



Determination of Economic Threshold Level (Etl) of Safflower Aphid, *Uroleucon Compositae* (Theobald)

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Abstract

A field experiment was conducted to determine the economic threshold level of safflower aphid, *Uroleucon compositae* (Theobald) in rabi season of 2016. The results revealed that, the economic injury level (EIL) of safflower aphid was found to be 66.44 aphids on 5 cm apical twig per plant. The economic threshold level (ETL) of safflower aphid was worked out as 49.8 aphids on 5 cm apical twig per plant. The correlation coefficient between aphid population and seed yield of safflower was negatively related, $r = (- 0.97)$ and $b = (- 0.09)$ in agro climatic region of Nagpur, Maharashtra.

Key words *Uroleucon compositae* (Theobald), Economic injury level, Economic threshold level, Safflower.

Introduction

Safflower (*Carthamus tinctorius*L.) is an important rabi oilseed crop with multipurpose use, unexploited potential and world adaptability. Mainly the safflower has been cultivated for the vegetable oil extraction from its seeds. The crop is grown mostly at rainfed conditions in parts of India. A total of 101 insect pests have been recorded on safflower, of these, the safflower aphid, *Uroleucon Compositae* (Theobald) is one of the most destructive pests. Seed and oil content losses due to this pest ranges from 20 to 80 per cent which has been reported from different parts of country [1]. Nymphs as well as adults suck the cell sap from the lower surface of the leaves and tender shoots and impair the vitality of the plants. EIL and ETL are considered as most important aspect in the pest management decisions. Many researchers reported the importance of EIL and ETL in pest management of various crops [2-4]. By considering the necessity of economic injury level (EIL) and economic threshold level (ETL) in pest management, the present study was undertaken.

Materials and Methods

The field experiments was carried out at Research Farm, Entomology Section, College of Agriculture, Nagpur, Maharashtra, (India) during the rabi season of 2016 using Bhima variety of safflower. The crop was sown at 4th week of

November 2016 raised by providing the recommended agronomic practices except the pest management. The experiment was executed in randomized block design having 7 treatments and 3 replications. Seven exposure periods for aphid infestation were maintained by spraying the dimethoate 30 EC at (0.05 %) at weekly intervals. Treatment having zero week exposure to aphid incidence received six insecticide applications. Treatment having 6 week exposure period to aphid incidence is treated as untreated control having no insecticide application. Observation on the number of aphid on 5 cm apical twig per plant was initiated from first aphid incidence in crop from five randomly selected plants in each replication. Seed yields recorded after the harvest and analysed. Linear regression equation was developed between aphid population(x) and seed yield (y). Treatment cost of 2 sprays of insecticide and market price of safflower were considered for calculating the gain threshold (GT). Economic injury level (EIL) was computed by dividing gain threshold from regression coefficient (b). The economic injury level of safflower aphid was determined as per Stone and Pedigo [3] while economic threshold level as per Pedigo [5].

The mathematical procedures and steps for calculating economic injury level are given below:

1. Gain threshold (kg/ha) =
$$\frac{\text{Cost of treatment (₹/ha)}}{\text{Price of safflower (₹/kg)}}$$
 2. Regression equation between aphid population (x) and seed yield (y) of safflower (kg/ha) (y) : $y = (a \pm bx)$
 - a = pure constant
 - b = regression coefficient
- Gain threshold (kg/ha)

3. Calculated EIL = $\frac{\text{Regression coefficient (b)}}{\text{UAI}}$
4. Actual EIL = EIL (Cal.) + UAI
Whereas, UAI = Unavoidable aphid infestation

Results and Discussion

Table 1. Incidence of safflower aphid (On 5 cm apical twig per plant)

