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Taxonomic analysis of phototactic insect pest species collected through light trap in rice ecosystem at Jabalpur

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Abstract
The field experiment was conducted at Jawaharlal Nehru Agriculture University, Jabalpur (Madhya Pradesh) at the duration period June to October 2016, and light trap device used as mechanical method in paddy ecosystem for management of insect pest species, Phototactic harmful biodiversity of rice collected with light trap with 80 Watt mercury Vapor lamp was used to taxonomic analysis of insect's catches in rice ecosystem from June to October 2016, Taxonomic analysis revealed that these 36 insect pest species belonging to 6 orders and 20 families were recorded throughout the *kharif* season (2016). Based on number of species collected, largest collection was represented by order Lepidoptera 22 species of 8 families (61%) after that order Hemiptera 6 species (17%), Orthoptera 4 species (11%), coleoptera 2 species (6%), isoptera 1 species (3%), and Diptera 1 species (3%) in descending order respectively. Documentation of these 36 insect pest species placed on of their economical point of view, harmful insects- as crop pests they were cached with the help of light trap regularly period from beginning to end of the *kharif* crop time of rice.

Keywords: Phototactic, light trap, taxonomic analysis, rice, harmful insects

Introduction
Light trap is one of the very effective mechanical methods of insect pest management in sustainable agriculture. This trapping device are properly worked at in the field condition in darkness of light for the collection of different types of population of insects like bugs, lepidopteron pest, beetles and other small to large bugs etc. Taxonomical analysis released that these 36 insects' species belonging to 6 orders and 20 families were record during the june to October season of paddy crop, (2016). Most of the insect's pests are nocturnal nature and some diurnal insects are positively phototropic in nature. Record of those insect pest including major phototactic insect fauna. harmful insect as crop pest was maintained which were collected in light trap regularly full duration period of rice crop from june to October. In Madhya Pradesh. rice is cultivated on 1.76 million hectares with annual production of 3.00 million tones and productivity of 1807 kg ha-1 (Anonymous, 2015) [1].
Worldwide food plants are damaged by more than 10,000 species of insects (Dhaliwal *et al*., 2007) [5]. In India average losses in paddy production due to insect pests are 25-30% (Dhaliwal and Arora, 2010) [4] and in Madhya Pradesh about 40-100% losses were observed (Dhamdhere, 1990) [6]. Phototropic behavior and phototactic response of insects are being largely used to monitor pest activity for their effective suppression (Dhiman, 2001) [7]. The forecasting and predication of insect occurrence or outbreak can be made by using light trap (Singh *et al*, 2007) [14]. Method of light trap is the oldest, conventional and effective method for collecting phototatic species and used in sustainable farming. The aim of this study was to identify phototactic harmful insect fauna using light trap device in rice field and identify them on the basis of taxonomic classification and economic values.

Materials and Methods
The research was conducted at the Krishi Nagger experimental farm, Jawaharlal Nehru Agriculture University, Jabalpur (M.P) duration period of rice crop from June to October, 2016, with Jawahar light trap model (SM- 96) with mercury vapor lamp (80 Watt bulb) used for the effect of nocturnal harmful insect pest of rice was recorded on daily basis by using the light trap device at in rice field condition.

Geographical area and Climate: The research work was conducted at the Krishi Nager experimental farm, Adhartal, Jabalpur (MP) at the duration period of June to October, 2016. The weather parameters favorable in Jabalpur are essentially semi-arid and sub-tropical. It is situated at 23.9°N latitude. 79.58° E longitude and at an altitude of 411.78 m above the mean sea level. The annual rainfall varies from 1300 to 1400 mm with an average of 1350 mm.

Light trap design: Jawahar light trap model (SM- 96) developed at JNKVV, Jabalpur with mercury vapor lamp (80 Watt bulb) as light source was used for the purpose of study. The light trap units comprised of two parts are as follows.

1. **Trapping device:** This device 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 collection trey.
2. **Insect collection device:** This device 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. this chemical worked as fumigating agents which is directly placed in collection plate for instant killing of trapped insects pest

Identification of insects: Experimental research for the purpose of taxonomical analysis, the light trap device was regulate every night and collection of the insect was observed on the next day morning, after that we collect various number of species insect pest species that is harmful for crops. Observations will be recorded every day throughout the *kharif* season (June to October). Total number of insects was observed and sorted out on the basis of their order and family and harmful nature of different species of insect. Identification of insect's species was done on the basis of specimens available in insect museum of the Department of Entomology, Jawaharlal Nehru Agriculture University, Jabalpur, Department of Entomology, UAS, Bangalore and Zoological Survey of India, Jabalpur. Dried specimens was prepared by keeping the pinned insects in oven for 24 hours at 30 °C and thereafter well labeled specimens was stored in insect boxes as proper manner.

