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Microbes Associated with the Avocado Flower and Fruit: The Good, the Bad and the Ugly

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ABSTRACT

The fungal microbial populations of the tissues of stems and flowers from avocado inflorescences were investigated as an initial step in determining the role of these fungi in early fruit and flower drop. Samples were surface sterilized, plated on potato dextrose agar, incubated, and isolates identified on the basis of spore types. The population isolated generally corresponded with that recorded for most other crops. The avocado pathogen, *Colletotrichum gloeosporioides* was isolated, but its role in early fruit drop is yet to be determined. *Trichoderma,* a fungus previously used as a biological control agent, was also isolated. This could present an opportunity for natural control of pathogens.

INTRODUCTION

Early fruit and flower drop is an economically important matter to the South African avocado industry. However, no specific data regarding the economic aspect of the problem is available. A number of postharvest avocado pathogens have been shown to infect the fruit through the pedicel (Darvas, 1982). Their role in the early abscission of the avocado flower and fruit has been questioned. The dynamic interaction between the pathogens and the normal microflora in the stem, flower and fruit of avocado tissues has recently attracted attention as playing a possible role in flower and fruit abscission, because early fruit drop in the citrus industry has been shown to be associated with infection of citrus blooms by *Colletotrichum gloeosporioides* Penzig (Agostini *et al.,* 1993).

In order to commence meaningful research towards a solution to the problem, fundamental information must be obtained regarding the nature of the host and its associated microflora and pathogens. For this, a thorough study of the ecological situation is necessary. This study should include an estimation of the populations in the habitat, in terms of species diversity and richness.

The possible role of fungi on the pistils of avocado flowers after pollination in negatively affecting fruit set has previously been investigated (Thomas *et al,* 1994). It was concluded that some of the fungi on the pistils could possibly play a role in flower abscission. Besides this study, there is very little information on the microbial ecology of the avocado flower and fruit, especially with regard to early fruit drop. The aim of our research was, therefore, to provide insight into the fungi inhabiting avocado tissues.

MATERIALS AND METHODS

Collection of avocado stem and flower material

Avocado flower cones were collected during July 1995 from five Fuerte avocado trees at Westfalia Estate, northern Province. For each sample, three cones of approximately the same size with young avocado flowers on them were picked at four points around each tree representing north, south, east and west. Samples were placed in brown paper bags and stored in a cooler box until processing in the laboratory.

Isolation of internal fungal microflora

Each cone was submerged in NaOH and shaken for roughly 10 seconds to remove and kill any surface microflora. The cones were rinsed in sterile, distilled water and blotted dry on paper towels. Samples were taken from three places on each cone, viz. main stem, side stem and flower. Three pieces of tissue (each approximately 1 mm in width) were cut from locations along the main stem of each cone. The same procedure was followed for two side stems of each cone. A tissue disc was also cut from the base of one flower on each cone. Samples were placed on potato dextrose agar (Biolab) (PDA) plates supplemented with 0,025 % chloramphenicol. Plates were incubated at 25 °C and colonies that developed were purified. Isolates were stored on agar slants and in sterile water and frozen away at -78 °C.

Identification

Fungal cultures were distinguished from one another on the basis of visual growth, and further identified according to spore type.

Table 1
Identity and isolation percentage of fungi isolated from avocado inflorescence tissues

Fungal genera	*Main stem*	*Side stem*	*Flower*
Alternaria sp.	8,5	6,8	5,3
Aspergillus sp.	—	1,1	18,7
Bipolaris sp.	0,9	1,1	—
Botrytis sp.	—	1,1	—
Cladosporium sp.	55,7	43,2	36
Colletotrichum sp.	—	—	2,7
Epicoccum sp.	—	5,7	—
Gliocladium sp.	0,9	1,1	1,3
Gonatobotryum sp.	0,9	—	—
Khuskia sp.	—	1,1	—
Leptosphaerulina sp.	0,9	—	—
Nigrospora sp.	4,7	7	1,3
Penicillium sp.	0,9	—	—
Periconia sp.	1,9	3,4	1,3
Pestalotia sp.	6,6	11,4	8
Phoma sp.	—	1,1	—
Pithomyces sp.	2,8	1,1	—
Pyrenochaeta sp.	—	1,1	—
Torula sp.	1,8	—	—
Trichoderma sp.	3,8	1,1	—
Unidentified isolates	9,7	12,7	25,3

