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ASSESSMENT OF BIO-CONTROL AGENT PERFORMANCE AND INSECTICIDAL PROPERTIES OF BIO-EXTRACTS AGAINST APHID (*SCHIZAPHIS GRAMINUM* R.) ON WHEAT, (*TRITICUM AESTIVUM* L.) CROP.

Muhammad Ali [1*], Muhammad Ashfaq[2], Muhammad Ashfaq[1], Muhammad Tariq[4], Asim Gulzar[4], Abdul Ghaffar[3] and Muhammad Shahzad[1].

[1]Institute of Agricultural Sciences, University of the Punjab, Lahore, Pakistan.
[2]Department of Entomology, University of Agriculture, Faisalabad.
[3]Directorate of Agronomy, Ayub Agricultural Research Institute, Faisalabad, Pakistan.
[4]Department of Entomology, PMAS-Arid Agriculture University Rawalpindi, Pakistan

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***Corresponding Author**:
Muhammad Ali

E-mail: ali.klasra@gmail.com

ABSTRACT

An experiment was conducted on wheat variety, Pasban 90, at Post Graduate Agricultural Research Station (PARS), University of the Agriculture Faisalabad during 2009-10 to study the effectiveness of bio-extracts (Neem leaves extract, neem seed kernel extract, ginger extract mixed with neem leave extract and a bio-agent (*Chrysoperla carnea)* against wheat aphid. The experiment was conducted under RCBD with three replications. Neem leaves extract mixed with ginger extract significantly lowered the aphid mean population 1.10 (86.08% mortality) per tiller followed by neem leave extract mixed with surfactant, where mean aphid population remained 1.95 (82.20% mortality) and neem seed kernel extract where mean aphid population recorded was 2.28 (81.27% mortality) per tiller after 24 hrs, 72 hrs, 7 days, 15 days and 22 days. *Chrysoperla carnea* also reduced the aphid mean population to some extent and mean aphid population was 8.14 (29.49%) in comparison with check treatment after 24 hrs, 72 hrs, 7 days, 15 days and 22 days. Yield data per acre showed significant differences among each treatment. Data was analyzed and compared with the help of (LSD) Test ≤ 0.05.

Keywords: *Triticum aestivum* L, *Aphis* spp, Bio-pesticides, *Chrysoperla carnea,* Neem Extract.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the important cereal crop and contained first position as staple food in Pakistan. The wheat contained big source of carbohydrate and provides near about 20% of the world's food calories and nearly 40% food for total world's population (Wiese, 1987). The shortfall in wheat yield is attributed to several factors and one of them is insect pests. Many insect pest attack wheat crop but the green bug or wheat aphid has attained a great importance during the last few years. There are many aphid species present on the wheat all over the world such as *Schizaphis graminum* (green bug), *Rhopalosiphum padi* (Bird cherry-oat aphid), *Diuraphis noxia* (Russian wheat aphid), *Metopolisphum dirhodum* (rose grass aphid) and *R. maidis* (corn leaf aphid). Aphids pierce and suck sap from leaves and stems and inject toxic substances during feeding on plants that destroy plant tissues. When these aphid species start feeding above the ETL numbers they create significant damage to host plants and also facilitate development of important wheat disease barley yellow dwarf virus (Gair *et al.,* 1983). If any of the aphid species directly given free hand can cause 35-40% yield loss and 20-80% losses indirectly by transmitting viruses and fungal disease (Trdan and Mileroj, 1999) during the early stages of plant growth e.g. 30 aphids/tiller feeding for 10 days cause about 20% yield loss at harvest, but there is uncertainty about losses incurred during the time when and after grain heads form.

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R. padi and S. *graminum* are (most likely to occur in the field on maturing grain) caused yield losses of 19 to 31% at booting stage and 15 to 20% at flowering stage (Voss *et al.,*1996). The problem due to aphid can be handled by the application of commonly used insecticides but drawbacks, here lies with their haphazard use which results in the health hazards, insecticide residues in grains, environmental pollution and development of resistance in insect pest against these chemicals. It has been recently realized in general, that some alternative to these highly toxic and persistence material should be found out for managing insect pests of wheat in particular, that may be cheap, easily available, and acceptable both by the public and health authorities.

There are many bio-pesticides and bio-control agents available to control aphids. Field experiments are needed to explore the efficacy of these bio-pesticides and bio-agents. Several methods have been practiced for the control of aphids. These include cultural, physical, mechanical, biological, chemical and host plant resistance. Combinations of the non-chemical control method keep aphids population normally below economic injury level. But, in cases of aphid's population build ups chemicals have to be used for control and yield assessment (Webster, 1987; Storck, 1989; Zheng and Tang, 1989; Avila, 1992; Hatchett and Khaliq *et al.,* 1995; El-Hag and Zaitoon, 2000a).

The present study was carried out to compare the effectiveness of a biopesticide to control aphid population and to check the efficacy of *Chrysoperla carnea*.

