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Seasonal incidence of insect pests of rice at Pajancoa and RI, Karaikal, U.T. of Puducherry

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Abstract
The Seasonal incidence of insect pests of rice were studied with a light trap during *Kharif* 2019 and *Rabi* 2019-2020. The results exhibited that yellow stem borer, *Scirpophaga incertulas* was first observed during 28th meteorological standard week (0.14) and its activity gained momentum from August to November (*Kharif* 2019) and January to February (*Rabi* 2019-2020) and reached its highest peak during 43rd MSW (2.86) and green leafhopper, *Nephotettix virescens* commenced during 47th MSW (1.43) and populations reached its highest level during 1st MSW (4.86) and 4th MSW (5.29). Brown planthopper, *Nilaparvata lugens* occurred first during 50th MSW (0.29) and its major activity was observed during 1st MSW (2.29) and 3rd MSW (1.86). White leafhopper, *Cofana spectra* arrived first during 48th MSW (0.29) with highest peak of population during 3rd MSW (1.71) during *Rabi* 2019-2020.

Keywords: rice, seasonal incidence, light trap, abiotic factors, stem borer, brown planthopper, green leafhopper

Introduction
Asian cultivated rice *Oryza sativa* (2n=24) is the world's most important food crop and is a primary source of energy for more than one third of world's population. Rice accounts for 35 to 60 % of the calories consumed by three billions Asian people (Khush, 2005) [4]. Light trap is an important tool to monitor and minimize the insect pests damage without any toxic hazards (Sharma *et al.*, 2004) [12]. 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. (Sharma *et al.*, 2010) [11]. The forecasting and predication of insect occurrence or outbreak can be made by using light trap. These studies are helpful in the rational and timely application of insecticide which may lead to better and cheaper insect control with least hazards.

Materials and Methods
Seasonal incidence of major insect pest species of rice was studied with a light trap during *Kharif* 2019 and *Rabi* 2019-2020 at Pandit Jawaharlal Nehru College of Agriculture and Research Institute (PAJANCOA & RI), Karaikal district, U.T. of Puducherry daily. The light trap was allowed to illuminate from 6.00 pm to 9.00 pm to monitor the activity of rice pests alone. The daily trap catch on the seasonal abundance of rice pests was converted into weekly average. Observations of weather data like maximum and minimum temperature, morning and evening relative humidity and rainfall were recorded on daily basis from Agronomy meteorological observatory. The relationship between weather parameters and major pests was determined through correlations.

Results and Discussion
Seasonal incidence of rice insect pests exhibited that yellow stem borer, *S. incertulas* appeared first during 28th mean standard week (MSW) (0.14) in the light trap (Table 1) during *Kharif* 2019. Major activity started from August to November and January to February with three distinct peaks *viz.*, 43rd MSW (2.86), 45th MSW (1.71) and 5th MSW (2.14). The highest peak was recorded during 43rd MSW (2.86) in *Rabi* 2019 2020. Green leafhopper appeared first during 47th MSW (1.43). It had major activity from November to February with three distinct peaks during 48th MSW (4.29), 1st MSW (4.86) and 4th MSW (5.29). The highest peak was recorded during 4th MSW (5.29).

Brown planthopper appeared first during 50th MSW (0.29). Its major activity was recorded from December to February with two distinct peaks *viz.*, 1st MSW (2.29) and 3th MSW (1.86). White leafhopper occurred first during 48nd MSW (0.29), and its major activity was registered from December to February, and it had a highest peak during 3rd MSW (1.71). White leafhopper appeared first at 51st MSW and showed the highest peak of 1.71 at 3rd MSW. However, it had its activity from 51st to 7th MSW during *Rabi* 2019 -2020. It was inferred from the study that November and December 2019 received the highest rainfall and recorded more than 70 per cent relative humidity which were the favourable and conducive climate for the occurrence of brown planthopper, white leafhopper and green leafhopper during *Rabi* 2019 -2020 alone.

