Univ. j. zool. Rajshahi Univ. Vol. 30, 2011 pp. 09-15
http://journals.sfu.ca/bd/index.php/UJZRU
ISSN 1023-6104

New records of butterflies and their species diversity in four different areas of Savar, Dhaka, Bangladesh

A T M F Islam[1], M H Islam[1], A S M Saifullah[1], K Endo[2] and Akira Yamanaka[2]

[1]Institute of Food and Radiation Biology, Atomic Energy research Establishment, GPO Box-3787, Dhaka-1000, Bangladesh
[2]Department of Physics, Biology and Informatics, Faculty of Science, Yamaguchi University, Yamaguchi 753, Japan

Abstract: Field studies of butterflies were carried out in four different selected areas i.e. Krishnopur, AERE campus, Rajalak Farm and Horters (Part of JU campus) at Savar, Dhaka. Butterflies identified of those areas constituted 158 species belonging 10 families, 87 species of which are newly-recorded in Bangladesh. Numbers of species identified in each family reached 47 in Lycaenidae (30 newly recorded), 32 in Hesperiidae (22 new), 22 in Pieridae (11 new), 19 in Nymphalidae (6 new), 14 in Papilionidae (7 new), 14 in Saytridae (8 new), 5 in Danaidae (1 new), 3 in Riodinidae (1 new), 1 in Acraeidae and 1 newly recorded Amathusiidae. The maximum 130 species and the minimum 65 species were recorded in Krishnopur and Rajalak Farm, respectively. Almost all butterfly families were found to be dominant in Krishnopur. Among the total identified species, 35.44% belonged to very rare (VR) and 20.25% to rare (R) categories, whereas 12.18%, 12.03% and 13.29% species were very common (VC), common (C) and not rare (NR) categories, respectively. It may be that the numbers of butterfly species as well as their fauna vary greatly depending on the floral and ecological conditions in and around the study areas.

Key words: New record, species, diversity, butterfly, Savar, Dhaka.

Introduction

Butterflies, estimated to reach 28,000 species in the world (Robbins & Opler, 1997), are found to inhabit various environmental conditions existing in hot to cold, moist to dry and low to high-mountain areas. Butterfly species are abundant in tropical areas, especially in tropical rainforests. Large numbers of butterfly species are identified in tropical countries including rain forests and low to high-mountain areas, for example, over 3700 species are identified in Peru. Butterfly species are reported to reach 643 in Nepal, 1163 in India, 242 in Sri Lanka and 237 in Japan. In Bangladesh, few works are available on butterfly species diversity, status and distribution except for the preliminary field studies of butterflies in Jahangirnagar University (JU) campus to clarify the fauna and its seasonal fluctuations of butterflies in Savar (Islam *et al*., 2007; Shahjahan *et al*., 2008). Savar is known as one of industrial areas of Bangladesh, but there are wide cultivating and forest areas in addition to many campuses of Government Organizations, such as Public Administration Training Centre (PATC), Bangladesh Livestock Research Institute (BLRI), Jatiya Sriti Shoudho, Centre for the Rehabilitation of the Paralyzed (CRP), Radio Station, (JU), Atomic Energy Research Establishment (AERE) and Bangladesh Krira Shikkha Prothistan (BKSP). The cultivating and forest areas as well as the campuses of those Government Organizations are covered with various vegetations and undisturbed areas for butterfly, on which various butterfly populations, suppose to be retained.

In the present study, we tried to examine the diversity, dynamics, ecological status and migration of butterfly populations in Savar, Dhaka, Bangladesh, which are changing with seasonal and habitat conditions of the area.

Materials and Methods

***Selection of study areas*:** We selected study areas at Savar, the north-west suburbs of Dhaka City that vary in its vegetation characteristics. The meteorological conditions include a mean annual temperature of 30.5°C and a mean monthly rainfall of 215 mm. We selected the following four study areas (Area-1 to Area–4) in and around Savar.

Area-1: Krishnopur, located at about 4 km east-sides from Savar, spreads over 200 ha, in which there is a wide habitat range. This area, low disturbed by the human interference, is composed of mixed vegetation lands cultivating for fruit plants, timber plants, grasses, flowers and vegetables. Natural vegetation including small natural forests was mainly covered with weeds and bamboo bushes.

