Chapter 20

Sclerotinia as Mycoherbicide

The terms “mycoherbicide” or “bioherbicide” or “biological herbicide” imply that the target weed is killed. All mycoherbicides do not necessarily kill, but have different effects on the target weed. Recent research has shown that like any other biological herbicide, *Sclerotinia* in the soil can have detrimental effects on seed germination and root growth without infecting and resulting in disease symptoms on the target weed (Boyetchko, 1996; Daniel et al., 1973). The idea of using plant pathogen for control of weeds was reported before the turn of the century, but it is only in the last three decades that it has received increasing interest (Charudattan, 1991; Freeman et al., 1978; Tebeest, 1996; Templeton, 1982; Watson, 1991; Wilson, 1969). More than 23 exotic plant pathogens have been investigated classical biological control of weeds, more than 67 weeds have been targeted using atleast 107 fungal taxa as mycoherbicide agents (Mortensen and Hogue, 1995). However, *Sclerotinia* is effective as mycoherbicide on more than ten weed hosts (Table 20.1).

The potential of *S. sclerotiorum* as mycoherbicide against *Circium arvense*, *Colseum arvense* and *Cardecus mutans* in pastures has been discussed (Bourdot et al., 1996). In a field experiment conducted in a sheep grazed pasture in New Zealand, the effects of the fungus *S. sclerotiorum* on the long term dynamics of a population of *Cirsium arvense* have been determined by Bourdot et al. (2006). The pathogen is applied in mid-spring either once or thrice when the *C. arvense* shoots are vegetative rosettes, using a granular mycelium on boheat preparation that lodge on the host leaves, stems and in the leaf axils. The disease results in a temporary (17 months) reduction in population size through initial mortalities among treated shoots and results in reduction in root growth, adventitious roots, buds, subterranean shoots and aerial shoots population size. The *S. sclerotiorum* has potential as a mycoherbicide for *C. arvense* in sheep grazed pasture in New Zealand (Bourdot et al., 1995). Applications made during the spring and early summer months of October, November and December significantly reduces the ground cover of *C. arvense* by 67, 67 and 44 per cent, respectively. Reduction in ground cover is from 38 to 81 per cent (Hurrell et al., 2001).

*Sclerotinia minor* Jagger is a promising biocontrol agent for dandelion in turf grass. When a flowering dandelion population is treated with *S. minor*, flowering accelerates to the fruiting stage within four days. This developmental response is
four to five days earlier than in the control, untreated plants and is not observed in herbicide-treated plants. Seeds obtained from the fungal treated plants were smaller, lighter and their germination rate is reduced by 48.4 and 47.3 per cent for spring and fall applications, respectively. *S. minor* is not detected in dandelion seeds from the fungal-treated plants. In addition to effective control of mature (flowering) dandelions, seeds dispersed by dying plants have reduced germination and are not transferring *S. minor* off target (Abu Dieyeh et al., 2005). Sequential treatments of sub lethal rates (25 or 50 per cent of the recommended field rate) and *S. minor* (60 g/m²) can interact positively to increase damage to common dandelion weed (Schnick et al., 2002). A mycoherbicide based on *S. sclerotiorum* has shown promise for the control of *Ranunculus* sub. sp acris (Giant buttercup) in New Zealand dairy pastures. Farm fertilizer management practices and moisture levels are likely to be important variables affecting the on farm efficacy of *S. sclerotiorum* used as a mycoherbicide for controlling giant buttercup (Pottinger et al., 2004). Mycelium on wheat formulation of fungus @ 500kg/ha broadcasted in the infested pasture causes mortality of the giant buttercup plants upto 63 per cent (Verkaaik et al., 2004). However, Harvey et al. (2001) obtained 30–50 per cent reduction in the cover of giant buttercup when *S. sclerotiorum* is applied through broadcast treatment as dry kibbled wheat formulations. Crop disease risk after using *S. sclerotiorum* for weed control in pasture is defined as ratio of added to natural inoculum. Taking 1.0 to be a risk averse value for this ratio perimeter safety zone and 50 m wide are predicted for dairy and sheep grazed pastures (Bourdot et al., 2001). *S. sclerotiorum* has been found to infect *Chrysanthemoides monilifera* (bitou bush) at a number of sites along coastline of eastern Australia by Cother et al. (1996). In New Zealand, a strain of *S. sclerotiorum* isolated from Californian thistle has been found to be virulent also on scotch thistle (*C. vulgare*), nodding thistle (*Carduus nutans*) and ragwart (*Senecio jacobaea*) when applied as a mycelium on wheat formulation to the foliage of these weeds under green house conditions. Under field conditions,