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A preliminary survey on lepidopteran caterpillar diversity in Karnatak University, Dharwad

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Abstract

Among insects, lepidopterans (butterflies and moths) are most successful group of animals found in nature. The vast majority of Lepidopterans are found in the tropics, but substantial diversity exists in most of the continents. In nature several varieties of caterpillars and their corresponding butterflies and moths can be seen. There is a need to study the community structure of this dynamic group of lepidopterans with respect to different regions of our country. Hence, the present survey work was undertaken to study the diversity of caterpillars from Karnatak University (KU) Campus, Dharwad by dividing the whole campus into five survey sites. During the present survey, a total of 52 species of caterpillars were collected, out of which 25 species belonging to 11 families have been identified. Among these 11 families, more number of species (04) were observed under the Lymantriidae, Nymphalidae, Sphingidae families followed by Arctidae with three species and Erebididae, Noctuidae, Papilionidae with two species each and least number of species were observed under the families Crimbidae, Plutellidae, Geometridae and Hesperidae with one species each. The diversified flora of the campus provides suitable atmospheric conditions and protection to the caterpillars.

Keywords: Biodiversity, Lepidoptera, Moths and Butterflies, Karnatak University Campus, Dharwad

Introduction

Caterpillar is the larval stage of both moths and butterflies belonging to the order Lepidoptera. The caterpillar hatches from a tiny egg and eventually pupates and ultimately turns into an adult butterfly/ moth^[1]. The larval stage usually lasts for about two weeks to a month and we come across tri, tetra and penta moulter species. Larva is the main feeding stage of both moths and butterflies, feeds constantly and grows with amazing rate within a short period^[2].

We come across large variety of caterpillars and their corresponding moths and butterflies in nature³. Identification of caterpillar is much more difficult as the larvae of some other insects such as beetles, saw flies etc. also resemble caterpillars, but the term caterpillars is used only to denote the larvae of moths and butterflies^[4].

Among the insects, lepidopterans are most successful group of animals found in all continents except Antarctica and inhabit all terrestrial habitats ranging from desert to rain forests, from low grass lands to mountain plateau but always associated with higher plants^[5] especially angiosperms (flowering plants). Some of the caterpillar species exhibit sympatric, phoretic or parasitic mode of life style inhabiting the bodies of some organisms rather than on the plants^[6]^{7]}. Some of the caterpillars are covered with poisonous hairs or spines similar to those of wild bees and wasp stings^[8].

Around 1,80,000 Lepidopteran species are described under 46 super families and 126 sub-families^[9], out of which India harbours 18,000 species of butterflies and 10,000 species of moths and in Karnataka, 318 butterfly species have been recorded^[10].

Majority of Lepidopterans are found in the tropics, but substantial diversity exists in most of the continents, where, North America has over 700 species of butterflies and over 11,000 species of moths, while about 400 species of butterflies and 14,000 species of moths are reported from Australia^[11]. Lepidopteran diversity under different faunal regions such as, Palearctic (22,465), Nearctic (11,532), Neotropic (44,791), Afrotropic (20,491) and Indo-Australian (47,286)^[12].

There is lot of variations in caterpillars with respect to their body textures (smooth, hairs, horns and thorns on their body) coloration (green, yellow, red and black) and also the markings (strips and spots).

Generally, caterpillars of moths and butterflies are quite different from each other; however, in few species it is difficult to distinguish between the larvae of each other. All caterpillars have a segmented body consisting of head, thorax and abdomen. Usually, they have strong mandibles to chew plant leaves, three pairs of thoracic legs, five pairs of pro-legs (4 pairs of abdominal, 1 pair of caudal legs) and six pairs of simple eyes [13, 14, 15].

There is a need to study community structure, diversity and distribution of dynamic lepidopteran group with respect to different regions of our country. Hence, the present survey work was undertaken to study the diversity of caterpillars of moths and butterflies from the Karnatak University Campus, Dharwad and to create a base line data for future research work.

