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Bio-efficacy of some newer insecticides against *Uroleucon compositae* (Theobald) infesting safflower, *Carthamus tinctorius* Linnaeus

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Abstract
Field experiments were conducted during the *rabi* seasons of 2004-05, 2005-06 and 2006-07 to evaluate the efficacy of newer insecticides from different groups against safflower aphid (*U. compositae* T.). The variety Bhima was sown in randomized block design with 9 treatments (including absolute control), 3 replications and plot size of 5.0 X 4.5 m^2 each. Two foliar sprays at 40-45 and 55-60 DAS were given. Among eight chemical treatments, Thiamethoxam 0.005 % and Acetamiprid 0.004% proved best by recording maximum per cent decline in aphid population and providing the highest seed yield of 1087 kg/ha and 952 kg/ha, respectively. The B:C ratio was highest in Thiamethoxam (1.89) followed by Acetamiprid (1.62), Dimethoate (1.52), and Imidachloprid (1.46). Thus, to achieve an effective and efficient control of safflower aphid and producing higher seed yields, two sprayings either of 0.005 % Thiamethoxam (Actra) 25 WG or 0.004 % Acetamiprid (Pride) 20 SP or one spray each alternatively first at ETL i. e. 40-45 DAS (46th MW, min. temp. below 20^{o}C) and second spray at 55-60 DAS (48th MW, min. temp. around 15^{o}C) may be recommended particularly in the safflower growing scarcity zone of Maharashtra (India).

Key words: *Carthamus tinctorius*, bio-efficacy, newer insecticides, *Uroleucon compositae* etc.

Introduction

Safflower (*Carthamus tinctorius* L.) is one of the important oilseed crops in the world. In India, it occupies an area of 3.5 lakh ha with a production of 2.3 lakh tonnes and productivity of 627 kg/ha (Anonymous, 2007). Accordingly, India ranks first in area and second in production of safflower in the world. The predominant safflower growing states of the country are Maharashtra and Karnataka. Maharashtra is largest producer of safflower having 2.63 lakh ha area and 1.58 lak h tonnes production with the productivity of 604 kg/ha, which is considerably low.

Safflower crop is often subjected to various insect-pests among which, the important and most devastating pest is aphid, *Uroleucon compositae* Theob. (Akashe *et. al.,*1999). Seed and oil content losses due to this pest to the extent of 20 to 80 per cent have been reported from different parts of country (Singh *et. al.,* 2000). The aphids not only reduce yields of seed and oil content but also attack petals lowering the quality of the value added product of this part of the plant (Sastry, 1997). Control of safflower aphid has been achieved by using different insecticides (Neharkar *et. al.,* 2003). This unilateral approach has provided an effective but short term remedy. The major limitations of this method are high cost of cash inputs and insecticidal hazards for plant protection. On the other hand, control of aphid is difficult due to its fast development rate and high reproductive potential. To achieve satisfactory control of this noxious and destructive pest, testing and evaluation of newer insecticides is quite necessory. Efforts were, therefore, made in the present investigation to evaluate the bio-efficacy of some of the newly developed insecticides from different groups in comparison with earlier recommended dimethoate for the control of safflower aphid.

Materials and methods

The effectiveness of some new insecticides *viz.,* Imidachloprid (Confidor 200SL) 17.8 % @ 0.0045%, Acetamiprid (Pride) 20SP @ 0.004%, Thiamethoxam (Actra) 25 WG @ 0.005%, Fipronil (Regent) 5 SC @ 0.01%, Abamectin (Vertimec) 1.8 EC @ 0.0009%, Difenthiuron (Polo) 50 WP @ 0.06% and Buprofexin (Applaud) 25 EC @ 0.04% in comparison with Dimethoate (Rogar) 30EC @ 0.03% were tested for their efficacy against safflower aphid (*U. compositae* T.) during *rabi* 2004-05, 2005-06 and 2006-07 at AICRPO (Saff.), Solapur (M.S., India). The field experiments were conducted using cv. Bhima in RBD with 9 treatments, 3 replications and plot size of 5.0 X 4.5m^2 each. Two need based foliar sprayings were given at an interval of 15 days during each season. The observations on aphid count (5 cm apical twig/pl.) were recorded on three randomly selected plants in each treatment before and after sprays. Pre count was taken a day prior to the treatment. The data on surviving aphid per plant before and after treatment were subjected to pooled statistical analysis by transforming average count to the arcsine values. The per cent decline in aphid population over untreated control due to different treatments after both the sprayings was worked out. Seed yield (kg/ha) of each treatment was also recorded at harvest during all the years. The benefit cost ratio was calculated to assess the economic of each treatment. The observations on aphid population recorded in promising treatments (Thiamethoxam and Acetamiprid) and in absolute control were correlated with maximum and minimum temperatures.

