



Evaluation of insecticides efficacy against *thrips Tabaci lindeman* on onion

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Abstract

Thrips tabaci is an important pest of onion crops and causes significant yield losses globally. This study aimed at evaluating the efficacy of different insecticides to control onion thrips on onion crops during the years 2021–2022. The experiment was set up and conducted in an open field located in the village of Barilevë, municipality of Prishtina, Kosovo. The experiment design was according to randomized Fisher blocks in three replications. Insecticides were from different groups of chemicals: Mospilan 20 SP (*Acetamiprid*), Actara 25 WG (*Thiametoksan*), Talstar 10 EC (*Bifenthrin*), Karate 2.5 EC, Dimetogal (*Dimetoat*), Deltarin 2,5 EC (*Deltamethrin*), and control. The insecticides treatment were in minimal and maximal doses as recommended by the producers. All the insecticides were significantly better than untreated checks at reducing onion thrips numbers after the application of each of the doses. Even though there were no significant differences between the insecticides used in terms of reducing the onion thrips population, Karate has shown the highest efficiency in reducing the number of onion thrips, while Talstar showed to be the least efficient. Therefore, we recommend the use of all insecticides at minimal doses to control the pest in onions.

Keywords: *Thrips tabaci*, insecticide, efficacy, doses, onion

Introduction

Thrips tabaci is considered the most economically important pest of onions worldwide (Gachu *et al.* 2012) [5]. Adults and larvae feed on leaves and reduce onion yield by up to 50% (Fournier *et al.* 1995) [4]. The use of insecticides is considered the most common tactic to manage pest infestations in Kosovo, as it is elsewhere (Reitz 2014 [18]; Gill *et al.* 2015 [7]). Several authors have evaluated the efficacy of the insecticide against *T. tabaci* worldwide (Bhargava 2010 [1]; Patil *et al.* 2010 [17]; Ullah *et al.* 2010 [24]; Waters & Walsh 2010) [25]. Larvae are often more likely to be killed by insecticides compared with other stages, as is the case with Spirotetramat, which is effective against larvae but less so for adults (Guillen *et al.* 2014) [8]. The other insecticides have shown great effectiveness in controlling *T. tabaci*. Sadozai *et al.* (2009) [19] found that Karate 2.5, Confidor 20 SL, and some other insecticides he tested were significantly better than untreated controls at reducing the pest population in onions. Thiodan proved to be the most efficient, followed by Karate and Curacron. Hussain *et al.* (1997) [11] found that methamidophos was the most efficient insecticide to control *T. tabaci*, followed by other insecticides like endosulfan, monocrotophos, and cypermethrin. Kisha (1979) [12] reported that *T. tabaci* can be managed by methomyl (0.53 a.i. kg ha⁻¹), phenthoate (1.08kg ha⁻¹), and malathion (1.0 kg ha⁻¹) when applied at an interval of 14 days. Repeated application of insecticides in the field often favors unwanted effects such as pesticide resistance, the elimination of non-target insect species, pest resurgence, and secondary outbreaks of the pest (Foster *et al.* 2010) [3]. Most insecticides showed to be ineffective against *Thrips tabaci* because a large number of the pest leaves between the inner leaves of the plant where they are protected as well the pupal stage is in the soil (Shelton *et al.*

2003 [21], 2006 [22]; Nault & Shelton 2010 [16]). Thrips may rapidly develop resistance against insecticides, which finally results in the rapid loss of effectiveness of new insecticides (Reitz 2014) [18]. Insecticide resistance was confirmed in a large number of insecticide classes like organochlorines, carbamates, pyrethroids, organophosphates, and spinosad (Bielza *et al.* 2007 [2]; Herron *et al.* 2008 [10]; Nault *et al.* 2013[15]). In New York, *T. tabaci*, which was collected from onion fields, showed to be resistant to methomyl and k-cyhalothrin (Shelton *et al.* 2003 [21], 2006 [22]). In Canada, insecticide resistance in onion thrips has been reported for k-cyhalothrin, deltamethrin, and diazinon (MacIntyre-Allen *et al.* 2005[13]). In New Zealand, onion thrips have also been reported to be resistant to diazinon, deltamethrin, and dichlorvos (Martin *et al.* 2003) [14]. In Australia, onion thrips taken from onion fields were resistant to a-cypermethrin, k-cyhalothrin, diazinon, and dimethoate, although no resistance was shown with omethoate, malathion, and methidathion (Herron *et al.* 2008) [10].

