

Assessment of Decline and Contributing Diseases in White Ash Stands in Michigan

Forest Health Monitoring Project



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BACKGROUND

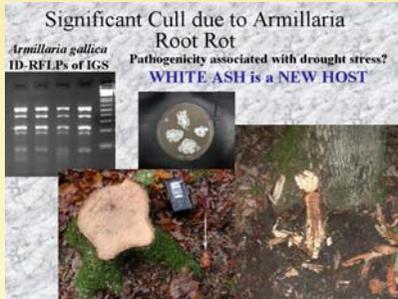
During FIA monitoring, ash decline was noted throughout the species range in Michigan, affecting white, green and black ash growing under a wide variety of moisture and soil regimes. Ash trees under stress from ash decline are highly susceptible to attack by emerald ash borer (EAB), *Agrilus planipennis*. Therefore, it was our goal to improve early detection of high-risk stands beyond the generally-infested area of Michigan as a critical part of efforts to control this pest.

Ash Yellows has been implicated as a major factor in ash decline in prior studies of forests in Northeastern North America. The distribution and severity of Ash Yellows was unknown in Michigan, so it was a goal in this work to gather data on that. We coordinated this study with the teams of inspectors monitoring the EAB detection trees. The ash trees used in detection efforts are located with GPS coordinates, evaluated for health and crown condition, girdled and revisited in subsequent years. Girdling created conditions conducive to formation of water sprouts, Witches' brooms and epicormic shoots. The inspectors gathered and mailed to us green sprouts from detection trees which we used to evaluate for presence or absence of Ash Yellows (AshY) symptoms and infection by the AshY phytoplasma. We were also able to examine the relationship between the presence of ash yellows phytoplasma and ash decline, including poor crown conditions, and other visual symptoms of decline.

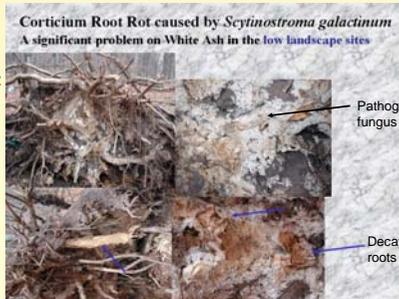
White ash (*Fraxinus americana*) is a frequent component of the mesophytic forests in Michigan which requires substantial soil moisture and fertility. Stands with high proportions of white ash were chosen for study ash decline in the forests. To remove poor site conditions as a contributing factor to white ash decline, research plots were established in forests of high site index and of early and intermediate stages of plant succession (ash tree ages ca. 45, 65, & 85 yrs, respectively). Again, the relationship between presence of ash yellows phytoplasma, poor crown conditions and other visual symptoms of decline were studied. The study identified other contributing factors to decline such as the presence of windthrow, root and butt rots, including specific *Armillaria* species, and estimated their role in white ash mortality.

This project aims to provide a current and detailed estimation of the role of various diseases in white ash decline in Michigan forests. The results of the study should improve decision-making in the management of white ash and emerald ash borer in Michigan.

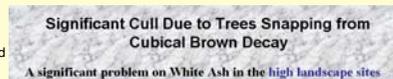
Contributing Diseases



physiographic site factors:
low landscape



physiographic site factors:
high landscape



Distribution of Ash Yellows



Based on 200 samples in which ca. 10% were rt-PCR positive [did not include regions with EAB]



Radial growth of white ash

25 AshY positive trees are compared to 25 negative trees in a 65 years old stand: Mean DBH is the same (16 inches) for both cohorts.

Frequency of AshY occurrence

In the lab, the sprouts from EAB detection trees are

a. visually evaluated for presence of AshY: results-- 27% of 1028 trees were positive for AshY based on axil bud break

b. DNA is extracted from leaves: results-- 10% of 200 trees were positive for AshY based on real-time PCR



Bud Break of the Axil buds is the Dependent Symptom of AshY

36-40% of 50 stumps from recently cut white ash were Positive for AshY in one forest (65 yrs.) based on real-time PCR.

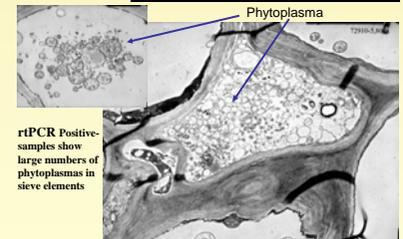


Real-time PCR detection of AshY was comparable whether Roots or Sprouts were assayed[50 stumps sampled in September]

Accomplishments to date:

- Distribution of AshY is statewide in Michigan
- Frequency of AshY in EAB detection trees is 10-27%
- Frequency of AshY in white ash in forests varies from 0% to 40%
- Crown decline is not correlated with AshY in forests
- Declining white ash in the forest are not exhibiting the Cytospora canker and dieback noted in other studies
- A forest WITH evident witches' brooms, epicormic shoots, & deliquescent branching yielded 33% AshY
- A nearby forest WITHOUT evident witches' brooms, epicormic shoots, & deliquescent branching yielded 36% AshY
- Real Time PCR positive and negative samples have been verified by Transmission Electron Microscopy (TEM) based on presence and absence of phytoplasma in sieve elements
- Mean radial growth (mean DBH) is identical for white ash trees whether they are positive or negative for AshY, in a 65 yr. old stand
- White ash decline in Michigan forests may be due to root and butt rots

Transmission Electron Microscopy



rtPCR Positive samples show large numbers of phytoplasmas in sieve elements

NEXT STEPS

Tree-ring data from 80 white ash will be evaluated to determine whether ash decline appeared following successive years of drought

Tree-ring data will be studied to determine whether AshY affects recovery from drought

White ash with basal cracks will be assayed to determine whether they are correlated with Ash Yellows

Real-time PCR and TEM assays will be compared to DAPI fluorescence microscopy for correlation