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Research Article

EFFICACY OF BOTANICAL EXTRACTS AGAINST LEAF HOPPER (*AMRASCA BIGUTTULA BIGUTTULA* (ISHIDA) ON OKRA (*ABELMOSCHUS ESCULENTUS* L.) CROP

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ABSTRACT

Okra is a vegetable crop belonging to the Malvaceae family that is widely cultivated around the globe. Many insect pests cause losses in the yield of okra crop, however; the leaf hopper (*Amrasca biguttula biguttula*-commonly known as *Jassid*) is considered as the most damaging sucking insect pest of okra crop. Jassid can reduce yield up to 50% leading to significant economic losses. This study was carried out to identify the insecticidal potential of five different plant extracts viz., that includes Garlic (*Allium sativum* L.), Parthenium (*Parthenium hysterophorus* L.*)*, Turmeric (*Curcuma longa* L.*)*, Red chilli and Garlic (*capsicum annum* and *Allium sativum*). The experiment was laid out by the Randomize Complete Block Design (RCBD) having three replications of each treatment. Each treatment was used at 20% concentration. The data was recorded on per leaf infestation of jassids after 24, 48, 72, 168 and 240 hours of exposure period. Among the tested plant products, the extracts of garlic and garlic + red chilli extract were found to be the most effective against leaf hopper while red chilli as least effective. Among the tested plant products, the extracts of Garlic and Garlic and red chilli extract were found most effective against plant hopper at seven days after treatment and resulted in a minimum per leaf population of the tested insect. It is recommended that the extracts of Garlic and red chilli should be used as an effective control measure against the leaf hopper.

KEYWORDS: Jassids, Okra, *Amrasca biguttula biguttula*, Plant extracts

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1. INTRODUCTION

Okra (*Abelmoschus esculentus* L.) a grown vegetable, is highly adaptive to different climates and found in sub-tropical regions of world. Lady's finger and Bhindi are its common names (Hathi et al. 2022). Okra belongs to the Malvaceae family. In different countries like Brazil, West Africa and India, tender pods are utilized as vegetable and also preserved in canned and dehydrated forms. In Africa, India and USA sun dried, frozen and sterilized pods are also available in markets (Rajani et al. 2022). The growth of okra crop is good at 24-30°C and 65-85% relative humidity. Height of plant can be up to 6 feet, fruit or pod is of green

color having sticky juice in it, an average weight of a pod 10.13g, and its length can be 3-10 inches. In Pakistan okra cultivation is nearly 1.55 x 10^4 hectares and annual yield is about 1.19x 10^5 tons (Hussain and Mukhtar 2019; Iram et al. 2022). Pakistan ranks 5th with 2% contribution of okra production across the world. Okra share is 1.2% of vegetable production in Pakistan (Ahmad S. 2020). During 2013, the okra crop grown on area of 1.126 million hectare with total production of 8.947 million tons around the globe (Moosavi et al. 2018).

Okra seeds are considered as a good supplement for fatty acids and some amino acids which are essential for healthy life. Leaves are used as green vegetable, okra extracts can also be used as food additive, i.e., okra gum can be used as stabilizer or emulsifier in beverage industry (Liu et al. 2021). In Pakistan, the yield of okra crop is low compared to other advanced countries of world due to some of biotic and abiotic factors including insect pest attack. Okra is susceptible to many insect pests among which jassid is considered as the predominant in terms of destruction or damage to crop, literature reveals that 72 insect species have been reported on okra. Among them, leaf hopper (*Amrasca biguttula biguttula*) can cause yield losses up to 63.41% of yield, reduction in height of plant can be 49.8% and number of leaves can be reduced by 45% (Kaur et al. 2017). Leaf hopper sucks the sap of plant and found throughout the growing season on okra. It injects toxic material and cause marginal discoloration, chlorosis and reddening. Humid and hot areas are suitable for their development, and it becomes most destructive pest of all vegetable crops (Iqbal et al.. 2010; Devi et al. 2018). Common symptoms of jassid attack appear after they suck sap from tender and lower side of leaves (Biswas, 2015). After infestation, symptoms of leaf hopper (jassid) attack appears such as tender leaf turned into yellowish color, reddening of leaf margins recorded and they curl downwards, browning of leaves appear, if crushed, margins of leaves are crumbled and broken and leaves becomes dry and shed down resulting stunted growth (Chandrasekaran et al. 2021).

