

Species Diversity of Butterflies from Khed Tahsil of Pune District (MS) India

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Abstract: Butterflies are an integral part of the forest ecosystem. They show distinct patterns of habitat utilization. Being highly sensitive to changes in the environment, they are easily affected by even relatively minor perturbations in the habitat, so much so that, they have been considered as indicators of environment quality and health of an ecosystem. In the present investigation, during August 2007 to August 2009 in various habitats from the study area, we observed 56 species of Butterflies belongs to 5 families namely Papilionidae (4), Pieridae (12), Nymphalidae (21), Lycaenidae (15) and Hesperidae (4). The seasonal pattern in the abundance of butterflies, their biotopes and nectar food plants were also studied.

Key words: Lepidoptera • Seasonal Pattern • Nectar Food Plants

INTRODUCTION

Pune District is one of the important industrial Districts in the Maharashtra State. The increased industrialization and urbanization has several adverse effects on the ecology of this region. It has fourteen Tahsils, out of which, Khed Tahsil was selected for the study of Butterfly Diversity in Relation to Nectar Food Plants. Butterflies are scaled wing insects belonging to order Lepidoptera of class Insecta. There is an intimate association between Butterflies and plants and their lives are exceptionally interlinked [1], which leads to different patterns in their distribution depending on the availability of their food plants. The number of Indian Butterflies count to one fifth of the world total of Butterfly species. The Himalayan mountain range harbors major share of the Indian Butterfly diversity [2]. Although, only a quarter of India's Butterfly diversity is represented in the Western Ghats, it has the characteristic of high alpha diversity of Butterflies in certain locations [3, 4].

Among the insects, Butterflies occupy a vital position in ecosystems and their occurrence and diversity are considered as good indicators of the health of any given terrestrial biotope [5- 7]. As herbivorous insects, the distribution of larval and nectar host plants has a distinct impact on the status of Butterfly diversity [8, 9].

Earlier, various workers viz. Kunte [10] studied seasonal patterns in Butterfly abundance and species

diversity in four tropical habitats in Northern-Western Ghats. These four sites were close to Pune city within a radius of 20km. Kunte [5] studied the Butterfly diversity of Pune City along human impact gradient. Rane and Ranade [11] studied Butterflies of Tamhini-Dongarwadi area, Mulshi, Maharashtra. Padhye *et al.* [12] studied season and landscape wise distribution of Butterflies in Tamhini, Northern Western Ghats of India. Sharma [13] studied the fauna of Bhimashankar Wildlife Sanctuary, Maharashtra. Tiple *et al.* [14] investigated Butterfly-Flower morphological interrelationships for 108 Butterfly species and 20 plants at Nagpur. Nimbalkar, *et al.* [15] studied Butterfly diversity in relation to nectar food plants from Bhor Tahsil, Pune district, Maharashtra, India. According to Shinde *et al.*, [16] species richness of Lepidoptera in forest does not vary in forest but, season had a large effect on the number of individual sampled. Chandekar *et al.* [17] studied the seasonal patterns in the abundance of Butterflies, their biotopes and nectar food plants from Maval Tahsil, Pune District, Maharashtra, India.

MATERIALS AND METHODS

Tahsil Khed (Rajgurunagar Figure 1) is located 48 km from Pune city at north-west direction. It is situated at 18°31' North latitude and 73°51' East longitude. It has an elevation of about 615 meters above mean sea

MAP OF KHED TAHSIL

(DIST. PUNE, INDIA)



Fig. 1:

level. Khed Tahsil has irregular shape, having an area of 1400 sq. km., bordered by Tahsil Maval and Haveli south-west, Ambegaon and Shirur on north-east and district Raigad on north-west. Rainfall is moderate. River Bhima flows through the area. The study area was fully explored during August 2007 to August 2009 and observation sites were decided. To study the seasonal patterns/diversity in Butterfly abundance in relation to nectar food plants, the entire year was divided into three seasons. The three seasons of the year are Pre-Monsoon i.e. from February to May, Monsoon i.e. from June to September and Post-Monsoon i.e. from October to January. The study area

was visited twice in each season during the two years i.e. 2007-2008 and 2008-2009. In the said investigation the selected sites were surveyed mainly between 7.30 am to 12.30 pm. Butterfly species were identified directly in the field visually with the help of field guides followed by photography, in difficult cases, rarely by capture. Collection was restricted to those specimens that could not be identified directly. All scientific names follow Varshney [18] and common English names follow Wynter Blyth [19]. Classification of Butterflies is after Gaonkar [3]. Benthum and Hooker [20] system of classification is followed for plants.

