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Environmental Correlates of Population Build of Rice Parasitoids through Solar Powered Light Trap Catches

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A B S T R A C T

The present study was undertaken to analysis the major insect parasitoids on rice collected in solar powered light trap and influence of meteorological parameters during Kuruvai, Samba and Navarai seasons at Annamalai nagar during the year 2017 – 2019. Major parasitoids of rice were collected and observed on daily basis, in order to study the seasonal incidence, week division was based on Standard Meteorological Week (SMW), observation of weather data viz., maximum temperature, minimum temperature, relative humidity, sunshine and rainfall were recorded on daily basis from the Meteorological observatory, Department of Agronomy, Faculty of Agriculture, Annamalai University. In Navarai season, the maximum population of Chalcids and Platygasterids adults trapped during 28th and 41st standard weeks respectively. The maximum, minimum temperature and sunshine showed a positive correlation, relative humidity and rainfall showed a negative correlation with Chalcids population. In Kuruvai season, the peak populations of Chalcids, totally 39 adults were collected during 28th standard week. The minimum number of Platygasterids was collected in 11th standard week. The Chalcids population was positively correlated with maximum and minimum temperature and relative humidity and negatively correlated with sunshine and rainfall. In samba season, the peaks of Platygasterids in 41st standard week (38 adults) and another peak were recorded in 20nd standard week. The minimum numbers of adults were collected in 11th and 23rd standard weeks and the Chalcids and Platygasterids population was positively correlated with sunshine and negatively correlated with maximum and minimum temperature, relative humidity and rainfall.

***Key words*:** Rice, Solar powered light trap, Parasitoids, Seasonal incidence, Environmental factors

Rice is an important cereal crop in the world serving as staple diet for millions of peoples. Rice stands second in the world after wheat in area and production. About 90 percent of world rice is produced and consumed in Asia [1]. In India it is cultivated in an area of 44.00 million hectares with the production of 104.80 million tonnes with a productivity of 2177 kg per ha [2]. Rice crop in the field is attacked by numerous insect pests, but few cause significant losses [3]. In India, average losses in rice grain production due to insect pests were 25-30% [4] and in Tamil Nadu about 42% losses were reported [5].

Rice field is frequently influenced by various farming practices. The use of pesticides is not often without associated harmful effects and the most commonly confronted are elimination of beneficial insect fauna, pest resistance to specific insecticides and various human health problems. Natural enemies are often important biological control agents of various insect pests of rice eco system [6]. Information on species diversity and population dynamics of parasitoids are important basic component for implementation of biological control programme in rice eco system.

The existence of parasitoids in the rice field can be detected with various trap tools that one of them uses a light trap. Distribution of parasitoids in relation to climatic factors is a basic requirement for any newer pest management programme in specific agro ecosystem. Therefore, the present study was undertaken with following objectives, Identification of parasitoids collected in solar powered light trap and to find out the influence of meteorological parameters on solar powered light trap catches of parasitoid species during Navarai, Kuruvai and samba seasons of rice at Annamalai Nagar.

MATERIALS AND METHODS

The present study was carried out in the Department of Entomology, Faculty of Agriculture, Annamalai University during the year 2017 – 2019 (Navarai season - February to May, Kuruvai season - June to August and Samba season - October to January). The solar powered light trap was setup in the garden land area of the Annamalai University

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Experimental Farm. The farm is situated at an elevation of 5.79 M above the Mean Sea Level. The trap was placed three feet above the crop level at each stage of crop. The trap was operated continuously from 2017 to 2019, covering all three seasons.

Operation procedure for solar powered light trap

Switch ON the button to start the operation and keep the device under the direct sunlight location, never turn OFF switch while the device is in use, because light turns ON automatically when the sun set happen. When the device is not used for longer duration, switch OFF the device and keep it under safe. To keep minimum of 8 hours on solar light charging every weeklong time switch OFF. To drain the water in the tub, unscrew the bottom knob of the tub, when water is fully drained and close the knob, and refill the tub with 2 lit of water mix with soap solution (Soap solution is the preservative agent).

Parasitoids Identification

For the taxonomic documentation the light trap was operated every night (6.00 PM to 6.00 AM) and collection was observed on the next day morning, Observation was recorded everyday throughout the cropping season on the three seasons of experimentation. Parasitoids were sorted out on the basis of specimens available in the Department of Entomology, Faculty of Agriculture, and Annamalai University.

