Description and assessment of health condition of the forest stands of Jan Kolowrat properties in the Orlicki mountains

Thomas L.Cech & Hannes Krehan

At an excursion in the forest stands of the Orlicki Mountains, Czech Republic, on 21st and 22nd of August 2000, together with the forest owner Count Jan Kolowrat and D. Ing. Husak, the following symptoms were observed:

Photos: Kolowrat

Young stands and afforestations along the forest roads on the top of the moutains:

- Young trees show abnormal shoot lengths (more than 50 cm in the last 3 years) in spite of the rough climate in that high altitude).
- The colour of the needles of all trees was intensively dark green. Browning or discolouration of the needles was not found in contrast to observations in spring (photo!).

- Most of the spruces also show symptoms of twig dieback affecting lateral branches as well as main shoots (top dying), which is typical for fungal infections.

- Many trees also show snake like distortions of the leader as a consequence of partially successful defences of fungal attacks
- Many branches of the lower part of the trees were broken off .
- No symptoms of insect attacks were observed. Only some lachnid aphids (Cinaria sp.) sucking on the stem were found on a few trees. The black covering (sooty moulds) of some older needles and the bark is a consequence of aphid attack but does not harm the trees.

In the center of the diseased stands some trees are already dead. More than 60 % show symptoms of severe shoot and twig dieback and the rest of the trees primary infection symptoms .

Photos.: Kolowrat

The few remaining older stands in the higher parts of this mountainous area also show good growth of shoots and branches, but sometimes dead branches and adventitious shoot growing could be observed. The fungal attack seems to damage the old trees too.

Obviously there are no differences among the many planted spruces concerning the intensity of the fungal infection. In the lower parts of the forest districts also natural regenerated spruces showed initial fungal attack.

Photos: Kolowrat

The first occurrence of this fungal disease was, according to observations from the owner and D.I.Husak, in 1995 on the highest point of the afforestation area. Meanwhile the infection has spread according to D.I.Husak over more than 1000 ha in the Kolowrat forests, also in the lower altitudes, and symptoms of shoot dieback were observed in other forests of the Orlicki Mountains too.

Results and conclusions

There can be no doubt, that the reason for the damages in both the Norway spruce and Blue spruce stands visited in August, 21tst and 22nd is the *Scleroderris*-canker disease (*Gremmeniella abietina*, asexual stage *Brunchorstia pinea*). Fruiting structures of the asexual stage are abundant on the twigs, quite often they can be found even on partially living shoots. Bark necroses and cankers as commonly described in the literature can be observed in high numbers on the twigs and branches. In both stands where samples were taken, twig and branch dieback is a consequence of infections between 1998 and 2000. Twig dieback from the years before could not be identified, since these twigs are already missing. The ubiquitous abnormalities in branching, especially in the lower parts of the trees are, however, a suitable sign for the previous presence of this fungus. The abnormal vigorous growth of the leader in connection with the reduced ramification and the large cankers in the upper crown parts goes back to the year 1995, which can be clearly seen from the number of callus rings. The reduced lignification of the twigs and the stems is striking: especially the lignification towards the end of the season is sparse. This might be a key for the enormous vigour of the disease, the trees somehow "collapse" under the massive infections.

Major attendance on *Scleroderris* problems with spruce has been drawn by Barklund & Rowe 1981 (Pia Barklund und Janet Rowe 1981, EJFP11, 97-108: Gremmeniella abietina (*Scleroderris* lagerbergii), a primary parasite in a Norway spruce dieback) attributing the phenomenon merely to climatic stress factors. Symptoms described from Swedish spruce stands were quite similar to those seen in Orlicke Mountains:

Dieback phenomena were predominantly confined to upper crown parts with the leader commonly surviving. At the beginning the last year's needles became red and were shed just before bud burst as a result of a bark necrosis at the base of the shoots. Most of these shoots died soon, if they survived, the terminal bud was dead. New shoots developing from nodes under such shoots were abnormal short and numerous. On older stem portions cankers and early stages of cankers were seen with abnormal masses of dormant buds bursting above those cankers.

