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SOIL BORNE PATHOGENS WITH ECONOMIC IMPORTANCE FOR EGGPLANT CROPS IN THE FIELD

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Abstract: The experiment was done in 2017 at RDIVFG-Vidra and has as purpose controlling of soil borne pathogens *Fusarium oxysporum* f. sp. *melongenae* and *Verticillium dahliae* which produce vascular wilting of eggplants. The experimental variants were as follows: V1. Topsin 500SC 0.14%, 0.5 litres/plant (on the soil), 2 treatments at 30 days interval, V2. Topsin 500SC 0.3% (foliar), 6 treatments at 10 days intervals, V3. Altosan 10 litres/ha, 0.5 l/plant (on the soil), 2 treatments at 30 days interval, V4. Condor 2kg/ha, 0.5 litres/plant (on the soil), 2 treatments at 30 days interval and V5. Untreated control. The best results were obtained at V2 (84.4% average eficacy, yield 3.952 kg/m^2) and at V1 (76.4% average eficacy, yield 3.890 kg/m^2) as compared to V5 (untreated control) where the yield was 3.370 kg/m^2. Altosan (V3) was noted among the "bio" products with an average efficacy of 67.5% and a yield of 3.615 kg/m^2.

Key words: *soil pathogens, eggplants, field*

INTRODUCTION

Eggplant *Fusarium* wilt produced by *Fusarium oxysporum* f. sp. *melongenae* (Matuo et Ishigani) and *Verticillium* wilt produced by *Verticillium dahliae* (Kleb.) have been reported in most countries from the Europe and Asia where this species is cultivated, including Italy, Greece, Turkey, Israel and Japan (Altinok, 2005). In Romania, *Fusarium* wilt was observed for the first time in 1974 in the eggplant crops from the Ploiesti Tătărani glasshouses (Costache, 1974), and the *Verticillium* wilt was reported in 1969 in glasshouses, the attack frequency sometimes reaching 50 - 60% (Costache & Raicu, 1974). The appearance and evolution of the attacks produced by *F. oxysporum* f. sp. *melongenae* and *V. dahliae* are favored by soil temperatures of 24 - 28°C and 20 - 24°C, respectively.

Among the methods to prevent the occurrence and evolution of attacks we mention: soil disinfection with fumigants (Costache et al., 2007, 2018), soil treatments with products based on methyl thiophanate (Costache et al., 2007, 2018), biological control with soil antagonistic microorganisms (Mukhopadhyay, 1987; Fravel et al., 2003; Altinok et al., 2013) and grafting eggplants on resistant rootstocks (Blestos et al., 2003; Bogoescu & Doltu, 2014).

The experiment done at R.I.V.F.G Vidra had as purpose preventing the occurrence and controlling the attack of those pathogens by using some chemical and biological products.

MATERIALS AND METHODS

The experiment was done at R.I.V.F.G Vidra in 2017, using the Luiza eggplant variety and included 5 variants, in 4 replications. Planting was done on May, 12.

The experimental variants were the following:
V1. Topsin 500 SC 0.14%, 0.5 litres/plant (on the soil), 2 treatments at 30 days interval;
V2. Topsin 500 SC 0.3% (foliar), 6 treatments at 10 days intervals;
V3. Altosan 10 litres/ha, 0.5 litres/plant (on the soil), 2 treatments at 30 days interval;
V4. Condor 2 kg/ha, 0.5 litres/plant (on the soil), 2 treatments at 30 days interval;
V5. Untreated control.

Observations on the occurrence and evolution of the attack of pathogens (frequency and intensity of the attack) were made using a rating scale from 0 to 6. On the basis of the obtained results, the degree of attack (%) and the efficacy (%) of the treatments were calculated. Yield was recorded on variants and replications, the data being processed by the method of variance analysis.

RESULTS AND DISCUSSIONS

Fusarium wilt - *Fusarium oxysporum* f. sp. *Melongenae*. The first symptoms appear as clarification of the secondary nervures (while the main nervures remain green) and the yellowing of the leaves (Figure 1). Subsequently, the lower leaves and then the upper leaves wilt and die. Especially in the basal part of the plants, on a length of 5 - 10 cm, the walls of the conductive vessels show a strong browning which is extended also in the main and secondary roots. The root system of diseased plants is poorly developed, is browning and rotting. On the plants attacked by *Fusarium*, unlike those infected with *Verticillium*, browning is limited in the basal part. The highest and fructification of diseased plants are lower compared to healthy ones.

