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Comparison of butterfly diversity of Khanyan and Chinsurah rice research station as a measure of habitat destruction

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Abstract
Butterfly diversity and abundance was studied in two different places of Hooghly district. One village and one urban area was taken for the study and their differences were noted. Pollard walk was followed for sampling for butterfly observation and counting. Total number of species found in Khanyan and Chinsurah Rice Research Station was 40 and 29 respectively in 3 months post monsoon span in one year. Among the found species 6 were very rare (VR), 14 were rare (R) species, 8 were not rare (NR) species, 11 were common (C) species and 1 was very common (VC) species in Khanyan region. Whereas We found only 2 very rare (VR) species here alongwith 9 common (C), 11 rare (R) and 7 not rare (NR) species in CRRS region. In Khanyan the highest abundant species was *Catopsilia pyranthe* (Mottled emigrant) and least abundant species was *Castalius rosimon* (Common Pierrot) whereas in Chinsurah Rice Research Station *Junonia atlites* (Grey Pansy) was highest abundant and *Papilio polytes* (Common Mormon) was least abundant species. In Khanyan and in Chinsurah both places family Nymphalidae showed highest abundance. Family Papilionidae was least abundant found in both places. The abundance of butterfly species can be correlated with the presence of their larval host plant and nectar plant.

Keywords: butterfly diversity, mean abundance, habitat destruction, Khanyan, Chinsurah

Introduction
Butterflies have always been delighted mankind since ancient time. Among insects they are obviously most beautiful creatures. They are certainly most popular, best known and most studied insect group. There was a time when butterflies were collected like postage stamps for hobby. Maximum information on their taxonomy, migration, variation, mimicry, speciation, evolutionary biology was gathered in that period. Nowadays worldwide increasing trend in urbanization is a major cause of habitat destruction and fragmentation which causes loss of many species and lowering diversity of butterflies. Thus, study on butterflies is more necessary to conserve them. Nowadays several species of butterflies are used by conservation biologists as indicator species to identify habitats. Large areas, once forests or wasteland, full of weeds that caterpillars eat, have now been cleared for agriculture. Due to this habitat loss almost all Indian butterflies are under threat, and some are critically endangered. Thus, conservation biologists use butterflies to identify habitat those are critical in state and need to be restored and protected. Butterflies are also monitored to indicate climate changes and environmental degradations. Besides the habitat loss the extensive use of chemical insecticides has drastically reduced their numbers. In this man engineered era, the clouds of butterflies that used to fly up in wild places can no longer be taken for granted. They are no longer to fly around us, if we clear weeds, forests, wastelands which are meaningless, not useful and eye soothing to us, but actually they provide life to these beautiful creatures of nature.

Butterfly diversity of any area indicates the health of the environment and ecosystem. Areas rich in butterflies and moths are rich in other invertebrates as well. These collectively provide a wide range of ecosystem services including pollination (Tiple et. al. 2006) [7] and natural pest control. They are herbivore (Tiple et. al. 2006) [7] and are very choosy about nectar plant and host plant as these serve food for adult and larvae. Thus, their availability is highly correlated with these plants. Loss of habitat directly affects their abundance (Kunte 2000) [2]. Thus, ecologists can measure human interference by monitoring butterfly population. And conservation of any butterfly needs an immediate restoration of their habitat.

The study was aimed to enlist the butterfly population of two regions, Khanyan and Chinsurah Rice research Station. Two areas show many dissimilarities in respect to vegetation pattern, human interference, urbanization. So, it was a target to compare butterfly population of those two areas and to check the health of the ecosystems of both places. Checklist of both places were prepared to study the variation of abundance of those areas.

Materials and Methods
Study site
The study was conducted in the Khanyan village (22°02'44" N, 88°18'19" E). The roadside areas from station to Itachuna Rajbati was studied. Both side of road was observed during sampling. The vegetation was composed of local weeds, herbs, shrubs and natural trees. But there was no trace of forest area, no dense vegetation was observed. Human disturbance is moderate and urbanization practice is also moderate.

