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Population dynamics of safflower aphid, *Uroleucon compositae* (Theobald) as influenced by weather parameters*

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ABSTRACT

Field experiments were conducted during two consecutive *rabi* seasons of 2007-08 and 2008-09 at All India Co-ordinated Research Project on Safflower, Zonal Agricultural Research Station, Solapur, M. S. (India) with treatment comprising two varieties and the influencing abiotic factors viz., average minimum and maximum ambient temperature, relative humidity and rainfall. The results revealed that the safflower aphid (*Uroleucon compositae* Theob.) was active during 47th to 1st SMW on elongation and branching stages of safflower crop, but its appearance on crop totally depends upon prevailing climatic conditions. Low temperature and high humidity were conducive for the multiplication of this pest. Accordingly, aphid population attained a peak of 147.5 aphids/5 cm twig/plant in the 52nd SMW when the mean minimum and maximum temperatures, morning and evening relative humidity were 31.6^0, 11.4^{0}C, 71 and 28%, respectively. Thus, for the effective and efficient control of safflower aphid and producing higher seed yields, two sprayings of recommended 0.005% thiamethxam 25 WG or 0.004% acetamiprid 20 SP at ETL i. e. 40-45 DAS (46th to 47th SMW, min. temp. below 20^{o}C) and second spray at 55-60 DAS (48th to 49th SMW, min. temp. around 15^{o}C) are recommended particularly in the safflower growing scarcity zone of Maharashtra (India).

Key words : Population dynamics, *Uroleucon compositae*, weather parameters

Safflower (*Carthamus tinctorius* L.) is one of the major *rabi* oilseed crops of the country. It is gown over an area of 3.20 lakh ha with a production of 2.25 lakh tonnes and productivity of 701 kg ha^{-1} (Anonymous, 2009). Maharashtra state of the country is the largest producer of safflower having 2.31 lakh ha area and 1.54 lakh tonnes production with the productivity of 667 kg ha^{-1}, which is considerably low. Besides its superior adaptability to scanty moisture condition, safflower produces oil rich in polyunsaturated fatty acids (linoleic acid 78%) which play an important role in reducing the human blood cholesterol level. Recently, safflower gaining an additional importance because of its use in the medicines and also the value adding products like safflower petals for herbal tea. Among the various biotic and abiotic constraints, safflower aphid (*Uroleucon compositae* Theob.) is the only key pest limiting safflower productivity. Seed and oil content losses due to this pest were reported from 20 to 80% (Singh *et al.*, 2000). The aphids not only reduce yields of seed and oil content but also attack petals lowering the quality of value adding product of this part of the plant (Sastry, 1997). The control of aphid is difficult due to its fast development rate and high reproduction potential under congenial climate. Efforts were, therefore, made during the investigation to correlate aphid population with weather parameters so as to manipulate correct timing of pesticide application.

MATERIALS AND METHODS

The field experiments were conducted during two consecutive *rabi* seasons of the years 2007-08 and 2008-09 at the Research Farm of All India Co-ordinated Research Project on Safflower, Zonal Agricultural Research Station, Solapur, M. S. (India) to study the influence of abiotic factors viz., average minimum and maximum ambient temperature, relative humidity and rainfall on the population build-up of safflower aphid. Experiment comprised two varieties Bhima (tolerant) and CO-1 (susceptible). Two blocks of 200 m^2 for each cultivar were sown under untreated late sown condition to have maximum aphid build-up. The observations on aphid count (5 cm apical twig/plant) commencing from 44th MW upto 5th MW were recorded on five randomly selected plants in each untreated block. Correlation coefficient (r values) analysis was performed between weather parameters and pest population.

RESULTS AND DISCUSSION

The data presented in Table 1 indicate that the pest occurrence started in the 44th MW. However, the pest activity and population level were found to be increased during 47th to 1st MW synchronizing with the elongation and branching stages of the crop. The aphid population slightly varied during the two crop seasons. The initial mean aphid population

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Table 1: Average aphid population vs, air temperature and relative humidity along with this correlation.

