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Evaluation of the Efficacy of Chemical and Non-chemical Insecticides Against Onion Thrips in Field Conditions

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ABSTRACT

Onion thrips pose a significant threat to onion crops worldwide through their feeding habits, which can lead to visible damage and potential yield loss. This research aimed to investigate the effects of chemical and non-chemical insecticides on the management of onion thrips. This experimental study was conducted at the Faculty of Agriculture, Kabul University, to evaluate the efficacy of different chemical insecticides, a botanical insecticide, attractive plant, and intercropping for the management of onion thrips (*Thrips tabaci*) (Thysanoptera; Thripidae) on onion crops in 2023. Seven treatments were applied with three replications in a randomized complete block design. The first data collection occurred on July 12, 24 hours before the application of insecticides. Subsequent data were recorded 24 hours, 72 hours, and 7 days after each spray application. Three chemical insecticides were tested: carbaryl (Sevin® 85% WP) at a rate of 650 g/hectare, cyhalothrin (2.5% EC) at a rate of 550 ml/hectare, and cypermethrin (10% EC) at a rate of 400 ml/hectare. Additionally, a botanical insecticide derived from *Melia azedarach* (water extract of seeds) was applied at a rate of 12 L/hectare. After three applications, carbaryl showed significant efficacy compared to the other two chemical insecticides, while the botanical insecticide did not yield significant results. Attractive plants and intercropping demonstrated significant results when the leaves of the onions began to harden.

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INTRODUCTION

Onion (*Allium cepa*) is essential in nearly every kitchen worldwide. It serves as a vital condiment and vegetable for Afghans, with green leaves and bulbs consumed raw or used in various recipes. Its significance in the Afghan food market is considerable (Minoia *et al* ., 2014). Onions are cultivated extensively across Europe, America, Asia, and Africa (Gachu et al., 2012; Duchovskiene, 2006). However, onions face threats from numerous pests, one of the most dangerous being the onion thrips (Sadozai et al., 2009; Shiberu et al., 2013). The onion thrips, scientifically known as *Thrips tabaci* Lindeman, is a polyphagous insect that has spread globally and is recognized as an economically harmful pest affecting both field and greenhouse crops (Pourian et al., 2009; Din et al., 2016). Hot and dry weather conditions can exacerbate the populations of onion thrips and intensify the damage they inflict on onions.

This phenomenon is likely a combination of factors, including a shorter generation time and reduced mortality due to rain and plant pathogens (Shiberu *et al*., 2013). Heavy rains have been shown to wash onion thrips off plants; additionally, water stress may affect the nutritional quality of onion plants and increase their attractiveness to thrips (Gill et al., 2015; Gill et al., 2015; Zepa et al., 2011).

Onion thrips (*Thrips tabaci*) have an extensive host range, reportedly feeding on over 300 plant species across various families. Their adaptability allows them to infest various crops and ornamental plants, making them a significant agricultural pest. In Hawaii, onion thrips were reported to feed on 66 plant species from 25 families (Gill et al., 2015). It has been found to infest such vegetables as asparagus, bean, beet, cabbage, cantaloupe, carrot, cauliflower, celery, cowpea, cucumber, garlic, kale, leek, mustard, parsley, pea, pepper, pigeon pea, potato, pumpkin, spinach, squash, sweet potato, tomato, and turnip (Broughton, 2011; Din et al., 2016).

Some populations may specialize in a single plant species, such as tobacco, while others can infest multiple plant families (El-Naggar and El-Hoda, 2013). Onion is considered the preferred host for onion thrips, where they can cause significant damage. Other crops like potatoes and sweet potatoes may also be attacked but typically do not suffer economic damage at the same level as onions (Capenira, 2001; Gholami et al., 2015). Onion thrips (*Thrips tabaci*) are significant pests of onion crops. They are known vectors for various viral diseases, notably the Tomato Spotted Wilt Virus (TSWV) and Iris Yellow Spot Virus (IYSV) (Schwartz et al., 2014; Toda *et al*., 2007; Khaliq et al., 2014; Brunner et al., 2004). Immature stages of onion thrips prefer to inhabit the central leaves of onion plants, significantly reducing the plants' photosynthetic ability (Ullah et al., 2010; Das et al., 2017). This feeding behavior affects plant health and contributes to the overall impact of IYSV, as infected plants exhibit characteristic symptoms such as yellow- to straw-colored diamond-shaped lesions on their leaves. These lesions can reduce vigor and bulb size, ultimately affecting yield and quality (Pourian et al., 2009; Pathak et al., 2018; Ashari et al., 2018; Sathe and Mithari, 2015). The main objectives of this research are as follows:

- To compare the effectiveness of chemical and non-chemical methods in reducing onion thrips populations.
- To identify the most effective and sustainable strategy for managing onion thrips in field conditions.

