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Phytopathogens Causing Wilt in Pepper – Distribution, Symptoms and Identification

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Abstract

In 2012 the evaluation on the development and spread of phytopathogens, causing wilt in pepper was conducted. The observations were carried out under field conditions and natural infectious background in the Plovdiv region. In laboratory conditions were isolated and identified four phytopathogenic fungi of the genus *Rhizoctonia*, *Fusarium*, *Verticillium* and *Phytophthora*. The results of the analysis showed that the highest percentage of pepper wilt was caused by the fungus - *Rhizoctonia solani*.

Key words: pepper accessions, wilting, soil phytopathogens

Introduction

The soil phytopathogens is a serious problem in the production of healthy and quality products not only in vegetable crops. In recent years, the area under pepper in Bulgaria is constantly increasing. In some areas of the country pepper is grown on the same land, leading to increased infectious pressure from the soil phytopathogens (Neshev, 1997). Under favorable conditions for their development individually or in combination with each other, these diseases are able to completely compromise yields of pepper (Neshev et al., 1995).

Materials and methods

Field inspections were carried out on the pepper collection existing at the Institute of Plant Genetic Resources, Sadovo. The evaluated accessions were collected by expeditions in Plovdiv region (Table 1). The study was conducted in the quarantine section in field and laboratory conditions. From each studied genotype were seedling

80 plants. In field observations in all samples pepper was reported percentage of spread of diseases, caused by soil pathogens of the genus *Rhizoctonia*, *Fusarium*, *Verticillium* and *Phytophthora*. The field evaluation was collected infected plants for laboratory analysis. Isolations were made on potato dextrose and SNA^{+} agar (Special Nirenberg Agar). For insulation of *Phytophthora capsici* used oat agar. Samples were placed in an incubator. The cultures were incubated at 25° C for 14 days. Only isolation from *Verticillium dahliae* were incubated at 27° C for 10 days (Tsror et al., 1995). After the development of the mycelium was performed microscopically analysis for the identification of soil pathogens.

Tab. 1. Pepper accessions included in the phytopathology evaluation
Prinove paprike uključene u evaluaciju fitopatogena

№ *Br.*	Cat. № *Kat. br.*	Origin *Porijeklo*	№ *Br.*	Cat. № *Kat. br.*	Origin *Porijeklo*
1	A8E0086	Local, Plovdiv region *Lokalno, regija Plovdiva*	11	B1E0504	Local, Plovdiv region *Lokalno, regija Plovdiva*
2	A8E0087	Local, Plovdiv region *Lokalno, regija Plovdiva*	12	B1E0514	Local, Plovdiv region *Lokalno, regija Plovdiva*
3	A8E0088	Local, Plovdiv region *Lokalno, regija Plovdiva*	13	B1E0515	Local, Plovdiv region *Lokalno, regija Plovdiva*
4	A8E0089	Local, Plovdiv region *Lokalno, regija Plovdiva*	14	B1E0516	Local, Plovdiv region *Lokalno, regija Plovdiva*
5	B1E0491	Local, Plovdiv region *Lokalno, regija Plovdiva*	15	B1E0521	Local, Plovdiv region *Lokalno, regija Plovdiva*
6	B1E0492	Local, Plovdiv region *Lokalno, regija Plovdiva*	16	B1E0524	Local, Plovdiv region *Lokalno, regija Plovdiva*
7	B1E0493	Local, Plovdiv region *Lokalno, regija Plovdiva*	17	B1E0525	Local, Plovdiv region *Lokalno, regija Plovdiva*
8	B1E0494	Local, Plovdiv region *Lokalno, regija Plovdiva*	18	B1E0532	Local, Plovdiv region *Lokalno, regija Plovdiva*
9	B1E0495	Local, Plovdiv region *Lokalno, regija Plovdiva*	19	B1E0533	Local, Plovdiv region *Lokalno, regija Plovdiva*
10	B1E0501	Local, Plovdiv region *Lokalno, regija Plovdiva*	20	B1E0537	Local, Plovdiv region *Lokalno, regija Plovdiva*

