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Moth (Lepidoptera: Heterocera) Fauna of Delhi with Notes on Their Role as Potential Agricultural Pests

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Abstract: The present study deals with moth inventory in Delhi carried out from 2014 to 2015. During the study 36 species of moths belonging to 31 genera and 7 families were added to the existing moth fauna of Delhi. After the present study, the moth fauna of Delhi comprises a total of 47 species belonging to 42 genera and 9 families. Among these, species richness was found to be highest for family Noctuidae (17 spp.) followed by Erebidae (11 spp.) and Sphingidae (6 spp.). The paper also provides information about moths acting as potential agricultural pests of common vegetables and crops of Delhi region based on secondary data.
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Keywords：Agricultural pests, Delhi, Heterocera, Moth'

Introduction

Insects being largest funal group form a major component of the biodiversity of any area and hence, documentation of this group is indispensable to any scientific study and conservation programme (Abang & Karim, 2002). Moths (Lepidoptera: Heterocera) represent one of the most heterogeneous groups among insects. There are about 1, 27,000 species of moths from all over the world (Alfred et al., 1998) and of these, over 5000 species are reported from India (Cotes & Swinhoe, 1887-89; Hampson, 1892-96; Bell & Scott, 1937; Chandra, 2007; Smetacek, 2011; Gurule et al., 2013).

Moths play a very important role in urban landscapes as agricultural pests (Sharma, 2011; Sharma & Bisen, 2013), night pollinators (Devoto et al., 2011; LeCroy et al., 2013) and indicators of ecological health (Holloway, 1985). But studies on moths are highly neglected in the National Capital region of India that represents one of the unique urban habitats in the world having a city forest, the Delhi Ridge at the bank of river Yamuna and traversed by one of the oldest mountain system of the world, the Aravalli hills. So far only 11 species of moths belonging to 11 genera and 7 families are reported from Delhi (Ghosh & Varshney, 1997). The present study aims to document this faunal group in Delhi region based on sampling carried out from 2014 to 2015 and also to find out their role as potential agricultural pests in this region based on secondary information.

Methodology

The study was carried out from April 2014 to March 2015 following opportunistic search and light trap collection in selected residential areas of Delhi and their surroundings within 1 km range. Opportunistic search was carried out in all possible microhabitats i.e. tree bark, leaves, bushes, herbs/grasses, shrubs, walls, ceiling/wall/floor of houses, on grounds and under street light poles during evening hours of day (6 – 9 pm). Light trap was also set during the same time period using a 160W mercury vapour bulb over a $3x3m^2$ white cloth sheet which was hung between two vertical poles. The moths sitting on the white cloth were picked into the killing bottles containing chloroform ($CHCl_3$). Later they were stretched properly using entomological pins and have been kept properly in the insect box for later identification. Wing measurements were done in millimetres by measuring the length of the straight line between the two forewing tips. Identification was done using manuals of Hampson (1892-96) and Bell and Scott (1937). Also secondary data was analysed to find out moths playing role as potential agricultural pests of common vegetables and crops grown in Delhi region.

Results and discussion

During the study 40 species of moths belonging to 35 genera and 7 families were recorded from the study area of which 36 species of 31 genera and 7 families were added to the existing moth fauna of Delhi. (Table 1, Figs. 1, 3 & 4) Only 4 species viz. *Chiasmia fidoniata, Euproctis lunata, Trigonodes hyppasia* and

Dichagyris flammatra which were previously reported by Ghosh & Varshney (1997) from this region was recorded during the present study. Majority of moth species previously reported from this region remained unnoticed and the reason may be our study was random and only a limited area was covered during the study.

After the present study, the moth fauna of Delhi comprises a total of 47 species belonging to 42 genera and 9 families. Among these, species richness was found to be highest for family Noctuidae (17 spp.) followed by Erebidae (11 spp.) and Sphingidae (6 spp.) (Table 1; Figure 1). Polyphagous nature of Noctuidae members may account for their higher species richness. The study also revealed that among the heteroceran species so far reported from Delhi, 19 species belonging to 17 genera and 6 families are potential agricultural pests of common vegetables and crops of this region. (Cabello, 1989; Cunningham et al., 1999; Krishnamurthy et al., 1999; Vargo, 2000; Sharma et al., 2008; Sharma, 2011; Rao et al., 2012; Sharma & Bisen, 2013; Abbas et al., 2015; Grigolli et al., 2015) (Table 1; Figure 1).

