Butterfly Fauna (Order: Lepidoptera) in Five Major Tea Gardens of Sivasagar District, Assam, India

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ABSTRACT: The present paper is based on observations and sighting records of butterfly fauna from March 2012 to February 2013 in five major Tea Gardens, Sivasagar District of Assam, India. The district has 119 tea estates which covers an area of 88, 008 hectares of land. The beautiful tea gardens provide a very attractive landscape to the district. Based on the study of butterfly diversity in the study area, a checklist has been prepared. A total of 104 butterfly species belonging to 5 families of order Lepidoptera were recorded during the study period. The family Nymphalidae, represented by 46 species was the most dominant followed by Lycaenidae (23 species), Hesperiidae (13 species), Pieridae (13 species) and Papilionidae (9 species) being the least. From the conservation point of view, the study areas are undisturbed and rich in butterfly fauna.

Keywords: Tea gardens, Sivasagar District, Assam, India, butterfly species.

INTRODUCTION

Geographically, the state of Assam is situated between 24°10' to 27°58' N latitude and 89°49' to 97°26' E longitude. Sharing its borders with Arunachal Pradesh on the north; Nagaland, Manipur and Arunachal Pradesh on the east; Meghalaya, Mizoram and Tripura on the south and Meghalaya on the west, Assam is located on the north-eastern part of the Indian sub-continent. The state is connected with the rest of the Indian Union by a narrow corridor in West Bengal that runs for 56 Kms. below the foothills of Bhutan and Sikkim. The prime geographical characters that form the topographical features of Assam are the Barak Valley and the River of Brahmaputra.

The state occupies a total area of about 78,523 sq km. placed on the foothills of the majestic Himalaya, Assam Forest covers a major part of the total land available in the state. Going by a survey conducted by the Forest Department of Assam Government, in the year 2003, the state possessed a total of 26, 781.91 sq km forest land. Bamboo and timber are the two prime forest products of Assam. The specialty of Assam Climate lies in its highest levels of humidity. Assam is known to have maximum amount of rainfall. The temperatures never go beyond the standard 35° to 38°C. While, the hilly regions of Assam experience a suitable sub-alpine climatic condition, the plain lands of the state go through excessive humid weather. Primarily, the climate of Assam is categorized under two prime heads - rainy season and winter months.

The rainy season starts from June while the winter months begin with the onset of October. The minimum temperature which is found in the coldest of months in Assam ranges from 6 to 8°C.

Assam is the world's largest tea growing region and not only famous for its quality of tea as well as the natural beauty of the tea plantation area. Beautiful tea estates of Assam cover about 2, 16, 200 hectares of land comprises of more than 100 tea estates. Enormously found mountain region, its greenery and pleasant climate make this location popular not only for its tea, but also for being a popular spot for enjoying eco-vacations. The both sides of the famous river, Brahmaputra, constitute the world's largest Tea growing area. The tea plants are grown in the lowlands of Assam, unlike Darjiling and Nilgiris, which are grown in the highlands. The Assam tea bush grows in a lowland region, in the valley of the Brahmaputra River, an area of clay soil rich in the nutrients of the floodplain. The climate varies between a cool, and winter and hot, humid rainy seasons- the conditions ideal for growing tea. Because of its lengthy growing seasons and generous rainfall of about 250-300 mm (during the monsoon season), Assam is one of the most prolific tea-producing region in the world. This region of India is so famous for its tea plantation that Assam tourism has organized the Assam Tea festival in the month of November every year that makes a totally new experience to enjoy this place.

