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Comparative studies on the diversity of butterflies between coastal and arid zones

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ABSTRACT: Butterflies are biological indicators of the habitats. They are very sensitive to their environment, their very presence or absence indicates the health of the environment. Though there are reports of butterfly diversity in various parts of our country, hardly there are any reports on comparative studies on these organisms. Hence, comparative studies on diversity of butterflies in coastal and arid zone were conducted. The coastal area of Goa was compared with arid zone Bagalkot (Karnataka State), for the diversity of butterflies. During the study period, a total of 80 species of butterflies, of which 56 species of butterflies were from arid zone Bagalkot (Karnataka) and 50 species were recorded from coastal region Goa. Among these, members belonging to the family Nymphalidae, were the most common. The maximum diversity and abundance was observed in the arid region, with around 26 species common to both, 30 different species restricted only to arid area and 24 different species to the coastal area.. Result showed that, the populations differed in variability and responses to endogenous and exogenous factors.

KEYWORDS: Arid zone, Bagalkot, butterfly species, coastal area, Goa, habitat, diversity

INTRODUCTION

Among insects, butterflies are the most studied group taxonomically, which have received a reasonable amount of attention throughout the world (Ghazoul, 2002). Many of butterfly species are strictly seasonal and prefer only a particular set of habitat (Kunte, 1997) and they are good indicators in terms of anthropogenic disturbance and habitat quality (Kocher and Williams, 2000). The topics such as butterfly community assemblage and factors influencing it, have been of interest to ecologists and conservationists. Since the turn of the 19th century, many workers (Bingham, 1905, 1907; Williams, 1927) have recorded butterfly species in south India. In 1987, Larsen made a detailed survey of butterflies of Nilgiri Mountains and recorded nearly 300 species including endemic ones. Many researchers have

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contributed to our understanding of butterfly abundance and diversity (Gascon *et al.*, 1999; Kunte *et al.*, 1999; Rickets *et al.*, 2001; Pai, 2002; Arun and Azeez, 2003; Eswaran and Pramod, 2005; Xavier, 2006; Pramod Kumar *et al.*, 2007; Krishnakumar *et al.*, 2008) and on habitat association, effect of disturbance and area clearance (Soubadra and Priya, 2001; Sreekumar and Balakrishnan, 2001; Dolia *et al.*, 2008), seasonal abundance and migration patterns (Kunte, 1997, 2000; Arun, 2002; Kunte, 2005; Padhye *et al.*, 2006) and on conservation (Mathew and Binoy, 2002; Mathew and Anto, 2007; Kunte, 2008; Ramesh *et al.*, 2010) from Western Ghats.

However, almost no attention has been paid to understand the butterfly diversity, density and community composition in arid zones. Further, a comparative study between coastal areas and arid plains, to understand the butterfly diversity and distribution pattern is unheard. Hence, to fill these lacunae, an attempt was made to study and compare the butterfly diversity and distribution pattern in coastal regions of Goa with that of arid zone of Bagalkot (Karnataka).

MATERIAL AND METHODS

The present study started with a view to examine the different species of butterflies across two different habitats namely coastal Goa and arid zone Bagalkot.

Study site: Goa, the land of sun, sand and sea, lies between 15°48′00″N and 14°53′54″N and 74°20′13″E and 74°40′33″E, though has a limited land area of about 3701 Km^2 is warm humid typical coastal weather. Bagalkot district, Karnataka State (160° 12′N 750° 45′E), is basically an arid zone and has warm and dry weather. Both places, exhibit a diversity of plant species, which are congenial for the butterflies.

Collection by using net was the primary method of collection. In addition to sweeping, baiting and collecting and rearing of immature stages were also used. In Goa, the coastal areas, 3–5 km from coast line was surveyed. While in Bagalkot, almost all places, in district were covered. In both the cases, opportunistic survey method was employed.