Delhi being an urban area, first time reporting of 36 spp. of moths from this region is highly encouraging. We expect many more species from the area in future through systematic surveys covering all seasons of the year and that will no doubt help to understand overall species diversity as well as seasonal variations in moth abundance in this region and underlying biotic interactions.

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Table 1. Addition to the moth fauna of Delhi

Genus/species	Common Name	Wingspan (in mm)	Micro habitat	Locality
				Super family: Bombycoidea
				Family: Eupterotidae
Eupterote fabia (Cramer, 1779)	Monkey moth	84	House ceiling	Dwarka
		Family: Sphingidae		
Acherontia styx Westwood, 1847	Death's-head hawk moth	104	Grass	Dwarka
Clanis phalaris (Cramer, 1777)	-	115	House wall	Dwarka
Hippotion celerio(Linnaeus,1758)	Vine-striped hawk moth	78	Tree Bark (*Aurocaria* sp.)	Dwarka
Psilogramma sp.	-	86	Grass	Janakpuri
Theretra oldenlandiae (Fabricius, 1775)	Impatiens hawk moth	61-70	Shrub (*Petunia* sp.)	Dwarka
		Super family: Geometroidea		
		Family: Geometridae		
Cleora acaciaria (Boisduval, 1833)	-	28-30	Light trap	Dwarka
Cleora cornaria (Guenée, 1857)	-	33-35	Light trap	Dwarka
		Family: Lasiocampidae		
Trabala vishnou (Lefèbvre, 1827)		50	Grass	Dwarka
		Superfamily: Noctuoidea		
		Family: Erebidae		
Achaea janata (Linnaeus, 1758)	Castor semi-looper moth	60-64	Light trap	Dwarka
Amata cyssea Stoll, 1782	Handmaiden moth	28-30	House wall	Dwarka
Creatonotos gangis (Linnaeus, 1763)	-	40-41	Grass, Light Trap	Dwarka, Pusa
Dysgonia torrida (Guenée, 1852)	Jigsaw moth	39-40	Grass	Dwarka
Lymantria sp.	-	25	Light trap	Dwarka
Ophiusa triphaenoides (Walker, 1858)	-	33-41	Light trap	Dwarka, Janakpuri, Sriniwas Puri
Spirama retorta (Clerk, 1764)	Indian owlet moth	60	Grass	Dwarka
Utethesia pulchella (Linnaeus,1758)	Crimson speckled moth	31-35	Tree leaf (*Acacia* sp.)	Dwarka, Sriniwas Puri
		Family: Noctuidae		
Acontia lucida (Hufnagel, 1766)	Pale Shoulder moth	27-30	Light trap	Kashmere Gate
Asota ficus Fabricius, 1775	-	49	Light trap	Kashmere Gate
Agrotis ipsilon (Hufnagel, 1766)	Dark sword-grass moth	47-50	Light trap	Dwarka
Chrysodeixis chalcites (Esper, 1789)	Golden twin-spot moth	34-35	Light trap	Dwarka
Digama hearseyana Moore, 1859	-	32-34	Light trap	Dwarka
Helicoverpa armigera (Hübner, 1809)	Cotton bollworm moth	35-37	Light trap	Dwarka, Janak Puri, Pusa, Sriniwas Puri
Helicoverpa assulta (Guenée, 1852)	Oriental tobacco budworm moth	34-35	Light trap	Dwarka
Helicoverpa punctigera Wallengren, 1860	Native budworm moth	34-35	Light trap	Dwarka
Mythimna loreyi (Duponchel, 1827)	Maize caterpillar moth	34-37	Light trap	Mayur Vihar, Pusa
Mythimna separata Walker, 1865	Oriental armyworm moth	45-50	Light trap	Dwarka
Pandesma sp.	-	37	Light trap	Dwarka
Spodoptera litura (Fabricius, 1775)	Oriental leafworm moth	35	House Wall	Dwarka, Sriniwas Puri
Spodoptera exigua (Hübner, 1808)	Beet armyworm moth	27-30	Light trap	Dwarka
Thysanoplusia orichalcea (Fabricius, 1775)	Golden plusia	38-42	Light trap	Dwarka
Xestia sp.	-	30	Grass	Dwarka
		Superfamily: Pyraloidea		
		Family: Crambidae		
Cnaphalocrocis sp.	-	37	Light trap	Dwarka
Diphania indica (Saunders, 1851)	Cucumber moth	15	Light trap	Dwarka
Maruca vitrata (Fabricius, 1787)	Bean pod-borer moth	27-28	House Ceiling	Dwarka
Spoladea recurvalis (Fabricius, 1775)	Hawaiian beet webworm moth	22	Light trap	Dwarka