Sankpal (2011) [9] expressed that the activity of adult moths of yellow rice stem borer was recorded from the third week of August to second week of November with peak levels during the second week of September. Similarly, Justin and Preetha (2013) [3] also stated that the infestation of *S. incertulas* in rice during August-September and December-February during 2008-09, 2009-10 and 2010-11 at Agricultural Research Station, Thirupathisaram, Kanyakumari district. Adiroubane and Raja (2010) [1] also stated that yellow stem borer had high incidence during the months of March *(Navarai – Rabi, 2005*), August- September (*Kuruvai –Kharif, 2006*) and October -November (*Samba – Rabi, 2006*) at Karaikal. Baskaran *et al.* (2017) [2] expressed that the activity of yellow stem borer was noticed during the first week of August 2016 (31st MSW) and reached the maximum during first week of September 2016 (36th MSW) and second week of October 2016 (MSW). These findings are in conformity with the present findings.

Sabale *et al.* (2010) [8] reported that first peak occurrence of green leaf hopper, *N. virescens* during 38th to 41st MSW, the second peak was observed during 45th MSW and the third peak was observed during 52nd to 2nd MSW. Srinavasa *et al.* (1991) [13] recorded the peak abundance of *N. virescens* in November and May. Meena *et al.* (2018) [5] stated that green leaf hopper was first recorded during 27th MSW and activity period of *N. virescens* was observed from July to mid of November with two distinct peaks during 34th and 42nd MSW. These observations are in accordance with the present findings.

Sulagitti *et al.* (2017) [14] recoded that *N. lugens* appeared in rice crop during first week of August (2 / 10 hills) and its activity gained momentum during the third week of August and a reached highest level during 2nd week of October (32 / 10 hills). Satheesha *et al.* (2020) [10] reported that appearance of *C. spectra* was observed in 36th MSW with 0.66 hoppers and gradual increase in the population from 37th to 41th MSW (3.20 to 8.00 hoppers/trap) with first peak was noticed during 39th SMW (8.00 hoppers/trap) and 46th MSW (12 hopper/trap).

The correlation study between the meteorological parameters and rice pests indicated that yellow stem borer recorded a significant negative correlation with maximum (-0.58) and minimum temperature (-0.55) and non-significant positive correlation with morning (0.07) and evening RH (0.11) and rainfall (0.14) during *Kharif* 2019 (Table 2). It was found that yellow stem borer and green leafhopper registered a non-significant positive correlation (0.46, 0.08) with maximum temperature during *Rabi* 2019-2020. A non-significant negative correlation (-0.16, -0.29) was observed in brown planthopper and white leafhopper with maximum temperature (Table 3).

A significant negative correlation (-0.71) was recorded in white leafhopper and non-significant negative correlation (-0.41, -0.11, -0.31) in yellow stem borer, green leafhopper and brown planthopper with minimum temperature was recorded. A significant positive correlation in green leafhopper (0.73) and non-significant correlation (0.18, 0.12, 0.40) in yellow stem borer, brown planthopper and white leafhopper were recorded with morning RH.

A significant negative correlation was observed in yellow stem borer (-0.65) and non-significant negative correlation (-0.03, -0.03, -0.29) was observed in green leafhopper, brown planthopper and white leafhopper with evening RH. A significant negative correlation with rainfall (-0.57) was observed in yellow stem borer and a significant positive correlation (0.12, 0.24, 0.21) was observed in green leafhopper, brown planthopper and white leafhopper with rainfall.