Taking into account that insect resistance development towards insecticides is a worldwide problem, it is of great interest to evaluate the new insecticides as well as the existing ones for their efficacy against harmful insects in agriculture. Keeping this in mind, the experiment goal was to evaluate some insecticides of different chemical groups in order to manage *T. tabaci* in onion crops cultivated at the farm level.

Materials and methods

Location and cultural practices

To evaluate insecticides effectiveness, the experiment was set up in the open field on an area of 2.1 ha planted with onions at farm level, located in the village of Barilevo in the municipality of Prishtina, situated at 42°6882' latitude,

21°1466' longitude, and an altitude of 603 m above sea level. The cultivar of onion used in our investigations was Stuttgarter Reisen, which is originally from the Netherlands and is traditionally the most-grown onion variety in Kosovo. Beginning in April the onion sets were planted in the field at a distance of 20 cm between rows and 15 cm within rows.

Experimental design

The experimental plot was divided into six parts of 0.30 ha each for each treatment in three repetitions, while the rest of the plot (0.30 ha) was not treated and served as control plots. The experiment design was according to Fisher blocks randomized in three repetitions. Insecticides were from different groups of chemicals: Mospilan 20 SP (*Acetamiprid*), Actara 25 WG (*Thiametoksan*), Talstar 10 EC (*Bifenthrin*), Karate 2.5 EC, Dimetogal (*Dimetoat*), Deltarin 2,5 EC (*Deltamethrin*) and control. The insecticides we have used in minimal and maximal doses are as follows: Actara 25 WG (100 and 150 gr/ha), Mospilan 20 SP (150 and 300 gr/ha), Talstar 10 EC (0.02 and 0.05%), Karate 2.5 EC (0.4-0.5 kg/ha), Dimetogal (0.7-1.0 l/ha), Deltarin 2.5 (0.3-0.5 l/ha), and control (treated just with clean water).

Field and laboratory work

Treatments were performed using a sprayer CP3 of 20 L capacity, while for all treatments, the water consumption was 400 l/ha to give complete coverage of onion plants. The treatments of the plots were in the first week of June, for both years of the experimental work, 2021 and 2022 respectively. The evaluation of the presence of onion thrips was before the treatment while the effectiveness of the

insecticide action was 2 days, 7 days, and 14 days after the treatment. By random method 10 plants were analyzed for the presence of insects on the leaf surface, from each plot. In the laboratory, the identification of *T. tabaci* was done according to Mound & Walker (1982)^[27]. Relevant data such as the sampling date accompanied each sample to the laboratory of the Crop Protection at the Faculty of Agriculture in Prishtina, Kosovo.

Finally, after counting the living individuals of *T. tabaci*, the percentage of pest reduction as well as the efficacy of each insecticide used in comparison to the control plots were registered and calculated according to the formula given by (Shiberu & Negeri 2014) ^[23].

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

The data were processed and analyzed using ANOVA and tested by LSD (P < 0.01 and 0.05).

Results and discussion

The efficacy percent of treatments were observed after 2 days, 7 days, and 14 days for onion thrips mortality, and the results are in Table 1. Results showed a significant reduction in the onion thrips after the application of insecticides on all plots except the untreated control. The reduction in the number of pests was different depending on the type and dose of the insecticide used. In relation to the control plot, all the insecticides used have shown different efficiencies in reducing onion pest populations in both years of research (Table 1).

