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RIGOROUS, A HOMEOPATHIC MEDICINE, EFFECTIVE FOR CONTROLLING APHIDS IN BREAD WHEAT

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ABSTRACT

Rigorous is a homoeopathic and natural product, which was designed to control the wheat Aphid and enhance the production of wheat. The cultivar SEHER-06 was grown in 5 districts of Punjab in Randomized Complete Block Design with three replications to evaluate this medicine against aphids in wheat. Four different treatments of Rigorous were applied and represented as T1-T4. Post treatment data for aphid population/tiller and percent mortality as compared to pre-treatment data were taken at different time points (after 24, 72 hours and 7 days). The results revealed that treatment-2 (T2) (Rigorous 1.5% solution @ 1.5 litre + 100 litre of water/acre) revealed minimum aphid population and maximum aphid mortality percentage for all time points. The results showed that aphid population decreased and the mortality rate increased with the passage of time from 24 hour to 7 days. The treatment, T3 (water only) was the least detrimental for the coccinellids predator for all time points. There was a positive correlation between aphid population per tiller and number of coccinellids per plant for all durations. Rigorous application resulted in significant increase in grain yield per hectare as compared to control. The results concluded that Rigorous could be efficiently utilized for controlling aphids in bread wheat in addition to less detrimental effects to the natural enemies of aphids.

Keywords: Rigorous, wheat, aphids, coccinellids, grain yield

INTRODUCTION

Wheat is the most widely produced cereal crop in the world and its global world trade is presently greater than the other most grown crops i.e. rice, maize and potato (Webb, 2000, Curtis, 2002). Wheat is the most important staple food crop of Pakistan (Anwar *et al.*, 2009). It is severely attacked by vaiours aphids *spp.* but *Sitobian avenae* F. has attained the status of potential insect pest resulting in drastic effects on grain yield of the crop (Mohyuddin, 1981, Grima *et al.* 1993). The aphids suck cell sap mostly from spikes, rolled flag leaves and cause considerable reduction in the plant vigor (Kauffman and Laroche, 1994). The affected leaves become yellowish, wilted and silky (Ashfaq *et al.* 2007). The aphid attack causes deposition of honeydew that encourages the growth of sooty fungus on the foliage which ultimately influences the photosynthesis rate in the leaves (Kindler *et al.* 1995).

Aphids of cereal crops are a dangerous problem for wheat (Dixon 1987) and its populations stay on wheat for a short, distinct time period during which they proliferate swiftly (Jarosik *et al.* 2003). Aphids cause substantial yield losses by the direct effect of their feeding (Keickhefer and Kantack 1980) and as a vector of several plant viruses (Aheer *et al.* 2008). Aheer *et al.* (1994) found that one aphid caused 2.20 percent loss in grain yield. The yield loss ranges from 30 to 40 percent at 15 aphids per plant have also been reported by Kiechkhefer and Gellner (1992).

Different control measures might be used to check the aphid population below economic threshold level without disturbing the environment and affecting the non-target organisms. Among them, the exploitation of natural enemies and host plant resistance are regarded as more attractive substitutes to insecticides because of their low cost and environmentally friendly action (Quisenberry and Schotzko, 1994). Therefore, efficient control of aphids on wheat can be obtained through biological agents like predators and parasites (Iqbal *et al.* 2008a). In this context, about 17 species of Coccinellid beetles have been recorded as predators of aphids out of which *Coccinella septempunctata* L. is the most important (Krotova, 1994). Their immature and mature stages feed hungrily on aphid and their reproductive potential is high due to long oviposition period ((Krotova 1994, Karpacheva, 1991, Iqbal *et al.* 2008b). Many studies also revealed that coccinellids and chrysopid population in the field are efficient against aphids populations (Araya and Cambron 1992, Kauffman and Laroche, 1994, Pell and Vandenberg, 2002, Iqbal *et al.*, 2008a).

However, to tackle with high aphid population which may cause heavy yield loss, insecticides are used for their instant knock down overlooking their ailing effects (Riazuddin *et al.* 2004 more reference needed). Some studies demonstrated that use of various

insecticides can be helpful in managing aphids on wheat (Ahmed *et al.* 2001, Iqbal *et al.* 2005) but their haphazard use might results in evils of health risks, polluted environment and development of resistance in insects against insecticides in addition to the destruction of natural enemies i.e. coccinellids (Iqbal *et al.* 2008a, 2008b). However, Jansen (2000) concluded that aphids could be managed with insecticides, fenvalerate and fluvalinate that were safe to natural enemies in wheat.