MW No.	Aphids/plant	Temperature (°C)		Relative humidity (%)	
		Maximum	Minimum	Morning	Afternoon
44	5.0	33.5	14.8	62	23
45	5.0	32.8	15.7	64	32
46	11.5	31.3	17.4	73	43
47	19.0	31.5	18.7	80	48
48	24.0	30.2	16.4	77	55
49	29.0	31.7	14.4	75	35
50	42.5	31.6	16.3	79	44
51	62.5	31.4	13.1	77	33
52	147.5	31.6	11.4	71	28
1	110.0	30.4	13.2	75	35
2	45.0	30.7	15.4	79	37
3	30.0	31.0	13.9	69	33
4	10.0	34.2	14.5	61	23
5	0.0	34.9	15.6	49	26
	Correlation coefficient	-0.37	-0.38	0.18	-0.22

Table 2: Efficacy of newer insecticides for the control of safflower aphid

Treatment	Av. aphids/5 cm twig/plant			Grain yield ($kg\ ha^{-1}$)	B : C ratio
	Before spray	After 1st spray	After 2nd spray		
Imidachloprid @ 0.0045%	54.92	12.93	5.92	836	1.69
Acetamiprid @ 0.004%	54.08	9.36	3.13	1035	1.86
Thiamethoxam @ 0.005%	54.75	7.38	2.71	1224	2.28
Fipronil @ 0.01%	55.17	31.48	18.08	552	1.05
Abamectin @ 0.0009%	54.58	32.73	24.88	598	0.87
Difenthiuron @ 0.06%	54.42	35.71	22.00	559	0.76
Buprofexin@ 0.04%	54.83	41.93	29.83	509	0.94
Dimethoate@ 0.03%	56.42	16.03	10.04	866	1.82
Absolute control	55.58	67.79	72.79	265	0.53
S. E.±	0.93	0.97	0.93	50.31	-
C. D. (P=0.05)	NS	2.73	2.64	142.10	-
CV (%)	5.86	11.79	15.38	24.34	-

NS : Not Significant.

per plant was observed to be 5.0. However, with the decrease in temperature and little rise in relative humidity, aphid population gradually increased and attained a peak of 147.5 aphids per plant in the 52nd MW when the temperatures, morning and evening relative humidity were 31.6^0, 11.4^0C, 71 and 28%, respectively. The correlation studies further indicated that the decrease in temperature and rising relative humidity during crop growth period favoured the pest activity. The weather factors for 1 to 2 weeks prior to corresponding period of pest activity also provided congenial conditions for population build-up. However, actual rainfall received during the season neither influenced the pest build-up nor the activity. Thus, minimum temperature plays an important role in increasing the aphid population. The weather conditions existing during 49th to 52nd MW were most congenial for the development of aphid population. The results are supported by the findings of Akhauri *et al.* (2007) who has studied the population dynamics of mustard aphid. Srivastava *et al. (*1995) reported the range of maximum temperature 15.8 to 27.7°C, minimum temperature 10.2 to 16.0°C and relative humidity 61 to 65% prevailing in February were conducive for the rapid multiplication of aphid on Indian

mustard. Present findings are quite useful in casual and regular fore warming of the safflower aphid and help in devising pest control module in realistic sense under rainfed condition.

The analyzed results (Table 2) revealed the significant differences for the treatments studied in respect of both aphid population after each spray and seed yield. However, aphid population recorded in all treatments before first spray was statistically non-significant which indicated the uniformity in pest population. All the treatments were significantly superior to the absolute control (67.79 and 72.79 aphids/plant) in respect of reduction in aphid population. Amongst the treatments, thiamethoxam @ 0.005% (7.38 and 2.71), acetamiprid @ 0.004% (9.36 and 3.13) and imidachloprid @ 0.0045% (12.93 and 5.92) registered the less aphid population than the earliar recommended dimethoate @ 0.03% (16.03 and 10.04) after both the sprays and provided efficient control of safflower aphid. However, thiamethoxam and acetamiprid were at par with each other in respect of aphid population after both the sprays.

The mean seed yield of safflower varied from 265 to 1224 kg ha^{-1}. All the treatments yielded significantly higher than absolute control. Significantly highest seed yields of 1224 and 1035 kg ha^{-1} were produced by thiamethoxam and acetamiprid, respectively, over rest of the treatments followed by dimethoate (866 kg ha^{-1}) and imidachloprid (836kg ha^{-1}) and were at par with each other. The economics of the treatments showed that the treatment 0.005% thiamethoxam recorded highest B : C ratio of 2.28 followed by 0.004% acetamiprid (1.86), 0.03% dimethoate (1.82) and 0.0045% imidachloprid (1.69). Rest of the treatments were economically ineffective.

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