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Sclerotinia sclerotiorum, a potential biocontrol agent for *Chrysanthemoides monilifera* (bitoubush)

E.J. COTHER, A. NIKANDROW and R.L. GILBERT

NSW Agriculture, Agricultural Research and Veterinary Centre, Forest Road, Orange, NSW 2800, Australia

Abstract. Bitoubush is an introduced, invasive weed of the coastline of eastern Australia where it is affected by a necrotic leaf spot and a die-back disease. Several fungi are associated with these lesions but no single isolate has proved pathogenic and die-back may be the result of infection by a complex of fungi. However, a different, less frequent, but more invasive disease has been observed at some sites. The primary cause of this disease was *Sclerotinia sclerotiorum*. At these sites, the disease has progressed rapidly into the bush and lesions have been observed in older stems up to 35 mm diameter. Sclerotia are produced in much lower numbers than are formed by this pathogen in annual hosts such as lupins. Symptoms of this disease have not been observed on native shrubs or other exotic weeds growing in the vicinity of diseased bushes. In spite of the wide host-range of the pathogen, it is nevertheless contended that *S. sclerotiorum* has potential for further study as a biocontrol agent, given the environment in which it would be applied.

Introduction

Bitoubush, *Chrysanthemoides monilifera* sub sp. *rotundata* (DC.) Norl., is an invasive weed of coastal sand dunes in eastern Australia. Bitoubush is present along >60% of the coastal zone in New South Wales (NSW) and is the dominant vegetation of nearly a quarter of the coastline. The most vulnerable areas for invasion are foredune grasslands, dune scrub, dune forest, headland grassy heaths and littoral rainforest. The potential distribution of bitoubush in Australia, as judged by bioclimatic data, far exceeds its present distribution and it is continuing to spread.

Control of this weed has been confined to limited herbicide applications or physical removal of bushes. Sustainable control has not been achieved where there has been inadequate attention to seedling recruitment. Although biological control of bitoubush is a realistic additional control option, thus far in Australia only classical biocontrol with exotic insects has been studied. No attention has been given to naturally-occurring indigenous- or naturalized-fungal pathogens of this plant, although disease in the form of leaf spots or die-back of stems and branches is relatively common in bitoubush along the NSW coast. Biological control, using plant pathogens, as mycoherbicides, is a potentially viable strategy.

Common die-back of bitoubush

A systematic survey was instigated to determine the fungal pathogens associated with bitoubush die-back, their geographic distribution and association with different symptoms. Sampling sites along the NSW coast were chosen for the accessibility and presence of bitoubush, using the data of Love (1984). Information on seasonal variation of the diseases and associated fungi was gained from surveying in spring and autumn. Forty-eight sites from Byron Bay in the north of the state (29°S) to Tathra in the south (37°S) were sampled in spring 1992 and, or, autumn 1993. Of these, 21 sites were sampled in both seasons and 31 sites were sampled in spring 1993 and autumn 1994. At each site, die-back lesions, leaf lesions and, or, symptomless tissue were sampled from bushes at random within an area of several thousand square metres. A total of twelve different symptoms were identified from the survey. The most common die-back symptom was a stem necrosis extending up to 60 cm along the stem and terminating in a clearly defined interface of dark brown and green tissue. This was commonly associated with a tip necrosis, which was either limited to floral parts or progressed more extensively down the stem.

Six hundred samples collected over four seasons produced a total of 2535 isolates representing 55 taxa.

Phomopsis sp. and *Stemphylium* sp. were recovered in high frequencies from almost all lesion-types. A marked effect of season was observed. Infrequently, more than half of a bush was killed by diseases but, generally, the die-back appeared to have no long-term debilitating effect on the plant. Pathogenicity tests with six of the most commonly isolated fungi, in genera known to include plant pathogens, have so far yielded inconclusive results. The general die-back observed in bitoubush is believed to be a disease complex. The role of the many fungi isolated in initiation and progression of this disease remains to be defined.

Sclerotinia sclerotiorum die-back

On several occasions in both spring and autumn, a more invasive disease was observed at a number of sites ranging from the subtropical north coast to the cool temperate south. Symptoms were similar to the common die-back except that the flaccid nature of the necrotic foliage suggested that disease progression was much more rapid than the usual die-back where tissue was more dehydrated. The disease was observed as either a tip or stem infection. The infection site was surrounded by concentric bands of alternating tan (3-5 mm wide) and dark brown (2 mm wide) tissue. Necrosis from tip infections progressed down the stem. If infection occurred further into the larger branches of the bush, extensive wilting and leaf death was observed in the distal portions of the branch. Large areas of a bush were often affected and lesions occurred on stems up to 35 mm in diameter. Sclerotia formed on, or just below, the stem surface of bushes growing in humid, sheltered sites. *Sclerotinia sclerotiorum* (Lib.) de Bary was isolated from the diseased stem tissue; it was rarely isolated from necrotic leaves or flowers. The surrounding vegetation was examined closely but at no site or sampling time were disease symptoms observed on any of the native vegetation (e.g. *Acacia*, *Banksia*, *Leptospermum* or *Leucopogon* species) or on any of the introduced weeds (e.g. *Gazania*, *Oenothera* or *Senecio* species).

When inoculated with mycelial fragments, plants developed lesions on the leaves within two days. These started as dark brown water-soaked spots which, within 5 days, rapidly expanded to tan-coloured lesions 5-10 mm diameter surrounded by a larger water-soaked area. Infected leaves collapsed within 7-10 days, as the infection progressed into the stem. Sclerotia eventually formed on the stems adjacent to the leaf axils or on infected leaves. Plants died 12-20 days after inoculation. Some variation has been observed between isolates in the speed of infection and consequent plant death. This variability may possibly be utilized to select isolates for greater specificity and, or, virulence to bitoubush.

The published host-range of *S. sclerotiorum* suggests that woody plants are rarely infected and the majority of hosts are herbaceous (Purdy 1979; Boland and Hall 1994). This may make it less likely that the native woody species on the coast would be susceptible to infection. It has yet to be determined if the local species are immune, resistant or escape infection because ascospore-discharge does not coincide with a susceptible period of plant growth.

The potential of *S. sclerotiorum* as a biocontrol agent is marked by its pathogenicity to bitoubush, the location of the target weed, absence of known, agriculturally-important crops in proximity to the dunes and the apparent absence of disease on the native vegetation. If it can be established that *S. sclerotiorum* does not pose a threat to native coastal vegetation, this fungus becomes a priority candidate for further study in the biocontrol of bitoubush. Its potential in other weed biocontrol situations has been reported (Sands *et al.* 1990; Harvey *et al.* 1994).

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