South African Avocado Growers' Association Research Report for 1978. 2:45-47

ANTHRACNOSE OF AVOCADOS

JM KOTZÉ
DEPARTMENT OF MICROBIOLOGY AND PLANT PATHOLOGY, UNIVERSITY OF PRETORIA

OPSOMMING

Antraknose van avokados is 'n latente siekte, omdat besmettings reeds maande voor pluktyd in die boord plaasvind. Die simptome ontwikkel eers nadat die vrugte gepluk is. Ontwikkeling van die simptome word deur temperatuur be'invloed. By 5°C word die swam feitlik heeltemal ge'inhibeer terwyl die simptome vinnig ontwikkel tussen 20° - 24°C. Die lewensiklus van die swam word vir die eerste maal volledig voorgestel.

INTRODUCTION

Post-harvest rot of avocado fruit is a major problem especially on exported fruit. The bulk of the South African avocados is exported by sea and the time lag from picking until marketing is mostly more than three weeks.

Several fungi may be involved in fruit rot, but *Colletotrichum gloeosporioides* and *Dothiorella* spp. seem to be the most important.

THE PROBLEM

Anthracnose is seldom seen during the harvesting and packing stages. It is a latent disease, and although the fruit is already infected at the time of harvesting, symptoms only appear when the fruit becomes soft. The rotting process is accelerated as the fruit reaches peak maturity. When an avocado fruit becomes soft, latent infections of many rot causing fungi become active. The loss of resistance as storage time increases, follows the pattern of lead discolouration as shown by Jacobs, 1974. (Figure 1)

The severity of anthracnose varies over the season on the export market. Some consignments may be completely unmarketable, while others may be relatively free from symptoms.

All avocado cultivars are susceptible but Fuerte, the most important export cultivar at this stage, is very susceptible. Although growers are more concerned about anthracnose on the export markets, the disease is sometimes also severe on local fruit.

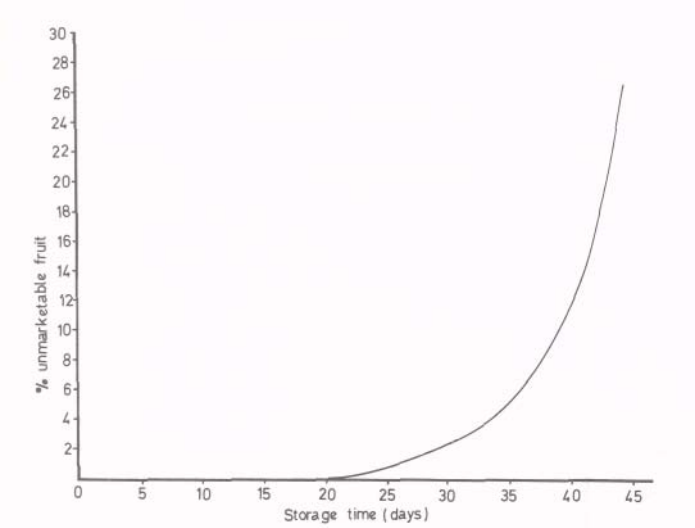

Fig 1 The development of internal lead discolouring in Fuerte avocados after different storage periods. (after Jacobs 1974)

THE CAUSE OF ANTHRACNOSE

Two variants of *Colletotrichum* are commonly isolated from anthracnose lesions, viz. an isolate which readily forms the ascegerous stage on PDA medium and corresponds with the description of *Glomerella cingulata.* Another isolate does not normally produce a perfect stage and the asexual spores vary considerably in size. Until greater clarity comes to hand the causal organism must be taken as *Colletotrichum gloeosporioides* Penz. (Gorter, 1977). This fungus attacks many subtropical plants, including citrus, mangoes and papaya.

Another fungus which is usually associated with large superficial necrosis of the peel, is *Dothiorella* sp. of which the perfect stage is probably *Botryosphaera.* These lesions are usually much larger than those caused by Colletotrichum. The lesions are initially restricted to the peel, but spread to the flesh when the fruit reaches maturity. When this fungus gains entry through wounds, decay spreads rapidly and discolouration of the vascular tissues occurs frequently.

