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Common Moths and Their Ecological Importance in Bisra Range, Rourkela Forest Division, Odisha, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Rourkela Forest Division presents a sub-tropical climatic condition with high humidity and rainfall after the onset of the monsoon. Lepidopterans are a group of insects that are potent pollinators and protectors of different terrestrial ecosystems. Among all the Lepidopterans, moths are cosmopolitan and very important. Moths are mostly nocturnal pollinators and play a vital role in the pollination of different plant species and their seed production. Besides that, they play the important role of both prey and predator in a food chain. They are less known and have always been given less importance, unlike bees and butterflies, because very few studies have been done about moths and their importance in ecosystems. A field survey was done for the documentation of some common moths' diversity in Bisra Range, Rourkela Forest Division, Odisha, India, during 2022–2023. About 20 species of common moths were reported from the study area. This study depicts the ecological importance of moths, how they are inevitable members of the food chain in different types of terrestrial ecosystems, and their interactions with other plant and animal species in the division.

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Macrobrochis gigas and *Phocoderma velutina* larvae are abundant and major defoliators of *Shorea robusta* during the rainy season; *Lymantria mathura* is a major defoliator of *Mangifera indica, Shorea robusta, Terminalia, Mitragyna,* and *Eugenia* spp.; *Xyleutes strix* and *Xyleutes persona* are stem borers; and *Phocoderma velutina* shows a relationship with a parasitic fungus.

Keywords: Moths; diversity; India; defoliators; borer; parasitic.

1. INTRODUCTION

Among the invertebrates, the phylum Arthropoda is one of the most diversified and efficient phyla in every type of ecosystem, except the oceanic benthic zone Abrol, 2019; Jamal, [1]. Pollinators are the soul of every ecosystem; they pollinate different plant species, and the majority of pollination occurs by bees and wasps (56%), followed by birds (12%), moths and butterflies (11%), flies (10%), wind (8%), and beetles (3% (Wychkyus, 2019). Adult moths mainly feed on the nectar and juice of extra-ripe fruit [2,3]. Moths belonging to the order Lepidoptera are nocturnal insects and are mainly responsible for pollinating night-blooming flowers [4]. Moths are indicators of climate change, primary consumers, potent pollinators, and crucial members of the nutrient-cycling process [5] so they are considered ecologically important insects. Moths can be easily identified by their activities, antennae structure, and wings. Unlike butterflies, moths have saw-edged antennae and drab-coloured scales on their bodies. Moths are prey to different animals like bats, lizards, amphibians, and some insectivorous birds. There are approximately 160,000 species of moths found worldwide, among them about 12,000 species found in India [6] with at least a few thousand undescribed species. Moths are divided into five families: Arctiidae, Noctuidae, Geometridae, Saturniidae, and Sphingidae. Mostly moths are infamous as dull-coloured insects and the 'poor cuisine' of butterflies. Contrary to the fact that some of the moth species have bright body colours with spectacular patterns on their wings, it is well known that invertebrates play the most important role in any type of ecosystem Cardinal et al., [7] Bashir, 2019; Shakeel, 2019).

1.1 Study Area

Rourkela Forest Division is one of the three forest divisions in Sundargarh District. Other divisions are the Sundargarh Forest Division and the Bonai Forest Division (Pradhan et al., 2023). The division has Reserved Forests, Proposed Reserved Forests, Demarcated Protected Forests, Village Forests, Protected Forests, and DLC Forests. The total forest area was computed to be 1100.43 sq. km, which is about 36.73% of the geographical area of the division. It is also known as the "Steel City of Odisha," and it is situated to the North of Sundargarh district, Odisha, India.

2. METHODOLOGY

A field survey was conducted in the monsoon months from June to July 2023, i.e., for 2 months. In the present study, preliminary data were collected during a field survey in Rourkela Forest Division, Odisha, India. A total of two surveys were done at 12 different sites, during both day and night. Each site was approximately 2–3 km away from the next site. During the field survey, moths were collected through light traps, which attracted the moths on white cloth. The photographs of attracted moths were taken and released into their wild habitat. Moth specimens were identified by the authors using their morphological characters and with the help of available literature [2].

