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Taxonomic documentation of phototactic insect pests species collected from light trap during *Rabi* season vegetable ecosystem at Chhindwara (M.P.)

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Abstract
An experiment was conducted under the taxonomic documentation of phototactic insect pests collected in light trap during *Rabi* season in vegetable ecosystem at Chhindwara (M.P.). Information on insect fauna of vegetable collected at Chhindwara M.P. The data of trap catch during Rabi 2019-20 was classified on taxonomic basis, economic aspect (crop pest) and bio control significance (parasite and predators) a total 64 insect species belonging to 10 orders and 33 families were recorded throughout the season (Rabi 2019-20) based on number of species collected, largest collection was represented by order Lepidoptera 24 species (44.75%) followed by order Hemiptera 14 species (21.87%), Coleoptera 9 species (14.06%), Orthoptera 3 species (4.68%) and Hymenoptera 2 species (3.12%) in descending order respectively. Orders of minor significance are represented by Odonata, Diptera and Neuroptera having 2 species each while Dermaptera and Dictyoptera were represented by one species only. Based on economic importance this collection was represented by 44 species of harmful insects (as crop pest) 20 species of predatory and parasitic insects (useful as bio control agents). Category of harmful insect pests includes the major and minor pest species of vegetables, major polyphagous pest, pest of cereals, oilseeds and other crops.

Keywords: Trap catches, vegetable ecosystem, taxonomic basis, polyphagous

Introduction
India's diverse climate ensures availability of all varieties of vegetables. It ranks second in vegetable production in the world, after China. In India the total area of vegetables is 10259 thousand ha, production 184394 thousand MT and productivity of vegetables 17.97 MT /ha. In Madhya Pradesh it was cultivated in 889.74 thousand ha and production 17545.48 thousand MT during 2017-18. In district Chhindwara of Madhya Pradesh total cultivated area of vegetable was 41.92 thousand ha with production 1051.82 thousand MT during 2016-17 (Horticultural Statistics at a Glance 2018) [4].

Light trap is an important tool for minimizing the insect pests damage without any toxic hazard. Apart from this light trap has been used to supplement the knowledge of pest fauna of given locality, geographical distribution and their seasonal activity. Insects are the most species-rich taxon with about one million species described worldwide, corresponding to more than half of all known species

Due to their high ecological diversification and short generation times, insects are useful indicators of environmental change. Lepidoptera (butterflies and moths) is one of the largest insect orders with 160,000 described species, of which 95% are moths. Moths play important roles in many ecosystems as pollinators, herbivores, and prey for a wide range of species such as birds and bats. The distribution and ecology of moths are well known in comparison to many other invertebrates.

Extensive work has been carried out by Vaishampayan, Sharma and associates on various aspects of light-trap designs, light sources and seasonal activities of major insect pests of chickpea and paddy but very little information is available on phototactic insect fauna of vegetable crops particularly in Chhindwara (M.P.), therefore present investigation is proposed to fill up this gap with Taxonomic documentation of phototactic insect pests collected in light trap during rabi season in vegetable ecosystem at Chhindwara (M.P.)

Materials and Methods
The present experiment was conducted on two distinct farmer's field at district Chhindwara (MP) during the *rabi* season 2019-20.

Experiment conducted by standard design of Jawahar light trap by using 125-watt mercury vapor lamp.

Light trap was operated every night and collection was observed on the next day morning. Observations will be recorded every day throughout the Rabi season. Total insects were observed and sorted out on the basis of orders, species and their family.

Specimens were prepared by keeping the pinned insects in oven for 24 hours at 30 °C and thereafter well labelled specimens were stored in insect boxes and show cases. Detail photographic presentation of these species was also made.

Results and Discussion

Taxonomic analysis revealed that these 64 insect species belonging to 10 orders and 35 families were recorded throughout the season (Rabi 2019-20) based on number of species collected, largest collection was represented by order Lepidoptera 28 species (44.75%) followed by order Hemiptera 14 species (21.87%), Coleoptera9 species (14.06%), , Orthoptera 3 species (4.65%) and Hymenoptera 2 species (3.12%) in descending order respectively. Orders of minor significance are represented by Odonata, Diptera and Neuroptera having 2 species each while Dermaptera and Dictyoptera were represented by one species only (Fig.1).

