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Seasonal variability among butterfly biodiversity of Tadoba National Park, Chandrapur, Maharashtra

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Abstract
Butterflies are one of the most important treasuresamong insects that act as a bio-indicators, ecological sensors as well as bio-pollinators.Butterflies sustain the wealth of ecosystem. Butterflies enable sustenance of ecosystem services through their role in pollination and serving as an important food chain component.
The Government of India constituted Tadoba National Park and Tadoba Andhari Wildlife Sanctuary both fall under contiguous biogeographic areas. Tadoba National Park bearing a diverse terrain, climate and vegetation and thus it harbours variability among butterfly biodiversity. Tadoba is endowed with the centrally located splendid 120 hectare, perennial natural water body. Tall and evergreen Jamun trees border this large reservoir and provide good nesting sites for a variety of Birds and Butterflies. Seasonal variations are prominent in the Tadoba national park which is affecting the bio fauna. Summer begins with elevated 47°c, with hot and dry air blows continue with heavy shower in months of July to December and then atmosphere change to pleasant weather with 3°c is recorded in month of January.
A total of 45 species of butterflies under 5 different families and 30 genera were recorded during November, 2016 to January 2018 in the Tadoba national park, Chandrapur, Maharashtra. Nymphalidae was recorded as the most dominant family in terms of number of species, represented by 20 species followed by Lycaenidae (12), Pieridae (10), Papilionidae (6) and Hesperiidae (1). Due to construction of Maharashtra state highway via Wani-Warora-Chimur-Kolara much of habitat destruction occurring in Tadoba national park and as a result butterfly fauna is under constant threat. The objective of the present study is focused on the assessment of the diversity and seasonal abundance of butterflies with vegetation composition of habitat and conservation priorities in the study area.

Keywords: seasonal variability, butterfly biodiversity, ecosystem

Introduction
The area of Tadoba Andhari Tiger Reserve falls in 20° 25' 50" to 20° 04' 53" N latitude and 790 33' 34" E longitudes. The entire area comes under District Chandrapur of Maharashtra State and it lies on the northern part of the Deccan Plateau. The forests are well distributed over all the agro-climatic zones. Tropical dry deciduous forests of Tadoba national park is home to a variety of flora and fauna. It has three main seasons the wet Monsoon and post-Monsoon season from June to October, the cool dry winter from October to March and the hot dry season from April till the onset of rains. The temperature of this reason ranges from a minimum of 12-25^{0}C to a maximum of 30-48°C with relative humidity varying from 10-15% to 60-95%. Annual precipitation is 1700mm 90% of the precipitation falls in four months, i.e. from June to September (Tiple 2009).
An instance of changes in the seasons of this region causes divergence among the species of butterfly. Number of individuals and species of Butterflies peaked in the middle of the rainy season (August/2017) with a progressive and substantial reduction along the dry season.During the survey it has been found that seasonal variability is prominent in butterfly fauna of Tadoba national park. The local vegetation is composed of endemic species of the Bamboo and Teak and also serves as an important biological element of jungle of Tadoba national park.
In the history of butterfly surveys of the Tadoba national park, 43 species of butterflies of 29 genera from the Tiger Reserve in Tadoba National Park, Maharashtra (Rai *et al*. 2006); and 68 species of butterflies of 50 genera were recorded from Tadoba Andhari Tiger Reserve (Sharma & Radhakrishnan 2006).

Materials and Methods
To sample the butterflies, three sites with different topography were established,

1. Entire area of FDCM (Forest Development Cooperation of Maharashtra) near Kalara gate of Tadoba Andhari Tiger Reserve with small trees and shrubs.
2. Some pathways of Mohorli village completely disturbed area, predominantly open, with grassland ecosystem.
3. A narrow trail near Jamani village and Chimur adjacent bamboo plantation and depending on the season varied grasses.

Garden area of FDCM is abundant with biodiversity of Butterflies during pre-winter season when there is lots of nectar secreting plants are available for sufficient feed.

Result and Discussion
Seasonal variations of butterflies have been extensively studied to evaluate the conservation state of natural areas, effects of land management and fragmented habitat, monitoring of populations and to assess ecological parameters. The compilation of all these studies in Tadoba

national park and stray records resulted in the enumeration of 51 species of butterflies belonging to 9 genera representing five families and is given in Table 1. The highest number of butterflies recorded belonged to the Nymphalidae (21 species), followed by Lycaenidae (09 species), Hesperiidae (05 species), Pieridae (11 species) and Papilionidae (05 species). All scientific names follow reports by Varshney (1983); Kunte (2000) and common English names are after Wynter-Blyth (1957). Continuous exploration in Vidarbha region could add many more new records for the region. In the tropics, periods of drought and intense rainfall are strong regulators of the seasonal flowering cycles, leading to a direct response of the insect communities that rely on leaves, flowers, and fruits as feeding resources. In most of the seasonal areas of this country butterflies show strong abundance fluctuations throughout the year.

