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Seasonal activity of major insect pest species of crops collected in light traps

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Abstract
Seasonal activity of seven species viz, *Holotrichia consanguinea*, *Gryllus bimaculatus*, *Gryllotalpa orientalis*, *Hyblaea puera*, *Plusia chalcites*, *Spodoptera litura* and *Spilosoma obliqua* were observed in trap catches operated in field (Kharif crop) regularly in considerable numbers were studied in Kharif season during the period June to October end (2017). Two to three peaks were observed in general, showing period of highest & lowest activity both. Seasonal changes in the activity of pest species in adult stage monitored by light trap catches (weekly total) operated by Mercury vapour as well as Ultraviolet light source have been shown in population graphs of both the light sources. These graphs show the comparative changes in populations with major peaks throughout the active season during the period June IV Week to October end.

Keywords: Light trap, mercury vapour, ultraviolet, peaks

Introduction
Light trap studies are helpful in the rational and timely application of insecticide which may lead to better and cheaper insect control with least hazards El-Saadany (1974). Light traps are used for general survey of insect diversity and usually are simple interception devices that attracts and capture insects moving through an area. Light trap is also used for detection of new invasions of insect pest in time and/or space, for delimitation of area of infestation, and for monitoring population levels of established pests. Use of light trap is one such approach in which pest control is achieved without the use of insecticides Vaishampayan and Vaishampayan (2016) [4]. In apple orchards use of insecticides is prohibited. Codling moth (*Cydia pomonella*) is a serious pest in apple orchards, in Leh Laddakh, Kargil and Kashmir regions. Adult Emergence of codling moths starts as soon the winter season is over and summer season (spring season) starts. Adults are known to be strongly attracted towards UV black light lamps. Pest can be controlled very effectively using light traps in a period coincided with the emergence of first brood of codling moths during June – July and again in a following generation (Brood) coinciding with peak of adult activity. Ultra Violet 15 watt BL lamps were found to be very efficient in trapping codling moths Madson and Sandborn (1962) [2]. Most attractive region of the spectrum was found to be between 300-400nm wavelength or near Ultra violet and violet region Marshall and Hienton (1935) [3]. In the view of above it is propose that light trap will be helpful in detection of seasonal activities of insect pest and their collective response to two different light sources.

Materials and Methods
The experiment was conducted in JNKVV Jabalpur (MP) during the period from last week of June to last week of October, 2017. The experiment was conducted by using SMV-4 light trap model with Ultraviolet light 8+8 watt (12" tubes each of 8 watt) and Mercury Vapour 160 watt was used as light source. In all, two light traps were installed in the experimental area. This area was covered mainly by a soybean crop in around 30 ha of crop area. Spacing between each trap was approximately 100 meter. The insects collected in the collection bag were killed by the exposure of Dichlorvos 76 EC vapours (as fumigating agent) released in a dispenser with scrubber, placed in a collection tray for instant killing of trapped insects. Insects were collected from the collection bag every morning. Seasonal activities of major insect pest species of Kharif crops (Table no. 2) collected in light trap were studied by operating light trap with MV 160 watt and UV 8+8 watt light sources. The experiments were conducted on the Breeding seed farm, Adhartal, JNKVV Jabalpur (MP) during the period between last week of June to last week of October, (2017 -2018). Soybean was the principle crop grown on the farm in light trap area. Record of daily collection of insect species of Kharif crops based on our experience occurring regularly throughout the season was maintained.

The data of every day catch of major insect pest of Kharif crops collected in trap were converted to weekly total (corrected to seven days) in Table. No.1.
T1 - MV (Mercury Vapor) lamp 160 watt
T2 - UV (Ultra Violet) tube 8+8 watt

Result
Seasonal activity data is based on weekly total of trap catch / week (Corrected to 7 days), from period 4th week of June to Last week of October (2017). The seasonal variation in the level of pest population in adult stage i.e the seasonal activity of major insect pest, which were trapped regularly every week was studied. In all seven species of major insect pest, Lepidoptera (4), Orthoptera (2), Coleoptera (1) were recorded as regular pest. Observations on their seasonal activity i.e trends in population with major peaks observed have been discussed species wise, in brief below:

Table 1: Seasonal activities of insect pest species towards light sources.

