



Effect of Different Spinosad Concentrations on Tomato Moth *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae)

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Abstract The Tomato Moth *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) is the main pest of tomatoes and is widespread worldwide. Spinosad is an insecticide that has contact and stomach action and is naturally obtained from the soil-borne actinomycete bacterium *Saccharopolyspora spinosa*. In this study, the effects of Spinosad 240g/l at 30-40 and 50 ml/100 l water and Spinosad 480 g/l at 15-20-25 ml/100 l water doses on *T. absoluta* in greenhouse tomato cultivation were investigated. The study was established in the producer greenhouses in Antalya and Mugla provinces in June-August 2022 according to the randomized block design with 8 characters (3 doses of trial insecticides, control insecticide and control) and 4 replications. Spinetoram was used as the comparison insecticide at the recommended dose of 120 g/l. In the evaluation of the study, counts were made 3, 7 and 14 days after spraying. The live larvae and infected fruit rates in the % effectiveness of the pesticides were calculated using the Abbott formula. In addition, variance analysis and Duncan test were applied to the angle value correspondences of the determined percentage effects of the doses. As a result of the statistical evaluation; Spinosad 240g/l 50 ml/100 l water dose (91.16%) and Spinosad 480g/l 25 ml/water dose (93.73%) showed the highest effect in both provinces.

Keywords *Tuta absoluta*, Spinosad, tomato, greenhouse

1. Introduction

Tomatoes are raw materials in the production of canned food, pickles, salads, ketchup and dried ready-made sauces and soups, and are one of the most popular vegetables. According to TÜİK data, Turkey's vegetable production as of 2021 is approximately 32 million tons. Tomatoes, which are the most produced vegetable in Turkey, have a share of 41.2% (13.1 million tons) in the total vegetable production in 2021 in terms of production amount. Tomato production is carried out both in the open and under greenhouses in Turkey. In 2021, 4.4 million tons of tomatoes were produced under greenhouses in Turkey. The most important pest that reduces the quality and yield of tomato plants is the Tomato Moth *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae). This pest originates from South America and was first detected in Argentina in 1964. The pest was detected on tomatoes in the southern parts of countries such as Italy, France, Greece, Portugal, Algeria and Tunisia in 2008 and 2009 [1]. *Tuta absoluta*, first seen in Turkey in 2009, is a worldwide economic pest of tomatoes and other solanaceous crops. [2, 3, 4, 5, 6]. The larvae of the pest cause damage by opening galleries in the leaves, stems, trunks and fruits of the plant [3]. Chemical control of the pest is difficult and there are resistance problems against insecticides [7, 8]. Spinosad, a combination of spinosyn A and D produced by *Saccharopolyspora spinosa*, is a highly effective pesticide and is safe against natural enemies [9, 10]. In this study, the effects of Spinosad 240 g/l at 30-40 and 50 ml/100 l water and Spinosad 480 g/l at 15-20-25 ml/100 l water doses on *T. absoluta* in greenhouse tomato cultivation were investigated.



2. Materials and Methods

The trial was established in the producer greenhouses of Antalya and Muğla provinces (Türkiye) according to the randomized block design with 8 characters (3 doses of the trial insecticides, control insecticide, and control (water)) and 4 replications in the June-August 2022 period. The selected provinces are located in different geographical regions. Spinetoram was used at the recommended dose of 120 g/l as the comparison insecticide. It was taken to apply the pesticide to all parts of the plants and to distribute it homogeneously to the plants in the plots. In the evaluation of the study, counts were made 3, 7 and 14 days after spraying. In the counts, live larvae on 50 randomly selected tomato leaves of 10 randomly selected plants in each plot were counted and recorded. In addition, 50 tomato fruits were examined in each plot and the fruits infected with the pest were counted and recorded and the rate of infected fruit was found. The live larvae and infected fruit rates in the % effectiveness of the pesticides were calculated using the Abbott formula [11]. In addition, variance analysis and Duncan test were applied to the angle value correspondences of the determined percentage effects of the doses. No other pesticide application was made in the experimental area during the trial period.

3. Results & Discussion

The counting results and percentage effects of the insecticides from the trial conducted to determine the biological effectiveness of different Spinosad concentrations in producer greenhouses in Antalya and Muğla provinces are given in Table 1 (live larvae %) and Table 2 (infected fruit%).

