AGROSYM

BOOK OF PROCEEDINGS

XV International Scientific Agriculture Symposium

"Agrosym 2024"

Jahorina, October 10-13, 2024

AgroSym 2024

Agrosym 2024

BOOK OF PROCEEDINGS

XV International Scientific Agriculture Symposium
“AGROSYM 2024”

Jahorina, October 10 - 13, 2024

Impressum

XV International Scientific Agriculture Symposium „AGROSYM 2024"

Book of Proceedings Published by

University of East Sarajevo, Faculty of Agriculture, Republic of Srpska, Bosnia
University of Belgrade, Faculty of Agriculture, Serbia
Mediterranean Agronomic Institute of Bari (CIHEAM - IAMB) Italy
International Society of Environment and Rural Development, Japan
Balkan Environmental Association (B.EN.A), Greece
CDR, University of Natural Resources and Life Sciences (BOKU), Austria
Perm State Agro-Technological University, Russia
Voronezh State Agricultural University named after Peter The Great, Russia
Tokyo University of Agriculture, Japan
Jiangsu University, People's Republic of China
Shinshu University, Japan
Faculty of Agriculture, University of Western Macedonia, Greece
Arid Agricultural University, Rawalpindi, Pakistan
Chapingo Autonomous University, Mexico
Selçuk University, Turkey
University of Agronomic Sciences and Veterinary Medicine of Bucharest, Romania
Slovak University of Agriculture in Nitra, Slovakia
National University of Life and Environmental Sciences of Ukraine, Kyiv, Ukraine
Saint Petersburg State Forest Technical University, Russia
University of Valencia, Spain
Faculty of Agriculture, University of Zagreb, Croatia
Voronezh State University of Forestry and Technologies, Russia
Tarbiat Modares University, Islamic Republic of Iran
Northwest Normal University, People's Republic of China
Valahia University of Targoviste, Romania
Faculty of Agriculture, University of Akdeniz - Antalya, Turkey
Cangzhou Normal University, People's Republic of China
Ukrainian Institute for Plant Variety Examination, Kyiv, Ukraine
Institute of Animal Science - Kostinbrod, Bulgaria
National Scientific Center "Institute of Agriculture of NAAS", Kyiv, Ukraine
Department of Agricultural, Food and Environmental Sciences, University of Perugia, Italy
Watershed Management Society of Iran
Faculty of Agriculture, Cairo University, Egypt
Higher Institute of Agronomy, Chott Mariem-Sousse, Tunisia
Faculty of Economics Brcko, University of East Sarajevo, Bosnia and Herzegovina
Biotechnical Faculty, Montenegro
Institute of Field and Vegetable Crops, Serbia
Institute of Lowland Forestry and Environment, Serbia
Institute for Applied Science in Agriculture, Serbia
Agricultural Institute of Republic of Srpska - Banja Luka, Bosnia and Herzegovina
Maize Research Institute "Zemun Polje", Serbia
Faculty of Agriculture, University of Novi Sad, Serbia
Institute for Animal Science, Ss. Cyril and Methodius University in Skopje, North Macedonia
Serbian Academy of Engineering Sciences, Serbia
Balkan Scientific Association of Agricultural Economics, Serbia
Institute of Agricultural Economics, Serbia

Editor in Chief

Dusan Kovacevic

Tehnical editors

Sinisa Berjan
Milan Jugovic
Rosanna Quagliariello

Website:
http://agrosym.ues.rs.ba

CIP - Каталогизација у публикацији
Народна и универзитетска библиотека
Републике Српске, Бања Лука

631(082)(0.034.2)

INTERNATIONAL Scientific Agriculture Symposium "AGROSYM" (15 ; 2024 ; Jahorina)
Book of Proceedings [Електронски извор] / XV International Scientific Agriculture Symposium "AGROSYM 2024", Jahorina, October 10 - 13, 2024 ; [editor in chief Dusan Kovacevic]. - Onlajn izd. - El. zbornik. - East Sarajevo : Faculty of Agriculture, 2024

Системски захтјеви: Нису наведени. - Način pristupa (URL): https://agrosym.ues.rs.ba/article/showpdf/BOOK_OF_PROCEEDINGS_2024_FINAL.pdf. - Ел. публикација у ПДФ формату опсега 1552 стр. - Насл. са насловног екрана. - Опис извора дана 2.12.2024. - Библиографија уз сваки рад. - Регистар.

