

ECOLOGY AND PATHOLOGY OF *CERATOCYSTIS* SPECIES ASSOCIATED WITH CONIFER-INFESTING BARK BEETLES

Thomas Kirisits¹, Mauricio Marin^{2,3}, Michael J. Wingfield⁴, Paal Krokene⁵ and Halvor Solheim⁵

¹ Institute for Forest Entomology, Forest Pathology and Forest Protection (IFFF), Department of Forest and Soil Sciences, BOKU – University of Natural Resources and Applied Life Sciences, Vienna, Austria. ² Department of Microbiology and Plant Pathology, Forestry and Agricultural Biotechnology Institute (FABI), University of Pretoria, Pretoria, South Africa. ³ Department of Biosciences, Faculty of Sciences, National University of Colombia, Medellín, Colombia. ⁴ DST/NRF Centre for Tree Health Biotechnology, Forestry and Agricultural Biotechnology Institute (FABI), University of Pretoria, Pretoria, South Africa. ⁵ Norwegian Forest and Landscape Institute, Ås, Norway.

thomas.kirisits@boku.ac.at

Nine *Ceratocystis* species are known from conifers within the genera *Picea*, *Pinus*, *Larix* and *Pseudotsuga*. They cause vascular stain diseases and sap-stain on their host trees. Five of the nine *Ceratocystis* species on conifers are associated with aggressive bark beetles (*Coleoptera*: *Curculionidae*, *Scolytinae*) in the genera *Ips* and *Dendroctonus* in the Northern hemisphere. Four of these species, including *C. polonica*, *C. laricicola*, *C. fujiensis* and *C. rufipenni* are closely related to each other and belong to the *Ceratocystis coerulescens* complex. They are relatively virulent pathogens that cause necrotic lesions in the phloem and desiccation and blue-stain in the sapwood of their hosts. Within the *C. coerulescens* complex, three species, *C. polonica*, *C. laricicola* and *C. fujiensis* form the *C. polonica* complex. These taxa are morphologically identical, but can be separated based on molecular markers and phenotypic characteristics. They also differ in ecology and geographic distribution and partly show host specialization. *Ceratocystis polonica* occurs on various spruce species (*Picea* spp.) and is associated with *Ips typographus* and other *Ips* species in Europe and Japan. *Ceratocystis laricicola* is vectored by *I. cembrae* that infests larch (*Larix* species) in Europe and parts of Asia. The third species in this complex, *C. fujiensis*, is associated with *I. subelongatus* on Japanese larch (*Larix kaempferi*) in Japan. *Ceratocystis rufipenni* occurs in Western North America, where it is vectored by *Dendroctonus rufipennis* on *Picea* species. Finally, *C. bhutanensis* was isolated from individuals of *I. schmutzenhoferi* on *Picea spinulosa* in Bhutan. This species is only distantly related to taxa in the *C. coerulescens* complex, but groups phylogenetically with species in the *C. moniliformis* complex on hardwoods. Recent recognition of cryptic species in the genus *Ceratocystis* has also made it possible to gain further insights in the pathology and ecology of these fungi, specifically those that are associated with conifer-infesting bark beetles.