MATERIALS AND METHODS

The population development of onion thrips (*Thrips tabaci*) was studied using the "Kandahari local" onion variety, which was planted on May 31, 2023, at the Agriculture Faculty of Kabul University. The experiment consisted of three replications across a total of 21 plots. Each plot measured 1 x 2 meters, with a plant-to-plant distance of 15 cm and a row-to-row distance of 25 cm. The main irrigation channel was 1.0 meters wide, and a sub-irrigation channel measured 1.0 meters. The width of the bund was 0.5 meters, while the experimental area measured 15 meters in length and 11 meters in width, resulting in a net cultivated area of 48 m^2 and a gross cultivated area of 165 m^2. The fertilizer application consisted of DAP and urea at 80 kg/ha and 120 kg/ha, respectively. The experiment was designed using a Completely Randomized Block Design (CRBD) with seven treatments and three replications. Data collection began on July 12, following the onset of onion growth, to record the population buildup of *Thrips tabaci*. Five plants were randomly selected from each sampling unit, and the number of thrips present was visually counted and averaged to determine the mean population per treatment. Treatments carbaryl (Sevin®85%WP) at rate of 650 g/ hectare, cypermethrin EC10% at rate of 400ml/ hectare, cyhalothrin 2.5% EC at rate of 550 ml/ hectare, *Melia azedarach* (water of seed extract) at rate of 12 Li/ hectare, Intercrop (carrot), Attractive plant (white flower ***"Paeonia lactiflora"***) and untreated (check) were applied.

All chemicals were applied using knapsack sprayers. Except for the attractive plant and intercrop treatments, these treatments were administered three times during the cropping season at 38-day intervals (on July 12 and August 19). When the thrips population reached 39.6 thrips per plant, chemical and botanical insecticides were sprayed. The efficacy of the botanical and chemical insecticides was determined by counting the thrips on five plants randomly selected from each replication. Before spraying, the population of onion thrips was recorded at regular intervals by visually counting and averaging the number of thrips present on five randomly selected plants from each sampling unit to obtain the mean population for each replication. Post-spray data were recorded 24 hours, 3 days, and 7 days after the application of the insecticides.

Data Analysis

The data were analyzed utilizing Statistical Analysis Software (SAS) (SAS Institute, 2002). Analysis of variance (ANOVA) was also constructed to test for significant differences between the variables. The formula of Shibro and Negri (2014) was used to find the percentage of mortality, as reported below.

$$\text{Efficacy (\%)} = \frac{Pre\ spray\ count - Post\ spray\ count}{\text{Pre}-\text{spray count}} \times 100$$

$$\text{Reduction efficacy \%}\ \frac{Control\ count - Post\ spray\ count}{\text{Control count}} \times 100$$

RESULTS

The population of the thrips for three times sprays was recorded before the application of treatments, followed by intervals of 24 h, 3 days, and 7 days after spraying. Amongst all treatments at first time before spry, statistically, there were no significant differences in *T. tabaci* numbers during observation. However, 24h, post-treatment, the density of *T. tabaci* in control plots, attractive plant plots, and intercrop plots were significantly higher (Table 1). The lowest density of thrips after the first treatment was recorded in the carbaryl, followed by cyhalothrin 2.5% EC and cypermethrin EC10%, respectively.

The data analyses showed significant differences between chemical and botanical insecticides (Botanical Insecticides). All applied insecticides are affected at various degrees compared to untreated (check). The intercrop and attractive plant did not decrease the population of thrips after the first spray (Table 1).The data obtained after three days of the first spraying showed that thrips population in plants treated with attractive plants (42.2), Intercrop (34.3), botanical insecticides (33.7), cypermethrin EC10% (16.5), carbaryl (7.86), cyhalothrin 2.5% EC (11.6), and control (39.5). The mean number of thrips per plant in all treatments that applied chemical insecticides was significantly lower than in the control plots (39.5), while in the botanical treatment, it was slightly lower than in the control plots (33.7). Attractive plant and intercrop was not affected (table 1). Finally, the data recorded after 7 days of first spraying indicated which thrips population in plants treated with attractive plant (43.6), intercrop (38.3), botanical insecticide (36.5), cypermethrin EC10% (17.5), carbaryl (9.1), cyhalothrin 2.5% EC (13), and Control (41.6) (table 1).

