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Bio-efficacy of different insecticides against aphid, *Aphis gossypii* Glover infesting isabgul

MK Katesiya and BG Prajapati

Abstract
A field experiment was conducted during *rabi* 2017-18 to evaluate different insecticides against aphid, *Aphis gossypii* Glover infesting isabgul at Sardarkrushinagar. Among them, flonicamid 50WG (0.015%) was proved as most effective insecticide (0.76 aphid index) for the management of isabgul aphid and it was followed by the treatments of thiamethoxam 25WG (0.0084%) and imidacloprid 17.8 SL (0.005%) which registered 0.90 and 0.97 aphid index, respectively at seven days of second spray. Flonicamid 50WG (0.015%) had obtained the highest seed yield of isabgul (1012 kgha^{-1}) but it was statistically at par with thiamethoxam 25WG (0.0084%) (918 kgha^{-1}).

Keywords: Isabgul, isbgul aphid, *Aphis gossypii* Glover, bio-efficacy

Introduction
Isabgul (*Plantago ovata* Forsk.), a medicinal plant, is widely used in traditional and industrial pharmacology. India holds monopoly in the production and export of Isabgul to the world market. About 80 to 90% produce is mainly exported to U.S.A., West Germany, U.K. and France. The most important component of Isabgul is husk obtained from its seed. Isabgul husk is popularly known as "Sat Isabgol" in Indian market.It is an important medicine for intestinal and stomach disorders.

Isabgul is commercially grown as a winter crop cultivated in North Gujarat, Saurashtra and Kachchh region of Gujarat state. Isabgul is ravaged by number of insect pests. Among them, Isabgul aphid, *Aphis gossypii* Glover, seed beetle, *Lasioderma serricorne* Fabricius, termite, *Odontotermes obesus* Rambur and white grub, *Holotrichia consanguinea* Blanchard are major insect pests attacking in Isabgul crop (Reddy, 2009) [4]. Out of which Isabgul aphid, *Aphis gossypii* Glover (Homoptera: Aphididae) has been reported as a major pest of Isabgul (Sagar and Jindla, 1984) [6]. It is a polyphagous pest which infesting number of field crops. It has been reported to attack 220 host plants belonging to 46 families throughout the world (Roy and Behura, 1983) [5]. Regular occurrence of *A. gossypii* on Isabgul crop in North Gujarat and South Rajasthan regions causing enormous economic yield losses. Very few research work on the management of Isabgul aphid in North Gujarat Agro- Climatic Zone. Keeping these points in view, the present study for the management of Isabgul aphid was conducted during *rabi* 2017-18.

Materials and methods
A field experiment was carried out during *rabi* 2017-18 at Agronomy Instructional Farm, C.P. College of Agriculture, Sardarkrushinagar to find out an effective insecticide against aphid infesting isabgul. The trial was laid out in a randomized block design (RBD) with nine treatments and three replications. The isabgul variety Gujarat Isabgul 4 was spaced with 30cm drilling. The size of each plot measured 3.00m x 2.40m. All agronomical practices were adopted to raise the healthy crop. A total of nine treatments *viz*., thiacloprid 21.7SC (0.024%), acetamiprid 20SP (0.008%), clothianidin 50WDG (0.025%), flonicamid 50WG (0.015%), carbosulfan 25EC (0.05%), thiamethoxam 25WG (0.0084%), flupyradifuron 17.09EC (0.0089%), imidacloprid 17.8SL (0.005%) and untreated control. Two foliar sprays of each insecticide were applied by means of manually operated knapsack sprayer. First foliar spray was made at 1.5 aphid index and second spray was applied after 10days of the first spray.

