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Study of butterfly diversity in agronomy field, OUAT, Bhubaneswar, Odisha, India

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Abstract
Butterflies are bright colored scaly winged insects of order Lepidoptera and one of the important species for conservation of invertebrates. A short-term survey was conducted for a period of one year within the agronomy field of Orissa University of Agriculture and Technology (OUAT) campus in order to study the diversity of butterflies and their distribution among respective families, subfamilies and genera. During the course of survey, a total number of 48 species of butterflies belonging to 5 families, 13 sub families and 34 genera are recorded. It was observed that family Nymphalidae is the most dominating family in the study area representing 6 subfamilies, 15 genera and 21 species. Lowest number of butterflies are found in Hesperiidae family. Between these according to IUCN Stripped albatros, Grey pansy, Danaid eggfly, yalm fly are under very rare category. Rare species are angled castor, common sergent, common sailor.

Keywords: Butterfly, diversity, macrolepidoptera, conservation, invertebrates, iucn

Introduction
The earth exhibits a great diversity of flora and fauna throughout the globe. India is considered as one of the 17th mega diversity country of the world, where richness of plant as well as animal life is observed. Among these order Lepidoptera is one of the important components of biodiversity [11]. Along with some large moths all butterflies are included under group Macrolepidoptera. They prefer specific habitats and their diversity is restricted to different seasons [6, 12]. They are largely sensitive to environmental alternation so much that they have been considered as excellent bio-indicators of climate [1, 3, 20, 21]. Butterflies are important component of biodiversity as well as ecologically important due to the role they played in food chain of forest ecosystem. Their eggs, larvae, and adult stages form the food for various birds and reptiles. They also help in pollination of flowers [17, 18]. There are little bit confusion occurs between moths and butterflies. The main characteristics which differentiated them include club shaped antennae and overlapping rows of tiny scales on the wings of butterflies [7]. More than 17000 species of butterflies are found in world [5] about 1502 species of butterflies have been reported from India [18] and about 100 species are endemics [17]. Nearly 351 species are found in Peninsular India [19]. About 200 species of butterflies have been reported in Odisha (India). Out of which 170 species are found in Bonai Forest Division [9]. The aim of this study is to enumerate the butterfly diversity in Agronomy field, OUAT, Bhubaneswar, Odisha, India.

Materials and Methods
Study site
Agronomy field of OUAT, Bhubaneswar (latitude 20 15' 53.8" N and longitude 85 48' 36.9" E) is located in the center of Bhubaneswar city. It is comprised of 32.6 ha and the perimeter is 3.09 km. The field is managed on regular basis by University authority for practical and field demonstration purpose for several agricultural researches and learning program.

Fig 1: Map of Agronomy Field of OUAT, Bhubaneswar with green and orange demarcation.

The survey was conducted for a period of 1 year from 31st July 2016 to 31st July 2017. Between these maximum species of butterflies were recorded during day time at the time of puddling except *Melanitis leda* (common evening brown) and *Melanitis pnedima* (dark evening brown). These are recorded during night hours. Butterflies are photographed by using digital camera i.e. CANON SX 400 and by mobile phone i.e. MI4i. The species are identified by appropriate field guide [17, 6, 9, 10]. The identified species were listed and classified into their families, subfamilies and genera.

Results and discussion

The present study documented a total 48 species of butterflies belonging to 5 families, 13 subfamilies and 35 genera (Table 1 and Table 2). The maximum number of species were found in family Nymphalidae i.e., 21 species which is 43.75% of total butterflies' population found in the campus belonging to 15 genera and followed by family Pieridae i.e 9 species. Further it was observed that Nymphalinae (Nymphalidae) subfamily and Hesperiinae (Hesperiidae) were found to be the most dominating subfamilies. Between these according to IUCN Stripped albatros, Grey pansy, Danaid eggfly, Yalm fly are under very rare category. Rare species are Angled castor, Common sergent, Common sailor.