MATERIALS AND METHODS

The experiment was conducted on wheat variety, Pasban 90, at Post Graduate Agricultural Research Station (PARS), University of the Agriculture Faisalabad during 2009-10 to compare the effectiveness of a bio-pesticide against the wheat aphid. There were five treatments replicated three times in a randomized complete block design (RCBD). All the agronomic practices were adopted equally in treatments. The treatment size was kept 10×5 m with row-to-row distance maintained at 25 cm in each treatment. The data were collected randomly from the 130 tillers from each treatment.

Use of *Chrysoperla carnea*

Chrysoperla carnea 1st Instar larvae were collected from insect rearing laboratory university of the Agriculture Faisalabad and released on treatment blocks which were covered with net to manage escape of bio-agent to other treatment blocks. It was ensured that *Chrysoperla carnea* were released after bio-spray application and other treatment blocks have been fully accomplished. This was done to minimize the effect of bio-sprays on *chrysoperla carnea* larvae. The application ratio of green lace wing was 4000 larvae/acre.

Use of Bio-pesticides

Neem leaves extract, neem seed kernel extract and ginger extract were obtained by boiling these fresh plant material for two hours. This boiled material was left for three days and the extract sieved through muslin cloth. Plant material and water ratio were kept 1:2 for the preparation of crude extract. Separate crude extract for each is prepared and than mixed for mixture used. For Surfactant-Neem leaves mixture 100g surfactant is mixed with 1 liter of neem leaves crude extract. As field application 15% dilution of each treatment was used with water. After the calibration of area for each treatment, the extract was sprayed over the cultivar

The mean population of the aphids were calculated before treatments and after treatment of 24 hours, 72 hours, 7 days, 15 days and 22 days. Five Experimental treatments along with combination are given as

Table 2.

Mean aphid population density on various days, total mean density and percent mortality of aphids.

Treatments	Before treatment	24 hours	72 hours	7 days	15 days	22 days	Mean total Density	% Mortality	Yield (kg/A)
Neem leaves extract @ 400 ml per acre mixed with 100gm surfactant	13.54	2.41 c	1.75 c	0.69 c	1.20 d	3.58 d	1.93 d	81.2	1487 ab
Neem seed kernel extract @ 600 ml acre -1	12.76	2.39 c	1.87 c	0.84 c	2.08 c	4.06 c	2.25 c	80.3	1448 b
Ginger extract mixed with Neem leave extract @ 500ml acre-1	13.62	1.90 d	0.92 d	0.27 d	0.2 e	2.14 e	1.09 e	85.0	1527 a
Chrysoperla Carnea @ 4000 larve acre -1	13.70	9.66 b	7.44 b	6.83 b	7.22 b	9.04 b	8.04 b	29.1	1379 c
Control	11.97	12.08 a	13.61 a	12.85 a	13.29 a	13.95 a	13.16 a	-	1306 d
LSD at P = 0.05	-	0.2855	0.3572	0.3420	0.3622	0.3368	0.3315	-	50.39

T1 Neem leaves extract + 100gm surfactant
T2 Neem seed kernel extract
T3 Ginger extract +Neem leave extract
T4 *Chrysoperla carnea*
T5 Control

The average nymph/adult population tiller^{-1}, for each treatment, was calculated by the simple arithmetic means i.e.

$$\mathbf{X} = X_1 + X_2 + X_3 \ldots\ldots\ldots\ldots X_{130}$$

NWhere, N= Total number of tillers, and $X_1 + X_2$ -------- = Sum of total number of aphids tillers. The percentage mortality of aphid with respect to pretreatment data was calculated by formula.

$$\% \text{ Mortality} = \frac{\text{Pre Treatment} - \text{Post Treatment}}{\text{Pre Treatment}} \times 100$$

Data was analyzed statistically using MSTAT package and the differences among treatments were compared with the help of a Least Significant Difference (LSD) Test ≤ 0.05 (Steel and Torrie,1997).

RESULTS AND DISCUSSION

Effectiveness of Treatments on various days: The collective results of the experiment presented in Table 2 revealed that the mortality of aphids on wheat crop significantly varied (P< 0.05) against botanical extracts and *Chrysoperla carnea* after 24 hours.

The most effective treatment in lowering the pests population was cocktail of ginger extract mixed with neem leaves extract where mean aphid population remained 1.90 per tiller followed by neem seed kernel extract and neem leaves extract with mean aphid population 2.39 and 2.41 respectively. *Chrysoperla carnea* was least effective in controlling the pest i.e., 9.66 mean aphid density per tiller but was significant different when compared with control where mean aphid density recorded as 12.08 per tiller. The data was also recorded after 72 hours, 7 days and 22 days after treatment (Table 2). On all these observation days almost a similar pattern of pest incidence was recorded, the lowest mean population density per tiller for all these observation days was 0.27, 0.20 and 2.14 respectively, which was recorded on ginger extract mixed with neem leaves extract . The second effective treatment was neem leaves extract mixed surfactant where mean aphid population density per tiller remained 1.75, 0.69, 1.20 and 3.58 followed by neem seed karnel extract with 1.87, 0.84, 2.08 and 4.06 mean aphid population density, respectively, similarly as per data recorded the least effective treatment was *C. carnea* where mean aphid population was 7.44, 6.83, 7.22 and 9.04 respectively, for all above mentioned observation days while it was still rated significant in comparison with control where aphid mean density per tiller was 13.61, 12.85, 13.29 and 13.16 respectively (Figure 1).