Area-2: AERE Campus, located at about 15 km north of Savar and beside the Dhaka-Jumuna bridge high way, spreads over 135 ha. Vegetation includes mixed type such as fruit plant, timber plant and flower gardens, grasses in addition to building areas for offices, residences and ponds. It is a low human disturbed area.

Area-3: Horters (Part of JU Campus), situated at about 3 km north of Savar and by the Dhaka-Aricha road, spreads about 4 ha. Vegetations, mainly seedlings of fruit and flowering plants, are of mixed types. It is a high human disturbed area.

Area-4: Rajalak Farm, situated at west side of the Savar bus-stand, spreads about 9 ha. Vegetations mostly consist of fruit and herb plants in addition to some areas cultivating for shrubs and vegetables. It is also a high human disturbed area.

Identification of species*:* Butterflies were collected in each study area with handheld aerial sweep nets and killed immediately by pressing their thorax carefully for minimizing damages of the external organs (scales, legs and wing veins). They were identified using the specimen books "Butterflies in Thailand, Vol. 1-6 (Kurani & Pinratana, 1981, 1983, 1985; Pinratana & Eliot, 1982, 1996a, 1996b) and common English names (Wynter-Blyth, 1957).

Survey of the butterfly fauna: The butterflies were collected on sunny days of every month for three consecutive years from 2008 to 2010. Total numbers of days (or hours) shared for the field observations and collections of butterflies reached 144 days (*ca*. 576 hrs). Field observations and collections were made in between 10 am and 2 pm, when the butterflies used to be sunning in cool and cold seasons. The collected specimens were classified into one of the five categories as: very common (VC), common (C), not rare (NR), rare (R) and very rare (VR) following Tiple *et al*. (2006, 2007).

Results and Results

One hundred fifty eight species of butterflies belonging to 10 families were identified in the present study. The number of butterfly species reached 130 in Krishnopur, 87 in AERE campus, 72 in Horters and 65 in Rajalak Farm (Table 1), of which 87 were newly recorded in Bangladesh. The rest 71 species of butterflies were identified and reported in a previous study (Islam *et al*., 2007).

The most dominant family of butterflies in the study areas was Lycaenidae (47 species) followed by Hesperiidae (32 species), Pieridae (22 species) and Nymphalidae (19 species). Thirty species of Lycaenid butterflies were newly recorded in Bangladesh (designated with * marks in Table 1). However, the lycaenid butterflies were found to vary among the study areas owing mostly to the differences in vegetations. All of the dominant families were found in Krishnopur. We identified 32 species of Hesperiidae (22 newly recorded) and 22 species of Pieridae (11 newly recorded). Amathusiid and riodinid butterflies were found only in Krishnopur; likewise acraeid butterflies were found only in AERE campus (Table 2).

Table 1 Butterfly species recorded from 4 different areas of Savar, Bangladesh.

Common names	Families and scientific Names	Status	Distribution
	Family- Papilionidae		
1. Common Mime	*Chilasa clytia clytia*	NR	K,A,H,R
2. Lime Swallowtail	*Papilio demoleus demoleus*	VC	K,A,H,R
3. White head Batwing	*Papilio sycorax*	NR	K,A,H,R
4. Red Helen	*Papilio helenus helenus*	VR	K
5. Common Mormon	*Papilio polytes polytes*	C	K,A,H,R
6.*	**Papilio polytes romulus*	NR	K
7. Great Mormon	*Papilio memnon agenor*	VR	K
8. *	* *Papilio* sp.	VR	K
9. *	**Papilio* sp.	VR	K
10. *Common Rose	**Pachliopta aristrochiae goniopeltis*	VR	A,H
11 *	**Pachliopta aristrochiae asteris*	NR	K
12. *Common Jay	**Graphium doson axion*	R	A
13. Tailed Jay	*Graphium agamemnon agamemnon*	NR	K,A
14. *Great Jay	**Graphium eurypylus cheronus*	VR	A
	Family- Danaidae		
1. Plane Tiger	*Danaus chrysippus chrysippus*	VC	K,A,H,R
2. Common Tiger/ Indian Monarch	*Danaus genutia genutia*	VC	K,A,H,R
3. Blue Tiger	*Tirumala limniace limniace*	C	K,A,H.R
4. Common Indian Crow	*Euploea core godartii*	VC	K,A,H.R
5. *Striped Blue Crow	**Euploea mulciber mulciber*	VR	A

