Bulgarian Journal of Agricultural Science, 19 (No 4) 2013, 728-731
Agricultural Academy

POSSIBILITIES FOR CONTROL OF TOMATO LEAF MINER *TUTA ABSOLUTA* (MEYRICK) BY APPLICATION OF INSECTICIDES IN TOMATO GREENHOUSE GROWING

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Abstract

YANKOVA, V. and D. GANEVA, 2013. Possibilities for control of tomato leaf miner *Tuta absoluta* (Meyrick) by application of insecticides in tomato greenhouse growing. *Bulg. J. Agric. Sci.,* 19: 728-731

Tomato leaf miner *Tuta absoluta* (Meyrick 1917) is one of dangerous pests in greenhouse tomato production. Studies with tomato for mid-early production in unheated greenhouses were conducted in the Maritsa Vegetable Crops research Institute - Plovdiv during the period 2010-2011. Seven products for plant protection were applied in the biological study of tomato as the insecticides Alverde 20 ml/da, Confidor Energy OD 0.08 % and Avant 15 SC 20 ml/da are with high effectiveness (over 75%) against first-second instars of larvae of tomato leaf miner. These products could be included in the plant protection systems for pest control in tomato growing in cultivation facilities.

Key words: Tuta absoluta, tomato, insecticides, effectiveness, glasshouse, damage

Introduction

Recently tomato leaf miner *Tuta absoluta* (Meyrick) (*Lepidoptera*: *Gelechiidae*) became one of the dangerous pests in tomato greenhouse production. Leaves and fruits are mainly damaged (Caffarini et al., 1999; Harizanova et al., 2009). This pest could be observed in the cultivation facilities from seedlings stage until the harvesting. Its control is difficult because of latent way of live of larvae in the mines, development of 10-12 progenies for year, manifestation of resistance to great part of applied insecticides (Sequera et al., 2000; Lietti et al., 2005). Plant protection systems for control of *T. absoluta* include a complex of practices: crop rotation, application of pheromone traps, installation of insect nets, application of bioagents and bioproducts, treatment with insecticides (OEPP/EPPO Bulletin, 2005; Benvenga et al., 2007; Faria et al., 2008). An optimal variant for successful pest control is combining of bioagents and selective plant protection products (Riquelme Virgala et al., 2006). At present the control of the tomato leaf miner is carried out mainly by the application of plant protection products with active ingredient (a. i.). Studies for establishment of the insecticide effectiveness with different mechanism of action towards *T. absoluta* were performed. Product Affirm (a. i. emamectine) demonstrates good effectiveness in Spain (López et al., 2011). Products with active ingredients a. i. deltametrin, lamda tsihalotrine and indoxakarb have been used for pest control (Salazar and Araya, 2001; Korycinska and Moran, 2009). Collavino and Giménez (2008) report that Confidor 100 CL (a. i. imidaklopride) could be applied for control of tomato leaf miner.

The purpose of the study was to establish the biological activity of plant protection products with different active ingredients towards tomato leaf miner (*Tuta absoluta* Meyrick) in tomatoes grown under greenhouses.

Material and Methods

The studies were performed with mid-early tomato under unheated greenhouse (transplanting date – the 30^{-th} of March; harvesting date – the 28^{-th} of August) in the Maritsa vegetable Crops Research Institute, Plovdiv during the period 2010-2011. The effectiveness of seven plant protection products for control of this pest has been established in tomato variety Belle grown under unheated greenhouses without any treatments (Table 1).

The readings were made on preliminary marked plants and leaves at natural population density of *T. absoluta*, in June (early stages of the larvae L1 and L2) and in August (L3 and

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L4). Number of replications per treatment – 5. Alive larvae were counted before the treatment and in intervals 3-rd, 7-th and 14-th day after treatment. The effectiveness (E%) was calculated according the formula by Henderson-Tilton. It was made a comparative analysis by Duncan's multiple range test (1955).

Results and Discussion

It was observed a comparatively high effectiveness of the products included in the study at 14-th day after treatment of the plants in the beginning of fruitage phenophese at 1st and 2nd instars larvae (L1 and L2) as well as in mass fruitage phenophase - at 3rd and 4th instars larvae (L3 and L4). Considerable higher effectiveness was observed in treatment in June (L1 and L2) that is probably due to both the lower population density of the pest and the earlier stage of development when the larvae are more susceptible to the applied insecticides (Tables 2, 3 and 4).

