

ARBORICULTURAL ABSTRACTS

GROWING TREES IN ROAD FOUNDATION MATERIALS

P. Kristoffersen

The use of traditional methods for establishing road foundations makes root growth from trees planted in holes within the foundations or close to them impossible. The performance of commonly used urban tree species in traditional and alternative foundation materials was documented through a growth test, which used a total of 8 materials and 3 species of tree: *Acer platanoides* 'Emerald Queen', *Fraxinus excelsior* 'Westhof's Glory', and *Tilia ∞ vulgaris* 'Pallida'. Three crushed materials—granite, lava, and brick—when combined with topsoil, allowed root growth and consequent crown growth and are suited for practical use. The root:crown ratio for plants cultivated in the 3 mixtures, in which soil constituted a maximum of 30% of the total volume, was higher than for plants cultivated in unmixed topsoil. The study also shows that roots cannot grow in "correctly" compacted foundations, and that standing water in plant holes is a strong limiting factor for the growth and vitality of the 3 tree species used in the study. (*Arboric. J.* 1999. 23:57–76)

THE CERATOCYSTIS SPECIES ON CONIFERS

T.C. Harrington and M.J. Wingfield

Seven *Ceratocystis* species are recognized as having conifers as their primary hosts, and these species comprise a monophyletic group. Despite being morphologically similar, these taxa are distinguished by intersterility and isozyme electromorphs. The first described species in the group, *Ceratocystis coerulescens* (Munch) Bakshi, is neotypified; it causes bluestain of *Picea* and *Pinus* in Europe and North America. A similar species, *Ceratocystis pinicola* sp.nov., also causes bluestain but has thus far been recorded only on *Pinus* in Britain. In contrast, *Ceratocystis resinifera* sp.nov. has been recorded from *Picea* on continental Europe and North America and invades wounds of living trees. *Ceratocystis polonica*

(Siemaszko) *C. Moreau* is neotypified and distinguished ecologically from *Ceratocystis laricicola* Redfern & Minter; both species occur across Eurasia and are associated with *Ips* bark beetles North America, *Ceratocystis rufipenni* Wingfield, Harrington, & Solheim and *Ceratocystis douglasii* (Davidson) Wingfield & Harrington, which occur on *Picea* and *Pseudotsuga*, respectively. (*Can. J. Bot.* 1998. 76:1446–1457)

SPECIALIZED PHLOEM PARENCHYMA CELLS IN NORWAY SPRUCE (PINACEA) BARK ARE AN IMPORTANT SITE OF DEFENSE REACTIONS

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The bark anatomy of Norway spruce clones that were resistant or susceptible to *Ceratocystis polonica*, a bark-beetle-vectored fungal pathogen, was compared. The major difference concerned the axial parenchyma cells, called polyphenolic parenchyma (PP cells) because of their vacuolar deposits. The phenolic nature of the deposits was indicated by autofluorescence under blue light, and immunocytochemical studies demonstrating PP cells are enriched in phenylalanine ammonia lyase (EC 4.3.1.5.), a key enzyme in phenolic synthesis. Susceptible-clone PP cells occurred as single rows filled with dense deposits. The resistant clone had 40% more PP cells, which occurred in rows 2 cells thick plus as individual cells scattered among the sieve cells, and had lighter deposits. Trees inoculated with fungus were analyzed, but a distinct fungal response could not be separated from the general wound response. In the resistant clone, phenolic bodies were reduced in size and density or disappeared completely 12 days after wounding, and PP cell size increased. The susceptible-clone phenolics and cell size changed only slightly. These data show that PP cells are active in synthesis, storage, and modification of phenolics in response to wounding, providing an important site of constitutive and inducible defenses. (*Am. J. Bot.* 1998. 85(5):601–615)

REGENERATION OF BARK AND FORMATION OF ABNORMAL BIRCH WOOD

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To find the mechanism of figured abnormal wood formation in Karelian birch, experiments based on artificially induced disturbances of cambial activity on both common and Karelian birches were carried out. To that end, the cambial layer was removed by stripping some bark from the wood during the period of active radial trunk growth. Macro- and microstructure of the tissues regenerating in the "apertures" were studied. Light microscope observations were carried out on tissue sections at the end of the growing period during which the wound was inflicted and on cross-sections of the trunk 2 years later. Many structural aberrations recorded in wounded wood of common birch were also characteristic for the figured wood of Karelian birch. The formation of abnormal wood in both cases is discussed in relation to disturbances in the transport of assimilates. (*Trees* 1998. 13:74–79)

STEM-GROWTH RESPONSE OF PINUS SYLVESTRIS AND PICEA ABIES TO NITROGEN FERTILIZATION AS RELATED TO NEEDLE NITROGEN CONCENTRATION

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Responses of stem-volume growth to N applications were evaluated in relation to foliar N concentrations. Data from N-fertilization in 28 *Pinus sylvestris* stands and 21 *Picea abies* stands were used. Relative stem growth responses were negatively related to concentrations of N in current-year needles of unfertilized trees. There appeared to be a threshold value of 15 to 16 mg (g · DM)⁻¹ N in current-year needles, above which N-application is unlikely to stimulate growth. However, relations were nonsignificant between N concentrations in current-year needles and the abso-

lute stem-growth response [dm³ · ha⁻¹ (5 years)⁻¹]. The indicated threshold values are discussed in relation to other variables reflecting the N richness of the environment. (*Trees* 1998. 12:208–214)

PHOTOSYNTHESIS OF 2 POPLAR CLONES CONTRASTING IN O₃ SENSITIVITY

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Two clones of poplar known for their phenomenological difference in response to ozone were fumigated with 150 nl · l⁻¹ of ozone for 5 hours. In both clones, the treatment significantly reduced the light-saturated rate of CO₂ uptake of recently mature leaves and this was accompanied by decrease in stomatal conductance. Intercellular CO₂ concentration of the resistant clone increased following fumigation. After 20 hours of recovery, photosynthesis recovered only in the resistant clone. Electrolyte leakage of leaf disks increased in both clones to indicated damage to membranes; after the recovery time, this parameter only reached values of the control in the resistant clone. In the other clone, the treatment caused a decline of all chlorophyll fluorescence parameters and only some of them returned to normal values after recovery time. The physiological response appears to be different in the 2 clones. In the resistant one, the most probable mechanism involved in the photosynthetic reduction was a regulatory reduction in CO₂ fixation. Also, data obtained by the solute leakage indicate that in the resistant clone, repair mechanisms play a role. The reduction of photosynthesis observed in the sensitive clone is related both to strong stomatal closure and to impairment in fluorescence parameters. These alterations can indicate a general disruption at the membrane level as confirmed by the solute leakage data. (*Trees* 1998. 12:196–200)