Materials and Methods

Study area

Karnatak University, Dharwad Campus (15° 26' 24" N and 74° 59' 3" E) is located at an elevation of 698.97m above MSL. It is commonly known as "Chota Mahabaleshwar Hill" on the western frontier of the Dharwad city (Figure-1). It is spread over an area of 750 acres with undulating topography. It covers a botanical garden, 50 Post-Graduate Departments, Hostels, Staff quarters and two Stadiums. The vegetation is of dry deciduous, endowed with more than 150 families of plants [16]. The distribution of plant density within the campus varies, with densely at botanical garden and less dense towards the road sides, staff quarters, hostels and other various departments of the KU campus. Temperature ranges between 16 to 38 °C throughout the year. It receives an annual rainfall of about 800 to 900mm.

The survey was carried out by dividing the whole campus area into following five observational sites,

Site 1: Karnatak University gate no. 1 at Srinagar, Regional science center, Rani Channamma girl's hostel and surrounding areas (Study sites Plate 1A,B).

Site 2: Rani Channamma stadium, Working womens P.G. hostel and surrounding areas (Study sites Plate 1C).

Site 3: Botanical garden, University canteen, Department of Vivekananda studies and surrounding areas (Study sites Plate 1D, E, F).

Site 4: Nijallingappa boys hostel, Bhima boys hostel, Golden jubilee building and surrounding areas (Study sites Plate 2G, H, I).

Site 5: Green garden, University administrative building, University main building, Flower garden and surrounding areas (Study sites Plate 2J, K, L).

Survey work

A regular survey was carried out weekly twice, during morning hours between 7:00am to 9:00am and evening at 4:00pm to 6:00pm from August, 2015 to March, 2016 (8 months). The observations were made by visual encounter method, by taking into consideration of habitat source, damage caused on the foliage and the fecal matter on the ground. Soon after spotting the caterpillars, they were identified in the field by using standard keys and were photographed by using NIKON D520 camera and used for further identification of few of the species where there was

confusion.

Results

During our caterpillar survey in the KU campus, Dharwad, we have collected 52 species, out of which we could identify about 25 species belonging to 11 families (Table-1 and Species Plates 1 to 5).

The maximum numbers (4 species each) of identified caterpillars belong to the family Lymantriidae, Nymphalidae and Sphingidae. All these species are polyphagous. All the species belonging to Lymantidae, are hairy caterpillars but whereas the species belonging to Nymphalidae have spiny combs and are called as Monarch butterflies. The species belonging to Sphingidae are smooth bodied having tail spine.

Table 1: Family wise distribution of identified caterpillars

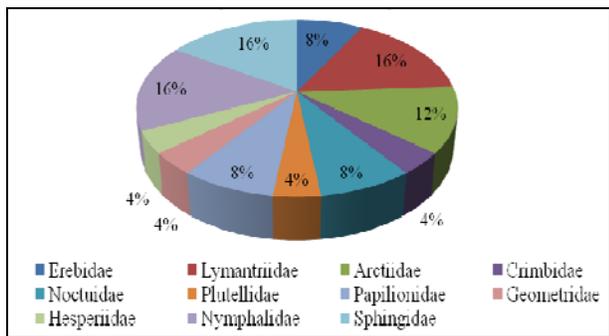
Sl. No.	Family name	Scientific name	Common name
Plate 1			
1	Erebidae	<i>Lymantria dispar</i>	Gypsy Moth
2		<i>Eudocima phalonia</i>	Fruit Piercing Moth
3	Lymantriidae	<i>Orygia leucostigma</i>	White Marked Tussock Moth
4		<i>Orygia antiqua</i>	Live Oak Tussock Moth
5		<i>Orygia australis</i>	Painted Pine Moth
6		<i>Euproctis vasquez</i>	Sweet Potato Tussock Moth
Plate 2			
7	Arctiidae	<i>Hypercompe scribonia</i>	Giant Leopard Moth
8		<i>Spilosoma oblique</i>	Sunflower Bihar Hairy
9		<i>Arctia caja</i>	Garden Tiger Moth
10	Crambidae	<i>Uresiphita reversalis</i>	Genista Broom Moth
11	Noctuidae	<i>Polytella gloriosae</i>	Lily Moth
12		<i>Spodoptera litura</i>	Taro Caterpillar
Plate 3			
13	Plutellidae	<i>Plutella xylostella</i>	Diamond Back Moth or Cabbage Moth
14	Papilionidae	<i>Graphium agamemnon</i>	Tailed Jay
15		<i>Papilio demoleus</i>	Citrus Papilla Butterfly or Citrus Swallow Tail
16	Geometridae	<i>Biston betularia</i>	Peppered Moth
17	Hesperiidae	<i>Erynnis baptisiae</i>	Wild Indigo Dusky Wing
18	Nymphalidae	<i>Danaus gilippus</i>	Queen Butterfly
Plate 4			
19		<i>Euthalia aconthea</i>	Common Baron
20		<i>Euploea core</i>	Common Crow Butterfly
21		<i>Ariadne merione</i>	Common Castor Butterfly
22	Sphingidae	<i>Deilephila elpenor</i>	Elephant Hawk Moth
23		<i>Hippotion celerio</i>	Vine Hawk Moth
24		<i>Acherontia atropos</i>	Death's Head Hawk Moth
Plate 5			
25		<i>Ceratonia undulosa</i>	Waved Sphinx Moth