Observation Period	Species wise weekly total catch/trap (corrected to seven day)							
	Holotrichia consanguinea		*Gryllus bimaculatus*		*Gryllotalpa orientalis*		*Hyblaea puera*	
	T1	T2	T1	T2	T1	T2	T1	T2
	MV 160 w	UV 8+8w	MV 160 w	UV 8+8w	MV 160 w	UV 8+8w	MV 160 w	UV 8+8w
Jun IV Week	11	20	1160	1784	17	15	0	0
Jul I Week	40	37	535	632	25	20	71	94
Jul II Week	28	39	998	1461	47	16	252	305
Jul III Week	0	0	9812	3213	70	21	627	492
Jul IV Week	0	0	1353	1497	18	22	270	488
Aug I Week	0	0	727	184	22	18	25	21
Aug II Week	0	0	703	702	32	42	85	85
Aug III Week	0	0	663	409	27	24	64	51
Aug IV Week	0	0	659	488	23	22	0	0
Sept I Week	0	0	589	555	72	48	0	0
Sept II Week	0	0	744	373	138	40	0	0
Sept III Week	0	0	854	769	30	37	0	0
Sept IV Week	0	0	858	436	285	96	0	0
Oct I Week	0	0	536	870	96	63	0	0
Oct II Week	0	0	701	625	130	65	0	0
Oct III Week	0	0	760	592	78	68	0	0
Oct IV Week	0	0	539	512	68	86	0	0
Total	79	96	22191	15102	1178	703	1394	1536

Observation Period	Species wise weekly total catch/trap (corrected to seven day)					
	Plusia chalcites		*Spodoptera litura*		*Spilosoma obliqua*	
	T1	T2	T1	T2	T1	T2
	MV 160 w	UV 8+8w	MV 160 w	UV 8+8w	MV 160 w	UV 8+8w
Jun IV Week	0	0	0	0	0	0
Jul I Week	0	0	0	0	0	0
Jul II Week	0	0	0	0	0	0
Jul III Week	0	0	23	32	0	0
Jul IV Week	0	0	66	39	0	0
Aug I Week	125	126	29	22	40	42
Aug II Week	152	135	32	14	32	22
Aug III Week	189	150	25	28	43	25
Aug IV Week	169	143	63	44	29	23
Sept I Week	217	97	65	26	77	75
Sept II Week	139	83	111	61	105	45
Sept III Week	190	118	67	54	71	78
Sept IV Week	172	85	59	32	36	37
Oct I Week	37	47	53	25	41	32
Oct II Week	81	57	48	36	15	25
Oct III Week	26	34	29	48	12	18
Oct IV Week	32	39	48	34	23	24
Total	1529	1114	718	495	524	446

Table 2: Name of major species observed in trap catches

S. No.	Common name	Scientific name	Order	Family
1.	White grub	*Holotrichia consanguinea*	Coleoptera	Scarabaeidae
2.	Field cricket	*Gryllus bimaculatus*	Orthoptera	Gryllidae
3.	Mole cricket	*Gryllotalpa orientalis*	Orthoptera	Gryllotalpidae
4.	Teak defoliator	*Hyblaea puera*	Lepidoptera	Hyblaeidae
5.	Soybean semilooper	*Plusia chalcites*	Lepidoptera	Noctuidae
6.	Tobacco caterpillar	*Spodoptera litura*	Lepidoptera	Noctuidae
7.	Bihar Hairy caterpillar	*Spilosoma obliqua*	Lepidoptera	Arctiidae

Insect pest species wise seasonal activities are described below:

White grub (*Holotrichia consanguinea*)

White grub is a sporadic pest of many agricultural crops and teak seedlings in forest nurseries, severely damaging root systems of host plants during August and September in many parts of India. The pest was active with the onset of monsoon. Activity started in June IV Week at low level. Population reached at its peak in July I Week and declined sharply in July III Week. No activities were seen from July III week and onward up to the end of the October in both the light traps. Weekly catches of pest population varied between 10–40 white grubs. (Fig.1) Population trend in seasonal activity, showed one peak in July I Week in MV as well as in UV light source (40 and 37 grubs) respectively, while another additional peak was observed in UV light source in July II Week (39 grubs). Population was little higher in UV compared to MV.

