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MYCOPOPULATIONS OF CORIANDER SEEDS

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Abstract

Coriander (*Coriandrum sativum* L.) is a valuable multipurpose medicinal plant. All parts of the plant are edible, but the dried seeds (*Coriandri fructus*), fresh leaves (*Coriandri folium*) and aerial parts of the plant (*Coriandri herba*) are the most commonly used. In folk medicine, the seeds of coriander are used as an aromatic, carminative, antispasmodic remedy used to treat gastrointestinal complains such as dyspepsia and gastralgia. It is often recommended for insomnia and anxiety. Seed is also used as an analgetic and antirheumatic agent. This paper aims to present the results of research of mycopopulation on coriander seeds in Serbia.
The pathogenic mycobiota of coriander seeds was studied on the commercial plantation of the three localities in Serbia: Pančevo municipality, Ostoićevo and Mošorin villages during 2012-2013. Mycopopulations of coriander were studied by seed incubation on filter paper and on potato dextrose agar (PDA), according to the International Seed Testing Association (ISTA) rules. The active growing mycelia from the seeds were transferred on PDA: Monosporial isolates were used for this investigation. Identification of obtained isolates was based on the morphological and cultivation characteristics of isolated fungi.
The seeds of coriander were affected by different pathogenic and saprophytic fungi. Incidence of *Alternaria* species was 44 and 66%, *Rhizoctonia* spp. 3 and 7 % and *Fusarium* spp. 2 and 6% in 2012 and 2013, respectively. The other fungi (*Aspergillus niger*, *Aspergillus flavus*, *Penicillium* spp., *Epiocccum purpuescens*, *Cladosporium cladosporioides*) were present in sporadically (1-2%), while incidence of *Trichothecium roseum*, *Trichoderma viride*, *Myrothecium leucotrichum*, *Nigrospora macrospora*, *Mucor* spp., *Rhisopus* spp. was up to 5%.

Key words: *coriander, seed, mycopopulation*

Introduction

Coriander, *Coriandrum sativum* L., is an annual herb in the family *Apiaceae*. This plant, native to southern Europe, northern Africa, and southeastern Asia, is used in cooking as well as for medicinal uses.
In many countries and cultures, throughout history, coriander has been used as medicinal for treatment of digestion organs, diabetes and urinary tract diseases, as well as for excretion of heavy metals from organism, for treatment of insomnia, as aphrodisiac and as anthelmintic. Contemporary methods of research have confirmed the effect of this plant on all mentioned diseases and in addition they have confirmed its antibacterial, antioxidant, antiinflammatory and anticancer effect. Due to its complex chemical structure, coriander has a wide range of application. All parts of plant are used for medicinal and nutrition purposes of humans and animals, but they also have a non-food use in perfume, pharmaceutical and tobacco industry. Coriander is used for production of biodiesel, as insecticide and fungicide in organic

agriculture and it is often used as protection crop, because large quantities of its nectar and pollen attract various useful insects.

Interest in growing coriander is growing, especially in developing countries, where people are increasingly turning to alternative treatments, primarily traditional medicine, which has almost disappeared during the industrialization. Nowadays, modern scientific methods, confirmed by numerous medicinal properties of this plant, and it quickly found its place in people's lives, as a spice, medicine or functional food.

It is estimated that the Holy coriander grown on about 550,000 ha per year and that its production of 600,000 t (Diederichsen, 1996).

Many fungal diseases to date in the world spread by infected seeds of coriander. Stakvilevičienė (2003) isolated on Lithuanian coriander seeds: *Botrytis cinerea, Fusarium sambucinum* (*Gibberella pulicaris), Mortierella isabellina* (*Umbelopsis isabellina), Sclerotinia sclerotiorum* and *Thielaviopsis basicola*. Seed germination was markedly suppressed by fungi, i.e. *Aspergillus flavus, A. niger, A. fumigatus, Alternaria alternata, Cochliobolus lunatus, Fusarium solani, F. chlamydosporum* and *Rhizopus stolonifer* (Samota and Singh, 2006).