Treatments	Exposure period (Days)	Standard meteorological weeks (SMW)						Mean
		52	1	2	3	4	5	
T1	35	15.10 (3.94)	17.97 (4.29)	66.63 (8.19)	114.77 (10.73)	127.77 (11.34)	106.03 (10.32)	74.71
T2	28	13.63 (3.75)	24.57 (5.00)	54.67 (7.42)	66.37 (8.17)	118.97 (10.93)	85.87 (9.29)	60.68
T3	21	14.48 (3.87)	24.00 (4.89)	52.37 (7.27)	47.77 (6.94)	64.00 (8.00)	48.97 (7.03)	41.93
T4	14	10.67 (3.34)	24.47 (4.99)	10.33 (3.29)	29.13 (5.44)	58.43 (7.67)	48.27 (6.98)	30.21
T5	7	10.63 (3.33)	16.67 (4.14)	9.23 (3.11)	16.53 (4.12)	24.00 (4.89)	17.90 (4.28)	15.82
T6	0	11.70 (3.49)	6.37 (2.62)	5.97 (2.54)	8.07 (2.92)	13.60 (3.75)	7.57 (2.84)	8.88
T7	42	26.40 (5.18)	29.57 (5.48)	88.70 (9.44)	108.37 (10.43)	145.50 (12.08)	112.80 (10.64)	85.22
	Mean	14.66 (3.89)	20.51 (4.58)	41.13 (6.45)	55.86 (7.50)	78.90 (8.91)	61.07 (7.84)	-
	F test	Non sig.	Sig.	Sig.	Sig.	Sig.	Sig.	-
	SE (m) ±	-	2.71	4.41	5.00	6.98	3.03	-
	CD	-	8.35	12.62	15.44	21.51	9.33	-

(Figures in parentheses are corresponding values of square root transformation.)

Economic injury level (EIL) of safflower aphid

The crop exposed to different periods showed the varied degree of aphid infestation. Lower aphid incidence observed being 8.88 aphids on 5 cm apical twig per plant, when the crop was under zero week exposure period (T6) to aphid incidence. The aphid incidence under the zero week exposure period is considered as the unavoidable aphid infestation. The aphid incidence increased with the increase in exposure to aphids and significantly higher aphid incidence (85.22) was observed when crop was under 6 week exposure period (T7). Seed yield decreased with increase in aphid incidence. Maximum seed yield (1407 kg/ha) was obtained during the zero

week exposure period (T6) against the lowest yield (603 kg/ha) from 6 week exposure period (T7). Highly significant negative relation ($r = -0.97$) existed between the aphid population and the seed yield. The gain threshold (GT) value is calculated as (55.26 kg/ha). The linear regression equation is formed as $y = (15.05 - 0.09x)$ and economic injury level (EIL) was calculated to be 57.5 aphids on 5 cm apical twig per plant, but there was 8.88 aphids on 5 cm apical twig per plant as unavoidable aphid infestation for the experiment period. So the actual EIL will be sum of calculated EIL and unavoidable aphid infestation which is 66.44 aphids on 5 cm apical twig per plant.

Table 2. Effect of different exposure period on aphid incidence, seed yield of safflower and ICBR

Exposure periods (Days)	No. of sprays	Mean yield of safflower (kg/ha)	Yield increase over control		Cost of plant protection (₹/ha)			Net monetary return (₹/ha)	ICBR
			(kg/ha)	(₹/ha)	Cost of Insecticide	Wages and sprayer charges	Total cost of protection		
35	1	803	200	7600	389.99	660	1049.99	6550.01	6.23
28	2	1023	420	15960	779.99	1320	2099.99	13860.01	6.60
21	3	1110	507	19266	1169.99	1980	3149.99	16116.01	5.11
14	4	1237	634	24092	1559.98	2640	4199.98	19892.02	4.73
7	5	1310	707	26866	1949.97	3300	5249.97	21616.03	4.11
0	6	1407	804	30552	2339.96	3960	6299.96	24252.04	3.84
42	0	603	-	-	-	-	-	-	-

Cost of labor charge (3 labours @ ₹ 200/ day and sprayer charge ₹ 20/ sprayer/ day), cost of Dimethoate 35 EC @ ₹ 468 per litre, and market price of safflower @ 38 ₹/kg.

