

# Seasonal activity and diversity of insect fauna collected through light trap in protected and unprotected conditions during *rabi* season

## Abstract

The present investigation carried out by installing two light traps with different light sources in the experimental site one is inside the polyhouse and the other is outside the polyhouse. Insects were collected regularly from third week of September 2019 to second week of March 2020. During study, in all 8 predaceous and 6 harmful species were observed in light trap inside polyhouse. Seven major insect pest species and some unidentified Lepidopteran moths were identified collected outside the polyhouse, as important positively phototropic insect pest in *rabi* crops. The light sources used in light trap SMV-4 models were 8+8 watt UV (10" tubes) and 15 watt UV (15" tube).

**Key words:** Insect Fauna, Light trap, Poly house, Protected condition, Solar trap, UV

## 1. Introduction

Traps are used for general survey of insect diversity and usually are simple interception devices that attracts and capture insects moving through an area. Traps also are used for detection of new invasions of insect pest in time and space, for delimitation of area of infestation and for monitoring population levels of established pests. Light trap helps to minimize the pest population by mass trapping of reproducing adults of both the sexes from the crop ecosystem. It is absolutely an eco-friendly approach of insect pest management <sup>[1-2]</sup>. In areas, where organic farming is a common practice and use of insecticides is prohibited (by law), it is the only available practical method of pest control to minimize the crop losses due to insect pests effectively without the use insecticides. Environmental conditions inside the polyhouse/ greenhouse can be modified suiting to the potential growth of plants. Partial control of microclimatic conditions, which have major influence on plant growth characteristics, can be achieved in poly greenhouses <sup>[3]</sup>. The growing conditions within the protected environment of greenhouse/ polyhouse are highly favorable to arthropod pests. In India, about twenty insect and mite species have been recorded to be associated with the crops under protected environment <sup>[4-5]</sup>.

Seasonal activities of insect pest species can be monitored very effectively through trap catches. Conducted a study to collect valuable information on seasonal activity of four major insect pest species namely white backed plant hopper, rice leaf folder, army worm

grass hopper (complex) insect pest species of paddy <sup>[6]</sup> and to find out its relationship with weather parameters <sup>[7]</sup>. Used Ultra-violet light traps for insect capture and found that Coleopterans dominate the catches followed by Hemipterans <sup>[8]</sup>, Hymenopterans and Lepidopterans. Low wattage of ultra violet (Black light) lamps 8 and 15 watt with low electricity consumption, maintaining high trapping efficiency, makes these lamps most convenient to operate the light traps with solar panel or a set of dry recharging batteries, even in remote areas in the farmer's field where electricity is not available <sup>[9]</sup>. Findings of suggest that highly toxic wavelengths of visible light are species-specific in insects<sup>[10]</sup>, and that shorter wavelengths are not always more toxic. For some animals, such as insects, blue light is more harmful than UV light.

## **2. Materials and Methods**

The experiments were conducted in JNKVV campus, Jabalpur (MP) during the period between third week of October to third week of March, (2019-20). Light Trap model SMV-4 (UV 8+8w) was used inside the polyhouse and model SMV-4 (UV 15w) were used in open field for the monitoring of insect pest. Light traps were operated every night and collection was being observed next morning. Observations were recorded every day throughout the *rabi* season. Total insect fauna was observed and sorted out based on major species and order groups. Data of daily trap catch was maintained. Weekly records of day to day catches were maintained order, family and species wise. In all, two light traps were installed in the experimental area. The area was covered mainly by a gram around 5 hecters of crop area outside the polyhouse and tomatoes were grown inside the polyhouse. Spacing between two traps was approximately 300 meters. The data of every day catch of major insect pests collected in trap were converted to weekly total (corrected to seven days).

