Population dynamics of Castor insect pests in relation to the weather parameters of Southern Telangana Zone

ABSTRACT

Castor (*Ricinus communis*L.) is an important oilseed crop of dry land area with huge industrial importance. However, biotic stresses are becoming major bottleneck in yield improvement. In view of change in insect pest status in current agricultural scenario and flctuations in climatic conditions will influence the incidence and severity of insect pests.keeping in this point of view studies on pest population in relation to the weather parameters was carried out to assess the population fluctuations of insect pests of castor during *kharif*, 2020 at Regional Agricultural Research Station, Palem and relationship between pests and weather parameters. Which revealed that leafhoppers have shown positive significant association with maximum temperature (r=0.48) and negative significant with minimum temperature (r=-0.59), evening relative humidity (r=-0.56). and rainfall (r=-0.60). Thrips has negative significant assocation with rainfall (r=-0.65). Semilooper has a positive correlation with maximum temperature (r=0.17). *Spodoptera litura* exhibits positive significant relationship with maximum temperature (r=0.24), Percent capsule damage by capsule borer had a negative significant relation with maximum temperature (r=-0.49) and minimum temperature(r=-0.55).

Keywords: Pests, castor, weather parameters, correlation coefficients, population dynamics, southern Telangana.

INTRODUCTION

"Castor (*Ricinuscommunis*L.) is an important non-edible oilseed crop of the spurge (Euphorbiaceae) family and is believed to have originated in Abyssinia". (Patel, 2015). "Mainly grown in arid and semiarid regions. It has gained great potential as its oil is being used in aircrafts as lubricant and also for grease, hydraulic fluids, soaps, Printing inks and for ayurvedic medicine also. India is the major producer in the world, castor seed with a production of17.95 lakh tonnes (lt) during 2021-22 season, against 17.89 lt in 2020-21". (Anon, 2022). "Development of location-specific varieties and hybrids with appropriate crop production technologies lead to increased production and productivity of the crop. However incidence of insect pests is becoming major obstacle in castor production. Castor is majorly grown in areas where mean monthly temperature across the growing season ranges from 22.7 to34.3 ^{0}C". (Akashe *et al*, 2017). "These temperatures are favorable for the incidence of several insect pests *viz.*, semilooper (*Achoea janata* L.), tobacco caterpillar (*Spodoptera litura* F.) , shoot and capsule borer (*Conogethes punctiferalis* Guen.) and leaf hopper (*Empoasca flavescens* Fabr.) of castor causing severe economic losses" (Lakshminarayana, 2010) .

"More than 60 species of insects and pests were reported to cause damage to the castor crop and the yield losseswere estimated to be about 40-89%". (Lakshminarayan and Duraimurugan, 2014). Multitude of insect pests attack was reported at all phenological stages viz., seedling, vegetative and reproductive of the crop. The defoliators, *viz.*, castor semilooper, Spodoptera &other hairy caterpillars, and sucking pests, such as jassid, whitefly, thrips and mites, cause huge damage to the castor crop. In Tamil Nadu, the incidence of leafhopper was observed on 90-100 days old crop, while the population of *S. litura* and semilooper was high during October and November. A maximum of 29.2% capsule borer incidence was recorded during III week of December 2003 (Suganthy, 2007). Weather conditions play a major role on the population dynamics of insect pest species. Temperature, rainfall and relative humidity are the weather parameters influencing the pest incidence.

An integrated approach is essential to control these insect pests. Thus integrated pest management (IPM) with the knowledge of pest ecology, information on incidence of pests of castor at different growth stages of the crop and their relation with weather parameters is vital for the effective management of these insect pests. This particular study will enable to find out the suitable weather conditions for particular pest incidence, which helps to forewarn the farmers to take up preventive measures against insect pests. Further long-term data on population dynamices of insect pests in relation to weather parameters will helps in preparing forecasting modules for effective control of the pests.

MATERIALS AND METHODS

The investigation on population dynamics of major insect pests *viz.*, semilopper, *Spodoptera*, capsule borer, leafhopper and thrips (Table 1) was carried out on castor hybrid PCH-111 at Regional AriculturalReserach Station, Palem duringkharif 2020 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 insect pests 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.

