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BIOEFFICACY OF SYNTHETIC INSECTICIDES ON SAFFLOWER APHID, *U. compositae*

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Abstract: *Thepresent investigation was conducted in rabi 2014-15 at experimental farm, College of Agriculture, Puneto evaluate the efficacy of synthetic insecticidesviz., clothianidin 50 % WDG, thiamethoxam 25% WDG, acetamiprid 20% SP, imidacloprid 17.8 SL, buprofezin 25% SC, dimethoate 30% ECagainst safflower aphid, Uroleucon compositae. The infestation of aphid, U. compositaewas effectively checked due to spray of thimethoxam @ 25 g a. i./ha was found to be most superior. Next best treatment in the order of statistical significance was imidacloprid @ 15 g a. i./ha which was followed by acetamiprid @ 10 g a. i./ha and buprofezin @ 250 g a. i./ha followed by clothianidin @ 20 g a. i./hafollowed by dimethoate @ 200 g a. i./ha. Buprofezin@ 250 g a. i./ha observed to becomparatively safest than the four neo-nicotinoids to predatory coccinellids. Whereas treated check, dimethoate @ 200 g a. i./hawas observed to be relatively toxic. Thus use ofthiamethoxam 25% WDG @ 25 g a. i./hacan form cost effective option for safflower aphid, Uroleucon compositae management.*

Keywords: *Bioefficacy, biopesticides, safflower aphid.*

Introduction

Safflower (*Carthamus tinctorius* L.)is the most important *rabi* oilseed crop widely grown in India. The cropped area during year 2013-14 under the country reported to be 349.2 thousand ha and with seed production of 128.3 thousand tonnes with an average productivity of 367kg / ha; amongst, Maharashtra state contributed to be 72 per cent (Anonymous, 2014). Although India being the largest producer of safflower in the world, its field productivity per hectare seems to be very low. One of the major limiting factors for the low productivity due to field infestation of the insect pests (80 species). Amongst, the most notorious one is the safflower aphid, *Uroleucon compositae* that causes yield losses to the extent of 20 to 55 per cent in Maharashtra (Ghorpade, 1995). Both nymphs and adults of the aphid suck the cell sap constantly from leaves and tender shoots of plant, as a result plant becomes yellow and dries in case of severe infestation. Besides, both nymphs and adults excrete honeydew like substance on leaves on which black sooty mould develops and adversely affect the crop physiology intervening plant photosynthetic activity.

Among the various strategies adopted to combat this pest, insecticides are the first line of defence. Most of the insecticides used on agricultural crops are based on quit limited number of chemically different classes out of them the most important classes of inorganic insecticides that are used against the pest of safflower belongs to neo-niconoides, organophosphate and IGR. Therefore the efforts has been made in the present investigation to evaluate the efficacy of the neo-nicotinoids, organophosphate and IGR *viz.* Clothianidin, thimethoxam, acetamiprid, imidacloprid, buprofezin and dimethoate againstsafflower aphid, *Uroleucon compositae.*

Materials and Methods

A field experiment was conducted at experimental farm, College of Agriculture, Pune to evaluate the efficacy of neo-nicotinoids, organophosphate and IGR against safflower aphid, *Uroleucon compositae* using SSF-658 cultivar of safflower comprising seven treatments and three replications in randomized block design during the *Rabi*season during November 2014 to March 2015. The treatments under the studies constituted four neo-nicotinoids, one IGR, one conventional insecticide (treated check) and the untreated check.Initially, the test treatments were applied when precountpopulation exceeded ETL 38-45 aphids / 5 cm apical twig (Akashe *et al.*1997) on the crop. Five plants were randomly selected and tagged plants to record the observations. The pre treatment counts of surviving aphids occurring on 5cm apical twig were recorded a day before spray application and post-count populations were recordedat 3rd, 7th and 10th day after each of the spray schedules.The mean coccinellid population count was taken simultaneously with regular observation. The experimental data on population of the aphid and predatory coccinellids were first transformed to their corresponding square root of (X + 0.5) values and then statistically analyzed as a randomized block design (Panse and Sukhatme, 1967).