Seasonal incidence of parasitoids

Seasonal incidence study of major parasitoids was done by operating the solar powered light trap in Navarai, Kuruvai and samba seasons. Major insect parasitoids were collected and observed, in order to study the seasonal incidence, daily collection was converted into weekly total (weekly mean per day), week division was based on standard meteorological week (SMW), observation of weather data (maximum temperature, minimum temperature, relative humidity, sunshine and rainfall) was recorded on daily basis from the Meteorological observatory of Department of Agronomy, Faculty of Agriculture, Annamalai University.

Statistical method

The method given by [7] was followed for statistical analysis to study the effects of meteorological parameters and seasons on parasitoids catches. Following statistical analysis was worked out, the correlation coefficient between various parasitoids trap catches and meteorological parameters were calculated using the following formula,

$$Fxy = \frac{xy - (\sum x)(\sum y)/n}{\sqrt{(\sum x^2 - (\sum x)^2/n)\ (\sum y^2 - (\sum y)^2/n)}}$$

Where,

Fxy - Correlation coefficient between insect and a particular meteorological parameter

x - Particular meteorological parameter (Standard week)

y - Parasitoid catches

RESULTS AND DISCUSSION

Population of major parasitoids on rice collected in light trap was studied by operating solar powered light trap at Annamalai Nagar. The data of everyday catches of major parasitoids of rice collected in trap were converted into standard week averages. The population variation in parasitoids collections was observed throughout study period. The increases and decreases the population was highly dependent in habit, habitat and growth stages of crop which was the ultimately source of growth and development of the parasitoids [8]. The attraction of moth and other beneficial insects to light is a well-known phenomenon and has been used for collecting insects since the beginning of scientific Entomology [9].

The light trap is an effective monitoring tool and it has often been used in ecological studies of insects diversity in various agro ecosystems [10]. Prediction of the buildup of parasitoids population can increase our preparedness towards better management to crop pests. Forecasting the occurrence of rice plant may help the farmers to adapt the management practices well in advance their by minimizing the pest damage [11]. The meteorological parameters play an important role in seasonal abundance, distribution and population buildup of parasitoids in the rice ecosystem [12].

Table 1 Correlation of meteorological parameters with the trap catches of chalcids and platygasterids collected during Navarai season

Parasitoids	Maximum temperature °C	Minimum temperature °C	Relative humidity %	Sunshine (hours)	Rainfall (mm)
Chalcids	0.098*	0.012	-0.261	0.253	-0.635*
Platygastrids	0.034	-0.130	-0.577*	0.072	-0.090**

Level of significance (at 5%)

Table 2 Correlation of meteorological parameters with the trap catches of chalcids and platygasterids collected during Kuruvai season

Parasitoids	Maximum temperature °C	Minimum temperature °C	Relative humidity %	Sunshine (hours)	Rainfall (mm)
Chalcids	-0.462	0.166	0.143	-0.296	-0.731
Platygastrids	-0.060**	-0.096**	0.278	-0.060**	-0.464

Level of significance (at 5%)

Chalcids

The maximum population of Chalcids was recorded in 28th standard week. The collected Chalcids adult population were correlated with different meteorological parameters, the maximum temperature had significant positive correlation in Navarai season and negative correlation in Kuruvai and samba seasons, minimum temperature had positive correlation in Navarai and Kuruvai seasons however negative correlation in samba season, relative humidity shows positive correlation in kuruvai season and negative correlation in Navarai and samba seasons and the rainfall had significant negative correlation in Navarai and samba seasons (Table 1-3). In accordance with the present findings, [13] reported that the abiotic factors like minimum temperature, relative humidity significant positive

correlation with population buildup of chalcids. Similarly, [14] reported that the Chalcid population was positive correlation in relative humidity and sunshine. In contrast with the present findings, Chalcids population negatively correction with minimum temperature and rainfall [15]. Rainfall will reduce the fecundity of adult chalcids [16].

Table 3 Correlation of meteorological parameters with the trap catches of chalcids and platygasterids collected during Samba season

Parasitoids	Maximum temperature °C	Minimum temperature °C	Relative humidity %	Sunshine (hours)	Rainfall (mm)
Chalcids	-0.302	-0.479	-0.560*	0.488	-0.627*
Platygastrids	-0.086**	-0.088**	-0.117*	0.355	-0.269

Level of significance (at 5%)

Platygastrids

The mean populations of platygastrid adults collected during Navarai, Kuruvai and samba seasons were 20.43, 24.91 and 27.8 respectively. The different meteorological parameters were collected and correlated with population of platygastrids during Navarai, Kuruvai and samba seasons, the maximum temperature had positive correlation in Navarai season and significant negative correlation in Kuruvai and samba seasons, minimum temperature and rainfall had no significant positive correlation in Navarai, Kuruvai and samba seasons, relative humidity had positive correlation in Kuruvai season however significant negative correlation in Navarai and samba seasons, the sunshine showed positive correlation in Navarai and samba seasons (Table 1-3). Platygastrid had positive correlation with maximum temperature and sunshine [17]. In contrast with the present findings, [18] reported that platygastrids has negative correlation with maximum temperature and rainfall. Moreover, rainfall is found to affect the longevity and developmental stages of platygastrids.