3. RESULTS AND DISCUSSION

The survey revealed a total of 20 common moth species, out of which 18 species were in adult moth form (Plate 1) and the remaining 02 were in caterpillar form (Plate 2), belonging to 17 genera and 10 different families from study areas (Table 1). Among the reported 20 common moth species, 5 were considered serious pests and ecologically important, and 1 moth species was found to have prey-predator interaction with a parasitic fungus. The common moth diversity of the study areas indirectly portrayed the ecological and biodiversity status of the study areas. From the reported 20 species of common moths, 2 species belong to the family Cossidae, 7 species to Erebidae, 1 species to Eupterotidae, 3 species to Geometridae, 2 species to Sphingidae, and 1 species to Limacodidae, Lasiocampidae, Notodontidae, Saturniidae, and Uraniidae, respectively. The study areas were dominated by the family Erebidae, followed by Geometridae, Cossidae, and Sphingidae (Fig. 1). *Macrobrochis gigas* and *Phocoderma velutina*

larvae were abundant and major defoliators of *Shorea robusta* during the rainy season; *Lymantria mathura* was found to be a major defoliator of *Mangifera indica, Shorea robusta, Terminalia, Mitragyna,* and *Eugenia* spp.; *Xyleutes strix* and *Xyleutes persona* were stem borers; and *Phocoderma velutina* showed a relationship with a parasitic fungus. It was observed that *Phocoderma velutina* and *Macrobrochis gigas* were very common in the study areas, and their caterpillars were abundant during the monsoon season. The present study revealed that the study area is home to one of the ecologically important fungi, *Cordyceps* spp. which is a parasitic fungus that grows on different wasps and caterpillars of *Phocoderma velutina.* The predator fungus growth was facilitated by the high humidity, rainfall, and diversified species composition of the study area.

Table 1. Checklist of common moths recorded in the study areas

Family	Scientific name	Species descriptor
Cossidae	*Xyleutes strix*	Guillou, 1841
	Xyleutes persona	Linnaeus, 1758
Erebidae	*Thyas coronata*	Fabricius,1775
	Lymantria semicincta	Walker, 1855
	Lymantria mathura	Moore, 1866
	Lymantria marginata	Walker,1855
	Eudocima materna	Linnaeus, 1767
	Macrobrochis gigas	Walker,1854
	Mocis undata	Fabricius, 1775
Eupterotidae	*Eupterote hibisci*	Fabricius, 1775
Geometridae	*Eumelea ludovicata*	Guenee, 1858
	Hyperythra lutea	Stoll, 1781
	Scopula ornata	Scopoli, 1763
Limacodidae	*Phocoderma velutina*	Koller, 1844
Sphingidae	*Ambulyx moorei*	Moore,1858
	Theretra silhetensis	Walker, 1856
Saturniidae	*Loepa katinka*	Westwood, 1848
Lasiocampidae	*Trabala vishnou*	Lefebvre, 1827
Notodontidae	*Phalera grotei*	Moore, 1859
Uraniidae	*Acropteris striataria*	Clerck, 1764

Plate 1. Some common moths in study areas

1) Loepa katinka 2) Lymantria semicincta 3) Thyas coronata 4) Lymantria marginata 5) Theretra silhetensis 6) Ambulyx moorei 7) Phalera grotei 8) Eudocima materna

