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POPULATION DYNAMICS OF SUCKING PEST COMPLEX OF CASTOR (Ricinus communis Linnaeus)

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Abstract- The experiment on population dynamics against sucking pest complex of castor,a field experiment was conducted during 2012-13 on castor (Ricinus communis) at Main Castor and Mustard research station, Sadarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar. The studies on population dynamics of leafhopper, Empoasca flavescens revealed that the pest remained active during second week of September to third week of April. The population attained three peak periods of activity i.e., the first peak (5.44 nymphs/three leaves/plant) during fourth week of October, second (6.08 nymphs/three leaves /plant) in third week of November and third peak (3.88 leafhoppers/three leaves/plant) in second week of March. Leafhopper population had non-significant and positive correlation with morning relative humidity as well as mean bright sunshine (r = 0.11 and r = 0.13, respectively), whereas it had significant and negative correlation with minimum temperature, evening relative humidity as well as wind velocity (r = - 0.58, - 0.53 and - 0.41, respectively). Thrips, Scirtothrips dorsalis first appeared in second week of September and continued throughout the crop season. The population reached peak level of activity twice, the first (3.44 thrips/three leaves/plant) during first week of November and second (3.68 thrips/spikes/ plant) during fourth week of March. Thrips population had negative and significant correlation with minimum as well as morning and evening relative humidity (r = -0.45, -0.38 and -0.55, respectively). Population study of whitefly, T. ricini revealed that the pest remained active from second week of September to third week of April. Three peaks were observed for whitefly, the first (1.64 whiteflies/three leaves/plant) during second week of October, second (2.44 whiteflies/three leaves/plant) during fourth week of November and third (3.08 whiteflies/three leaves/plant) during second week of March. Whitefly population exhibited significant negative correlation (r = -0.59) with morning relative humidity.

Keywords- Castor, Population dynamics, Sucking pest.

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Introduction

Castor, *Ricinus communis* Linnaeus, is an important industrially valued non edible oilseed crop in the world belong to the family Euphorbiaceae. India is the world leader in castor, producing nearly two-thirds of the total global production followed by Brazil.India is largest producer of castor seed in the world and it constitutes 55-60 percent total global production. India occupies the next best position in the world's castor market earning foreign exchange by exporting major part of its total produce and thus plays an important role in agricultural economy of our country. In India, Gujarat, Andhra Pradesh and Rajasthan are the major castor producing States (84 % of total area), followed by Chhattisgarh (9.1 %), Karnataka (2.3 %), Orissa (2 %) and Tamilnadu (0.6 %). Total area under castor crop in India for the year 2010-11 is 8.59 lakh ha out of which Gujarat occupies 4.83 lakh ha with an average yield of 1781 kg/ha. Castor seed production Gujarat is largest producer of castor seed in the country and contributes 75% in total domestic output. Other major producing states are Rajasthan and Andhra Pradesh. It is cultivated under rainfed as well as irrigation conditions. The production has averaged at 11.3 lakh tonnes in last eight years. The highest output was in 2011-12 that is 15.76 lakh tonnes. Gujarat is the largest producer in the country with Mehsana, Banaskantha, Ahmedabad, Kachchh, Gandhinagar and Sabarkantha are the major castor producing districts in the State. (Fundamental Trading Opportunity Report On Castor Seed (07 March 2011).The seed yield losses in castor due to insect pests varied widely depending on the season, severity of major pests and with variety/hybrids [1]. The yield losses to the tune of 12.4 to 15 per cent wasreported due to sucking pests from Gujarat [2]. Castor is attacked by insect pests right from sowing to harvesting. Among these insects, sucking pests *viz*., leafhoppers, whiteflies 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.

