RESEARCH ARTICLE

Determination of Economic Injury Level (EIL) for leaf webber and capsule borer, *A. catalaunalis* (Duponchel) in sesamum

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ABSTRACT

A field trial was conducted at Agronomy Instructional Farm, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar (Gujarat) - 385 506 during *kharif* 2012 and 2013 on Gujarat *Til* 2 variety. The correlation coefficient between the larval population and yield was found highly significant and relationship was found negative during both the years. The regression equation showed that the yield of sesamum seeds was reduced by 0.5730 and 0.4383 q/ha for every increase of one larvae/quadrate during *kharif* 2012 and 2013. The economic injury level at 40 days after germination *i.e.,* at pod initiation stage was found 0.26 and 0.23 larvae/quadrate for sesamum during *kharif* 2012 and 2013, respectively.

Key words: Economic Injury Level, *A. catalaunalis* and sesamum.

INTRODUCTION

Sesamum popularly known as til, sesame and gingelly is important edible oil seed crop in India and called the "Queen of Oilseed crops". Sesame is being cultivated in an area of about 1.73 million hectare with a production of 7.39 million tones and productivity of 345 kg/ha (Anon., 2009). In Gujarat, it occupies an area of about 2.26 lakh hectares with production of 0.89 lakh mt and productivity of 414 kg/ha in *kharif* 2010-2011 (Anon., 2012). Sesamum is infested by as many as 29 insect pests among that the leaf webber and capsule borer, *A. catalaunalis* is the key pests and capable to cause complete failure of the crop as it attacks the plant in all growth stages except roots. According to (Stern *et al.*, 1959) EIL is the lowest pest population density that will caused economic damage. It is the level at which damage can no longer be tolerated and therefore, at that point or before reaching that level, it is desirable to initiate deliberate control operation.

MATERIALS AND METHODS

A field trial was conducted at Agronomy Instructional Farm, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar (Gujarat) - 385 506 during *kharif* 2012 and 2013 on Gujarat *Til* 2 variety. The experiment was laid out in Randomized Block Design with nine treatments

including control having three replications. The treatments including infestation levels *viz.,*0, 1, 2, 3, 4, 5, 6, 7, and 8 larvae per plant.

For stock culture of the pest, late instar larvae of *A. catalaunalis* were collected from sesamum crop and brought to the laboratory for rearing. The larvae were kept in the plastic jar (20 cm x 16 cm) up to pupation. The larvae were provided with fresh food *viz.,* tender leaves and flowers as their diet. The plastic jar clean every day to maintain sanitation and fresh diet was provided daily according to need. The top of plastic jar was covered with a piece of fine muslin cloth with the help of rubber band. After pupation of larvae in silken cocoon, they all were collected and placed in a petri dish. The petri dish was kept inside the wooden rearing cage (35 cm x 35 cm x 35 cm) for the emergence of the adults. A tender twig and inflorescence of sesamum were placed inside the cage for oviposition and resting of moths. To maintain turgidity, the cut end of the twig was wrapped with cotton plug soaked in water and then placed in each petri dish. A swab of absorbent sponge dipped in 5 % honey solution was kept in rearing cage as a food for adults. The twigs were changed daily and the eggs laid on them were carefully collected by moistened camel hair brush and placed in the Petri dishes (7.5 cm x 2.0 cm) for hatching. The larvae thus obtained were used for artificial release in economic injury trials.

In each plot screen cages with a dimension of 1 m x 1 m x 1 m was erected. Twelve plants were covered under each cage. A window was kept at one side of the cage had an opening for releasing the larvae. The plants in screen cages were infested artificially with first instar larvae (1 to 2 days old). According to treatment, the number of larvae were transferred by means of soft camel hair brush. The plants were artificially infested at 40 days after germination (at pod initiation stage). After introducing the larvae, window of the cages were closed and the bottom of the cages were sealed with mud to prevent entry of other insects. Plants were periodically observed for pre and post infestation of other pests. The plots not under treatment were kept free from insect infestation by spraying profenofos 50 EC, 0.05 % at an interval of 15 days before infestation and also 15 days after the larvae pupated on the treated plants. The larvae soon after infestation started webbing the leaves, feeding on flowers and boring to the pods. After the larvae pupated, the cages were removed. The use of screen cages did not adversely affect the plant growth.