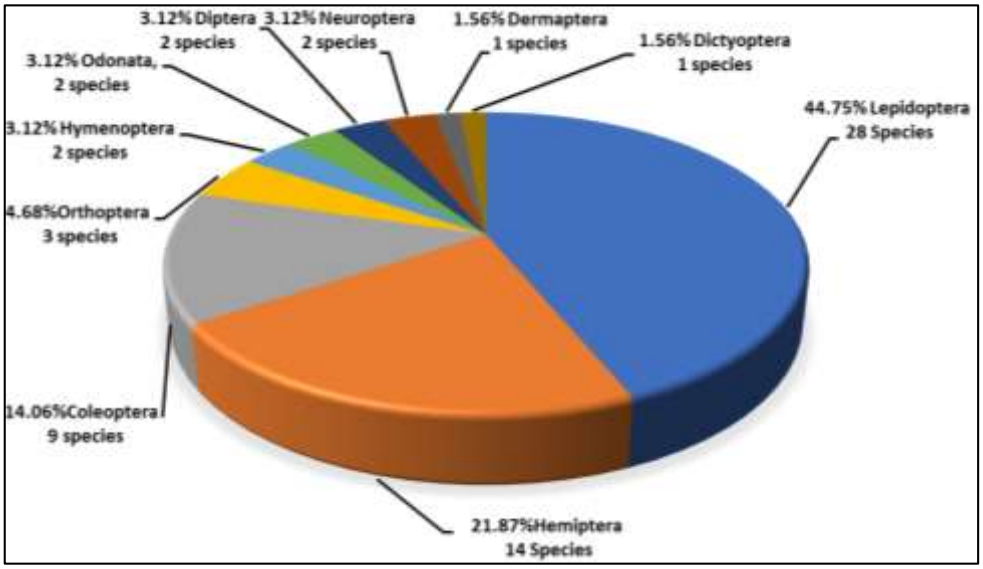

Fig 1: Percent distribution of insect species of different orders trapped in light trap installed in vegetable fields during Rabi 2019-20 at Chhindwara (M.P.)

Table 1: Taxonomic distributionof insect fauna collected in light trap during Rabi 2019-20 at Chhindwara (M.P.) Group-I) Harmful insects- as crop pests

S No.	Insect species collected	Total collection	Status of insects
	Order- Lepidoptera		
	A) Family-Noctuidae		
1	*Spodoptera litura* (Fabricius)	662	Major polyphagous pest of soybean, cabbage, cucurbits, potato, chilli and pea etc.
2	*Helicoverpaarmigera* (Hubner)	552	Major polyphagous pest of pulses, potato, tomato, chilli, okra and cotton.
3	*Chrysodeixischalcites* (Esper)	25	Pest of soybean, potato, tomato and bean etc.
4	*Plusiaorichalcea* (Fabricius)	1511	Major polyphagous pest of vegetable crops, cabbage, cauliflower etc.
5	*Mythimna separata* (Walker)	281	Major pest of paddy.
6	*Eariasvitella*(Linnaeus)	70	Major pest of paddy.
7	*Agrotisipsilon*(Hufnagel)	376	Major polyphagous pest of pulses, pest of cabbage, cucurbits, potato
8	*Asotaficus* (Fabricius)	79	Fodder pest
9	*Spodoptera frugiperda (*J. E. Smith, 1797	385	Major Pest of Maize
	B) Family- Arctiidae		
10	*Creatonotosgangis* (Linnaeus)	942	Polyphagous pest
11	*Amata* sp.	965	Fodder pest
12	*Spilosomaobliqua* (Walker)	27	Major polyphagous pest of sesame, linseed and minor pest of cabbage and sweet potato
13	*Utheasiapulchella*(Linnaeus)	41	Major pest of sunhemp
	C) Family-Sphingidae		
14	*Agrius convolvuli* (Linnaeus)	39	Major pest of sweet potato, sunflower and soybean
15	*Acherontiastyx* (Westwood)	4	Major pest of sesame and minor pest of potato
16	*Daphinisnerii*(Linnaeus)	6	Feed on nectar of variety of flowers. Like Petunia, Jasmine and Honeysuckle.
	D)Family- Geometridae		
17	*Buzurasuppressaria* (Guenee)	3	Pest of tea
	Family- Lasiocampidae		
18	*Metanastriahyrtaca* (Linnaeus)	2	Pest of Almond, Guava, Sal tree, Babul and Cashew nut etc
19	*Trabalavishnou* (Lefebve)	1	Pest of pomogranate, castor, almond, jamun, guava, Acacia and Eucalyptus etc
	E)Family- Plutelidae		
20	*Plutellazylostella*(Linnaeus, 1758)	1622	Major pest of cabbage and cauliflower
21	**F)Family-Pyraustidae**		
22	*Leucinodesorbonalis(*Guenée, 1854)	672	Major pest of brinjal
	G)Family- Pyralidae		
	Chilopartellus (Swinhoe)	11	Major pest of maize and sorghum

