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A preliminary report on the diversity of moths (Insecta: Lepidoptera: Heterocera) from Daringbadi, Odisha, India

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Abstract
A preliminary survey of moth diversity was conducted in the forested regions of Daringbadi, Kandhamal district, Odisha, India, from November 12 to 16, 2024, using light trapping methods. This study recorded a total of 52 moth species belonging to 44 genera and distributed across 12 families. Among these, the family Erebidae was the most dominant, contributing 22 species, followed by Crambidae and Geometridae (6 species each), Noctuidae (5 species), and other families including Drepanidae, Hyblaeidae, Lacturidae, Nolidae, Notodontidae, Pyralidae, Sphingidae, and Tineidae represented by 1–3 species each.
Rare sightings included species such as *Creatonotos gangis-interrupta* complex and *Plodia interpunctella*, each represented by a single observed individual. The dominance of Erebidae indicates a high level of ecological adaptability and richness within the Daringbadi ecosystem. This investigation marks the first systematic documentation of moth diversity in this region and emphasizes the area's role as a potential hotspot for lepidopteran diversity, thereby underlining the need for sustained biodiversity monitoring and taxonomic research.

Keywords: Moth diversity, Daringbadi, Odisha, light trapping, species diversity, ecological adaptability, biodiversity monitoring, lepidopteran diversity, rare moth species

Introduction
Moths (Order: Lepidoptera) are among the most diverse and ecologically significant groups of insects, playing essential roles as pollinators, prey for various organisms, and indicators of environmental health. Globally, moths are estimated to comprise more than 160,000 species, with India accounting for approximately 10,694 recorded species from 75 families (Sidhu, 2023; Zhang, 2011) [6, 9]. These nocturnal insects are pivotal in sustaining food webs and facilitating pollination in nocturnal ecosystems (Dar *et al*., 2021) [2].
Daringbadi, located in the Eastern Ghats of Odisha and popularly known as the "Kashmir of Odisha," offers a unique microclimate with altitudes averaging 3,000 feet above sea level. The region features a mosaic of tropical moist deciduous forests, coffee plantations, bamboo groves, and rolling hills, which together support a rich diversity of flora and fauna (Kandhamal District Statistical Handbook, 2013) [3]. Despite its ecological richness, the moth fauna of Daringbadi remains largely undocumented.
The present study aims to bridge this knowledge gap by documenting the diversity and abundance of moth species in the region. The outcomes of this study provide baseline data for future ecological and conservation research, especially in the context of climate change and habitat disturbance.

Study Site
This research was carried out in the forested landscape of Daringbadi (19.8955°N, 84.1582°E), located in the Kandhamal district of Odisha, India. Characterized by moderate to cool temperatures and dense vegetation, the area is well-known for its biodiversity. Fieldwork was conducted during the post-monsoon season in mid-November, when moth activity is typically high due to stable climatic conditions.
During the study period, daytime temperatures ranged from 18°C to 22°C, while nighttime temperatures dropped to 10°C–13°C. Light to moderate evening showers were recorded on two days, contributing to increased nocturnal insect activity. The study site featured hilly terrain interspersed with dense deciduous and semi-evergreen forests, waterfalls, and minimal artificial lighting, thus offering ideal conditions for effective light-trap sampling (Figure 1).

