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ESTIMATION OF DAMAGE LEVELS OF LEAF DEFOLIATOR *CATOPSILIA PYRANTHE*, IN INDIAN SENNA *CASSIA ANGUSTIFOLIA* VAHL.

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ABSTRACT

The larvae of the mottled emigrant butterfly *Catopsilia pyranthe* has been reported as a major defoliator in Indian Senna, *Cassia angustifolia* Vahl where it can causes economic damage to the leaves which is internationally and widely accepted for its medicinal laxative properties. Field experiments were carried out at Directorate of Medicinal and Aromatic Plants Research, Boriavi Anand to find out the larval population of the pest at which economic yield loss can occur. The economic threshold levels (ETL) of the pest were determined in the Senna crop at 45 days after sowing (DAS) and at 75 DAS. At 45 DAS, the ETL level was found to be 3.3 larvae/plant and at 75 DAS 7.9 larvae /plant. Thus, finding the economic threshold level of a pest practically gives an insight about the timely intervention of the management practices.

INTRODUCTION

Indian Senna (*Cassia angustifolia* Vahl), is a perennial shrub of high medicinal importance belongs to the family Caesalpiniaceae. The leaves and pods are the economic parts, containing sennosides which are responsible for its laxative properties. It is commercially cultivated in about 20,000 ha land (Paul and Dasgupta, 2014) in Jodhpur (Rajasthan), Mehasana (Gujarat), Tirunelveli, Ramanthapuram and Madurai districts (Tamil Nadu), parts of Karnataka, Andhra Pradesh and Maharashtra producing 10,000 Metric tonnes of leaves (Planning commission report, GOI, 2007). India earns approximately 7.63 million US dollars from export of senna leaves and pods (Uniyal., 2005).

Catopsilia pyranthe, the mottled emigrant butterfly has been reported as a major defoliator of Senna when cultivated in North India (Singh *et al.,* 1984). Chaudhary and Sharavanan, (2009) reported that this pest is regular throughout the year on Senna and is a major pest in the Charotar area (Anand) of Gujarat. Eggs are laid singly on young, soft and light green leaves at the terminal parts of growing stem (Atluri *et al.,* 2012). The fourth and fifth instar larvae consume more food, egested more faeces and gained more weight than other instars (Atluri *et al.,* 2003). Till today, there are no comprehensive management strategies for this pest; most of the control measures carried out against this green caterpillar was the manipulation of planting time to avoid its occurrence and the use of chemical insecticides which leaves residue in the raw material causing health hazards and also having adverse effect on the export potential of this crop (Singh *et al.,* 1984). Hence, there is an urgent need to develop an Integrated Pest Management (IPM) module for managing this important pest of Senna so as to reduce the yield loss without reduction in quality of leaves.

Economic threshold levels (ETL) are the key stone of IPM programmes. Sensible pesticide use is possible only with an understanding of the insect population level that causes economic damage. Similar ETL studies had been conducted by authors in various other high value crops like cotton, pulses etc (Dhawan *et al.,* 2014, Ragsdale *et al.,* 2007, Zahid *et al.,* 2007) . In medicinal plants the study is more relevant since untimely and unwanted use of plant protection chemicals can lead to the residue problems which are having zero tolerance in the international market. Therefore, the present experiment is carried out to fix the ETL (economic threshold level) of this pest which in turn will help in developing an integrated pest management (IPM) module in Senna. These pest management strategies will serve as a component of the GAP (Good Agricultural Practices) protocol for senna cultivation.

MATERIALS AND METHODS

A field experiment was laid out at Randomized block design with three replications. Seeds of senna variety AFLT 2 were sown during second week of June 2013 in plots of size 20m^2 at spacing of 45 × 30 cm.

The methods of artificial infestation (Pedigo, 2002) by different levels of larval population were followed to establish economic threshold levels (ETL) of *Catopsilia pyranthe*. The ETL was estimated twice at vegetative stage *i.e.* 45 DAS (days after sowing) and at 75 DAS. Different larval densities were released at 45 days after sowing (DAS) (0 larvae/ plant, 1 larvae/ plant, 2 larvae/ plant, 3 larvae/ plant, 4 larvae/ plant, 5 larvae/ plant, 6 larvae/ plant, 7 larvae/ plant) and at 75 DAS (0 larvae/plant, 5 larvae/ plant, 7 larvae/ plant, 10 larvae/ plant,12 larvae/ plant) in separate experiments. The plants used for larval release were covered with nylon mesh cages of size 1m × 1m × 1.5 m to avoid natural infestation. The cages were designed in such a way that they did not interrupt ventilation and aeration to growing plants inside. Care was taken to check the escape or entry of larvae. These nylon cages were erected in supporting poles and regular monitoring was made through entry point purposely kept and held in position by Velcro tapes. The third instar larvae were released at 45 DAS and at 75 DAS. The released larvae were monitored daily for their feeding

Relationship between per cent leaf damage and larval intensity was worked out by correlation and regression equations. Harvesting of senna leaves were done at 90 DAS and at 120 DAS. Yield data was converted in to kg/ha. Yield loss due to different treatments was derived by deducting the yield of respective treatment from the yield of control (where no larvae were released). The value of yield loss was determined according to the market price of senna. Seventy five per cent of yield loss was considered to avoid with insecticidal treatment hence it was taken as avoidable loss or yield saved. Economic Injury level was calculated by fitting regression equation Y= a+bx (x and y are coordinates of the line, a = y intercept b =slope of line) between larval population levels and benefit cost ratio. The larval density corresponding to unit benefit cost ratio was taken as economic injury level and economic threshold level was set as 75% of EIL (Pedigo, 2002).

