

mortality of unknown cause on over 100,000 hectares of remote forest land in southeast Alaska. Since its nearly simultaneous onset at numerous sites around 1880, decline has apparently not spread to any new sites but has spread locally (up to 100m) along gradients from areas with wet, poorly drained soil to areas with better soil drainage. Dead fine and small diameter roots and necrotic lesions spreading from coarse roots up the bole are common on declining trees. Entire crowns of some affected trees die quickly; others thin gradually for ten or more years before death. VA mycorrhizae and *Mycelium radicans atrovirens* are common in cortical cells of fine roots on both healthy and declining trees. None of the organisms associated with declining cedar, including 50 taxa of fungi, nematodes, *Phloeosinus* bark beetles, and Alaska brown bears, appear to be the primary cause. Foliar and soil analyses indicate that nutrient deficiencies or toxicities do not cause decline. The date of onset, remoteness, and lack of human disturbance in declining forests suggest that this decline is not induced by human involvement.

## 757

COMPARATIVE PATHOLOGY OF *FUSARIUM* SUBGLUTINANS ISOLATED FROM MONTEREY PINE IN CALIFORNIA AND SOUTHERN PINES. L. D. Dwinell. USDA For. Serv., Southeast. For. Expt. Sta., Athens, GA 30602.

In a greenhouse study, new growth of 1-yr-old seedlings of Monterey, eastern white, Scots, Virginia, loblolly and slash pines was inoculated with 9 isolates of *F. subglutinans* taken from cankers on Monterey (7), loblolly (1), and slash (1) pines. There were 10 replicates of each treatment combination. Final data on shoot mortality and canker dimensions were taken after 8 wk. Experimental variation was attributable to pine host and not isolate or isolate x host interaction. Monterey and Virginia pines were the most susceptible species. Scots, slash, and loblolly pines were intermediate. Eastern white pine was moderately resistant. The pathotype of *F. subglutinans* causing pitch canker on Monterey pine in central coastal California appears to be the same as found on pines in the Southern U.S.

## 758

*FUSARIUM* DISEASES OF CONTAINERIZED CONIFER SEEDLINGS IN NORTHERN ROCKY MOUNTAIN NURSERIES: SOURCES OF INOCULUM AND CONTROL TESTS. R. L. James, R. K. Dumroese and D. L. Wenny. USDA Forest Service TCPFM, P. O. Box 7669, Missoula, MT 59807 and University of Idaho Research Nursery, Moscow, ID 83843.

Sources of *Fusarium* inoculum causing diseases of containerized conifer seedlings in northern Rocky Mountain nurseries included infected seed, soilless media, greenhouse weeds, and styroblock or Leach pine cell containers which were reused for several crops. *Fusarium* spp. were isolated from seedcoats and endosperms at levels that differed widely among conifer species and seedlots. A treatment of Douglas-fir seed with 3X hydrogen peroxide after stratification was most effective in reducing seed contamination while maintaining high germination. *Fusarium* was not commonly isolated from peat vermiculite media. Weeds and other organic debris on the floors of greenhouses harbored several *Fusaria*. Containers used to grow seedlings were probably the most important inoculum source for new crops of seedlings. Standard cleaning treatments did not eliminate this inoculum.

## 759

SEIRIDIUM CANKER OF *JUNIPERUS* SPP. AND *THUJA ORIENTALIS* IN KANSAS. N. Tisserat and A. Nus, Department of Plant Pathology, Kansas State University, Manhattan, KS 66506.

A general decline and branch dieback has been observed in several eastern redcedar and oriental arborvitae windbreaks in northern Kansas. The decline has often been attributed to adverse environmental conditions or poor management practices. Nevertheless, close examination of declining trees often revealed flattened, resin-soaked cankers on the branches and main stem. A fungus, tentatively identified as *Seiridium unicorne*, was consistently isolated from and observed fruiting in cankers. Three trees each of one- to two-year-old Rocky Mountain juniper, eastern redcedar, and oriental arborvitae were inoculated by inserting mycelium of the fungus into fresh stem wounds. All trees developed sunken, bleeding cankers 1 mo after inoculation in the greenhouse. One tree each of eastern redcedar and Rocky Mountain juniper were killed after 3 mo. Results indicate that *Seiridium* canker may contribute to decline of these species in windbreaks.