ISBN 978-99976-816-8-3

COBISS.RS-ID 141807105

MYCOPOPULATION ON RASPBERRIES IN SERBIA

Tanja VASIĆ[1*], Sanja ŽIVKOVIĆ[1], Darko JEVREMOVIĆ[2], Aleksandra LEPOSAVIĆ[1,2], Stefan KOVAČEVIĆ[2], Jordan MARKOVIĆ[3], Aleksandra BULAJIĆ[4]

[1]Faculty of Agriculture, University of Niš, Kosančićeva 4, 37000, Kruševac, Serbia
[2]Fruit Research Institute, Kralja Petra I 9, 32102, Čačak, Serbia
[3]Institute for Forage Crops, 37251, Globoder, Kruševac, Serbia
[4]Faculty of Agriculture, University of Belgrade, Nemanjina 6, 11080, Belgrade, Serbia
*Corresponding author: tanjavasic82@gmail.com,vasic.tanja@ni.ac.rs

Abstract

Raspberry is a perennial deciduous plant, bushy or semi-shrubby, with annual and long biennial shoots, which belongs to the rose family. For many years, raspberries have been among the most economically important types of fruit in the Republic of Serbia. So far, there have been no systematic researches on raspberry mycopopulation in Serbia. In this paper, we present the results of preliminary research on raspberry mycopopulation originating from Serbia. A total of 28 randomly collected samples from three locations in Serbia were analyzed. Root and stem were analyzed. Plant fragments were carefully washed under running water. The samples thus prepared were disinfected with 1% sodium hypochlorite (NaOCl) for 1 minute and washed three times in sterile distilled water. They were then dried on sterile filter paper and placed on potato dextrose agar (KDA). In each Petri dish, five fragments taken per sample were placed in five repetitions, and incubated in a thermostat at 24°C. The examination was performed every three days, and on most samples mycelia developed around the plant fragment by the 14th day. Microscopic examination was performed using an Olympus CX31 microscope. The frequency of isolation was calculated in % according to the formula: number of colonized parts with fungi/total number of analyzed plant parts x 100. A total of 700 plant fragments were examined, from which six genera of fungi were isolated: *Didymella, Fusarium, Rhizoctonia, Verticillium, Alternaria* and *Epicoccum.*

Key words: *Frequency of isolation, mycopopulation, raspberry*

Introduction

Raspberry is a perennial deciduous plant, with bushy or semi-shrub growth, with annual and long biennial shoots, which belongs to the Rosaceae family. For many years, raspberries have been among the most economically important fruit species in the Republic of Serbia (Leposavić, 2023). The world production of raspberries in 2019 was 684,000 tons (Petrović *et al*., 2020; Leposavić, 2023). On the European continent, Russia, Poland, Serbia and Spain are the biggest producers. However, the largest commodity production is realized in Serbia, because more than 95% of processed and fresh raspberry fruits are placed on the world market.

The most common causes of raspberry diseases are phytopathogenic fungi, bacteria and viruses. Due to the characteristic habitus of plants and intense vegetative growth, microclimatic conditions are created in raspberry plantations that favor the development of pathogens and the emergence of infections. Phytopathogenic fungi represent a very numerous and economically harmful group of pathogens on raspberries. The most economically important fungal diseases on raspberry are: *Didymella applanata* (Niessl.) Sacc. – spur blight; *Elsinoe veneta* (Burkh.) Jenkins – anthracnose (cane spot); *Phragmidium rubi-idaei* de Candolle P. Karsten – raspberry rust; *Paraconiothyrium fuckelii* (Saccardo) Verkley &