RESULTS AND DISCUSSION

In general, the fungal population isolated (table 1) corresponded with that reported for most other crops. The species *Alternaria alternata (Fr.)* Keissler represented 95% of the *Alternaria* isolates.

This is an extremely common cosmopolitan saprophyte found on many kinds of plants and substrata (Ellis, 1971). It should, however, be noted that *Alternaría* species have also been encountered as pathogenic on particular hosts.

One species of *Botrytis,* viz. *Botrytis cinerea* Pers. ex Pers. was isolated. This cosmopolitan grey mould damages flowers, leaves, stems, fruit and other parts of all sorts of plants including many of economic importance such as beans, lettuce, tomatoes and vines (Ellis, 1971).

A common and widespread plant inhabitant, *Cladosporium,* was frequently isolated, as expected, but it is not known to be pathogenic on avocados.

Colletotrichum gloeosporioides, the cause of anthracnose and stem-end rot in avocados, was isolated. In the citrus industry this fungus was associated with poor fruit set (Agostini *et al.,* 1993). Further studies are required to determine whether systemic

infection by this fungus through the inflorescence plays a role in early fruit and flower drop.

The primary leaf saprophyte, *Phoma* Desm. has been recorded as pathogenic on various hosts, but not avocado. It has, however, also been found to be an antagonist of certain pathogens (Fokkema, 1976; Skidmore, 1976). This presents opportunities for biological control.

Trichoderma Pers. was isolated and has previously been used as a biological control agent (Fokkema, 1976; Skidmore, 1976; Agrios, 1988) and could therefore present opportunities for the natural control of pathogens in the avocado flower and fruit tissues.

This study is the first step in the investigation of the microbial succession in avocado flower and fruit tissues. The association of these fungal populations with early fruit drop must now be determined. Special attention will be paid to the role of *C. gloeosporioides* as a possible systemic pathogen, and to the use of *Trichoderma* as a biological control agent. If it is found that some of these fungi could be responsible for early flower and fruit drop, various control methods will be investigated.

REFERENCES

AGOSTINI, J.P., GOTTWALD, T.R. & TIMMER, L.W. 1993. Temporal and spatial dynamics of postbloom fruit drop of citrus in Florida. *Phytopathol.* 83: 485 - 490.

AGRIOS, G.N. 1988. *Plant Pathology.* 3 ed. Academic Press, New York.

DARVAS, J.M. 1982. *Etiology and control of some fruit diseases of avocado* (Perseae Americana *Mill.) at Westfalia Estate.* Unpublished D.Sc. (Agric) thesis, University of Pretoria, Pretoria.

ELLIS, M.B. 1971. *Dematiaceous hyphomycetes.* Commonwealth Agricultural Bureaux, England.

FOKKEMA, N.J. 1976. Antagonism between fungal saprophytes and pathogens on aerial plant surfaces. In: C.H. Dickinson & T.F. Preece, *(Eds.).Microbiology of Aerial Plant Surfaces.* 529 - 558. Academic Press, London.

SKIDMORE, A.M. 1976. Interactions in relation to biological control of plant pathogens. In: C.H. Dickinson & T.F. Preece, (Eds.). *Microbiology of Aerial Plant Surfaces.* 507 - 528. Academic Press, London.

THOMAS, TV. EICKER, A. & ROBBERTSE, P.J. 1994. Possible role of fungi in negatively affecting fruit-set in avocados. *S. Afr. J. Bot.* 60: 251 - 256.