Result and discussion

The results of the study are presented in Table 2. The first symptoms of wilt in pepper were reported in phase blooms. In plants infected by *Rhizoctonia solani* (Fig. 1) root neck symptom was observed (Fig. 2). Infected plant parts (roots, root neck) are brown colored. The number of infected plants in other studied accessions ranged from 2 in A8E0087 to 26 in B1E0501, which is 2.5% to 32.5% wilted plants. Only in two samples (B1E0492, B1E0524) were not reported pathogen infections. In the other included in the study varieties the percentage of distribution ranged were from 3.7% to 27.5%.

Fig. 1. Mycelium of *Rhizoctonia solani* – isolate (rhs 14)
Micelija Rhizoctonia solani – izolat (rhs 14)
(photo by P. Chavdarov)

Fig. 2. Symptoms of *Rhizoctonia solani*
Simptomi Rhizoctonia solani
(photo by P. Chavdarov)

Fig. 3. Seedling damping off
Polijeganje sijanaca
(photo by P. Chavdarov)

Tab. 2. Distribution of pepper diseases (%) in natural infection
Distribucija bolesti paprike (%) kod prirodne infekcije

№ *Br.*	Сат № *Kat. br.*	number plants *broj biljaka*	*Rhizoctonia solani*		*Phytophthota capsici*		*Fusarium oxysporum*		*Verticillium dahliae*	
			infected plants *inficirane biljke*	%	infected plants *inficirane biljke*	%	infected plants *inficirane biljke*	%	infected plants *inficirane biljke*	%
1	A8E0086	80	12	15.0	3	3.7	-	0.0	1	1.2
2	A8E0087	80	2	2.5	-	0.0	-	0.0	-	0.0
3	A8E0088	80	6	7.5	1	1.2	-	0.0	-	0.0
4	A8E0089	80	4	5.0	-	0.0	-	0.0	-	0.0
5	B1E0491	80	10	12.5	-	0.0	-	0.0	4	5.0
6	B1E0492	80	-	0.0	-	0.0	-	0.0	-	0.0
7	B1E0493	80	3	3.7	-	0.0	7	8.7	-	0.0
8	B1E0494	80	9	11.2	-	0.0		0.0	-	0.0
9	B1E0495	80	18	22.5	-	0.0	5	6.2	-	0.0
10	B1E0501	80	26	32.5	-	0.0	-	0.0	-	0.0
11	B1E0504	80	14	17.5	-	0.0	-	0.0	-	0.0
12	B1E0501	80	18	22.5	-	0.0	-	0.0	-	0.0
13	B1E0504	80	22	27.5	-	0.0	1	1.2	3	3.7
14	B1E0514	80	13	16.2	4	5.0	-	0.0	-	0.0
15	B1E0515	80	9	11.2	-	0.0	-	0.0	-	0.0
16	B1E0516	80	3	3.7	-	0.0	3	3.7	-	0.0
17	B1E0521	80	5	6.2	-	0.0	-	0.0	6	7.5
18	B1E0524	80	-	0.0	-	0.0	-	0.0	-	0.0
19	B1E0525	80	6	7.5	-	0.0	-	0.0	-	0.0
20	B1E0532	80	11	13.7	2	2.5	1	1.2	-	0.0

Pathogenicity of the fungus (*Rhizoctonia solani*) was studied under laboratory conditions. With this pathogen was inoculated sterile soil, where sowing peppers seeds. After germination typically symptoms of "damping off" (Fig. 3) were observed. This fungus is one of the main causes of this disease. Every year this pathogen is a problem in the production of vegetable seedlings.

Symptoms of wilting of the plants caused by *Phytophthora capsici* (Fig. 4) was observed in four of all studied pepper accessions (A8E0086, A8E0088, B1E0514, B1E0532). Symptoms are expressed in the form of root rot and browning of the stems of the infected plants above the soil level. Disease progression in infected pepper varieties ranged from 1.2% to 5.0%. At the other samples symptoms of the phytophthora blight were not observed.

