Research Article

Assessment of Different Indigenous Plant Extracts Against Pea Aphids *(Acyrthosiphon Pisum)* Under Field Condition

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Abstract | Aphid is one of the most destructive pests of pea and. it reduces the quantity and quality of the crop. The aimed of study to determine the efficacy of various plant extracts viz., (Green Chili (*Capsicum* spp.), Garlic Fresh Cloves (*A. sativum)*, Chinaberry Fresh leaves (*M. azedarach*), *Eucalpytus* leaves against pea aphid *Acyrthosiphon pisum*. The research experiment was design randomize complete block (RCBD) with three replications and two sprays were applied at 14 days interval. After 7 and 14 days of 1st and 2nd application the minimum means density of aphids were recorded in plot treated with *Eucalpytus* leaves (8.33, 4.66) and (5, 3) respectively and followed by Garlic fresh cloves (13, 11). After 2nd spray followed by green chili (12.66) and chinaberry (11). After 7 and 14 days maximum mean density of aphids after 1st and 2nd spray application (14, 16) and (19, 17) were observed in control plot. The highest yield Were recorded in plot treated with *Eucalpytus* leaves (1728.3kg/ha) followed by Garlic fresh cloves (1555.3kg/ha). While lowest yield (904.7kg/ha) was recorded in control plot. It was concluded from the study that all the botanical extracts reduce the population of aphids but *Eucalpytus* leaves showed best results in aphid papulation reduction and yield. It is recommended that the botanical extract of *Eucalpytus* leaves was most superior at the rest of the other botanical extracts.

Received | January 04, 2023; **Accepted** | March 25, 2023; **Published** | March 30, 2023
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Citation | Hussain, R., A. Ihsan, W. Khan, S. Malik, H. Jameel, H. Ullah, S. Ahmad, J. Anwar and M. Ali. 2023. Assessment of different indigenous plant extracts against pea aphids (*Acyrthosiphon Pisum*) under field condition. *Pakistan Journal of Weed Science Research,* 29(1): 52-57.
DOI | https://dx.doi.org/10.17582/journal.PJWSR/2023/29.1.52.57
Keywords | Botanical extracts, Yield, Pea crop, Aphid

Introduction

Pea *(Pisum sativum)* is an essential vegetable crop in Fabaceae family. It is an annual and rabbi crop, mainly grown in cooler areas worldwide. The crop is very important in terms of yield and sowing area after chick pea and faba bean. It is mainly cultivated in tropical and sub-tropical countries i.e., India, Peru,

Pakistan, China, France, Tunisia, Sweden, Sudan, Australia, Germany Egypt, Morocco, Ethiopia and Burma (Khan *et al*., 2013). Canada is one the pea producing country over the last few years (Smykal *et al*., 2012). In Pakistan, the average production of pea is 1000 kgha^{-1} cultivated with an area of 100,000 ha. Pakistan's pea crop is cultivated on 24.854 hectares of area and yields a total of 170,836 tonnes. Khyber Pakhtunkhwa has 1.959 hectares of pea farmland, producing 15.789 tonnes of peas (Anonymous, 2019). The average production of Pakistan is low regardless of the cultivation of high number of cultivars. Some factors like pest attack, diseases, poor cultural practices and weeds are accountable (Khan *et al*., 2013). Several insect pests i.e., thrips (*Caliothrips indicus*), aphids (*Acyrthosiphon pisum*), leaf miner (*Chromatomyia horticola*), stem fly (*Melanagromyza phaseoli*), *H. armigera* and pod borer (*Etiella zinckenella*) attack on the crop among which pod borer and *H. armigera* are the most serious. Pod stages are considered the most important factor in limiting the pea production (Singh *et al*., 2010).

Pea aphids found on the underside of the leaves and stem. They are greenish in colour. They suck cell sap from plant and the leaves turn pale yellow. The pea aphids feed on wild legumes, alfalfa, pea, bean and lentil crips (Caillaud and Via, 2000).

Chemical insecticides showed best results but is harmful to beneficial insects (Hussain *et al*., 2022). Plant extracts are safe and not hazardous to the environment as compare to synthetic insecticides. About 2400 plant species are discovered having insecticidal and anti-pathogenic characteristics (Karunamoorthi, 2012). Keeping in view the significance of pea crop, the current research was aimed with the objective to investigate the efficacy of green pesticides against it.