MATERIAL AND METHODS

Study Area. The present study was conducted to study the diversity of butterfly fauna in five major tea gardens of Sivasager district, Assam, India from March 2012 to February 2013. Sivasagar district is situated in the North-Eastern part of Assam between 94.25° to 95.25° N latitude and 26.45° to 27.15° E longitude. It is placed in 99 meters to 103 meters elevation range above sea level.
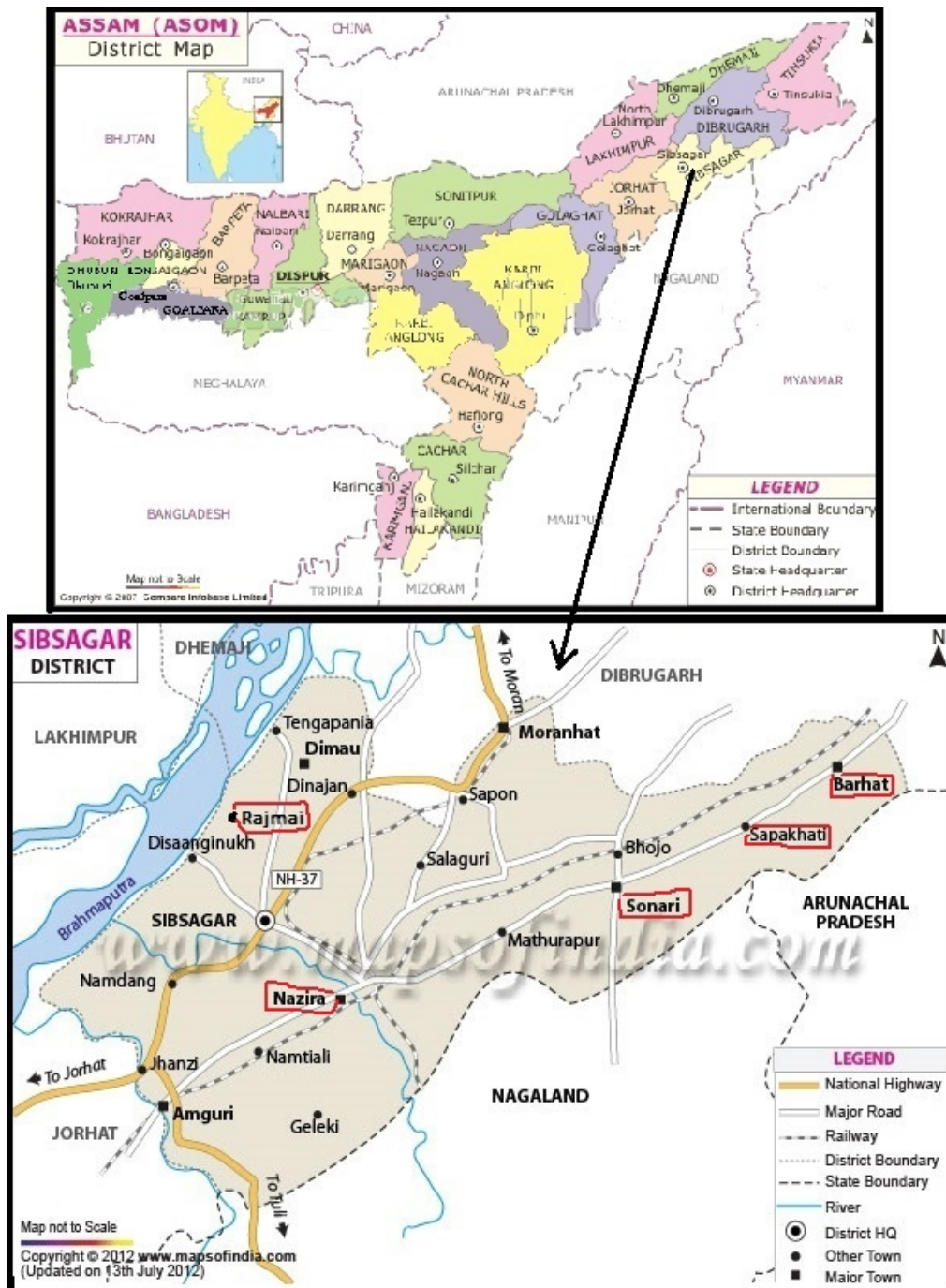

Fig.1. Location map of Sivasagar District showing study sites.

The district is surrounded by Lakhimpur and Dibrugarh in the north, Arunachal Pradesh and Dibrugarh in the east, Arunachal Pradesh and Nagaland in the south, Jorhat district of Assam in the west. The Naga Hills lie towards the south, while the Brahmaputra River is on the north. The district is located at Upper Brahmaputra Valley of Agro-climatic zone of the state and occupies a total geographical area of 2668 sq.km. The district is situated in the humid sub-tropical region and characterized by heavy rainfall and high relative humidity above 90%; high temperature up to 38°C is observed in the summer season and comparatively low temperature up to 7°C in winter. The soils of this zone is immature alluvial in char to mature ultisol in the piedmont high and hill areas. The vegetation is mostly tropical evergreen with trees like Hollong, Titachapa, Nahor, Mekai etc. dominating the forest canopy.