FRUIT SUSCEPTIBILITY

Artificial inoculations indicate that Fuerte avocado fruit can become infected in the orchard at any stage of development. Infections take place through wounds but by far the most important mode of infection is by direct penetration (Table 1).

TABLE 1: Development of anthracnose symptoms on fully grown Fuerte fruit, when they were sprayed with conidia of *Colletotrichum gloeosporioides* two weeks before picking and kept at 100% RH for 72 hrs

Average number of anthracnose lesions for 10 fruit at eating soft stage	
Not inoculated	inoculated
1	68

Binyamini and Schiffmann-Nadel showed that spores of *C. gloeosporioides* germinate on the fruit and produce a germ tube which enters the thick wax layer above the cuticle and forms dark appressoria. These appressoria do not develop further and represent the latent stage of infection until the fruit ripens. During softening of the fruit, after picking, infection pegs from the appressoria penetrate the cuticle and epidermis. As the softening process progresses the mycelium invades the peel and the pulp and the typical half moon shape anthracnose symptom appears.

Fruit which are inoculated with spores after picking become diseased in a similar way providing the minimum moisture requirements are provided.

In an experiment where firm fruit of the Fuerte, Edranol, Hass and Ryan cultivars were inoculated with fresh conidia through wounds, Ryan showed exceptional resistance to the spread of infection. Wounds actually healed after inoculation. Towards the end of the avocado season Ryan sometimes became injected, but the results were erratic which might indicate that there are factors involved that are not fully understood at present.

Fuerte and Edranol were very susceptible. The infection spread faster in soft Fuerte fruit than in any of the other cultivars.

Mass showed greater resistance than Edranol and Fuerte but when the fruit became edible infections also spread rapidly. The results of the inoculation studies are shown in Figure 2.

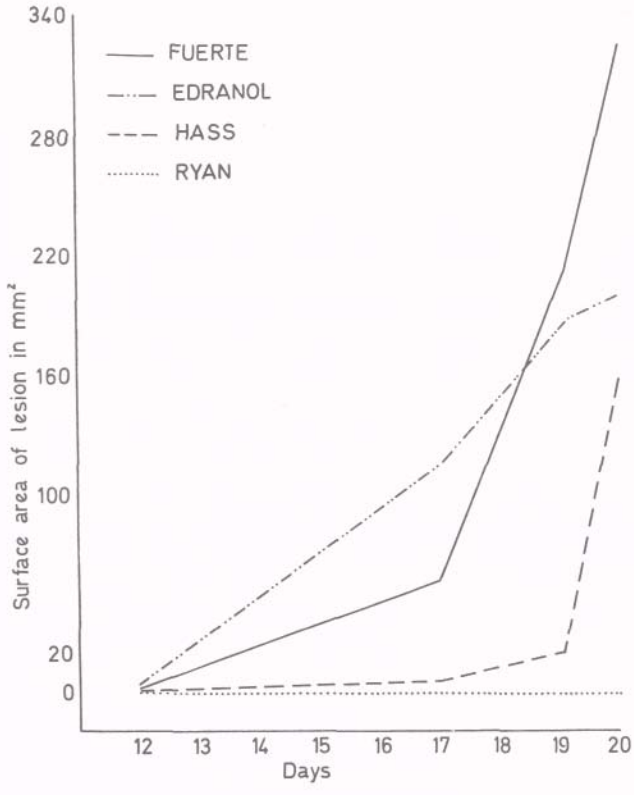

FIG. 2: Average lesion diameter of different avocado cultivars inoculated with *Colletotrichum gloeosporioides*

TIME OF INFECTION

Fruits become infected in the orchard. Infection depends on prevailing climatic conditions. Peterson (1978) found that fruit infection is closely correlated with rainfall and that four consecutive days of rain are necessary for infection to become established. The amount of rainfall recorded was not important but the period of wetness was a significant factor.

The fruit is susceptible at any stage.