Gruyter – raspberry blight; *Phytophthora rubi* Man in't Veld – raspberry root rot; *Podosphaera macularis* (Wallroth) Braun & Takamatsu – powdery mildew; *Verticillium dahliae* Klebahn and *Verticillium albo-atrum* Reinke & Berthold – verticillium wilt; *Botrytis cinerea* Pers. Fr. (teleomorph *Botryotinia fuckeliana* (de Bary) Whetzel) – raspberry gray mold (Hai and Sutton, 1997; Munro *et al.,* 1988; Williamson, 2003; Williamson *et al.,* 2007; Mirković *et al.,* 2015). Among the bacterial disease-causing agents of raspberry, the most important are: *Agrobacterium tumefaciens* (Smith & Townsend) Conn – crown gall disease, *Pseudomonas syringae* pv. *syringae* van Hall. – pseudomonas blight disease and *Erwinia amylovora* (Burrill) Winslow, Broadhurst, Buchanan, Krumwiede, Rogers & Smith – fire blight (Braun and Hildebrand, 2006; Ivanović *et al.,* 2012). More than 30 viruses that can infect raspberries have been described in the world literature. Viral diseases occur everywhere where raspberries are grown. Economically the most important some viruses of raspberries are: black raspberry necrosis virus, BRNV; Raspberry leaf mottle virus, RLMV; Rubus yellow net virus, RYNV; raspberry bushy dwarf virus, RBDV; raspberry leaf blotch virus, RLBV and others (Jevremović and Paunović, 2011; Jevremović *et al*., 2016; Jevremović *et al*., 2019).

Considering the great importance of raspberry as a fruit species, especially for less developed hilly and mountainous areas in Serbia, the aim of this work was the isolation and morphological determination of mycopopulation on raspberry in order to better understand the problems in raspberry production (extinction of plants and reduction of yield) as a consequence of the presence of phytopathogenic fungi. Despite the intensive effort to find alternative solutions for controlling phytopathogenic fungi on raspberry, chemical protection is the dominant method. However, the application of chemical measures is difficult. The biggest problem is the timing of fungicide application, because flowering and raspberry harvest often overlap, and the presence of pesticide residues in fruits can be a problem. Also, the significant problem is the fact that a small number of fungicides are registered for the control of phytopathogenic fungi on raspberries.

Materials and methods

The samples were collected from 2019 to 2022 in the period June - August. A total of 28 samples from three localities in Serbia were analyzed (Čačak 8, Ivanjica 10, and Arilje 10). The experiment was conducted in the phytopathological laboratory of the Faculty of Agriculture in Kruševac, University of Niš. The plant parts were carefully washed under running water. After washing, parts of the stem and roots were cut into pieces measuring 0.5–1 cm. The samples thus prepared were disinfected with 96% ethanol for 30 seconds, 1% sodium hypochlorite (NaOCl) for 1 min and washed three times in sterile distilled water. They were then dried on sterile filter paper and placed on potato dextrose agar (PDA) with streptomycin. In each Petri dish, 5 plant parts were placed, in five repetitions. They were kept in a thermostat at 24°C and a light regime of 12 hours day/12 hours night. Examination was performed every 3 days, and on most samples, mycelia developed up to two weeks. The developed mycelia were screened on a new PDA substrate and, after the initial growth, the top part of the mycelium was screened again on PDA. Microscopic examination was performed using an Olympus CX31 microscope. Morphological identification of fungi was performed using standard keys (Dhingra and Sinclair, 1995). The frequency of isolation in % was calculated according to the formula (Vrandečić *et al*., 2011):

$$\text{(\%) Isolation frequency} = \frac{\text{Number of segments containing the fungal species}}{\text{Total number of segments used in the isolation}} \times 100$$

Results and discussion

A total of 700 plant parts were examined, from which 6 genera of fungi were isolated: *Didymella, Fusarium, Rhizoctonia, Verticillium, Alternaria* and *Epicoccum* (Table 1). Macroscopic symptoms of infection were clearly visible on the plants from which the fungi were isolated. On all plants from which the fungi were isolated, clearly expressed symptoms on the stems in the form of necrotic spots and lesions were observed. From those plants *Alternaria* fungi were isolated. In plants where purple-brown necrosis was observed on the stems, in the lower third of the stem, the fungi from the genus *Didymella* were isolated. Fungi from the genera *Fusarium* and *Rhizoctonia* were isolated from the plants with symptoms in the form of light to dark brown necrosis on the root system. Discoloration of the conducting tissue was also observed in some plants on the root system, and fungi from the genus *Verticillium* were isolated from those plants.