Table 2: Number of caterpillar species observed at different sites of KU campus, Dharwad

Site No.	No. of species	Families
1	04	Erebidae, Papilionidae, Plutellidae, Arctidae.
2	01	Hesperiidae
3	12	Sphingidae, Nymphalidae, Cribidae, Lymantriidae, Arctidae, Geometridae, Papilionidae
4	02	Lymantriidae, Erebidae
5	06	Lymantriidae, Arctidae, Noctuidae, Nymphalidae

Table 3: Family wise percent occurrence of caterpillar species in the study area

Sl. No.	Family	No. of species	% occurrence
1	Erebidae	02	8
2	Lymantriidae	04	16
3	Arctidae	03	12
4	Cribidae	01	04
5	Noctuidae	02	08
6	Plutellidae	01	04
7	Papilionidae	02	08
8	Geometridae	01	04
9	Hesperiidae	01	04
10	Nymphalidae	04	16
11	Sphingidae	04	16



Graph 1: Pie chart showing family wise percent occurrence of caterpillar species in the study area



Study sites-Plate 1: A. Regional Science Center, Dharwad B. Rani Channamma Girl's Hostel C. Working Women's P.G D. Botanical Garden E. Department of Physics F. Department of Vivekananda Studies



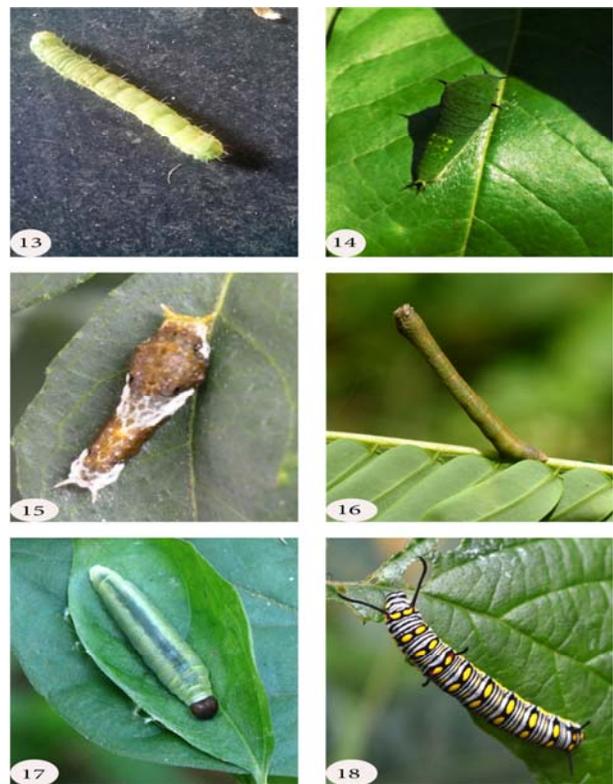
Study site-Plate 2: G. Nijalingappa Boys Hostel H. Bhima Boys Hostel I. Golden Jubilee Hall J. Green Garden K. Administrative Building L. University Main Building