23			
H) Family- Nymphalidae			
24	*Melanitisleda ismene* (Cramer)	5	Major pest of paddy
I) Family- Lymantriidae			
25	*Euproctissimilis* (Moore)	63	Minor pest of paddy and ragi
J)Family- Erebidae			
26	*Cyana peregrine* (Walker)	4	Pest of grasses
27	*Digama* sp. (Moore)	5	Pest of Natal plum (Carissa sp.)
K)Family- Crambidae			
28	*Palpitavitrealis* (Rossi)	5	Pest of ornamental plant (Jasmine)
Order- Hemiptera			
A)Family-Pentatomidae			
29	*Nezaraviridula* (Linnaeus)	315	Major polyphagous pest of soybean, pigeon pea and vegetable crops
30	*Antestiopsiscruciata* (Fabricius)	816	Pest of coffee and jasmine
B) Family- Cicadellidae			
31	*Nephotettixvirescens*(Distant 1908)	305	Major pest of paddy
32	*Idioscopusniveosparsus*(Lethierry)	1	Major pest of mango
33	*Ledra sp.*	**6**	Phytophagous pest
C) Family-Pyrrhocoridae			
34	*Dysdercuscoingii*(Fabricius, 1775)	251	Pest of Okra and cotton
35	*Ectatops sp.*	5	Phytophagous
36	*Probergrothius sp.*	3	Pest of okra and cotton
Order- Coleoptera			
A)Family- Scarabaeidae			
37	*Holotrichiaconsanguinea*(Hope)White grub	19	Polyphagous pest of various crops
B)Family- Chrysomelidae			
38	*Aulacophorafoveicolis(Lucas)*	192	Major pest of cucurbitaceous particularly pumpkin
39	*Altica oleracea* (Linnaeus)	17	Pest of brassica crops
C)Family- Cerambycidae			
40	*Stromatiumbarbatum*(Fabricius)	4	Pest of bamboo andTeak
Order- Orthoptera			
A)Family- Gryllidae			
41	*Euscyrtusconcinnus*(de Haan)	875	Pest of fodder grasses
B)Family- Gryllotalpidae			
42	*Gryllotalpa orientalis* (Burmeister)	182	Minor pest of paddy
Order- Diptera			
A)Family- Bibionidae			
43	*Pleciaamplipennis*(Skuse)	398	Fodder pest
B) Family- Calliphoridae			
44	*Chrysomya sp.* (Robineau-Desvoidy)	5	Feed on flowers of many plants, decaying matter

These species were grouped on the basis of their economic importance in two major categories *viz.* Harmful insects- as crop pests and beneficial insects- as bio-control agents (Predators and parasites) were given in Table1and 2. Among the harmful crop pest species order Lepidoptera was represented by the highest number of 11 families including 28 species (52%), in which, family Noctuidae had the highest 9 species (Fig.2).

