

Infestation of Polish agricultural soils by *Plasmodiophora brassicae* along the Polish-Ukrainian border

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Received: March 26, 2014

Accepted: July 18, 2014

Abstract: There has been a rapid, worldwide increase in oilseed rape production that has resulted in enormous intensification of oilseed rape cultivation, leading to tight rotations. This in turn, has caused an accumulation of pests as well as foliar and soil-borne diseases. Recently, clubroot has become one of the biggest concerns of oilseed rape growers. Clubroot is caused by the soil-borne protist *Plasmodiophora brassicae* Woronin. The pathogen may be present in groundwater, lakes, and irrigation water used in sprinkling systems. It can be easily transmitted from one field to another not only by water, but also by soil particles and dust transmitted by wind and on machinery. The aim of our overall study was to check for *P. brassicae* infestation of Polish agricultural soils. This paper presents the 2012 results of a study performed along the Polish-Ukrainian border in two provinces: Lublin (Lubelskie Voivodeship) and the Carpathian Foothills (Podkarpackie Voivodeship), in south-east Poland. Monitoring was done in 11 counties, including nine rural and two municipal ones. In total, 40 samples were collected, out of which 36 were collected from fields located in rural areas and four from municipal areas, with two per municipal region. Each sample was collected at 8–10 sites per field, using a soil auger. The biotest to detect the presence of *P. brassicae* was done under greenhouse conditions using seedlings of the susceptible Brassicas: *B. rapa* ssp. *pekinensis* and the Polish variety of oilseed rape *B. napus* cv. Monolit. Susceptible plants grown in heavily infested soils produced galls on their roots. A county was regarded as free from the pathogen, if none of the bait plants became infected. The pathogen was found in three out of 40 fields monitored (7.5%) in the Carpathian Foothill region. The fields were located in two rural counties. The pathogen was not found in Lublin province, and was also not detected in any of the municipal counties. The detection with a biotest was fully confirmed by PCR-based molecular detection of *P. brassicae* DNA in soil samples.

Key words: clubroot, oilseed rape, *Plasmodiophora brassicae*, resting spores, soil infestation

Introduction

Clubroot, caused by the protozoan *Plasmodiophora brassicae* Woronin, is a damaging and commonly occurring pathogen of cruciferous plants in Europe and North America (Agrios 1988; Diederichsen *et al.* 2009; Strelkov and Hwang 2014). The pathogen includes many pathotypes, differing in virulence on different hosts (Lüders *et al.* 2011). For the last few years, the pathogen has posed a serious challenge to growers of oilseed rape in Poland (Korbas *et al.* 2009). The disease was reported by farmers from various regions of the country. According to recent reports the pathogen is present in more than one-third of the area under cultivation of oilseed rape. The further expansion of the pathogen is still being observed (Konieczny 2012).

Resting spores of *P. brassicae* can survive in soil for 20 years or more and maintain infectivity (Dixon 2009a). It was also demonstrated that resting spores can be present in pond water sediment (Datnoff *et al.* 1984). The disease can spread at an extremely high rate. It was found, that after three years from the onset of disease symptoms

on a small number of plants, the pathogen can infest the whole field in favorable conditions. This situation appears when no crop rotation is used, which may happen in regions with intensive cultivation of oilseed rape. Research carried out in the north and north-east of Germany and in some parts of France, England, and Scandinavia showed that the presence of *P. brassicae* on fields of this crop is associated with plant cultivation intensity (Rimmer *et al.* 2007). In Alberta, Canada, spring oilseed rape fields, referred to as canola, showed similar situations with many fields of no more than a one-year break between the cultivation of canola (Gossen *et al.* 2013).

Research on clubroot in Poland mostly concentrated on vegetable Brassicas, where clubroot has caused considerable problems (Robak 1991). The first studies on winter oilseed rape were performed by Kurowski *et al.* (2008), who demonstrated the usefulness of fluazinam in decreasing the severity of disease symptoms, similarly to the activity of this compound in vegetable Brassicas (Robak 2001). The studies of Korbas *et al.* (2009) covered West Pomerania, Pomerania, Varmia and Mazuria, as well as

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