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Total insect fauna of order lepidoptera collected through light trap installed in paddy field

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Abstract

The present investigation study on total insect fauna of order lepidoptera collected through light trap installed in a paddy field at Jabalpur was carried out at the Krishi Nagar experimental farm, Adhartal, JNKVV, Jabalpur, Madhya Pradesh during the period between the last week of June to the last week of December, 2014. Result showed that trap catches total of 40 species belonging to 10 families of order Lepidoptera were recorded throughout the season (*kharif* 2014). Based on number of species collected, the largest collection was represented by family Noctuidae (12 species) followed by Erebidae (8 species), Arctiidae (5 species), Geometridae (4 species), Sphingidae (3 species), Pyralidae (2 species), Lymantriidae (2 species) and Lasiocampidae (2 species) respectively while family Nymphalidae and Crambidae were represented by single species only.

Keywords: Light Trap, Lepidoptera, Rice, Family

Introduction

Rice (*Oryza sativa* L.) is an important cereal crop in the world serving as staple diet for millions of peoples. Rice stands second in the world after wheat in area and production. Almost 90% of rice is grown and consumed in Asia [2]. At global level, rice is grown on an area of about 155.2 million ha with production and productivity of 461 million tonnes and 4.09 tonne ha⁻¹ respectively. India ranks first in respect of area 43.95 million ha second in producing 106.54 million tonne, only after China, but the productivity of rice is very low only 2.42 tonne ha⁻¹. In Madhya Pradesh rice is cultivated in an area of 1.93 million ha with production of 2.78 million tonne and productivity of 1.44 tonne ha⁻¹ [3]. Worldwide food plants are damaged by more than 10,000 species of insects [11]. In India, average losses of paddy production due to insect pests are 25-30% [10] and in Madhya Pradesh about 40-100% losses were observed [12].

Nocturnal insects are often attracted to light sources that emit large amount of UV radiation, and devices that exploit this behavior, such as light traps for forecasting pest outbreaks, and electric insect killers, have been developed [32, 15] reported that phototactic behavior toward ultraviolet light varies among nocturnal flying insects [34]. Suggested that light trap is an effective, bias-free monitoring tool of moth pests, it has often been used in the ecological studies of lepidopteron insect pests in agro-ecosystems [31]. Suggested that light trap is an important tool for minimizing the insect pests damage without any toxic hazards [23]. Revealed that 69 species belonging to 11 orders and 37 families were recorded throughout the season (*kharif* 2013) by light trap catches. Largest collection was represented by order Lepidoptera (20 species) followed by orders Hemiptera (15 species), Coleoptera (15 species) Orthoptera (6 species) and Hymenoptera (5 species) in descending order respectively. Orders of minor significance were represented by Odonata and Neuroptera having 2 species each while Isoptera, Diptera, Dermaptera and Dictyoptera were represented by one species only. The present investigation is proposed to observe the "Total Insect Fauna of Order Lepidoptera Collected Through Light Trap Installed in Paddy Field".

Materials and Methods

The present experiment entitled, "Total Insect Fauna of Order Lepidoptera Collected Through Light Trap Installed in Paddy Field" was carried out at the Krishi Nagar experimental farm, Adhartal, JNKVV, Jabalpur, Madhya Pradesh during the period between the last week of June to the last week of December, 2014.

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Details of light trap unit

New Jawahar light trap model developed at JNKVV, Jabalpur with mercury vapor lamp (80 W) as light source was used for the present study. The light trap units comprised of two components are as follows:-

A) Trapping device

It is made up of 24 gauge GI sheet consisting of a funnel (40 cm top diameter), baffle plates each 30 x 12 cm in size. In this design long funnel stem (pipe) is provided in place of collection chamber which is directly attached to a collection tray.

