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EFFICACY OF DIFFERENT BOTANICALS PRODUCTS AGAINST *SCHIZAPHIS GRAMINUM* (RONDANI) ON WHEAT IN PUNJAB, PAKISTAN

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ABSTRACT

This study was done to check the effectiveness of bio-rational pesticides on wheat aphid (*Schizaphis graminum* (Rondani)) under field conditions. Faisalabad-2008 of wheat variety was selected to perform experiment. The extracts of five plants were used i.e., Garlic (*Allium sativum* L.), Red chili (*Capsicum annum* L.), Amaltas (*Cassia fistula* L.), Eucalyptus (*Eucalyptus oblique* L'Hér.*)* and Green chili leaves (*Capsicum frutescent* L.) were tested against wheat aphid population. The extracts were prepared through Soxhlet apparatus and applied at 15% concentration. The data was taken after 24, 48, 72 and 168 h of botanical application. Garlic (*Allium sativum*) + detergent showed highest while Green chili leaves showed least mortality against aphid population. These extracts may be used as an alternative of chemical insecticides and incorporated in integrated management program to manage different aphids on wheat crop.

Keywords: Wheat aphid, botanical extracts, *Schizaphis graminum*.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the major staple and world's leading cereal crop. It extensively grown in rain fed as well as irrigated areas throughout the world (Anonymous, 2014). It is widely cultivated in more than 150 countries, occupying approximately 220 million hectares worldwide and feeding approximately 4.5 billion of the world population (FAOSTAT, 2019). The cereal is grown on 23% globally cultivated land area and it has great importance in bread, diet, pharmaceutics and other industries. Almost 70% of the human population uses wheat as a source of food (Ullah *et al.*, 2014) In Pakistan, there are various wheat varieties based on commercial types and growth habits. Bread wheat (*T. aestivum*) and Macaroni wheat (*T. durum*) are mostly consumed commercial types of wheat.

Many factors affecting the yield of wheat including late sowing, seedbed preparation through conventional ways, poor quality seed, non-judicious use of chemicals, poor insect management, undesired weeds and water shortage (Kibe *et al*., 2006; Khattak *et al*., 2007; Khan *et al*., 2012; Memon *et al*., 2013; Faheem *et al*., 2019). Wheat aphid (Homoptera: Aphididae) have achieved peak position in reducing plant yield and health by sucking cell sap and causes death of plant. These tiny creatures induce sticky substance production known as sooty mold which acts as a medium for fungal growth and leads to reduction in plant photosynthesis process (Kindler, 1995). As a sucking pest, they prefer to puncture the soft surface of leaf with their stylets for maximum food supply (Ahmed and Aslam, 2000).

In Nature, some plants possess pesticidal properties which are safe and environment friendly. They are known as "Green Pesticides or Bio Pesticides" which are extracted from suitable plants by using a suitable solvents in which these chemicals were found naturally. (Koul and Walia, 2009). The use of plant extracts as repellent is important and with this it is also important to share the knowledge for the benefit of public so that they can knew about the mode of action and develop their best strategies for controlling the different species of aphids (Choochote *et al*., 2007). Isman (2006) has reported that more than 2500 plant species have been recorded to have pesticidal activities. All of them are effective against aphid species but their range of effectiveness varies. Botanicals are extensively used in various countries including China, Greece, and India etc. Some synthetic insecticides are highly significant in results as compared to botanicals but their results are unpredictable.

The uses of selected and non selected pesticides are creating our health problems and environmental issues. Many people are trying to avoid the use of pesticide crops and use the organic food. So, in this study we try to use the plant extracts as a bio-pesticides to control the wheat aphids which are safe for the human health and also for our environment.

MATERIALS AND METHODS

The research trial was conducted at Faculty of Agricultural sciences, University of Punjab, during the year of Rabi-2021. The experiment was performed under field conditions by using Randomized complete block design (RCBD) with three replications Seed beds were prepared by following all agronomic practices. Pre-irrigated field for the experiment were prepared by ploughing. Wheat seeds were sown at the rate of 50 kg per acre in each block by means of a ferti-seed drill machine. Macro nutrients were supplied by using fertilizers at the rate of 120kg N (Nitrogen), 60kg P (Phosphorous), and 40kg K (Potassium) per acre at sowing time besides after sowing. Study field and surrounding areas were made weed free by removal of weeds regularly with manual operations. The different five plants extracts were used i.e., Garlic (*Allium sativum* L.), Red chili (*Capsicum annum* L.), Amaltas (*Cassia fistula* L.), Eucalyptus (*Eucalyptus oblique* L'Hér.*)* and Green chili leaves (*Capsicum frutescent* L.) were tested against wheat aphid population. The appearances of aphid were started from the second week of February. In the month of February, 2022 the average weather condition in Lahore region was 12°C± 25°C temperature, 29.9 mm of rain fall and 52 % humidity. While in the month of March the average temperature was 16°C ±31°, 26.27 mm of rain and 43% humidity. The harvesting of crop was done at maturity stage after the 145 days of sowing.