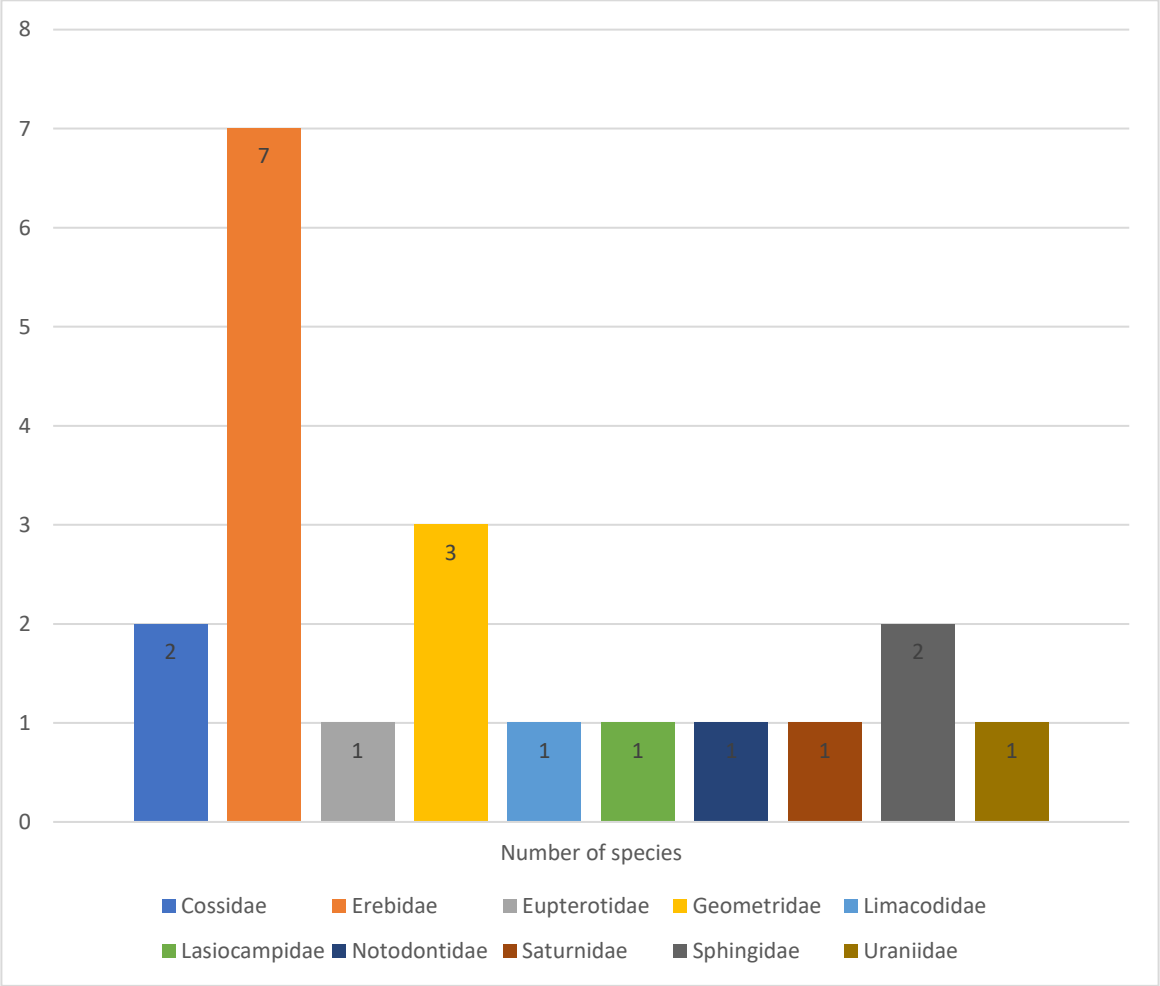

Fig. 1. Moth species diversity in study areas

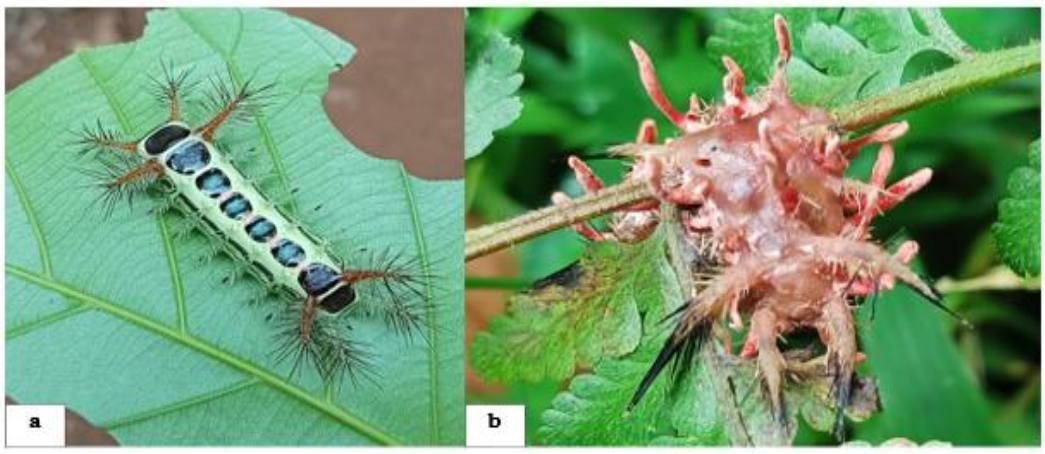

Plate 2. a. Caterpillar of *Phocoderma velutina*, b. *Cordyceps* spp. infested caterpillar of *P. velutina*

Other researchers have also studied moth diversity and reported their diversity in different parts of the country. In 2018, Jena et al. [8] reported 30 different species of moths from the Gupteswar, Proposed Reserve Forest of Eastern Ghats, Koraput, Odisha, India. In 2022, Sanath

et al. reported 31 moth species of 12 different families from Barsuan Range, Bonai Forest Division, Odisha, India. In 2019, Singh et al. [9] reported 486 species of moths from different districts of Punjab. Alex et al. [10] also reported moths of 503 different species from the Kavvai river basin of Kerala. In 2021, Pawar et al. [11] reported 45 moth species from Panvel, Navi Mumbai, Maharashtra, India. In 2021, Singh et al. [12] reported 17 moth species from the Lalwan Community Reserve of Punjab.

3.1 Ecological Importance of Moths

Moths are very important members of different terrestrial ecosystems. Most of these are nocturnal, some are diurnal and crepuscular, and they mostly pollinate night-blooming flowers. It is well known that moths play an important role in different types of food chains as herbivores, creating connections between primary producers and consumers at different trophic levels of the food chain, food web, and food pyramid. In the present study, it was observed that the larvae of *Phocoderma velutina* (Koller, 1844) were infested by *Cordyceps* spp. (a parasitic fungus). *Cordyceps* spp. contains