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Original Research Article

Sustainable Management of Rice Insect Pests Chinsurah Light Trap at Uttar Pradesh

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A B S T R A C T

Chemical pesticides play crucial roles in the management of insect pests of rice crop. Hence, the knowledge of insect catch in light traps may also be used for developing measures to safeguard the health of agriculture environments. The present investigation study on Seasonal Incidence of Insect Pest Species of Paddy Collected Through Chinsurah. Light Trap was carried out at the Crop Research Station, Masodha, Ayodhya during the period between the first week of June to the last week of December, 2016,2017 and 2018.Result showed that all 6 species were identified as pests of paddy having regular occurrence in light trap catches i.e. Green leaf hopper, *Nephotettix virescens (Distant)*,leaf folder, *Cnaphalocrocis medinalis (Guene)*, gundhi bug, *Leptocorisa acuta (Thunberg)*, grass hopper, *Nephotetix virescence*, Yellow Stem borer *Scirphophaga incertulas* and case worm *Nymphula depunctalis (Guenee)* (*pyralidae : Lepidoptera*). Correlation studies revealed that between various weather parameters. and Green leaf hopper, leaf folder, rice gundhi bug, yellow stem borer catches were found significant and case worm, brown plant hopper that non significant positive correlation with maximum temperature. As a result, the quality and security of agricultural products are reduced, and the ecological and environmental integrities are threatened. Recently, environment-friendly pest management measures have been introduced and adopted to manage rice insect pests and reduce the use of insecticides.

Introduction

Many of the insect species, mostly nocturnal are known to be positively phototrophic and are attracted towards artificial light in large numbers. Gardens may utilize this phenomenon to capture night flying insects in a device called light trap. Light trap is an important tool for minimizing the insect pests damage without any toxic hazards (Sharma *et al.*, 2004). Other than this light trap has been used to supplement the knowledge of pest fauna of given locality, geographical distribution and their seasonal activity etc. (Verma and Vaishampayan, 1983 and Sharma *et al.*, 2010). The insect pests of all cereal crops, pulse crops, vegetable crops as well as horticultural crops can be mass trapped by using light traps. Light trap is also useful to know the effect the weather factors on species abundance (Jonason *et al.*, 2014). 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; Ramamurthy *et al.,* 2010). Rice (*Oryza sativa* L.) is one of the most important cultivated plants of tropics and subtropics, it occupies third place in global cereals production and is the most important staple food crop with more than half of the world's population relying on rice as the major daily source of calories and protein (Khanjani, 2006; Tiwari *et al.,* 2014). Rice (*Oryza sativa* L.) is one of the most important crops of the world and provides food to more than 50% global population .More than 90% of the world's rice is grown and consumed in Asia, where 60% of the earth's people live .It was estimated that 35-60% of the calories consumed by 3 billion Asians comes from rice. India continues to remain the fastest growing major economy in the world in 2018- 19, despite a slight moderation in its GDP growth from 7.2 per cent in 2017-18 to 6.8 per cent in 2018-19. Real growth in 'Agriculture & allied' sector was lower in 2018-19 at 2.9 per cent, after two years of good agriculture growth . As per the 3rd Advance Estimates released by Ministry of Agriculture & Farmers Welfare, the total production of food grains during 2018-19 is estimated at 283.4 million tonnes, as compared to 285 million tonnes in 2017-18. Agriculture sector in India typically goes through cyclical movement in terms of growth and production (Economic Survey 2018-19 govt. of India).

