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Research Paper

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Preliminary study of moth (Insecta: Lepidoptera) in Coonoor forest area from Nilgiri District Tamil Nadu, India

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Abstract: This present study was conducted at Coonoor Forestdale area during the year 2018-2019. Through this study, a total of 212 species was observed from the study area which represented 212 species from 29 families. Most of the moth species were abundance in July to August. Moths are the most vulnerable organism, with slight environmental changes. Erebidae, Crambidae and Geometridae are the most abundant families throughout the year. The Coonoor Forestdale area was showed a number of new records and seems to supporting an interesting the monotypic moth species have been recorded. This preliminary study is useful for the periodic study of moths.

***Keywords*:** Moth, Environment, Nilgiri, Coonoor

I. INTRODUCTION

The Western Ghats is having a rich flora, fauna wealthy and one of the important biodiversity hotspot area. The Western Ghats southern part is called NBR (Nilgiri Biosphere Reserve) in the three states of Tamil Nadu, Kerala and Karnataka. It is one of a UNESCO world heritage site. The Nilgiri hills the word Nilgiri meaning "Blue Mountain" which is the junctionof the Western Ghats and Eastern Ghats. In Nilgiri hills is having four important type of forests i.e. tropical wet ever green forests, semi evergreen forests, thorny and moist deciduous forest. Many investigators havebeen used the order Lepidoptera as model to assess the impact of disturbance and management performson forest ecosystem ([22], [13], [4], [21], [3], [7]).

Moths and butterflies are belonging to the order (Lepidoptera: Heterocera). This is the second largest and most diverse order of the Class Insecta[6]. So far, 316 butterflieswere recorded in Nilgiri Biosphere Reserve. Monitoring the moths in Coonoor range give us vital indication to conserve in our identifiable environment. Moths are mostly nocturnal, but there are also diurnal species. Totally 12,000 moths wererecorded under 41 families in India[8]. A total of 1, 60, 000 moth species have been described in World. The moths are economically important since they are primary herbivorous in the forest ecosystem [19]. Moths are involving the pollination during night time with night-blooming flowers with heavy fragrance and copious dilute nectar. Most of the moths' family is commonly an agricultural pests. In Nilgiris Diamond back moth larva is the one of the cabbage parasite in the larval population at higher altitude [9]. Thenocturnal birds, reptiles, small mammals and rodents are important predator of moths. The moths are consider as a biological indicator of environmental quality[12]. In this presentstudy moths were collected and documented from different families at Coonoor forest area in the Nilgiri District.

II. MATERIAL AND METHODS

This study was carried out from March2018 to February2019 in Nilgiri Biosphere Reserve the average 1000 meters above the sea level. Average rain fall of the Nilgiri district is 192cm. Moths were observed from Coonoorforestdale [11°21'59.32"N 76°47'43.91"E] (Fig-7) area during night (6 PM to 10 PM). Major observation site is Coonoor forestdaleand shola forest using light trap method for surveying moths. The light traps of various farms have been used to collect and study moths for well over 100 yrs [16]. We haven't collected the moth specimens consider the cause of biodiversity and ecological conservation. We have done the visually observation, photography by day and night time lighting photography by using Olympus camera.

III. RESULT AND DISCUSSION

A total of 212 moths belonging to 29 families was observed during the study period in 2017 to 2018. In our study most of the moths were found in season of early spring (March to May) and Monsoon season (September to November). Six month of moth collection (May to October) regarding their seasonal abundance the activity of moths was found higher in month of August [10]. In northern Western Ghats 418 species of moths belonging to

28 families were recorded by [18]. Based on the field observation the most species rich families are Erebidae, Noctuidae and Nolidae belonging to the superfamily Noctuoidea. The Northern Maharashtra is characterized by larger proportions of moth families such asErebidae, Noctuidae, Crambidae, Geometridae and Sphingidae, which are also among the most diverse families of moths in this region [17]. In the present study revealed that the most abundant species family is Erebidae. Subsequently the second most abundant families are Geometridae and Crambidae. Family Geometridae is semi nocturnal in their habits. Totally 41 species have been recorded from the family Geometridae under 4 subfamilies in 10 tribes in field study.Thus far, totally 67 species were recorded belonging to the family Erebidae from Western Ghats by [20].

