

DIVERSITY AND VIRULENCE OF *FUSICOCUM QUERCUS* OUDEM., THE CAUSE OF A BARK DIEBACK IN OAKS

Zaspel, I. and Stauber, T.

Federal Research Centre for Forestry and Forest Products
Institute for Forest Genetics and Forest Tree Breeding
D-15377 Waldsieversdorf, Eberswalder Chaussee 3, Germany

Introduction

The anamorphic fungus *Fusicoccum quercus* Oudem. (form-genus *Coelomyces*, *Deuteromycotina*) is frequently distributed in cultures of sessile, pedunculate, and red oak and causes bark necrosis on young plants as well as twig dieback on adult trees in forest stands. The incidence of *F. quercus* is supported by sandy soils with low water capacity and drought periods especially in spring. The description of the morphology and the epidemiology of the pathogen is given by Butin 1981.

Stronger damage was observed subsequent to the afforestation of former arable areas with pure cultures of oak and broadleaf mixtures with an oak species in the north-east of Germany. In the case of severe extend of damage the whole culture was dying-off in the course of two years and was renewed by another tree species. With milder disease incidence a dieback of the terminal shoot could be observed immediately followed by a bushy growth habit of the plants.

In this work a collection of fungal strains originating from three oak host species with different age were compared regarding their diversity *in vitro* and their virulence causing necrosis on oak plantlets.

Material and methods

- **Fungal material:** The identification of *F. quercus* isolates was based on their conidial state of pycnidia of bark necrosis. From such identified lesions single-spore isolates were used for further investigations.

A collection of 40 well growing *Fusicoccum* strains isolated from three oak species has been selected for characterization *in vitro* and for study of their virulence (*Q. robur*: 30, *Q. petraea*: 7, *Q. rubra*: 3 strains). The relation of selected strains corresponded to the frequency distribution founded at oak species in nature. The strains 37 and 38 derived from twigs of adult trees, all the others from young cultures.

The strains were cultivated on 2% MEA and assessed regarding their colony growth, appearance *in vitro* and production of macroconidia. Furthermore the exoenzyme activities of the decomposition of lignin (polyphenoloxidase) and cellulose (β - 1,3 glucosidase) were determined on tannin acid agar (0.5%) and arbutin agar (0.5%).

For detection of vegetative compatibility groups all strains were paired with each strain.

- **Plant material:** Rooted clone plants of two pedunculate oak clones (585/7-5/2, 593/25-31) in Jiffy pots were infested with 100 μ l conidial suspension on two leave axis with 4 replications. The concentration was 120 - 150 conidia per infection court. At the time of inoculation the plants were 4 - 5cm in height and had 4 - 6 leaves. They were growing at a temperature regime of 22 - 24°C with a 16 hour photoperiod in white light conditions with a quantum of 35 - 40 μ E cm⁻² s⁻¹. After 12 weeks the plantlets were assessed regarding symptoms on shoots and leaves. A score from 0 - 4 was used which described the plants without symptoms (0), with single small spots on leaves (1), large spots and reduced growth (2), complete brown leaves with brown upper part of the shoot (3) and dead plants (4).

- **Explorative statistics:** The observed variables were analysed by principal component analysis and correspondence analysis with procedures contained in SAS.

Results and discussion

- **Incidence and damage:** The highest losses by the oak damaging bark fungus were assigned with 2–5-year-old plants. From older plants the fungus was isolated occasionally only. *Q. robur* was damaged by infestation with *F. quercus* most of all. That means that this tree species is stressed by water deficit on pure sites more than the other *Quercus* species. This result showed the importance of choice of species and provenance for the establishment of oak cultures.

- **Culture:** The fungal isolates showed large diversity in culture. This was indicated by the mycel color, growth rate, and macroconidia production. Furthermore the studies *in vitro* showed different activities of production of exoenzymes like polyphenoloxidase and β -1,3 glucosidase.

All incompatibility pairings between the different isolates of *F. quercus* resulted in demarcation zones. No vegetative compatibility groups were therefore detected.

The structure of interrelations of data was studied by principal component analysis and showed an association between the mycel color and frequency of macroconidia.

- **Virulence of pathogens:** The virulence of the isolates tested at two sessile oak clone plants differed considerably. After a lag period of 30–35 days the first spots slowly appeared on shoots and leaves. With severe incidence of the disease the plants died after 6 weeks and pycnidia were produced on the dead tissue. The sample means of virulence of each strain ranged from „non virulent“ to „high virulent“. Both oak clones had been infested in the same way.

A host specificity of the fungal strains was not detected. Pathogenic isolates from other oak species like *Q. petraea* or *Q. rubra* showed similar damage as the strains isolated from *Q. robur*.

An increased influence of one trait on the sum of variance was not detected with help of factorial analysis because of low correlations between the relevant traits. Therefore the selection of avirulent strains from this limited fungal population basing on results of virulence tests and their culture characters is uncertain. A trend was observed that fungal strains showing pale-coloured and flat-immersed mycel, no macroconidia production, and partial restricted growth caused lower damage in plants.

Summary

The investigated clone collection of *F. quercus* strains revealed a large heterogeneity. Associations between the traits of fungal isolates acting *in vitro* and their virulence on plants require the distinct extension of population. The choice of appropriate oak species and provenances in favour to the afforestation of arable areas is an important precondition for the establishment of oak cultures aimed at sufficient growth performance and habit in future.

Literature

Butin, H.: Über den Rindenbranderreger *Fusicoccum quercus* Oudem. und andere Rindenpilze der Eiche. Eur. J.For. Path. 11 (1981) 33-44