## **3. Result and Discussion**

### **3.1. Seasonal activity and diversity of insect fauna collected through light trap in protected condition (polyhouse)**

Results of experiment on seasonal activity and diversity of insect fauna collected through light Trap in polyhouse using UV (8+8 watt) light source 12" Tube length as a light source are described in brief below: Seasonal activities of insect fauna (Table no. 1) collected in light trap were studied by operating light trap with UV 8+8 watt light source. The experiment was conducted in polyhouse at Krishi Vigyan Kendra, JNKVV Jabalpur (MP) during the period between third week of September to second week of March, (2019 - 2020). Tomato was the principle crop grown inside polyhouse in light trap area which was installed at the centre of polyhouse. The data in Table. No.1 and 2 showing seasonal activity



Total	127(48.44)	49 (29.8)	100(37.03)	172(48.4)	16(23.36)	07(20.82)	08(20.6)	03(18.42)
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Value in parenthesis is square root transformation value (SQRT)

**Table 2: Seasonal activity of insect-pests collected during September to March 2019-2020**

Observation period weekly	<i>Forficula auricularia</i>	<i>Riptortus strenuus</i>	<i>Gryllus bimaculatus</i>	<i>Cofana spectra</i>	<i>Flata sps.</i>	<i>Spodoptera litura</i>
Sept III wk	00 (0.71)	00 (0.71)	20 (4.53)	00 (0.71)	00 (0.71)	00 (0.71)
Sept IV wk	00 (0.71)	00 (0.71)	31 (5.61)	00 (0.71)	00 (0.71)	00 (0.71)
Oct I wk	16 (4.06)	00 (0.71)	33 (5.79)	00 (0.71)	00 (0.71)	00 (0.71)
Oct II wk	04 (2.12)	16 (4.06)	27 (5.24)	00 (0.71)	01 (1.22)	00 (0.71)
Oct III wk	04 (2.12)	17 (4.18)	25 (5.05)	02 (1.58)	10 (3.24)	00 (0.71)
Oct IV wk	06 (2.55)	14 (3.81)	17 (4.18)	01 (1.22)	02 (1.58)	00 (0.71)
Nov I wk	02 (1.58)	14 (3.81)	08 (2.92)	02 (1.58)	01 (1.22)	03 (1.87)
Nov II wk	01 (1.22)	04 (2.12)	00 (0.71)	00 (0.71)	00 (0.71)	01 (1.22)
Nov III wk	03 (1.87)	05 (2.35)	00 (0.71)	00 (0.71)	00 (0.71)	03 (1.87)
Nov IV wk	00 (0.71)	01 (1.22)	00 (0.71)	00 (0.71)	00 (0.71)	02 (1.58)
Dec I wk	00 (0.71)	00 (0.71)	00 (0.71)	00 (0.71)	00 (0.71)	07 (2.74)
Dec II wk	00 (0.71)	01 (1.22)	01 (1.22)	00 (0.71)	00 (0.71)	05 (2.35)
Dec III wk	00 (0.71)	00 (0.71)	00 (0.71)	00 (0.71)	00 (0.71)	03 (1.87)
Dec IV wk	00 (0.71)	00 (0.71)	00 (0.71)	00 (0.71)	00 (0.71)	00 (0.71)
Jan Iwk	00 (0.71)	00 (0.71)	02 (1.58)	00 (0.71)	00 (0.71)	00 (0.71)
Jan II wk	00 (0.71)	00 (0.71)	04 (2.12)	00 (0.71)	00 (0.71)	02 (1.58)
Jan III wk	00 (0.71)	00 (0.71)	00 (0.71)	00 (0.71)	00 (0.71)	02 (1.58)
Jan IV wk	00 (0.71)	00(0.71)	00 (0.71)	00 (0.71)	00 (0.71)	01 (1.22)
Feb Iwk	00 (0.71)	00 (0.71)	00 (0.71)	00 (0.71)	00 (0.71)	01 (1.22)
Feb II wk	00 (0.71)	00 (0.71)	00 (0.71)	00 (0.71)	00 (0.71)	03 (1.87)
Feb III wk	00 (0.71)	00 (0.71)	00 (0.71)	00 (0.71)	00 (0.71)	01 (1.22)
Feb IV wk	00 (0.71)	00 (0.71)	00 (0.71)	00 (0.71)	00 (0.71)	00 (0.71)
March Iwk	00 (0.71)	00 (0.71)	00 (0.71)	00 (0.71)	00 (0.71)	00 (0.71)
March IIwk	00 (0.71)	00 (0.71)	00 (0.71)	00 (0.71)	00 (0.71)	06 (2.55)
Total	36 (27.55)	72 (34.09)	168 (48.15)	05 (19.24)	14 (21.41)	40 (31.83)

Value in parenthesis is square root transformation value (SQRT)

**Family: Carabidae (Coleoptera):** The beetles are predominantly predaceous. Both in the larval and adult stage

**1. *Chlaenius circumdatus* Brullé:** It is a general predator of caterpillars and soft bodied insects. The insect was active from IV week of September to February II week.