Common names	Families and scientific Names	Status	Distribution
	Family- Pieridae		
1. Red-Spot Jezebel	*Delias descombesi descombesi*	R	H
2. Painted Jezebel	*Delias hyparete indica*	VC	K,A,H.R
3. Common Gull	*Cepora nerissa dapha*	C	A,H.R
4. Striped Albatross	*Appias libythea olferna*	VC	A,H.R
5.*Ceylon Lesser Albatross	**Appias paulina adamsoni*	NR	A
6.Great Orange Tip	*Hebomoia glaucippe glaucippe*	R	A,R
7. Pale Wanderer	*Pareronia anais*	VC	K,A,H.R
8. Mottled Emigrant	*Catopsilia pyranthe pyranthe*	VC	K,A,H,R
9. Lemon Emigrant	*Catopsilia pomona pomona*	VC	K,A,H,R
10.*Common Emigrant	**Catopsilia pomona jugurtha*	R	A.
11.*	**Catopsilia pomona hilaria*	VR	K,A.R
12.*	**Catopsilia pomona catilia*	R	K,A.R
13.*	**Catopsilia pomona alcmeone*	VR	K,A,H
14.*Psyche	*Leptosia nina nina*	VC	K,A,H,R
15.	**Artogeia canidia indica*	VR	A
16.*Yellow Orange Tip	**Ixias pyrene verna*	VR	K
17.*	**Saletara liberia distanti*	VR	A
18. Common Grass Yellow	*Eurema hecabe contubernalis*	VC	K,A,H,R
19*One-Spot Grass Yellow	**Eurema andersonii andersonii*	NR	A
20.*	**Eurema ada jona*	NR	A
21.	*Eurema simulatrix tecmessa*	NR	A
22.*	**Eurema simulatrix inouei*	VC	K,A
	Family- Satyridae		
1.Common Evening Brown	*Melanitis leda leda*	VC	K,A,H,R
2. Common Palmfly	*Elymnias hypermnestra tinctoria*	VC	K,A,H,R
3.*	**Elymnias hypermnestra meridionalis*	VC	K
4.Dark-Brand Bushbrown	*Mycalesis mineus mineus*	VC	K,A,H,R
5. Lilacine Bushbrown	*Mycalesis francisca sanatana*	VC	K
6. Common Bushbrown	*Mycalesis perseus cepheus*	NR	K
7.*Burmese Bushbrown	**Mycalesis perseoides perseoides*	VR	K
8.*	**Mycalesis intermedia*	VR	K
9.*	**Mycalesis sangaica tunicula*	VR	K
10.*Nigger	**Orsotriaena medus medus*	R	K
11.*Bamboo Treebrown	**Lethe europa niladana*	R	K
12.*Common Fivering	**Ypthima baldus baldus*	R	K
13.*	**Ypthima nebulosa*	VR	K
14. Common Fourring	*Ypthima huebneri*	R	K
	Family- Amathusiidae		
1.*Duffer	*Dischophora sondaica zal*	NR	K
	Family- Riodinidae		
1. Palm Judy	*Abisara echerius paionea*	VR	K
2. Punchinellow	*Zemeros flegyas flegyas*	VR	K
3.	**Abisara abnormis*	VR	K
	Family- Acraeidae		
1.Tawny Coster	*Acraea violae*	VC	A
	Family- Nymphalidae		
1. Leopard Lacewing	*Cethosia cynae euanthes*	C	K,A,H,R
2. Common Leopard	*Phalanta phalantha phalantha*	VC	K,A,H,R
3. Chocolate Pansy	*Junonia iphita iphita*	R	K,A
4. Grey Pansy	*Junonia atlites atlites*	VC	K,A,H,R
5. Peacock Pansy	*Junonia almana almana*	VC	K,A,H,R
6. Lemon Pansy	*Junonia lemonias lemonias*	VC	K,A,H,R
7. Yellow Pansy	*Junonia hierta hierta*	C	K,H
8.*Blue Pansy	**Junonia orithya ocyale*	VR	K
9. Great Eggfly	*Hypolimnas bolina jacintha*	C	K,A,H,R
10. Common Castor	*Ariadne merione tapestrina*	VC	K,R
11. Common Baron	*Euthalia aconthea apana*	C	K,A,H,R
12.	**Euthalia alpheda verena*	VR	K.A

