



Research Article

STUDY ON BIODIVERSITY OF PHOTOTACTIC HARMFUL INSECT FAUNA COLLECTED IN LIGHT TRAP IN CHICKPEA (*Cicer arietinum* Linn.) ECOSYSTEM

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Abstract- The present experiment was conducted under the study on scope and use of light trap as IPM tool in chickpea ecosystem. Documentation of information was done on biodiversity of harmful insect fauna in chickpea ecosystem collected in light trap at Jabalpur. Standard design of Jawahar light trap with 80 W mercury vapor lamp was used to record the insect catches in chickpea crop from September 2012 to April 2013. Data was classified on taxonomic and economic aspect as crop pests. In all 51 species of insects were collected during the cropping season of chickpea. These insect species belongs to 6 insect orders and 23 families. Lepidoptera was the largest order with 30 species. Other major orders were Hemiptera (9 species), Coleoptera (4 species) and Orthoptera (6 species). Isoptera (1 species) & Diptera, (1 species) were the other orders of minor significance. Based on economic importance this collection was represented by 51 species of harmful insects.

Keywords- Chick pea, Light trap, Bio diversity, and Insect Fauna

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Introduction

The maintenance of biodiversity within agricultural environments is widely recognized as being essential for their agronomic sustainability [1,2]. Many of the insect pests mostly nocturnal and few diurnal species are positively phototropic and are attracted towards light. Use of light trap is one of the oldest, traditional and Indigenous technologies of pest control for sustainable agriculture, which was very common in early decade of 20th century mostly for the control of insect pests. In recent years use of light trap occupied an important place in entomological studies and IPM systems all over the world for survey, detection and control of insect pest population. Chickpea (*Cicer arietinum* Linn.) is a major winter pulse crop grown in India. Among the pulses, chickpea occupies 30 per cent of annual production in India. Chickpea is pure dominant crop among pulses in Madhya Pradesh, occupying 279.0 thousand ha area with 258.0 thousand tones production [3]. By far the most economically important insect pest of chickpea is the pod borer, *Helicoverpa armigera* Hubner in various chickpea growing areas of India, yield losses in particular fields or plots in the range of 10-85% have been documented [4-7].

Maximization of natural control is an important principal of integrated pest management; is to maximize natural control; therefore, the temporal changes in arthropod abundance, diversity, species richness and community structure are important consideration in designing pest management strategies [8]. Although much work has been done on use of light trap against major pests of pulses and paddy but very few little information is available on biodiversity of phototactic insect fauna of chickpea ecosystem particularly in Jabalpur region of M.P. The objective of this study was to identify phototactic harmful arthropod species using light trap in chickpea ecosystem and describe them on the basis of taxonomic and economic aspects, in order to provide theoretical basis for the sustainable management of chickpea pests.

Material and Methods

Study site: The experiment was conducted at JNKVV research farm, Jabalpur (MP) during 2012-2013. The climatic conditions prevalent 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.

Light trap design: The experiment was conducted by using the new low cost hanging type of light trap having attracted ting device made up of 24 gauge iron sheet and collection device made of raxine. The trap was hanged on inverted 'L' shape angle iron rod. Mercury vapor lamp of 80 W. was used as light source. The insects collected in the collection bag of light trap are killed by the exposure of Dichlorvos 76 EC vapor (as fumigating agent) which is directly placed in collection bag.

Sampling and sorting for specimen: Light trap was operated every night but collection of single day per week was recorded from October 2012 to April 2013. Division of weeks was based on calendar days (i.e. 1st Week (1-7th day), 2nd Week (8th to 15th day) 3rd Week (16th to 23rd day), 4th Week (24th to 30th/31st day). Insect pests collected through light trap were first divided and recorded in to different taxonomical categories. Thereafter, the insect-pests are categorized on the basis of their economic importance viz., harmful (crop pests)

Identification of insects: Identification of insects was done on the basis of specimens available in insect museum of the Department and with the help of Department of Entomology, UAS, Bangalore and Zoological Survey of India, Jabalpur (MP). After counting the, dried specimens were prepared by keeping the pinned insects in oven for 24 hours at 30°C while the small insects, such as leaf hoppers are directly mounted over the small pieces of card sheets with the help of gum and thereafter well labeled specimens were stored in insect boxes and show

cases. Detail photographic presentation of these species was also made.

Result and Discussions

Taxonomic analysis on composition of insect pest fauna - Taxonomic analysis revealed that 51 species belonging to 6 orders and 23 families were

recorded throughout the period from October 2012 to April 2013. Based on number of species collected, largest collection was represented by order Lepidoptera (30 species) followed by orders Hemiptera (9 species), Coleoptera (4 species), Orthoptera (6 species) in descending order respectively. Orders of minor significance including Isoptera, Diptera, were represented by one species only.

