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To study the seasonal activities of major insect pest species of paddy collected in light traps

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Abstract
Seasonal changes in the activity of pest species in adult stage monitored by light trap catches (weekly total) operated by MV as well as UV 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 July to October end. This study examined the Seasonal activity of six species viz. *Nephotettix virescens, Leptocorisa acuta, Cnaphalocrocis medinalis, Mythimina separate Parapoynx stagnalis, Melanitis leda ismene* were observed in trap catches operated in paddy field regularly in considerable numbers were studied in kharif season during the period July to October end (2017). Two to three peaks were observed in general, showing period of highest & lowest activity both.

Keywords: Mercury vapour, ultraviolet, insect pest, kharif, paddy eco-system, peaks

Introduction
Light trap is an effective, bias-free monitoring tool of insect pest, it has often been used in the ecological studies of Lepidopterous insect in paddy ecosystems. Sinu *et al.* (2013) [2] suggested that light trap is an important tool for minimizing the insect pest damage without any toxic hazards. Many insects are positively phototrophic in nature and use of light traps for insect catches produces valuable faunistic data. This data can be seen as a parameter of health of biodiversity of the concerned vicinity. The data provided by light trap catches could throw light on period of maximum activity of insects. (Dadmal and Khadakkar, 2014) [1]. By mass trapping of reproducing adults of both the sexes from the crop ecosystem, light trap helps to minimize the pest population and its carry over effectively, without the use of insecticides. It is absolutely an eco-friendly approach of insect pest management. 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. (Vaishampayan and Vaishampayan, 2016) [4]. Proposed a new concept of adult-oriented pest management strategy, which is based on the suppression of pest population through mass trapping and killing of adults using their behavioral responses (visual, olfactory, gustatory, sexual reproductive, biological, etc.) and described the salient points of using light traps as a component of such strategy. Now the use of light trap has become a common tool for various studies in entomological research. Vaishampayan (2002) [3]

Materials and Methods
The experiments were conducted on the Krishi Nagar experimental farm, Adhartal, JNKVV Jabalpur (MP) during the period between first week of July to last week of October, (2017 - 2018). The experiment was conducted by using SMV-4 light trap model with Ultraviolet light 15 watt tubes and Mercury vapour 125 watt was used as light source. Comparison of Ultraviolet Black light lamp and Mercury vapour lamp against major insect pest in paddy eco-system was based on catches obtained on daily basis by operating the light trap throughout the kharif season and were converted into standard weekly averages. As per the objectives of the study experiments were conducted in the field. Light traps were operated every night and collection was being observed next morning. Observations were recorded every day throughout the *Kharif* season. Total insects fauna was observed and sorted out on the basis of major species and order groups. Data of daily trap catch was maintained.
In all, two light traps were installed in the experimental area. This area was covered mainly by a paddy crop. 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.

Results

Seasonal activities of major insect pest of Paddy collected in light trap were studied by operating light trap with MV 125 watt and UV 15 watt light sources. The experiments were conducted during the period between first week of July to last week of October, 2017. Paddy was the only principle crop grown in the area surrounded by the light trap operated in the field. Record of daily collection of insect species of paddy based on our experience occurring regularly throughout the season was maintained. The data of every day catch of major insect pest of paddy collected in trap were converted to weekly total (corrected to seven days) in Table No.2 In all, 6 species were found in the paddy ecosystem having regular occurrence in light trap catches which have been listed in Table No.1.

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 six species of major insect pest, Lepidoptera (4), Hemiptera (2) 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:

Treatments

T1 -MV (Mercury Vapor) lamp 125 watt
T2 - UV (Ultra Violet) tube 15 watt (18'' length)

Note: The seasonal activity data is based on species wise weekly total catches (corrected to seven day).

Table 1: Name of major species observed in trap catches

Sr. No	Common Name	Scientific Name	Order	Family
1	Green leaf hopper	*Nephotettix virescens*	Homoptera	Cicadellidae
2	Gundhi bug	*Leptocorisa acuta*	Homoptera	Coreidae
3	Leaf folder	*Cnaphalocrocis medinalis*	Lepidoptera	Pyralidae
4	Rice caseworm	*Parapoynx stagnalis*	Lepidoptera	Crambidae
5	Rice Armyworm	.*Mythimina separata*	Lepidoptera	Noctuidae
6	Rice butterfly	*Melanitis leda ismene*	Lepidoptera	Nymphalidae

