Study Concerning the Occurrence of the Organisms of Phytosanitary Quarantine and Other Harmful Pathogens upon Potato and Tomato Cultures in Jucu, County of Cluj

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ABSTRACT

The organisms of phytosanitary quarantine play an important role within national monitoring programmes of vegetable cultures. Whatever, pathogens, weeds, etc. they are nominated and taken under strict survey by national authorities. In Romania, they are nominated, monitored and managed by the National Phytosanitary Authority. Experiments were developed during March and middle of July 2014. The experimental field was located in Jucu village, belonging to the University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, on potato and tomato cultures. The presence of the pathogens and mites was monitored, and their attack degree was recorded. Data were statistically processed with IBM SPSS 20 programme. The results of our experiment emphasized that only small part of the organisms under phytosanitary quarantine were present, weeds mainly, but diseases produced by other pathogens (late blight and powdery mildew) were recorded, and they produced important damages in monitored cultures. Our study demonstrates that not all phytosanitary quarantine organisms nominated by the Romanian National Phytosanitary Authority were recorded in tomato and potato cultures managed in conventional system in Cluj area, but the most important damages were produced by other pathogens, late blight and powdery mildew, respectively.

Keywords: *monitoring, National Phytosanitary Authority, plant diseases.*

INTRODUCTION

Even majority of organisms of phytosanitary quarantine are worldwide well known, they are permanently monitored and studied at global scale. The reason is determined by their important role in maintaining healthy crops (Oroian and Oltean, 2003). For this reason, in Romania, as in majority of countries, they are included within national monitoring programmes of vegetable cultures. Whatever, pathogens, mites, weeds, etc. they are nominated and taken under strict survey by national authorities.

The National Phytosanitary Authority is the Romanian body in charge with the management of these organisms (Oroian and Oltean, 2003). This structure coordinates the 42 county phytosanitary units, and 8 border inspection points. In this context, we have to mention that the activity of this authority is governed by the rules imposed by the Council Directive 2000/29EC, which is harmonized with the national legislation represented by the Government Ordinance no. 136/2000 concerning the protective measures against the introduction into the Romania of organisms harmful to plant and

plants products and against their spread within the Romania, and the Government Decision no. 1030/2001, which provides the methodological norms for above mentioned directive enforcement (that is amended in 2003). In this context, we have to emphasize the importance of potato and tomato cultures in Romania, generally speaking, and in Transylvania, in particular.

These vegetables like other crops, are confronting with important disease threats (Adler *et al.*, 2002; Iederan *et al.*, 2011; Iederan *et al.*, 2011). According to literature (Oroian *et al.*, 2006; Iederan *et al.*, 2011; Iederan *et al.*, 2011; Zitter, 2001), ourdays, in potato, the most important harmful organisms are *Phytophthora infestans* Mont de Bary, and *Alternaria solani* Sorauer, but also quarantine organisms as: *Clavibacter michiganensis* ssp. *sepedonicus*, *Ralstonia solanacearum*, *Synchytrium endobioticum*, and *Potato cyst nematodes*. In tomato, also *Phytophthora infestans* Mont de Bary, and *Alternaria solani* Sorauer, are the most important pathogens, but as quarantine organisms we can mention: *Xantomonas* spp. *Helicoverpa armigera*, *Spodoptera litura*, *Liriomyza huidobrensis*, *Bemisia tabaci*, and *Tetranychus urticae*. In this context our aim was to identify the occurrence of the organisms of phytosanitary quarantine and other harmful

pathogens in potato and tomato cultures in Jucu, County of Cluj.

MATERIALS AND METHODS

The experiments were carried out in 2014, during March and middle of July. The experimental field of 500 m² is located in Jucu village, county of Cluj, on research plots belonging to the University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca (Fig. 1). One potato and one tomato cultures were established, and occurrence of mites and pathogens was monitored.

The potato and tomato cultures were specific fertilizing and maintaining conditions (Mogarzan *et al.*, 2004; Oroian and Oltean, 2003).

The attack intensities and frequencies of the identified pathogens were recorded two/three times a week. Their attack degrees were calculated according to established methodology. The temperature (°C) and rainfall regimen (mm), parameters with well-known influence in appearance and action of potato and tomato pathogens, were daily recorded with an automatic weather monitoring station. All data were statistically processed with IBM SPSS 20 programme.

Results are presented as averages by entire experimental period, March , up to mid-July 2015.

Fig. 1. The experimental field (www.google.com)

RESULTS AND DISCUSSION

The study we performed in experimental conditions of the field located in Jucu, County of Cluj emphasize the lack of phytosanitary quarantine organisms monitored in Romania in potato and tomato cultures, but late blight and early blight were identified in about mentioned tomato and potato cultures (Tab. 1). In March no pathogens were observed, while beginning April up to mid-June, end of the experimental period, *Phytophthora infestans* (late blight) occurrence was reported in both monitored cultures. Early blight (*Alternaria solani*) occurrence was reported since April in potato culture, while in tomato, since May (Tab. 1).

The biggest attack degrees (%) were recorded for late blight attack in both potato ($14.44\% \pm 1.02\%$) and tomato ($12.53\% \pm 0.86\%$) cultures.

The mean early blight attack in tomato was of $9.44\% \pm 0.45\%$, while in potato it was of $11.22\% \pm 0.91\%$ (Tab. 2). Very significant interactions ($p < 0.001$) were reported between late blight (Fig. 1) and early blight (Fig. 2) and climatic conditions, while for early blight they were statistically assured at significance threshold of 1% (Tab. 3 and Tab. 4).

