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BIOEFFICACY OF SOME NEWER INSECTICIDES AND BIO-PESTICIDES AGAINST BARLEY APHID, *RHOPALOSIPHUM MAIDIS* (FITCH)

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ABSTRACT

In a study on bioefficacy of some newer insecticides and bio–pesticides against the barley aphid, imidacloiprid (0.005%) proved most effective followed by dimethoate (0.03%) and thiamethoxam (0.025%) in reducing the aphid population. *Metarhizium anisopliae* (2×10^7 spores l^{-1}) was least effective followed by azadirachtin (5 ml l^{-1}) and NKSE (10%). Maximum seed yield of 42.81 q hal^{-1} was obtained from the plots treated with imidacloprid followed by dimethoate (42.58 q ha^{-1}) and thiamethoxam (42.21 q ha^{-1}) and minimum was in the plots treated with *M. anisopliae* (36.42 q ha^{-1}). However, highest benefit cost ratio (10.14) was recorded in the treatment of dimethaote followed by imidacloprid (7.16) and endosulfan (6.50).

Key words: Barley, *Hordeum vulgare* Linn., insecticides, bio-pesticides, aphid, *Rhopalosiphum*

Barley an important *rabi* crop is an ideal feed and fodder for livestock besides having acquired the status of an industrial crop for malting and brewing. In Rajasthan, it is cultivated in about 2.5 lac hectares with a production of 5.39 lac mt. tonnes and productivity of 2163 kg ha^{-1} (Anonymous, 2007). The barley aphid, *R. maidis* is a key pest with regular occurrence (Sharma, 1990 and Kumawat and Jheeba, 1999). As insecticides seem to be the only way out to manage these aphids, in the present study, some newer insecticides were evaluated together with some biopesticides for their bioefficacy.

MATERIALS AND METHODS

The field experiment was carried out on the Agronomy Farm, S.K.N. College of Agriculture Jobner during *rabi* 2007-08 and 2008-09. The experiment was laid out in simple randomized block design (RBD) with ten treatments (insecticides) including untreated control, each replicated thrice. The plot size was 3.0 × 1.8 m^2 keeping row to row and plant to plant distance of 25 cm and 10 cm, respectively. The genotype RD-2052 recommended for this region was sown on 15th November during both the crop seasons (*Rabi*, 2007-08 and 2008-09). The bio-efficacy of imidacloprid (0.005%), thiamethoxam (0.025%), spinosad (0.01%), endosulfan (0.07%), *M. anisopliae* (2×10^7 spores l^{-1}), diflubenzuron (0.05%), NKSE (10%), azadirachtin (5 ml l^{-1}) and dimethoate (0.03%) was evaluated against the aphid, *R. maidis* on barely crop. The aphid population was recorded on five randomly selected tagged plants (5 tillers/ plant) in each plot one day before and 1, 3, 7 and 15 days after application of insecticides.

The economics of various treatments was also worked out by computing the cost of insecticides as well as their cost of application.

RESULTS AND DISCUSSION

Data presented in the Table 1 show that imidacloprid (0.005%) was most effective in reducing the aphid population followed by dimethoate (0.03%) and thiamethoxam (0.025%) that resulted up to 90.38, 88.96 and 87.54 per cent reduction in aphid population, respectively. Similar reports of imidacloprid being most effective against aphids of wheat and barely has been made by Babu and Sharma (2003) and Bhargava (2009).

The neem products *viz.*, NSKE (10%) and azadirachtin (5 ml l^{-1}) and entomopathogenic fungus, *M. anisopliae* (2×10^7 spores l^{-1}) were less effective as compared to synthetic insecticides, as they registered up to 53.22, 50.69 and 47.00 per cent reduction of the aphid population, respectively. Earlier, Radha *et al.* (2006) reported that nimbicidine was least effective against *R. maidis* on maize crop. Similarly, Sachan *et al.* (2006) reported that NSKE and neem oil were least effective insecticides against mustard aphid *L. erysimi*.