Table 1: Percentage effect of insecticides tested in Antalya and Muğla provinces (Türkiye) on live larvae *

Insecticide (dose/100 l water)	Antalya (larva %)			Muğla (Canlı larva %)		
	T+3	T+7	T+14	T+3	T+7	T+14
Spinosad 240g/l (30 ml)	62.49c	66.81c	59.89c	64.03c	68.00c	58.29c
Spinosad 240g/l (40 ml)	71.06b	74.14b	69.96b	76.08b	79.55b	67.57b
Spinosad 240g/l (50 ml)	89.66a	92.82a	86.31a	91.72a	92.65a	81.47a
Spinosad 480 g/l (15ml)	66.01c	68.11c	57.45c	61.94c	63.32c	54.88c
Spinosad 480 g/l (20 ml)	74.85b	77.74b	69.05b	73.51b	76.88b	66.71b
Spinosad 480 g/l (25ml)	90.68a	94.00a	83.60a	92.16a	93.45a	78.08a
Spinetoram 120 g/l (50 ml)	89.33a	93.37a	86.39a	92.84a	94.22a	82.50a
Control live larva	62.25			59.75		

*Means followed by different lowercase letters are significantly different ($P < 0.05$) within a column for the first. When Table 1 is examined, it was observed that in the counts carried out 3, 7, 10 and 14 days after spraying, 50 ml/100l water dose of Spinosad 240 g/l was 89.66%, 92.82%, 86.31%; 25 ml/100l water dose of Spinosad 480 g/l was 90.68%, 94% and 83.60% effective, respectively in Antalya province. The comparator insecticide Spinetoram was effective by an average of 89.33%, 93.37% and 86.39%, respectively, on the same counting days. A similar situation is valid for the trial conducted in Muğla province. Spinosad 240 g/l 50 ml/100 l dose was 91.72%, 92.65%, 81.47%; Spinosad 480 g/l dosed with 25 ml/100 l water was observed to be 92.96%, 93.45% and 78.08% effective, respectively. Spinetoram, the comparator insecticide, was 92.84%, 94.22% and 82.50% effective, respectively, on the same counting days. In the statistical evaluations, 50 ml/100l water dose of Spinosad 240 g/l and 25 ml/100l water dose of Spinosad 480 g/l had the highest effect. This effect was also found to be statistically significant.

Table 2: Effect of different spinosad doses on prevention of fruit infection (%)*

Insecticide (dose/ 100 l water)	Antalya (Infected fruit %)	Muğla (Infected fruit %)
Spinosad 240g/l (30 ml)	64.91c	65.11c
Spinosad 240g/l (40 ml)	72.52b	77.26b
Spinosad 240g/l (50 ml)	91.84a	93.21a
Spinosad 480 g/l (15ml)	65.17c	63.32c
Spinosad 480 g/l (20 ml)	75.51b	76.88b
Spinosad 480 g/l (25ml)	93.17a	93.45a
Spinetoram 120 g/l (50 ml)	92.39a	91.18a
Control		

*Means followed by different lowercase letters are significantly different ($P < 0.05$) within a column for the first



When Table 2 is examined; 7 days after spraying, the percentage effects of pesticides used on the prevention of fruit infection were found to be 64.91-65.11, 72.52-77.26, 91.84-93.21 effective at 30-40 and 50 ml/ water doses of Spinosad 240 g/l in Antalya and Mugla provinces, respectively. It was observed that Spinosad 480 g/l was 65.17-63.32, 75.51-76.88, and 93.17-93.45 effective at 15-20 and 25 ml doses, respectively. It was observed that 50ml/100l water dose of Spinosad 240g/l and 25ml/100 l water dose of Spinosad 480g/l had similar effects to Spinetoram 120g/l 50ml/water dose in terms of both the effect on live larvae and the prevention of fruit infection and were statistically in the same group. As it is known, Spinosad is a highly effective insecticide and can be used reliably against natural enemies [9,10]. There are studies on whether pests are resistant to spinosad [11, 12]. In our study, 50ml/100l water dose of Spinosad 240g/l and 25ml/100l water dose of Spinosad 480g/l were found to be effective against *T.absoluta*.

4. Conclusion

Tuta absoluta is a pest that causes significant yield losses in tomato plants all over the world. Considering the possible side effects of pesticides on the environment and natural enemies, as well as resistance problems, it is necessary to be very careful in pest control. Spinosad is known to be of bacterial origin and is reliable against both the environment and natural enemies. In our study, the effectiveness of different spinosad concentrations against *T.absoluta* under field conditions was investigated. As a result of the evaluations, it can be said that 50ml/100l water dose of Spinosad 240 g/l and 25ml/100l water dose of Spinosad 480 g/l can be used successfully against *T.absoluta*.

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