Rigorous is a homoeopathic and natural based broad-spectrum pesticide against wheat Aphid. In Rigorous, highly diluted & potentized homoeopathic medicines are used as active ingredients. It is a mixture of the extracts of different homeopathic medicines like Mother tincture of CALENDULA, Mother tincture of GINKGO BILOBA, GRANATUM, CALOTROPIS GIG, CORNUS FLORIDA, FICUS RELGIOSA. It is specially designed against the wheat aphid because all the available pesticides are poisonous, which are not recommended for application against aphids in wheat. However, Rigorous is a homoeopathic & natural product, which was designed to meet the requirements of needful. This is contact and systemic natural pesticide with special drug affinity towards the oxidation centre of the pest and causes the suffocation, which results in mortality of the pest. This has not been used before for controlling of aphids in wheat. The aphids in wheat were supposed to be target of above-mentioned homoeopathic pesticide.

This study was planned to exploit a homeopathic medicine Rigorous for controlling aphid population in bread wheat and effect of its application in terms of grain yield. The investigation was also extended to examine the response of natural enemy, coccinellids against different levels of Rigorous.

MATERIALS AND METHODS

The study regarding Rigorous efficacy trials were conducted at five different locations in the province of Punjab, Pakistan i.e. Gujranwala (32°10′N, 74°10′E), Sheikhupura (31°43′N, 73°59′E), Sargodha (32°09′N, 74°21′E), Mandi Baha-ud-Din (31.95′N, 73.75′ E) and Multan (30°18′N, 71°29′E). The variety used for the study was SEHER-06. The experiment was conducted in Randomized Complete Block Design with three replications. Dibbler was used for sowing and the gross experimental plot for each treatment in each replication comprised of 30 sq. m (10m x 30m). The seed rate used was 100 kg ha^{-1} and NPK fertilizers were applied @ 100-100-0 kg ha^{-1} at each location uniformly. Four treatments were utilized for the studies as given below;

T_1= Rigorous 1% solution @ 1 litre + 100 litre water on per acre basis

T_2= Rigorous 1.5% solution @ 1.5 litre + 100 litre water on per acre basis

T_3= Simple water @ 100 litre water on per acre basis

T_4= Control

Knapsac Hand Sprayer was used for application of these treatments. The observations on aphid population and mortality percentage of aphid along with yield data were taken. The data were recorded as;

(ii) Pretreatment data (Just before spray)

(ii) Post treatment data (after 24, 72 hours & 7 days)

Aphid population per tiller basis was recorded from 15 tillers selected randomly in each treatment while predators (Coccinellids) population was counted per plant basis randomly from 15 plants in each plot. The data for aphid population, mortality and yield were statistically analyzed following Steel *et al.* (1997) and the means were compared according to Duncan (1955). The correlation was calculated using SPSS 12.0 computer software.

RESULTS AND DISCUSSION

Aphids are destructive pests of wheat which mostly attack on leaves and suck the cell sap but some of them e.g., *Sitobian avenae* F. also attacks on spike zone to suck the cell sap from green succulent tissues of spike (Ashfaq *et al.* 2007). Aphids being a potential pest of wheat crop (Aheer *et al.*, 2007; Aheer *et al.*, 2008) can cause up to 30 to 40% grain yield losses in wheat (Kiechkhefer and Gellner 1992). Rigorous was utilized for their control as the application of insecticide to control them was found to be harmful for human health, environment and friendly insects like predators.

The efficacy of Rigorous on aphid population is given in Table 1. The post treatment data of aphid population and the resultant mortality percentage revealed significant difference at different durations i.e. 24 hours, 72 hours and 7 days at all the locations except Gujranwala and Multan. In Gujranwala, mortality percentages at 24 hours and 72 hours was only significant while mortality at 7 days and number of aphids per tiller after treatment with rigorous was non-significant for all time durations. Similarly, in Multan district the data for mortality percentages were non-significant for all time points while post treatment aphid population was non-significant only after 72 hours. At Sheikhupura, Sargodha and Mandi Bahaudin, T2 (Rigorous 1.5% solution @ 1.5 litre + 100 litre of water) resulted in minimum aphid population and maximum aphid mortality percentage for all the durations. Relatively similar pattern of effectiveness of rigorous was observed in the other two districts (Gujranwala and Multan).

Average population/tiller and mortality percentage for different treatments (Table-2) revealed that use of 1.5% solution of rigorous (T2) had long lasting effects with minimum number of aphids/tiller and maximum mortality for 72 hours up to 7 days. However, after 24 hours, T1 (Rigorous 1% solution @ 1 litre + 100 litre of water) showed maximum mortality. But still in this case

the lowest aphid population was observed for T2 treatment which again recommended this treatment.

