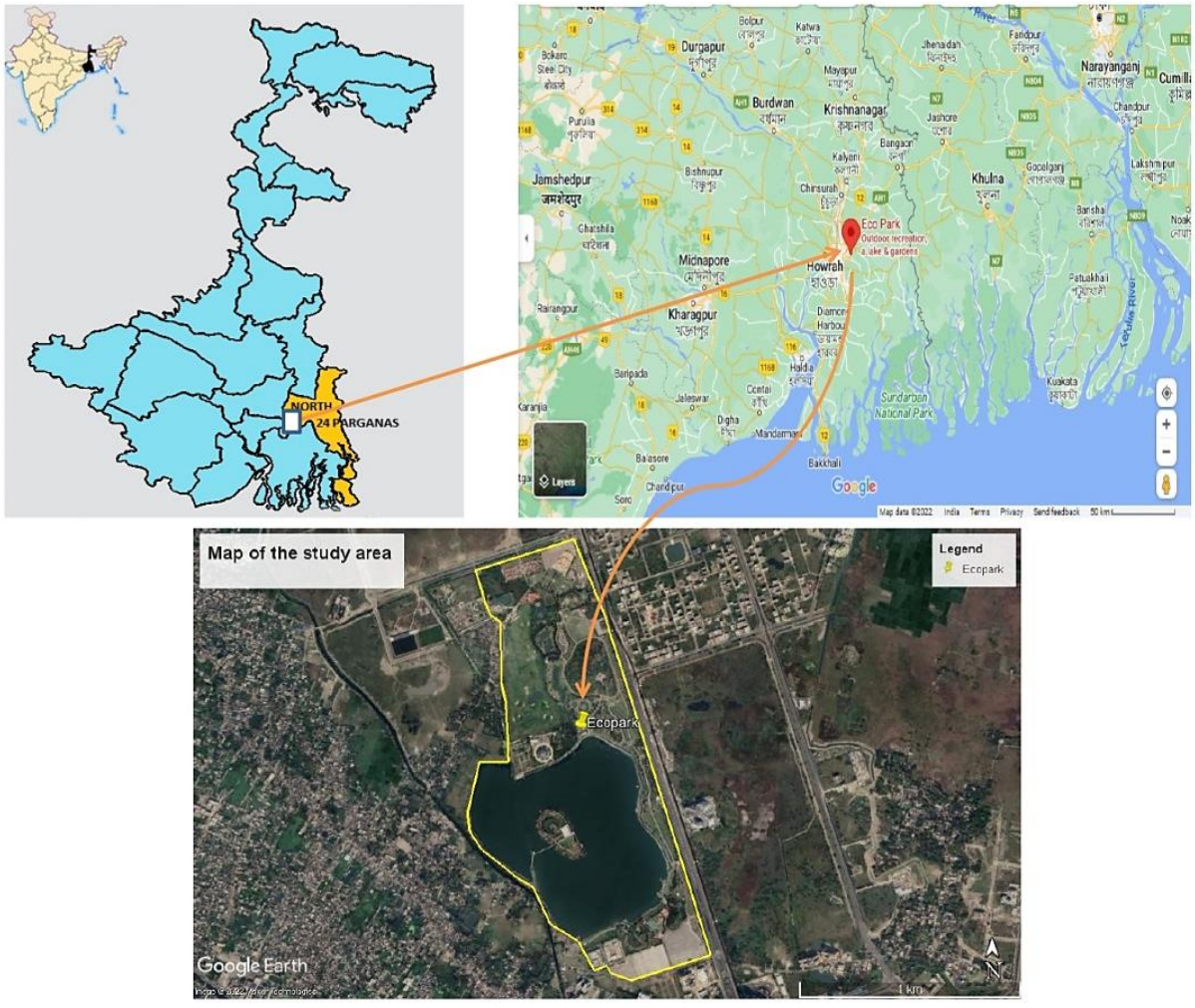

Figure 1. Map of the study area

Previously Roy et al. 2016 [9] studied insect faunal diversity in Saltlake city where they observed 6 families with 13 species of moths. Mitra et al. 2018 [10] found 7 families with 11 species of moths in Chintamani Kar Bird Sanctuary, a protected area of West Bengal. Shah et al. 2017[11] studied moth diversity in Neora Valley National Park in the Northern part of West Bengal, they found 52 species with 12 families.

This is the first documentation and evaluation of the role of moths in the food web maintenance of birds, specially focused on an urban park in Kolkata.

