Original Research Article

Seasonal Incidence of Castor Sucking Pests in Southern Telangana Zone, India

ABSTRACT

A study on the population dynamics of sucking pests of castor was conducted at the Indian Institute of Oilseeds Research (IIOR), Rajendranagar, Hyderabad, from November 2023 to March 2024. The sucking pest infestation was started from vegetative stage and continued till harvesting stage. The leafhopper incidence was started in 48^{th} SMW with population of 6.2 leafhoppers/three leaves/plant and reached peak in the 10^{th} SMW with 74.8 leafhoppers/three leaves/ plant. Whitefly infestation was first observed in the 4th SMW with a population of 10.8whiteflies/top leaf/plant, with a peak population of 68.6 whiteflies/top leaf/ plant in the 13th SMW. Thrips infestation was started during the 52^{nd} SMW with a population of 1.2thrips/spike, with a peak population of 32 thrips/spike in the 8^{th}SMW. All pests showed significant positive correlations with maximum temperature, wind speed, and evaporation and significant negative correlations with morning and evening relative humidity. Specifically, whiteflies were positively correlated with minimum temperature, while leafhoppers and thrips showed no significant correlation with this factor. Leafhoppers and thrips populations were significantly positively correlated with sunshine hours, whereas whiteflies were not. Rainfall had a non-significant negative correlation with all the pest populations.

*Keywords:*Castor, leafhoppers; whiteflies; thrips; weather; seasonal incidence.

1. INTRODUCTION

Castor (*Ricinus communis* Linnaeus), a member of the Euphorbiaceae family, is an important annual non-edible oilseed crop primarily cultivated in arid and semi-arid regions under rainfed conditions. Castor seeds contain up to 42% extractable oil, which has various industrial, agricultural, domestic, and medical applications [1]. India is the world's largest producer and exporter of castor oil. The oil produced from castor seeds is highly valued in the global specialty chemical industry as it is the sole commercial source of hydroxylated fatty acid.

The area, production, productivity of castor in India 2022-2023 is 10.19 lakh hectare, 19.80 lakh tonnes, 1942 Kg/Hectare and in Telangana is 5000 hectare, 5000 tonnes, 984 kg/hectare respectively. Among states, Gujarat is the leading producer of castor followed by Rajasthan, Andhra Pradesh, Odisha and Tamil Nadu [6]. In Telangana state Narayanpet 149 ha (369 acres), Wanaparthy 53 ha (131 acres), Mahabubnagar 52 ha (129 acres), Nagarkurnool 39 ha (96 acres) and Gadwal 36 ha (90 acres) are major castor growing districts [5].

Insect pests affect castor during the entire growing and harvesting stages. It has been discovered that over 60 different types of insects and mites are detrimental to castor, resulting in a 40–89% output reduction [10]. Numerous insect pest attacks have been documented during the crop's seedling, vegetative and reproductive phases. The castor crop is severely harmed by sucking pests like jassid (*Empoascaflavescens*), whitefly (*Trialeurodesricini*), thrips (*Scirtothrips dorsalis*), and mites, as well as defoliators such as castor semilooper, *Spodoptera*, and other hairy caterpillars [3].

Sucking pests, particularly leafhoppers, whiteflies, and thrips, are major threats, causing significant grain yield loss [12]. In Gujarat, India, a 14-15% yield loss due to these pests has been recorded [9]. Leafhoppers, both nymphs and adults, damage the crop by sucking sap from the undersides of leaves, leading to yellowing, curling, and severe hopper burn symptoms [7]. Since these pests are active from sowing to harvesting and are especially detrimental in the early stages, understanding their dynamics is crucial for sustainable management of the castor crop [12].

A correlation study examining temperature, relative humidity and other environmental factors with pest infestation is crucial for effective pest management, as these factors significantly influence pest occurrence and damage [8]. Implementing prophylactic control measures based on seasonal pest occurrences and their natural enemies can reduce the need for curative practices [15]. Therefore, the current study aims to investigate insect pests occurrence in castor crop to ensure the environmental safety [14].