Table 1. Mean Thrips population in different treatments

First application				
Treatments	**Pre-treatments**	**24-hours**	**3-days**	**7-days**
Attractive Plant (*Paeonia lactiflora)*	36.8 ± 1.5^{ab}	41.1 ± 1.6^{a}	42.2 ± 0.8^{a}	43.6 ± 0.9^{a}
Intercrop (Carrot)	36.1 ± 2.4^{b}	36.1 ± 3.2^{ab}	34.3 ± 2.8^{b}	33.3 ± 3.2^{bc}
Botanical insecticide (*Melia azedarach*)	38.9 ± 1.6^{a}	34.1 ± 3.5^{b}	33.7 ± 2.8^{b}	36.5 ± 2.1^{c}
cypermethrin EC10%	36.6 ± 2.1^{b}	17.8 ± 2.5^{c}	16.5 ± 2.1^{c}	17.5 ± 1.8^{e}
carbaryl	37.1 ± 0.6^{ab}	10.7 ± 0.8^{d}	7.86 ± 0.6^{e}	9.1 ± 3.0^{e}
cyhalothrin 2.5% EC	35.9 ± 1.2^{b}	14.1 ± 0.8^{c}	11.6 ± 0.2^{d}	13 ± 3.3^{d}
Control	37.2 ± 2.3^{ab}	38.9 ± 1.1^{ab}	39.5 ± 0.7^{a}	41.6 ± 2.3^{ab}
LSD	2.25	4.99	3.38	3.95
CV	3.42	9.87	6.69	6.53
F	1.88	57.09	161.56	45.78
P	0.1654	0.0001	0.0001	0.0001
Second application	**Pre-treatments**	**24-hours**	**3-days**	**7-days**
Attractive Plant (*Paeonia lactiflora)*	40.6 ± 2.1^{a}	37.3 ± 1.9^{a}	34.0 ± 0.6^{b}	32.8 ± 1.7^{d}
Intercrop (Carrot)	43.1 ± 1.6^{b}	42.9 ± 3.5^{b}	40.3 ± 1.5^{b}	37.1 ± 1.4^{d}
Botanical insecticide (*Melia azedarach*)	38.2 ± 2.0^{c}	35.2 ± 2.8^{c}	34.5 ± 2.5^{c}	45.8 ± 6.1^{b}
cypermethrin EC10%	27.4 ± 1.2^{e}	21.6 ± 1.4^{d}	19.6 ± 1.0^{d}	22.3 ± 3.7^{d}

carbaryl	27.2 ± 2.9^{e}	4.33 ± 1.0^{e}	3.66 ± 0.7^{e}	4.1 ± 1.2^{e}
Cyhalothrin 2.5% EC	30.6 ± 2.7^{d}	21.5 ± 1.8^{d}	24.1 ± 6.1^{d}	27.3 ± 5.0^{d}
Control	43.2 ± 2.3^{b}	43.8 ± 2.5^{ab}	52.1 ± 4.5^{a}	73.2 ± 3.9^{a}
LSD	1.66	3.62	5.73	7.602
CV	2.49	6.41	9.96	9.74
F	249.94	160.48	74.72	33.56
P	0.0001	0.0001	0.0001	0.0001
Third application				
Attractive Plant (*Paeonia lactiflora)*	30.4 ± 1.7^{e}	28.9 ± 1.4^{e}	28.5 ± 1.4^{c}	30.7 ± 2.6^{c}
Intercrop (Carrot)	33.8 ± 1.5^{f}	32.6 ± 1.1^{e}	30.9 ± 1.1^{c}	30.9 ± 2.9^{c}
Botanical insecticide (*Melia azedarach*)	56.9 ± 2.0^{b}	52.4 ± 1.2^{b}	49.8 ± 1.2^{b}	53.4 ± 2.0^{b}
cypermethrin EC10%	44.2 ± 2.3^{d}	34.8 ± 3.2^{e}	31.5 ± 3.2^{e}	33.9 ± 2.9^{c}
carbaryl	12.9 ± 2.1^{g}	3.10 ± 1.5^{f}	5.73 ± 1.5^{d}	6.26 ± 1.6^{d}
cyhalothrin 2.5% EC	56.2 ± 2.9^{bc}	45.2 ± 3.7^{d}	44.7 ± 3.7^{b}	50.4 ± 2.2^{b}
Control	77.7 ± 2.3^{a}	78.5 ± 2.4^{a}	81.0 ± 2.4^{a}	81.9 ± 3.0^{a}
LSD	1.14	2.93	3.28	4.04
CV	1.34	3.98	4.6	5.44
F- value	1986.25	423.03	397.83	279.46
P-value	0.0001	0.0001	0.0001	0.0001