Meena *et al.* (2018) [5] also reported that positive non-significant correlation with maximum temperature and non-significant negative correlation with rainfall and evening relative humidity were observed in green leafhopper. Nag *et al.* (2018) [7] stated that population of yellow stem borer showed non-significant positive correlation with maximum temperature (r = 0.07) and wind velocity (r = 0.57), whereas minimum temperature (r = 0.83), morning relative humidity (r = 0.80), evening relative humidity (r = 0.82), rainfall (r = 0.64), and sunshine hours (r = -0.88) had a significant positive correlation. These findings are in contradiction with the present findings. Mishra *et al.* (2019) [6] stated that non-significant negative correlation with rainfall was observed in green leafhopper. Sulagitti *et al.* (2017) [14] stated that correlation analysis of *N. lugens* revealed a positive non-significant correlation of pest population with rainfall (r =0.292), temperature (r =0.295) and relative humidity (r =0.543). Satheesha *et al.* (2020) [10] stated correlation analysis, rainfall and number of rainy days had significantly negative effect on the population build up of white leafhoppers. But, maximum temperature, minimum temperature, morning relative humidity had influenced positively and were non-significant. This report is in opposite with the present findings.

Conclusion

The result of the present study depicted that the yellow stem borer was first observed during 28th MSW and reached its highest peak during 43rd MSW and green leafhopper commenced during 47th MSW and populations reached its highest level during 4th MSW. Brown planthopper occurred first during 50th MSW and its major activity was observed during 1st MSW. White leafhopper arrived first during 48th MSW with highest peak of population during 3rd MSW.

Table 1: Seasonal incidence of insect pests of rice during *Kharif* 2019 and *Rabi* 2019-2020 (weekly average)