Table 1: Onion thrips number and reduction in percentages after treatments (2021-2022)

Year	Insecticide	Insecticide doses	Average number of onion thrips after treatments			Reduction percentages of onion thrips after treatments		
			2 day	7 day	14 day	2 day	7 day	14 day
2021	Mospilan 20SP	Minimal	0	6	48	100.00	89.60	16.77
		Maximal	0	0	3	100.00	100.00	94.80
	Actara 25WG	Minimal	0	2	42	100.00	96.53	27.17
		Maximal	0	0	7	100.00	100.00	87.86
	Talstar 10 EC	Minimal	0	7	53	100.00	87.86	8.10
		Maximal	0	3	9	100.00	94.80	84.40
	Karate 2.5 EC	Minimal	0	2	16	100.00	96.53	72.25
		Maximal	0	0	2	100.00	100.00	96.53
	Dimetogal	Minimal	2	0	29	96.53	100.00	49.71
		Maximal	0	0	7	100.00	100.00	87.86
	Deltarin 2.5	Minimal	0	3	35	100.00	94.80	39.31
		Maximal	0	0	12	100.00	100.00	79.19
Pre-treatment (Control)			57.67					
2022	Mospilan 20SP	Minimal	0	0	13	100.00	100.00	70.35
		Maximal	0	0	5	100.00	100.00	88.59
	Actara 25WG	Minimal	0	9	7	100.00	79.47	80.03
		Maximal	0	2	2	100.00	95.44	95.44
	Talstar 10 EC	Minimal	0	0	24	100.00	100.00	45.26
		Maximal	0	0	6	100.00	100.00	86.31
	Karate 2.5 EC	Minimal	0	3	11	100.00	93.16	74.91
		Maximal	0	1	2	100.00	97.72	95.44
	Dimetogal	Minimal	0	0	17	100.00	100.00	61.22
		Maximal	0	0	3	100.00	100.00	93.16
	Deltarin 2.5	Minimal	0	0	5	100.00	100.00	88.59
		Maximal	0	0	0	100.00	100.00	100.00
Pre-treatment (Control)			43.84					

During the year 2021, on the second day after treatment, all the insecticides used, both at the maximum and the minimum dose, reduced the number of the pest by 100%, with the exception of dimethogal at the minimum dose, where the reduction in the number of this pest was 96.53%. After 7 days, all the insecticides used in the maximum doses have shown a satisfactory efficiency of 100% in onion thrips reduction, with exception of Talstar, where the efficacy recorded was 94.80%. At the minimum doses, again, the reduction in the number of pests was at a satisfactory level. The percentage of onion thrips reduction with Dimethogal was 100%, while with other insecticides it was as follows: Mospilan 89.60%, Actara 96.53%, Talstar 87.86%, Karate 96.53%, and Deltarin 94.80%, in relation to the control plot. On the 14th day, the reduction was also different, so the highest reduction of the pest was with Karate at the maximum doses (96.53%), while the lowest was with Talstar at the minimum doses (8.10%).

During the year 2022, on the second day after treatment, all insecticides used, both in the maximum and minimum doses, reduced the number of onion thrips by 100%. After 7 days following treatment, all the insecticides used in the maximum dose have shown a satisfactory efficiency of 100%. With Actara and Karate, the efficiency was different both in the minimum and maximum doses in relation to the control plot and had values of 79.47 and 93.16, respectively, of 95.44 and 97.72 percent in onion thrips reduction. On the 14th day after treatment, the reduction was also different, so the highest reduction of the pest was with Deltarin at the maximum dose of 100.00%, while the lowest was with Talstar at minimum doses with an almost 45.26% reduction of thrips numbers (Table 1).

Various researchers have previously reported the effectiveness of insecticides against onion thrips. The results of our work are in line with the data of Worthing (1987)^[26], who reported that the insecticide Deltamethrin has very good residual effects for insect pests, as it was in our case with Karate. The results of this study are also in conformity with the findings of previous authors who used synthetic insecticides to manage onion thrips in different parts of the world and got a considerable knockdown effect (Haug &

Hoffman 1990^[9]; Gandhale *et al.* 1984^[6]; Kisha 1979^[12]; Hussain *et al.* 1997^[11]).

