INTERNATIONAL JOURNAL OF PLANT PROTECTION
VOLUME 9 | ISSUE 2 | OCTOBER, 2016 | 418-423

● e ISSN-0976-6855 | Visit us : *www.researchjournal.co.in*

IJPP

RESEARCH PAPER

DOI : 10.15740/HAS/IJPP/9.2/418-423

Effect of different newer pesticides on aphid population of summer okra

■ Y.T. JADHAV*, S.R. MANE[1] AND D.S. SHINDE[2]

Department of Agricultural Entomology, Ratnai Agriculture College, AKLUJ (M.S.) INDIA
[1]Department of Horticulture, Ratnai Agriculture College, AKLUJ (M.S.) INDIA
[2]Department of Agricultural Entomology, College of Agriculture, PANIV (M.S.) INDIA

ARITCLE INFO

Received : 14.06.2016
Revised : 09.08.2016
Accepted : 23.08.2016

KEY WORDS :
Bio-efficacy, Imidacloprid, Thiamethoxam, Fipronil, Diafenthiuron

*Corresponding author:
Email : rupayogeshjadhav@gmail.com

ABSTRACT

The studies on bio-efficacy of aphid population showed quite promising results and from the pooled data at first spray, the results revealed that all the treatments proved their superiority over untreated control showing imidacloprid 70WG as the most effective treatment followed by thiamethoxam 25 WG, fipronil 5SC and diafenthiuron 50WP. The second spray results showed that thiamethoxam 25WG, imidacloprid 70WG and fipronil 5SC proved to be the best treatments with maximum reduction of population and were found at par with each other.

How to view point the article : Jadhav, Y.T., Mane, S.R. and Shinde, D.S. (2016). Effect of different newer pesticides on aphid population of summer okra. *Internat. J. Plant Protec.*, **9**(2) : 418-423, **DOI : 10.15740/HAS/IJPP/9.2/418-423**.

INTRODUCTION

Okra [*Abelmoschus esculentus* (L.) Moench] originated from Africa commonly known as "Lady's finger" or "Okra" under Malvaceae family is a flowering plant which has multipurpose crop value producing high valued edible green pods with good nutritional.

In okra cultivation and production India ranks first with an area of 532.64 thousand hectares and production of 6346.40 thousand tones alongwith productivity of 13.14 mt/ha (Anonymous, 2013). Okra is also known as the house of pests due to its two distinct *i.e.* vegetative and fruiting growing stages. As high as 72 species of insects have been recorded on okra. Aphids is one of the important pest in the early stage of the crop which desap the plants, make them weak and reduce the yield. Failure to control them in the initial stages was reported to cause an yield loss to the tune of 54.04 per cent (Chaudhary and Dadeech, 1989).

Due to which, the present investigation were undertaken with an objective to know better management of these destructive okra.

MATERIAL AND METHODS

A field experiment was conducted at Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani to study the bio-efficacy of newer pesticides against okra aphids during summer 2013 and summer 2014.

The field design was RBD with two replications and fourteen treatments in which Mahyco Popular okra number 1 variety was sown keeping spacing of 60cm x 60cm plant to plant. Observations were made by randomly selecting 5 plants from each plot and top, middle and bottom leaves of each randomly selected plants were considered for counting number of aphids. Pre-treatment observations were recorded one day before the application of pesticide and post- treatment observations were recorded on 1, 3, 7 and 14 days after spraying. The data were averaged and subjected to square root transformation and then statistically analyzed and the results were interpreted at five per cent level of significance by using ICAR wasp 2 software. To compare the bio-efficacy of different newer pesticides, per cent reduction in the population of aphids over untreated control (water spray) was calculated using Henderson and Tilton (1955) formula.

RESULTS AND DISCUSSION

The bio-efficacy data regarding aphid during summer 2013 and 2014 (Pooled) on okra were recorded with an objective to develop economically feasible management strategy, to reduce unwarranted pesticide load in the environment and to gain knowledge on safer pesticides during the study period.

Aphid (*Aphis gossypii* Glover) :

First spray :

In two successive cropping years, the results during first spray were depicted in Table 1 which revealed that significant reduction was noticed in aphid population on one, three and seven day after application of pesticides as compared to untreated check.

