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Research Article

Bio-efficacy of some new insecticides against foliage feeding barley aphids (*Rhopalosiphum maidis*)

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Abstract

The present investigation was undertaken to identify highly effective insecticides for the management of foliar aphid of barley. The bioefficacy of seven different insecticides viz., imidacloprid 200 SL, thiamethoxam 25WG, flubendiamide 480 SC, quinalphos 25 EC, dimethoate 30 EC, acetamiprid 20 SP and clothianidin 50 WDG were tested for two year along with untreated control. All the insecticides significantly reduced aphid population as compared to untreated control, however flubendiamide 480 SC @250ml/ha. was most effective against barley aphid. Being safer to natural enemies, it might fit best in integrated pest management module of barley aphid. On the basis of grain yield, flubendiamide 480 SC @ 250ml/ha. was again the best treatment 48.29 q/ha and it was at par with clothianidin 50 WDG @ 30 gm/ha (47.71q/ha.), acetamiprid 20 SP @ 100gm/ha. (47.63 q/ha) and significantly better than untreated control (38.21 q/ha).

Key words: Barley, *Hordeum vulgare, Rhopalosiphum maidis,* imidacloprid, flubendiamide, clothianidin

1. Introduction

Barley (*Hordeum vulgare*) is an important winter cereal crop of India and it is grown in northern hills, north western plains and central India for food, feed and malt purpose. In India barley is cultivated on 6.95 lakh ha area with a production of 17.43 lakh tonnes and productivity per hectare was 2508 kg (Anonnymous, 2012-13). In Haryana and Punjab, barley production got boost during recent year's due to initiation of contact farming by brewing companies. The shift in cultivation under such conditions also provided conducive microclimate for the incidence and spread of some insect pests and diseases. Barley is attacked by a complex of *rabi* cereal aphids (Singh, 1983). The three main species which attacks barley are *Rhopalosiphum maidis* (Fitch), *Rhopalosiphum padi* L. and *Sitobion avenae* (Fabricius). Among these, *R. maidis* is the most destructive species on the barley crop. The foliar aphid infest the barley crop from tillering to earhead formation and cause huge damage by sucking the sap which result in quantitative and qualitative loss 29.61% grain yield loss has been reported due to aphid infestation in barley aphid in India (Chillar and Verma, 1982; Sharma and Bhatnagar, 2004).

For the integrated management of aphids numbers of practices are being used such as. resistant varieties, sticky cards, alternation in cultural practices and chemical insecticides. However, the varieties under cultivation in India are not resistant to aphid. Therefore, once aphid infestation starts, the chemical insecticides become more important to check their further spread.

A number of chemicals like imidacloprid 200 SL, acetamiprid 20 SP quinalphos 25 EC, thiamethoxam 25WG (Mhaske *et al*., 2007), clothianidin 50 WDG (Babu *et. al*., 2012) and flubendiamide 480 SC (Kumar *et al., 2001;* Tohnishi *et al*., 2005) are being used to manage aphids in different crops. However, very scanty information is available for aphid management in barlay.

Recently, novel chemical with new mode of action has been introduced in market which require less quantity as compared to older class of compounds. These are considered comparatively less hazzardous to environment and natural predators.Therefore studies were planned to assess comparative efficacy of some new chemicals for the management of aphids in barley.

2. Materials and methods

The present investigations were carried out during 2012-13 and 2013-14 crop seasons under All India Co-ordinated Wheat and Barley Improvement Project (AICW&BIP) at the Crop Research farm, S.D. University of Vijapur Gujarat, India. The experiment was conducted in randomized block design and each treatment was replicated thrice. The different treatments used were as under :

T1- Imidacloprid 200 SL (100 ml/ha.), T2- Thiamethoxam 25WG (50 gm /ha.), T3- Flubendiamide 480 SC (250ml/ha.), T4- Quinalphos 25 EC (1500ml/ha.), T5- Dimethoate 30 EC (1000ml/ha.), T6- Acetamiprid 20 SP (100gm/ha.), T7- Clothianidin 50 WDG (30 gm/ha.), T8-untreated control

Barley variety 'RD 2052' was sown in plots having six rows of 4 m length at 25 cm apart from each other. The sowing was done in second fortnight of November and standard package of practices were followed to raise crop (Kumar *et al*., 2001).