B) Insect collection device

It is made up of 24 gauge GI sheet 40 cm x 40 cm x 15 cm in size with cupboard and built-in locking system. The insects collected in the chamber of light trap were killed by the exposure of Dichlorvos 76 EC vapours (as fumigating agent) which is directly placed in the collection tray for the instant killing of trapped insects.

Observation procedure

For the taxonomic documentation, the light trap will be operated every night and collection will be observed on the next day morning. Observations will be recorded every day throughout the *kharif* season. Total Lepidopteron insects will be observed and sorted out on the basis of species and their family. Identification of insects was done on the basis of specimens available in insect museum of the Department, Department of Entomology, UAS, Bangalore and Zoological Survey of India, Jabalpur. After counting, dried specimens were prepared by keeping the pinned insects in oven for 24 hours at 30 °C and thereafter well labeled specimens were stored in insect boxes and show cases. Detail photographic presentation of these species was also made.

Results and discussion

Taxonomic analysis of trap catches revealed that a total of 40 species belonging to 10 families of order Lepidoptera were recorded throughout the season (*kharif* 2014). Based on number of species collected, the largest collection was represented by family Noctuidae (12 species) followed by Erebiidae (8 species), Arctiidae (5 species), Geometridae (4 species), Sphingidae (3 species), Pyralidae (2 species), Lymantriidae (2 species) and Lasiocampidae (2 species) respectively while family Nymphalidae and Crambidae were represented by single species only (Table- 1).

In accordance with the present findings, Sharma and Bisen [27] also reported that 23 species of 7 families belonging to order Lepidoptera through light trap catches during *kharif* season 2006 at Jabalpur. Among these species highest numbers of species belonged to family Noctuidae (13 species), similarly Sharma *et al.* [29] also reported 8 families of order Lepidoptera by using light trap in paddy ecosystem, among these family Noctuidae was dominant with 13 species. Ayberk *et al.* [4] recorded a total of 194 specimens from 48 different locations at Sile (Istanbul), in which family Noctuidae was represented by the highest number of species (26) followed by Geometridae (16) and Notodontidae (6) similarly Bernardi *et al.* [5] from municipality of Pinheiro Machado, RS. (Portuguese) reported that the families with the highest number of species collected in light trap were Noctuidae (59), Geometridae (30), Arctiidae (28) and Saturniidae (14).

Per cent distribution of order Lepidoptera in trap catch indicated that maximum percentage of species was shared by

family Noctuidae (67.21%) followed by Arctiidae (18.75%), Erebiidae (3.64%), Sphingidae (2.90%) Lymantriidae (2.18%) Pyralidae (2.04%), Geometridae (1.73%), and Nymphalidae (1.00%), family Lasiocampidae and Crambidae having the least share of 0.49% and 0.42% respectively.

While Keresi and Almasi [20] recorded that, a total of 179,031 specimens belonging to 177 species and 14 families were collected. The most abundant species belonged to the Noctuidae (54.9%), Pyralidae (27.4%), Geometridae (8.3%) and Arctiidae (6.1%).

Among all families of order Lepidoptera Family Noctuidae was represented by a total of 12 species as important pests of different crops.

In accordance to the present findings, Parra *et al.* [25] reported family Noctuidae as the most diversified group of Lepidoptera having major economic importance, similarly Stojanovic *et al.* [35], Hakyemez & Hzal [17] and Kumar *et al.* [21] also reported that family Noctuidae was the dominant and important family of order Lepidoptera in light trap catches.

Comparing the total size of trap catches, highest trap catch was observed of teak defoliator, *Hyblaea puera* Cramer (4104 moths) followed by green semilooper, *Chrysodeixis chalcites* (Esper) (1719 moths).

In contrast with the present findings, Sharma *et al.* [30] from Jabalpur observed highest trap catch of *Plusia acuta* Fabricius (1367 moths) followed by *Hyblaea puera* Cramer (962 moths) among all the species of family Noctuidae in paddy ecosystem, similarly Sharma [31] also reported that cabbage semi-looper, *Plusia acuta* having the highest catch (1407 moths) in light trap among all the noctuids, while El-Mezayyen *et al.* [14] reported that *Spodoptera litura* Fabricius constituted the highest 53.34% of total trap catches.