Table 2. Heteroceran pests feeding /attacking common crops/vegetables grown in Delhi

Common crops /vegetables grown in Delhi	Heteroceran pests recorded from Delhi during the study
Maize	*Chrysodeixis chalcites, Earias insulana**, *Helicoverpa armigera, Mythimna loreyi, M. separata, Spodoptera exigua, S. litura*
Soybean	*Agrius convolvuli**, *C. chalcites, Maruca vitrata, M. separata, S. exigua, S. litura, Thysanoplusia orichalcea*
Castor	*Achaea janata, Asota ficus, H. armigera, S. litura, S. exigua, Trabala vishnou*
Pulses (chick pea/pigeon pea/black gram)	*A. convolvuli**, *H. armigera, M. vitrata*
Cabbage	*S. litura, T. orichalcea*
Tomato	*Acherontia styx, C. chalcites, H. armigera, S. exigua, T. orichalcea*
Potato	*H. armigera, S. exigua, T. orichalcea*
Brinjal	*A. styx, C. chalcites, S. litura*
Cauliflower	*Agrotis ipsilon, S. litura, T. orichalcea*
Lady's finger	*H. armigera, S. exigua, E. insulana**
Sweet potato	*A. convolvuli**, *Creatonotos gangis*
Beet root	*Hippotion celerio, S. litura*
Taro	*H. celerio, S. litura, Theretra oldenlandiae*
Onion	*S. exigua, C. chalcites, A. ipsilon, T. orichalcea*
Garlic	*A. ipsilon, S. exigua*
Pea	*A. ipsilon, M. separate*
Gourd	*Diphania indica*
Turnip	*M. separata, S. litura*
Radish	*T. orichalcea*
Chilly	*H. armigera*

Note: * Heteroceran pests previously reported from Delhi (Ghosh & Varshney, 1997).