Field cricket (*Gryllus bimaculatus*)

Very little is known about the status of these species as a pest of agricultural crops. Field crickets are known to damage many cultivated crops as soil pest damaging roots. Pest was active throughout the Kharif season from June IV Week to October end. Activity started in June IV Week at low level. Population reached at its peak in July III Week and declined sharply in July IV Week. In MV light source, peak was distinctly higher (9812 crickets) compared to UV light source (3213 crickets). The pest population was considerably low during rest of the period up to October IV Week, remained almost at the same level in both the light sources. Weekly catch of pest population varied between 500-800 crickets. (Fig. 2) Population trend in seasonal activity, showed only one peak appearing in July III Week, in both the light sources i.e MV and UV. Population was distinctly higher in MV compared to UV in this period.

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 damaging the root. Pest was active throughout the Kharif season from June IV Week to October end. Activity started in June IV Week at low level. Population reached at its peak in September IV Week in both the light sources. There were four distinct peaks in the population in MV light source appearing first in July III Week, second in September II Week, third in September IV Week and fourth in October II Week with catch of 70, 138, 285 and 130 mole crickets respectively. Weekly catch of pest population varied between 15-285 mole crickets. In case of UV light source three peaks were observed first in August II Week, second in September I Week and third in September IV Week with catch of 42, 48 and 96 mole crickets respectively. Population at highest peak in UV light source was however, very low compared to MV light source 96 and 285 mole crickets respectively. Population level was considerably higher in MV compared to UV light source. (Fig. 3)

Teak defoliator (*Hyblaea puera*)

It is a serious defoliator pest of teak and active during July and August. Pest was active during the Kharif season from July I Week to August III Week. Activity started in July I Week at low level. Population reached at its peak in July III Week in both the light traps. i.e MV (627 moths) and UV (492 moths) and declined onwards July IV Week till August III Week. Weekly catch of pest population varied between 21-627 moths. Population trend in seasonal activity, with one peak in July III Week, was almost similar in both the light sources i.e MV and UV. Another additional peak was observed in UV light only in July IV Week (488 moths). Small peak was observed in August II Week in both the light sources i.e MV (85 moths) and UV (85 moths). Pest disappeared onward August IV Week. The overall response was however higher in UV light compared to MV light source. (Fig. 4)

Soybean Semilooper (*Plusia chalcites*)

It is a major pest of many Kharif pulses including soybean. Pest was active during the kharif season from August I Week to October end. Activity started in August I Week. Initially no activity was seen from June IV Week to July IV Week. Population reached at its highest peak in September I Week in MV light source (217 moths). Weekly catch of pest population varied between 26-217 moths. Population trend in seasonal activity, showed four peaks appearing first in August III Week (189 and 150 moths) second and third peak in September I Week (217 and 97) and III Week (190 and 118 moths) respectively. Fourth peak was observed at low level in October II Week 81 and 57 moths) in both the light sources Population was considerably higher in MV compared to UV. (Fig. 5)

Tobacco caterpillar (*Spodoptera litura*)

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, urid and soybean. Pest was active during the Kharif season from July III Week to October end. Activity started in July III Week at low level. Initially no activity was seen from June IV Week to July II Week. Population reached at its peak in September II Week in MV and UV with catch of 111 and 61 moths respectively. Weekly catch of pest population varied between 20-120 moths. Population trend in seasonal activity, showed three peaks appearing first in July IV Week (66 and 39 moths), second in August IV Week (63 and 44 moths) and third highest peak in September II Week (111 and 61 moths) in both the light sources i.e MV and UV respectively. Population was considerably higher in MV compared to UV. (Fig. 6)

Bihar hairy caterpillar (*Spilosoma obliqua*)

It is a polyphagous pest attacking sunflower, castor, cotton, greengram, bengalgram, maize and sunhemp. It is a major pest of sunflower. Pest was active during the Kharif season from August I Week to October end. Activity started in August I Week. Initially no activity was seen from June IV Week to July IV Week. Population reached at its peak in September II Week (105 moths) in MV light source. The pest was active from August I Week to October end almost at the same level. Weekly catch of pest population varied between 12-105 moths. (Fig. 7)

Graphical representation of seasonal activities of various insect pest species towards light sources tested during Kharif season 2017-18