Sivasagar's biggest contribution to the world is its tea plantation. There are 119 tea estates in the district which covers an area of 88, 008 hectares. Besides these tea estates, 80 registered small tea growers and 4, 004 small tea growers covers the 5356 hectares of land in this district. The district produces some of the finest and most expensive teas in the world. Tea gardens of the district not only produce economy but also it adds the scenic beauty. The beautiful tea gardens provide a very attractive landscape to the district.

The five major tea gardens of the district where the study was conducted are as follows –

Sector 1: Maskara Tea Estate, P.O. Rajmai: Total area under tea cover is 44.71 hectares.
Sector 2: Bezbaruah Tea Estate, P.O. Sapekhati: Total area under tea cover is 89.43 hectares.
Sector 3: Aideobari Tea Estate, P.O. Sonari: Total area under tea cover is 150.65 hectares.
Sector 4: Bemolapur Tea Estate, P.O. Borhat: Total area of the estate is 1214 hectares, out of which 527 hectares is under tea cover.
Sector 5: Behubor Tea Estate, P.O. Nazira: Total area under tea cover is 533.86 hectares.

Taxonomic Study. Field notes, photographs (camera: Nikon d5100) and observations of butterflies were taken for the entire growing season during the day light hours. The population trends of butterflies were monitored for one year using transects counting method (Barhaum *et al.*, 1980). Butterflies were netted only when necessary to prevent the possibility of handling effect (Morton, 1984). Species were noted along with the date, location of capture and any plant association. Other factors noted include the time of day using a twenty-four hour clock and the weather conditions. At each location the same route of inspection was followed each time to reduce the number of variables presents

(Pyle, 1984) and to avoid any personal difference all the counts were made by the same person.

An effort has been made to use the latest nomenclature and common names as far as possible as per Evan (1932), D' Abrera (1982-1986), Varshney (1990) and Kehimkar (2008). The relative abundance or say status of individual species is categorized within the tea gardens as **"Very Rare" (VR)** when recorded rarely; **"Rare" (R)** when recorded occasionally; **"Uncommon" (UC)** when recorded frequently; **"Common" (C)** when recorded regularly; **"Very Common" (VC)** when recorded regularly in large numbers.

RESULT AND DISCUSSION

During the study, a total of 104 species belonging to 72 genera under 5 families were recorded from the selected five major tea garden areas (Table 1). The family Nymphalidae showed the maximum species richness, comprising of 27 genera and 46 species, followed by Lycaenidae (21 genera, 23 species), Hesperiidae (12 genera, 13 species), Pieridae (9 genera, 13 species) and Papilionidae (3 genera, 9 species) being the least (Fig. 2). Abundance showed that out of the 104 butterfly species recorded, 33 are uncommon, 39 are common, 11 are very common, 12 are rare and 9 are very rare to the study area. A total of 5696 individuals were recorded from the five tea gardens, of which the Sector 5 representing the Behubor Tea Estate contributing 1587 individuals was dominant while the Sector 1 representing the Maskara Tea Estate with 941 individuals was the least (Fig. 3). *Eurema hecabe* (Linn.) was the most dominant species of butterfly in terms of number of individuals (156) followed by *Papilio polytes* (Linn.) (150), *Pieris canidia* (Sparrman) (142), *Catopsilia pomona* (Fabricius) (141), *Ypthima baldus* (Fabricius) (138) and 6 other species in the study area (Table 1, *Marked Asterisks). *Discophora timora* (Westwood) and *Mycalesis gotama* (Moore) (3 individuals each) were the rarest species followed by *Chliaria othona* (Hewitson) (4), *Polyura agraria* (Swinhoe) (4) and 5 other species (Table 1, #Marked Asterisks).

Results suggested that the family Nymaphalidae with 27 genera and 46 species was the most dominant in the study area. Members of the Nymphalidae were always dominant in the tropical region because most of the species are polyphagous in nature, consequently helping them to live in all the habitats. Additionally, many species of this family are strong, active fliers that might help them in searching for resources in large areas (Eswaran and Pramod 2005; Krishna Kumar *et al.* 2007). A high proportion of nymphalid species thus clearly indicates high host plant richness in the study areas.

Table 1: Checklist of Butterflies and their abundance recorded in selected five major Tea Gardens, Sivasagar District, Assam.

