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A preliminary checklist of moths (Lepidoptera: Heterocera) along Mahananda Wildlife Sanctuary, West Bengal, India

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Abstract
A pilot study of moth diversity was conducted along the transitional area of the Mahananda Wildlife Sanctuary, West Bengal, India. A total of 226 species of moths belonging to 193 genera, 14 Superfamilies, 25 families, and 54 Subfamilies were recorded and identified within the study area. All specimens were collected using light traps, and opportunist survey methods. The family wise species richness data indicated family Crambidae the highest with 28 % of the total species followed by Erebidae 19.11 %, Geometridae 16.88 %, Noctuidae 4.4%, Sphingidae 3.11% while the rest 28.5% species belonged to 20 other families.

Keywords: moth, diversity, lepidoptera, heterocera, mahananda wildlife sanctuary, West Bengal

Introduction

Moths are nocturnal, holometabolous, phytophagous insects that provide important ecosystem services like pollination of crepuscular and night flowering plants, as well as serving as prey in the food chain (Shah and Mitra, 2015) [33]. Moths have a wide range of species and can adapt to almost any climatic situation, making them one of the most successful animals on the planet (Sekhon, 2015) [32]. More than 90% of all lepidopterans on the planet are members of these polyphyletic insect group, and a considerable number of moth species, mainly from tropical locations, are still waiting to be discovered and named (Heppner, 2008) [21]. India also exhibits a very rich assemblage with over 12,000 species of moths (Chandra and Nema, 2007) [6]. In West Bengal, India recently Shah. *et al*., (2018) [34] have documented information of 1058 species belonging to 614 genera and 36 families.

The earliest work on moths from the adjoining regions are described by Hampson, (1892, 1894, 1895, 1896) [11-14]; Bell and Scott, (1937) [4] in their books Fauna of British India. More recently Shah and Mitra, (2015) [33] reported 39 species of moths associated with a few tea gardens of Darjeeling district a very popular agricultural landscape of North Bengal and areas surrounding the Mahananda Wildlife Sanctuary. Chettri and Yonle, (2021) [7] have also recently reported 407 species of moths from the Darjeeling hills of West Bengal.

The Mahananda Wildlife Sanctuary located in the lower hills and terai plains of Darjeeling District along the western bank of the river Tista also falls within the rich biodiversity hotspot region of the Eastern Himalayas. The riverain and dense mixed wet forests with varying altitudes ranging from 150 meters to 1300 meters hosts the existence of many species of flora and fauna. A field survey of Mahananda Wildlife Sanctuary by Wildlife wing, Forest Development Corporation, Forest Division of West Bengal, and natural environment and wildlife organization reported a total of 29 species of Lepidoptera. However, no moth species were mentioned in the project report (Bagchi and Bagchi, 1996) [2]. Ghosh and Biswas, (2019) [8] have also recorded 46 species of moths in their biodiversity report for North Bengal Wild Animal Park, NBWAP, a zoological park adjacent to Mahananda Wildlife Sanctuary. However, significant literature and documentation on Mahananda Wildlife Sanctuary's moth variety are still lacking. The goal of this research is to compile a preliminary checklist of moth species found in and around the Mahananda Wildlife Sanctuary.

Materials and Methods

The present study was conducted in three study sites. Sukna forest (site 1), North Bengal Wild Animal Park, NBWAP (site 2), and Latpanchar forest (site 3) transitional areas from the western, southern, and northern boundary of Mahananda Wildlife sanctuary respectively during 2019 – 2020 (Fig. 1A). The study at NBWAP was done in the three animal night shelters *viz*. tiger, leopard, and bear shelters of the NBWAP. The continuous illumination of the animal shelters during the night in the form of the actinic source i.e., fluorescent light bulb, LED bulbs, halogen bulbs, UV insect traps, and incandescent light bulb acted as a light trap/ attractant for the moths. Light trap sheet made up of white cloth measuring 4 by 6 feet with light-emitting actinic source i.e., fluorescent light bulb (15W) and incandescent light bulb (60W) was used as a primary means of documentation of moths from Sukna forest and Latpanchar forest.

The documentation of moths was based mainly on opportunistic surveys that were conducted in morning and night visits to these animal night shelters of NBWAP whereas a total of 74 survey nights were conducted and the moths were observed for about five hours every night from 1900 h till 2200 h in Sukna forest and Latpanchar forest. The moths were not collected but were identified using digital colour photographs.

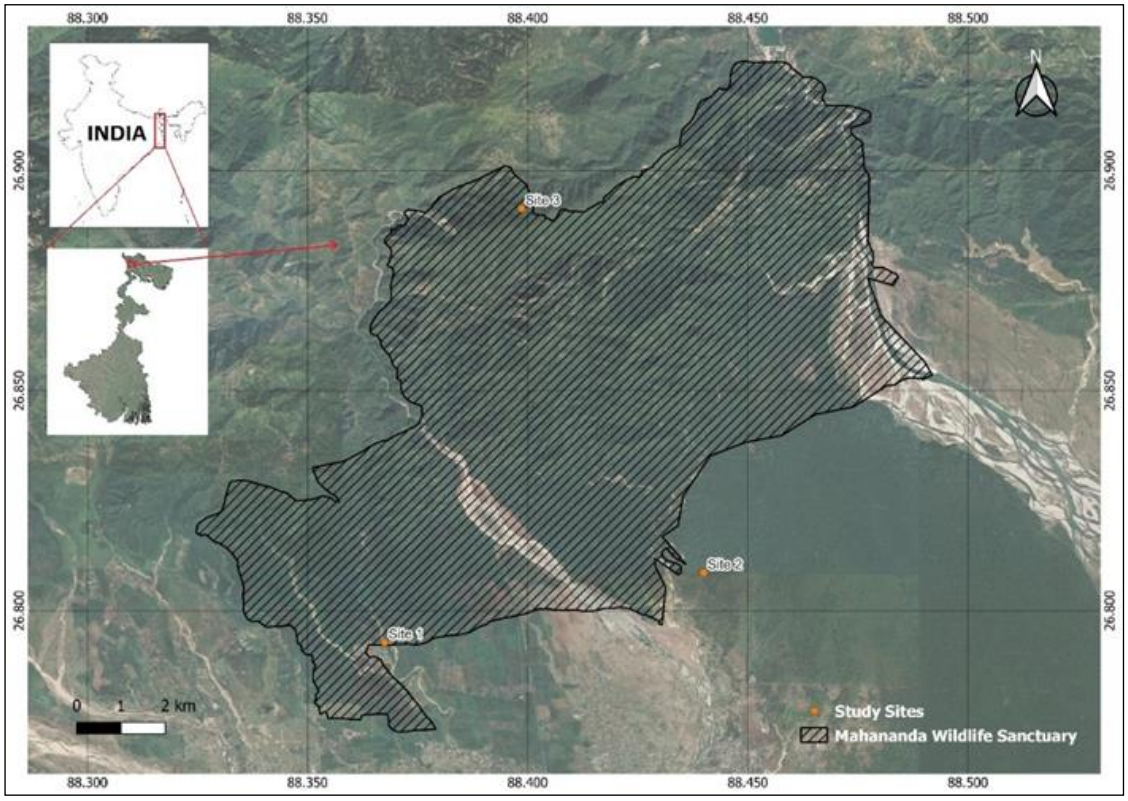

Fig 1A: Map of the study area with site locations.