In western Himalayas most dominant moth family is Geometridae in all vegetation [1]. Totally 41 species of moths were identified belonging to the family Crambidae in 4 subfamilies recorded in the present study. Similarly 42 species was recorded of Crambidae different places in Tamil Nadu by [15]. 29 species were collected from the superfamily Noctuoidea with species under 5 subfamilies. [19] reported 154 species of Noctuidae moths classified under 85 genus and 23 subfamilies from Nilgiri Biosphere reserve.Noctuidae was predominant among the moths (14).In our study the least species abundant was shown the families Lasiocambidae, Sphingidae, Zygaenidae, Plutellidae. The macro moths consider the following families are observed in the field study Tineoidea, Gracillarioidea, Yiponomeutoidea, Gelechoidea, Alucitoidea, Pterophoridae, Carposinoidea and Tortricoidea. Main source of feeding and host behaviours are an angiosperms, gymnosperms and mosses. 43 specimens belonging to the superfamily Tineoidea was observed from Western Ghats [2]. The genus*Macroglossum* was under family of Spingidae*Macroglossummitchellii* Imperator (Fig. 2), *Macroglossumpassalus*(Fig. 1) *Hypochrosishyadaria* are rareobservation from Nilgiri hills. In our field observation *Macroglossummitchellii imperator* taken nector from Rubiacea family plant. The genus *Macroglossum* is feeding the nectar of flowers from the Rubiacea family [5]. *Trabalagaruda*(Fig.4),*Lygropiadistorta,Omiziamiliaria*(Fig. 5), *Macroglossumpassalus* is the first time recorded from Nilgiri Biosphere Reserve. *Macroglossumpassalus* first photo observation record In Nilgiri hills. Genus*Nepita* is a monotypic moth genus in the subfamily Arctiinae described by (Moore 1860). It also called foot man moth observed in field study. Genus *Nepita* that contain individual that are morphologically identical to each other but belongs to different species. In this moth pattern and colour is totally different by *Nepitaconferta*. Lunar moth *Actiasselene* is one of the most beautiful moths in India and the developmental transformation have been given through photography in this study (Fig. 3). *Attacus* moth is considered to be the largest moth in the world under the family Saturniidae. The growth of moth is accompanied by its host plants,destruction of moths by destroying host plants that eat caterpillars' rapid urbanization surely the cause of disturbing the moth population.

IV. SYSTEMATIC ACCOUNT OF RARE AND NEW RECORD OF MOTHS

Order: Lepidoptera
Family: Spingidae
Genus: *Macroglossum*
Species: *mitchelli*
Sub species: *imperator* Butler, 1875.
Macroglosssummitchelli Imperator (Butler 1875). P; 243, xxxvii, Fig.4
(Ceylon): Hampson 1892. P.118
Description: Male: Head and thorax with two broad gray striper contrasting stronglywith the greenish olive black at head and thorax (Fig. 1). A lack discal band of forewing triangularly diluted, behind M1, joining the Subapical and apical blackspots it including yellow band broader and hardly constricted at middle (Fig. 2).

Order: Lepidoptera
Family: Spingidae
Genus: *Macroglossum*
Species: *passalus*
Macroglossumpassalus(Drury 1773)
Description: This species and the next species having a dark brown to black basal half to the forewing with a straight (or slightly concave in *faro*) distal boundary; beyond this the wing is pale grey, grading darker towards the apex, though with a paler lunule on the costa subapically. In *faro* the dorsum of thorax and abdomen is greener. The basal half of the hindwing below is much more suffused with yellow scales in *passalus*. *M. faro* is much larger than *passalus*.

