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Influence of Weather Parameters on the Population of Sucking Pests in Castor Genotypes

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

Field experiment were carried out to study the seasonal incidence of leafhopper, *Empoasca flavescens* and thrips, *Scirtothrips dorsalis* and also the influence of weather parameters on the sucking pest population in five castor genotypes *i.e*., DCH-519, DCH-177, ICH-66, NBCH, PCH-111 during *Rabi,* 2020-21 at the research farm of RARS, Palem, PJTSAU, Telanagana. The pest population was recorded from 10 random plants and the incidence was observed from 48th standard meterological week and the peak population of sucking pests was observed during 6th to 8th standard week. PCH-111 and NBCH were observed to be more susceptible to sucking pests whereas DCH-519 was least susceptible. The observed pest population is correlated with weather parameters by taking the weather data from the agro meteorological observatory located at RARS, Palem. Correlation studies indicated that all the parameters except max temperature had a negative influence on thrips whereas temperature showed positive influence towards hoppers.

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1. INTRODUCTION

Castor (*Ricinus communis*) is an industrially important non-edible oilseed crop of Euphorbiaceae family. The crop is predominantly grown in rainfed areas. India is the world's leading producer and exporter of castor beans. India meets more than 70 per cent of world requirement of castor oil. As per the government's third advance estimates, total castor production in India is 17.74 lakh tonnes in 2020-21 and the castor productivity in Telangana state is 355 kg/ha according to 4th estimates [1]. Excessive damage caused by the crop pests is one of the major constraints that limits the castor productivity. The major pests that damages the castor crop are semilooper, tobacco caterpillar, capsule shoot and capsule borer, leafhoppers and thrips [2].

The variability in pest populations on crops is due to the influence of weather conditions on the pest population [3]. Weather variables like rainfall, temperature, relative humidity and wind speed were found to significantly affect pest numbers [4]. In order to carry out Integrated pest management, the knowledge of pest ecology, information regarding the pest incidence at different growth stages and its relation with weather parameters is necessary [5,6]. The study of seasonal incidence of pests and the period of their peak activity helps in taking prophylactic measures and reduce the curative management practices [7]. For effective pest management, the data regarding the influence of weather on population fluctuation on a crop might be helpful [8]. This will help to find out under what weather conditions, the particular pest will be attacked and so can forewarn the farmers to follow the essential preventive measures.

So, the main objective of the present study was to determine the population fluctuation pattern of sucking pests of castor crop and to investigate the relationship between population density of pests and weather parameters. The data generated would also be useful for predicting outbreaks of castor pests under varied climatic conditions and to evolve suitable management strategies.

2. MATERIALS AND METHODS

The field experiment were carried out during Rabi 2021 to study the seasonal incidence and influence of weather parameters on the population of leafhopper, E*. flavescens* and thrips, *S. dorsalis* in five genotypes of castor viz., DCH-519, DCH-177,ICH-66, NBCH and PCH-111. The experiments were conducted at the research farm of RARS, Palem, PJTSAU, Telanagana. Experiment was laid out in Randomized Block Design (RBD) and each treatment (genotype) was replicated thrice. Plot size of each treatment was 5m x7m (35m^2) with a spacing of 120 cm X 45 cm. All the agronomic practices were followed as per the recommendations except the plant protection measures. Observations were recorded based on standard weeks from 10 randomly selected plants in each replication by counting the number of hopper population on top, middle and bottom leaf of the plant. For studying the relationship between weather parameters and the pest incidence, the data on weather parameters such as relative humidity (RH1, RH2), maximum temperature (Tmax), minimum temperature (Tmin) were recorded from the agro meteorological observatory located at RARS, Palem and correlation coefficients were worked out between weekly weather data of preceding one week and sucking pest incidence.

3. RESULTS AND DISCUSSION

The data obtained from weekly observations of sucking pests indicated that the incidence of the leaf hoppers and thrips was low during the 48th standard week and their intensity increased gradually till the 8th standard week in all the genotypes. Highest thrips population was observed during 8th standard week, while the incidence of leafhopper showed sudden increase during 51st and 52nd standard weeks as mentioned in Table 1 and Fig. 1. These results are in accordance with Suganthy [9], who reported that leafhopper incidence ranged from 37.9-180.4 hoppers/3 leaves/ plant in all the fields during 2nd fortnight of December.

