

ARBORICULTURAL ABSTRACTS

TRANSLOCATION AND EFFICACY OF A NEEM-BASED INSECTICIDE IN LODGEPOLE PINE USING *IPS PINI* (COLEOPTERA: SCOLYTIDAE) AND AN INDICATOR SPECIES

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Recent research suggests that mountain pine beetles, *Dendroctonus ponderosae* Hopkins, may be controlled on pine using systemic applications of extracts from seeds of the neem tree, *Azadirachta indica*. We investigated the extent of translocation of neem extracts in the bole of lodgepole pines, *Pinus contora* variety *latifolia* Engelmann. Because attacks by *D. ponderosae* do not always occur high on the bole of standing trees, the pine engraver, *Ips pini*, was used as an indicator species. A proprietary emulsifiable concentrate formulation of neem seed extract containing 20,000 ppm azadirachtin was applied into a basal axe frill around the root collar of lodgepole pines. After 1 wk, the trees were felled and the logs were baited at 3.9 and 15 m from the base with the pheromone ispidienol to induce attack by *I. pini*. Six weeks later, bolts were removed from the trees at the bait positions and held for further 16 weeks in rearing. At 3 and 9 m from the base, populations of *I. pini* (emerged and remaining under the bark) were significantly reduced by 87% and 77%, respectively, indicating that the active ingredients translocated at least 9 m up the bole and persisted for at least 6 wk. Numbers of emergence holes also were significantly reduced by 89%, 88%, and 63% at 3, 9, and 15 m, suggesting that the translocation extended beyond 9 m. Neem treatment had no impact on gallery construction and attack density, but significantly reduced the number of progeny per egg gallery. Unlike the currently used systemic arsenical, neem extracts would pose no toxicity to verte-

brates and would have a short residual activity in the environment. There would be little chance of resistance developing because of neem's multiple modes of action and the fact that very few infested trees in a given year would ever be treated. (J. Econ. Entomol. 1999. 92(1):180-186)

SUITABILITY OF POLYMERASE CHAIN REACTION-BASED APPROACHES FOR IDENTIFICATION OF DIFFERENT GYPSY MOTH (LEPIDOPTERA: LYMANTRIIDAE) GENOTYPES IN CENTRAL EUROPE

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Two different molecular marker approaches—random amplified polymorphic DNA (RAPD) and restriction site polymorphism analysis of a polymerase chain reaction (PCR) product of the internal transcribed spacer region (ITS-2)—have been used to assess whether Asian genotypes of the gypsy moth, *Lymantria dispar* L., have been introduced or migrated to central Europe. In previous studies, both marker systems have proved to be reliable for distinguishing Asian and North American genotypes of this insect and thus for detecting the geographical origin of pheromone-trapped specimens in North America. RAPD analysis of >1,000 samples from 18 different geographical origins in Europe revealed that—with the exception of 2 locations—Asian, North American, and hybrid RAPD markers were present at varying proportions in all European populations. However, none of the European gypsy moth specimens was classified as Asian genotype after analysis of the ITS-2 region. The results are discussed in relation to the possible bottlenecks associated with the release of a small number of European moths in North America and the different genomic regions analyzed with both marker systems. These effects may have influenced the suitability of both diagnostics for dis-

tinguishing gypsy moth isolates from different geographical origins. (Ann. Entomol. Soc. Am. 1999. 92(5):737-741)

ENDOPHYTIC PRESENCE OF *DICULA QUERCINA* ON DECLINING *QUERCUS CERRIS*

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The presence of *Discula quercina* on dormant buds and twigs of declining *Quercus cerris* was studied on two test sites. A number of fungi, including some endophytic ones, were isolated in association with *D. quercina* as part of the total oak mycoflora: *Acermonium* spp., *Diplodia mutila*, *Phomopsis quercina*, *Hypoxyylon mediterraneum*, *Cylindrocarpon* sp., *Phoma cava*, and *Trichoderma viride* plus some less frequent species. The distribution of these fungi did not appear to be related to the altitude of the test sites studied: sea level and 600 m a.s.l., nor to the differing composition of the site vegetation. *Discula quercina* was isolated both from the twigs (18.02% from woody tissue; 5.82% bark tissue) and from the buds (11.62% embryo; 14.55% bud scales). The results indicate that *D. quercina* is able to live in symbiosis with its host. Although the colonization of the aerial parts of *Q. cerris* is possible through infection with windborne inoculum, leaf infection can also occur through overwintering mycelium migrating to the leaves mainly from the buds, but also to a lesser extent from the twigs. (J. Phytopathol. 1999. 147:437440)