PREPARATION OF EXTRACTS

Extracts were prepared through Soxhlet apparatus. After plant collection, they were washed to remove dust and debris. They were dried and were grinded properly using pestle and mortar and weighed by electric balance. The sample was packed into a thimble and kept into main chamber of Soxhlet apparatus. In this procedure, Ethanol was used as a solvent. Rotary evaporator was used to remove excessive solvent.

BIOPESTICIDES APPLICATION

To count the pre-application population of aphid, data were recored at weekly basis from the month of February. As the aphid population on the wheat plants reached economic threshold level (ETL), the application was done. After the application of treatments leaves of ten randomly plants each leaf from each tiller plant(Upper leaf of one plant, middle leaf of second plant and lower leaf of third plant) were counted from each block and their average were calculated. Same procedure was adopted for all units. These five treatments included Garlic crush + detergent (T1), Eucalyptus leaves (T2), Amaltas leaves (T3), Red chili (T4), green chili leaves (T5) and control plot (T0). Each biopesticdes were sprayed by the hand automisers with the concentration of 15%. There were separate automisers for each botanical extract. No application was done in control treatment. It was left untreated to comapre with treated blocks. The mortality of aphid was recorded after 24, 48, 72 and 168 h of application. The application of treatments were done at the morning time.

APHID MORTALITY

Following formula was used to calculate the mortality of aphids :

% Mortality = Pre-treatment – post-treatment / pre-treatment x 100

STATISTICAL ANALYSIS

The data were analyzed by using two way analysis of variance to check the significance among treatment means. The mean were separated by using means of least significant difference test (LSD) Statistical Software Statistics (8.1) was used for the purpose .

RESULTS AND DISCUSSION

The application of different bio-pesticides showed the differential results. The data were expressed per leaf basis (Fig. 1; Table 1).

Aphid (*S. graminum*) population after 24 h of botanicals exposure

After 24 h exposure of herbal pesticides, aphid population was significantly affected. Highest population was found on untreated plants. It was significantly lower in all other treatments. Aphid population was lowest found on

plants which were treated with garlic extract + detergent which was 28 aphids per leaf. Amongst various extracts aphid population was lower than that in control but significantly different from each other

Aphid (*S. graminum*) population after 48 h of botanicals exposure

After exposure of 48 h, all botanicals showed a significant effect ($P < 0.05$) on population. Highest population was observed on untreated plants. Least population was found on Garlic+ detergent treated plants followed by Eucalyptus, Amaltas and red Chilli.

Aphid (*S. graminum*) population after 72 h of botanicals exposure

After 72 h of application several of herbal pesticides, aphid showed significant results ($P < 0.05$). Maximum population was found on untreated plants of control which were statistically different from others. Lowest population of aphids was measured on garlic + detergent treated a plant which was 9.33 aphids per leaf while maximum aphid infestation was recorded on plants treated with green chili leaves 24.66 aphid per leaf.

Aphid (*S. graminum*) population after 168 h of organic pesticides exposure

The infestation of wheat aphid on control plants (untreated) was statistically different from all treatments. Garlic extract+ detergent was found extremely effective in reducing the aphid population below ETL.

Table 1. Two-way ANOVA for Aphid Population in response to application of biopesticides at different time intervals

Source	SS	df	MS	F	p
Time	3698.2	3	1232.72	569.42	0.0000**
Biopesticides	12642.6	5	2528.53	1167.99	0.0000**
Time x Biopesticides	182.4	15	12.16	5.62	0.0000**
Error	99.6	48	2.16	-	-
Total	16771.9	71	-	-	-

