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Effect of different non-chemical and chemical measures against onion thrips

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Abstract
The effect of insecticides (Imidacloprid 200SL, 250 ml/acre; Imidacloprid + Fipronil 80 WG, 60 gm/acre, Chlorfenapyr 36SC, 50WDG, 100ml/acre and leaf extracts of (*Nerium indicum*, *Calotropis procera* and *Datura stramonium* seed extract of each at 5%) were evaluated against *Thrips tabaci* in farmer's field. Data recording intervals were 24, 48, 72-hours and 7-days. The results revealed that maximum population reduction was observed in Imidacloprid + Fipronil 80WG (94.28%) followed by Chlorfenapyr 50WDG (93.37%), Chlorfenapyr 36SC (91.26%) and Imidacloprid 200SL (85.06%) and where mean population of thrips per five plants were recorded 2.33, 2.33, 2.73 and 6.26, respectively. After 24-hours of data recording interval among the botanicals, *D. stramonium* gave significantly lower population of thrips (9.700 per five plants) and highest reduction percentage (82.36) after 48-h of intervals followed by *C. procera* and *N. indicum* with mean population 11.36, 13.90 showing reduction percentage 79.33 and 74.76, respectively.

Keywords: Thrips, *Nerium indicum*, *Calotropis procera, Datura stramonium,* Imidacloprid, Chlorfenapyr

1. Introduction

Various sucking insect pests attack onion crop. *Thrips tabaci* Lind (Thysanoptera: Thripidae) is a major insect pest of onion, both nymph and adults cause severe damage [4]. The attacked leaves become curled, wrinkled, and gradually dry up. Heavily infested plants do not form bulbs or the flowers produce seed [4]. *T. tabaci* having a piercing-sucking mouthparts, leaving silvery areas on leaves [15] *T. tabaci* feeding on onion leaves may aid in development of purple blotch disease [3]. This species acts as a major vector of viral plant diseases [8]. Thrips are present in all onion growing areas and can cause up to 59% loss in yield [17]. Currently, growers manage thrips by applying insecticides several times in the growing season. However, most insecticides become ineffective because a large number of thrips are protected between the inner leaves of the onion plant where the pupal stage is spent in the soil. In addition, *Thrips tabaci* is a very prolific species with many overlapping generations [10, 2, 13]. Development of resistance by onion thrips to most commonly used insecticides has been reported [9] which with increasing the cost of production, extensive use of insecticides leads to the problems of pest resistance, resurgence and pesticides residues causing destruction of beneficial fauna and environmental pollution [1]. Therefore, there is a need to incorporate the use of chemicals with other methods of control such as botanicals. Many of the botanicals have been explored having broad spectrum activity and have the potential to become alternatives to chemical insecticides. Since botanicals are effective and environmental friendly, so the focus should be on the encouragement of the use of botanicals to deal with problems associated with other insecticides [16]. Therefore, this study was undertaken to evaluate effectiveness of newly introduced insecticides and botanicals on the management of onion thrips.

2. Materials and Methods

A field experiment was laid in vegetable area at Ayub Agricultural Research Institute Faisalabad during Rabi season 2015 using onion variety Phulkara. Randomized Block Design was used in eight treatments each with three replications. Treatments were *N. indicum* 5% (T_1), *D. stramonium* 5%(T_2), *C. procera* 5%(T_3), Imidacloprid (Confidor) at the rate of 600 ml/ hectare (T_4), Imidacloprid+Fipronil (Lasenta) at the rate of 144 g/ hectare (T_5), Chlorfenapyr (Foxal 36 SC) at the rate of 240 ml/hectare (T_6), Foxal 50 WDG at the rate of 240 gm/ hectare (T_7), without any treatment (T_8) applied on Phulkara variety.

2.1 Data collection
Pre-spray population of onion thrips was recorded at regular intervals from randomly selected five plants from each sampling unit and number of thrips present were visually counted and averaged to get mean population from each replication. When thrips population reached 30-40 thrips/plant then the above botanicals and insecticides were sprayed. The efficacy of each insecticide and botanicals was determined by counting the thrips on 5 plants randomly taken from each replication. The post spray data was taken after 24 hours, 48 hours, 5 days and 7 days intervals.

