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Taxonomic Study on Phototactic Insect Pests Intercepted by Light Trap in Soybean Ecosystem

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Abstract—*The present taxonomic study was conducted record the phototactic insect pests through light trap in soybean ecosystem at Jabalpur region. A total of 37 species were recorded. These phototactic insects belongs to 5 orders and 21 families. Lepidoptera was the largest order with 23 species .Other orders were Hemiptera (6 species), Orthoptera (4 species) and Coleoptera (3 species). Isoptera was the other order of minor significance. These harmful insect pests includes 8 major and minor pest species of soybean, major polyphagous pests , pests of pulses ,cereals, oilseeds vegetables, fodder crops and forest trees etc. The present study reviles the valuable base line data on biodiversity of phototactic insect pests of soybean ecosystem and provides broader scope of using light trap as Integrated Pest Management tool in soybean and other crops.*

Keywords*: Light trap, Insect Pests, Soybean, Ecosystem*

Introduction

Light traps are effectively used for entomological studies and in IPM systems all over the world for survey, detection and control of insect pest population. One of the most noticeable tendencies of insects is flying towards a light source at night known as phototaxis or phototactic. Many researchers has done their work on use of light trap against pests of paddy and pulses but very little information is available on pests of soybean particularly in Jabalpur region. Soybean is a 21st century crop introduced and commercially exploited in India [2]. Madhya Pradesh is a soybean state of India with highest area 62.20 lakh ha. and production 59.457 lakh tones. Insect pest damage is detrimental for the productivity of soybean. About 65 insect species have been reported to attack soybean from cotyledon to harvesting stage. In an effort to expand our knowledge on the arthropod (insect) fauna in the soybean ecosystem of Jabalpur region of Madhya Pradesh,

Material and Methods

The experiment was conducted at JNKVV research farm, Jabalpur during 2013. The experiment was conducted by using the standard design of Jawahar light trap. The trap design was having attracting device and collection device which is made up of 24 gauge iron sheets. Mercury vapor lamp of 80 W. was used as light source. The insects collected in the collection chamber of light trap are killed by the exposure of Dichlorvos 76 EC vapor (as fumigating agent) which is directly placed in collection chamber. Light trap was operated every night but collection of single day per week was recorded from July 2013 to November 2013. Division of weeks was based on calendar days (i.e. Ist Week (1-7th day), IInd Week (8th to 15th day) IIIrd Week (16t^{h} to 23rd day), IV^{rth} Week (24rth to 30th/31st day). Insects collected through light trap were divided and recorded in to different taxonomical categories.

Identification of insects was done on the basis of specimens available in insect museum of the department and with the help of Zoological Survey of India, Jabalpur. After counting the, specimen of concerned species were preserved as per the standard procedure. Dried specimens were kept in insect boxes and showcase for identification.

Results and Discussion

Analysis on composition of insect pests on taxonomic basis:

Documentation of taxonomic analysis (table1) revealed that 58 species of insect pest and beneficial once were recorded in soybean ecosystem. These phototactic insects belongs to 5 orders and 21 families. Lepidoptera was the largest order with 23 species .Other orders were Hemiptera (6 species), Orthoptera (4 species) and Coleoptera (3 species). Isoptera was the other order of minor significance..

Record of 62 species through light trap catches were reported at Jabalpur (2002-03) [12]. These species belonging to 11 orders and 36 families. Lepidoptera was the largest order with 31 species. 35 species of Endoptera and Exoptera were collected in light trap catches [3&4].

Analysis on composition of arthropod fauna (insects) on economic basis:

The total 37 species were grouped taxonomically on the basis of their economic role as harmful insect pests of different crops. Among them order Lepidoptera was the largest group including 8 families and 23 species. Under this order family Noctuidae included largest number of 11 species. A total of 438 species of Lepidoptera including Noctuids (222 species), Geometrids (127 species), Notodontids (27 species), Arctiids (26 species), Sphingids (10 species) and Saturniids (9 species) [1]. Similarly collection of 44 species of families Sphingidae and Noctuidae of order Lepidoptera [5].

