



## MOTH DIVERSITY IN THE MAHAMAYA RESERVE FOREST, KOKRAJHAR, ASSAM

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### ABSTRACT

The present study was conducted in the Mahamaya Reserve Forest area of Kokrajhar, Assam for one year from 2021 to 2022 to record the moths found in the area. A total of 129 species were identified, belonging to 20 families and 114 genera. The most predominant are the Erebidae and Crambidae, with 13 species being identified as new records from this region of Assam. The diversity indices revealed moderate dominance (D 0.19) of moths in the study sites. Simpson diversity with 0.8, Shannon diversity presented 2.1 moderate diversity. Margalef index value with 4.012 at par and Berger-Parker index 0.3 indicated a good diversity of moths in the region.

**Key words:** Assam, Biodiversity, Entomofauna, moths, Lepidoptera, Heterocera, Crambidae, Erebidae, new record, Saturniidae, Kokrajhar, reserve forest

Moths are a diverse group of insects of the order Lepidoptera. Moths are characterized by their wings which are open when in resting position. The wings are covered by scales just like butterflies but are comparatively dull in color. The antennae are feather shaped and straight (Scoble, 1995). Moths are nocturnal insects and found to be more prevalent in summer than in winter. Moths live in diverse habitats. Adult moths feed on plant sap from flowers using their long proboscis and larval forms feed directly on leaves (Krenn, 2010). Moths are very sensitive to changes on their environment. They are good indicators of environmental degradation and can be used to monitor environmental changes in an area (Van Khen, 2006). There is recorded evidence that moths adapt ecological changes in order to survive in particular environments (Coulthard et al., 2019). There are a number of global records that describe human catalyzed effects on moth fauna. One of the most well-known examples is the case of industrial melanism recorded in Europe (Brakefield, 1987). The total number of moth species recorded worldwide is estimated to be around 1,74,250 species belonging to 126 families and 46 superfamilies. The approximate number of moths recorded from India is 12000 species belonging to 41 families (Elanchezhian et al., 2014). In case of North East India, the available records report 265 species of moths belonging to 1,519 genera under 60 families of 24 superfamilies divided under 5 clades. The maximum moth diversity is reported from Meghalaya (2,247 species), followed by Assam (1,365 species), Nagaland (855 species), Manipur (502

species), Mizoram (463 species) and Tripura (403 species) (Joshi et al., 2021).

The recent records show constant decline in moth species around the world. It can be easily presumed that constant human interference in the ecosystem cause unparallel effects on the insect fauna especially on insects easily susceptible to environmental changes such as moths. The present study was undertaken with the intention of recording the diversity of moths in a protected forest area which is not completely debarred from anthropological influences due to its location near large human settlements. The Mahamaya Reserve Forest is located in the North East of India in the state of Assam. It falls in the Indo-Burma biodiversity hotspot. The area is rich in forest resources and is especially reserved for trees like *Shorea robusta*, *Tectona grandis* and many other medicinal and valuable plants. The area also has a rich entomofauna. As the human influence grows in the area then it is inevitable that the insect population will suffer. Thus, it is important to record the insect population. In the present study the focus was placed mostly on moths, one of the insects that might suffer the most due to the environmental changes. Simple survey methods were used and insects were identified through photographs. The study was an attempt to make a preliminary record of the moth species found in the Mahamaya Reserve forest.

### MATERIALS AND METHODS

The study area selected for the study was Mahamaya

Reserve Forest under Khoraghat Range, Porbatjhora division, Kokrajhar, Assam, India. The forest is spread over a total area of 99.13°59 ha and extends from 26.40°1436 N to 90.26°6701 E with an elevation ranging upto 155 feet above the sea level. The climate is warm and temperate with an average annual temperature of around 24.3°C and rainfall of 3139 mm. The seasons change between pre-monsoon, monsoon, retreating-monsoon and winter. Field visits were undertaken every seven days for a year, from August, 2021 to July, 2022. The majority of insects were photographed between 7- 10 pm at night. All visual sightings were recorded with photographs wherever possible. A number of species were collected using light traps, sweep nets as well as by handpicking methods. The species thus recorded were identified using available literature such as Moore (1880-1840), Hampson (1891-1896), Bell and Scott (1937), Barlow (1982), Holloway (1983-2011), Pinratana and Lampe (1990) and Kirti and Singh (2015- 2016). The classification system forwarded by Van Nieuwerkerken et al. (2011) was followed. The statistical parameters included in the study are Simpson index, Shannon index, Evenness index, Brillouin index, Menhinick index, Margalef index, Equitability Index, Fisher index, Berger- Parker index and Chao index. Statistical analysis was done by PAST v4 software.