Table 2: Seasonal activities of insect pest species towards light sources

Observation period	Species wise weekly total catches (corrected to seven day)											
	N. virescens		*L. acuta*		*C. medinalis*		*P. stagnalis*		*M. separata*		*M. leda ismene*	
	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2
Standard week	MV 125w	UV 15w	MV 125 w	UV 15 w	MV 125w	UV 15w	MV 125 w	UV 15 w	MV 125 w	UV 15 w	MV 125 w	UV 15 w
July I wk	0	0	0	0	0	0	0	0	0	0	0	0
July II wk	0	0	0	0	0	0	0	0	0	0	0	0
July III wk	0	0	0	0	0	0	0	0	0	0	0	0
July IV wk	0	0	0	0	0	0	0	0	0	0	0	0
Aug I wk	0	0	0	0	0	0	0	0	0	0	0	0
Aug II wk	149	113	0	0	0	0	0	0	0	0	0	0
Aug III wk	264	172	0	0	0	0	0	0	0	0	0	0
Aug IV wk	355	255	10	10	0	0	0	0	0	0	0	0
Sept I wk	274	1013	41	60	39	27	0	0	0	0	8	9
Sept II wk	930	669	82	146	41	52	0	0	22	29	8	7
Sept III wk	1077	992	116	131	34	51	19	11	29	20	9	7
Sept IV wk	1447	1149	200	220	53	42	22	15	15	41	12	8
Oct I wk	2201	2473	150	201	100	104	74	56	31	42	9	8
Oct II wk	1702	2011	120	162	37	60	71	40	33	31	9	13
Oct III wk	1160	1233	158	138	31	31	22	22	36	21	10	7
Oct IV wk	655	607	73	43	26	24	23	18	26	16	0	0
Total	10214	10687	950	1111	361	391	231	162	192	200	65	59

Insect pest species wise seasonal activities are described below:

1. Green leaf hopper *(Nephpotettix virescens)*

Green leaf hoppers are the most common leaf hoppers in rice fields and are primarily critical because they spread the viral disease. They are not prevalent in upland rice. They are vectors of viral diseases such as tungro, yellow dwarf, transitory yellowing, and dwarf.Pest was active during the kharif season from August II wk to October end. Activity started in August II wk at low level. Population reached at its higher peak in October I wk in both the light sources i.e MV and UV almost at the same level. Peak was little higher in UV (2473 hoppers) compared to MV light source (2201hoppers). Weekly catch of pest population varied between115 to 2473hoppers. Population trend in seasonal activity in UV light source showed two peaks appearing in September I wk and October I wk (1013 and 2473 GLH) respectively. In case of MV light source two peaks were appeared in September II wk and October I wk (1077 and 2201 GLH) respectively.

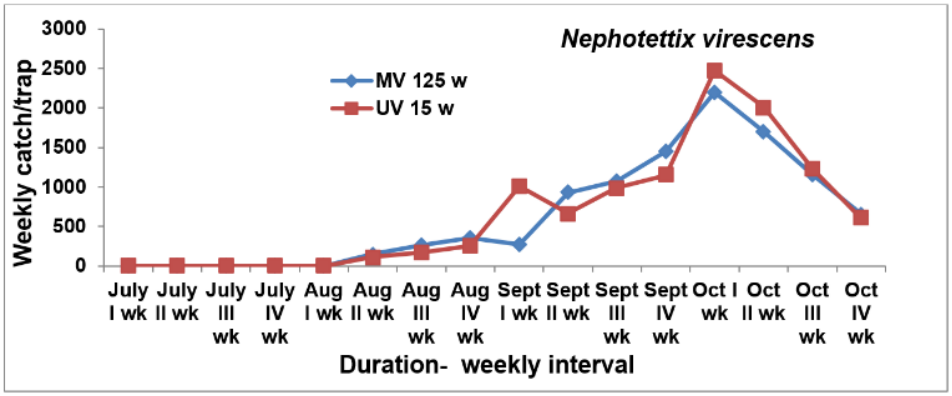

Fig 1: Seasonal activity of Green leaf hopper *(Nephpotettix virescens*) monitored by light trap catch.

2. Gundhi bug *(Leptocorisa acuta)*

Gundhi bugs are found in all rice environments. They are more common in rainfed and upland rice and prefer the flowering to milky stages of the rice crop. They can be serious pests of rice and sometimes reduce yield by as much as 30%.

