

Peronospora hariatii on *Buddleja* in the Czech Republic

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Abstract

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A downy mildew was observed on *Buddleja* × *weyeriana* Weyer ex Rehd. (*B. davidii* × *globosa*) cv. Sungold in a nursery in the northern part of the Czech Republic in July 2008. This downy mildew disease of *Buddleja* (Butterfly Bush) had been unknown in the country so far. Characteristics of visual symptoms and microscopic features are described. The morphology of the fungus was typical for *Peronospora hariatii*, conforming to the published description by GÄUMANN (1919). The sexual stage was not found. This is the first report of *Peronospora hariatii* causing leaf spot disease on *Buddleja* in the Czech Republic.

Keywords: downy mildew; *Peronospora hariatii*; Butterfly Bush; *Buddleja*

Most species of the genus *Buddleja* L. (Butterfly Bush) are evergreen, sometimes deciduous, shrubs, rarely trees, semi-shrubs or herbs, which grow particularly in the tropical regions of South America and South Africa. Only a few species occur in East Asia and North America (KOBÍŽEK 2000). Ornamental species of the genus *Buddleja* grown in the Czech Republic are exclusively shrubs (HIEKE 1994). *Buddleja davidii* Franch. was imported to Europe from China in 1890 as an ornamental plant and planted in the south of Britain; from there it spread all over Great Britain and Ireland (PRESTON *et al.* 2002).

Downy mildews are obligate biotrophic parasites and are the causal agents of diseases not only in commercially important crops, but in ornamental plants as well. *Peronospora hariatii* is not a frequently occurring downy mildew and its pathogenicity and distribution has not been studied in detail. The downy mildew was dis-

covered on leaves of *Buddleja globosa* J. Hope as early as 1913 in France, and Hariot identified it as *Peronospora sordida* Berk. et Br. After several years, GÄUMANN (1919) revised this collection and described the downy mildew as a new species (FRANCIS 1983); the type specimen is deposited in the PC herbarium (CONSTANTINESCU 1991). Since then the fungus has not been mentioned until the 1970's and 1980's (FRANCIS & WATERHOUSE 1988). KOCHMAN and MAJEWSKI (1970) detected this downy mildew in Poland, but did not give the locality. In 1981 it was detected in England on very young seedlings of ornamental shrubs of *B. globosa* and *B. davidii* (FRANCIS 1983). In accordance with earlier reports on the occurrence of the downy mildew on seedlings of *Buddleja* sp. (HALL 1989) presents PREECE (2002) first report on the downy mildew on naturalised plants of *B. davidii*, and since then every year at various places, both on commercially grown *B. davidii* seedlings

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as well as naturalised plants. The downy mildew was also reported in the USA (South Carolina) (www.prevalentfungi.org).

Past development of the incidence of *P. hariatii* is reminiscent of the incidence of *P. grisea* (Unger) Unger on species of the genus *Hebe* where the inoculum originates from closely related wild species rather than being introduced with the host. *Peronospora hariatii* has been found on several species and cultivars of the genus *Buddleja*, indicating a low resistance of the host; in the future this pathogen can be expected to spread and its importance to increase (HALL 1989). SHATTOCK *et al.* (2006) explored whether *P. hariatii* could be an “exotic” form of *P. sordida*. The differences in ITS sequences could be a reflection of mutations accumulated in two geographically isolated populations of the individual species which were newly integrated via international horticultural trade. *Buddleja* and *Hebe* are introduced “exotic plants” which could have been infected with identical or two very closely related downy mildews from native host plants. The case of *B. davidii* and the downy mildew *P. hariatii* have connection with the undesirable spreading of the host in the lowlands of Britain. The objective of the present study was to identify and describe the pathogen on *Buddleja* × *weyeriana* in the Czech Republic and to offer potential options for protection.

MATERIAL AND METHODS

Seedlings of the ornamental *Buddleja* × *weyeriana* cv. Sungold with symptoms of leaf spot appeared had originally been imported from Holland. Parasitic *Peronospora hariatii* Gäum. was



Figure 1. *Buddleja* × *weyeriana* cv. Sungold

recorded from a sample of seedlings sent in July 2008 in order to identify the causal agent of the disease. The downy mildew was taken from the lower side of leaf blades which had yellowish spots and was examined microscopically (200–500× magnification) in lactophenol and lactic acid (3%). No oospores of the downy mildew were detected in samples of the infected tissues of living (in lactophenol, magnification 200× and 400×) or dry leaves (magnification 200×).