The Chinsurah Rice Research Station (CRRS) was previously known as 'Chinsurah Farm' (22052' N & 88024' E). It is the main RRS in West Bengal and the campus area is approximately one square km (1 sq Km). This walled area is situated between the urban and rural habitations of

Chinsurah. The area between the river and the CRRS is densely populated. The western side of the CRRS is surrounded by mango orchards and cultivated fields. There is no trace of forest in the entire area and the vegetation is composed of local weeds, shrubs and planted trees. The entire habitat in this area is rapidly degrading due to extensive agricultural practices and urbanization (Mandal 2016) [3]. One irrigation canal with aquatic vegetation covers the whole area for irrigation.

Study period

Butterflies were studied in the above said area from October to December 2018. In the post monsoon season the population of butterflies take a peak because their host plant and flowers of nectar plants were highly abundant. Thus, that season was chosen for butterfly study.

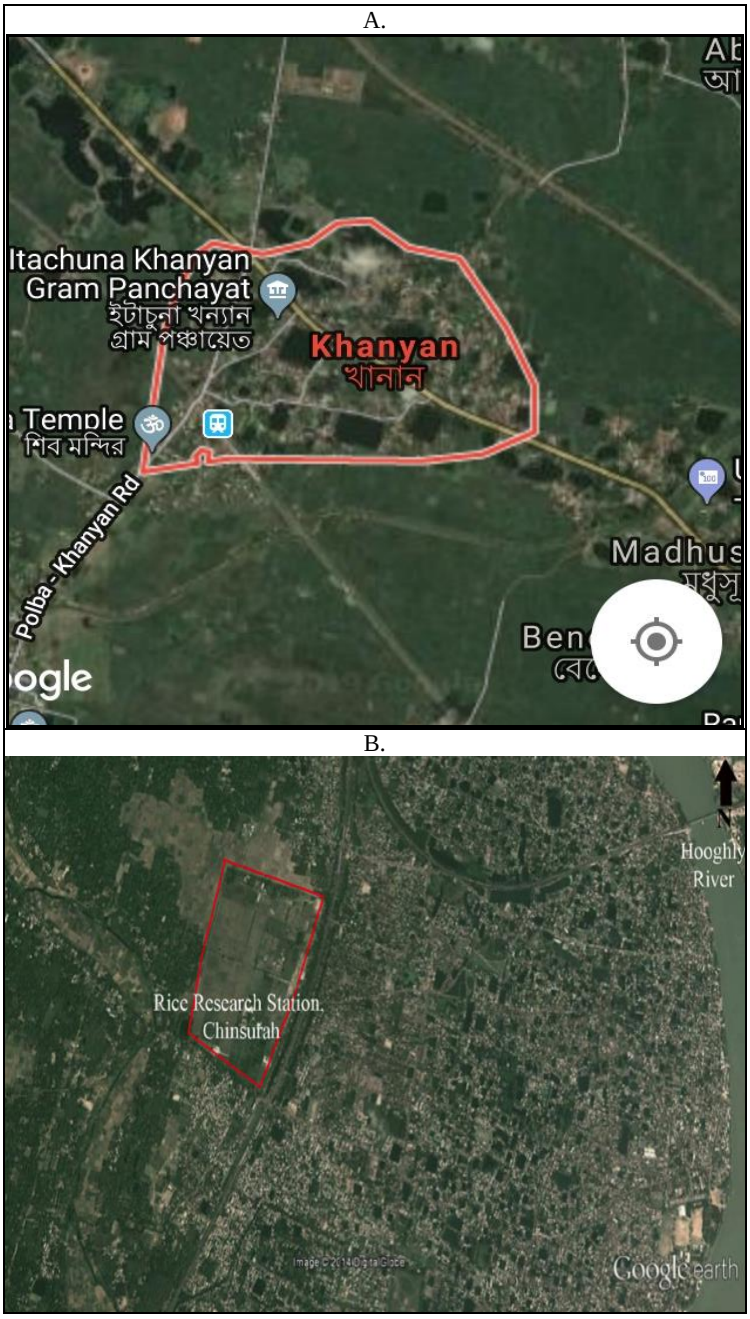

Fig 1: Satellite images of A. Khanyan village and B: Chinsurah Rice Research Station.