Green leafhopper Nephotettix virescens (Cicadellidae, Hemiptera) and plant hoppers Cofana spectra (Delphacidae, Hemiptera) and C. yasumatsui Young (Kolla mimica, Hemiptera) are important insect pests of rice.These insects are serious pests in Asia, where not only cause direct damage by removing plant sap, but also act as vectors of rice virus diseases, such as rice tungro virus. Rice gundhi bug Leptocoriza acuta Thunberg (Alydidae, Hemiptera) is the most important insect pest in rice growing areas of India especially in state of Uttar Pradesh (U.P.). This is a serious pest of rice and can reduce yield by as much as 30%. Rice bug nymphs are more destructive than the adults. They prefer grains at milky stage. Rice bugs damage rice by sucking out the contents of developing grains from pre flowering spikelets to soft dough stage. Both nymphs and adults feed on grains at the milky stage. Such grains remain empty or only partially filled. The panicles in heavy infested fields contain many shriveled and unfilled grains and usually remain erect. An infested field can be recognized by the rice bugs severe odour. Adults are active in the late afternoon and early morning, resting in the shaded areas (Pathak, 1977). The estimated losses caused by insects are about 31.5% in Asia. The importance of agricultural pests is indicated by the fact that only a 10% increase or decrease in food grain production, on global scale, can make the difference between a glut and acute scarcity (Heinrichs, 1998). Meteorological factors play an important role in seasonal abundance, distribution and population build up of insect pests. It is difficult to find direct cause and effect relationship between any single factor and pest activity because the impact of meteorological factor on pests is usually compounded (Garg and Sethi, 1980; Krishnaiah *et al.,* 1996; Harinkhere *et al.,* 1998). Abiotic factors affect the light trap of the insect directly and indirectly. Bhatnager and Saxena (1999) reported that minimum temperature played an important role in the population build up of green leafhopper and rice gundhi bug, besides evening relative humidity and rainfall. Verma *et al.,* (1982)

reported that the effect of meteorological factors viz. temperature, relative humidity and rainfall found to be non significant and of short nature only in case of Heliothis armigera Hubn. Persson (1976).The term 'Light trapping' refers to "attracting moths with light, but sampling them by hand or net". Light can be assumed to sample the community more 'neutrally' than using food or pheromones, where specializations are more likely to occur (Southwood and Henderson 2000). The use of artificial light sources is a commonly employed technique to attract night-active Lepidoptera for the study of taxonomy,biogeography and biodiversity (Holloway *et al.,* 2001; IntachatandWoiwod,1999). Collections of a light trap provide significant clue to the diversity of insects active even at night (Southwood and Henderson, 2000), their respective affinity to light and to understand and predict how populations function (Southwood and Henderson, 2000). While neither the physiological mechanism, as used by Spencer *et al.,* (1997), nor the evolutionary significance (Holloway,1967)

Materials and Methods

A chinsurah type light trap (Rice Research Station, Chinsurah, West Bengal India), fitted with 200-watt electric bulb, is an indigenous device. It had been installed long ago at the Crop Research Station (formerly Rice Research Station), Masodha, A.N.D., University of Agriculture and Technology, Faizabad, (U.P.), India,during the period between first week of June and last week of December, 2016, 2017 and 2018. A wooden box containing killing bottle having plaster of paris and potassium cyanide is placed under the bulb. The insects that circle around the bulb drop in the wooden box and they are counted in the morning. Thus trap catches of green leafhopper Nephotettix virescens, planthopper Cofana spectra and C. yasumatsui and rice gundhi bug Leptocoriza acuta have been recorded daily during rice growing season from June to december during 2016, 2017 and 2018 along with daily observations of meteorological variables, viz. temperature (maximum and minimum), rainfall, and relative humidity. These observations were compiled and arranged per weeks and weekly averages were recorded. After this the observations were pooled for 3 years. Then regression analysis was applied separately taking each insect pest as dependent variables and meteorological variables as independent variables to know the effect of independent variables in each week on each insect pest. To know the direct and indirect effects of meteorological variables on trap catches, path analysis was also done following Dewey and Lu (1959). Correlation and regression of the abiotic factors on major insects were worked out by using the formula as suggested by Snedecor and Cochran (1967).