Thrips population density increased after 18 days of pesticide application in all plots. Following the second and third applications of pesticides, the overall trend of thrips density in the experimental plots differed from that observed after the first treatment. Notably, the effectiveness of the attractive plants and intercrops changed on the first and second days of August due to crop maturity and leaf hardening (table 1). Among the applied chemical insecticide treatments, carbaryl recorded significantly the least population of thrips per plant and the highest reduction percentage in all recording data (Tables 2 and 3). The botanical efficacy was the same as the first application.

Table 2. percentage mortality of onion Thrips after spraying

Treatments	First application		
	24-hours	**3-days**	**7-days**
Attractive Plant (*Paeonia lactiflora)*	0 ± 0^{e}	0 ± 0^{d}	0 ± 0^{d}
Intercrop (Carrot)	0.0 ± 0.0^{de}	4.20 ± 1.9^{c}	9 ± 1.1^{cd}
Botanical insecticide (*Melia azedarach*)	15.2 ± 3.5^{c}	16.3 ± 4.0^{c}	15.30 ± 5.3^{bc}
cypermethrin EC10%	52.3 ± 5.1^{b}	56.3 ± 9.3^{b}	48.9 ± 7.3^{a}
carbaryl	75.9 ±1.3^{a}	82.3 ± 6.7^{a}	80.9 ±2.1^{a}
cyhalothrin 2.5% EC	60.1 ± 0.7^{b}	67.6 ± 9.2^{b}	65.1 ± 2.1^{b}
Control	0 ± 0^{e}	0 ± 0^{d}	0 ± 0^{d}
LSD	9.08	12.06	14.88
CV	19.74	23.46	74.45
F- value	110.02	73.86	21.06
P-value	0.001	0.0001	0.0001
Second application	**24-hours**	**3-days**	**7-days**
Attractive Plant (*Paeonia lactiflora)*	0 ± 0^{e}	2.40 ± 1.2^{de}	15.3 ± 6.8^{ab}

Intercrop (Carrot)	4.40 ± 0.10^{e}	2.2 ± 0.20^{e}	5.00 ± 5.0^{ab}
Botanical insecticide (*Melia azedarach*)	12.3 ± 3.5^{d}	13.3 ± 9.7^{bc}	12 ± 1.5^{bc}
cypermethrin EC10%	34.2 ± 6.3^{c}	39.2 ± 6.1^{b}	38 ± 8.5^{d}
carbaryl	84.2 ± 2.1^{a}	86.8 ± 1.8^{a}	82.6 ± 8.5^{a}
cyhalothrin 2.5% EC	32.1 ± 20^{b}	33.7 ± 19.2^{b}	30.3 ± 2.8^{d}
Control	0 ±0^{e}	0 ± 0^{f}	-0.0 ± 0^{e}
LSD	7.06	14.59	23.43
CV	20.55	44.70	-74.70
F- value	147.56	43.84	17.42
P-value	0.0001	0.0001	0.0001
Third application	**24-hours**	**3-days**	**7-days**
Attractive Plant (*Paeonia lactiflora)*	15.50 ± 0.8^{cd}	15.1 ± 3.5^{cd}	17.8 ± 1.0^{bc}
Intercrop (Carrot)	5.50 ± 1.4^{de}	8.66 ± 5.8^{d}	8.73 ± 6.6^{d}
Botanical insecticide (*Melia azedarach*)	7.70 ± 1.9^{cd}	12.3 ± 0.5^{cd}	12.16 ± 4.0^{cd}
cypermethrin EC10%	21.3 ± 3.4^{b}	28.8 ± 2.9^{b}	23.4 ± 2.9^{b}
carbaryl	63.6 ± 3.0^{a}	77.1 ± 4.7^{a}	75.2 ± 5.1^{a}
Cyhalothrin 2.5% EC	19.7 ± 2.5^{b}	16.8 ± 1.0^{c}	10.2 ± 2.0^{cd}
Control	0.0 ± 0.0^{e}	0 ± 0.0^{e}	0.0 ± 0.0^{e}
LSD	5.50	7.03	8.001
CV	18.95	19.28	25.69
F- value	127.62	111.86	87.37
P-value	0.0001	0.0001	0.0001