Methodology followed

A weekly random sampling was carried out in the chosen sites. The observations were made from 0900 h to 1200 h, the peak time for butterfly activity. Olympus binocular (7X35) was used for watching butterfly activity and Canon Power Shot SX60 was used for photography. The butterflies were recorded in the field following "Pollard walk" method (Pollard 1977) [6]. Some were directly identified in field and some were identified later by photography. Specimens were collected with handle held sweep nets for further study and records and scientific documentation but not for hobby. Each specimen was collected in separate specimen containers and each container was given a unique number for future data analysis if required. The specimens were allowed to dye and dry naturally and were handled carefully to assure minimum loss of scales. Collected specimens were carried to laboratory for identification with the help of field guide (Winter-Blyth 1957, Kunte 2000, Kehimkar 2008) [10, 2, 1]. All scientific name of the butterflies used in this study is followed by Varshney (1983) [9]. The observed butterflies

were categorized family wise and the checklist was prepared of that area of that time. The observed butterflies also grouped into five types according to their status (C=Common, VC=Very Common, NR=Not rare, R=Rare, VR=Very rare). Familywise and monthwise abundance was also checked and compared of those places.

Result

In both the places sampling was started from post monsoon season and ended at the onset of winter. All the butterfly families were rich in number and showed higher activity during the first stage of sampling and their number declined collectively as the winter started.

Total number of species found in Khanyan was 40 from 30 genera of 5 families. Whereas in CRRS total number of species was 29 from 20 genera of 5 families. In Khanyan the highest abundant species was *Catopsilia pyranthe* (Mottled emigrant) (8.5±1.63) and lowest abundant species was *Castalius rosimon* (Common pierrot) (0.08±0.08) (Figure 2, Table 1). Whereas in CRRS *Junonia atlites* (Grey Pansy) was highest abundant (30.08±5.89) species and *Papilio polytes* (Common Mormon) was lowest abundant (0.09±0.09) species (Figure 2, Table 2). Both in Khanyan and CRRS family Nymphalidae was highest abundant and family Papilionidae was least abundant (Table 1 & 2).

Those found species were categorized into five types (VR, R, NR, C, VC) to check whether they were common or not. Among the found species 6 (15%) were very rare (VR), 14 (35%) were (R) species, 8 (20%) were not rare (NR) species, 11 (27.5%) were common C species and 1 (2.5%) was very common (VC) species in Khanyan region (Table 1). Whereas we found only 2 (6.89%) very rare (VR) species alongwith 9 (31.03%) common (C), 11 (37.93%) rare (R) and 7 (24.13%) not rare (NR) species in CRRS region (Table 2).

Discussion

In the present study at both places Khanyan and CRRS, family Nymphalidae was the highest abundant and family Papilionidae was the least abundant, which can be correlated with many similar studies (Tiple 2012, Nair et al 2014, Mandal 2016) [8,5,3].

Highest abundant species in Khanyan was *Catopsilia pyranthe* (Mottled emigrant). Its high abundance can be correlated with larval host plant *Cassia sophera*, *Cassia tora* abundance. Those plants were highly abundant in the roadside areas of Khanyan. Whereas high abundance of *Junonia atlites* (Grey Pansy) in CRRS can be correlated with the abundance with the larval host plant *Hygrophila auriculata* (Khulekhara). *Hygrophilata auriculata* were very common in irrigation canals at CRRS at that time.

Lesser number of species was found in CRRS (29) compared with Khanyan (40). It may be due to lesser variation in the host plant as well as nectar plants, which can be an indication of habitat destruction in CRRS. It is due to extensive agricultural practices and urbanization (Mandal 2016) [3]. Conservation of habitat is immediately needed to conserve the butterfly species of CRRS.

It was also observed that mean abundance of different butterfly species was highest during post monsoon period. Later the abundance was gradually decreased with the onset of winter. It is the general trend of butterflies of different areas of India (Mukherjee et. al. 2015) [4]. Large number of host plants, nectar plants grows during monsoon, which support large number of butterflies to grow in post monsoon period. In winter many of them opt for hibernation, which is a cause of population drop off during this period. In the present study we found lesser number of butterfly species than previous (Mandal 2016) [3], it may be due to habitat destruction. More detailed study is needed in both of the places.