Common names	Families and scientific Names	Status	Distribution
13.*Common Sergent	**Athyma perius perius*	VR	A
14.Himalayan Sergent	*Athyma opalina shan*	C	K,A,H
15. Color Sergent	*Athyma inara*	R	H
16.*Common Sailor	**Neptis hylas*	R	H
17.Chestnut-Streaked Sailer	*Neptis jumbah jumbah*	VC	H
18. *Commander	**Moduza procris procris*	VR	A
19.*Tawny Rajah	**Charaxes bernardus hierax*	VR	K
	Family- Lycaenidae		
1.	*Allotinus unicolor unicolor*	R	A
2	*Celastrina transpecta*	NR	K,A
3. Common Pierrot	*Castalius rosimon rosimon*	VC	K,A,H,R
4. Spotted Pierrot	*Tarucus callinara*	R	K
5. Angle Pierrot	*Caleta caleta decidia*	NR	A,H
6. Lime Blue	*Chylades lajus lajus*	C	A
7.*	**Chylades lajus tavoyanus*	C	A
8. Plains Cupid	*Chylades pandava pandava*	C	A
9. Forest Quaker	*Zizula hylax hylax*	R	K,R
10. Opaque Six-Lineblue	*Nacaduba beroe gythion*	R	K
11.*	**Catochrysops panormus exguus*	C	A
12. Common Cerulean	*Jamides celeno celeno*	R	K,A
13.*Dark Cerulean	**Jamides bochus bochus*	R	K,A
14.*Pea Blue	**Lampides boeticus boeticus*	VR	A
15.*Common Red Flash	**Rapala airbus iarbus*	R	K
16. Slat Flash	*Rapala manea schistacea*	C	K,A
17.*Scarce Slat Flash	**Rapala scintilla scitilla*	VR	K
18.*Scarlet Flash	**Rapala diences diences*	NR	K
19. Cornelian	*Deudorix epijarbas amatius*	VR	K
20. Chocolate Royal	*Remelana jangala ravata*	C	K
21. Long-Banded Silverline	*Spindasis lohita batina*	R	K
22.*Club Silverline	**Spindasis syama latipicta*	R	K
23.	*Acytolepis lenya*	C	K,A
24.*Gram Blue	**Euchrysops cnejus cnejus*	VR	K
25.*	**Miletus mallas mallas*	VR	A
26.*	**Miletus nymphis fictus*	VR	A
27. Yamfly	*Loxura atymnus continentalis*	VC	K,A,H
28.*Quaker	**Neopithecops zalmora zalmora*	R	K
29.*Apely	**Spalgis epius epius*	R	K,R
30.*	**Spalgis sp.*	C	K
31.*	**Callenya melaena*	VR	K
32.*Zebra-Blue	**Syntarucus plinius*	VR	K
33.*Tailless Line Blue	**Prosotas dubiosa indica*	VR	K,R
34.*Common Line Blue	**Prosotas nora ardates*	R	K,R
35.*Pale Grass Blue	**Zizeeria maha maha*	VR	K
36.*Dark Grass Blue	**Zizeeria karsandra karsandra*	NR	K,R
37.*Lesser Grass Blue	**Zizina otis sangra*	VR	K
38.*Pointed Ciliate Blue	**Anthene lycaenina lycambes*	VR	R
39.*Ciliate Blue	**Anthene emolus emolus*	VR	K
40.*Common Acacia Blue	**Surendra quercetorum quercetorum*	NR	A
41.*Peacock Royal	**Tajuria cippus maxentius*	VR	H
42.*Sunbeam	**Curetis thetis*	VR	K
43.*Sunbeam	**Curetus sp.*	R	K
44.Common Oakblue	*Arhopala pseudocentaurus nakula*	C	K,H
45.*Indian Cupid	**Everes lacturnus lacturnus*	VR	K
46.*	**Aphnaeus ictis*	VR	A
47.*	**Drupadia* sp.	VR	K,R

