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Effects of weather factors on diversity and abundance of moths in sub-alpine forests of Tangmarg district Baramulla state Jammu and Kashmir India

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Abstract

The Effect of weather factors on the existence of moth species was investigated in the Tangmarg region of Baramulla district. During the study a total of eight species belonging to five families were recorded. Erebidae family was the most dominant family with maximum number of species. Maximum number of species was recorded during the month of July.

Keywords: Weather, moth diversity, Tangmarg, Shannon-Wiener diversity index

1. Introduction

The order Lepidoptera comprises Butterflies and Moths, which are the most common insects of the forest ecosystems and agricultural fields and are often termed as the biological indicators of the ecosystem. Lepidoptera is the second largest and the most diverse order of the class Insecta [3]. Most of the biological researchers have used many Lepidopteras as a model organism to assess the impact of human and pollution disturbance and management practices of the forest ecosystems [30]. Insects are the most species-rich taxa with about one million species described worldwide, corresponding to more than half of all known species [12]. Due to their ecological diversification and short generation times, insects are useful indicators of environmental change [23]. Lepidoptera (Butterflies and moths) is one of the largest insect orders with 160,000 described species, of which 95% are moths [18]. Moths play important roles in many ecosystems as pollinators, herbivores and prey for a wide range of species such as birds and bats [26]. In India it is estimated that approximately 12,000 species of moths belongs to 41 families are recorded [4]. Distribution and ecology of moths are well known in comparison to many other invertebrates. In recent decades, steep declines in moth populations have been observed. For instance, in Great Britain, the abundance of macro-moths decreased by 28% between 1968 and 2007 [9] and similar negative trends have been found in Sweden [10] and the Netherlands [11]. Such declines are expected to have cascading effects at both higher (bats, birds) and lower (plants) trophic levels due to the keystone role of moths in many ecosystems [27].

The aim of the present work was to identify and study the diversity of moth species from Tangmarg area which still was lacking fresh documentation of moth fauna.

2. Material and Methods

2.1 Study Area

All legal permits required to carry out field work was authorised by the District commissioner, Baramulla. The study was carried out at Tangmarg region of District Baramulla, State Jammu and Kashmir about 39 km from Srinagar. Tangmarg is a hilly area with most parts covered by lush green forests, with latitude 33.80 and longitude 75.36. It is an established and observed fact that topography of Tangmarg Tehsil is ideal for various and varied kinds of medicinal and aromatic plants. Many of them are of international repute mentioning here a few are Taxus, Podophyllum, Dioscorea, Zera, and Kuth. *Rosa Damascena* is the world's best rose as per its medicinal value and aroma is concerned. A total of eight species from six subfamilies were recorded from this area.

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2.2 Weather condition

The climate is marked by well-defined seasons, with four seasons a year: winter (December- February), spring (March-

May), summer (June- August) and autumn (September- November).

Table 1: Meteorological data of study site Tangmarg during study period (2014-2016) and number of moth individuals recorded

Season	Month	Max. Temp. (°C)	Min. Temp. (°C)	Average (°C)	Precipitation (mm)	No. of Species	No. of individuals
Spring	March	9.1	1.2	5.1	135	0	0
	April	15.2	6.1	10.6	134	0	0
	May	20.7	9.8	15.2	97	0	0
Summer	June	24.9	13.3	19.1	53	1	11
	July	25.4	15.6	20.5	80	4	60
	August	24.5	15.2	19.8	85	2	43
Autumn	September	23.0	11.4	17.2	67	1	7
	October	18.6	6.1	12.3	47	0	0
	November	12.5	0.9	6.7	28	0	0
Winter	December	6.3	-2.3	2.0	37	0	0
	January	2.3	-4.0	-0.9	83	0	0
	February	4.2	-3.3	0.4	89	0	0

2.3 Moth study

Moth study was conducted between March 2014 to October 2016. Moths were attracted by using a light trap running for 6 hours from 7pm to 1am, in the three seasons, viz., spring summer and autumn during various expeditions. Light traps were set using a solar powered lantern or gas petromex in front of a white 10' x 6' cloth sheet hung between two vertical poles in such a way that whole sheet was brightly illuminated for moth attraction and photography of moths was done. Identification of the moths was carried out with the help of identification keys, standard reference books, and available literature. Species, whose identities could not be ascertained from external morphology, were not assigned to species level. The moths were classified by using Bell and Scott [2]. Research works of Sachin A. Gurule [13] and with the kind help of zoological survey of India Jabalpur, Madhya Pradesh.