To assess the incidence of semilooper and tobacco caterpillar the larval counts were taken on randomly selected twenty-five plants. Whereas for shoot and capsule borer, the incidence was recorded by counting the number of infested capsulesper total number of capsules on twenty-five randomly selected plants and % capsule damage was worked out.

$$\text{Per cent capsule infestation} = \frac{\text{Number of capsules infested}}{\text{Total number of capsules observed}} \text{X100}$$

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 count was recorded as number of thrips/spike/plant by taping the spike and collecting the thrips on a whitepaper and counting them. The data on weather parameters like maximum temperature (Tmax), minimum temperature (Tmin), morning and evening relative humidity (RHM and RHE) and rainfall (mm) were recorded from the agro meteorological observatory located at RARS, Palem. The correlation coefficients between weather parameters and pest incidence were worked using OPSTATsoftware.

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RESULTS AND DISCUSSIONS

Survey conducted at the research station on the incidence of insect pests of castor (cv. PCH-111) revealed (Fig 1) heavy infestation of leafhopper, defoliators (Semilooper and *Spodoptera. litura*) and very low infestation of capsule borer.

The activity of leafhoppers was started during the month of September ranging 13.6leafhoppers/3 leaves/plant maintaining moderate infestation till November and a maximum of 155.7 leafhoppers/3 leaves/plant recorded during the second fortnight of December (19^{th}-27^{th} December) followed by decline in leaf hopper population by February. Similar results were reported bySingh *et al*. 2002 who observed highest incidence of hoppers during the month of December. Correlation studies revealed that leafhoppers has shown positive significant association with maximum temperature (r= 0.48) and with minimum temperature (r=-0.59), evening relative humidity (r=-0.56) and negative significantassociation with rainfall (r=-0.60). Temperature stress conditions coupled with less relative humidity has resulted in higher incidence of leafhopper. On the other hand, continous rainfall during the crop growth creates unfavourable conditions for leafhopper incidence. (Ranganath *et al* 2021). In addition to the current findings, several studies also reported significant impact of sunshine hours on laef 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 (Patel *et al*.,2015). 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.

Activity of semilooper was noticed from August first fortnight (1.8 larvae/plant) to November second fortnight (2.1 larvae/ plant) with highest population of 6.8 larvae/plant observed during second fortnight of October (22^{nd}-30^{th} October).present findings are similar with Manjunatha*et al* who reported The incidence of semilooper started from first fortnight of September and continued till the first fortnight of December with a peak (2.70 larvae/ plant)

population at the first fortnight of October and there after no incidence. Suganthy 2007 &Anon.,2011reported initial infestation of semilooper has started from August and reached peek during October. These results are in agreement with (Gedia *et al.*, 2007), who reported the highest peak of male moth catches in the 36th and 43rd standard weeks and 44th (5th week of October) week during 2003-04 and 2004-05, respectively in castor. Correlation studies revelaed that semilooper has shown a positive association with maximum temperature (r=0.17) thus increase in temperature leads to gradual increases in the insect activity.

The activity of *Spodopteralitura* larvae was observed from second fortnight of August (18th -25th August) till (1-8th January) and was highest during second fortnight of October (14th- 21st October) with maximum number of 7.4 larvae/plant. These results were similar with the previous findings of Ahir*et al*. 2017 but differed with another observations Naik*et al* who reported that the population was found from first fortnight of September to the first fortnight of November. Thus, weather parameters prevailing in a locality and sowing dates play a major role in the incidenece of pest. Positive significant association of *S.litura* with maximum temperature (r=0.24) was observed during the study. Thus, increase in temperature resulted in increase in the insect population (Sailaja Rani *et al*. 2006 and Ahir*et al*. 2017).

Capsule damage due to capsule borer ranged from 1.6 to 2.8% during October second fortnight to November second fortnight, respectively. As the reproductive stage coincides with the capsule borer The results obtained were in confirmation with the previous observations of Manjunatha*et al*. 2018 reported similar results that the infestation starts from the second fortnight of August to the second fortnight of November. but contradicting with the others observation of (Madhuri C *et al*, 2006) who reported peak infestation during the second week of March. The change may be due to growing season of the crop. Maximum temperature has shown negative significant association with capsule borer damage (r= -0.49) and minimum temperature has shown negative significant relation with percent capsule damage by capsule borer (r= -0.55).

Parasitization of semilooper by *Snelleniusmaculipennis*was observed only during the month of October as 12.4 and 17.6 per cent(table 2).