The varietal preference of sucking pests indicated that among the five genotypes, PCH-111 was highly preferred by leafhoppers with a mean population of 4.87 hoppers/3 leaves/plant followed by NBCH with 4.09 hoppers/3 leaves/plant. DCH-519 and DCH-177 were least preferred with 3.1 and 3.69 hoppers/3 leaves/ plant, respectively. A mean population of 6.16 thrips/3 leaves/plant was recorded in NBCH indicating its susceptibility to thrips whereas least mean population of 4.82 thrips/3 leaves/plant was recorded on the castor genotype DCH-519 (Table 2 and Fig. 2).

The results obtained in the correlation studies are mentioned in Table 3 and Table 4 where max temperature showed positive correlation on leaf hopper and thrips incidence on all the genotypes except PCH-111(r= -0.7836) and DCH-519 (r= -0.4044) respectively, These observations are similar to the findings of Ranganath et al. [10] according to whom max temperature positive correlation existed between max temperature and leaf hopper on DCH-177 variety and also similar to the findings of Duraimurugan and Jagadish [11] where the incidence of *S. dorsalis* on rose was significantly positively correlated with the maximum temperature. RH1 and RH2 had a negative influence on both leafhoppers and thrips on all the five genotypes which is in line with the results of Patel et al. [12]. Minimum temperature also showed negative influence on the thrips population in all the tested castor genotypes which was in accordance with the findings of Panickar and Patel [13] who observed a significant negative relationship between population of *S. dorsalis* on chilli and minimum temperature and mean relative humidity. The negative influence of temperature on thrips population was similar to the findings of Shambhavi et al. [14]. Based on the regression analysis the equations were presented in Table 5 and Table 6 by which the influence of the weather parameters on leafhoppers and thrips was predicted.

Table 1. Population of leafhoppers observed in five genotypes of castor during rabi 2021

SMW	DCH-519	DCH-177	ICH-66	NBCH	PCH-111
48	1.73	1.87	2.07	0.93	2.2
49	3.93	2.27	3	1.2	2.27
50	1.33	2.93	2.53	2.8	3
51	2.4	4	5.2	5	5.8
52	2.27	3.73	4.47	5.8	6.87
1	2.2	3.4	4.8	5.33	5.57
2	1.47	3.67	3.8	3.47	4.53
3	1.4	3.13	3.8	3.47	5.4
4	2	3.93	3.47	3.4	3.93
5	1.8	2.73	2.8	4.87	4.87
6	6	5.07	5.07	5.33	5.93
7	6.8	5.27	4.8	5.53	6.4
8	7	6	6.53	6	6.53
Mean	3.1	3.69	4.03	4.09	4.87

(SMW- Standard Meteroogical Week, DCH-519,DCH-177,ICH-66,NBCH,PCH-111- Castor varieties)

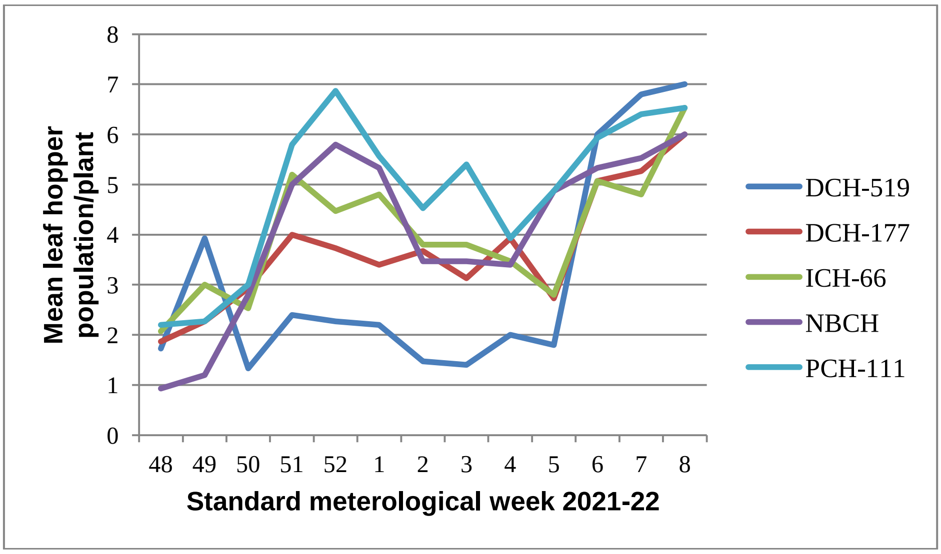

Fig. 1. Effect of weather parameters on the population dynamics of leafhopper in castor