Table-1 Taxonomic distribution of insect pest species collected in light trap in paddy ecosystem in kharif 2013. Harmful insect pest species as crop pests.

S. No.	Insect species collected	Total of seasons collection* (Oct. 2012 to April. 2013)	Economic status As crop pest
ORDER- LEPIDOPTERA			
A) Family- Noctuidae			
1	<i>Helicoverpa armigera</i> (Hubner) Gram pod borer	194	Major polyphagous pest of pulses, potato, tomato, chilli, okra and cotton
2	<i>Agrotis ipsilon</i> (Hufnagel) Black cut worm	160	Major pest of pulses
3	<i>Spodoptera litura</i> Fabricius Tobacco caterpillar	367	Major polyphagous pest of soybean, cabbage, cucurbits, potato, chilli and pea etc.
4	<i>Chrysodeixis chalcites</i> (Esper) Green semi looper	133	Pest of soybean, potato, tomato and bean etc
5	<i>Thysanoplusia orichalcea</i> (Fabricius)	157	Major pest of sunflower, potato and soybean
6	<i>Mythimna separata</i> (Walker) Army worm	166	Major pest of paddy
7	<i>Hyblaea puera</i> Cramer Teak defoliator	77	Major pest of teak
8	<i>Earias vittella</i> Shoot and fruit borer	122	Major pest of okra, cotton
9	<i>Asota ficus</i> (Fabricius)	141	Fodder pest
10	<i>Sesamia</i> sp. Jowar stem borer	41	Major pest of sorghum
11	<i>Achaea janata</i> Cabbage semilooper	169	Major pest of cabbage
12	<i>Trigonodes hyppasia</i> (-)	195	-
13	<i>Remigea archesia</i> (-)	222	-
B) Family- Arctiidae			
14	<i>Cretonotos gangis</i> (Linnaeus) Tiger moth	471	Polyphagous pest
15	<i>Amata</i> sp.	354	Fodder pest
16	<i>Utetheisa pulchella</i> Sunn hemp hairy caterpillar	129	Major pest of Sunnhemp
17	<i>Spilosoma obliqua</i> Walker Bihar hairy caterpillar	293	Major polyphagous pest of sesame, linseed and minor pest of cabbage and sweet potato
18	<i>Amsacta moorei</i> Butler Red hairy caterpillar	9	Major pest of sun hemp, maize and jowar
C) Family- Spingidae			
19	<i>Agrius convolvuli</i> (Linnaeus)	166	Major pest of sweet potato, sunflower and soybean
20	<i>Acherontia styx</i> (Westwood) Til hawk moth	75	Major pest of sesame and minor pest of potato
21	<i>Daphnis nerii</i>	39	-
D) Family- Pyralidae			
22	<i>Cnaphalocrocis medinalis</i> (Guene) Rice leaf folder	614	Major pest of paddy
23	<i>Chilo partellus</i> Swinhoe Maize stem borer	48	Major pest of maize and sorghum
24	<i>Scirpophaga nivella</i> Sugarcane top shoot borer	144	Major pest of sugarcane
E) Family- Nymphalidae			
25	<i>Melanitis leda ismene</i> Cramer Rice butter fly	164	Major pest of paddy
F) Fam. : Hesperidae			
26	<i>Pelopidas mathias</i> Rice skipper	139	Pest of paddy
G) Family- Lymantriidae			
27	<i>Euproctis similis</i> (Moore)	117	Minor pest of paddy and ragi
28	<i>Psalis pennatula</i> (Fabricius)	60	Minor pest of paddy and sorghum
H) Family- Crambidae			
29	<i>Palpita vitrealis</i> (Rossi)	44	Pest of ornamental plant (Jasmine)
I) Fam. : Syntomidae			
30	<i>Creyx godarti</i>	895	-