Identification was based on morphological characters using standard literature, illustrated guides, and online biodiversity portals available like Hampson (1892, 1894, 1895, 1896) [11-14], Bell and Scott (1937) [4], Schintlmeister and Pinratana, (2007) [31]; Kononenko and Pinratana, (2013) [26]; Haruta, (1992, 1993, 1994, 1995, 1998, 2000) [15-20]; Mishra *et al*., (2016) [27]; Sanyal *et al*., (2013, 2018) [29-30]; Singh *et al*., (2017a,b) [36-37]; Sondhi and Sondhi, (2016) [38]; Gielis and Wangdi, (2017) [10]; Shah *et al*., (2018) [34]; Irungbam *et al.*, (2016, 2017)[22-23]; Kirti and Singh, (2015)[24]; Kirti *et al.*, (2019) [25]; Shubhalaxmi, (2018) [35]; Ghosh and Chaudhury, (1997) [9]; Volynkin *et al*., (2019) [40]; LepIndex Beccaloni *et al*., (2003)[2]; (http://www.mothsofndia.org/; Sondhi *et al*., 2020) [39].

The nomenclature for families has been followed according to Van Nieukerken *et al*., (2011) [28]. The images were compared through visual similarities and then verified for identification. The identified photographed species were then catalogued as in (Table.1).

Table 1

Sl. No.	Super family	Family	Sub family	Name	Author, Year
1.	Alucitoidea	Alucitidae	-	*Alucita sp.*	Linneaus, 1758
2.	Bombycoidea	Eupteroidae	Eupterotinae	*Ganisa similis*	Moore, 1884
3.	Bombycoidea	Endromidae	Bombycinae	*Mustilia sp.*	Moore, 1879
4.	Bombycoidea	Saturniidae	Saturniinae	*Cricula trifenestrata*	Helfer, 1837
5.	Bombycoidea	Sphingidae	Macroglossinae	*Acosmeryx naga*	Moore, 1858
6.	Bombycoidea	Sphingidae	Macroglossinae	*Acosmeryx sericeus*	Walker, 1856
7.	Bombycoidea	Sphingidae	Macroglossinae	*Cechetra scotti*	Rothschild, 1920
8.	Bombycoidea	Sphingidae	Macroglossinae	*Hippotion Celerio*	Linnaeus, 1758
9.	Bombycoidea	Sphingidae	Macroglossinae	*Pergesa acteus*	Walker, 1856
10.	Bombycoidea	Sphingidae	Macroglossinae	*Theretra nessus*	Drury, 1773
11.	Bombycoidea	Sphingidae	Smerinthinae	*Ambulyx cyclasticta*	Joicey &Kaya, 1917
12.	Bombycoidea	Sphingidae	Sphinginae	*Acherontia styx*	Westwood, 1847
13.	Cossoidea	Cossidae	Zeuzerinae	*Zeuzera sp.*	Latreille, 1804
14.	Drepanoidea	Drepanidae	Cyclidiinae	*Cyclidia rectificata*	Walker, 1862
15.	Drepanoidea	Drepanidae	Drepaninae	*Callidrepana argenteola*	Moore, 1860
16.	Drepanoidea	Drepanidae	Drepaninae	*Drapetodes mitaria*	Guenée, 1857
17.	Drepanoidea	Drepanidae	Thyatirinae	*Gaurena florens*	Walker, 1865
18.	Drepanoidea	Drepanidae	Thyatirinae	*Gaurena florescens*	Walker, 1865
19.	Gelechioidea	Depressariidae	Ethmiinae	*Ethmia lineatonotella*	Moore, 1868
20.	Gelechioidea	Lecithoceridae	-	*Aeolanthes sp.*	Meyrick, 1907
21.	Gelechioidea	Lecithoceridae	-	*Scythropiodes sp.*	Matsumura, 1931
22.	Geometroidea	Geometridae	Desmobathrinae	*Eumelea ludovicata*	Guenée, 1858
23.	Geometroidea	Geometridae	Desmobathrinae	*Eumelea rosalia*	Stoll, 1781
24.	Geometroidea	Geometridae	Ennominae	*Abraxas neomartaria*	Inoue 1970