The application of synthetic insecticides can be hazardous if crop is in fruit bearing stage, because the picking of pods is done frequently, and residual effects of these toxic chemicals may remain in the pods and may exceed from Maximum Residual Limit (MRL) (Ghosh and Chakraborty 2015). Excessive use of pesticides, insecticides, and toxic material are accumulated as residue in water, soil, air and food. Soil enzymes, which control the quality of soil, are also affected by these pesticides (Campos et al. 2019). A general perception was built about chemical insecticides as these are threat, not only for environment but also for the human health (Haddi et al. 2020). The frequent use of systemic insecticides, to manage insect pests, leads to the destabilization of ecosystem, disrupt the delicate balance between the insect pests and their natural enemies and enhance resistance to insecticides in the pests (Ahmad *et al*. 1999; Villegas *et al*. 2006), suggesting a clear need for alternatives. Awareness about the risk of pesticide use, led the people to demand a sustainable agriculture and safe environment to minimize the sufferings to human beings and other organisms (Bolzonella et al. 2019). In recent years, biopesticides proved very effective for management of different pests. Popularity and share of biorational insecticides have been increased in global market (Haddi et al. 2020) derivatives of aromatic plants proved effective against pests and can be considered as alternative of synthetic pesticides (Campos et al. 2019). To protect human health and environment, a safe and effective management strategy of insect pests is required. This research study is an effort to find out a better management option of jassid

with the biopesticides which are based on the plants extracts and can help to protect our environment and human health.

2. MATERIALS AND METHODS

2.1. Experimental site

The Okra cultivar ''Saloni F_1'' was grown on the experimental farm longitude (31.4790˚ N) and latitude (74.2662˚ E) at Faculty of Agricultural Sciences, University of the Punjab, Lahore, Punjab, Pakistan. The okra seed was purchased from the vegetable seed market of Lahore.

2.2. Preparation of land and lay out

To attain the fine tilth, field was ploughed with power tiller and exposed to sunlight for few days. Experimental field was ploughed several times and clod crushing was performed until it reached to desired tilth for seed sowing. After the removal of weeds, stubbles and dead roots from soil, the plot was divided according to the experimental layout. Edges of experimental units were raised to check runoff water and nutrients. Experiments were laid out in a Randomized Complete Block Design (RCBD) having three replications of each treatment.

2.3. Seed sowing

The sowing was performed on ridges with 50 cm R × R distance and 20 cm P × P distance. Early sowing was done during February with seed rate of 10 kg/acre. The field was irrigated properly after sowing to facilitate better germination and plant growth.

2.4. Intercultural Practices

Throughout the growing period, the suitable intercultural equipment was used to perform required intercultural operations. To make this possible, the field was kept under close observation to facilitate better growth of plants and yield of okra crop.

2.5. Application of extracts and data collection

Botanicals used in the form of extracts, that includes Garlic (*Allium sativum* L.), Parthenium (*Parthenium hysterophorus* L.*)*, Turmeric (*Curcuma longa* L.*)*, Red chilli (*capsicum annum* L.), and Red chilli and Garlic (*Capsicum annum* and *Allium sativum*) with 1:1. All extracts were applied with the 20% concentration. T_1 = Garlic, T_2 = Parthenium, T_3 = Turmeric, T_4 = Red chilli, T_5 = Garlic and Red chilli, T_6 = Control. The botanical material for the extract was purchased from the vegetable market.

The data was recorded averagely on the number of jassid on ten randomly selected okra leaves in each experimental unit (Upper leaves of one plant, middle leaves of second and lower of third plants) . The mean jassid population per leaf was calculated before and after extracts application. Selected botanicals were applied when the population of jassid reached at economic threshold level (ETL).

2.6. Preparation of botanical extracts

Botanical extracts used in this study were prepared by Soxhlet apparatus with methanol as solvent (Schwanninger et al., 2002). Turmeric and red chilli were used in powder form; Parthenium's shade dried leaves were also crushed into powder and used in Soxhlet extraction. The garlic extract was squeezed through muslin cloth from well-grounded garlic paste (using pestle and mortar).