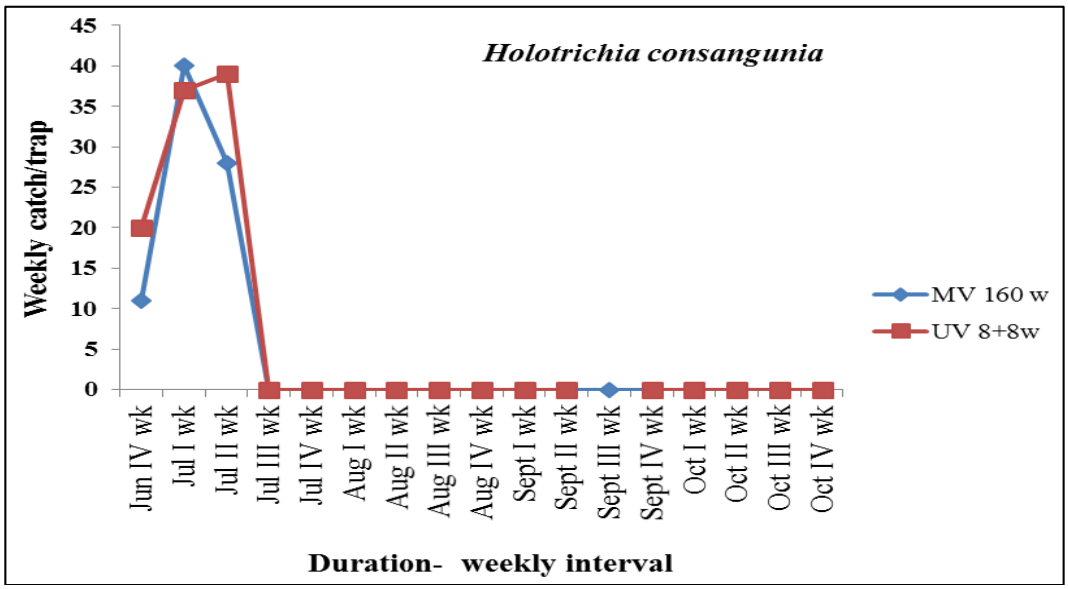

Fig 1: Seasonal activity of white grub (*Holotrichia consanguinea*) monitored by light trap catch.

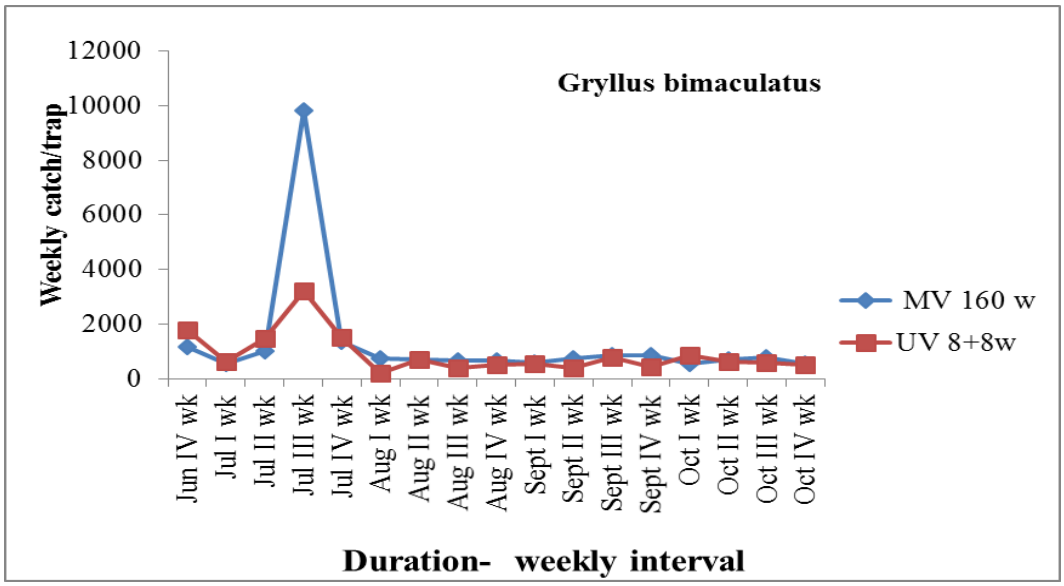

Fig 2: Seasonal activity of field cricket (*Gryllus bimaculatus*) monitored by light trap catch.