Table 1. Frequency of fungal isolation on raspberry

Location	Number of samples Plant part	Fungi species	(%) Isolation frequency
Čačak 1	25	*Alternaria* sp., *Fusarium* sp., *Didymella* sp., *Verticillium* sp.	15, 10, 25, 10
Čačak 2	25	*Didymella* sp., *Alternaria* sp., *Epicoccum* sp.	25, 10, 5
Čačak 3	25	*Alternaria* sp., *Didymella* sp., *Verticillium* sp.	25, 20, 40
Čačak 4	25	*Alternaria* sp., *Didymella sp.*, *Verticillium sp.*	15, 35, 15
Čačak 5	25	*Didymella* sp., *Fusarium* sp., *Rhizoctonia* sp., *Epicoccum* sp.	25, 10, 5, 5
Čačak 6	25	*Didymella* sp., *Verticillium* sp.	60, 10
Čačak 7	25	*Didymella* sp., *Alternaria* sp., *Epicoccum* sp.	40, 15, 5
Čačak 8	25	*Didymella* sp., *Rhizoctonia* sp.	35, 20
Ivanjica 1	25	*Didymella* sp., *Fusarium* sp., *Epicoccum* sp.	20, 5, 5
Ivanjica 2	25	*Didymella* sp., *Alternaria* sp., *Fusarium* sp., *Rhizoctonia* sp.	60, 20, 10, 5
Ivanjica 3	25	*Didymella* sp., *Epicoccum*sp.	30, 35
Ivanjica 4	25	*Didymella* sp., *Alternaria* sp., *Fusarium* sp.	15, 35, 5
Ivanjica 5	25	*Didymella* sp., *Epicoccum* sp., *Rhizoctonia* sp.	25, 5, 15
Ivanjica 6	25	*Didymella* sp., *Verticillium* sp.	25, 15
Ivanjica 7	25	*Didymella* sp., *Fusarium* sp., *Rhizoctonia* sp.	35, 10, 5

Ivanjica 8	25	*Didymella* sp., *Epicoccum.* sp., *Fusarium* sp., *Rhizoctonia* sp.	35, 5, 20, 5
Ivanjica 9	25	*Didymella* sp., *Verticillium* sp., *Alternaria* sp., *Epicoccum* sp.	10, 15, 5, 5
Ivanjica 10	25	*Didymella* sp., *Fusarium* sp., *Rhizoctonia* sp.	25, 10, 15
Arilje 1	25	*Didymella* sp., *Rhizoctonia* sp., *Alternaria* sp., *Epicoccum*.sp.	25, 15, 5, 10
Arilje 2	25	*Didymella* sp., *Fusarium* sp., *Rhizoctonia sp.*	25, 10, 10
Arilje 3	25	*Didymella* sp., *Fusarium* sp., *Alternaria* sp., *Epicoccum* sp.	25, 10, 15, 15
Arilje 4	25	*Didymella* sp., *Fusarium* sp., *Rhizoctonia* sp.	30, 5, 15
Arilje 5	25	*Didymella* sp., *Fusarium* sp., *Rhizoctonia sp.*	15, 10, 5
Arilje 6	25	*Didymella* sp., *Fusarium* sp., *Rhizoctonia* sp., *Alternaria* sp.	5, 10, 5, 10
Arilje 7	25	*Didymella* sp., *Fusarium* sp., *Rhizoctonia* sp.	25, 10, 10
Arilje 8	25	*Didymella sp.*, *Fusarium* sp., *Rhizoctonia* sp., *Alternaria* sp.	30, 15, 20, 5
Arilje 9	25	*Didymella* sp., *Fusarium* sp., *Alternaria* sp., *Epicoccum*.sp	30, 5, 10, 20
Arilje 10	25	*Didymella* sp., *Fusarium* sp., *Rhizoctonia* sp.	15, 20, 5

D. applanata is widespread in all raspberry growing regions in Europe, America, Africa, Asia and Australia (Mirković, 2018). In the Fraser Valley, British Columbia in the 1930s, several phytopathogenic fungi were isolated from infected raspberry plants: *Leptosphaeria coniothyrium* (*Coniothyrium fuckelii*), *Ilyonectria destructans* (*Cylindrocarpon radicicola*), *Fusarium* spp., *Cylindrocladium* spp., *Pythium* spp., *R. solani*, *Rhizoctonia* spp. After artificial inoculations of healthy raspberry plants, obtained with fungal isolates, it was determined that all isolated species can cause necrosis on the roots of healthy plants (Berkeley, 1936). Raspberries are the third most popular berry in the United States and a growing specialty crop for both the wholesale industry. Postharvest susceptibility to gray mold (*B. cinerea*) drastically reduces the shelf life of this delicate fruit (Hai and Sutton, 1997; Williamson, 2003; Williamson *et al.*, 2007; Harshman *et al*., 2014). *D. applanata* causes spur blight of raspberry was isolated from canes of diseased raspberries in a plantation in Novosibirsk, Russia (Shternshis *et al.,* 2006). *Alternaria tenuissima* has been reported on raspberries in China, in 2014 and 2015, as a leaf spot disease was observed on cultivated raspberry. The disease incidence averaged approximately 75%. Some small, circular, light brown spots appeared on the leaves in the early stage of disease development. The spots gradually enlarged and became round or irregular, dark brown, and developed concentric rings with dark brown margins normally surrounded by light yellow halos measuring 0.5 to 4.0 mm. Finally, the necrotic spots often coalesced to large blights of 11.0 to 15.0 mm. Severely infected leaves aged early and some fell off (Cong *et al.,* 2016). Raspberry cane disease is caused by various phytopathogenic fungi, including *Fusarium avenaceum* (Fusarium wilt), *D. applanata* (spur blight), *L. coniothyrium* (cane blight) and *B. cinerea* (cane *Botrytis*) with *F. avenaceum* being the major cause of cane diseases in Northern

