MELANOSE

Diaporthe citri (Faure.) Wolf

1 PATHOLOGICAL PROFILE

1.1 Distribution and status

Melanose is widespread in the eastern and northern citrus production areas of southern Africa but is important only in plantings where inoculum is abundant and when abnormally high late winter and early spring rainfall occurs during the period of early fruit development.

1.2 Description

Two types of spores are formed by melanose: asexual and sexual spores.

Asexual spores, called **pycnidiospores** or conidia (alpha and beta) are the main source of inoculum in the orchard and are produced in spore-bearing structures called pycnidia (Figure 1). Pycnidia develop on dead twigs, particularly those that have died back recently. The pycnidia are scattered or clustered, are initially immersed and later erupt. They are black in colour and are conical to lenticular in shape (200 to 600 µm in diameter) with ostioles or openings through which the conidia are dispersed. Infections are caused mainly by alpha conidia. The diagnostic features of these spores are as follows:

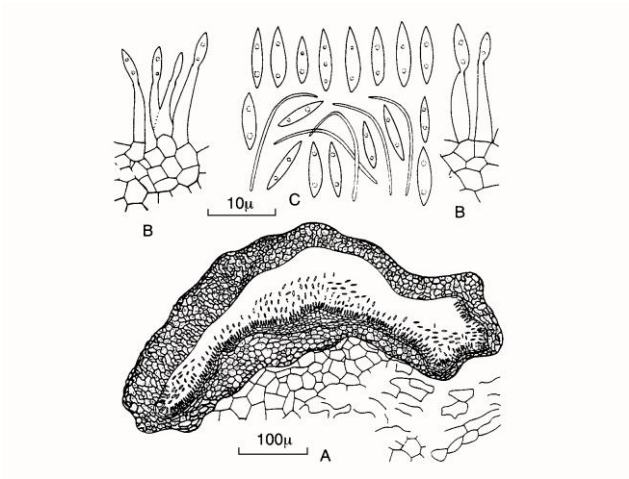

Figure 1. A, vertical section of a pycnidium; B, part of pycnidial wall, conidiogenous cell and conidia; C, alpha and beta conidia (Courtesy Punithalingam and Holliday).

Alpha conidia are unicellular, hyaline and biguttulate, measuring 6 to 10 µm x 2 to 4 µm.

Beta conidia are unicellular, hyaline, filiform, curved and often strongly hooked with dimensions of 20 to 30 µm x 0,5 to 1,5 µm. They do not germinate and usually predominate in older pycnidia.

When wet, these spores are extruded in a slimy mass, whereas under conditions of high humidity they exude to form a spore tendril or cirrhus. The spores in these tendrils can endure desiccation and can be dispersed later by water. Since they are only dispersed by the splashing of raindrops, dissemination occurs over only short distances.

Sexual spores called **ascospores** are produced in spore-bearing structures called perithecia. Perithecia develop singularly or in groups on twigs that have mostly ceased producing pycnidia. They are spherical (125 to 160 µm in diameter) and flattened at the base, with long (200 to 800 µm), black, tapering beaks.

The diagnostic features of the ascospores are as follows:

Ascospores are hyaline and two-celled, with each cell containing two guttulae and measure 11,5 to 14,2 µm x 3,2 to 4,5 µm.

Ascospores are airborne and therefore disseminated over long distances. However, they are usually not the main source of inoculum. At times they can be numerous enough to cause a problem, particularly if there is a lot of dead wood on the trees or on the ground, or if heaps of citrus brush are left unburnt in the orchard.

1.3 Symptoms

Melanose symptoms appear on leaves and fruit about one week after infection as small, brown, discrete or confluent, sunken spots. Epidermal and sub-epidermal cells (up to six cells deep) are killed and become impregnated with reddish brown gum. A periderm develops underneath and lifts the dead cells as well as the pycnidia above the host surface; the resulting lesions are known as pustules.

1.3.1 Leaves

Pustules on leaves are at first surrounded by a yellow halo. Later the chlorotic areas re-green, and only corky pustules remain, leaving a sandpaper-like appearance. Severe infection of shoot apices takes place while leaves are unfolding, causing leaf distortion and even die-back. When infection occurs at a later stage of shoot development, the effects are less severe, the pustules are smaller and mostly discrete and little or no distortion of leaves or reduction in leaf size occurs. Leaves become resistant to infection once they are fully expanded.

1.3.2 Fruit

Pustules on fruit vary in size, depending on the age of the fruit at the time of infection. When infection occurs soon after petal fall, pustules become larger and if numerous enough, coalesce to form extensive diseased areas. Such areas often crack, producing a pattern known as **mudcake melanose**. Infection at a later stage of fruit development produces relatively small discrete pustules. The distribution of pustules depends on the manner in which water settles or flows over the fruit surface. A **tear-streaked melanose** pattern results when spore-laden water flows over the fruit in definite paths or patterns.

1.4 Seasonal occurrence

Long periods of continuous wetting are needed for spore germination and host penetration. The required period of wetting also increases greatly as the temperature decreases. For example, at 25°C a minimum period of 8 to 10 hours is required for the initiation of infection, whereas at 15°C the minimum wetting period for infection increases to 18 to 24 hours. Rain showers, occurring in the late afternoon and followed by warm nights during which the fruit remains wet, are conducive to infection.

2 MANAGEMENT ASPECTS

2.1 Disease assessment

Disease severity is determined mostly by the amount of inoculum-bearing dead wood in the upper tree canopy and by the frequency and duration of periods during which fruit and foliage remain wet following rainfall or overhead sprinkler irrigation.

Young trees are usually less affected by melanose than older trees, because they have less dead wood. Dead twigs colonised by melanose begin to produce inoculum after a period of approximately 2 months.

2.2 Control options

2.2.1 Cultural

Pruning of dead twigs or even branches of old trees is feasible but these must be removed from the orchard and burnt to prevent spore release.

2.2.2 Plant protection products

Fungicide spray treatments have little effect in preventing infection of vegetative shoots unless applied frequently. Copper fungicides do not have sufficient antisporulant action to provide acceptable melanose control if applied before shoot emergence or petal fall. They are only effective for melanose control if the whole fruit surface is covered with fungicide. When abnormally high, late winter and early spring rainfall occurs during the period of early fruit development, plant protection products should be applied as recommended in Table 1.

Table 1. Recommended spray programmes for the control of melanose.

Weather conditions	Fungicide*	Dosage / 100 ℓ water	Application dates / intervals
Normal season	Mancozeb	200 g	First application during 3rd week of October. Follow up with a further 2 applications at 25 day intervals.
	Copper oxychloride/ copper hydroxide	200 g	First application during 3rd week of October. Follow up with a further 2 applications at 30 to 35 day intervals.
Wet season	Mancozeb + mineral oil**	150 g + 500 ml	First application at 100% petal fall in late September to early October. Follow up with 4 applications at 25 day intervals ***
	Copper oxychloride/ Copper hydroxide	200 g	First application at 100% petal fall in late September to early October. Follow up with 3 applications at 30 to 35 day intervals ***

* The other contact fungicides registered for the control of black spot also control melanose. Consult Table 1 in part 3 on black spot in this chapter.

** The oil component in the treatment may have a detrimental effect on yield if the tree is under stress. Consult part 11-4 on red scale in the IPM recommendations (Chapter 3) for comments on the use of narrow range mineral oils.

*** An additional two to three applications may be necessary depending on rainfall.