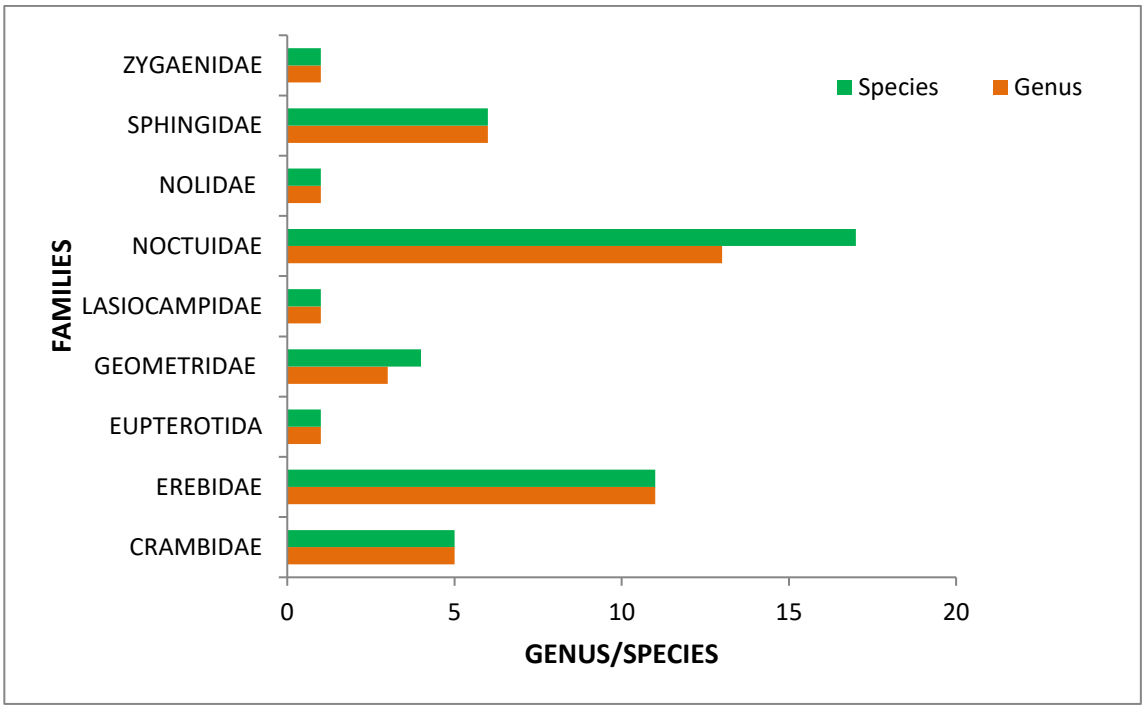

Figure 1. Moth diversity of Delhi

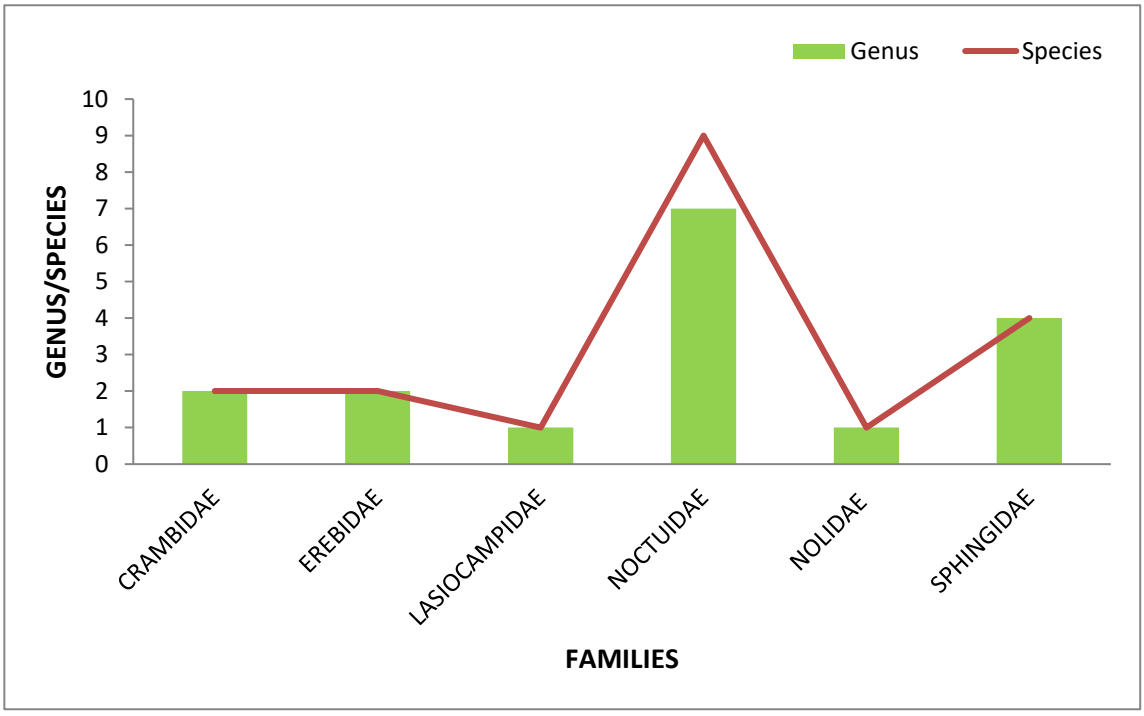

Figure 2. Heteroceran pests of common crops/vegetables in Delhi.