For recording the observations, five plants were selected randomly from each net plot. Observations on aphid population were recorded before and after 1, 3 and 7 days of application of different insecticides at both of the sprays. The data thus, obtained were statistically analyzed after suitable transformation. Following aphid index given by Bank (1954) [1] was fixed for estimating the population of aphid and the average aphid index was worked out by adopting following formula.

$$\text{Average aphid index} = \frac{0N + 1N + 2N + 3N + 4N}{\text{Total number of plants observed}}$$

Where, 0, 1, 2, 3, 4 are aphid index
N = Number of plant showing respective aphid index

Aphid Index

Aphid Index	Degree of infestation
0	Plant free from aphid
1	Aphid present, but colonies did not build up. No injury due to pest apparent on the plant
2	Small colonies of aphid were present
3	Large colonies of aphid were present on tender parts. Counts of aphids in colonies were possible and tender plant part show damage symptoms due to aphids
4	Entire plant was covered by aphids. Counts of aphids in colonies were impossible and plant show damage symptom due to aphids

Seed yield of isabgul was recorded from each net plot at harvest and yield data were converted into hectare basis.

Results and discussion

Before spray

The results on aphid index prior to spray are summarised in table 1. The results showed that there were non-significant differences in aphid index prior to first spray among different treatments indicated that the aphid population in isabgul crop was uniformly distributed in the whole experimental plot.

First day after first spray

All the insecticidal treatments had recorded significantly superior over untreated control at first day after first spray. Flonicamid 50WG (0.015%) had recorded significantly the lowest aphid population (1.27 aphid index) among the all the treatments and it was proved to be the most effective insecticide against isabgul aphid, but it was remained at par with thiamethoxam 25WG (0.0084%) (1.38 aphid index), imidacloprid 17.8SL (0.005%) (1.49 aphid index), flupyradifuron 17.09EC (0.0089%) (1.87 aphid index), carbosulfan 25EC (0.05%) (1.98 aphid index). Acetamiprid 20SP (0.008%) (2.01 aphid index) and clothianidin 50WDG (0.025%) registered 2.16 aphid index, but it was at par with the treatment of thiacloprid 21.7SC (0.024%) had recorded the higher aphid population (2.20 aphid index) and proved to be the least effective.

Three days after first spray

The aphid index recorded at 3 days after first spray indicated that flonicamid 50WG (0.015%) found highly effective treatment as it recorded minimum aphid index (1.22). However, it was statistically at par with thiamethoxam 25WG (0.0084%) (1.32 aphid index), imidacloprid 17.8SL (0.005%) (1.42 aphid index), flupyradifuron 17.09EC (0.0089%) (1.63 aphid index), carbosulfan 25EC (0.05%) recorded 1.69 aphid index, acetamiprid 20SP (0.008%) (1.88 aphid index) and clothianidin 50WDG (0.025%) (2.00 aphid index). Thiacloprid 21.7SC (0.024%) was proved to be the least effective as it recorded higher aphid index (2.04 aphid index), whereas, untreated control had recorded 2.95 aphid index at 3 days after first spray.

Seven days after first spray

All the insecticidal treatments had recorded significantly lower aphid index as compared to untreated control against isabgul aphid. Flonicamid 50WG (0.015%) ranked first in reducing the aphid population in isabgul crop as it recorded significantly lower aphid index 1.14, but it was remained at par with thiamethoxam 25WG (0.0084%) (1.31 aphid index), imidacloprid 17.8SL (0.005%) (1.35 aphid index), flupyradifuron 17.09EC (0.0089%) (1.57 aphid index), carbosulfan 25EC (0.05%) recorded 1.68 aphid index, acetamiprid 20SP (0.008%) (1.86 aphid index) and thiacloprid 21.7SC (0.024%) (1.73aphid index), respectively. Clothianidin 50WDG (0.025%) (1.95 aphid index) was found to be the least effective as it recorded higher aphid index, whereas, untreated control had recorded 3.20 aphid index at 7 days after first spray.