Fig 2: Photographs of some butterfly taken during the study. A- *Graphium Agamemnon*, B- *Graphium closon*, C- *Papilio polytes*, D- *Delias eucharis*, E- *catopsilia pyranthe*, F- *Cepora nerissa*, G- *Leptosia nina*, H- *Eurema hecabe*, I- *Junonia atlites*, J- *Junonia almana*, K- *Junonia lemonias*, L- *Ariadne ariadne*, M- *Euploea core*, N- *Phalanta phalantha*, O- *Melanitis leda*, P- *Danaus chrysippus*, Q- *Hypolimnas misippus*, R- *Elymnias hypermnestra*, S- *Castalius rosimon*, T- *Euchrysops cnejus*.

Table 1: Checklist of Khanyan

Sl no.	Common name	Scientific Name	Mean±SE	Status
Family: Papilionidae				
1	Common Mormoon	*Papilio polytes* (Linnaeus, 1758)	1.14± 0.70	R
2	Common Mime	*Papilio clytia* (Linnaeus, 1758)	1.17±0.66	C
3	Lime	*Papilio demoleus* (Linnaeus, 1758)	0.86±0.70	C
4	Tailed Jay	*Graphium agamemnon* (Linnaeus, 1758)	1±0.31	C
5	Common Rose	*Pachliopta aristolochiae* (Fabricius, 1775)	0.86±0.70	R
Family: Pieridae				
6	Common Emigrant	*Catopsilia pomona* (Fabricius, 1775)	3±1.94	NR
7	Mottled Emigrant	*Catopsilia pyranthe* (Linnaeus, 1758)	8.5±0.13	NR
8	Stripped Albatross	*Appias libythea* (Fabricius, 1775)	1.43±0.87	R
9	Common Wanderer	*Pareronia valeria* (Cramer, 1776)	0.143±0.142	VR
10	Common Gull	*Cepora nerissa* (Fabricius, 1775)	0.29±0.18	R
11	Common Jejebel	*Delias eucharis* (Drury, 1773)	6.92±1.06	C
12	Common Grass Yellow	*Eurema hecabe* (Linnaeus, 1758)	7.7±3.56	C
13	One spot Grass Yellow	*Eurema andersoni* (Moore, 1878)	0.33±0.33	VR
14	Psyche	*Leptosia nina* (Fabricius, 1793)	6.29±3	NR
Family: Nymphalidae				
15	Blue Tiger	*Tirumala limniace* (Cramer, 1775)	1±0.72	R
16	Plain Tiger	*Danaus chrysippus* (Linnaeus,1758)	3±4.08	C
17	Stripped Tiger	*Danaus genutia* (Cramer, 1779)	1±0.72	R
18	Common Crow	*Euploea core* (Cramer, 1780)	3.7±2.33	NR
19	Common Evening Brown	*Melanitis leda* (Linnaeus, 1758)	0.57±0.37	R
20	Common Bushbrown	*Mycalesis perseus* (Fabricius, 1775)	0.143±0.143	VR
21	Common Palmfly	*Elymnias hypermnestra* (Linnaeus, 1763)	1.7±1.71	R
22	Common Rore ring	*Ypthima huebneri* (Kirby, 1871)	0.71±0.71	R
23	Common Five ring	*Ypthima baldus* (Fabricius, 1775)	0.286±0.286	R
24	Common Leopard	*Phalanta phalantha* (Drury, 1773)	0.17±0.11	C
25	Grey Pansy	*Junonia atlites* (Linnaeus, 1763)	5.17±1.39	VC
26	Lemon Pansy	*Junonia lemonias (Linnaeus, 1758)*	0.29±0.29	R
27	Peacock Pansy	*Junonia almana (Linnaeus, 1758)*	8.1±1.9	C
28	Angled Castor	*Ariadne ariadne (Linnaeus, 1763)*	5.7±2.04	NR
29	Common Castor	*Ariadne merione (Cramer, 1779)*	0.29±0.29	VR
30	Great Eggfly	*Hypolimnas bolina (Linnaeus, 1758)*	0.29±0.29	VR
31	Danaid Eggfly	*Hypolimnas misippus (Linnaeus, 1764)*	0.43±0.29	R
Family: Lycaenidae				
32	Pale Grass Blue	*Pseudozizeeria maha* (Kollar, 1844)	3.14±2.34	NR
33	Pea Blue	*Lampides boeticus* (Linnaeus, 1767)	0.17±0.17	VR
34	Slate Flash	*Rapala manea* (Hewitson, 1863)	1.14±0.85	R
35	Common Silverline	*Spindasis vulcanus* (Fabricius, 1775)	7±3.29	C
36	Rounded Pierrot	*Tarucus nara* (Kollar, 1848)	2.57±1.02	NR
37	Dark Grass Blue	*Zizeeria karsandra* (Moore, 1865)	0.86±0.70	R
38	Common Pierrot	*Castalius rosimon* (Fabricius, 1775)	0.08±0.08	C
Family: Hesperiidae				
39	Rice Swift	*Borbo cinnara* (Wallace, 1866)	5.71±5.54	NR
40	Dark Palm Dart	*Telicota ancillabambusae* (Moore, 1878)	0.85±0.59	R