The experimental research of coriander seeds' mycopoulation has been conducted during 2012-2013 on the cultivating plantations of the Institute for Medicinal Plants Research 'Dr Josif Pančić' and on the cooperative fields in Serbia. The aim of the investigation is to represent the results of the presence a number of different fungi species for the first time on the coriander seeds' in Serbia.

Material and methods

The pathogenic mycobiota of coriander seeds was studied on the commercial plantation of the three localities: Pančevo municipality, Ostoićevo and Mošorin villages during 2012-2013. Mycopopulation of coriander were checked by seed incubation on filter paper and on potato dextrose agar (PDA), according to the ISTA rules (ISTA, 2003).

Exactly 400 seeds (4 trials each with 100 seeds) from each locality were sterilized with NaOCl for 3 minutes and then rinsed with sterile water and transferred to the filter paper on Petri dishes. Also 10 seeds were taken from each lot after surface sterilization where transferred to Petri dishes with potato dextrose agar medium (PDA). Seeds were incubated for 7 days at 25 C. The pathogenicity test was confirmed by method of Molt and Simone (1967). The active growing mycelia from the seeds were transferred on PDA. Monosporial isolates were used for investigation. Identification of obtained isolates was based on the morphological and cultivation characteristics using the taxonomic keys for identification (Neergard, 1979; Sutton, 1980; Nelson et al., 1983; Lesli and Summerrll, 2006; Simmons, 2007).

Results and discussion

Analysing results of the collected coriander seeds mycopopulation enabled 23 different species from 18 genus to be identified (Table 1).

Alternaria alternata was a predominant fungal species on seeds, accounting 55 and 66% in localities Pančevo and Mošorin while a slightly lower in Ostoićevo 44 and 57% in 2012 and 2013, respectively. This fungus is also dominant on other medicinal plants such as valerian (Pavlović, 2003), camomile, St. John's worth (Pavlović and Dražić, 2000; Pavlović et al., 2000), marshmallow and ehinacea (Pavlović et al., 2006; 2007). Kohmoto and Otani (1991) shoved that isolates belonging to the species *A. alternata* have the possibility to cause infection and disease on many plant hosts.

Table.1. Incidence of fungi (%) on coriander seeds in Serbia during 2012 and 2013

Fungal species	Locality					
	Pančevo		Ostoićevo		Mošorin	
	2012	2013	2012	2013	2012	2013
Alternaria alternata	55	66	44	57	56	66
Alternaria spp.	0	0	4	16	3	6
Aspergillus niger	2	2	3	2	3	1
Cladosporium cladosporioides	2	2	2	0	2	0
Epicoccum purputescens	2	2	1	3	0	3
Botrytis cinerea	0	0	2	1	0	0
Fusarium oxysporum	3	3	3	4	2	6
Fusarium verticillioides	3	2	0	0	0	3
Fusarium equiseti	1	1	0	2	3	4
Fusarium sporotrichioides	2	2	2	0	2	0
Fusarium semitectum	1	0	0	0	0	0
***Penicillium* spp.**	2	2	0	0	1	3
Nigrospora macrospora	2	1	1	3	1	0
***Mucor* spp.**	3	5	1	3	3	0
***Rhisopus* spp.**	2	1	2	2	2	1
***Rhizoctonia* spp.**	3	3	4	7	6	2
Sclerotinia sclerotiorum	1	2	3	0	1	3
Myrothecium leucotrichum	2	1	2	1	1	2
***Phoma* spp.**	0	0	0	0	2	2
***Acremonium* sp.**	1	2	0	1	2	0
***Physarum* sp.**	2	2	0	0	0	0
Trichothecium roseum	2	1	2	2	1	0
Trichoderma viride	2	1	1	3	0	0

