Premature Pine Mortality, Root-Inhabiting Bark Beetles and Blue-Stain Fungi

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Abstract

Premature pine mortality has been observed on southeastern industrial forest lands. Root-inhabiting bark beetles and their blue-stain fungal associates were observed in roots of chlorotic loblolly pine trees. Evidence of previous damage was present in trees with red crowns along with minimal activity in asymptomatic trees.

Fig. 1. High mortality in loblolly pine plantation north of Centreville, Alabama

Introduction

Stagnant growth, thinning crowns, chlorotic foliage and premature mortality has been observed in Alabama and Georgia pine plantations. The cause of pine mortality is largely unknown. However, a group of root-feeding bark beetles in the genus *Hylastes* have been observed in intensively managed pine forests experiencing disturbances (Menard et al., 2006). *Hylastes* spp. are known to vector several prominent blue-stain *Leptographium* spp. in the southeastern U.S. (Eckhardt et al., 2007). *Leptographium* spp., vectored by *Hylastes* bark beetles, have recently been observed causing significant damage to southern pine root tissue (Matusick and Eckhardt unpublished).

Methods

A thirty year-old intensively managed loblolly pine plantation north of Centreville, Alabama experiencing high rates of mortality (Figs. 1.) was surveyed for potential root pests. Two trees exhibiting red (dead) and yellowing (dying) crown conditions respectively were selected along with one green asymptomatic tree. Tree stems were initially surveyed for bark beetle presence and other pest activity. Due to the absence of above-ground pests, primary lateral roots were excavated. Approximately three meters of each root was examined for insect damage and blue-stain fungal colonization. Two primary lateral roots were excised for further observations and tissue culture. Bark beetle numbers and life stages were recorded for each root (Fig. 2). Maturation feeding and beetle breeding galleries were traced on clear transparent sheets (Fig. 3). Blue-stain ophiostomatoid fungi were isolated and identified from adult bark beetles and root gallery tissue.

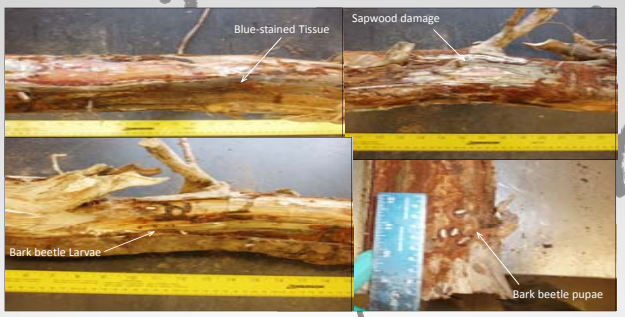

Fig. 2. Primary lateral roots from sample tree #3 illustrating bark beetle larvae and pupae, resinosis, and blue-stain

Fig. 3. Bark beetle feeding galleries in primary lateral roots of sample tree #4

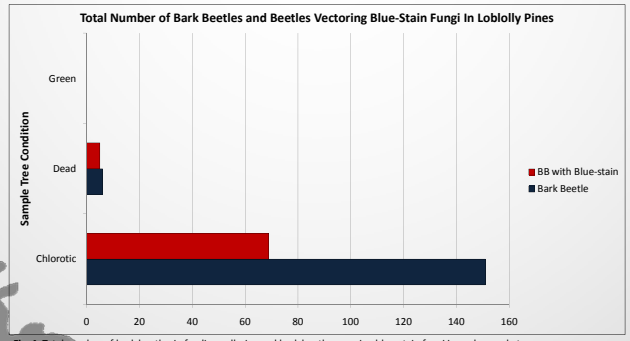

Fig. 4. Total number of bark beetles in feeding galleries and bark beetles carrying blue-stain fungi in each sample tree

Fig. 5a. Late bark beetle larval instar feeding

Fig. 5b. Recently hatched bark beetle larva

Fig. 5c. *Hylastes* spp. pupa with fungal associate

Fig. 5d. Adult *Hylastes salebrosus* exiting root tissue

	Dead		Chlorotic		Healthy	
	Tissue	Beetles	Tissue	Beetles	Tissue	Beetles
L. terebrantis	1	1	1	1	0	0
G. huntii	1	1	1	1	0	0
L. procerum	0	0	1	1	1	0
L. serpens	0	0	0	1	0	0
Unknown	1	0	1	1	0	0

Fig. 6. Presence/ absence of prominent blue-stain species found in roots and adult beetles in each crown class

Fig. 7a. New un-described *Ophiostoma* species

Fig. 7b. Dark stained root tissue with perithecia

Fig. 7c. Perithecia fruiting on root tissue

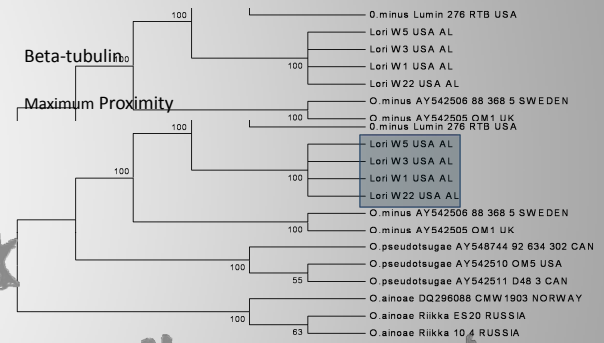

Fig. 8. Phylogenic tree illustrating beta-tubulin sequence relationships between known and unknown *Ophiostoma* species

Results/ Discussion

The majority of insect and fungal damage was observed in chlorotic trees (Fig 4). Little evidence of pest damage was observed in roots of the green asymptomatic tree. Evidence of previous insect and fungal damage was observed in dead trees, but limited current activity was observed. The highest number of adult bark beetles were of the genus *Hylastes*. A limited number of black turpentine beetle (*Dendroctonus terebrans*) and other bark beetles were found. Bark beetle larvae, pupae and adults (Fig. 5a-d)were found associated with galleries and feeding in roots of chlorotic trees. Prominent blue-stain fungi including *Leptographium terebrantis*, *L. huntii*, *L. procerum* and *L. serpens*, were isolated from adult beetles as well as stained tissue surrounding beetle galleries (Fig. 6). In addition to isolating the before mentioned *Leptographium* species, a previously unknown, undescribed *Ophiostoma* species was isolated from root tissue and insect vectors (Fig. 7.a-c). This new *Ophiostoma* species is closely related to *O. minus*, as illustrated by sequence data (Fig. 8). These observations provide preliminary evidence that root-inhabiting bark beetles and their associated blue-stain fungal species are most active in chlorotic loblolly pines.

References

Eckhardt, L.G., Weber, A.M., Menard, R.D, Jones, J.P., and Hess, N.J. 2007. Insect-fungal complex associated with loblolly pine decline in central Alabama. Forest Science 53(1):84-92.

Menard, R., L. Eckhardt, and N. Hess. 2006. Assessment of loblolly Pine on Fort Benning Military Reservation, Fort Benning, Georgia. Report No. 2006-02-01. Pineville, LA: U.S. Department of Agriculture, Forest Service, Forest Health Protection.