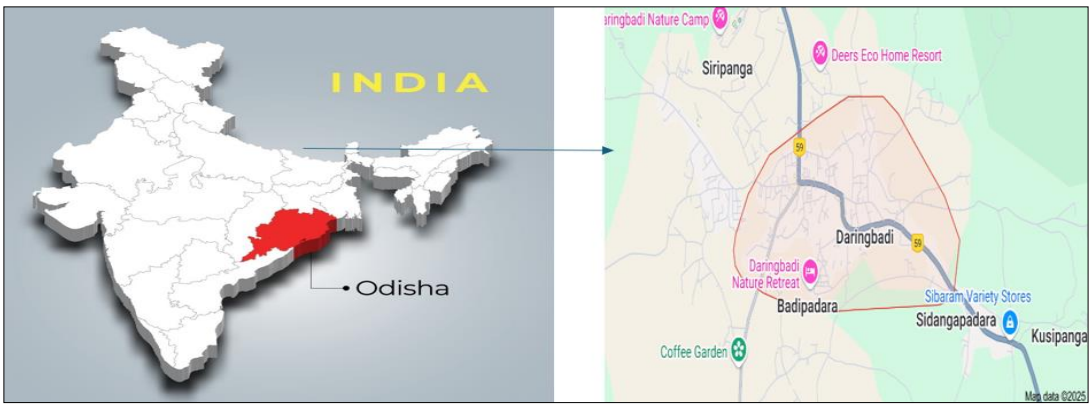

Fig 1: study site

Fig 2: Box Type Light Trap Used to Capture Moths

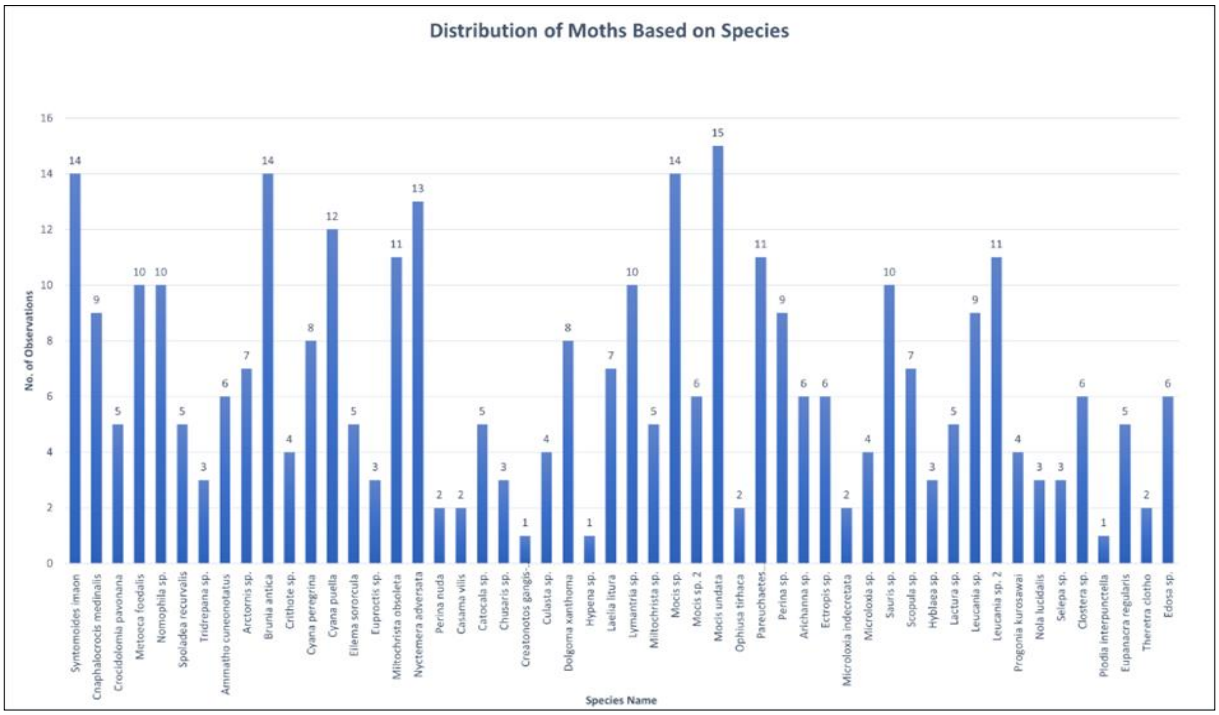

Fig 3: Distribution of moths based on species

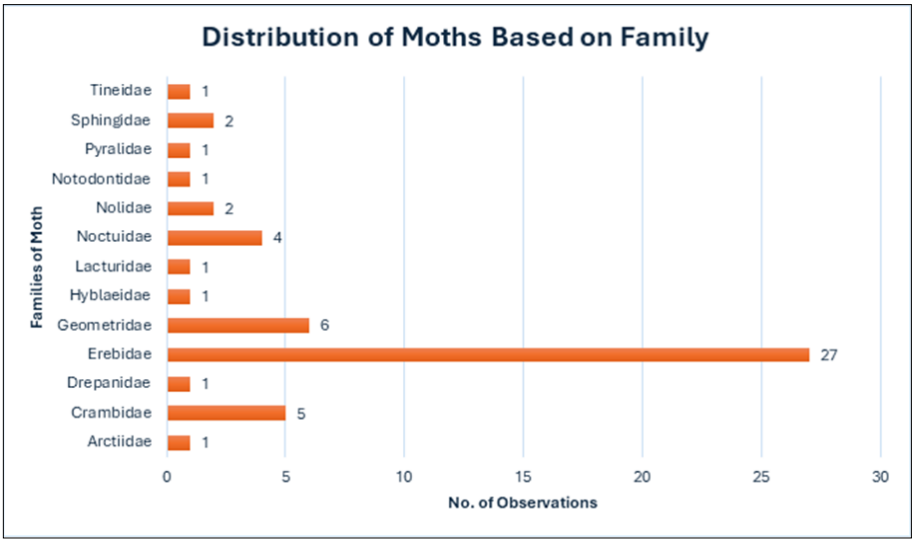

Fig 4: Distribution of moths based on family

Materials and Methods

1. Collection of Moths

Moth specimens were collected using a box-type light trap fitted with a 160W mercury vapor lamp powered by a portable generator. The trap was operated from 6:00 p.m. to 1:00 a.m. each night. Moths attracted to the light were collected using hand nets and temporarily stored in killing jars charged with ethyl acetate. Specimens were then pinned and spread using insect stretching boards to ensure uniform wing display. These were later stored in airtight entomological boxes lined with naphthalene to prevent fungal growth and pest damage. Field collection was carried out with appropriate care to minimize habitat disturbance.

2. Identification of Moths

Collected specimens were submitted to the Entomology Laboratory, Vidyasagar College, Salt Lake Campus, Kolkata, for identification. Standard taxonomic keys and available literature, including online databases such as the India Biodiversity Portal and moths of India, were consulted for species-level identification (Singh *et al*., 2023). Voucher specimens were preserved for future reference (Figure 2).

Table 1: Checklist of Different Moth Species Observed

Sl. No.	Family	Scientific Name	Total No. Observed
1	Arctiidae	*Syntomoides imaon* (Cramer, 1780)	14
2	Crambidae	*Cnaphalocrocis medinalis* (Guenee, 1854)	9
3	Crambidae	*Crocidolomia pavonana* (Fabricius, 1794)	5
4	Crambidae	*Metoeca foedalis* (Guenée, 1854)	10
5	Crambidae	*Nomophila* sp.	10
6	Crambidae	*Spoladea recurvalis* (Fabricius, 1775)	5
7	Drepanidae	*Tridrepana* sp.	3