Verticillium wilt - *Verticillium dahliae*. Yellowing areas appear on the leaves followed by tissue necrosis on one half of the leaf, which later extends to the other half (Figure 2 and 3). The necrotic areas are light brown and are flaccid. The edges of the leaves attacked turn upwards. At a later stage, the leaves dry out, have a brown color and hang along the stem. The defoliation of the plants takes place gradually, starting with the leaves from the base and progressing to the top. On transverse or longitudinal sections, through the stem of the diseased plants is observed the browning of the walls of the conducting vessels, which extends into the leaf petiole and sometimes even into the fruit.

Figure 1. *Fusarium oxysporum* f. sp *melongenae* attack on the eggplants (original)

Figure 2. *Verticillium dahliae* attack on the eggplant leaf (original)

Figure 3. *Verticillium dahliae* attack on the eggplants (original)

Under the climatic conditions of the year 2017, the attack produced by *V. dahliae* on eggplants manifested from the middle of July (18.07) and had a slow evolution till the end of

September when the value of the attack degree reached 4.1%. The evolution of the attack was inhibited by the high temperatures in August (28.7 - 36.6ºC).

The attack produced by *F. oxysporum* f. sp. *melongenae* debuted at the end of July (31.07) and had a rapid evolution favored by the high temperatures in August and in September, so that at the end of September the attack reached 44.4% (Table 1).

Table 1. Occurrence and evolution of the attack of pathogens *F. oxysporum* f. sp. *melongenae* and *V. dahliae* on the eggplant crop in the field in correlation with climatic factors (Vidra, 2017)

Pathogens and climatic factors	Appearance of attack	Attack frequency/degree of attack (%) / month/ ten days period										
		AF (%)	June	July			August			September		
		DA (%)	III	I	II	III	I	II	III	I	II	III
F. oxysporum f. sp. *melongenae*	31.07. 2017	AF (%)	0	0	0	5.8	10.1	15.0	25.4	36.2	40.3	45.6
		DA (%)	0	0	0	2.7	6.9	12.4	18.6	28.3	35.1	44.4
V. dahliae	18.07. 2017	AF (%)	0	0	0.5	1.1	1.9	2.8	3.5	4.8	5.8	6.8
		DA (%)	0	0	0.3	0.9	1.4	2.0	2.6	3.0	3.4	4.1
Min TºC	-	-	16.3	15.9	15.9	17.5	21.1	18.3	15.1	13.7	15.3	10.5
Med TºC	-	-	23.8	22.0	22.0	24.0	30.8	25.6	21.3	20.8	21.5	14.2
Max TºC	-	-	31.9	28.4	28.9	31.0	36.6	31.8	28.7	28.8	29.4	19.2
Mini R.H. (%)	-	-	36.4	46.0	37.8	35.7	26.9	27.4	30.2	29.3	30.8	41.7
Med R.H. (%)	-	-	56.4	57.9	47.6	46.8	36.7	38.7	41.7	46.9	44.8	50.7
Max R.H. (%)	-	-	82.5	74.7	63.6	63.3	52.4	57.0	56.4	72.3	61.7	64.6
Rainfall (mm)	-	-	1.0	84.0	8.5	6.5	0	0	45.0	30.0	1.0	2.0

Among the variants of treatments with chemical products were noted: V2 (Topsin 500 SC 0.3%, 6 foliar treatments, at 10 days intervals) with an average efficacy of 84.4%, V1 (Topsin 500SC 0.14%, 0.5 litres/plant on the soil, 2 treatments at 30 days interval) with an average efficacy of 76.4% and of those with "bio" products V3 (Altosan 10 litres/ha, 0.5 litres/plant, on the soil) where the average efficacy was 67.5% (Table 2).

Table 2. Efficacy of some products in the control of soil borne pathogens *F. oxysporum* f. sp. *melongenae* and *V. dahliae* on eggplant crop in the field (Vidra, 2017)

Variant	Number of treatments/ interval (days)	*Fusarium oxysporum* f.sp. *melongenae*			*Verticillium dahliae*			Mean E (%)
		Attack frequency (%)	Degree of attack (%)	E (%)	Attack frequency (%)	Degree of attack (%)	E (%)	
1. Topsin 500SC 0.14%, 0.5 litres/plant (on the soil)	2/30	14.2	12.3	72.3	1.1	0.8	80.5	76.4
2. Topsin 500SC 0.3% (foliar)	6/10	12.9	8.4	81.1	0.9	0.5	87.8	84.4
3. Altosan 10 l/ha, 0.5 litres/plant (on the soil)	2/30	16.9	14.8	66.7	1.8	1.3	68.3	67.5
4. Condor 2 kg/ha, 0.5 litres/plant (on the soil)	2/30	19.2	17.9	59.7	2.5	1.8	56.1	57.9
5. Untreated control	-	45.6	44.4	-	6.8	4.1	-	-

The eggplant yields in variants were: V2 = 3.952 kg/m^2, V1 = 3,890 kg/m^2 and V3 = 3.615 kg/m^2, V5 (untreated control) = 3.370 kg/m^2 (Table 3).