## 760

ASSOCIATION OF PYTHIACEOUS FUNGI, ROOTLET MORTALITY, AND DIEOFF OF SHADSCALE IN THE GREAT BASIN OF UTAH. D. L. Nelson and D. J. Weber, USDA Forest Service, Intermountain Research

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Shadscale salthush (*Atriplex confertifolia*), an endemic salt desert shrub of the western United States, forms vast genetically uniform polyploid populations on Pleistocene lake bottoms of the Great Basin. Toward the end of a historical record high precipitation period (1980-86), complete death of many populations occurred from an unknown cause on thousands of acres. Increasing fine rootlet mortality was correlated with dieoff symptom severity index. Pythiaceae fungi were isolated from rootlets and occurred at high soil population levels in soil assay tests. A complex of *Fusarium* spp. were consistently isolated from small rootlets, main tap roots, and basal stems of symptomatic plants. *Alternaria* was associated with shoot tip dieback.

## 761

ENZYME ANALYSIS OF *PERIDERMIUM HARKNESSII* IN NEBRASKA PONDEROSA PINE PLANTINGS. J. A. Walla, Plant Pathology Dept, G. A. Tuskan, Horticulture & Forestry Dept, North Dakota State Univ, Fargo, 58105 and G. W. Peterson, Rocky Mountain Forest & Range Exp. Stn., Forestry Sciences Lab, Univ Nebr, Lincoln 68583.

Variation in *P. harknessii* in 2 Nebraska ponderosa pine plantings was evaluated using zymograms constructed from profiles of 14 isozymes resolved by horizontal starch gel electrophoresis. Infected seedlings planted in 1968 were later identified, recorded as epicenters of disease development and removed. In a planting where infection resulted from one gall, one homozygous zymogram (type A) in spores from each of 23 galls indicated stability of zymograms over time. In a planting where infection resulted from galls on an estimated 31 seedlings (the position of which caused 18 epicenters), spores from each of 4 galls around each of the 18 epicenters displayed one of two homozygous zymograms (type A,B). Type B was randomly distributed across the planting on 5 of 72 galls, and was possibly introduced from a later planting near this site.

## 762

FIELD PERFORMANCE OF SYMPTOMATIC SURVIVORS OF LOBLOLLY PINE FAMILIES INOCULATED WITH *CRONARTIUM QUERCUM* F. SP. *FUSIFORME*. Thomas Miller and Fred R. Matthews, S.E. For. Exp. Sta., Dept. of For., Univ. of Florida, Gainesville, FL 32611 and For. Sciences Lab., Athens, GA 30602.

Progeny of four half-sib loblolly pine families and one seed source were inoculated with basidiospores of *Cronartium quercuum* f. sp. *fusiforme* to evaluate the field performance of seedlings developing stem symptoms other than galls. After 9 months, galled and asymptomatic seedlings were discarded. Symptomatic seedlings (SS) and uninoculated controls were outplanted in a high rust incidence area. Seedlings were examined at 1,2,4,6, and 12 years for rust and rust-associated mortality (RAM). Mean, cumulative rust (stem galls) for the SS families ranged from 17 to 56%, with 92% in the controls. Mean, cumulative RAM ranged from 2 to 22%, with 53% in the checks. The 12-year field performance of the SS families did not change the relative resistance rankings previously determined from inoculations at the seedling stage.

## 763

ANATOMICAL RESPONSES OF SLASH PINES FOLLOWING GREENHOUSE INOCULATIONS WITH *CRONARTIUM QUERCUM* F. SP. *FUSIFORME*. C. H. Walkinshaw, USDA, Forest Service, Southern Forest Experiment Station, Gulfport, MS 39505.

Twenty open-pollinated and 17 control-pollinated slash pine families were inoculated with 9 single gall field isolates of the rust fungus. Specimens for histology were fixed after 9 to 60 days in formalin acetic acid alcohol, dehydrated, embedded in paraffin, cut at 12 millimicrons, and stained according to a variety of schedules. Observations showed that the anatomy of initial lesions was determined by pine parents and by rust inocula. Variations in lesions included size, periderm formation, presence of viable rust hyphae, and accumulation of ergastic substances within affected cells. Rust resistance was indicated by a decrease in nuclear staining of cortical cells in the infection court. Susceptibility was accompanied by increased staining of cytoplasm in cortical cells beyond the penetration site.

## 764

PROTOPLASTS FROM *CRONARTIUM QUERCUM* F. SP. *FUSIFORME* MYCELI AND BASIDIOSPORES. P.C. Spaine, O.M. De Vries, and W.