

- Distinct areas of dead and dieing trees seen from the Berjaya Beach Hotel, Mahé. Some crowns are still producing new leaves though these are unlikely to be vigorous or healthy trees. *September 2002*



SANDRAGON DISEASE

Update of Current Knowledge: *Interim Comments on Control & Management*

Background

It is now four years since the first *Pterocarpus indicus* died in Mahé. A technical cooperation project (TCP) of the FAO has recently begun and research efforts to understand the cause of the problem have intensified. A programme of field monitoring and assessment is underway and will continue at least until 2003. Pest organisms associated with the disease are being isolated and identified. Training in tree health assessment and detection methods has been successfully completed.

Purpose of this report

This note summarises our knowledge of the disease and how this is being used to resolve and reduce its impact on the Seychelles. Preliminary comments are made on proposed control measures.



- It is difficult to assess the health of trees based on leaf loss and dieback (left). The vascular streaking (right) is more distinctive and indicative of disease processes. *September 2002*



Description of problem

The original name given to the disease was Pterocarpus Wilt but repeated attempts to find wilt symptoms have failed. **Sandragon Disease** is used here in preference to Pterocarpus wilt but both refer to the same problem.

The most commonly observed symptom is a dieback and premature loss of leaves leading to a rapid death of trees in all ages, including the oldest trees in the Seychelles. Other general observations include a change in the pattern of new leaf production and flowering. The premature loss of leaves and late flushing of new leaves is commonly found in crowns that have dieback and this association is currently being monitored in selected trees across Mahé. The significance of this altered growth and the time taken from infection to death of trees are not known.

A loss of leaves and dieback are general symptoms in trees and have several possible causes. A closer examination of medium-sized and small branches has only recently revealed a distinctive streaking once the outer tissues are lightly peeled away (above). This symptom is also found in surface roots and is regularly associated with trees that have sparse crowns and dieback. The vascular streaking gives a clearer indication that trees are diseased.

The relationship between streaking and presence of a disease-causing fungus is actively being investigated. The initial theory is that infection by a fungus induces a defensive reaction in the tree. Vessels blocked with gum prevent spread of the fungus but also affect leaf viability and dieback. Blocked vessels and other defensive reactions may well be linked to the observed altered patterns of growth.

Cause of the problem and how it is spread

Angsana wilt has affected *Pterocarpus indicus* in Malaysia and Singapore for over a hundred years. Its general features are similar to Sandragon disease with two notable exceptions: wilt symptoms are present and spread by insects has been confirmed. Boring caused by beetles¹ occurs in dead wood of sandragon trees but has not been seen in healthy tissue or in association with areas of vascular streaking.

Although there are differences between Angsana wilt and Sandragon Disease their general features are similar. Angsana wilt is caused by *Fusarium oxysporum* and the existing evidence points to the same fungus being responsible for the death of trees in the Seychelles. Intensive efforts are now under way to identify fungi from areas of vascular streaking and results are expected by November at the earliest.



- The disease is present on La Digue (left) and Praslin (right), where close examination of a branch cut from the lower part of the trunk first revealed the vascular streaks associated with dead and dieing trees.
September 2002



In the absence of any obvious insect vector how might Sandragon Disease spread? *Fusarium* is a soil-borne fungus and one possibility is spread by root contact. Detailed investigations are outside the scope of the present TCP, though other evidence may help to support the theory of transfer from tree to tree via root systems.

A less well known wilt disease of *Pterocarpus angolensis* was investigated in Zambia in the 1970s, where it caused widespread decline and death of this native species. *Fusarium oxysporum* was associated with a vascular streaking and wilt symptoms.

Limiting spread and impact

There is much public interest about the second major problem to afflict an important tree in the Seychelles. I now consider a number of key questions which have been asked by senior Government officials and the public at large and conclude by stating what action is appropriate in the light of our current knowledge.



- Training courses provide new ways of understanding symptoms and their causes (left) while laboratory classes explain how to handle samples and isolate fungi.
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▶ WILL THE DISEASE AFFECT OTHER TREES?

Takamaka wilt and Sandragon Disease are two separate problems. *F. oxysporum* is a distinct and different fungus to the fungus causing takamaka wilt. *F. oxysporum* infects a range of plants, including annual crops, but each disease is linked to a specific form of the fungus closely adapted to its host.