Sl. No.	Scientific Name	Sector 1	Sector 2	Sector 3	Sector 4	Sector 5	Total	Relative Abundance
	Family: Hesperiidae							
1.	*Bibasis oedipodea* (Swainson)	05	04	02	00	06	**17**	UC
2.	*Hasora chromus* (Cramer)	02	06	02	02	05	**17**	UC
3.	*Pseudocoladenia dan* (Fabricius)	12	19	13	17	23	**84**	C
4.	*Tagiades japetus* (Stoll)	07	04	06	10	13	**40**	UC
5.	*Oriens goloides* (Moore)	20	15	16	08	21	**80**	C
6.	*Telicota ancilla* (Herrich-Schaffer)	12	18	09	16	18	**73**	C
7.	*Pelopidas mathias* (Fabricius)	10	09	14	12	17	**62**	C
8.	*Pelopidas assamensis* (de Niceville)	04	00	03	07	06	**20**	UC
9.	*Suastus gremius* (Fabricius)	00	02	04	06	09	**21**	UC
10.	*Matapa aria* (Moore)	12	05	10	13	19	**59**	C
11.	*Iambrix salsala* (Moore)	02	04	03	05	06	**20**	UC
12.	*Koruthaialos butleri* (de Niceville)	01	00	03	02	03	**09**	R
13.	*Sancus fuligo* (Mabille)	09	12	04	11	15	**51**	C
	Family: Papilionidae							
*14.	*Papilio polytes* (Linn.)	22	33	19	34	42	**150**	VC
15.	*Papilio memnon* (Linn.)	13	09	15	21	18	**76**	C
16.	*Papilio protenor* (Cramer)	06	01	05	10	07	**29**	UC
*17	*Papilio demoleus* (Linn.)	21	19	34	23	35	**132**	VC
18.	*Papilio helenus* (Linn.)	04	07	13	09	06	**39**	UC
19.	*Graphium sarpedon* (Linn.)	11	13	09	08	14	**55**	C
20.	*Graphium doson* (C. & R. Felder)	04	05	00	07	11	**27**	UC
21.	*Graphium agamemnon* (Linn.)	13	08	23	06	18	**68**	C
22.	*Atrophaneura aristolochiae* (Fabricius)	01	00	03	01	07	**12**	R
	Family: Pieridae							
*23.	*Eurema hacabe* (Linn.)	23	32	34	25	42	**156**	VC
24.	*Eurema blanda* (Boisduval)	14	23	15	27	21	**100**	C
*25.	*Catopsilia pomona* (Fabricius)	13	18	35	32	43	**141**	VC
26.	*Catopsilia pyranthe* (Linn.)	12	17	09	14	21	**73**	C
27.	*Colotis etrida* (Boisduval)	01	03	02	05	04	**15**	R

28.	*Hebomoia glaucippe* (Linn.)	12	15	07	16	19	**69**	C
29.	*Appias libythea* (Fabricius)	03	00	04	05	08	**20**	UC
30.	*Appias lyncida* (Cramer)	11	13	09	15	21	**69**	C
*31.	*Pieris canidia* (Sparrman)	21	23	32	39	27	**142**	VC
32.	*Cepora nadina* (Lucas)	03	06	09	04	07	**29**	UC
33.	*Delias pasithoe* (Linn.)	07	04	02	04	09	**26**	UC
34.	*Delias descombesi* (Boisduval)	05	06	09	03	07	**30**	UC
35.	*Leptosia nina* (Fabricius)	12	18	14	23	32	**99**	C
Family: Lycaenidae								
36.	*Spalgis epius* (Westwood)	00	00	03	05	07	**15**	R
37.	*Arhopala pseudocentaurus* (Dubleday)	18	14	21	17	23	**93**	C
38.	*Loxura atymnus* (Stoll)	04	02	06	02	14	**28**	UC
39.	*Cheritra freja* (Fabricius)	12	14	07	13	21	**67**	C
40.	*Hypolycaena erylus* (Godart)	07	04	00	05	09	**25**	UC
#41.	*Chliaria othona* (Hewitson)	00	01	02	00	01	**04**	VR
42.	*Rapala pheretima* (Hewitson)	04	07	05	08	15	**39**	UC
43.	*Rapala iarbus* (Fabricius)	12	12	14	18	16	**72**	C
44.	*Rapala manea* (Hewitson)	03	00	07	05	04	**19**	R
45.	*Spindasis lohita* (Horsfield)	03	04	00	05	04	**16**	R
#46.	*Anthene emolus* (Godart)	02	00	00	01	02	**05**	VR
47.	*Castalius rosimon* (Fabricius)	09	14	17	20	22	**82**	C
48.	*Leptotes plinius* (Fabricius)	11	18	15	22	12	**78**	C
49.	*Prosotas nora* (C. Felder)	19	12	13	12	20	**76**	C
50.	*Jamides celeno* (Cramer)	21	13	22	20	27	**103**	C
51.	*Lampides boeticus* (Linn.)	07	00	08	14	11	**40**	UC
52.	*Zizeeria karsandra* (Moore)	15	19	21	18	26	**99**	C
53.	*Pseudozizeeria maha* (Kollar)	12	14	09	21	19	**75**	C
54.	*Zizina otis* (Fabricius)	21	17	08	13	24	**83**	C
55.	*Neopithecops zalmora* (Butler)	27	14	10	12	34	**97**	C
56.	*Euchrysops cnejus* (Fabricius)	10	03	01	07	14	**35**	UC
*57.	*Chilades lajus* (Stoll)	14	31	15	18	25	**103**	VC
58.	*Zemeros flegyas* (Cramer)	19	07	12	14	20	**72**	C