During our study all five butterfly families Papilionidae, Piridae, Nymphalidae, Lycaenidae, Hesperiidae were reported in the study area. Most common species observed butterflies were *Papilio demoleus, Papilio polytes, Pieris brassica, Danus genutia, Acraea terpicorea, Junonia atlitis.* Most of the species belong to family Nymphalidae as due to their polyphagous nature, body size and activity flying ability [2, 4]. Least number of species were reported in family Hesperiidae as these are highly site specific, shade loving and prefer specific host plants. According to Singh (2011) Nymphalidae is the most diverse family in India representing 522 species of butterflies, followed by Lycaenidae 443 species of butterflies, Hesperiidae (321species), Pieridae (109 species), Papilioniodae (107 species) [17].

In Odisha, India few studies related to butterfly have been done. According to a survey conducted by Nair, 2007 [10] in Similipal Tiger Reserve, a total 106 species of butterflies are found belonging to 5 families and 15 subfamilies. Most species were belonging to family Nymphilidae i.e. 42 species. Palai and Rath, 2014 [13] studied the species diversity of butterflies of Sunabeda Wildlife Sanctuary and reported 40 species belonging to Family Nymphalidae. Mishra *et al*., 2010 [8] recorded 92 species belonging to 68 genera in Nandankanan Wildlife Sanctuary, Bhubaneswar. Priyambada *et al*. at Regional Institute of Education Campus, Bhubaneswar reported 45 species of butterflies belonging to 5 families, 14 subfamilies and 35 genera in 2016 [16]. Fakir Mohan University, Balasore reported 53 species of butterflies belonging to 5 families in 2016 [14]. A study conducted in Utkal University Campus, Bhubaneswar, Odisha revealed that 24 species of Nymphalidae, 14 species of Pieridae, 12 species of Lycaenidae, 7 species of Hesperiidae and 6 species of Papiolionidae. Under which 4 species found to come under IWPA, 1972 [22]. An assessment of butterfly in Manchabandha and Budhikhamari reserve Forest, Myurbhanj, Odisha shown that 135 species of genera, 89 species of butterfly belonging to five family [23]. 60 species 46 genera under 5 families of butterfly diversity were found in agroforestry plantations of Eastern Ghats of southern Odisha [24]. 136 species of butterfly from six families were recorded from Athgarh Forest Division [25]. According to Panda *et al.* 101 species of butterflies from 5 families of Lepidoptera are found in Population Habitat of Bhubaneswar out of which Nymphalidae was found to be dominate i.e. 35 species [15].

Conclusion

Although the current study was restricted to a limited period of time (31st July 2016 to 31st July 2017) it suggests that the butterfly diversity of Agronomy field, OUAT, Bhubaneswar, Odisha is sufficiently rich in butterfly species diversity. The present study is an attempt to prepare a checklist of butterfly species in the study area which will be subjected to continue updating for further reference.

Acknowledgement

We would like to thank Mr. Bibhu Prasad Panda (PhD Scholar), Department of Environmental Sciences, SOA University Bhubaneswar for proper identification of the butterfly specimens and Dr. Siba Prasad Parida, Associate Professor, Centurian University, Bhubaneswar for constant support throughout the study period.

Table 1: A checklist of butterflies found in Agronomy field, OUAT Campus, Bhubaneswar