Family: Lasiocampidae
Order: Lepidoptera
Genus: Trabala
Species: *Trabalagaruda*
Description: Male species colour is fully green. The male as smaller than female the male genitalia have a small pair of relatively close triangular or bidentate process on the tegumen

Order: Lepidoptera
Family: Geometridae
Genus: *Hypochrosis*
Species: *hyadaria*
Description: The wingspan ♂52 mm, ♀ 64 mm. Palpiporrect extending forward, and not reached beyond the frons the body pale red, with a purplish tinge and with dark stream.

Order: Lepidoptera
Family: Geometridae
Genus: *Omiza*
Species: *miliaria*
Description: The male of *miliaria* having a strong forewing submarginal patch centrally, but the antemedial is only strong at the costa rather than extending weakly arc

to the dorsum. In *herois* the hindwing margin excavate subdorsally and tinged brown there. In the female the forewing antemedial more definite, curved in *herois,* and the basal pale zone of the hindwing makes an irregular, mottled incursion into the centre of the distal brown area, this boundary being more or less straight in *miliaria.*

Order: Lepidoptera
Family: Crambidae
Genus: *Lygropia*
Species: *distorta*
Description: Species colour is fully yellow and black line boxes wings edges dark brown thick edges.

Fig-1 Study Area Map.

S.No	Superfamily	Family	Subfamily	Tribe	Genus	Species
1		Geometridae			*Xanthohoe*	
2		Geometidae			*Scopula*	*Scopulaemissaria*
3		Zygaenidae			*Eterusia*	*Eterusiaaedea*
4		Crambidae			*Sygamia*	*Sygamialatimarginalis*
5			Arctiinae		*Cyana*	*Cana puella*
6		Noctuidae	Catocalinae		*Arcte*	*Arctecoerula*
7		Noctuidae			*Ctenoplusia*	*Ctenoplusiaalbosrtiata*
8		Sphingidae			*Macroglossum*	*Macroglossummitchelli*
9		Noctuidae	Hadeninae			
10		Lasiocampidae			*Trabala*	*Trabalagaruda*
11		Noctuidae	Noctuinae		*Xestia*	*Xestia c-nigrum*
12		Noctuidea			*Lygniodes*	sp.
13		Crambidae			*Spoladea*	*Spoladearecurvalis*
14		Lasiocampidae			*Trabala*	*Trabalavishnov*
15		Crambidae				
16		Noctuidae			*Ericeia*	*Ericeiainangulata*
17	Noctuoidea	Erebidae	Lymantriinea		*Orgyiini*	sp.
18	Noctuoide	Erebidae	Arctiinae		*Lyclene*	sp.
19	Noctuoidea	Noctuidae	Hadeninae			
20	Noctuoide	Erebidae	arctiinae	Lithosiini		
21	Pterophoroidea	Pterophoridae				
22		Geometridae	Geometrinae			
23	Noctuoidea	Erebidae	Arctiinae	Lithosiini		
24	Noctuoidea	Erebidae	Lymantriinae		*Orgyiini*	sp.
25		Geometridae	Ennominae	Boarmiini	*Cleora*	sp.
26	Noctuoidea	Erebidae			*Barsine*	*Barsineorientalis*
27	Geometroidea	Geometridae	Larentiinae			
28		Geometridae	Larentiinae	Eupitheciini		
29	Tortricoidea	Tortricidae				
30	Noctuoidea	Erebidae	Lymantriinae			