Fig. 4. Phytophthora blight on pepper
Plamenjača na paprici
(photo by P. Chavdarov)

Fig. 5. Mycelium of Phytophthora capsici – isolate (phc 11)
Micelija Phytophthora capsici – izolat (phc 11)
(photo by P. Chavdarov)

Fig.6. Development of mycelium on pepper fruits
Razvoj micelija na plodovima paprike
(photo by P. Chavdarov)

Fig. 7. Typical symptoms of pepper stem
Tipični simptomi na stabljici paprike
(photo by P. Chavdarov)

Pathogenicity of the fungus (*Phytophthora capsici*). was studied under laboratory conditions. With a spore suspension of the pathogen was artificially infected young pepper plants and fresh peppers fruits. On the third day after inoculation was observed mycelium of the fungus on the fruit (Fig. 6) Typical symptoms of the disease in the artificially infected plants were observed on the fifth day (Fig. 7).

Fusarium wilt in pepper (Fig. 8) was found in five samples (B1E0493, B1E0495, B1E0504, B1E0516 and B1E0532). Prevalence rates on fusarium wilt in pepper is reported in the range of 1.2% to 8.7%. Symptoms on aerial parts of plants occur as wilting foliage in the hottest hours. Brown rot symptoms observed on roots and roots neck . In humid conditions on diseased tissue may appear to pink mycelium coating. Sick plant parts were put on selective medium (SNA^{+}). After microscopic analysis in the laboratory was identified soil fungus *Fusarium oxysporum* f. sp. *capsici*, (Fig. 9). This pathogen is the main causal agent of fusarium wilt in pepper.

Fig. 8. Fusarium wilt on pepper
Fuzariozno uvenuće na paprici
(photo by P. Chavdarov)

Fig. 9. Mycelium of *Fusarium oxysporum* isolate (fo 19)
Micelija *Fusarium oxysporum* izolat (fo 19)
(photo by P. Chavdarov)

Symptoms of the diseases were observed of four pepper accessions (A8E0086, B1E0491, B1E0504 and B1E0521). The percentage of spread of the diseases in infected accessions varied from 1.2% to 7.5%..At the beginning on the lower leaves of infected plants observed yellowing. Later on the plants are defoliated. External root system is healthy .When we cut the stem we observed brown coloration of the vascular system. The fungus invades xylem elements and disrupts water transport. Infected plants may recover at night a few day before permanent wilting and death occur. The laboratory tests confirmed the presence of the fungus *Verticillium dahliae.* On the PDA the fungus forms numerous microsclerotia (Fig. 10).

Fig. 10. Mycelium and microsclerotia of *Verticillium dahliae* – isolate (vd 11)
Micelija i mikrocklerocija Verticillium dahliae – isolate (vd 11)
(photo by P. Chavdarov)

Conclusion

As a result of the study it was established that the most widespread soil pathogen is *Rhizoctonia solani.* The pathogen caused wilting in 18 of the studied accessions.

Other isolated and identified pathogens are significantly less prevalent compared to *Rhizoctonia solani.*

For proper isolation and identification of pathogens in the soil a selective medium should be used, since it may very often have a mixed infection. This may obstruct the proper establishment of primary infection in infected plants.

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Fitopatogeni koji izazivaju uvenuće kod paprike – distribucija, simptomi i identifikacija

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Sažetak

Evaluacija razvoja i širenja fitopatogena koji izazivaju uvenuće kod paprike sprovedena je 2012. Posmatranja su izvedena u terenskim uslovima i okruženju prirodne zaraze u regiji Plovdiva. U laboratorijskim uslovima izolovane su i identifikovane četiri fitopatogene gljive roda *Rhizoctonia*, *Fusarium*, *Verticillium* i *Phytophthora*. Rezultati analiza pokazali su da je najviši procenat uvenuća kod paprike izazvala gljiva - *Rhizoctonia solani*.

Key words: prinove paprike, uvenuće, fitopatogeni zemljišta

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