Tobacco caterpillar, *Spodoptera litura* Fabricius (1313 moths), gram pod borer, *Helicoverpa armigera* (Hubner) (380 moths), soybean looper, *Trichoplusia orichalcea* (Fabricius) (197 moths) and cut worm, *Agrotis ipsilon* (Hufnagel) (54 moths) were among the major polyphagous pest species of this family.

In accordance with the present findings, Dangi [9] reported that *Spodoptera litura*, *Helicoverpa armigera*, *Agrotis ipsilon* and *Plusia orichalcea* were the major polyphagous pests in light trap catches, similarly Sharma and Vaishampayan [28] and Sharma [31] also reported that *Helicoverpa armigera*, *Agrotis ipsilon* and *Spodoptera litura* were the major polyphagous pests of family Noctuidae through trap catches in paddy ecosystem at Jabalpur. Nowinszky and Puskas [24] observed that Cotton bollworm (*H. armigera*) specimens have regularly been present in the light trap catches. Bisht *et al.* [6] studied the seasonal activity of cutworm through light trap catches. Cameron *et al.* [8] also reported soybean looper *Thysanoplusia orichalcea* (Plusiinae: Noctuidae) moths through light trap catch in New Zealand.

Rice army worm, *Mythimna separate* (Walker) (816 moths) was recorded as major pest species of paddy in this region.

In conformity to the present findings, Sharma *et al.* [30], Sharma & Vaishampayan [28] and Sharma and Bisen [27] also reported that rice army worm, *Mythimna separata* as a major pest of paddy through light trap catches.

Okra shoot and fruit borer, *Earias vittella* (Fabricius) (75 moths), hispid moth, *Asota ficus* (Fabricius) (426 moths), *Digama hearseyana* Moore (226 moths), *Xanthodes intersepta* Guenee (125 moths) and *Hypospila bolinoides* Guenee (107 moths) were other pest species of family Noctuidae collected in light trap during the *Kharif* 2014.

Family Arctiidae was the next economically important family

in trap catches which was represented by 5 insect pest species. Red hairy caterpillar, *Amsacta moorei* Butler (412 moths) and bihar hairy caterpillar, *Spilarctia obliqua* Walker (159 moths) were the major polyphagous pests of this family.

In accordance with the present findings, Dangi ^[9] also reported *Amsacta moorei* and *Spilosoma obliqua* through light trap catches, similarly Kasyapa *et al.* ^[19] also observed attraction of adults of red hairy caterpillar (*Amsacta albistriga*) to light trap. Vaishampayan ^[37] suggested that light traps are efficient tools for use in the monitoring and partial control of the red hairy caterpillar, *Amsacta moorei* Butler.

Highest trap catches of family Arctiidae was observed of tiger moth, *Cretonotos gangis* (Linnaeus) (1636 moths).

In conformity to present findings Muchhala ^[23] also reported that tiger moth, *C. gangis* (1275 moths) was highest in light trap catches among all the species of family Arctiidae.

Sunhemp hairy caterpillar, *Utethesia pulchella* Fabricius (41 moths) and *Amata* sp. (415 moths) were the other pests species of family Arctiidae collected in light trap during the *kharif* 2014.

Family Erebidae was the next family after Noctuidae in terms of number of species. This family was represented by 8 insect pest species of minor significance in this region including *Mocis undata* Fabricius (102 moths) *Grammodes geometrica* Fabricius (91 moths), *Artaxa digramma* Boisduval (73 moths), semi-looper *Trigonodes hyppasia* Cramer (70 moths), *Anomis fulvida* Guenee (57) and *Cyna peregrine* Walker (40 moths), *Perina nuda* Fabricius (66 moths) and castor semi-looper, *Achaea janata* Linnaeus (18 moths).