RESULTS AND DISCUSSION

During the study period, a total of 80 species of butterflies, of which 56 species of butterflies were from arid zone Bagalkot (Karnataka) and 50 species were recorded from coastal region Goa (Table 1). Among these, members belonging to the family Nymphalidae, were the most common. A similar pattern of predominance of *Nymphalidae* was also reported by different researchers (Kunte, 1997; Kunte *et al.*, 1999; Eswaran and Pramod, 2005; Dolia *et al.*, 2008; Krishnakumar *et al.*, 2008; Soubadra and Priya, 2001; Pramod Kumar *et al.*, 2007; Padhye *et al.*, 2006) from Western Ghats.

Fig. 1. exhibits the Graph of Families of Butterflies V/s number of different species of Butterflies, wherein members of Nymphalidae show maximum number in both arid and coastal regions under study.

Fig. 2 (Graph) shows the number of different families of butterflies V/s number of same species of Butterflies found in these two regions. The graph indicates that,

TABLE 1. Distribution pattern of Butterflies in the arid and coastal regions

Sr. No.	Common name	Scientific name	Arid Area	Coastal Area (Pai, 2002)
1	Blue Mormon	*Papilio polymnestor* (Cramer)	✓	✓
2.	Common bottle blue	*Graphium sarpedon* (Linnaeus) (=*Zetides sarpedon* (Linnaeus))	✓	-
3.	Common Mormon	*Papilio polytes polytes* (Linnaeus)	✓	✓
4.	Common Mormon	*Papilio polytus Romulus* (Cramer)	✓	-
5.	Common Mormon	*Papilio polytus stichius* (Hubner)	✓	-
6	Common Rose	*Pachliopta aristolochiae* (Fabricius) (=*Tros aristolochiae* (Fabricius))	✓	✓
7	Crimson Rose	*Pachliopta hector* (Linnaeus) (=*Tros hector* (Linnaeus))	✓	✓
8.	Lime Butterfly	*Papilio demoleus* (Linnaeus)	✓	-
9.	Red Helen	*Princeps helenus* (Linnaeus)	✓	
10	Southern Birdwing	*Troides minos* (Cramer) (=*T. helena)*	-	✓
11	Tailed Jay	*Graphium agamemnon* (Linnaeus) (=*Zetides agamemnon* (innaeus))	✓	✓
12.	Capers	*Catopsilia pyranthe* (Linnaeus)	✓	-
13.	Common/Lemon Emigrant	*Catopsilia crocale* (Cramer)	✓	✓
14.	Common Albatross	*Appias albino* (Felder)	✓	-
15.	Common Gull	*Cepora nerissa* (Fabricius) (=*Huphina nerissa* (Fabricius))	✓	✓
16.	Common Jezebel	*Delias eucharis* (Drury)	✓	✓
17.	Common Wanderer	*Pareronia valeria* (Fabricius)	✓	✓
18.	Crimson tip	*Colotis danae* (Frabricius)	✓	-
19.	Great orange tip	*Hebomoia glaucipe* (Linnaeus)	✓	-
20	Mottled Emigrant	*Catopsilia pyranthe* (Linnaeus)	✓	✓
21.	Painted saw tooth	*Prioneris sita* (C.Felder)	✓	-

TABLE 1. Contd . . .