Methodology

The investigation on population dynamics of major sucking pests viz., Empoasca flavesens Fabricius, Scirtothrips dorsalis Hood and Trialeurodes ricini Misra was carried out on castor variety GCH 7 at Main Castor and Mustard Research Station, Sadarkrushinagar Dantiwada Agricultural University, Sadarkrushinagar during 2012-13 from an isolated plot of 0.10 ha with 90×60 cm spacing. The area was kept unsprayed throughout crop season. Observations of sucking pests viz., leafhopper, thrips and whiteflies were recorded at weekly intervals from twenty randomly selected plants from the unsprayed plot .Leafhopper counts were done on 3 leaves/plant selecting one leaf from top (excluding 2 top most leaves), middle (medium maturity) and bottom (leaving one or two bottom most leaves) on main shoot. Thrips counts were recorded as number of thrips/spike/plant by taping the spike and collecting the thrips on a whitepaper and counting them.The number of adult whiteflies were recorded from top, middle and bottom leaves from the each selected plant. The correlation between population and weather parameters worked out.

Result and Discussion

Leafhopper, E. flavescens

The results [Table-1] and [Fig-1] indicated that population of leafhopper ranged between 0.92-6.08 nymphs per three leaves. The incidence of leafhopper was first appeared after 3rd week of sowing i.e. 2nd week of September (1.36 nymphs/three leaves), it increased gradually and attained first peak population level of 5.44 nymphs per three leaves during 4th week of October i.e. 9th week after sowing. The second peak of 6.08 nymphs per three leaves was observed in the 3rd week of November i.e. 13th week after sowing. Thereafter the pest population started declining up to 2nd week of February then increased gradually and reached to a third peak level of 3.88 leafhoppers per three leaves during 2nd week of March i.e. 29th week after sowing.The population of E. flavescens was at its peak (23.8 nymphs/leaf) during second fortnight of November [3]. Leafhopper incidence was more in second fortnight of October compared to first fortnight of October and first fortnight of November. [4]. The observations of earlier workers are in support of the present finding.