Results

The data on mean aphid population before and after the spray and average per cent decline in aphid population after first and second sprays are presented in Table 1 and 2, respectively. The average seed yield (kg/ha) and benefit : cost ratio obtained due to different treatments during all the three years are given in Table 3. The analyzed results revealed the significant differences for the treatments studied in respect of both aphid population after each spray and seed yield during three years. However, aphid population recorded in all treatments before first spray were statistically non significant which indicated the uniformity in pest population.

The data on pooled mean (Table 1 and 2) of aphid population built up after both the sprays during all three seasons revealed that all the treatments were significantly superior to the absolute control (71.33 and 72.16 aphids/plant) in respect of reduction in aphid population. Amongst the chemical treatments, thiamethoxam @ 0.005% (8.78 and 3.22), acetamiprid @ 0.004% (10.76 and 3.50) and imidachloprid @ 0.0045% (13.74 and 6.00) registered the less aphid population than the recommended dimethoate @ 0.03% (16.76 and 10.06) after both the sprays during all three seasons 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 during all the seasons whereas, imidachloprid was at par with dimethoate. On the basis of pooled data the highest per cent decline in aphid population over control after two sprays were recorded with thiamethoxam (87.69 and 95.54%) followed by acetamiprid (84.92 and 95.15%), imidachloprid (80.74 and 91.69%), dimethoate (76.50 and 86.06%) and fipronil (46.36 and 74.13%).

The mean seed yield of safflower (Table 3) varied from 166 to 1087 kg/ha. The yield level of 2004-05 was lower compared to later two years due to scanty rainfall during the crop growth period. All the treatments yielded significantly higher than absolute control. Significantly highest seed yield of 1087 kg/ha was produced by thiamethoxam and acetamiprid (952 kg/ha) over rest of the treatments and were at par with each other followed by imidachloprid (812.33 kg/ha) and dimethoate (792.61 kg/ha) 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 1.89 followed by 0.004% acetamiprid (1.62), 0.03% dimethoate (1.52) and 0.0045% imidachloprid (1.46). The rest of the treatments were economically ineffective.

Discussion and Conclusion

The results of present investigation in respect of effectiveness and compatibility of thiamethoxam 70 WS when used as seed dresser for sucking pests are in agreement with Satpute *et. al.,* (2002), Prasanna *et. al*., (2002) and Bhat *et. al.,*(2003). Hegde (2005) also reported that thiamethoxam 25 WG @ 25 g.a.i./ha and imidachloprid 17.8 SL @ 25 g.a.i./ha were equally effective in reducing the population of brown plant hopper on rice.

Overall pooled results showed that the two sprayings of thiamethoxam 0.005% or acetamiprid 0.004% one at the ETL(46 MW) when minimum temperature goes below 20 ^{o}C and second spray 15 days thereafter (48 MW, minimum temperature around 15 ^{o}C) are beneficial for the effective management of safflower aphid as well as for producing the good seed yield of safflower under dry land conditions. The lowest B:C ratio of 0.33 noticed in absolute control indicated the importance of aphid management through such newer insecticides having different chemical class and novel mode of actions as an alternative to the earlier recommended one.

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Table 1: Efficacy of newer insecticides for the control of safflower aphid (2004-05, 2005-06 and 2006-07)

Treatment	I st Spray : Av. aphids/5 cm twig/plant								
	Before Spray				After Spray				Average % decline over control
	04-05	05-06	06-07	Mean	04-05	05-06	06-07	Mean	
Imidachloprid @ 0.0045%	53.66 (47.10)	74.67 (59.85)	45.33 (42.32)	57.89 (49.76)	05.00 (11.90)	25.89 (30.58)	10.33 (18.73)	13.74 (20.41)	80.74
Acetamiprid @ 0.004%	56.33 (48.64)	71.00 (57.44)	43.33 (41.17)	56.89 (49.09)	01.67 (05.94)	23.11 (28.71)	07.50 (15.86)	10.76 (16.83)	84.92
Thiamethoxa-m @ 0.005%	59.33 (50.38)	72.67 (58.54)	41.00 (39.82)	57.67 (49.58)	00.33 (01.91)	19.33 (26.07)	06.67 (14.93)	08.78 (14.30)	87.69
Fipronil @ 0.01%	57.00 (49.03)	73.33 (58.96)	46.00 (42.71)	58.78 (50.23)	27.33 (31.35)	53.89 (47.24)	18.00 (25.09)	33.07 (34.56)	46.36
Abamectin @ 0.0009%	53.66 (47.11)	75.00 (60.07)	44.67 (41.93)	57.78 (49.71)	37.67 (37.84)	50.78 (45.44)	13.33 (21.33)	33.93 (34.87)	47.57
Difenthiuron @ 0.06%	51.66 (45.96)	75.67 (60.49)	45.33 (42.32)	57.55 (49.59)	29.50 (32.83)	61.67 (51.76)	24.17 (29.44)	38.45 (38.01)	46.18
Buprofexin @ 0.04%	59.00 (50.21)	72.67 (57.45)	44.67 (41.94)	58.78 (49.87)	40.67 (39.62)	64.22 (53.25)	25.00 (29.98)	43.30 (40.96)	39.30
Dimethoate @ 0.03%	58.33 (49.81)	77.67 (61.82)	44.00 (41.55)	60.00 (51.06)	07.17 (15.16)	34.45 (35.94)	08.67 (17.10)	16.76 (22.74)	76.50
Absolute control	56.00 (48.45)	75.00 (60.07)	45.67 (42.51)	58.89 (50.34)	59.00 (50.18)	93.67 (77.27)	61.33 (51.60)	71.33 (59.85)	-
S.E. ±	01.38	01.53	00.77	00.76	01.77	01.76	01.13	01.11	-
C.D. at 5%	NS	NS	NS	NS	06.67	06.55	03.38	03.14	-
CV %	04.79	06.32	03.20	04.55	15.29	08.58	07.84	10.56	-