RESULTS AND DISCUSSION

The economic threshold level was estimated at two periods of the vegetative stage *ie* at 45 DAS and at 75 DAS. Per cent leaf damage and yield reduction over control was worked out at different larval densities and presented in Table 1 and 2.

Economic threshold level of *C. pyranthe* at 45 DAS

At 45 DAS, the percent leaf damage was maximum (82.12 %) when 7 larvae were released per plant and minimum (23.37 %) when a single larva was released. At harvest (at 90 DAS) the average leaf yield obtained from maximum larval infestation (7 larvae / plant) is 2.83g (dry wt). The control plants (0 larvae /plants) recorded an average dry weight yield of 44.9 g/ plant. The other treatments *ie,* 1 larvae/ plant, 2 larvae/ plant, 3 larvae/ plant, 4 larvae/ plant, 5 larvae/ plant, 6 larvae/ plant recorded 39.73g, 29.17g, 24.17g, 20.33g,13.17g, 8.33g dry leaves respectively (Table 1).

The per cent yield reduction over control was worked out for all the treatments and leanier regression was used to relate yield reduction to larval density (Fig. 1) and slope (b) and intercept (a) were worked out. The regression equation obtained from the graph is Y= 2.48+ 13.35 X and the R^2 was find out to be 0.98. Economic Injury Level (EIL) was calculated based on the methodology of Pedigo, (2002) which is given below.

Gain threshold	=	C/V
C	=	Cost of management per hectare (taken as 1800 Rs/ha)
V	=	Market value per unit of produce (taken as 30 Rs/kg)
b	=	yield loss per insect (slope of line taken from regression equation)
EIL	=	Gain threshold /b
ETL	=	75% of EIL.

The Economic threshold level of *Catopsilia pyranthe* at 45 DAS is 3.3 larvae per plant.

Economic threshold of *C. pyranthe* at 75 DAS

At 75 DAS the per cent leaf damage was maximum (40.15 %) when 12 larvae were released per plant and minimum (26.9 %) when a single larva was released. At harvest (at 120 DAS) the average leaf yield obtained from maximum larval infestation (12 larvae / plant) is 22 g (dry wt). The control plants (0 larvae /plants) recorded an average dry weight yield of 51 g/ plant. The other treatments *ie,* 5 larvae/ plant, 7 larvae/ plant, 10 larvae/ plant recorded 37.5 g, 31g, 28g dry weight respectively (Table 2) .

The per cent yield reduction over control was worked out for all the treatments and the leanier regression was used to relate yield reduction to larval density (Fig. 2) and slope (b) and intercept (a) were worked out. The regression equation obtained from the graph is Y= 2.2+5.67X and the R^2 was find out to be 0.98. The same methodology described above for 45 DAS by Pedigo (2002) was used to calculate the ETL. The ETL at 75 DAS was worked out to be 7.4 larvae per plant.

Limited research has been conducted in the pest management of medicinal plants and there is no literature available

Table 1: Economic threshold level of *C. pyranthe* at 45 DAS

No of larvae released per plant	Per centLeaf damage	Leaf yield Dry wt (g/plant)	Per cent yield reductionover control	Coefficient of determination(R^2)	Regression equation
0	0	44.9	0	0.98	Y=2.48+ 13.35X
1	23.4	39.7	11.5		
2	31.4	29.2	35.0		
3	41.2	24.2	46.2		
4	49.1	20.3	55.2		
5	61.1	13.2	70.7		
6	77.3	8.3	81.5		
7	82.1	2.8	93.7		

Table 2: Economic threshold level of *C. pyranthe* at 75 DAS

No of larvae released per plant	Per cent Leaf Damage	Leaf yield Dry Wt (g/plant)	Per cent Yield Reduction over control	Coefficient of determination (R^2)	Regression equation
0	0	51	0	0.98	Y= 2.2x+5.67x
5	26.9	37.5	26.47		
7	32.7	31	39.21		
10	36.6	28	45.09		
12	40.15	22	56.86		