Table 3. Economic threshold level based on seed yield and aphid infestation in safflower

Gain threshold (kg/ ha)	Pure intercept (a)	Regression coefficient (b)	Correlation coefficient (r)	Unavoidable aphid infestation (%)	EIL		ETL
					Calculated	Actual	
55.26	15.05	-0.09	-0.97	8.88	57.5	66.4	49.8

These results are in agreement with findings of Akashe et al. [6] who reported economic injury level of safflower aphid as 60.97 aphids on 5 cm apical twig per plant. The present result is supported by Kamath and Hugar [7] who determined the economic injury level of safflower aphid as 48.12 aphids on 5 cm apical twig per plant. These findings are in agreement with the Hemagirish et al.[8] who determined economic injury level of safflower aphids as 52.50 aphids on 5 cm apical twig per plant. The findings from the study are supported by observations of Biradar et al. [9]who determined the economic injury level of linseed budfly as 11.70 % bud infestation.

Economic threshold level (ETL) of safflower aphid

Economic threshold level (ETL) indicates the pest population density at which control measures should be initiated to check the further increase of pest population reaching the EIL. According to the Pedigo the ETL is set as 75 % of EIL. Accordingly in present study, economic threshold values are determined from economic injury level as 49.8 aphids on 5 cm apical twig per plant. Earlier works on EIL by Akashe et al, Kamath and Hugar, and Hemagirish et al. who reported economic threshold level for safflower aphid as 48.78, 38.5, and 42 aphids on 5 cm apical twig per plant. Biradar et al. estimated ETL of linseed budfly as 8.77 % bud infestation.

Results of the present study showed that the control measures should be initiated in safflower for aphid management when the aphid population reaches 49.8 aphids on 5 cm apical twig per plant, in order to prevent the pest population crossing the economic injury level (66.44 aphids on 5 cm apical twig per plant). The economic threshold for the pest varies due to effects of prevailing agro - climatic conditions, increased market price of crop and cost of plant protection. The threshold level for a pest is determined for a specific area.

References

Singh, V., H. Shing, D.M. Hegde, S.A. Ghorpade and U.B. Men, 2000. Insect pest of safflower and their management. J. Applied Zoo. 13(5): 196-213.

Stern, V.M., R.F. Smith, R.V.D. Bosch, and K.S. Hagen, (1959). The integrated control concept. Hilgardia. 29: 91-99.

Stone J.D and L.P. Pedigo, (1972). Development and economic injury level of the green clover worm on soybean in India. J. Econ. Entomol. 65: 197-201.

Smith R.F and R.V.D. Bosch, (1967). Integrated control in pest control, biological, physical, and selected methods. Kilgore WW Doult RL (eds.) Acad press, New York, pp 477.

Pedigo L.P, (1991). Entomology and Pest management. Macmillan Publ. Co, New York, pp 107-119.

Akashe, V.B., S.P. Mehtre, and M.R. Shewale, 1997. Estimation of economic threshold level of safflower aphid (*Uroleucon compositae* Theobald) on Bhima. IN: Proceedings of IVth international safflower conference, Bari (Italy), June 2-7, pp.317-319.

Kamath, S.P. and P.S. Hugar, 2001. Determination of economic threshold level of safflower aphid *Uroleucon compositae* (Theobald). Karnataka J. Agric. Sci. 13(2): 349-353.

Hemagirish, M.B., K.B. Goud and C.P. Mallapur, 2001. Utilization of *Chrysoperla lacamea* Stephens in the management of safflower aphid, *Uroleucon compositae* Theobald. Kamataka J. Agric. Sci. 14(3): 806-808.

Biradar, V.K., A.Y. Thakare, and P.P. Deshpande 2016. Determination of Economic Threshold Level of Linseed Budfly, *Dasyneuralini* (Barnes). Environment and Ecology. 35(2): 774-777.