According to the biological study of the plant protection products in June (pheniphase – start of harvesting) was established that the highest effectiveness has been recorded in Alverde 20 ml/da (E=76.43%), Confidor Energy OD 0.08% (E=75.55%) and Avant 15 SC 20 ml/da (E=75.21%) at 14-th day after treatment in the two experimental years. Comperatively low effectiveness has been demonstrated by the piretroid Decis 2.5 EC 0.05% (E=51.00%). The products included in the group of the neonikotinoids Actara 25 WG 0.03%, Pikador 20 SL 0.05% and Mospilan 20 SP 0.02% show inadequate effectiveness towards this pest – from 58.81% to 65.24% (Table 3).

The effectiveness of the products included in the study has been lower when the treatments were performed in the phenophase mass fruitage of the tomatoes at higher larvae density and in subsequent stage of larvae development (L3 and L4). The products Confidor Energy OD 0.08%, Alverde 20 ml/da and Avant 15 SC 20 ml/da demonstrate sufficient effectiveness 14-th day after treatment (over 60%) while the biological activity of Decis 2.5 EC 0.05%, Mospilan 20 SP 0.02%, Actara 25 WG 0.03% and Pikador 20 SL 0.05% remain insufficient during the whole period of reading. The lowest effectiveness was recorded in Decis 2.5 EC where the maximal value was only 45.81% (Table 4).

The products Alverde 20 ml/da, Confidor Energy 0.08 % and Avant 15 SC 20 ml/da show comparatively good biological activity against the tomato leaf mined among the insecticides included in this study. They could control the pest

Table 1
Products for plant protection included in this study

Plant protection product	Active ingredient	Concentration/Dose
Alverde*	metaflumizon	20 ml/da
Avant 15 SC*	indoxakarb	20 ml/da
Decis 2.5 EC	deltametrin	0.05%
Mospilan 20 SP	acetamiprid	0.02%
Confidor Energy OD	imidakloprid+deltametin	0.08%
Actara 25 WG	thiamethoxam	0.03%
Pikador 20 SL	imidakloprid	0.05%

***-**the product is not registered for greenhouses in Bulgaria.

Table 2
Average larvae number *Tuta absoluta* **Meyrick per a leaf in the variants before treatment**

Variant	Average larvae number per leaf in the variants before treatment			
	June		August	
	2010	2011	2010	2011
Alverde 20 ml/da	6.20	6.40	10.73	10.67
Avant 15 SC 20 ml/da	5.73	6.73	9.87	9.53
Decis 2.5 EC 0.05%	6.00	6.53	10.47	10.47
Mospilan 20 SP 0.02%	6.07	6.60	10.13	10.87
Confidor Energy OD 0.08%	6.40	6.93	10.47	10.13
Actara 25 WG 0.03%	5.87	6.33	9.60	9.93
Pikador 20 SL 0.05%	5.80	6.60	9.20	9.93

Table 3
Effectiveness of plant protection products against larvae of tomato leaf miner (*Tuta absoluta* Meyrick) (L1 и L2) in tomato variety Belle (Recoding period: June – start of fruitage)

Variant	Days after treatment	Effectiveness, %		
		2010	2011	average
Alverde 20 ml/da	3	53.42± 6.96 a	47.33±7.96 ab	50.38±7.18 a
Avant 15 SC 20 ml/da		49.91±10.35 ab	49.91±10.35 a	49.91±8.51 a
Decis 2.5 EC 0.05%		35.61±5.74 c	36.66±7.46 c	36.14±2.73 c
Mospilan 20 SP 0.02%		39.90±7.01 bc	38.33±7.46 bc	39.12±2.38 bc
Confidor Energy OD 0.08%		54.28±10.83 a	44.90±4.76 abc	49.59±3.80 a
Actara 25 WG 0.03%		46.57±8.54 abc	43.81±6.86 abc	45.19±3.77 ab
Pikador 20 SL 0.05%		44.00±5.47 abc	34.99±3.73 c	39.50±2.61 bc
Alverde 20 ml/da	7	61.52±4.84 ab	58.09±8.35 a	59.81±4.58 a
Avant 15 SC 20 ml/da		60.19±3.89 ab	54.76±8.91 a	57.47±5.06 a
Decis 2.5 EC 0.05%		45.14±4.58 d	38.10±6.74 b	41.62±3.86 c
Mospilan 20 SP 0.02%		50.57±6.11 cd	40.00±6.39 b	45.29±4.53 bc
Confidor Energy OD 0.08%		63.42±7.40 a	52.86±6.39 a	58.14±3.90 a
Actara 25 WG 0.03%		56.67±9.13 abc	41.90±8.35 b	49.28±6.10 b
Pikador 20 SL 0.05%		53.43±4.80 bc	38.09±6.74 b	45.76±3.92 bc
Alverde 20 ml/da	14	73.57±6.21 a	79.28±8.31 a	76.43±6.58 a
Avant 15 SC 20 ml/da		73.29±8.26 a	77.14±7.82 a	75.21±6.89 a
Decis 2.5 EC 0.05%		50.57±6.11 c	51.43±5.97 b	51.00±5.16 c
Mospilan 20 SP 0.02%		60.95±10.19 b	56.67±10.43 b	58.81±6.82 bc
Confidor Energy OD 0.08%		73.24±9.07 a	77.86±7.32 a	75.55±6.08 a
Actara 25 WG 0.03%		69.05±9.52 ab	61.43±7.61 b	65.24±6.27 b
Pikador 20 SL 0.05%		62.85±5.22 ab	60.12±10.99 b	61.49±3.97 b

