Association of *Endothia parasitica* with Mites Isolated from Cankers on American Chestnut Trees

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ABSTRACT

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Cankers from American chestnut stump sprouts in Virginia and two large surviving American chestnut trees in Virginia and West Virginia were examined for the presence of mites (Acarina). All canker samples examined contained mites, many in the families Oribatidae, Belbidae and Parasitidae. Of 162 mites recovered from American chestnut stump sprout cankers and placed on acidified potato-dextrose agar, 56 (34.6%) were associated with propagules of *Endothia parasitica*. These results suggest that mites may disseminate *E. parasitica*.

In North America, biological control of chestnut blight by hypovirulent strains of *Endothia parasitica* (Murr.) P. J. & H. W. Anderson has been hampered by inadequate spread of hypovirulent strains (2). Natural occurrence of hypovirulent strains of *E. parasitica* was discovered on large surviving American chestnut trees in their natural range (5,6), in a part of Michigan outside the natural range (3), and more recently, in other localities in the natural range of American chestnut (7,10). Little is known, however, how these strains may spread from canker to canker on a single tree or among trees. Previously, certain birds (9,12) and insects (14) have been found to be carriers of the chestnut blight fungus. Windblown ascospores (8) and rain-splashed conidia (13) are also important in the spread of virulent strains. No production of ascospores and low production of conidia, however, are usually associated with hypovirulent strains (2,4). Clearly, more information on the means by which *E. parasitica* may be spread by carriers is needed before we can understand the spread of hypovirulent strains. This study examines the possibility that mites (Acarina) may be carriers of *E. parasitia*.

MATERIALS AND METHODS

Cankers from five American chestnut stump sprouts in the Johns Creek area of the Jefferson National Forest, VA, one large, surviving American chestnut tree in Virginia, and one large tree in West Virginia were excised and examined with a dissecting microscope to determine if mites occur commonly on cankers. Also, decayed bark material obtained from the bases or crotches of American chestnut trees was examined. Cankers were removed from trees with a hammer and chisel; an attempt was made to excise the entire canker. Cankers from a given area were collected in separate plastic bags.

Decayed bark material from the bases or crotches of the two large surviving American chestnut trees and five stump sprouts was placed in Berlese funnels equipped with 40W incandescent light bulbs for 72 hr. Mites were collected in a jar of ethanol at the base of the funnel.

To determine if mites could carry *E. parasitica* propagules on or in their bodies, canker materials were excised from five to 15 diseased American chestnut stump spouts from each of eight areas including some in the Jefferson National Forest, VA. All mites found on these diseased tissues were transferred asceptically to Difco acidified potato-dextrose agar (APDA). Mites were alive when transferred. One plate of APDA was used per mite. A total of 162 mites were plated. Petri plates were incubated in a closed incubator at 25 C for about 2 wk and examined periodically for *E. parasitica* colonies.

RESULTS

Association of mites with cankers. All canker surfaces contained mites as did all decayed bark material samples. Mites were most often found in moist fissures and cracks of cankers. Five to 10 mites from each canker or bark material sample were mounted on slides for identification. Mites found in both canker and bark samples belonged to the families Belbidae, Oribatidae, and Parasitidae.

Association of *E. parasitica* with mites. Of 162 mites recovered from cankers and placed on APDA, 56 or 34.6% were associated with *E. parasitica* (Table 1). One to 16 mites from each of the eight locations were associated with the fungus.

DISCUSSION

Results indicate that mites are commonly associated with blight cankers on American chestnut and that *E. parasitica* frequently is associated with those mites. Thus, mites may be carriers or disseminators of *E. parasitica*.

Mites, especially those in the family Oribatidae, are often fungus feeders. If a relatively monophagous species of mite could be found that feeds on *E. parasitica*, this species might be important in the spread of hypovirulent strains of *E. parasitica* from biocontrolled cankers to virulent cankers. When the mites seek out new food sources, they may move from one canker with little or no *E. parasitica* thallus (biocontrolled) to another, perhaps on the same tree, that has abundant virulent thallus. This hypothesis could be important for explaining natural biological control of blight if the *E. parasitica* strain(s) being carried are of the same or similar vegetative compatibility type as the virulent *E. parasitica* strains causing cankers (1,2,4,11). This hypothesis also suggests that the rate of hypovirulence spread may be slow because mites may not move until the food source declines. This is consistent with present knowledge on the rate of natural spread of hypovirulent strains (4).

Many insects, such as orders Coleoptera and Lepidoptera, which have been associated with blight cankers (14), undergo a complex metamorphosis that causes them to move among different

Table 1. Recovery of *Endothia parasitica* on acidified potato-dextrose agar from mites associated with cankers on American chestnut trees in eight Virginia locations

Location	No. mites assayed	No. mites yielding *E. parasitica*
1	26	8
2	33	10
3	7	2
4	6	1
5	23	12
6	30	16
7	30	6
8	7	1

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habitats and food sources. Similarly, birds that carry *E. parasitica* may move from tree to tree without preference to trees having virulent *E. parasitica*. In contrast, mites may produce several generations per year, and the progeny may seek out new but similar food sources. Although not examined here, it is possible that bits of mycelium or conidia may be the propagules carried by mites.

The limited mobility of mites is a factor that potentially restricts their effectiveness as long-distance carriers of *E. parasitica*. Mites may be windblown or carried on animals, birds, ants, or beetles; however, this may not necessarily result in movement of hypovirulent strains to cankers caused by virulent *E. parasitica*.

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