25.	Geometroidea	Geometridae	Ennominae	*Alcis albifera*	Moore, 1888
26.	Geometroidea	Geometridae	Ennominae	*Amblychia angeronaria*	Guenée, 1858
27.	Geometroidea	Geometridae	Ennominae	*Catoria sp.*	Walker, 1866
28.	Geometroidea	Geometridae	Ennominae	*Celenna festivaria*	Fabricius, 1794
29.	Geometroidea	Geometridae	Ennominae	*Chiasmia emersaria*	Walker, 1861
30.	Geometroidea	Geometridae	Ennominae	*Chiasmia sp.*	Hubner, 1823
31.	Geometroidea	Geometridae	Ennominae	*Chiasmia xanthonora*	Walker, 1861
32.	Geometroidea	Geometridae	Ennominae	*Cleora contiguta*	Denis &Schiffermüller, 1775
33.	Geometroidea	Geometridae	Ennominae	*Ectropis bhurmitra*	Walker, 1860
34.	Geometroidea	Geometridae	Ennominae	*Fascellina plagiata*	Walker, 1866
35.	Geometroidea	Geometridae	Ennominae	*Heterolocha biplagiata*	Bastelberger, 1909
36.	Geometroidea	Geometridae	Ennominae	*Heterostegane urbica*	Swinhoe, 1885
37.	Geometroidea	Geometridae	Ennominae	*Hypomecis lioptilaria*	Swinhoe, 1903
38.	Geometroidea	Geometridae	Ennominae	*Hyposidra talaca*	Walker, 1860
39.	Geometroidea	Geometridae	Ennominae	*Leptomiza calcearia*	Walker, 1860
40.	Geometroidea	Geometridae	Ennominae	*Myrioblephara duplexa*	Moore, 1888
41.	Geometroidea	Geometridae	Ennominae	*Ophthalmitis herbidaria*	Guenée, 1858
42.	Geometroidea	Geometridae	Ennominae	*Petelia medardaria*	Herrich-Schäffer, 1856
43.	Geometroidea	Geometridae	Ennominae	*Pseudomiza cruentaria*	Moore, 1867
44.	Geometroidea	Geometridae	Ennominae	*Qurapteryx sciticaudaria*	Walker, 1863
45.	Geometroidea	Geometridae	Ennominae	*Sirinopteryx quadripunctata*	Moore, 1868
46.	Geometroidea	Geometridae	Geometrinae	*Agathia carissima*	Butler, 1878
47.	Geometroidea	Geometridae	Geometrinae	*Agathia lycaenaria*	Kollar, 1844
48.	Geometroidea	Geometridae	Geometrinae	*Comostola laesaria*	Walker, 1861
49.	Geometroidea	Geometridae	Geometrinae	*Hemithea tritonaria*	Walker, 1863
50.	Geometroidea	Geometridae	Geometrinae	*Oenospila flavifusata*	Walker, 1869
51.	Geometroidea	Geometridae	Geometrinae	*Pingasa ruginaria*	Guenée, 1857
52.	Geometroidea	Geometridae	Geometrinae	*Tanaorhinus kina*	Swinhoe, 1893
53.	Geometroidea	Geometridae	Geometrinae	*Tanaorhinus viridiluteata*	Walker, 1861
54.	Geometroidea	Geometridae	Geometrinae	*Thalassodes immissaria*	Walker, 1861
55.	Geometroidea	Geometridae	Larentiinae	*Apithecia viridata*	Moore, 1868
56.	Geometroidea	Geometridae	Larentiinae	*Dysstroma cinereata*	Moore, 1868
57.	Geometroidea	Geometridae	Larentiinae	*Ecliptopera triangulifera*	Moore, 1888
58.	Geometroidea	Geometridae	Larentiinae	*Eois sp.*	Hubner, 1818
59.	Geometroidea	Geometridae	Larentiinae	*Perizoma sp.*	Hübner, 1825
60.	Geometroidea	Geometridae	Sterrhinae	*Antitrygodes divisaria*	Walker, 1861
61.	Geometroidea	Geometridae	Sterrhinae	*Idaea violacea*	Hampson, 1891
62.	Geometroidea	Geometridae	Sterrhinae	*Scopula emissaria*	Walker, 1861
63.	Geometroidea	Geometridae	Sterrhinae	*Synegiodes diffusifascia*	Swinhae, 1892
64.	Geometroidea	Geometridae	Sterrhinae	*Timandra ruptilinea*	Warren, 1897
65.	Geometroidea	Uraniidae	Epipleminae	*Dysaethria quadricaudata*	Walker,1861
66.	Geometroidea	Uraniidae	Epipleminae	*Epiplema sp.*	Herrich- Schaffer, 1855
67.	Geometroidea	Uraniidae	Epipleminae	*Phazaca theclata*	Guenée,1857
68.	Hyblaeoidea	Hyblaeidae	Hyblaea	*Hyblaea puera*	Cramer, 1777
69.	Lasiocampoidea	Lasiocampidae	Lasiocampinae	*Trabala ganesha*	Roepke, 1951
70.	Noctuoidea	Erebidae	Arctiinae	*Adites frigida*	Walker,1854
71.	Noctuoidea	Erebidae	Arctiinae	*Ammatho cuneonotatus*	Walker, 1855
72.	Noctuoidea	Erebidae	Aganainae	*Asota caricae*	Fabricius, 1775
73.	Noctuoidea	Erebidae	Arctiinae	*Creatonotos gangis*	Linnaeus, 1763
74.	Noctuoidea	Erebidae	Arctiinae	*Creatonotos transiens*	Walker, 1855
75.	Noctuoidea	Erebidae	Arctiinae	*Cyana arama arama*	Moore, 1859
76.	Noctuoidea	Erebidae	Arctiinae	*Cyana catorhoda*	Hampson, 1897
77.	Noctuoidea	Erebidae	Arctiinae	*Cyana detrita*	Walker, 1854
78.	Noctuoidea	Erebidae	Arctiinae	*Cyme euprepioides*	Walker, 1862
79.	Noctuoidea	Erebidae	Arctiinae	*Eugoa sp.*	Francis & Walker, 1858
80.	Noctuoidea	Erebidae	Arctiinae	*Gampola sp.*	Moore, 1878
81.	Noctuoidea	Erebidae	Arctiinae	*Hemonia orbiferana*	Walker, 1863
82.	Noctuoidea	Erebidae	Arctiinae	*Huangilene alikangiae*	Strand, 1917
83.	Noctuoidea	Erebidae	Arctiinae	*Kailasha effracta*	Walker, 1854
84.	Noctuoidea	Erebidae	Arctiinae	*Lobobasis niveimaculata*	Hampson, 1896
85.	Noctuoidea	Erebidae	Arctiinae	*Miltochrista calamaria*	Moore, 1888
86.	Noctuoidea	Erebidae	Arctiinae	*Miltochrista dharma*	Moore, 1879
87.	Noctuoidea	Erebidae	Arctiinae	*Miltochrista obsolete*	Moore, 1878
88.	Noctuoidea	Erebidae	Arctiinae	*Miltochrista paraarcuata*	Singh and Kirti, 2016
89.	Noctuoidea	Erebidae	Arctiinae	*Miltochrista sp.*	Hubner, 1819
90.	Noctuoidea	Erebidae	Arctiinae	*Nyctemera adversata*	Schaller, 1788
91.	Noctuoidea	Erebidae	Arctiinae	*Pseudoblabes oophore*	Zeller, 1853
92.	Noctuoidea	Erebidae	Arctiinae	*Spilarctia sp.*	Staudinger, 1891