The plants were harvested, labelled, depodded and dried separately. Later, the data on the weight per quadrate were recorded and statistically analysed to know the impact on the number of larvae per quadrate causing the loss to the crop. Relationship between the larval density and the reduction in yield was worked out by correlation coefficient and regression equations. Finally, the economic injury level for sesamum leaf webber and capsule borer was calculate by fitting regression equation Y = a + bx, between the larval density and reduction in yield.

The EIL was computed based on the procedure given by Stone and Pedigo (1972) and modified by Ongulana and Pedigo (1974) using the following formula.

$$\text{EIL} = \frac{\text{Grain threshold}}{\text{Yield reduction per larvae}}$$

$$\text{Grain threshold} = \frac{\text{Management cost (Rs/ha)}}{\text{Market value of grain (Rs/q)}}$$

RESULT AND DISCUSSION

The relationship between the number of sesamum leaf webber larvae (0, 1, 2, 3, 4, 5, 6, 7 and 8 larvae per one square meter quadrate) and yield per hectare, when plants were infested at 40 days after germination in Gujarat *Til* 2 variety during *kharif* 2012 and 2013 was determined by obtained correlation coefficient values and regression equation by statistical analysis. Perusal of the data for *kharif* 2012 presented in Table 1 revealed that the correlation coefficient between larval population and yield was found highly significant and relationship was found negative. The regression equation (Table 1 and Fig. 1) showed that the yield of sesamum seeds was reduced by 0.5730 q/ha for every increase of one larvae/quadrate. The economic injury level at 40 days after germination *i.e.,* at pod initiation stage was found 0.26 larvae/quadrate for sesamum variety Gujarat *Til* 2 during *kharif* 2012. As the larval population per quadrate increased, the rate of reduction in yield (q/ha) per larva was also found to be smaller.

Similarly perusal of the data for *kharif* 2013 presented in Table 2 revealed that the correlation coefficient

Table 1: Effect of *A. catalaunalis* infestation (artificial release) at 40 days after germination on yield per hectare of sesamum during *kharif* 2012

Number of larvae/quadrate (1m x 1m)	Weight of seeds/ quadrate (g)	Yield (q/ha)	Reduction in weight of seeds/ larva (g)	Reduction in yield/ larva (q/ha)
0	57.20	5.72	--	--
1	53.13	5.31	4.07	0.41
2	48.61	4.86	4.52	0.45
3	42.34	4.23	6.27	0.63
4	37.50	3.75	4.84	0.48
5	32.13	3.21	5.37	0.54
6	25.61	2.56	6.52	0.65
7	18.70	1.87	6.91	0.69
8	11.12	1.11	7.58	0.76

Correlation of coefficient (r) = - 0.9963
Coefficient of determination (R^2) = 0.9926
Regression

$$\hat{Y} = 5.9164 - 0.5730\ X$$

** Significant at 0.01 level

$$\text{Economic injury level} = \frac{\text{Gain threshold}}{\text{Yield reduction per larva}} = \frac{0.15}{0.5730}$$

= 0.26 larvae/quadrate

$$\text{Where, Gain threshold} = \frac{\text{Cost of pest control(Rs/ha)}}{\text{Market value of produce}} = \frac{1020}{7000} = 0.15$$

Table 2: Effect of *A. catalaunalis* infestation (artificial release) at 40 days after germination on yield per hectare of sesamum during *kharif* 2013

Number of larvae/quadrate (1m x 1m)	Weight of seeds/ quadrate (g)	Yield (q/ha)	Reduction in weight of seeds/ larva (g)	Reduction in yield/ larva (q/ha)
0	41.10	4.11	--	--
1	37.06	3.71	4.04	0.40
2	32.31	3.23	4.75	0.48
3	27.82	2.78	4.49	0.45
4	23.43	2.34	4.39	0.44
5	18.63	1.86	4.80	0.48
6	13.71	1.37	4.92	0.49
7	10.12	1.01	3.59	0.36
8	7.20	0.72	2.92	0.29