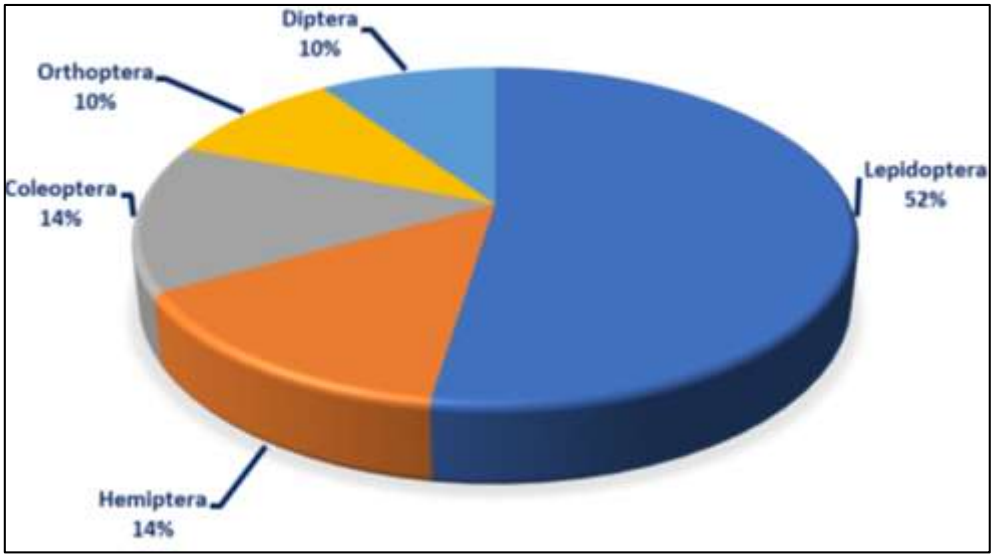

Fig 2: Percentage distribution of harmful insects- as crop pests of different order trapped in light trap installed in Vegetable field at Chhindwara Rabi 2019-20.

This family includes 7 species as important pests of different crops. Among these species, *Plusiaorichalcea* (Fabricius) has the highest size of trap catch (1511 moths) followed by *Spodoptera litura* (Fabricius) (662moths), while the lowest size of trap catch was of *Chrysodeixischalcites* (Esper) (27 moths) and *Spilosomaobliqua* Walker (27 moths), Sharma and

Bisen (2013) [11] 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 number of species belonged to family Noctuidae. Five major polyphagous pest species of Lepidoptera namely, *Spodoptera litura Fabricius* (662 moths), *Chrysodeixischalcites* (Esper) (27 moths), *Helicoverpaarmigera* (Hubber) (552 moths), *Eariasinsulana* (70 moths), and *Agrotisipsilon* (Hufnagel) (376 moth) were also recorded during the season in trap catch. Dangi (2004) [1] reported that *Spodoptera litura* Fabricius, *Helicoverpaarmigera* (Hubner), *Agrotisipsilon* (Hufnagel) and *Plusiaorichalcea* (Febricius) as polyphagous pests of family Noctuidae, in light trap catches at Jabalpur.

After Lepidoptera, Hemiptera was the next highest order of pest species in trap catches with 3 families and 7 species. The family Pentatomidae was represented by *Antestiopsiscruciata* (Fabricius) with a highest trap catch of (816 bugs) followed by *Nezaraviridula* (Linnaeus) (315 bugs), *Nephotettixvirescens* (Distant) (305 hoppers), *Dysdercuskoenigii* (Fabricius) (251 bugs) and *Idioscopusniveosparsus* (Lethierry) (1 hopper).Order coleoptera was represented by 3 families and 3 species. Among three species of this order highest trap catch was ofpumkin beetle *Aulacophorafoveicolis (Lucas)* (192 beetles) followed by white grub, *Holotrichiaconsanguinea* (Hope) (19) and *Altica oleracea* (Linnaeus) (17)

Order Orthoptera was represented by 2 families and 2 species. Among two species of this order highest trap catch was of Field cricket, *Euscyrtusconcinnus* (de Haan) (875 crickets) followed by Mole cricket, *Gryllotalpa orientalis* (Burmeister) (182 crickets), Sharma et al. (2006) [13] reported that order Orthoptera was represented by 3 families in which highest trap catch was of *Gryllus* sp. (3854) (fam. Gryllidae) followed by Grass hoppers *Trilophidiacristella* S. (311) & Gastrimargus transversus T. (387) and *Gryllotalpa gryllotalpa* Linn. (213) at Jabalpur. Order Diptera was represented by two family i.e. Bibionidae with single species *Pleciaamplipennis* (Skuse) (398 flies) and family Calliphoridae, *Chrysomya sp*. (5 flies), Muchhala (2014) [8] also reported that order Diptera was represented by only one family i.e. Bibionidae with single species *Pleciaamplipennis* (Skuse.) The size of catch was 2941 adults.

