BATTLING BRANCH DIEBACK, CANKERS AND FRUIT ROTS IN YOUR AVOCADO ORCHARD: WHAT YOU NEED TO KNOW ABOUT THE *BOTRYOSPHAERIACEAE*

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Often referred to as "green gold", avocados hold significant economic importance in South Africa. The country's avocado industry is expanding rapidly, positioning itself as a leading exporter of this globally sought-after crop (Donkin, 2023). However, the sustainability of avocado production is challenged by both abiotic and biotic stressors that reduce productivity in nurseries and orchards. Among the most concerning biotic threats are fungal pathogens, particularly those belonging to the *Botryosphaeriaceae* family that affect avocado scions.

Reports of this fungal family infecting avocados are increasing worldwide (Avenot *et al*., 2023; Fiorenza *et al*., 2023; Guarnaccia *et al*., 2020; Hernandez and Kc, 2024). They can cause significant problems like branch cankers, dieback, and fruit rots, leading to reduced orchard productivity, reduced fruit quality, and substantial yield losses (Pérez-Jiménez, 2008). With *Botryosphaeriaceae* infections reported in every avocado-producing province of South Africa (Beukes, unpublished data), understanding and managing these pathogens are essential to prevent them from becoming a major threat to the avocado industry.

What are these fungi, and how do they cause disease?

The *Botryosphaeriaceae* is a diverse family of fungi with an exceptionally broad host range, having been reported on over 500 plant species, including fruit trees, native vegetation, and various vegetable crops (Úrbez-Torrez *et al*., 2013).

A notable feature of these fungi is their ability to colonise host plants as endophytes, meaning they can reside within plant tissues without causing immediate symptoms (Dissanayake *et al*., 2016). In avocado trees, this latent lifestyle allows them to persist undetected until triggered by stress factors such as drought, nutrient deficiencies, or physical injury (Slippers and Wingfield, 2007). Under these conditions, the fungi shift from a latent phase to an active pathogenic state, leading to disease development. In severe cases, vascular disruption can impair water and nutrient transport, resulting in foliage browning and retention, dieback of branches, and overall tree decline. Infected trees often exhibit reduced vigour and increased susceptibility to secondary infections, ultimately diminishing orchard productivity (Valencia *et al*., 2019).

Recognising the symptoms

On branches and trunks, infection can present as sunken lesions or cankers (Fig. 1). These cankers can exude a reddish sap that then dries to become a

Figure 1: Canker on an avocado branch.

white-beige powder (Fig. 2). Over time, the affected bark can become brittle and peel off easily, revealing red or dark brown wood underneath. If you cut into an infected branch, distinct wedge-shaped discolouration extending deep into the wood is visible (Fig. 3). Additionally, the bark in these areas may appear blackened, sunken, or may even split. Severe infections on branches and stems can block the flow of water and nutrients, leading to leaves that turn brown but remain attached to the tree (Fig. 4), and ultimately causing branch dieback (Auger *et al*., 2013).

Infected avocado nursery seedlings often exhibit shoot dieback, beginning with the wilting and browning of leaves and shoots, typically starting at the tips (Fig. 5). The apical shoot may become dry and brittle, and lateral branches may also progressively die back. Leaf symptoms commonly include premature yellowing or browning, with some leaves wilting yet remaining attached to the stem, contributing to a general decline in seedling vigour. In grafted seedlings, *Botryosphaeriaceae* infections can result in graft failure, where the graft union fails to establish properly or deteriorates over time. Affected graft sites may show signs of darkening, cracking, or tissue collapse, often leading to the death of the scion and reduced overall seedling viability (Beukes, unpublished data).