## RESULTS AND DISCUSSION

During the study period a total of 129 species of moths were recorded, and those belong to 20 families and 114 genera (Table 1). The dominant genera among these were Erebidae, Crambidae, Geometridae Saturniidae, Noctuidae mostly Erebidae and Crambidae. Erebidae, Crambidae and Saturniidae were found in almost all seasons. The other groups were mostly observed in summer and occurred very rarely in winter months. Erebidae, Cambidae, Geometridae, Noctuidae appeared most frequently in the study area while Limantridae, Drepanidae, Eupterotidae, Tineidae were found on rare occasions. The diversity indices revealed moderately dominance (D 0.19), Simpson diversity was found to be 0.8 and Shannon diversity presented 2.1 moderate diversity. Margalef index value (4.01) was at par, evenness was ranging from 0.38 to 0.53 and Berger-Parker index 0.3 indicated a good diversity of moths in the region (Table 2).

The Euclidean similarity index (Bray-Curtis) presented similarity among the Geometridae with Noctuidae at the highest level of similarity in diversity of their association. The genetic similarity base found to be highly similar and originates from Erebidae and

Crambidae. Among all the species of moths recorded from the area of study only a few families appeared all year long. While in case of other families only a few sightings were recorded over the course of a year. Among all the species 13 were recorded for the first time in this region of Assam. The species are *Cnaphalocrocis medinalis*, *Urola nivelis*, *Nacoleia ostasema*, *Botyodes diniasalis*, *Prasinocyma ocyptera*, *Lochmaeus sbillineata*, *Epiphyas postvittana*, *Metoea foederalis*, *Cleora inoffensa*, *Omiodes tristralis*, *Eusobena paraphragma*, *Ambulyx pryeri*, *Isocentris filalis*, *Orvasca subnotata*. North East India is a biodiversity hotspots and is the home to a large number of unique species of plants and animals (Chatterjee et al., 2006). Butterflies and moths form an important of that biological diversity. Around 85 species of Butterflies were recoded from the area, the latest butterfly and moth recorded from all of North East emerging in more than 500 species. In the year 2021 Mrunalini Sonne and Shreyas Gaikwad documented 40 moth species from the Ziro in lower subansiri district of Arunachal Pradesh. Subhasish Arandhra et al., 2017, documented 333 macro moths from Tinisukia district of Assam in the year of 2013-2016. Rose documented 81 moth fauna from Jatinga Assam in 2002. Some of the moths are the major pest like *Hyposidra talaca* it is a major pest of tea, *Leucinodes orbonalis* also known as brinjal fruit or shoot borer a pest of brinjal.

Both adult moths and their caterpillars are food for a wide variety of wildlife, including other insects, spiders, frogs, toads, lizards, shrews, hedgehogs, bats and birds. Since they are so widespread and found in so many different habitats, and are so sensitive to changes, moths are particularly useful as indicator species. Areas rich in butterflies and moths are rich in other invertebrates. These collectively provide a wide range of environmental benefits, including pollination and natural pest control. Moths and butterflies are important elements of the food chain and are prey for birds, bats and other insectivorous animals (for example, in Britain and Ireland, Blue Tits eat an estimated 50 billion moth caterpillars each year). Butterflies and moths support a range of other predators and parasites, many of which are specific to individual species, or groups of species. The unique biogeography of the areas where the forests ecosystems merge with urban settlements provides an interesting canvas to study biodiversity. Especially in case of moths which are easily affected by environmental disturbances, these types of areas are notable choice of habitat. The area is constantly under anthropological stress but still home