During field work from study area, hygrometer was used to keep record of humidity and temperature. Global Positioning System (GPS) instrument was used to record latitude, longitude and altitude (Table 4). Rainfall records of study period were obtained from Indian Meteorological Centre, Mumbai.

RESULTS

During the course of study, 56 species of Butterflies belonging to five families were recorded in Khed Tahsil. Out of 56 species, 4 belong to Papilionidae, 12 to Pieridae,

21 to Nymphalidae, 15 to Lycaenidae and 04 to Hesperidae (Table 1). Species belonging to family Nymphalidae, were the most dominant (38%) followed by Lycaenidae (27%), Pieridae (21%). However family Papilionidae and Hesperidae (07%) were found to have same status. The status recording was as follows: VC- very common (75-100 sightings), C- common (50-75 sightings), NR- not rare (25-50 sightings), R- rare (5-25 sightings) and VR- very rare (1-5 sightings). Among the 56 species 15 were found very common, 27 species common, 11 species not rare and 03 species were found rare. None of the species were observed in very rare

Table 1: Seasonal Observation of Butterfly Species from Khed Tahsil of Pune District (MS) India Suborder: Rhopalocera

Sr. No.	Common Name	Scientific Name	Seasonal Sightings				Total	Status	Biotope	Human Impact Gradient
			Pre Monsoon	Monsoon	Post Monsoon					
Family: Papilionidae Subfamily: Papilioninae										
1	Common Bluebottle	<i>Graphium sarpedon</i> L.	10	28	12	50	C	BPF	AD	
2	Common Mormon	<i>Papilio polytes</i> L.	18	42	25	85	VC	BFGP	AD	
3	Lime Butterfly	<i>Papilio demoleus</i> L.	5	30	25	60	C	BFGPS	AD	
4	Crimson Rose	<i>Pachliopta hector</i> L.	6	29	15	50	C	BFPS	AV	
Family: Pieridae Subfamily: Coliadinae										
5	Three Spot Grass Yellow	<i>Eurema blanda</i> B.	5	20	15	40	NR	FS	AD	
6	Small Grass Yellow	<i>Eurema brigitta</i> C.	18	50	28	96	VC	BFGPS	AD	
7	Common Grass Yellow	<i>Eurema hecabe</i> L.	27	48	22	97	VC	BFGPS	AD	
8	Spotless Grass Yellow	<i>Eurema laeta</i> B.	10	30	15	55	C	FGPS	AD	
9	Common Emigrant	<i>Catopsilia pomona</i> F.	19	45	35	99	VC	BFGPS	AD	
10	Lemon Emigrant	<i>Catopsilia crocale</i> C.	4	29	19	52	C	FGPS	AD	
11	Mottled Emigrant	<i>Catopsilia pyranthe</i> L.	12	42	24	78	VC	BFGPS	AD	
Subfamily: Pierinae										
12	Small Orange Tip	<i>Colotis etrida</i> B.	5	4	7	16	R	GPS	AV	
13	White Orange Tip	<i>Ixias marianne</i> C.	15	17	30	62	C	BFPS	AD	
14	Common Wanderer	<i>Pareronia valeria</i> C.	10	33	28	71	C	BFPS	AD	
15	Common Gull	<i>Cepora nerissa</i> F.	15	35	25	75	C	FGPS	AV	
16	Pioneer	<i>Belenois aurota</i> F.	19	39	37	95	VC	BFGPS	AD	
Family: Nymphalidae Subfamily: Danaeinae										
17	Blue Tiger	<i>Tirumala limniace</i> C.	6	35	25	66	C	FPS	AD	
18	Plain Tiger	<i>Danaus chrysippus</i> L.	25	40	35	100	VC	BFGPS	AD	
19	Common Indian Crow	<i>Euploea core</i> C.	20	37	24	81	VC	BFGPS	AD	
Subfamily: Satyrinae										
20	Common Evening Brown	<i>Melanitis leda</i> L.	11	43	32	86	VC	BFGPS	AD	
21	Dark Evening Brown	<i>Melanitis phedima</i> C.	5	13	8	26	NR	FPS	AV	
22	Common Tree Brown	<i>Lethe rohria</i> F.	3	15	9	27	NR	FS	AV	
23	Common Bush Brown	<i>Mycalopsis perseus</i> F.	9	31	28	68	C	FGPS	AV	
24	Common Three Ring	<i>Ypthima asterope</i> K.	4	17	9	30	NR	FGS	AV	
25	Tawny Coster	<i>Acraea violae</i> F.	14	33	25	72	C	BGPS	AD	
26	Common Leopard	<i>Phalanta phalantha</i> D.	26	38	26	90	VC	FGPS	AD	
Subfamily: Limenitinae										
27	Common Baron	<i>Euthalia aconthea</i> C.	13	30	18	61	C	FGS	AV	