93.	Noctuoidea	Erebidae	Arctiinae	*Stictane rectilinear*	Snellen, 1879
94.	Noctuoidea	Erebidae	Arctiinae	*Syntomoides imaon*	Cramer, 1779
95.	Noctuoidea	Erebidae	Arctiinae	*Teuloma nebulosa*	Walker, 1862
96.	Noctuoidea	Erebidae	Arctiinae	*Vamuna remelana*	Moore, 1866
97.	Noctuoidea	Erebidae	Boletobiinae	*Ataboruza divisa*	Walker, 1862
98.	Noctuoidea	Erebidae	Boletobiinae	*Eublemma accedens*	Felder &Rogenhofer, 1874
99.	Noctuoidea	Erebidae	Boletobiinae	*Eublemma roseonivea*	Walker, 1863
100.	Noctuoidea	Erebidae	Calpinae	*Eudocima salaminia*	Cramer, 1777
101.	Noctuoidea	Erebidae	Calpinae	*Tamba rufipennis*	Hampson, 1895
102.	Noctuoidea	Erebidae	Erebinae	*Bastilla absentimacula*	Guenée, 1852
103.	Noctuoidea	Erebidae	Erebinae	*Bastilla crameri*	Moore, 1885
104.	Noctuoidea	Erebidae	Erebinae	*Bastilla joviana*	Stoll, 1782
105.	Noctuoidea	Erebidae	Erebinae	*Erebus Macropus*	Linnaeus, 1768
106.	Noctuoidea	Erebidae	Erebinae	*Grammodes geometrica*	Fabricius, 1775
107.	Noctuoidea	Erebidae	Erebinae	*Hypopyra vespertilio*	Fabricius, 1787
108.	Noctuoidea	Erebidae	Erebinae	*Pindara illibata*	Fabricius, 1775
109.	Noctuoidea	Erebidae	Erebinae	*Serrodes campana*	Guenée, 1852
110.	Noctuoidea	Erebidae	Erebinae	*Spirama sp.*	Hübner, 1824
111.	Noctuoidea	Erebidae	Herminiinae	*Hydrillodes lentalis*	Guenée, 1854
112.	Noctuoidea	Erebidae	Hypeninae	*Hypena laceratalis*	Walker, 1859
113.	Noctuoidea	Erebidae	Hypeninae	*Hypena obacerralis*	Walker, 1859
114.	Noctuoidea	Erebidae	Lymantriinae	*Arctornis sp.*	Germar, 1810
115.	Noctuoidea	Erebidae	Lymantriinae	*Artaxa sp.*	Francis & Walker, 1855
116.	Noctuoidea	Erebidae	Lymantriinae	*Dasychira chekiangensis*	Collenette, 1938
117.	Noctuoidea	Erebidae	Lymantriinae	*Lymantria bivitatta*	Moore, 1879
118.	Noctuoidea	Erebidae	Lymantriinae	*Lymantria mathura*	Moore, 1866
119.	Noctuoidea	Erebidae	Lymantriinae	*Nygmia plana*	Walker, 1856
120.	Noctuoidea	Erebidae	Lymantriinae	*Olene inclusa*	Walker, 1856
121.	Noctuoidea	Erebidae	Lymantriinae	*Orgyia postica*	Walker, 1855
122.	Noctuoidea	Erebidae	Lymantriinae	*Ramadra calligramma*	Walker, 1865
123.	Noctuoidea	Erebidae	Lymantriinae	*Somena scintillans*	Walker, 1856
124.	Noctuoidea	Erebidae	Lymantriinae	*Somena similis*	Moore, 1860
125.	Noctuoidea	Erebidae	Tinoliinae	*Tinolius eburneigutta*	Walker, 1855
126.	Noctuoidea	Noctuidae	Acronictinae	*Diphtherocome sp.*	Warren, 1907
127.	Noctuoidea	Noctuidae	Aganainae	*Mecodina praecipua*	Walker, 1865
128.	Noctuoidea	Noctuidae	Calpinae	*Gesonia obeditalis*	Walker, 1859
129.	Noctuoidea	Noctuidae	Eriopinae	*Callopistria placodoides*	Guenée, 1816
130.	Noctuoidea	Noctuidae	Eustrotiinae	*Maliattha signifera*	Walker, 1857
131.	Noctuoidea	Noctuidae	Noctuinae	*Leucania sp.*	Ochsenheimer, 1816
132.	Noctuoidea	Noctuidae	Noctuinae	*Pseudeustrotia sp.*	Warren, 1913
133.	Noctuoidea	Noctuidae	Noctuinae	*Spodoptera litura*	Fabricius, 1775
134.	Noctuoidea	Noctuidae	Plusiinae	*Chrysodeixis eriosoma*	Doubleday, 1843
135.	Noctuoidea	Noctuidae	Plusiinae	*Zonoplusia ochreata*	Walker, 1865
136.	Noctuoidea	Nolidae	Nolinae	*Nola lucidalis*	Walker, 1864
137.	Noctuoidea	Notodontidae	Pygaerinae	*Spatalia sikkima*	Moore, 1879
138.	Noctuoidea	Notodontidae	Notodontinae	*Syntypistis pallidifascia*	Hampson, 1893
139.	Pterophoroidea	Pterophoridae	Pterophorinae	*Stenoptilodes taprobanes*	Felder &Rogenhofer, 1875
140.	Pyraloidea	Crambidae	Acentropinae	*Ambia sp.*	Walker, 1859
141.	Pyraloidea	Crambidae	Acentropinae	*Elophila sp.*	Hubner, 1822
142.	Pyraloidea	Crambidae	Acentropinae	*Eoophyla peribocalis*	Walker, 1859
143.	Pyraloidea	Crambidae	Acentropinae	*Parapoynx bilinealis*	Snellen, 1876
144.	Pyraloidea	Crambidae	Acentropinae	*Parapoynx crisonalis*	Walker, 1859
145.	Pyraloidea	Crambidae	Acentropinae	*Parapoynx fluctuosalis*	Meyrick, 1899
146.	Pyraloidea	Crambidae	Crambinae	*Chrysoteuchia sp.*	Hubner, 1825
147.	Pyraloidea	Crambidae	Glaphyriinae	*Crocidolomia pavonana*	Fabricius, 1794
148.	Pyraloidea	Crambidae	Odontiinae	*Autocharis fessalis*	Swinhoe, 1886
149.	Pyraloidea	Crambidae	Odontiinae	*Pitama lativitta*	Moore, 1888
150.	Pyraloidea	Pyralidae	Phycitinae	*Epicrocis oegnusalis*	Walker, 1859
151.	Pyraloidea	Pyralidae	Phycitinae	*Epicrocis sp.*	Zeller, 1848
152.	Pyraloidea	Crambidae	Pyralinae	*Endotricha mesenterialis*	Walker, 1859
153.	Pyraloidea	Pyralidae	Pyralinae	*Endotricha sp*	Zeller, 1847
154.	Pyraloidea	Pyralidae	Pyralinae	*Hypsopygia mauritialis*	Boisduval, 1833
155.	Pyraloidea	Pyralidae	Pyralinae	*Pyralis manihotalis*	Guenée, 1854
156.	Pyraloidea	Crambidae	Pyraustinae	*Hyalobathra coenostolalis*	Snellen, 1890
157.	Pyraloidea	Crambidae	Pyraustinae	*Isocentris filalis*	Guenée, 1854
158.	Pyraloidea	Crambidae	Pyraustinae	*Mabra eryxalis*	Walker, 1859
159.	Pyraloidea	Crambidae	Pyraustinae	*Nacoleia sp.*	Walker, 1859
160.	Pyraloidea	Crambidae	Pyraustinae	*Ostrinalis sp*	Hübner, 1796

