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G.M. Moore

### **Root Tip Growth and the Presence of Leaves Affect Epicormic and Lignotuberous Shoot Development and Survival of Stressed *Eucalyptus obliqua* L'Herit. Seedlings..... 133**

**Abstract.** The shoots produced from axillary, epicormic, and lignotuberous buds are significant parts of stress recovery responses in many tree species. The production of either epicormic or lignotuberous shoots does not guarantee survival of a tree, as the mortality of shoots is high. This research investigated the relationship between root tip growth and shoot production and survival after stress and its implications for urban tree managers. Seedlings of *Eucalyptus obliqua* L'Herit. were stressed by decapitation or different levels of heat stress at temperatures ranging from 40 °C to 100 °C for 2 to 128 minutes, as well as combinations of the two stresses. While the temperatures are not as high as those experienced in a forest fire, the stresses imposed can inform plant responses to stress such as fire. Lower temperatures and shorter durations were often sub-lethal, and decapitation, to the same extent as heat killing of plant tissues, elicited similar levels of epicormic and lignotuberous shoot growth. The root systems of the seedlings were inspected to determine whether the root tips were healthy, and selected root tips were monitored to determine if and when they had resumed growth. Survival rates of epicormic and lignotuberous shoots were enhanced by the presence of healthy leaves. The recommencement of growth after stress by the development of epicormic or lignotuberous shoots was preceded by root tip growth, which emphasises the importance of a healthy root system. Managing for the best soil conditions possible during and immediately after stress may be a key to successful shoot production and tree recovery.

**Keywords.** Decapitation; Epicormic Shoot; Heat Stress; Lignotuber; Root Tip Growth.

Astrid Moser-Reischl, Thomas Rötzer, Stephan Pauleit, and Hans Pretzsch

### **Urban Tree Growth Characteristics of Four Common Species in South Germany..... 150**

**Abstract.** Urban trees are important, green features of cities. However, knowledge of the size development of frequently planted tree species, which is the basis for modeling environmental benefits of urban trees, is mostly limited. Within this study, allometric relationships for tree structures like tree height, crown parameters, and leaf area were developed for 4 common urban tree species in South Germany (horse chestnut [*Aesculus hippocastanum*], small-leaved lime [*Tilia cordata*], black locust [*Robinia pseudoacacia*], and plane tree [*Platanus × hispanica*]). Growth and size differences between different tree species, cities, and planting sites (street, park, square) were analyzed. Moreover, the above- and belowground growing conditions were compared and their influences on growth analyzed. Marked differences in the structural development between species were found, mostly due to their species characteristics. Fast growing species (e.g., *R. pseudoacacia*) also showed fastest development of the tree structures compared to other species. Differences between cities were minor, especially for trees younger than 100 years, whereas the variation of growing conditions within cities strongly influenced their growth. Park trees mostly had greater tree structures compared to trees at other growing sites, though this was also species-dependent. Above- and belowground conditions varied between species, cities, and sites (street, park, square), with obstacles (trees, buildings) south of the trees having a negative influence on crown growth. These patterns can be helpful for better planning of green features in cities. They provide a basis for urban tree management based on the growing space requirements of tree species and their ecosystem service provision.

**Keywords.** *Aesculus*; Growing Space Requirement; *Platanus*; *Robinia*; *Tilia*; Tree Growth Dynamics; Urban Tree Allometry.

Glynn C. Percival and Sean Graham

### **Calcium and Silicon Fertiliser Influence on Fungicide Efficacy Against *Guignardia* Leaf Blotch and Apple Scab Management ..... 170**

**Abstract.** Management of fungal diseases within urban landscapes relies heavily on repeat fungicide sprays. Environmental concerns have led to a need to eliminate or reduce fungicide use. Foliar sprays of calcium- (Ca) and silicon- (Si) based fertilisers have been shown to reduce symptom severity of several fungal pathogens. The aim of our research was to evaluate the influence of Ca chloride, Ca metasolate, tetra ethyl

silicate, and potassium silicate fertilisers, applied independently and in combination with a synthetic fungicide (penconazole) at full and half strength, on apple scab (*Venturia inaequalis*) and *Guignardia* leaf blotch (*Guignardia aesculi*) symptom severity, as well as leaf chlorophyll content, fruit yield, and crown volume. Trials used container-grown *Aesculus hippocastanum* and field-grown *Malus domestica* cv. 'Golden Delicious'. Applications of Ca, Si, and penconazole sprays alone significantly reduced scab and leaf blotch severity compared to water-sprayed controls; however, a significant difference between the type of Ca and Si fertilisers was recorded. A combined mix of a Ca or Si fertiliser with a full or half dose of penconazole was more effective at reducing symptom severity of both foliar pathogens than a full or half dose of penconazole alone. Data analysed with Limpel's formula indicated positive synergistic effects between Ca and Si and penconazole in some, but not all, cases. The integration of Ca and Si foliar sprays as an alternative to, or additive with, penconazole for scab and leaf blotch management appears feasible based on results of our studies and may have applicability against other fungal pathogens.

**Keywords.** Disease Management; Fruit; Holistic Approach; Integrated Pathogen Management; Pathogen Control; Plant Health Care; Urban Landscapes.

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