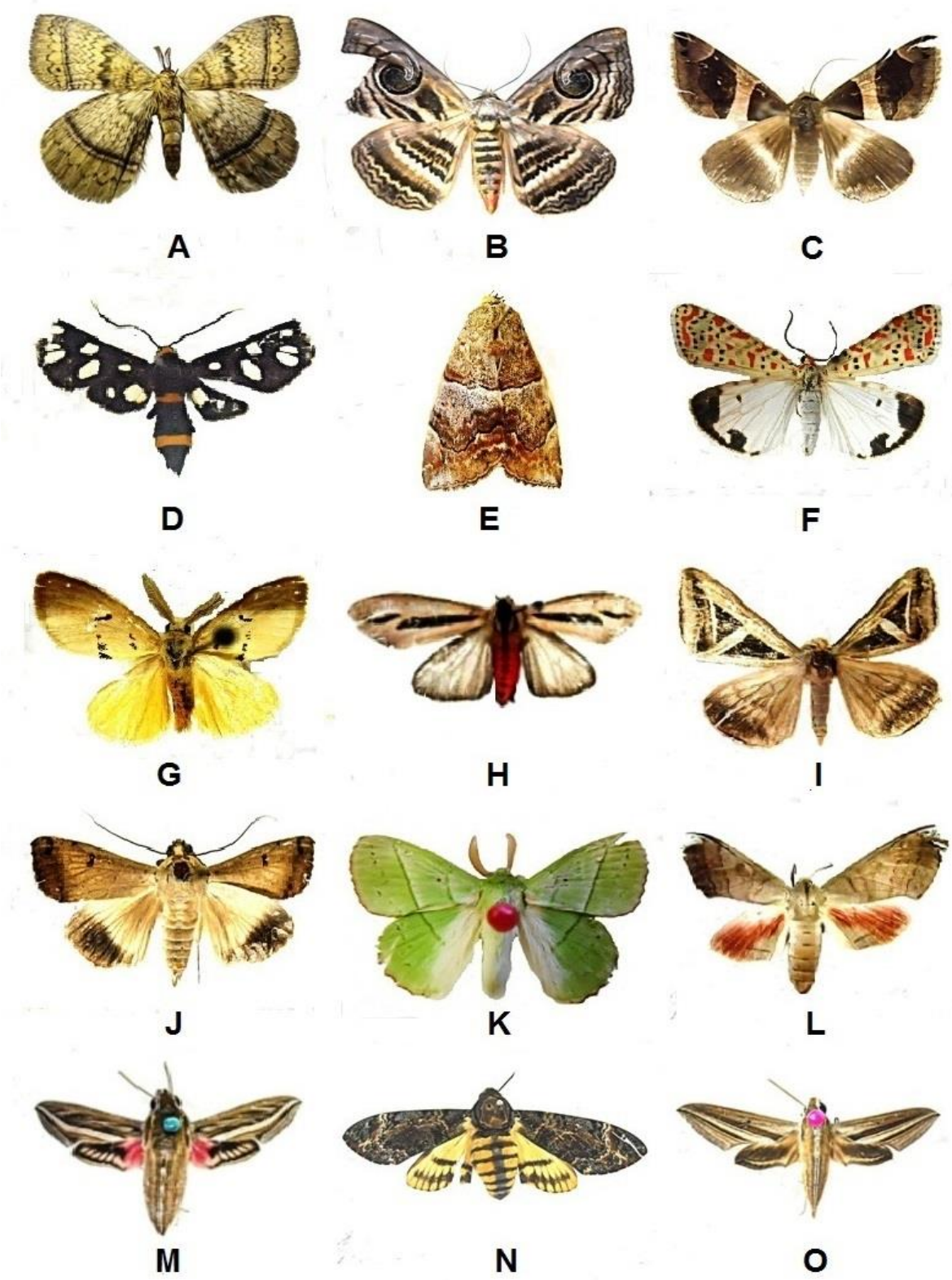

Figure 3. A (Eupterotidae): *Eupterote fabia* (A); B-J (Erebidae): *Spirama retorta* (B), *Dysgonia torrida* (C), *Amata cyssea* (D), *Achaea janata* (E), *Utetheisa pulchella* (F), *Euproctis lunata* (G), *Creatonotos gangis* (H), *Trigonodes hyppasia* (I), *Ophiusa triphaenoides* (J); K (Lasiocampidae): *Trabala vishnou* (L); L-O (Sphingidae): *Clanis phalaris* (L), *Hippotion celerio* (M), *Acherontia styx* (N), *Theretra oldenlandiae* (O).