Table 1. Showing list of moth species Mahamaya Reserve Forest

S. No.	Species name	No of individuals	S. No.	Species name	No of individuals
Erebidae			50	<i>Glyphodes caesalis</i> (Walker, 1859)	143
1	<i>Asota caricae</i> (Fabricius, 1775)	110	51	<i>Eoophyla</i> spp (C. Swinhoe, 1900)	65
2	<i>Speiradonia mutabilis</i> (Fabricius, 1794)	98	52	<i>Nacoleia octasema</i> (Meyrick, 1886)	145
3	<i>Eudocima sikhimensis</i> (Billberg, 1820)	120	53	<i>Diaphania indica</i> (Saunders, 1851)	257
4	<i>Nepita conferta</i> (Moore, 1860)	67	54	<i>Botyodes diniasalis</i> (Walker, 1859)	98
5	<i>Dysgonia stuposa</i> (Fabricius, 1787)	95	55	<i>Heortia vitessoides</i> (Moore, 1855)	97
6	<i>Orgyia postica</i> (Walker, 1855)	134	56	<i>Omiodes tristrialis</i> (Bremer, 1864)	254
7	<i>Dasychira</i> spp (Hubner, 1809)	76	57	<i>Isocentris filalis</i> (Guenée, 1854)	190
8	<i>Cretonotus transiens</i> (Walker, 1855)	220	58	<i>Spoladea recurvalis</i> (Fabricius, 1775)	167
9	<i>Euchromia polymena</i> (Linnaeus, 1758)	189	59	<i>Cydalima laticostalis</i> (Guenée, 1854)	198
10	<i>Pareuchaetes pseudoinculata</i> (Regobarros, 1956)	185	60	<i>Patania balteata</i> (Fabricius, 1798)	210
11	<i>Tussock</i> spp (Hampson, 1893)	298	61	<i>Cnaphalocrocis poeyalis</i> (Boisduval, 1833)	118
12	<i>Euproctis lutea</i> (Fabricius, 1775)	198	62	<i>Pleuroptya iopasalis</i> (Walker, 1859)	98
13	<i>Anomis flava</i> (Fabricius, 1775)	67	63	<i>Meteoca foederalis</i> (Guenée, 1854)	200
14	<i>Cretonotus gangis</i> (Linnaeus, 1763)	339	64	<i>Pleuroptya ruralis</i> (Scopoli, 1763)	209
15	<i>Trigonodes hyppasia</i> (Cramer, 1779)	85	65	<i>Pycnarmon jaguaralis</i> (Guenée, 1854)	187
16	<i>Nyctemera adversata</i> (Schaller, 1788)	136	66	<i>Someodes cancellalis</i> (Zeller, 1852)	124
17	<i>Mitochrista gratiosa</i> (Guerin-Meneville, 1843)	49	67	<i>Congethes punctifiralis</i> (Guenée, 1854)	176
18	<i>Barsine rufumdefecta</i> (Walker, 1854)	42	68	<i>Omphisa anastomosalis</i> (Guenée, 1854)	93
19	<i>Catocala ilia</i> (Schränk, 1802)	18	69	<i>Pycnarmon lactiferalis</i> (Walker, 1859)	145
20	<i>Egnasia</i> spp (Walker, 1859)	45	70	<i>Meroctena tullalis</i> (Walker, 1859)	165
21	<i>Spilosoma obliqua</i> (Walker, 1855)	178	71	<i>Eurrhyarodes tricoloralis</i> (Zeller, 1852)	74
22	<i>Eudocima salaminia</i> (Cramer, 1777)	154	72	<i>Arthroschista hilaralis</i> (Walker, 1859)	188
