International Journal of Environmental Science: Development and Monitoring (IJESDM)
ISSN No. 2231-1289, Volume 4 No. 3 (2013)

Taxonomic documentation of insect pest fauna of vegetable ecosystem collected in light trap.

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ABSTRACT

The present study was conducted under the study of scope of light trap as IPM technology in Vegetable ecosystem. Information on insect pest fauna of vegetable ecosystem collected in Balaghat region of M.P. The data of trap catch during the year 2006 (Kharif season) was classified on taxonomic basis, economic aspect (crop pest) and bio control significance (parasite and predators) a total of 56 species were recorded in Kharif cropping season of vegetable cropping area. These insect pest belongs to 8 orders and 34 families .Lepidoptera was the largest order with 23 species .Other orders were Hemipterra (14species), Coleoptera (11 species) and Orthoptera (4 species). Odonata ,Hymenoptera ,Isopteran and Dictioptera were the other order of minor significance .Based on economic importance this collection was represented by 39 species of harmful insects (as crop pest) 17 species of predatory insects (useful as bio-control agents).Category of harmful insect pests includes the major and minor pest species of vegetables, major polyphagous pests, pests of Paddy, Pulses ,Cereals, Oilseeds and other crops .The present study reviles that documented information on these species gives broader scope of using light trap as Integrated Pest Management tool against these insect pests of vegetables and other crops. The trap catch data also provide voluble information on bio control agents (predatory) active in vegetable ecosystem.

Keywords-taxonomoc; documentation; insect pest; vegetable; light trap

1. INTRODUCTION

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 technology of pest control for sustainable agriculture, which was very common in early decade of 20th century mostly for the control of insect pests. The indiscriminate and consistent use of insecticides to achieve 100% control of pest for over three decades badly disturbed the stable ecosystem of vegetable and other crops. It also gave rise to several problems such as environmental pollution, hazards to human being and beneficial fauna & flora, insecticidal resistance, sudden outbreak of insect pest and resurgence of new insect pest species. Entomologists soon realized these problems and diverted their attention to non chemical technologies such as light trap which are based on sound ecological principles. 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. Although much work has been done on use of light trap against pests of pulses and paddy but little information is available on pests of vegetable particularly in Balaghat region of M.P. Solsoly *et al* 2011 from Phillipins reported 25 to 100 percent reduction chemical insecticides after using light trap in vegetable cops and Mango. There are few reports of work done on light trap against pests of vegetable crops in different workers including {Wafa *et al.* (1972), Vaishampayan (1981), Sivaprakasam (1996) and Begemann and Schoeman. (1996)}.Therefore evolution of light trap in collection of information and documentation on major species of insect pests and natural enemies collected in light trap in vegetable ecosystem is also very important. So the present study is a step forward in this direction of collecting valuable information on insect pest fauna collected in light trap classified on taxonomic basis, economic aspect (crop pests) and bio-control significance.

The present study is in support of the new concept of "Use of light trap as a component of adult oriented strategy of pest management "presented by Vaishampayan (2002).

2. METHOD AND MATERIALS

The experiment was conducted at farmer's field (Village –Atri) during Kharif season Kharif 2006 at Balaghat. The experiment was conducted by standard design of light trap (model SM-01) by using 15 watt ultra violet lamp. Light

trap was operated every night but collection of single day per week was recorded during the principal cropping season from July to December.

From the light trap catches the specimen of concerned species were preserved by keeping the pinned specimens for 24 hrs. at 30^{o}C while the small insects ,such as leaf hoppers are directly mounted over the small pieces of card sheets with the help of gum. Dried specimens were kept in insect boxes and showcase for identification. A detailed photographic presentation of these insects were also prepared

3. RESULT AND DISCUSSION

Documentation of taxonomic analysis (table1&2) revealed that 56 species of insect pest and beneficial once were recorded in paddy ecosystem. These insect species belongs to 8 insect orders and 34 families. Lepidoptera was the largest order with 23 species. Other major orders were Hemiptera (13 species), Coleoptera (11 species) and Orthoptera (4 species). Odonata, Hymenoptera, Isoptera and Dictioptera were the other orders of minor significance (Fig.1).

The total 56 species were grouped on the basis of their economic role in two categories namely (i) Harmful insect pests of crop (39 species) (ii) Beneficial bio control agents (17 predatory species).

