Table 3 Capsule damage caused by *D. punctiferalis* in different insecticides and its effect on yield and economics (pooled over sprays and years)

Sr. No.	Treatment	Capsule damage (%)				Yield (q/ha)	ICBR
		Before spray	First year	Second year	Pooled over years		
T_1	Chlorantraniliprole 18.5 SC 0.006 %	14.97	15.44a (7.09)	15.41a (7.06)	15.42a (7.07)	30.72c	1:9.30
T_2	Spinosad 45 SC 0.018%	15.11	18.67b (10.25)	19.21b (10.83)	18.93b (10.52)	24.06b	1:4.47
T_3	Novaluron 10 EC 0.01 %	16.05	18.78b (10.36)	19.48b (11.12)	19.13b (10.74)	21.14b	1:4.08
T_4	Chlorpyrifos 50% + cypermethrin 5% EC 0.055%	14.54	18.74b (10.32)	19.34b (10.97)	19.04b (10.64)	22.87b	1:17.50
T_5	flubendiamide 48 SC 0.015%	15.15	15.58a (7.21)	15.66a (7.29)	15.62a (7.25)	29.37c	1:7.93
T_6	Indoxacarb 15.8 EC 0.015%	14.59	15.65a (7.28)	15.66a (7.29)	15.66a (7.29)	28.85c	1:18.55
T_7	Emamectin benzoate 5 SG 0.0025%	15.27	15.68a (7.30)	15.79a (7.40)	15.74a (7.36)	28.71c	1:12.24
T_8	Quinalphos 25 EC 0.05%	15.85	18.71b (10.29)	19.33b (10.96)	19.02b (10.62)	23.53b	1:10.92
T_9	Control	15.31	21.81c (13.80)	22.73c (14.93)	22.28c (14.37)	16.02a	-
S. Em ± (T)	Treatment	0.68	0.30	0.41	0.25	1.02	-
	Period (P)	0.33	0.18	0.24	0.15	0.50	-
	T X P	1.00	0.53	0.58	0.44	1.50	-
	C.V. %	11.43	7.29	9.66	8.51	10.39	-

Figures in parentheses are retransformed values; those outside are arcsine transformed value

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Field evaluation for bio-efficacy of some insecticides against wheat aphid (*Rhopalosiphum maidis*)

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ABSTRACT

The present experiments were conducted to evaluate the bio-efficacy of some insecticides against wheat aphid during 2015-16 and 2016-17 *Rabi* seasons on cv. GW 322 at Wheat Research Station, SDAU, Vijapur, Gujarat. It was found that insecticidal treatment of dimethoate 30 EC have least number of aphid population followed by treatment of monocrotophos 40EC in all the post count i.e. 1st, 2nd, 7th and 15th days after spraying of insecticides. The maximum aphid population was recorded in untreated control plot where no any insecticides were sprayed during both the crop seasons. The pooled data on grain yield has resulted that the maximum grain yield was obtained in dimethoate 30EC (35.86 q/ha) followed by imidacloprid 200 SL (30.42 q/ha). Thus, the pooled data has revealed that all the six insecticidal treatments reduced the population of aphids significantly and increased the grain yield of wheat as compared to untreated control check.

Key words: *Rhopalosiphum maidis*, aphid population, bio-efficacy, insecticidal treatments, grain yield

Among the major insect-pests on wheat crop, aphids have been recorded as a key and most dreaded pest in all the major wheat growing regions in India (Singh, 1986). Many aphid species usually attack the wheat crop, such as *Sitobion miscanthi* (Takanashi), *S. avenae* (Fabricius), *Rhopalosiphum maidis* (Fitch) and R. *padi* (Linnaeus) in India. The changes in agronomic practices such as sowing time, availability of relatively photo-insensitive varieties, temperature tolerant genotypes and higher fertilizer input have led to change in pest complex of wheat and shifted the status of wheat aphid from occasional to regular pests on wheat since 2002 (Patil *et al.*, 2009). The aphid complex caused 3.53-21.05 per cent yield losses in variety PBW 343 in Punjab (Singh and Deol, 2003). Kuroli and Nemeth (1987) reported that reduction of 50 and 70 per cent grains weight per year due to the infestation of wheat aphid in both winter and spring wheat in Hungary, respectively. Overall, the direct reduction of grain yield caused by wheat aphids ranged from 35 to 40 per cent when 15 aphids were maintained per seedling for 30 days (Kiechkhefer and Gellner, 1992).

