Indian Journal of Entomology 84(4): 933-936 (2022) DoI No.: 10.55446/IJE.2021.308

POPULATION DYNAMICS OF INSECTS AND THEIR NATURAL ENEMIES IN RICE ECOSYSTEM ASSESSED WITH LIGHT TRAPS

Selvam K*, K Archunan, P Pavitradevi, V Mary Floret and R Kannan

Department of Entomology, Faculty of Agriculture, Annamalai University, Chidambaram 608003, India
*Email: selvamentomology@gmail.com (corresponding author)

ABSTRACT

The seasonal incidence of pests and their natural enemies in rice ecosystem was studied using yellow and white light traps during kharif 2019 in Annamalainagar. The trap catches were initiated from 34th Standard Meteorological Week (SMW) and the overall catches in the white light trap was the maximum in 36th SMW (113 adults) followed by 35th and 37th SMW. These declined in 44th SMW (36 adults). In yellow light trap, the peak catches were during 37th SMW (62 adults), while the least catch was during 43th week (23 adults). The natural enemies (predators and parasitoids) were noticed during 35th MSW (22 in both the light traps), which increased up to 40th SMW in white, and 39th week in yellow light traps, coinciding with the peak activity of pests. Correlation coefficients of trap catches revealed positive relationships with minimum temperature (0.644, 0.137), and sunshine hours (0.352, 0.214), whereas rainfall exhibited a negative one (-0.252, -0.048).

Key words: Yellow light trap, white light trap, rice, pests, natural enemies, seasonal incidence, temperature, relative humidity, sunshine hours, rainfall, wind speed, correlation coefficients

Rice (*Oryza sativa* L.) as a staple food in India, China, Indonesia and Bangladesh (Anuradha Narala, 2010). In Tamil Nadu it is cultivated in 33.24 lakh ha with productivity is 2244 kg/ ha in 2016-17 (Meenasulochani et al., 2018). Incandescent lights, mercury lamps, and black lights had been employed to forecast the insect pest outbreak in Japan (Katayama et al. 1993; Matsumura, 2001). Nocturnal insects are often attracted to UV radiation (Shimoda and Honda, 2013). Weather factors play an important role in seasonal abundance, distribution and population buildup of rice stem borer and leaf folder (Murali Baskaran et al., 2017) Ramamurthy et al. (2010) used mercury, black and ultraviolet light traps for capture and found that coleopterans dominate the catches followed by others. Light trap plays an important role in monitoring and management of insect pests. This study observed the seasonal incidence of major insect pests and their natural enemies in rice with yellow and white light and correlated these trap catches with weather factors to assess the population dynamics.

MATERIALS AND METHODS

Filed experiment was carried out in the Experimental Farm, Faculty of Agriculture, Annamalai Nagar (11.3853° N, 79.7224°E) during 2019- 2020. Insects were trapped in light traps and the catches were correlated with weather parameters. Observations were made from last week of August to first week of November, 2019 using funnel type traps with light source as follows- made up of 24-gauge GI sheet consisting of a funnel (40 cm top dia), baffle plates each 30 x 12 cm in size; with the long funnel stem provided to reach collection chamber placed on to collection tray. It is made up of 24-gauge GI sheet 40 cm x 40 cm x 15 cm in size with cupboard and built-in locking system. The insects collected were killed in 90% ethanol. Light sources used include: White light (LED bulb, 9W) and yellow light (incandescent bulb, 60W). Light traps were switched on/ off in evening at 6 pm to morning 6 am and catches obtained. Major and minor pests of rice collected were sorted out and observed. In order to study the seasonal activity, daily trap catches were converted into weekly total and mean/ day/ week (weekly mean/ day). Meteorological Standard Week (MSW) was used to correlate with weather data (maximum temperature, minimum temperature, relative humidity morning and evening, rainfall, number of rainy days, sunshine hours, wind velocity, morning and evening vapour pressure and evaporation etc.). These weather data were obtained from Annamalai University meteorological observatory. Correlation coefficients were computed from the data using Microsoft Excel software.