	ORDER- HEMIPTERA		
	A) Fam.-Delphacidae		
31	<i>Sogatella furcifera</i> (Harvath) (White backed plant hopper)	11568	Major pest of paddy
	B) Family- Cicadellidae		
32	<i>Nephotettix virescens</i> (Distant) Green leaf hopper	9567	Major pest of paddy
	c) Family-Pentatomidae		
33	<i>Nezara viridula</i> Linnaeus Green sting bug	845	Major polyphagous pest of soybean, pigeon pea and vegetable crops
34	<i>Antestiopsis cruciata</i> (Fabricius) Coffee plant bug	88	Pest of coffee and jasmine
35	<i>Plautia crossota</i> (Dallas)	41	Pest of pulse and cotton crop
36	<i>Cofana spectra</i> (Distant) White hopper	264	Pest of paddy
	D) Family- Lophopidae		
37	<i>Pyrilla perpusilla</i> Walker Sugarcane leaf hopper	1118	Major pest of sugarcane, wheat and maize,
	E) Family-Pyrrhocoridae		
38	<i>Dysdercus koenigii</i> Fabricius Red cotton bug	455	Major pest of cotton and okra
	F) Family- Coreidae		
39	<i>Leptocoris acuta</i> (Thunberg) Rice gundhi bug	511	Major pest of paddy
	ORDER- COLEOPTERA		
	A) Family- Chrysomelidae		
40	<i>Aulacophora foveicollis</i> (Lucas) Red pumpkin beetle	456	Major pest of cucurbitaceous particularly pumpkin
	B) Fam.-Meloidae		
41	<i>Mylobris pustulata</i> (Blister beetle)	149	Pest of sorghum and minor pest of chick pea
	C) Fam. : Scarabaeidae		
42	<i>Anomala viridis</i> (Cockchafer beetle)	57	Pest of paddy
43	<i>Chiloloba acuta</i> (Wiedemann)	31	Pest of maize, sorghum and folder grasses
	ORDER- ORTHOPTERA		
	A) Family- Gryllidae		
44	<i>Euscyrtus concinnus</i> (de Haan) Field cricket	577	Pest of paddy and folder grasses
45	<i>Gryllus bimaculatus</i> De Geer Gryllid	84	Pest of folder grasses
	B) Family- Acrididae		
46	<i>Oxya yezoensis</i> Shiraki	35	Pest of paddy and maize
47	<i>Trilophidia cristata</i> (grass hopper)	74	Major pest of paddy
	C) Family- Gryllotalpidae		
48	<i>Gryllotalpa orientalis</i> Burmeister Mole cricket	174	Pest of paddy
	D) Family- Tetrigidae		
49	<i>Tetrix subulata</i> Linnaeus Short horn grass hopper	354	Pest of paddy
	ORDER- ISOPTERA		
	A) Family- Termitidae		
50	<i>Odontotermes obesus</i> (Rambur) Termite	145	Major pest of Wheat, gram and sugarcane & minor pest of many cereals and pulses crops
	ORDER- DIPTERA		
	A) Family- Bibionidae		
51	<i>Plecia ampliipennis</i> Skuse	764	Fodder pest

*= Insect collection of one day per week

Similarly [9] also reported a record of 62 species through light trap catches at Jabalpur (2002-03). These species belonging to 6 orders and 23 families. Lepidoptera was the largest order with 30 species, followed by Hemiptera (9 species), Coleoptera (4 species) and Orthoptera (6 species). Isoptera and Dictyoptera were the other orders of minor significance. [10,11] also reported 35 species of Endoptera [Lepidoptera (38.8%), Coleoptera (27.7%), Hymenoptera (17.1%) & Diptera (16.4%)] and 26 species of Exoptera [Hemiptera (20.0%), Orthoptera (18.2%), Dermeptera (16.7%), Isoptera (16.5%), Dictyoptera (14.6%) & Odonata (14.0%)]. Similarly [12] also reported that Lepidoptera, Coleoptera, Hemiptera, Hymenoptera, Diptera, Odonata and other minor order were collected in light trap catches.

Analysis on composition of insect pest fauna on economic basis

For the analysis on economic basis the entire species collection was categorized on the basis of their economic role namely as 1. Harmful insects- as crop pests.

I) Harmful insects- as crop pests

Among the harmful crop pest species order Lepidoptera was represented by the highest number of 9 families including 30 species, in which, family Noctuidae has the highest 13 species. This family includes 11 species as important pests of different crops. [13] 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).

Comparing the relative size of trap catches of order Lepidoptera the highest catch was observed of *Spodoptera litura* (Linnaeus) (367 moths) Family Arctiidae. [14] reported that *Spodoptera litura* Fabricius constituted the highest 53.34% of total trap catches.

Gram pod borer *Helicoverpa armigera* (194), gram cut worm and *Agrotis ipsiton* (160) were recorded in trap catches among the major pests of chick pea. [15] also reported the activity of the noctuids *Helicoverpa armigera* (Hubner) and *Agrotis ipsiton* Hufnagel, at Varanasi, Uttar Pradesh, India, during 1991-93 using light traps. *Chrysodeixis chalcites* (Esper) (133) and *Thysanoplusia orichalcea* (Fabricius) (157) were among the other major polyphagous pests. [16] also reported *Chrysodeixis chalcites* (Esper) in trap catches.