Table 1: Bioefficacy of synthetic insecticides against *U. compositae* after first spray

S N	Treatments	Dose/ha (g a. i./ha)	Mean surviving aphid population (5 cm apical twig)				
			Precount	DAS			Mean
				3	7	10	
1	Clothianidin 50 % WDG	20	53.40 (7.34)	27.19 (5.26)	8.51 (3.00)	15.98 (4.06)	17.23 (4.11)
2	Thiamethoxam 25% WDG	25	50.60 (7.15)	21.42 (4.68)	3.83 (2.08)	11.35 (3.44)	12.20 (3.40)
3	Acetamiprid 20% SP	10	52.33 (7.27)	26.49 (5.19)	5.66 (2.48)	12.33 (3.58)	14.83 (3.75)
4	Imidacloprid 17.8 SL	15	54.08 (7.39)	25.72 (5.12)	4.98 (2.34)	11.87 (3.52)	14.19 (3.66)
5	Buprofezin 25% SC	250	51.44 (7.21)	26.56 (5.20)	6.63 (2.67)	12.76 (3.64)	15.32 (3.84)
6	Dimethoate 30% EC	200	52.60 (7.28)	27.65 (5.31)	11.35 (3.44)	18.62 (4.37)	19.21 (4.37)
7	Untreated check	----	51.63 (7.22)	54.23 (7.40)	57.97 (7.65)	61.33 (7.86)	57.84 (7.64)
SE±			**0.11**	**0.05**	**0.04**	**0.06**	**0.05**
CD at 5%			**NS**	**0.16**	**0.12**	**0.19**	**0.16**
Figure in parenthesis are square root of (X+0.5) transformed values							

Table 2: Bioefficacy of synthetic insecticides against *U. compositae* after second spray

S N	Treatments	Dose/ha (g a.i./ha)	Mean surviving aphid population (5 cm apical twig)			
			DAS			Mean
			3	7	10	
1	Clothianidin 50% WDG	20 g	16.23 (4.09)	4.50 (2.23)	7.85 (2.89)	9.53 (3.07)
2	Thiamethoxam 25% WDG	25 g	11.73 (3.50)	0.85 (1.16)	3.04 (1.88)	5.21 (2.18)
3	Acetamiprid 20% SP	10 g	14.23 (3.84)	2.68 (1.78)	5.45 (2.44)	7.45 (2.69)
4	Imidacloprid 17.8 SL	15 g	12.29 (3.58)	1.39 (1.37)	4.26 (2.18)	5.98 (2.38)
5	Buprofezin 25% SC	250 g	15.95 (4.06)	3.49 (1.99)	6.35 (2.62)	8.60 (2.89)
6	Dimethoate 30% EC	200 g	18.55 (4.36)	6.05 (2.55)	9.73 (3.20)	11.44 (3.37)
7	Untreated check	----	65.36 (8.11)	69.23 (8.35)	74.18 (8.64)	69.59 (8.37)
SE±			**0.04**	**0.06**	**0.05**	**0.05**
CD at 5%			**0.12**	**0.18**	**0.16**	**0.16**
Figure in parenthesis are square root of (X+0.5) transformed values						

Table 3: Bioefficacy of synthetic insecticides against *U. compositae* after third spray