2. MATERIAL AND METHODS

The current investigation into the seasonal incidence of major sucking pests *viz.,* leafhoppers, whiteflies and thrips on castor hybrid ICH - 66 was conducted during *Rabi* 2023-2024 at Indian Institute of Oilseeds Research (IIOR) in Rajendranagar, Hyderabad. Which falls underthe Southern Zone of Telangana. The population fluctuation studies were carried out on the hybrid ICH- 66, sown on 7th November 2023 and the experimental plot was maintained with standard agronomic practices [2] except plant protection measures to maintain optimum insect population. Observations were recorded from ten randomly selected plants at different phenological (growth) stages of the crop from germination to harvest at weekly intervals. The meteorological data for the study period was collected from ARI, Rajendranagar, Hyderabad (Table 1; Fig 1).

2.1Leafhoppers: Leafhopper counts (nymphs and adults) were recorded on three randomly selected leaves on each plant from top (excluding two top most leaves), middle (medium maturity) and bottom (leaving one or two bottom most leaves) on the main shoot. Population was recorded as number of leafhoppers per three leaves per plant. Further the percent leaf area showing hopper burn injury per plant was recorded as average of three leaves per plant.

2.2 Whitefly: The absolute population of whiteflies (nymphs and adults) were recorded from 3 leaves/plant similar to leafhoppers.

2.3 Thrips: Absolute population of thrips per spike was recorded by beating the spikes on a white or black cardboard sheet and counting the number of adults and nymphs of thrips.

Insect pests were correlated with weather parameters like minimum and maximum temperatures, morning and evening relative humidity (RH), rainfall, windspeed , evaporation and sunshine hours (SSH).The correlation coefficients between weather parameters and pest incidence were worked out using OPSTAT software.

3. RESULTS AND DISCUSSION

3.1 Seasonal incidence of sucking pests on castor

The weekly observations on the incidence of sucking pests were made from the second week of November, 2023 to last week of March, 2024. The pest attack was observed from vegetative stage to till harvesting stage.

3.1.1 Seasonal incidence of leafhoppers on castor

Leafhoppers of the genus *Empoasca* were observed, with their incidence starting at the 48^{th} Standard Meteorological Week (SMW), coinciding with the beginning of the vegetative stage, 25 days after germination. At this time, the population was 6.20 leafhoppers per 3 leaves per plant, consistent with the findings of Shambavi *et al*., (2023) [14]. The peak population was recorded at the 10^{th} SMW, reaching 74.8 leafhoppers per 3 leaves per plant (Table 2).

3.1.2 Seasonal incidence of whiteflies on castor

The population of whiteflies (*Trialeurodesricini*) started to appear at the 4^{th} SMW, with an initial count of 10.8 whiteflies per 3 leaves per plant during the capsule formation stage. The peak population was observed at the 13^{th} SMW, with the number of whiteflies increasing as the crop matured(Table 2).

3.1.3 Seasonal incidence of thrips on castor

The population of thrips (*Scirtothrips dorsalis*) was first observed at the 52ndSMW with a count of 1.2 thrips per spike. Peak activity occurred during the 8th SMW, reaching 32 thrips per spike, after which the population declined(Table 2).