The major soybean and polyphagous pest species of this family includes *Helicaverpa armigera* (Hub.) (211), *Agrotis ipsiton* Huf. (164) *Spodoptera litura* Fab. (645). *Chrysodeixis chalcites* (Esper) (389) and *Thysanoplusia orichalcea* (Fabricius) (332). Comparing the relative size of trap catches of order Lapidoptera the highest catch was observed of Rice leaf folder, *Cnaphalocrocis medinalis* G. (1168 moths) belonging to family Pyralidae (table 1) . Similariy the highest trap catch of *Cnaphalocrocis medinalis* G. was reported at Jabalpur [10]. Other major pest species are *Spilarctia obliqua* (644) and *Amsecta moorei* (411) of family Arctiidae and *Acherontia styx* (441) of family Sphingidae . The soybean defoliators [*Spdoptera litura* (Fab.), *Thysanoplusia orichalcea* (Fab.) *Spilarctia obliqua* (Wlk.)] and *Helicoverpa armigera* (Hubner) are feeding on foliage, flower and pods causing significant yield loss [10].

After Lepidoptera, Hemiptera was the next highest order of pest species in trap catch with 6 families and 6 species. The family Delphacidae was represented by *Sogatella furcifera* Harvath with highest trap catch of 1,345 hoppers. *Nephotettix* sp. (877), *Pyrilla* sp. (623) are the other major pest species of this order. Among the soybean pest green stink bug, *Nezara viridula* Linnaeus (841 bugs) family Pentatomidae was recorded throughout the period in trap catch. Similarly *Nezara viridula* was one of the most abundant species recorded in light trap collection [9&11].

Order Coleoptera was represented by 4 families and 3 species. *Aulocophora faveicollis* was highest in trap catch size (474 beetles). The other major species of this order included**,** *Mylobris pustuleta* (142) and *Holotrichia consenguainea* (322). In conformity with the present findings Sharma and Bisen (2013) also reported highest trap catch of *A. faveicollis* among the other coleopterous including *Mylobris pustuleta, Anomola viridis* and *Holotrichia consenguainea.* Similarly collection of white grubs, *Holotrichia consenguinea* and blister beetle *Epicacuta* sp. was reported in light trap [7&8]

Order Orthoptera was represented by 3 families in which highest trap catch was of *Gryllus* sp.(4, 345) (fam. Gryllidae) followed by Grass hoppers, *Trilophidia cristata* (289) & *Gastrimaris transversus* (257) and Mol cricket *Gryllotalpa gryllotalpa* (230). also reported light trap catches of grass hoppers, *Trilophidia cristata* and *Gastrimargis transversus*, at Jabalpur (M.P.). Similarly nocturnal Orthopteraus were represented by six families viz. Gryllidae, Gryllotalpidae, Tettigoniidae (belonging to Suborder Ensifera) and Acrididae, Tridactylidae, and Tetrigidae (belonging to Suborder Caelifera) in light trap catches [15].

Order Isoptera was the smallest one with single family (Termitidae) and single species *Odontotermes obesus* (Rambur) (612). Simlarly the termite swarming was reported through light trap [6&13].

The present investigation has provided very important information on presence, occurrence, taxonomic distribution and population dynamics of 37 phototactic insect species in soybean ecosystem at Tikamgarh-Bundelkhand region of M. P. Among these 41 crop pest species 8 species belongs to soybean and remaining 33 pest species of different agricultural crops and forest trees .This will serve as base line information, useful at present and in future for surveillance and monitoring of insect pests, for forecasting and also in use of light trap as Integrated Pest Management tool against these pest species of soybean and other economically important crops of this region.

Table 1: Taxonomic distribution of insect pest species collected in light trap in soybean ecosystem during 2013

S. No.	Insect species collected		Season's total collection* (July 2013 to Nov. 2013)	Economic status as crop pest
	Order-LEPIDOPTERA			
	i) Fam.-Noctuidae			
1.	1.	Helicoverpa arimgera (Hubner) (Gram pod borer)	211	Major polyphagous pest of pulses, cotton & vegetable. Major Pest of Soybean
2.	2.	Agrotis ipsilon (Hufnagel) (Black cut worm)	164	Major pest of pulses
3.	3.	Spodoptera litura Fabricius (Tobacco caterpillar)	645	Major polyphagous, pest of vegetables, peas. Major Pest of Soybean
4.	4.	Thysanoplusia orichalcea (Fabricius) (Green semilooper)	332	Pest of cabbage and cauliflower Major Pest of Soybean
5.	5.	Chrysodeixis chalcites (Esper) (Cabbage semilooper)	389	Pest of cabbage and cauliflower