Shubhalaxmi *et al.* ^[33] reported that family Erebidae was dominant among the 28 families collected in light trap catches at eight sites in Northern Western Ghats of India, while Metzler *et al.* ^[22] observed *Cisthene perrosea* (Dyar) of family Erebidae in the light trap catch at New Mexico.

After Erebidae, Family Geometridae is represented by 4 insect pest species of minor significance in this region.

While Doganlar and Arap ^[13] recorded a total of 47 species belonging to 35 genera (Geometridae). Januario *et al.* ^[18] collected 387 individuals, divided in 10 genus and 25 species of family Geometridae, whereas Akbulut *et al.* ^[1] and Bittencourt *et al.* ^[7] reported that family Geometridae was represented by the highest number of species in light trap catches among the families of the order Lepidoptera.

Dilinia medardaria (Herrich-Schiffer) (47 moths), white looper moth *Pingasa chlora* Stoll (79 moths), *Thalassodes* sp. (63 moths) and giant looper *Ascotis selenaria* Schiffermuller (57 moths) were the major species of this family recorded through light trap catches.

In accordance to present findings, Keresi and Almasi ^[20] also recorded *A. selenaria*, while Sinu *et al.* ^[34] observed *Hyposidra talaca*, *Hyposidra infixaria*, *Buzura suppressaria*, *Ectropis obliqua*, *Ascotis* sp. (all Geometridae) through light trap catches in north east India.

Family Sphingidae was the next economically important family, which is represented by 3 species. Among these one is the major pest of sesame namely til hawk moth, *Acherontia styx* (Westwood) (33 moths) and other two are the polyphagous pests namely sweet potato horn worm, *Agrius convolvuli* (Linnaeus) (312 moths) and *Macroglossum* sp. (68 moths).

Similarly Muchhala ^[23] also reported *A. styx* (13 moths) and *A. convolvuli* (298 moths) in the paddy ecosystem through light trap catches, whereas Rose *et al.* ^[26] from Himachal Pradesh reported 15 species of Sphingidae.

Family Pyralidae was the next family of economic importance after Sphingidae having 2 crop pest species namely rice leaf folder, *Cnaphalocrocis medinalis* (Guenee) (161 moths) and maize stem borer, *Chilo partellus* Swinhoe (130 moths).

In accordance to present findings, Sharma *et al.* ^[30] also reported *Cnaphalocrocis medinalis* as a major pests of paddy through light trap catches and Sharma & Vaishampayan ^[28] observed the highest trap catches of *Cnaphalocrocis medinalis* among all the Lepidopteron species in paddy ecosystem at Jabalpur region.

In contrast to the present findings, Keresi and Almasi ^[20] recorded that within Pyralids, the dominant species were *Ostrinia nubilalis* (Hubner, 1796) and *Margaritia sticticalis* (Linnaeus, 1761).

Family Lymentriidae is represented by 2 species of minor significance in this region namely yellow tail moth, *Euproctis similis* (Moore) (68 moths) and yellow hairy caterpillar, *Psalis pennatula* (Fabricius) (248 moths).

In conformity to the present findings, Muchhala ^[23] from Jabalpur also reported *E. similis* (155 moths) and *Psalis pennatula* (15 moths), while Sinu *et al.* ^[34] from north east India reported that *Arctornis submarginata* (Lymantridae) was caught in the light traps.

Family Lasiocampidae was also represented by 2 species namely *Trabala vishnou* Lefebve (42 moths) and *Metanastris hyrtaca* Cramer (28 moths) having status of minor pest against wide host range. Szabo *et al.* ^[36] also reported family Lasiocampidae in light trap catches.

Family Nymphalidae was represented by only one species rice butterfly *Melanitis leda ismene* Cramer (85 butterflies). It is having the status of an important pest of paddy.