Subfamily	Common	Scientific name	IWPA	Status
	Name		,1972	
	Family: Papilionidae			
	Common	*Papilio polytes*		VC
	mormon			
	Common	*Altophanaura*		C
Papilioninae	rose	*aristolochiae*		
	Common	*Graphium sarpendon*		
	blue bottle			
	Common Jay	*Graphium doson*		C
	Common	*Papilio demoleus*		VC
	lime			
	Crimson rose	*Altophaneura hector*	I	C
	Common	*Papilio crino*		UC
	banded			
	peacock			
	Tailed jay	*Graphium agamenon*		C
	Family: Pieridae			
	Psyche	*Leptosia nine*		C
	Cabbage	*Pieris brassicae*		UC
	white			
Pierinae	Common	*Appias albina*	IV	VC
	albatross			
	Stripped	*Appias libythea*	I	VR
	albatross			
	Common	*Catopsilia pomona*	VC	
	emigrant			
	Small grass	*Eurema brigitta*	VC	
Coliadinae	yellow			
	Spotless	*Eurema laeta*	C	
	grass yellow			
	Common	*Eurema hecabe*	VC	
	grass yellow			
	Dark clouded	*Colias fieldii*		
	yellow			
	Striped tiger	*Danaus genutia*		VC
	Plain tiger	*Danaus chrysippus*		VC
Danainae	Glossy tiger	*Parantica aglea*		
	Common	*Euploea core*	IV	VC
	crow			
	Common	*Melanitis leda*		VC
	evening			
	brown			
	Dark evening	*Melanitis pnedima*		VC
Satyrinae	brown			
	Common	*Mycalesis perseus*		
	bush brown			
	Common	*Elymnias hypermnestra*		C
	palm fly			
Heliconiinae	Twany	*Acraea tericore*		VC
	coaster			
	Common	*Phalanta phalantha*		VC
	leopard			
Biblidinae	Angled castor	*Ariadna merione*		R
	Common	*Athyma perius*		R
Limentidinae	sergeant			
	Common	*Neptis hylas*		R
	sailor			
	commander	*Moduza procris*		UC
	Common	*Symbrenthia hippoclus*		
	jester			
	Lemon pansy	*Junonia lemonias*		C
	Grey pansy	*Junonia atlites*		VR
Nymphalinae	Peacock	*Junonia almana*		C

	pansy			
	Great eggfly	*Hypotimnas bolina*		C
	Danaid eggfly	*Hypolimnas misippus*	III	VR
	Chocolate	*Junonia lemonias*		C
	pansy			

	Yalm fly		*Loxuna atymnus*	VR
Lycaeninae	Common		*Lycaena phlaeas*	
	copper			
	Common		*Spindasis vulcanus*	C
	silver line			
Theclinae	Monkey		*Rathinda amor*	UC
	puzzle			
	Pale	grass	*Pseudozizeeria maha*	
Polyommatinae	blue			
	Forget	me	*Catochrysops strobo*	
	not			

Hesperiinae	Common	*Oriens goloides*	
	darlet		
	dark palm	*Telicota ancilla*	
	dart		
	Straight swift	*Parnara guttata*	VC
	Rice swift	*Borbo cinnara*	C

Abbreviation: -VC – Very common (50 – 70 sightings), C - Common (30-50 sightings),
UC – Uncommon (5 - 30 sightings), R – Rare (1-5 sightings)
IWPA- Indian Wildlife Protection Act, 1972.

Table 2: Distribution of genera and species of butterflies in their respective family and subfamily.

S. No.	Family	Sub family	No. Of genera	Total no. Of genera	%	No. Of species	Total no. Of species	%
1	Papilionidae	Papilioninae	3	3	8.82	8	8	16.66
2	Pieridae	Pierinae	3	6	17.64	4	9	18.75
		Coliadinae	3			5		
3	Nymphalidae	Danaidae	3	15	44.11	4	21	43.75
		Satyrinae	3			4		
		Heliconiinae	2			2		
		Biblidinae	1			1		
		Limentidinae	3			3		
		Nymhalinae	3			7		
4	Lycaenidae	Lycaeninae	2	6	17.64	2	6	12.5
		Theclinae	2			2		
		Olyommatinae	2			2		
5	Hesperiidae	Hesperiinae	4	4	11.76	4	4	8.33