Table 1. Meteorological data

SMW	T max	T min	RH I	RH II	Sunshine hours	Wind speed	Evaporation	Rainfall
45	30.7	21.1	88.0	51.0	3.5	3.5	3.2	1.0
46	31.1	17.9	84.0	42.0	7.3	2.7	3.9	0.0
47	29.1	19.4	88.0	60.0	4.5	3.8	3.2	0.0
48	29.5	19.4	84.0	50.0	3.2	3.3	3.3	0.0
49	27.7	18.6	84.0	62.0	4.2	4.5	3.2	0.0
50	30.5	16.5	88.0	37.0	5.6	2.9	3.2	0.0
51	31.2	16.6	85.0	35.0	7.2	3.5	4.0	0.0
52	29.6	15.8	85.0	40.0	7.1	3.7	3.8	0.0
1	28.7	15.4	90.0	38.0	7.6	3.9	3.1	0.0
2	29.4	16.6	88.0	36.0	5.2	3.7	3.0	0.0
3	31.1	16.2	83.0	37.0	7.4	3.1	3.9	0.0
4	30.6	17.2	84.0	39.0	6.7	3.9	4.1	0.0
5	30.8	15.6	87.0	32.0	8.1	3.4	4.3	0.0
6	33.9	18.6	84.0	35.0	8.2	3.8	4.9	0.0
7	33.1	15.3	83.0	21.0	9.3	4.4	5.5	0.0
8	34.3	17.7	81.0	28.0	8.8	3.6	5.5	0.0
9	34.0	19.4	74.0	29.0	8.9	4.8	5.8	0.0
10	36.2	21.1	76.0	28.0	8.1	4.3	6.4	0.0
11	36.1	22.5	77.0	33.0	5.4	4.9	6.0	0.0
12	35.4	21.6	74.0	32.0	6.7	4.1	6.1	0.0
13	38.5	21.3	66.0	34.0	7.5	3.8	7.9	0.0