Analyzing results using ANOVA (Table 2), it was shown that there are statistically significant differences regarding the efficacy of the insecticide by year (Factor A), type of insecticide (Factor B), doses of insecticide (Factor C), and interaction among factors (A x B x C).

On average, the highest number of pests was during the year 2021 (15.10 individuals), whereas the lowest one was in the year 2022 (8.88 individuals). According to the data obtained, it was shown that differences in terms of the number of onion thrips recorded between the years of investigations are statistically highly significant, and we can conclude that onion thrips pressure in onion crops was higher in the year 2021 compared to the year 2022. As for the type of insecticides that were evaluated (Factor B), compared to the control, there were highly significant differences in the efficacy, and we can conclude that all the insecticides evaluated have shown high efficacy against onion thrips. On the other hand, although the insecticides used were efficient in managing the onion thrips, a very destructive pest not only for the onion but also for other vegetables and field crops, the difference between the types of insecticides was not statistically significant. The lowest number of onion thrips, in general, was recorded with the insecticide Karate (3.08), while the highest one was recorded with the insecticide Talstar (8.50), excluded the control, where the number of onion thrips recorded was very high (50.75 individuals).

With regard to the doses of insecticides that were used in our investigations (Factor C), the lowest value of the onion thrips frequency was recorded for the second variant C2 (maximal doses), where the number of onion thrips on average was 11.24, while the highest number was recorded for the first variant C1 (minimal doses), where the number of the pest on average was 12.74. These differences in the number of onion thrips recorded in the statistical approach are not significant, and we can conclude that, in general, both doses (minimal and maximal) were equally efficient in managing onion thrips, thus reducing the pest populations in the onion crop, and the differences were just a coincidence.

Table 2. The frequency of onion thrips after treatment in onion crop (ANOVA)

Year (A)	Insecticide (B)	Doses (C)		Average (AB)	Average (A)
		Minimal	Maximal		
2021	Mospilan 20SP	18.00	1.00	9.50	15.10 **
	Actara 25WG	14.67	2.33	8.50	
	Talstar 10EC	20.00**	4.00	12.00	
	Karate 2.5EC	6.00	0.67	3.33	
	Dimetogal	10.33	2.33	6.33	
	Deltarin 2.5	12.67	4.00	8.33	
	Pre-treatment (Control)	39.00	76.33	57.67	
Average (AC)		17.24	12.95		
2022	Mospilan 20SP	4.33	1.67	3.00	8.88 **
	Actara 25WG	5.33	1.33	3.33	
	Talstar 10 EC	8.00	2.00	5.00	
	Karate 2.5 EC	4.67	1.00	2.83	
	Dimetogal	5.67	1.00	3.33	
	Deltarin 2.5	1.67	0.00**	0.83	
	Pre-treatment (Control)	28.00	59.67	43.84	
Average (AC)		8.24	9.52	Average (B)	
Insecticide x Doses (BC)	Mospilan 20SP	11.17	1.33	6.25	
	Actara 25WG	10.00	1.83	5.92	
	Talstar 10 EC	14.00	3.00	8.50NS	
	Karate 2.5 EC	5.33	0.83	3.08NS	

		Dimetogal		8.00	1.67	4.83		
		Deltarin 2.5		7.17	2.00	4.58		
		Pre-treatment (Control)		33.50	68.00	50.75**		
		Average (C)		12.74	11.24	AxBxC		
FACTOR		A	B	C	AB	AC	BC	ABC
LSD	1%	4.33887	13.72132	5.65410	23.54658	8.77402	21.49390	47.89552
	5%	3.29619	9.78683	4.29536	15.54296	6.44647	14.18818	26.09203

Regarding the interaction of the factors (AxB, AxC, BxC, and AxBxC), there were statistically significant differences at different levels (Table 2). As for the interaction of factors AxB (year x insecticide), the highest number of the pest was recorded in variant A1B3 in both years of the experimental work (12.00 and 5.00 individuals), while the lowest one was recorded in variant A2B4 during the year 2021 (3.33 individuals) and A1B6 during the year 2022 (0.83 individuals). As for the interaction AxC, the highest average number of pests was recorded for variant A1C1 (18.00 individuals), whereas the lowest one was recorded for variant A2C6 (1.67 individuals). In terms of the interaction of factors BxC, variant B3C2 had the lowest average number of onion thrips (0.83 individuals), while variant B3C1 had the highest (14.00 individuals). Between the other variants of interactions of factors BxC, statistically, significant differences at different levels were recorded (Table 2).