2.2 Data Analysis
The data were analyzed using Statistical Analysis Software. Analysis of variance (ANOVA) also constructed to test for significant differences between the variables. Shiberu and Negeri, (2014) reported the efficacy percentages by using the following formulas:

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

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

3. Results and Discussion
All of the insecticides and botanicals assured the control of onion thrips at various degrees of significances over the untreated check. The population of thrips (both nymphs and adults) per plant a day before application of treatments in different treatments was uniform which ranged from 31.93 to 38.63

Among the applied insecticides treatments Imidacloprid + Fipronil 80 WG recorded significantly least population of thrips/plant and highest reduction percentage in all data recording interval. Efficacy of insecticide treatments decreased with increase in data collecting interval. After 24 hours of insecticide application Imidacloprid+Fipronil 80 WG gave least population of thrips /plant (2.33) and highest reduction percentage (94.28) followed by Chlorfenapyr 36 SC, Chlorfenapyr 50 WDG and imidacloprid 200 SL their mean population (2.33),(2.73), (6.26) and reduction percentage were 91.26, 93.37 and 85.06; respectively. After 2 days, 3-days and 7-days results showed significantly least population of thrips/plant recorded in Imidacloprid+Fipronil 80 WG (2.80), (3.76), (4.90) and its reduction percentage were 94.29, 93.156 and 92.30; respectively followed by Chlorfenapyr 50 WDG, Chlorfenapyr 36 SC and imidacloprid 200 SL. Lasenta 80 WDG gave best control against onion thrips because it is the combination of two active ingredients imidacloprid and fipronil while in other insecticides there is only one active ingredient. Imidacloprid is a systemic insecticide, which acts as an insect neurotoxin and act on the central nervous system. Due to presence of two active ingredients they enhance the activity of insecticide and killed more insects as compared to other insecticides. Similarly, [18] reported that Imidacloprid and spinosad decreased thrips populations. (12) tested the efficiency of different insecticides against onion thrips and reported that Thiodon 800 ml/ha gave best results than all other pesticides. [11] documented that carbofuran and endosulfan were very effective in reducing the incidence of *Thrips tabaci* on onion. [6] tested different insecticides against *Thrips tabaci* and found that Methamidophos was the most effective insecticides for the control followed by Dicrotophos and Endosulfan. Cypermethrin and Monocrotophos were the least effective.

Among the botanicals *D. stramonium* recorded significantly lower population of thrips and highest reduction percentage in the entire data collecting interval. In case of botanicals efficacy of plant extracts increased with increase of the data collecting interval but after 3 days efficacy was decreased. After 3-days of treatments application results found that botanicals *D. stramonium* (13.20) showed significantly lower population of thrips and highest reduction percentage (68.43) followed by *C. procera* and *N. indicum* their mean population (14.13), (16.56) and their reduction percentage were (71.26), (66.40); respectively. After 24-hours, 48 hours and 7-days results found that *D. stramonium* showed least population of thrips/plant (13.20), (10.63),(11.867) and reduction percentage (68.43), (78.30), (81.328) respectively, followed by *C. procera* and *N. indicum. D. stramonium* gave best results as compared to other botanicals. *D. stramonium* plants contain tropane alkaloids such as scopolamine, hyoscyamine, and atropine, primarily in their seeds and flowers. Due to the potent combination of anticholinergic substances *Datura* intoxication typically produces effects similar to that of an anticholinergic delirium. [14] tested the efficiency of different insecticides and botanicals and found that insecticides Cutter 112 E. C. and Triger 5 E.C were found to be comparable and effective to the standard check Diazinon 60 E. C. in controlling onion thrips, *Thrips tabaci* (L.) population. Botanicals *Azadirachta indica* leaf extract and *Dodonae angustifolia* fresh leaf extract were the second best botanical insecticide over all. (7) reported that *Azadirachtin* performed poorly compared to the conventional insecticides for thrips control. (5) tested the bioefficacy of Nicotinamide Diatomite (TD-Extract) against onion thrips. Results revealed that TD-Extract @ 1.5 liters per acre gave 79.65% mortality; TD-Extract @ 2 liters per acre gave 80.58% mortality of onion thrips almost equal /slightly better than synthetic insecticide advantage-20EC Carbosulfan @ 500 ml per acre.