SN	Treatments	Dose/ha (g a.i./ha)	Mean surviving aphid population (5 cm apical twig) DAS 3	7	10	Mean
1	Clothianidin 50% WDG	20 g	11.73 (3.50)	3.85 (2.08)	6.52 (2.65)	7.37 (2.74)
2	Thiamethoxam 25% WDG	25 g	8.60 (3.02)	0.41 (0.94)	2.49 (1.73)	3.83 (1.90)
3	Acetamiprid 20% SP	10 g	10.85 (3.37)	2.90 (1.84)	4.50 (2.24)	6.08 (2.48)
4	Imidacloprid 17.8 SL	15 g	8.93 (3.07)	1.30 (1.34)	3.45 (1.99)	4.56 (2.13)
5	Buprofezin 25% SC	250 g	10.80 (3.36)	3.53 (2.01)	5.43 (2.44)	6.59 (2.60)
6	Dimethoate 30% EC	200 g	14.11 (3.82)	6.67 (2.68)	8.97 (3.08)	9.92 (3.19)
7	Untreated check	—	78.25 (8.87)	81.56 (9.06)	77.16 (8.81)	78.99 (8.91)
SE±			**0.06**	**0.06**	**0.05**	**0.06**
CD at 5%			**0.20**	**0.20**	**0.16**	**0.19**
Figure in parenthesis are square root of (X+0.5) transformed values						

Table 4: Overall bioefficacy of synthetic insecticides against *U. compositae*

SN	Treatment	Dose/ha (g a.i./ha)	Mean surviving aphid population (5 cm apical twig) DAS 3	7	10	Mean
1	Clothianidin 50% WDG	20 g	18.38 (4.28)	5.62 (2.44)	10.12 (3.60)	11.37 (3.44)
2	Thiamethoxam 25% WDG	25 g	13.92 (3.73)	1.70 (1.39)	5.63 (2.76)	7.08 (2.63)
3	Acetamiprid 20% SP	10 g	17.19 (4.13)	3.75 (2.03)	7.43 (3.29)	9.46 (3.15)
4	Imidacloprid 17.8 SL	15 g	15.65 (3.92)	2.56 (1.68)	6.53 (3.10)	8.25 (2.90)
5	Buprofezin 25% SC	250 g	17.77 (3.87)	4.55 (2.22)	8.18 (3.42)	10.16 (3.17)
6	Dimethoate 30% EC	200 g	20.10 (4.50)	8.02 (2.89)	12.24 (3.53)	13.45 (3.64)
7	Untreated check	—	65.95 (8.13)	69.59 (8.35)	70.89 (8.44)	68.81 (8.31)
SE±			**0.05**	**0.05**	**0.05**	**0.05**
CD at 5%			**0.16**	**0.17**	**0.17**	**0.17**
Figure in parenthesis are square root of (X+0.5) transformed values						

Table 5: Influence of synthetic insecticides on the abundance of coccinellid grubs

SN	Treatments	Dose/ha (g a.i./ha)	Mean surviving coccinellids per plant (Recorded after each spray schedule) Precount	Spray 1st	2nd	3rd	Mean
1	Clothianidin 50% WDG	20 g	3.31 (1.95)	0.88 (1.17)	0.86 (1.17)	0.82 (1.15)	0.85 (1.16)
2	Thiamethoxam 25% WDG	25 g	4.46 (2.23)	0.84 (1.16)	1.09 (1.27)	1.06 (1.25)	1.00 (1.23)
3	Acetamiprid 20% SP	10 g	3.49 (2.00)	0.82 (1.15)	0.98 (1.22)	0.94 (1.20)	0.91 (1.19)
4	Imidacloprid 17.8 SL	15 g	3.59 (2.02)	0.87 (1.17)	0.91 (1.19)	0.86 (1.17)	0.88 (1.18)

5	Buprofezin 25% SC	250 g	4.10 (2.14)	3.07 (1.89)	3.19 (1.92)	3.03 (1.88)	3.10 (1.90)
6	Dimethoate 30% EC	200 g	3.73 (2.06)	0.58 (1.04)	0.46 (0.98)	0.42 (0.96)	0.49 (0.99)
7	Untreated check	—	3.26 (1.94)	3.98 (2.11)	4.42 (2.21)	4.79 (2.30)	4.40 (2.21)
	SE±		**0.04**	**0.05**	**0.07**	**0.06**	**0.03**
	CD at 5%		**NS**	**0.16**	**0.21**	**0.19**	**0.08**
Figure in parenthesis are square root of (X+0.5) transformed values							