Pest was active during the kharif season from August IV wk to October end. Activity started in August IV wk. Initially no activity was seen from July I wk to August III wk. Population reached at its highest peak in September IV wk in both the light sources UV (220 bugs) and MV (200 bugs). This highest activity of bugs is coincided with the milking stage of rice earhead during the month of September. Gundhi bug is most active sap sucking pest of paddy during this period. Weekly catch of pest population varied between 10-220 bugs. Population was little higher in UV compared to MV.

Population trend in seasonal activity, in UV light source showed two peaks were observed in September II and IV wk (146 and 220 bugs).In case of MV light source two peaks while appeared in September IV wk (200 bugs) and October III wk (158 bugs).

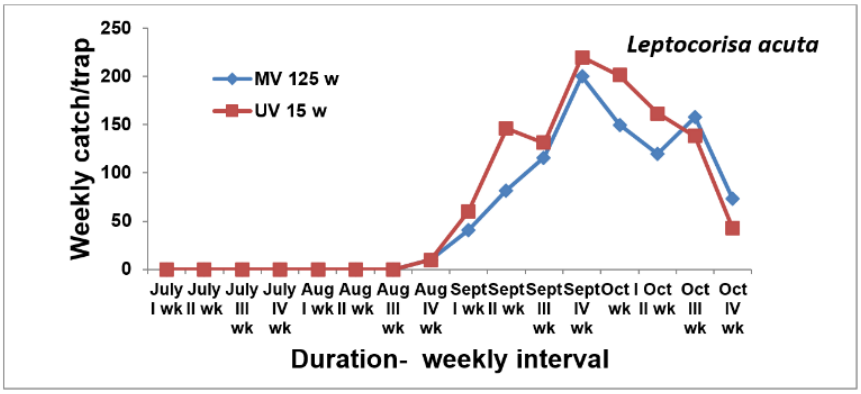

Fig 2: Seasonal activity of Gundhi bug *(Leptocorisa acuta)* monitored by light trap catch.

3. Leaf folder *(Cnaphalocrocis medinalis)*

Rice leaf folders occur in all rice environments and are more abundant during the rainy season. They are commonly found in shady areas and areas where rice is heavily fertilized.

Pest was active during the kharif season from September I wk to October end. Activity started in September I wk. Initially no activity was seen from July I wk to August. Population reached at its highest peak in October I wk in both the light sources i.e UV (104 moths) and MV (100 moths) respectively. Weekly catches of pest population varied between 30-100 moths. Population was little higher in UV Compared to MV.

Population trend in seasonal activity, showed only one major peak appearing in October I wk (100, 104 moths) in both the light sources. Additional peak was observed earlier in September II wk in UV light source (52 moths).

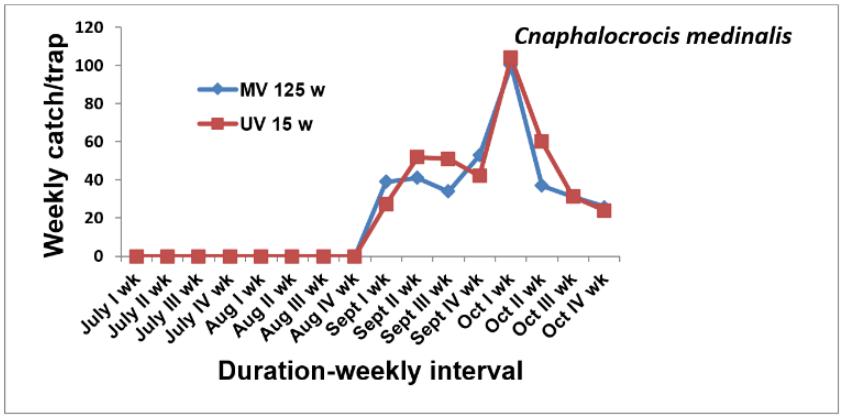

Fig 3: Seasonal activity of Leaf folder *(Cnaphalocrocis medinalis)* monitored by light trap catch.

4. Rice caseworm (*Parapoynx stagnalis*)

The insect is commonly found in rice fields in low populations. The adults are nocturnal and are attracted to light traps. Severe infestation may be observed occasionally on dwarf, compact, heavy tillering, and high yielding varieties during the rainy season.

Pest was active during the kharif season from September III wk to October end. Initially, no activity was seen from July I wk to August I wk to September II wk. Population reached at its highest peak in October I and II wk (74 and 71 moths) in MV light source. Weekly catches of pest population varied between 10-74 moths. Population was little higher in MV compared to UV.

