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Comparative analysis of harmful and beneficial insect species collected through light trap in poly house

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Abstract
Experiment was conducted by using a light trap (model SMV 4) installed inside polyhouse at Krishi Vigyan Kendra (KVK), Jawaharlal Nehru Krishi Vishwa Vidyalaya Jabalpur during Rabi 2019-20 in Jabalpur district, Madhya Pradesh. The crop was tomato inside polyhouse. Comparative analysis of harmful species through light trap collection in polyhouse ecosystem revealed that in terms of total trap catch, percentage of predatory species (*Chlaenius circumdatus*, *Ophionea indica*, *Coccinella septumpunctata*, *Dytiscus marginalis*, *Brachinus longipalpis*, *Chlaenius nigricans*, *Chlaenius medioguttatis and Sirthenea carinata*) was higher than harmful species of insects, namely (*Forficula auricularia*, *Riptortus strenuus*, *Gryllus bimaculatus*, *Cofana spectra*, *Flata sps*. and *Spodoptera litura*). Overall comparison of predator v/s pest species through trap catch revealed that it was 482 and 335 respectively. There was very high activity of predacious species (58.99%) in light trap compared to pest species (41%) shows the importance of minimum use of pesticides and by not running light trap all night but only for particular periods of time during the night to reduce the consumption of electricity and the numbers of beneficial insects caught (approximately by 50%) by the traps. There is no much economic importance of predators that were trapped in light trap, they all are general predators.

Keywords: light trap, polyhouse, harmful insect, predators, comparative analysis

Introduction
Trapping of insects using light trap for pest control is an age old practice known to the entomologists in India since 19th century period itself when insect control was based only on non chemical methods, including use of cultural and mechanical control practices. With the revival of interest in non-chemical methods of control and more emphasis on ecological consideration, use of light trap gained a wide spread importance in IPM strategies all over the world (Vaishampayan, 1997) [8]. The response to light may be either positive or negative in nature, and there are of course, all gradations of type and degree of responses. This response is called as phototropic behavior of insects.

In protected environment, the natural environment is modified for optimum plant growth which ultimately provides quality vegetables. Microclimate modification is an intended change in the soil-plant-atmosphere system, which alleviates stress or prevents damage with the aim of attaining improved yields. Main purpose of protected cultivation is to create a favourable environment for the sustained growth of plant so as to realize its maximum potential even in adverse climatic conditions. Greenhouses, rain shelter, plastic tunnel, mulches, shade nets etc. are used as protective structures. Environmental conditions inside the 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 (Ganeshan, 1999) [5].

Besides the pests natural enemies are also collected in light trap as reported by several workers (Atwal *et al*., 1969; Debach, 1974; Upadhyay, 1999; Bharti *et al*., 2009 and Sharma *et al*., 2006) [1, 3, 7, 2, 6]. Therefore collection of information and documentation on major species of insect pests and natural enemies collected in light trap in paddy ecosystem is also very important. The present study deals with comparative analysis on activity of major predatory and pest species of paddy based on light trap catches.

Materials and Methods
The experiment was conducted by using a light trap (SMV 4) installed inside polyhouse (fig.1)

at Krishi Vigyan Kendra (KVK), Jawaharlal Nehru Krishi Vishwa Vidyalaya Jabalpur (Madhya Pradesh) was used as a source of collection. Light trap was operated every night using Ultraviolet (8+8 watt) light source 12" Tube length during the period of 3rd week of September till 2nd week of March, (2019-20). The trap was operated every night from sunset to sunrise. Tomato crop was planted inside polyhouse.

Close view of UV (8+8 Watt) 12" tube length light trap.

Light trap model SMV 4 inside view

Fig 1: Light trap model SMV 4 installed inside polyhouse

For comparing the activity of pests and predators, the data of 'once in a week collection' of insect-pest species, was considered for the valid comparison during the principal cropping season (rabi) from 3rd week of September to 2nd week of March, (2019-20). The comparison was done by converting the season's total trap catch of each insect species in to ratio of percentage as proposed by Verma (1980).

Results and Discussions

Comparison of quantitative difference between predator v/s pest species trapped in light trap inside polyhouse.

