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Course of colonization and potential for seed transmission of *Verticillium longisporum* in winter and spring type oilseed rape (*Brassica napus* L.) under field conditions and the role of soil temperature

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Oilseed rape (OSR, *Brassica napus*), an important source of vegetable plant oil, is threatened by *Verticillium longisporum* (VL), a soil-borne vascular fungal pathogen so far occurring in OSR growing regions in Europe and Canada. Since infection with VL remains symptomless for an extended period of time, the course of systemic colonization in roots, stem bases and stems of field-grown OSR with VL was followed by real-time PCR in field experiments with microsclerotia inoculated plots and either spring type or autumn sown (winter type) OSR. A strikingly discontinuous colonization pattern with low fungal growth during juvenile growth stages was observed in field-grown winter OSR. The lack of stem invasion by VL during juvenile stages and the extended latency period of the pathogen in the field were related to soil temperature. Climate chambers experiments indicated a threshold soil temperature of $>12^{\circ}\text{C}$ to enable root infection with VL. In Germany, soil temperature reaches this threshold only in early autumn and from end of April resulting in a period of 6 months in WOSR and of just one month in SOSR required by the pathogen to spread into the shoot. A significant positive correlation of root infection with average soil temperatures 7 days before sampling was verified. To study the potential of VL dissemination by seeds, a series of greenhouse experiments with VL resistant and susceptible cultivars of winter and spring types of OSR were conducted. Greenhouse inoculation studies with a DsRed labeled isolate of VL confirmed the systemic growth of the pathogen from roots to seeds. Frequency of recovery of viable VL colonies from seeds harvested from greenhouse-grown inoculated plants ranged from 0.08 to 13.3%. Only 1.7 to 2.3% of offspring plants showed disease symptoms as confirmed by the formation of microsclerotia in the stems. However, seed transmission of VL from field harvested seeds was only detected in spring type but not in winter type OSR. The results suggest that the rate of seed transmission of VL depends on the time course of plant colonization which is significantly faster under greenhouse than field conditions and in a spring-sown compared to autumn-sown OSR crop.

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