22.	Pioneer white	*Belenois auroto* (Fabricius)	✓	-
23.	Plain orange tip	Colotis eucharis (Fabricius)	✓	-
24.	Psyche	*Leptosia nina* (Fabricius)	✓	✓
25.	Small / little orange tip	*Colotis etrida* (Boisdvual)	✓	-
26.	Small Grass Yellow	*Eurema hecabe simulate* (Cramer) (=Terias hecabe (Linneaus))	✓	✓
27.	Small salmon Arab	*Colotis amata* (Fabricius)	✓	-
28.	White orange tip	*Ixias Marianne* (Fabricius)	✓	-
29.	Yellow Orange tip	*Ixias pyrene* (Cramer)	✓	-
30.	Baron	Euthalia aconthea (Hewitson) (=*Euthalia garuda* (Moore))	✓	✓
31.	Black Prince	*Rohana parisatis* (Moore)	-	✓
32	Black Rajah	*Charaxes solon solon* (Fabricius.) (=*Charaxes fabius)* (Fabricius.)	-	✓
33.	Blue pansy	*Junonia orithya* (Linnaeus) (=Precis orithya)	✓	-
34.	Blue Tiger	*Tirumala limniace exoticus* (Butler) *(=Danaus limniace leopardus)*	-	✓
35.	Bush brown	*Mycalesis subdita* (Moore)	✓	✓
36.	Chocolate Pansy	*Junonia iphita* (Cramer) (=*Precis iphita*)	✓	✓
37.	Commander	*Moduza procris undifragus* (Cramer) *(=Limenitis procris)*	-	✓
38.	Common Castor	*Ariadne merione* (Cramer) (=*Ergolis merione* (Cramer))	✓	✓
39.	Common Evening Brown	*Melanitis leda* (Linnaeus) (=*Melanitis leda ismene* (Cramer))	✓	✓
40.	Common Fivering	*Ypthima baldus* (Fabricius)	✓	-
41.	Common Indian Crow	*Euploea core* (Cramer)	✓	✓
42.	Common Leopard	*Phalanta phalantha* (Drury) *(=Atella phalantha)*	-	✓
43.	Common Palmfly	*Elymnias hypermnestra caudate* (Drury)	-	✓

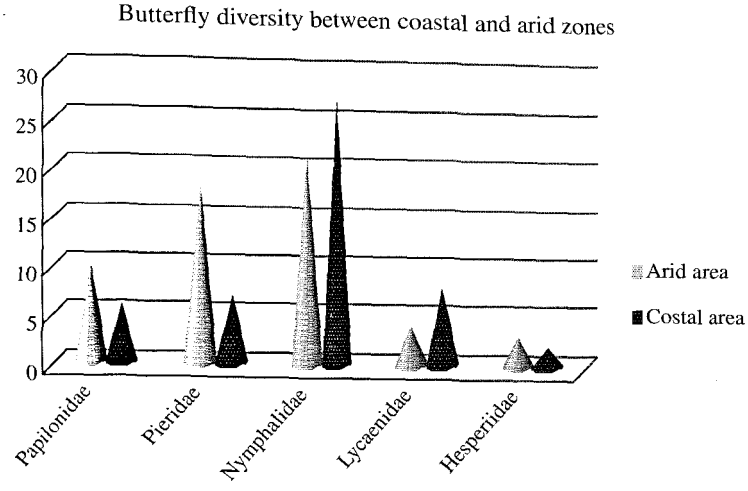
TABLE 1. Contd . . .

44.	Common Sergeant	*Athyma perius* (Linnaeus) *(=Pantoporia perius)*	-	✓
45.	Danaid Eggfly	*Hypolimnas misippus* (Linnaeus) (=*Diadema misippus*)	✓	✓
46.	Dark Blue Tiger	*Tirumala septentrionis dravidarum* (Butler) *(=Danaus melissa)*	-	✓
47.	Dark band Bushbrown	*Mycalesis mineus* (Linnaeus)	✓	-
48.	Glassy Blue Tiger	*Parantica aglea* (Stoll) (=*Danaus aglea* (Cramer))	✓	✓
49	Great Eggfly	*Hypolimnas bolina jacintha* (=*Hypolimnas bolina* Linnaeus)	✓	✓
50.	Great evening brown	*Melanitis zitentius* (Herbst)	✓	-
51	Grey Count	*Tanaecia lepidea miyana* (Frushstorfe) (=*Euthalia lepidea* Butler)	-	✓
52	Grey Pansy	*Precis atlites* (Johanssen)	-	✓
53.	Joker	*Byblia ilithyia* (Drury)	✓	-
54	Lemon Pansy	*Junonia lemonias* (Linnaeus) (=*Precis lemonias*)	✓	✓
55.	Map Butterfly/ common Map	*Cyrestis thyodamas indica* (Evans)	✓	✓
56.	Painted Lady	*Vanessa cardui* (Linnaeus)	-	✓
57.	Peacock Pansy	*Junonia almana* (Linnaeus) (=*Precis almana* (Linnaeus))	✓	✓
58.	Plain Tiger	*Danaus chrysippus* (Linnaeus) (=*Danais chrysippus* (Linnaeus))	✓	✓
59.	Striped Tiger	*Danaus genutia* (Cramer) (=*Danais plexippus* (Linnaeus))	✓	✓
60.	Tamil Yeoman	*Cirrochroa thais thais* (Fabricius)	-	✓
61.	Tawny coster	*Acrae terpsicore* (Linnaeus)	✓	-
62	Yellow Jack Sailor	*Lessipa viraja viraja (moore)*	-	✓
63.	Yellow Pansy	*Junonia hierta* (Fabricius)	✓	-