Fig 1

Fig 2

Fig 3

Fig 4

Fig 5

Fig 6

Fig 7

Fig 8

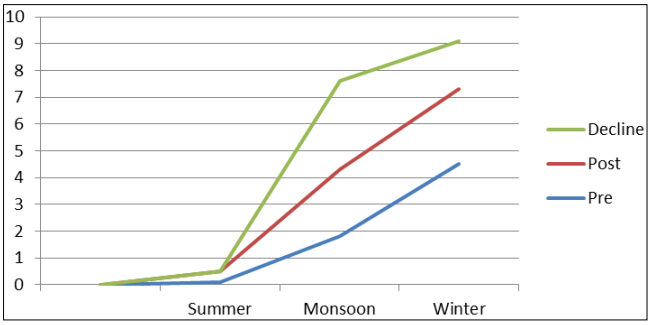

Fig 9

Discussion

This study evidenced a highly seasonal pattern of abundance and richness within the local nectar feeding butterfly community. A significant decline of both variables occurs during the dry season, as a consequence of intense plant defoliation and decreasing flower availability. It is known that insufficiency of food puts an end to the annual cycle of most butterfly species, some of which migrate to more humid areas, aestivate, or enter reproductive diapauses. Thus, in October, the first month of the dry season, the vegetation still exhibited green leaves and abundance of flowers, capable of harboring the richest butterfly fauna of the sampling period. On the other hand, in the first rainy month of this study (June-July/2017), the food available for both larvae and adults was still scarce. Seasonality also showed remarkable effects on the butterfly populations when the sample units were analyzed separately. The higher abundance found in the most open and disturbed site reflects the large proportion of common, sun-loving species. However, such predominance vanished during the dry season, when the area became too hot. In this period, the individuals tend to search for cooler areas.

Table 1: Butterfly Biodiversity of Tadoba National Park.

Sr. no.	I Family- Papilionidae A Subfamily- Papilioninae	Status
1	Common Rose Pachlioptaaristolochiae (Fabricius, 1775)	VR
2	Common Mormon (Male) Papiliopolytes (Linnaeus, 1758)	VC
3	Common Mormon (Female- Form Stichius)Papiliopolytes	VC
4	Common Yellow Swallotail (Linnaeus, 1758)	NR
5	Lime Butterfly Papiliodemoleus (Linnaeus, 1758)	NR
	II Family- Pieridae A Subfamily-Coliadinae	
1	Common Grass Yellow Euremahecabe (Linnaeus, 1758)	VC
2	Small Grass Yellow Euremabrigitta (Cramer, 1775)	VC
3	Mottled Emigrant Catopsilia Pomona (Fabricius, 1775)	NC
	B Subfamily-Pierinae	
1	Common Jezebel Delias eucharis (Drury, 1770)	NC
2	Psyche Leptosianina (Fabricius, 1775)	C
3	Common Gull Ceporanerissa (Fabricius, 1775)	VC
4	Yellow Orange Tip Ixias pyrene (Linnaeus, 1758)	VC
5	White Orange Tip Ixias Marianne (Cramer, 1775)	VC
6	Great Orange Tip Hebomoiaglaucippe (Linnaeus, 1758)	NC
7	Common Wanderer Pareroniahippia (Cramer, 1775)	NC
8	Large Salmon Arab Colotisfausta (Oliver)	VC
	III Family- Nymphalidae A Subfamily-Danainae	
1	Plain Tiger Danauschrysippus (Linnaeus, 1758)	C
2	Striped Tiger Danausgenutia (Cramer, 1775)	C
3	Blue Tiger Tirumalalimniace (Cramer, 1775)	NC
4	Common Crow Euploea core (Cramer, 1775)	VC
	B Subfamily-Charaxinae	
1	Black Rajah Charaxes solon (Fabricius, 1775)	VR
2	Common NawabPolyuraathamas (Drury, 1770)	VR
	C Subfamily- Satyrinae	
1	Evening Brown Melanitisleda (Cramer, 1775)	C
2	Common BushbrownMycalesisperseus (Fabricius, 1798)	C
	D Subfamily-Helicominae	
1	Tawny Coaster Acraeaviolae (Fabricius)	VC
2	Common Leopard Phalantaphalantha (Drury, 1770)	C
	E Subfamily-Limenitinae	
1	Commander Moduzaprocris (Cramer, 1777)	NC
2	Common SailerNeptishylas (Moore, 1872)	VC
3	Common Baron Euthaliaaconthea (Cramer, 1874)	NC
4	Baronet Symphaedranais (Forster)	VC
	F Subfamily-Nymphalinae	
1	Pansy, Peacock Junoniaalmana (Linnaeus)	C
2	Pansy, Lemon Junonialemonias (Linnaeus)	C
3	Pansy, Grey Junoniaatlites (Linnaeus)	C
4	Pansy, YellowJunoniaatlites (Linnaeus)	VC
5	Pansy, Chocolate Junoniaiphita (Cramer, 1771)	VC
6	DanaidEggflyHypolimnasmisippus (Linnaeus)	NC
7	Great EggflyHypolimnasbolina (Linnaeus)	NC

IV Family- Lycaenidae A Subfamily-Theclinae		
1	Common SilverlineSpindasisvulcanus(Fabricius)	C
B Subfamily-Polyomamtinae		
1	Common PierrotCastaliusrosimon(Fabricius)	C
2	Plains Cupid Chiladespandava (Horsfield)	VC
3	Gram Blue Euchrysopscnejus (Fabricius)	VC
4	Common Cerulean Jamidesceleno (Cramer)	VC
5	Pea Blue Lampidesboeticus (Linnaeus)	C
6	Forget Me Not Catochrysops Strabo (Fabricius)	C
7	Tiny Grass Blue Zizulahylax (Fabricius)	C
8	Pale Grass Blue Pseudozizeeriamaha (Kollar)	C
V Family- Hesperiidae A Subfamily-Pyrginae		
1	Indian Skipper Spialiagalba (Fabricius)	C
B Subfamily-Hesperiinae		
1	Dark Palm Dart Telicotaancilla (Herrich-Schaffer)	C
2	Pale Palm Dart Telicota colon (Fabricius)	C
3	Small Banded Swift Pelopidas mathias (Fabricius)	NC
4	Rice Swift Borbocinnara (Wallace)	NC

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