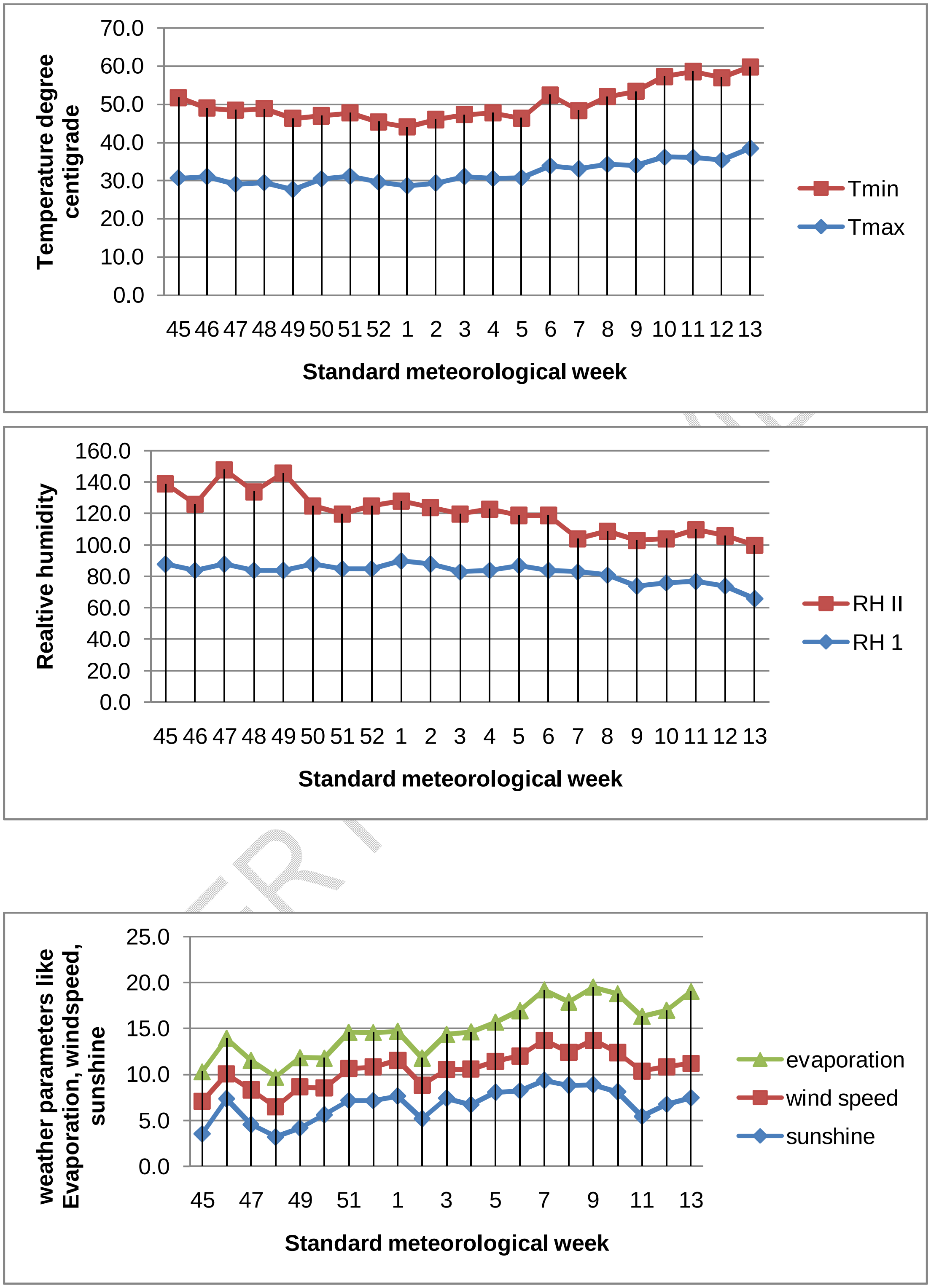

Fig 1. Relationship between standard meteorological week and weather parameters

Table 2.Seasonal incidence of Sucking pests observed on castor during *Rabi* 2023-2024

Standard week	Age of crop (DAS)	Leafhopper (No./3 leaves /plant)	White flies (No./top leaf/ plant)	Thrips (No./ spike)
45	4	0	0	0
46	11	0	0	0
47	18	0	0	0
48	25	6.2	0	0
49	32	8.6	0	0
50	39	10.4	0	0
51	46	16.8	0	0
52	53	21.8	0	1.2
1	60	24.2	0	2.2
2	67	27.8	0	4.8
3	74	30.2	0	5.6
4	81	34.4	10.8	6
5	88	36.2	16.6	7.8
6	95	41.0	21.4	16.6
7	102	43.4	25	29.4
8	109	47.4	31.2	32
9	116	62.4	33.4	28.4
10	123	74.8	46.8	27
11	130	67.4	55.6	26.2
12	137	53.8	64.2	24.6
13	144	41.2	68.6	20.8

