

Invited Paper

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Ophiostomoid Fungi Associated with Bark Beetle species Colonizing White Spruce in the Great Lakes Region

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White spruce plantations in various State and National forests in Northern Minnesota, Northern Wisconsin and the Upper -Peninsula of Michigan were used to collect bark beetles and identify their fungal associates. Trees were felled twice during the summer flight season and left on the forest floor for 6 weeks, in order, to be colonized by beetles (May and July). In the Fall insects were reared from the felled trees and a microbial dilution plating technique was used to isolate Ophiostomoid fungi from live bark beetles (Klepzig 1991). Fungi were also isolated from colonized and uncolonized host tissue.

The felled trees were predominantly colonized by nonaggressive, secondary bark beetle species: *Crypturgus borealis*, *Dryocetes affaber*, *Dryocetes autographus*, *Ips pini*, and *Polygraphus rufipennis*. Only one aggressive species was found, *Dendroctonus rufipennis*. There were over 14,500 secondary beetles and only 30 *Dendroctonus rufipennis* that emerged from the 55 felled white spruce trees. The dispersal time varied among insect species. *Dryocetes affaber* heavily colonized trees felled in July and only sparsely colonized the trees felled in May (7 to 1). *Polygraphus rufipennis* was found in greater abundance in the early set of trees (6 to 1). Overall, half the beetle species colonized the early set of felled trees (May) and half colonized the trees felled in July (3 to 3). Spatial preference within a tree also varied among beetle species. Sections were cut from the felled trees, after colonization, at three different heights: base, middle-bole, and basal crown. *Dryocetes affaber* equally colonized all three sections. All other species significantly preferred the basal section of the trees (4/1, 2/1, 3/1, 2/1, 5/1).

The Ophiostomoid fungi isolated from bark beetles varied among species (see Table 1.). Five out of the six Ophiostomoid species were isolated from the beetles and the host tissue of the colonized trees. *Ophiostoma nigrocarpum* was the only species found in the colonized tissue, but not on the beetles (2% association). No Ophiostomoid fungi were found on uncolonized (healthy) spruce trees. This data illustrates that the beetles are vectors for the Ophiostomoid fungi. The following is a list of the Ophiostomoid species isolated from bark beetles, in descending order of association,: *Ophiostoma europioides*, *Leptographium abietinum*, *O. bicolor*, *O. ips*, *O. piceae*. For *Dryocetes affaber*, and *Polygraphus rufipennis* there was a spatial correlation between the tree section the beetle emerged from and the section we took the tissue sample (spatial correlation was not

analyzed for the other species). Out of the 120 beetles that carried Ophiostomoid fungi, only 6 individuals carried multiple species. Each beetle species predominantly carried one Ophiostomoid species (see Table 1 for most frequent fungus). Multiple colonies of the predominant fungus was often isolated from individual insects. This data suggests a mutualistic relationship between the bark beetle species and the most frequent Ophiostoma species.

Additional research is needed to understand the relationship between secondary bark beetles and their association with Ophiostomoid fungi. Research efforts are often concentrated on the aggressive species because of their economic importance. An interesting study would be to compare an aggressive beetle species with a nonaggressive species that carries the same Ophiostomoid fungus.

Table 1. Fungal Associates of Bark Beetles

Beetle Species	# Beetles with Fungi	# Fungal Species	Most Frequent Fungus
<i>Dryocetes affaber</i>	85/185	5	<i>Ophiostoma europhioides</i>
<i>Dryocetes autographus</i>	4/5	1	<i>O. europhioides</i>
<i>Ips pini</i>	7/8	3	<i>O. ips</i>
<i>Polygraphus rufipennis</i>	24/125	4	<i>Leptographium abietinum</i>

- No Ophiostomoid fungi were isolated from *Dendroctonus rufipennis* or *Crypturgus borealis*. Only two specimens each were looked at for fungal presents.

Klepzig, KD, Raffa KF, Smalley EB. 1991. Association of an insect-fungal complex with red pine decline in Wisconsin. For. Sci. 37:1119-1139.

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