A day before first spray, no significant difference were observed among the evaluated treatments showing aphid population range of 5.46 to 6.99 aphids/ 3 leaves. Pooled aphid population recorded on 1day after the first spray ranged from 1.30 to 7.65 aphids/ 3 leaves. Treatment T_3 (imidacloprid 70WG) showed best result with lowest number of aphid population (1.30 aphids/ 3 leaves) which was followed by T_4 (fipronil 5SC) showing 1.98 aphids population/ 3 leaves and was found at par with T_2, T_{13} and T_1. The least effective treatment recorded was T_{10} (propargite 57EC) showing maximum population incidence of 4.15 aphids/ 3 leaves as compared to untreated check (7.65 aphids/ 3 leaves).

Three days after first spray, among the evaluated treatments T_3 (imidacloprid 70WG) recorded the lowest aphid population of 0.51 aphid / 3 leaves and was found at par with T_2 (thiamethoxam 25WG) showing aphid population of 0.80 aphid/ 3 leaves whereas the highest aphid population of 8.82 aphids/ 3 leaves was recorded in untreated check. The second best treatment *i.e.*, T_2 showed the results at par with T_4 (fipronil 5SC) and T_1 (diafenthiuron 50WP). The above results indicated in similar trend that were observed in the data on seven days after spraying.

At 14 days after the first spray, there was no change in the trend observed in which imidacloprid 70WG showed the best efficacy in controlling the aphid population by recording the lowest aphid population of 2.14 aphids/ 3 leaves and followed by thiamethoxam 25WG (3.46 aphids/ 3 leaves) and was also at par with T_4, $T_{12,}$ $T_{7,}$ T_1, T_5. The treatment T_{11} (chlorfenapyr 10SC) with 6.58 aphids/ 3 leaves showed least effective results above untreated check (10.62 aphids/ 3 leaves).

The present investigation on newer pesticides against okra aphid is in line with the finding of Day *et al*. (2005) who reported that imidacloprid 70 WG provided excellent protection against aphid upto 45 days after sowing and two foliar sprays of imidacloprid 200 SL provided excellent control of aphids upto 15 days after spraying. Similar results were seen under the work done by Targe and Kurtadikar (2003).

The effectiveness of thiamethoxam treatment against okra aphid is in line with the findings of Lawson *et al.* (2000) indicating that the thiamethoxam provides excellent control of *Aphis gossypii, Bemisia tabaci* etc. Also thiamethoxam 25 WG as foliar sprays was found significantly superior in controlling aphid (Misra, 2002).

Present findings on fipronil 5SC against aphids are in line with the report of Wadnerkar *et al.* (2003) showing that that fipronil 5 per cent @ 50 and 75g a.i./ha were found effective in reducing sucking pests population. According to Patil *et al.* (2009) significantly lower population of thrips, leaf hopper, aphid were obtained in fipronil 5 SC (100 g/ha) as compared to other treatments.

The efficacy of diafenthiuron 50WP in reducing the aphid population has been documented by Rathod *et al.* (2003) against jassids, aphids and thrips infesting cotton showing lowest mean population of jassids (0.99), aphids (4.41) and thrips (1.73) per 3 leaves with 10g imidacloprid/kg, 300 g diafenthiuron /ha and 5 g

Table 1 : Bio-efficacy of newer pesticides against aphids, *A. gossypii* Glover after first spray on okra (pooled of summer 2013 and 2014)