Results and Discussion

Six species were identified as pests of paddy having regular occurrence in light trap catches i.e. gundhi bug, *Leptocorisa acuta (Thunberg)*, Green leaf hopper, *Nephotettix virescens (Distant)*, leaf folder, *Cnaphalocrocis medinalis (Guene)*, grass hopper, brown plant hopper. Yellow Stem borer Correlation studies revealed that between various weather parameters during rice growing seasons from June to December during 2016, 2017 and 2018. The populations build up of insect pests through trap collections. Rice gundhi bug, Leptocorisa acuta (Thunberg), Green leaf hopper, leaf folder, yellow stem borer catches were found significant and grass hopper, brown plant hopper that non significant positive correlation with maximum temperature. Correlation and regression of the abiotic factors on major insects were worked out by

using the formula as suggested by Snedecor and Cochran (1967).

Green leafhopper *Nephotettix virescens*

Green leaf hopper was first appeared during 24th SW in light trap. Major activity period was July to December with three distinct peaks during 34th SW, 38th SW and 42nd SW respectively. Highest peak was recorded during 34th SW.

Confirms the present findings Sharma et. al. (2004) who also reported that maximum population of *N.virescens* was recorded during the 3rd week of October. On the contrary Rai *et al.,* (2002), Manimaran and Manickavasagam (2000) and Sabale *et al.,* (2010).

Maximum population was recorded during the SW 44thNovember. Meteorological parameters had no significant effect with population build up. Path analysis revealed that the direct contribution of maximum temperature and rainfall on population build up of male green leafhopper. But, indirect contribution of rainfall through maximum temperature on population build up. Similarly indirect contribution of maximum temperature through rainfall. Similarly, maximum temperature and rainfall were contributing (directly negative and indirectly positive) in the case of female green leafhopper's population build up.

Rice leaf folder, *Cnaphalocrocis medinalis (Guene)*

Rice leaf folder was first recorded during SW 22ndJune in light trap. The activity period of *C. medinalis* was observed from June to December.

The one‟s only one distinct peak was recorded in August.Patel *et al.,* (2011) also reported that rice leaf folder, *C. medinalis* reached its peak level during 34th SW, Khan and Ramamurthy (2004). In contrast with the present findings, Harinkhere *et al.,* (1998) who reported that first appearance of C. medinalis in trap catches started from 2nd week of August. Similarly Manisegaran and Letchoumanane (2001) reported that weekly catches of rice leaf folder were highest during October and November in Tamil Nadu. Sharma et. al. (2013). Correlation between various weather parameters and adults of rice leaf folder catches were found significant.

Rice gundhi bug *Leptocoriza acuta*

Rice gundhi bug was first appeared during 32nd SW (August 2nd week) in light trap. Regression analysis revealed that the population build up of rice gundhi bug had positive significant with rainfall in the third week of October. Highest peak was recorded during 34th SW.

Grass hopper, *Tetrixsubulata Linnaeus*

High population of grass hopper was recorded in third week of of October and it was found that meteorological parameters do not play any significant role in the population build up. The highest peak was observed 42st SW.

Williams *et al.,* (1996) also observed *Tetrix subulata Linnaeus* in light trap catches. In contrast to the present findings Sharma (2006) observed two species of grass hopper viz. *Trilophidia cristella S. and Gastrimargus transversus* in light trap catches in paddy field during 2002 (kharif season) at Jabalpur, while similar to the present findings, Singh and Ramaneek (2007) reported that population fluctuations of twenty four species of orthopterans, were correlated with temperature and relative humidity.