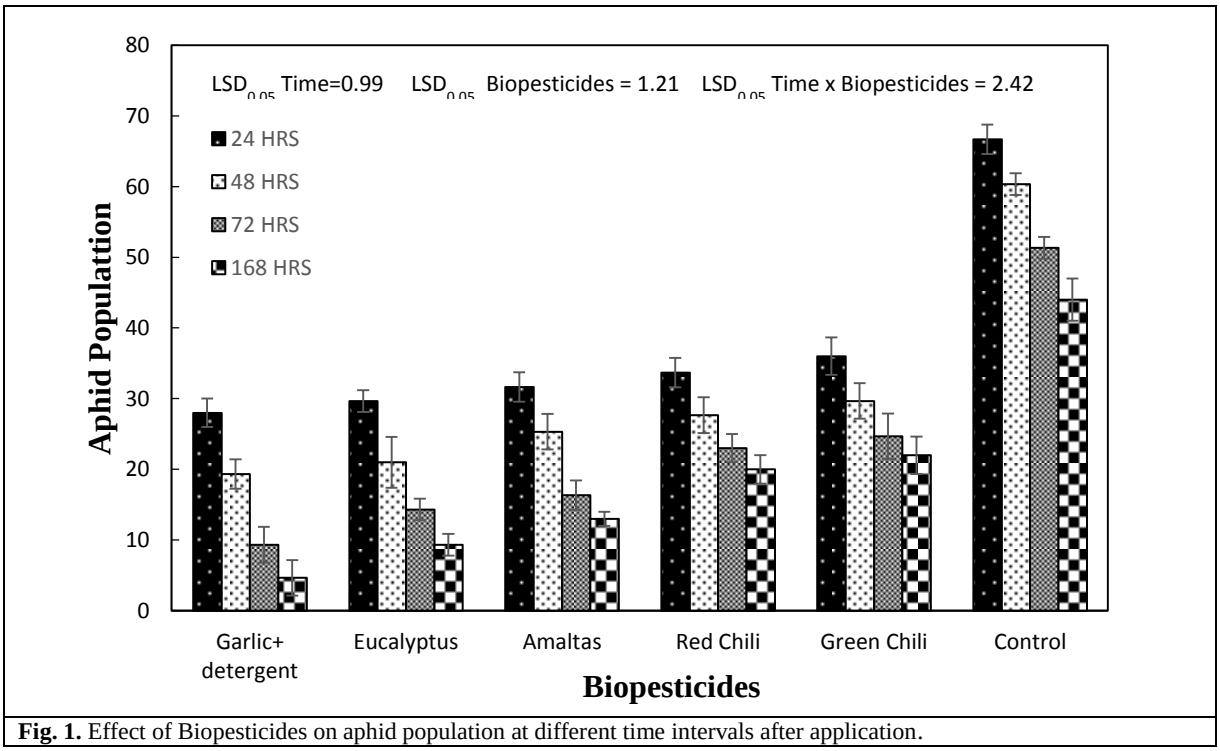

Fig. 1. Effect of Biopesticides on aphid population at different time intervals after application.

Percentage mortality

A close observation of Figure 2 shows that the treatment application of garlic+ detergent resulted in maximum mortality of aphid at all the time intervals studied during the research project. A comparison of the treatment where garlic and detergent were applied in combination with that of control shows that the maximum control of the pest was achieved in the case of treatment. The garlic+detergent showed the maximum 93.7 % mortality of aphid took place. The efficacy of the extracts increased with the increase in the exposure period. At 5% significance level, data of aphid mortality was subjected to Least Significant Difference (LSD) test for calculating difference among means of data (Fig.2; Table 2).