Materials and Methods

The study was carried out at the University of Agriculture Peshawar during 2021. During the study, 5 treatments were applied with 3 replications using RCBD design. Row-row Plant-plant distance was kept 45-60 and 60-75 cm, respectively.

Plant extracts preparation

Green chili (*Capsicum* spp.): Fifty grams of fresh chili pepper was grinded and added to 1 L of water for 1 day in order to create one litre of solution, the solution was then filtered through fine cloth.

Garlic fresh cloves (*A. sativum*): Fresh 235 grams of Garlic cloves was crushed and then added to 1 liter of water for 1 day. After that solution was filtered through a fine cloth.

Chinaberry fresh leaves (*M. azedarach*): Fresh leaves of Chinaberry (4 grams) were crushed and added to 1 liter of water for 3 hrs. The solution was then filtered with a fine cloth.

***Eucalpytus* leaves:** The *Eucalpytus* leaves were dried for two days and chopped into powder. The powder (100g) was then added to 1 L of water for 24 hrs and was filtered. After 2 days the solution was ready for field use.

Aphids population or data recording

The pea aphid population was recorded on 7th and 14th days after spray application. Five plants were randomly selected in each treatment. The aphids were removed through camel brush from the plants and then counted.

$$\text{Mean density of}\frac{\text{Aphid}}{\text{plant}} = \frac{\text{Total number of Aphid /plants}}{\text{Total number of plants}}$$

Yield kg/ha

After each picking the yield was calculated and transformed into kgha^{-1} with following formula:

$$\text{Yield in kg per ha} = \frac{\text{pods weight (kg)}}{\text{Plot size}} \times 10000$$

Statistical analysis

The Analysis of Variance (ANOVA) appropriate for RCBD was examined by using Statistix 8.1 software. To determine the significance level and differences among the treatments, the LSD Test was used with a 5% probability level.

Results and Discussion

Results of the present study revealed that highest (14 aphids plant^{-1}) mean density of aphids was recorded in control plot which was followed by garlic fresh cloves (13 aphids plant^{-1}), Chinaberry fresh leaves (12.66 aphids plant^{-1}) and green chili (12 aphids plant^{-1}), while, the minimum mean density of aphids

per plant was recorded in *Eucalyptus* leaves i.e. 8.33 aphids plant^{-1}. *Eucalyptus* leaves recorded significant difference with all the treatments along with the control. The treatments green chili, Garlic fresh cloves and Chinaberry fresh leaves were not significantly different from each other, however green chili has significant difference with *Eucalyptus* leaves and control.

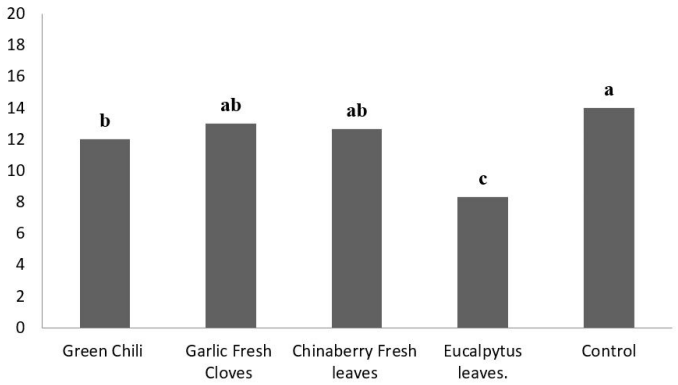

Figure 1: *Mean density of Aphids (A. pisum) plant^{-1} after 7 days of 1st spray application.*

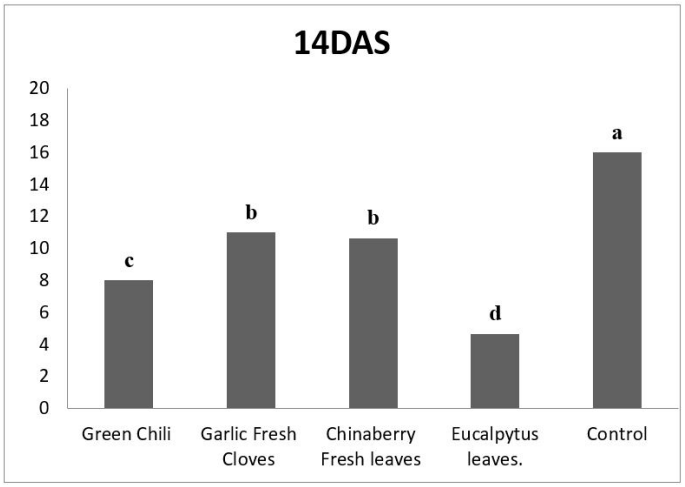

Figure 2: *Mean density of Aphids (Acyrthosiphon pisum) per plant after 14 days of 1st spray application.*