Table 2. Population of thrips observed in five genotypes of castor during rabi 2021

SMW	DCH-519	DCH-177	ICH-66	NBCH	PCH-111
48	3.43	4.27	2.33	2.2	1.67
49	1.07	4.07	5.67	5.67	4.8
50	4.67	5.03	4.67	4.67	4
51	4.73	4.8	6.2	6.27	7.13
52	5.73	5.33	5.8	6.67	7.53
1	6.33	6.93	6.67	6.4	7.2
2	6.47	6.47	5.67	6.27	7
3	4.87	5.67	6.6	6.07	6.07
4	5.87	6.37	6.67	7.2	6.8
5	6.33	6.33	6.53	7.07	6.2
6	6.33	6.2	6.53	6.6	7
7	3.8	6.93	5.07	7.53	6.8
8	3	7.33	7.27	7.47	7.2
Mean	4.82	5.82	5.82	6.16	6.11

(SMW- Standard Meteroogical Week, DCH-519,DCH-177,ICH-66,NBCH,PCH-111- Castor varieties)

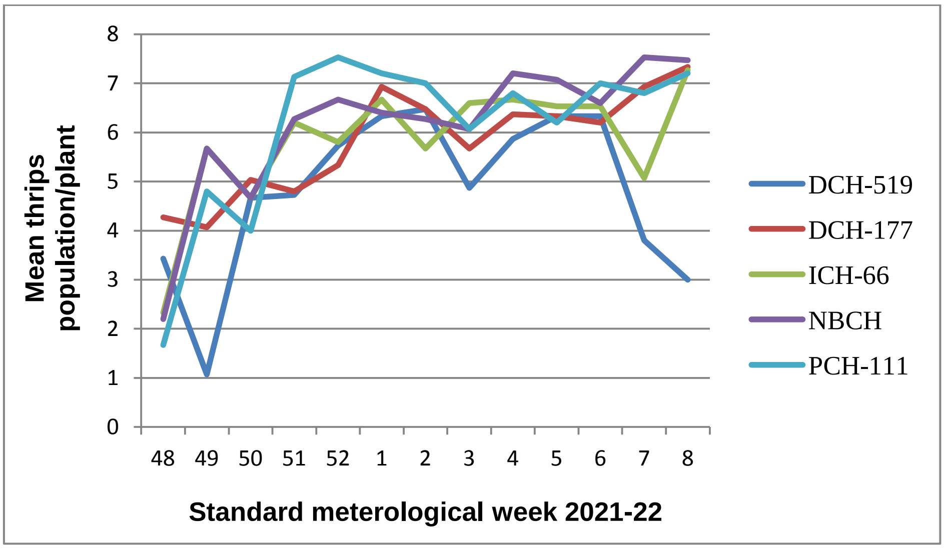

Fig. 2. Effect of weather parameters on the population dynamics of thrips in castor

Table 3. Correlation between weather parameters and leafhopper population in different genotypes of castor

	DCH-519	DCH-177	ICH-66	NBCH	PCH-111
Max temp	0.809	0.6969	0.5369	0.3485	-0.7836
Min temp	0.4277	0.106	-0.0282	-0.1791	0.3136
RH1	-0.6629	-0.779	-0.6638	-0.8591	-0.1841
RH2	-0.3505	-0.654	-0.6466	-0.8941	-0.8059

(RH- Relative humidity, DCH-519,DCH-177,ICH-66,NBCH,PCH-111- Castor varieties)

Table 4. Correlation between weather parameters and thrips population in different genotypes of castor

	DCH-519	DCH-177	ICH-66	NBCH	PCH-111
Max temp	-0.4044	0.5429	0.2557	0.4189	0.1925
Min temp	-0.1891	-0.2486	-0.1829	-0.2466	-0.3036
RH1	-0.3266	-0.8275	-0.5202	-0.7621	-0.6848
RH2	-0.5704	-0.8198	-0.6388	-0.7873	-0.8309

(RH- Relative humidity, DCH-519,DCH-177,ICH-66,NBCH,PCH-111- Castor varieties)

Table 5. Regression equations developed for leafhopper in different genotypes of castor