**2. *Ophionea indica* Thunberg:** It is an important predator of nymph and adult of brown plant hopper. Both the grubs and adults of the carabid beetle are reported as predator. The insect was active from 2<sup>nd</sup> week of October to 4<sup>th</sup> week of November.

**3. *Brachinus longipalpis* Wiedemann:** The insect (general predator) was active from last week of October. Population declined from Nov II wk to Jan III wk then population reached at peak at Jan IV wk and Feb I wk.

**4. *Chlaenius nigricans* Wiedemann:** Predaceous upon *Laphgmapyra ustanubilalis* and *Pinusinsiguos* sp. The larvae feed exclusively on amphibians. The adult beetles are generalist predators. The insect was active from first week of October to Nov II week.

**5. *Chlaenius medioguttatis* Chaudoir:** It is a general predator of lepidopterous larvae. The insect activity started from October III wk with a peak of 3. Activity started in Oct I wk and slightly increases at Oct IV wk. Population started declining from Nov I wk onwards and no activity was observed then.

**Family: Coccinellidae (Coleoptera)**

**6. *Coccinella septumpunctata* Linn:** Coccinellids are best known as predators of aphids and scale insects. Species are significant predators of the eggs and larvae of moths such as species of *Spodoptera* and the Plutellidae. The insect activity started from Sept III wk till Nov I wk. and then no activity was observed

**Family: Dytisidae (Coleoptera)**

**7. *Dytiscus marginalis* Linnaeus:** They are the predaceous diving beetles. Scavenger beetles will feed on decomposing organic material that has been deposited. The insects activity were started from Sept III wk till December I week.

**3.1.4. Family: Reduviidae (Hemiptera):** The Reduviidae are members of the suborder Heteroptera of the order Hemiptera. The family members are almost all predatory. They are general predators. Nymphs and adults of most species are predatory upon other insects.

**8. *Sirthena carinata* Fabricius:** *Sirthena* is one of the genera included and is exceptional in being subterranean. *Sirthena carinata* is a generalist predator of mole crickets. Insect was active during the season from October III wk to November I wk.

**Family Coriidae (Hemiptera):** Most hemipterans are phytophagous, using their sucking and piercing mouthparts to feed on plant sap. These include leafhoppers, plant hoppers, aphids, whiteflies, scale insects, and some other groups. Some are monophagous, being host specific and only found on one plant taxon, others are oligophagous, feeding on a few plant groups, while others again are less discriminating polyphagous and feed on many species of plant.

**9. *Riptortuss trenuus* Fabricius:** Pest was active during the season from October II wk to December II wk. Activity started in October II wk. Initially no activity was seen from September III wk to October I wk. Population reached at its peak in October III wk with catch of 17. Then the population started declining from November IV wk onwards and becomes zero.

### **Family Cicadellidae (Hemiptera)**

**10. *Cofana spectra* (Distant):** The white leafhopper (WLH) *Cofana spectra* is a pest, which suck sap from the leaves and results drying of leaf tips leading the leaf tip orange and curl. Pest was active during the season from October III wk to November I wk.

### **Family Flatidea (Hemiptera)**

**11. *Flata* sp. Fabricius:** Pest of various crops. Pest was active during the season from October II wk to November I wk.

### **Family Forficulidae (Dermaptera)**

**12. *Forficula auricularia* Linnaeus:** The European earwig (*Forficula auricularia*) can be quite common in greenhouses. Earwigs are nocturnal and feed on a variety of things, including plants and other insects. Earwigs have occasionally become a problem in greenhouse crops by moving into the crop canopy and damaging fruit. Pest was active during October I wk to November III wk.