Germany (Girichev *et al.,* 2018). Soilborne pathogens are a major concern to red raspberry and strawberry producers throughout the Pacific Northwest. Red stele, caused by *Phytophthora fragariae* var. *fragariae*, and raspberry root rot, caused by *P. fragariae* var. *rubi*, can cause serious economic losses in cool, wet production areas (Pinkerton *et al*., 2002). Soilborne fungal pathogens (such as *Phytophthora* spp., *Verticillium* spp., *Rhizoctonia* spp., *Pythium* spp. and *Fusarium* spp.), lesion nematode (*Pratylenchus penetrans*) and weeds are common pests of Mexican strawberry and raspberry nurseries. Phytophthora root rot caused by *P. fragariae* var. *rubi* is the most serious root disease of red raspberries in many growing regions Mexico. Raspberry roots are also very sensitive to excessive moisture and lack of oxygen in the soil for extended periods of time. These conditions cause decay and root death. Best roots are produced in non-infested soils with good drainage (Lopez-Aranda *et al.,* 2016).

Conclusion

Growing raspberries is a very important and economically significant activity in Serbia. One of the most important factors that limits the profitability of raspberry cultivation are phytopathogenic fungi, the cause of economically important diseases. In rainy and humid conditions, diseases develop more intensively, and yields in the following year may be significantly reduced. The use of pesticides, i.e., fungicides, is the dominant method for phytopathogenic fungi control in raspberries. The reason why raspberry protection is based on the use of fungicides is the lack of raspberry varieties that show tolerance to economically significant disease agents. Such as *Didymella, Rhizoctonia, Verticillium, Phytophthora* and *Botrytis*. However, the implementation of these measures is difficult. The biggest problem is the limited time of pesticide application because the flowering and harvesting of raspberries can take a very long time, over 60 days. As a problem in the chemical protection of raspberries, a fairly poor range of fungicides is cited as a result of chemical companies' lack of interest in registering new active substances and formulations because the market is small and the registration of preparations is expensive. However, the application of chemical agents to protect raspberries from pathogenic fungi is the only measure that is necessary for profitable production. Without the application of all other available measures, primarily agrotechnical and mechanical, their full effect will be absent.

Acknowledgement

This work was supported by the Ministry of Science, Technological Development and Innovations of the Republic of Serbia, contract 451-03-65/2024-03/ 200383 and 451-03-66/2024-03/200215

References

Berkeley G. H. (1936): Root rots of the raspberry. Canadian Journal of Research, 14c: (8) https://doi.org/10.1139/cjr36c-024

Braun P. G., Hildebrand P. D. (2006): Epidemiology of fire blight of floricane fruiting red raspberry caused by *Erwinia amylovora.* Canadian Journal of Plant Pathology, 28:(1), 95 – 99. DOI: 10.1080/07060660609507275

Cong Y. L., Liu Z. H., Lu B. H., Yang L. N., Wang X., Gao J. (2016): *Alternaria tenuissima* Causing Alternaria Leaf Spot on *Rubus crataegifolius* in Jilin Province, China. Plant Disease, 100: (11), 2321.

Dhingra O.D., Sinclar J.B. (1995): Basic Plant Pathology Methods, second edition. CRC Press, INc., Boca Raton, Florida, USA.