Common names	Families and scientific Names	Status	Distribution
	Family- Hesperiidae		
1.*Palm Redeye	**Erionata torus*	R	A
2. Giant Redeye	*Gangara thyrsis thyrsis*	VR	K,A
3. Brown Redeye	*Badamia exclamationis*	R	K,A
4. Grass Demon	*Udaspes folus*	NR	K,H
5. Common Snow Flat	*Tagiades japetus ravi*	VC	K
6. *Snow Flat	**Tagiades japetus atticus*	R	K
7.*	**Ancistroides nigrita diocles*	R	A
8.*Chestnut Angle	**Odontoptilum angulatum angulatum*	NR	K
9.*	**Caltoris brunnea caere*	VR	K
10.*Blank Swift	**Caltoris kumara moorei*	VR	K
11.*Common Banded Demon	**Notocrypta paralysos asawa*	VR	K
12.*Tree Filtter	**Hyarotis adrastus praba*	VR	H
13. Grey Brand-Redeye	*Matapa druna*	C	K,A
14.*Common Redeye	**Matapa aria*	VR	K
15. Contiguous swift	*Polytremis lubricans lubricans*	NR	K,A,H,R
16.Yellow Spot Swift	*Polytremis eltola eltola*	VC	K,A,H,R
17.*Indian Palm Bob	**Suastus gremius gremius*	VR	K
18.*Small Branded Swift	**Pelopidas mathius mathius*	R	K
19. *Great Swift	**Pelopidas assamensis*	VR	A
20.*	**Pelopidas agna agna*	VR	K,A
21.*	**Halpe porus*	VC	K
22.*Straight Swift	**Parnara naso bada*	VR	K,R
23.Straight Swift	*Parnara guttata apostate*	VC	K,A,H,R
24.Chestnut Bob	*Iambrix salsala salsala*	C	K,A
25.*	**Iambrix sp.*	NR	K
26.*Veined Scrub Hopper	**Aeromachus stigmatus shanda*	R	K
27.Pigmy Scrub Hopper	*Aeromachus pygmaeus*	VR	K
28.*	**Telicota hilda*	R	K
29.*	**Telicota besta besta*	VR	K
30.*Pale Palm Dart	**Telicota colon stinga*	VR	K
31.*	**Telicota linna linna*	VR	K
32.*Common Dartlet	**Oriens gola pseudolus*	NR	K

K=Krishnopur, A=AERE Campus, H=Horters (part of JU Campus) and R=Rajalak Farm; * Newly- recorded species for Bangladesh

Table 2 Butterfly species diversity recorded from the study areas at Savar, Bangladesh

Families	Butterflies collected from the study areas			
	Krishnopur	AERE Campus	Horters	Rajalak Farm
Papilionidae	12	9	8	7
Danaidae	4	5	4	4
Pieridae	17	18	13	11
Satyridae	13	6	5	5
Amathusiidae	1	0	0	0
Riodinidae	3	0	0	0
Acraeidae	0	1	0	0
Nymphalidae	16	16	14	12
Lycaenidae	33	22	17	17
Hesperiidae	31	10	11	9
Total	**130**	**87**	**72**	**65**

Nineteen of Nymphalidae (6 newly recorded species), 14 of Satyridae (8 new), 14 of Papilionidae (7 new), and 5 of Danaidae (1 new) butterflies were identified. In addition, a single species of Acraeidae, 3 of Riodinidae and a single species each of Amathusiidae, Riodinidae and Amathusiidae butterflies were recorded to be new for the country (Table 1).

All 158 species of butterflies were identified and classified into VC, C, NR, R and VR categories which are presented in Table 3. More than half of butterfly species were judged to be classified into VR or R categories, the species numbers of which reached 56 and 32 (35.44% and 20.25%), respectively, whereas those of the other 30, 19 and 21 species were classified into VC, C and NR categories, the proportions of which were12.18%, 12.03% and 13.29%, respectively.

Table 3 Classification of butterfly species according to their availability at selected study areas at Savar.