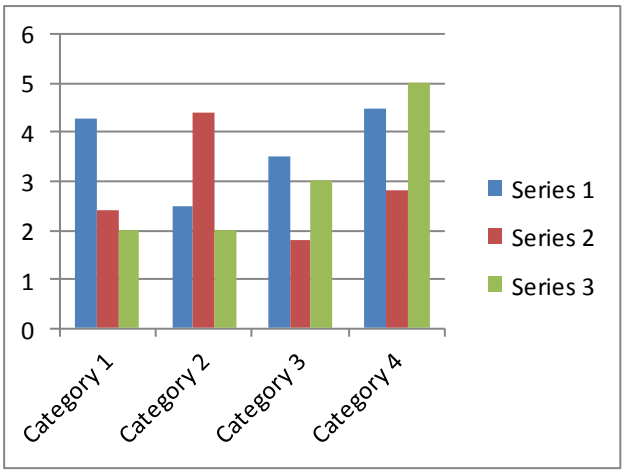
Table.1 Seasonal incidence of insect pest species of paddy during kharif 2016,2017,-2018 Temp. Soil temp. and Vapour pressur (yearly average)

Date	Temperature °C						Soil Temperature °C							Vapour pressur	
	Dry	Wet	Dry	Wet	Max	Min	Grass Min	5 cm	10 cm	20 cm	5 cm	10 cm	20 cm	mm mercury	mm mercury
January	9.01	8.50	21.48	15.75	21.82	6.73	6.65	10.23	11.03	11.66	21.94	21.16	20.39	7.79	10.09
February	13.22	12.53	22.74	17.39	23.12	9.52	9.36	12.73	13.64	14.50	22.98	22.04	21.23	9.89	16.08
March	17.08	15.82	28.88	20.16	29.66	13.10	12.63	16.65	17.60	18.56	29.99	29.08	28.21	12.80	12.29
April	24.51	21.89	36.35	25.30	36.77	20.55	20.03	23.13	24.10	25.10	37.80	36.83	35.88	18.25	17.50
May	30.12	25.18	40.05	25.59	40.90	24.89	24.40	27.55	28.44	29.31	41.81	40.87	39.97	20.64	15.89
June	30.61	26.09	37.94	27.15	38.85	26.87	26.36	30.00	30.97	31.93	39.95	39.00	38.17	23.05	20.55
July	28.46	26.70	31.92	27.81	33.60	26.18	25.66	25.19	26.23	27.23	33.18	32.27	31.34	25.25	25.33
August	28.97	27.14	32.24	28.45	33.02	26.38	25.85	24.52	25.42	26.42	33.16	32.27	31.27	25.85	26.74
September	27.00	26.01	29.83	27.29	31.02	25.25	24.75	24.12	24.97	25.97	31.07	30.22	29.32	24.65	25.75
October	21.95	21.16	29.94	24.78	30.77	20.06	19.52	20.33	21.27	22.23	30.59	29.52	28.53	18.42	20.27
November	15.93	15.27	27.99	22.77	28.55	14.14	13.64	14.48	15.17	16.17	28.62	27.71	26.76	12.76	17.61
December	11.14	10.18	18.98	14.72	19.19	8.74	8.30	9.42	10.19	11.13	19.26	18.37	17.47	9.28	10.55

Table.2 Seasonal incidence of insect pest species of paddy during kharif 2016, 2017,-2018 RH%, Wind, Sunshine, Rainfall, Cloud cover , Weather remark and Evap, (yearly average)