The strong correlations between late blight attack degrees in potato (0.920) and tomato (0.944), and climatic conditions of the studied areal represented by temperature, and rainfall have a high representativeness demonstrated by the determination coefficients of 84.60%, and 89.10%, respectively (Tab. 3).

These results emphasize the strong dependence of late blight attack in potato and

Tab. 1. Occurrence of organisms of phytosanitary quarantine and other harmful pathogens upon potato and tomato cultures in Jucu, County of Cluj

No. crt.	Culture	Pathogen/Mite	Quarantine	Occurrence			
				March	April	May	June
1	Potato	<i>Alternaria solani</i>	No		x	x	x
2		<i>Clavibacter michiganensis</i> ssp. <i>sepedonicus</i>	Yes				
3		<i>Phytophthora infestans</i>	No		x	x	x
4		Potato cyst nematodes	Yes				
5		<i>Ralstonia solanacearum</i>	Yes				
6		<i>Synchytrium endobioticum</i>	Yes				
1	Tomato	<i>Alternaria solani</i>	No			x	x
2		<i>Bemisia tabaci</i>	Yes				
3		<i>Helicoverpa armigera</i>	Yes				
4		<i>Liriomyza huidobrensis</i>	Yes				
5		<i>Phytophthora infestans</i>	No		x	x	x
6		<i>Spodoptera litura</i>	Yes				
7		<i>Tetranychus urticae</i>	Yes				
8		<i>Xantomonas</i> spp.	Yes				

Tab. 2. The means and dispersion parameters of late blight and early blight attack degrees in potato and tomato cultures, within experimental field Jucu, County of Cluj, from March up to mid-July 2014

No.crt.	Culture	Pathogen	N	$\bar{X} \pm s_x$	s
1	Potato	<i>Alternaria solani</i>	36	11.22 ± 0.91	5.46
2		<i>Phytophthora infestans</i>	36	14.44 ± 1.02	6.12
3	Tomato	<i>Alternaria solani</i>	36	9.44 ± 0.45	2.70
4		<i>Phytophthora infestans</i>	36	12.53 ± 0.86	5.16

$\bar{X}$ -mean; s_x -standard error of mean; s-standard deviation

Tab. 3. The multiregression analyze of the late blight attack degree in potato and tomato function of temperature and rainfall within experimental field Jucu, County of Cluj, from March up to mid-July 2014

Culture	Issue	Values
Potato	F	29.423
	p	<0.001
	Coefficient of multiple regression, R	0.920***
	Coefficient of multiple regression, R	0.846
Tomato	F	35.481
	p	<0.001
	Coefficient of multiple regression, R	0.944***
	Coefficient of multiple regression, R	0.891

***, p < 0.001

Fig. 2. The evolution of the late blight attack degree in potato (a) and tomato (b) function of temperature and rainfall within experimental field Jucu, County of Cluj, from March up to mid-July 2014**Tab. 4.** The multiregression analyze of the early blight attack degree in potato and tomato function of temperature and rainfall within experimental field Jucu, County of Cluj, from March up to mid-July 2014

Culture	Issue	Values
Potato	F	44.12
	p	<0.001
	Coefficient of multiple regression, R	0.688**
	Coefficient of multiple regression, R	0.624
Tomato	F	38.15
	p	<0.001
	Coefficient of multiple regression, R	0.522***
	Coefficient of multiple regression, R	0.273

***, p < 0.01

Fig. 3. The evolution of the early blight attack degree in potato (a) and tomato (b) function of temperature and rainfall within experimental field Jucu, County of Cluj, from March up to mid-July 2014

tomato cultures within experimental conditions of Jucu field located in the County of Cluj (Fig. 2a, and Fig. 2b).

Concerning early blight attack, in the same experimental field, average correlations (weaker compared to late blight) were reported between about mentioned pathogen attack degrees in potato (0.688) and tomato (0.522), and climatic conditions represented by temperature, and rainfall. They have moderate to low representativeness emphasized by the determination coefficients of 38.15%, and 27.30%, respectively (Tab. 4). These results emphasize moderate dependence of early blight attack in potato and tomato cultures within experimental conditions of Jucu field located in the County of Cluj (Fig. 3a, and Fig. 3b).

We also report the biggest influence of temperature upon both potato and tomato cultures, compared to rainfall regimen (Fig. 2 and Fig. 3).

CONCLUSIONS

In experimental conditions of Jucu field located in the County of Cluj, Transylvania, no quarantine organisms were identified in monitored potato and tomato cultures. Nevertheless, important late blight (*Phytophthora infestans*) and early blight (*Alternaria solani*) presences were identified in above mentioned cultures.

Concerning late blight attack (*Phytophthora infestans*), in potato was recorded biggest mean

attack degree (14.44%), compared to tomato (12.53%) cultures, while concerning early blight (*Alternaria solani*), is reported the same situation. In potato, the mean early blight attack degree was of 11.22%, while in tomato cultures, it was reported a mean of 9.44%.

Between late blight and early blight attack degrees recorded in potato, and climatic conditions of Jucu village located in the County of Cluj, Transylvania, strong correlations were identified (0.920, and 0.944, respectively, with high representativeness), while between the same pathogens attack degrees and climatic conditions represented by temperature and rainfall regimen, in the same experimental conditions, in tomato cultures, average correlations were identified (0.688, and 0.522, respectively, with moderate to low representativeness). In all cases, temperature had bigger influence in pathogens attack, compared to rainfall regimen.

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