Finally, after analyzing the second and third stages of spraying, it was found that thrips population density increased again after 18 to 20 days in the treatments where chemical insecticides and plant-based insecticides were used. In contrast, in the treatments involving attractive plants and intercrops, the number of thrips significantly decreased after 25 to 32 days of planting the seedlings.

Table 3. Mean reduction percentage of onion thrips population

Treatments	**First application**		
	24-hours	3-days	7-days
Attractive Plant (*Paeonia lactiflora)*	0.0 ± 0.0^{d}	0.0 ± 0.0^{d}	0.0 ± 0.0^{e}
Intercrop (Carrot)	0.3 ± 0.1^{cd}	1.1 ± 0.2^{c}	7.06 ± 1.7^{cd}
Botanical insecticide (*Melia azedarach*)	12.2 ± 11.4^{c}	14.6 ± 8.3^{c}	11.3 ± 1^{c}
cypermethrin EC10%	54.2 ± 5.3^{b}	58.6 ± 4.5^{b}	44.7 ± 3.6^{a}
carbaryl	72.4 ±2.8^{a}	80.1 ±1.8^{a}	78.3 ±9.1^{a}
Cyhalothrin 2.5% EC	63.7 ± 3.1^{ab}	70.9 ± 1^{b}	53.1 ± 4.2^{b}
LSD	13.224	8.1637	9.1904
CV	29.33930	15.508	33.20671
F- value	53.93	161.57	50.51
P-value	0.0001	0.0001	0.0001
Second application	**24-hours**	**3-days**	**7-days**
Attractive Plant (*Paeonia lactiflora)*	3.1 ± 0.2^{e}	11.3 ± 4.8^{d}	45.3 ± 4.8^{b}
Intercrop (Carrot)	7.26 ± 4.0^{d}	15.1 ± 3.0^{d}	42.2 ± 3.0^{bc}
Botanical insecticide (*Melia azedarach*)	20.4 ± 6.2^{c}	21.4 ± 5^{c}	22.4 ± 3.1^{cd}
cypermethrin EC10%	50.5 ± 6.2^{b}	62.5 ± 6.7^{b}	47.3 ± 6.7^{b}

carbaryl	90.1 ± 1.8^{a}	93.1 ± 6.7^{a}	89.8 ±6.7^{a}
Cyhalothrin 2.5% EC	50.9 ± 3^{b}	55.7 ± 3.8^{b}	52.9 ± 3.8^{bc}
LSD	7.837	10.39	10.02
CV	16.88	16.031	14.692
F-value	178.18	84.89	35.85
p-value	0.0001	0.001	0.0001
Third application	**24-hours**	**3-days**	**7-days**
Attractive Plant (*Paeonia lactiflora)*	55.4 ± 0.5^{b}	59.5 ± 3.2^{b}	62.5 ± 1.4^{b}
Intercrop (Carrot)	58.4 ± 0.5^{b}	61.5 ± 2.8^{b}	62.3 ± 3.2^{b}
Botanical insecticide (*Melia azedarach*)	23.1 ± 1.7^{e}	30.9 ± 2.3^{c}	28.8 ± 4.0^{b}
cypermethrin EC10%	55.6 ± 2.8^{b}	60.8 ± 2.8^{b}	58.6 ± 2.1^{b}
carbaryl	88.4 ± 1.6^{a}	92.8 ± 2.9^{a}	92.3 ± 2.0^{a}
Cyhalothrin 2.5% EC	42.5 ± 3.0^{c}	41.8 ± 3.2^{c}	38.4 ± 3.7^{c}
LSD	3.685	3.869	4.7974
CV	4.537	4.479	5.677
F- value	435.96	443.82	296.39
P-value	0.0001	0.0001	0.0001

Discussion

The present study examined the effectiveness of three chemical insecticides—carbaryl, cypermethrin (EC 10%), and cyhalothrin (2.5% EC)—along with a botanical insecticide (*Melia azedarach*), an attractive plant (*Paeonia lactiflora*), and an intercrop (carrot) on onion thrips. The chemical insecticides were selected from various chemical classes. The results demonstrated that carbaryl exhibited higher efficacy than the other chemical insecticides. In the same way, the botanical treatment had minimal effect, and the efficacy of the attractive plant and intercrop began only after the maturation and leaf hardening of the onions (Tables 1, 2, and 3).