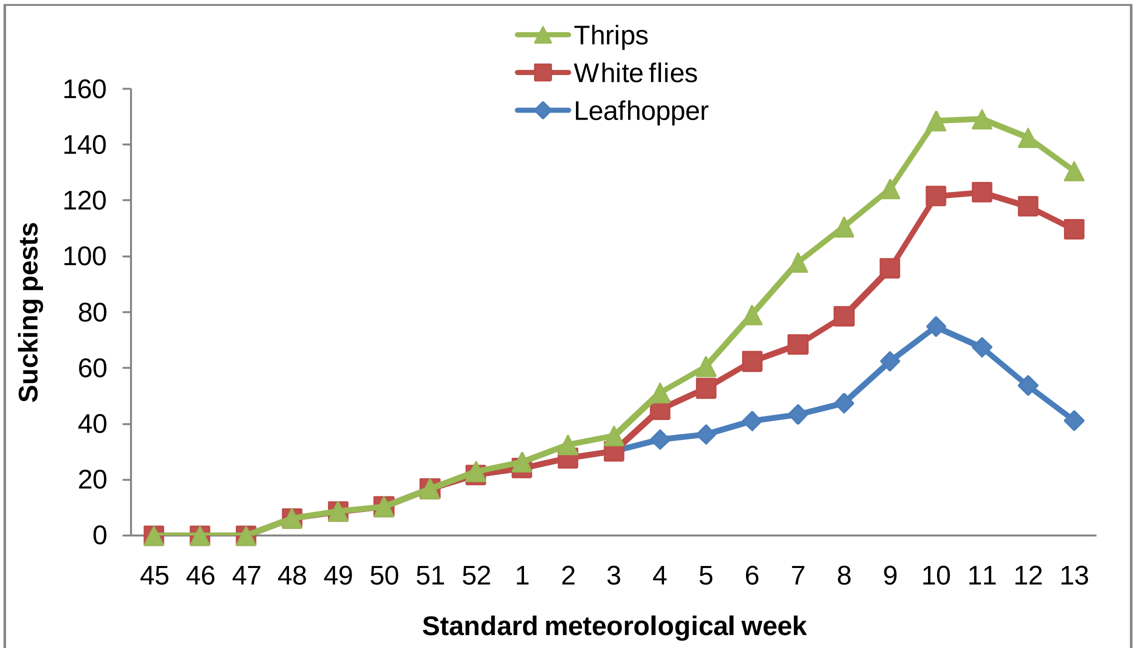

Fig 2. Relationship between meteorological parameters and sucking pests population on castor

3.2 Correlation between sucking pests and meteorological parameters

Table 3. Correlation between sucking pests of castor with weather parameters during *Rabi* 2023-2024

Sucking pests	Tmax	Tmin	RH I	RH II	Sunshine hours	Windspeed	Evaporation	Rainfall
Leafhoppers	0.772**	0.315^{NS}	-0.663**	-0.758**	0.599**	0.644**	0.794**	-0.313^{NS}
Whiteflies	0.931**	0.641**	-0.888**	-0.543*	0.371^{NS}	0.535*	0.947**	-0.174^{NS}
Thrips	0.835**	0.371^{NS}	-0.707**	-0.725**	0.607**	0.574**	0.872**	-0.207^{NS}

**Correlation is significant at the 0.01 level, *Correlation is significant at the 0.05 level, NS is Non significant

3.2.1Correlation between leafhopper population and meteorological parameters

The incidence of leafhoppers showed a significant positive correlation with maximum temperature (r=0.772**), whereas the correlation with minimum temperature was non-significant (r=0.315NS). These findings differ from those of Madhuri*et al*., (2023) [11]. Morning relative humidity (r=-0.663**) and evening relative humidity (r=-0.758**) had significant negative effects on leafhopper incidence, aligning with the reports by Madhuri *et al*., (2023) [11] and Ranganath *et al*., (2021) [13]. Additionally, sunshine hours, wind speed, and evaporation were positively and significantly correlated with leafhopper incidence, while rainfall exhibited a non-significant negative correlation (Table 3; Fig 2).

3.2.2Correlation between whitefly population and meteorological parameters

A significant positive correlation was observed between the whitefly population and maximum temperature (r=0.931**), minimum temperature (0.641**), wind speed (r=0.535*), and evaporation (r=0.947**). Sunshine hours showed a non-significant positive correlation (r=0.371NS). Conversely, significant negative correlations were found with morning relative humidity (r=-0.888**) and evening relative humidity (r=-0.543*), while rainfall exhibited a non-significant negative correlation (r=-0.174NS) (Table 3; Fig 2). These findings contrast with those of Shambavi *et al*., (2023) [14].

3.2.3 Correlation between thrips population and meteorological parameters

The thrips population exhibited a significant positive correlation with maximum temperature (r=0.835**), wind speed (r=0.574**), sunshine hours (r=0.607**), and evaporation (r=0.872**), while there was a non-significant positive correlation with minimum temperature (r=0.371NS). Significant negative correlations were observed with morning relative humidity (r=-0.707**) and evening relative humidity (r=-0.725**) (Table 3; Fig 2) aligning with the findings of Duraimurugan and Jagdish [4]. However, only sunshine hours were consistent with Madhuri *et al*., (2023) [11], while the other correlations contrast with their results. These findings are consistent with Patel *et al*., (2015) [12] and differ from Shambavi *et al*., (2023) [14] who reported a positive correlation between thrips population and both morning and evening relative humidity.