(Figures in parentheses are arc-sine transformed values)

Table 2: Efficacy of newer insecticides for the control of safflower aphid (2004-05, 2005-06 and 2006-07)

Treatment	After II[nd] Spray :Av. aphids/5 cm twig/plant(15 days after first spray)				
	04-05	05-06	06-07	Mean	Average % decline over control
Imidachloprid @ 0.0045%	03.33 (08.19)	07.50 (15.81)	07.17 (15.51)	06.00 (12.95)	91.69
Acetamiprid @ 0.004%	01.33 (03.85)	06.50 (14.59)	02.67 (09.22)	03.50 (09.22)	95.15
Thiamethoxa-m @ 0.005%	02.33 (07.02)	05.50 (13.43)	01.83 (07.66)	03.22 (09.37)	95.54
Fipronil @ 0.01%	12.33 (20.50)	27.17 (31.37)	16.50 (23.95)	18.67 (25.27)	74.13
Abamectin @ 0.0009%	26.00 (30.66)	31.00 (33.82)	16.17 (23.68)	24.39 (29.39)	66.20
Difenthiuron @ 0.06%	10.33 (18.72)	38.33 (38.25)	18.83 (25.75)	22.50 (27.57)	68.82
Buprofexin @ 0.04%	35.00 (36.27)	41.83 (40.30)	20.00 (26.56)	32.28 (34.38)	55.27
Dimethoate @ 0.03%	04.00 (11.28)	15.00 (22.77)	11.17 (19.50)	10.06 (17.85)	86.06
Absolute control	61.33 (51.56)	83.83 (67.53)	71.33 (57.82)	72.16 (58.97)	-
S.E. $^{+}$	01.93	01.68	01.40	01.20	-
C.D. at 5%	07.90	06.01	04.20	03.41	-
CV %	21.86	11.24	10.42	14.37	-

(Figures in parentheses are arc-sine transformed values)

Table 3: Average seed yield and economics of safflower under various aphid control treatments (2004-05, 2005-06 and 2006-07).

Treatment	Grain yield (kg/h)				Benefit Cost Ratio			
	04-05	05-06	06-07	Mean	04-05	05-06	06-07	Mean
Imidachloprid @ 0.0045%	461.72	1078.92	0896.34	0812.33	1.12	1.73	1.54	1.46
Acetamiprid @ 0.004%	575.91	1203.71	1076.90	0952.18	1.29	1.83	1.74	1.62
Thiamethoxam @ 0.005%	701.62	1413.05	1145.34	1086.67	1.58	2.19	1.91	1.89
Fipronil @ 0.01%	364.03	0529.39	0241.35	0378.26	0.84	0.81	0.40	0.68
Abamectin @ 0.0009%	307.11	0565.63	0608.30	0493.68	0.49	0.69	0.79	0.66
Difenthiuron @ 0.06%	318.38	0394.53	0635.27	0449.39	0.45	0.44	0.76	0.55
Buprofexin @ 0.04%	284.77	0408.62	0417.28	0370.22	0.59	0.62	0.68	0.63
Dimethoate @ 0.03%	546.50	1125.21	0706.12	0792.61	1.31	1.92	1.33	1.52
Absolute control	132.13	0181.16	0185.19	0166.16	0.33	0.32	0.35	0.33
S.E. $^{+}$	075.70	0168.16	0063.134	0048.29	-	-	-	-
C.D. at 5%	160.48	0356.49	0189.28	0137.32	-	-	-	-
CV %	022.60	0026.86	0016.65	0023.70	-	-	-	-