

Wilt of Takamaka (*Calophyllum inophyllum* L.) in Seychelles

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Abstract: Dieback and mortality of Takamaka on Mahé is a Vascular Wilt Disease apparently new to this host in Seychelles. During a survey in August 1994 disease foci were recorded from 3 localities on the island on Mahé. These were all small in extent, although the pathogen seems to be very aggressive to this host once infection is established. The disease is associated with the fungus *Verticillium calophylli* (Wiehe) W. Gams, which is known from Mauritius and Central America as the causal organism of a vascular wilt of *Calophyllum* spp.

Introduction

Takamaka (*Calophyllum inophyllum* L.) is a common constituent of the coastal vegetation around the island of Mahé, providing shade at the edge of many of the best-known beaches, as well as being an important local timber tree. It also occurs as a littoral species throughout the Indo-Malayan region of the tropics from Seychelles to the western Pacific islands, where it is known as Alexandrian or Indian Laurel, growing mainly on deep coastal sands (Kadambi 1957). It is a handsome, ornamental evergreen tree of medium to large size, usually with a short, thick bole and spreading branches. It is very resistant to salt spray and brackish water, as well as being very wind-fast.

Few diseases have been reported on *Calophyllum* species apart from vascular wilts in Mauritius on *C. inophyllum* associated with a *Haploglyphium* species (Carver 1940; Wiehe 1939). This was identified at the Imperial (presently International) Mycological Institute and shown to be highly pathogenic on *C. inophyllum* and slightly pathogenic on *Eugenia glomerata* Lam. and *Mimusops maxima* (Poir.) Dubard by Wiehe (1939) and Carver (1940). Vascular wilt caused by the same fungus was also reported by Crandall (1949) in El Salvador killing 50% of *C. brasiliensis* Camb. plantations. He also confirmed its pathogenicity on this species (Anon. 1949; Crandall 1949). In addition Spaulding (1961) lists *Haploglyphium calophylli* Wiehe associated with *C. brasiliensis* and *C. tacamahaca* Willd. from unspecified countries. Similar fatal diseases of *C. inophyllum* have also been reported from India (Kadambi 1957) and Indonesia on trees up to 45 years old (Zwart 1927).

The causal fungus was first called *Cephalosporium calophylli* Crandall, however, Gams (1971) found that it was never validly published. He considered it to be synonymous with *H. calophylli*, which he transferred to the genus *Verticillium* as *V. calophylli* (Wiehe) Gams.

Dieback and mortality of Takamaka was first reported from Seychelles on the island of Mahé in March 1994 (Ivory & Andre 1996). The outbreak was

subsequently examined by the senior author with a view to diagnosing the causal organism, determining the extent of the outbreak and making recommendations to the Division of the Environment regarding control or eradication of the disease in Seychelles. the results of this study were subsequently submitted to the Government of Seychelles (Ivory 1994).

Methods

The disease was surveyed at the sites previously detected by the Forestry section's staff and along the sides of the perimeter road running around the island of Mahé on 11th and 12th August 1994, with all trees with noticeable dead foliage being examined. Samples of stems from 4 affected trees were collected on 11th August and stored in polythene bags for subsequent isolation attempts later the same day.

Attempts to isolate the causal organism into pure culture were made using small vials containing malt extract agar and paper discs impregnated with Tetracycline antibiotic. Small pieces of affected wood were taken aseptically from stem discs of 4 trees (one from Notholme Hotel and 3 from Sans Souci) soon after collection and placed in the vials. Pieces were also taken from discs of the same trees which had been incubated in damp paper for 3 days. Small pieces of stained vascular tissues from green wilted coppice shoots of a tree in Victoria Botanical Gardens were also cultured.

Further surveys have been made on the island of Mahé since August 1994 by Environment Division staff.

Results & Discussion

1. Disease symptoms: The first macro-symptoms are a wilting and drooping of the leaves on one or more branches with little discoloration of the dark green leaves. Subsequently, affected leaves and branches become necrotic and die. The disease may initially affect only one small branch, but appears to spread rapidly to the remainder of the tree causing death of the branch or the whole tree within a few months. A characteristic dark brown streaking is always present in the vascular tissues of all affected branches and is particularly noticeable in freshly wilted branches. these symptoms are all typical of vascular wilt diseases.