Khaliq et al. (2016) applied to cotton, tomato, red pepper, and okra as intercropping to control onion thrips. After comparing the cultivars, they found that these plants significantly affected onion thrips and recommended that they could also play a role in reducing chemical pollution. In a study conducted by Asghar et al. (2018), using insecticides such as carbosulfan, cypermethrin EC10%, carbaryl, deltamethrin+ triazophos, bifenthrin, and dimethoate for controlling *Thrips tabaci*, the results of the analysis indicated that carbaryl had the greatest effect, while the other insecticides did not show significant differences from one another. The findings of this study are consistent with those of Asghar et al. (2018). On the other hand, from the results of this research, it was found that among the chemical insecticides used, carbaryl was the most effective in controlling thrips because it showed high effectiveness against onion thrips in three applications. In contrast, the efficacy of cyhalothrin 2.5% EC and cypermethrin EC 10% decreased during the second and third applications, especially the efficacy of cyhalothrin (2.5% EC) showed a significant decrease (table 1. 2 and 3). Farmanullah et al. (2010) applied Thiodan®, Confidor®, Tracer®, Megamos®, and Actara® for the management of onion thrips. Except for Actara®, all the other insecticides significantly decreased onion thrips. The results of this application quite agree with those of Khaliq et al. (2014), who utilized three botanical (neem, datura, and bitter apple) and chemical (acephate, spirotetramat, and spinetoram) insecticides against onion thrips. The results indicated that the efficacy of the chemical insecticides was better than that of the botanical insecticides. Sadozi *et al*. (2009) used several insecticides, including Karate®, Thiodan®, Confidor®, Curacron®, and Crown®, to control onion thrips. The results showed that all the insecticides used significantly reduced the onion thrips population compared to the control. However, Thiodan® was the most effective, followed by Curacron® and Karate®.

Numerous studies conducted on onion thrips have found that the repeated use of certain insecticides, such as cyhalothrin (2.5% EC), triazophos, bifenthrin, dimethoate, and cypermethrin, leads to the development of resistance in various populations of this pest. As a result, in some cases, the effectiveness of these insecticides has decreased, and no significant differences are observed between their second and third applications (Shiberu et al., 2013; Din et al., 2016). Using insecticides with a higher mortality rate on thrips, to which thrips cannot develop resistance, is the most effective method for preventing thrips damage and reducing environmental pollution.

CONCLUSION AND RECOMMENDATION

This research concluded that carbaryl gave better results than other chemical and botanical insecticides against *Thrips tabaci*. It recorded the lowest population of thrips/plant and highest reduction percentage in all data recording intervals among the treated chemical insecticides, botanical insecticides, attractive plants, and intercrop. Moreover, after three times of application, little resistance against carbaryl has been seen. Therefore, it can be recommended that carbaryl, when used in the right amount, at the right time, and in the right dosage, provides good results for controlling onion thrips. This method, combined with other integrated pest management strategies, can also lead to better outcomes in controlling onion thrips and protecting the environment.

This research concluded that carbaryl gave better results than other chemical and botanical insecticides in controlling *Thrips tabaci*. It recorded the lowest thrips population per plant and the highest reduction percentage in all data recording intervals compared to other treatments, including chemical insecticides, botanical insecticides, attractive plants, and intercropping. Furthermore, after three applications, minimal resistance to carbaryl was observed, indicating that it remains effective against the pest with repeated use.

Therefore, carbaryl can be recommended as an effective option for controlling onion thrips, provided it is applied in the right amount, at the right time, and with the correct dosage. This method, when combined with other integrated pest management (IPM) strategies, can lead to better outcomes in controlling onion thrips while also protecting the environment. This conclusion highlights the importance of using carbaryl smartly as part of a comprehensive pest control program that ensures both effectiveness and environmental protection.