Population trend in seasonal activity, showed two peaks, appearing in October I and II wk (74 and 71 moths) in MV light source respectively. In case of UV light source only one distinct peak was observed in October I wk (56 moths). In MV the population level was little higher than UV source.

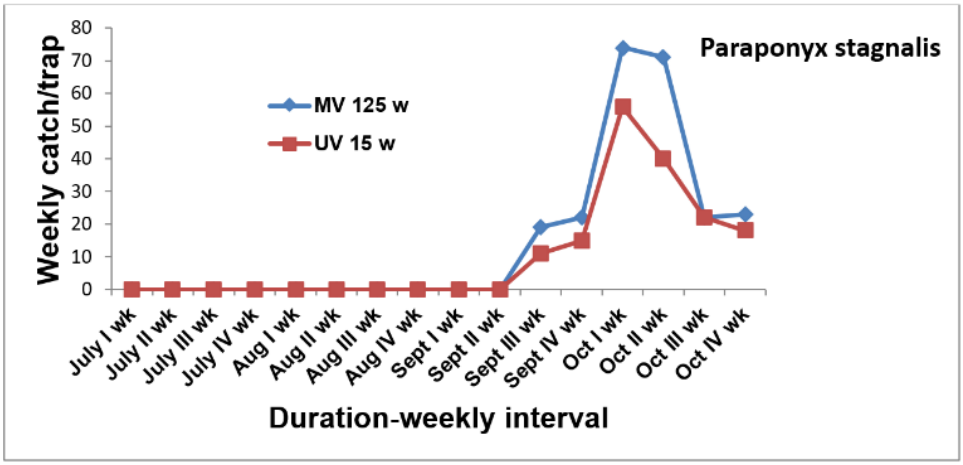

Fig 4: Seasonal activity of Rice caseworm (*Parapoynx stagnalis*) monitored by light trap catch.

5. Armyworm *(Mythimna separata)*

Rice armyworm also called as "swarming caterpillar". Periods of drought followed by heavy rains, and the presence of alternate hosts also sustain the development of armyworms.

Pest was active during the kharif season from September II wk to October end. Activity started in September II wk. Initially no activity was seen from July I wk to September I wk. Population reached at its highest peak in October I wk (42 moths) in UV light source and in October III wk in MV light source (36 moths). Weekly catches of pest population varied between 15-45moths.Population was higher in UV Compared to MV.

Population trend in seasonal activity, showed two peaks in UV light source appearing first in September III wk and second in October I wk (29 and 31moths) respectively. In MV light source population level was distinctly low during the active period of the pest from September to October. No distinct peak was observed on MV light source.

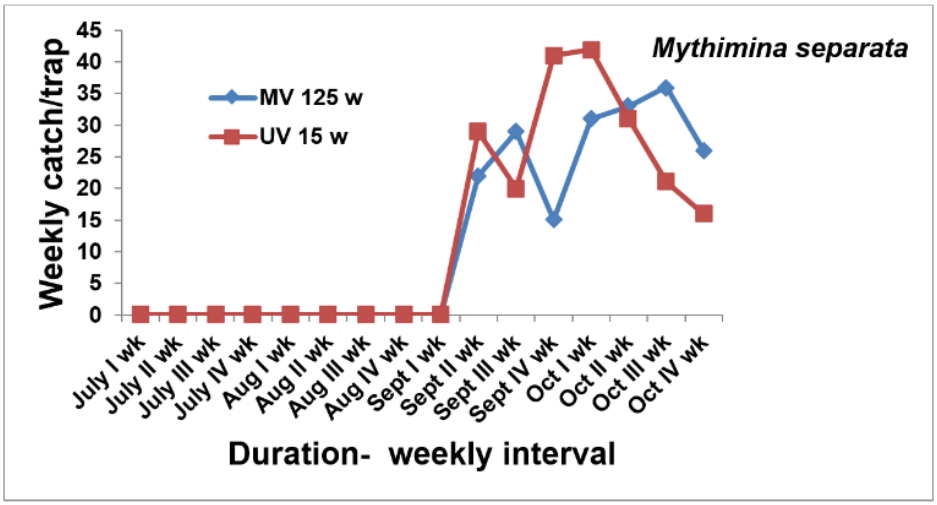

Fig 5: Seasonal activity of Armyworm *(Mythimna separata)* monitored by light trap catch.