	Family: Nymphalidae							
59.	*Tirumala limniace* (Cramer)	02	04	05	03	09	**23**	UC
60.	*Tirumala septentrionis* (Butler)	04	02	00	05	09	**20**	UC
61.	*Danaus chrysippus* (Linn.)	12	14	09	21	30	**86**	C
62.	*Danaus genutia* (Cramer)	04	07	11	09	12	**43**	UC
63.	*Parantica aglea* (Stoll)	12	15	21	13	24	**85**	C
64.	*Euploea Sylvester* (Fabricius)	04	04	07	11	13	**39**	UC
65.	*Euploea mulciber* (Cramer)	02	08	00	09	12	**31**	UC
66.	*Euploea midamus* (Linn,)	01	03	00	05	06	**15**	R
67.	*Euploea core* (Cramer)	03	02	07	05	10	**27**	UC
#68.	*Polyura agraria* (Swinhoe)	01	00	00	01	02	**04**	VR
69.	*Discophora sondaica* (Boisduval)	02	03	05	02	14	**26**	UC
#70.	*Discophora timora* (Westwood)	00	00	02	00	01	**03**	VR
71.	*Melanitis leda* (Linn.)	10	12	07	23	20	**72**	C
72.	*Melanitis phedima* (Cramer)	03	04	03	08	11	**29**	UC
#73	*Melanitis zitenius* (Herbst)	01	03	00	00	00	**04**	VR
74.	*Lethe europa* (Fabricius)	06	07	05	04	09	**31**	UC
#75.	*Lethe chandica* (Moore)	00	02	00	00	02	**04**	VR
76.	*Elymnias hypermnestra* (Linn.)	11	23	17	12	15	**78**	C
#77.	*Mycalesis gotama* (Moore)	02	00	00	00	01	**03**	VR
*78.	*Mycalesis perseus* (Fabricius)	12	15	23	20	32	**102**	VC
79.	*Mycalesis mineus* (Linn.)	19	07	05	12	20	**63**	C
80.	*Ypthima huebneri* (Kirby)	17	13	14	21	18	**83**	C
*81.	*Ypthima baldus* (Fabricius)	21	25	26	32	34	**138**	VC
82.	*Cethosia biblis* (Drury)	02	04	00	03	02	**11**	R
83.	*Argyreus hyperbius* (Linn.)	06	08	09	11	07	**41**	UC
84.	*Vagrans egista* (Cramer)	12	10	18	21	25	**86**	C
*85.	*Phalanta phalantha* (Drury)	21	23	23	29	31	**127**	VC
86.	*Moduza procris* (Cramer)	12	09	03	11	07	**42**	UC
87.	*Athyma perius* (Linn.)	12	23	14	20	19	**88**	C
88.	*Athyma nefte* (Cramer)	12	18	21	12	23	**86**	C

