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Population dynamics of leaf eating caterpillar *Spodoptera litura* (Fab.) in relation to weather parameters in groundnut in south Saurashtra region

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ABSTRACT

Spodoptera litura (F.) commonly known as the leaf-eating caterpillar is one of the serious pests of groundnut in Saurashtra region causing extensive losses. Regression analysis of pheromone catches of *S. litura* for nine consecutive years (1991-1999) at Junagadh, Gujarat was used to predict the population dynamics of *S.litura* in relation to weather parameters. There was no significant difference between the actual and predicted values of moth catches for certain standard weeks, indicating the feasibility of predicting the population occurrence using the prevailing weather factors.

Key words: *Spodoptera litura*, Weather parameters

Spodoptera litura (F.) commonly known as the tobacco caterpillar is one of the serious pests of groundnut. This pest has been reported from 51 countries causing damage to more than 120 species of plants belonging to 44 families. In India it feeds on 74 species of cultivated crops and some wild plants. Besides groundnut, it attacks tobacco, cotton *(Gossypium spp.)*, pulses and several vegetables crops (Singh and Jalali, 1997). It has been reported that an infestation level of one larva/plant during the seedling or flowering stage can result in 20% yield loss in groundnut. Severe outbreak of the pest can result in 30-40% loss in pod formation. However, there were a number of instances where total crop failures were reported despite intensive pest management practices (Wightman and Ranga Rao, 1993). The outbreak is initiated by heavy rainfall after the dry spell lasting for 4-7 days under north Indian condition. Favorable weather conditions like heavy rainfall following a prolonged dry spell can contribute to outbreak of *S. litura* (Chelliah, 1985).

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 *spodoptera* male moth catch in pheromone trap. The stepwise regression technique was followed to develop the prediction equation for population buildup of groundnut insect 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.

Detection of occurrence of the pest and its activities is essential to apply need based IPM strategy. Effect of weather parameters on the pest population out breaks have been worked out by many workers (Patil *et al.*, 1992; Nandihalli *et al.*, 1989 and Chaudhari *et al.*, 1999). However limited information is available on the incidence and survival of the pest in relation to weather parameters in south Saurashtra agro-climate region. Hence the present investigation was taken up to ascertain the peak activity period and population build up of *S. litura* in relation to weather parameters, which could help in the management of this pest effectively.

MATERIALS AND METHODS

Field experiments were carried out for 9 years from 1991 to 1999 at National Research Centre for Groundnut (NRCG), Junagadh. Cultivated varieties of groundnut such as GG-2 and GG-20 were sown in 10 to 15 hectares during rainy season followed by sowing of cv. GG-2 in the first week of every month in a 25 m^2 area to continue the monitoring of male moths. Commercially available *S. litura* pheromone (spodolure) (ZE) 9,11 tetradecadienyl acetate and (ZE) 9,12 tetradecadienyl in the ratio 9: 1 was used for monitoring adult male moths. Two Pheromone traps baited with spodolure were installed at 1m height. The maximum and minimum temperatures, morning and evening vapour pressure, morning and evening relative humidity, rainfall, rainy days and sunshine hours were recorded from a weather station located in the experimental site along with weekly male moth catches of *S. litura*.

Statistical tools were used to work out the inter relationship between the pest population and weather parameters. Statistical analysis were made using MSTAT sofware. t' test was applied to test the significance of these correlations at 5% level. Step wise regression technique was applied when more than one weather parameter have been found to be significantly correlated (5% level) with *S. litura* moth catch. Based on the correlation data, regression equation along with the multiple correlation coefficients were worked out.

RESULTS AND DISCUSSION

The incidence of *S.litura* male moths was abundant during the crop season and reached peak from August to September. The multiple correlation and regression of male moth population with weather parameters are given in Table 1. During the experimental period, temperature and relative humidity played a major role in the population fluctuations. Results of the cumulative data correlation showed that the population of *S. litura* was found to have significant and positive correlation with maximum temperature and sunshine hours whereas minimum temperature, morning vapour pressure, evening vapour pressure and morning RH showed negative

Table 1: Correlation between *Spodoptera litura* population and weather parameter at Junagadh

Weather Parameters	Correlation coefficient
Max temperature	0.413
Min. temperature	-0.402
Vapour pressure (morning)	-0.440
Relative humidity (morning)	-0.411
Relative humidity (evening)	-0.504
Sunshine hours	0.520

Multiple correlation co-efficient (R) = 0.63

Table 2: Actual and predicted populations of *S.litura*

Year/std wk	Actual population	Predicted population
1991-31	6.5	5.8
32	12.5	15.1
38	83.0	81.7
1992-36	14.0	15.5
1994-40	106.5	102.0
41	96.5	94.2
42	93.5	92.9
1995-32	7.0	6.5
1996-31	1.5	2.4
1997-27	5.5	4.9
33	7.5	7.0
1998-30	4.0	4.4
35	14.5	16.4
1999-30	8	9.4
31	5.5	4.2
32	5	7.2

correlation. These findings were in concurrence with the reports of Malik and Parihar (1996) and Dhawan and Simwat (1996). During this period, maximum temperature on an average ranged from 27.9°C to 38.3°C, morning RH from 52% to 99%, evening RH from 20% to 98% and rainfall from 0 to 29 mm.

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 pheromone catches of *S. litura* and weather parameters was 28.5. Following would be the forecasting model (regression equation) was developed for pheromone catches of *S.litura* based on weather parameters from 1991to 1999 in Saurashtra region.

$$S.\ litura = 224.25 - 4.68X_1 - 1.11X_2 + 8.71X_3$$

where

X_1 = Maximum temperature

X_2 = Evening relative humidity

X_3 = Bright hours of sun shine

Based on the prediction equation, the actual and predicted values of the moth catches were worked out (Table 2). There was no significant difference between the actual and predicted values indicating that abiotic factors can be of significant use in

predicting population build up of this pest. In practical application, the forecast incidence of the third generation of the bollworm between 1994 to 1998 was in conformity with the actual incidence.

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