

# POWDERY MILDEWS AS INVASIVE PLANT PATHOGENS: NEW EPIDEMICS CAUSED BY TWO NORTH AMERICAN SPECIES IN EUROPE

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Some species of the Erysiphales have long been known to cause biological invasions. The introduction and spread of the North American grape powdery mildew pathogen, *Erysiphe necator* (syn. *Uncinula necator*) in Europe in the 19<sup>th</sup> century (Bulit & Lafon 1978) is a good example for invasions caused by powdery mildew fungi. *Podosphaera mors-uvae* (syn. *Sphaerotheca mors-uvae*) has invaded Europe and Asia from North America in a similar way at the beginning of the 20<sup>th</sup> century where it caused a serious plant disease called ‘American gooseberry mildew’ (Weltzien 1978).

The histories of two recent severe European powdery mildew epidemics seem to be similar to that of the grape powdery mildew disease in the 19<sup>th</sup> century. In both cases, species known from North America only, namely *E. flexuosa* (syn. *U. flexuosa*) infecting horse chestnut (*Aesculus* spp.) and *E. elevata* (syn. *Microsphaera elevata*) infecting Indian beam (*Catalpa bignonioides*) trees, appeared in Europe and spread rapidly from one country to another causing serious epidemics (Ale-Agha *et al.* 2000, 2004). These disease outbreaks were, most probably, the results of new biological invasions because there are no previous records of these powdery mildew species on horse chestnut and Indian beam trees in Europe. However, their invasive nature has not been highlighted so far (Kiss 2005).

After being detected for the first time in Germany (Ale-Agha *et al.* 2000), the epidemic spread of *E. flexuosa* was reported from Switzerland (Bolay 2000), England (Ing & Spooner 2002) and other European countries (Zimmermannova-Pastircakova *et al.* 2002, Kiss *et al.* 2004). Apparently, the introduction of *E. elevata* to Europe has happened even more recently, as the pathogen was first reported to cause severe epidemics on *Catalpa* trees in 2002 in Hungary (Vajna *et al.* 2004), and, at the same time, similar epidemics have also been observed in many other European countries (Ale-Agha *et al.* 2004, Cook *et al.* 2004). Both powdery mildew species are generally considered to come from North America as their occurrence is well documented there (Braun 1987, Farr *et al.* 1989). However, the Balkanian origin of *E. flexuosa* has also been suggested (Ing & Spooner 2002) and the origin of *E. elevata* might also require further studies.

Recently, some other powdery mildew species previously not recorded in Europe have also appeared in some European countries. For example, *M. azaleae* (syn. *E. azaleae*), known to infect *Rhododendron* spp. in North America, was detected on rhododendrons in Germany (Inman *et al.* 2000); *U. kusanoi* (syn. *E. kusanoi*), an Asian pathogen of *Celtis* trees, was identified on *C. australis* in Serbia (Rankovic 2000); and *M. symphoricarpi* (syn. *E. symphoricarpi*), known only from North America until the 1990s, is now present on snowberry (*Symphoricarpos albus*) bushes in some European countries (Kiss *et al.* 2002, Szentiványi *et al.* 2004). However, none of these three recently emerged powdery mildew pathogens have spread rapidly from one European country to another, and none of them have caused any severe epidemics in their new environments. Consequently, in contrast to *E. flexuosa* and *E. elevata*, they cannot be considered as invasive species.

Powdery mildews are ubiquitous plant pathogens as the symptoms they cause are obvious on leaves and other aerial parts of their host plants. Thus, their occurrence and spread can easily be monitored. This should make the invasive species of the *Erysiphaceae* ideal targets for future studies of biological invasions.

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