Second spray

First day after second spray

At first day after second spray, all the different insecticidal treatments (Table 1) had significantly lowered the aphid population in comparison to untreated control. Flonicamid 50 WG (0.015%) had exhibited significantly the lowest population of aphid (1.07 aphid index), but it was statistically at par with thiamethoxam 25WG (0.0084%) (1.13 aphid index), imidacloprid 17.8SL (0.005%) (1.19 aphid index), flupyradifuron 17.09EC (0.0089%) (1.40 aphid index), carbosulfan 25EC (0.05%) recorded 1.48 aphid index, acetamiprid 20SP (0.008%) (1.73aphid index) and thiacloprid 21.7SC (0.024%) (1.64 aphid index). Clothianidin 50WDG (0.025%) was found the least effective as it recorded higher aphid index (1.89 aphid index), whereas, untreated control had recorded 3.33 aphid index at first days after second spray.

Three days after second spray

The aphid index recorded at 3 days after second spray indicated that flonicamid 50 WG (0.015%) found effective treatment as it recorded minimum aphid index (0.88) and it was statistically at par with the treatments of thiamethoxam 25WG (0.0084%) (1.00 aphid index), imidacloprid 17.8SL (0.005%) (1.06 aphid index), flupyradifuron 17.09EC (0.0089%) (1.38 aphid index), carbosulfan 25EC (0.05%) recorded 1.47 aphid index and acetamiprid 20 SP (0.008%) (1.55 aphid index). Thiacloprid 21.7SC (0.024%) had exhibited 1.61 aphid index, but it was remained at par with clothianidin 50WDG (0.025%) as it recorded higher aphid index (1.73 aphid index) in comparison to untreated control (3.42 aphid index) at 3 days after second spray.

Seven days after second spray

At seven days after second spray, all the insecticides were recorded significantly reduced the population of aphid as compared to untreated control. Perusal of the results revealed that flonicamid 50WG (0.015%) ranked first in reducing the population of aphid as it recorded lower aphid index of 0.76, but it was at par with treatments of thiamethoxam 25WG (0.0084%) (0.90 aphid index), imidacloprid 17.8SL (0.005%) (0.97 aphid index), flupyradifuron 17.09EC (0.0089%) (1.25 aphid index), carbosulfan 25EC (0.05%) (1.34 aphid index) and acetamiprid 20SP (0.008%) (1.38 aphid index). Clothianidin 50WDG (0.025%) had recorded 1.51 aphid index, but it was remained at par with thiacloprid 21.7SC (0.024%) was found least effective as it recorded higher aphid index (1.54) in comparison to untreated control (3.58 aphid index) at 7 days after second spray.

Seed yield of isabgul

Perusal of the results on seed yield of isabgul presented in table 1 revealed that flonicamid 50WG (0.015%) had

harvested the highest seed yield of isabgul (1012 kgha^{-1}) but it was statistically at par with the treatment of thiamethoxam 25WG (0.0084%) (918 kgha^{-1}), whereas, untreated plots of isabgul had obtained lowest (580 kgha$^{-1)}$ seed yield of isabgul.

Table 1: Bio-efficacy of different insecticides against aphid, *A. gossypii* infesting isabgul