Table 1: Continued

Sr. No.	Common Name	Scientific Name	Seasonal Sightings				Total	Status	Biotope	Human Impact Gradient
			Pre Monsoon	Monsoon	Post Monsoon					
Subfamily: Biblidinae										
28	Angled Castor	<i>Ariadne ariadne</i> L.	13	40	31	84	VC	BGPS	AD	
29	Common Castor	<i>Ariadne merione</i> C.	12	29	17	58	C	BGPS	AD	
Subfamily: Nymphalinae										
30	Painted Lady	<i>Vanessa cardui</i> L.	7	29	25	61	C	GPS	AD	
31	Blue Pansy	<i>Junonia orithiya</i> L.	17	27	21	65	C	FGPS	AD	
32	Yellow Pansy	<i>Junonia hierta</i> F.	10	24	19	53	C	FGPS	AD	
33	Chocolate Pansy	<i>Junonia iphita</i> C.	8	32	16	56	C	BFGPS	AD	
34	Grey Pansy	<i>Junonia atlites</i> L.	8	18	24	50	C	BFPS	AV	
35	Lemon Pansy	<i>Junonia lemonias</i> L.	22	48	30	100	VC	BFGPS	AD	
36	Great Eggfly	<i>Hypolimnas bolina</i> L.	18	36	28	82	VC	BFPS	AD	
37	Danaid Eggfly	<i>Hypolimnas misippus</i> L.	7	44	25	76	VC	BFPS	AD	
Family: Lycaenidae Subfamily: Theclinae										
38	Silver Streak Blue	<i>Iraota timoleon</i> S.	5	16	7	28	NR	FP	AV	
Subfamily: Polyommattinae										
39	Zebra Blue	<i>Leptotes plinius</i> F.	4	31	19	54	C	FGPS	AD	
40	Tailless Lineblue	<i>Prosotas dubiosa indica</i> E.	0	40	19	59	C	FGS	AV	
41	Common Cerulean	<i>Jamides celeno</i> C.	20	34	25	79	VC	FP	AD	
42	Metallic Cerulean	<i>Jamides alecto</i> F.	7	32	21	60	C	FGS	AV	
43	Forget-me-not	<i>Catochrysops strabo</i> F.	6	13	9	28	NR	FPS	AV	
44	Pea Blue	<i>Lampides boeticus</i> L.	18	20	30	68	C	BFGS	AD	
45	Rounded Pierrot	<i>Tarucus nara</i> K.	4	37	18	59	C	FGPS	AV	
46	Dark Grass Blue	<i>Zizeeria karsandra</i> M.	7	20	14	41	NR	FGPS	AD	
47	Pale Grass Blue	<i>Pseudozizeeria maha</i> K.	5	17	8	30	NR	BGPS	AD	
48	Tiny Grass Blue	<i>Zizula hylax</i> F.	15	37	20	72	C	BFGPS	AD	
49	Red Pierrot	<i>Talicerca nyseus</i> Guerin M.	10	21	14	45	NR	BPS	AD	
50	Plains Cupid	<i>Chilades pandava</i> H.	3	19	9	31	NR	GPS	AV	
51	Lime Blue	<i>Chilades laius</i> S.	10	36	25	71	C	BP	AV	
Subfamily: Riodininae										
52	Plum Judy	<i>Abisara echerius</i> S.	10	19	29	58	C	FPS	AV	
Suborder: Grypocera										
Family: Hesperidae Subfamily: Pyrginae										
53	Fulvous Pied Flat	<i>Pseudocoladenia dan</i> F.	7	29	17	53	C	FP	AV	
Subfamily: Hesperinae										
54	Conjoined Swift	<i>Pelopidas conjuncta</i> Herrich-Schaffer	1	8	5	14	R	FP	AV	
55	Vindhyan Bob	<i>Arnetta vindhiana</i> M.	0	17	8	25	R	FP	AD	
56	Chestnut Bob	<i>Iambrix salsala</i> M.	5	22	23	50	NR	FP	AV	