In accordance to present findings, Sharma ^[31] and Sharma and Vaishampayan ^[28] also reported rice butterfly as important pest of paddy collected in light trap at Jabalpur (M.P.).

In contrast to present findings, Gokturk ^[16] from Turkey reported a total of 192 butterfly species belonging to 15 families, the family Lycaenidae was represented by the highest number of species (62) followed by Satyridae (27), Nymphalidae (25) and Hesperidae (20).

Family Crambidae was represented by jasmine moth, *Palpita vitrealis* (Rossi) (60 moths). It is having minor significance in this region. Shubhalaxmi *et al.* ^[33] also reported the species of family Crambidae through light trap catches.

Table 1: Taxonomic distribution of Lepidoptera fauna collected through light trap in paddy during *kharif* 2014 at Jabalpur

Sr. No.	Insect species collected	Total collection in seasons (June to December)	Economic status as crop pest
Order- Lepidoptera			
A) Family-Noctuidae			
1	<i>Spodoptera litura</i> Fabricius Tobacco caterpillar	1313	Major polyphagous pest of soybean, cabbage, cucurbits, potato, chilli and pea etc.
2	<i>Helicoverpa armigera</i> (Hubner) Gram pod borer	380	Major polyphagous pest of pulses, potato, tomato, chilli, okra and cotton
3	<i>Chrysodeixis chalcites</i> (Esper) Green semi-looper	1719	Pest of soybean, potato, tomato and bean etc
4	<i>Trichoplusia orichalcea</i> (Fabricius) Soybean looper,	197	Major pest of sunflower, potato and soybean
5	<i>Mythimna separata</i> (Walker) Army worm	816	Pest of paddy, oat, wheat, barley, winter rye, maize, soybean and fodder grasses etc.
6	<i>Hyblaea puera</i> (Cramer) Teak defoliator	4104	Major pest of teak (<i>Tectona grandis</i>)
7	<i>Asota ficus</i> (Fabricius) Hipsid moth	426	Pest of Fig (<i>Ficus</i> sp.), Bark Cloth Tree (<i>Antiaris toxicaria</i>),
8	<i>Xanthodes intersepta</i> Guenee	125	Pest of Castor (<i>Ricinus communis</i>) and Banana (<i>Musa sapientum</i>)
9	<i>Digama hearseyana</i> Moore	226	Pest of Natal plum (<i>Carissa</i> sp.)
10	<i>Agrotis ipsilon</i> (Hufnagel) Cut worm	54	Polyphagous pest
11	<i>Hypospila bolinoides</i> Guenee	107	Pest of Leguminosae floral plants (<i>Derris</i> sp.)
12	<i>Earias vittella</i> (Fabricius) Okra shoot & fruit borer	75	Major pest of okra
B) Family-Erebidae			
13	<i>Mocis undata</i> Fabricius	102	Pest of legumes (<i>Arechis</i> , <i>Butea</i> , <i>Cajanus</i> , <i>Crotolaria</i> , <i>Derris</i> , <i>Glycine</i> , <i>Phaseolus</i> , <i>Vigna</i> etc) & grasses,
14	<i>Artaxa digramma</i> Boisduval Tussock moth	73	Pest of Mango, Litchi, Baheda and various plantation crops
15	<i>Grammodes geometrica</i> Fabricius	91	Pest of <i>Diospyros</i> , <i>Ricinus</i> , <i>oryza</i> , <i>Ziziphus</i> & grasses (Graminae)
16	<i>Anomis fulvida</i> Guenee	57	Pest of Valvetleaf (<i>Abutilon</i>), Hollyhock (<i>Alcea rosea</i>), Red cotton tree (<i>Bombax</i> sp.) Cotton (<i>Gossypium</i>), <i>Hibiscus</i> and <i>Citrus</i> sp.
17	<i>Trigonodes hyppasia</i> Cramer Semi-looper moth	70	Pest of gramineae & Leguminosae plants
18	<i>Cyna peregrine</i> Walker	40	Pest of grasses
19	<i>Perina nuda</i> Fabricius Jackfruit leaf webber	66	Pest of Fig (<i>Ficus benjamina</i>)
20	<i>Achaea janata</i> Linnaeus Castor semi-looper	18	Major pest of Castor
C) Family- Arctiidae			
21	<i>Cretonotos gangis</i> (Linnaeus) Tiger moth	1636	Polyphagous pest
22	<i>Amata</i> sp.	415	Pest of fodder crops
23	<i>Spilarctia obliqua</i> Walker Bihar hairy caterpillar	159	Major polyphagous pest of sesame, linseed and minor pest of cabbage and sweet potato
24	<i>Amsacta moorei</i> Butler Red hairy caterpillar	412	Major pest of Sunhemp, Maize and Jower
25	<i>Utethesia pulchella</i> Fabricius Sunhemp caterpillar	41	Major pest of Sunhemp
D) Family-Geometridae			
26	<i>Dilinia medardaria</i> (Herrich- Schiffer)	47	Pest of Ber (<i>Ziziphus</i> Sp.), Japanese Raisintree (<i>Hovenia dulcis</i>) and Various flowering plant.
27	<i>Pingasa chlora</i> Stoll White looper moth	79	Pest of ornamental plants Rambutan Lychee, Ribbonwood, Silver Ash and Poison Peach etc.
28	<i>Thalassodes</i> sp.	63	Pest of Castor, Mango, Jute and Rosa sp.
29	<i>Ascotis selenaria</i> Schiffermuller Giant looper,	57	Polyphagous pest
E) Family-Sphingidae			
30	<i>Agrius convolvuli</i> (Linnaeus) Sweet potato horn worm	312	Major pest of sweet potato, sunflower and soybean
31	<i>Acherontia styx</i> (Westwood) Til hawk moth,	33	Major pest of sesame and minor pest of potato
32	<i>Macroglossum</i> sp.	68	Pest of a wide range of ornamental flowers (<i>Galium</i> , <i>Rubia cordifolia</i> etc.)
F) Family- Pyralidae			
33	<i>Cnaphalocrocis medinalis</i> (Guenee) Rice leaf folder	161	Major pest of paddy
34	<i>Chilo partellus</i> Swinhoe Maize stem borer	130	Major pest of maize and sorghum
G) Family- Lymantriidae			