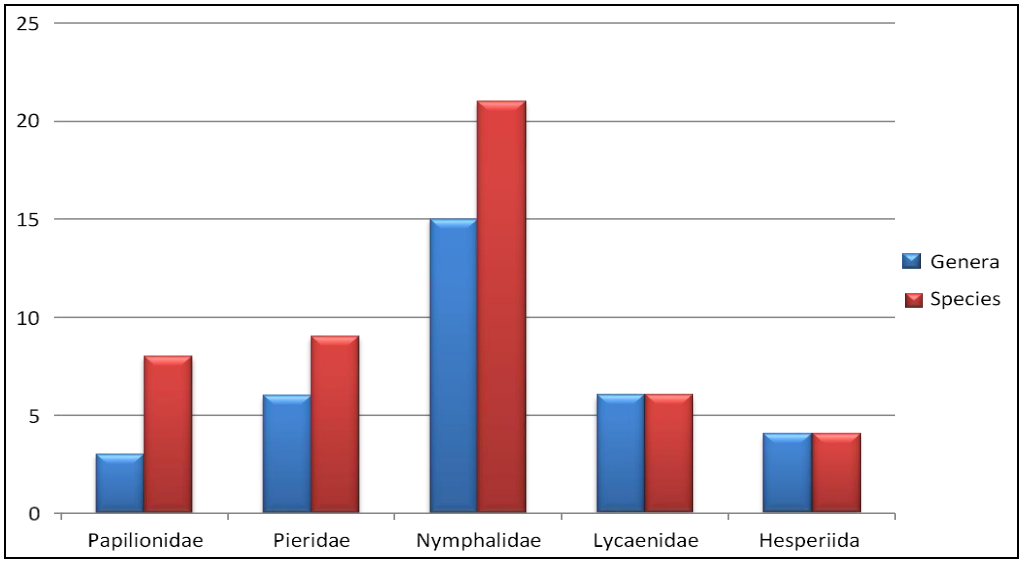

Fig 1: Graph showing family wise distribution of butterflies in OUAT campus

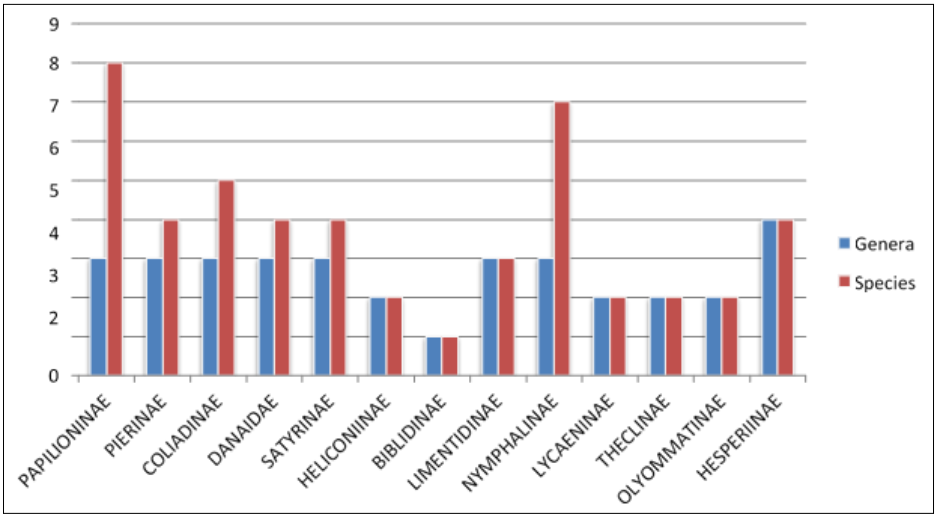

Fig 2: Graph showing subfamily wise distribution of butterfly in OUAT campus

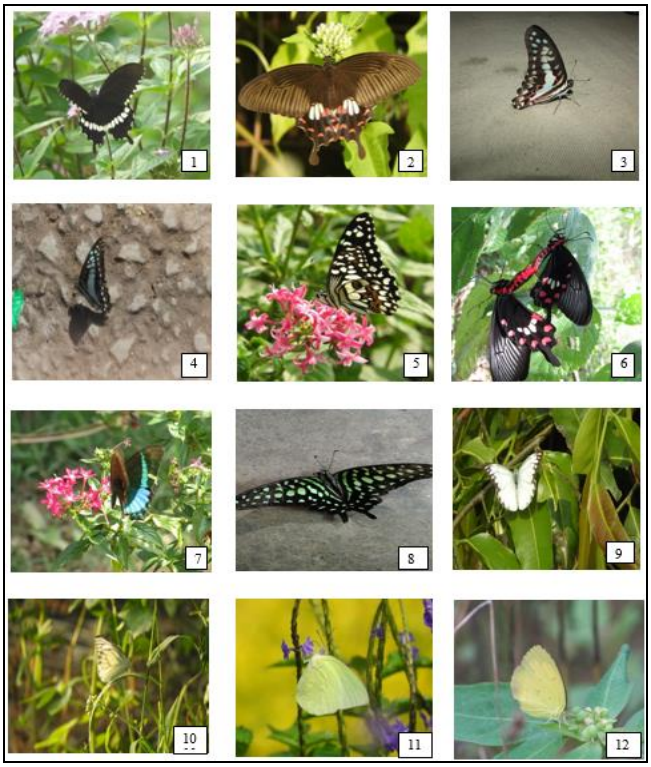

Plate 1: 1- *Papilio polytes* (Common Mormon), 2- *Altophanaura aristolochiae* (Common rose), 3- *Graphium sarpendon* (Common blue bottle), 4- *Graphium doson* (Common Jay), 5- *Papilio demoleus* (Common lime), 6- *Altophaneura hector* (Crimson rose), 7- *Papilio crino* (Common banded peacock), 8- *Graphium agamenon* (Tailed jay), 9- *Appias albino* (Common albatross), 10-*Appias