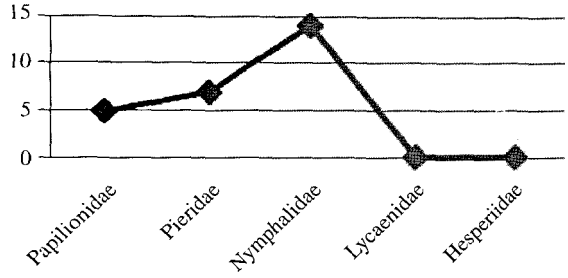
TABLE 1. Contd . . .

64.	Branded Blue pierrot	*Discolampa ethion* (Westwood) (=Castalius ethion)	✓	-
65.	Common Cerulean	*Jamides celeno aelianus* (Fabricius) (=*Jamides celeno celeno* (Cramer))	-	✓
66.	Common Gem	*Poritia hewitsoni hewitsoni* (Moore)	-	✓
67	Common Pierrot	*Castalius rosimon rosimon* (Fabricius)	-	✓
68.	Common silverline	*Castalius rosimon rosimon* (Fabricius)	✓	-
69.	Cornelian	*Deudorix epijarbus amatius* (Moore)	-	✓
70.	Forget me not	*Catochrysops Strabo* (Fabricius)	✓	-
71.	Gram Blue	*Euchrysops enejus* (Fabricius)	✓	-
72.	Monkey Puzzle	*Rathinda amor* (Fabricius)	-	✓
73.	Red Pierrot	*Talicada nyseus nyseus* (Guirin-Menevile)	-	✓
74.	White banded Royal	*Ancema cotys (Hawitson) (=Pratapa cotys)*	-	✓
75.	Yamfly	*Loxura atymnus atymus* (Cramer)	-	✓
76.	Dark banded swift	*Pelopidas agna* (Moore)	✓	-
77.	Indian skipper/ Indian Grizzled	*Spialoa galba* (Fabricius)	✓	-
78.	Malabar Flat	*Celaenorrhinus ambareesa* (Moore)	-	✓
79.	Multi Spotted Flat	*Celaenorrhinus pulomaya pulomaya* (Mielke)	✓	-
80.	Small branded Swift	*Pelopidas mathias (Fabricius)*	✓	-

maximum number of species of butterflies encountered in the present studies was from Nymphalidae and the Hesperiedae represented by minimum number of butterflies. Is also interesting to note that, some species of butterflies showed specificity or restriction to particular habitat for eg., *Graphium sarpedon* (Linnaeus), *Papilio polytes romulus* (Cramer), *Papilio polytes stichius* (Hubner), *Papilio demoleus* (Linnaeus),



FIGURES 1. Graph of Families of Butterflies V/s number of different species of Butterflies.



FIGURES 2. Graph of Different families of butterflies V/s number of same species of butterflies found in these two regions.

Princeps helenus (Linnaeus), belonging to family papilionidae were noticed only in the arid area/region. Similarly *Troides minos* (Carmer), belonging only to coastal region.