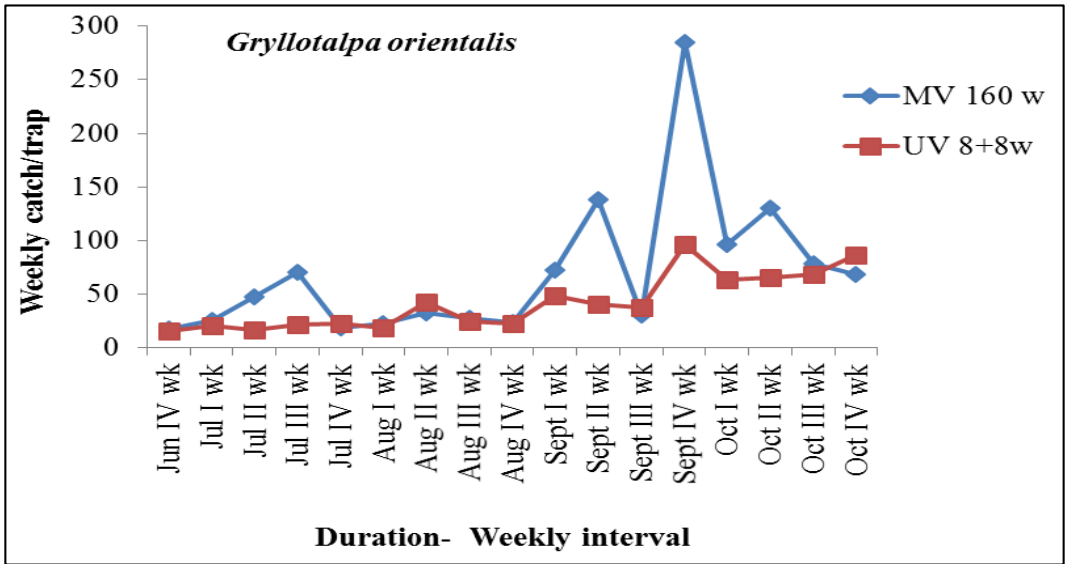

Fig 3: Seasonal activity of mole cricket (*Gryllotalpa orientalis*) monitored by light trap catch.

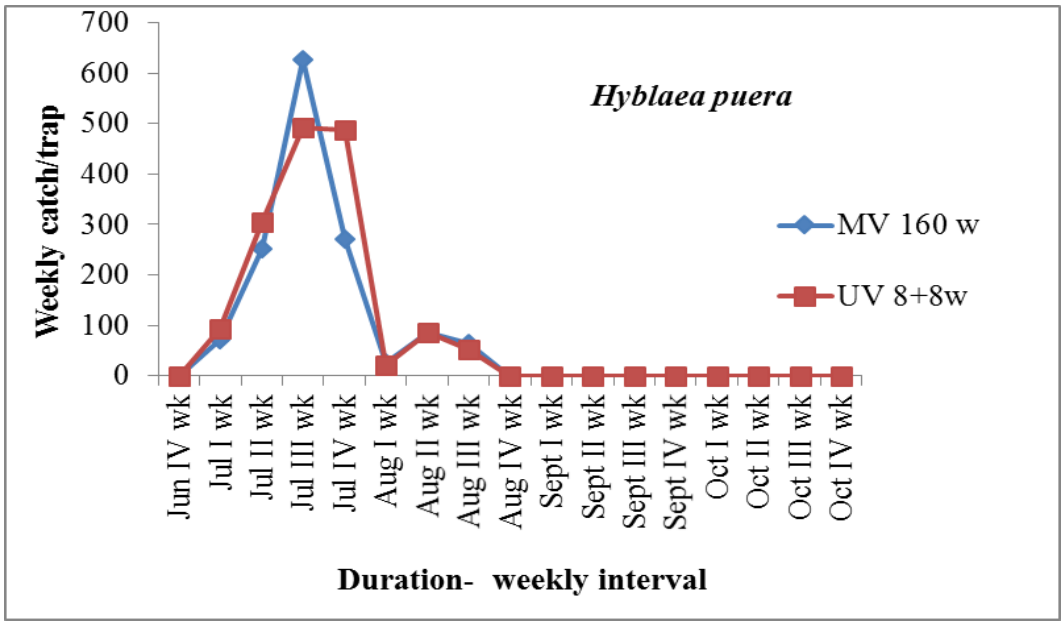

Fig 4: Seasonal activity of teak defoliator (*Hyblaea puera*) monitored by light trap catch.