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6.	6.	Mythimna separata (Walker) (Army worm)	188	Major pest of Paddy
7.	7.	Hyblaea puera Cramer (Teak defoliator)	233	Major pest of Teak
8.	8.	Earias vittella Fab. (Shoot and fruit borer)	145	Major pest of Okras, cotton
9.	9.	Sesamia inferens (Jowar stem borer)	345	Major pest of Sorghum
10.	10.	Achaea janata (Cabbage semilooper)	165	Major pest of cabbage
11.	11.	Remigea archesia	189	Forest and fodder crop pest
12.	12.	Polytela glosiacae	721	Forest and fodder crop pest
	ii) Fam.- Arctiidae			
13.	13.	Spilarctica obliqua Walker (Bihar hairy caterpillar)	644	Major polyphogous pest Sesamam, mung, linseed, mustard and vegetables Major Pest of Soybean
14.	14.	Amsacta moorie Butler (Red hairy caterpillar)	411	Major pest of sunnhemp, maize and jowar Minor Pest of Soybean
15.	15.	Utetheisa pulchella (Sunnhemp hairy caterpillar)	255	Major pest of sunnhemp
16.	16.	Creatonotus ganogis	1168	Forest and fodder crop pest
	iii) Fam.-Pyralidae			
17.	17.	Cnaphalocrocis medinalis (G.) (Rice Leaf folder)	445	Major pest of paddy
18.	18.	Scirpophaga nivella (Sugarcane top shoot borer)	234	Major pest of sugarcane
	iv) Fam.- Hypsidae			
19.	19.	Argna cribraria (Sunnhemp caterpillar)	135	Pest of sunnhemp
20.	20.	Hypsa ficus	94	Forest and fodder crop pest
	v) Fam.-Sphingidae			
21.	21.	Acherontia styx (Westwood) (Til howk moth)	441	Major pest of sesamum and minor pest of potato, bringal etc. Minor Pest of Soybean
22.	22. .	Daphinis nerii	311	Forest and fodder crop pest
	vi) Fam.-Nymphalidae			
23.	23.	Melanitis ismene Cramer (Rice butterfly)	112	Pest of paddy
	vii) Fam.-Hesperiidae			
24.	24.	Pelopidas mathias (Rice skipper)	62	Pest of paddy
	viii) Fam.-Syntomidae			
25.	25.	Creyx godarti	655	Forest and fodder crop pest
	ORDER-HEMIPTERA			
	i) Fam.-Delphacidae			
26.	1.	Sogatella furcifera (Harvath) (White baked plant hopper)	1345	Major pest of paddy
	ii) Fam.- Cecadeliadae			
27.	2.	Nephotettix sp. (Green leaf hopper)	877	Major pest of paddy
	iii) Fam.- Fulgoridae			
28.	3.	Pyrilla sp. (Sugarcane leaf hopper)	623	Major pest of sugarcane
	iv) Fam.-Coreidae			
29.	4.	Leptocorisa sp. (Rice gandhi bug)	77	Major pest of paddy
	v) Fam.-Pyrrhocoridae			
30.	5.	Dysdercus cingulatus. Fabricius (Red cotton bug)	88	Major pest of cotton. miner pest of okra, maize &pearlmillet

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	vi) Fam.-Pentatomidae			
31.	6.	Nezara viridula Linnaeus (Green stink bug)	841	Pest of potato and Minor Pest of soybean
	Order-COLEOPTERA			
	i) Fam.- Chrysomelidae			
32.	1.	Aulacophora foveicollis (Lucas) (Red pumpkin beetle)	474	Major pest of cucurbitaceous vegetables
	ii) Fam.-Rutelinae			
	iii) Fam.-Melalonthidae			
33.	3.	Holotrichia consenguainea (White grub)	322	Major Pest of Soybean Polyphagous pest, particularly of sugarcane, sorghum, maize and vegetables etc.
	iv) Fam.-Meloidae			
34.	4.	Mylobris pustulata (Blister beetle)	133	Pest of sorghum
	Order-ORTHOPTERA			
	i) Fam.- Acridiidae			
35.	1.	Trilophidia cristata Grass hopper	321	Major pest of paddy
38.	2.	Gastrimargus transversus	266	Major pest of paddy
	ii) Fam.-Gryllidae			
39.	3	Gryllus sp. (Field cricket)	4965	Pest of paddy
	iii) Fam.- Gryllotalpidae			
40.	4.	Gryllotalpa gryllotalpa	259	Pest of paddy
	ORDER-ISOPTERA			
	i) Fam.-Temitidae			
41.	1.	Odontotermes obesus (Rambur) (Termite)	569	Major pest of wheat, sugarcane and cereals

*Single day's collection per week and 4 days collection per month

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