Original Research Article

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

ABSTRACT

Study onPopulation dynamics of Castor insect pests 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. 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 production is 17.95 lakh tonnes (lt) during 2021-22 season, against 17.89 lt in 2020-21 Development of location-specific varieties and hybrids with appropriate crop production technologies led to increased production and productivity of the cropCastor is grown in areas where mean monthly temperature across the growing season ranges from 22.7 to34.3 ^{0}C. These temperatures are favorable for the castor insect pests. Incidence of different insect pests is observed throughout the crop growth period of castor causing severe economic losses.

More than 60 species of insects and mites 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 attacking the crop at all phenological stages and includes seedling pests, foliage feeders and inflorescence pests. The red hairy caterpillar in endemic areas, the defoliators, *viz.*, castor semilooper, Spodoptera and other hairy caterpillars, and sucking pests, such as jassid, whitefly, thrips and mites, cause huge damage to castor crop. An integrated approach is essential to control the insect pests of castor. 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 insect pests. This information will enable to find out the suitable weather conditions for particular pest incidence that helps to forewarn the farmers to take up preventive measures against insect pests. The present study aims to explore the population fluctuation pattern of insect pests on castor in relation to the weather parameters inSouthern Telangana Zone.

Comment [DSAHR1]: Introduction data is insufficient. Need to add more data and literature. You need to cite and take information from following papers
Effect of climate change on insect pests
(**The impact of climate change on agricultural insect pests**)
Measuring and modelling crop yield losses due to invasive insect pests under climate change

Comment [DSAHR2]: Take information from following paper
Need to explain insects' pests of various crops and yield losses, what are the eco-friendly approaches of insect pests' management . Take information from following paper
Environmentally-friendly landscape management improves **oilseed** rape yields by increasing pollinators and reducing **pests**
Development and evaluation of emulsifiable concentrate formulation containing Sophora alopecuroides L. extract for the novel management of Asian citrus psyllid
Efficacy of some selected synthetic chemical insecticides and bio-pesticides against cotton mealybug, Phenacoccus solenopsis Tinsley (Sternorrhyncha: Pseudococcidae) under agro

Comment [DSAHR3]: Aim of study needs to clear

MATERIALS AND METHODS

The investigation on population dynamics of major insect pests *viz*., semilopper, *Spodoptera*, capsule borer and leafhopper (Table 1) was carried out on castor hybrid PCH-111 at Regional AriculturalReserach Station, Palem during kharif 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 temperature, relative humidity and rainfall were obtained from AWS located at RARS, Palem. The correlation coefficients between weather parameters and pest incidence were worked using OPSTATsoftware.

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.

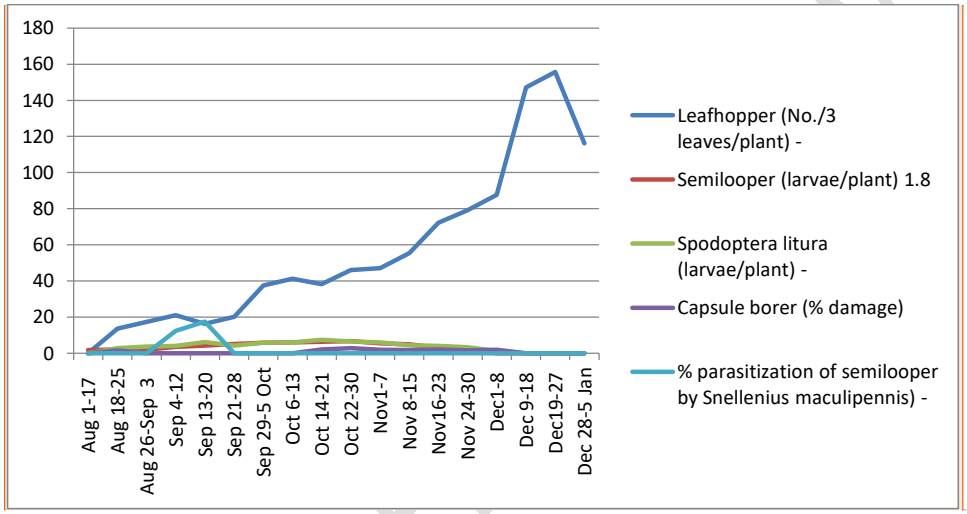
The activity of leafhoppers was started during the month of September ranging 13.6leafhoppers/3 leaves/plant maintained moderate infestation till November and a maximum of 155.7 leafhoppers/3 leaves/plant recorded during the second fortnight of December (19^{th}-27^{th} December) later declined by February. 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 rainfall (r=-0.60) had negative significant. This shows that leaf hoppers increases with increase in temperature and reduces with rainfall Ranganath*et al* 2021 reported leafhopper population had significant positive association with maximum daily temperature and positive correlation with minimum temperature. Jena and Kuila (1996) 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.

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). Suganthy 2007 &Anon.,2011reported initial infestation of semilooper has started from August and reached peek during october.Semilooper has a positive correlation with maximum temperature (r=0.17) which reveal that increase in temperature increases the insect activity

The activity of *Spodopteralitura* larvae was observed from second fortnight of August (18^{th} -25^{th} August) and was highest during second fortnight of October (14^{th}- 21^{st} 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. These variations might be due to weather parameters prevailing in that locality and sowing dates of the crop. *Spodopteralitura* exhibits positive significant relationship with maximum temperature (r=0.24)

which shows increase in temperature increases the insect population similar results were found by 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.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.Parasitization of semilooper by *Snelleniusmaculipennis* was observed only during the month of October as 12.4 and 17.6 per cent(table 2).



Comment [DSAHR4]: Figure quality and presentation is not good

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

CONCLUSION

The present study generated data on the population dynamics of insect pests on castor crop and the influence of weather parameters. As the castor crop is being grown as a rainfed crop in dry land areas and the probable incidence of these major pests need to be addressed with appropriate management strategies, particularly on the early stage crop till maturity for leaf hopper incidence, middle aged crop for semilooper and *S. litura*. During capsule formation stage capsule borer need to be managed**.**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.

Comment [DSAHR5]: Conclusion and future recommendation need to improve

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