RESULTS AND DISCUSSION

While macroscopic symptoms of the downy mildew, i.e. yellow to brown, angular spots on the leaves, were visible, sporulation of the downy mildew was very poor and appeared on the underside of the leaves that are covered with a thick layer of star-shaped trichomes, and can therefore hardly be seen under a microscope. The pathogen was identified on 18 July 2008 from a sample of *Buddleja* × *weyeriana* Weyer ex Rehd. (*B. davidii* × *globosa*) cv. Sungold which came from the greenhouse of the nursery of ornamental tree species in Silesia (district Opava); the infected leaves have been deposited in the herbarium J. Müller. On the basis of the morphology of the downy mildew, which is in accordance with the original description of GÄUMANN (1919), the pathogen was classified as the downy mildew *Peronospora hariatii* Gäum. – Bull. Soc. Neuchâtel. Sci. Nat., 43: 302–303 (1919).

Description of the pathogen isolated from a sample of *Buddleja* × *weyeriana* cv. Sungold: the upper surface of the leaf has yellow-green, later brown-green, mostly angular spots, surrounded

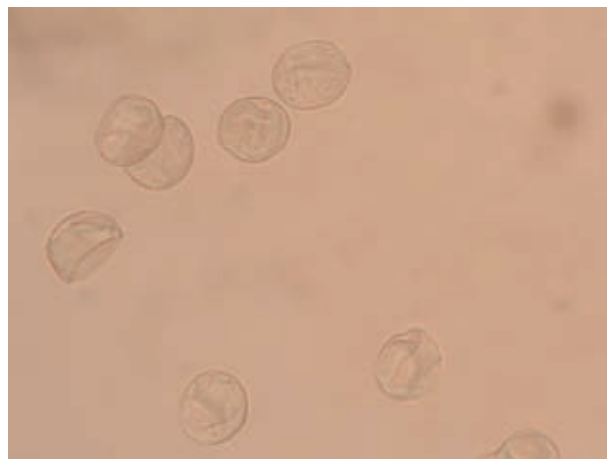


Figure 2. Light brown mildew on the underside of the leaves

Figure 3. Conidiophore of *P. hariatii*

by leaf veins (Figure 1). At the places of the spots, the underside of the leaves shows a very fine, thin, flaky, light brown downy mildew growth, virtually invisible on the sample (Figure 2). Conidiophores are 296–375 μm long and about 6 μm thick, the unbranched part is of about 1/2–3/4 of the total length, 5x dichotomously branched, branches bent, with beak-like bending of the end twigs, the lower twig frequently with strong short downward bending, as long as 30 μm and 3 μm thick at the base, tapering towards the tip, at right angle (Figure 3). Conidia are broadly ellipsoid to almost globose, sometimes with remains of the stalk at the base, brownish, 21–30 \times 19–24 μm (Figure 4). Oogonia and oospores were not detected.

The taxonomic classification of the genus *Buddleja* is still unclear. The genus has been successively classified within three families: *Scrophulariaceae*, *Loganiaceae* and recently *Buddlejaceae* (LEEUWENBERG 1979). Present studies of the gene sequences of chloroplasts and the chemical composition indicate a close relationship between the genus *Buddleja* and species of the genus *Scrophularia* (figwort). Both genera are infected by the closely related or con-specific *Peronospora hariatii* and *P. sordida*. RODRIGUES (2003) assumed that the phylogenies of the hosts and pathogens are corresponding. Feeding habits of certain species of insects and beetles indicate an affinity between the

Figure 4. Conidia of *P. hariatii*

genus *Buddleja* and the family *Scrophulariaceae* (WILLIS 1973). In his reports on the incidence of the downy mildew on cultivated and naturalised species of the genus *Buddleja*, PREECE (2002) confirmed the assumption of HALL (1989) that the distribution and importance of the downy mildew should increase. On the basis of own investigations and with regard to the first recorded incidence of *P. hariatii* on young imported seedlings of the ornamental *Buddleja* \times *weyeriana* cv. Sungold in the Czech Republic, we can assume that the pathogen has not yet spread to its potential geographic range, and for the time being it is not necessary to consider suitable methods of control. It is necessary, however, to devote more attention to young *Buddleja* \times *weyeriana* cv. Sungold seedlings, particularly those imported from countries where the downy mildew has been reported and established. Due to inadequate information about the biology of the pathogen, its mode of distribution and survival and very often unsuccessful artificial infections, it is uncertain whether the application of fungicides registered against downy mildew diseases on ornamental plants will bring the intended effect. These aspects should, therefore, be investigated in detail. If this downy mildew spreads to adult plants, treatment has to take place at a time other than flowering due to the great attractiveness of the flowers for insects (TANNER 1999).

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