Since, no any sources of resistant varieties are available against wheat aphid in India, so their infestation is usually controlled by relaying on the use of conventional insecticides. So, the application of insecticides either seed treatments or foliar sprays is one of the most important control measures for reducing the infestation of wheat aphids (Ahmed *et al.*, 2001; Royer *et al.*, 2005; Zhang *et al.*, 2015). Insecticides commercially available for used as seed treatment include imidacloprid 20% SC, thiamethoxam 25% WP, acetamiprid 20% SP and dinotefuran 20% SG for managing wheat

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aphid. Moreover, a number of insecticides such as imidacloprid 200 SL, acetamiprid 20 SP, quinalphos 25 EC, thiamethoxam 25 WG (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 the problem of aphids in different crops. Thus, the present investigation was carried out to evaluate bio-efficacy of some insecticides for the management of wheat aphid at field condition.

MATERIALS AND METHODS

The present experiments were conducted to evaluate the bio-efficacy of some insecticides against wheat aphid during 2015-16 and 2016-17 *Rabi* seasons on cv. GW 322 at Wheat Research Station, Sardarkhrushinagar Dantiwada Agricultural University, Vijapur, Gujarat. Experiments were laid out in Randomized Block Design (RBD) in three replications. The net plot size was 1.6 m x 5 m with row to row spacing of 20 cm. Total of six insecticidal treatments *viz.*, dimethoate 30 EC @ 0.03 per cent, phosphamidon 40 EC @ 0.03 per cent, monocrotophos 40 EC @ 0.04 per cent, imidacloprid 200 SL @ 0.01 per cent, triazophos 40 EC @ 0.05 per cent, Neem Seed Kernel Suspension (NSKS) @ 5 per cent and untreated control were evaluated against wheat aphid at field condition. The sowing was done in second fortnight of November and standard package of practices were followed to raise the wheat crop during both the experimental years of study. The insecticidal sprays were applied at the time when average infestation of aphids reached upto 10 number of aphid/middle shoot/plant with 750 liters of spray fluid per hacter with knapsack sprayer. Then, five shoot were selected randomly from each replication for recording of observations. Observations were recorded on the basis of average population of number of survived aphids. Pre-count was taken 24 hrs before spray and post counts were taken on 1st, 2nd, 7th and 15th days after spraying of insecticides. Only the numbers of live aphids were counted after the applications of insecticidal treatments. The average population of aphids survived per shoot was subjected for further analysis of variance and critical difference was calculated for the comparison of effect of all tested six insecticidal treatments and untreated control. Moreover, at the end of *Rabi* seasons of both the experimental years under study, grain yield in q/ha were recorded for the comparison of effect of all the insecticidal treatment and untreated control against wheat aphid in field condition.

RESULTS AND DISCUSSIONS

The population of aphids did not differ statistically among all the insecticidal treatments in 24 hrs before spraying of insecticides in both the experimental years of study. The pooled data has revealed that on 1st day after spraying of insecticides, aphid population was minimum in treatment of dimethoate 30 EC (8.73 aphids/shoot) followed by treatment of monocrotophos 40 EC (10.60 aphids/shoot) (Table 1). Similarly, on later dates i.e. 2nd, 7th and 15th days after spraying of insecticides, the minimum population of aphids was recorded in treatment of dimethoate 30 EC followed by treatment of monocrotophos 40 EC. However, based on pooled data all the insecticidal treatments were found to have significantly less number of aphid populations as compared to untreated control as shown in table 1. The pooled data on grain yield revealed that the maximum grain yield was obtained in treatment of dimethoate 30 EC (35.86 q/ha) followed by treatment of imidacloprid 200SL (30.42 q/ha) while the lowest grain yield was recorded in untreated control (25.85 q/ha) as shown in table 2. Thus, the pooled data of two years of experimental study has suggested that all the six

insecticidal treatments significantly reduced the aphid's population and increased the grain yield as compared to untreated control plot.

Similar result was also reported where efficacy of six insecticidal treatments were carried out during 2013-14 crop season at four locations i.e. Karnal, Ludhiana, Niphad and Pantnagar against foliar aphid complex in wheat. The result has indicated that flubendamide 480 SC @ 20g a.i./ha was recorded with least number of aphid populations at Karnal and Ludhiana. However, thiamethoxam 25 WG @12.5g a.i./ha and chlorabtranilipride 18.5 SC @ 20 g a.i/ha were observed with lowest number of aphid population at Niphad and Pantnagar. The maximum yield of 45.42 q/ha and 58.31 q/ha were recorded at Karnal and Ludhiana with acetamiprid 20 SP @ 20g a.i./ha (Katare *et al.*, 2017). Moreover, the different insecticides *viz.*, imidacloprid 200 SL, thiamethoxam 25 WG and dimethoate 30 EC (Babu *et al.*, 2006), acetamiprid 20 SP, clothianidin 50 WDG and flubendiamide 480 SC has been reported effective for the management of aphids in barley and other crops (Mhaske *et al.*, 2007, Babu *et al.*, 2012, Thania and Mathew, 2012).