Families	Number and percentages of variously categorized butterfly species									
	VC		C		NR		R		VR	
	Total	%	Total	%	Total	%	Total	%	Total	%
Papilionidae	1	7.14	1	7.14	5	35.71	1	7.14	6	42.86
Danaidae	3	60.00	1	20.00	0	00.00	0	0.00	1	20.00
Pieridae	8	36.37	1	4.55	4	18.18	4	18.18	5	22.27
Satyridae	5	35.71	0	0.00	1	7.14	4	28.57	4	28.57
Amathusiidae	0	0.00	0	0.00	1	100.00	0	00.00	0	0.00
Riodinidae	0	0.00	0	0.00	0	0.00	0	0.00	3	100.00
Acraeidae	1	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Nymphalidae	6	31.58	5	26.32	0	0.00	3	15.79	5	26.32
Lycaenidae	2	4.24	9	19.15	5	10.64	13	27.66	18	38.30
Hesperiidae	4	12.50	2	6.25	5	15.63	7	21.88	14	43.57
Total	30	18.99	19	12.03	21	13.29	32	20.25	56	35.44

VC=Very Common (>100 species), C=Common (50-100 species), NR=Not Rare (15-50 species), R=Rare (2-15 species) and VR=Very Rare <2 species).

Relatively large proportions of VR and R species belonged to Lycaenidae (18 and 13 species) and Hesperiidae (14 and 7 species). The numbers of Lycaenidae and Hesperiidae species were found to show larger fluctuations among the four study areas as compared to those of the other families (Table 3).

Here we identified 158 species of butterflies, 87 species of which were newly-recorded in Bangladesh and rest 71 species were reported earlier (Islam *et al*., 2007). The VR and R categories were respectively 56 and 32 (35.44% and 20.25%) of 158 butterfly species (Tables 1 and 3). Numbers of Papilionidae and Danaidae species of butterflies, which are known to show long-distance flights, were identified in all study areas, whereas large numbers of species of Lycaenidae and Hesperidae, which show short-distance flights, were identified in only Krishnopur and AERE Campus. In addition to the differences in floral types in and around the study areas, perhaps the flying ability of the butterflies is a significant factor to determine the species diversity. That is, larvae of many butterfly species feed on leaves of specific or relatively limited plants. The types of floral abundance in the study areas seem to vary depending on such vegetative conditions as farms, gardens and forests, essential for serving the foods for butterflies (Vickery, 1998).

Although the present 87 species of butterflies were newly recorded in Bangladesh, we did not find 9 species which were identified in our previous studies (Islam *et al*., 2007). These were *Papilio helenus helenus, Papilio memnon agenor* (Papilionidae), *Ypthima hubneri* (Satyridae), *Abisara echerius paionea, Zemeros flegyas flegyas* (Riodinidae), *Junonia iphita iphita, Athyma inara* (Nymphalidae), *Deudorix epijarbas amatius* (Lycaenidae) and *Aeromachus pygmaeus* (Hesperiidae). This does not suggest only a possibility that we failed to find these species in our present study, but there is also another possibility that Savar and its surrounding areas lost the ability to support the populations of those butterfly species due to the damage of vegetations by industrial and residential activities like gardening, frequent grass-cuttings and cultivation for vegetables, fruits and flowers (Dennis & Williams, 1986). In contrast, 30 and 19 species of butterflies were classified into VC and C categories, respectively, which seemed to adapt the disturbances of ecological conditions owing to the industrial and residential activities mentioned above.

The maximum 130 species of butterflies were identified in Krishnopur, where the species diversity of butterflies may be supported by various types of environmental and vegetative conditions such as standing forests, grasslands and cultivating lands for agriculture. The minimum

number of butterfly species (65 species) was recorded in Rajalak Farm, the environmental and vegetative conditions of which may not be congenial for supporting the diversity of butterfly species. The diversity of butterfly species or other organisms is supposed to depend on diversities of environmental and vegetative conditions, the damage of which seem to be accompanied by the contraction of species diversity. The present results may be useful to estimate the actual and transitional state of environmental and vegetative conditions in and around the study areas and to search a policy for conserving our natural resources on the development of industrial and residential activities.

Acknowledgements

This work was conducted under IFRB (Bangladesh) and YU (Japan) agreement for research cooperation (2010-2015). ATMF Islam and Akira Yamanaka were the respective national counterparts.

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Manuscript received on 30.052011, accepted on 01.02.2012