Fruit rots are symptoms of postharvest *Botryosphaeriaceae* infections. One form is postharvest fruit

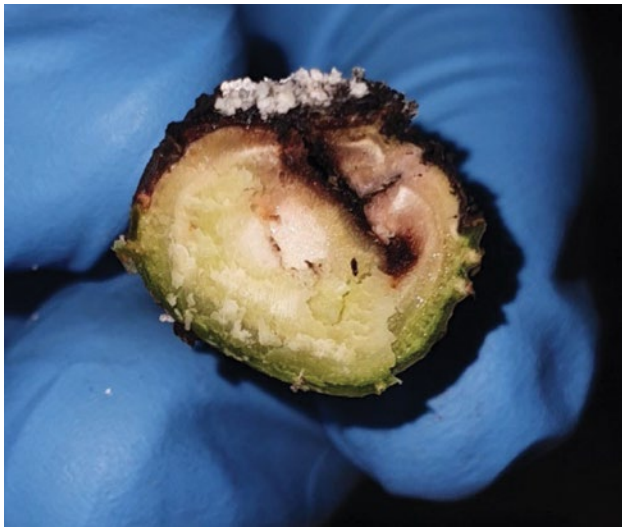

Figure 2: Cross section of an avocado branch displaying a canker with dried white exudate (From Möller *et al*., 2025).

Figure 3: Cross section of an avocado branch displaying the distinct wedge-shaped wood discolouration.

Figure 4: Foliage on infected trees turn brown but remain attached to the branch.

Figure 5: Dieback on the apical tips of etiolated seedlings.

rot, which typically starts as irregular reddish-brown lesions on the skin that become worse as the fruit ripens. The decay often follows the vascular bundles inside the fruit. As the fruit ripens, these lesions expand rapidly, become sunken, and turn black. In later stages, a watery decay spreads through the fruit, causing it to shrivel and smell unpleasant. In some cases, grey mould might appear on the surface. Interestingly, before the fruit ripens, these symptoms are not visible because the fruit skin contains natural antifungal compounds that suppress the fungus. As these compounds decrease during ripening, the dormant infections become active and the rot develops (Menge and Ploetz, 2003).

Another type of fruit rot is stem-end rot, which starts at the stem-end of the fruit, sometimes causing slight shriveling around the stem button (Fig. 6). Dark brown to black lesions then develop at the stem-end and spread across the fruit as it ripens, eventually making the fruit shrunken and soft, and potentially covered with fungal growth (Menge and Ploetz, 2003).

How do these fungi spread?

Botryosphaeriaceae spores are primarily spread by water, through rain splash or irrigation sprinklers (Michailides and Morgan, 1993). Spores are produced in fungal fruiting bodies that develop on the bark, particularly near cankers, as well as on dead twigs, leaves, and fruit. Infected or dead plant material within the orchard serves as a reservoir for these spores (Avenot *et al*., 2023), which can be dispersed by wind, rain splash, or tools, contributing to the spread of disease. While mulching the orchard floor provides numerous benefits, it is essential to maintain good sanitation practices to prevent the accumulation of inoculum and reduce the risk of new infections.

The fungal spores are believed to enter the avocado host mainly through wounds, such as pruning cuts, and possibly through natural plant openings like stomata and lenticels (Navarro *et al*., 2022).

Which trees are most at risk?

Available research indicates that the Hass avocado cultivar is particularly susceptible to *Botryosphaeriaceae* infections. This is of major concern given that 'Hass' is the most widely cultivated avocado variety globally and represents approximately 80% of avocado plantings in South Africa (Donkin, 2023). Pathogens have also been isolated from Lamb Hass, Fuerte, and Edranol cultivars. Unfortunately, there is limited research comparing the susceptibility of other avocado varieties, making it difficult to fully understand how different cultivars respond to these infections.

Figure 6: Stem-end rot of avocado fruit (From Möller *et al*., 2025).

There is growing concern that latent infections in nursery stock may serve as a primary pathway for the introduction of *Botryosphaeriaceae* into new orchards. Although the exact source of infection in nursery material remains unclear, young trees may be asymptomatically infected at the time of planting. These infections can remain dormant for years and only become active when trees are exposed to stress. This highlights the urgent need for routine screening and strict phytosanitary audits of nursery stock to detect and eliminate pathogens before planting.