35	<i>Euproctis similis</i> (Moore) Yellow tail moth	62	Minor pest of paddy and ragi
36	<i>Psalis pennatula</i> (Fabricius) Yellow hairy caterpillar	248	Minor pest of paddy and sorghum
H) Family-Lasiocampidae			
37	<i>Trabala vishnou</i> Lefebve	42	Pest of pomogranate, castor, almond, jamun, guava, Acacia and <i>Eucalyptus</i> etc.
38	<i>Metanastria hyrtaca</i> Cramer	28	Pest of Almond, Guava, Sal tree, Babul and Cashew nut etc.
I) Family- Crambidae			
39	<i>Palpita vitrealis</i> (Rossi) Jasmine moth	60	Pest of ornamental plant (<i>Jasmine</i> sp.)
J) Family- Nymphalidae			
40	<i>Melanitis leda ismene</i> Cramer Rice butterfly	85	Pest of paddy

Conclusion

Taxonomic analysis of trap catches revealed that a total of 40 species belonging to 10 families of order Lepidoptera were recorded throughout the season (kharif 2014). Based on number of species collected, the largest collection was represented by family Noctuidae (12 species) followed by Erebidae (8 species), Arctiidae (5 species), Geometridae (4 species), Sphingidae (3 species), Pyralidae (2 species), Lymantriidae (2 species) and Lasiocampidae (2 species) respectively while family Nymphalidae and Crambidae were represented by single species only.

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