Chaga/Cinder Conk (*Inonotus obliquus*)

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Hosts:

Birches (*Betula spp*.), occasionally beech (*Fagus spp*.) and hophornbeam (*Ostrya virginiana*). Host species in Maine are primarily yellow birch (Betula alleghaniensis) and paper birch (*Betula papyrifera*). Anecdotal information suggests that chaga are most commonly found growing on yellow birch.

General Information:

The fungus that forms chaga, *Inonotus obliquus*, is native to Maine and can be found throughout the northern hemisphere where host trees grow. Information about *I. obliquus* is somewhat limited, however more is being learned due to the increased interest in the fungus's purported human health benefits. What is known about the fungus, however, is that it is a tree pathogen with a predicted natural occurrence in the northeastern forest of three to four percent[1] of birch trees. Classified as a canker rot, *I. obliquus* kills cambium tissues near the point of infection and causes extensive internal wood staining and decay that may lead to structural failure.

Left: A sterile conk (chaga) resulting from infection by I. obliquus; Middle: A cross-section of the chaga conk showing the contrasting dark, rough outer surface and the light brown inside; Right: A tree following chaga harvest with some chaga remaining. Note the area of dead cambium and callus tissue formed in the tree's response to injury by the canker rot fungus I. obliquus.

Life Cycle:

The fungus requires a fresh infection court (wound) to infect a tree and is capable of causing several inches of internal decay each year, depending on host vigor and virulence of the fungal strain. The reproductive biology of *I. obliquus* is poorly understood compared to many other forest pathogens. Spores of *I. obliquus* are not produced on the chaga, which is a sterile conk (it does not produce reproductive spores). Rather, a structure called a basidiocarp forms after the host tree's death, usually after the tree falls. These 'spore mats' are believed to form only once in the life cycle of the fungus within 12 years after tree death. Thus, sporulating basidiocarps of *I. obliquus* are not often encountered. Basidiospores produced on the basidiocarp of *I. obliquus* are thought to be primarily spread by wind, although there is speculation that the fungus may be vectored (spread) by insects. Basidiocarps often show signs of intense insect feeding, indicating that some insects are highly attracted to them.

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Symptoms and Signs:

Symptoms begin to appear as swelling and/or bark cracking near the site of infection. Over time a conk with a charred appearance will begin to form at the site -- this can take as little as five years, but may take much longer. As the fungus spreads within its host, staining develops ahead of an expanding column of rotting wood. This process continues until tree death, but may not be primarily responsible for tree death. Often, trees weakened by infection by *I. obliquus* will succumb to secondary agents of tree decline. Trees are also more likely to break at the point of infection due to structural weakness.

Left: (top) A cross-section of the main stem of a birch tree infected by I. obliquus, showing staining and decay resulting from infection by the pathogen; (bottom) A close-up of the main stem of a paper birch tree infected by I. obliquus showing the chaga (orange arrow), the decay and contrast to decay-free wood (green arrows); Middle: A portion of the main stem of a paper birch tree showing the chaga (orange arrow) and extensive staining and decay above and below where the chaga has emerged through the bark; Right: The longitudinal sections of a birch log showing stem swelling, the chaga (orange arrow) and staining associated with I. obliquus infection. The yellow arrow points to a stem swelling called a burl, showing no sign of associated decay.

Management

One important aspect of management is that spores of *I. obliquus* need to land on a fresh wound to successfully infect a host tree. Forest management activities, like thinning, can often wound trees in the residual stand. For these reasons, neighboring landowners should be informed of local chaga production and time their forest management activities in forests with susceptible hosts to avoid likely periods of spore dispersal. Since spores are thought to be primarily dispersed at some time during the growing season, it may be prudent to, for example, time thinning operations for the winter months in forest types with a high birch component that are close to chaga farms.

Further Reading:

[1]Brydon-Williams, R., Munck, I. A., & Asbjornsen, H. (2021). Incidence and ecology of the chaga fungus (Inonotus obliquus) in hardwood New England–Acadian forests. Canadian Journal of Forest Research, 51(1), 122-131.

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