▶ WHERE HAS THE DISEASE COME FROM?

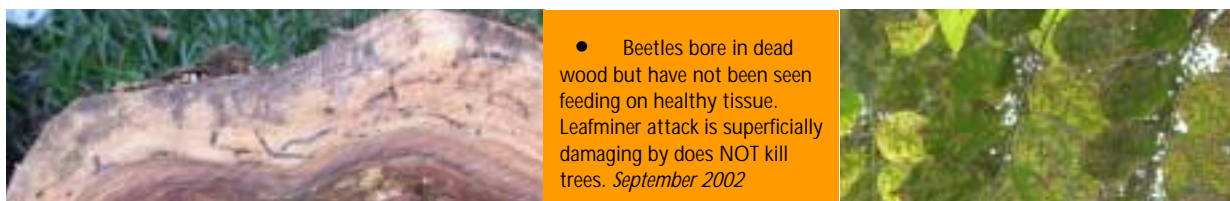
The widespread occurrence and apparently rapid spread of Sandragon Disease (Mahé, nearby islands e.g. Round Island, Praslin, La Digue) is difficult to explain. There is no regular movement of sandragon planting material around the islands and no obvious insect vector. One explanation is that a fungus was already present (*Fusarium* species are common in all soils) but causing little or no damage until four years ago. Why such a fungus might have changed and become more aggressive is unclear and would require

¹ Specimens are currently being identified in the UK.

detailed research. The 'sudden appearance' of the disease in the Seychelles is misleading since it refers to the first clearly visible external symptoms. The original infection will have occurred some time before, possibly up to several years previously.

▶ SHOULD ACTIVE STEPS BE TAKEN TO PREVENT MOVEMENT OF SANDRAGON?

The disease is widespread in Mahé and restriction on the movement of living or dead trees is unlikely to have a major effect on future damage. Areas of healthy sandragon might benefit from protection but even apparently healthy trees should be checked for vascular streaking and fungus. Comparing isolates of *Fusarium* from the Seychelles with available isolates of *F. oxysporum* from Singapore will help in tracing the origins of the disease and the need for quarantine measures.



▶ IS IT NECESSARY TO CUT DOWN DEAD AND DIEING TREES?

Cutting down dead trees will have little effect on the future impact of the disease. The main reason for removing dead trees or parts of them is because of potential hazards to buildings and people. Cutting out diseased areas of the crown will not limit the spread of an infection that has already entered the main trunk and is systemic. We do not know whether all the trees in poor condition or with vascular streaking will die. Monitoring plots and observation trees are assessing the future impact of the disease.

▶ WHAT CAN BE DONE NOW TO REDUCE THE IMPACT OF THE DISEASE?

The only viable option available in the short term is to undertake an injection programme similar to that which has proved successful for takamaka. This is being actively considered but requires that we first confirm the cause of the disease.

▶ WHAT ABOUT LEAFMINER DAMAGE?

This recently observed event has been linked to the death of the trees but the main damage is visual and does not fundamentally affect trees that are not already weakened by other factors. **It should be clearly and unequivocally stated that leafminers are NOT killing trees.** Scarce funds are best directed at improving our understanding of the disease based on the clear evidence emerging of a fungus infection.

Summary of key points

- Sandragon disease is widespread and of possible local origin. Vascular streaking is the most distinctive symptom associated with dead and dieing trees.
- Removal of dead trees or parts of them is only necessary where a hazard exists.
- Leafminers are not killing trees and control efforts should not be a priority.
- Injection of trees is at present the only option for reducing impact of the disease; confirmation of the cause of the disease is needed before proceeding further.

These notes were written by Dr Eric Boa (CABI *Bioscience*), a consultant employed by FAO and GoS. The opinions and interpretations of facts are based on work carried out by the Plant Protection Service (Ministry of Agriculture and Marine Resources), the Forestry Department (Ministry of Environment) and diagnostic investigations carried out under the supervision of Ms Paula Nash (CABI *Bioscience*). Discussions with Ms Gillian Allard of the FAO, Ms Helda Antoine of Plant Genetic Resources and other officials within the two main ministries involved in this project have contributed towards the preparation of this interim statement.