# Investigation of Biological Peculiarities of *Blumeriella jaapii*

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**Abstract**

Leaf spot pathogen is characterized as a highly developed parasite after investigation of development peculiarities of the fungus in pure culture and natural conditions. The degree of correlation depended on the medium. Impact of incubation temperature on *Blumeriella jaapii* (Rehm) Arx growth was different. Fungi colonies formed more intensively and their diameter increased significantly under higher temperature. Optimal conditions for the disease prevalence are 15–20°C and moisture. Relative humidity and precipitation influenced maturation of ascomycetes and discharge of ascospores ($r = +0.89$). Microscopic analysis of leaves showed that during winter thaw, when the average temperature is about $0 \pm 5$°C and relative humidity is higher than 70%, was possible to detect mature ascomycetes and conidia. It is possible to affirm that lower temperature than it was assumed is sufficient for formation of ascomycetes.

**Keywords**: *Blumeriella jaapii*; sour cherry; cherry leaf spot; medium, mycelium; growth speed; conditions

## INTRODUCTION

Cherry leaf spot, caused by *Blumeriella jaapii* (Rehm) Arx (syn. *Coccomyces hiemlis* Higg.), is a widespread disease of sour cherry (*Prunus cerasus* L.). It is a major disease of sour cherries in North America (SJULIN *et al*. 1989), and in Europe serious losses have been reported in Poland (BIELENIN *et al*. 1991), Denmark (PEDERSEN & HOCKENHULL 1996), Germany (NIEDERLEITNER & KNOPPIK 1997), Belarus (VISHINSKAJA 1984).

Sour cherry leaf spot is the most severe disease due to which sour cherry plantations have nearly died out in Lithuania in the last years. Cherry leaf spot reduces winter resistance and productivity of fruit trees and worsens fruit quality. Alternating ecological factors affect negatively the immune system of plants and induce pathogenity of disease pathogens. Cherry leaf spot epiphytoties used to manifest themselves every 5–10 years. Recently they have been displayed every 2–3 years. In 1992, 1995 and 1997 epiphytoties determined extinction of sour cherries in number of districts. Extremely high amount of sour cherries froze out in the winter of 1995/1996. Therefore, it is expendient to investigate the biological peculiarities of *Blumeriella jaapii*.

## MATERIALS AND METHODS

In 1996–1999 the fungus *Blumeriella jaapii*, a pathogen of sour cherry leaf spot, and the accompanying micromycetes were investigated at the Lithuanian Institute of Horticulture, Plant Protection Laboratory. Micromycete cultures from cherry leaves were isolated and examined according to mycological and phytopathological investigation methods. Preparations were reproduced 3 times on agarised malt extract medium, pH 4.5–5.0. Cultures were incubated in a thermostat at $20 \pm 20$°C for 60 days. Dominating isolates were identified by a comparison method cultivating them into Petri dishes on different agarised media. For the cultivation there were used the following agarised media: 1. Malt extract; 2. Potato-glucose; 3. Heneberg's; 4. Leonian's; 5. Modified Magie; 6. Sour cherry leaves-branches. Radial speed of colony growth was calculated according to the formula: Kr = R/T; where: Kr – radial speed of colony growth; R – colony diameter; T – growth time.

## RESULTS AND DISCUSSION

Samples of cherry leaves were collected in different agroclimatic zones of Lithuania. In samples leaf spot was found in two development stages of a fungus: ascomata – *Blumeriella jaapii* was abundant in overwintered leaves and summer conidia – *Phloeosporella padi* (Lib.) Arx [syn. *Cylindrosporium padi* (Lib.) Karst.] formed reddish brown spots on leaves. In 1996–1999 apothecium of a fungus were becoming mature in the period from the 3rd decade of April till the 2nd decade of May (the average temperature was 10°C). Microscopic analysis of leaves showed that during winter thaw, when the average temperature is about 0–+5°C and relative humidity is higher than 70%, it is possible to detect mature apothecium and conidia. It is possible to affirm that lower temperature than it was assumed is sufficient for formation of apothecium. During investigation years the optimal temperature for maturation of apothecium was 10–13°C. Other authors (EISENSMITH *et al*. 1982; OGAWA 1995; GARSIA & JONES 1993; VISHINSKAJA 1984) indicate that apothecium form when the average temperature is higher than 15°C. Ascospores on apothecium started formation in the 3rd decade of May and proceeded for 30–40 days. Maximal development of leaf spot was fixed at the end of June – beginning of July, when individual or coalesced tiny dark brown spots showed on the leaves and clusters of summer conidia shot out on the underside of a leaf.

In the investigation years precipitation, relative humidity and average temperature determined spore formation of a pathogen. Release of ascospores coincided with swelling of cherry buds and beginning of flowering. Relative humidity and precipitation in May affected maturation and release of apothecium ($r = +0.89$), and in June these factors induced initial infestation of leaves by ascospores ($r = +0.78$). Very close correlation of precipitation and relative humidity remains throughout all vegetation because usually the temperature is sufficient. Conidia stage of a leaf spot pathogen was fixed in the 2nd decade of June when the average temperature becomes higher than 15°C. Secondary infection of fruit trees by summer conidia was induced by average 15–20°C temperature and higher than 60% relative humidity. The longer periods of rain, the more intensively released spores. On dry days, when relative humidity was lower than 50%, release was minimal. OGAWA (1995) indicates that the highest discharge of ascospores occurs at 16–30°C, smaller – at 12°C and very small – at 4–8°C.