Tr. No.	Treatments	Dose (a.i./ha)	Number of aphids/ 3 leaves														
			1 DBS			1 DAS			3 DAS			7 DAS			14 DAS		
			2013	2014	Pooled	2013	2014	Pooled	2013	2014	Pooled	2013	2014	Pooled	2013	2014	Pooled
T_1	Diafenthiuron 50WP	600 g	5.63 (2.35)	7.21 (2.68)	6.42 (2.53)	2.76 (1.66)	2.66 (1.63)	2.71 (1.65)	0.85 (0.92)	1.76 (1.33)	1.31 (1.12)	1.75 (1.32)	2.16 (1.47)	1.96 (1.40)	4.62 (2.15)	4.26 (2.06)	4.44 (2.11)
T_2	Thiamethoxam 25WG	100 g	5.78 (2.40)	8.14 (2.85)	6.96 (2.64)	1.63 (1.27)	2.68 (1.64)	2.16 (1.46)	0.51 (0.71)	1.08 (1.02)	0.80 (0.88)	0.62 (0.78)	0.61 (0.77)	0.62 (0.78)	3.21 (1.75)	3.70 (1.92)	3.46 (1.86)
T_3	Imidacloprid 70WG	35 g	5.81 (2.41)	5.11 (2.25)	5.46 (2.34)	1.40 (1.17)	1.19 (1.05)	1.30 (1.14)	0.48 (0.69)	0.53 (0.72)	0.51 (0.71)	0.31 (0.55)	0.29 (0.50)	0.30 (0.55)	1.97 (1.40)	2.30 (1.49)	2.14 (1.46)
T_4	Fipronil 5SC	1000 ml	5.69 (2.34)	6.55 (2.55)	6.12 (2.47)	2.06 (1.43)	1.90 (1.35)	1.98 (1.41)	0.75 (0.86)	1.05 (0.99)	0.90 (0.95)	0.71 (0.81)	0.97 (0.98)	0.84 (0.91)	3.31 (1.82)	3.93 (1.98)	3.62 (1.90)
T_5	Buprofezin 25SC	300 ml	5.92 (2.43)	7.25 (2.67)	6.59 (2.56)	2.82 (1.67)	2.78 (1.67)	2.80 (1.67)	1.64 (1.27)	1.76 (1.33)	1.70 (1.30)	3.05 (1.74)	2.87 (1.69)	2.97 (1.72)	4.82 (2.20)	4.10 (2.03)	4.46 (2.11)
T_6	Fenpropathrin 30EC	200 ml	5.99 (2.45)	5.96 (2.43)	5.98 (2.44)	2.89 (1.70)	2.73 (1.65)	2.81 (1.68)	2.07 (1.42)	2.28 (1.51)	2.18 (1.47)	3.82 (1.94)	3.13 (1.74)	3.48 (1.86)	4.97 (2.23)	5.30 (2.30)	5.14 (2.27)
T_7	Dimethoate 30EC	1000 ml	5.87 (2.42)	8.11 (2.84)	6.99 (2.64)	2.78 (1.66)	3.22 (1.79)	3.00 (1.73)	1.39 (1.16)	1.74 (1.32)	1.57 (1.25)	1.37 (1.15)	1.74 (1.29)	1.56 (1.25)	4.53 (2.13)	4.28 (2.07)	4.41 (2.10)
T_8	Fenazaquin 10EC	1000 ml	5.68 (2.38)	6.88 (2.61)	6.28 (2.51)	3.29 (1.80)	4.08 (2.02)	3.69 (1.92)	2.92 (1.71)	3.37 (1.84)	3.15 (1.77)	3.35 (1.83)	3.92 (1.98)	3.64 (1.91)	6.51 (2.55)	5.49 (2.34)	6.00 (2.45)
T_9	Spiromesifen 22.9SC	400 ml	6.17 (2.48)	5.74 (2.38)	5.96 (2.44)	3.69 (1.91)	4.35 (2.09)	4.02 (2.00)	3.48 (1.86)	3.86 (1.95)	3.67 (1.92)	4.17 (2.02)	3.28 (1.81)	3.73 (1.93)	5.29 (2.30)	7.60 (2.74)	6.45 (2.53)
T_{10}	Propargite 57EC	1500 ml	5.83 (2.41)	6.55 (2.56)	6.19 (2.49)	3.45 (1.85)	4.84 (2.20)	4.15 (2.03)	3.66 (1.91)	3.93 (1.97)	3.80 (1.95)	5.02 (2.23)	3.61 (1.90)	4.32 (2.07)	6.17 (2.47)	6.71 (2.57)	6.44 (2.54)
T_{11}	Chlorfenapyr 10SC	750 ml	5.17 (2.25)	7.25 (2.68)	6.21 (2.48)	3.34 (1.82)	4.07 (2.01)	3.71 (1.92)	3.09 (1.76)	3.26 (1.81)	3.18 (1.78)	4.82 (2.15)	4.37 (2.09)	4.60 (2.14)	6.31 (2.51)	6.84 (2.61)	6.58 (2.56)
T_{12}	Dicofol 18.5EC	1250 ml	5.95 (2.44)	6.11 (2.47)	6.03 (2.46)	2.83 (1.67)	2.78 (1.67)	2.81 (1.68)	1.57 (1.23)	2.01 (1.37)	1.79 (1.34)	2.85 (1.69)	2.03 (1.42)	2.45 (1.56)	4.73 (2.17)	3.98 (1.99)	4.36 (2.09)
T_{13}	Azardirachtin 3000ppm	1250 ml	6.08 (2.47)	5.81 (2.40)	5.95 (2.44)	2.89 (1.69)	2.43 (1.56)	2.66 (1.63)	1.49 (1.21)	1.84 (1.36)	1.67 (1.29)	2.98 (1.73)	1.99 (1.37)	2.49 (1.57)	4.91 (2.22)	5.20 (2.28)	5.06 (2.25)
T_{14}	Untreated check	-	6.03 (2.41)	7.36 (2.68)	6.70 (2.55)	6.77 (2.60)	8.53 (2.92)	7.65 (2.76)	7.91 (2.81)	9.73 (3.12)	8.82 (2.94)	8.87 (2.95)	11.49 (3.39)	10.18 (3.18)	9.09 (3.01)	12.15 (3.48)	10.62 (3.25)
	S.E.±		0.24	0.25	0.16	0.14	0.14	0.09	0.14	0.17	0.07	0.17	0.18	0.11	0.13	0.17	0.10
	C.D. (P=0.05)		NS	NS	NS	0.44	0.44	0.26	0.42	0.51	0.22	0.53	0.53	0.33	0.41	0.51	0.32
	CV %		13.86	13.56	9.33	11.92	11.17	6.89	13.99	15.38	6.97	15.09	15.51	9.49	8.54	10.45	6.57