RESULTS AND DISCUSSION

The data given in Table 1 indicate that the light

Table 1. Population dynamics of pests and their natural enemies in rice ecosystem assessed through light traps in Annamalai Nagar (2019)

Name of traps	MSW	Borers	Leaf feeder	Sucking pest	Total no. of pests	Predators	Parasitoids	Total no. of NE		Weather parameters					
										Maxi. temp.	Mini. temp.	Relative humidity	Sunshine hours	Rainfall	Wind speed
White light trap	34	3	0	36	39	11	6	17	Total no. of pests (r^2)	0.121	0.644*	-0.127	0.352	-0.252	0.800**
	35	54	8	45	107	14	8	22							
	36	59	18	36	113	16	13	29							
	37	41	15	30	86	21	16	37							
	38	18	20	25	63	26	19	45							
	39	29	16	30	75	18	24	42							
	40	18	12	31	61	23	18	41							
	41	16	8	21	45	18	15	33	Total no. of NE (r^2)	-0.213	0.200	0.368	0.331	-0.151	-0.203
	42	15	10	27	52	15	13	28							
	43	10	8	23	41	14	8	22							
	44	8	13	15	36	12	13	25							
Yellow light trap	34	15	6	14	35	4	7	11							
	35	12	5	11	28	17	5	22							
	36	19	6	17	42	13	9	22	Total no. of pests (r^2)	-0.269	0.137	0.446	0.214	-0.048	-0.106
	37	24	14	24	62	16	22	38							
	38	16	23	17	56	24	13	37							
	39	14	17	17	48	22	21	43							
	40	11	14	23	48	14	16	30							
	41	11	14	23	48	13	21	34							
	42	8	12	19	39	9	15	24	Total no. of NE (r^2)	-0.053	-0.123	0.577	0.169	-0.268	-0.424
	43	4	6	17	27	17	12	29							
	44	9	15	15	39	17	15	32							

MSW- Standard Meteorological Week; NE- Natural Enemies; *Significance at p= 0.05% (0.576); **Highly significant at p=0.01% (0.708)

trap catches got initiated from 34th MSW, with catches in white light trap being maximum in 36th MSW (113 adults) followed by 35th and 37th MSW of kharif crop and declined in 44th MSW (36 adults). In yellow light trap, it was maximum during 37th SMW (62 adults), and on 43th SMW it was the least (23 adults). These results derive support from the results of Garg (2012), who noticed that the peak activity period for most of the rice insect pests was during the second fortnight of September to second fortnight of October during kharif season. Similarly, Bisen et al. (2019), Dhaliwal et al. (2018), Rai and Khan (2002) revealed that there were peak catches of rice pests during first fortnight of August in the kharif season. In white light trap, during the kharif season, maximum number of stem borer (59) and sucking pests (45) were trapped during 36th and 35th MSW, respectively (last week of August and first week of September 2019). While, the leaf folder collection was at peak (30) observed during the 38th MSW (third week of September). With yellow light trap, maximum stem borer (24) and sucking pests (24) were recorded during 37 MSW (second week of September 2019); here the leaf folder collection (24) peaked during 38th MSW (first week of September 2019). The peak activity of pest population was observed from 35 to 36 MSW (August last week to third week of September 2019) after which there was decline up to 44th week (last week of October 2019). These results are in line with those of Shekhar et al. (2018) wherein the peaks in stem borer moths was found during October to November.

The important natural enemies observed in the rice ecosystem are spiders, staphylinids, lady birds, rove beetle and damselfly. These were trapped in both the light sources, and along with parasitoids, these were noticed during 35th MSW in both the light traps. These were in an increasing trend up to 40th week in white light trap and 39th week in yellow light trap which coincides with the peak activity of rice pests. In these periods the peak activity of stem borer, leaf folder and sucking pests were observed in white light trap, while iin yellow light trap, it was during 37th, 38th and 37th MSW for stem borer, leaf folder and sucking pests, respectively. These observations corroborate with those of Garg (2012) who observed the highest number of predators and parasitoids during October in Raipur.

The correlation coefficients of weather parameters with incidence of pests and natural enemies given in Table 1, revealed a positively correlation with maximum (r= 0.125) and minimum temperature (r= 0.644), sunshine hours (r= 0.352) and wind speed (r=0.8004); with relative humidity (RH) (r=-0.128) and rainfall (r=-0.253), it was negatively correlated. These findings are in accordance with Ahmad et al. (2010) as regards RH and minimum temperature. Table 1 reveals that minimum temperature (r=0.201), RH (r=0.369), and sunshine hours (r=0.331) were positively correlated with the occurrence of natural enemies as shown from catches in white light trap, while maximum temperature (r= -0.213), wind speed (r=-0.204) and rainfall (r=-0.151) were found negatively correlated. Present observations are in accordance with Anon. (2007) that light trap catches of rice pests were observed to be negatively correlated with rainfall and relative humidity. Yellow light trap catches were found to be positively correlated with minimum temperature (r=0.137), RH (r=0.4465) and sunshine hours (r= 0.214); while maximum temperature (r=-0.269), wind speed (r=-0.106) and rainfall (r=-0.152) exhibited a negative correlation; RH (r=0.578) and sunshine hours (r=0.169) were positively correlated with the natural enemies trapped in the yellow light traps, but minimum (r=-0.053) and maximum temperature. (r= -0.123), wind speed (r=-0.424) and rainfall (r=-0.268) were negatively correlated. These results are in accordance with the results of Patel et al. (2005) wherein the observed spider population had significant positive correlation with maximum temperature, average temperature and sunshine hours, with negative correlation documented with rainfall and minimum temperature.

