



Molecular Communication in Plant Pathogen Interactions

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The ability of microbial pathogens to colonize their host plants is the result of chemical communication processes, which are based on a multitude of molecular interactions both during the course of evolution and the specific host-pathogen interactions. Plants learnt to recognize pathogens through structural patterns at different levels of specificity and to initiate defense mechanisms. Pathogens adapted by evolving mechanisms to escape recognition and to manipulate the physiology of the plants. Our work focuses on a leaf spot disease of barley and other sweet grasses (*Poaceae*), which is caused by fungi of the genus *Rhynchosporium*. In particular the damage to barley is economically relevant, where regional yield losses of more than 50% have been reported. In 2015, average yield losses of c. 5% in the major growing areas led to an estimated loss in earnings of about 460 Mio. €.

The *Rhynchosporium* leaf spot disease

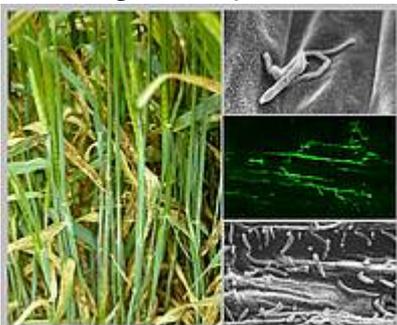


Fig. 1. Natural infection of barley plants with *R. commune* (left); germinating spores (top right) and sporulation (bottom right) on the surface of a barley leaf; subcuticular mycelium of a fluorescence-labeled mutant of *R. commune* (mid right). (Click to enlarge.)

The genus *Rhynchosporium* comprises five host-specific species. *R. commune* mainly infects common barley (*Hordeum vulgare*) and other *Hordeum* species, whereas *R. secalis* colonizes the cereals rye (*Secale cereale*) and triticale (*x Triticosecale*) and *R. agropyri* grows on different couch grasses (*Agropyron* spp.). These three evolutionary young *Rhynchosporium* species presumably originate from the host jump of a common ancestor in Northern Europe. They form one of the two branches (BCG) of the *Rhynchosporium* phylogeny. The other branch (CCG) includes *R. orthosporum* und *R. lolii*, which are pathogenic to orchard grass (*Dactylis glomerata*) and perennial ryegrass (*Lolium perenne*), respectively. Best studied is the barley pathogen *R. commune*. This fungus grows extracellularly in leaves of its host plant between cuticle and outer walls of the epidermis cells. The typical disease symptoms occur after a long symptomless developmental period that can last for several months in the field. Due to this mode of life the fungus is classified as hemibiotroph.

Research Goals

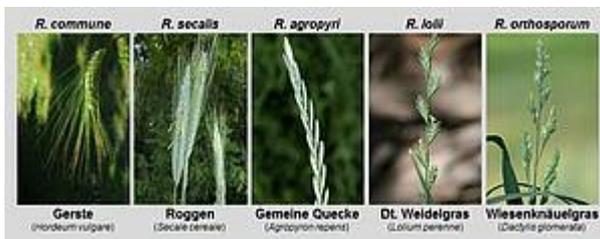


Abb. 2. Major host plants of the *Rhynchosporium* species. (Click to enlarge.)

Based on the close relationship in particular of the BCG species the goal of our work is to unravel the mechanisms, which enable the adaptation of the individual fungi to their host species. In this context the role of possible sexual reproduction in generating biological variability is taken into account as well as the importance of cell wall-degrading enzymes and secondary metabolites for the virulence of the single fungal species. Most important starting point, however, is the identification of species-specifically occurring effector proteins, which are secreted during penetration and colonization of the host plant to optimize the fungal living conditions.