The first report of *Ochrospora ariae* and *Septoria sorbi* on whitebeam (*Sorbus aria*) seedlings in Montenegro

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Abstract

Symptoms of disease were recorded on leaves of whitebeam (*Sorbus aria* (L.) Crantz) seedlings in one stand in Montenegro. Analysis showed fungi *Ochrospora ariae* (Fuckel) Ramsb. and *Septoria sorbi* Lasch were present on infected trees. Species *Seporia sorbi* was associated with necrotic reddish and brown spots while species *Ochrospora ariae* was associated with necrotic reddish spots and yellow pustule of uredinia on leaves. Species were recorded both separately and simultaneously on leaves. This is the first record of *Ochrospora ariae* and *Seporia sorbi* on whitebeam (*Sorbus aria*) in Montenegro. Results will contribute to better knowledge of diseases and better protection of whitebeam (*Sorbus aria*) in early stages of growth in this part of its areal.

Keywords

Sorbus aria; *Ochrospora ariae*; *Septoria sorbi*; leaves

Contents

1 Introduction

Investigation of pathogens and hosts in different environments serve as basis for prediction and limitation of plant diseases (Agrios 2005; Scholthof 2007). It is widely accepted that fungi cause most of the forest diseases (Karadžić 2010; Edmonds et al. 2011). However, distribution of forest pathogens is significantly dependant from their interactions including competition and host variability (Kearney and Porter 2009). Genus *Sorbus* contains about 90 trees species of trees and shrubs in northern hemisphere (Cvjetićanin et al. 2016). All species in domestic forests were insufficiently studied in term of forest diseases. In especial interest is species whitebeam (*Sorbus*

aria (L.) Crantz) as species rarely distributed in this part of its areal (Cvjetićanin et al. 2016).

To manage forest diseases one of the major tasks is to understand epidemiology (Edmonds 2013). During the monitoring of health condition of different trees species in Montenegro, symptoms of leaves decline on whitebeam (*Sorbus aria*) seedlings were frequently noticed in locality Bukovica. Aim of this research was to identify fungi associated with these symptoms in order to form appropriate protection strategies of this species rarely distributed in this part of its areal.

2 Material and method

2.1 Study area

Leaves from symptomatic whitebeam (*Sorbus aria*) seedlings were sampled in July and August 2021 in locality Bukovica (43°01'11''N, 19°08'39''E; Figure 1). Seedlings were 3-10 years old.

Figure 1. Location of observed fungi: A-B beginning of monitoring.

2.2 Laboratory methods

Observation of fungal fruit bodies and spores was performed with microscope Am Scope B120 C E1 under 400 x enlargements. Preparation of samples for microscopic procedure was according to Muntanola-Cvetković (1990). In cases of absence of fruit bodies, occurrence was stimulated in moisture chambers. Identification was performed using descriptions of microstructures from authors Ellis and Ellis (1985) and Cummings and Hiratsuka (2003).

3 Results

3.1 Symptoms of disease

Reddish and brown round spots were recorded on whitebeam (*Sorbus aria*) leaves (Figure 2). Necrotic spots didn't cause premature shedding of leaves in year of monitoring (Figure 2).

Figure 2. Symptoms of leaf necrosis on whitebeam (*Sorbus aria*) leaves A-B necrotic lesions caused by pathogenic fungi.

3.2 Identified fungi

Fungi *Ochrospora ariae* (Fuckel) Ramsb. and *Septoria sorbi* Lasch were determined on infected leaves (Figure 2). Both species of fungi caused leaf necrosis with characteristics spots (Figure 2). Spots of *Ochrospora ariae* and *Septoria sorbi* occurred on the same trees in within the trees on separate and the same leaves (Figure 3). *Ochrospora ariae* was more abundant based on visual evaluation of symptoms.

Spots caused by *Ochrospora ariae* were characterized with round spots reddish in color when young and turning brown when old (Figure 3 A). A characteristic for these spots is the presence of yellow uredinia mostly on lower side of leaves (Figure 3 B). In the case of older spots uredo pustule could be gone or become darker in color before degradation (Figure 3 A-B).