### **Family Gryllidae (Orthoptera)**

**13. *Gryllus bimaculatus*, (De Geer):** Field cricket is an opportunistic scavenger and will feed on a variety of organic material. In greenhouses, it is known to damage young plants. Pest was active during the season from September III wk to January II wk.

### **Family Noctuidae (Lepidoptera)**

**14. *Spodoptera litura*, (Fabricius):** *S.litura* also cause considerable damage in some poly houses. It is a polyphagous pest and has been reported to do serious damage as foliage feeder in crops like groundnut, tomatoes, cabbage, cauliflower and many Kharif pluses like moong, urd and soybean. Leaf defoliator and also damages fruits. Pest was active during the season from November I wk to March II wk. Activity started from November I wk. Population showed a highest peak of 7 in December I wk and again of 6 in March II wk. Initially no activity was seen from September III wk to October IV wk.

## **3.2. Seasonal Activity and Diversity of Insect Fauna Collected through Light Trap in Unprotected Condition (Outside Polyhouse)**

Major insect pest species of Rabi crops (Table no.3) collected in light trap were studied by operating light trap with SMV-4 15watt UV light sources. The trap was installed behind the biotechnology center, JNKVV campus. Seven insect pest species namely Gram pod borer *Helicoverpa armigera*, Black cutworm *Agrotis ipsilon*, Tiger moth *Cretonotos gangis*, Field cricket *Gryllus bimaculatus*, Mole cricket *Gryllotalpa orientalis*, Cabbage semilooper *Plusia orichalcea*, Unidentified Lepidoptera moth were identified as important positively phototropic insect pest in rabi crops. Chickpea was the principle

crop grown on the farm in light trap area. Record of daily collection of insect species of rabi crops based on our experience occurring regularly throughout the season was maintained. The data of every day catch of major insect pest collected in trap were converted to weekly total (corrected to seven days) <sup>[14-15]</sup>. Species wise description of trap catches is given in Table No.3 and the seasonal activity is given in Table No.4

**Table No. 3: Important positively phototropic insect pest collected in light trap**

S. N	Common name	Scientific name	Order	Family
1.	Gram pod borer	<i>Helicoverpa armigera</i>	Lepidoptera	Noctuidae
2.	Black cutworm	<i>Agrotis ipsilon</i>	Lepidoptera	Noctuidae
3.	Tiger moth	<i>Cretonotos gangis</i>	Lepidoptera	Noctuidae
4	Cabbage semilooper	<i>Plusia orichalcea</i>	Lepidoptera	Noctuidae
5	Feild cricket	<i>Gryllus bimaculatus</i>	Orthoptera	Gryllidae
6	Mole cricket	<i>Gryllotalpa oreintalis</i>	Orthoptera	Gryllotalpidae
7	Unidentified Lepidoptera moth	Miscellaneous species	Lepidoptera	-----

**Table No. 4: Seasonal activity of insect pest species collected in light trap (Model SMV-4 UV 15 watt)**

S. No.	Observati on period weekly	Species wise mean per day per trap						
		<i>Helicoverpa armigera</i>	<i>Agrotis ipsilon</i>	<i>Cretonotos gangis</i>	<i>Plusia orichalcea</i>	<i>Gryllus bimaculatus</i>	<i>Gryllotalpa oreintalis</i>	Unidentified Lepidoptera moth
1	Oct III wk	0	0	19	0	12.8	0.5	5.94
2	Oct IV wk	0	0	16.05	0	7.46	0.11	6.10
3	Nov I wk	0	0	6.5	0	3.14	0.79	2.28
4	Nov I wk	0	0	4.43	0	2.07	1.93	1.14
5	Nov III wk	0	0	7.69	0	1.57	3.64	3.14
6	Nov IV wk	0	0	6.67	0	1.0	3.20	5.25
7	Dec I wk	0	0	6.78	0	0.86	2.22	7.22
8	Dec II wk	0	0	4.10	0	0.65	2.28	4.72
9	Dec III wk	0	0	2.94	0	0	1.57	4.5
10	Dec IV wk	0.20	0.30	1.42	0	0.36	0.74	3.66
11	Jan I wk	0.14	0.20	1.36	0.79	0.72	0.57	2.72
12	Jan II wk	0.12	0.10	1.36	0.64	0.72	0.36	1.29