2. RESULT

2. 1. Materials and methods

The study concentrated on urban moth diversity in Ecopark (22°36'11"N 88°28'01"E), one of the largest urban park of India. Ecopark has an area of approximately 480 acres (Fig. 1). The study was conducted from May 2020 to April 2022. The data was taken from various areas of the park, everyday by direct observation. Nocturnal moths were documented in and around various light sources throughout the park in the evening. No moths were collected to make specimens, all were released after observation and photography for identification. Each species was meticulously captured on camera or a mobile device. The documented specimens were identified by the expert, with the help of published journals, books and 'Moths of India' Website [12]. Birds feeding observation was noted down regularly throughout the day by direct observation.

2. 2. Data Analysis

Table 1. The diversity of moths found in Ecopark

Order	Family	Scientific Name
Lepidoptera	Noctuidae	*Chrysodeixis eriosoma* (Doubleday, 1843)
Lepidoptera	Noctuidae	*Polytela gloriosae* Fabricius, 1781
Lepidoptera	Noctuidae	*Episteme adulatrix* (Kollar, [1884])
Lepidoptera	Noctuidae	*Spodoptera litura* (Fabricius, 1775)
Lepidoptera	Crambidae	*Marasmia poeyalis* (Boisduval, 1833)
Lepidoptera	Crambidae	*Parapoynx stagnalis* Zeller, 1852
Lepidoptera	Crambidae	*Glyphodes bivitralis* Guenée, 1854
Lepidoptera	Crambidae	*Hymenia perspectalis* Hübner, 1796
Lepidoptera	Crambidae	*Maruca vitrata* (Fabricius, 1787)
Lepidoptera	Crambidae	*Diaphania indica* Saunders (1851)

Lepidoptera	Crambidae	*Scirpophaga incertulas* (Walker, 1863)
Lepidoptera	Crambidae	*Sameodes cancellalis* Zeller, 1852
Lepidoptera	Crambidae	*Cnaphalocrocis medinalis* (Guenée, 1854)
Lepidoptera	Crambidae	*Spoladea recurvalis* Fabricius, 1775
Lepidoptera	Crambidae	*Metoeca foedalis* (Guenée, 1854)
Lepidoptera	Crambidae	*Parapoynx diminutalis* Snellen, 1880
Lepidoptera	Erebidae	*Creatonotos transiens* Walker, 1855
Lepidoptera	Erebidae	*Eressa confinis* (Walker, 1854)
Lepidoptera	Erebidae	*Orgyia* sp.
Lepidoptera	Erebidae	*Sphrageidus* sp.
Lepidoptera	Erebidae	*Asota caricae* Fabricius, 1775
Lepidoptera	Erebidae	*Amata cyssea* Stoll, 1782
Lepidoptera	Erebidae	*Syntomoides imaon* Cramer, 1779
Lepidoptera	Erebidae	*Argina astrea* (Drury, 1773)
Lepidoptera	Erebidae	*Olepa ricini* (Fabricius, 1775)
Lepidoptera	Zygaenidae	*Trypanophora semihyalina* Kollar, 1844
Lepidoptera	Zygaenidae	*Thyrassia subcordata* Walker, 1854
Lepidoptera	Sphingidae	*Macroglossum* sp.
Lepidoptera	Sphingidae	*Theretra silhetensis* Walker, 1856
Lepidoptera	Uraniidae	*Micronia aculeata* Guenée, 1857
Lepidoptera	Pyralidae	*Pyralis pictalis* (Curtis, 1834)
Lepidoptera	Pyralidae	*Pyralis manihotalis* Guenee, 1854
Lepidoptera	Pterophoridae	*Sphenarches* sp.
Lepidoptera	Euteliidae	*Chlumetia transversa* (Walker, 1863)
Lepidoptera	Geometridae	*Chiasmia emersaria*(Walker, 1861)
Lepidoptera	Nolidae	*Nola taeniata* Snellen, 1875
Lepidoptera	Limacodidae	*Parasa lepida* (Cramer, 1799)

A total of thirty seven species belonging to twelve families were collected from the study area. Acording to the result Crambidae shares maximum species 12 followed by Erebidae with 9 species; Noctuidae with 4 species; Zygaenidae, Sphingidae, Pyralidae each with 2 species and Uraniidae, Pterophoridae, Euteliidae, Geometridae, Nolidae, Limacodidae each with 1 species (Table 1).