LIFE CYCLE

The life cycle of *C. gloeosporioides* is illustrated schematically in Figure 3. At this stage the relative importance of ascospores versus conidia is not known under our conditions. It is important however, to note that leaves, twigs and fruit can serve as sources of inoculum. The debris normally found on the orchard floor may play an important role in the epidemiology. Inoculum is present throughout the year. Long wet periods and the presence of fruit are all that are necessary to secure infection.

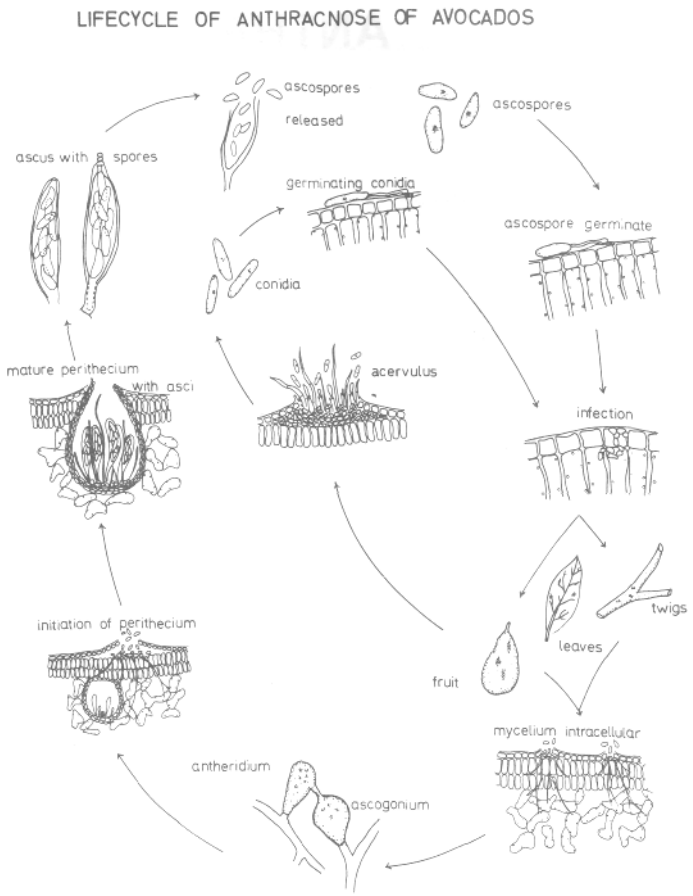

FIG. 3: Schematic presentation of the life cycle of *Colletotrichum gloeosporioides* on avocados

SEASONAL VARIATION OF ANTHRACNOSE

During the 1978 season fruit was obtained on a weekly basis on the Pretoria Municipal Market. Fruit from Westfalia Estate was regularly available but the other packhouses and co-ops did not have fruit on the Pretoria market for extended periods. In order to investigate the incidence of anthracnose on the fruit from various areas, two boxes of avocados per week from every area were kept at 20°C until edible and the number of anthracnose lesions was recorded as expressed per 10 fruit.

Isolations were made at a rate of 100 per week to confirm the cause of the lesions. The seasonal variation of anthracnose on local market avocados for Westfalia Estate and the Levubu area (including Louis Trichardt) is given in Figure 4. These observations should continue in future, but at this stage no conclusions can be drawn.