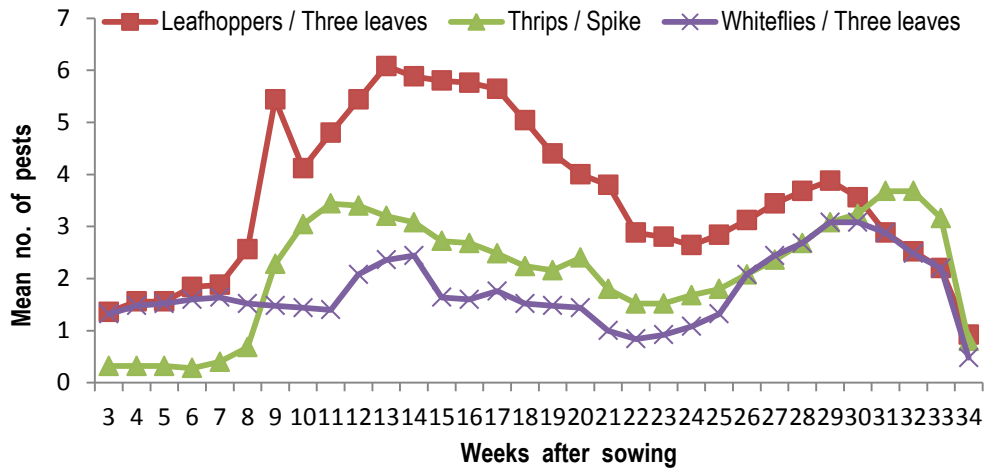

Fig-1 Seasonal incidence of sucking pests on castor

Correlation studies between leafhopper population and weather parameters

The influence of weather parameters on leafhopper population at Sardarkrushinagar on var. GCH 7 is depicted in [Table-2] and [Fig-2]. A perusal of the data summarized in [Table-4] clearly indicated that among various environmental factors, leafhopper population exhibited non-significant and positive correlation with morning relative humidity as well as mean bright sunshine (r = 0.11 and 0.13, respectively). Leafhopper population exhibited significant and negative correlation with minimum temperature, evening relative humidity as well as wind velocity (r = - 0.58, - 0.53 and -0.41, respectively), but it has shown a non-significant and negative correlation with maximum temperature (r = - 0.32). Thus, it can be inferred that leafhopper population increase as temperature and evening relative humidity decreases. Increase in bright sunshine hours and morning relative humidity, has a positive effect on population. According to Singh *et al.* (1990) [5] leafhopper population had significant positive association with maximum daily temperature and positive correlation with minimum temperature. Jena and Kuila (1996) [6] reported that leafhopper infestation had positive correlation with maximum temperature whereas it was negatively correlated with sunshine. 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.

Thrips, S. dorsalis

The effect of weather parameters on population of thrips on castor var. GCH 7 is presented in [Table-1] and [Fig-1]. The results indicated that population of thrips ranged between 0.32 to 3.68 nymphs per spike. The pest first appeared 3rd week after sowing i.e. 2nd week of September with a low population (0.32 nymphs per spike), it increased gradually and attained first peak level of 3.44 nymphs per spike during 1st week of November i.e. 11th week after sowing. The second peak of 3.68 thrips per spike was observed in the 4th week of March i.e. 31st week after sowing. Thereafter the pest population started declining. Chauhan (1974) [7] noticed maximum attack of thrips in castor in april at Anand (Gujarat). Highest thrips population also noticed in the second fortnight of October at Junagadh [8]. Thus, the present observation on incidence of thrips on castor crop is more or less in accordance with the earlier reports.

Correlation studies between thrips population and weather parameters

The results on influence of weather parameters on thrips population summarized in [Table- 2] and [Fig-2] clearly indicated that among various environmental factors, thrips population exhibited non-significant and negative correlation with maximum temperature as well as wind velocity (r = - 0.05 and - 0.14, respectively), whereas, a significant negative correlation with minimum temperature as well as morning and evening relative humidity (r = - 0.45, - 0.38 and - 0.55, respectively), 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.* (2008) [9] thrips population exhibited significant negative correlation with evening relative humidity and rainfall and positive correlation with bright sunshine. Duraimurugan and Jagadish (2002) [10] reported significant negative correlation with mean relative humidity which confirms the present finding.

Whitefly, *T. ricini*

The population of the whiteflies during the crop period presented in [Table-1] and [Fig-1] indicated that whitefly population on castor commenced after 3rd week of sowing i.e. 2nd week of September, with a population of 1.32 whiteflies per three leaves. The pest population increased gradually and reached to a peak level of 1.64 whiteflies per three leaves during 2nd week of October i.e. 7th week after sowing. Thereafter, it started declining up to 1st week of November i.e. 11th week after sowing. Further, it showed an increasing trend reached to a second peak level of 2.44 whiteflies per three leaves during 4th week of November i.e. 14th

Table-1 *Standard week wise sucking pests population on castor in relation to weather parameters*