In crop pest category order Lepidoptera was the largest group including 7 families and 23 species. Under this order family Noctuidae included largest number of 13 species. Similarly Martien et al. (2000) reported collection of 44 species belonging to families Sphingidae and Noctuidae of order Lepidoptera through light trap catches in Madeira during 1998.

The major polyphagous pest species of this family namely *Helicoverpa arimgera* Hub. (201), *Agrotis ipsilon* Huf. .(92) and *Spodoptera litura* Fab. (221) were also recorded in trap catches during the season. Sivaprakasam (1996) reported *H. armigera* through light trap in tomato fields similarly Wafa *et al.* (1972) used light trap against *S. litura* in vegetables. *Earias vittella* Linn..(200) is a major pest of okra. Sharma *et al.*(2006) also reported *E. vittella* in kharif season through light trap. Cabbage semiloopers *Pulsia orichalcea* Fab. (190) and *Plusia acuta* Wal.(811) are among the others major noctuids.

Comparing the relative size of trap catches of order Lapidoptera the highest catch was observed of Rice leaf folder, *Cnaphalocrocis medinalis* Guen.(4,756 moths) belonging to family Pyralidae. Chang and Wu (1999) from Tiwan, Harinkhere *et al.* (1998) from Waraseoni, Madhya Pradesh and Manisegarn and Letchoumanane (2001) from Karikal in Tamil Nadu have also reported activity of *Cnaphalocrocis medinalis* in light trap catches. Other major species are *Amsacta moorie* But.(903) and *Spilosoma obliqua* Wal.(150) of family Arctiidae and *Acherontia styx* West. (136) of family Sphingidae.

After Lepidoptera, Hemiptera was the next highest order of pest species in trap catch with 7 families and 8 species. The family Delphacidae was represented by *Sogatella furcifera* Harv. with highest trap catch of 18,175 hoppers. *Nilaparvata lugens* Stal. (10,967), Nephotettix sp.(10,803) are the other major species of this order.

Family Pentatomidae was represented by *Nezara viridula* Linn. (236), which is pest of tomato, potato, bringal . Salem et al. (1990) from Al-Arish city, North Sinai reported that family Pentatomidae and Lygaeidae contained the highest number of species. *Nezara viridula* Linn. was one of the most abundant species recorded in light trap collection.

Order Coleoptera was represented by 4 families and 4 species *Aulacophora fovecollis* Linn. Has the highest trap catch size (412 beetles). The other major species of this order included, *Holotrichia insularis* Bren. (452), *Anomala viridis* Fab. (181) and *Mylobris pustuleta* (143). Nath et al. (1978) observed that adults of white grubs. *Holotrichia consenguinea* were attracted toward light between 8.30 to 10.30 p.m. with peak period at 9.30 p.m. Nabli et al. (1999) reported collection of blister beetle *Epicacuta* sp. (Coleoptera : Meloidae) among the various species attracted to light trap.

Order Orthoptera was represented by 3 families in which highest trap catch was of *Gryllus* sp. (3854) (fam. Gryllidae) followed by Grass hoppers *Trilophidia cristella* S. (311) and *Gastrimargus transversus* T. (387) and *Gryllotalpa gryllotalpa* Linn. (213).Vaishampayan (2002) reported 5 year data of annual collection of grass

hoppers, *Trilophidia cristella* S. and *Gryllotalpa gryllotalpa* Linn. collected in light trap catches at Jabalpur (M.P.). Soni (1998) reported peak catches of grass hoppers during 2nd week of Nov.

Order Isoptera was the smallest one with single family (Termitidae) and single species (*Microtermes obesi* Hol.-664). *Mederios* et al. (1999) also recorded the seasonal activity of termite swarming through light trap catches.