Date	Relative Humidity		Wind			Sun shine	Rain (mm)	Cloud Cover		Weather Remark		Evap (mm)
	%	%	Past 24 Hrs (km/hr)	Direction	Direction	Hrs on previous day	Past 24 Hrs. ending 08.30	Time of observation in okta	Time of observation in okta	Time of observation	Time of observation	Past 24 Hrs. ending 08.30
January	93.10	50.71	3.07	236.61	213.39	5.95	41.00	1.48	1.29	0.42	0.35	3.29
February	91.82	56.36	3.52	202.50	202.50	5.52	13.50	3.38	2.29	0.88	0.61	3.74
March	87.45	41.35	3.43	236.61	254.03	8.44	5.00	0.97	0.48	0.23	0.13	5.09
April	78.70	39.60	4.41	153.00	240.00	8.93	2.00	0.73	0.47	0.17	0.10	6.74
May	65.29	28.61	6.15	213.00	276.00	9.54	0.00	0.31	0.31	0.12	0.12	8.23
June	69.13	41.70	6.47	123.39	135.00	7.55	24.00	2.60	2.53	0.60	0.70	8.08
July	87.68	72.87	5.71	149.52	135.00	4.15	396.50	5.68	6.26	1.45	1.55	5.83
August	86.39	74.26	4.25	126.29	120.48	5.59	123.20	4.52	4.06	1.19	1.03	5.96
September	91.90	81.90	4.16	60.00	66.00	3.37	396.00	6.80	5.60	1.70	1.40	4.92
October	91.97	63.44	1.35	188.44	182.81	5.37	10.00	3.06	2.63	0.72	0.63	4.37
November	93.14	61.72	1.83	206.38	274.66	4.75	0.00	3.10	1.10	0.83	0.31	3.30
December	91.87	64.87	3.05	242.42	259.84	3.58	22.00	4.32	2.13	1.00	0.55	2.68

Table.3 Seasonal incidence of insect pest species of paddy during kharif (June to December) Weekly average

	**Stem Borer**	**Leaf Folder**	**GLH**	**Case Worm**	**Grass Hopper**	**Gundhi bug**
June	6	6	-	7	15	-
23	4	5	-	9	12	-
24	4	3	29	12	7	-
25	4	5	40	12	10	-
26	8	7	43	7	7	-
27	11	6	53	8	7	-
28	15	40	100	23	14	-
29	6	16	81	19	14	-
30	7	14	66	9	9	-
31	12	6	74	7	7	-
Aug-32	39	10	165	29	21	-
33	83	121	282	71	39	8
34	110	146	261	140	34	11
35	79	132	351	190	73	14
Sep-36	30	54	317	141	42	19
37	22	74	354	83	31	12
38	22	76	356	105	67	25
39	20	56	296	147	57	38
Oct-40	26	51	289	123	79	45
41	24	57	264	153	84	59
42	68	66	353	171	109	107
43	46	77	396	179	45	78
Nov-44	74	58	410	154	55	94
45	91	36	329	166	68	81
46	47	43	295	179	32	72
47	96	45	270	246	25	52
48	40	36	263	166	11	35
Dec-49	11	26	125	63	19	29
50	15	16	109	29	15	21
51	9	21	109	25	8	9
52	6	7	56	14	10	11

Yellow stem borer *scirpophaga incertulas Walker (Lepidoptera: Pyralidae)*

Maximum population was recorded during the third week of August. Meteorological parameters had no significant effect with population build up. Path analysis revealed that the direct contribution of maximum temperature and rainfall on population build up. Is the dominant species in India and rice plant are most prone to stem borer infestation at the tillering and flowering stage. Stem borer infestation at vegetative stage of crop produces dead heart symptoms while infestation at reproductive stage produces white ear.

New agricultural technology using light is starting to attract attention. Advances are also expected in the use of light for pest control as a result of these technological developments in lighting, we hope to ensure the further development of applied technology founded on a good balance of input from basic research in universities and independent administrative institutions and applied technology from public research institutes and private companies to establish the next generation of pest control technology.

Rice Caseworm*Nymphula depunctalis (Guenee) (pyralidae Lepidoptera*)

The rice caseworm, *Nymphula depunctalis (Guenee) (pyralidae : Lepidoptera)* is an importantinsect pest of rice (Pathak & Khan, 1994). A number of related species occur in Asia but N.depunctalis is most widely distributed (Reissig *et al.*, 1995). It is an important pest of irrigated andrainfed wetland rice and occurs only in rice field with standing water. Rice caseworm was first recorded in first week of June in light trap. The activity period of *C. medinalis* was observed from June to December.High population of case worm was recorded in third week of of November and it was found that meteorological parameters do not play any significant role in the population build up.

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