International Journal of Environment and Climate Change

Volume 13, Issue 11, Page 2023-2029, 2023; Article no.IJECC.108606
ISSN: 2581-8627
(Past name: British Journal of Environment & Climate Change, Past ISSN: 2231–4784)

Population Dynamics of Leafhopper (*Empoasca flavescens*) and Thrips (*Scirtothrips dorsalis*) of Castor (*Ricinus communis* L.)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJECC/2023/v13i113361

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/108606

Original Research Article

Received: 24/08/2023
Accepted: 30/10/2023
Published: 01/11/2023

ABSTRACT

The experiment on population dynamics against leafhopper and thrips of castor,a field experiment was conducted during 2021 & 2022 on castor (Ricinus communis) at Regional Agricultural Research Station Palem, PJTSAU. The studies on population dynamics of leafhopper (*Empoasca flavescens*) revealed thatthe activity of leafhoppers was moderate to heavy with maximum of 120.8 leafhoppers/3 leaves/plant was recorded during the second fortnight of December (52 SMW, 24th-31st Dec). Leafhopper population had non-significant and negative correlation with maximum temperature (r = -0.24 and r = -0.29, respectively), whereas it had significant assocation and

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negative correlation with minimum temperature, morning relative humidity, evening relative humidity as well as rainfall (r = - 0.64 - 0.50, r=-0.61 and - 0.52, respectively). Thrips infestationwas observed from October first fortnight (40 SMW 1st Oct -7th Oct) to December second fortnight (52 SMW, 24th-31st Dec) with peak infestation 31.1 thrips/spike.Thrips population had non-significant and negative correlation with maximum temperature (r = -0.29), whereas it had significant assocation and negative correlation with minimum temperature, morning relative humidity, evening relative humidity as well as rainfall (r = - 0.68, r= -0.55, r=-0.63 and, r=- 0.49 respectively). Leafhopper and thrips has significant association and positive correlation with sunshine hours (r=0.55 & r=0.51).

Keywords: Castor; leafhopper; thrips; weather; dynamics.

1. INTRODUCTION

“Castor (*Ricinus communis* L.) is an important non edible oilseed crop of dry land area with huge industrial importance” [1]. “It is widely distributed and adapted throughout the tropics, subtropics and temperate areas due to its low demand on soil fertility, requirement of moderate rainfall, less competition with other food crops and food grade oils. Castor is grown for its seeds, which isextracted for the non-edible oil mainly used in the manufacturing ofpaints, lubricants, soaps, hydraulic brake fluids, polymers and per-fumery products, among others; several derivatives of castor oil areused in a variety of industries” [2]. India is the major producer in the world, castor seed with a production of 17.95 lakh tonnes (lt) during 2021-22 season, against 17.89 lt in 2020-21 [3]. Among states, Gujarat is leading with 6.52 lakh ha (13.45 lakh tonnes) under castor followed by Rajasthan 1.77lakh ha (2.76 lakh tonnes), Andhra Pradesh 0.16 lakh ha (0.064 lakh tonnes), and Telangana 0.022 lakh ha (0.037 lakh tonnes). According to government 2nd advance estimates, all India castor production in 2022-23 is at area 8.917 lakh ha, production 18.82 lakh tonnes. [Source: Directorate of Economics and Statistics (DES). * 2nd Advance estimates. “Castor is attacked by insect pest sright from sowing to harvesting. Morethan 60 speciesofinsectsand mites have been reported to cause damage to the castor crop and their related yield loss has been estimated to be about 40-89%” [4,5,6]. “These yield loss sincastor due to insect pests varied with the season, the severity of the pest and the hybrid variety of the plant” [7]. “The sucking pests such as leafhoppers (*Empoasca flavescens*),whiteflies and thrips have been known to be the most important pest sattacking castor resulting in excessive loss of grain yield” [8]. “14-15% of yield loss caused by sucking pests was recorded in Guajarat in India” [9]. “Nymphs and adults of leafhopper suck the sap from the under surface of the leaves causing leaf margins to become yellow, curling and under severe infestation, hopper burn symptoms were also noticed” [10].

“Castor is attacked by insect pests right from sowing to harvesting. Among these insects, sucking pests viz., leafhoppers and thrips play an important role in early stagesresulting in extensive loss in the grain yield, Hence it is necessary to know the dynamics of different sucking pests in castor crop for sustainable management” [8].