DAS – Days after spraying Figures in the parentheses are square root transformed values NS=Non-significant

Table 2 : Bio-efficacy of newer pesticides against aphids, *A. gossypii* Glover after second spray on okra (pooled of summer 2013 and 2014)

Tr. No.	Treatments	Dose (a.i./ha)	Number of aphids/ 3 leaves														
			1 DBS			1 DAS			3 DAS			7 DAS			14 DAS		
			2013	2014	Pooled	2013	2014	Pooled	2013	2014	Pooled	2013	2014	Pooled	2013	2014	Pooled
T_1	Diafenthiuron 50WP	600 g	8.12 (2.70)	15.92 (3.98)	12.03 (3.43)	3.03 (1.74)	3.71 (1.93)	3.37 (1.83)	1.19 (1.09)	1.51 (1.23)	1.35 (1.16)	2.33 (1.52)	3.09 (1.73)	2.71 (1.64)	4.43 (2.11)	8.69 (2.94)	6.56 (2.53)
T_2	Thiamethoxam 25WG	100 g	8.29 (2.88)	14.82 (3.85)	11.56 (3.40)	1.67 (1.29)	1.84 (1.35)	1.76 (1.32)	0.64 (0.80)	0.68 (0.82)	0.66 (0.81)	0.68 (0.81)	0.71 (0.84)	0.70 (0.83)	2.58 (1.60)	6.01 (2.44)	4.30 (2.03)
T_3	Imidacloprid 70WG	35 g	8.85 (2.95)	15.84 (3.98)	12.35 (3.51)	2.23 (1.47)	2.22 (1.46)	2.23 (1.49)	1.39 (1.15)	0.74 (0.84)	1.07 (1.02)	0.82 (0.90)	0.69 (0.83)	0.76 (0.87)	2.97 (1.69)	4.91 (2.16)	3.94 (1.97)
T_4	Fipronil 5SC	1000 ml	7.30 (2.70)	13.91 (3.70)	10.61 (3.25)	2.14 (1.44)	2.82 (1.68)	2.48 (1.57)	1.48 (1.19)	1.10 (1.03)	1.29 (1.13)	1.63 (1.27)	1.62 (1.27)	1.63 (1.28)	3.31 (1.80)	7.96 (2.82)	5.64 (2.32)
T_5	Buprofezin 25SC	300 ml	8.17 (2.86)	14.27 (3.68)	11.22 (3.32)	3.13 (1.77)	3.60 (1.90)	3.37 (1.83)	1.84 (1.35)	1.73 (1.31)	1.79 (1.34)	2.57 (1.60)	3.27 (1.81)	2.92 (1.71)	4.68 (2.16)	9.52 (3.09)	7.10 (2.62)
T_6	Fenpropathrin 30EC	200 ml	8.49 (2.91)	16.16 (4.02)	12.33 (3.51)	2.88 (1.70)	3.11 (1.76)	3.00 (1.73)	2.91 (1.71)	3.54 (1.88)	3.23 (1.79)	3.18 (1.78)	4.93 (2.22)	4.06 (2.00)	4.83 (2.20)	10.11 (3.18)	7.47 (2.69)
T_7	Dimethoate 30EC	1000 ml	8.53 (2.92)	16.64 (4.05)	12.59 (3.54)	3.19 (1.79)	3.97 (1.98)	3.58 (1.89)	1.32 (1.15)	2.21 (1.49)	1.77 (1.32)	2.43 (1.56)	2.26 (1.50)	2.35 (1.53)	4.60 (2.14)	8.07 (2.84)	6.34 (2.49)
