Naturally Occurring Mature American Chestnut Trees *(Castanea dentata)* in Northwest Indiana

James Willut, Gayton Marks, and Garland Hicks
Department of Biology
Valparaiso University
Valparaiso, Indiana 46383

Abstract

Three mature (14-17 m, 38-56 cm DBH) and several smaller American chestnuts were located within 200 m of one another on a farm woodland in Union Township, Porter County, Indiana. Two of the larger trees are heavily infected with the blight fungus *Endothia parasitica*. *E. parasitica* isolated from these trees is similar in appearance and invasiveness to highly pathogenic strains. The third mature tree shows no sign of infection.

Introduction

Three mature American chestnuts (*Castanea dentata* Borkh.), recently discovered five miles west of Valparaiso, Indiana, in Union Township (R6W T35N Sect. 19 NW quarter) are on wooded sites bordered by cultivated fields. Two are infected by the chestnut blight fungus, whereas the third shows no signs nor symptoms of the disease.

Endothia parasitica (Murr.), the causative agent of the chestnut canker disease, was first described in New York City in 1904. The fungus came to North America from Asia and by 1940 the disease had spread through the entire range of the chestnut. Uncultivated, mature trees are very rare today though small trees are quite common, particularly in the Appalachian region (e.g. 4).

These most unusual trees constitute an *in situ* laboratory for diverse studies of both host and pathogen. Initially, investigations were restricted to positive identification of tree and fungus, to recording the progress of the infections and to obtaining presumptive information about possible disease resistance of host or degree of virulence of the *E. parasitica*.

Methods

The trees were identified as American chestnuts through use of keys and by comparison to herbarium specimens. Tree A, arbitrarily designated, is about 17 m high and has a DBH of 44 cm (17.5 in); B is 14 m, DBH 56 cm (22 in); C is 17 m, DBH 38 cm (15 in). Four smaller trees, 6-11 m, DBH 5-13 cm (2-5 in), were located within 16 m of C. The trees were observed regularly from March through October to determine characteristics of the infection through one full growing season.

E. parasitica was isolated from a canker on A. Potato dextrose agar (PDA), Sabouraud's agar and host tissue were used to culture the fungus. Identification was made by analysis of morphology in the various media and confirmed by comparison to a known culture.

Invasiveness of this isolate in freshly cut host twigs was compared with that of a known virulent strain of *E. parasitica*. Sets of twigs from each of trees A, B and C were inoculated with both fungus strains by the methods of Clapper (3). PDA plugs about 7 mm in diameter containing mycelium and spores were inserted aseptically, surface side down, in cuts in the twigs. The inoculation points then were sealed with Parafilm and the cut ends of the twigs were maintained in water. The experimental infections were observed for several weeks to discern similarities in growth rate or growth characteristics.

Results

The mature trees are situated within 200 m of one another in a roughly triangular formation with A and B at the peripheries of wooded areas and C in the center of a small bottomland wooded tract. A and B are heavily infected with *E. parasitica* and each has several cankers. C apparently is uninfected, as are the smaller trees. The predominant trees of the area are black oak, black cherry, small-fruited hickory, black walnut and sugar maple. Three secondary hosts of *E. parasitica*, shagbark hickory, red maple and staghorn sumac, are also common.

There are two large infections on the trunk of A. One, 3 m from the ground, measures 53 x 86 cm at a trunk circumference of 124 cm. This infection extends to a lateral branch which has been girdled and killed. The tissues at the center of the canker are well decomposed and some bark has fallen from it. Much of the canker is covered with *Endothia* pustules which contain pycnidia and characteristic spore horns. A second infection, 51 x 46 cm, is 5.8 m from the ground at a trunk circumference of 114 cm. This canker appears younger than the first and consists of a slightly raised area with intermittent pustules. The bark here is not severely decomposed or split.

The one large infection on the trunk of B is 3.7 m from the ground and measures 33 x 25 cm at a trunk circumference of 124 cm. It consists of intermittent patches of pustules and is less developed than the two cankers on A. A second canker girdled and killed this year a lateral branch which joins the trunk at a height of 3.4 m. Wilt, chlorosis or similar manifestations are inapparent on all chestnuts; the trees outwardly appear to be thriving.

Our isolate of *E. parasitica* was morphologically indistinguishable on host tissue or on artificial media from known virulent strains of *E. parasitica*. The characteristics of the experimental infections produced by both strains of *E. parasitica* were identical on all twigs from all three trees, which suggests that our isolate and the known virulent strain of the fungus possess similar invasive capabilities.

Discussion

These chestnuts may have survived because they were isolated for a number of years at the fringe of the former chestnut range (5) and have only recently become diseased. However, the infections are

well established and are progressing, albeit slowly, on trees A and B. The rotted condition of the canker on A is indicative of a much older infection than one that would hypothetically result from the 16 cm annual growth rate reported by Anderson (1) in 1914. The apparently uninfected state of tree C in an area of high and sustained *Endothia* inoculum is particularly intriguing. Indeed, this tree may have significant natural resistance to the blight, though the growth of *Endothia* in the cut twigs would not suggest this.

It is most unlikely that these chestnuts are hybrids with the disease resistant Chinese chestnut (*C. mollissima*) or Japanese chestnut (*C. crenata*). Their character is solely that of the American species. Furthermore, the trees are located in a random pattern in a small but fairly wild area which is a good distance from dwellings or roads. This suggests strongly that they were free from man's horticultural influence and occurred naturally.

Tree B, left photograph, is typical in size of all three mature chestnuts. Note root sprout at base, common to such diseased chestnuts. The apparently uninfected tree is shown at right.

Tentative future work will include attempts to propagate the uninfected tree, to study the influence that *Endothia* toxins (2) may have in these infections and to conduct further tests for fungal virulence. These trees lie in prime development land; chain saws may terminate this research rather abruptly.

Acknowledgments

We thank John and Tom Peabody who, at the suggestion of Marion T. Jackson, brought the location of these trees to our attention. We also thank Richard Jaynes for providing *E. parasitica* cultures.

Literature Cited

1. ANDERSON, P. J. 1914. The morphology and life history of the chestnut blight fungus. Pa. Chestnut Blight Bull. No. 7.
2. BAZZIGHER, G. 1953. Beitrag zur kenntnis der Endothia parasitica (Murr.) And., der erreger des kastaniensterbens. Phytopath. Zeits. 21:105-132.
3. CLAPPER, R. B. 1944. Improved cork borer method for inoculating trees. Phytopath. 34:761-762.
4. MACKEY, H. E., and N. SIVEC. 1973. The present composition of a former oak-chestnut forest in the Allegheny Mountains of western Pennsylvania. Ecol. 54:915-919.
5. SWINK, FLOYD. 1974. Plants of the Chicago Region. Morton Arboretum, Lisle, Ill. 474 p.