Table 1, ***Taxonomic distribution of insect pest species collected in light trap in vegetable ecosystem in main activity season (Kharif year 2006) based on seasons total collection.***

Group-I: Harmful insect pest species as crop pest

S. No.	**Insect species collected**		**Total of seasons collection (July to Dec.)***	**Economic status as crop pest**
	ORDER-LEPIDOPTRA		**Year 2006**	
	i) Fam.-Noctuidae			
1.	1.	*Helicoverpa arimgera* Hub. (Gram pod borer)	201	Major polyphagous, pest of **potato, tomato, okra, chilli**, pulses &cotton
2.	2.	*Agrotis ipsilon* Huf. (Black cut worm)	92	Major pest of pulses, pest of **cabbage, cucurbits, potato.**
3.	3.	*Spodoptera litura* Fab. (Tobacco caterpillar)	221	Major polyphagous, pest of **cabbage, cabbage, potato, chilli**, soybean, **peas**.
4.	4.	*Pulsia orichalcea* Fab. (Green semilooper)	190	Pest of cabbage and cauliflower
5.	5.	*Plusia acuta* Wal. (Cabbage semilooper)	881	Pest of cabbage and cauliflower
6.	6.	*Mythimna separata* C. (Army worm)	398	Major pest of Paddy
7.	7.	*Hyblaea puera* Cram. (Teak defoliator)	212	Major pest of Teak
8.	8.	*Earias vittella* Linn. (Shoot and fruit borer)	274	Major pest of **okra**, cotton
9.	9.	Sesamia inferens Wal. (Jowar stem borer)	144	Major pest of Sorghum
10.	10.	*Achaea janata Linn.* (Cabbage semilooper)	102	Major pest of **cabbage**
	ii) Fam.- Arctiidae			
11.	11.	*Spilosoma obliqua* Wal. (Bihar hairy caterpillar)	150	Major polyphogous pest, particularly- Sesamam, linseed and minor pest of **cabbage, sweet potato**
12.	12.	*Amsacta moorie* But. (Red hairy caterpillar)	903	Major pest of sunnhemp, maize and jowar
13.	13.	*Utetheisa pulchella* Linn.. (Sunnhemp hairy caterpillar)	85	Major pest of sunnhemp
14.	14.	*Creatonotus ganogis* (Hairy caterpillar)	704	-
	iii) Fam.-Pyralidae			
15.	15.	*Cnaphalocrocis medinalis* G. (Rice Leaf folder)	4756	Major pest of paddy
16	16.	*Scirpophaga nivella* Fab. (Sugarcane top shoot borer)	156	Major pest of sugarcane
17.	17.	*Tryporyza incertulas* (Rice stem borer)	188	Major pest of paddy

	iv) Fam.- Hypsidae			
18	18	*Argna cribraria* (Sunnhemp caterpillar)	124	Pest of sunnhemp
19	19	*Hypsa ficus*	90	Pest of sunnhemp
	v) Fam.-Sphingidae			
20	20.	*Acherontia styx* West.	136	Major pest of sesamum & minor pest of **potato, bringal** etc.
21		*Daphinis nerii* Linn.	302	
	vi) Fam.-Nymphalidae			
22.	22.	*Melanitis ismene* Cram. (Rice butterfly)	99	pest of paddy
	vii) Fam.-Hesperiidae			
23.	23.	*Pelopidas mathias* Fab. (Rice skipper)	118	pest of paddy
	ORDER-HEMIPTERA			
	i) Fam.-Delphacidae			
24.	1.	*Sogatella furcifera* Harv. (White baked plant hopper)	18175	Major pest of paddy
25.	2.	*Nilaparvata lugens* Stal. (Brown plant hopper)	10967	Major pest of paddy
	ii) Fam.- Cecadeliadae			
26.	3.	*Nephotettix* sp. (Green leaf hopper)	10803	Major pest of paddy
	iv) Fam.- Fulgoridae			
27	4.	*Pyrilla* sp. (Sugarcane leaf hopper)	574	Major pest of sugarcane
	v) Fam.-Pyrrhocoridae			
28.	5.	*Dysdercus cingulatus* Fab. (Red cotton bug)	102	Pest of paddy
	vi) Fam.-Pentatomidae			
28.	6.	*Nezara viridula* Linn. (Green stink bug)	236	Major pest of paddy
	vii) Fam.- Coreidae			
29	7.	*Leptocorisa* sp. (Rice gandhi bug)	223	Major pest of paddy
	viii) Fam.-Belostomatidae			
30	8.	*Belostoma indica*	91	
	ORDER-COLEOPTERA			
	i) Fam.- Chrysomelidae			
31.	1.	*Aulacophora fovecollis* Linn. (Red pumpkin beetle)	412	Major pest of cucurbitaceous vegetables (**pumpkin, tinda, melon** etc.)
	ii) Fam.-Rutelinae			
32.	2.	*Anomala viridis* Fab. (Cockchafer beetle)	181	Pest of paddy
	iii) Fam.-Melalonthidae			
33.	3.	*Holotrichia insularis* (White grub)	452	Polyhagous pest, particularly of sugarcane, sorghum, maize and minor pest of **potato & tomato**
	iv) Fam.-Meloidae			
34.	4.	*Mylobris pustulata* (Blister beetle)	189	Pest of sorghum
	ORDER-ORTHOPTERA			
	i) Fam.- Acridiidae			
35	1.	*Trilophidia cristella S. (Grass*	311	Major pest of paddy