2.7. Data Analysis

The mean were separated by using means of least significant difference test (LSD). Data obtained were analyzed statistically with two-way ANOVA using software 'Statistix 8.1'.

3. RESULTS

Botanicals used in the form of extracts, including Garlic (*Allium sativum* L.), Parthenium (*Parthenium hysterophorus* L.), Turmeric (*Curcuma longa* L.*)*, Red chilli (*capsicum annum* L.), and Red chilli and Garlic (*Capsicum annum* and *Allium sativum*). All extracts were applied at 20% concentration. The data presented in Figure (1) indicated that the application of different bio-pesticides had great influence on the

infestation of jassids on okra crop. The data recorded after 24 hours of the application showed significant differences among the treatments. As compared to control, maximum reduction in the population after 24 hours of jassids were recorded on okra plants treated with combination of two biopesticides consisting of garlic and red chilli is (2.06/ leaf). While in contrast to this, the highest population (4.23/leaf) of jassids was recorded when okra plants were treated with red chilli extracts. The garlic, parthenium and turmeric extracts also showed their effectiveness in controlling jassids and resulted into 2.43, 3.33 and 3.93 jassids per leaf, respectively.

After application of plant extracts for 48 hours, the maximum mean population (4.00/leaf) of jassid was recorded on plants treated with red chilli and minimum population (1.5/ leaf) was recorded at garlic + red chilli extracts. A significant population decrease was recorded after 48 hours of application.

Maximum mean population (4.00/leaf) of jassid was recorded on untreated okra plants (control), after the 72 hours which was significantly different from rest of the treatments. It was, followed by okra plants treated with red chilli, parthenium, turmeric and garlic extracts, respectively. The minimum mean population of jassids (0.87/leaf) was found on plants treated with the mixture of garlic and red chilli extracts.

According to the Figure (1), after 168 hours data recording of minimum population (0.87) were recorded on plants where only garlic extracts were applied followed by 0.9 /leaf on plants treated with garlic and red chilli extracts. The plants treated with