CONCLUSION

The studies revealed that potency of the chalcids and platygasterids as effective parasitoids of rice pests, and it is prospective to be exploited for biological control agent against the insect pests in rice eco system. Hence if parasitoid complex such as Chalcids and Platygasterids of rice-ecosystem is conserved with a need-based application of plant protection chemicals particularly at the time of pest resurgence, the major rice pests can be kept under check at sub economic level.

LITERATURE CITED

1. Anonymous. 2016. Agriculture statistics at a glance, Department of Agriculture and co-operation, *Ministry of Agriculture*, Government of India, New Delhi.
2. Anonymous. 2018. Agriculture statistics at a glance, Department of Agriculture and co-operation, *Ministry of Agriculture*, Government of India, New Delhi.
3. Dhaliwal GS, Arora R. 1996. *Principles of Insect Management*. Commonwealth Publishers, New Delhi.
4. Dhaliwal GS, Arora R. 2010. *Integrated Pest Management*. Kalyani Publishers, New Delhi, India. pp 369.
5. Dhamdhere SV. 1990. *Phansalon ke pramukh hanikark keet*. Hariyana Sathiya Academy, Chandigarh. pp 37.
6. Thies C, Steffan-Dewenter I, Tscharntke T. 2008. Interannual landscape changes influence plant -herbivore -parasitoid interactions. *Agriculture Ecosystems and Environment* 125: 266-268.
7. Panse VK, Sukhatme. 1957. *Statistical Methods for Agricultural workers*, ICAR, New Delhi. pp 367.
8. Alam MZ. 2013. Survey and assessment of insect management technologies and environmental impact on rice ecosystem of Bangladesh. *International Journal of Applied Research and Studies* 2(4): 1-16.
9. Beavis IC. 1995. *Insect and other Invertebrates in classical Antiquity*. Exeter University Press, Exeter, UK.
10. Sinu PA, Mandal P, Banerjee D, Malik S, Talukadhar T, Pathak SK. 2013. Moth pest collected in light trap in tea plantation in North East India. Species composition, seasonality and effects of habitat type. *Current Science* 104(5): 646-651.
11. Yang LN, Peng LM, Zhang LL, Zhang, Yang SS. 2009. A prediction model for population occurrence of paddy stem borer (*Scirpophaga incertulas*), based on back propagation artificial neural network and principal component analysis. *Computer and Electronics in Agriculture* 68: 200-206.
12. Gangwar RK. 2005. Life cycle and abundance of rice leaf folder, *Cnaphalocrocis medinalis*. (Guenee) - A review. *Journal of Natural Sciences Research* 5(15): 20-25.
13. Sheela A, Narendran TC, Tiwari RN. 2003. Contribution to the knowledge of Chalcididae of India. *Records of the Zoological survey of India* 101(4): 247-266.
14. Vinson SB, Iwantsch GF. 1980. Host suitability for insect parasitoids. *Annual Review of Entomology* 25: 397-491.
15. Rechav Y. 1978. Biological and ecological studies of the parasitoids (Hymenoptera: Braconidae) in Israel, IV. Ovipositional, Host preference and sex ratio. *Entamopha* 23(1): 95-102.
16. Mao H, Kumini Y. 1994. Logevity and fecundity of *Brachymeria lasusI* (Walker) (Hymenoptera: Chalcididae), a pupal parasitoid of oriental tea tortix, *Homona magnanima* Diakonoff (Lepidoptera: Torricidae) under laboratory condition. *Applied Entomology and Zoology* 29: 237-243.
17. Lakshimi VJ, Sureka K, Pasalu IC. 2010. Parasitisation of rice yellow stem borer, *Scipophaga incertulas* (Walker) egg masses. *Annals of Plant Protection Science* 18(2): 366-369.
18. Rahim A, Asghar H, Nasir AK. 1991.Effects of temperature and relative humidity on longevity and development of (Hymenoptera: Eulophidae). *Journal of Biological Control* 8(1): 10-13.