Results and Discussion

The performance of test treatments after first spray based on the mean indicated that treatment with thimethoxam (12.20) was found to be most effective and significantly superior over rest of the treatments in reducing the aphid population. Next best treatment in the order of statistical significance was imidacloprid (14.19), which was on par with acetamiprid (14.83), buprofezin (15.32) followed by clothianidin (17.23) followed by dimethoate (19.21), which were statistically in similar range. (Table 1)

The performance of test treatments after second spray based on the mean indicated that treatment with thimethoxam (5.21) was found to be most effective which was followed by imidacloprid (5.98). Next best treatment in the order of statistical significance was acetamiprid (7.45) followed by buprofezin (8.60) followed by clothianidin (9.53) followed by dimethoate (11.44). (Table 2)

The performance of test treatments after third spray based on the mean indicated that treatment with thimethoxam (3.83) was found to be most superior. Next best treatment in the order of statistical significance was imidacloprid (4.56) which was followed by acetamiprid (6.08) and buprofezin (6.59) followed by clothianidin (7.37) followed by dimethoate (9.92). (Table 3)

The overall performance of test treatments based on the mean indicated that treatment with thimethoxam (7.08) was found to be most superior. Next best treatment in the order of statistical significance was imidacloprid (8.05) which was followed by acetamiprid (9.46) and buprofezin (10.16) followed by clothianidin (11.37) followed by dimethoate (13.45). (Table 4)

The findings of the investigation in respect of overall influence of test insecticides on the population of predatory coccinellids in safflower ecosystem based on mean population data revealed that the untreated check (4.40) was found to be significantly highest suggesting the test treatments were relatively less safe to field prevailingpredatory coccinellids. Buprofezin (3.10) noticed to be comparatively safest thanthe four neo-nicotinoids under the studies, and treated check, dimethoate (0.49) was observed to be relatively toxic. (Table 5).

Among the neo-nicotinoids thiamethoxam 25 % WDG found to be significantly superior in reducing aphid population. These results are in agreement with Wadnerkar *et al.* (2004) who reported that thiamethoxam 25 % WDG was found significantly superior over imidacloprid (15 g.a.i./ha); Akashe *et al.* (2007 and 2008) advocated thiamethoxam (20 g.a.i./ha) and acetamiprid (10 g.a.i./ha); Gore *et al.* (2010) recommended thiamethoxam (20 g.a.i./ha), acetamiprid (10 g.a.i./ha) and imidacloprid (15 g.a.i./ha) and Jemimah *et al.* (2013) advocated thiamethoxam (20 g.a.i./ha) and acetamiprid (10 g.a.i./ha). Gaikwad *et al.* (2014) recommended dimethoate (200 g.a.i./ha) and imidacloprid (15 g.a.i./ha).

In declining population of the aphid, Wadnerkar *et al.* (2004) recommended thiamethoxam (20 g.a.i./ha) was found significantly superior over imidacloprid (15 g.a.i./ha); Akashe *et al.* (2007 and 2008) advocated thiamethoxam (20 g.a.i./ha) and acetamiprid (10 g.a.i./ha), buprofezin being the least effective; Gore *et al.* (2010) recommended thiamethoxam (20 g.a.i./ha), acetamiprid (10 g.a.i./ha) and imidacloprid (15 g.a.i./ha) and Jemimah *et al*. (2013) advocated thiamethoxam (20 g.a.i./ha) and acetamiprid (10 g.a.i./ha).

In the present studies, thiamethoxam found to be superior most followed by imidacloprid and acetamiprid followed by buprofezin followed by clothianidin, dimethoate being least effective. The findings in respect of thiamethoxam, imidacloprid and acetamiprid are in agreement with that reported by the aforesaid workers. Perusal of literature reveals that there is a paucity of literature on the test aphid species in respect of buprofezin and clothianidin.

Under the present investigations, thiamethoxam was observed relatively less safe to predatory coccinellids and the finding is in confirmation with that reported by Katole and Patil (2000). Perusal of literature reveals that there is a paucity of literature on coccinellids in respect of remaining treatments under the studies.

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