ɔREST TREES

ference
ʀots

ʻ.02.01

Organizers

ᴇEDINGS

ıier, Editors

ʻ007
ford, Oregon

ᴈerkeley, USA

12th International Conference on Root and Butt Rots

Organizing Committee

Dr. Matteo Garbelotto
Dr. Gregory Filip
Ms. Ellen Goheen
Ms. Amy Smith

Scientific Committee

Dr. Matteo Garbelotto, University of California at Berkeley, USA
Dr. Paolo Gonthier, University of Torino, Italy
Dr. Gregory Filip, USDA Forest Service, USA

Technical Editing of Proceedings

Ms. Rachel Linzer, University of California at Berkeley, USA

The Conference was financially supported by:

The Koret Foundation, San Francisco, CA
United States Department of Agriculture, Pacific Southwestern Station
University of California, Berkeley
University of California, Agriculture and Natural Resources

ISBN 9780615230764
Printed by: University of California, Berkeley, CA 94720

To cite this book:
M. Garbelotto & P. Gonthier (Editors). Proceedings of the 12th International Conference on Root and Butt Rots of Forest Trees. Berkeley, California - Medford, Oregon, 12th-19th August 2007. The University of California, Berkeley, USA, 2008. 268 pp.

Studies on black stain root disease on ponderosa pine

W.J. OTROSINA[1], J.T. KLIEJUNAS[2], S.S. SUNG[1], S. SMITH[2] AND D.R. CLUCK[2]

[1] USDA Forest Service, Disease and Invasives Team, USA.
[2] USDA Forest Service, Region 5, Forest Health Protection, USA.

CONFERENCE ABSTRACT
Black stain root disease of ponderosa pine, caused by *Leptographium wageneri* var. *ponderosum* (Harrington & Cobb) Harrington & Cobb, is increasing on many eastside pine stands in northeastern California. The disease is spread from tree to tree via root contacts and grafts but new infections are likely vectored by root feeding bark beetles (Coleoptera:Scolytidae). Soil and site relations along with disturbance are factors in the etiology of the disease. Thinning and prescribed burning are important silvicultural tools in maintaining forest health in eastside pine stands. Because soil compaction is a concern in many sites, skid trails are treated by subsoiling equipment to alleviate compaction where this might be an issue. However, little is known of the effects of these silvicultural treatments on incidence of black stain root disease on sites with high disease risk. These studies were initiated to address these concerns.

Black stain root disease of ponderosa pine, caused by *Leptographium wageneri* var. *ponderosum* (Harrington & Cobb) Harrington & Cobb, is increasing on many eastside pine stands in northeastern California. The disease is spread from tree to tree via root contacts and grafts but new infections are likely vectored by root feeding bark beetles (Coleoptera:Scolytidae). Soil and site relations along with disturbance are factors in the etiology of the disease. Thinning and prescribed burning are important silvicultural tools in maintaining forest health in eastside pine stands. Because soil compaction is a concern in many sites, skid trails are treated by subsoiling equipment to alleviate compaction where this might be an issue. However, little is known of the effects of these silvicultural treatments on incidence of black stain root disease on sites with high disease risk. This study was initiated in 2000 to address these concerns.

A site near Poison Lake on the Lassen National Forest in California was selected for this study. This predominantly ponderosa pine site has numerous black stain root disease centers and was thinned during the fall of 1999. Prior to thinning, the average basal area was 263 ft^2 / acre (60 m^2 / hectare) and the average QMD (quadratic mean diameter) was 7.9 inches (20 cm). Post thinning stand density was

121 ft^2 / acre (28 m^2 / hectare) with an average QMD of 14.8 inches (38 cm). Treatments consisting of underburning, subsoiling, underburning and subsoiling, and untreated control were completed during the 2000 season. The study design is a randomized complete block replicated four times. Each treatment plot is approximately 2.5 hectares in size. An unthinned area near the experimental plots was maintained as a comparison, but not included in the overall experimental design.

Pretreatment surveys were conducted and pre-existing mortality and symptomatic trees identified and tagged. Post treatment, during the spring of 2001 and 2002, Lindgren flight traps were deployed and trapped insects were counted and identified. Sub-samples of these species from the trap catches were subjected to DNA analyses to determine presence of *L. wageneri*. We conducted the final post-treatment survey during June 2005 and recorded data on mortality, black stain root disease, and crown symptoms.

Experiments involving large woody root inoculations were conducted to provide information on the minimum amount of spores carried by insects that are necessary to start root infection. In June 2005 and again in August, spore suspensions containing 50, 500, and 5,000, spores were injected in artificial wounds created by coring to 2 cm depth in the xylem with a 4 mm diameter increment hammer. The spore suspensions were placed into roots of randomly selected trees in the burn only and control plots. Lesions, including sterile control wounds were measured after 9 weeks. Two trees selected from each burn only and control plot were inoculated with either 5,000 spores (August 2004) or an *L. wageneri* infested wood core (June 2004). These roots were excavated in June 2005. We obtained data on stem cambial sucrose synthase (SCSS) activity, a surrogate for determining stress and carbohydrate status of the trees, during the 2002, 2003, and 2004 season.

While the study is long-term, intermediate results are interesting. Several root feeding insect species of interest, suspected to be potential vectors of *L. wageneri*, were caught during the two seasons. Among the more common species were *Hylastes macer*, *Hylurgops subcostulatus*, and *Hylurgops porosus*. Treatment differences in total insect trap catches are not obvious, although the underburn only plots tended to have slightly higher catches during the latter half of the flight season. In 2002, this trend appeared to be more marked, with greater catch numbers later in the season. Recently, DNA evidence indicates the insect species mentioned above, among others trapped on the study plots are carrying *L. wageneri*, presumably as spores (3). Such insect species have been suspected but heretofore have not been confirmed to be carrying *L. wageneri* in ponderosa pine stands. This confirms the long held notion that root feeding Scolytids serve as

potential vectors of the fungus, c
longer distances.