The insecticidal sprays were applied at the time when average infestation of aphids reached at 20 aphids/shoot/plant. Five shoot were selected randomly from each replication for recording the observations. Observations were recorded on the basis of average population of survival aphids. Pre-count was taken 24 hours before spray and post-count was taken on 1, 2, 7 and 15 days after spray. Only live aphids were counted after the application of treatments. The 200-250 liters of spray fluid was used per hectare for spraying insecticides with knapsack sprayer. The spraying was done in the evening hours at the time of low wind velocity to keep spray drift to the minimum in the field. At the end of the season, grain yield was taken on whole plot basis and used for statistical analysis. The average population of aphids survived per shoot was worked out and the data were subjected to square root transformation and further for analysis of variance through ANOVA using SPSS software.

3. Results and discussion

The pooled data for consecutive two years (2012-13 to 2013-14) pertaining to effect of various insecticides on aphids management in barley is presented in Table 1. The data revealed that all the treatments reduced the aphid population significantly as compared to untreated control. The aphid populations was non-significant before application of the insecticides. The pooled data revealed that the one day after spray aphid population was minimum in acetamiprid 20 SP (15.17aphids/shoot/plant),which was statistically at par with dimethoate 30 EC (15.27 aphids/shoot/plant) followed by imidacloprid 200 SL (15.90 aphids/shoot/plant). Similarly on later dates at 2, 7, and 15 days after spraying, all the insecticides were found to be statistically at par with each other except thiamethoxam 25WG and found significantly superior over untreated control (25.00-34.13 aphids/shoot/plant). However, the numerical advantage in reduction of aphid population at 15 days after spraying was recorded in flubendiamide 480 SC (0.37 aphids/shoot/plant) followed by clothianidin 50 WDG.

The data on yield differences due to spraying of insecticides are presented in Table1. Flubendiamide 480 SC @ 250ml/ha recorded highest yield of 48.29 q/ha which was at par with clothianidin 50 WDG @ 30 gm/ha (47.71q/ha), acetamiprid 20 SP @ 100gm/ha. (47.63 q/ha), imidacloprid 17.8 SL@ 100 ml/ha.(44.92 q/ha), dimethoate 30 EC @ 1000 ml /ha. (44.29 q/ha), quinalphos 25 EC @ 1500 ml /ha (43.50q/ha) and thiamethoxam 25WG @ 50 gm /ha (42.13 q/ha). Lowest yield was recorded from untreated control (38.21 q/ha). Flubendiamide 480 SC @ 250ml/ha gave maximum 10 q./ha. yield advantage over control followed by clothianidin 50 WDG (9.50q/ha) and acetamiprid 20 SP(9.42q/ha).

Though the majority of insecticides tested were found statistically at par in reduction of aphid population but flubendiamide 480 SC and clothianidin 50 WDG having numeric advantage as well as applied at low doses, thus required less in quantity and become economical in comparison to other chemicals.

The different insecticide viz**.** imidacloprid, thiamethoxam 25WG and dimethoate 30 EC (Babu *et al*., 2006) acetamiprid 20 SP, alothianidin 50 WDG and flubendiamide 480 SC has been reported effective against aphids in barley as well as other crops (Mhaske *et al*., 2007, Babu *et al*., 2012 ,Kumar *et al*., 2010 Tohnishi *et al*., 2010 and Thania *et al*., 2012). A new class of insecticides neonicotinoids has been introduced in 1990's which were very effective against sucking pests including aphids (Babu *et al*., 2012). However, most of the insecticides from neonicotinoids were reported toxic to the natural enemies. Flubendiamide, a novel insecticide recently introduced, was reported effective against wheat aphid (Mhaske *et al*., 2007), mustard aphid (Khedkar *et al*., 2012) and aphids in other crops (Tohnishi *et al*., 2010). Our results are also in coroboration to earlier reports, that flubendiamide and neonicotinoids (imidacloprid, acetamipridand clothianidin) are effective against barley aphid. Whereas, flubendiamide 480 SC having numeric advantage over other chemicals in reduction of aphid population as well as in yield. flubendiamide has been reported as less hazardes to natural enemies when applied in tomato crop against fruit borer (Ameta and Bunker, 2007). It is also reported comparatively safe to spider and lady bird beetle, the natural enemies of aphid (Lalit *et al*., 2009). Shahid and his co-workers (2011) studies the harmful effect of different insecticides on *T. chilonis* and

Table-1. Bio-efficacy of some newly insecticides against foliage feeding barley aphids (*Rhopalosiphum maidis*) (Pooled Data-2012-13 to 2013-14).