	DCH-519	DCH-177	ICH-66	NBCH	PCH-111
Max temp	y = 0.4531x + 28.363	y = 0.6898x + 27.222	y = 0.5022x + 27.747	y = 0.2433x + 28.775	y = 0.0657x + 29.214
Min temp	y = 0.3824x + 15.991	y = 0.1675x + 16.559	y = -0.0421x + 17.346	y = -0.1995x + 17.992	y = -0.2179x + 18.239
RH1	y = -3.8085x + 84.238	y = -7.9104x + 101.63	y = -6.3702x + 98.07	y = -6.1537x + 97.573	y = -6.0127x + 101.9
RH2	y = -2.8936x + 65.1	y = -9.5406x + 91.35	y = -8.9154x + 92.018	y = -9.2008x + 93.726	y = -8.79x + 98.659

(RH- Relative humidity, DCH-519,DCH-177,ICH-66,NBCH,PCH-111- Castor varieties)

Table 6. Regression equations developed for thrips in different genotypes of castor

	DCH-519	DCH-177	ICH-66	NBCH	PCH-111
Max temp	y = -0.2933x + 31.182	y = 0.6105x + 26.213	y = 0.2376x + 28.386	y = 0.3488x + 27.62	y = 0.2736x + 4.1923
Min temp	y = -0.2189x + 18.232	y = -0.4461x + 19.775	y = -0.2713x + 18.756	y = -0.3276x + 19.195	y = -0.3408x + 19.259
RH1	y = -2.4306x + 84.133	y = -9.5455x + 128.03	y = -4.9591x + 101.29	y = -6.5099x + 112.53	y = -4.6893x + 101.67
RH2	y = -6.0983x + 85.503	y = -13.586x + 135.26	y = -8.7495x + 107.06	y = -9.6615x + 115.65	y = -8.5453x + 108.49

(RH- Relative humidity, DCH-519,DCH-177,ICH-66,NBCH,PCH-111- Castor varieties)

4. CONCLUSION

The sucking pests population was found to be at their peak during 5th to 8th standard meterological week i.e., 29th January to 25th February and they were negatively related to both morning and evening relative humidity. Maximum temperature showed positive influence on the sucking pest population. Among the five castor genotypes PCH-111 is highly preferred by the sucking pests and DCH-519 is least preferred. This correlation study of weather parameters with the pest incidence is useful in forecasting the pest population and thus helps the farmers in taking precautionary measures to control the pest incidence and reduce the yield losses.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Available:www.agri.telangana.gov.in
2. Lakshminarayana M, Raoof MA. Insect pests and diseases of castor and their management. Directorate of Oilseeds Research, Hyderabad. 2005;78.
3. Kirk WD. Distribution, abundance and population dynamics. Thrips as Crop Pests. CABI, UK. 1997;217-258.
4. Ananthakrishnan TN. Bionomics of thrips. Annual Review of Entomology. 1993;38: 71-92.
5. Singh HA, Kaur PR, Mukherjee JO. Impact of weather parameters and plant spacing on population dynamics of sucking pests of cotton in south western Punjab. Journal of Agricultural Physics. 2015;15(2):167-74.
6. Bhamare VK, Phatak SV, Bade AS, Kumbhar SC. Effect of weather parameters on population dynamics of sucking insect-pests infesting sole soybean and soybean intercropped with pigeonpea. Journal of Entomology and Zoology Studies. 2018; 6(5):413-20.
7. 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.
8. Selvarani SS, Singh TK. Influence of meteorological factors on population dynamics of pod fly *Melanogromyza obtuse* Malloch (Diptera: Agromyzidae) in pigeon pea under agro- climatic conditions of Manipur, Indian Journal Entomology. 2016;69(1):78-80.
9. Suganthy M. Survey and monitoring the incidence of pests of castor. Madras Agricultural Journal. 2007;94:133-135.
10. Ranganath TR, Shivanna BK, Hugar AY, Jayalaxmi NH, Shashidara KC. Population dynamics of insect pests in castor. Indian Journal of Entomology. 2021;83(2):235-237.
11. 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. In Resource management in plant protection during twenty first century. 2007;II:180-183.
12. Patel BC, Patel PS, Patel SA, Trivedi JB. Population dynamics of sucking pest complex of castor (*Ricinus communis* Linneaus). International Journal of Agricultural Science. 2015;7(8):596-600.
13. Panickar BK, Patel JR. Population dynamics of different species of thrips on chilli, cotton and pigeonpea. Indian Journal of Entomology. 2001;63:170-175.
14. Shambhavi HT, Srinivas Reddy KM, Yamanura, Mohan kumar R, Keshava Reddy G, Abhishek DK. Population dynamics of insect pests of castor. The Pharma Innovation Journal. 2023;12(5): 112-118.

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