

## Survey on *Heterobasidion* species and perspectives of butt rot control in Germany

B. Metzler<sup>1</sup>, G. Langer<sup>2</sup>, P. Heydeck<sup>3</sup>, F. Peters<sup>1</sup>, J. Scham<sup>4</sup>, A. Renfer<sup>1</sup>, E. Langer<sup>5</sup>

<sup>1</sup>Forestry Research Institute of Baden-Wuerttemberg (FVA), Wonnhaldestr. 4, D- 79100, Freiburg/Br, Germany.

<sup>2</sup>Forestry Research Institute of North-West Germany (NW-FVA), Grätzelstraße 2, D-D-37079, Göttingen, Germany.

<sup>3</sup>Eberswalde Forestry Competence Center (LFE), Eberswalde, Germany.

<sup>4</sup>Forest Administrative District Sigmaringe, Germany.

<sup>5</sup>University of Kassel, D-34132 Kassel, Germany.

Corresponding author e-mail address: [berthold.metzler@forst.bwl.de](mailto:berthold.metzler@forst.bwl.de)

**Abstract.** In southern Germany the most important forest tree species economically is Norway spruce (*Picea abies*). Its value is influenced significantly by attacks of *Heterobasidion parviporum*. In contrast, Scots pine (*Pinus sylvestris*) is the prevailing conifer in north and northeastern Germany, which is attacked by *H. annosum* s. str., especially after thinnings in afforestations on former arable land and on lignite mine sites. This pathogenic species affects also in some cases underplantings of Douglas fir (*Pseudotsuga menziesii*) in pine stands. Silver fir (*Abies alba*), however, is known to be void of butt rot problems within its natural distribution in southern Germany. However, *H. abietinum* could be detected here for the first time. *Heterobasidion*-strains isolated from coniferous forests in Germany are characterized by means of PCR methods in order to verify the distribution of the respective species. In order to reduce economic losses due to butt rot in susceptible forest stands, conidial suspensions of *Phlebiopsis gigantea* have increasingly been used for stump treatment in mechanized wood harvesting since 2002. Urea may rather be used as an alternative in small scale forestry during motor manual thinnings. Efficacy and consequences are discussed.

### Introduction

The 2<sup>nd</sup> National Forest Inventory ( [www.bundeswaldinventur.de](http://www.bundeswaldinventur.de) ) shows that 57.6% (i.e. more than 6 Mio ha) of the German forest area are covered by coniferous forests which can potentially be affected by *Heterobasidion* root and butt rot. Regarding the latter, this paper concentrates on four topics with relevant problems a) the southwestern Norway spruce forests b) the northern and north eastern Scots Pine forests c) threat of Douglas fir butt rot after pine d) *H. abietinum* in the regional context of the south-western silver fir forests.

More than 50 *Heterobasidion* strains from the above mentioned regions were identified to species level by molecular methods. Polymorphism of the ribosomal IGS1 region (Kasuga and Mitchelson, 2000) was used to differentiate *H. annosum* from both *H. parviporum* and *H. abietinum*. In some cases sequences of other portions of DNA regions were used. *H. abietinum* was distinguished by differences in the sequence of the elongation factor 1- $\alpha$  (Johannesson and Stenlid, 2003) as published in NCBI.

### **Southwestern Norway Spruce forests**

Besides some incidental occurrence of *Armillaria ostoyae*, butt rot problems arise mainly from *H. parviporum* and nearly all strains of this species are isolated from living Norway spruce.

Severe damage is concentrated in stands of former arable land on calcareous soil. For example annual economical losses caused by butt rot in Norway spruce aspects were calculated for the county of Sigmaringen/Swabian Alb at approx. 1.2 Mio. € (44 €/ha). In a stump treatment experiment with the antagonist *Phlebiopsis gigantea* (as product ROTSTOP) comprising 5 pairs of plots including 182 stumps 80% reduction of infected stumps was recorded after 6 to 12 months (Metzler *et al.*, 2005). A similar ratio of benefit had been recorded in the remaining stand 12 years after experimental stump treatment with a chemical and by the examination of 350 trees (Metzler and Kublin, 2003). Better efficacy was found in stump treatment trials with urea, which can easily be used by small scale forest owners. Generally it is assumed that losses caused by butt rot can be reduced by 50% when applying meaningful stump treatment. Costs and benefit ratio is expected to be 1/3.5.

### **The northern and north eastern Scots pine forests**

Scots pine (*Pinus sylvestris*) is the prevailing conifer in northern and northeastern Germany, which is also the main distribution area of *H. annosum* s.str. Recent estimations in Lower Saxony show more than 100,000 ha of infested forest stands. Afforestations on former arable land and on lignite mine recultivation sites in southern Brandenburg are prone to early mortality due to *H. annosum* s.str. The pH value of such sites is shown to be typically higher than 6.0. A few years after the first thinnings typical but rott mortality gaps appear. Stump treatment experiments with two different strains of *P. gigantea* show a very good establishment of the antagonist (Heydeck *et al.*, 2010).

### **Threat of Douglas fir butt rot after pine**

Although Douglas fir and beech are not very susceptible to root and butt rot, there are some cases where they become lethally infected by *H. annosum* s.s. in underplantings in pine stands. Older Douglas fir trees may be diseased by butt rot on former pine forests. These are emerging problems in Lower Saxony but also in some cases in the sandy soils of the upper Rhine valley in the southwest.

### ***H. abietinum* in the regional context of silver fir forests**

Forest of *A. alba* occurring in the south of Germany are void of butt rot problems. However, this is the first record of *H. abietinum* strains identified by PCR in Germany. It was found a) parasitic causing butt and stem rot in *A. alba* trees of unknown provenance planted outside of the natural distribution area of silver fir b) parasitic in a garden plant of *Chamaecyparis lawsoniana*, c)

saprophytic in timber of *A. alba* and *P. abies* under water storage and d) saprophytic in a rotting stump of *A. Alba*

### Prospect

There is some variety of ecological niches in German forest used/occupied by the three European *Heterobasidion* species. From the economic point of view, the respective most spectacular butt rots are on soil types of high pH-value, esp. in pure stands of Norway spruce on calcareous soil in the south and of Scots pine on sandy soils and on recultivation sites in the north and north-east of Germany. Here stump treatment with antagonistic fungi or with urea seem to be feasible in order to reduce the economical losses. Respective experiments as well as some practical work are on the way.

### References

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