NITROGEN NUTRITION OF CONTAINERIZED *THUJA* × 'GREEN GIANT'

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Rooted stem cuttings of 'Green Giant' arborvitae (*Thuja L.* × 'Green Giant') were grown in 3.8-L (#1) plastic containers containing a pine bark:sand (8:1 by vol) substrate. Plants were fertilized three times weekly for 15 weeks with a complete nutrient solution at N application rates (NARs) of 0, 10,

20,40, 80, 160, or 320 mg/L (ppm) supplied as ammonium nitrate (NH_4NO_3). Both shoot and root dry weights were significantly affected by NAR. Maximum shoot weight, as predicted by a quadratic plateau model, was reached at a NAR of approximately 100 mg/L (ppm), representing a 200% increase over controls [0 mg/L (ppm) N]. Maximum and minimum root dry weights occurred at 0 mg/L (ppm) N and approximately 50 mg/L (ppm) N, respectively, representing a 37% decrease. Root length decreased 36% at a NAR of approximately 50 mg/L (ppm). Root diameter (root area + root length) increased before reaching a plateau at approximately 130 mg/L (ppm) N, indicating that root lignin decreased faster than root area at low N concentrations. Shoot concentrations of N, P, Mg, and S were maximized at approximately 71,41,48, and 52 mg/L (ppm) N, respectively. Uptake of K and Ca were unaffected by N concentrations. (J. Environ. Hortic. 1999. 17(2):76-79)

POPULATION DIFFERENCES IN WATER-USE EFFICIENCY OF *EUCALYPTUS MICROTHECA* SEEDLINGS UNDER DIFFERENT WATERING REGIMES

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Gas exchange, water-use efficiency (WUE), carbon isotope composition ($\delta^{13}\text{C}$), and growth traits were compared among five populations of *Eucalyptus microtheca*. Seedlings grown from seed collected across the natural distribution of the species were maintained under water-stressed and well-watered conditions. Gas exchange was measured in terms of net photosynthesis (A) and transpiration (E); WUE was measured in terms of instantaneous water-use efficiency (WUE_i) and transpiration efficiency (WUE_T); growth traits were measured in terms of total biomass (TB), root/shoot ratio (RS), and specific leaf-area density (DEN). Significant differences in all traits were detected among populations. Overall population variation was 1.68 to 2.50 and 1.48 to 2.26 $\mu\text{mol CO}_2$ uptake per mmol H_2O transpired (WUE_i),

1.97 to 3.04 and 1.64 to 2.36 g dry matter accumulation per kg water transpired (WUE_T), and $\delta^{13}C$ was -28.81% to -26.75% and -30.56 to -30.04% under the water-stressed and well-watered conditions, respectively. In addition, WUE_i , WUE_T , and $\delta^{13}C$ were significantly correlated with A, E, RS, DEN, and TB. The study indicated that measurement of WUE may be a useful trait for selecting genotypes with improved drought adaptation and biomass productivity under different environmental conditions. (Physiol. Plant. 2000. 108:134-139)

EFFECTS OF PRUNING LIRIOPE BIBS DURING DIVISION ON SUBSEQUENT GROWTH

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Three experiments were conducted to determine if shoot pruning of liriope [*Liriope muscari* (Decne.) L.H. Bailey 'Big Blue', 'Evergreen Giant', and

'Variegata'] at division affected subsequent growth of roots and shoots. Plants were divided into single bibs and shoots were either left unpruned or pruned 5 cm (2 in.) above the plant crown. Plants with shoots pruned took longer to develop 25 new root tips and had smaller root masses at the end of the experiment. 'Big Blue' plants had 7.5 bibs per container when plants were not pruned and 4.2 bibs per container when plants were pruned. Root system number at division was also evaluated. Plants with larger root systems (10 or more roots) developed 25 new roots faster and produced more bibs than plants with smaller root systems (3 to 5 roots) at division. In experiments 2 and 3, 'Evergreen Giant' was similar to 'Big Blue' in that plants that were not pruned developed 25 new roots faster and had larger root systems at the end of the experiment than plants that were pruned. Results with 'Variegata', known to be a slower growing cultivar, were varied. (J. Environ. Hortic. 1999. 17(3):119-122)