.		*hopper)*		
36.	2.	*Gastrimargus transversus T.* . *(Grass hopper)*	387	Major pest of paddy
	ii) Fam.-Gryllidae			
37.	1.	*Gryllus* sp. (Field cricket)	3854	Pest of paddy
	iii) Fam.- Gryllotalpidae			
38.	1.	*Gryllotalpa gryllotalpa* Linn. (Mole cricket)	213	Pest of paddy
	ORDER-ISOPTERA			
	i) Fam.-Temitidae			
39.	1.	*Microtermes obesi* Hol. (Termite)	664	Major pest of wheat, sugarcane and cereals

***Number of insects collected in light trap/total of 4 days collection per month (Single day's per week)**

Group of beneficial predatory species as natural Bio-control agent was represented by 5 orders, 13 families and 17 species, table 2. Among these orders Coleoptera was the highest order with 5 families and 7 species. Family Carabidae has the maximum number of 3 species namely *Deserida lineola* Macl. (137), *Crospedophorus elegans* Dej. (143) and *Chlaenius* sp. (51). The highest size of trap catch of 3,230 beetles was recorded in Coccinella sp. of the family Coccinellidae. Activity of the beetle was however very low in the filed crop of paddy, Goel (1976) observed 17 families of Coleoptera trapped at light including 89 species of Carabidae and 13 species of Coccinellidae in North India. Similarly Ghorpade (1979) from Karnataka recorded 8 species of Coccinellides (Coleoptera) collected in light trap.

Order Hemiptera was represented by 4 families and 6 species. Major predatory species were *Canthacona furcellata* (176), *Antilochus* sp. (126). *Geocories bullatus* S. (105) and *Sirthenea* sp. (96).

Among the other predatory orders Odonata was represented by *Libellula* sp. (213) and *Coenagrion* sp. (48) belonging to family Libellulidae and Conenagriidae, respectively. Orders Hymenoptera and Dictioptera were represented by only one species each, namely *Eumenes* sp. (fam Eamenidae) and *Statilia maculata* Thun. (fam. Mentidae), respectively.

Khan (1983 Unpublished Theses work) observed 21 predaceous and 8 parasitic species of insects collected in light trap at Jabalpur. Species of Carabidae and Cicindelid among the predacious Coleoptera and Reduvids among the Hemiptera were however, most responsive but Coccinellids were the least responsive to light which is in contrast with the current findings Coccinellids were observed in significantly high number in present study.

Table 2, ***Taxonomic distribution of insect species collected in light trap in vegetable ecosystem in main activity season (Kharif year 2006) based on season's total collection.***

Group-II beneficial – Predatory species as natural bio control agents

S. No.	Insect species collected	Total of seasons collection(July to Dec.)*	Economic status beneficial predator – as bio control agents
	ORDER-COLEOPTERA	**Year 2006**	
	i) Fam.-Carabidae		
1.	1. *Deserida lineola* Macl.	138	
2.	2. *Crospedophorus elegans*Dej.	143	Predator of lepidopterous larvae and soft bodied insects
3.	3. *Chlaenius* sp.	51	Predaccous upon *Laphgma pyrausta nubilalis,*
	ii) Fam.-Coccinellidae		
4.	4. *Coccinella* sp.	3230	Predator of aphids, coccids, white fly & bugs
	iii) Fam.-Cantharidae		
5.	5. *Cantharis* sp.	133	
	iv) Fam.- Cicindelidae		