Biotores: B - Botanical and Nursery Garden; F - Forest; G - Grassland; P - Plantation; S - Scrub

Status: C - Common; VC - Very Common; R - Rare; NR - Not Rare

Human Impact Gradient: AD - Adapter, AV - Avoider

Table 2: Nectar Food Plants and Other Food Sources of Butterfly Species Observed from Khed Thasil of Pune District (MS) India

Sr No.	Common Name of Butterfly	Scientific Name of Butterfly	Scientific Name of Plant / Other Food Source
1	Common Blue bottle	<i>Graphium sarpedon</i> L.	<i>Cosmos bipinnatus</i> , <i>Zinnia elegans</i> and Mud-puddling.
2	Common Mormon	<i>Papilio polytes</i> L.	<i>Cosmos bipinnatus</i> , <i>Cussia siemia</i> , <i>Lantana camara</i> , <i>Zinnia elegans</i> and Mud-puddling.
3	Lime Butterfly	<i>Papilio demoleus</i> L.	<i>Lantana camara</i> , <i>Moringa oleifera</i> , <i>Tephrosia purpurea</i> , <i>Trichodesma indicum</i> and <i>Tridax procumbens</i> .
4	Crimson Rose	<i>Pachliopta hector</i> L.	<i>Tridax procumbens</i> .
5	Three Spot Grass Yellow	<i>Eurema blanda</i> B.	<i>Tephrosia purpurea</i> , <i>Tridax procumbens</i> and Mud-puddling
6	Small Grass Yellow	<i>Eurema brigitta</i> C.	<i>Lantana camara</i> , <i>Urena lobata</i> and <i>Zinnia elegans</i>
7	Common Grass Yellow	<i>Eurema hecabe</i> L.	<i>Celosia argentea</i> , <i>Lantana camara</i> , <i>Tephrosia purpurea</i> , <i>Tribulus terrestris</i> , <i>Tridax procumbens</i> and <i>Zizyphus mauritiana</i>
8	Spotless Grass Yellow	<i>Eurema laeta</i> B.	<i>Celosia argentea</i> , <i>Lantana camara</i> , <i>Trichodesma indicum</i> and <i>Tridax procumbens</i>
9	Common Emigrant	<i>Catopsilia pomona</i> F.	<i>Cassia auriculata</i> , <i>Lantana camara</i> , <i>Tephrosia purpurea</i> and <i>Tridax procumbens</i>
10	Lemon Emigrant	<i>Catopsilia crocale</i> C.	<i>Catharanthus roseus</i> , <i>Cussia siemia</i> , <i>Lantana camara</i> , <i>Sida acuta</i> , <i>Tephrosia purpurea</i> and <i>Tridax procumbens</i>
11	Mottled Emigrant	<i>Catopsilia pyranthe</i> L.	<i>Catharanthus roseus</i> , <i>Cussia siemia</i> , <i>Lantana camara</i> , <i>Sida acuta</i> , <i>Tridax procumbens</i> and <i>Zizyphus mauritiana</i>
12	Small Orange Tip	<i>Colotis etrida</i> B.	<i>Tridax procumbens</i> .
13	White Orange Tip	<i>Ixias marianne</i> C.	<i>Calotropis gigantea</i> , <i>Lantana camara</i> and <i>Tridax procumbens</i>
14	Common Wanderer	<i>Pareronia valeria</i> C.	<i>Bauhinia purpurea</i> and <i>Tagetis erecta</i>
15	Common Gull	<i>Cepora nerissa</i> F.	<i>Asclepias curassavica</i> , <i>Lantana camara</i> , <i>Tagetis erecta</i> and <i>Tridax procumbens</i>
16	Pioneer	<i>Belenois aurota</i> F.	<i>Calotropis gigantea</i> , <i>Lantana camara</i> and <i>Tridax procumbens</i>
17	Blue Tiger	<i>Tirumala limniace</i> C.	<i>Crotalaria juncea</i> , <i>Lantana camara</i> , <i>Tagetis erecta</i> , <i>Trichodesma indicum</i> , <i>Trichodesma zeylanica</i> and <i>Tridax procumbens</i>
