Beech Bark Disease Management Information

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1.0 Introduction

Few options are available to manage beech bark disease in natural areas (Wiggins et al., 2004). Most control methods focus on reducing populations of the beech scale, as *Neonectria* are unable to colonise trees that have not been previously infested with the scale, and thus control of *Cryptococcus fagisuga* is likely to slow the spread of BBD (Wiggins et al., 2004).

A number of factors influence BBD, including species composition and density of stands, history of land-use, and the size, age and vigour of trees. Selecting management options will depend on these factors, as well as the stage of infestation, i.e. not yet infested, within the ‘advancing front’, within the ‘killing front’ or the ‘aftermath forest’ (McCullough et al., 2003; Heyd, 2005). If an area is not yet affected by BBD the distance from the nearest ‘advancing front’ should be taken into consideration (Heyd, 2005).

2.0 Monitoring

Teale et al. (2009) developed a quantitative method for measuring the density of scale insects based on the area of wax masses on trees. The strong relationship between these variables mean that *C. fagisuga* densities can be accurately, rapidly and non-destructively sampled (Teale et al., 2009).

3.0 Cultural

Thinning and removal of infected or susceptible trees, while retaining resistant trees is a commonly used management strategy. This is important for decreasing long-term susceptibility and vulnerability of forests to beech bark disease. Potentially resistant trees can be identified by smooth bark and vigour. In contrast, large overmature trees, trees with rough bark, and trees with wounds, broken tops or other obvious problems are most likely to be infested by beech scale and most vulnerable to *Neonectria* infection (McCullough et al., 2003). However such practices not feasible in large areas of natural forest due to labour, financial and practical constraints (Wiggins et al., 2004).
4.0 Physical control

Physical removal of scale insects by scrubbing trees, high pressure water, or use of petroleum-based oils, which cover and suffocate scale insects may be used on individual high-value ornamental or yard trees (McCullough et al., 2003).

5.0 Chemical control

There is no practical chemical control for beech scale (Pond, 2008), although insecticides may be used for individual high-value ornamental or yard trees (McCullough et al., 2003). Herbicides may be used in some cases to control beech regeneration, in order to minimise root sprouting and the creation of dense beech thickets (McCullough et al., 2003). Pesticides are not acceptable control options in large natural areas because of labour, financial, environmental and practical constraints (Wiggins et al., 2004).

6.0 Biological control

The most desirable option for control of BBD is a biological control agent of C. fagisuga (Wiggins et al., 2004). A number of natural predators and pathogens of C. fagisuga have been identified including coccinellids, mites, gall gnats and a fungus (Shingo, 1964 in Houston, 1994a; Wiggins et al., 2004; Dukes et al., 2009). However none are effective in stopping its spread to date (Pond, 2008), and much further research is required (Wiggins et al., 2004).

7.0 Genetic resistance

An estimated 1% of American beech trees are resistant to scale insect infestation, and thus BBD. The cause of resistance to BBD remains unidentified (Koch et al., 2007), although in European beech resistance appears to be due to anatomical features that act as barriers to infestation (layers of difficult-to-penetrable sclerophyll cells that are thicker, more continuous, and nearer to the bark surface than in susceptible trees) (Lonsdale, 1983a in Houston, 2005), whereas in American beech resistance may be associated with less total and amino nitrogen concentration. Amino nitrogen is a major limiting factors in nutrition of sucking insects (Wargo, 1988 in Houston, 2005). Recent findings suggest that resistance to BBD ranges from partial to total resistance (Ramirez et al., 2007).
Currently the only known method to identify resistant trees is the artificial infestation method developed by Houston (1982). Drawbacks to this method include the minimum 1-year wait for results and the reliance on live scale eggs which could result in spread of the insect. Thus much research is focused on identification of genetic markers for resistance, trials to clarify modes of inheritance via cross-breeding resistant and susceptible individuals, and methods of propagation via somatic embryogenesis (Koch & Carey, 2005; Loo et al., 2005; Pond, 2008)