libythea* (Stripped albatross), 11- *Catopsilia Pomona* (Common emigrant), 12- *Eurema brigitta* (Small grass yellow)

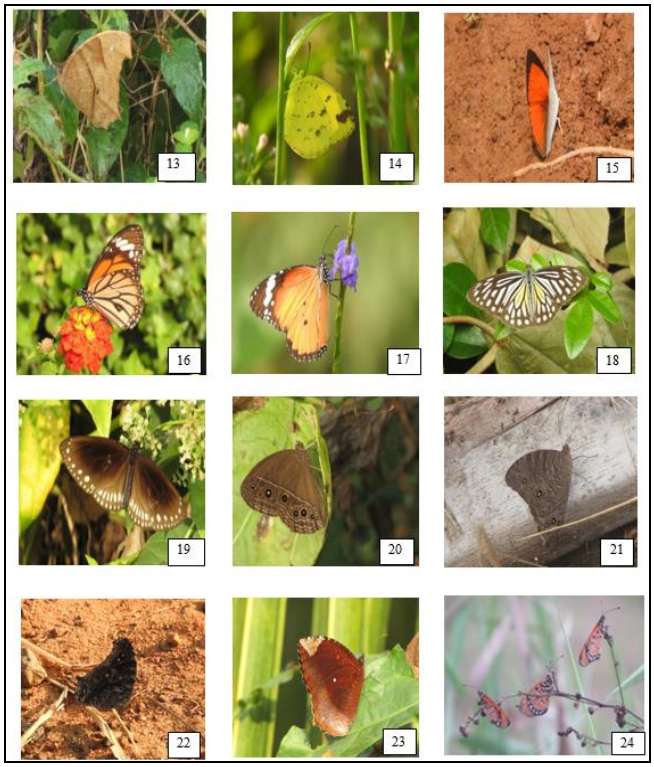

Plate 2: 13- *Eurema laeta* (Spotless grass yellow), 14- *Eurema hecabe* (Common grass yellow), 15- *Colias fieldii* (Dark clouded yellow), 16- *Danaus genutia* (Striped tiger), 17- *Danaus chrysippus* (Plain tiger), 18- *Parantica aglea* (Glossy tiger), 19- *Euploea core* (Common crow), 20- *Mycalesis perseus* (Common bush brown), 21- *Melanitis leda* (Common evening brown), 22- *Melanitis pnedima* (Dark evening brown), 23- *Elymnias hypermnestra* (Common palm fly), 24- *Acraea tericore* (Twany coaster)