18	Plain Tiger	<i>Danaus chrysippus</i> L.	<i>Catharanthus roseus</i> , <i>Celosia argentea</i> , <i>Crotalaria juncea</i> , <i>Gaillardia picta</i> , <i>Lantana camara</i> , <i>Trichodesma indicum</i> , <i>Tridax procumbens</i> , <i>Vitex negundo</i> , <i>Zinnia elegans</i> and Mud-puddling
19	Common Indian Crow	<i>Euploea core</i> C.	<i>Celosia argentea</i> , <i>Cosmos bipinnatus</i> , <i>Lagasca mollis</i> , <i>Lantana camara</i> , <i>Tridax procumbens</i> , <i>Zinnia elegans</i>
20	Common Evening Brown	<i>Melanitis leda</i> L.	<i>Tridax procumbens</i> , Rotting Fruits, Tree Sap and Mud-puddling
21	Dark Evening Brown	<i>Melanitis phedima</i> C.	Fallen Fruits, Rotting Fruits and Tree Sap
22	Common Tree Brown	<i>Lethe rohria</i> F.	Fallen Fruits, Rotting Fruits and Tree Sap
23	Common Bush Brown	<i>Mycalesis perseus</i> F.	<i>Tagetis erecta</i> and Mud-puddling
24	Common Three Ring	<i>Ypthima asterope</i> K.	<i>Celosia argentea</i> , <i>Tagetis erecta</i> , <i>Tridax procumbens</i> and Mud-puddling
25	Tawny Coster	<i>Acraea violae</i> F.	<i>Lagasca mollis</i> , <i>Lantana camara</i> , <i>Tridax procumbens</i> and <i>Vitex negundo</i>
26	Common Leopard	<i>Phalanta phalantha</i> D.	<i>Celosia argentea</i> , <i>Gaillardia picta</i> , <i>Lantana camara</i> , <i>Tridax procumbens</i> , <i>Xanthium indicum</i> and Mud-puddling
27	Common Baron	<i>Euthalia aconthea</i> C.	Fallen Fruits, Rotting Fruits, Tree Sap and Mud-puddling
28	Angled Castor	<i>Ariadne ariadne</i> L.	<i>Lantana camara</i> , <i>Tagetis erecta</i> and <i>Tridax procumbens</i>
29	Common Castor	<i>Ariadne merione</i> C.	<i>Lantana camara</i> , <i>Tagetis erecta</i> , <i>Tridax procumbens</i> and Mud-puddling
30	Painted Lady	<i>Vanessa cardui</i> L.	<i>Carissa congesta</i> , <i>Gnidia glauca</i> , <i>Lantana camara</i> and <i>Tridax procumbens</i>
31	Blue Pansy	<i>Junonia orithiya</i> L.	<i>Celosia argentea</i> , <i>Lantana camara</i> , <i>Trichodesma indicum</i> and <i>Tridax procumbens</i>
32	Yellow Pansy	<i>Junonia hierta</i> F.	<i>Celosia argentea</i> , <i>Lantana camara</i> , <i>Tephrosia purpurea</i> , <i>Tridax procumbens</i> and Mud-puddling
33	Chocolate Pansy	<i>Junonia iphita</i> C.	<i>Tephrosia purpurea</i> .
34	Grey Pansy	<i>Junonia atlites</i> L.	<i>Celosia argentea</i> , <i>Cosmos bipinnatus</i> , <i>Tridax procumbens</i> and Mud-puddling
35	Lemon Pansy	<i>Junonia lemonias</i> L.	<i>Asclepias curassavica</i> , <i>Celosia argentea</i> , <i>Tephrosia purpurea</i> and <i>Tridax procumbens</i>
36	Great Egg fly	<i>Hypolimnas bolina</i> L.	<i>Bauhinia purpurea</i> , <i>Celosia argentea</i> , <i>Lantana camara</i> and Mud-puddling
37	Danaid Egg fly	<i>Hypolimnas misippus</i> L.	<i>Asclepias curassavica</i> , <i>Celosia argentea</i> , <i>Lantana camara</i> , <i>Zinnia elegans</i> and Mud-puddling
38	Silver Streak Blue	<i>Iraota timoleon</i> S.	Mud-puddling
39	Zebra Blue	<i>Leptotes plinius</i> F.	<i>Celosia argentea</i> , <i>Lantana camara</i> , <i>Tephrosia purpurea</i> , <i>Tridax procumbens</i> and <i>Zizyphus mauritiana</i>
40	Tailless Line blue	<i>Prosotas dubiosa indica</i> E.	<i>Celosia argentea</i>