Mean Standard week	Rice pests				Meteorological parameters				
	Yellow Stem borer	Green leaf hopper	Brown plant hopper	White leaf hopper	Max. Temp (0C)	Min. Temp (0C)	Max. RH (%)	Min. RH (%)	Rain Fall (mm)
***Kharif* 2019**									
19th (May 6-12)	0.00	0.00	0.00	0.00	38.71	27.44	80.43	49.00	0.00
20th (May 13-19)	0.00	0.00	0.00	0.00	38.67	28.19	82.71	51.29	0.00
21th (May 20-26)	0.00	0.00	0.00	0.00	38.37	28.49	82.00	47.29	0.00
22th (May 27-Jun 2)	0.00	0.00	0.00	0.00	38.94	28.76	77.57	49.14	0.00
23th (Jun 3-9)	0.00	0.00	0.00	0.00	38.11	28.57	76.00	51.86	0.00
24th (Jun 10-16)	0.00	0.00	0.00	0.00	39.44	28.37	68.00	37.86	0.00
25th (Jun 17-23)	0.00	0.00	0.00	0.00	38.97	28.99	65.14	37.43	0.00
26th (Jun 24-30)	0.00	0.00	0.00	0.00	38.37	27.06	70.57	35.43	1.57
27th (Jul 1-7)	0.00	0.00	0.00	0.00	38.19	27.50	69.71	37.71	0.00
28th (Jul 8-14)	0.14	0.00	0.00	0.00	36.66	26.46	79.43	52.00	2.29
29th (Jul 15-21)	0.43	0.00	0.00	0.00	36.41	26.37	77.43	51.57	2.64
30th (Jul 22-28)	0.43	0.00	0.00	0.00	36.56	26.54	75.14	44.43	0.00
31th(Jul 29-aug 4)	0.57	0.00	0.00	0.00	37.29	27.14	74.43	43.14	0.00
32th (Aug 5- 11)	1.00	0.00	0.00	0.00	36.81	26.76	71.57	41.71	0.07
33th (Aug 12-18)	1.14	0.00	0.00	0.00	36.04	25.64	81.71	52.14	3.79
34th (Aug 19-25)	0.14	0.00	0.00	0.00	34.61	24.64	89.86	58.71	11.21
35th (Aug 26-sep1)	0.43	0.00	0.00	0.00	34.90	26.39	76.14	51.00	0.00
36th (Sep 2-8)	1.14	0.00	0.00	0.00	35.63	26.14	78.00	50.71	2.06
37th (Sep 9-15)	0.43	0.00	0.00	0.00	35.09	24.53	89.29	57.43	15.33
38th (Sep 16-22)	1.57	0.00	0.00	0.00	33.33	25.24	91.00	68.14	8.14
39th (Sep 23-29)	0.57	0.00	0.00	0.00	32.30	24.81	87.71	72.29	14.19
40th(Sep 30- Oct 6)	1.14	0.00	0.00	0.00	33.86	25.60	86.00	66.43	0.50
***Rabi* 2019-2020**									
41th (Oct 7-13)	1.43	0.00	0.00	0.00	32.87	25.77	87.29	64.57	0.14
42th (Oct 14-20)	2.29	0.00	0.00	0.00	31.00	24.97	92.71	78.43	15.93
43th (Oct 21-27)	2.86	0.00	0.00	0.00	31.70	24.76	90.86	74.43	15.13
44th(Oct 28- Nov 3)	1.57	0.00	0.00	0.00	31.07	23.51	92.71	78.14	16.93
45th (Nov 4-10)	1.71	0.00	0.00	0.00	33.30	24.70	91.00	64.00	15.50
46th (Nov 11-17)	0.29	0.00	0.00	0.00	31.40	24.50	93.00	68.00	58.00
47th (Nov 18-24)	0.00	1.43	0.00	0.00	30.10	23.70	93.00	83.00	174.50
48th(Nov 25- Dec1)	0.00	4.29	0.00	0.29	30.20	24.00	93.00	83.00	263.50
49th (Dec 2-8)	0.00	3.14	0.00	0.29	29.60	23.40	91.00	77.00	127.40
50th (Dec 9-15)	0.14	1.14	0.29	0.00	29.70	22.60	87.00	72.00	42.50
51th (Dec 16-22)	0.29	2.29	0.14	0.29	29.60	23.20	93.00	76.00	28.00
52th (Dec 23- 29)	1.00	4.43	0.29	0.43	29.40	22.40	94.00	75.00	120.50
1st (Dec 30-Jan 5)	0.43	4.86	2.29	0.57	30.90	23.60	92.00	71.00	4.00
2nd (Jan 6-12)	1.00	3.14	1.57	1.14	29.90	20.50	93.00	68.00	2.50
3rd (Jan 13-19)	0.43	4.86	1.86	1.71	30.19	21.19	91.71	68.00	0.79
4th (Jan 20-26)	1.43	5.29	0.43	1.43	30.26	21.44	94.57	66.00	0.00
5th (Jan 27- Feb 2)	2.14	5.00	0.00	1.14	30.69	20.93	93.43	55.57	0.00
6th (Feb 3-9)	1.86	3.29	0.29	0.43	30.64	21.13	92.57	61.14	0.29
7th (Feb 10-16)	0.57	2.00	0.00	0.29	31.03	21.74	88.00	60.14	0.00
8th (Feb 17-23)	1.29	0.86	0.00	0.00	31.47	22.13	87.43	57.29	0.50
9th (Feb 24- Mar 1)	0.86	0.29	0.00	0.00	31.78	22.67	92.83	58.00	0.00

Table 2: Correlation of meteorological parameters against the population of major rice pests during *Kharif* 2019

Sl. No.	Parameters	Population of yellow stem borer
1.	Maximum temperature (^{0} C)	-0.58*
2.	Minimum temperature (^{0} C)	-0.55*
3.	Morning relative humidity (%)	0.07
4.	Evening relative humidity (%)	0.11
5.	Rainfall (mm)	0.14

'*' significance at 0.0.05 level

Table 3: Correlation of meteorological parameters against the population of major rice pests during *Rabi* 2019 -2020

Sl. No.	Parameters	Population of			
		Yellow stem borer	Green leafhopper	Brown planthopper	White leafhopper
1.	Maximum temperature (^{0}C)	0.46	0.08	-0.16	-0.29
2.	Minimum temperature (^{0}C)	-0.41	-0.11	-0.31	-0.71*
3.	Morning relative humidity (%)	0.18	0.73*	0.12	0.40
4.	Evening relative humidity (%)	-0.65*	-0.03	-0.03	-0.29

5.	Rainfall (mm)	-0.57*	0.12*	0.24*	0.21*

'*' significance at 0.0.05 level

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