In all, 14 species of crop pests were observed in the crop ecosystem, having regular occurrence in light trap catches. Of the 14 species recorded, 6 species were harmful and 8 were beneficial collected inside polyhouse, the collection was taken regularly from third week of September 2019 to second week of March 2020. It was found that the beneficial insects (58.99%) were abundant than harmful insects (41%).From the present study it was found that Coleoptera is the most diverse insect order in tomato polyhouse ecosystem followed by Orthoptera. Table number 1. and Table number 2. showing economic status of beneficial insects and harmful insect-pests respectively. The total collected data contained 482 beneficial and 335 harmful insects (Fig.2).

Vaishampayan (1997) [8] reported that observation were made during 1983-84 crop season at Jabalpur (M.P.) on beneficial crop parasitic and predatory insects collected on light trap. In all 21 predacious and 8 parasitic species were recorded to appear in significant numbers. Their proportion compared to the catch of harmful pest species was very low below 2 per cent. El-mezayyen *et al*. (1997) [4] found that in a field study in 1994 in Egypt, a light trap was used to monitor pest infestation in cotton over 8 months. Twenty two insect species were recorded. Pests constituted 89.29% of the catch while predators 7.5%.

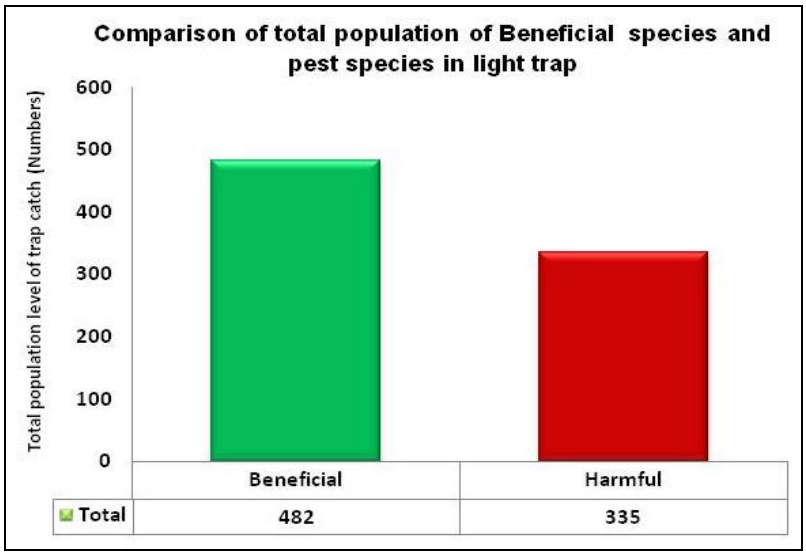

Fig 2: Comparative analysis of beneficial and harmful insects collected through light trap in polyhouse.

Table 1: Economic status of beneficial insects (total 8 species)

S. No.	Insect species collected	Total of seasons collection (Sep. to March)	Economic status
	ORDER- Coleoptera		
	A) Family- Carabidae		
1	*Chlaenius circumdatus*	127	General predator of caterpillars and soft bodied insects.
2	*Ophionea indica*	49	Important predator of nymph and adult of brown plant hopper. Both the grubs and adults of the carabid beetle are reported as an important predator.
3	*Brachinus longipalpis*	16	General predator.
4	*Chlaenius nigricans*	7	The larvae feed exclusively on amphibians, which they lure by making prey-like movements. The adult beetles are generalist predators, but can also feed on amphibians much larger than themselves.
5	*Chlaenius medioguttatis*	8	General predator of Lepidopterous larvae.
	B) Family- Dytisadae		
6	*Dytiscus marginalis*	172	Predaceous diving beetles. Scavenger beetles will feed on decomposing organic material that has been deposited
	C)Family-Coccinellidae		
7	*Coccinella septumpunctata*	100	Coccinellids are best known as predators of aphids and scale insects, significant predators of the eggs and larvae of moths such as species of *Spodoptera* and the Plutellidae
	D) Family-Reduviidae		
8	*Sirthenea carinata*	3	General predators. Nymphs and adults of most species are predatory upon other insects. Sirthenea carinata is a generalist predator of mole crickets and Gryllus sp.