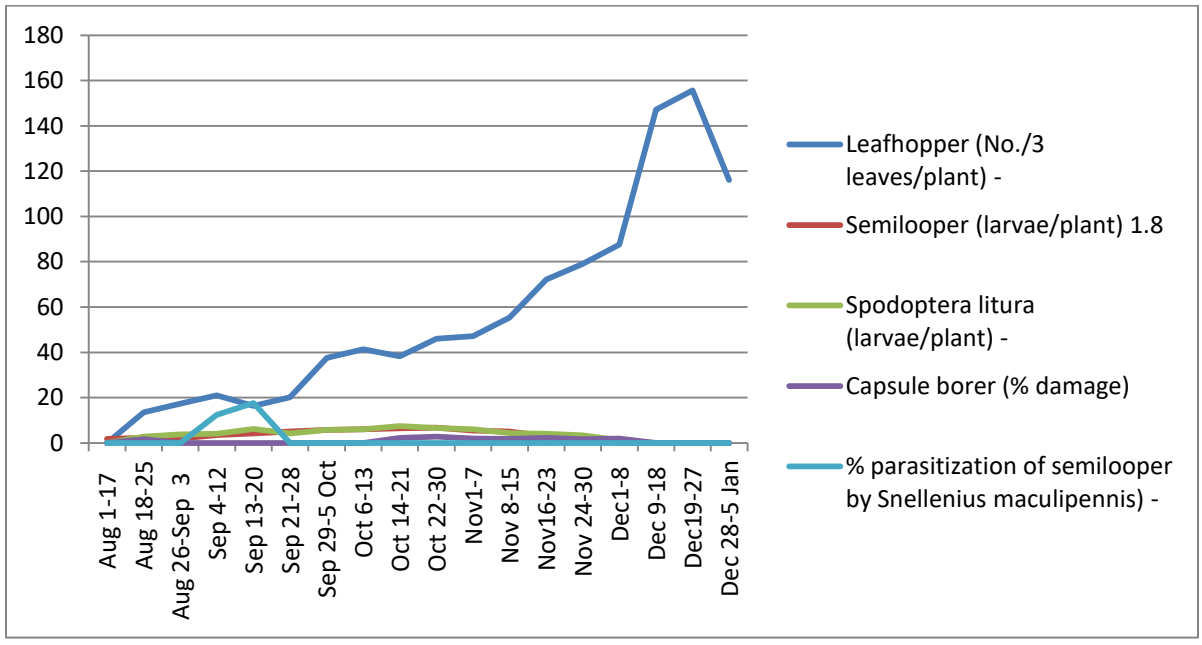

Fig:1 incidence of different pests of castor during 2020-21

Table 1. List of major insect pests observed on castor during 2020-21

S. No.	Insect pest	Scientific name	Family	Order

1	Semilooper	*Acathodelta janata* (Linnaeus)	Noctuidae	Lepidoptera
2	Tobacco caterpillar	*Spodoptera litura* (F.)	Noctuidae	Lepidoptera
3	Shoot and capsule borer	*Conogethespunctiferalis*(Guenn.)	Pyralidae	Lepidoptera
4	Leaf hopper	*Empoasca flavescens* (Fabricius)	Cicadellidae	Hemiptera

Table 2. Correlation analysis of major insect pests and natural enemies of castor with weather parameters(Palem, 2020-21)

Insect pests & natural enemies	Max. Temp. (^{O} C)	Mini. Temp. (^{O} C)	RH-1 (%)	RH-2 (%)	Rainfall (mm)
Leafhopper (No./3 leaves/plant)	0.48*	-0.59**	0.15	-0.56*	-0.60**
Semilooper (Larvae/plant)	0.17*	-0.13	-0.09	0.16	-0.17
Spodoptera (Larvae/plant)	0.24*	-0.14	-0.08	0.20	-0.20
Capsule damage due to capsule borer (%)	-0.49*	-0.55*	-0.16	-0.21	-0.34

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

CONCLUSION

Castor crop in southern Telangana Zone is minly grown as a rainfed crop in dry land areas thus weather plays a crucial role in crop growth and incidence of several pests on the crop. Rainfall during crop growth stage reduces the leafhopper incidence, maximum and minimum temperature mainly influnce the *S.litura* ,semilooper and capsule borer.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.

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COMPETING INTRESTS

Authors have declared that no competing interests exist.

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