BIODIVERSITY: COLOUR PATTERN AND BUTTERFLY DIVERSITY IN TIGER RESERVE IN TADOBA NATIONAL PARK, MAHARASHTRA

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ABSTRACT

Biodiversity is contraction of two simple terms "Biological Diversity". This means that sum total of all biological variations in a particular ecological system. Although biological diversity can never be fully assessed by assigning single number study of particular facets, it has led to rapid, exciting and sometimes alarming discoveries. There is no doubt that humans are now destroying the diversity at an alarming rate. Biodiversity has multitude facts that can be quantified using common measures, which are classified into three approaches such as, numbers of individuals, similarities or evenness and differences. The present report describes the diversity of butterflies in Tadoba Tiger Reserves; the butterflies recorded in this reserve belong to 7 families comprised of 29 genera and 43 species.

INTRODUCTION

The diversity of biological organisms at one place, group or time is in itself more or less not useful, but comparable measurements of diversity from multiple places, groups or times will answer crucial questions about how the diversity arose and how we may best act to maintain it.

THE GROWING BIOSPHERE

Technological advances and the sense of urgency imparted by the rate of habitat loss are combining to yield discoveries at an incredible rate. An average day sees the formal description of around 300 species across the whole range of life, and there is no slowdown in sight. The physical limits of the biosphere have been pushed back by the recent discovery of microbial communities in sedimentary and even igneous rocks over 2km below the surface.

There are two ways in which the biosphere can perhaps be said to be growing. The first is that the rate, which taxonomists spilt, one previously recognized species into two or more exceeds the rate at which they clump different species together, especially in taxa that are of particular concern to conservationists. A second way in which the catalogue of diversity is growing, is computer databases and the Internet which are making the process of information gathering more truly cumulative than perhaps ever before.

TEMPORAL DIVERSITY

The temporal pattern of disparity is also of great interest. There are more families now than ever before, and a model of exponential growth provides a good overall fit to the number of families through time, suggesting expansion without limit and no major role for competition in limiting diversity. Families do not arise overnight: they are the result of speciation and a lot of time, like logistic growth at higher levels. Rates of morphological and taxic diversification are often incongruent, or even uncoupled, again highlighting that there is more to biodiversity than number of taxa.

THE SHRINKING BIOSPHERE

A simple calculation shows that the recent rates of species losses are unsustainable. If there are 14 million species at present, the last century saw the end of 20 mammalian species alone, a pruning of the mammalian tree that would take at least 200 centuries to redress. The rate at which tropical forest – probably the habitat for most species – is lost is about 0.8% to 2% per year. We must expect about 1% of the tropical forest populations to be lost with it , a figure that may be as high as 16 million populations per year, or one every two seconds. Wilson famously used the species – area relationship to estimate an annual extinction rate of 27,000 species – one species every twenty minutes.

BIODIVERSITY AND THE STABILITY AND FUNCTIONING OF ECOSYSTEMS

Principal environmental factors such as climate, soil type and disturbance strongly influence ecosystem functioning, but likewise organisms can affect their environment. Some of the first ideas on how biodiversity

could affect the way ecosystems function are attributable to Darwin and Wallace, who stated that a diverse mixture of plants should be more productive than monoculture. Compared with systems that have lost species, diverse plant communities often have a greater variety of positive and complementary interactions and so outperform any single species, and have more chance of having the right species in the right place at the right time. About 95% of experimental studies support a positive relationship between diversity and ecosystem functioning; many have found that only 20-50% of species are needed to maintain most biogeochemical ecosystem processes. Biodiversity can also impact ecological processes such as the incidence of herbivory and disease, and the resistance of communities to invasion. Second, although we know that local extinction is often not random, many recent experiments compare the performance of communities differing in the presence or absence of a random set of species. Third, how will species loss interact with other components of global change such as rising CO_2? Finally, how do we integrate these new within–habitat relationships between diversity and ecosystem processes with large-scale pattern in biodiversity and environmental parameters, as reviewed by Gaston?