Girichev V., von Reth M., Hanke M. V., Hofer M., Schulte E., Flachowsky H. (2018): Evaluation of Rubus genetic resources on their resistance to cane disease. Genetic Resources and Crop Evolution, 65:1979–1993. https://doi.org/10.1007/s10722-018-0670-1

Hai Y., Sutton J. C. (1997): Morphological development and interactions of *Gliocladium roseum* and *Botrytis cinerea* in raspberry, Canadian Journal of Plant Pathology, 19: (3), 237 – 246, DOI: 10.1080/07060669709500518

Harshman J. M., Jurick W. M., Lewers K. S., Wang S. Y., Walsh C. S. (2014): Resistance to *Botrytis cinerea* and Quality Characteristics during Storage of Raspberry Genotypes. Horts Science 49: (3), 311–319. https://doi.org/10.21273/HORTSCI.49.3.311

Ivanović Ž., Stanković S., Živković S. Gaavrilović V., Kojić M., Fira Đ. (2012): Molecular characterization of *Pseudomonas syringae* isolates from fruit trees and raspberry in Serbia. European Journal of Plant Pathology, 134, 191 – 203. https://doi.org/10.1007/s10658-012-9978-4

Jevremović D., Paunović S. (2011): Raspberry bushy dwarf virus: Agrapevine pathogen in Serbia. Pesticidi i fitomedicina, 26: 55 – 60.

Jevremović D., Leposavić A., Paunović S. (2016): Raspberryleaf blotch virus – a common raspberry pathogen in Serbia. Journal of Mountain Agriculture on the Balkans, 19: (3), 147 – 156.

Jevremović D., Leposavić A., Paunović S. (2019): Genetic diversity of Raspberry leaf blotch emaravirus in red raspberries from Serbia. Spanish Journal of Agricultural Research, 17: (1), e1004.

Leposavić Aleksandar (2023): Modern raspberry production. Institute of Fruit Growing Čačak and Faculty of Agriculture Kruševac. Grafoprint, Gornji Milanovac, 1 – 178.

Lopez-Aranda J. M., Gomez F., Puga M., Zamora R., Daugovish O., Cotero M.A. (2016): Chemical soil fumigation for raspberry nursery in Jalisco (Mexico). Journal of Berry Research 6, 37–46. DOI:10.3233/JBR-150112

Mirković B., Delibašić G., Stević M., Vukša P., Tanović B. (2015): *Didymella applanata* – the cause of raspberry brown spotting. Biljni lekar/Plant doctor, 43: (3), 287 – 293.

Mirković, Biljana (2018): Effects of fungicides on *Didymella applanata* (Niessl.) Sacc. *in vitro* and possibility of chemical protection of raspberry. Doctoral Dissertation. Faculty of agriculture, University of Belgrade, 1- 110.

Munro J. M., Dolan A., Williamson B. (1988): Cane spot (*Elsinoë veneta*) in red raspberry: infection periods and fungicidal control. Plant Pathology, 37: (3), 390 – 396.

Petrović S., Milošević T., Jevremović D., Glišić I., Milošević N. (2020): Strawberry fruit - Cultivation, protection and processing technology. Faculty of Agriculture Čačak and Institute of Fruit Growing Čačak. Biograf Comp, Belgrade, 1 – 726.

Pinkerton J. N., Ivors K. L., Reeser P. W., Bristow P. R., Windom G. E. (2002): The use of soil solarization for the management of soilborne plant pathogens in strawberry and red raspberry production. Plant Disease 86:645-651.

Shternshis M.V., Beljaev A.A., Shpatova T.V., Duzhak A. B., Panfilova Z. I. (2006): The Effect of Chitinase on *Didymella applanata*, the Causal Agent of Raspberry Cane Spur light. Biocontrol 51, 311–322. https://doi.org/10.1007/s10526-005-1034-2

Vrandečić K., Ćosić J., Jurković D., Poštić J. (2011): Mikopopulacija ljekovitog bilja u Hrvatskoj. Poljoprivreda, 17: (2), 18-21.

Williamson B., Tudzynski B., Tudzynski P., Van Kan J. A. L. (2007): *Botrytis cinerea*: the cause of grey mould disease. Molecular plant pathology, 8: (5), 561 – 580.

Williamson B. (2003): A possible resurgence of minor fungal diseases in *Rubus* caused by a reduction in fungicide use. Integrated Plant Protection in Orchards – Soft Fruits IOBC/wprs Bull. 26: (2), 139 – 146.