6.	6.	*Cicindela* sp.	142	Predaceous upon small insects
	v) Fam.-Hydrophillidae			
7.	7.	*Hydrophilus* sp.	716	
	ORDER-HEMIPTERA			
	i) Fam.-Reduvidae			
8.	1.	*Sirthenea sp*.	96	General predatornfeed upon *Orycetes* sp.
9.	2.	*Ectomocoris cordiger* Stal.	97	Predator upon- Caterpillars and small insects
	ii) Fam.-Pentatomidae			
10.	3.	*Canthecona furcellata*	176	Predaceous up on caterpillars and small insects
11.	4.	*Erthesina fullo*	99	Predaceous habitually or occasionally
	iii) Fam.- Pyrrhocoreidae			
12.	5.	*Antilochus* sp.	126	Predator of nymphs of red cotton bug
	iv) Fam.-Coreidae			
13.	6.	*Geocoris bullatus* S.	105	
	ORDER-ODONATA			
	i) Fam.-Libellulidae			
14.	1.	*Libellula* sp.	213	General predator of Lepidotarous, dipterous and Hyomenopterous insects
	ii) Fam. – Coenagriidae			
15.	2.	*Coenagrion* sp.	44	General predator
	ORDER-HYMENOPTERA			
	i) Fam.- Eumenidae			
16.	1.	*Eumenes sp.*	51	Predaceous upon green semilooper and caterpillars
	ORDER-DICTYOPTERA			
	i) Fam.-Mantidae			
17.	1.	*Statilia maculata Thun.*	33	Nypmhs feed upon- leaf hoopers and aphids while adults feed on caterpillars, grass hopper

***Number of insects collected in light trap/total of 4 days collection per month (Single day's per week)**

Species under the group of harmful as crop pest species are classified on the basis of different crop groups (table 3).This reviles that light trap collection in Vegetable ecosystem of this region also includes number of other crop pest species other then safflower pests (13 species). Among these highest number of crop pest species (14) in trap catch belongs to Paddy because Balaghat district has predominantly dominated by paddy cultivation in kharif and summer season. Number of pest species belongs to other groups are Polyphagous (6), Pulses (5), Cereals (6), Oilseeds (7), Sugarcane (4), Fodder crops (8) and Forest trees& others (7).

Table 3, ***Classification of number of Insect pest species collected in light trap according to different crop groups (year 2006)***

S.No,.	Crop Pest Group	Number of Species Captured
1.	Pest of Vegetable crops	13
2.	Pest of Paddy	14
3	Polyphagous Pest Species	6

4.	Pest of Oilseeds	7
5.	Pest of other Cereals	6
6.	Pest of Pulses	5
7.	Pest of Sugarcane	4
8.	Pest of Fodder crop	8
9.	Pest of Forest & others	7

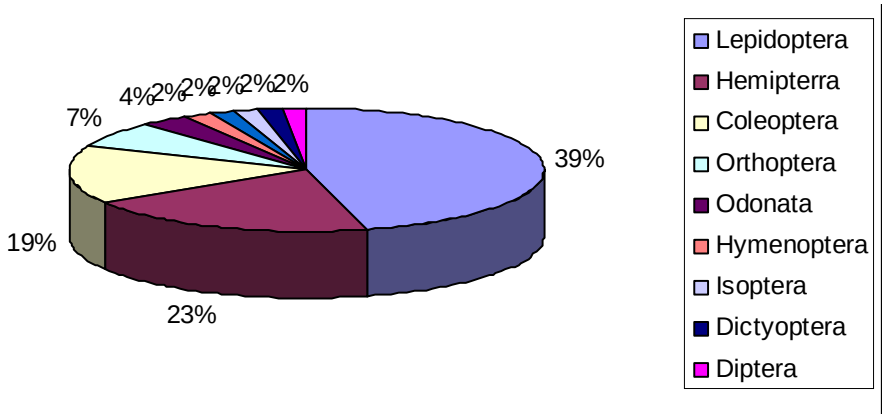

Figure1. ***Percentage shared by different orders in seasonal total trap catch (2006)***

4. CONCLUSION

The present investigation has provided voluble information on presence occurrence, distribution and population dynamics of 56 phototropic insect species in vegetable ecosystem at Balaghat .Among these 39 crop pest species 13 species belongs to vegetable crops and remaining 26 species of different agricultural crops and forest trees . 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 vegetables and other economically important crops of this region.. It will provide scope for other regions also. Successful pest control has already been achieved and hounerd in case of paddy crop through light trap (Sharma, 2007). The present study also gives the status of beneficial insects as bio control agents (predatory species), their occurrence, activity and distribution in vegetable ecosystem of this region which is very important in planning the IPM programme for different crops of this region with a view to conserve the bio control agents.

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