Table 2: Continued

Sr No.	Common Name of Butterfly	Scientific Name of Butterfly	Scientific Name of Plant / Other Food Source
41	Common Cerulean	<i>Jamides celeno</i> C.	<i>Celosia argentea</i> , <i>Tephrosia purpurea</i> , <i>Tridax procumbens</i> and <i>Zizyphus mauritiana</i>
42	Metallic Cerulean	<i>Jamides alecto</i> F.	<i>Lantana camara</i> and <i>Nothapodytes nimmoniana</i>
43	Forget-me-not	<i>Catochrysops strabo</i> F.	<i>Celosia argentea</i>
44	Pea Blue	<i>Lampides boeticus</i> L.	<i>Celosia argentea</i>
45	Rounded Pierrot	<i>Tarucus nara</i> K.	<i>Lagasca mollis</i> , <i>Lantana camara</i> , <i>Tridax procumbens</i> , <i>Zizyphus mauritiana</i> and Mud-puddling
46	Dark Grass Blue	<i>Zizeeria karsandra</i> M.	<i>Lantana camara</i> and <i>Tridax procumbens</i>
47	Pale Grass Blue	<i>Pseudozizeeria maha</i> K.	<i>Lantana camara</i> and <i>Tephrosia purpurea</i>
48	Tiny Grass Blue	<i>Zizula hylax</i> F.	<i>Tridax procumbens</i> and <i>Zinnia elegans</i>
49	Red Pierrot	<i>Talicauda nyseus</i> Guerin M.	<i>Tridax procumbens</i> and <i>Zinnia elegans</i>
50	Plains Cupid	<i>Chilades pandava</i> H.	<i>Cucurbita pepo</i> , <i>Lantana camara</i> , <i>Tribulus terrestris</i> , <i>Tridax procumbens</i> and <i>Zizyphus mauritiana</i>
51	Lime Blue	<i>Chilades laius</i> S.	<i>Sida acuta</i>
52	Plum Judy	<i>Abisara echerius</i> S.	Mud-puddling
53	Fulvous Pied Flat	<i>Pseudocoladenia dan</i> F.	<i>Lantana camara</i> , <i>Sida acuta</i> and Mud-puddling
54	Conjoined Swift	<i>Pelopidas conjuncta</i> Herrich-Schaffer	<i>Lantana camara</i>
55	Vindhyan Bob	<i>Arnetta vindhiana</i> M.	<i>Lantana camara</i>
56	Chestnut Bob	<i>Iambrix salsala</i> M.	<i>Tridax procumbens</i> and <i>Zinnia elegans</i>

Table 3: Nectar Food Plants of Butterfly Species and Floral Characteristics of Plants from Khed Thasil of Pune District (MS) India