23	<i>Syntomoides imaon</i> (Cramer, 1780)	300	73	<i>Agriphilas traminella</i> (Denis, 1775)	78
24	<i>Brunia antica</i> (Walker, 1854)	20	74	<i>Cirrhochrista fumipalpis</i> (C. felderet, 1875)	87
25	<i>Eressa confinis</i> (Walker, 1854)	175	Geometridae		
26	<i>Eilema</i> spp (Hubner, 1819)	39	75	<i>Prasinocyma ocyptera</i> (Meyrick, 1888)	59
27	<i>Lyclene</i> spp (Moore, 1860)	168	76	<i>Thalassodes immissaria</i> (Walker, 1861)	107
28	<i>Mocis frugalis</i> (Fabricius, 1775)	238	77	<i>Scopula</i> spp (Schränk, 1802)	270
29	<i>Dasychira</i> spp (Hubner, 1823)	175	78	<i>Cleora sabulata</i> (Curtis, 1825)	174
30	<i>Orvasca subnotata</i> (Walker, 1865)	59	79	<i>Chorondna strixaria</i> (Guenée, 1858)	67
31	<i>Barsine cuneonotata</i> (Walker, 1855)	54	80	<i>Eumelea</i> spp (Duncan, 1841)	49
32	<i>Erebus caprimulgus</i> (Fabricius, 1781)	185	81	<i>Borbachia punctipardaria</i> (Moore, 1887)	87
33	<i>Cyana coccinea</i> (Moore, 1878)	132	82	<i>Agathia lycaenaria</i> (Kollar, 1848)	54
34	<i>Erebus terminitincta</i> (Gaede, 1938)	130	83	<i>Scopula straminea</i> (Felder, 1875)	29
35	<i>Manulea lurideola</i> (Zincken, 1817)	98	84	<i>Hyposidra talaca</i> (Walker, 1860)	74
36	<i>Arctornis submarginata</i> (Walker, 1855)	87	Noctuidae		
37	<i>Ericeia</i> spp (Walker, 1858)	75	85	<i>Chalciope mygdon</i> (Cramer, 1777)	123
38	<i>Arna pseudoconspersa</i> (Strand, 1914)	50	86	<i>Thysanoplusia orichalcea</i> (Fabricius, 1775)	50
39	<i>Rhynchina obliqua</i> (Koller, 1844)	96	87	<i>Chasmina</i> spp (Walker, 1856)	134
40	<i>Pseudoblabes oophora</i> (Zeller, 1853)	78	88	<i>Spodoptera ornithogalli</i> (Guenée, 1852)	75
41	<i>Simpliciabi marginata</i> (Walker, 1864)	36	89	<i>Acontia lucida</i> (Hufnagel, 1766)	19
42	<i>Hypena laceratalis</i> (Walker, 1859)	45	90	<i>Bastilla cramerii</i> (Moore, 1885)	150
43	<i>Euchromia polymena</i> (Hubner, 1819)	254	91	<i>Dysgonia algia</i> (Linnaeus, 1767)	40
Crambidae			92	<i>Amyna axis</i> (Guenée, 1852)	67
44	<i>Parotis marginata</i> (Hampson, 1893)	233	93	<i>Condiaca illecta</i> (Walker, 1865)	59
45	<i>Leucinodes orbonalis</i> (Guenée, 1854)	287	94	<i>Pindara illibata</i> (Fabricius, 1775)	54
46	<i>Eusobena praphragma</i> (Meyrick, 1889)	34	95	<i>Spodoptera mauritia</i> (Boisduval, 1833)	90
47	<i>Maruca vitrata</i> (Fabricius, 1787)	206			
48	<i>Cnaphalocrocis medinalis</i> (Guenée, 1854)	145			
49	<i>Paraponyx fluctuosalis</i> (Meyrick, 1899)	267			