Results and Discussion

Taxonomic analysis of composition of phototactic harmful insects fauna of rice: Taxonomic analysis revealed that these 36 insect pest species belonging to 6 orders and 20 families were recorded throughout the *kharif* season (2016). Based on number of species collected, largest collection was represented by order Lepidoptera 22 species of 8 families (61%) after that Hemipteran 6 species (17%), Orthoptera 4 species of insects (11%), coleoptera 2 species of insects (6%), isoptera 1 species of insects (3%), Diptera1 species (3%) and isoptera 1 species (3%) in descending order respectively (Fig.1). Documentation of this 36 insect pest species placed on economical point of view, harmful insects- like crop pests they were recorded with the help of trap regularly all over the growing season of rice crop. Insects that can be considered harmful on crops are those that accomplish something negative effect on ecosystem, destroying various cereal crops and vegetable crops (Table 1.)

Table 1: Taxonomical distribution of harmful pests observed by using light trap device at Jabalpur during *kharif* season (2016). Harmful insects species- as crop pests.

S. No.	Insect species collected	Total number of seasons collection (June to Octo.) 2016	Economic status As crop insect pest
	Order Lepidoptera		
	A) Family-Noctuidae		
1)	*Spodoptera litura* Fabricius Tobacco caterpillar	529	It is a harmful insect of soybean crop, cucurbits, potato, chili and pea etc. caterpillars cut the young seedlings
2)	*Helicoverpa armigera* (Hubner) Gram pod borer	102	It is a harmful insects of pulses, chili, okra and cotton and tomato. Pest bore inside the cotton bolls/squres
3)	*Chrysodeixis chalcites* (Esper) Green semi Looper	450	Semi looper mainly feed on Glycine max crop, Beans etc.
4)	*Thysanoplusia orichalcea* (Fabricius)	386	Feed on sunflower. soyabean (glycine max)
5)	*Mythimna separata* (walker) Army worm	182	Insect feed on wheat and rice crop
6)	*Hyblaea puera* Cramer Teak defoliator	741	Serious pest of teak tree
7)	*Asota ficus* (Fabricius)	410	Harmful insect of fodder crops
8)	*Earias insulana* (Boisaduval)	39	Harmful pest of cotton
9)	*Mythimna unipuncta* (Haworth)	52	Pest of barley, rice and sorghum
	B(FAMILY- Arctidae		
10	*Creatonotos gangis* (Tiger moth)	543	Tiger moth is serious pest of grasses and garden crops
11)	*Amata* sp.	233	Larva of *Amata* species feed on lichens and algae
12)	*Spilosoma obliqua* (Walker) Bihar hairy caterpillar	249	Serious insect of sesame, cabbage, linseed
13)	*Amsacta moorei* Red hairy caterpillar	126	Serious insects of jower, corn and sunhemp, late inster of larvae cause defoliation
	C) Family-Sphingidae		
14)	*Agrius convolvuli* (Linnaeus)	140	Pest of sweet potato, and soybean
15)	*Acherontia styx* (Westwood) Til hawk moth	40	Major pest of sesame and minor pest of potato
16)	*Daphnis nerii* (Linnaeus)	15	Feed on nector variety of flowers, petunia, jasmine
	D) Family- Pyralidae		