Weeks after sowing	Standard weeks	Date of observation	Mean number of pest (adults/nymphs/ 20 plants)			Weather parameters					
			Leafhopper/ 3 leaves	Thrips/ spike	Whiteflies/3 leaves	Temperature (^{o}C)		Relative humidity (%)		Mean Bright sunshine hours X_5	Wind velocity (km/hrs) X_6
						Max. X_1	Min. X_2	Morning X_3	Evening X_4		
3	37	11-09-12	1.36	0.32	1.32	29.5	25.1	95	85	1.3	7.1
4	38	18-09-12	1.56	0.32	1.48	32.5	24.4	91	55	7.0	4.6
5	39	25-09-12	1.56	0.32	1.52	33.8	22.8	89	44	8.9	3.2
6	40	02-10-12	1.84	0.28	1.60	37.1	22.2	84	32	9.8	2.6
7	41	09-10-12	1.88	0.40	1.64	36.5	18.8	76	27	9.5	2.5
8	42	16-10-12	2.56	0.68	1.52	36.0	19.7	77	28	9.6	2.5
9	43	23-10-12	5.44	2.28	1.48	32.8	18.8	78	19	9.5	4.2
10	44	30-10-12	4.12	3.04	1.44	33.9	13.7	88	21	9.5	2.9
11	45	06-11-12	4.80	3.44	1.40	32.3	13.5	85	23	8.4	2.1
12	46	12-11-12	5.44	3.40	2.08	33.1	14.8	77	23	9.4	2.4
13	47	20-11-12	6.08	3.20	2.36	31.8	13.4	79	21	9.1	2.2
14	48	27-11-12	5.88	3.08	2.44	30.5	12.9	78	24	8.9	5.2
15	49	04-12-12	5.80	2.72	1.64	30.9	14.2	87	30	7.7	2.8
16	50	11-12-12	5.76	2.68	1.60	29.4	12.9	91	35	7.6	2.2
17	51	18-12-12	5.64	2.48	1.76	28.9	12.4	79	30	8.1	6.4
18	52	25-12-12	5.04	2.24	1.52	28.6	8.2	83	19	9.2	2.5
19	01	01-01-13	4.40	2.16	1.48	24.7	6.0	83	20	8.8	4.6
20	02	08-01-13	4.00	2.40	1.44	27.4	8.2	91	21	8.5	2.3
21	03	15-01-13	3.80	1.80	1.00	24.6	9.0	82	30	7.1	5.0
22	04	22-01-13	2.88	1.52	0.84	26.6	7.0	66	32	9.2	4.7
23	05	29-01-13	2.80	1.52	0.92	30.4	12.5	74	36	7.1	3.1
24	06	05-02-13	2.64	1.68	1.08	26.8	12.7	77	23	8.3	6.6
25	07	12-02-13	2.84	1.80	1.32	29.3	12.1	86	36	8.5	4.8
26	08	19-02-13	3.12	2.08	2.08	29.9	13.1	74	27	9.4	6.0
27	09	26-02-13	3.44	2.36	2.44	31.8	11.5	67	13	10.4	5.7
28	10	05-03-13	3.68	2.68	2.68	36.4	14.6	51	22	9.5	4.8
29	11	12-03-13	3.88	3.08	3.08	35.3	15.8	59	23	8.7	5.6
30	12	19-03-13	3.56	3.24	3.08	35.7	15.9	50	29	8.6	4.5
31	13	26-03-13	2.88	3.68	2.88	28.9	15.2	64	38	8.8	5.1
32	14	02-04-13	2.52	3.68	2.48	36.6	18.2	69	29	10.5	4.9
33	15	09-04-13	2.20	3.16	2.20	36.3	20.5	59	23	8.4	5.3
34	16	16-04-13	0.92	0.8	0.48	36.9	21.8	70	43	10.0	10.6