Correlation of coefficient (r) = - 0.9986
Coefficient of determination (R^2) = 0.9973
Regression

$$\hat{Y} = 4.1011 - 0.4383\ X$$

** Significant at 0.01 level

$$\text{Economic injury level} = \frac{\text{Gain threshold}}{\text{Yield reduction per larva}} = \frac{0.10}{0.4388}$$

= 0.23 larvae/quadrate

$$\text{Where, Gain threshold} = \frac{\text{Cost of pest control(Rs/ha)}}{\text{Market value of produce}} = \frac{1020}{10500} = 0.10$$

between larval population and yield was found highly significant and the relationship was found negative. The regression equation (Table 2 and Fig. 2) showed that the yield of sesamum seeds was reduced by 0.4383 q/ha for every increase of one larvae/quadrate. The economic injury level at 40 days after germination *i.e.,* at pod initiation stage was found 0.23 larvae/quadrate for sesamum variety Gujarat *Til* 2 during *kharif* 2013. As the larval population per quadrate increased, the rate of reduction in yield (q/ha) per larva was also found smaller.The method suggested by Stone and Pedigo (1972) mainly depends on the market price of the produce and cost of plant protection, as a result EIL varies from time to time, crop to crop and locality to locality. The difference in the present findings from earlier reports may be due to this reason.

This indicated that the EIL was directly related to the cost of control measures and inversely related to the market price of sesame. It helped the decision marker *i.e.,* if the cost of plant protection was more, it was profitable only when the damage caused by the pest was higher enough to justify its use. On the other hand if the market price of produce was higher, costlier control measures even could be applied at low damage levels, but when the price was low, it was not advisable to use any control unless the damage was sufficient high meet the cost of control measures.

It concluded that EIL is a dynamic parameter, varying with a number of factors. For a given variety in a particular geographical area, the EIL will change with any change in (i) the market value of the crop (ii) cost of plant protection (iii) the environment of the plant and pest.

The present findings were contrary to Bharodia (1997) who reported the economic injury level of 1.01 and 1.18 larvae/quadrate of *A. catalaunalis* in sesamum at 40 days after germination *i.e.,* at pod initiation stage obtained with monocrotophos 0.04 per cent during *kharif* 1995 and 1996, respectively. Manisegaran *et al.* (2002) reported that for increase in 1 larvae/m^2 the yield loss was 18 to 200 kg/ha during vegetative and reproductive stage of the crop.

REFERENCES

Anonymous (2009) *Annual report of AICOR, sesame and Niger,* AICRP, JNKVV, Jabalpur. pp. 71-72.

Anonymous (2012) District wise area, production and yield per hectare of important food and non-food crops in Gujarat state, 2008-09, 2009-10 and 2010-11. Directorate of Agriculture, Krushibhavan, Gandhinagar. pp. 26.

Bharodia RK (1997) Integrated approaches for the management of *Antigastra catalaunalis* (Duponchel) along with population dynamics and varietal susceptibility of *Asphondylia sesami* Felt on sesamum. M.Sc. (Agri.) *Thesis* submitted to Gujarat Agricultural University, Junagadh.

Manisegaran S, Manimegalai N, Pushpa J and Mohammed Naina SE (2002) Estimation of yield loss and determination of economic threshold of sesame shoot webber and capsule borer, *Antigastra catalaunalis* (Duponchel). *J. Oilseeds Res.,* 19(1): 146-147.

Stern VM, Smith RF, Vanden Bosch R and Hagen KS (1959) The integrated control concept. *Hilgarda,* 29(2): 81-101.

Stone JD and Pedigo LP (1972) Development and economic injury level of green clover worm on soybean in Iowa. *J. Econ. Entomol.,* 65 (1): 197-201.