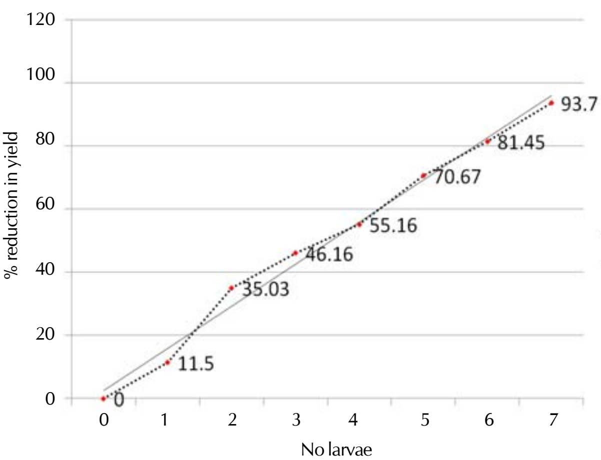

Figure 1: Linear regression graph that relate no: of larvae (released at 45 DAS) to yield reduction

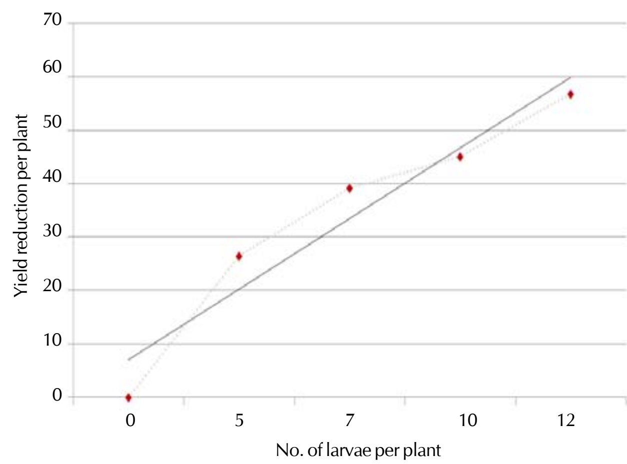

Figure 2: Linear regression graph that relate no: of larvae (released at 75 DAS) to yield reduction

regarding the estimation of economic threshold levels of pests in medicinal plants. But there are many reports on the estimation of ETL of various insect pests in various other crops like pulses, soybean, cotton etc (Dhawan *et al.,* 2014), Zahid *et al.,* 2007). The reason for this less attention in medicinal plants may be due to reduced area of cultivation, lower prize and highly fluctuating market rates and ignorance as compared to food crops. But now, WHO had developed guidelines to promote the safety and quality of medicinal plant materials through Good Agricultural Practices. Good Agricultural Practices in medicinal plants cultivation emphasize the need of managing pest and diseases that leave no harmful residues in the end product. So the present investigation is very much needed for the timely and need based management in Indian senna.

REFERENCES

Atluri, J. B., Sandhya deepika, D., Bhupathirayalu, M. and Chinna Rao, K. 2012. Host plant utilization by butterflies at Visakhapatnam. *Bioscan*. **7(1):** 85-90.

Atluri J. B., Vankatta Ramana S. P. and Subba Reddi C. 2004. Ecobiology of the tropical pierid butterfly *Catopsilia pyranthe*. *Current Science*. **86(3):** 457-463.

Chaudhary, V. and Saravanan, L. 2009. Studies of population dynamics of *Catopsilia pyranthe* on Indian Senna in Gujarat. *In. Proceedings of International Conference on Nurturing Arid Zones for people and Environment*. The Issues and agenda for 21st century, organized by Arid zone Association of India, CAZRI Jodhpur, 24-28. Dec 2009. pp. 114-115.

Dhavan S. P, Wadaskar, R. M. and Patil, S. C. 2014. Assessment of Economic Threshold level for blister beetles (*Mylabris phalerata*) on Green gram. *Indian J. Ecology*. **41(2):** 304-306.

Paul, P. C. and Das Gupta, B. 2014. A new report of tip blight and leaf spot of *Acorus calamus* caused by *Nigrospora oryzae* from West Bengal, India. *The Bioscan*. **9(1):** 355-357.

Pedigo L. P. 2002. *Entomology and Pest Management*. *Prentice-Hall of India Private Limited*. New Delhi 110001. pp. 260-261.

Planning Commission 2007. Report of the working group on horticulture, plantation crops and organic farming for the XI five year plan (2007-12). Planning commission, Government of India, New Delhi, 2007.

Ragsdale, D. W., Mc Cornack, B. P., Venette, R. C., Potter, B. D., Macrae, I. V., Hodgson, E. W., O'Neal, M. E., Johnson, K. D., O'Neil, R. J., Difonzo, C. D., Hunt, T. E., Glogoza, P. A. and Cullen, E. M. 2007. Economic threshold of Soybean Aphid (Hemiptera: Aphididae). *J. Economic Entomology*. **100(4):** 1258-1267.

Singh, D., Tripathi, A. K. and Rao, S. M. 1984. Sowing time of Indian Senna in relation to the management of the larvae of *Catopsilia pyranthe* Linn. *Indian J. Agricultural Sciences*. **54(12):** 1073-1075.

Uniyal, R. C. 2005. Export potential of medicinal, aromatic and dye plants, *Medplant network News*. **5(3):** 1-3.

Zahid, M. A., Isiam, M. M., Reza, M. H., Prodhan, M. H. Z. and Rumana, B. 2008. Determination of economic injury level of *Helicoverpa armigera* (Hubner) in Chick Pea. *Bangladesh J. Agricultural Research*. **33(3):** 555-563.