T_8	Fenazaquin 10EC	1000 ml	9.37 (3.04)	15.07 (3.88)	12.22 (3.49)	3.60 (1.90)	4.92 (2.22)	4.26 (2.06)	1.93 (1.39)	5.01 (2.23)	3.47 (1.81)	2.69 (1.64)	5.81 (2.40)	4.25 (2.03)	4.87 (2.21)	9.12 (3.02)	7.00 (2.61)
T_9	Spiromesifen 22.9SC	400 ml	8.49 (2.91)	13.70 (3.68)	11.10 (3.32)	4.64 (2.15)	4.66 (2.16)	4.65 (2.16)	2.51 (1.58)	5.17 (2.27)	3.84 (1.93)	4.06 (1.99)	6.52 (2.55)	5.29 (2.28)	6.76 (2.60)	13.07 (3.61)	9.92 (3.11)
T_{10}	Propargite 57EC	1500 ml	8.08 (2.82)	13.69 (3.70)	10.89 (3.30)	3.46 (1.86)	4.62 (2.15)	4.04 (2.01)	2.07 (1.44)	4.64 (2.15)	3.36 (1.80)	3.91 (1.95)	5.58 (2.36)	4.75 (2.17)	6.05 (2.45)	13.15 (3.63)	9.60 (3.04)
T_{11}	Chlorfenapyr 10SC	750 ml	8.66 (2.94)	13.75 (3.71)	11.21 (3.35)	4.79 (2.18)	5.22 (2.28)	5.01 (2.24)	2.68 (1.64)	5.05 (2.25)	3.87 (1.94)	4.18 (2.02)	6.92 (2.62)	5.55 (2.34)	6.99 (2.64)	9.27 (3.04)	8.13 (2.84)
T_{12}	Dicofol 18.5EC	1250 ml	8.35 (2.89)	14.36 (3.78)	11.36 (3.37)	3.17 (1.78)	4.03 (2.01)	3.60 (1.89)	1.70 (1.30)	1.89 (1.37)	1.80 (1.34)	3.39 (1.84)	3.19 (1.79)	3.29 (1.81)	4.61 (2.15)	9.13 (3.01)	6.87 (2.58)
T_{13}	Azardirachtin 3000ppm	1250 ml	8.53 (2.92)	15.16 (3.89)	11.85 (3.44)	3.54 (1.88)	3.08 (1.75)	3.31 (1.82)	1.89 (1.37)	1.96 (1.40)	1.93 (1.39)	3.56 (1.89)	2.44 (1.56)	3.00 (1.72)	4.92 (2.22)	9.22 (3.04)	7.07 (2.63)
T_{14}	Untreated check	-	8.77 (2.96)	16.04 (4.00)	12.40 (3.52)	10.32 (3.21)	17.49 (4.18)	13.91 (3.70)	11.78 (3.43)	19.53 (4.42)	15.66 (3.93)	13.43 (3.66)	21.19 (4.60)	17.31 (4.19)	14.03 (3.75)	26.77 (5.17)	20.40 (4.46)
	S.E. ±		0.30	0.32	0.22	0.13	0.12	0.13	0.11	0.13	0.20	0.15	0.15	0.19	0.14	0.18	0.13
	C.D. (P=0.05)		NS	NS	NS	0.41	0.37	0.39	0.34	0.39	0.62	0.46	0.46	0.58	0.43	0.55	0.39
	CV %		14.90	11.58	9.00	10.18	8.30	9.21	11.01	10.28	17.76	12.44	10.65	14.31	8.87	8.12	6.68