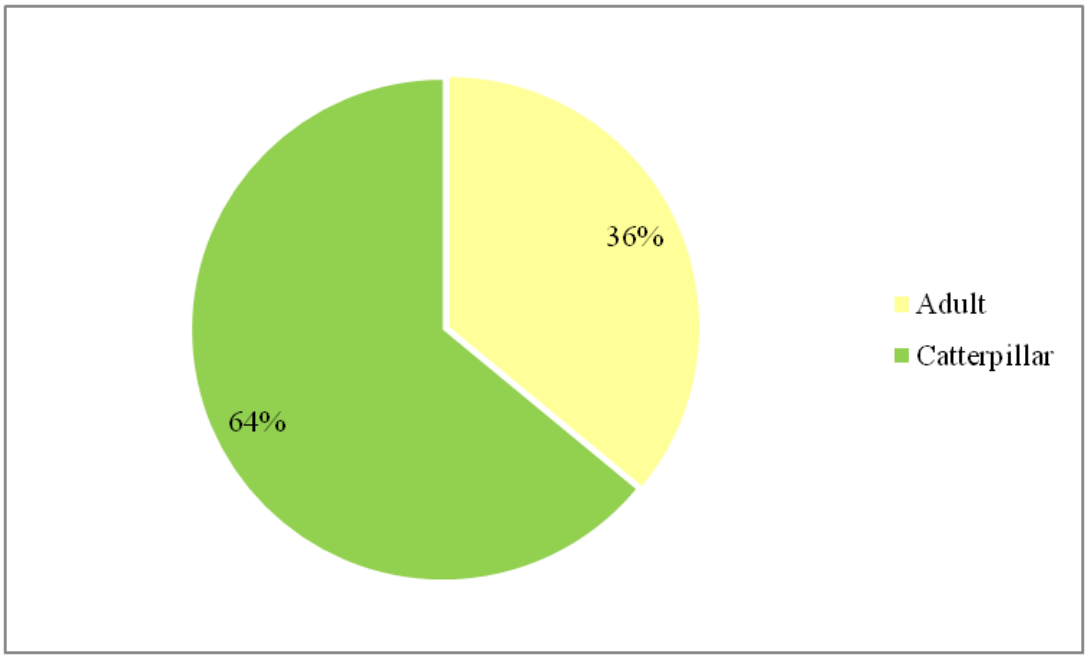

Figure 2. Percentage of adult and catterpillar of moths feed by birds

A total no of 9 insectivorous birds were observed to feed on 1031 moths (Table 2). Among them 64% were caterpillar and 36% were adult moths (Fig. 2).

Table 2. Observed insectivorous birds feed on moth

Sl No.	Bird species	Scientific Name	Bird count	Moth	
				Adult	Caterpillar
1	Black Drongo	*Dicrurus macrocercus* Vieillot, 1817	112	98	14
2	Black-hooded Oriole	*Oriolus xanthornus* (Linnaeus, 1758)	57	0	57
3	Common Hawk Cuckoo	*Hierococcyx varius* (Vahl, 1797)	38	0	38
4	Common Myna	*Acridotheres tristis* (Linnaeus, 1766)	216	53	163

5	Common Tailorbird	*Orthotomus sutorius* (Pennant, 1769)	70	0	70
6	Jungle Babbler	*Turdoides striata* (Dumont, 1823)	245	0	245
7	Jungle Myna	*Acridotheres fuscus* (Wagler, 1827)	21	16	5
8	Plaintive Cuckoo	*Cacomantis merulinus* (Scopoli, 1786)	49	0	49
9	Red-vented Bulbul	*Pycnonotus cafer* (Linnaeus, 1766)	223	204	19

3. CONCLUSIONS

Role of moths in the maintenance of Trophic chain balance in study area

In the era of global urbanization, urban parks serve as a nature reserve to the biodiversity, but the narrowing range of trees, plants are causing the shrinkage of the associated species, including the insect community. Moths are known as a good environment indicator, but also considered as horticulture and agricultural field pest. However, the percentage is too small for the true pests. Some particular species of moths are only found in the urban areas, indicates the ecological disturbance. According to the result larva of moths to be found in study area were herbivorous. The shrinkage of greenery makes bird's food diet more rigid but not the moth genealogy because the highest number of the caterpillars of moth were found on *Crotalaria retusa, Hymenocallis littoralis, Hiptage benghalensis, Ziziphus ziziphus, Moringa oleifera, Pithecellobium dulce, Lantana camara* etc. in the study area, that are very common plant species specially in an urban park. So, it can be said that moth diversity will not affect that much if the aforesaid plants are at least present in good abundance in various urban parks.