Coccinellids are natural enemies for wheat aphids and their population plays a significant role in decreasing aphid density (Araya and Cambron 1992, Kauffman and Laroche, 1994, Farid *et al.*, 1997, Pell and Vandenberg, 2002, Iqbal *et al.*, 2008 a,b). Various treatments studied here revealed significant affect on the population of coccinellids per plant in different time points (Table-3). First treatment showed more unfavourable condition for coccinellids in all time points whereas T2 (1.5% solution) was less detrimental. This suggested that application of Rigorous was not detrimental for coccinellids predators, so, it can be efficiently used for controlling aphids in wheat without harming these friendly insects. Although, the population of these predators were much more in T3 (water only) and control but in T2 in was comparable with the pre-treatment data of the predators.

However, there was a positive correlation between aphid population per tiller and number of coccinellids per plant for 24 h ($r=0.97^{**}$), 72 h ($r=0.84^{ns}$) and 7 days ($r=0.93^{*}$) of post treatment (Table-3). Positive and significant effect of coccinellids on aphid population has also been recorded (Anon. 2003-2004) while Krotova (1994) found a negative correlation between aphids and coccinellid population. This suggested that after application of different treatments the populations of both the pest and predators increased however rate of mortality was much higher in case of aphids.

Application of Rigorous resulted in significant increase in grain yield per hectare (Figure-2). All the treatments displayed more grain yield as compared to control where the Rigorous was not applied. The highest yield was observed in case of T2 (4571.47 kg/ha), again advocating the application of 1.5% Rigorous solution (Figure-2a). Similarly T2 also showed the greatest percentage increase in grain yield (10.4%) as compared to T1 (3.12%) and T3 (4.53%) as represented in Figure-2b. this suggested that rigorous can be efficiently used for controlling the aphids and attaining higher grain yield in wheat.

Table-1: Efficacy of Rigorous against aphid on wheat crop

Sr.#	District	Treatments	Pre-treatment Data Aphid /tiller (Mean value)	Post Treatment Data aphids/tiller			% mortality		
				24 hours	72 hours	7 days	24 hours	72 hours	7 days
1	Sheikhupura	T_1	22.69	14.42 bc	9.42 bc	3.62 b	36.48 b	69.82 a	83.22 a
		T_2	21.33	12.13 c	5.73 c	2.31 b	43.13 a	73.23 a	89.23 a
		T_3	17.75	15.95 ab	14.15 ab	11.48a	10.08 c	20.09 b	35.59 b
		T_4	19.29	18.75a	16.28 a	13.55 a	2.78 d	15.81 b	29.61 b
		LSD value		2.903	6.015	3.779	1.042	23.56	19.99
2	Gujranwala	T_1	22.70	13.37	8.83	15.33	35.38 a	56.50a	77.89
		T_2	20.03	13.00	7.08	2.89	44.32 a	69.06a	86.24
		T_3	17.03	15.67	15.60	11.00	8.10b	16.77b	30.24
		T_4	16.56	18.23	14.40	13.64	0.00b	13.26b	22.11
		LSD value		N.S	N.S	N.S	26.71	28.14	NS
3	Sargodha	T_1	33.09	21.69 b	13.89 b	9.22 b	34.46b	57.91a	72.03b
		T_2	38.09	23.24 b	12.47 b	7.87 b	45.18a	67.44a	79.39a
		T_3	47.11	40.42 a	34.80 a	32.80 a	14.19c	25.87b	30.48c
		T_4	37.40	34.35 a	27.75a	29.24a	8.17d	25.70b	22.12d
		LSD value		6.699	7.523	7.891	3.8	16.22	7.296
4	Mandi Bahaudin	T_1	43.96	29.47a	18.18 b	13.00 b	32.61b	58.12a	70.50b
		T_2	24.98	14.45 b	7.60 c	5.91 c	42.15a	68.45a	76068a
		T_3	38.98	29.66 a	32.65 a	27.32 a	17.34c	23.87b	29.87c
		T_4	20.47	18.27 b	16.22 b	15.31 b	10.86d	20.61b	25.10d
		LSD value		6.527	2.260	3.948	4.559	11.47	3.798
5	Multan	T_1	16.36	7.38 c	4.40	0.53 bc	54.89	73.20	96.51
		T_2	19.66	10.40 bc	4.52	0.38 c	42.43	77.80	97.82
		T_3	20.33	13.04 ab	7.00	0.82 ab	31.38	64.48	95.55
		T_4	20.83	15.83a	6.78	0.93 a	24.95	68.46	95.56
		LSD value		3.377	NS	0.3159	NS	NS	NS

Where T_1=Rigorous 1% solution @ 1 litre + 100 litre of water/acre, T_2=Rigorous 1.5% solution @ 1.5 1 litre + 100 litre of water/acre, T_3= Simple water @ 100 litre of water/acre and T_4= Control without any treatment. The values carrying different letters are different from each other. LSD= Least significant difference.