REFERENCES

Ahmad H Khan, R B Sharma, D Jamwal, V V S, Gupta S. 2010. Seasonal incidence, infestation and trap catches of *Cnaphalocrocis mendinalis* (Guenee) in rice. Annals of Plant Protection Sciences 18(2): 380-383.

Anonymous. 2006. Rice in India hand book of statistics, Director of Rice Development, Government of India, Hyderabad.

Anonymous. 2007. Monitoring of natural enemy populations in rice ecosystem. All India Coordinated Rice Improvement Programme, Annual Progress Report. DRR, ICAR, Rajendra Nagar, Hyderabad (AP) 2: 108-114.

Anuradha Narala. 2010. Technical efficiency rice farmers under irrigated conditions in central Gujarat. M Sc Thesis submitted to Anand Agricultural University, Gujarat.

Bisen D, Bisen U, Bisen S. 2019. Studies on major insect pests of rice crop (*Oryza sativa*) at Balaghat district of Madhya Pradesh. Journal of Entomology and Zoology Studies: 7(2): 625-629.

Dhaliwal L K, Sandhu S K, Kaur S, Singh S. 2018. Effect of meteorological parameters on incidence of brown leaf spot in rice crop under different planting methods. Journal of Agrometeorology 20(1): 53-56.

Garg V. 2012. Monitoring of rice insect-pest and their natural enemies during kharif season at Raipur (Doctoral dissertation, Indira Gandhi Krishi Vishwavidyalaya, Raipur). 29-30 pp.

Katayama E, Fukuda T, Nozawa H. 1993. Light trap monitoring of the stink bugs attacking fruit trees and their ovarian development. Bull Tochigi Agricultural Experiment Station 40: 59-74.

Matsumura M. 2001. The current status of occurrence and forecasting system of rice planthoppers in Japan. Journal of Asia-Pacific Entomology 4: 195-199.

Patel M L, Patel K G, Pandya H V. 2005. Correlation of spiders with weather parameter and Insect pests of rice (*Oryza sativa* L.). Insect Environment 11(1): 23-25.

Meenasulochani. R T. Rajendran J Pushpa, S Senthilnathan. 2018. Technical efficiency of paddy production and factors affecting the efficiency in Nagapattinam District, Tamil Nadu, International Journal of Agriculture Innovations and Research 6: 2319-1473.

Rai A K, Khan M A. 2002. Light trap catch of rice insect pest, *Nephotettix virescens* (Distant) and its relation with climatic factors. Annals of Plant Protection Sciences 10(1): 17-22.

Ramamurthy V V, Akhtar M S, Patankar N V, Menon Pratibha, Kumar Rajesh, Singh S K, Shama Parveen, Shaloo Ayri, Mittal Vishal. 2010. Efficiency of different light sources in light traps in monitoring insect diversity. Munis Entomology and Zoology 5(1): 109- 114.

Murali Baskaran R K, Sharma K C, Jagdish Kumar. 2017. Seasonal and relative abundance of stem-borer and leaf-folder in wet land rice ecosystem. Journal of Entomology and Zoology Studies 5(2): 879-884

Shekhar, Chander, Ram Singh, Lakhi Ram, Anilkumar, Pankaj Kumar, Dharmendar Singh. 2018. Influence of weather parameters on insect pests of rice in Haryana. Journal of Agrometeorology 20: 307-310.

Shimoda M, Hondac K. 2013. Insect reactions to light and its applications to pest management. Applied Entomology and Zoology 48(4): 413-421.

(Manuscript Received: November, 2020; Revised: January, 2021;
Accepted: January, 2021; Online Published: March, 2021)
Online First in www.entosocindia.org and indianentomology.org Ref. No. e20374