Regarding the interaction of all factors evaluated, AxBxC (year x insecticide x doses) also recorded statistically significant differences; thus, the highest number of the pest was recorded for variant A1B3C1 (20.00), whereas the lowest one was recorded for variant A2B6C2 (0.00 individuals), and we can conclude that these differences are statistically highly significant. Also, for the other combinations of the factors AxBxC, statistically, significant differences were recorded (Table 2).

The presented findings are consistent with the work of other authors (Shafiq and Maher, 2016)^[20], who found that Deltamethrin significantly reduced onion thrips populations when compared to the control. Several authors have evaluated the effect of insecticides against *T. tabaci* in their work both in laboratory and field conditions that have shown great effectiveness against the onion thrips compared with the untreated plot (Bhargava 2010^[1]; Patil *et al.* 2010^[17]; Ullah *et al.* 2010^[24]; Waters & Walsh 2010^[25]), and our results are in line.

Conclusions

The experimental results proved that all insecticides used have shown high efficiency in reducing the populations of the pest *T. tabaci* in comparison to untreated plots (control). Among the insecticides used, Karate has shown the highest efficiency in reducing the number of *T. tabaci*, while Talstar showed to be the least efficient. Both doses used showed satisfactory efficacy, and there was no significant difference between them. Therefore, based on this work, we strongly recommend using minimum doses of these insecticides to control *T. tabaci* in onions.

References

- Bhargava KK. Management of onion thrips, *Thrips tabaci* Lindeman, through seedling root dip in insecticidal solution and sprays of conventional insecticides in the semi-arid regions of Rajasthan. *Pest Management and Economic Zoology*,2010:18:199-204.
- Bielza P, Quinto V, Contreras J, Torne M, Martín A, Espinosa PJ. Resistance to spinosad in the western flower thrips, *Frankliniella occidentalis* (Pergande), in greenhouses of South-Eastern Spain. *Pest Management Science*,2007:63:(7):682-687.
- Foster P, Gorman K, Denholm I. English Field Samples of *Thrips tabaci* Show Strong and Ubiquitous Resistance to Deltamethrin. *Pest Management Science*,2010:66:(8):861-864.
- Fournier F, Boivin G, Stewart RK. Effect of *Thrips tabaci* (Thysanoptera: Thripidae) on yellow onion yield and economic thresholds for its management. *Journal of Economic Entomology*,1995:88(5):1401-1407.
- Gachu SM, Muthomi JW, Narla RD, Nderitu JH, Olubayo FM, Wagacha JM. Management of thrips (*Thrips tabaci*) in bulb onion by use of vegetable intercrops. *International Journal of AgriScience*,2012:2(5):393-402.
- Gandhale DN, Paatitil AS, Swate BG, Naik LM. Evaluation of certain insecticides for control of onion thrips in Maharashtra. *Journal of Maharashtra Agricultural Universities*,1984:9:(1):104-105.
- Gill HK, Garg H, Gill AK, Gillett-Kaufman JL, Nault BA. Onion Thrips (Thysanoptera: Thripidae) Biology, Ecology, and Management in Onion Production Systems. *Journal of Integrated Pest Management*,2015:6:(1):1-9.
- Guillen J, Navarro M, Bielza P. Cross-resistance and baseline susceptibility of spirotetramat in *Frankliniella occidentalis* (Thysanoptera: Thripidae). *Journal of Economic Entomology*,2014:107:(3):1239-1244.
- Haug G, Hoffman H. *Chemistry of Plant Protection 4: Synthetic Pyrethroid Insecticides: Structures and Properties*. Springer-Verlag. Berlin, Heidelberg, New York, 1990.
- Herron G, James TM, Rophail J, Mo J. Australian population of onion thrips, *Thrips tabaci* Lindeman (Thysanoptera: Thripidae), are resistant to some insecticides used for their control. *Australian Journal of Entomology*,2008:47:361-364.
- Hussain T, Iqbal M, Ullah F, Anwar M. Population trend. Varietal preference and chemical control of garlic thrips (*Thrips tabaci* L.). *Sarhad Journal of Agriculture*,1997:13:(2):175-180.
- Kisha JSA. Insecticides for the control of *Thrips tabaci* on onion in Sudan. *PANS*,1979:25:(1):19-24.
- MacIntyre-Allen JK, Scott-Dupree CD, Tolman JH, Harris CR. Resistance of *Thrips tabaci* to pyrethroid and organophosphorus insecticides in Ontario, Canada. *Pest Management Science*,2005:61:(8):809-815.
- Martin NA, Workman PJ, Butler RC. Insecticide resistance in onion thrips (*Thrips tabaci*) (Thysanoptera: Thripidae). *New Zealand Journal of Crops and Horticultural Sciences*, 2003:31(2): 99-106.
- Nault BA, Hsu C, Hoepfing C. Consequences of co-applying insecticides and fungicides for managing

