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Influence of weather parameters on the population dynamics of sesbania thrips *(Caliothrips indicus* Bagnall) in groundnut in Saurashtra region

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ABSTRACT

Caliothrips indicus Bagnall commonly known as sesbania thrips is one of the serious pests of groundnut in Saurashtra region causing extensive losses. Regression analysis of populations of *Caliothrips indicus* for five consecutive years (1994-1998) at Junagadh in Saurashtra region of Gujarat were used to develop forecasting model in relation to weather parameters. Using regression equation the predicted values of occurrence of thrips were calculated from 1999 to 2002. There was minimum deviation between the actual and predicted values of thrips population during certain months, indicating the feasibility of predicting the population occurrence using the prevailing weather factors.

Key words: *Caliothrips indicus*, Weather parameters

Among the various pests attacking the groundnut crop, thrips species occur as a complex, starting from vegetative stage till harvest of the crop. The major thrips species attacking groundnut are *Scirtothrips dorsalis* Hood, *Frankliniella schultzei* Trybom, *Thrips palmi* Karny, *Megalurothrips usitatus* (Bagnall) and *Caliothrips indicus* Bagnell. The former three species are dominant in southern parts of India while the latter one is predominantly occurring in western India (Ranga Rao and Wightman, 1993; Nandagopal and Vasanta, 1991). All the species of the thrips are polyphagous in nature occurring in almost all the groundnut growing countries in Asia and cause extensive damage to the crop. However, since last few years the proportion of these species increased rapidly and caused severe damage to the groundnut crops in India both damaging the standing crop during the early vegetative stage and as vectors of viral diseases (Vijayalakshmi, 1994).

The species *Caliothrips indicus* is referred with scientific synonymous viz., *Selenothrips indicus* Begnall, *Hercothrips indicus and Heliothrips indicus.* Both adults and nymphs inhabit older leaves and feed on the upper surface. Feeding results in white spots or streaks. In severe infestations the plants are stunted with stippled leaves and ultimately such leaves get dry. High population of this species occurs during hot dry periods. The pest appears at the early stage of the crop and sometimes even 15 days after sowing. It builds up its population during dry spell of the *kharif* season, though it also appears during summer season. Upadhyay and Vyas (1983) recorded 28 and 22.5 per cent avoidable loss in *kharif* and summer seasons, respectively. Ghewande (1987) recorded the yield loss to the tune of 17 to 40 per cent in Gujarat. The *Caliothrips indicus* is reported to be a “menace” to groundnut, particularly in dry years (Ananthakrishnan,1973).

Detection of occurrence of the pest and its activities is essential to apply need based IPM strategy. However limited information is available on the incidence and survival of the this pest in relation to weather parameters in Saurashtra region. Hence the present investigation was taken up to ascertain the peak activity period and population build up of the this pest in relation to weather parameters.

MATERIALS AND METHODS

Field experiments were carried out for 5 years from 1994 to 1998 at NRCG, Junagadh, Gujarat. Groundnut was sown in the first week of every month from July to December in a 25 m^2 (5m X 5m) plot. The maximum and minimum temperatures (Tmax and Tmin.), morning and evening vapour pressure (Vpm. and Vpe.), morning and evening Relative humidity, (Rhm and Rhe), rainfall, rainy days and sunshine hours were recorded from a weather station located in the experimental site. The abundance of thrips was

Table 1: Correlation matrix of thrips population with weather parameters at Junagadh during month of July to Dec (1994-1998)

	Tmax	RHavg	Rainy days	Sunshine hours	Thrips
Tmax (X_1)	1.000				
RHavg (X_2)	-0.388	1.000			
Rainy days (X_3)	-0.457	0.735	1.000		
Sunshine hours (X_4)	0.492	-0.887	-0.742	1.000	
Thrips (Y)	**0.389**	**-0.321**	**-0.413**	**0.327**	**1.000**

