INCIDENCE OF *BOTRYTIS CINEREA* AND COLONISATION OF NECROTIC LEAF TISSUE IN KIWIFRUIT CANOPIES

S.M. HOYTE, L.J. PERRY-MEYER and R.A. HILL

*The Horticulture and Food Research Institute of New Zealand Ltd,
Ruakura Research Centre, Private Bag 3123, Hamilton*

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Stem end rot of coolstored kiwifruit caused by *Botrytis cinerea* is of major importance to the New Zealand kiwifruit industry. During each growing season, *B. cinerea* survives as a saprophyte and weak pathogen within host tissue, leading to deposition of spores on fruit surfaces (Elmer *et al.* 1993). Research in kiwifruit orchards has shown that necrotic leaves infected with *B. cinerea* were the principle source of inoculum in kiwifruit vines at harvest (Manning and Pak 1993; Elmer *et al.* 1993). High humidity incubation of necrotic leaf discs has been used to measure relative incidence of *B. cinerea* in kiwifruit (Manning and Pak 1993). Incubation of whole leaves with necrotic lesions has also been used to quantify *B. cinerea* populations (Elmer *et al.* 1993; Hoyte *et al.* 1993). This paper describes a method for quantifying *B. cinerea* colonisation and inoculum production on necrotic leaf tissue. Two adjacent orchards at Te Puna, near Tauranga, with different pruning management were compared. Orchard A was lightly pruned and had a dense leaf canopy, whereas Orchard B was heavily pruned.

Beginning on 25 March, seven samples of four leaves, representative of four necrosis types, were randomly collected at weekly intervals from each of 20 single vine plots in each orchard. The four necrosis types were: (i) Necrotic - clearly defined necrotic lesions on green leaves; (ii) Senescent - physiological necrosis on senescent leaves; (iii) Dead - whole leaf necrotic; (iv) Red Brown - dry brittle lesions. Leaves were placed into humidity chambers constructed from two 300 x 350 x 25 mm "plex" food trays. Paper towels in the base of each tray were moistened with sterile water to maintain high humidity. The area of necrosis on each leaf was estimated using a sheet of acetate marked with 1 cm² graduations, before the trays were sealed in plastic bags and incubated in a controlled environment room at 20°C, 10:8 light:dark. After 18 h incubation, the number of *B. cinerea* colonies and the total area of sporulation was estimated using the acetate grid. A sub-sample of 20 leaves with a range of sporulation areas was used to estimate the number of spores/cm². Each leaf was washed in 20 ml sterile water and the number of spores counted with a haemocytometer. On 5 May the total number of leaves and the number of leaves in each necrosis category were determined by removing all leaves from a 1 m² quadrat in each of ten plots in each orchard. The number of 'Senescent' and 'Dead' leaves was higher in Orchard A than in Orchard B (Table 1), which was most likely due to the higher canopy density in Orchard A (Manning and Pak 1993). Incidence of *B. cinerea* colonisation on 'Necrotic' and 'Senescent' lesions was significantly higher in Orchard A than in Orchard B (Table 1). Spore production was much higher in Orchard A than in Orchard B, and in both orchards was higher from leaves in the 'Necrotic' category compared with production from other types of necrosis (Table 1). Although there were large numbers of leaves with 'Red Brown' lesions in Orchard B, these had little influence on overall spore production, due to low incidence and sporulation area of *B. cinerea*.

On 'Dead' leaves, colonies of *B. cinerea* tended to be smaller than 1 cm² and most of the necrotic tissue was colonised by saprophytic fungi such as *Cladosporium*. *Botrytis cinerea* colonised a greater proportion of necrotic tissue on 'Necrotic' leaves than on 'Dead' leaves (Fig. 1). These data indicate that on 'Necrotic' type lesions, *B. cinerea* has the ability to pre-dominate, while on 'Dead' leaves it is present only as a saprophyte.

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TABLE 1: Mean percentage of necrosis type, mean incidence of *B. cinerea* and relative spore production on kiwifruit leaves sampled over 7 weeks from Orchards A and B.

Type of necrosis	% leaves		Incidence of <i>B. cinerea</i> (%) ²		Relative spore production (%) ³	
	A ¹	B ¹	A	B	A	B
'Necrotic'	11	19	27	7	100	20
'Senescent'	12	7	18	4	53	3
'Dead'	17	1	32	25	65	2
'Red Brown'	0	26	0	3	0	4
SED (average)	6	6	4	4		

¹ A = Orchard A lightly pruned (mean total leaves/m² = 216) and B = Orchard B heavily pruned (mean total leaves/m² = 133).

² Following 18 h incubation at high humidity.

³ = lesion incidence x *B. cinerea* incidence x sporulation area for each necrosis type, relative to Orchard A 'Necrotic'.

Figure 1: Frequency distribution of the percent area of necrotic tissue colonised by *Botrytis cinerea* for 'Necrotic' and 'Dead' kiwifruit leaves from Orchards A and B.

The number of spores ranged from 9×10^3 – 3×10^5 spores/cm² sporulation area (mean of 8×10^4 spores/cm²). Based on our incubation data and spore counts, the estimated spore production from necrotic leaf tissue was 1.2×10^7 /m² in Orchard A and 1.6×10^6 /m² in Orchard B. This difference was similar in magnitude to the eight-fold difference in numbers of spores recovered in spore traps operating throughout the sampling period (Hoyte *et al.* 1993). The increased risk of picking scar contamination in Orchard A was apparent in a storage trial from these orchards, where rot incidence was 2.4% compared with 0.6% in Orchard B (Hoyte *et al.* 1993).

Incubating whole kiwifruit leaves for determining the incidence and spore production of *B. cinerea* was a reliable technique. Both the level of leaf necrosis and the actual incidence and sporulation potential of *B. cinerea* on the types of necrosis present are important in determining *B. cinerea* populations and the quantity of inoculum present at harvest.

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