2.4 Statistical analysis

The type of diversity used here is α - diversity which is the diversity of species within a community or habitat. The diversity index was used to examine the relationship between species diversity and weather. The diversity index was calculated by using the Shannon-Wiener diversity index.

Diversity index = $H = -\sum P_i \ln P_i$

Where $P_i = S/N$

S= number of individuals of one species

N= total number of all individuals in the sample

ln= logarithm to base e

3. Results and Discussion

Through field observations Erebidae, Noctuidae, Geometridae, Crambidae and Arctiidae were recorded from the Tangmarg region of District Baramulla, State Jammu and Kashmir. Five families include eight species belonging to 8 genera of 6 subfamilies. The number of species differs in various subfamilies. The maximum number of species was recorded in the subfamilies Arctiinae (2) and Lithosiinae (2). Subfamilies Trifinae, Boarmiinae, Erebiniae and Noctuinae each with one species. Family Erebidae was the dominating family found in this area. Moths were surveyed during three years in all four seasons but their appearance was highest in

the month of July. The highest number of moth specimens (43) belonged to family Noctuidae, while family Arctiidae with a total number of 11 moth specimens, represented the minimum number. Figure-1 represents the diversity index of each family of moths at Tangmarg area. The Erebidae family had the highest diversity index of 1.02 while the family Noctuidae showed the lowest value with 0.159 diversity index. Table-2 represents the abundance of moth individuals in each season. The highest number of individuals was reported in the month of July.

The number of moths that were attracted towards light trap were closely related to weather conditions, with more records on warmer nights than on cold nights [14]. Intachat *et al.* (2001) noted that the abundance of geometrid moths in a tropical rain forest was greater when flowering and flushing were high. The peak existence of moths was in July month which was likely synchronized with the blooming of host floral resources [7]. Timing of adult emergence is an adaptive trait that depends on nectar availability and host plant resources [24]. Although the general pattern of invertebrate fauna seemed to change with the change in habitat and that too with temperature [22]. The present work similarly showed more composition of moths in summer and reflects the effect of temperature on moth existence. Temperature is considered as most important factor responsible for their reproduction, growth and development as invertebrates are Poikilothermic as they slightly change their body temperature with external variable of temperature. Slight variation in temperature declines insect population [8]. Temperature and moisture are two important soil conditions which affects invertebrate fauna the most [1]. From the present work highest record of moths was found in the month of July. Similar kind of work was carried out by Syed and Bhat [24] on epigeal invertebrate fauna from Sonamarg area which also showed abundance in the month of July. Kriti *et al.* (2014) too showed the maximum population of moth pests within the range of one month i.e. July. These findings revealed that the mean maximum temperature 24.9°C and mean minimum temperature 13.3 °C proved conducive for the multiplication of moths in this particular area.

Table 2: Moth species recorded from Tangmarg area their seasonal appearance and abundance

Family	Subfamily	Species	Appearance	No. of Individuals
Erebidae	Erebinae	<i>Ophiusa tirhaca</i> (Cramer, 1777)	July	16
-	Arctiinae	<i>Utetheisa lotrix</i> (Cramer, 1779)	July	14
-	Arctiinae	<i>Mangina astrea</i> (Drury, 1773)	September	7
Noctuidae	Trifinae	<i>Agrotis c-nigrum</i> (Linnaeus, 1775)	August	18
-	Noctuinae	<i>Mythimna separate</i> (Walker, 1865)	August	25
Geometridae	Boarmiinae	<i>Urapteryx ebuleata</i> (Guenee 1878),	July	12
Crambidae	Lithosiinae	<i>Chrysorabdia bivitta</i> (Walker, 1856)	July	18
Arctiidae		<i>Cyana perornata</i> (Walker, 1854)	June	11

