

STUDY OF THE EARLY BLIGHT AT TOMATO SEEDLING IN ORGANIC AGRICULTURE

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INTRODUCTION

Tomato is an important crop for Romania, being cultivated on 43,900 ha in 2014 with an annual production of 706,200 t (Romania's Statistical Yearbook, 2014). Browning of tomato leaves – early blight produced by the pathogen *Alternaria porri* (Ell.) Nerg f. sp. *solani* (Ell. et al.) Nerg. can cause significant production losses (Costache et al., 2007) and can be found in protected areas and open fields in all phases of tomato plants.

Limiting the losses caused by early blight can be achieved by crop rotation, the cultivation of tolerant varieties to disease attack and the use of biological fungicides (Babu et al., 2000, Patil et al., 2001).

Due to the particularity of the pathogen to attack in all phases of the development of tomato plants, the control treatments can be applied both in the early stages of the plant ontogenesis (germination, seedling), but also after planting in the open field (Costrache et al., 2007, Spletzer and Enyedi, 1999).

The emergence of *Alternaria* sp. strains resistant to chemical fungicides, environmental pollution and the presence of toxic residues in and on tomato fruit has led to the search for innovative and safe new methods and practices for consumers and the environment.

These are the biological fungicides and herbal extracts that have been effective in controlling the early blight attack at tomatoes and are environmentally friendly methods of control.

This paper presents the efficacy of biological products and plant extracts in the control of the pathogen - *Alternaria* spp. at tomatoes, seed germination and planting of the seedlings in the field.

MATERIAL AND METHODS

Research on the efficacy of biological products and herbal extracts was performed under laboratory and field conditions (Table 1).

Table 1 Study of the efficacy of some products in the control of tomato pathogens

Va-ri-ant	Vegetation pheno phase	The product	Active substance	Concen - trațion (%)
1	2	3	4	5
Experience 1 - Unibac tomato artificially infected in laboratory conditions with <i>Alternaria solani</i>				
V1	The emergence of plants	Condor	<i>Trichoderma atroviride</i> and <i>Glomus</i> spp	0,25
V2	The emergence of plants	Funres	Extract from <i>Mimosa tenuifolia</i> L. and citrus seeds	0,25
V3	The emergence of plants	Blocks	Seaweed	0,25
V4	The emergence of plants	Nettle macerate	One kg of fresh plants / 10 l of water macerated in 10 days	0,5
V5	The emergence of plants	The bordeaux mixture	Copper sulphate neutralized with lime	0,5
V6	The emergence of plants	Untrated	x	x

1	2	3	4	5
Experience 2 - Unibac tomatoes cultivated in open field under natural pathogen infection				
V1	Seedling after planting	Condor	<i>Trichoderma atroviride</i> and <i>Glomus</i> spp	0,25
V2	Seedling after planting	Funres	Extract from <i>Mimosa tenuifolia</i> L. and citrus seeds	0,25
V3	Seedling after planting	Blocks	Seaweed	0,25
V4	Seedling after planting	Nettle macerate	One kg of fresh plants / 10 l of water macerated in 10 days	0,5
V5	Seedling after planting	The bordeaux mixture	Copper sulphate neutralized with lime	0,5
V6	Seedling after planting	Untrated	x	x

The study of the efficacy of products allowed in organic farming for *Alternaria* sp. was performed in the field on natural infection and in the laboratory under artificial infection conditions. Under laboratory conditions the response of the germinating tomato plants infected with *Alternaria* spp. was studied in the treatments with the products of Table 1.

For this purpose, the tomato seeds were placed in growth vessels on paper wet filter at 22 - 26°C with spore of *Alternaria* sp. suspension infection.

Observations were carried out after seed germination. The seed germination, roots and stem length were used as the test-to-test of plant reaction in the early stage of ontogenesis.

The analysis of the reaction of tomato plants to the products during the emergence period revealed responses of: inhibition of stem and embryonic root growth, vegetation stimulation, plant death, lack of reaction.