Fungus *Ochrospora ariae* formed characteristics uredospores during this stage of rust development (Figure 4). Spores were characteristics for this species, echinulate with obscure pores (Figure 4).

Spots caused by *Septoria sorbi* resembled those caused by *Ochrospora ariae* (Figure 5).

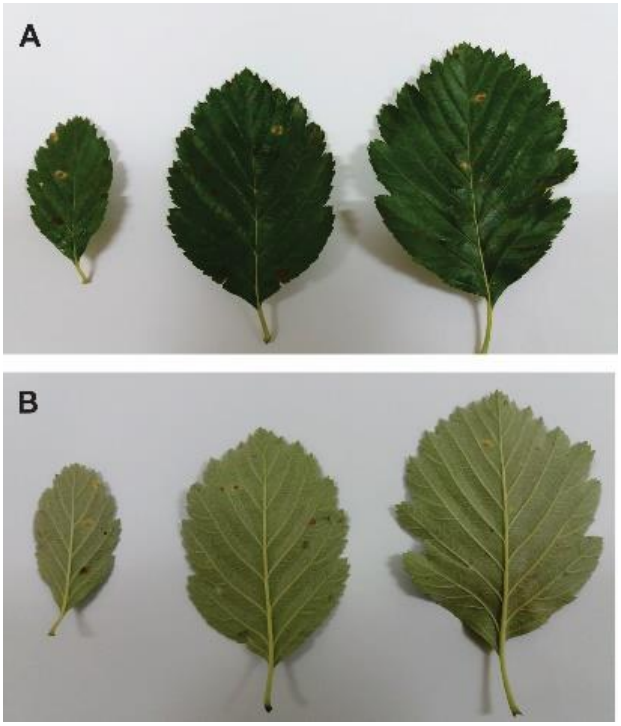

Figure 3. *Ochrospora ariae* leaf rust: A – reddish and brown spots on upper surface of leaves, B – uredinia (yellow pustules) on lower side of leaves.

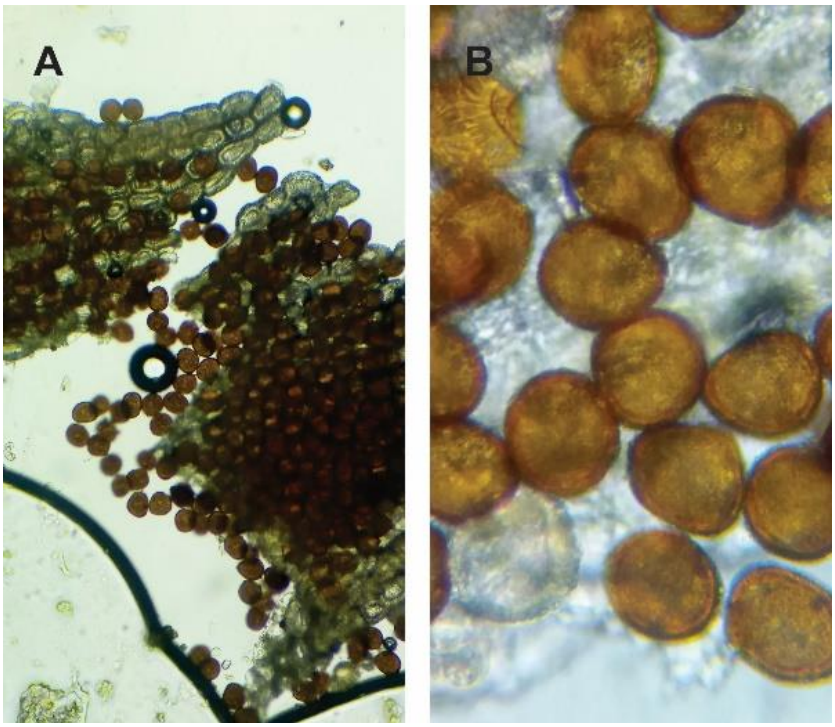

Figure 4. Uredospores of *Ochrospora ariae*.

Figure 5. *Septoria sorbi*: A – development of necroses. B – typical spots with fruit bodies forming on necroses.

However, instead of formation of uredinia in some stage of disease, black pycnidia were formed on symptomatic spots but in most cases due to period of observation pycnidia were not present on attached leaves and their production was artificially stimulated.