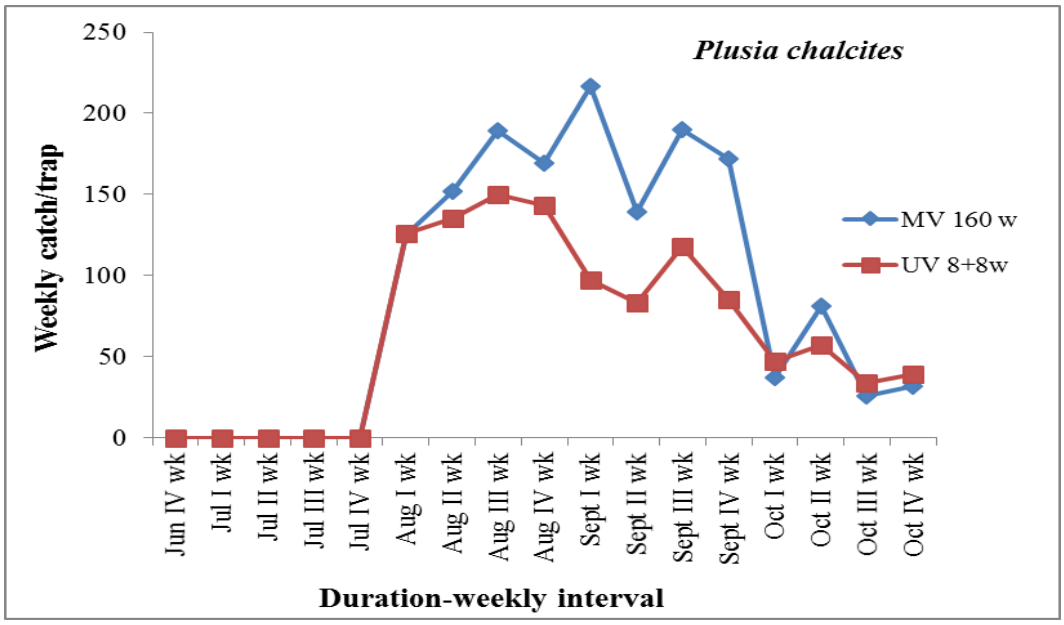

Fig 5: Seasonal activity of soybean semilooper (*Plusia chalcites*) monitored by light trap catch.