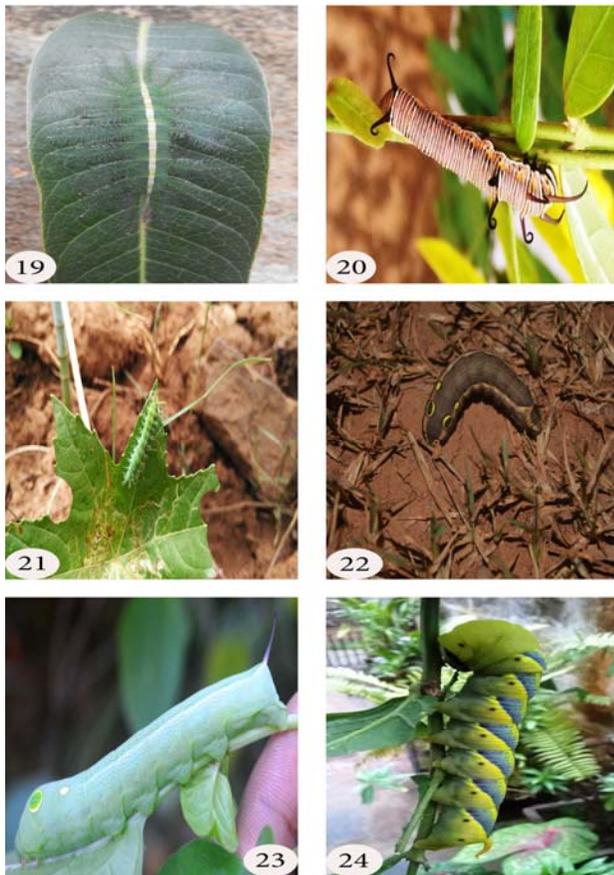
Species Plate 2: 7. Giant Leopard Moth (*Hypercompe scribonia*) 8. Sunflower Bihar Hairy (*Spilosoma oblique*) 9. Garden Tiger Moth (*Arctia caja*) 10. Genista Broom Moth (*Uresiphita reversalis*) 11. Lily Moth (*Polytella gloriosae*) 12. Taro Caterpillar (*Spodoptera litura*)



Species Plate 1: 1. Gypsy Moth (*Lymantria dispar*) 2. Fruit Piercing Moth (*Eudocima phalonia*) 3. White Marked Tussock Moth (*Orgyia leucostigma*) 4. Live Oak Tussock Moth (*Orgyia antiqua*) 5. Painted Pine Moth (*Orgyia australis*) 6. Sweet Potato Tussock Moth (*Euproctis vasquez*)



Species Plate 3: 13. Diamond Back Moth (*Plutella xylostella*) 14. Tailed Jay (*Graphium agamemnon*) 15. Citrus Papilla Butterfly (*Papilio demoleus*) 16. Peppered Moth (*Biston betularia*) 17. Wild Indigo Dusky Wing (*Erynnis baptisiae*) 18. Queen Butterfly (*Danaus gilippus*)



Species Plate 4: 19. Common Baron (*Euthalia aconthea*) 20. Common Crow Butterfly (*Euploea core*) 21. Common Castor Butterfly (*Ariadne merione*) 22. Elephant Hawk Moth (*Deilephila elpenor*) 23. Vine Hawk Moth (*Hippotion celerio*) 24. Death's Head Hawk Moth (*Acherontia atropos*)



Species Plate 5: 25. Waved Sphinx Moth (*Ceratomia undulosa*)

Discussion

Caterpillars play an important role in nature, many a times we try to avoid them thinking that they destroy our crop or garden plants and we spray some pesticides or try to remove them by hand picking and kill them. Here, we need to remember that caterpillar is an intermediate stage of butterflies and moths, most of which are beneficial to mankind. According to Food and Agriculture Organization (FAO) of United Nations (UN), caterpillars contain lot of proteins and healthy fats, even some vital minerals such as K, Ca, Zn, Fe etc. Hence, the larvae of many species are used as food in some parts of the world. Caterpillars of *Gonim brasiabelina* and *Ustater psichare* are used as food source in