The butterfly species such as *Catopsilia pyranthe* (Linnaeus), *Appias albina* (C. Felder), *Colotis danae* (Fabricius), *Hebomoia glaucippe* (Linnaeus), *Prioneris sita* (C. Felder), *Belenois aurota* (Fabricius), *Colotis eucharis* (Fabricius), *Colotis etrida* (Boisduval), *Colotis amata* (Fabricius), *Ixias marianne* (Cramer), *Ixias pyrene* (Linnaeus) belonging to family Pieridae and showed the specificity only towards arid region and none from coastal area.

Species of the family Nymphalidae such as *Junonia orithya* (Linnaeus), *Ypthima baldus* (Fabricius), *Mycalesis mineus* (Linnaeus), *Melanitis zitenius* (Herbst), *Byblia ilithyia* (Drury), *Acreae terpsicore* (Linnaeus), *Junonia hierta* (Fabricius) restricted only to arid region and *Rohana parisatis* (Moore), *Charaxes solon solon* (Fabricius), *Tirumala limniace exoticus* (Butler), *Moduza procris undifragus* (Cramer), *Pha-*

lanta phalantha (Drury), *Elymnias hypermnestra caudata* (Drury), *Athyma perius* (Linnaeus), *Tirumala septentrionis dravidarum* (Butler), *Tanaecia lepidea miyana* (Butler), *Precis atlites* (Johanssen), *Vanessa cardui* (Linnaeus), *Cirrochroa thais thais* (Fabricius), were found only in coastal area. Species belonging to family Lycaenidae *Discolampa ethion* (Westwood), *Spindasis vulcanus vulcanus* (Fabricius), *Catochrysops strabo* (Fabricius), *Euchrysops cnejus* (Fabricius), found only in the arid region and *Jamides celeno aelianus* (Fabricius), *Poritia hewitsoni hewitsoni* (Moore), *Castalius rosimon rosimon* (Fabricius), *Deudorix epijarbus amatius* (Moore), *Rathinda amor* (Fabricius), *Talicada nyseus nyseus* (Guerin-Meneville), *Ancema cotys* (Hawitson), *Loxura atymnus atymus* (Fruh), were found specific only to the coastal region. *Pelopidas agna* (Moore), *Spialia galba* (Fabricius), *Pelopidas mathias* (Fabricius), belonging to family Hesperiidae were specific only to the arid region and *Celaenorrhinus ambareesa* (Moore), *Celaenorrhinus pulomaya pulomaya* (Mielke), species of butterflies were specific to the coastal region.

Apart from the above, some species of butterflies such as *Papilio polymnestor* (Cramer), *Papilio polytes polytes* (Linnaeus), *Pachliopta aristolochiae* (Fabricius), *Pachliopta hector* (Linnaeus), *Graphium agamemnon* (Linnaeus), *Catopsilia crocale* (Cramer), *Cepora nerissa* (Fabricius), *Delias eucharis* (Drury), *Pareronia valeria* (Fabricius), *Catopsilia pyranthe* (Linnaeus), *Leptosia nina* (Fabricius), *Eurema brigitta* (Cramer), *Euthalia aconthea* (Hewitson), *Mycalesis subdita* (Moore), *Junonia iphita* (Cramer), *Ariadne merione* (Cramer) , *Melanitis leda* (Linnaeus), *Euploea core* (Cramer), *Hypolimnas misippus* (Linnaeus), *Parantica aglea* (Stoll), *Hypolimnas bolina jacintha* (Linnaeus), *Junonia lemonias* (Linnaeus), *Cyrestis thyodamas indica* (Evans), *Junonia almana* (Linnaeus), *Danaus genutia* (Cramer) *and Danaus chrysippus* (Linnaeus) were found common to both habitats.

Thus the studies show that, whether it is coastal or arid zone, butterflies do show diversity, probably depending upon various aspects such as agro-climatic condition, flora, availability of food etc., There may be several common species of butterflies found in both coastal and arid zone, but there too exists some specific species of butterflies for coastal and arid zones. These species can be considered as indicator species of a specific agro-climatic condition and further in case any change occurs in the climatic conditions, these butterflies can be used as indicator species to indicate such climatic changes.

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