Seed yield of barley was highest (42.81 q/ha ha^{-1}) in the plots treated with imidacloprid followed by dimethoate (42.58 q/ha) and thiamethoxam (42.21 q ha^{-1}).

Table 1. Bio–efficacy of newer insecticides against aphid, *R. maidis* on barley during *Rabi*, 2007-08 and 2008-09

S. No.	Insecticides	Conc. (%) or dosage*	Mean per cent reduction in aphid population days after									
			First spray					Second spray				
			1	3	7	15	Mean	1	3	7	15	Mean
1.	Imidaclorpid 17.8 SL	0.005	89.11 (70.73)	96.45 (79.14)	84.72 (66.99)	68.64 (55.94)	84.73 (67.00)	94.03 (75.86)	97.58 (81.05)	90.96 (72.50)	78.95 (62.69)	90.38 (71.93)
2.	Thiamethoxam 25 WG	0.025	87.01 (68.87)	92.92 (74.57)	81.07 (64.21)	66.02 (54.34)	81.76 (64.72)	91.68 (73.23)	94.81 (76.83)	87.78 (69.54)	75.90 (60.60)	87.54 (69.33)
3.	Spinosad 2.5 SC	0.01	76.24 (60.83)	83.67 (66.16)	69.53 (56.49)	46.85 (43.19)	69.07 (56.21)	78.71 (62.52)	85.83 (67.89)	74.17 (59.45)	63.15 (52.62)	75.46 (60.30)
4.	Endosulfan 35 EC	0.07	80.45 (63.76)	86.01 (68.03)	72.63 (58.45)	49.80 (44.88)	72.09 (58.11)	81.95 (64.86)	88.12 (69.84)	76.35 (60.90)	65.70 (54.15)	78.03 (62.05)
5.	*M. anisopliae* 1.15 WP	2×10^7 spores l^{-1}	24.03 (29.35)	39.53 (38.96)	60.10 (50.83)	46.32 (42.89)	42.49 (40.68)	26.43 (30.94)	43.00 (40.98)	61.17 (51.45)	57.28 (49.19)	47.00 (43.28)
6.	Diflubunzuron 25 WP	0.05	73.71 (59.15)	81.84 (64.78)	71.53 (57.75)	44.98 (42.12)	68.01 (55.56)	74.70 (59.80)	84.25 (66.62)	76.64 (61.10)	65.37 (53.95)	75.24 (60.16)
7.	NSKE	10	47.63 (43.64)	63.34 (52.74)	48.49 (44.13)	31.84 (34.35)	47.82 (43.75)	47.81 (43.74)	64.82 (54.83)	53.24 (46.86)	47.01 (43.28)	53.22 (46.85)
8.	Azadirachtin 0.3 EC	5 ml l^{-1}	44.31 (41.73)	57.49 (49.31)	45.49 (42.41)	28.90 (32.52)	44.04 (41.58)	45.10 (42.19)	60.59 (51.11)	51.35 (45.77)	45.71 (42.54)	50.69 (45.39)
9.	Dimethoate 30 EC	0.03	88.30 (70.00)	94.75 (76.75)	83.04 (65.68)	67.81 (55.43)	83.47 (66.01)	93.25 (74.94)	96.20 (78.76)	89.04 (70.67)	77.37 (61.59)	88.96 (70.59)
10.	Control	-	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
	SEm ±		0.80	0.92	0.79	0.69	0.78	0.86	0.89	0.84	0.76	0.85
	CD (5%)		2.29	2.63	2.26	1.96	2.24	2.47	2.55	2.39	2.18	2.44

Figures in the parentheses are angular transformation values; *Mean of three replications

Table 2. Assessment of losses caused by aphid, *R. maidis* and comparative economics of insecticidal treatments on barley during *rabi*, 2007-08 and 2008-09