Group of beneficial insects as natural biocontrol agents was represented by 7 orders, 13 families &18 species as predators and 1 order, 2 families and 2 species as parasites. Among the predatory species order Coleoptera was represented by the highest number of 3 families including 6 species followed by order Hemiptera was represented by 3 families and 5 species, order Hymenoptera was represented by 2 families and 2 species as parasites, order Odonata and Neuroptera were represented by 2 species while order Dermaptera, Dictyoptera and Orthoptera were represented by only one species each. Among the predatory species order Coleoptera was represented by the highest number of 3 families including 6 species in which family Carabidae has the highest 3 predatory species namely *Prothyma* sp. (39 beetles*), Chlaeniuspictus* (Choudoir) (12 beetles), and *Cicindelaflexuosa* (Distant) (9 beetles), while family Hydrophilidae was represented by one species of water beetle, *Hydrocharacaraboides* Latreille (172 beetles).

Table 2: Taxonomic distributionof insect fauna collected in light trap during Rabi 2019-20 at Chhindwara (M.P.) Group- II) Beneficial insects- as bio-control agents (Predators and parasites)

S.No.	Insect species collected	Total collection	Status of insects
	Order- Hemiptera		
	A) Family-Pyrrhocoridae		
1.	*Antilochus coquebertii*(Fabricius, 1803)	69	Predator on other Pyrrhocoridae species
	B) FamilyReduviidae		
2	.*Sirtheneacarinata*(Fabricius 1798)	5	Predator on various insects
3.	*Scadraannulipes*Reuter, 1881	210	Predator on various insects
4.	*Ectomocorisululans* (Rossi, 1790)	5	Predator on various insects
5.	*Sirthenea sp.*	16	Predator on various insects
	C) Family-Belostomidae		
6.	*Diplonychusrusticus* (Fabricius)	31	Feed on aquatic insects
	Order- Coleoptera		
	A)Family- Scarabaeidae		
7.	*Onitis falcutus* (Wulfen)	81	General predator of aphid, coccids, white fly and bugs
	B)-Hydrophidae		
8.	*Hydrocharacaraboides* (Latreille)	172	General predator of aquatic insects
	C)Family- Carabidae		
9.	*Prothyma* sp.	39	Predator of Colorado potato beetle and small insects
10.	*Cicindelaflexuosa* (Distant)	9	General predator of small insects
11.	*Chlaenius pictus* (Choudoir)	12	General predator of Lepidopterous larvae
	Order- Orthoptera		
	C)Family- Tettigoniidae		
12.	*Conocephalus* sp.	5	Predator of Lepidopteran eggs
	Order- Hymenoptera		
	A) Family- Ichneumonidae		
13.	*Enicospiluspurgatus*(Say)	59	Larval parasite of stem borer, leaf folder and Lepidopterous insects
	B) Family- Formicidae		
14.	*Dorylus*sp.(Fabricius)	1183	General parasite of Lepidopterous and Dipterous insects
	Order- Odonata		
	A)Family- Libellulidae		
15	*Pantalaflavescens* Dragon fly (Fabricius)	25	General predator on Lepidopterous, Dipterous and Hymenopterous insects

B)Family- Coenagrionidae			
16.	*Coenagrion*sp. Damsel fly (Kirby)	7	Predator of monarch butterfly, stem borer, gall midge and leaf eating caterpillar
Order- Neuroptera			
A)Family- Ascalaphidae			
17.	*Ascalaphus* sp. Owl fly (Walker)	135	Adult feed on caterpillars and grubs
B) Family- Chrysopidae			
18.	*Chrysoperlasillemi*(Esben-petersen)	147	General predator on leaf hoppers and aphids
Order- Dermaptera			
Family- Forficulidae			
19.	*Elaunonbipartitus* (Kirby)	3	General predator on Lepidopteran larvae
Order- Dictyoptera			
Family- Mentidae			
20.	*Archimantislatistyla*(Serville)	15	Nymph feed on leaf hopper and aphids while adult feed on caterpillars

Conclusion

The present investigation has provided voluble information on taxonomic analysis of 64 insect species belonging to 10 orders and 33 families were recorded throughout the season (Rabi 2019-20) based on number of species collected, largest collection was represented by order Lepidoptera 28 species (44.44%) followed by, Hemiptera 14 species (14.81%), order Coleoptera 9 species (16.66%) Orthoptera 3 species (5.55%) and Hymenoptera 2 species (3.77%) in descending order respectively. Orders of minor significance are represented by Odonata, Diptera and Neuroptera having 2 species each while Dermaptera and Dictyoptera were represented by one species only.

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