

Does management of crown breakage reduce subsequent bark beetle infestation in Norway spruce forests?

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Tree tops broken by snow, ice or storm events may substantially increase the risk for subsequent bark beetle infestation in Norway spruce forests, although at a lower magnitude compared to windthrow. The state of knowledge, however, e.g. regarding risk quantification following crown breakage or the role of crown management, is scarce. This case study examines the risk of infestation by two most relevant bark beetle species (*Ips typographus*, *Pityogenes chalcographus*) at broken crowns, as well as at remaining stumps and unbroken neighboring trees over the course of a season – in each case with and without the timely removal of the crown material. Due to the high beetle densities, a very high risk of infestation of almost 100 % was observed at broken crowns, with clear species-specific diameter preferences. Stumps with a small amount of remaining crown (< 20 %), and stumps with a lower social status (Kraft class 3), showed higher infestation risk. The timely management of broken tree crowns could reduce infestation risk both for stumps and for unbroken neighboring trees. Based on empirical data, this study contributes to answering open questions that are relevant in forestry, and emphasizes the importance of applying management measures when crown breakage in spruce stands had occurred.

Rapid spread of the invasive oak lace bug, *Corythucha arcuata*, in Austria

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Two surveys in September 2020 and 2021 together with individual observations in 2022 demonstrated that *Corythucha arcuata* (Heteroptera: Tingidae) is established in Austria and has been spreading rapidly since the first record in September 2019. The populations in the early invaded areas in the south of the federal provinces Styria and Burgenland increased significantly. Severe damage of the foliage was noticeable on all observed oaks in September 2022 in this region. In Vienna, *C. arcuata* was first recorded in late summer 2021 – almost simultaneously in several parts of the city. Moreover, we found infestations in north eastern Lower Austria (Weinviertel) and central Burgenland. Data from the survey give strong indications for the substantial importance of anthropogenic passive transport with traffic for the long range dispersal of *C. arcuata*. Resulting satellite populations dispersed locally and also infested isolated oaks in mixed forest stands. Invasion into and dispersal in Austria likely took place along several routes. Three years after the first record in late summer 2019, *C. arcuata* has become established in the south of Styria, the whole of Burgenland, north-eastern Lower Austria, and Vienna.

First record of the bark aphid *Cinara splendens* on Douglas fir in Austria

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As part of a master's thesis on the occurrence of honeydew producers on Douglas fir (*Pseudotsuga menziesii*), a lachnid species previously unknown in Austria was found in summer 2022. On the basis of morphological and molecular investigations the juvenile and adult specimens could unequivocally be identified as the conifer aphid *Cinara splendens* (Homoptera: Lachnidae) originating from North America. This originally nearctic species was first collected in southern Bohemia in 2009 from a Douglas fir in a park and has spread slowly within the Czech Republic in the past decade. The reason for this is probably the relatively small number of alate viviparous females within a colony, so that the population densities are not as high as those of other conifer aphids. Thus, hardly any negative effects of *C. splendens* on Douglas firs are to be expected. However, it cannot be ruled out that certain climatic conditions such as a warm spring combined with longer dry periods have a beneficial effect on the aphid's population dynamics. Likewise, the increased planting of Douglas fir as a substitute for Norway spruce could trigger a more rapid spread and colonization of Douglas fir stands by this bark aphid in Austria. This also raises the question of whether the honeydew of *C. splendens* is collected by bees and plays a role in honey production.

Austrian Bio-Indicator Grid enabled method development for mercury determinations in annual growth rings with the quadrant method

Michael Tatzber

In the last two years, a method has been developed at BFW that allows tracing mercury concentrations in annual growth rings of stem disks over periods of up to centuries. These are relative changes that can be compared for different years. Mercury concentrations can vary significantly within an annual ring. Sampling the same annual rings in different directions (divided into quadrants) makes it possible to average these differences. Sampling in the width of the annual rings allows targeted examination of individual years for their mercury concentrations. For method development, the data of the Austrian Bio-Indicator Grid proved to be a very important source about mercury emission, allowing the sourcing of high-quality samples. Since 2020, stem discs from Kürnberg near Linz, Donawitz, Brückl, Brixlegg, Gmunden, Vienna and the lower Lavant valley could be investigated using this methodology. Differences to the list of mercury point sources in Annex D of the Minamata Convention on mercury at the Austrian level, such as primary iron production, could also be identified in the Austrian Bio-Indicator Grid and explained via national circumstances (e.g. Austrian iron ores have a significantly higher mercury content than usual). Therefore, the Austrian Bio-Indicator Grid was able to identify further sites for sampling that were not included in this list of point sources.

Root rot as a consequence of climate and stand limitations of northern red oak

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The northern red oak (*Quercus rubra*) is one of the tree species that are in the focus of silvicultural considerations as a replacement for indigenous species no longer adapted due to climate change. Here we report two cases where northern red oaks were damaged to a threatening extent by the root rot pathogen *Gymnopus fusipes* (spindleshank mushroom) on two sites where the requirements of the tree species were not met. The comparison of climate, soil and increment data shows that the likelihood of infection and the spread of rot are largely controlled by the factors precipitation and certain soil properties. A combination of drought stress, low water storage capacity and high lime content in the deeper soil layers promotes infections by the spindleshank mushroom, to which large parts of the root system fall victim over the course of several years.

The development of ash on the example of three strict forest reserves in Upper Bavaria

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For this study three strict forest reserves in Upper Bavaria "Echinger Lohe", "Fasanerie" and "Neukreut" were observed. The used data consisted of older stand inventories and one new survey conducted in 2020. To determine the status of the ash dieback caused by the fungus *Hymenoscyopus fraxineus* the degree of crown thinning was assessed using the scale described by Lenz et al. (2012a). Indications for an infestation with *Armillaria* spp. and ash bark beetle were also noted. It was shown that all ash stands were noticeably damaged and no ash trees free of ash die back symptoms could be found. However, the reduction in standing volume was over the last five years (three years in the case of "Echinger Lohe") significantly worse in the two drier stands compared to the waterlogged stand. The two dry stands "Echinger Lohe" and "Fasanerie" lost 56 % and 57 % respectively, while the moister stand "Neukreut" only lost 18 % of its standing volume over the last three or five years. *Armillaria gallica* and ash bark beetle could be found on all three sites but were much more frequent at the dry sites than the moist site. *Armillaria gallica* was the only *Armillaria* species that could be identified, which suggests that the observable root rot and rhizomorphs were mostly caused by this species. However, other *Armillaria* species could still be present.

Pine wood nematode surveillance in Austria in 2021

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The pine wood nematode (*Bursaphelenchus xylophilus*) is the causative agent of pine wilt disease, which occurred for the first time for Europe in 1999 on maritime pine (*Pinus pinaster*) in Portugal. Despite various eradication measures carried out, the spread within Portugal and to Spain (mainland), as well as to the island of Madeira could not be prevented. The pine wood nematode is considered an EPPO listed A2 quarantine pest, which uses longhorn beetles of the

genus *Monochamus* as vectors. Due to climatic changes in recent years, there is a real risk of introduction into other European countries, as well as into Austria in *Pinus* stands. Annual sampling in the course of a survey programme of the pine wood nematode aims to prevent an establishment of the economically important pest to Austria. The 2021 nematode survey revealed Austria to be free of *Bursaphelenchus xylophilus* and confirmed the presence of the native non-harmful *Bursaphelenchus* species *B. sextendati* and *B. mucronatus mucronatus*.

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