Sr.	Plant Family	Botanical Name	Habit	Flowering Period	Flower Colour	Corolla Shape	Flower Abundance
1	Amaranthaceae	<i>Celosia argentea</i> L.	Herb	Aug-Feb	Pink, White	NT	D
		<i>Cussia siemia</i> L.	Tree	Jan-Dec	Yellow	T	S
2	Apocynaceae	<i>Carissa congesta</i> Wight	Shrub	Apr-Jun	White	T	M
		<i>Catharanthus roseses</i> (L.) G. Don	Shrub	Jan-Dec	White	T	D
3	Asclepiadaceae	<i>Asclepias curassavica</i> L.	Undershrub	Jan-Dec	Red, Yellow	NT	D
		<i>Calotropis gigantea</i> (L.) Ait.	Shrub	Oct-July	Purple, White	NT	M
4	Asteraceae	<i>Cosmos bipinnatus</i> Cav.	Herb	Aug-Nov	Orange, Yellow	T	D
		<i>Gaillardia picta</i> Pursh.	Shrub	Jan-Dec	Red, Yellow	T	D
		<i>Lagasca mollis</i> Cav.	Herb	Jun-Nov	White	T	D
		<i>Tagetis erecta</i> L.	Shrub	Jan-Dec	Red, Yellow	T	D
		<i>Tridax procumbens</i> L.	Herb	Jan-Dec	Yellowish White	T	D
		<i>Xanthium indicum</i> Koen.	Herb	Aug-Feb	Green	T	D
		<i>Zinnia elegans</i> Jacq.	Herb	Aug-Dec	Pink, Yellow	T	D
5	Boraginaceae	<i>Trichodesma indicum</i> (L.) Lehm.	Herb	Jan-Dec	Blue, White	T	M
		<i>Trichodesma zeylanica</i> (Brum. F) R. Br.	Herb	Jan-Dec	Yellow	T	D
6	Caesalpiniaceae	<i>Bauhinia purpurea</i> L.	Tree	Sep-Jan	Purple	NT	S
		<i>Cassia auriculata</i> L.	Shrub	Jan-Jul	Yellow	NT	M
7	Cucurbitaceae	<i>Cucurbita pepo</i> L.	Climber	Jul-Dec	Yellow	T	S
8	Fabaceae	<i>Tephrosia purpurea</i> (L.) Pers.	Undershrub	Jan-Dec	Rosy Purple	NT	M
		<i>Crotalaria juncea</i> L.	Herb	Oct-Jan	Yellow	NT	M
9	Icacinaceae	<i>Nothapodytes nimmoniana</i> (J. Grah.) Mabberley	Tree	Aug-Nov	White	T	D
10	Malvaceae	<i>Sida acuta</i> Burm. F.	Herb	Jul-Nov	Creamy	T	D
		<i>Urena lobata</i> L.	Shrub	Jul-Dec	Pink	T	S
11	Moringaceae	<i>Moringa oleifera</i> Lam.	Tree	Jan-Dec	White	T	S
12	Rhamnaceae	<i>Zizyphus mauritiana</i> Lam.	Tree	Jul-Nov	Creamy	NT	S
13	Thymeleaceae	<i>Gnidia glauca</i> (Fresen.) Gilg.	Shrub	Oct-Jun	Bright Yellow	T	D
14	Verbenaceae	<i>Lantana camara</i> L.	Shrub	Jan-Dec	Orange, Red	T	D
		<i>Vitex negundo</i> L.	Shrub	Jan-Jul	Bluish Purple	T	M
15	Zygophyllaceae	<i>Tribulus terrestris</i> L.	Herb	Jun-Oct	Yellow	NT	M

Corolla Shape: T tubular, NT non-tubular

Flower Abundance: S sparse, M moderate, D dense.

Table 4: Site Location of Khed Thasil of Pune District (MS) India

Sr. No.	Locations	GPS Readings			Type of Biotope
		Latitude	Longitude	Altitude	
1	Chakan	18°45.806'	73°51.678'	2023 Ft	Scrub
2	Chandoli	18°50.488'	73°52.864'	1980 Ft	Grassland
3	Jaidwadi	18°54.974'	73°55.139'	2531 Ft	Forest
4	Kharabwadi	18°17.042'	73°50.354'	2097 Ft	Garden
5	Tukaiwadi	18°52.284'	73°53.838'	2086 Ft	Plantation

category from study area. Nine species (*Pachliopta hector*, *Pareronia valeria*, *Cepora nerissa*, *Euploea core*, *Euthalia aconthea*, *Hypolimnas misippus*, *Jamides alecto*, *Lampides boeticus* and *Euchrypsops cnejus*) come under the protection of the Indian Wildlife (Protection) Act 1972. Out of the 56 species 26 species were recorded from botanical and nursery garden, 48 from forest area, 36 from grassland, 49 on plantation and 47 from scrub biotope. Results are indicated about Nectar Food Plants and other food sources of Butterfly Species (Table 2) and Floral Characteristics of Plants are indicated in (Table 3) respectively. Mudpuddling is usually observed in males. However, females of *Hypolimnas bolina* and *Hypolimnas misippus* were observed while mudpuddling (Table 2).