| 89.	*Pantoporia hordonia* (Stoll)	03	00	03	02	01	**09**	R
90.	*Neptis hylas* (Linn.)	12	12	15	17	20	**76**	C
86.	*Moduza procris* (Cramer)	12	09	03	11	07	**42**	UC
87.	*Athyma perius* (Linn.)	12	23	14	20	19	**88**	C
88.	*Athyma nefte* (Cramer)	12	18	21	12	23	**86**	C
90.	*Neptis hylas* (Linn.)	12	12	15	17	20	**76**	C
91.	*Neptis clinia* (Moore)	03	01	02	00	04	**10**	R
#92.	*Phaedyma columella* (Cramer)	00	00	02	01	00	**03**	VR
93.	*Euthalia aconthea* (Cramer)	09	04	11	02	09	**35**	UC
94.	*Tanaecia lepidea* (Butler)	12	03	17	12	18	**62**	UC
95.	*Tanaecia jahnu* (Moore)	00	03	02	00	05	**10**	R
96.	*Lexias pardalis* (Moore)	01	02	03	00	05	**11**	R
97.	*Ariadne merione* (Cramer)	11	12	09	09	12	**53**	UC
#98.	*Vanessa indica* (Herbst)	00	00	01	00	01	**02**	VR
*99.	*Junonia atlites* (Linn.)	21	20	18	20	32	**111**	VC
*100.	*Junonia almana* (Linn.)	23	17	24	19	30	**113**	VC
101.	*Junonia lemonias* (Linn.)	12	15	07	18	15	**67**	C
102.	*Junonia hierta* (Fabricius)	09	06	12	07	09	**43**	UC
103.	*Junonia iphita* (Cramer)	12	13	17	21	26	**89**	C
104.	*Hypolimnas bolina* (Linn.)	09	13	14	08	32	**76**	C
	Total	**941**	**980**	**1019**	**1169**	**1587**	**5696**	
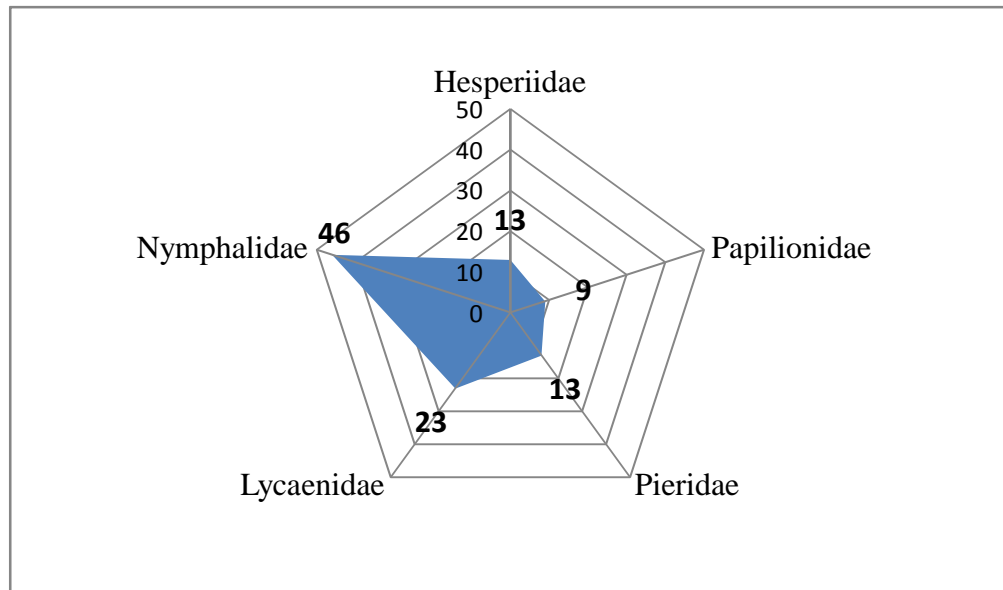
Fig. 2. Filled Radar showing species diversity of the five families.
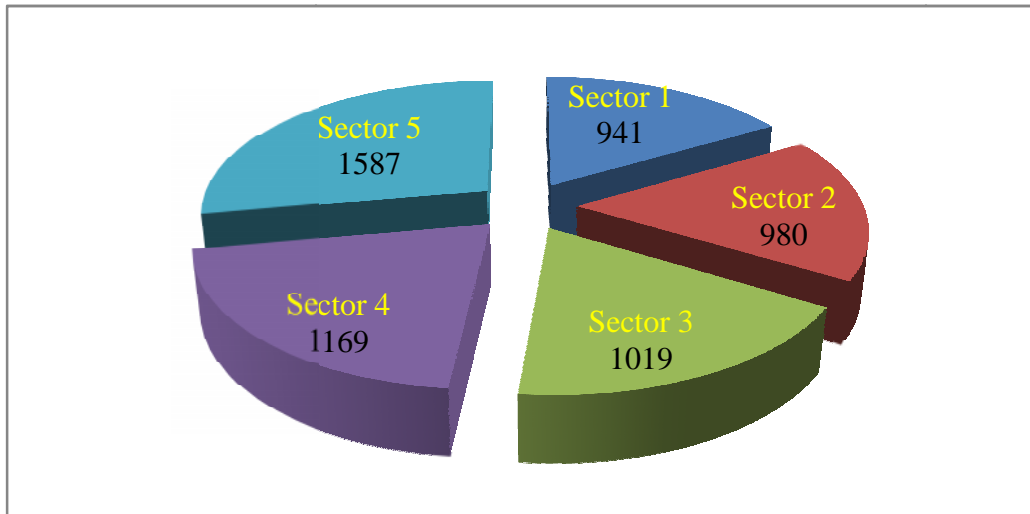
Fig. 3. Pie Diagram showing no. of individuals recorded in the selected five tea gardens.
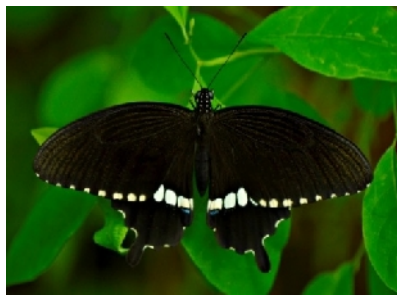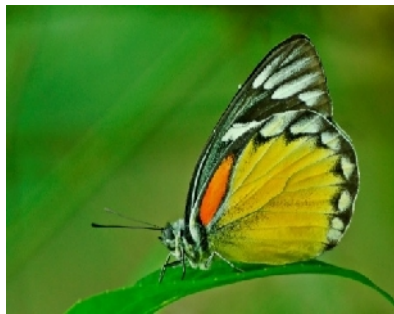