8	Erebidae	*Ammatho cuneonotatus* (Walker, 1855)	6
9	Erebidae	*Arctornis* sp.	7
10	Erebidae	*Brunia antica* (Walker, 1854)	14
11	Erebidae	*Crithote* sp.	4
12	Erebidae	*Cyana peregrina* (Walker, 1854)	8
13	Erebidae	*Cyana puella* (Drury, 1773)	12
14	Erebidae	*Eilema sororcula* (Hufnagel, 1767)	5
15	Erebidae	*Euproctis* sp.	3
16	Erebidae	*Miltochrista obsoleta* (Moore, 1878)	11
17	Erebidae	*Nyctemera adversata*	13
18	Erebidae	*Perina nuda* (Fabricius, 1787)	2
19	Eribidae	*Casama vilis* (Walker, 1865)	2
20	Eribidae	*Catocala* sp.	5
21	Eribidae	*Chusaris* sp.	3
22	Eribidae	*Creatonotos gangis-interrupta complex* (Linnaeus, 1763)	1
23	Eribidae	*Culasta* sp.	4
24	Eribidae	*Dolgoma xanthoma* (Singh, Kirti, Datta & Volynkin, 2019) [7]	8
25	Eribidae	*Hypena* sp.	1
26	Eribidae	*Laelia litura* (Stephens, 1828)	7
27	Eribidae	*Lymantria* sp.	10
28	Eribidae	*Miltochrista* sp.	5
29	Eribidae	*Mocis* sp.1	14
30	Eribidae	*Mocis* sp. 2	6
31	Eribidae	*Mocis undata* (Fabricius, 1775)	15
32	Eribidae	*Ophiusa tirhaca* (Cramer, 1777)- Green Drab	2
33	Eribidae	*Pareuchaetes pseudoinsulata* (Régo Barros, 1956)	11
34	Eribidae	*Perina* sp.	9
35	Geometridae	*Arichanna* sp.	6
36	Geometridae	*Ectropis* sp.	6
37	Geometridae	*Microloxia indecretata* (Walker, 1863)	2
38	Geometridae	*Microloxia* sp.	4
39	Geometridae	*Sauris* sp.	10
40	Geometridae	*Scopula* sp.	7
41	Hyblaeidae	*Hyblaea* sp.	3
42	Lacturidae	*Lactura* sp.	5
43	Noctuidae	*Leucania* sp.1	9
44	Noctuidae	*Leucania* sp. 2	11
45	Noctuidae	*Progonia kurosawai* (Owada, 1987)	4
46	Nolidae	*Nola lucidalis* (Walker, 1864)	3
47	Nolidae	*Selepa* sp.	3
48	Notodontidae	*Clostera* sp.	6
49	Pyralidae	*Plodia interpunctella* (Hübner, 1813)	1
50	Sphingidae	*Eupanacra regularis* (Butler, 1875)	5
51	Sphingidae	*Theretra clotho* (Drury, 1773)	2
52	Tineidae	*Edosa* sp.	6