Sour cherry is most disease susceptible in spring, during flowering and unfolding of leaves when the fungus *Blumeriella jaapii* matures spores, which have overwintered in fallen leaves, and discharges them.

Isolated cherry leaf spot pathogen was grown on various natural and synthetic media. Cultural and morphological characters of a fungus varied depending on the medium. *Blumeriella jaapii* exercised variable growth on media. The weakest growth was observed on the natural medium of sour cherry leaves and branches (Figure 1). In 60 days of incubation (20 + 2°C) the average diameter of colonies reached 5.9 cm. On Heneberg's, Leonian's and Magie media mycelium grew and developed best, on average colony diameter reached 8.9–9.0 cm. On malt extract and potato – glucose media mycelium grew sufficiently well, the average diameter of colonies was 7.9–8.8 cm. Posi-

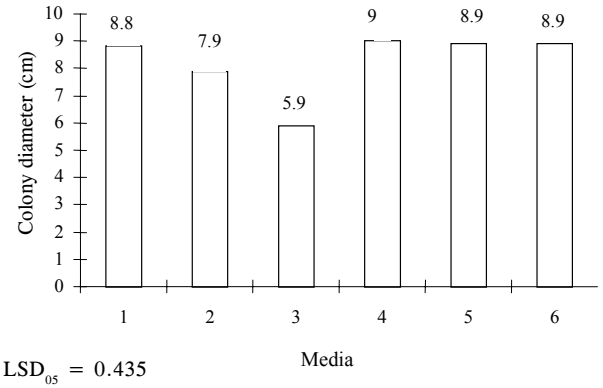



Figure 1. *Blumeriella jaapii* growth on different media, (1 – malt extract; 2 – potato-glucose; 3 – sour cherry leaves – branches; 4 – Heneberg's; 5 – Leonian's; 6 – Magie)

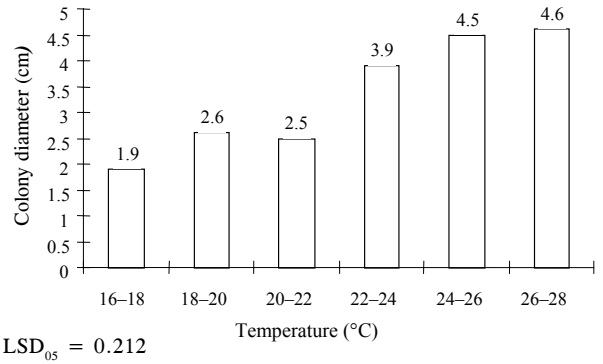
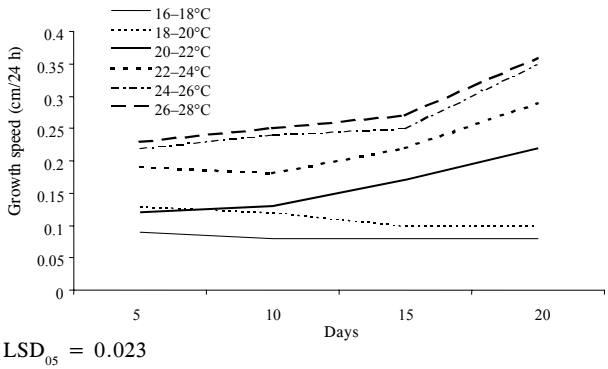



Figure 2. Impact of temperature on growth of pathogen colonies




$LSD_{05}$ = 0.023

Figure 3. Impact of temperature on growth speed of mycelium

tive correlation was established between growth speed of colonies and diameter ($r$ = 0.99). The degree of correlation depended on the medium.

According to many authors (EISENSMITH & JONES 1981; OGAWA 1995; PEDERSEN & HOCKENHULL 1996) the main climatic factors that determine the disease rise, prevalence and development are temperature and moisture. Impact of incubation temperature on *Blumeriella jaapii* growth was different. It was established that fungi colonies form more intensively and their diameter increases significantly under higher temperature.

At 16–18°C the fungus grew very slowly and in 15 days growth speed was 0.06–0.09 cm/24 hrs. At 18–20°C mycelium grew a little quicker – 0.10–0.13 cm per 24 hrs. It was observed that at 20–22°C growth speed reduce to 0.12 cm/24 hrs (Figure 3). It is possible to suppose that after formation of initial mycelium, growth is stabilised and inhibited for a while. At higher temperature secondary mycelium starts growing, which develops much quicker than the initial mycelium. In 15 days it increases till 4.6 cm in diameter (Figure 2). The size of pathogen colonies depended on growth speed of mycelium. Close correlation of these characters was established, $r$ = 0.99.

Cherry leaf spot pathogen is characterised as a highly developed parasite after investigation of development peculiarities of the fungus in pure culture and natural conditions (slow growth, insistence on nutrient medium, narrow specialisation).

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