2. MATERIALS AND METHODS

The field experiment was conducted at Regional Agricultural Research Station, Palem during 2021-2022 to study on population dynamics of major sucking pests viz., leafhopper (*Empoasca flavesens* Fabricius), and thrips (*Scirtothrips dorsalis* Hood) was carried out on castor hybrid PCH-111 in an isolated plot of 500 m 2 with a row spacing of 90 cm and 60 cm between the plants. All the recommended agronomic practices were followed to raise the crop. The area was kept unsprayed throughout crop season. The observations were made at various growth stages of castor at weekly intervals to know the occurrence of sucking pests (leafhopper & thrips) on crop from seedling stage to harvest of the crop. Twenty-five plants were randomly selected and tagged to assess the incidence of insect pests. Leafhopper counts (nymph) were recorded on three leaves in each plant selecting one leaf from top (excluding 2 topmost leaves), middle (medium maturity) and bottom (leaving one or two bottom most leaves) on the main shoot. Population recorded as number of leafhoppers/3 leaves per plant and percent leaf area burnt per plant (average of 5 plants). Hopper burn injury was recorded as per the scale suggested by Anjani et al. [2] and Absolute population of thrips per spike was recorded by beating the spikes on a white cardboard sheet and counting the number of adults and nymphs of thrips. The data on weather parameters like maximum temperature (Tmax), minimum temperature (Tmin), morning and evening relative humidity (RHM and RHE), rainfall (mm) and sunshine (hours)were recorded from the agro meteorological observatory located at RARS, Palem. The correlation coefficients between weather parameters and pest incidence were worked using OPSTAT software.

3. RESULTS AND DISSCUSSION

Survey conducted at the research station on the incidence of insect pests of castor (cv. PCH-111) revealed (Table 2) heavy infestation of leafhopper and thrips.The activity of leafhoppers was moderate (Fig. 1) to heavy with maximum of 120.8 leafhoppers/3 leaves/plant was recorded during the second fortnight of December (52 SMW, 24th-31st Dec) (Fig. 2). Similar results were reported by Singh et al. [11] who observed highest incidence of hoppers during the month of December.

Correlation studies revealed (Table 3) that leafhopper population had non-significant and negative correlation with maximum temperature (r = -0.24 and r = -0.29, respectively), whereas it had significant assocation and negative correlation with minimum temperature, morning relative humidity, evening relative humidity as well as rainfall (r = - 0.64 - 0.50, r=-0.61 and -0.52, respectively). Temperature stress conditions coupled with less relative humidity has resulted in higher incidence of leafhopper. On the other hand, continuous rainfall during the crop growth creates unfavorable conditions for leafhopper incidence [12]. In addition to the current findings, several studies also reported significant impact of sunshine hours on leaf hopper incidence Jena and Kuila 1996. However in contrary to the findings several studies have also reported an increase in bright sunshine hours and morning relative humidity has a positive effect on the population [13]. “The variable effect of different weather parameters on the pest population might be due to the difference in phenology of the crop and time of appearance of the pest at different localities, where crops have been grown” [8].

Thrips infestation was observed from October first fortnight (40 SMW 1st Oct -7th Oct) to December second fortnight (52 SMW, 24th-31st Dec) with peak infestation 31.1 thrips/spike (Fig. 4 & Table 2). Thrips population had non-significant and negative correlation with maximum temperature (r = -0.29), whereas it had significant assocation and negative correlation with minimum temperature, morning relative humidity, evening relative humidity as well as rainfall (r = - 0.68, r= -0.55, r=-0.63 and, r=- 0.49 respectively). Leafhopper and thrips has significant association and positive correlation with sunshine hours (r=0.55 & r=0.51).

However it has shown non-significant positive correlation (r = 0.28) with mean bright sunshine hours. Thus, present investigation revealed that thrips population favours low temperature as well as relative humidity and a positive effect with bright sunshine hours. According to Bhede et al. [14] “thrips population exhibited significant negative correlation with morning and evening relative humidity and rainfall and positive correlation with bright sunshine”. Duraimurugan and Jagadish [15] reported “significant negative correlation with mean relative humidity which confirms the present finding”.