DAS – Days after spraying Figures in the parentheses are square root transformed values NS=Non-significant

imidacloprid/kg, repectively.

Second spray :

The data on second spray pooled over periods on number of aphid population is presented in Table 2 indicated that all the treatments were significantly superior over control in reducing the aphid population.

A day before spray showed no significant difference of aphid population among the evaluated treatments which ranged from 10.61 to 12.59 aphids/ 3 leaves. By observing the pooled mean data regarding 1 DAS, it was evident that treatment T_2 (thiamethoxam 25WG) has recorded the lowest aphid population of 1.76 aphids/ 3 leaves followed by imidacloprid 70WG and fipronil 5SC which recorded 2.23 and 2.48 aphids/ 3 leaves and found at par with each other, whereas treatments T_6, T_{13}, T_5 and T_1 showed the results at par with treatment T_3. The treatment T_{11} (chlorfenapyr 10SC) was proved to be the most ineffective in controlling the aphid population with 5.01 aphids/ 3 leaves.

The pooled data collected on 3 DAS revealed that all the treatments had significant differences with control. The least number of aphids recorded in the treatment T_2 (thiamethoxam 25WG) with 0.66 aphids/ 3 leaves followed by T_3, T_4, T_1, T_7, T_5, T_{12} and T_{13} which were at par with the best treatment and each other. Among different treatments, chlorfenapyr 10SC recorded the highest of 3.87 aphids/ 3 leaves, next to it was untreated control (15.66 aphids/ 3 leaves).

After 7 days of spray, the per 3 leaves aphid population ranged from 0.70 to 17.31. The most effective treatments in controlling the aphid was T_2 (thiamethoxam 25WG), T_3 (imidacloprid 70WG) and T_4 (fipronil 5SC) with maximum reduction of population to 0.70, 0.76 and 1.63 aphids/ 3 leaves, respectively and were found at par with each other. The treatment T_{11} (chlorfenapyr 10SC) and T_9 (spiromesifen 22.9SC) were proved to be the most ineffective treatment in controlling the aphid population during the consecutive years. Somewhat similar trend of result was observed during fourteen days after spray except the superior treatment been T_3 (imidacloprid 70WG) with maximum reduction of 3.94 aphids/ 3 leaves.

Nakat *et al.* (2002) reported that thiamethoxam 70WS @ 0.5 per cent was most effective treatment, followed by imdacloprid 70 WS @ 0.5 per cent in controlling aphid, jassids and whitefly. Similar results were seen under the work carried out by Wadnerkar *et al.* (2004) and Bhalala *et al.* (2006).

The effectiveness of imidacloprid treatment against okra aphid resembled with the findings of Misra (2002) whose results revealed that imidacloprid and thiamethoxam proved significantly superior in controlling aphids and leaf hoppers on okra compared to other conventional insecticides and were also found similar with the findings of Targe and Kurtadikar (2003) and Pachundkar *et al.* (2013).Similar work related to the present investigation was also carried out by Patel *et al.*(2015); Patil *et al.* (2014); Singh and Lal (2012) and Swarnalata *et al.* (2015).

REFERENCES

Anonymous (2013). Indian Horticultural Database 2013-14. National *Horticultural Board*, Ministry of Agriculture, Government of India.

Bhalala, M.K., Patel, B.H., Patel, J.J., Bhatt, H.V. and Maghodia, A.B. (2006). Bio-efficacy of thiomethoxam 25 WG and various recommended insecticides against sucking pest complex of okra. *Indian J. Entomol.*, **68**(3) : 293-295.