Conflict of Interest: The author(s) claimed no conflict of interest.

REFERENCES

Asghar, M., Baig, M. M. Q., Afzal, M. & Faisal, N. (2018). Evaluation of different insecticides for the management of onion thrips (*Thrips tabaci* Lindeman, 1889) (Thysanoptera, Thripidae) on onion (*Allium cepa L.*) crops. *Journal of Entomology*, 87: 167-176. https://doi.org/1080/0021213X.2018.1484423

Azazy, A., Abdelall, M. F. M., El-Sappagh, I. A., & Khalil, A. E. H. (2018). Biological control of the onion thrips, Thrips tabaci Lindeman (Thysanoptera: Thripidae) in open field using Egyption entomopathogenic nematode isolates. *Egyptian journal of biological pest control*, 28: 1-6. https://doi.org/10.1016/j.ejbc.2018.03.001

Brunner, P. C., Chatzivassiliou, E. K., Katis, N. I., & Frey, J. E. (2004). Host- associated genetic differentiation in *Thrips tabaci* (Insecta; Thysanoptera), as determined from mt DNA sequence data. *Nature publishing group*, 93: 364-470. https://doi.org/*10.1038/sj.hdy.6800512*

Capenira, J. L., (2001). Hand books of vegetable pests. Academic press. Pp 541.

Din, N., Ashraf, M., & Hussain, S. 2016. Effect of different non-chemical and chemical measures against onion thrips. *Journal of Entomology and Zoology Studies*, 5: 10-12. 10.22271/chemi.2016.v4.i10.760

Duchovskiene, L. (2006). The abundance and population dynamics of onion thrips (*thrips tabaci* Lind) in leek under the field conditions. *Journal of Agronomy Research*, 4: 163-166. 10.15159/AR.06.016

El-Naggar, J. B., & El-Hoda, N. Z. (2013). Field evaluation of imidacloprid and thiamethoxam against sucking insects and their side effects on soil fauna. *Journal of Plant Protection Reseach*, 53: 375-387.

Fernandes, F. L., & Fernandes, M. E. S. (2015). Flight movement and spatial distribution of immunomarked thrips in onion, potato, and tomato. *Brasilia*, 50: 399-406. *10.1590/S0100-204X2015000500007*

Farmanullah, F., Mulk M., Farid A., Saeed M. Q., & Sattar S. (2010). Population dynamics and chemical control of onion thrips (*Thrips tabaci* Lindeman). *Pakistan Journal of Zoology*, 42: 401-402.

Gachu, S. M., Muthomi J. W., Narla R. D., Nderitu J. H., Olubayo F. M., & Wagacha J. M.(2012). Management of thrips *(Thrips tabaci*) in bulb onion by use of vegetable intercrops. *International Journal of Agriculture Science*, 2: 39-43. 10.17582/journal.pjz/2010.42.4.401.406

Gill, H. K., Garg H. Gill A.K., Kaufman G.J.L., & Nault B. A. (2015). Onion thrips (Thysanotera: Thtipidae) Biology, Ecology and management in onion production systems*. Journal of International Pest management*, 6:1-9. *10.1093/jipm/pmv006*

Gholami, Z., Sadeghi, A., Garjan, A. S., Rafi, J. N., & Gholami, F. (2015). Susceptibility of western flower thrips *Frankliniella occidentalis* (Thysanoptera: Thripidae) to some synthetic and botanical insecticedes under laboratory conditions. *Journal of Crop Protion*, 4: 627-632. 10.22067/jcp.v4i4.48043

Jacobson, A., Nault, B. A., Vargo, E. L., & Kennedy, G. G. (2016). Restricted gene flow among lineages of *thrips tabaci* supports genetic divergence among cryptic species groups. *Journal of plant protection research*, 12: 67-75. 10.1515/jppr-2016-0042

Khaliq, A., Abas K. A., Afzal M., Tahir H. M. Raza A. M., & Khan A.M. (2014). Field evaluation of selected botanicals and commercial synthetic insecticides against *Thtips tabaci* Lindeman (Thysanotera: Thripidae) populations and predators in onion field plots. *Journal of Crop Protection*, 62: 1-10. 10.22067/jcp.v3i2.48042

