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Economic threshold level for *Uroleucon compositae* infesting safflower

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Abstract
Effective and economic suppression of insect pests in safflower ecosystem by the judicial use of pesticides on the basis of economics threshold levels is very essential. Investigations on economic threshold level for *Uroleucon compositae* were carried out in College of Agriculture Latur, Maharashtra during *Rabi*, 2020. On the basis of equality of management cost and revenue of safflower yield which was saved from pest damage. Further modified, the Economic Threshold Level worked out for *Uroleucon compositae* on safflower was 9.60 aphids / 5 cm apical twig.

Keywords: Economic Threshold Level, *Uroleucon compositae*, safflower

Introduction
Safflower (*Carthamus tinctorius* L.) belongs to family Compositae found in many parts of world namely Asia, Africa, Mediterrian region, out of these only (*C. tinctorious* L.) (2n=24) is cultivated in India. Safflower (*Carthamus tinctorius* L.) is commonly known as Karadayee and grown in *rabi* seasons of the country and well adopted to dry region. Safflower oil which is sold as saffola, is considered to be more preferred oil due to rich poly unsaturated fatty acid (73-79% lenoleic), which help in reducing the blood cholesterol level. The oil is mainly used as edible oil. It is also used in manufacture of paints, varnishes and linoleum. The yield losses caused by aphids have been reported to the extent of 56 to 60 percent in Karnataka, 20 to 55 percent in Maharashtra. In case of severe infestation, the yield losses range from 24.20 to 67.72 percent Shetgar *et al.*, (1993) [4]. Seed and oil content losses due to aphid infestation to the tune of 24 to 60 percent Bhumaneshvar and Tontadarya (1979) [2]. Stern and its co-worker formally proposed the concept of economic threshold level (ETL) as the number of insects (density or intensity) when management action should be taken to prevent the increasing pest population from reaching the EIL, which cause economic damage. Therefore, the present study was aimed to work out the economic threshold level for aphid the key pest of safflower Stern *et al.*, (1959) [5].

Materials and Methods
The experiment was carried out at the research farm of Department of Agricultural Entomology, College of Agriculture, Latur during *Rabi*, 2020 to determine economic threshold level for aphid (*U. compositae*). The variety PBNS-86 was shown on 9th November, 2020 with 45 x 20 cm^2 row to plant spacing, 4.5 x 4.0 m^2 plot size in RBD. Insecticide used for spraying was Dimethoate EC @ 660 ml/ha. Detailed spray schedules given below.

Table 1: Details of chemical treatment.

Spray Schedule			
Tr. No.	**Treatment**	**Spray schedule**	**Tentative (DAG)**
T_1	Control	Without any spray (Untreated)	--
T_2	1 spray	30 Days after germination (DAG)	30
T_3	2 sprays	30 DAG and 10 days after 1st spray	30,40
T_4	3 sprays	30 DAG and 10 days after 1st spray and 20 days after 1st spray	30,40,50
T_5	4 sprays	30 DAG and 10 days after 1st spray, 20 days after 1st spray and 30 days after 1st spray	30,40,50,60
T_6	5 sprays	30 DAG,10 days after 1st spray, 20 days after 1st spray, 30 days after 1st spray and 40 days after 1st spray,	30,40,50,60,70
T_7	6 sprays	30 DAG, 10 days after 1st spray, 20 days after 1st spray, 30 days after 1st spray, 40 days after 1st spray and 50 days after 1st spray	30,40,50,60,70, 80

DAG* Days after germination.

Five plants from each treatment were selected and labeled for recording observations on aphids. The number of aphids per plant apical twig from each treatment was recorded from selected observation plants before each spray and 1, 3, 7, 9 days after the spray was recorded and from this mean was be worked out.

Yield

- The yield of net plot from each treatment was converted to quintal per hectare. The 'additional yield' for each treatment was worked out by subtracting the yield of control plot from the yield of treatment. The value of additional yield was considered as 'revenue'.
- Cost of insecticide application (cost of insecticide, labour charge, rent of sprayer etc.) and market price for the year was used for calculating the ETL.
- The EIL was determined as suggested by Stone and Pedigo (1972) [6] and further modified by Ogunlana and Pedigo (1974) [3]. The economic threshold level (ETL) was then calculated as 75 percent of EIL.

