Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2020; 8(6): 2006-2009

Received: 17-09-2020
Accepted: 24-10-2020

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Seasonal abundance of tea mosquito bug, *Helopeltis antoni* signoret infesting neem

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DOI: https://doi.org/10.22271/j.ento.2020.v8.i6aa.8118

Abstract

Seasonal abundance of tea mosquito bug, *Helopeltis antonii* infesting neem was studied at weekly intervals between May 2019 and April 2020 by direct counting at Forest College and Research Institute, Mettupalayam. After the northeast monsoon shower ceased, the population of tea mosquito bug started infesting neem during October-November, 2019. The bugs were active in neem until April, 2020 at varied levels of intensity and the pest population reached its peak during January, 2020. The highest number of tea mosquito bugs was recorded (9.60 per three terminal shoots per tree) during the third standard week of 2020 and the lowest numbers were recorded during 15th standard week of 2020 (2.00 per three terminal shoots per tree). Wind velocity and maximum temperature (T_{max}) were found to be negatively correlated with the population of tea mosquito bugs with the R-values of -0.632 and -0.493 and were found to be statistically significant at 1 per cent level. Rainfall and relative humidity were also found to be negatively correlated with r values of -0.159 and -0.086, respectively. Similarly, sunshine hours and evaporation rates were also negatively correlated with r values of -0.187 and -0.048, respectively. While, the minimum temperature (T_{min}) was positively correlated with the population abundance of tea mosquito bug with the r value of 0.099.

Keywords: Seasonal abundance, tea mosquito bug, *helopeltis antonii*, neem

Introduction

Neem (*Azadirachta indica*) the evergreen tree which belongs to Meliaceae family is found throughout the world (Sithisarn and Gritasnapan, 2005) [12]. It is originally from the Indian subcontinent (Roxburg, 1874) [11]. It is one of the most flexible, multifarious tropical trees and is commonly referred to as 'Indian Lilac'. The annual output of seeds from 14.9 million trees is 4,42,300 tonnes, which is converted to 88,400 tonnes of neem oil and 3,53,800 tonnes of neem cake, giving these items in India a monetary value of several million dollars (Hedge,1996) [4]. It is often used against various pest controls as an eco-friendly tool and material with distinct standards. It has been demonstrated that neem exhibits insect control behaviours against as many as 250 species of insects. More than 150 compounds from various parts of this mysterious tree have been extracted (Nagendra *et al.*, 2010) [7]. The ingredients are considered to have a major impact on up to 350 species of agricultural pests (Tewari, 1992; Hegde, 1996) [14, 4]. Neem as a tropical tree evoked interest as a non-toxic, beneficial, biodegradable and relatively less costly, healthy natural pesticide among several choices. The move towards organic agriculture raises the market for neem-based goods. Neem is regarded as a golden tree that has acquired world-wide importance for its multiple uses. It is used in pest control, cosmetics, pharmaceuticals, plant and animal nutrition and energy production, in addition to agroforestry. Because of its multi-purpose nature, neem is considered as a divine tree in India and its commercial importance was known since the Vedic period of about 1500 B.C.

Change in climatic conditions lead to abnormal weather events such as unusual rainfall and very high and low temperature which resulted in pest and disease outbreak (Nest, 2004) [8]. When the environment is warm, insects eat, grow, reproduce and disperse, but they live for a shorter period (Drake, 1994) [3]. Abundance of insects in a particular crop varies over time due to macro and micro climatic conditions and accessibility of food supplies. The weather-based forecasting system and its knowledge are important in order to understand the weather parameters as a prerequisite for insect pest population dynamics and to formulate successful management strategies.

Considering the above facts, present study was carried out to study the seasonal abundance of tea mosquito bug, *H. antonii* infesting neem and to correlate the population abundance with the weather parameters.

Materials and Methods

The seasonal abundance of tea mosquito bugs was recorded by direct counting from May 2019 to April 2020 in the neem plantation at Forest College and Research Institute, Mettupalayam. Weekly observations were made on the population of tea mosquito bugs on ten randomly selected trees. In each tree, the number of nymphs and adults of tea mosquito bugs were counted on any three randomly selected shoots in the 15 cm terminal shoots and expressed as number per tree.

The weekly counts of tea mosquito bug population were correlated with weekly weather parameters such as maximum temperature (T_{max}), minimum temperature (T_{min}), relative humidity (RH), rainfall (mm), evaporation rate (mm), wind speed (km/h) and sunshine hours (h/day) obtained from the weather station of Forest College and Research Institute, Mettupalayam.