Barklund and Rowe assume that the epidemic was a result of a combination of drought stress and wrong provenance, since they observed, that diseased trees (diseased as well as not diseased parts) sprout significantly later than healthy spruces: as a consequence of the drought stress late sprouting spruces suffer from reduced lignification. They also observed the abnormal length growth of diseased trees.

Concerning the question of a probable influence of aerial pollution, we must state, that from literature we didn't find any evidence for a direct influence, which might have led to the epidemic.

High amounts of sulphurdioxid do not favour the infection by *Scleroderris*, despite the fact, that the elimination of the surface bacterial flora might reduce the resistance against infection, as indicated by Ranta et al. 1994 and needles containing high loads of copper or nickel are not more attractive to the fungus than needles with low concentrations of these elements (Ranta, H., Neuvonen, S. und T.Virtanen, Effects of sulphuric acid and heavy-metal deposition on frequency of asymptomatic infections of Gremmeniella abietina in Scots pine seedlings, European Journal of Forest Pathology 25, 1994).

The abnormally dark green colour of the needles and the very intensive shoot growth are typical symptoms of high nutrient levels, especially nitrogen.

Nitrogen plays a major role in *Scleroderris* infection biology. As shown by

Ylimartimo et al. 1993, elevated relations between nitrogen and potassium as well as potassium and magnesium reduce the resistance of *Pinus sylvestris* needles against *Scleroderris*-infection and enhance the fungus' growth by changing the proportion of certain

amino-acids (Ylimartimo, Anneli und P.Haansuu, European Journal of Forest Pathology 1993).

There should be three main fields of further investigations on the special problem of *Scleroderris*-canker in Orlicke Mts :
One is the complex of questions concerning the soil chemistry. Our soil ecologists compared the data which we had received to the European standards. From a first raw analysis there is no critical amount of chemicals which could have triggered the outbreak of the *Scleroderris*-infection eo ipso. Even nitrogen is, - from the data -, though at a quite high level, not present in abnormal high concentrations. There is only one fact which could be questionable: the changes of the ph in the humus layer between 1993 and 1999 is extremely unlikely without any massive anthropogenic influence. This is something which cannot be explained by natural circumstances alone. For a closer critical look at the data, however, it would be necessary to get more information about the backgrounds of the analyses:
For instance:
differences between A (1993-1998) and B (1999): number of samples the same? Samples taken from the same places ? Single value leaves: what does (horizon) “02, 07, 08, 11-51” mean? What are the units for the nutrients?
The second question concerns the provenance of the spruces. Provenance trials with material from high altitudes in the stands could yield differences in the sprouting behaviour between those plants and the diseased ones.
The third complex of facts, which always has to be cleared when dealing with *Scleroderris*-problems, concerns the climate. It is evident from numerous investigations, that certain constellations of temperature as well as duration snow cover are able to unleash epidemics of this fungus by themselves. Although we do not believe in the exclusive climatic cause of the actual epidemic, a careful analysis of the climatic situation within the last decade will probably be indispensable.

Photo: Kolowrat

Measurements

As literature shows *Scleroderris* disease is often regulated by climatic influences. In the present infestation in the Orlicki mountains. The intensity of the fungal disease is so high, that a short-term breakdown of the disease can not be expected by natural (climatic) causes.
To avoid intensive further spreading of the disease by the spores of the fungus, it is recommended to cut and (if possible) burn all the heavy infested trees.

The planting of new trees (spruces) should be retarded to avoid new infestation on them. We recommend the use of trees from different mountainous-origins with slow growth rate and good lignification if possible. It is also recommended to plant some larches inside a fence where the site conditions allow growing of larch roots.

A further very important task is to find out the reason for the rather high level of nitrogen according to the presented soil and needle analysis data in comparison to other essential nutrients. The shoot growth of the tree is too high. The trees produce too less compression wood.

First of all fertilisation measurements should be avoided because there is, according to the presented soil and needle analysis, no acute lack of essential nutrients, The nitrogen level is a little bit too high but has not changed dramatically. Perhaps the sulphur / nitrogen relation is not correct for these site conditions.

As the experiences in the past demonstrated, we cannot recommend fungizide control measurements so far. It will be better to try to improve the chemical site conditions in order to reduce the easy spread of Gremmeniella abietina. Therefore soil experts as well as plant physiologists should analyse the present situation in Orlicke Mountains and the surroundings.