CONCLUSION

Castor can be cultivated during both the *Kharif* and *Rabi* seasons, with weather conditions significantly impacting crop growth and pest incidence. In the *Rabi* season, factors such as maximum temperature, sunshine hours, wind speed, and evaporation play a crucial role in influencing the population of sucking pests *viz.*, leafhoppers, whiteflies, and thrips. To recommend effective control measures for these key pests, it is essential to understand the pest dynamics, population trends, and the emergence of new pests specific to the region.

REFERENCES

1.Agyenim-Boateng KG, Lu JN, Shi YZ, Yin XG. Review of leafhopper (*Empoascaflavescens*): A major pest in castor (*Ricinus communis*). Journal of Genetics & Genomic Sciences. 2018;3:009.

2. Anonymous. Crop protection. Annual Report (2019- 2020). Indian Institute of Oilseed Research, Hyderabad, 2020;41-54.

3. Basappa, H. and Lingappa, S. Damage Potential of *Achaea Janata* Linn, at Different Phenological Stages of Castor. Indian Journal of Plant Protection. 2001;29:17-24.

4. Duraimurugan P, Jagadish A. Seasonal incidence and effect of weather parameters on the population dynamics of chilli thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) on rose. Resources management in plant protection during twenty first century, Hyderabad, India. 2002;2:180- 183.

5. https://pjtsau.edu.in

6. IndiaStat. Area, production and productivity of castor :2023.

Available: http://www. indianstat.com

7. Jayaraj S. Studies on the resistance of castor plant (*Ricinus communis* L.) to the leaf hopper, *Empoascaflavescens*(F.) (Homoptera, Jassidae). Zeitschrifffurangewandte. entomologie. 1967;59:117- 126.

8. Karan GR. Diversity of insect pests of castor, *Ricinus communis* L. and their ecological interaction in southwest Haryana. International Journal of Farm Sciences. 2014;4(4):147-152.

9. Khanpara DV, Patel GM. Need based plant protection and avoidable losses in hybrid castor. Indian Journal of Entomology. 2002;64:175- 184

10. Lakshminarayan M, Duraimurugan P. Assessment of avoidable yield losses due to insect pests in castor (*Ricinus communis* L.). Journal of Oilseeds Research. 2014;31:140-144.

11. Madhuri, G., Sadaiah, K., Duraimurugan, P., Rani, V.D., Reddy, G.E., Neelima, G., Nalini, N., Sujatha, M. and Goverdhan, G. Population Dynamics of Leafhopper (*Empoascaflavescens*) and Thrips (*Scirtothrips dorsalis*) of Castor (*Ricinus communis* L.). International Journal of Environment and Climate Change. 2023;13(11):2023-2029.

12. Patel BC, Patel PS, Trivedi JB, Patel SA. Population dynamics of sucking pest complex of castor (*Ricinus communis* Linnaeus). International Journal of Agriculture Sciences. 2015;7:596-600.

13. Ranganatha TR, Shivanna BK, Ajgar BY, Narayan HJ, Shashidara KC. Population dynamics of insect pests of castor. Indian Entomologist. 2021;83(2):235-237

14. Shambhavi, H.T., Srinivas Reddy, K.M., Yamanura, M.K.R., Reddy, K. and Katteppanavar, A.D. Population dynamics of insect pests of castor. The pharma innovation journal. 2023;*12*(5):112-118.

15. Singh SK, Patel N, Jadon KS, Sharma AK. Bio-intensive prophylactic integrated pest management in castor for arid environment. Proceedings of the National Academy of Sciences, India Section B: Biological Sciences. 2020; 90(5):1017-1024.