Table 2: Diversity Indices of Moth Families

Sl. No	Family	Simpson's diversity index (D_S)	Shannon-Weiner index (H)	Pielou's evenness index (J')	Margalef's richness (D_{MG})
1	Arctiidae	1	0	0	0
2	Crambidae	0.197	1.567	0.971	1.092
3	Drepanidae	1	0	0	0
4	Erebidae	0.684	3.321	1.007	4.965
5	Geometridae	0.173	1.697	0.947	1.406
6	Hyblaeidae	1	0	0	0
7	Lacturidae	1	0	0	0
8	Noctuidae	0.351	1.025	0.933	0.629
9	Nolidae	0.4	0.693	1.0	0.558
10	Notodontidae	1	0	0	0
11	Pyralidae	1	0	0	0
12	Sphingidae	0.524	0.599	0.863	0.514
13	Tineidae	1	0	0	0

Results

The survey recorded 52 moth species belonging to 44 genera across 12 families. The most dominant family was Erebidae, comprising 22 species, followed by Crambidae and Geometridae (6 species each), and Noctuidae (5 species). Families such as Drepanidae, Nolidae, Notodontidae, Pyralidae, Sphingidae, Lacturidae, Hyblaeidae, and Tineidae were represented by fewer species (1–3).

Quantitative analysis using biodiversity indices revealed significant diversity within the Erebidae and Crambidae families. Diversity metrics such as Simpson's Index, Shannon-Weiner Index, Pielou's Evenness, and Margalef's Richness Index were calculated to assess family-wise distribution and ecological dominance (Table 2).

Fig 5: Pictures of all moth species observed through light traps at Daringbadi

1. Syntomoides imaon, 2. Cnaphalocrocis medinalis, 3. Crocidolomia pavonana, 4. Metoeca foedalis, 5. Nomophila sp., *6. Spoladea recurvalis, 7. Tridrepana* sp., *8. Ammatho cuneonotatus, 9. Arctornis* sp., *10. Brunia antica, 11. Crithote* sp., *12. Cyana peregrina, 13. Cyana puella, 14. Eilema sororcula, 15. Euproctis* sp., 16. *Miltochrista obsoleta, 17. Nyctemera adversata, 18. Perina nuda, 19. Casama vilis, 20. Catocala* sp., *21. Chusaris* sp., *22. Creatonotos gangis-interrupta complex, 23. Culasta* sp., *24. Dolgoma xanthoma, 25. Hypena* sp., *26. Laelia litura, 27. Lymantria* sp., *28. Miltochrista* sp., *29. Mocis* sp.1, *30. Mocis* sp. 2, *31. Mocis undata, 32. Ophiusa tirhaca, 33. Pareuchaetes pseudoinsulata, 34. Perina* sp., *35. Arichanna* sp., *36. Ectropis* sp., 37. *Microloxia indecretata, 38. Microloxia* sp., *39. Sauris* sp., *40. Scopula* sp., *41. Hyblaea* sp., *42. Lactura* sp., *43. Leucania* sp.1, *44. Leucania* sp.2, *45. Progonia kurosawai, 46. Nola lucidalis, 47. Selepa* sp., *48. Clostera* sp., *49. Plodia interpunctella, 50. Eupanacra regularis, 51. Theretra clotho, 52. Edosa* sp.

Discussion

The results from this preliminary study highlight Daringbadi as a region of significant lepidopteran diversity, particularly for the Erebidae family. The observed richness and evenness values for Erebidae suggest it is not only the most speciose family in the region but also widely adapted to local environmental conditions.

Families such as Crambidae and Geometridae also showed considerable representation, likely due to the presence of host plants and microhabitats within the moist deciduous forest. The low representation of Sphingidae and Pyralidae might be attributed to their more specialized habitat and feeding requirements.

The presence of rare or low-abundance species like Creatonotos gangis-interrupta complex and Plodia interpunctella is significant and warrants further investigation. These may indicate the presence of unique microhabitats or migratory patterns.

Overall, this study offers a foundational understanding of moth diversity in Daringbadi. It also highlights the need for periodic surveys and long-term monitoring to assess changes in species composition due to environmental stressors or anthropogenic influences.

Conclusion

The present study represents the first comprehensive documentation of moth diversity in the Daringbadi forest region. With 52 species identified across 12 families, the findings emphasize the ecological significance of this area and call for its conservation. Future studies incorporating seasonal data and larval host plant associations will provide deeper insights into the ecological dynamics of moth populations in this part of the Eastern Ghats.

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