4. Conclusion
This experiment concluded that Imidacloprid+Fipronil 80 WG and D. *stramonium* recorded least population of thrips/plant and highest reduction percentage in all data recording intervals among the treated insecticides and botanicals, respectively. Botanicals used as alternative insecticides for the control of onion in thrips.

Table 1: Mean Thrips population in different treatments

Treatments	Pre-treatment	24-hours	48-hours	3-days	7-days
N. indicum	36.56ab	18.86b ± 0.63	16.56b ±0.64	13.90b ± 0.66	17.13b ± 0.58
D. stramonium	38.63a	13.20b ± 0.49	10.63c ± 0.90	9.70c ± 0.83	11.86d ± 0.76
C. procera	37.53a	15.33b ± 0.63	14.13b ± 0.52	11.36bc ± 0.66	13.63c ± 0.46
Imidacloprid 200 SL	35.66abc	6.26c ± 0.28	7.73cd ± 0.53	8.93c ± 0.50	11.26d ± 0.60
Imidacloprid+Fipronil 80 WG	36.56ab	2.33c ± 0.31	2.80e ± 0.26	3.76d ± 0.20	4.90f ± 0.51
Chlorfenapyr 36 SC	33.36bc	3.63c ± 0.23	4.86de ± 0.20	5.76d ± 0.20	6.56e ± 0.24
Chlorfenapyr 50 WDG	31.93c	2.73c ± 0.32	3.76e ± 0.20	4.40d ± 0.37	5.23ef ± 0.44
Control	36.66ab	43.63a ± 5.35	49.56a ± 2.45	55.26a ± 2.21	63.43a ± 1.56
LSD	4.37	6.06	3.00	2.65	1.51

Table 2: Mean reduction percentage of thrips population

Treatments	24-hours	48-hours	3-days	7-days
N. indicum	55.05d ± 7.10	66.40f ± 2.18	74.76e ± 1.63	72.99e ± 0.53
D. stramonium	68.43c ± 5.43	78.30d ± 2.83	82.36c ± 1.89	81.32c ± 0.79
C. procera	63.24c ± 6.62	71.26e ± 2.40	79.33d ± 1.69	78.51d ± 0.44
Imidacloprid 200 SL	85.06b ± 2.41	84.41c ± 0.57	83.85c ± 0.25	82.25c ± 0.60
Imidacloprid+Fipronil 80 WG	94.28a ± 1.55	94.29a ± 0.74	93.15a ± 0.52	92.30a ± 0.66
Foxal 36 SC	91.26ab ± 1.70	90.10b ± 0.83	89.52b ± 0.63	89.65b ± 0.14
Foxal 50 WDG	93.37a ± 1.58	92.33ab ± 0.73	92.00a ± 0.83	91.76a ± 0.57
LSD	7.77	3.29	2.36	1.54

Table 3: % Efficacy of Insecticides and Botanicals against thrips population

Treatments	24-hours	48-hours	3-days	7-days
N. indicum	48.42e ± 1.36	54.71d ± 1.39	62.00c ± 1.59	53.16d ± 1.18
D. stramonium	65.71c ± 1.61	72.39b ± 2.48	74.85b ± 2.10	69.23c ± 1.81
C. procera	58.96d ± 2.75	62.18c ± 2.41	69.59b ± 2.40	63.52c ± 2.25
Imidacloprid 200 SL	80.35b ± 0.20	75.73b ± 1.40	71.91b ± 1.71	64.70c ± 0.58
Imidacloprid+Fipronil 80 WG	93.61a ± 0.89	92.33a ± 0.73	89.69b ± 0.58	86.59a ± 1.47
Foxal 36 SC	89.06a ± 0.52	85.30a ± 0.79	82.57a ± 0.98	80.17b ± 0.98
Foxal 50 WDG	92.33a ± 0.93	89.41a ± 0.68	87.63a ± 1.14	85.26ab ± 1.52
LSD	5.36	7.32	7.35a	6.37

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