CONCLUSION

From the present findings, it can be concluded that spraying of dimethoate 30 EC gave best result for controlling the aphid population in field condition and also provide higher grain yield of wheat. However, all the six insecticidal treatments reduced the population of wheat aphids and increased the grain yield as compared to untreated control. Thus, these six insecticides might be best fit in integrated pest management module for the management of wheat aphid.

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Table 1 Effect of some insecticidal treatment against wheat aphid

SN	Treatment	Dose (%)	Aphid population per shoot														
			Before spray			After spray											
						1st day			2nd day			7th day			15th day		
			15-16	16-17	Pooled	15-16	16-17	Pooled	15-16	16-17	Pooled	15-16	16-17	Pooled	15-16	16-17	Pooled
1	Dimethoate 30 EC	0.03	17.27	20.13	18.70	7.07a	10.40a	8.73a	3.93a	6.60a	5.27a	2.07a	3.60a	2.83a	0.93a	1.07a	1.00a
2	Phosphamidon 40EC	0.03	18.87	17.80	18.33	8.40a	15.07b	11.73ab	4.93ab	12.27bc	8.60a	3.63a	10.27bc	6.95ab	2.07a	7.73bc	4.90ab
3	Imidacloprid 200SL	0.01	17.80	18.07	17.93	9.60ab	17.27cd	13.43b	4.33a	15.27cd	9.80a	2.13a	14.07cd	8.10ab	1.93a	12.27cd	7.10abc
4	Monocrotophos 40EC	0.04	18.60	17.53	18.07	7.93a	13.27ab	10.60ab	4.27a	10.07b	7.17a	2.87a	7.67b	5.27ab	1.07a	5.13b	3.10a
5	Triazophos 40EC	0.05	15.93	20.00	17.97	9.47a	16.27bc	12.87b	5.60a	14.07c	9.83a	3.33a	12.27c	7.80ab	1.33a	9.87c	5.60ab
6	NSKS	5.00	16.73	18.80	17.77	17.40bc	19.33de	18.37c	9.87b	17.53de	13.70ab	5.80a	16.53de	11.17bc	6.53b	15.60de	11.07bc
7	Control	-	16.73	21.20	18.97	18.27c	21.40e	19.83c	25.53c	20.20e	22.87b	14.47b	19.60e	17.03c	10.67c	14.53e	12.60c
	S.Em. + T		2.59	1.30	1.40	2.55	1.12	1.34	1.71	1.12	2.68	1.76	1.05	1.83	1.10	1.05	1.80
	Y × T		-	-	2.05	-	-	1.97	-	-	1.44	-	-	1.45	-	-	1.07
	C.D. at 5% T		NS	NS	NS	7.85	3.46	3.86	5.26	3.46	9.26	5.42	3.23	6.33	3.38	3.23	6.21
	Y × T		-	-	NS	-	-	NS	-	-	4.21	-	-	4.23	-	-	3.13
	C.V.%		25.78	11.78	19.46	39.51	12.04	24.96	35.37	14.17	22.66	62.23	15.12	29.69	54.25	19.18	28.67

Table 2 Effect of some insecticidal treatment on grain yield (q/ha) against wheat aphid

S. N.	Treatment	Dose (%)	Grain yield (q/ha))		
			2015-16	2016-17	Pooled
1.	Dimethoate 30EC	0.03	38.36	33.36	35.86a
2.	Phosphamidon 40EC	0.03	28.93	23.93	26.43b
3.	Imidacloprid 200SL	0.01	32.92	27.92	30.42b
4.	Monocrotophos 40EC	0.04	30.20	25.20	27.70b
5.	Triazophos 40EC	0.05	32.17	27.17	29.67b
6.	NSKS	5.00	28.63	23.63	26.13b
7.	Control	-	28.35	23.35	25.85b
	S.Em. ± T		2.72	2.72	1.72
	Y × T		-	-	2.72
	C.D. at 5% T		NS	NS	4.97
	Y × T		-	-	NS
	C.V.%		15.04	17.89	16.34

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