In older orchards, the risk of disease increases with the age and size of the trees. Pathogen levels tend to build up over time, with persistent fruiting bodies on trees or on the ground.

Managing the *Botryosphaeriaceae* in your orchard and nursery

There are currently no registered fungicides for controlling *Botryosphaeriaceae* infections on avocados in South Africa and no cultivars showing signs of tolerance or resistance, therefore management primarily relies heavily on cultural practices (Möller *et al*., 2025).

Sanitation is critical. Remove old or infected fruits, shoots, twigs, branches, and any dead plant material from orchards to help reduce inoculum sources, as the fungi can survive and overwinter on these debris (Avenot *et al*., 2023). Dead and infected tissues often harbour fruiting structures that release spores, so their removal is essential.

Proper irrigation management is also important. Overhead irrigation should be avoided since both rain splash and sprinklers can disperse fungal spores (Michailides and Morgan, 1993). Instead, drip irrigation is recommended and should be tailored to the trees' specific water needs to maintain root health.

Pruning should be carried out annually during the dry season to promote tree vigour, as pruning wounds can serve as entry points for fungal spores dispersed during the wet season (Eskalen *et al*., 2013). However, intensive pruning should be avoided, as it can induce stress in the tree. Since no registered wound treatments are available for avocados, careful timing and proper technique are essential. In nurseries, seedlings exhibiting dieback symptoms should be pruned with sterile tools to minimise the risk of pathogen spread.

Stress reduction is another vital strategy, as these fungi often become pathogenic when the host is under stress. Managing stressors such as drought, hail damage, insect infestation, frost or snow, nutrient deficiencies, and plant competition can significantly

reduce disease severity (Menge and Ploetz, 2003). Ensuring that avocado varieties are suited to the orchard's elevation, soil type, and regional climate further supports plant resilience.

Chemical control options for *Botryosphaeriaceae* in avocados remain limited. In other woody perennial crops like grapevines, citrus, and nuts, common chemical treatments include broad-spectrum fungicides such as copper-based compounds (Reis *et al*., 2021), strobilurins (e.g. azoxystrobin) (Moral *et al*., 2019), and triazoles (e.g. tebuconazole) (Pitt *et al*., 2012). For instance, in grapevine cultivation, fungicides like pyraclostrobin are applied after pruning and at bud break to help prevent *Botryosphaeriaceae* infections (Ayres *et al*., 2017). Research in walnut orchards has also shown the efficacy of various fungicides, including tebuconazole and pyraclostrobin, against *Botryosphaeriaceae* species (Antony *et al*., 2024). Although some studies have explored potential fungicides for use in avocados (Twizeyimana *et al*., 2013), registered solutions are still lacking. The success seen in managing *Botryosphaeriaceae* in other crops using these types of fungicides underscores the need for similar research and development efforts for avocados.

Biological control presents a promising alternative, involving the use of beneficial microorganisms to suppress pathogens (Heydari and Pessarakli, 2010). While this approach has shown effectiveness against the *Botryosphaeriaceae* in other crops like grapevines, almonds, and pistachios (Kotze, 2008; Mondello *et al*., 2019; Billar de Almeida *et al*., 2020; Pollard-Flamand *et al*., 2023), evidence for its success in avocados is limited. Preliminary laboratory studies, such as those demonstrating garlic extract's inhibitory effects on a particular *Botryosphaeriaceae* species (Aidoo *et al*., 2024), are encouraging but have yet to be validated under field conditions. Overall, biological control strategies for tree crops, including avocado, remain under-researched and require further investigation.

The *Botryosphaeriaceae* pose a significant challenge to avocado production. While research is ongoing to find new detection tools and control methods, effective management in avocado primarily relies on diligent cultural practices, particularly focusing on sanitation, appropriate irrigation, careful pruning, and above all, minimising stress on the trees. Limiting the spread of the fungi is crucial because eradication is not currently possible.

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