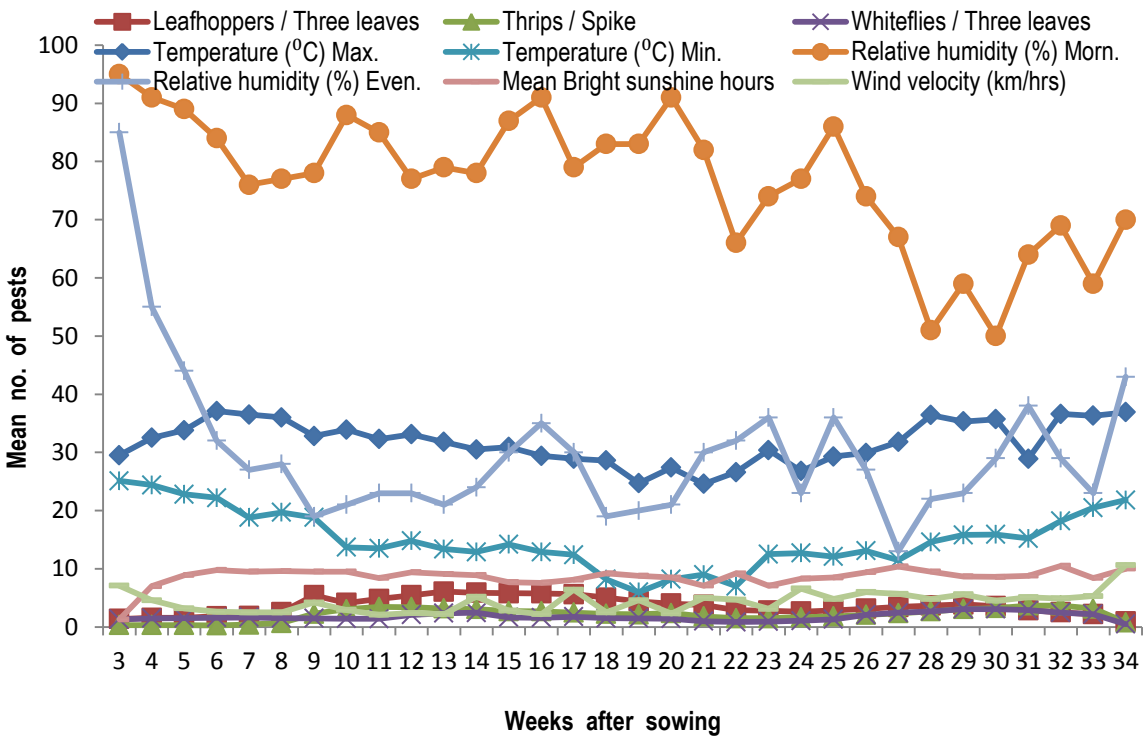

Fig-2 Seasonal incidence of sucking pests of castor in relation to abiotic factors

Table-2 *Correlation between sucking pests incidence with weather parameters*

Sr. No.	Name of pests	Weather parameters					
		Temperature (°c)		Relative humidity (%)		Mean Bright Sunshine hours (X_5)	Wind Velocity (km/hrs) (X_6)
		Max. (X_1)	Min. (X_2)	Morning (X_3)	Evening (X_4)		
1	Leaf hopper, *E. flavescens*	-0.32	-0.58*	0.11	-0.53*	0.13	-0.40*
2	Thrips, *S. dorsalis*	-0.05	-0.44*	-0.38*	-0.55*	0.28	-0.14
3	Whitefly, *T. ricini*	0.34	0.03	-0.59*	-0.29	0.23	0.06

* = Significant at 5% level

week after sowing. The population again showed a decreasing trend up to 2nd week of February, thereafter once again started building up gradually and reached to a third peak population level of 3.08 whiteflies per three leaves during 2nd week of March i.e. 29th week after sowing. . Whitefly population attained its peak infestation during September to October [11]. The maximum population (14.81 adults/plant) was noticed during the first fortnight of November at Sardarkrushinagar in North Gujarat [8]. Thus, the present observations on incidence of whiteflies on castor crop at Sardarkrushinagar are in accordance with the observation made by earlier workers.

Correlation studies between whitefly population and weather parameters

The correlation study between pest population and abiotic factors presented in [Table-2] and [Fig-2] indicated that whitefly population exhibited non-significant and positive correlation with minimum and maximum temperature (r = 0.34 and 0.03) and bright sunshine and wind velocity (r = 0.23 and 0.06). Whitefly population exhibited non-significant and negative correlation (r = - 0.29) with evening relative humidity and a significant negative correlation (r = - 0.59) with morning relative humidity. Thus present investigation revealed that whitefly population increased with the increase in temperature and bright sunshine favoured population build up. However population had an adverse effect with relative humidity. Prasad and Longiswaran (1997) [12] reported that the population of whitefly showed a significant positive correlation with maximum temperature, relative humidity and wind velocity in winter. Thus, the present observations on the influence of abiotic factors on whitefly population are in agreement with the earlier workers.

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