17)	*Cnaphalocrocis medinalis* (Guene) Rice leaf folder	66	Leaf folders feed on paddy, learve folds leaf marginally and feeds the leaf by scraping chlorophyll.
18)	*Chilo partellus* (Swinhoe)	30	Harmful insect of corn crop and sorghum crop
	***E*) Nymphalidae**		
19)	*Melanitis leda ismene* Red hairy caterpillar	71	Butterfly feed on paddy crop
	F) Family- Lymantriidae		
20)	*Euproctis similis* (Moore)	50	Feed on rice crop and ragi crop
	G) Family- Erebidae		
21)	*Euproctis lunata* (walker)	74	*Euproctis* feed on castor crop
	H) Family - Crambidae		
22)	*Palpita vitrealis*	33	Cause on ornamental plants like jasmine flowers
	ORDER – Hemiptera		
	A) Family - Pentatomidae		
23)	*Nezara viridula* Green stink bug	433	Harmful insect of soybean and vegetable crops
24)	*Antestiopsis cruciate* Coffee plant bug	17	Major insect of Coffee and jasmine plant
	B) Family -Cicadellidae		
25)	*Nephotettix virescens* Green leaf hopper	862	Nymphs and adults of pest suck the cell sap of rice leaves
	C) Family - Lophopidae		
26)	*Pyrilla perpusilla* Sugarcane leafhopper	323	Adult and nymph of *pyrilla* feed on sugarcane and wheat
	D) Family - Pyrrhocoridae		
27)	*Dysdercus Koenigii*	274	Feed on *gossypium* sp. and lady finger
	E) Family – Coreidae		
28)	*Leptocorisa acuta* Rice gundhi bug	313	Gundhi bug feed on paddy crop
	Order – Coleptera		
	F) Family – Scarabaeidae		
29)	*Holotrichia consanguinea* White grub	88	Serious insect of ground nut, soyabean and chili
	B) Family- Chrysomelidae		
30)	*Aulacophora foveicollis* Red pumpkin beetle	429	Major pest of cucurbitaceous particularly pumpkin
	Order- Orthoptera		
	Family - Gryllidae		
31)	*Euscyrtus concinnus*	5091	It feed on rice crop
32)	*Gryllus bimaculatus* Field cricket	139	Harmful insect of fodder crops
	Family – Gryllotalpidae		
33)	*Gryllotalpa orientalis*	219	Pest of rice
	C) Family- Tetrigidae		
34)	*Tetrix subulata* (Linnaeus) Short horn grass hopper	95	Pest of rice
	Order – isoptera		
	A) Family- Termitidae		
35)	*Odontotermes obesus* (Rambur) Termite	64	Major pest of Wheat, gram and sugarcane & minor pest of many cereals and pulse crops
	Order – diptera		
	A) Family- Bibionidae		
36)	*Plecia amplipennis* (Skuse)	25	Fodder pest

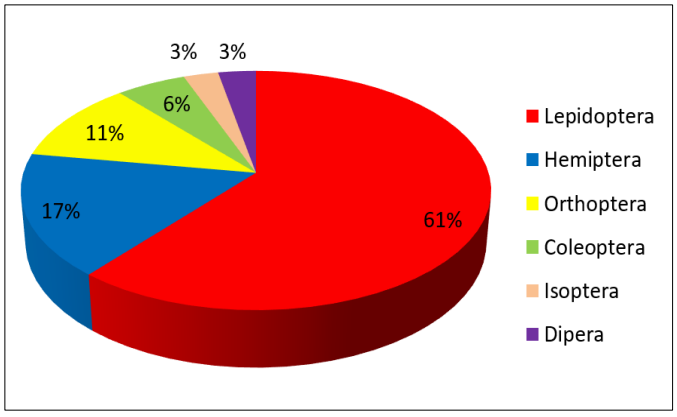

Fig 1: Percentage distribution of harmful in sect's pest's species of different order trapped through light trap device

Order Lepidopteron was represent the highest number of 8 families was represented by the highest number of 8 families included 22 species (61%), (Figure 1.) Family Noctuidea has the highest number of 9 species. This family includes 6 important harmful insect species of different crops. Out of these species, *Hyblaea puera* 741 moths has highest number of catches, after that *spodoptera litura 529 species*, *Chrysodeixis chalcites* number 450, *Mythimna separata* species 182. *Helicoverpa armigera* 102 moths. lowest trap catches are species *Mythimna unipuncta* (Haworth) (52).

Similar to the with present findings Butler *et al*. (2001) [2] observed a total of 438 species of Lepidoptera in 13 selected families were identified including Noctuids (222 species), Geometrids (127 species), Notodontids (27 species), Arctiids (26 species), Sphingids (10 species) and Saturniids (9 species). Sharma *et al*. (2006) [12] also reported from Jabalpur

that 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.

07 insects species of Lepidoptera, *Spodoptera litura 529 moths*, *Chrysodeixis chalcites 450 moths*, *Spilosoma oblique 249 moths*, Amsacta moorei 126 moth and *Helicoverpa armigera* 102 moths and *Thysanoplusia orichalcea* (386), *Earias insulana* Boisduval (39 moths) were also recorded during the season in trap catchs.