one of the polysaccharides, which is bioactive, exhibits a wide range of bioactivities and is used as a medicinal herb [13,14]. The infestation and parasitic growth of *Cordyceps* spp. inside the body of *P. velutina,* which controls the brain and derives nutrients and then finally leads to larval death, is a unique parasitic and prey-predator relationship. It shows that besides linking primary producers with different consumers as an herbivore, moths are also linking parasitic organisms with other organisms (Plate 2).

4. CONCLUSION

Rourkela Forest Division reveals biodiversity and different ecosystems, almost like the Mayurbhanj district in Odisha, India. The study areas were dominated by moths of the families Erebidae, Geometridae, Cossidae, and Sphingidae. During the monsoon season, a large number of caterpillars of *Phocoderma velutina* of the family Limacodidae and *Macrobrochis gigas* of the family Erebidae feed on their host plants like *Mangifera indica*, *Artocarpus heterophyllus,* and *Shorea robusta*. The study area offers dry deciduous and moist green forests of Sal and mixed-type forest ecosystems, along with their associated plant and animal species. The peculiarity of the study area is that its humid weather promotes the growth of *Cordyceps* spp., which is a parasitic fungus species. The present study highlights the diversified terrestrial ecosystems with some economically and ecologically important species and brings more attention to the conservation of the habitat of the Royal Bengal Tiger.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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