SN	Treatments	Dose (g.a.i.)	Pre count(Av. no. of aphids/shoot/plant)			Post count1DAS(Av. no. of aphids/shoot/ plant)			Post count 2 DAS (Av.no.of aphids/ shoot/plant)			Post count 7DAS(Av. no.of aphids/shoot/plant)			Post count 15 DAS (Av. no. of aphids/ shoot/plant)			Yield q/ha			Additional yield over control q/ha		
			12-13	13-14	Pooled	12-13	13-14	Pooled	12-13	13-14	Pooled	12-13	13-14	Pooled	12-13	13-14	Pooled	12-13	13-14	Pooled	12-13	13-14	Pool
1	Imidacloprid 200 SL	20	23.73 (4.97)	37.67 (6.22)	30.70 (5.63)	12.33 (3.65)	19.47 (4.52)	15.90 (4.11)	6.53 (2.74)	13.20 (3.77)	9.87 (3.30)	1.60 (1.61)	1.80 (1.67)	1.70 (1.64)	1.20 (1.48)	0.00 (1.00)	0.60 (1.26)	41.42	48.42	44.92	6.92	6.50	6.71
2	Thiamethoxam 25WG	12. 5	25.40 (5.14)	42.13 (6.57)	33.77 (5.90)	14.13 (3.89)	23.07 (4.91)	18.60 (4.43)	7.80 (2.97)	16.73 (4.21)	12.27 (3.64)	1.67 (1.63)	2.00 (1.73)	1.83 (1.68)	0.80 (1.34)	0.00 (1.00)	0.40 (1.18)	38.00	46.25	42.13	3.50	4.33	3.92
3	Flubendiamide 480 SC	20	24.13 (5.01)	39.87 (6.39)	32.00 (5.74)	12.67 (3.70)	20.53 (4.64)	16.60 (4.20)	6.13 (2.67)	14.80 (3.97)	10.47 (3.39)	0.87 (1.37)	1.40 (1.55)	1.13 (1.46)	0.73 (1.32)	0.00 (1.00)	0.37 (1.17)	46.83	49.75	48.29	12.33	7.83	10.00
4	Quinalphos 25 EC	125	22.07 (4.80)	38.47 (6.28)	30.27 (5.59)	11.53 (3.54)	20.33 (4.62)	15.93 (4.12)	6.67 (2.77)	17.53 (4.31)	12.10 (3.62)	1.73 (1.65)	2.07 (1.75)	1.90 (1.70)	1.33 (1.53)	0.00 (1.00)	0.67 (1.29)	41.21	45.79	43.50	6.71	3.87	5.29
5	Dimethoate EC	30100	24.00 (5.00)	35.60 (6.05)	29.80 (5.55)	11.53 (3.54)	19.00 (4.47)	15.27 (4.03)	6.47 (2.73)	14.33 (3.92)	10.40 (3.38)	1.07 (1.44)	1.73 (1.65)	1.40 (1.55)	1.40 (1.55)	0.00 (1.00)	0.70 (1.30)	42.17	46.42	44.29	7.67	4.50	6.08
6	Acetamiprid 20 SP	50	23.33 (4.93)	36.33 (6.11)	29.83 (5.55)	11.93 (3.60))	18.40 (4.4)	15.17 (4.02)	6.47 (2.73)	14.80 (3.97)	10.63 (3.41)	1.47 (1.57)	1.53 (1.59)	1.50 (1.58)	0.87 (1.37)	0.00 (1.00)	0.43 (1.20)	43.46	51.79	47.63	8.96	9.87	9.42
7	Clothianidin 50 WDG	5015	22.93 (4.89)	41.93 (6.55)	32.43 (5.78)	12.93 (3.73)	20.93 (4.68)	16.93 (4.23)	6.27 (2.70)	13.33 (3.79)	9.80 (3.29)	0.80 (1.34)	1.73 (1.65)	1.27 (1.51)	1.40 (1.55)	0.00 (1.00)	0.70 (1.30)	46.38	49.04	47.71	11.88	7.12	9.50
8	Untreated check	-	23.80 (4.98)	40.47 (6.44)	32.13 (5.76)	28.53 (5.43)	43.60 (6.68)	36.07 (6.09)	34.93 (5.99)	33.33 (5.86)	34.13 (5.93)	48.07 (7.00)	15.53 (4.07)	31.80 (5.73)	29.20 (5.50)	20.80 (4.66)	20.93 (5.09)	34.50	41.92	38.21	-	-	-
	CD at 5%		NS	NS	NS	0.40	0.67	0.40	0.44	0.50	0.34	0.37	0.39	0.27	0.26	0.00	0.27	7.454	11.351	6.00	-	-	-

* Figures in parentheses are √ n+1 values

reported flubendiamide most safe among all the tested insecticides.

Thus it is concluded that flubendiamide 480 SC is most effective against barley aphid and being safer to natural enemies, it might be best fit in integrated pest management module of barley aphid.

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