ZONES OF INSECT BIODIVERSITY

Insects occur throughout the world; however, a few orders are without any representative in every continent; many regions have insect faunas which remain quite distinct from those of others even when climate and terrain are similar. Many winged insects have managed to establish a nearly worldwide distribution primarily through adaptation to human trading and their exploitation of man’s dwellings and

products. Such insect distribution which is synthesized to some extent by zoologist's arrangement of the world into a number of zoogeographical regions, according to similarities in their faunal communities in general and these are,

1.	**Holartic**	:	**a) Palaeartic**- (Europe and Whole Northern Asia, including Arctic together with African Sahara Desert) **b) Nearctic**- (North America and Greenland)
2.	**Neotropics**	**:**	South Africa and North Mexico
3.	**Ethiopian**	:	Afro-Tropical, Sub-Saharan region (Africa, South of Sahara, Madagascar and Southern Arabia)
4.	**Oriental**	:	India, Southern China, and South Thailand
5.	**Australo-Oriental**	:	Malaysia, Indonesia, and New Guinea, etc.
6.	**Australasian**	:	Australia and Tasmania
7.	**Polynesian**	**:**	Pacific Islands, East of New Guinea, New Zealand
8.	**Antarctic**	**:**	These regions are not strict ecological units and hence within each variety of terrains (woodlands, grasslands, deserts marsh, etc.) supporting different insect faunas adapted to the particular conditions occurring in them.

MEASURE OF BIODIVERSITY

Diversity in one group of organisms can also promote diversity of associated groups. Roles of morphological and taxic diversification are often incongruent or even uncoupled, highlighting that there is more to biodiversity than number of taxa. Recent years have seen exciting advances in our knowledge of diversity, our identification has shaped its evolution and distribution and understanding of its importance. There is no shortcut – and we need more basic information about more groups and not just the species lists. No single measure will always be appropriate, rather different facets of Biodiversity can be quantified;

a. Number: The most commonly considered facet of biodiversity is species richness the number of species in a site, habitat or clad. Species are also sensible units to choose from a biological perspective. The current information suggests that there are about 14 million species but this is just a provisional figure. Regions with many species, especially endemic species as sometimes called “Hot Spots”. Species and regions differ in their number of populations. Population of a given species, if defined on the basis of limited gene flow among them, will evolve to an extent independently. Each population contributes additional diversity. The number of genetic populations in the world is estimated to lie between 1.1 and 6.6 billion.

b. Similarity/ evenness: A site containing thousand species might not seem particularly diverse if 99.9% of individuals that you find belong to the same species. Many diversity indices have been developed to convey the extent to which individuals are distributed evenly among the species.

c. Difference: Some pairs of species (alleles or populations) are very alike, whereas others are very different. Disparity and character diversity are measures of phenotypic differences among the species in a sample, and can be made independent of species number. Genetic variability among populations can also be measured in various ways.

COLOUR PATTERN DIVERSITY IN BUTTERFLY OF TADOBA NATIONAL PARK

Colour pattern mimicry, the adaptive resemblance of unrelated species, is a clear selection. Mimicry particularly in butterflies, the resemblance reaches unequalled phenotypic convergence within a locality. Despite the extraordinary diversity of colour-pattern and their clear adaptive mechanism underlying colour-pattern blend into the surrounding when they settled known as cryptive colouration and becomes extremely difficult to detect, butterfly species are unique and show general appearance and exhibit slight variations of colour in some show considerable variations in extreme cases of the same species within the sexes, known as sexual dimorphism. Colour pattern usually changes between sister species highlighting the role of colour-pattern speciation.

Tadoba National Reserve is one of the National Parks, which has global and national significance because of habitat of Indian Tiger (*Panthera tigris*). The Park is situated in Oriental Zoogeographical Region with tropical dry deciduous forest consisting of rich diversity of flora and fauna. The composite area of the park is about 116.55 sq. km. Many species of butterflies have been identified in the field even without killing them. The identification was based on transect

line methodology. Butterflies were most active between 8: 00 a.m. – 11:00 a.m. and with the rise of sun the activity decreases as soon as sun approaches towards noon. The transect method used between 7:30 and 11:00 hrs when activity was at their peak. The result was quite encouraging and about 43 species were recorded belonging to 29 genera from 7 families (Table 1). Of the total 43 species identified 13 species belonged to the family Nymphalidae contributing to 30.2% of the total butterflies identified, followed by 8 (18.6%) from Lycaenidae. Family Acraenae was represented by only 3 species contributing to 7% of the total number recorded (Table 2).