Tr. No.	Treatments	Aphid index at different intervals of spray						Seed Yield (kgha^{-1})
		Before spray	1st Spray			2nd Spray		
			1 DAS	3 DAS	7 DAS	1 DAS	3 DAS	7 DAS	
1.	Thiacloprid 21.7SC (0.024%)	1.81* (2.77)	1.64*^{ab} (2.20)	1.60*^{ab} (2.04)	1.49*^{b} (1.73)	1.46*^{bc} (1.64)	1.45*^{b} (1.61)	1.43*^{b} (1.54)	683de
2.	Acetamiprid 20SP (0.008%)	1.75 (2.57)	1.63^{abc} (2.01)	1.54^{b} (1.88)	1.53^{b} (1.86)	1.49^{bc} (1.73)	1.43^{bc} (1.55)	1.37^{bc} (1.38)	737^{cde}
3.	Clothianidin 50WDG (0.025%)	1.79 (2.69)	1.63^{ab} (2.16)	1.58^{ab} (2.00)	1.57^{b} (1.95)	1.55^{b} (1.89)	1.49^{b} (1.73)	1.42^{bc} (1.51)	697de
4.	Flonicamid 50WG (0.015%)	1.78 (2.66)	1.33^{c} (1.27)	1.31^{b} (1.22)	1.28^{b} (1.14)	1.25^{c} (1.07)	1.18^{c} (0.88)	1.12^{c} (0.76)	1012^{a}
5.	Carbosulfan 25EC (0.05%)	1.80 (2.75)	1.58^{abc} (1.98)	1.48^{b} (1.69)	1.48^{b} (1.68)	1.41^{bc} (1.48)	1.40^{bc} (1.47)	1.36^{bc} (1.34)	772^{bcd}
6.	Thiamethoxam 25WG (0.0084%)	1.76 (2.58)	1.37^{bc} (1.38)	1.35^{b} (1.32)	1.35^{b} (1.31)	1.28^{bc} (1.13)	1.22^{bc} (1.00)	1.18^{bc} (0.90)	918^{ab}
7.	Flupyradifuron 17.09EC (0.0089%)	1.78 (2.68)	1.54^{abc} (1.87)	1.46^{b} (1.63)	1.44^{b} (1.57)	1.38^{bc} (1.40)	1.37^{bc} (1.38)	1.32^{bc} (1.25)	803^{bcd}
8.	Imidacloprid 17.8 SL (0.005%)	1.81 (2.78)	1.41^{bc} (1.49)	1.38^{b} (1.42)	1.36^{b} (1.35)	1.30^{bc} (1.19)	1.25^{bc} (1.06)	1.21^{bc} (0.97)	880^{abc}
9.	Untreated Control	1.82 (2.81)	1.82^{a} (2.83)	1.86^{a} (2.95)	1.92^{a} (3.20)	1.96^{a} (3.33)	1.98^{a} (3.42)	2.02^{a} (3.58)	580^{e}
S.Em.±		0.13	0.09	0.09	0.10	0.08	0.08	0.09	53.85
C.D. at 5%		NS	0.28	0.27	0.29	0.25	0.25	0.26	161
C.V. %		12.71	10.48	10.46	11.30	10.00	10.26	10.80	11.96

*Figures outside the parentheses are $\sqrt{x + 0.5}$ transformed values, while in parentheses are retransformed values; DAS - Days after spray; Treatment means with the letter/letters in common are not significant by DNMRT at 5% level of significance

Similar observations were also reported by Ghosal *et al.* (2013) [3] who reported that imidacloprid 17.8SL (50g a.i./ha) was found as a most effective neonicotinoid insecticide against aphid. It recorded least aphid infestation and 84.54 per cent reduction of population over control. To control aphid population of okra the other two neonicotinoids *viz*., thiamethoxam 25WG (50g a.i./ha) and acetamiprid 20SP (40g a.i./ha) were also found at par with imidacloprid and showed better results than acephate 75WP and dimethoate 30EC. Considering incremental cost: benefit ratio acetamiprid 20SP (40g a.i./ha) was found most economic over other neonicotinoids. Saner *et al.* (2013) [7] studied on efficacy of newer insecticides on sucking pests in *Bt* cotton under in Khandesh region of Maharashtra showed that out of 9 treatments, all were significantly reduced by the test synthetic chemical insecticides in comparison to untreated control. Population of aphid was promisingly suppressed by thiamethoxam 25WG, fipronil 80WG, followed by fipronil 5SC, acetamiprid 20SP, lambda cyhalothrin 5SC, imidacloprid and triazophos. Gaurkhede *et al.* (2015) [2] reported that the application of flonicamid 50WG (0.02%), dinotefuran 20SG (0.008%) and imidacloprid 30.5SC (0.005%) were the superior most, recording 1.27, 1.37 and 1.92 aphids per leaf, respectively after three sprays. Next in order, the treatment with flonicamid 50WG (0.01%), fipronil 5SC (0.015%), acetamiprid 20SP (0.004%) and dinotefuran 20SG (0.006%) were found to be effective showing aphid population in the range of 2.07 to 2.24 aphids per leaf and they were at par with each other.

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