*Listed in Indian Wildlife (Protection) Act, 1972 VC-Very Common (> 100 sightings), C-Common (50-100 sightings), NR–Not Rare (15-50 sightings), R–Rare (2-15 sightings), VR-Very Rare (1-2 sightings)

Table 2: Checklist of Chinsurah Rice Research Station

Sl no.	Common name	Scientific Name	Mean ± SE	Status
Family: Papiolionidae				
1	Common Mime	*Papilio clytia* (Linnaeus, 1758)	0.5±0.3	C
2	Common Mormon	*Papilio polytes* (Linnaeus, 1758)	0.09±0.09	R
3	Lime	*Papilio demoleus* (Linnaeus, 1758)	0.42±0.22	C
4	Tailed Jay	*Graphium Agamemnon* (Linnaeus, 1758)	1±0.34	C
5	Common Jay	G*raphium closon* (Felder & Felder)	0.83±0.38	R
Family: Pieridae				
6	Mottled Emigrant	*Catopsilia pyranthe* (Linnaeus, 1758)	2±0.72	NR
7	Common Emigrant	*Catopsilia pomona* (Fabricius, 1775)	5.42±1.47	NR
8	Indian Cabbage White	*Pieris canidia* (Linnaeus, 1758)	0.45±0.24	R
9	Common Gull	*Cepora Nerissa* (Fabricius, 1775)	1.83±0.61	R
10	Common Grass Yellow	*Eurema hecabe* (Linnaeus, 1758)	27.33±4.82	C
11	Common Jezebel	*Delias eucharis* (Drury, 1773)	0.33±0.19	C
Family: Nymphalidae				
12	Danaid Eggfly	*Hypolimnas misippus* (Linnaeus, 1764)	0.75±0.25	R

13	Great Eggfly	*Hypolimnas bolina* (Linnaeus, 1758)	0.5±0.33	VR
14	common Palmfly	*Elymnias hypermnestra* (Linnaeus, 1763)	0.25±0.18	R
15	Common Crow	*Euploea core* (Cramer, 1780)	4.92±0.84	NR
16	Tawny Coster	*Acraea violae* (Fabricius 1775)	8.25±1.21	NR
17	Common Evening Brown	*Melanitis leda* (Linnaeus, 1758)	0.5±0.33	R
18	Common Castor	*Ariadne merione* (Cramer, 1779)	0.58±1.17	VR
19	Angled Castor	*Ariadne ariadne* (Linnaeus, 1763)	0.83±0.57	NR
20	Stripped Tiger	*Danaus genutia* (Cramer, 1779)	6±1.34	R
21	Plain Tiger	*Danaus chrysippus* (Linnaeus,1758)	17.5±3.14	C
22	Blue Tiger	*Tirumala limniace* (Cramer, 1775)	1.17±0.51	R
23	Dark Blue Tiger	*Tirumla septentrionis* (Butler)	0.25±0.25	R
24	Common Leopard	*Phalanta phalantha* (Drury, 1773)	3.5±1.17	C
25	Grey Pansy	*Junonia atlites* (Linnaeus, 1763)	30.08±5.89	C
26	Peacock Pansy	*Junonia almana* (Linnaeus, 1758)	10.17±2.99	C
Family: Lycaenidae				
27	Lesser Grass Blue	*Zizina otis* (Fabricius, 1775)	11.92±3.07	R
28	Gram Blue	*Euchrysops cnejus* (Fabricius, 1775)	5.92±1.79	NR
Family: Hesperiidae				
29	Rice Swift	*Borbo cinnara* (Wallace, 1866)	16.5±2.99	NR

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