Khan, A. B., Panhwar, W. A., Mehmood, S. A., Gilal, A. A., Ahmed, S., & F.Ullah, H. (2017). Population of *Thrips tabaci* Lindeman, 1889 in onion crop from district Mansehra, Khyber Pakhtunkhwa, Pakistan. *Journal of Entomology and Zoology studies*, 5: 502-505. 10.22271/chemi.2017.v5.i4.2100

Kaur, S., Kular, J. S., & Chandi, R. S. (2017). Effect of temperature on growth and development of *Thrips tabaci* Lindeman in BT cotton. *International journal of Microbiology*, 6: 2553-2560. *10.20546/ijcmas.2017.605.287*

Loomans, A. (2003). Parasitoids as biological control agents of *Thrips* pests. ISBN: 90-5808-884-7 Pp 5-9. 10.1007/978-94-010-0108-4_2

Malkeshi, S. H. (2005). Survey of reproduction methods and mass rearing of the minute pirate bug *Orius spp*. (Hem: Anthocoridae) and application of them in order to control of thrips on and ornamental plants in the integrated pests management (IPM). MSc Thises, Ferdowsi University, Mashhad, Iran. Pp87. (In Persain).

Nikolova, I., & Georgieva, N. (2013). Effect of botanical insecticides neemazal-t/s and pyrethrum applied alone and in combination with different organic products on *Thrips tabaci* population density. *Acta Entomological Society of Serbica*, 19: 1-12. 10.2298/AES1301001N

Pourian, H. R., Balou M. M., Alizadeh M., & Orosz S. (2009). Study on biology of onion thrips, *Thrips tabaci* Lindeman (Thyasanoptera: Thripidae) on cucumber (Var. Sultan) in laboratory conditions. *Journal of plant Protection Research*, 49: 390-393. https://doi.org/10.2478/v10045-009-0056-3

Pathak, M. K., Pandey, M. K., Gupta, R. C., & Gupta, P. K. (2018). Evaluation of different insecticides against thrips in onion seed production. *International journal of current microbiology and applied science*, 7: 4204-4207. https://doi.org/10.20546/ijcmas.2018.710.491

Sadozai, A., Zeb Q., Iqbal T., Anwar S., Badshah H., Ali A. Ahmad M., & Tahir M. (2009). Testing the efficacy of different insecticides against onion thrips in tarnab, Peshawar, *Sarhad Journal of Agriculture*, 25: 26-39. *https://doi.org/10.17582/journal.sja/2009/25.1.26.39*

Sedaratian, A., Fathipour, Y., Talebi, A. A., & Farahani, S. (2010). Population density and spatial distribution pattern of *thrips tabaci* (Thysanoptera: Thripidae) on different soybean varieties. *Journal agriculture science and technology*, 12: 275-288. https://doi.org/10.1007/BF03021014

Schwartz, H. F., Alston D., Alwang J., Bartolo A., Blunt T., Boateng C. O., Bunn B., & Cramer C. S. (2014). Onion thrips ipmPIPE: A Coocdinated effort to improve the management of onion thrips and *Iris yellow spot virus* for the U.S. Onion industry. *Plant health progress*, 15: 172-174. https://doi.org/10.1094/PHP-RS-14-0137

Shiberu, T., Negeri, M., & Selvaraj, T. (2013). Evaluation of some botanicals and entomopathogenic fungi for the control of onion thrips (*Thrips tabaci* L.) in West Showa, Ethiopia. *Journal of pathology and Microbiology*, 4: 1-7. https://doi.org/10.4172/2157-7471.1000210

SAS Institute, 2002. Proc User's Manual, Version 9. 1th ed. SAS Institute, Cary, NC. & Scholthof, K. B. G., (2007). The disease triangle: pathogens, the environment and society. *Natural reviews, Microbiology*, 5: 152-156.

Toda, S., & Murai, T. (2007). Phylogenetic analysis based on mitochondrial CO1 gene sequences in *thrips tabaci* Lindeman (Thysanoptera: Thripidae) in relation to reproductive forms and geographic distribution. *Journal of applied entomology and zoology*, 42: 309-316. https://doi.org/10.1303/jjaez.42.309

Wei Li, X., Fail J., Wang, P., Feng, Ji. N., & Shelton A. M. (2014). Arrhenotakous and Thelytokous *Thrips tabaci* (Thysanoptera: Thripdae) on onion and cabbage and its implications on evolution and pest management. *Journal of economic entomology*, 107: 1526-1527. https://doi.org/10.1603/EC14121