Mathematical procedures & Steps

$$\textbf{Gain threshold (GT)} = \frac{\text{Management cost (Rs/ha)}}{\text{Market value (Rs/Qtl)}}$$

$$\textbf{Calculated Economic injury level (EIL)} = \frac{\text{Gain threshold (Qtl/ha)}}{\text{Regression coefficient}}$$

Regression coefficient were worked out between yield and pest data using WASP 2.0 statistical analysis software.

Actual Economic injury level = Calculated EIL +UI

Where,
UI = Unavoidable infestation observed in complete protection treatment

Management cost = Cost of insecticide application
Final ETL for the pest was determined based on equality of management cost and revenue of safflower yield which was saved from pest damage.

Results and Discussion

In present investigation on determination of ETL, the EIL was determined as suggested by Stone and Pedigo (1972) [6] and further modified by Ogunlana and Pedigo (1974) [3]. The economic threshold level (ETL) was then calculated as 75 percent of EIL. The data from Table no 2 revealed that mean aphid's population 5 cm apical twig per plant in untreated control treatment was 29.84, while it was 14.91 for treatment T_1 (one spray) which goes on reducing and in treatment T_7 (Six sprays) the aphid (*U. compositae*) population reported was 3.02 per plant apical twig. The regression equation obtained for number of *U. compositae* was Y = 23.697+ (-0.133) X + 1.256. The value of actual EIL varies from 5.47 aphids / 5 cm apical twig for one spray to 17.80 aphids / 5 cm apical twig for six sprays. The value of ETL ranged from as low as 4.10 aphids / 5 cm apical twig for one spray to as high as 13.35 aphids / 5 cm apical twig for complete protection i.e., six sprays. On the basis of equality of management cost and revenue of safflower yield which was saved from pest damage, the final ETL worked out was 9.60 aphids (*U. compositae)* / 5 cm apical twig of safflower. The work on determination of ETL for *U. compositae* on safflower was worked out by Anand *et al*., (2017) [1] as 49.8 aphids on 5 cm apical twig per plant.

Table 2: Computation of gain threshold, EIL and ETL on the basis of number of U. compositae on safflower

Tr. No	Dimethoate- 30 EC @ 660 ml/ha	Safflower price (Rs/q)	Gain threshold (q/ha)	EI L	Actual EIL	ET L	Mean number of pest infestation	Yield (q/ha)	Additional yield (q/ha)	Revenue (Rs.)	Protection Cost (Rs.)
T1	Untreated control	4202	0	0	0	0	29.84	20.26	0	0	0
T2	1 Spray	4202	0.33	2.45	5.47	4.10	14.91	21.38	1.12	4706	1367
T3	2 Sprays	4202	0.65	4.89	7.91	5.93	14.94	21.48	1.22	5126	2734
T4	3 Sprays	4202	0.98	7.34	10.36	7.77	10.85	21.55	1.29	5420	4101
T5	4 Sprays	4202	1.30	9.78	12.80	9.60	4.21	21.61	1.35	5672	5468
T6	5 Sprays	4202	1.63	12.23	15.25	11.44	3.81	23.33	5.54	23279	6835
T7	6 Sprays	4202	1.97	14.78	17.80	13.35	3.02	25.44	7.27	30548	8262

Conclusion

The values of actual EIL varied from 5.47 aphids (*U. compositae*) per five-centimeter apical twig for one spray to 17.80 aphids (*U. compositae*) per five-centimeter apical twig for six sprays. The values of ETL ranged from as low as 4.10 aphids (*U. compositae*) per 5 cm apical twig for one spray to as high as 13.35 aphids (*U. compositae*) per five-centimeter apical twig for complete protection i.e., six sprays. On the basis of equality of management cost and revenue of safflower yield which was saved from pest damage, the final ETL worked out was 9.60 aphids (*U. compositae*) per five-centimeter apical twig of safflower.

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