The most destructive fungus in coriander seeds are species from genus *Fusarium.* Five *Fusarium* spp. were identified from the coriander seeds*: Fusarium oxysporum, F. verticillioides, F.equiseti, F. sporotrichioides* and *F. semitectum* (Fig.1: e,f,g,h:ž; Fig 2: a,b,c,d). The diseased seed is small and wrinkled, with changed colour, wilting and seedling decay, commonly known as firing and melting of seedlings (Jasnić and Maširević, 2006). This isolated species are known as pathogens different seeds, like: maize, millet, sugar beet, sunflower, alfalfa, etc. (Nirenberg and O'Donnell, 1998; Lević et al 2003; Stojšin, 2003; Krnjaja, 2004). In addition to these fungi, *Rhizoctonia* spp. was significantly present (3- 7%) in the coriander seed (Fig.1: e,f).

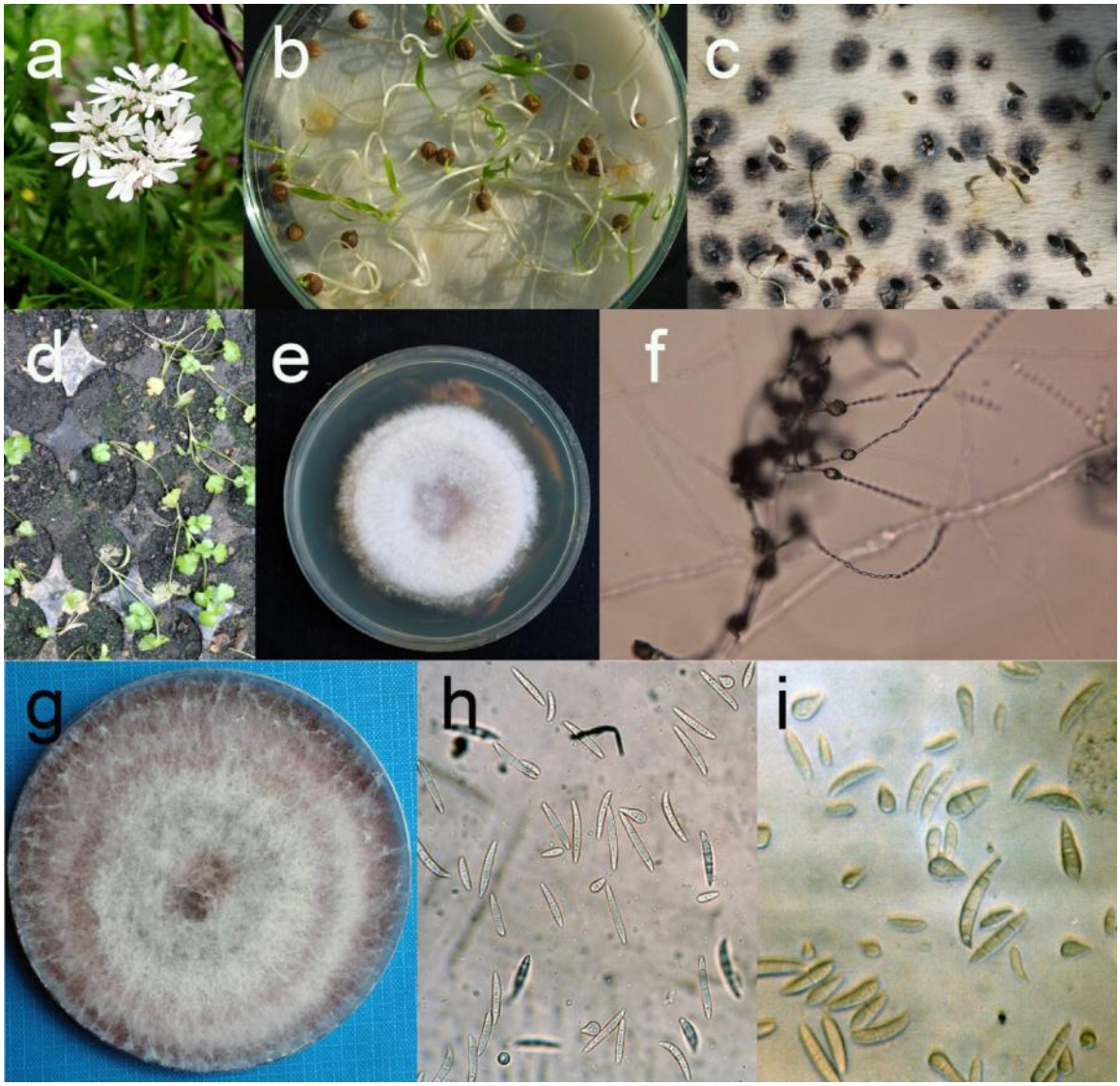

Fig. 1. *Coriandrum sativum*: healthy plant in the field (a) and healthy seedlings on filter paper (b); *Alternaria alternata*: non germinated and weakly seeds (c); *Fusarium oysporum*: pathogenicity test (d) and colony on PDA (e); *F. verticillioides*: appearance of microconidia *in sity* (f) *F. sporotrichioides*: colony on PDA (g), macroconidia formed in sporodochia (h) and microconidia (i).

The other fungi: *Aspergillus niger*, *Aspergillus flavus*, *Penicillium* spp., *Epiocccum purpuescens*, *Cladosporium cladosporioides*, were present in low percentage (1-2%), while incidence of *Trichothecium roseum*, *Trichoderma viride*, *Myrothecium leucotrichum*, *Nigrospora macrospora*, *Mucor* spp., *Rhisopus* spp. was up to 5%, even though does not make the problem on seed.

