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# Evaluation of Plant Extract against Onion Thrips, *Thrips tabaci* Lindeman (Thysanoptera: thripidae)

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## ABSTRACT

*Thrips tabaci* (Lindman) is a serious pest of onion. It sucks the plant sap, which causes chlorosis and leads to a remarkable loss in yield annually. Besides direct damage, *Thrips tabaci* is the vector of TSW, IYS, and TYR viruses. Application of chemical pesticide against thrips causes the more incidences of resistant individuals and causes the major environmental pollutant effects on the food safety and quality. The efficacy of four eco-friendly botanical extracts i.e. Mahanadi, Ferula-Powder, Datura and walnut along with Lemda cyhalothrin as positive and water as a negative control were applied to reduce rely on chemical insecticides against onion thrips. The experiment was conducted in RCBD design with three replications. The data was collected 24 hrs before and after 24, 48 and 72 hours of spray/treatments. There were similarities with the positive control in observed P-value with 0.388, 0.911, 0.636, and 0.474, respectively. High mortality obtained as compare to the negative control plot with the P-value 0.000, 0.001, 0.000 and 0.000) after 24-, 48-, and 72-hours timing interval, respectively. Onion yield with the P-value (0.006) has quite differences among the treatments. The yield checked with the negative control plot that significantly effected with obtained P-value 0.25, 0.002, 0.020 and 0.034. In result, the plant extracts effectively controlled the onion thrips and performed the positive role in increasing the onion yield. It has been concluded that, the botanical insecticide is the best option to substitute the chemical Insecticides with having high mortality performance and less residual effects.

**Keywords:** Botanical extract, thrips control, onion , plant extract

## INTRODUCTION

Onion (*Allium cepa* L.) is one of the most widely cultivated and consumed vegetable crops globally (Teshika *et al*., 2019). As the most significant member of the Alliaceae family, it has sustained human diets for generations. Globally, onion production reaches approximately 25 million tons, making it a fundamental component of human nutrition (Naseer *et al*., 2021). In Afghanistan alone, onions are cultivated over 30,000 hectares, yielding about 541,225 tons annually (*MAIL*, 2022). However, onion crops are vulnerable to various insect pests such as thrips, onion flies, cutworms, and tobacco caterpillars (Diaz-Montano *et al*., 2011). Among these, *Thrips tabaci* stands out as the most destructive species, causing severe feeding damage that reduces bulb development and market value. Yield losses caused by *T. tabaci* infestations range from 34.5% to 43% (Purnier *et al*., 2009), with average losses of 37% per bulb reported in affected fields (Haider *et al*., 2014). Beyond direct damage, this pest also acts as a vector for tospoviruses such as Tomato spotted wilt virus (TSWV), Iris yellow spot virus (IYSV), and

Tomato yellow ring virus (TYRV), further intensifying its impact on crop health.

Chemical insecticides have traditionally been used to control onion thrips; however, their excessive and repeated application has led to several negative consequences. These include the development of pesticide resistance, destruction of beneficial natural enemies, environmental contamination, and risks to human health (Woldemelak, 2020). Additionally, improper pesticide use can disrupt ecological balance by eliminating predators and parasitoids, leading to pest resurgence and harmful residue accumulation in soil and water systems (Wabale & Kharde, 2010).

Due to these challenges, there has been growing interest in the use of eco-friendly alternatives within Integrated Pest Management (IPM) strategies. Botanical pesticides derived from plants like hing, *Ferula asafetida* L., datura, *Datura alba*, walnut bark, *Juglans regia*, and henna, *Lawsonia inermis*, have shown promise. These natural extracts are less harmful to beneficial insects, degrade quickly in the environment, and offer a sustainable approach to managing onion thrips populations. Therefore, the main objective of this study is to reduce reliance on chemical insecticides and evaluate the efficacy of selected botanical extracts against onion thrips.