Results and Discussion

Seasonal abundance

The results of seasonal abundance of tea mosquito bug population at Forest College and Research Institute, Mettupalayam revealed that the highest number of bugs were reported during the third standard week of 2020 (9.60 per three shoots per tree) and the lowest number of bugs were recorded during 15th standard week of 2020 (2.00 per three shoots per tree). Maximum number of tea mosquito bugs was recorded during January and February, 2020 and the incidence was observed to be nil from 18th standard week to 40th standard week of 2019. (Table 1 and Figure 1)

The results are in line with the findings of Sundararaju (1984) [13] and Devasahayam (1985) [2] in cashew who reported the peak occurrence of tea mosquito bugs during January-February coinciding with the full bloom season of cashew tree. The authors also reported that the bugs were not found during the monsoon period of June to September due to non-availability of succulent plant parts.

Table 1: Monitoring of tea mosquito bugs population in neem during 2019-2020

Date / Month	Standard week	Population of tea mosquito bugs (Number per three shoots per tree)
2019		
29 to 05 May	18	0.00
06 to 12 May	19	0.00
13 to 19 May	20	0.00
20 to 26 May	21	0.00
27 to 02 June	22	0.00
03 to 09 June	23	0.00
10 to 16 June	24	0.00
17 to 23 June	25	0.00
24 to 30 July	26	0.00
01 to 07 July	27	0.00
08 to 14 July	28	0.00
15 to 21 July	29	0.00
22 to 28 July	30	0.00
29 to 04 August	31	0.00
05 to 11 August	32	0.00
12 to 18 August	33	0.00
19 to 25 August	34	0.00
26 to 01 September	35	0.00
02 to 08 September	36	0.00
9 to 15 September	37	0.00
16 to 22 September	38	0.00
23 to 29 September	39	0.00
30 to 06 October	40	0.00
07 to 13 October	41	3.20
14 to 20 October	42	0.00
21 to 27 October	43	3.80
28 to 03 November	44	5.20
04 to 10 November	45	6.00
11 to 17 November	46	5.40
18 to 24 November	47	6.40
25 to 01 December	48	3.20
02 to 08 December	49	6.80
09 to 15 December	50	7.20
16 to 22 December	51	7.80
23 to 29 December	52	8.60
2020		
30 to 05 January	01	9.00
06 to 12 January	02	9.20
13 to 19 January	03	9.60
20 to 26 January	04	9.00
27 to 02 February	05	8.80

03 to 09 February	06	8.60
10 to 16 February	07	7.80
17 to 23 February	08	8.00
24 to 01 March	09	7.40
02 to 08 March	10	8.40
09 to 15 March	11	6.60
16 to 22 March	12	4.20
23 to 29 March	13	3.80
30 to 05 April	14	2.20
06 to 12 April	15	2.00
13 to 19 April	16	0.00
20 to 26 April	17	0.00
Mean	-	3.23

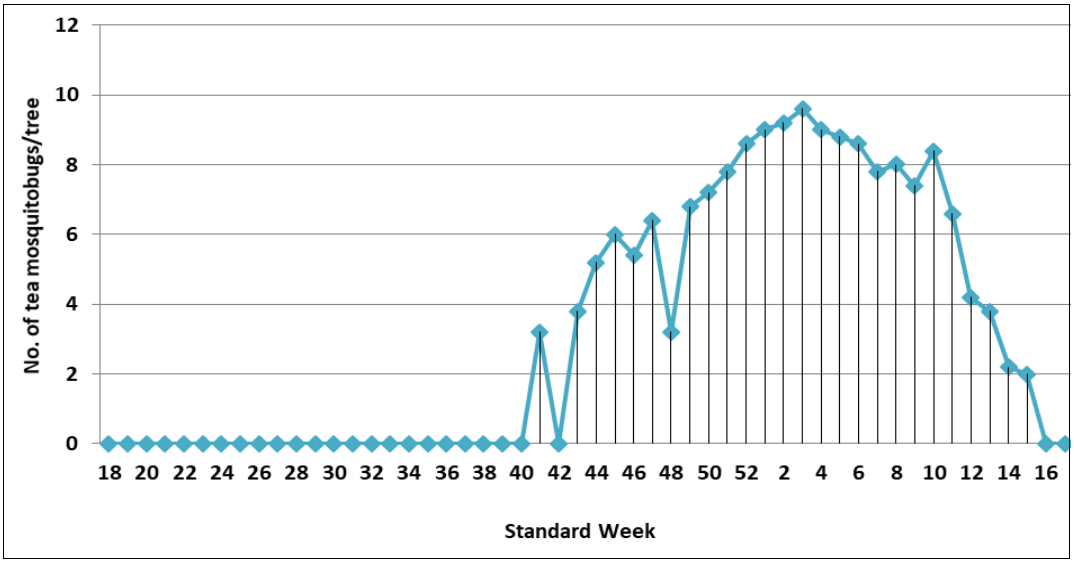

Fig 1: Seasonal abundance of tea mosquito bugs infesting neem during 2019-2020

Correlation between weather parameters and abundance of tea mosquito bug infesting neem

Results of the correlation analysis between weather parameters and tea mosquito bug abundance revealed that wind velocity and maximum temperature (T_{max}) were negatively correlated with the tea mosquito bug population with r values of -0.632 and -0.493, respectively and were found to be statistically significant at 1% level (Table 2).