Southern Africa. Also in nature, both adult moths and caterpillars serves as a source of food for insects, spiders, frogs, lizards, shrews, bats and birds etc. We all know that butterflies help in cross pollination of many of the plants. If we look from the biological point of view, if our garden is having more caterpillars then it's a good sign that there is rich biological activity going on. In the present survey also we got difference in the number of species occurring among the different sites within the campus and this can be attributed to the variation in the vegetation as well as the diversity of host plants. The KU campus harbors variety of plants belonging to around 150 families^[16] and the availability of abundant flora such as shrubs, herbs, flowering plants etc. that creates an ideal and favorable environment for these caterpillars.

If we look at the diversity of caterpillar w.r.t different sites, Site 3 had maximum number of species probably because it had Botanical garden having rich floral diversity, vegetation with diverse of food plants and also due to shady atmospheric conditions and availability of moist place, food, shelter for their survivability and less anthropogenic activities in this area compared to other sites. Less number of species (01) was noticed in Site-2 (Rani Channamma stadium, Working women's P.G. hostel and surrounding area) may be due to less availability of shady and moist places and presence of larger trees less and dry vegetation and heavy anthropogenic activities. There was moderate caterpillar diversity (2-6) in the remaining sites (1, 4 and 5) may be because of average vegetation with moderate food availability and shelter, less anthropogenic activities and so on.

We can easily differentiate between moths and butterflies but it is difficult to distinguish during caterpillar stage. But they can be identified by using taxonomic characters such as, the body colour pattern; presence of tapered tips (horns) and body hairs^[17]. Most of the caterpillars are colored either in shades or in single colour so that it is very difficult to spot them in their host plants. Some of the caterpillars are distinctively colored or have a large amount of hairs are likely to be poisonous; such caterpillars should be handled carefully. The sting of some caterpillars can cause nausea, chest ache, digestive dysfunctions and even death may occur in some sensitive people. In some cases, in fact they mimic actual thorns of trees and provide camouflage to the caterpillars^[18].

If someone finds difficulty in caterpillar identification then it is advised to rear it until it reaches adult stage, which may be easier to recognize. If we are following this method, we need to be aware of whether it is a monophagus or polyphagus and provide the leaves of their specific host plants accordingly with ideal conditions. Some caterpillars will pupate fastened to a plant stem, but you should also provide some soil or leaf litter for them to bury themselves for pupation. Some species use silk to fasten leaves together and hide inside to eat, others spin a large silk web, which protects a whole brood of caterpillars. Some caterpillars make less effort to hide themselves as they have developed other means of discouraging predators, such as a bitter taste or unpleasant hairs or bristles to irritate the throat (As some can irritate human skin or lungs, it is better not to handle any hairy caterpillar). Many such caterpillars are conspicuous as they use bright colours to warn that they are distasteful. A few large moth species have evolved caterpillars with eye-like markings, spikes that resemble stings, or weird postures, all designed to scare off predators, although they are actually harmless. In other words one should know their biology which will help the researcher to know the best time, place, host plants etc. to study their diversity effectively.

Summary and Conclusion

The survey of caterpillars was carried out in five different sites of KU Campus, Dharwad. Totally, 52 species were recorded, of which only 25 species belonging to 11 families were identified. More number (04) of species were recorded under the Lymantriidae, Nymphalidae, Sphingidae families followed by Arctidae with three species and Erebiidae, Noctuidae, Papilionidae with two species each and least number (01) of species were recorded under the families Crimbiidae, Plutellidae, Geometridae and Hesperiiidae.

As most caterpillars feed on the foliage, cell sap of plants and are totally depends on plants to complete their life cycle, the availability of rich vegetation/foilage will host maximum caterpillar diversity. In the present study also there is variation in the vegetation among the different selected sites correspondingly; we could observe variations in the number of species recorded within the KU Campus, Dharwad. This study being the preliminary survey of caterpillars further, detailed research is needed on different aspects of moths and butterflies such as, seasonal occurrence, interactions with different hosts, their biology and so on to establish some long term conclusions.

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