Table 2: Mean monthly population of thrips (July to Dec) from 1999 to 2002

Month	1999		2000		2001		2002	
	Actual	**Predicted**	**Actual**	**Predicted**	**Actual**	**Predicted**	**Actual**	**Predicted**
July	6.2	3.3	1.0	4.0	1.8	2.0	2.8	5.1
Aug	5.3	4.3	4.0	4.0	1.8	2.0	30.0	3.8
Sept	4.2	5.4	2.0	6.0	8.6	5.0	5.0	5.8
Oct	5.3	6.1	13.0	7.0	5.8	7.0	5.5	8.2
Nov	3.0	6.1	13.0	7.0	6.0	7.0	10.3	6.8
Dec	2.5	5.2	8.0	6.0	10.3	6.0	13.5	5.9
Mean	4.4	5.1	7.0	6.0	5.7	5.0	11.2	5.9

recorded by sweep net.

Inter relationships between the pest population and previous week weather parameters were worked out using MSTAT software. t' test was applied to these correlations at 5 % level. Step wise regression technique was applied when more than one weather parameter have been found significantly correlated (5% level) with thrips incidence and prediction equation was worked out. Using the regression equation predicted thrips population were worked out for the next four years i.e. from 1999 to 2002 and compared with the actual population of thrips.

RESULTS AND DISCUSSION

Correlation matrix of thrips population with weather parameters was given in table 1. During the experimental period, temperature and relative humidity played a major role in the population fluctuations. The maximum temperature was positively correlated ($r = 0.38$) with thrips population and it was negatively correlated with average RH ($r = -0.32$) and rainy days ($r = -0.41$). Whereas sunshine hours has a positive correlation ($r = 0.32$) with thrips population. Similarly, Shivasharanayya Nagaraju (2003) observed a positive correlation for the mean number of thrips on sunflower with maximum and minimum temperatures, bright sunshine hours and disease incidence.

High humidity more than (70 % Rh) coupled with dry spell about a week time favoured the heavy build up of thrips *C. indicus* population. Populations of *Caliothrips indicus* had a positive correlation with temperature, sunshine, rainfall and morning relative humidity and a negative correlation with evening relative humidity and wind speed (Jayanthi *et al.*, 1993).

Besides abiotic factors, there are several other crop factors such as sowing time, age of the crop, initial larval population, presence of natural enemies, other agronomical practices that influence the abundance of thrips population. The stepwise regression technique was followed to develop the prediction equation for population buildup of groundnut pests at Anand, Gujarat (Shekh *et al.*, 1999). The module developed seem to be very difficult as too many parameters (eight) were considered for developing the module, which in general would be very difficult to fit in and predict the populations.

Since the interaction of climatic factors is complex the stepwise analysis resulted in one or two or three independent factors as maximum temperature, average relative humidity, rainy days and sunshine hours for the dependent factor (thrips population). The correlation and regression coefficient analysis clearly indicated that the population build up was dependent on abiotic factors. From the results it may be concluded that it is difficult to find out the direct cause and effect relationship between any single climatic factor and pest activity. The impact of weather factors on pest are usually compounding. The coefficient of determination (R^2) between the thrips population and weather parameters was 0.47. It was very clear that the combination of weather factors would determine the population level up to 47 per cent. Following would be the forecasting model (regression equation) for thrips population based on weather parameters.

$$\text{Thrips (Y)} = -5.54 + 0.41X_1 - 0.02X_2 - 0.62X_3 - 0.14X_4$$

Where
x_1 = Maximum temperature
x_2 = Average relative humidity
x_3 = Rainy days
x_4 = Bright hours of sun shine

Based on the forecasting model, the predicted values of thrips population were worked out from 1999 to 2002 (Table 2). There was minimum deviation between the actual and predicted values during certain months indicating that abiotic factors can be of significant use in predicting population build up of this pest. Forecasting of population size and phenological occurrence of pests has long been to be a central feature of pest management. The rationale is that control tactics can be better targeted if the timing of peak pest abundance can be forecasted based on the weather parameters. More over the cost of making forecast is relatively small.

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