161.	Pyraloidea	Crambidae	Pyraustinae	*Ostrinia furnacalis*	Guenée, 1854
162.	Pyraloidea	Crambidae	Pyraustinae	*Pagyda salvalis*	Walker, 1859
163.	Pyraloidea	Crambidae	Pyraustinae	*Spoladae recurvalis*	Fabricius, 1775
164.	Pyraloidea	Crambidae	Schoenobiinae	*Scirpophaga incertulas*	Walker, 1863
165.	Pyraloidea	Crambidae	Spilomelinae	*Aethaloessa calidalis*	Guenée, 1854
166.	Pyraloidea	Crambidae	Spilomelinae	*Agathodes ostentalis*	Geyer, 1837
167.	Pyraloidea	Crambidae	Spilomelinae	*Agrotera basinotata*	Hampson, 1891
168.	Pyraloidea	Crambidae	Spilomelinae	*Arthroschista hilaralis*	Walker,1859
169.	Pyraloidea	Crambidae	Spilomelinae	*Bradina diagonalis*	Guenée, 1854
170.	Pyraloidea	Crambidae	Spilomelinae	*Ceratarcha umbrosa*	Swinhoe, 1894
171.	Pyraloidea	Crambidae	Spilomelinae	*Cirrhochrista brizoalis*	Walker, 1859
172.	Pyraloidea	Crambidae	Spilomelinae	*Conogethes punctiferalis*	Guenée, 1858
173.	Pyraloidea	Crambidae	Spilomelinae	*Cotachena nepalensis*	Yamanaka, 2000
174.	Pyraloidea	Crambidae	Spilomelinae	*Cydalima pfeifferae*	Lederer, 1863
175.	Pyraloidea	Crambidae	Spilomelinae	*Diaphania indica*	Saunders, 1851
176.	Pyraloidea	Crambidae	Spilomelinae	*Endocrossis flavibasalis*	Moore, 1867
177.	Pyraloidea	Crambidae	Spilomelinae	*Eurrhyparodes bracteolalis*	Zeller, 1852
178.	Pyraloidea	Crambidae	Spilomelinae	*Eusabena miltochristalis*	Hampson, 1896
179.	Pyraloidea	Crambidae	Spilomelinae	*Glycythyma chrysorycta*	Meyrick, 1884
180.	Pyraloidea	Crambidae	Spilomelinae	*Glyphodes actorionalis*	Walker, 1859
181.	Pyraloidea	Crambidae	Spilomelinae	*Glyphodes bicolor*	Swainson, 1821
182.	Pyraloidea	Crambidae	Spilomelinae	*Glyphodes bivitralis*	Guenée, 1854
183.	Pyraloidea	Crambidae	Spilomelinae	*Glyphodes caesalis*	Walker, 1859
184.	Pyraloidea	Crambidae	Spilomelinae	*Glyphodes canthusalis*	Walker, 1859
185.	Pyraloidea	Crambidae	Spilomelinae	*Glyphodes onychinalis*	Guenée, 1854
186.	Pyraloidea	Crambidae	Spilomelinae	*Glyphodes stolalis*	Guenée, 1854
187.	Pyraloidea	Crambidae	Spilomelinae	*Goniorhynchus gratalis*	Lederer, 1863
188.	Pyraloidea	Crambidae	Spilomelinae	*Haritalodes derogate*	Fabricius, 1775
189.	Pyraloidea	Crambidae	Spilomelinae	*Herpetogramma cynaralis*	Walker, 1859
190.	Pyraloidea	Crambidae	Spilomelinae	*Herpetogramma luctuosalis*	Guenée, 1854
191.	Pyraloidea	Crambidae	Spilomelinae	*Hydriris ornatalis*	Duponchel, 1832
192.	Pyraloidea	Crambidae	Spilomelinae	*Lamprosema tampiusalis*	Walker, 1859
193.	Pyraloidea	Crambidae	Spilomelinae	*Leucinodes orbonalis*	Guenée, 1854
194.	Pyraloidea	Crambidae	Spilomelinae	*Marasmia exigua*	Butler, 1879
195.	Pyraloidea	Crambidae	Spilomelinae	*Marasmia poeyalis*	Boisduval, 1833
196.	Pyraloidea	Crambidae	Spilomelinae	*Maruca vitrata*	Fabricius, 1787
197.	Pyraloidea	Crambidae	Spilomelinae	*Meroctena tullalis*	Walker, 1859
198.	Pyraloidea	Crambidae	Spilomelinae	*Metoeca foedalis*	Guenée, 1854
199.	Pyraloidea	Crambidae	Spilomelinae	*Nausinoe sp.*	Hubner, 1825
200.	Pyraloidea	Crambidae	Spilomelinae	*Nevrina procopia*	Stoll, 1781
201.	Pyraloidea	Crambidae	Spilomelinae	*Notarcha tigrine*	Moore, 1886
202.	Pyraloidea	Crambidae	Spilomelinae	*Omiodes pernitescens*	Swinhoe, 1894
203.	Pyraloidea	Crambidae	Spilomelinae	*Omiodes surrectalis*	Walker, 1866
204.	Pyraloidea	Crambidae	Spilomelinae	*Omphisa anastomosalis*	Guenée, 1854
205.	Pyraloidea	Crambidae	Spilomelinae	*Palpita annulifer*	Inoue, 1996
206.	Pyraloidea	Crambidae	Spilomelinae	*Pardomima distortana*	Strand, 1913
207.	Pyraloidea	Crambidae	Spilomelinae	*Parotis marginata*	Hampson, 1893
208.	Pyraloidea	Crambidae	Spilomelinae	*Patania iopasalis*	Walker, 1859
209.	Pyraloidea	Crambidae	Spilomelinae	*Pilerocera sodalist*	Leech, 1889
210.	Pyraloidea	Crambidae	Spilomelinae	*Poliobotys ablactalis*	Walker, 1859
211.	Pyraloidea	Crambidae	Spilomelinae	*Polythlipta divaricate*	Moore, 1885
212.	Pyraloidea	Crambidae	Spilomelinae	*Pycnarmon jaguaralis*	Guenée, 1854
213.	Pyraloidea	Crambidae	Spilomelinae	*Pygospila tyres*	Cramer, 1780
214.	Pyraloidea	Crambidae	Spilomelinae	*Rhimphalea ochalis*	Walker, 1859
215.	Pyraloidea	Crambidae	Spilomelinae	*Sameodes cancellalis*	Zeller, 1852
216.	Pyraloidea	Crambidae	Spilomelinae	*Syllepte gastralis*	Walker, 1866
217.	Pyraloidea	Crambidae	Spilomelinae	*Syllepte sellalis*	Guenée, 1854
218.	Pyraloidea	Crambidae	Spilomelinae	*Synclera traducalis*	Zeller, 1852
219.	Pyraloidea	Crambidae	Spilomelinae	*Terastia egialealis*	Walker, 1859
220.	Thyridoidea	Thyrididae	Striglininae	*Striglina scitaria*	Walker, 1862
221.	Tortricoidea	Tortricidae	Tortricinae	*Homona sp.*	Walker, 1863
222.	Tortricoidea	Tortricidae	Tortricinae	*Homona tabescens*	Meyrick, 1921
223.	Tortricoidea	Tortricidae	Olethreutinae	*Loboschiza koenigiana*	Fabricius, 1775
224.	Zygaenoidea	Limacodidae	Limacodinae	*Birthamoides junctura*	Walker, 1865
225.	Zygaenoidea	Zygaenidae	Chalcosiinae	*Eterusia aedea*	Clerck, 1759
226.	Zygaenoidea	Limacodidae	Limacodinae	*Miresa sp.*	Francis & Walker, 1855

Partial checklist of the Moths recorded from surroundings of Mahananda Wild life Sanctuary.