List of Moths

S.No	Superfamily	Family	Subfamily	Tribe	Genus	Species
31		Crambidae			*Chilo*	*Chilopartellus*
32		Bombycidae			*Bombyx*	*Bombyxmori*
33		Crambidae				
34	Noctuoidea	Arctiidae			*Lemyra*	sp.
35		Geometridae				
36		Noctuidae	Noctuinae		*Agrotis*	sp.
37	Noctuoidea	Noctuidae			*Xestia*	*Xestia c nigrum*
38		Geometridae		Boarmiini	*Psilalcis*	sp.
39	Noctuoidea	Nolidae	Risobinae		*Risoba*	sp.
40		Noctuidae	Noctuinae		*Agrotis*	sp.
41		Plutellidae			*Plutella*	sp.
42		Crambidae			*Nomophila*	*Nomophilanoctuella*
43	Noctuoidea	Erebidae	Hypeninae		*Hypena*	sp.
44		Geometridae		Sterrhini	*Idaea*	sp.
45		Geometridae	Larentiinae			
46		Tineidae	Tineinae		*Monopis*	sp.
47	Noctuoidea	Nolidae				
48		Geometridae	Ennominae			
49	Noctuoidea	Erebidae		Pandesmini	*Polydesma*	sp.
50		Geometridae	Ennominae			
51		Geometridae		Bistoni	*Biston*	
52		Geometridae	Ennominae	Hypochrosini	*Hypochrosis*	*Hypochrosishyadaria*
53		Geometridae	Ennominae	Baptini	*Synegia*	sp.
54		Geometridae	Larentinae			
55		Geometridae		Eupitheciini	*Eupithecia*	sp.
56	Noctuoidea	Erebidae	Herminiinae			
57	Gelechioidea	Depressariidae				
58	Noctuoidea	Erebidae		Nygmiini	*Artaxa*	sp.
59	Noctuoidea	Erebidae		Cisthenina	*Aemene*	sp.
60	Noctuoidea	Erebidae			*Mangna*	*Manginaargus*
61		Erebidae	Arctiinae		*Nepita*	*Nepitaconferta*
62	Noctuoidea	Erebidae	Lymantriinae	Nygmiini		
63		Geometridae	Ennominae	Boarmiini	*Alcis*	sp.
64		Sphingidae		Acherontiini	*Acherontia*	sp.
65		Geometridae		Abraxini	*Abraxas*	sp.
66		Geometridae	Sterrhinae	Timandrini	*Timandra*	sp.
67		Saturniidae			*Attacus*	*Attacus atlas*
68		Saturniidae			*Actias*	*Actiasselene*
69	Noctuoidea	Erebidae			*Erebus*	*Erebus macrops*
70	Noctuoidea	Erebidae		Lymantriini	*Lymantria*	
71		Erebidae	Arctiinae		*Amata*	*Amata cyssea*
72	Noctuoidea	Erebidae			*Euproctis*	*Euproctislutea*
73	Gelechioidea	Lecithoceridae				
74		Hepialidae	Endoclita			