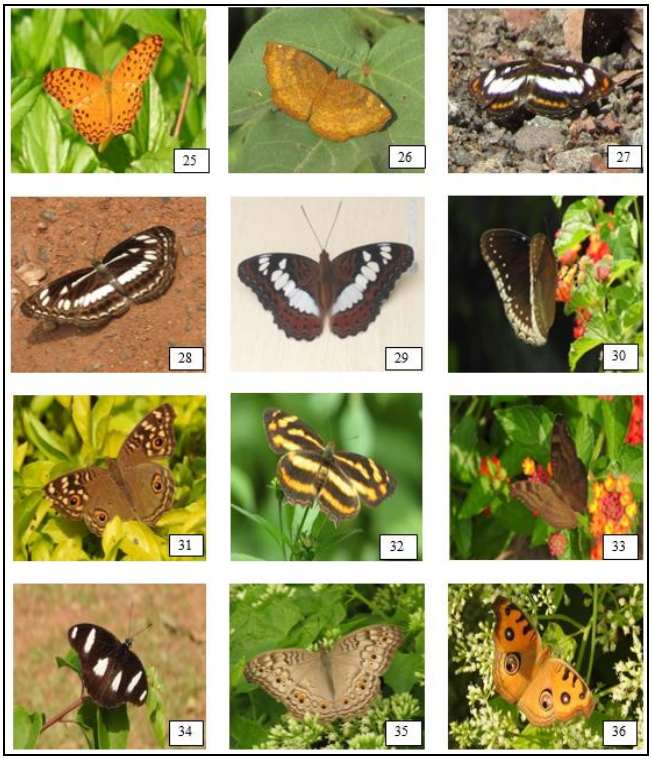

Plate 3: 25- *Phalanta phalantha* (Common leopard), 26- *Ariadna merione* (Angled castor), 27- *Athyma perius* (Common sergeant), 28- *Neptis hylas* (Common sailor), 29- *Moduza procris* (Commander), 30- *Hypotimnas bolina* (Great eggfly), 31- *Junonia lemonias* (Lemon pansy), 32- *Symbrenthia hippoclus* (Common jester), 33- *Junonia lemonias* (Chocolate pansy), 34- *Hypolimnas misippus* (Danaid eggfly), 35- *Junonia atlites* (Grey pansy), 36- *Junonia almanac* (Peacock Pancy)

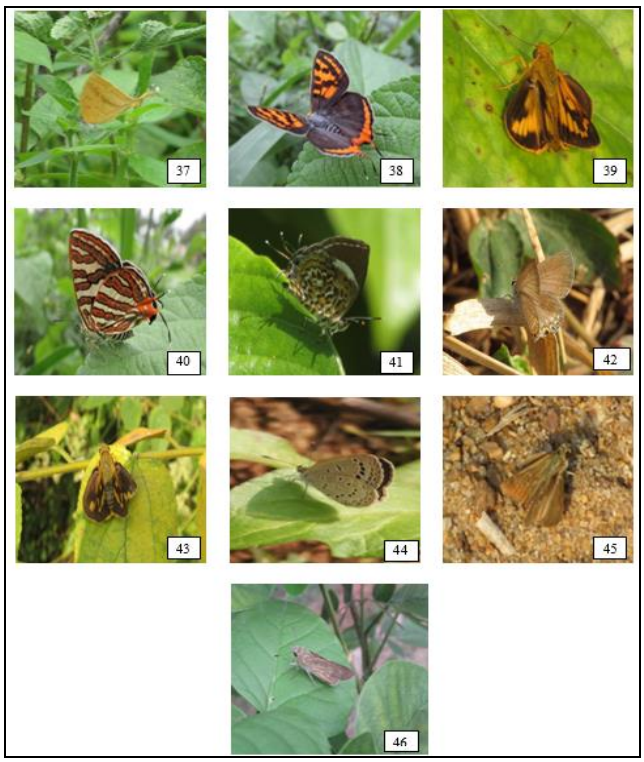

Plate 4: 37-*Loxuna atymnus* (Loxuna atymnus), 38- *Lycaena phlaeas* (Lycaena phlaeas), 39- *Telicota ancilla* (Dark palm dart), 40- *Spindasis vulcanus* (Common silver line), 41- *Rathindaamor* (Monkey puzzle), 42- *Catochrysops strobe* (Forget me not), 43- *Oriens goloides* (Common darlet), 44- *Pseudozizeeria maha* (Pale grass blue), 45- *Parnara guttata* (Straight swift), 46- *Borbo cinnara* (Rice swift)

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