Fig. 1. Incidence of leafhopper during 46th SMW

Fig. 2. Incidence of leafhopper with hopper burn damage during 52nd SMW

Fig. 3. Hopper burn damage caused by leafhopper

Fig. 4. Incidence of thrips on spike during 52nd SMW

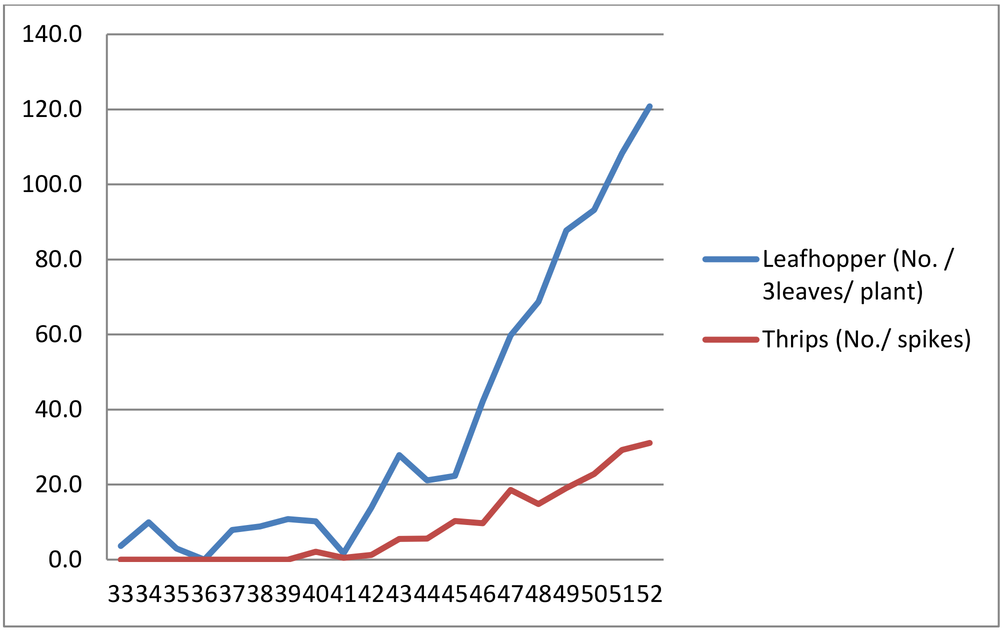

Fig. 5. Incidence of leafhopper and thrips of castor during 2021 & 2022

Table 1. List of sucking pests observed on castor during 2021 & 2022

S. No.	Insect pest	Scientific name	Family	Order
1	Leaf hopper	Empoasca flavescens	Cicadellidae	Hemiptera
2	Thrips	*Scirtothrips dorsalis*	Thripidae	Thysanoptera

Table 2. Survey and monitoring of castorleafhopper and thrips in the Research station during 2021 & 2022

S.no	Standard Meterological Week	Leafhopper (No. / 3leaves/ plant)	Thrips (No./ spikes)
1	33	3.7	0.0
2	34	10.0	0.0
3	35	3.0	0.0
4	36	0.0	0.0
5	37	7.9	0.0
6	38	8.9	0.0
7	39	10.8	0.0
8	40	10.3	2.2
9	41	1.7	0.5
10	42	13.9	1.3
11	43	27.9	5.5
12	44	21.2	5.7
13	45	22.3	10.3
14	46	42.2	9.7
15	47	59.8	18.6
16	48	68.7	14.8
17	49	87.8	19.1
18	50	93.2	22.9
19	51	108.3	29.2
20	52	120.8	31.1

Table 3. Correlation analysis of leafhopper and thrips of castor with weather parameters (Palem, 2021& 2022)

Insect pests & natural enemies	Max. temp. (^{O} C)	Mini. temp. (^{O} C)	RH-1 (%)	RH-2 (%)	Rainfall (mm)	Sun shine (hrs)
Leafhopper (No./3 leaves/plant)	-0.24 ^{NS}	-0.06**	-0.50*	-0.61**	-0.52*	0.55*
Thrips (No./spike)	-0.29 ^{NS}	-0.68**	0.55*	-0.63**	-0.49*	0.51**

***Correlation is significant at the 0.01 level (2-tailed); *Correlation is significant at the 0.05 level (2-tailed)*

4. CONCLUSION

Castor crop is mainly grown as a rainfed crop in dry land areas thus weather plays a crucial role in crop growth and incidence of leafhopper and thrips on the crop. Rainfall during crop growth stage reduces the leafhopper and thrips incidence. The pest scenario of a particular region and the trend of pest population, Incidence of new pests will be known which helps in taking control measures and the farmers thus shall get benefit on adoption of the control measures of key pests suggested.

ACKNOWLEDGEMENT

Authors are thankful to the Regional Agriculture Research Station, Palem and Indian Institute of Oilseeds Research, Rajendranagar for providing the necessary facilities and the moral support to carry out this study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/108606