In field conditions, control treatments were performed to report the attack by *Alternaria* spp. The determination and monitoring of the pathogen and pest attack was calculated by means of frequency, intensity and degree of attack indicators. The efficacy of the products was calculated using the Abbott method.

RESULTS AND DISCUSSIONS

The products tested in the seed germination phase showed the following results (table 2). The data presented show that the best efficacy in control of early blight at tomato in the seed germination phase was the variant treated with The bordeaux mixture - 0.5%, the percentage of healthy plants at 7 days after infection with *Alternaria* sp. being 90%.

Table 2. Effectiveness of products tested in control of early blight at tomatoes

VARIANT	% health plants*	Efficiency (%)
V1 Condor – 0,25%	85	85
V2 Funres – 0,25%	0	0
V3 Blocks – 0,25%	0	0
V4 Nettle macerate - 0.5%	50	50
V5 The bordeaux mixture 0.5%	90	90
Untrated	x	x

* 7 days after treatments

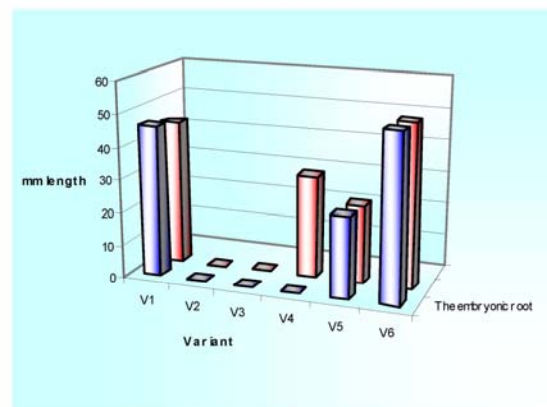


Fig. 1. Length (mm) of root and embryonic stem

It has been found, however, a strong retarding effect on the embryonal stem and root, with an decrease in dimensions of less than 54% in root and 47.31% for the strain (Fig. 1).

In V1 the efficiency was 85%. The length of the root and the stem was smaller compared with uninfected variant with 8.5% and 11.5% respectively. Variant 4 has shown that while treatment with 0.5% soak nettle is not fungicide, a percentage of 50% of the tomato plants were stimulated to develop tolerance after infection of plant with *Alternaria* sp.

In this case, there was also a reduction of the root and embryonic stem growth by 19.3 and 37.6%, respectively.

Variants treated with Funres - 0.25% and Blocks - 0.25% did not survive infection with *Alternaria* sp in the germination phase.

The effectiveness of the products studied in reducing the disease attack on field tomatoes was the following (Table 3).

The data presented show that variant 5, treated with The bordeaux mixture 0.5%, had the best efficacy - 84.5%, followed by variant 1, with an efficacy of 71.8%.

The variants treated with nettle macerate and Blocks had a lower efficacy of 54.3% and 53.3%, respectively.

Table 3. Efficiency of products tested in control of early blight at tomatoes

VARIANT	Attack degree (%)		Efficiency %
	Leaves	Fruits	
V1 Condor – 0,25%	2.6	0	71.8
V2 Funres – 0,25%	9.6	0	0
V3 Blocks – 0,25%	4.3	0	53.3
V4 Nettle macerate - 0.5%	4.2	0	54.3
V5 The bordeaux mixture 0.5%	1.4	0	84.5
V6 Untrated	9.2	0	0

The variant treated with Funres showed a lack of efficacy in control tomato early bight alternariosis. Percentage of healthy plants (Figure 2) varied depending on the variation being 96% in variant 5 treated with The bordeaux mixture 0.5% - 0.5%, 92% in variant 1 treated with Condor 0.25% (based on *Trichoderma atroviride* and *Glomus spp*) and 88% in variants treated with Nettle macerate / 0.5% and Blocks - 0.25%.