Table-2: Average aphid population/tiller and % mortality on pre and post treatment data after 24 hrs, 72 hrs & 7 days of application.

Treatments	Pre-treatment data (Aphid/teller)	Post treatment data after:-					
		24hrs		72hrs		7 days	
		Aphids/tiller	%mortality	Aphids/tiller	%mortality	AphidS / tiller	%mortality
T_1	22.7	13.37c	41.10a	8.83c	61.10ab	5.33c	76.52b
T_2	20.03	13.0c	35.09b	7.08c	64.65a	2.89d	85.57a
T_3	17.03	16.67ab	7.98c	15.6a	8.40c	11.0b	35.41c
T_4	16.56	18.23a	-10.08d	14.41ab	12.98c	13.64a	17.63d

Whereas, T_1=Rigorous 1% solution @ 1 litre + 100 litre of water, T_2=Rigorous 1.5% solution @ 1.5 1 litre + 100 litre of water, T_3= Simple water @ 100 litre of water and T_4= Control without any treatment. The values carrying different letters are sufficiently different from each other.

Table 3: Average Coccinellids population/plant of pre and post treatment data after 24hrs, 72 hrs & 7 days of application.

Treatments	Pre-treatment data (Coccinellids/plant)	Post treatment data after:-		
		24hrs	72hrs	7 days
		Coccinellids/ plant	Coccinellids/ plant	Coccinellids/ plant
T_1	0.20	0.22c	0.29cd	0.27c
T_2	0.18	0.24b	0.33c	0.24cd
T_3	0.24	0.31a	0.40ab	0.38b
T_4	0.22	0.33a	0.44a	0.59a
Correlation with Aphids/tiller		0.97**	0.84^{ns}	0.93*

Whereas, T_1=Rigorous 1% solution @ 1 litre + 100 litre of water, T_2=Rigorous 1.5% solution @ 1.5 1 litre + 100 litre of water, T_3= Simple water @ 100 litre of water and T_4= Control without any treatment. The values carrying different letters are different from each other. The values represent the average. ns=non-significant, *= significant at 5% level and **= significant at 1% probability level.

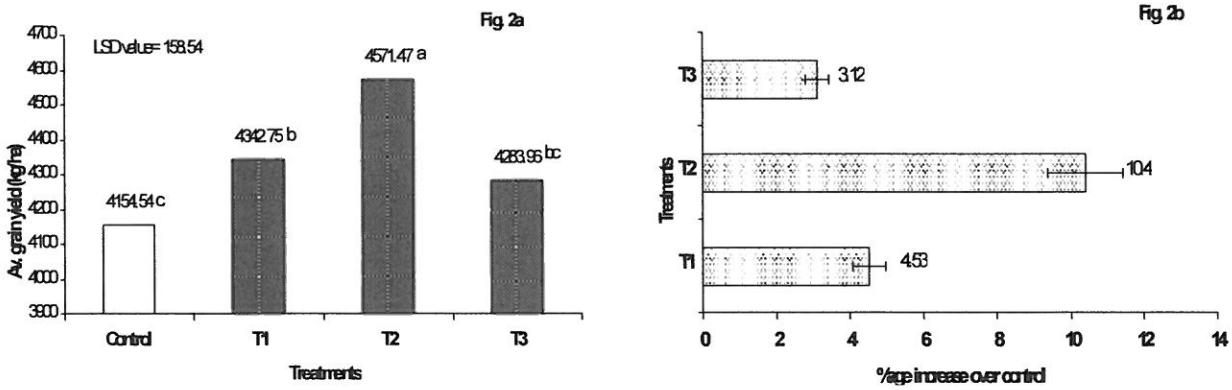

Figure-2: In Fig. 2a all the treatments represented higher grain yield per ha as compared to control which is also showed in Fig. 2b in terms of percentage. Whereas, T_1=Rigorous 1% solution @ 1 litre + 100 litre of water, T_2=Rigorous 1.5% solution @ 1.5 1 litre + 100 litre of water, T_3= Simple water @ 100 litre of water and Control= without any treatment. LSD= Least significant difference.

Conclusion: The results concluded that 1.5% solution (T2) of Rigorous revealed maximum control of wheat aphid at all time points. T2 also resulted in the highest mortality percentage with the passage of time for most of the districts. Similarly T2 was less lethal for predators followed by T1; however, population of coccinellid was much more in case of water and control. In addition to significant control on aphid population, T2 gives maximum grain yield per hectare which demonstrated that this treatment could be used effectively for controlling aphids to an acceptable level without harming crop friendly insects.

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