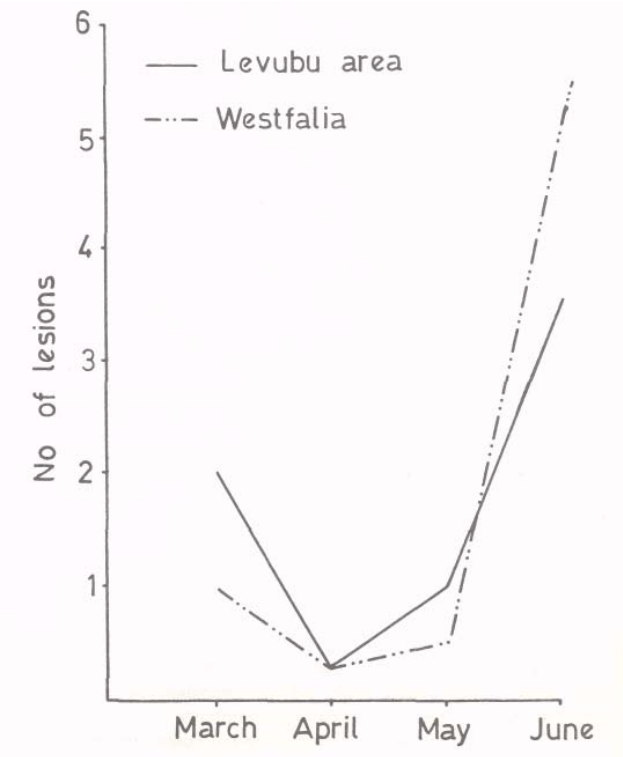

FIG. 4: Seasonal variation of anthracnose in two different areas during 1978

EFFECT OF TEMPERATURE ON THE GROWTH OF *C. GLOEOSPORIOIDES* AND *DOTHIORELLA* SPP.

A temperature study was carried out on PDA, using *C. gloeosporioides and Dothiorella* sp. The results of these experiments are given in Figure 5.

Firm Fuerte fruit was inoculated through artificial wounds and kept at 5, 10, 15, 20 and 24°C until edible. The development of anthracnose was determined by measuring the diameter of the resulting lesion. No lesions developed at 5°C for 21 days and the fruit remained firm. At 10°C the fruit was still fairly firm after 21 days but three lesions developed with an average size of 3,8 mm^2. At 20 and 24°C lesions developed within 7 days and became completely decayed after 11 days.

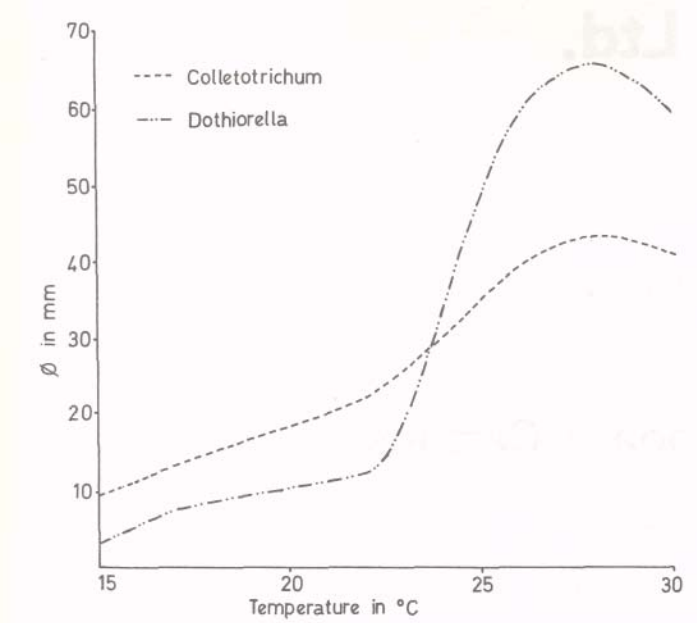

FIG. 5: Effect of temperature on the growth of *C. gloeosporioides* and *Dothiorella* sp

SUMMARY

Anthracnose of avocados is a latent disease and the symptoms only develop after picking while infection has taken place several months earlier in the orchards. Anthracnose symptom development is largely influenced by temperature. At 5°C the fungus is almost completely inhibited, while the symptoms develop rapidly between 20 - 24°C. The life cycle of the causal organism is presented schematically for the first time.

ACKNOWLEDGEMENTS

The assistance of Andre Strydom, Eileen Kuschke and Theresa Brits is gratefully acknowledged.

LITERATURE CITED

BINYAMINI, N and SCHIFFMANN-NADEL, M (1972). Latent infection in Avocado fruit due to *Colletotrichum gloeosporioides,* Phytophathology 62: 592 - 594.

JACOBS, CJ (1974). Probleme by die koelopberging van avokados. Citrus and Sub-Tropical Fruit Journal May 1974: 16 - 21.

PETERSON, RA (1978). Susceptibility of Fuerte avocado fruit at various stages of growth to infection by anthracnose and stem end rot fungi. Australian Journal of Experimental Agriculture and Animal Husbandry, 18: 158 - 60.