Chaudhary, H.R. and Dadeech (1989). Incidence of insects attacking okra and the available losses caused by them. *Ann. Arid Zone.*, **28** (3) : 305-307.

Day, P.K., Jana, S.K., Chakraborty, G. and Somuchoudhury, A.K. (2005). Evaluation of imidacloprid (70 WS and 20 SL) against sucking pest complex of okra. *J. Ent. Res.*, **29** : 215-218.

Henderson, C.F. and Tilton, E.W. (1955). Tests with acaricides against the brown wheat mite.*J. Econ. Entomol.*, **48**(2):157-161.

Lawson, D.S., Ngo, N. and Koenig, J.P. (2000). Comparison of Aerial and Ground Applied Thiamethoxam (ActaraTM & CentricTM) for Control of Cotton Pests. 2000 Proceedings Beltwide Cotton Conferences, San Antonio, USA, 4-8 Volume **2**: 1330-1333.

Misra, H.P. (2002). Field evaluation of some newer insecticides against aphids (*Aphid gossypii*) and jassids (*Amrasca biguttula biguttula*) on okra. *Indian J. Ent.*, **64**(1): 80-84.

Nakat, R.V., Khutwad, D.S. and Chavan, B.P. (2002). Efficacy of newer insecticides as seed dresser on sucking pests of green gram (*Vigna radiata* L.). *Pestology*, **26**(7): 27-29.

Pachundkar, N.N., Borad, P.K. and Patil P.A. (2013). Evaluation of various synthetic insecticides against sucking insect pests of cluster bean. *Internat. J. Scient. & Res. Public.*, **3**(8): 1-6.

Patel, S.M., Radadia, G.G., Pandya, H.V., Patel, S.D. and Dave, P.P. (2015). Comparative biology and predatory potential of green lace wing on different aphid species. *Internat. J. Plant Protec.*, **8**(1) : 13-20.

Patil, S.B., Udikeri, S.S., Matti, P.V., Guruprasad, G.S., Herekurubar, R.B., Shaila, H.M. and Vandal, N.P. (2009). Bioefficacy of new molecule fipronil 5 per cent SC against sucking pest complex in Bt cotton. *Karnataka J. Agric. Sci*., **22**(5): 1029-1031.

Patil, S.D., Sonawane, K.M. and Pawar, V.S. (2014). Efficacy of various insecticides against foliage feeding wheat aphids. *Internat. J. Plant Protec.*, **7**(1) : 111-114.

Rathod, K.S., Lavelkar, R.C., Pande, A.K., Patanage, N.R. and Sharma, O.P. (2003). Efficacy of imidacloprid against sucking pests of cotton. *Ann. Plant Prote. Sci.*, **11**(2): 369-370.

Singh, Arun Kumar and Lal, M.N. (2012). Bio-efficacy of some plant leaf extracts against mustard aphid, *Lipaphis erysimi* Kalt. on *Brassica campertries. Asian J. Bio. Sci.*, **7** (2) : 159-162.

Swarnalata, B., Patel, S.M., Pandya, H.V. and Patel, S.D. (2015). Bio-efficacy of insecticides against aphid (*Aphis craccivora* Koch) infesting cowpea [*Vigna ungiculata* (L.) Walp.]. *Asian J. Bio. Sci.*, **10** (1) : 83-88.

Targe, D.S. and Kurtadikar, J.S. (2003). Efficacy of Some Newer Insecticides Against Mites. Proceedings of State level Seminar on Pest Management for Sustainable Agriculture, Feb. 6-7, 2003. pp. 226-227, Marathwada Agricultural University, Parbhani (M.S.) INDIA.

Wadnerkar, D.W., Kawthkar, B.R. and Zanwar, P.R. (2003). Evaluation of fipronil 5 per cent SC against cotton insects pests. *Pestology*, **27**(9): 15-18.

Wadnerkar, D.W., Zanwar, P.R., Sangle, P.D. and Bhosale, A.M. (2004). Field Evaluation of Thiamethoxam (Taurus 25WG) Against Sucking Pests of Cotton.Int.Symp.on Stratg.For Sust. Cotton Pro. A Glo Vision, 23-25 November 2004, pp.190-191.University of Agricultural Sciences, Dharwad (KARNATAKA) INDIA.