Table 1. Butterfly species found in Tadoba Tiger Reserve during post monsoon months

S. No.	Family	Common Name	Zoological Name
1	Papilionidae	Lime butterfly	**Papilio demoleaus**
2		Common Mormon	*Papilio polytes*
3		Blue Mormon	*Papilio polymnestor*
4		Spot Swordtail	*Pathysa nomius*
5		Common Mime	*Chilasa cytia*
6		Common Rose	*Tros aristolochiae*
7	Pieridae	White Orange tip	*Ixias marianne*
8		Common Wanderer	*Parenonia valeria*
9		Common Gull	*Cepora nerissa*
10		Yellow orange tip	*Ixias pyrene*
11	Coliadinae	Common Emigrant	*Catopsilia crocale*
12		Lemon Emigrant	*Catopsilia pomona*

S. No.	Family	Common Name	Zoological Name
13		Common grass yellow	*Terias hecabe*
14		Spotless grass yellow	*Terias laeta*
15	Lycaenidae	Common Acacia blue	*Surendra quercetorum*
16		Common silverine	*Spindasis vulcanus*
17		Common red flash	*Rapala melampus*
18		Zebra blue	*Synlarucus rosimon*
19		Gram blue	*Euchrysops onejus*
20		Common hedge blue	*Acetolepis pusha*
21		Grass jewel	*Freyeria trochilus*
22		Dark carulean	*Jamides bochus*
23	Nymphalidae	Common evening brown	*Melanitis leda*
24		Common bush brown	*Mycalesis mineus*
25		Dark band bush brown	*Mycalesis perseus*
26		Tawny Rajah	*Charaxes polyxena*
27		Black Rajah	*Charaxes fabius*
28		Common sailer	*Neptis hylas*
29		Great eggfly	*Hypolimnas bolina*
30		Danaid eggfly	*Hypolimnas missipus*
31		Yellow pansy	*Percis hierta*
32		Blue pansy	*Percis orithyia*
33		Lemon pansy	*Percis lemonias*
34		Grey pansy	*Percis atlites*
35		Common Leopard	*Atelia phalantha*

S. No.	Family	Common Name	Zoological Name
36	Acraeinae	Common Tiger	*Danaus genutia*
37		Plain Tiger	*Danaus chrysippus*
38		Blue Tiger	*Danaus limniace*
39	Hesperiidae	Common banded owl	*Hasora alexis*
40		Common owl	*Hasora badra*
41		Grass demon	*Udaspes folus*
42		Indian skipper	*Spialia galba*
43		Common Darlet	*Oriens goloides*

Table 2 : Families of butterflies observed in Tadoba Tiger Reserve

Family	**Genus**	**Species**
Acraeinae	1	3
Coliadinae	2	4
Hesperiidae	4	5
Lycaenidae	8	8
Nymphalidae	7	13
Papilionidae	4	6
Pieridae	3	4
Total	**29**	**43**

Male and female usually are of similar colour pattern in 18 species. However in 24 species sexual dimorphism in

colour pattern was recorded. *Danaus chrysippus* commonly known as plain tiger representing family Acraeinae, comprised of 3 different colour pattern in male and similar in female but with three black dots on the hind wings. The above observation suggests the diverse nature of colour pattern even in closest member or in the same sex.

CHALLENGES AND PROSPECTS

Biodiversity cannot be reduced to a single number, such as species richness, a real problem for biologists, because a single number is often what policy- makers want. The study of biodiversity is becoming an ever-bigger research enterprise. The database is (more than ever) cumulative, the analyses more ambitious and involving more people. The second issue is whether we can study all processes at all scales. Perhaps the large –scale patterns are a blunt instrument for studying the underlying processes, which may operate on much smaller scales. Given the speed at which we are pruning the tree of life, we need good answers quickly.

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