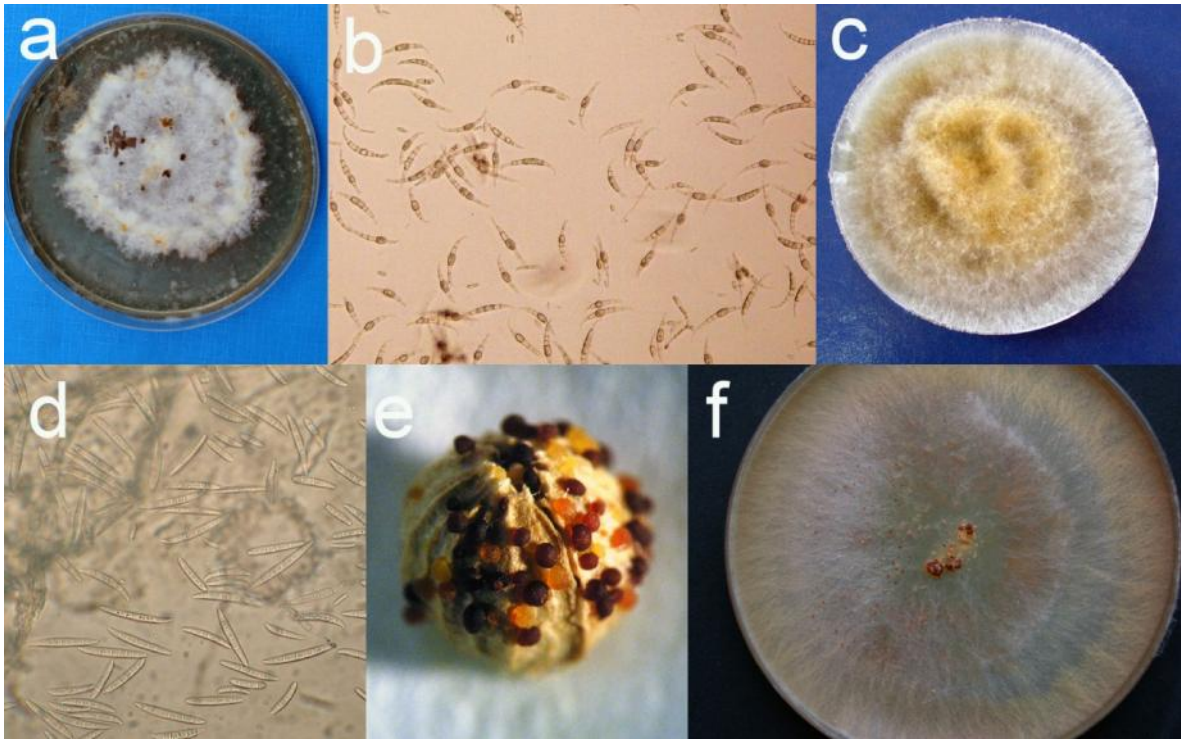

Fig. 2. *Fusarium equiseti*: colony on PDA (a) and conidia (b); *F. semitectum*: colony on PDA (c) and conidia (d); *Rhizoctonia* sp.: sclerotia on seed of coriander (e) and colony on PDA.

Sclerotinia sclerotiorum as very destructive pathogen causal plant wilts and collapse and *Botrytis cinerea* (Fig 3: a,b) were present in low percentage (1-2%). The cottony mycelium usually produces numerous sclerotia, black seed-like reproductive structures, a reliable diagnostic sign of *Sclerotinia* (Fig 3: a).

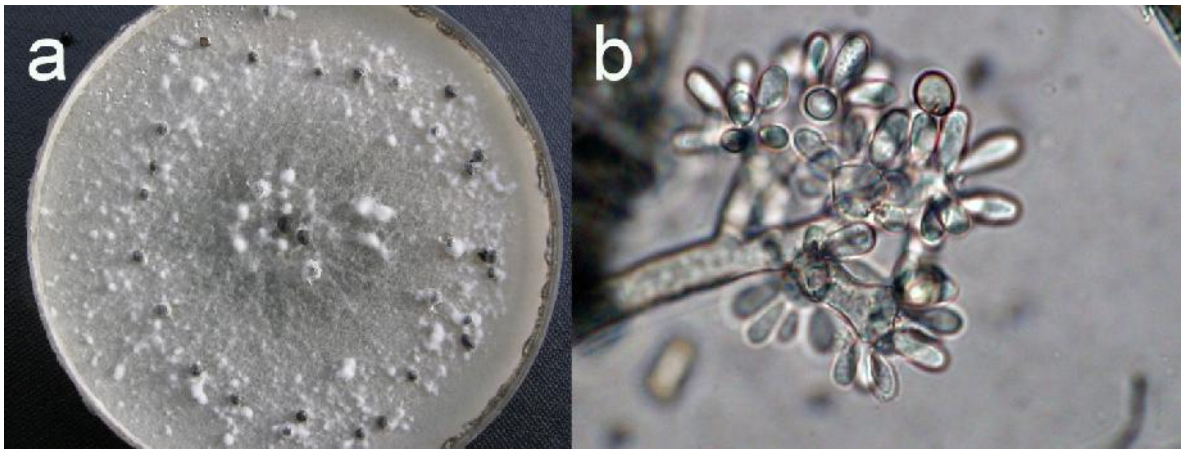

Fig. 3. *Sclerotinia sclerotiorum*: colony with sclerotia formed on PDA (a); *Botrytis cinerea*: conidiophore with conidia on PDA (b).

Conclusion

Twenty-three different species of fungi were identified in the mycopopulation of coriander seeds in 2012/2013 seasons. *Alternaria alternate* and *Fusarium* spp. were a predominant pathogen species on the coriander seeds. The infection of *Alternaria* and *Fusarium* spp. were frequent mixed infection of seeds. *Rhizoctonia* spp. was significantly present (3-7%), while *Sclerotinia sclerotiorum* and *Botrytis cinerea* were sporadically present (1-2%) in the coriander seeds.

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References

Diederichsen A. (1996). Coriander (Coriandrum sativum L.). Promoting the conservation and use of underutilized and neglected crops. 3, ed. Institute of plant genetics and Crop Plant research, Gatersleben/International plant genetic resources institute, Rome, Italy. http://www.seedtest.org/en/free-rules-downloads-content-1-1422-853.html

Health Testing Methods ISTA, Basserdof, Switzerland. Accessed on 30.06.2014.