75		Erebidae	Arctiinae		*Spilartia*	
76		Geometridae		Xanthorhoini	*Orthonama*	*Orthonamaobstipata*
77		Geometridae			*Chiasmia*	*Chiasmus emersaria*
78	Noctuoidea	Erebidae			*Rajendra*	*Rajendraperrottetii*
79	Bombycoidea	Eupterotidae				
80	Noctuoidea	Nolidae			*Nola*	*Nola aerugula*
81	Noctuoidea	Noctuidae	Eustrotiinae			
82	Pterophoroidea	Pterophoridae				
83		Erebidae	Arctiinae		*Amata*	*Amata cyssea*
84		Oecophoridae	Oecophorinae		*Promalctis*	sp.
85		Geometridae			*Abraxas*	*Abraxas notata*
86		Spinghidae			*Acherontia*	*Acherontialachesis*
87		Totricidae	Totricinae	Archipini		
88	Gelechioidea	Gelechiidae				
89		Eupterotidae			*Eupterote*	*Eupterotedaehnsataf.hirsuta*
90	Pyraloidea	Crambidae	Scopariinae			
91	Pyraloidea	Crambidae	Heliothelinae			
92		Geometridae			*Chiasmia*	*Chiasmus nora*
93		Eupterotidae			*Apona*	sp.
94		Crambidae			*Leucinodes*	*Leucinodesorbonalis*
95		Crambidae			*Herpetogramma*	*Herpetogrammabipunctalis*
96		Geometridae	Larentiinae	Eupitheciini	*Chloroclystis*	sp.
97	Tineoidea	Eriocottidae				
98		Crambidae				*Marucavitrata, Crambidae*
99	Noctuoidea	Erebidae				*Didugaflavicostata*
100		Erebidae	Arctiinae		*Syntomoides*	*Syntomoidesimaon*
101		Geometridae			*Rhodometra*	*Rhodometrasacraria*
102		Tineidae			*Opogona*	*Opogonadimidiatella*
103		Geometridae			*Abraxas*	*Abraxas martaria*
104		Erebidae	Boletobiinae		*Areapteron*	sp.
105		Noctuidae			*Hypena*	*Hypenalaceratalis*
106		Pyralidae			*Ariappara*	*Arippara indicator*
107	Noctuoidea	Noctuidae			*Sarobides*	*Sarobidesinconclusa*
108		Erebidae		Lithosiina	*Teulisna*	sp.
109	Noctuoidea	Noctuidae			*Spodoptera*	*Spodopteralitura*
110		Pyralidae			*Anonaepestis*	*Anonaepestisbengalella*
111		Noctuidae			*Thysanoplusia*	*Thysanoplusiaorichalcea*
112		Noctuidae			*Aedia*	*Aedialeucomelas*
113		Erebidae	Arctiinae		*Padenia*	*Padeniatransversa*
114		Noctuidae			*Leucania*	*Leucanialoreyi*
115	Noctuoidea	Noctuidae			*Lemyra*	*Lemyraspilosomata*
116		Crambidae			*Parotis*	*Parotismarginata*
117		Crambidae			*Musotima*	*Musotimasuffusalis*
118		Crambidae			*Glyphodes*	*Glyphodespulverulentalis*
119		Crambidae			*Palpita*	*Palpitanigropunctalis*
120	Division:Ditrysia	Ethmiidae			*Ethmia*	sp.

121		Uraniidae			*Phazaca*	*Phazacatheclata*
122		Crambidae			*Pygospila*	*Pygospilatyres*
123		Crambidae			*Bradina*	sp.
124		Crambidae			*Piletocera*	*Piletocerasodalis*
125		Crambidae			*Nosophora*	sp.
126		Crambidae			*Pycnarmon*	*Pycnarmoncribrata*
127	Noctuoidea	Erebidae			*Mocis*	*Mocisundata*
128		Crambidae			*Crocidolomia*	sp.
129	Noctuoidea	Erebidae		Cocytiini	*Avatha*	sp.
130		Crambidae			*Lamprosema*	*Lamprosemacommixta*
131	Gracillarioidea	Gracillaridae				
132		Crambidae			*Conogethes*	*Conogethespunctiferalis*
133		Plutellidae			*Plutella*	*Plutellaxylostella*
134		Noctuidae			*Elusa*	*Elusaantennata*
135		Nolidae			*Paracrama*	*Paracramadulcissima*
136		Geometridae		Eupitheciini	*Chloclystis*	sp.
137	Noctuoidea	Erebidae			*Ataboruza*	*Ataboruzadivisa*
138		Noctuidae			*Bastilla*	*Bastillajoviana*
139		Noctuidae	Euteliinae		*Anigraea*	sp.
140		Drepanidae	Drepaninae		*Teldenia*	sp.
141		Geometridae			*Petelia*	sp.
142		Crambidae	Spilomelinae			
143		Crambidae			*Lygropia*	*Lygropiadistorta*
144	Noctuoidea	Erebidae	Boletobiinae		*Laspeyria*	sp.
145		Nolidae	Chloephorinae		*Xanthodes*	*Xanthodesalbago*
146		Erebidae			*Grammodes*	*Grammodesgeometrica*
147		Pyralidae	Phycitinae			
148	Pyraloidea	Crambidae	Scopariinae			
149	Noctuoidea	Erebidae	Boletobiinae		*Corgatha*	
150	Noctuoidea	Erebidae		Lithosiina	*Gampola*	
151		Noctuidae			*Callopistria*	*Callopistriaguttulalis*
152		Crambidae			*Synclera*	*Syncleratraducalis*
153		Noctuidae			*Hipoepa*	sp.
154		Crambidae			*Uresiphita*	*Uresiphitareversalis*
155	Noctuoidea	Noctuidae		Caradrinini	*Conservula*	*Conservulaindica*
156	Noctuoidea	Erebidae			*Oeonistis*	*Oeonistisentella*
157		Crambidae			*Autocharis*	*Autocharishedyphaes*
158		Geometridae		Abraxini	*Heterostegane*	*Heterosteganesubtessellata*
159		Geometridae			*Hemithea*	*Hemitheatritonaria*
160		Crambidae			*Talanga*	*Talangasexpunctalis*
161		Crambidae			*Aetholix*	*Aetholixflavibasalis*
162		Geometridae		Comibaenini	*Protuliocnemis*	*Protuliocnemisbiplagiata*
163		Geometridae	Ennominae	Hypochrosini	*Omiza*	*Omizamiliaria*
164		Geometridae	Ennominae	Hypochrosini	*Achrosis*	sp.
165		Geometridae			*Oxymacaria*	*Oxymacariatemeraria*
166		Geometridae	Sterrhinae	Timandrini	*Timandra*	*Timandracomae*