Sharma (2004) [13] also recorded three major polyphagous pest species of family Noctuidae namely *Helicoverpa armigera* (143), *Agrotis ipsilon* (76) and *Spodoptera litura* (284) whereas rice leaf folder, *Cnaphalocrocis medinalis* and rice butterfly, *Melanitis ismene* were recorded as important pest of paddy during the *kharif* season in trap catch at Jabalpur. Comparing the relative size of trap catches of family Noctuidae the highest catch was observed of cabbage semilooper, *Plusia acuta* having highest catch (1407 moths) in light trap. Cameron *et al*. (2008) [3] also reported soybean looper *Thysanoplusia orichalcea* (Plusiinae: Noctuidae) moths through light trap catch in New Zealand.

Palpita vitrealis 33 moths present in family Crambidea and *Asota ficus* 410 moths (*Family noctuidae*) and Serious paddy pests *Melantis leda* 71 butterflies (Family Nymphalidea) *Mythimna Separate* 182 moths (family Noctudea), *Mythimna unipuncta* 52 moths (family Noctudea), *Euproctis lunata* 74 moths and *Cnaphalocrocis medinalis* 66 moths (Family Pyralidea), *Euproctis similis* 50 moths (Family Lymentriidea,) *Agrius Convolvuli* 140 and *Acherontia styx* 40 moths, *Daphinis nerii* (Family Sphingidea), *Cretonotos gangis* 543 moths, and *Amata* sp. 233 moths (family Arctidae) *Chilo partellus* 30 moths (family Pyralidea).

After that Order Lepidoptera, Hemiptera second largest order of pests species in light trap catches includes 5 families and 6 species (17%). *Nephotettix virecens* 862, *Nezara virudula* 433 bugs, *Pyrilla perpusilla* 323 hoppers. *Leptocorisa acuta* 313 bugs, *Dysdercus Koenigii* 274 bugs, *Antestiopsis cruciata* 17 bugs, while *Nilaparvata lugens* and *Sogatella Furcifera* present family Delphacidae were absent all over season in trap catches

Salem *et al*. (1999) [10] observed that number of species of hemiptran insects b using Robinson light trap device At Arish city, North Sinai 1994-96, 92 hemipteran species belonging to 58 genera of 16 families (Alydidae, Anthocoridae, Berytidae, Coreidae, Cydnidae, Drosophilidae, Joppeicidae, Lygaeidae, Miridae, Nabidae, Pentatomidae, Plasidae, Piesmidae, Pyrrhocoridae, Reduviidae and Rhopalidae) were identified.

Order Orthoptera was representing by 3 families and 4 species (11%). Among all highest trap catches was *Euscrtus concinnus* (5091 crickets), after that *Gryllotalpa orientalis* (219 crickets), *Gryllus bimaculatus* (139 crickets), *Tetrix subulata* (95 hoppers) and *Gryllid*.

Order Coleoptera represent 2 families and 2 species (6%). According to relative size of light trap catchs, *Aulacophora foveicollis* recorded highest trap catches 429 beetle followed by *Holotrichia consanguinea* 88 beetle. In conformity with the present findings Sharma *et al*. (2010) [11] also recored highest catches of *Aulacophora foveicollis* 451 beetles at Jabalpur region

Isoptera was represent one species (3%) family i.e Termitidae with single species *Odontotermes obesus*. Size of catches was 64 adults. Medrios *et al*. (1999) [8] found that 24 species of *Odontotermes obesus* presents to 03 families including termitidea family by light trap device catches at Atlantic forest of North east brazil. One species of order Diptera reported (3%) family i.e Bibionidea with single plecia amplepennis. Size of Catches 25 adults. For conformity with present findings Muchhala 2014 [9] recorded that Diptera was one family ex. Bibionidae with single species. Order Diptera was represented by only one (3%) family i.e. Bibionidae with single species *Plecia amplipennis* Skuse. The size of catch was 25 adults. In conformity with the present findings Muchhala (2014) [9] reported that order Diptera was represented by only one family i.e. Bibionidae with single species *Plecia amplipennis* Skuse.

Conclusions

Experiment has provided consequential knowledge on phototactic harmful fauna in rice ecosystem the taxonomic analysis revealed that 36 insect's species belonging to 6 orders and 20 families were found during June to October (*kharif* season). This essential details for survelliace and for monitoring of pests for forecasting and other one it is suitable for insect's catching in IPM as mechanical control.

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