Results and Discussion

The present study recorded 226 species of moths belonging to 193 genera, 14 Super families, 25 families and 54 Sub families. Out of these 226 moth specimens, 196 have been identified up to the species level while the rest 30 have been identified till the genus level. All the moths in the checklist are illustrated in the Fig.1B-226, (Table 1).

From this study, it was noted that family Crambidae had the highest species richness with 28% of the total species that was followed by Erebidae, Geometridae, Noctuidae and Sphingidae with 19.11%, 16.88%,4.44% and 3.11% of the total species respectively. The rest of the families accounted for 28.5% of the total species (Fig. 227). Among the families Crambidae showed the highest no species (75) and genera (63) followed by Erebiade (55 species, 43 genera), Geometridae (43 species,38 genera) Noctuidae (10 species and 10 genera), and others (Fig .228).

Fig 1B-32: *1B. Alucita sp. 2. Ganisa similis 3. Mustilia sp. 4. Cricula trifenestrata 5. Acosmeryx naga 6. Acosmeryx sericeus 7. Cechetra scotti 8. Hippotion Celerio 9. Pergesa acteus 10. Theretra nessus 11. Ambulyx cyclasticta 12. Acherontia styx 13. Zeuzera sp. 14. Cyclidia rectificata 15. Callidrepana argenteola 16. Drapetodes mitaria 17. Gaurena florens 18. Gaurena florescens 19. Ethmia lineatonotella 20. Aeolanthes sp.21. Scythropiodes sp.22 Eumelea ludovicata.23. Eumelea rosalia 24. Abraxas neomartaria 25. Alcis albifera 26. Amblychia angeronaria 27. Catoria sp. 28. Celenna festivaria 29. Chiasmia emersaria 30. Chiasmia sp 31. Chiasmia xanthonora 32. Cleora contiguta*

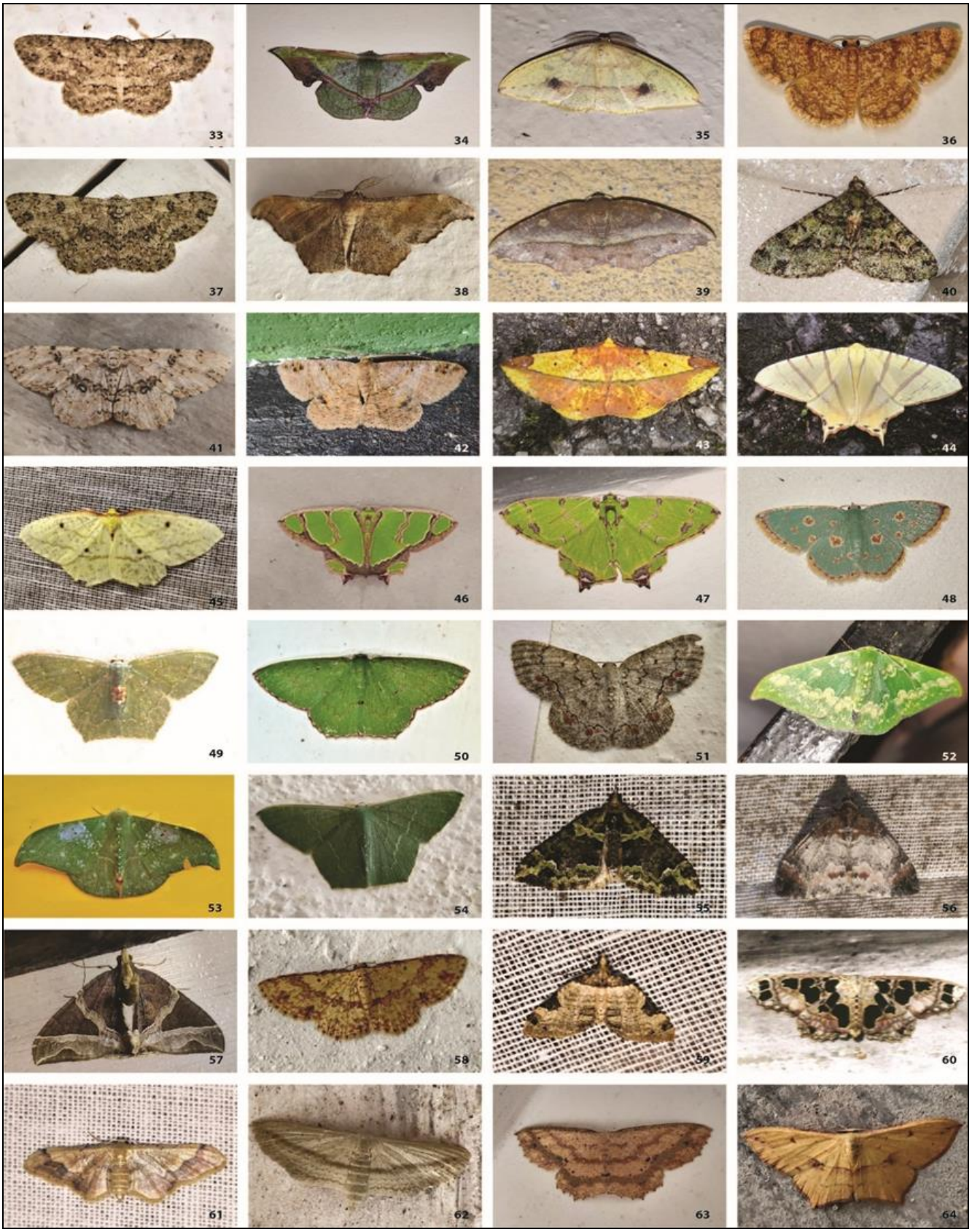

Fig 33- 64: *33. Ectropis bhurmitra 34. Fascellina plagiata 35. Heterolocha biplagiata 36. Heterostegane urbica 37. Hypomecis lioptilaria 38. Hyposidra talaca 39. Leptomiza calcearia 40. Myrioblephara duplexa 41. Ophthalmitis herbidaria 42. Petelia medardaria 43. Pseudomiza cruentaria 44. Qurapteryx sciticaudaria 45. Sirinopteryx quadripunctata 46. Agathia carissima 47. Agathia lycaenaria 48. Comostola laesaria 49. Hemithea tritonaria 50. Oenospila flavifusata 51. Pingasa ruginaria 52. Tanaorhinus kina 53. Tanaorhinus viridiluteata 54. Thalassodes immissaria 55. Apithecia viridata 56. Dysstroma cinereata 57. Ecliptopera triangulifera 58. Eois sp.59. Perizoma sp. 60. Antitrygodes divisaria 61. Idaea violacea 62. Scopula emissaria 63. Synegiodes diffusifascia 64. Timandra ruptilinea*