167		Geometridae	Ennominae	Macariini	*Chiasmia*	*Chiasmiafidoniata*
168		Geometridae		Hemitheini	*Comostola*	*Comostolalaesaria*
169	Noctuoidea	Erebidae		Subtribe: Nudariina	*Cyana*	*Cyanaperegrina*
170		Crambidae			*Filodes*	*Filodesfulvidorsalis*
171		Pyralidae		Endotrichini	*Endotricha*	sp.
172		Crambidae	Pyraustinae			
173		Geometridae		Macariini	*Isturgia*	sp.
174		Noctuidae	Euteliinae		*Targalla*	*Targallaapicifascia*
175		Erebidae	Arctiinae	Syntomini	*Amata*	sp.
176		Erebidae			*Grammodes*	*Grammodesstolida*
177		Noctuidae			*Callopistria*	sp.
178		Noctuidae	Hadeninae		*Sasunaga*	*Sasunagatenebrosa*
179		Crambidae			*Agrioglypta*	sp.
180		Crambidae			*Orphanostigma*	*Orphanostigmaabruptalis*
181	Geometroidea	Uraniidae	Epipleminae			
182		Geometridae			*Petelia*	sp.
183		Noctuidae			*Gesonia*	sp.
184		Erebidae			*Trigonodes*	*Trigonodeshyppasia*
185		Erebidae			*Oxyodes*	*Oxyodesscrobiculata*
186		Crambidae			*Conogethes*	sp.
187		Crambidae	Spilomelinae		*Lamprosema*	sp.
188		Crambidae			*Omiodes*	*Omiodesindicata*
189		Crambidae			*Pardomima*	*Pardomimadistorta*
190		Nolidae			*Eligma*	*Eligma narcissus*
191		Geometridae		Ourapterygini	*Ourapteryx*	*Ourapteryxkantalaria*
192	Noctuoidea	Erebidae			*Mocis*	*Mocisfrugalis*
193	Immoidea	Immidae			*Moca*	sp.
194		Geometridae			*Menophra*	sp.
195		Erebidae	Arctiinae		*Paraplastis*	*Paraplastishampsoni*
196		Tortricidae		Archipini	*Adoxophyes*	sp.
197		Crambidae	Spilomelinae		*Botyodes*	sp.
198		Crambidae			*Bacotoma*	*Bacotomaviolata*
199		Noctuoidea	Erebidae	Scoliopteryginae	*Cosmophila*	*Cosmophilaflava*
200		Stathmopodidae			*Stathmopoda*	*Stathmopodaauriferella*
201		Erebidae			*Sommeria*	
202		Erebidae			*Rivula*	*Rivula basalis*
203	Noctuoidea	Erebidae			*Erebus*	*Erebus hieroglyphica*
204		Oecophoridae			*Endrosis*	*Endrosissarcitrella*
205	Noctuoidea	Erebidae			*Speiredonia*	*Speiredoniamutabilis*
206		Sphingidae			*Macroglossum*	*Macroglossumpassalus*
207	Noctuoidea	Erebidae			*Digama*	*Digamainsulana*
208	Noctuoidea	Erebidae			*Digama*	*Digamahearseyana*
209	Noctuoidea	Erebidae	Herminiinae		*Hydrillodes*	*Hydrillodesgravatalis*
210	Noctuoidea	Erebidae			*Somena*	*Somenasimilis*
211	Noctuoidea	Erebidae			*Lacera*	*Laceranoctilio*
212		Erebidae	Arctiinae	Lithosiini	*Miltochrista*	sp.