Other major pest species of order Lepidoptera are *Agrius convolvuli* (Linnaeus) (166 moths) & *Acherontia styx* (Westwood) (75 moths) Family Sphingidae, *Spilosoma obliqua* Walker (293) family Arctiidae, *Euproctis similis* (Moore) (117 moths) & *Psalis pennatula* (Fabricius) (60 moths) family Lymentriidae, *Palpita vitrealis* (Rossi) (44 moths) family Crambidae. Among major paddy pests *Melanitis leda ismene* Cramer (164 butterflies) family Nymphalidae, *Mythimna separata* (Walker) (166 moths) family Noctuidae, *Scirpophaga nivella* (144), *Chilo partellus* Swinhoe (48 moths) *Cnaphalocrocis medinalis* (Guene) (614 moths) family Pyralidae were observed. *Cnaphalocrocis medinalis* (Guene) was observed as major pest of paddy with highest trap catch (1327) by [17].

After Lepidoptera, Hemiptera was the next highest order of pest species in trap catch with 6 families and 9 species. The family Delphacidae was represented by *Sogatella furcifera* (Horvath) with highest trap catch of 11,568 hoppers followed by *Nephotettix virescens* (Distant) with a highest trap catch of 9,567 hoppers, *Pyrilla perpusilla* Walker (1118 hoppers), *Nezara viridula* Linnaeus (845 bugs), *Leptocoris acuta* (Thunberg) (511 bugs), *Dysdercus koenigii* Fabricius (455 bugs), *Cofana spectra* (Distant) (264 hoppers), *Antestiopsis cruciata* (Fabricius) (88 bugs), *Plautia crossota* (Dallas) (41 bugs) while Brown plant hopper, *Nilaparvata lugens* (Stal) family Delphacidae was surprisingly absent throughout the season in trap catches.

[18] also recorded highest trap catch of *Sogatella furcifera* (Horvath) in light trap catch. [19] collected 78 species of Heteroptera in light trap, 45 species being caught regularly. [20] also observed the population densities of 92 hemipterous insect species by using Robinson light trap at Al-Arish city, North Sinai during 1994-96.

Order Orthoptera was represented by 4 families and 6 species. Among all the pest species of this order highest trap catch was of Field cricket, *Euscyrtus concinnus* (de Haan) (577 crickets) followed by Short horn grass hopper, *Tetrix subulata* Linnaeus (354 hoppers); Mole cricket, *Gryllotalpa orientalis* Burmeister (174 crickets); Gryllid, *Gryllus bimaculatus* De Geer (84 crickets) and grass hopper *Trilophidia cristata* (grass hopper) (74 hoppers).

In contrast with the present findings [17] reported that order Orthoptera was represented by 3 families in which highest trap catches was of *Gryllus* sp. (3854) (family Gryllidae) followed by Grass hoppers *Trilophidia cristella* S. (311) & *Gastrimargus transversus* T. (387) and *Gryllotalpa gryllotalpa* Linn. (213) at Jabalpur. While [21] reported that the nocturnal Orthoptera 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.

Order Coleoptera was represented by 3 families and 4 species. In terms of relative size of trap catch Red pumpkin beetle, *Aulacophora foveicollis* (Lucas) had the highest trap catch of 456 beetles followed by blister beetle (minor pest of chick pea), *Mylobris pustulata* (149 beetles), and *Chiloloba acuta* (Wiedemann) was represented by the lowest size of trap catch of 31 beetles. In conformity with the present findings [9] also recorded highest trap catch of *Aulacophora foveicollis* (451 beetles) among coleopterous at Jabalpur.

Order Isoptera was represented by only one family i.e. Termitidae with single species Termite, *Odontotermes obesus* (Rambur). The size of catch was 145 adults. [22] reported 24 species of Termites belonging to 3 families including Termitidae through light trap catches at Atlantic forest of North East Brazil.

Order Diptera was represented by only one family i.e. Bibionidae with single species *Plecia ampliipennis* Skuse. The size of catch was 764 adults.

Conclusion

The present investigation has provided valuable information on presence occurrence, distribution and population dynamics of 51 phototactic harmful insect species in chickpea ecosystem at Jabalpur. This will serve as base line data, useful at present and in future for surveillance and monitoring of insects for forecasting and also in use of light trap as Integrated Pest Management tool against these pest species of chickpea and other economically important crops of this region.

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