

# Spotlight on Agriculture

Ministry of Agriculture, Water and Forestry, Directorate of Agricultural Research and Training, Private Bag 13184, Windhoek

No 82 August 2004

## THE INVOLVEMENT OF PLANT PATHOGENIC FUNGI IN THE NATURAL DIEBACK OF BLACKTHORN IN NAMIBIA: PART 2

### INTRODUCTION

The previous paper (*Spotlight on Agriculture* No. 81) reviewed the activities of a project launched during 1985 to investigate the involvement of plant pathogenic fungi in the natural dieback of Blackthorn (*Acacia mellifera*) in Namibia. Four experts from the University of Stellenbosch in South Africa visited Namibia during March 1985. They investigated the possibility of a micro-organism (plant-pathogenic organisms) that might be causing Blackthorn bushes to die back and, if so, to describe the symptomatology of the disease.

This paper reviews their observations in the field, as well as the results of laboratory analyses of the plant material collected during the field trip (Holz 1985, 1986a).



Twig dieback and defoliation

### METHODOLOGY

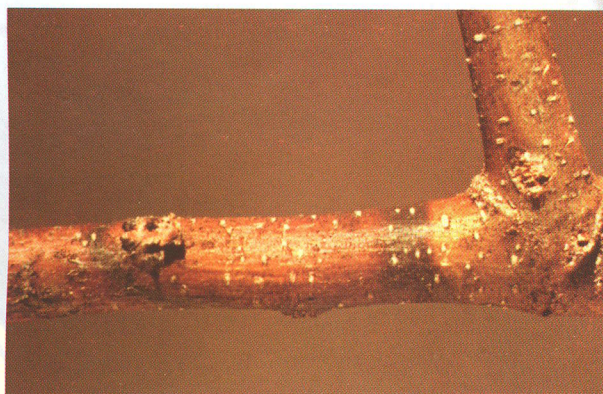
During the field trip, five sites in the bush-infested area were visited. Information that was collected included the degree of dieback (disease intensity) of individual plants; the degree of mortality of the population as a whole; age groups (height classes) that showed the highest degree of dieback; bush densities; and the presence of insects. The soil profile was also examined, and roots, twigs and branches of individual bushes were collected for laboratory analysis.

The severity of dieback in 119 Blackthorn bushes was monitored on the Sonnleiten Farm. The criteria used to estimate the degree of dieback in individual bushes as well as for the population as a whole were (a) whether a bush was healthy, i.e. showing no signs of dieback; (b) whether there was slight dieback; (c) whether a bush showed an advanced stage of dieback; and (d) dead bushes. The symptoms observed were twig dieback and defoliation.

### RESULTS

The results of the 119 Blackthorn bushes monitored showed that 38.6% of those smaller than 1 m in height were dead, and that 55.1% of the bushes larger than 1 m in height were dead.

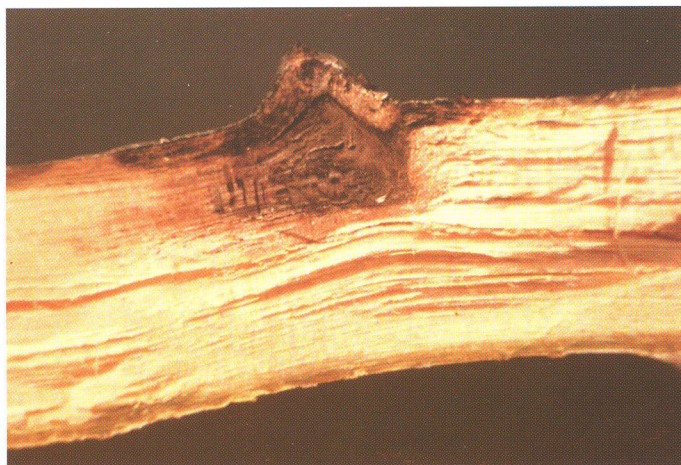
#### *Disease symptoms*



Black-brown discoloration around branch

Above-ground (foliage) disease symptoms observed revealed clear signs of twig and branch dieback, indicating the possibility of a micro-organism to be causal. It was also observed that, in the initial stage of dieback, only the young twigs showed dieback; moreover, the twigs were defoliated. Bushes in an advanced stage of dieback were partly or totally defoliated, while larger branches also showed dieback.

From the observations it appeared as if the dieback had a fixed pattern. Dieback started from younger twigs and stopped at the point where they joined an older branch, while the main stem of the bush remained unaffected. In some cases an abrupt black-brown discoloration, which might extend into the pith, occurred around and underneath some thorns from which the petioles (leaf stems) had dropped. In other cases the wood tissue of apparently healthy trees showed a dark brown discoloration for much of its length, although the bark appeared healthy.



Black-brown discoloration around the thorn extending into pith



Black-brown discoloration around the thorn

To establish the involvement of these fungi's relationship to the dieback with certainty, however, it was necessary to artificially inoculate healthy young plants with inoculums prepared from isolations. When inoculated, the healthy plant needed to develop corresponding symptoms of disease and begin to die back.

Another reason why no concrete conclusions were made was that the plant material obtained during the initial visit had been collected haphazardly and not from pre-selected sites with different degrees of disease (dieback) intensity. Moreover, only parts of individual plants had been selected. What was needed, therefore, was a more detailed study of the bushes as a whole, as well as a comparison of the factors affecting their health in different areas with different intensities of dieback. Only then would it be possible to convincingly establish the involvement of plant pathogenic fungi as the causal factor of the dieback.

*Phoma* is known as an extremely aggressive and destructive plant pathogen that causes normal plants to become severely diseased. However, it is also known as a weak, opportunistic pathogen that occurs as a parasite on plants that are under one or other form of stress. In the case of Blackthorn dieback, therefore, it was concluded that this specific *Phoma* was not only opportunistic, but also that it lived saprophytically on *Acacia mellifera* and that stress factors had induced a parasitical phase in its life cycle. The stress factors in question could be extreme temperatures, moisture stress, or defoliation. However, the plant needed to have been infected with this weak pathogen before the onset of the stress period.

#### References

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**Language Editor:** The Word Factory, PO Box 11465, Windhoek.

## Plant pathogenic organisms

From the twigs and branches that were collected during the field trip, a total of 24 organisms that were potentially related to Blackthorn dieback were isolated in the laboratory. Most of them were not constant in all plant samples. Nonetheless, one species of *Phoma* was consistently isolated from all the plants that had died back. The constant occurrence (Kosch's postulate) of these fungi suggested the possibility of it being the cause of the twig and branch dieback. Besides the constant isolation of *Phoma glomerata*, *P. cava* and *P. eupyrena*, *Cytospora chrysosperma* was also consistently found.

The other plant pathogens that were isolated occurred at a low frequency; for this reason their involvement in plant dieback was doubted. No micro-organisms were isolated from the root material collected, and no symptoms of any form of root infection were observed. The widespread distribution of infected plants in the country also eliminated the possibility of a root pathogen involvement.

## DISCUSSION

At that stage it was evident that a fungus was causal in the dieback of Blackthorn bushes. The dark-brown discoloration of the wood observed in this case agreed with the discoloration caused by other similar fungi in unrelated woody plants. The constant occurrence of the *Phoma* fungi in affected twigs indicated that these organisms were possibly the specific cause of the twig dieback of Blackthorn bushes. Further positive evidence for this assumption was the fact that the *Phoma* fungi occurred on seeds found in areas where the dieback had occurred. These naturally infected seeds, in turn, infected the germinating seedling (confirmed in laboratory tests), resulting either in a lesion or in killing the young plant.



Discoloration extending for some distance in a twig