4 Discussion

Before this research there wasn't detail study about fungi on whitebeam (*Sorbus aria*) leaves. This is the first report of fungi *Ochrospora ariae* and *Septoria sorbi* on whitebeam (*Sorbus aria*) leaves in Montenegro. Results will have practical importance in eradication of diseases of whitebeam (*Sorbus aria*) and probably other species in this genus in this part of their areal.

Foliar diseases of broad-leaved trees have significant importance due to establishment of forest plantations in the world for productive purposes and their negative impact also includes limitations of trees cultivation, decreasing of ornamental value and reduction of yield (Kowalski 2013). This type of disease is caused specific group of organisms including mostly necrothrophs and rarely biotrophs (Kowalski 2013). In this research, both types of parasites were present on whitebeam (*Sorbus aria*) leaves.

Fungus *Ochrospora ariae* is primarly associated with mountain ash (*Sorbus aucuparia* L.) especially in northern part of its areal (Gjaerum 1974) and it reduces flower production and rhizome length (García-Guzmán and Wennström 2001). Due to presence of mountain ash (*Sorbus aucuparia* L.) in investigated locality it is expected that fungus could infect it if adequate protective measures were not applied. Observation from previous monitoring in this area is that *Ochrospora ariae* was not present on mountain ash (*Sorbus aucuparia* L.) and species *Gymnosorangium cornutum* Arthur ex F. Kern was present instead. Due to presence of both fungi on

different *Sorbus* species on small locality it is interesting in future to examine their relationship including possible interactions and competitions.

Fugus *Septoria sorbi* belongs to genus familiar by causing leaf spots on many species of trees and shrubs. Taxonomic situation of this species is partly complicated as sexual stage belongs to genera *Sphaeria* (*Sphaeriella*) and *Micosphaerella* (Braun 2019). Because symptomatic spots on leaves were not accurate diagnostic sign for these two species, presence and type of fruit bodies should be considered before final diagnosis during further monitoring. Also, because fungus was present on the same trees as species *Ochrospora ariae* further investigation of their interaction is needed to fully understand the decline of whitebeam (*Sorbus aria*) trees.

This study was focused on fungi colonizing whitebeam (*Sorbus aria*) leaves. Other studies should be focused on fungi colonizing different organs including fruits of whitebeam (*Sorbus aria*). These fungi are from especially importance in understanding regeneration and production of seedlings for reforestation. For example, study involved service tree (*Sorbus domestica* L.) showed 22 fungal species in fruits with high myxotoxin potential of *Penicilium*, *Aspergillus* and *Fusarium* species (Labuda et al. 2005).

Diseases of rowen trees (*Sorbus* spp.) still are not completely studied. Now it is well known that cancer and dieback of *Sorbus* spp. is strongly associated with fungus *Cytospora rubescens* (MacBrayne 1981). Also, experiences from investigation of fungi on service tree showed 13 species in leaves, without presence of species from this study (Kačániová and Fikselová 2007). This implicates especially need in studding different fungal diseases on different species in this genus in order to understand risk of disease spread between different hosts.

5 Conclusion

Based on obtained results main conclusion were:

- Fungi *Ochrospora ariae* and *Septoria ariae* were recorded on whitebeam (*Sorbus aria*) for the first time in Montenegro.

- Symptoms of brown spots were similar between fungi *Ochrospora ariae* and *Septoria ariae*. Small differences were in development of leaf spots whereby spots caused by *Ochrospora ariae* were at first reddish and slowly became brown in color. Spots caused by *Septoria ariae* were more constantly brown. Occurrence of fruit bodies was the most accurate indicator for determination. *Ochrospora ariae* formed uredinia while *Septoria ariae* produced pycnidi.

- Fungi occurred on the same trees and within the same tree sometimes on the same leaves. Premature shedding of leaves was not recorded in year on monitoring although it is possible to occur in following years.

- Results will contribute to better knowledge of fungal diseases of whitebeam (*Sorbus aria*) in this part of its areal and better protection strategies. Collection and burning of fallen leaves in autumn is recommended in order to control diseases.

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