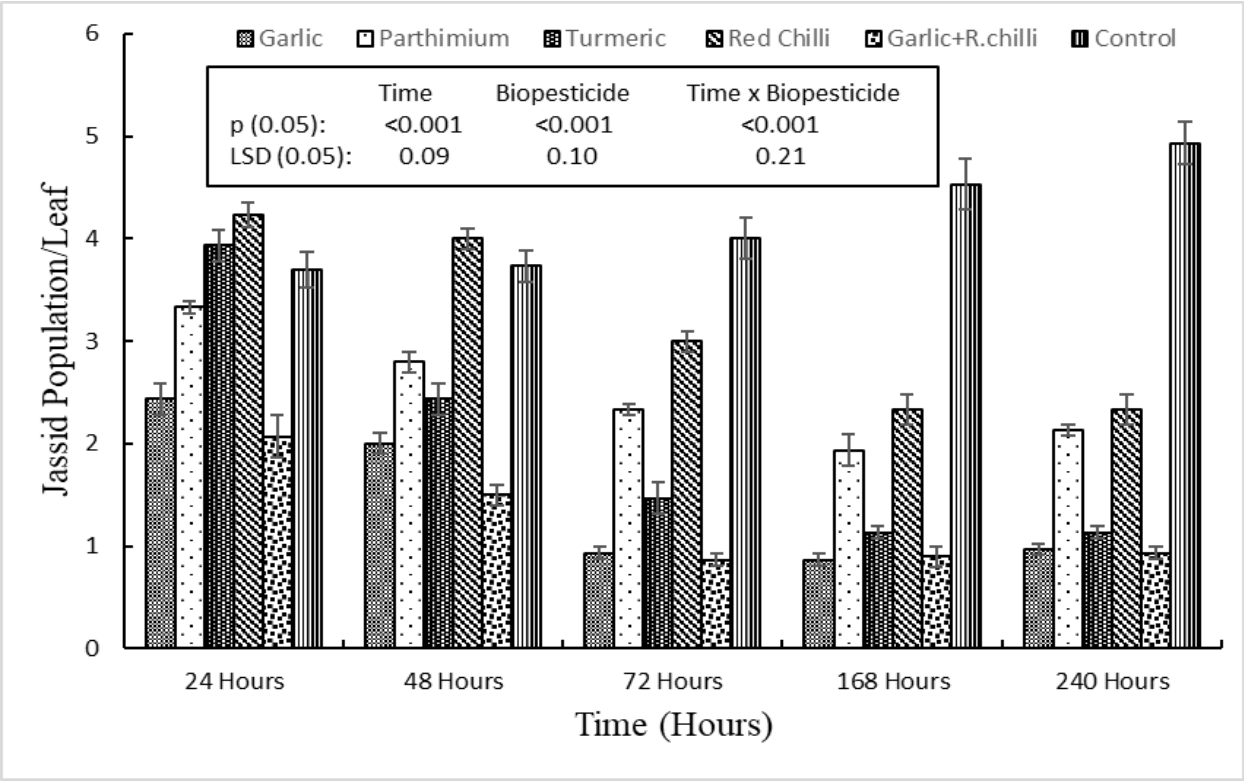

Figure 1: Comparison of application of different biopesticides on jassid population at different time intervals after application

turmeric extracts has population (1.13/leaf) which was found very close to ETL. Parthenium and red chilli extracts also showed some effectiveness against jassids but both extracts were unable to bring the population below ETL. At 240 hours after the application of plant extracts, the recorded data revealed that a slight reduction in the population of jassids was noted as compared to 168 hours after application. While slight increase in the population of jassid was noted in both (garlic extracts) and (garlic + red chilli extracts) treated plots.

4. DISCUSSION

The vegetables are usually utilized as early as possible after their collection from field. A range of insect pests have been reported to cause huge economic losses to okra crop in tropical and subtropical areas around the world. The farmers engaged in growing okra crop use synthetic chemicals for the management of these insect pests without considering their ill effects on the human and environmental health. The pesticides have a negative effect on environment and human health which mostly cause the diseases in humans. In the last two decades, there is a growing concern about the toxic effects of chemical insecticides on human beings and environment. For this purpose, plant products are being evaluated having repellent, growth inhibiting and insecticidal properties to overcome the outbreak of different insect pests. The plant extracts are considered as the best alternative to conventional chemicals (Ahmad et al. 2019). In the present study garlic + red chilli extract was found the most effective against the leaf hopper. Basic theme and purpose of this study was to find an alternate of risky and poisonous chemicals, which will be helpful to reduce harmful effects and challenges to overcome pest outbreak. Now a days, the use of plant extracts is getting an impetus and up till now more than 2400 plant species have been identified which possess repellent, anti-feedant, growth regulating and insecticidal properties (Rahman et al. 2016). Meena, et al. (2018) documented that among the biopesticides which were used against jassids on soybean crop, the *Azadirachta Indica* (Neem) seed extracts were found more effective against the jassid and whitefly. Results revealed that Neem and tobacco extract killed 60% population of jassid while garlic and ginger extracts reduced the population by 55% after 7 days of treatment (Iqbal et al. 2017). More studies are needed to strengthen the idea of bio-rational management considering all their positives and negatives too. Haddi et al. (2020) discussed that, replacing the synthetic compounds with bio-rationals without knowing their capability and effects can be harmful for their market sustainability.

The population of the leaf hopper gradually decreased with an increase in the exposure period of the botanical products. The maximum reduction in the population of jassids was noted at seven days after the application of plant products. These results are in complete conformity with the findings of Sardar et al. (2018). They reported that Garlic extracts caused 53.33% mortality of adult mealy bug, *Phenacoccus solenopsis* under laboratory conditions. Similarly, the plant powder prepared from garlic rhizomes has been found effective against adult maize weevil (*Sitophilus zeamais*) causing 67% mortality at 3% concentration at seven days after treatment at maize grains (Riaz-ud-din et al. 2020). Our results confirm that garlic and red-chili extracts carry strong insecticidal properties against plant hopper under field conditions. Future studies concentrating on the effects of these plant products in refined form are needed.

5. CONCLUSION

The present investigation confirmed that garlic + red chilli extract was found most effective after 168 hours against leaf hopper while at same time garlic also showed

excellent result. The use of garlic and red chilli is recommended as an effective control measure against the leaf hopper. The biopesticide is one of the effective tools to control jassid and is also helpful to save the environment and health of humans as compare to pesticide.

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