## MATERIALS AND METHODS

### *Study Area*

The experiment was conducted in Agriculture Faculty Research Farm with using Randomized Complete Block Design (RCBD). The plot size counted to be kept in the space between 1.5 x 2.5 m plant to plant and row to row were 15 and 30 cm, respectively. Afghan white (Trichmer) onion cultivars were transplanted in eighteen plots. Four local plants, *Lowsonia inermis*, *Ferula asafideta*, *Datura Alba* and *Jaglan regia* along with Lamda cyhathrin as a positive and water as a negative control were used for the management of *T. tabaci* (table1). Two kilograms of each plant materials were thoroughly washed with Distilled water and dried under the shade. Afterwards, plant materials were cut into small pieces and boiled in 2L water for 60 minutes. The solution will then sieve through find muslin cloth to get stock solution of the plants. In the final solution, 125gr detergent powders added to avoid the clothing of materials. The calibration of water and botanical extract related solution was done as per their recommended dose, and applied in the individual replicated plot.

Table1. Shows the applied treatment against onion thrips.

| Treatment | Name | Concentrate% |
|---|---|---|
| Lemda | Control | 20 |
| Lowsonia | Mehandi | 20 |
| Ferula | Hing | 20 |
| Datura | Datura | 20 |
| water | control | 20 |
| Jaglan regia | Walnut | 20 |

### *Samples Collection*

Five plants were randomly selected and the data has taken as the zigzag pattern across the field in each Plot. Five plants in each plot would tagged to continue sample the population density. The number of *T. tabaci* counted 24 hrs before spraying and the mortality of thrips counted 24, 48, and 72 h after application of spray. Five onion bulb per plot were harvested for weight and both parameters subjected for analyzing.

### *Statistical Analysis*

The collected data was analyzed using the SPSS software. ANOVA was calculated to test the significance difference between the treatments. The least significant difference (LSD) test was applied to differentiate the means and compare all treatments.

## RESULTS

### *Thrips Mortality*

The mean of mortality after spray application in 24-, 48- and 72-hours timing interval represented in figure.1

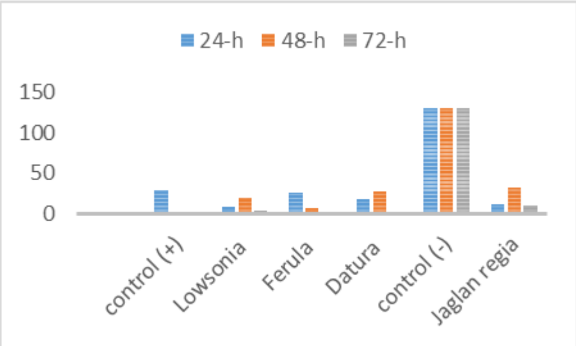


Figure1. The Y-axis shows the mean mortality after application at 24, 48, and 72 hours, and the X-axis shows the treatments.

Table 2. **Average Mortality of thrips in different timing interval**

| | hours-after spray | | |
|---|---|---|---|
| **Treatments** | **24** | **48** | **72** |
| Lemda cyhalothrine | 86 | 8 | 0 |
| Lowsonia inermis | 23 | 60 | 9 |
| Ferula asafedita | 78 | 20 | 0 |
| Datura alba | 52 | 80 | 2 |
| Control | 197 | 197 | 197 |
| Jaglan regia | 34 | 96 | 42 |

It is concluded that the mortality of insect in (24, 48 and 72 hrs) was gradually increased and the tested P-value test with ANOVA was significantly different with the obtained P-value 0.002, 0.002 and 0.001, respectively.

The LSD was calculated to compare the significance of each treatment with both (positive and negative) control plots.

The positive control with obtained P-value 0.388, 0.911, 0.636, and 0.474 was indicated no-difference of (Lowsonia), (ferula), (datura) and (juglan) with positive control plot. Because all the treatments positively worked in some extend where they show non-similarities.

In the negative control, The LSD indicated that the negative control with obtained P-value 0.001, 0.000, 0.001, 0.000 and 0.000 was significantly different with all treatments.

The bulb size was weighted; the relevant data subjected to ANOVA and the Mean of each treatment was separated. The ANOVA explored significant differences among yield with the received P-value (0.006). In the LSD of harvested yield in the plot of *Lowsonia inermis*, *Ferula asafedita*, *Datura Alba* and *juglan regia* were significantly different compare to negative control plot with the gained p-value 0.25, 0.002, 0.020 and 0.034, respectively (Figur.2).