(contd.)

(contd. Table 1)

S. No.	Species name	No of individuals	S. No.	Species name	No of individuals
Sphingidae			Pyralidae		
96	<i>Theretra nessus</i> (Drury, 1773)	109	116	<i>Endotricha flammealis</i> (Denis, 1775)	09
97	<i>Theretra silhetensis</i> (Walkar, 1856)	183	117	<i>Pyralis pictalis</i> (Curtis, 1834)	07
98	<i>Ambulyx pryri</i> (Distant, 1887)	18	Limaecodidae		
99	<i>Macroglossum sitiene</i> (Walker, 1856)	124	118	<i>Parasa lepida</i> (Cramer, 1799)	13
100	<i>Pergesa acteus</i> (Cramer, 1779)	90	Cossidae		
101	<i>Acosmeryx anceus</i> (Stoll, 1781)	54	119	<i>Xyleutes mineus</i> (Cramer, 1779)	08
Saturniidae			Zygaenidae		
102	<i>Cricula trifenestrata</i> (Helfer, 1837)	98	120	<i>Cyclosia panthona</i> (Stoll, 1780)	115
103	<i>Actias selene</i> (Hubner, 1807)	198	121	<i>Gynatocera papilionaria</i> (Guerin-Meneville, 1831)	78
104	<i>Actias luna</i> (Linnaeus, 1758)	167	Sesiidae		
105	<i>Antheraea paphia</i> (Linnaeus, 1758)	223	122	<i>Melittia</i> sp. 1	37
106	<i>Attacus atlas</i> (Linnaeus, 1758)	186	123	<i>Melittia</i> sp. 2	43
107	<i>Antheraea mylitta</i> (Drury, 1773)	119	Pterophoridae		
108	<i>Samia cynthia</i> (Drury, 1773)	89	124	<i>Pterophoridae</i> spp (Zeller, 1841)	26
109	<i>Antheraea assamensis</i> (Helfer, 1837)	112	Thyrididae		
Tortricidae			125	<i>Strigina scitaria</i> (Walker, 1862)	20
110	<i>Epiphya spostbittana</i> (Walkar, 1863)	64	Tineidae		
111	<i>Epiphya</i> spp (Turner, 1927)	10	126	<i>Tinea</i> spp (Linnaeus, 1758)	04
112	<i>Adoxophyes privatana</i> (Walker, 1863)	28	Lymantriidae		
Notodontidae			127	<i>Lymantria marginate</i> (Walker, 1855)	10
113	<i>Lochmaeu sbilineata</i> (Packard, 1864)	39	Drepanidae		
Uraniidae			128	<i>Cyclidia substigmata</i> (Hubner, 1831)	08
114	<i>Micronia eculeata</i> (Guenée, 1857)	06	Eupterotidae		
115	<i>Lyssa zampa</i> (Butler, 1869)	10	129	<i>Eupterote undata</i> (Blanchard, 1844)	06

Table 2. Diversity indices of moths (Mahamaya Reserve Forest)

	Total listed genus	Lower	Upper	Total listed species	Lower	Upper
Taxa_S	20	13	20	20	14	20
Individuals	114	114	114	129	129	129
Dominance_D	0.1904	0.1544	0.2453	0.1902	0.1551	0.2424
Simpson_1-D	0.8096	0.7547	0.8455	0.8098	0.7575	0.8449
Shannon_H	2.115	1.802	2.26	2.117	1.838	2.257
Evenness_e^H/S	0.4144	0.3843	0.5411	0.4153	0.3815	0.5341
Brillouin	1.896	1.639	2.037	1.917	1.684	2.053
Menhinick	1.873	1.218	1.873	1.761	1.233	1.761
Margalef	4.012	2.534	4.012	3.91	2.675	3.91
Equitability_J	0.706	0.6637	0.7795	0.7067	0.6638	0.7764
Fisher_alpha	7.027	3.78	7.027	6.624	3.994	6.624
Berger-Parker	0.3158	0.2632	0.4035	0.3333	0.2636	0.4109
Chao-1	29	14.75	44	27.2	15.2	41.5

to a number of species of plants and animals. The present study recorded 129 species of moths under 20 families. Diversity studies on moths allow us to obtain a comprehensive vision of wide range of ecological treasures. The unique biogeographic location of the area and its relation with human related activities has made the Mahamaya Reserve Forest an interesting space for diversity studies.

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## AUTHOR CONTRIBUTION STATEMENT

GA and RA conceived and designed the research. GA and AND conducted the study. GA, AND and LB analyzed the data and wrote the manuscript. All the authors read and approved the manuscript for submission.

## CONFLICT OF INTEREST

No conflict of interest.

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