Table 2: Economic status of Harmful insects- as crop pests. (Total 6 species)

S. No.	Insect species collected	Total of seasons collection (Sep. to March)	Economic status As crop pest
1	*Spodoptera litura* (Fabricius) Tobacco caterpillar	40	Major polyphagous pest of tomato, cabbage, cucurbits, potato, chilli and pea etc. leaf defoliator.
2	*Forficula auricularia*	36	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.
3	*Riptortus strenuus*	72	Some are being host specific and only found on one plant taxon, others are feeding on a few plant groups, while others feed on many species of plant.
4	*Cofana spectra*	5	Suck sap from the leaves and results drying of leaf tips leading the leaf tip orange and curl.
5	*Flata sps.*	14	Pest of various crops.
6	*Gryllus bimaculatus*	168	Cricket is an opportunistic scavenger and will feed on a variety of organic material. In greenhouses, it is known to damage young plants. Pest of fodder grasses

Coleoptera beetles dominated the community, making up 58.99% of the ground-active predator community in protected condition. Total predator densities and densities of carabid beetles, water beetles, and lady bird beetles were highest in comparison with other species.

In the year 2019-2020, 482 species belonging to Coleoptera and Hemiptera insect orders were collected through light trap installed inside polyhouse. Coleoptera was the predominant order represented by 479 species followed by Hemiptera (3 species) as shown in fig.3

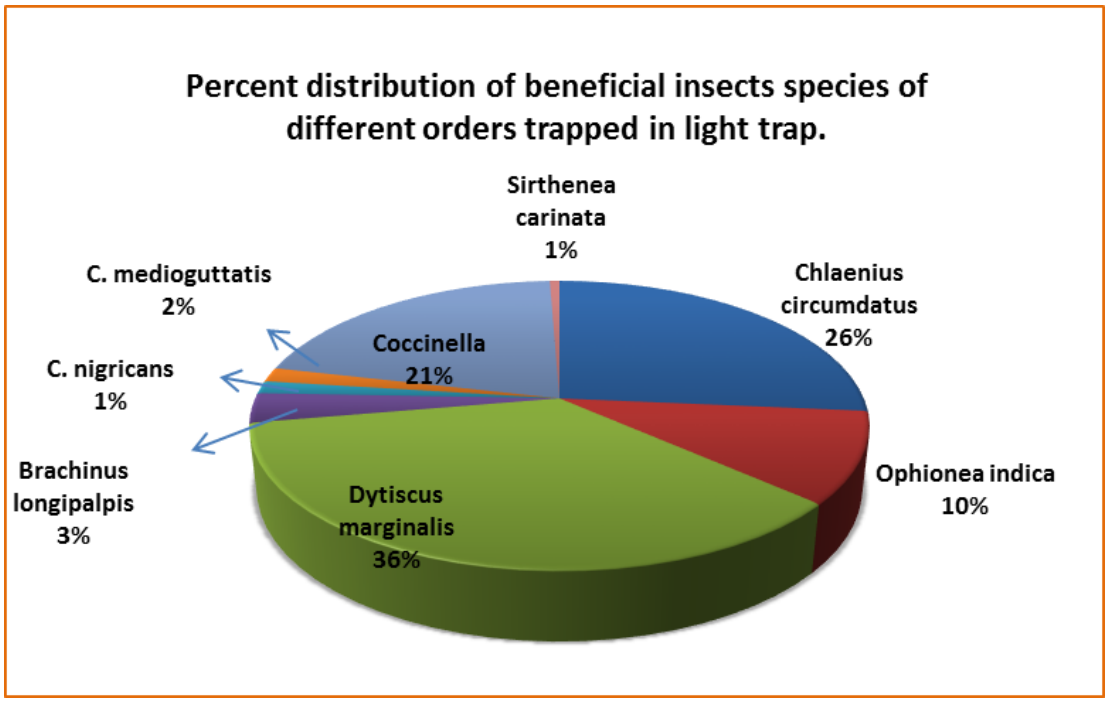

Fig 3: Percent distribution of beneficial species of different orders trapped in light trap.