6. Rice butterfly *(Melantis leda ismene)*

Rice butterfly is a minor pest of rice. The adults are attracted to light traps. The larvae blend easily with the rice foliage because of their color.

Pest was active during the kharif season from September I wk to October end. Activity started in September I wk. Initially no activity was seen from July I wk to August IV wk. Population reached at its highest peak in October II wk (13 butterflies) in UV light. In MV light source peak was observed in September IV wk (12 butterflies). Weekly catches of pest population varied between 7-13 butterflies. Population was little higher in MV compared to UV.

Population trend in seasonal activity, in MV showed distinct two peaks appeared first in September IV wk, second in October III wk (12 and 10 butterflies). In case of UV light source two peaks were appeared first in September I wk and second in October II wk (9 and 13 butterflies respectively.

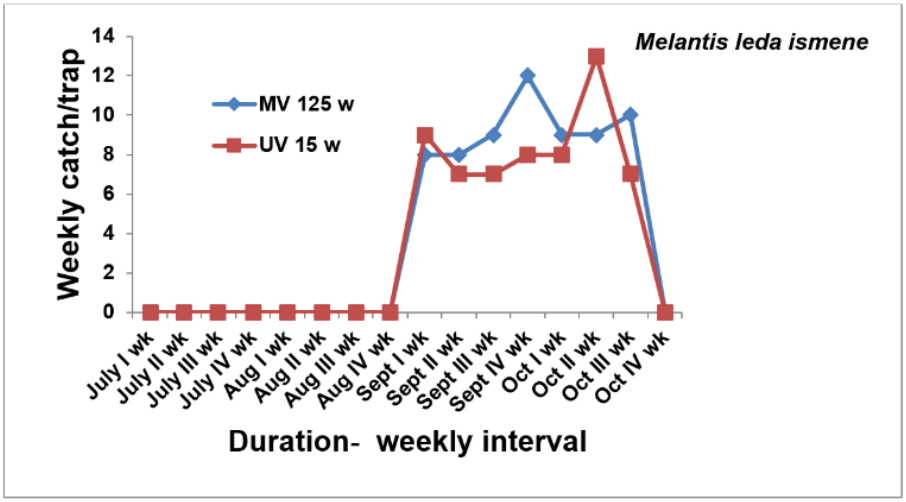

Fig 6: Seasonal activity of Rice butterfly *(Melantis leda ismene)* monitored by light trap catch.

Conclusion

Light trap will be helpful for insect-pest management by knowing their seasonal activities. Our observations showed that Ultraviolet light is a very good light source for its use in light trap for insect pest survey and control. The Ultra Violet light seems to be much cheaper and economic light source. The extensive work done in past 50 years in United States and other parts of the world, as discussed earlier strongly supports our observations on the utility of Ultraviolet light, Specifically UV 15 watt tube (18 inch) as a light source for use in light trap as survey and pest control tool. Ours is a very significant Indian work on the utility of Ultraviolet light source in light trap operation.

1. Green leaf hopper *(Nephpotettix virescens)* Pest was active during the kharif season from August II wk to October end. Activity started in August II wk at low level. Population reached at its higher peak in October I wk in both the light sources i.e MV and UV almost at the same level.

2. Gundhi bug *(Leptocorisa acuta)* Pest was active during the kharif season from August IV wk to October end. Activity started in August IV wk. Initially no activity was seen from July I wk to August III wk. Population reached at its highest peak in September IV wk in both the light sources UV and MV.

3. Leaf folder *(Cnaphalocrocis medinalis)* Pest was active during the kharif season fromSeptember I wk to October end. Activity started in September I wk. Initially no activity was seen from July I wk to August. Population reached at its highest peak in October I wk in both the light sources i.e UV and MV.

4. Rice caseworm (*Parapoynx stagnalis*) Pest was active during the kharif season from September III wk to October end. Initially, no activity was seen from July I wk to August I wk to September II wk. Population reached at its highest peak in October I and II wk in MV light source.

5. Armyworm *(Mythimna separate)* Pest was active during the kharif season from September II wk to October end. Activity started in September II wk. Initially no activity was seen from July I wk to September I wk. Population reached at its highest peak in October I wk in UV light source and in October III wk in MV light source.

6. Rice butterfly *(Melantis leda ismene)* Pest was active during the kharif season from September I wk to October end. Activity started in September I wk. Initially no activity was seen from July I wk to August IV wk. Population reached at its highest peak in October II wk in UV light. In MV light source peak was observed in September IV wk.

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