Macroscopic and molecular identification of the pathogens and dynamics of changes in ascospore concentrations of the fungi *Leptosphaeria maculans* (Desm.) Ces et de Not. and *L. biglobosa* Shoemaker and Brun sp. nov. as diagnostic criteria in the protection of winter oilseed rape against phoma stem canker

ABSTRACT

Winter oilseed rape (*Brassica napus* L. forma *biennis*) is a valuable cultivated plant in Poland, second in importance after the group of cereals. This crop is a source of native vegetable oil and high-energy animal feed. Rapeseed products are also used for technical purposes, and straw is a precious lignocellulosic additive to construction materials and composites, increasing their biodegradability and significantly changing their technical properties. High prices of oilseed rape in the world markets contribute to the popularity of this crop and bring a significant income for many farms. The frequent cultivation of rapeseed in many regions of the country means that fields are located in close proximity, which is conducive to unfavorable processes, such as the transfer of pathogens between individual crops. One of the diseases easily spread between rapeseed fields is stem canker (blackleg) caused by the fungi *Plenodomus lingam* (syn. *Leptosphaeria maculans*) and *P. biglobosus* (*L. biglobosa*). These fungi move between and within the fields as ascospores and within the fields also with conidia (pycnidiospores). The research hypothesis in these studies assumed high effectiveness and optimization of plant protection against stem canker based on knowledge about the presence and concentration of fungal inoculum. The concentration of ascospores in the air was measured using Hirst-type traps in three locations placed in the regions of intensive rapeseed cultivation in Poland (Radostowo, Pomerania; Krościna Mała, Lower Silesia; Sośnicowice, Upper Silesia). Determination of the ascospores of these pathogens was carried out using the microscopic method and/or molecular methods: Loop-mediated isothermal DNA amplification, LAMP (research conducted by the author) and Real Time PCR (performed by other team members). It was shown that both methods gave complementary results, so each of them can be used to fulfill the chosen goal. The study also assessed the severity of disease symptoms at different stages of plant development in 28 rapeseed varieties from five breeding companies and demonstrated the usefulness of the *Rlm7* resistance gene in reducing the symptoms and impact of the disease. In autumn and before harvest, the populations of both pathogen species significantly differed in favor of *L. maculans* on leaves in autumn and *L. biglobosa* on oilseed rape stems at harvest. Fungicide protection based on the ascospore concentration, i.e. fungicide treatments performed 4-10 days after the period of ascospore concentration above 10 spores per 1 m^3 of air contributed to increased yield and changed seed composition by increased amount of indole- and decreased amount of alkenyl- glucosinolates. Meteorological conditions were the particularly important elements affecting the occurrence of strong disease symptoms and the effectiveness of fungicide protection applied in autumn in the rosette stage of 5-6 leaves. Chemical treatments with azole-based fungicides were effective when disease symptoms were strong, which followed a warm and humid autumn, when the sum of average weekly temperatures measured in the BBCH14-BBCH19 stages exceeded 60^{o}C and rainfall in this period was higher than 110 mm. The results of the study confirmed that the knowledge of the dynamics of changes in the concentration of ascospores of the fungi causing stem canker is useful in combating this disease and contributes to the increase of winter oilseed rape seed yield and some parameters of its quality.