Maximum means density of aphids per plant after 14 days of 1st spray application (Figure 2) was recorded (16) in control plot followed by Garlic fresh cloves, Chinaberry fresh leaves and green chili (11, 10.66 and 8) respectively. While the lowest means density of aphid was recorded in *Eucalyptus* leaves (4.66).

The highest mean density of aphids per plant (Figure 3) After 7 days of 2nd spray application 19 aphids was recorded in control plot, followed by green chili, Chinaberry fresh leaves and Garlic fresh cloves (12.66, 12.33 and 10.66), respectively. While lowest means density of aphids per plant was recorded (5) in plot treated with *Eucalyptus* leaves.

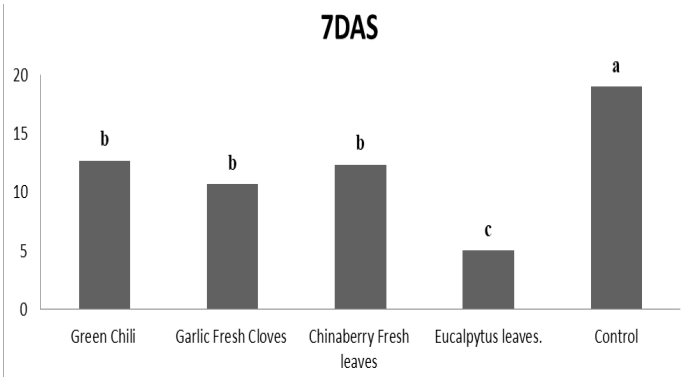

Figure 3: *Mean density of Aphids (Acyrthosiphon pisum) per plant after 7 days of 2nd spray application.*

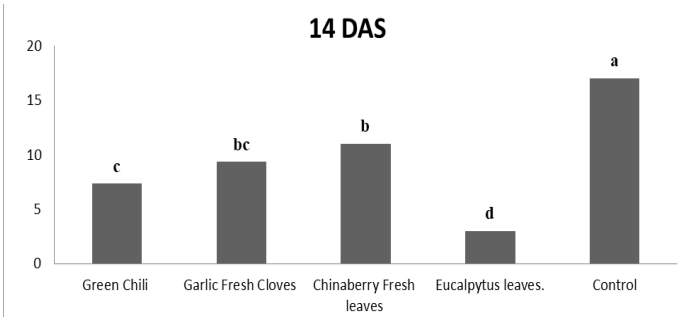

Figure 4: *Mean density of Aphids (Acyrthosiphon pisum) per plant after 14 days of 2nd spray application.*

The maximum mean density of aphid per plant (Figure 4) after 14 days of 2nd spray application 17 aphids were observed in the control plot which is closely followed by Chinaberry fresh leaves, Garlic fresh cloves and green chili (11, 9.33 and 7.33), respectively. While, lowest mean density of aphid per plant (3) was recorded *Eucalyptus* leaves.

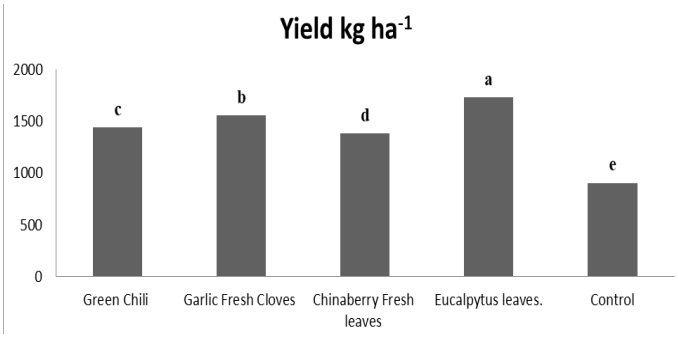

Figure 5: *Mean yield kg/ha of pea crop in different treated plot.*

The highest yield (1728.3kg/ha) (Figure 5) was recorded in *Eucalyptus* leaves treated plot followed by Garlic fresh cloves, green chili and Chinaberry fresh leaves (1555.3kg/ha, 1438kg/ha and 1381.7kg/ha), respectively. While lowest yield (904.7kg/ha) was observed in the control plot.