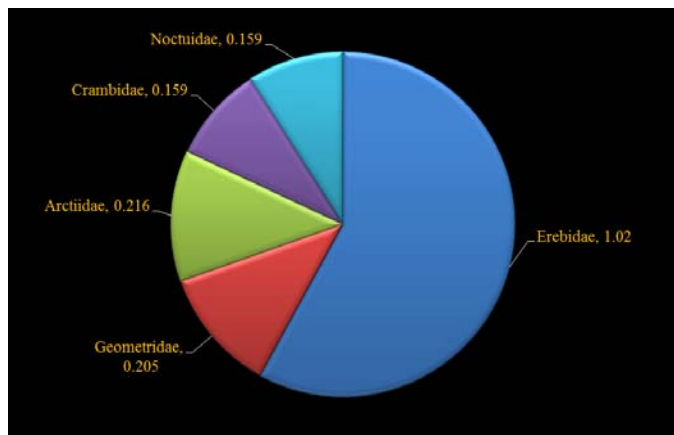
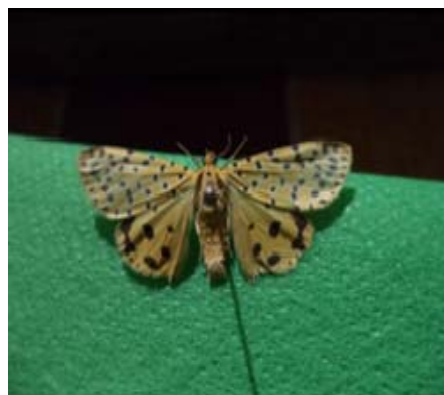


Fig 1: Diversity index of each family of moths recorded by using light traps in Tangmarg

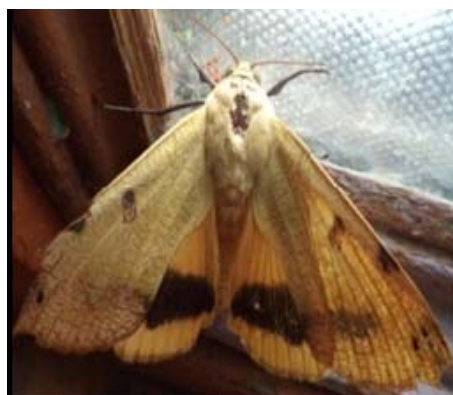


Mangina astrea

Moths recorded from Tangmarg area of Baramulla District of Kashmir.



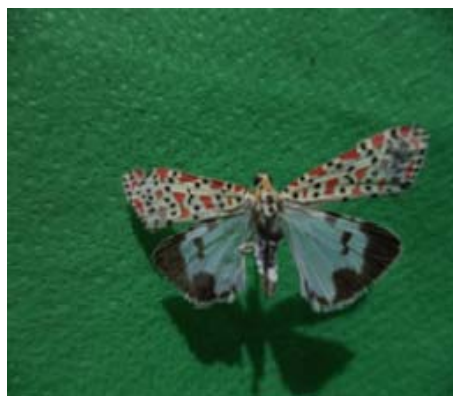
Agrotis c-nigrum



Ophiusa tirhaca



Mythimna separate



Utetheisa lotrix



Urapteryx ebuleata



Chrysoxystes bivitta



Cyana perornata

4. Conclusion

The present study has been carried out to elucidate a fauna which has not been touched before, and it is a small step towards a complete taxonomic understanding of moth species from the Tangmarg region. For the first time, a comprehensive report of moth diversity of Tangmarg has been provided. Though the study of moths in Tangmarg is still not exhaustive, it indicates the chance of discovery of a large number of known and unidentified species if the methodical surveys of uncharted and under explored regions are undertaken through the help of State Government agencies.

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