International Seed Testing Association (2003). Internation Rules for Seed Testing. Annex to Chapter 7 Seed Health Testing, Seed health testing Methods. ISTA, Basserdorf, Switzerland.

Jasnić,S., Maširević, S. (2006). Bolesti klijanaca suncokreta. Biljni lekar, 34:313-315.

Kohmoto, K., Otani, H. (1991). Host recognition by toxigenic plant pathogens. Experientia, 47: 755-764.

Krnjaja, V. (2004). Uloga Fusarium spp. u kompleksu prouzrokovača truleži korena lucerke (Medicago sativa L.). Doktorska disertacija, Poljoprivredni fakultet Beograd, pp. 124.

Lesli J., Summerrll (2006). The Fusarium Laboratory Manuel, Blackwell Publishing Profesional USA pp:1-388

Lević, J., Ivanović, D., Stanković, S. (2003). Paraziti kukuruza, sirka i prosa koji se prenose semenom. Biljni lekar, 31: 570-576.

Molt, P. M.and Simone, J. (1967). Technique de dentamination ortificiele des semences de Mais par les Fusarioses, Revue de Zoologie Agricole at Appliquie No: 1-3, 29-32.

Neergard P. (1979). Seed pathology. Vol. 1., The Macmilan press LTD, Copenhagen.

Nelson, P.E., Toussoun T.A., Marasas W.F.O. (1983). Fusarium species. An illustrated Manual for identification. The Pennsylvania State University Press, University Park and London, 1-193.

Nirenberg, H., O'Donnell K. O. (1998). New Fusarium species and combinations within the Gibberella fujikuroispecies complex. Mycologia 90 (3) pp 434-458.

Pavlović. S. (2003). Bolesti odoljena. str.63-70. Radanović D., Stepanović B., Nastovski Tatjana (Eds): Odoljen (Valeriana officinalis L.), monografska studija, IPLB »Dr. Josif Pančić«, Beograd

Pavlović, S., Dražić S. (2000). Microflora of chamomile seeds [Chamomilla recutita (L.) Rausch.]: Proceedings from the First Conference on Medicinal and Aromatic Plants of Southeast European Countries, Eds: Dragana Sekulović, Srboljub Maksimović, Jan Kišgeci, Institute for Medicinal Plant Research "Dr Josif Pančić" and FPAGRI, Belgrade, pp 269-274.

Pavlović S., Dražić, S.. Ivanović M.(2000). Microflora of St. John's wort seeds, Proceedings from the First Conference on Medicinal and Aromatic Plants of Southeast European Countries, Eds: Dragana Sekulović, Srboljub Maksimović, Jan Kišgeci, Institute for Medicinal Plant Research "Dr Josif Pančić" and FPAGRI, Belgrade, pp 339-346.

Pavlović S., Stojšin, V. Stojanović, S. (2007). Mycopopulation of marshmallow (Althaea officinalis L.). Zbornik Matice Srpske 113: 193-202.

Pavlović,S., Stojanović, S., Starović, M. (2006). Current study of the parasitic microorganisms of the medicinal and aromatic plants in Serbia. Preoceedings of the 4th Conference on Medicinal and Aromatic Plants of Southeast European Countries, Isai, Romania, 214-219.

Samota, R. K., Singh, S. D. (2006). Pathogenic potential of seed mycoflora of coriander (Coriandrum sativum L.).Journal of Mycology and Plant Pathology, 36 (1): 62-63.

Simmons, G. E. (2007). Alternaria: An identification Manual, pp:1-775.
Stakvilevičienė, S. (2003). Microfungi on the overground part of coriander (Coriandrum sativum L.). Vagos, 58: 39-42.
Stojšin, V. (2003). Etiologija bolesti korena šećerne repe u uslovima različite mineralne ishrane (The etiology of sugar beet disease in different conditions of mineral nutrition). PhD thesis, Faculty of Agriculture, Novi Sad, pp. 150.
Sutton, B.C. (1980). The Coleomycetes, Commonwealth Mycological Institute. Kew, Srrey, England.