Common Mormon	**Great Mormon**	**Common Lime**
Papilio polytes (Linn.)	*Papilio memnon* (Linn.)	*Papilio demoleus* (Linn.)
Common Grass Yellow	**Red-spot Jazebel**	**Common Pierrot**
Eurema hacabe (Linn.)	*Delias descombesi* (boisduval)	*Castalius rosimon* (Fabricius)
Common Lascar	**Grey Count**	**Vagrant**
Pantoporia hordonia (Stoll)	*Tanaecia lepidea* (Butler)	*Vagrans egista* (Cramer)

Fig. 4. Photographs of some Butterfly fauna recorded within the study areas.

The Government of India under Indian Wildlife (Protection) Act, 1972 provided protection to 452 species of butterfly in three Schedules (out of six) as in Schedule I, Part IV, 128 species of butterfly; in Schedule II, Part II, 30 species and in Schedule IV (Secs. 2, 8, 9, 11 and 61), 19 species listed (Anonymous, 2003b). A milestone of the study is the recording of the two species *Castalius rosimon* (Common Pierrot) and *Pantoporia hordonia* (Common Lascar) in the study area that are listed in the Indian Wildlife Protection Act, 1972 as under Schedule I and II (Anonymous, 2006). This two species were recorded in all the selected gardens with reasonable abundance indicating the superior quality habitat of the study areas. The Ministry of Environment and Forests, Government of India through various schemes and simple methods try to encouraged researchers and organization to develop and recreate habitats that might play a role in conserving butterfly fauna of India. These efforts were already become popular and successful in some states of India including Kerala, Tamil Nadu and Karnataka. Most tea gardens are governed by a strict administration that does not allow illegal anthropogenic activities inside the garden areas that fully supports the wildlife. From this study, it can be clearly suggested that tea gardens can be used as ideal habitats for conserving butterfly fauna by introducing appropriate, naturally occurring host plants. The photo gallery (Fig. 4.) provides the photographic proof of our study in the proposed study area.

ACKNOWLEDGEMENTS

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