Images of Moths Plate-1

Fig 2 *Macroglossumpassalus*

Fig. 3 *MacroglossumMitchelli Imperator*

Fig 4 *Actias Selene* developmental transformation.

Images of Moths

Plate-2

Fig 5 *Trabalagaruda*

Fig 6 *Omiziamiliaria*

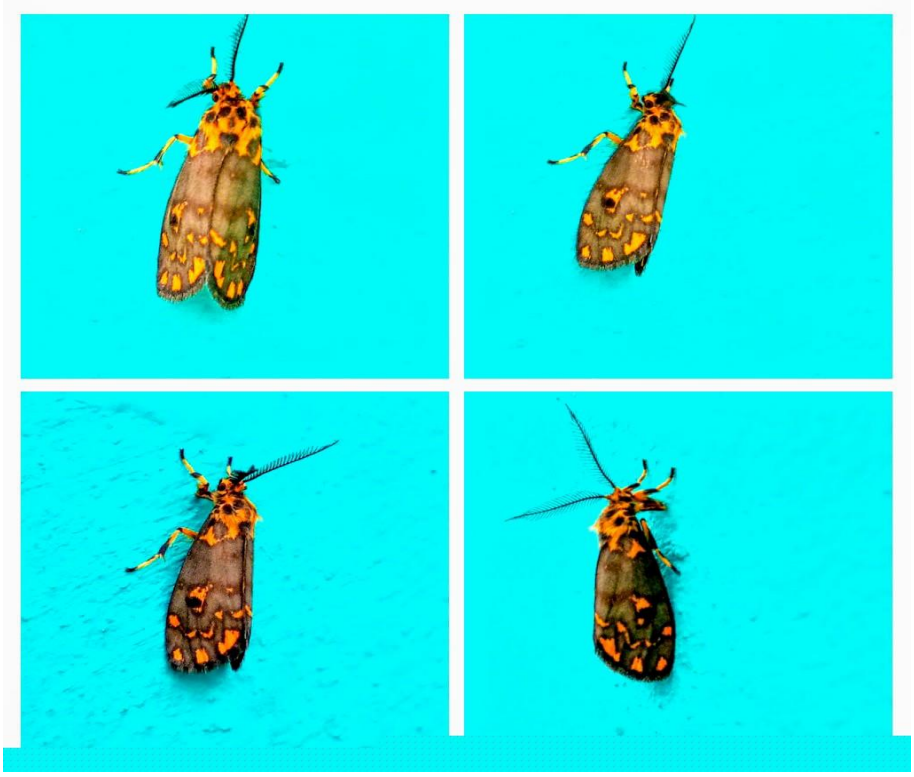

Fig 7 *Nepita* monotypic moth genus

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