Fig 65-95: 65. *Dysaethria quadricaudata 66. Epiplema sp.67. Phazaca theclata 68. Hyblaea puera 69. Trabala ganesha 70. Adites frigida 71. Ammatho cuneonotatus 72. Asota caricae73 Creatonotos gangis.74. Creatonotos transiens 75. Cyana arama arama 76. Cyana catorhoda 77. Cyana detrita 78. Cyme euprepioides 79. Eugoa sp.80. Gampola sp.81. Hemonia orbiferana 82. Huangilene alikangiae 83. Kailasha effracta 84. Lobobasis niveimaculata 85. Miltochrista calamaria 86. Miltochrista dharma 87. Miltochrista obsoleta 88. Miltochrista paraarcuata 89. Miltochrista sp.90. Nyctemera adversata 91. Pseudoblabes oophora 92 Spilarctia sp.93. Stictane rectilinear 94. Syntomoides imaon 95. Teuloma nebulosa 96. Vamuna remelana*

Fig 97-128*: 97. Ataboruza divisa 98. Eublemma accedens 99. Eublemma roseonivea 100. Eudocima salaminia 101. Tamba rufipennis 102. Bastilla absentimacula 103. Bastilla crameri 104. Bastilla joviana 105. Erebus macropus 106. Grammodes geometrica 107. Hypopyra vespertilio 108. Pindara illibata109. Serrodes campana 110. Spirama sp. 111. Hydrillodes lentalis 112. Hypena laceratalis 113. Hypena obacerralis 114. Arctornis sp.115. Artaxa sp.116. Dasychira chekiangensis 117. Lymantria bivitatta 118. Lymantria mathura 119. Nygmia plana 120. Olene inclusa 121. Orgyia postica 122. Ramadra calligramma 123. Somena scintillans 124. Somena similis 125. Tinolius eburneigutta 126. Diphtherocome sp. 127. Mecodina praecipua 128. Gesonia obeditalis*

Fig 129-160*: 129. Callopistria placodoides 130. Maliattha signifera 131. Leucania sp.132. Pseudeustrotia sp.133. Spodoptera litura 134.Chrysodexis eriosoma 135. Zonoplusia ochreata 136. Nola lucidalis 137. Spatalia sikkima 138.Syntypistis pallidifascia 139. Stenoptilodes taprobanes 140. Ambia sp 141. Elophila sp 142. Eoophyla peribocalis 143. Parapoynx bilinealis 144. Parapoynx crisonalis 145. Parapoynx fluctuosalis 146. Chrysoteuchia sp.147. Crocidolomia pavonana 148. Autocharis fessalis 149. Pitama lativitta 150. Epicrocis oegnusalis 151. Epicrocis sp.152. Endotricha mesenterialis 153. Endotricha sp 154. Hypsopygia mauritialis 155. Pyralis manihotalis 156. Hyalobathra coenostolalis 157. Isocentris filalis 158. Mabra eryxalis 159. Nacoleia sp.160. Ostrinalis sp*

Fig 161-192: *161. Ostrinia furnacalis 162. Pagyda salvalis 163. Spoladae recurvalis 164.Scirpophaga incertulas 164. Aethaloessa calidalis 166. Agathodes ostentalis 167. Agrotera basinotata 168. Arthroschista hilaralis 169. Bradina diagonalis 170. Ceratarcha umbrosa 171. Cirrhochrista brizoalis 172. Conogethes punctiferalis 173. Cotachena nepalensis 174. Cydalima pfeifferae 175. Diaphania indica 176. Endocrossis flavibasalis 177. Eurrhyparodes bracteolalis 178. Eusabena miltochristalis 179. Glycythyma chrysorycta 180. Glyphodes actorionalis 181. Glyphodes bicolor 182. Glyphodes bivitralis 183. Glyphodes caesalis 184. Glyphodes canthusalis 185. Glyphodes onychinalis 186. Glyphodes stolalis 187. Goniorhynchus gratalis 188. Haritalodes derogate 189. Herpetogramma cynaralis 190. Herpetogramma luctuosalis 191. Hydriris ornatalis 192. Lamprosema tampiusalis*

Fig 193-224*:* *193. Leucinodes orbonalis 194. Marasmia exigua 195. Marasmia poeyalis 196. Maruca vitrata 197. Meroctena tullalis 198. Metoeca foedalis 199 Nausinoe sp. 200. Nevrina procopia 201. Notarcha tigrine 202. Omiodes pernitescens 203. Omiodes surrectalis 204. Omphisa anastomosalis 205. Palpita annulifer 206. Pardomima distortana 207. Parotis marginata 208. Patania iopasalis 209. Pilerocera sodalis 210. Poliobotys ablactalis 211. Polythlipta divaricata 212. Pycnarmon jaguaralis 213. Pygospila tyres 214. Rhimphalea ochalis 215. Syllepte gastralis 216. Sameodes cancellalis 217. Syllepte sellalis 218. Synclera traducalis 219 Terastia egialealis.200. Striglina scitaria 221. Homona sp. 222. Homona tabescens 223. Loboschiza koenigiana 224. Birthamoides junctura*