Between 2001 and 2005, the b
mortality. Scorching was evident
succumbed within two years f
approximately a century since fir
subsoiling and burn treatment ha
burn only treatment. The subsc
mitigate at least partially fire seve
caution should be exercised wh
have not been burned for a consic

In 2005, 100% surveys of each pl
upon crown characteristics,
treatments, and few confirmed b
found. This is to be expected
anticipate from treatment initiat
symptom expression in the trees.
of these study plots is necessary a

Sucrose synthase activity, a me
shows a seasonal trend betweer
2004. Peak activity is attained
rapidly during September. This is
earlier for ponderosa pine (2).
determine relationships between p

Findings in 2004 inoculation exper
local isolate of *L. wageneri* spores

1) The June inoculations produ
weeks than the August inoculation
2) The lowest spore dose, 50 s
significantly larger than controls (J
3) This is noteworthy because it i
numbers found on potential inse
analyses.
4) Underburned plots had general
5) Lesions from August inoculati
June inoculations.
6) We recovered *L. wageneri* fr
(June 2005) after inoculation (Ju
5,000 spores or mycelial inoculum.

ACKNOWLEDGEMENTS
The authors wish to thank Al Va
National Forest, and Jeff Withr

potential vectors of the fungus, critical for spread of the disease over longer distances.

Between 2001 and 2005, the burn only treatment had the highest mortality. Scorching was evident on most of the mortality trees, which succumbed within two years following treatments. It has been approximately a century since fire last occurred in these stands. The subsoiling and burn treatment had considerably less mortality than the burn only treatment. The subsoiled skid trails may have served to mitigate at least partially fire severity or intensity in these plots. Thus, caution should be exercised when reintroducing fire to stands that have not been burned for a considerable time.

In 2005, 100% surveys of each plot showed symptomatic trees, based upon crown characteristics, were distributed evenly among treatments, and few confirmed black stain root diseased trees were found. This is to be expected due to the longer time interval we anticipate from treatment initiation to infection, colonization, and symptom expression in the trees. Thus, further long-term monitoring of these study plots is necessary and planned.

Sucrose synthase activity, a measure of tree physiological status, shows a seasonal trend between the sampled months in 2003, and 2004. Peak activity is attained during July and August and drops rapidly during September. This is consistent with other data reported earlier for ponderosa pine (2). These and future data are used to determine relationships between physiological status and infection.

Findings in 2004 inoculation experiments using the three dosages of a local isolate of *L. wageneri* spores (1) are summarized below.

1) The June inoculations produced larger lesions in roots after 9 weeks than the August inoculation.
2) The lowest spore dose, 50 spores, produced lesions that were significantly larger than controls (June inoculations).
3) This is noteworthy because it is consistent with the range of spore numbers found on potential insect vectors as determined by DNA analyses.
4) Underburned plots had generally smaller lesions than control plots.
5) Lesions from August inoculations were significantly smaller than June inoculations.
6) We recovered *L. wageneri* from lesions approximately one year (June 2005) after inoculation (June and August 2004) with either 5,000 spores or mycelial inoculum.

ACKNOWLEDGEMENTS
The authors wish to thank Al Vazquez, District Silviculturist, Lassen National Forest, and Jeff Withroe, Forest Ecosystems Manager,

Lassen National Forest, for their continued interest and generosity in providing very significant assistance during various phases of this project. We also thank James Cunningham, Jeffrey Magniez, Chris Crowe, and Michael Thompson of the Tree Root Biology Team for their essential contributions in the lab and field phases of this project.

REFERENCES

1. Otrosina, W., Sung, S., Cook, C., Kliejunas, J., Smith, S., Cluck, D. 2005. *Leptographium wageneri* spore dosage required for root infection in 80-year-old ponderosa pine subjected to prescribed burning plants following both stem and leaf applications. Phytopathology 95:S78.
2. Otrosina, W. J., sung, S-J. S., White, L. M. 1996. Effects of subsoiling on lateral roots, sucrose metabolizing enzymes, and soil ergosterol in two Jeffrey pine stands. Tree Physiol. 16:1009-1013.
3. Schweigkofler, W., Otrosina, W. J., Smith, S. L., Cluck, D. R., Maeda, K., Peay, K. G., Garbelotto, M. 2005. Detection and quantification of *Leptographium wageneri*, the cause of black-stain root disease, from bark beetles (Coleoptera: Scolytidae) in North California using regular and real-time PCR. Can. J. For. Res. 35:1798-1808.

Phlebiopsis gigante
natural

P. ŁAKOMY[1], K

[1] Department of Fores
University of Agricultı
Poznań, Poland.

CONFERENCE ABSTRACT
The study was carried out in
the investigation of *P. gigan*
and 6 years after treatment
saprotrophs and pathogens
stumps, randomly chosen,
analyzing the colonization
three and four years ago) w
and leaved for natural *P. gi*
and after half year were inv
after treatment *P. gigante*
disappeared or were totally
of saprotroph was found in
stumps in such stand occu
was found in stands treat
success of natural coloni
frequency of saprotroph in
for colonization and the tre

Biological control of H
pine stands growing
agricultural lands irres
Poland this method w
commercial formula
overgrowing the saw
stumps is done manu

The aim of this study
gigantea in stumps
colonization of appea

The study was carr
were chosen for
treatments. In those
was applied on the
were treated six, fi