In this study area moths are vital food source of various birds especially during their rearing of offspring. Alongside the insectivores, omnivores were also observed to be dependent on moths for the same purpose. Preference of food among the resident birds also found to be variable based on the bird species and the life stage of the moth. Some common resident birds like Red-vented Bulbul, Common Myna, Jungle Myna, Black Drongo were found to be feeding on adult moths, where as Common Tailorbird, Jungle Babbler, Cuckoos (Plaintive Cuckoo, Common Hawk Cuckoo etc.), Black-hooded Oriole were observed to feed on caterpillars more than the adults.

So, it can be concluded that in an urban park where vegetation and associated diversity is limited, moths can serve as a good supplementary food source for birds. It will now supply a preliminary concept for food source of urban birds. As we saw, the plants of urban park like *Crotalaria retusa, Hymenocallis littoralis, Hiptage benghalensis, Ziziphus ziziphus, Moringa oleifera, Pithecellobium dulce, Lantana camara* etc, which support various life cycles of different urban moths species, can be accommodated in urban park plantation planning.

So, the avifaunal diversity of Kolkata and its surrounding get an abundant supply of insect food sources throughout the year. This study shows the necessity of such study in an urban park for understanding the ecosystem service and the food chain consequences. In this rapid

urbanization period these understanding are a must, and urban plantation plan can be made on the basis of these kinds of studies. The result of this study also contributes to fill a gap in moth research in the expanding part of Kolkata. The study also exposed the scope of further research in this regard.

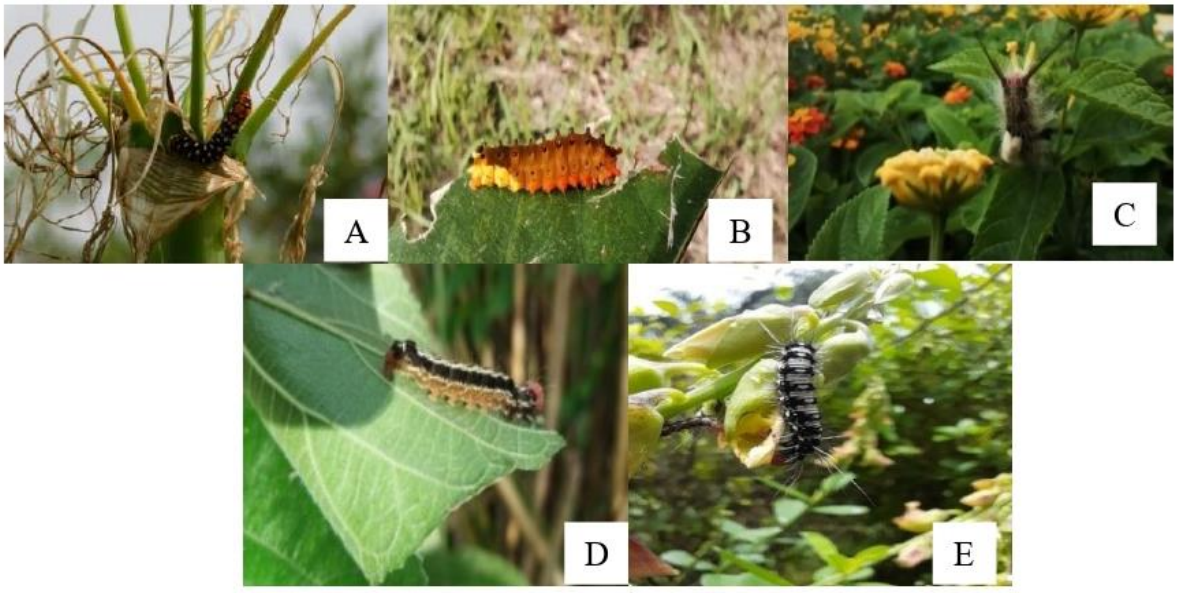

Figure 3. Some of the pictures of observed caterpillars of moth A) *Polytela gloriosae*, B) *Trypanophora semihyalina*, C) *Orgyia* sp., D) *Asota caricae* E) *Argina astrea*

Figure 4. Some of the pictures of observed birds foraging the caterpillars of moth A) *Pycnonotus cafer*, B) *Turdoides striata*, C) *Dicrurus macrocercus*

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