Fig 225- 226: *225. Eterusia aedea 226. Miresa sp.*

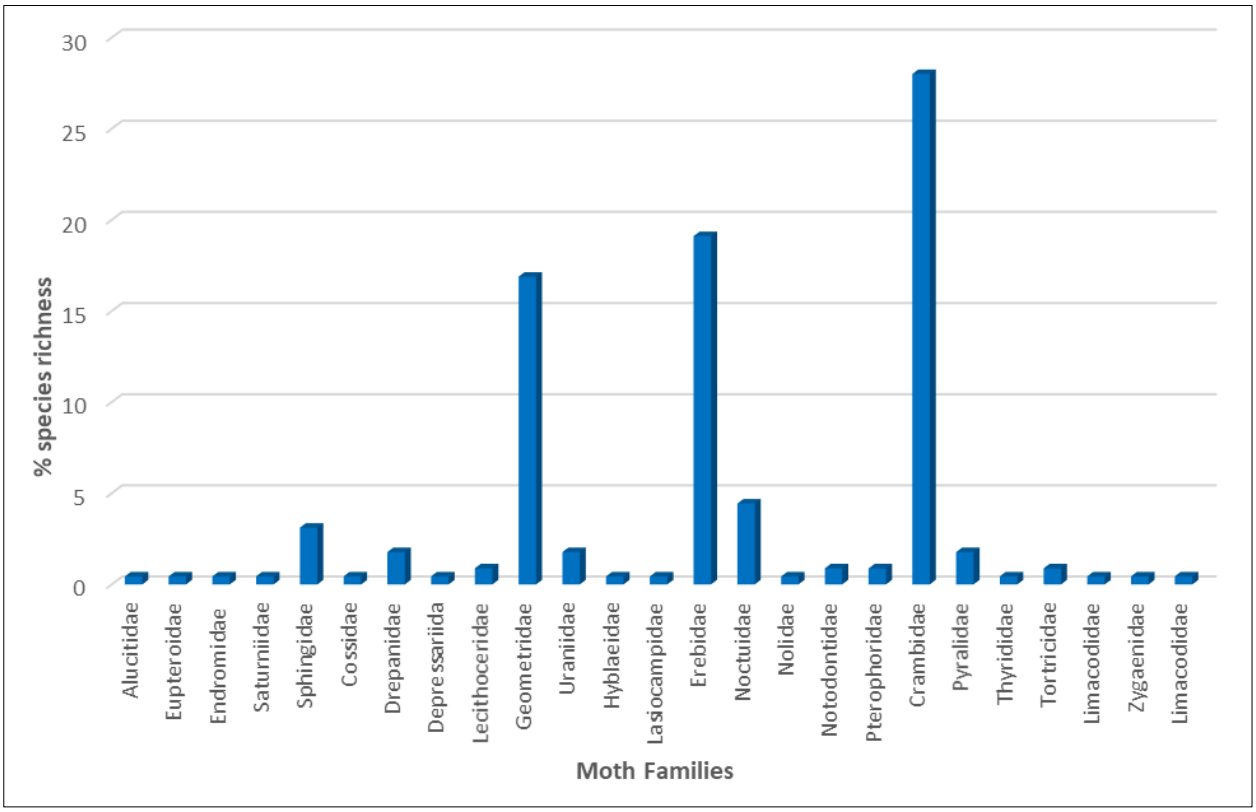

Fig 227: Family wise patterns of moths species richness from surroundings of Mahananda Wildlife Sanctuary.

The highest richness of family Crambidae in the study could be attributed to the various agro-ecosystems and grassy vegetation types surrounding the wildlife sanctuary. The higher species richness within the families Crambidae, Erebidae, Geometridae, and Noctuidae has also been reported from similar observations from other parts of India (Alex *et al*., 2021) [1]; (Biswas *et al*., 2016) [5]. Previously, a field study from Mahananda Wildlife Sanctuary failed to report any moth species (Bagchi and Bagchi, 1996) [2] . A more recent field study from NBWAP, previously a part of Mahananda Wildlife Sanctuary and Baikunthapur Forest Division_reported only 29 species of moths (Ghosh and Biswas, 2019) [8].

The Mahananda Wildlife Sanctuary has forest coverage ranging from 150 to 1300 meters, with relatively steep to precipitous mountain slopes and high ridges on the northern boundary and gently sloping to virtually flat areas on the terai and alluvial plains on the southern border. Sampling the entire elevational gradient would yield a more unique pattern of moth distribution and assemblages, as well as ecological reasons. This pilot study's goal is to provide an overview of moth diversity rather than comprehensive data. However, this study could serve as a starting point for more detailed and complete research in the Mahananda Wildlife Sanctuary and its environs.

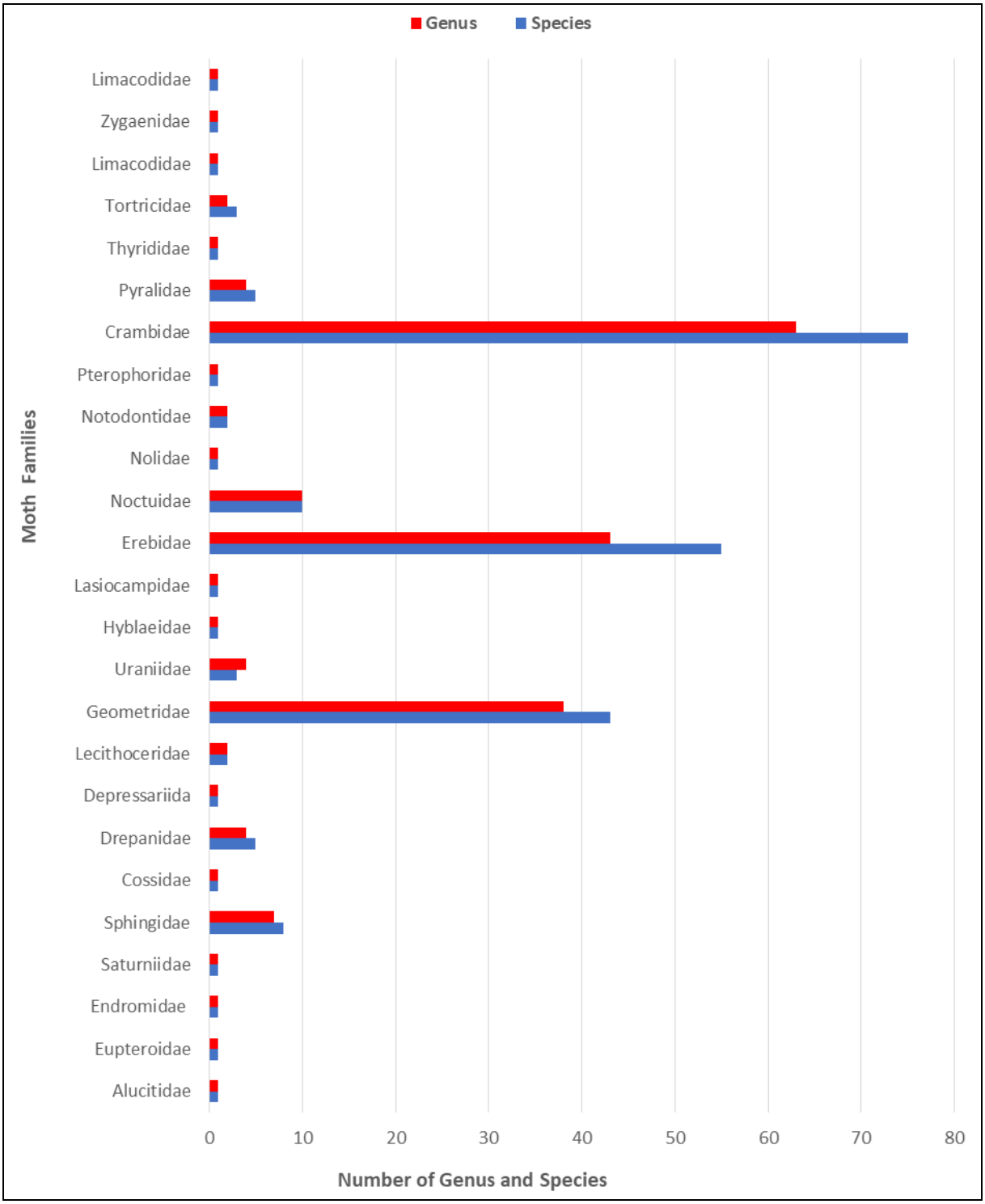

Fig 228: Number of moth species and genera recorded from surroundings of Mahananda Wildlife Sanctuary.

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