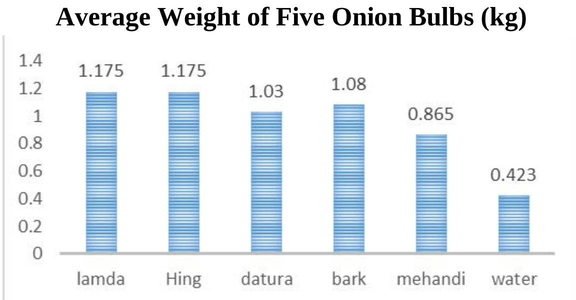


Figure2. Average Weight of Five Onion Bulbs Measured in Kilograms

## DISCUSSIONS

The present study evaluated the insecticidal efficacy of botanical extracts from *Lowsonia inermis*, *Ferula asafoetida*, *Datura alba*, and *Juglans regia* against *Thrips tabaci*, a major pest responsible for significant losses in onion yield due to direct feeding damage and virus transmission (Diaz-Montano *et al.*, 2011). The observed mortality rates in the treated plots demonstrated a clear superiority of botanical extracts over the negative control, aligning with earlier reports highlighting the potential of botanicals as effective alternatives to synthetic insecticides (Isman, 2006; Koul *et al*., 2008).

The mortality data at 24-, 48-, and 72-hours post-application revealed statistically significant differences compared with the negative control, indicating that the tested botanicals possess notable insecticidal activity. The similarities in efficacy between botanical treatments and the positive control lambda-cyhalothrin suggest that these natural extracts can approach the performance of conventional insecticides when applied under optimal field conditions (Musa *et al*., 2015). This finding is promising, especially considering the concerns regarding pesticide resistance and the environmental hazards associated with the overuse of synthetic chemicals (Woldemelak, 2020).

The increase in onion yield in botanical treatments compared to the negative control further supports the hypothesis that effective thrips management contributes to enhanced crop productivity, as previously reported by Haider *et al*. (2014) and Wabale and Kharde (2010). Additionally, botanical insecticides are known to degrade rapidly in the environment, minimizing the risks of harmful residues on food products and in ecosystems, thus offering a safer alternative for sustainable agriculture (Pavela, 2016; Regnault-Roger *et al*., 2012).

Moreover, the botanical treatments' effectiveness in controlling *T. tabaci* can be attributed to the bioactive compounds such as alkaloids, terpenoids, and phenolics known to exhibit antifeedant and toxic effects against insect pests (Nenaah, 2014; Pavela & Benelli, 2016). Unlike synthetic pesticides, botanicals are less likely to cause pest resurgence due to their multiple modes of action and reduced risk of resistance development (Isman, 2020).

## CONCLUSION

Onion thrips (*Thrips tabaci*) is one of the most destructive pests affecting onion crops globally. Although the application of synthetic insecticides can provide effective control to some extent, their repeated use has led to the development of resistance among thrips populations and raised concerns regarding residual toxicity in treated areas. Consequently, there has been growing interest in utilizing botanical insecticides as environmentally sustainable alternatives, particularly against soft-bodied insect pests.

Results demonstrated that all botanical treatments significantly reduced thrips populations, showing effects comparable to the positive control Lambda-cyhalothrin. Statistical analysis using LSD (Least Significant Difference) revealed significant differences between the botanical treatments and the untreated control. Among the botanicals, *Ferula asafetida*, *Datura alba*, *Lawsonia inermis*, and *Juglans regia* showed the highest thrips mortality rates, respectively.

In terms of crop performance, yield assessments indicated a significant increase in onion yield in all treated plots compared to the negative control. This suggests that botanical extracts not only suppressed pest populations effectively but also contributed to improved crop productivity and marketability.

In conclusion, the tested plant extracts offer an eco-friendly and effective alternative for the management of onion thrips. Their use in integrated pest management (IPM) programs is recommended to enhance sustainability of pest management practices, reduce chemical dependence, and improve yield outcomes.

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