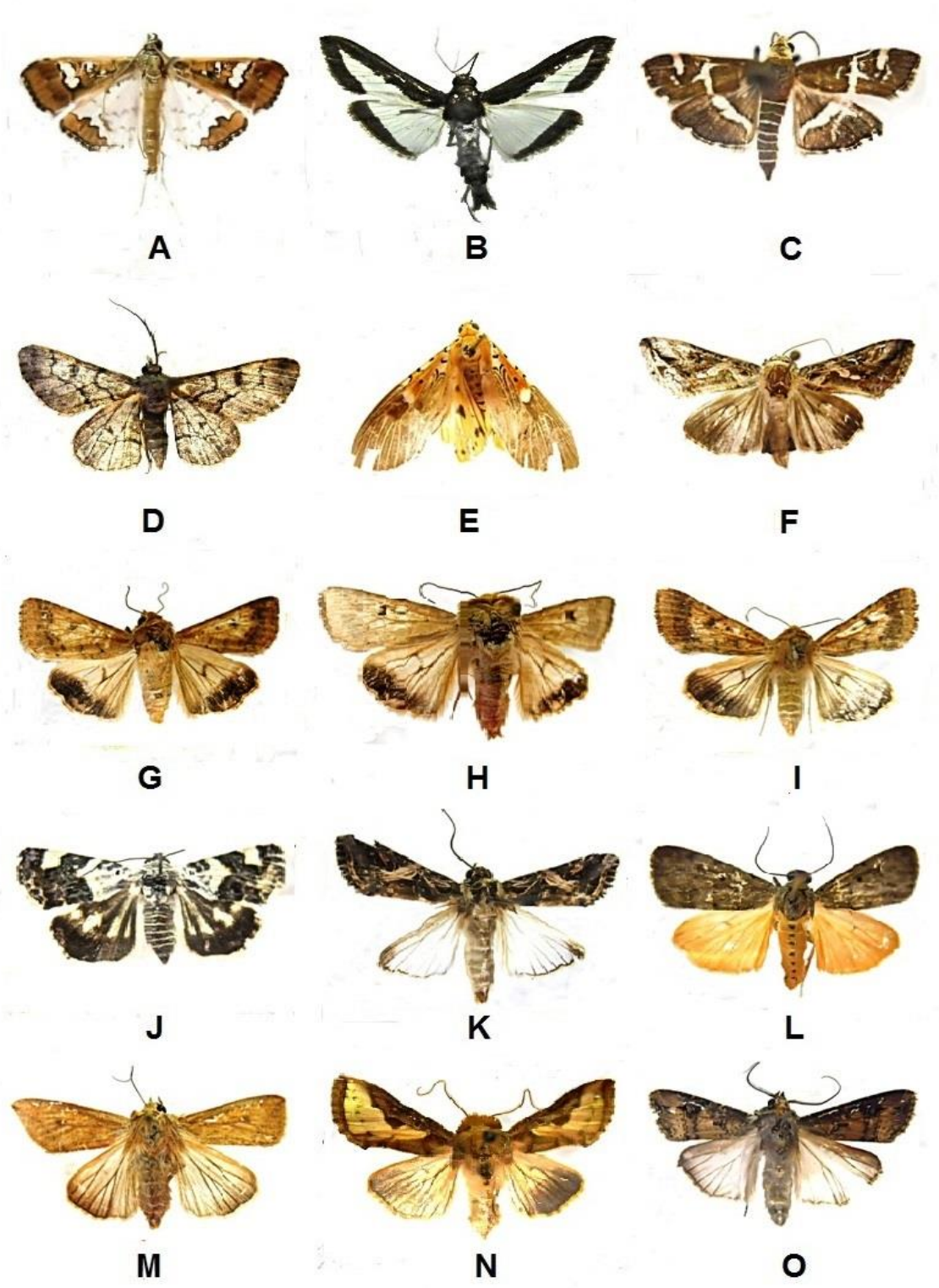

Figure 4. A-C (Crambidae): *Maruca vitrata* (A), *Diphania indica* (B), *Spoladea recurvalis* (C); D (Geometridae): *Cleora cornaria* (D); E-O (Noctuidae): *Asota ficus* (E), *Chrysodeixes chalcites* (F), *Helicoverpa armigera* (G), *Helicoverpa punctigera* (H), *Helicoverpa assulta* (I), *Acontia lucida* (J), *Agrotis ipsilon* (K), *Digama hearseyana* (L), *Mythimna separata* (M), *Thysanoplusia orichalcea* (N), *Spodoptera litura* (O).

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