- Thrips tabaci* (Thysanoptera: Thripidae) on onion. Pest Management Science,2013:69:(7):841-849
16. Nault BA, Shelton AM. Impact of insecticide efficacy on developing action thresholds for Pest management: a case study of onion Thrips (Thysanoptera: Thripidae) on onion. Journal of Economic Entomology,2010:103:(4):1315-1326
 17. Patil SD, Chandele AG, Wayal CB, Game BC. Efficacy of different newer chemicals and bioinsecticides against onion thrips in *Kharif* season. International Journal of Plant Protection,2010:2:(2):227-30.
 18. Reitz SR. Onion Thrips (Thysanoptera: Thripidae) and their management in the treasure valley of the Pacific Northwest. Florida Entomologist,2014:97:(2):349-354.
 19. Sadozai A, Zeb Q, Iqbal T, Anwar S, Badshah H, Ali A, Ahmad M, Tahir M. Testing the efficacy of different insecticides against onion thrips in Tarnab, Peshawar. Sarhad Journal of Agriculture,2009:25:(2):269-271.
 20. Shafiq AM, Maher AM. Influence of insecticides against onion thrips, *Thrips tabaci* (Lindeman) on onion crop. Journal of Insect Science,2016:29(1):179-185.
 21. Shelton AM, Nault BA, Plate J, Zhao JZ. Regional and temporal variation in susceptibility to k-cyhalothrin in onion thrips, *Thrips tabaci* (Thysanoptera: Thripidae), in onion fields in New York. Journal of Economic Entomology,2003:96:(6):1843-1848.
 22. Shelton AM, Zhao JZ, Nault BA, Plate J, Musser FR, Larentzaki, E. Patterns of insecticide resistance in onion thrips (Thysanoptera: Thripidae) in onion fields in New York. Journal of Economic Entomology,2006:99:(5):1798-1804.
 23. Shiberu T, Negeri M. Evaluation of insecticides and botanicals against Onion thrips, *Thrips tabaci* (L.) (Thysanoptera: Thripidae). Entomology and Applied Science Letters,2014:1(2):26-30.
 24. Ullah F, Maraj-ul-Mulk, Farid A, Saeed MQ, Sattar S. Population dynamics and chemical control of onion thrips (*Thrips tabaci*, Lindemann). Pakistan Journal of Zoology,2010:42:(4):401-06.
 25. Waters TD, Walsh DB. Onion Thrips control in Washington State. Washington State University Extension, Washington State University, Washington, USA, 2010.
 26. Worthing CR. The Pesticide Manual: A World Compendium. Eighth edition. Published by The British Crop Protection Council, 1987.
 27. Mound LA, Walker A. Terebrantia (Insecta: Thysanoptera). Fauna of New Zealand,1982:1:113.