The current study was done on Comparative study of different botanical extracts against pea aphid

(*Acyrthosiphon pisum*) in new developmental farm, The University of Agriculture Peshawar during 2021.

Statistical analysis indicates significant effect of botanical extracts against Pea aphid (*Acyrthosiphon pisum*). The current study was Randomized Complete Block Design (RCBD) having 5 treatments with 3 replications. The data was recorded one day before and then 7 and 14 days after spray application. The bug population was negligible in all treatments prior to the use of pesticides. The outcomes were equivalent to those of Hussain *et al.* (2022). Different plant extracts were used to reduce the population of pea aphids. The results revealed that a 10% application rate of all plant extracts tested, or 100g/1liter, was effective in reducing pea aphid population and their damage to field pea. The experiment's findings showed that eucalyptus globulus oil extracts performed considerably better result against piercing and sucking faba bean insect pests than the organophosphate insecticide dimethoate. These outcomes are at par with the results of Mishra *et al.* (2012) and Mousa *et al.* (2013). The study revealed that the chemical composition of eucalyptol, found in eucalyptus essential oil, was one of the most promising, which made up (82.25%) of the total chemical composition of the oil. The insecticide eucalyptol is effective against a wide variety of insect pests. The outcomes coincide with those of Ben-Issa *et al.* (2017), Koul *et al.* (2008) and Elbanna (2006), according to them, 20 ml of the eucalyptus seed extract at a concentration of 1000 ppm reduced *Culex pipiens* larvae by (80–100%) during 14 hours.

The botanical extracts of garlic also demonstrated prominent value of botanical extract neem. Similarly, Asare-Bediako *et al.* (2014) resulted best influence of botanical extract of neem leaf and garlic against sucking insect pests on different vegetable crops. Moreover, Singh and Singh (1995), Gareth *et al.* (2006) and Arain (2009) reported that botanical extracts of Neem and garlic control all developmental stages of many insect pests. The botanical extracts of neem (*Azadirachtin indica*) and garlic (*Allium sativum*) has an antifungal activity of 0.015% concentration, described by Rukhsana *et al.* (2010). The botanical extracts of garlic showed best results to other botanical extracts against sucking insect pests. A similar result was found by Natarajan *et al.* (2000) and Mousa *et al.* (2013). The indigenous plant extracts of garlic singly or in combination with other plant extracts i.e., tobacco, ginger, chili, neem and cow urine were also revealed best results against several insect pest in many crops (Lakshmanan, 2001). Garlic botanical extract can affect the hatching competency of *Aedes aegypti* (Jarial, 2001). Botanical extracts of many plants need some time to show their efficacy against many insect pests. Similarly, chemical insecticides rapidly show their efficacy but harmful to beneficial insect as compared to botanical insecticides (Khan and Atta, 2007; Ursani *et al.*, 2014; Khaliq *et al.*, 2014).

The yield of the crop in different plot was significantly affected by different botanical extracts as compared to untreated plot. The maximum pod production was noted in essential oils. Results showed that botanical insecticides can control the infestation of sucking insect pests were significantly as reported previously (Mochiah *et al.*, 2011). Several plant extracts found to be effective against the sucking insect (whitefly, thrips, aphids) (Malik *et al.*, 2003; Ahmad *et al.*, 2009).

Conclusions and Recommendations

It was observed from the study, that all the botanical insecticides were effective against sucking insect pests. However, *Eucalyptus* leaves were the most promising with lowest population density of aphids and highest yield.

Novelty Statement

This experiment is novel in describing best alternative of synthetic insecticides in which Eucalpytus leaves were found best in reducing pest population.

Author's Contribution

Fawad Ali: Conducted research.
Riaz Hussain: Main supercisor.
Adnan Ihsan: Wrote manuscript.
Najeeb Ullah: Technical support.
Waqar Khan: Financial support.
Hidayat Ullah and Shahab Ahmad: Provision of plants for extracts.
Jawad Anwar: Formulation of extracts.
Jawad Ali and Murad Ali: Design experiment.
Kajal Sana: Proof read.

Conflict of interest
The authors have declared no conflict of interest.

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