13	Jan III wk	0.14	0.11	1.69	1.36	0.43	0.59	1.77
14	Jan IV wk	0.14	0.57	1.06	0.81	1.18	0.94	5.45
15	Feb I wk	0.14	0.29	1.36	0.64	0.43	0.57	3.71
16	Feb II wk	0.22	0.79	1.29	0.43	0.86	0.14	2.86
17	Feb III wk	0.29	0.7	0.85	1.15	0.43	0.41	3.43
18	Feb IV wk	0.65	1.10	2.93	2.96	0.29	0.64	6.83
19	Mar I wk	0.71	1.93	6.71	2.65	1.14	1.07	9.0
20	Mar II wk	0.86	1.50	6.93	2.07	1.43	1.64	7.86
21	Mar III wk	1.5	1.42	7.14	1.29	1.86	1.0	8.92

**1. Gram pod borer (*Helicoverpa armigera*):** It is a major polyphagous pest of pulses, potato, tomato, chilli, and okra crops in Jabalpur. December to March was active period with two peaks in population.

**2. Field cricket (*Gryllus bimaculatus*):** Field crickets are known to damage many cultivated crops as soil pest damaging roots. Pest was active throughout the rabi season from standard week (SW) 43 to SW11.

**3. Mole cricket (*Gryllotalpa orientalis*):** Very little is known about the status of these species as a pest of agricultural crops. Mole cricket is known to damage many cultivated crops as soil pest. Pest was active from SW 43 to SW 11 wk.

**4. Tiger moth (*Cretonotos gangis*):** Pest was active throughout the rabi season from October (2019) to March 2020. Population started at its peak in SW 43 and declined sharply in SW 2.

**5. Cabbage semilooper *Plusia orichalcea*:** It is a major pest of vegetable crops in Jabalpur. Activity during January was slightly started. It is seen that after the appearance of adult moths in trap catches during SW I, a slight increase and decrease trends was observed from SW II to SW 10. Population trend in seasonal activity, showed peak appearing in SW 8,

**6. Cutworm *Agrotis ipsilon* (Hufnagel):** It is a major polyphagous pest of pulses and vegetable crops like cabbage, cucurbits, potato in Jabalpur as per the earlier records but this year activity of this pest was very low. Cutworm first appeared during SW IV in light trap. It is seen that after the appearance of moths in trap catches during SW 4, with a slight drop in catches during SW II it further increased and reached to its highest peak during SW 9 (17 moths). Population trend in seasonal activity, showed only one peak appearing in SW 9.

**7. Unidentified Lepidoptera Moth:** These Moths was active throughout the rabi season from SW 43 to SW 11. Activity started in SW 43. Population reached at its first peak in SW

44 and declined sharply in SW 2. In SMV-4 light source, peak was distinctly higher (78 moths).

The activity of the noctuids *Helicoverpa armigera* (Hubner), *Agrotis ipsilon* (Hufnagel) and *Thysanoplusia orichalcea* (Fabricius), population remained low during December, January and February <sup>[16]</sup>. March and April was a period of very high activity for all species. Observed *H. armigera* were most abundant in late summer <sup>[17]</sup>. Similar trends were apparent for catches of both male and female *H. armigera* in light traps. He also recorded correlations between autumn and winter rainfall in central Australia. Recorded the same pattern with MV light source <sup>[18]</sup>.

Observed the light trap catches of cabbage semilooper *Plusia orichalcea* during the period 1991-92 and 1992-93 Rabi season at Varanasi, and analyzed for various characters <sup>[19]</sup>. The activity of pest was low to medium in January and February (monthly catch-34 and 277 moths). Population suddenly raised to very high level in March (64,566 moths).

#### **4. Conclusion**

In conclusion the data collected and observed shows that since the percentage of beneficial species are more compared to harmful species, if light traps are operated selectively, avoiding the period from September to February the fauna of beneficial species group will not be affected much. Seasonal activity of 7 species of insect pest, which were observed in traps catches operated in field (rabi crop) regularly in considerable number were studies in rabi season during the period 3<sup>rd</sup> week October (2019) to 3<sup>rd</sup> week of March (2020). Two to three peaks were observed in general, showing period of highest & lowest activity both.

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