Fifteen families of Plants are used by Butterflies as Nectar Food Plants, as recorded from study area; 07 plants of family Asteraceae, two plants of each family viz. Amaranthaceae, Apocynaceae, Asclepiadaceae, Boraginaceae, Caesalpiniaceae, Fabaceae, Malvaceae and Verbenaceae, while only one plant of each family viz. Cucurbataceae, Icacinaceae, Moringaceae, Rhamnaceae, Thymeleaceae and Zygophyllaceae. Visits of Butterflies were more frequent to flowers of Herbs and Shrubs rather than to flowers of Trees.

DISCUSSION

The abundance of species rose from the beginning of monsoon, from the months June to July and reached a peak in the months from August to November. A decline in species abundance was observed from the months December to January and continued upto the end of May. A previous study of Winter Blyth [19] had identified two seasons as peaks, March-April and October for Butterfly abundance in India. However, our finding observed peak period in the months from August to November, in line with the findings of Kunte [5]. Bhusal and Khanal [21] reported that there is a significant correlation between species diversity and spring season, indicating the abundances of diverse species was positively affected by approaching warmer days, high relative humidity and

more rainfall. These factors help to flourish diverse vegetations, which are vital food sources for many Butterfly species. Gutierrez and Mendez [22] suggested that the abundance of Butterflies is not affected by altitudes but it is more related to the availability of food plants. A similar seasonal variation in species abundance was observed by Prajapati *et al.* [23] in Daman of Makawanpur District of Central Nepal. Plants have importance in increasing the Butterfly diversity and their abundance in the area. In study area, maximum species of Butterflies were recorded on plantation biotope than followed by forest and scrub biotope. However, grassland and botanical and nursery garden are not observed as rich biotopes; heavy grazing pressure on grassland and use of pesticides in gardens have adversely affected diversity of Butterflies in these biotopes. The nectar flowering plants visited by Butterflies, as observed in our findings, namely *Carissa congesta*, *Asclepias curassavica*, *Calotropis gigantea*, *Zinnia elegans*, *Cassia auriculata*, *Urena lobata*, *Cucurbita pepo* *Nothapodytes nimmoniana* and *Gnidia glauca* are not reported by Tiple *et al.* [14] and in their study area of Amravati University Campus and Nagpur, Central India, respectively. The herbs from study area namely *Celosia argentea*, *Tridax procumbens* and *Tethrosia purpurea* are more used by the Butterflies, probably due to flowering period of these herbs is throughout the year. The shrub *Lantana camara* is also having flowering period throughout the year, so it is more used by Butterflies as their food plant. A few species of Butterflies were observed feeding on either animal droppings or on ripe fruits or while mud puddling. Mud puddling is usually observed in males, but in our findings females of *Hypolimnas bolina* and *Hypolimnas misippus* Butterfly species were observed doing mud puddling (Table 2). Mathew and Binoy [24] reported that females of *Appias albina darada* were found to be very much active in mudpuddling. The requirement of more water and salt could be the reason for this.

Monitoring and mapping biodiversity is the first step in systematic conservation planning [25]. In study area, events like grazing pressure, influx of tourist, construction

highway, use of pesticides and change in land use pattern, are mainly responsible for diversity loss of both Butterflies and plants. Members from family Lycaenidae largely feed on grasses and cattle grazing affected their diversity and abundance. In the United Kingdom grazing by cattle and sheep has been practiced as a management tool [26] and there is ample scope for such practices in India. A total of three species of Butterflies from study area are designated as Rare while describing their status and justifies its inclusion in Scheduled List suggesting the need for its strict conservation measures. As reported by Kunte [5], an objective revision of the Scheduled List will be very useful in providing appropriate and adequate legal protection to Indian Butterflies. Nimbalkar *et al.* [15]. Studied Butterfly diversity in relation to nectar food plants from Bhor Tahsil and reported 64 Butterfly species feeding on 19 nectar food plants belonging to ten plant families. Chandekar *et al.*, [17] studied the seasonal patterns in the abundance of Butterflies, their biotopes and nectar food plants from Maval Tahsil, Pune District and recorded 85 species feeding on 32 nectar food plants belonging to 15 plant families. Khed Tahsil is not showing rich diversity as compared to findings of Nimbalkar *et al.* [15] and Chandekar *et al.* [17] from Bhor Tahsil and Maval Tahsil respectively. Habitat loss is responsible for loss of Butterfly and plant diversity. Regional faunistic studies are very important to know existing fauna. Similarly, it also helps to know the rare, endangered species in the area.

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