In the case of the variants 1 and 2, the yield differences obtained in addition to the untreated control variant were very significant and in the variant 3 the difference was significant.

Table 3. The eggplant productions in the experimental treatments for controlling soil borne pathogens *F. oxysporum* f. sp. *melongenae* and *V. dahliae* (Vidra, 2017)

Variants	Yields		
	kg/m^2	% as compared to untreated control	difference from untreated control (kg/m^2) and signification
1. Topsin 500SC 0.14 %, 0.5 litres/plant (on the soil)	3.890	115.4	0.520 ***
2. Topsin 500SC 0.3 % (foliar)	3.952	117.2	0.582 ***
3. Altosan 10 litres/ha, 0,5 litres/plant (on the soil)	3.615	107.1	0.245 *
4. Condor 2 kg/ha, 0.5 litres/plant (on the soil)	3.574	105.9	0.204 -
5. Untreated control	3.370	100.0	-

LD 5% = 0.236; LD 1% = 0.335; LD 0.1% = 0.485

CONCLUSION

Under the conditions of the year 2017, the pathogen *Fusarium oxysporum* f. sp. *melongenae* has caused significant damage to the field eggplant crops in the Vidra area.

From the variants of treatments, in terms of efficacy and yields, there were distinguished: V2 (Topsin 500 SC 0.3%, foliar applications, 6 treatments at 10 days intervals), V1 (Topsin 500 SC 0.14%, 0.5 litres/plant on the soil, 2 treatments at 30 days interval) and V3 (Altosan 10 litres/ha, 0.5 litres/plant, applied to the soil, 2 treatments every 30 days).

In the case of the variants 1 and 2, the yield differences realized in addition to the untreated control variant were very significant, and in the variant 3 the difference was significant.

REFERENCES

ALTINOK, H.H. (2005). First report of Fusarium wilt of eggplant caused by *Fusarium oxysporum* f. sp. *melongenae* in Turkay. *Plant Pathology*, 54, 577. doi: 10.1111/j. 1365 - 3059. 2005.01235.x

ALTINOK, H.H., DIKILITAS, M., YILDIZ, H.N. (2013). Potential of Pseudomonas and Bacillus isolates as biocontrol agents Fusarium Wilt of Eggplant. Biotechnology and Biotechnological Equipment, 27, 4, 3952 - 3958.

BLESTOS, F., THANASSOULOPOULOS, C.C., ROUPAKIAS, D.G. (2003). Effect of grafting on growth, yield and Verticillium wilt of eggplant. *HortScience*, 38, 2, 183-186.

BOGOESCU, M., DOLTU, M. (2014). Cultivarea pătlăgelelor vinete altoite. Editura Cermaprint.

COSTACHE M., (1974). Boli vasculare produse de ciuperci la legumele cultivate în sere. Analele I.C.L.F., 3, 603 – 619.

COSTACHE, M., RAICU, C. (1974). Ofilirea pătlăgelelor vinete produsă de *Verticillium* sp. în sere. Analele I.C.L.F., 3, 343 – 348.

COSTACHE, M., ROMAN, T., COSTACHE, C. (2007). Bolile și dăunătorii culturilor de legume, 61-62, Ed. Agris - Redacția Revistelor Agricole.

COSTACHE, M., ȘOVĂREL, G., BRATU, E. (2018). Bolile și dăunătorii culturilor de legume din spații protejate - Recunoaștere și combatere, 43-44. Ed. Ceres

FRAVEL, D., OLIVIAN, C., ALABOUVETTE, C. (2003). *Fusarium oxysporum* and its biocontrol. New Phytopatology, 157, 493-502.

MUKHOPADHYAY, A.N. (1987). Biological control of soil-borne plant pathogens by *Trichoderma* spp. Indian Journal of Mycology and Plant Pathology, 17, 1-9.