S. No.	Insecticides	Conc. (%) used	Yield (q ha^{-1})	Total avoidable losses (q ha^{-1})	Per cent avoidable losses	Total increase in yield over control (q ha^{-1})	Per cent increase in yield over control	Return of increased yield (Rs)*	Total expenditure (Rs)**	Net Profit (Rs ha^{-1})	B:C ratio
1.	Imidacloprid 17.8 SL	0.005	42.81	0.00	0.00	9.83	29.80	7372	1030	6342	7.16
2.	Thiamethoxam 25 WG	0.025	42.21	0.60	1.40	9.23	27.99	6922	5030	1892	1.38
3.	Spinosad 2.5 SC	0.01	40.85	1.96	4.58	7.87	23.86	5902	53150	– 47248	0.11
4.	Endosulfan 35 EC	0.07	41.21	1.60	3.74	8.23	24.95	6172	950	5222	6.50
5.	*M. anisopliae* 1.15 WP	2×10^7 spores l^{-1}	36.42	6.39	14.93	3.49	10.60	2617	806	1811	3.25
6.	Diflubunzuron 25 WP	0.05	40.29	2.52	5.89	7.31	22.16	5482	6590	– 1108	0.83
7.	NSKE	10	39.21	3.60	8.41	6.23	18.89	4672	7725	– 3053	0.60
8.	Azadirachtin 0.3 EC	5 ml l^{-1}	38.95	3.86	9.02	5.97	18.10	4477	1610	2867	2.78
9.	Dimethoate 30 EC	0.03	42.58	0.23	0.54	9.60	29.11	7200	710	6490	10.14
10.	Control	–	32.93	9.83	22.96	–	–	–	–	–	–

*Pooled price of barley seed was Rs. 750/- q^{-1}; ** It includes cost of insecticides andlabour charges

Sekhar and Singh (2001) also reported that per cent increase in yield over control in wheat crop was higher in the treatment of imidacloprid (125 g a.i. ha^{-1}) when applied against aphids infesting wheat crop. The findings are also in close agreement with those of Yadav and Jain (1999) who reported that the treatments of dimethoate (0.03%) gave highest seed yield in barely crop when applied as foliar spray. Srivastava and Bhatia (2005) reported that thiamethoxam (50 g a.i. ha^{-1}) was most effective in protecting the grain yield.

It was notable that the total avoidable losses and per cent avoidable losses were zero in the plots treated with imidacloprid followed by dimethoate and thiamethoxam in which the total avoidable losses were 0.23, 0.60 q ha^{-1} and avoidable losses of 0.54, 1.40 per cent, respectively. The maximum total avoidable losses (9.83 q ha^{-1}) and avoidable losses (22.96%) were recorded from control plots which was followed by *M. anisopliae*, azadirachtin and NSKE in which the total avoidable losses were 6.39, 3.86 and 3.60 q ha^{-1} and the avoidable losses were 14.93, 9.02, and 8.4 per cent, respectively. In the treatments of endosulfan, spinosad and diflubenzuron the total avoidable losses of 1.60, 1.96 and 2.52 q ha^{-1} and the avoidable losses of 3.74, 4.58 and 5.89 per cent, respectively were recorded.

The maximum net profit (Rs. 6490 ha^{-1}) was obtained from the plots treated with dimethoate, which had benefit cost ratio of 10.14 followed by imidacloprid and endosulfan in which the benefit cost ratio was 7.16 and 6.50, respectively. The treatment of *M. anisopliae*, azadirachtin and thiamethoxam gave benefit cost ratio of 3.25, 2.78 and 1.38, respectively. However, negative benefit cost ratio of 0.11, 0.60 and 0.83 were recorded in the treatments of spinosad, NSKE and diflubenzuron due to their higher cost. Khurana and Yadav (1995) recommended dimethoate (0.03%) against aphid on barely crop on the basis of efficacy and economics of application. Sachan *et al.* (2006) reported that dimethoate (0.03%), thiamethoxam (0.03%) and imidacloprid (0.04%) gave maximum benefit cost ratio, endosulfan gave moderate benefit cost ratio and neem products gave least benefit cost. Bhat and Baba (2007) also reported that the maximum net profit was obtained from imidacloprid treatment against *R. maidis* on maize crop.

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