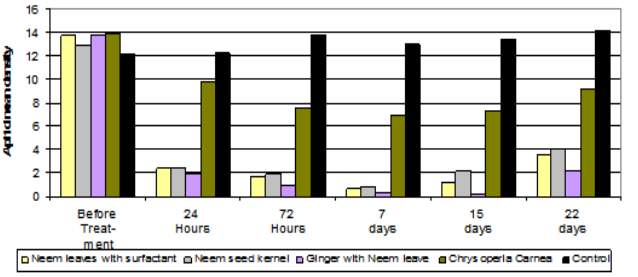

Figure 1.

Effectiveness of Treatments on various days

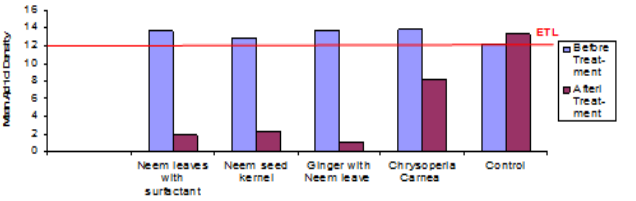

Figure 2.

Cumulative efficacy of Treatments

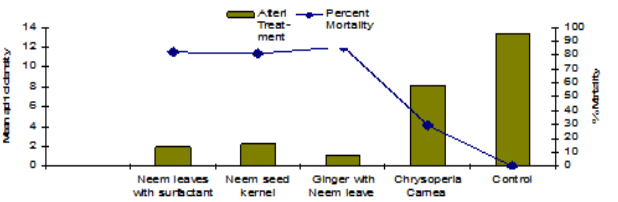

Figure 3.

Total mean density and % mortality of aphids

Cumulative efficacy of Treatments: Cumulative effect of experiment treatment was also calculated and highlighted in table 2. All treatments significantly reduced the pest population and capable of lowering the pest population below threshold level (Figure 2). The data indicated that the highly significant pest mortality of 85% at P< 0.05% was recorded on a plot sprayed with cocktail of ginger extract mixed with neem leaves extract with overall mean pest density 1.09 per tiller. Neem leaves extract mixed with surfactant appeared as second best treatment which significantly lowered the pest population by 81.2% mortality (Figure. 3) followed by neem seed karnel extract which showed significant mortality of 80.3%. The minimum suppression of pest was observed on the treatment where larvae of *Crysoperla carnea* were released but was significantly effective in comparison with

control (29.1% mortality). These results regarding mortality of aphid when treated with different botanicals are in accordance with the work reported by Roy *et al.* (2005). achieved 100% mortality of aphids through some botanical insecticides while in the current study the maximum mortality observed was 85%, this difference may be due to use of high concentration of bio-insecticides. The current study results are in agreement of the results reported by Sohail *et al.* (2012) in lowering the aphid population through the use of bio-extracts, they achieved 95% mortality by tobacco extract, 68% mortality by neem and 66% by garlic extracts, while in the current study neem and garlic extracts found superior, this may be due to difference in crop and environmental factors as they tested their bio-extracts on tea plants. Iqbal *et al*. (2011) also reported the effectiveness of various bio-extracts against wheat aphids. Numerious scientists Gaby (1996), Bhathal *et al.* (1994), Pandey *et al.* (1987) and Srivastava *et al.* (2003) work is in accordance with the current study where all of them reported bio-extracts effective against aphids ssp.

Yield data was also recorded to further examine the treatment effects. Maximum yield 1527 kg per acre was recorded where ginger extract mixed with Neem leaves extract was applied and was at par with yield of 1487 kg per acre with application of neem leave extract mixed with surfactant sprayed plot. The minimum yield of 1379 kg per acre was recorded on bio-agent released plot. Similar results have been reported. *C. carnea* found comparatively low in suppressing the pest population and some what in line with findings of Bennison (1992) and Oncuer *et al.*(1994) who concluded that *C. carnea* was least effective to establish and control the aphid under controlled conditions but appeared as a successful tool for aphid management. It also significantly lowered the pest population and the results are in agreement of different scientists (Traquet *et al*., 2007; Iqbal *et al.,* 2008).

CONCLUSION

It can be concluded from the present study that bio-extracts have good insecticidal properties especially against soft bodied insects like aphids and can effectively be used in IPM program because they are environment friendly and easy to prepare and use and thus cost effective. The present study also revealed a long term control of pest over 22 days which could be due to climatic factors that did not allow pest to multiply rapidly. It is suggested that further studies in relation with climatic factors along with bio-extracts should be done.

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