In the year 2019-2020, 335 species belonging to 4 insect orders were collected through light trap installed inside polyhouse. Orthoptera was the predominant order represented by 168 species followed by Hemiptera (91 species), Lepidoptera (40 species) and Dermaptera (36 species) as shown in fig.4.

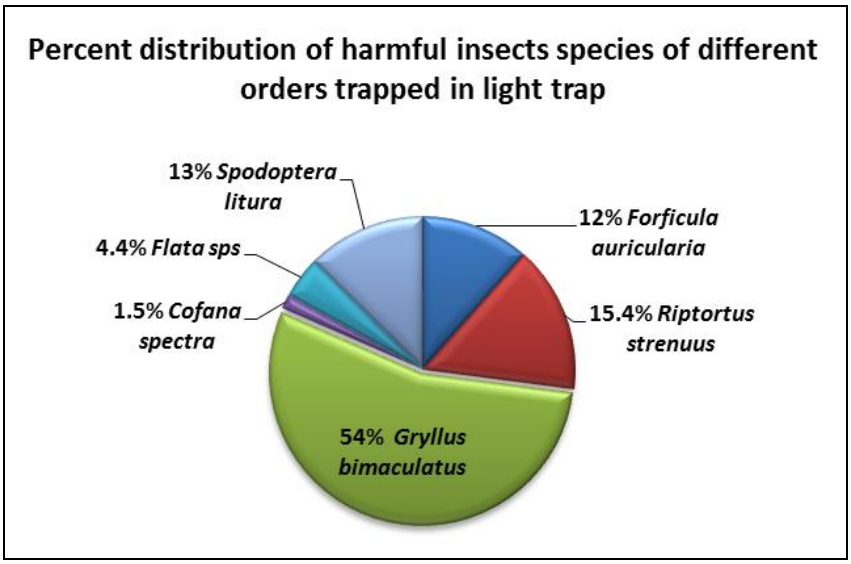

Fig 4: Percent distribution of harmful species of different orders trapped in light trap

Comparative analysis between insect-pest species trapped in light trap inside polyhouse and weather parameters.

For the comparative analysis, four weather parameters have been taken viz., maximum

Temperature (ºC), minimum temperature (ºC), rainfall (mm), relative humidity (%). The study revealed that beneficial insects were more positively correlated with weather parameters taken in experiment as compared to pest species. By combining weathers parameters, (table no.3) regression of insect fauna was computed to get resultant regression coefficient and result showed that on an average, percentage of beneficial insects was higher as compared to pest species. As per the present investigation, Wagh (2014) also reported regressions between weather parameters and sucking pests incidence at Parbhani station during the year 2001-2013.

Table 3: Significant regression coefficients of beneficial and harmful species by combining weather parameters at Jabalpur during the year 2019-20.

SN.	Weather Parameters	TMax (ºC)	TMin (ºC)	Rainfall (mm)	Morning RH (%)	Evening RH (%)
	Beneficial insects	**R2**	**R2**	**R2**	**R2**	**R2**
1.	*Chlaenius circumdatus*	20	40	-	-	-
2.	*Ophionea indica*	-	16	-	-	-
3.	*Dytiscus marginalis*	42	83	38	19	51
4.	*Coccinella septumpunctata*	32	72	48		53
	Harmful insects					
1.	*Forficula auricularia*	18	31	-	-	-
2.	*Riptortus strenuus*	18	20	-	-	-
3.	*Gryllus bimaculatus*	25	74	27	-	50
4.	*Cofana spectra*	16	-	-	-	-

R2 = regression coefficient TMax -maximum temperature
TMin- minimum temperature RH- relative humidity

Conclusion

In conclusion, comparison between beneficial and harmful species, studies indicated that of the 14 species recorded, 6 species were harmful and 8 were beneficial. It was found that the beneficial insects (58.99%) were abundant than harmful insects (41%). Since beneficial species got trapped more as compared to harmful species. Based on these differences, a beneficial-friendly strategy for trapping pest insects and reducing the numbers of beneficial insects captured by light traps operated in a polyhouse must develop. This beneficial-friendly trapping strategy complies with the government policy of saving energy and preserving biodiversity and also the growers' economic interest in reducing the cost of running the traps.

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