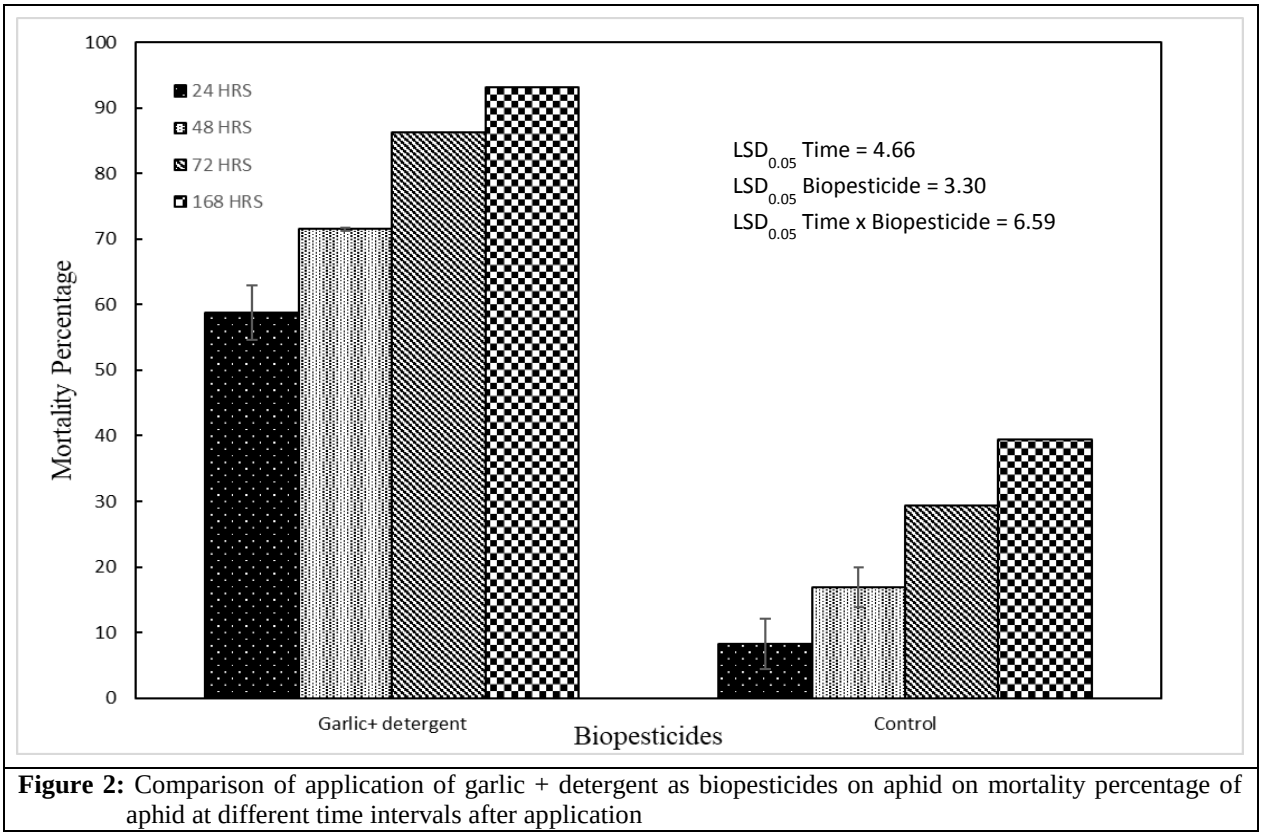

Figure 2: Comparison of application of garlic + detergent as biopesticides on aphid on mortality percentage of aphid at different time intervals after application

Table 2. Two-way ANOVA for Mortality percentage in response to application of biopesticides at different time intervals

Source	SS	df	MS	F	p
Time	3766.4	3	1255.5	86.46	0.0000**
Biopesticides	17437.4	1	17437.7	1200.96	0.0000**
Time x Biopesticides	31.8	3	10.6	0.73	0.0459*
Error	232.3	16	14.5	-	-
Total	21468.2	23	-	-	-

Aphid species live on wheat crop for a limited time period in which they start multiplying rapidly (Jarosik *et al*. 2003). Dixon (1987) found that the migration rate and growth level of aphid species are host dependent and varies according to climatic conditions as well. Mansoor *et al*. (2005) found that extracts originated from plants have insecticidal properties and are comparatively safer for the environment and public health. They have diversity in their mode of action being a repellent, killer or antifeedant.

Garlic has been reported to possess garlic pesticide properties that are very useful and affective against many insect and pest species, (Beltagy and Omar, 2016, Niroumand *et al.*, 2016, Baidoo and Mochiah, 2016, Anwar

et al., 2017). The garlic extract has very effective chemical composition which has very complex and many hundred chemical compounds which has beneficial effects. The presence of the sulphur atom is quite common and many compounds, such as thiosulfinates and disulfinates (including allicin) are found in the garlic extract composition (Rahman and Motoyama, 2000, Bravo *et al.,* 2004, Attia *et al.*, 2012). Botanicals used in above research are readily available. Rastogi and Mehrotra (1998; 2000) reported that chili contains capsaicin and its seeds contain saponin - capsicidin which is responsible for ovipositional deterrence and mortality of aphid species. Bergmann and Raupp (2014) found that aqueous extract of capsaicin is a great repellent and have killing capability against hemipterans. Extracts of garlic and onion were found effective in managing pest population (Debra and Misheck, 2014).

Amoabeng *et al*. (2013) controlled hemipterans by application of aqueous chili extract in field application. The active property of *C. annum* is as a larvicidal compound, effective against Mosquito species (*Anopheles stephensi* and *Culex quinquefasciatus*). Sharaby *et al*. (2012) found that eucalyptus oil extracts are pungent and produced from plant secondary metabolites. Various studies showed that Eucalyptus extract have insecticidal property for beetles (Brito *et al*., 2006), larvicial action on culicids (Cheng *et al*., 2009), repellent character for *Phlebotomus papatasi*.

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