The stems of affected trees are rapidly attacked by small boring insects and various saprophytic stain fungi which cause the wood to become discoloured. Care was taken to distinguish between this discoloration and the vascular streaking described above,

2. Isolation of the causal organism: One fungal species was consistently isolated from all 4 trees sampled, especially from the fresh wood discs. This was confirmed as *V. calophylli* (synonym *H. calophylli*) at the International Mycological Institute (IMI 363649). The same fungus was also cultured from the green wilted shoots. no attempt was made to confirm the pathogenicity of the fungus in Seychelles. however, this species has been shown to be highly pathogenic to *C. inophyllum* and *C. brasiliensis* (Wiehe 1939; Carver 1940; Anon.

1949; Crandall 1949), giving rise to wilt symptoms and death of pole-sized trees in 6 and 8 weeks respectively. Other fungi of this genus are also well-known as the causal organisms of vascular wilt diseases in trees and herbaceous plants.

Isolated of *V. calophylli* grow rapidly on 3% Malt extract agar forming greyish-white, flat, spreading colonies which become almost black with age. Abundant hyaline conidia are formed on dark conidiophores. It does not store well on this medium at 15°C and was non-viable after 4 months.

Various other fungi were obtained from the stem discs which were incubated in damp paper for 3 days. these were all common saprophytes.

3. Epidemiology: Disease development seems to have taken place very rapidly in affected trees and branches, with mature trees being rapidly killed. Most affected trees were either still partly alive or completely dead when examined. However, most dead branches or whole trees appeared to have died quite recently as most still retained many of their leaves and most were at a similar stage of decay. However, a few dead branches on 2 trees were leafless and in a more advanced stage of decay. These appeared to have been dead for about one year. additionally no old stumps were apparent at the disease foci located at Beau Vallon beach and Sans Souci forest station, which also suggests that the foci are of recent origin. However, infected coppice shoots on an old cut stump adjacent to an infected tree at Victoria Botanical Gardens could indicate either infection of the cut tree some years earlier, or recent infection of the shoots.

In August 1994 all the disease foci were small (<5 trees affected). New infections have arisen since then, but most appear to have developed as new foci rather than as expansions of existing foci.

Infection does not appear to be associated with tree pruning or stem damage, as this is unlikely to have been spread by such mechanical means. The dead stems of affected trees are, however, frequently infested with beetles. It is probable that one of these is the main vector giving rise to small scattered infection foci. This vector is probably very host specific, and probably forms an intimate relationship with the fungus. Infection is likely to take place on young green branches during feeding, at times of the year when adult beetles have just emerged from the stems. The beetles may also be preferentially attracted to trees which are under particular stress. Infection has been demonstrated in this way for this disease in Cuba via a scolytid beetle (Van Kerkhove, *pers. comm.* 1995). Spread through root grafts is also possible, but does not appear to be significant in Seychelles.

4. Distribution: In August 1994 affected Takamaka trees were found in only three localities on the islands of Mahé; namely, at Beau Vallon beach between Northolme Hotel and Le Meridien Fishermans Cove Hotel; at Victoria Botanical Gardens; and at 2 roadside sites near Sans Souci forestry station. Trees at all other sites along the coastal road were apparently healthy. Other forest localities were not visited by the consultant.

Subsequent surveys have detected further infection foci throughout the northern part of Mahé, with >300 trees affected by November 1995. Most of these

were felled and burnt; however, this does not appear to have checked the spread of the disease. Small infection foci have also been detected on the islands of Praslin and La Digue, forming a significant threat to the survival of the host tree on the latter and to its dependent endemic fauna.

Conclusions

The very restricted distribution of disease foci in Seychelles in August 1994, the subsequent spread of the disease into other areas and the absence of possible remains of older disease foci, suggest that the disease is of recent origin on this host in Seychelles and that the initial outbreak probably occurred on Mahé in 1993. The origin of this initial outbreak is however still unknown.

Disease spread probably occurs via an insect vector, such as a scolytid beetle, in a similar way to the spread of Dutch Elm Disease in Europe. Spread by this means is very difficult to prevent, which could explain the apparent failure of the eradication campaign presently being conducted in Seychelles.

Few records of this disease have appeared in the literature since it was first recognised, despite the widespread distribution of the host. These have appeared as scattered outbreaks around the tropics and have apparently faded out of notice within a few years, without causing the complete demise of the affected host species. It is therefore possible that the disease is subject to natural controls which cause the fungus or its vector to decline, or that outbreaks are predisposed by critical outside influences.

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