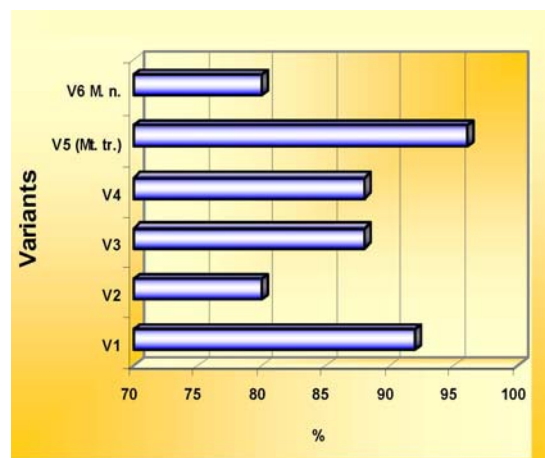


Fig. 2. % heth plants in tested variants

CONCLUSIONS

The best efficacy in control of early blight at tomato in the germination phase of the seeds was the variant treated with bordelae - 0.5%, the percentage of healthy plants after 7 days infection with *Alternaria* sp. being 90%. However, a strong retardant effect was observed on both the stem and the embryonic root, with a smaller growth rate of 54% for the root and 47.31% for the strain. In variant 1 the efficacy was 85%, the increase of the root and the strain being smaller compared to the uninfected variant, with 8.5% and 11.5%, respectively. Variant 4 demonstrated that although 0.5% nettle macerate treatment is not a fungicide, 50% of tomato plants have been stimulated to develop tolerance and vegetation following infection with *Alternaria* sp. In this case, there was also a reduction of the root and embryonic stem growth by 19.3 and 37.6%, respectively. The variant treated with Funres - 0.25% and Blocks - 0.25% did not survive infection with *Alternaria* sp in the germination phase.

In open field variant 5, treated with bordelae - 0.5% had the best efficacy - 84.5%, followed by variant 1, with an efficiency of 71.8%. The variants treated with nettle macerate and Blocks had a lower efficacy of 54.3% and 53.3%, respectively. The variant treated with Funres showed a lack of efficacy in control of tomato early blight. Percentage of healthy plants varied depending on the fungicides being 96% in variant 5 treated with bordelamine - 0.5%, 92% in variant 1 treated with 0.25% Condor (based on *Trichoderma atroviride* and *Glomus spp*) and 88% in variants treated with 0.5% nettle macerate and Blocks – 0,25%.

ABSTRACT

The best efficacy in control of early blight at tomato in the germination phase of the seeds was the variant treated with bordelae - 0.5%, the percentage of healthy plants after 7 days infection with *Alternaria* sp. being 90%. However, a strong retardant effect was observed on both the stem and the embryonic root, with a smaller growth rate of 54% for the root and 47.31% for the strain. In variant 1 the efficacy was 85%, the increase of the root and the strain being smaller compared to the uninfected variant, with 8.5% and 11.5%, respectively. Variant 4 demonstrated that although 0.5% nettle macerate treatment is not a fungicide, 50% of tomato plants have been stimulated to develop tolerance and vegetation following infection with *Alternaria* sp. In this case, there was also a reduction of the root and embryonic stem growth by 19.3 and 37.6%, respectively. The variant treated with Funres - 0.25% and Blocks - 0.25% did not survive infection with *Alternaria* sp in the germination phase.

In open field variant 5, treated with bordelae - 0.5% had the best efficacy - 84.5%, followed by

variant 1, with an efficiency of 71.8%. The variants treated with nettle macerate and Blocks had a lower efficacy of 54.3% and 53.3%, respectively. The variant treated with Funres showed a lack of efficacy in control of tomato early blight. Percentage of healthy plants varied depending on the fungicides being 96% in variant 5 treated with bordelamine - 0.5%, 92% in variant 1 treated with 0.25% Condor (based on *Trichoderma atroviride* and *Glomus* spp) and 88% in variants treated with 0.5% nettle macerate and Blocks – 0,25%.

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