Rainfall, relative humidity, sunshine hours and evaporation rates were also found to negatively correlated with r values of -0.159, -0.086, -0.187 and -0.048, respectively. While, the minimum temperature (T_{min}) was observed to be positively correlated with the population of tea mosquito bugs with the r value of 0.099 (Table 2).

These results are in accordance with the findings of Pillai *et al.* (1984) [9] who reported that the population of *H. antonii* was negatively correlated with the relative humidity and rainfall. Kumar and Krishnanaik (2002) [5] also reported that the population of *H. antonii* was negative correlated with maximum temperature in guava.

Table 2: Influence of weather parameters on seasonal abundance of tea mosquito bugs infesting neem during 2019-2020

Variables	Correlation coefficient
Maximum temperature (T_{max}) (°C)	-0.493**
Minimum temperature (T_{min}) (°C)	0.099
Relative humidity (%)	-0.086
Rainfall (mm)	-0.159
Sunshine (h/day)	-0.187
Wind velocity (km/h)	-0.632**
Evaporation rate (mm)	-0.048

**Correlation coefficient is significant at 1% level

Multiple linear regression analysis between weather parameters and abundance of tea mosquito bug infesting neem

Results of multiple linear regression analysis between weather parameters and tea mosquito bug population in the neem plantations at Forest College and Research Institute, Mettupalayam revealed that wind velocity and evaporation rate had significant contribution to the population of tea mosquito bugs with the R^2 value of 0.578. When the wind velocity increased by 1 km/h, the number of tea mosquito bugs decreased by 0.829 bugs per three shoots per tree, whereas, when the evaporation rate increased by 1 mm, the tea mosquito bug population increased by 0.229 bugs per three shoots per tree. Similarly, increase in sunshine hours by 1 h/day, increased the population of tea mosquito bugs by 0.871 bugs per three shoots per tree. Whereas, for every one degree Celsius increase in the maximum temperature, the number of tea mosquito bugs decreased by 0.970 bugs per three shoots per tree. (Table 3)

The results of present investigation are in agreement with the findings of Miller (1941) [6], Betrem (1950) [1] and Pillai *et al.* (1984) [9] who reported that the population of tea mosquito bug fluctuated in response to more localised and less frequent climatic events, preferring not to do well under conditions of heavy rain, high winds or low relative humidity. Whereas, according to Prabakaran (2017) [10], rainfall had significant contribution towards the abundance of tea mosquito bug population infesting guava with the R^2 value of 0.52

Table 3: Multiple linear regression analysis for the prediction of seasonal abundance of tea mosquito bugs infesting neem plantations

Variables	Regression coefficient (Y_1)
Intercept (a)	32.087
Maximum temperature (T_{max}) (°C) (X_1)	-0.970*
Minimum temperature (T_{min}) (°C) (X_2)	0.002
Relative humidity (RH) (%) (X_3)	-0.001
Rainfall (mm) (X_4)	-0.022
Sunshine (h/day) (X_5)	0.871*
Wind velocity (km/h) (X_6)	-0.829**
Evaporation rate (mm) (X_7)	0.229**
R^2	0.578

Regression equations

$Y_1 = 32.087 - 0.97^* X_1 + 0.002 X_2 - 0.001 X_3 - 0.022 X_4 + 0.871^* X_5 - 0.829^{**} X_6 + 0.229^{**} X_7$

*Regression coefficient is significant at 5% level

**Regression coefficient is significant at 1% level

Conclusion

Considering the significance of neem as a versatile tree species, this study on seasonal abundance of tea mosquito bug, *Helopeltis antonii* infesting neem will be helpful to determine the peak period of tea mosquito bug incidence in neem. From the results, it is revealed that the bugs were active in neem until April, 2020 and the pest population reached its peak during January, 2020. Wind velocity and maximum temperature (T_{max}) were found to be negatively correlated with the population of tea mosquito bugs with the r-values of -0.632 and -0.493 and were found to be statistically significant at 1 per cent level. Rainfall and relative humidity were also found to be negatively correlated with r values of -0.159 and -0.086, respectively. Correlation between the tea mosquito bug population and weather parameters will help to predict the pest outbreak, forewarn the farmers and to determine the management strategies well in advance.

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