a, b, c, d…n. s. - Duncan's multiple range test ($p \leq 0.05$)

Table 4
Effectiveness of plant protection products against the larvae of tomato leaf miner (*Tuta absoluta* Meyrick) (L3 и L4) in tomato variety Belle (Recording period: August – mass fruitage)

Variant	Days after treatment	Effectiveness (%)		
		2010	2011	average
Alverde 20 ml/da	3	36.49±9.67 n.s.	41.29±4.28 a	38.89±6.03 ab
Avant 15 SC 20 ml/da		38.64±6.80 n.s.	39.05±4.06 ab	38.85±5.03 ab
Decis 2.5 EC 0.05%		35.33±4.47 n.s.	33.79±6.56 b	34.56±4.07 b
Mospilan 20 SP 0.02%		42.52±6.00 n.s.	44.67±4.91 a	43.60±4.30 a
Confidor Energy OD 0.08%		40.72±4.56 n.s.	41.86±5.74 a	41.30±2.59 a
Actara 25 WG 0.03%		42.89±8.34 n.s.	40.16±2.86 a	41.52±3.69 a
Pikador 20 SL 0.05%		41.33±4.87 n.s.	41.98±2.73 a	41.66±1.56 a
Alverde 20 ml/da	7	54.37±9.97 ab	43.98±4.19 b	49.17±5.35 b
Avant 15 СК 20 ml/da		44.91±9.90 bc	45.98±4.21 b	45.44±4.16 bc
Decis 2.5 ЕК 0.05%		39.09±6.10 c	46.18±8.30 b	42.63±6.38 c
Mospilan 20 СП 0.02%		45.27±6.60 bc	50.91±4.98 ab	48.09±4.21 bc
Konfidor Energy ОД 0.08%		52.73±4.07 ab	45.98±4.21 b	49.35±3.21 b
Actara 25 ВГ 0.03%		50.00±5.56 ab	46.41±7.29 b	48.20±3.03 bc
Pikador 20 СЛ 0.05%		55.63±4.47 a	55.11±5.01 a	55.37±3.57 a
Alverde 20 ml/da	14	60.84±4.38 ab	59.50±6.17 a	60.17±2.69 a
Avant 15 SC 20 ml/da		61.67±4.17 ab	59.17±6.60 a	60.42±2.08 a
Decis 2.5 EC 0.05%		47.64±6.95 d	43.98±4.19 d	45.81±3.59 c
Mospilan 20 SP 0.02%		56.93±7.62 abc	52.02±2.79 bc	54.47±4.98 b
Confidor Energy OD 0.08%		64.00±8.94 a	57.89±2.23 ab	60.95±5.15 a
Actara 25 WG 0.03%		53.13±2.89 bcd	55.89±3.80 abc	54.51±3.12 b
Pikador 20 SL 0.05%		48.66±6.78 cd	49.32±6.99 cd	48.99±5.35 c

a, b, c, d…n. s. - Duncan's multiple range test ($p \leq 0.05$)

successfully at timely application against larvae 1st and 2nd instars in tomato grown in cultivation facilities. For that purpose, it is necessary to make accurate monitoring and suitable choice of insecticide.

Conclusion

It was established a good effectiveness (over 75%) of the products Alverde 20 ml/da, Confidor Energy OD 0.08% and Avant 15 SC 20 ml/da against tomato leaf miner (*Tuta absoluta* Meyrick) when the treatment was performed at the beginning of fruitage, against early pest stages in tomato for greenhouse production.

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Received July, 5, 2012; accepted for printing February, 2, 2013.