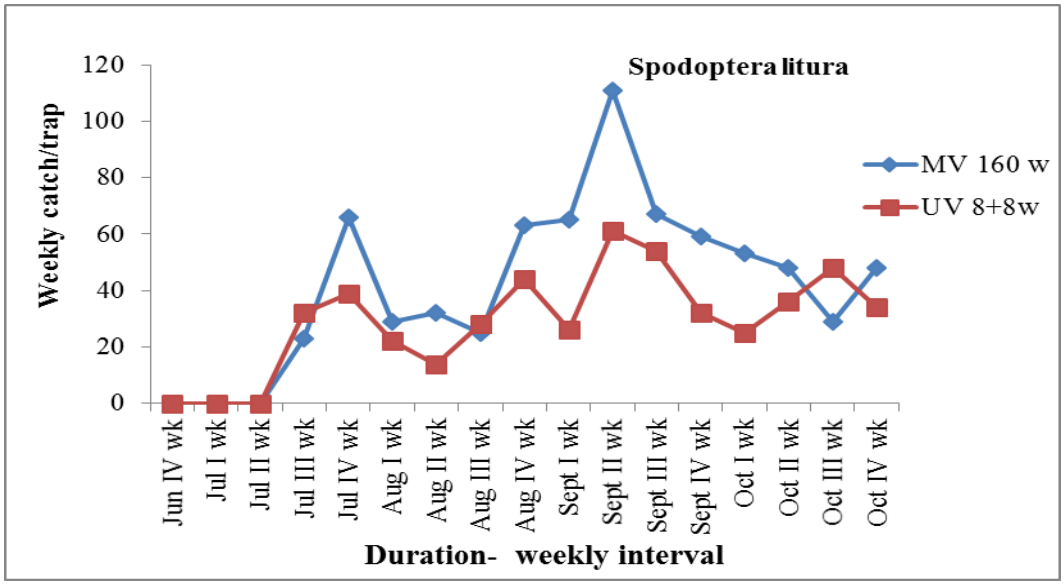

Fig 6: Seasonal activity of tobacco caterpillar (*Spodoptera litura*) monitored by light trap catch.

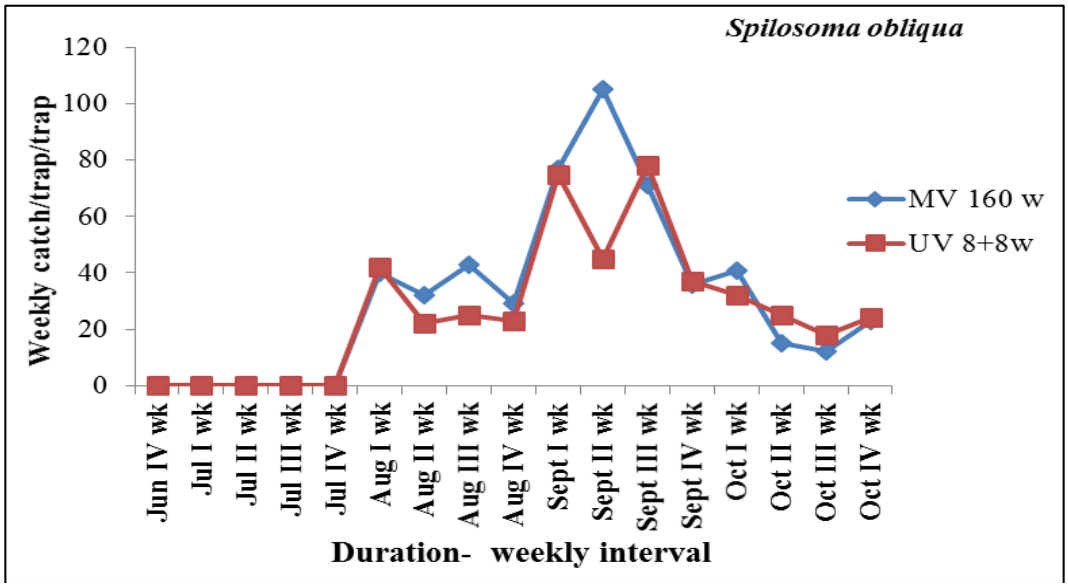

Fig 7: Seasonal activity of bihar hairy caterpillar (*Spilosoma obliqua*) monitored by light trap catch

Conclusion

With the extimities of temperature, flactuating environmental conditions, distrubtion of ecological balance, developedment of insecticide resistance the seasonal rhythm of insect-pest population is flatuated. For the proper decision making and establishment of ETL light traps will be the suitable, cheap and ecofriendly tool. The insect-pest cauth in light trap from which we coclude that with in this period the insect was active which will helpful for proper dicision making. Light trap will be helpful for insect-pest management by knowing their seasonal activities.

1. **White grub:** Population reached at its peak in July I Week and declined sharply in July III Week. No activities were seen from July III week and onward up to the end of the October.
2. **Field cricket:** Population reached at its peak in July III Week and declined sharply in July IV Week. In MV light source. The pest population was considerably low during rest of the period up to October IV Week.
3. **Mole cricket:** There were four distinct peaks in the population in MV light source appearing first in July III Week, second in September II Week, third in September IV Week and fourth in October II Week.
4. **Teak defoliator:** Population reached at its peak in July III Week in both the light traps
5. **Soybean semilooper:** Population trend in seasonal activity, showed four peaks appearing first in August III Week, second and third peak in September I Week, and III Week.
6. **Tobacco caterpillar:** Pest was active during the Kharif season from July III Week to October end. Population reached at its peak in September II Week.
7. **Bihar hairy caterpillar:** Population reached at its peak in September II Week in MV light source.

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