

FIRST RECORDS OF *PHYTOPHTHORA CINNAMOMI* IN PAPUA NEW GUINEA

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ABSTRACT

Phytophthora cinnamomi Rands was isolated from soil from three sites from two localities under dead indigenous *Nothofagus* and at the margin of a dead patch on Mt Giluwe, these being the first records of this fungus in Papua New Guinea. No claim is made that the fungus is the cause of the dead and dying *Nothofagus*, as the problem needs further investigation.

INTRODUCTION

DURING 1970 and 1971 reports of dead indigenous *Nothofagus* occurring in patches in various stands throughout the Western Highlands of Papua New Guinea were received by the senior author from Mr R. A. Hynes (pers. comm.). Because of the relative inaccessibility of the sites, soil/root samples were not obtained until March, 1972, when collections were made by Mr B. Zaney of the Department of Forests.

MATERIALS AND METHODS

The samples were from eight localities in the Iaro River area on Mt Giluwe about 31 miles (approximately 50 km) in direct line from the town of Mount Hagen in the Western Highlands and consisted of two samples from each of three sites at each of eight localities, the three sites in each case being from: (1) beneath recently dead *Nothofagus* spp‡; (2) the margin between dead and normal patches; and (3) beneath trees showing no deterioration.

The soils (with any roots at all which happened to be in them) were taken from the 0 to 4 inch (10 cm) layer after removal of surface litter. In the laboratory at Konedobu, Port Moresby, they were baited for *Phytophthora*

cinnamomi and other species of *Phytophthora* and *Pythium* as reported in a previous study (Stamps, Shaw and Cartledge 1972) using the lupin-baiting technique, with slight modifications, of Chee and Newhook (1965). Microscopic check for sporangia on radicles was made in only a few cases, but all radicles were plated on to nutrient antibiotic agars even if not showing lesions, or not showing sporangia when examined. Pure cultures were established on potato dextrose agar (PDA), maize meal-vitamin E agar, on sterile bean pod, on boiled grass in water and with sterile soil extract.

RESULTS

Only one type of sporangium was recorded on the radicles, and only one type of culture was isolated. The cultures were somewhat lobate, young hyphae were coralloid, and on boiled grass in water abundant hyphal swellings, irregularly botryose and somewhat smaller than those reported for *P. cinnamomi*, were produced, together with a few sporangia which were also smaller than those seen on the radicles and those reported in the literature. No sporangia were obtained on the agar media and no oospores were found on any media in Papua New Guinea. None of the isolates formed sex organs when paired with an A1 culture of *P. cryptogea* at the Commonwealth Mycological Institute, but all the isolates formed abundant sex organs when grown with an A2 *P. cinnamomi* isolate. The isolates are identified as *P. cinnamomi* Rands, of the A1 compatibility type.

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‡ The identities of the various species of *Nothofagus* on the mountain are still being determined by botanists.

The fungus was isolated from two sites (under dead *Nothofagus* and from the marginal area) at Locality No. 3, and from one site (under dead *Nothofagus*) at Locality No. 7. Sporangia of a type similar to *P. cinnamomi* were noted on radicles in the test of the marginal area soil from Locality No. 6, and from the soil under the apparently healthy trees in Locality No. 5, but no isolates were obtained in pure culture. The results are shown in the Table.

It should be noted that, although other species of *Phytophthora* and *Pythium* were isolated by the lupin-baiting method from soil/root samples (none of which, however, were from dead or dying *Nothofagus*) in a previous study (Stamps, Shaw and Cartledge 1972), no isolates of *P. cinnamomi* were recorded at that time. During the present study no species of *Phytophthora* other than *P. cinnamomi* and no species of *Pythium* were isolated from the Giluwe soil samples.

DISCUSSION

The A1 compatibility type appears less common in *P. cinnamomi* than the A2, which occurs in many countries on many hosts. The type A1 was first isolated from the trunks of Macadamia trees in Hawaii (Galindo and Zentmyer 1964) and later isolated in southern California from Camellia roots (Zentmyer and Erwin 1969); recently one of us (Stamps) has examined A1

isolates from South Africa, Australia and New Zealand at the Commonwealth Mycological Institute.

Although this paper records the occurrence of *P. cinnamomi* A1 from two sites with dead *Nothofagus* and from one marginal site (between an area with dead trees and apparently healthy ones), no claim is made that this fungus is the cause of the dead patches. To date no diseased *Nothofagus* roots have been available for study and no inoculation tests have been carried out. Isolations from *Nothofagus* roots will need to be made and inoculation tests on *Nothofagus* as well as on other plants carried out with *P. cinnamomi* as well as with other fungi if any are isolated in further studies.

The eight localities are situated on the south-east flank of Mt Giluwe at 8000 to 8,500 ft (2440 to 2593 m) altitude, in a region with stands of mainly *Nothofagus* interspersed with areas of mixed *Nothofagus* and montane forest species, and areas classed as "poor" montane forest by the Department of Forests. The localities sampled occur within a strip about 2 miles long by $\frac{1}{2}$ mile wide (approximately 3218 by 805 m) either on or just off the main walking track to the summit of the mountain, or on a nearly parallel foot track leading to a Forestry Trial Block where introduced species of *Pinus* (60 plants each of *P. elliotti*, *P. kesiya*, *P. patula* and *P. taeda*) were planted in June, 1971, in a suitability study, after transport to the area by helicopter.

Table.—Presence (+) or absence (–) of *P. cinnamomi* in soil/root samples from different localities on Mt Giluwe

Locality	Apparently healthy <i>Nothofagus</i>	Marginal Zone	Dead <i>Nothofagus</i>	Estimated extent of dead <i>Nothofagus</i> *	
				(acres)	(hectares)
No. 1, Mabelgema	–	–	–	0.1	0.04
2, Nongupiri	–	–	–	0.02	0.008
3, Tibugu	–	+	+	0.1	0.04
4, Miginzega 1	–	–	–	3.0	1.2
5, Sibuga	†	–	–	3.0–4.0	1.2–1.6
6, Miginzega 2	–	†	–	0.5	0.2
7, Koipu	–	–	+	0.1	0.04
8, Mauvi	–	–	–	0.5	0.2

* Estimations by Mr B. Zaneky, Department of Forests.

† *P. cinnamomi-cambivora* type sporangia seen on the radicles, but no isolations were obtained in pure culture.

The area of each dead patch, as estimated by Mr Zaneky, is shown in the *Table*. The marginal zones around the patches were reported to be roughly in the order of half a chain (approximately 10 m) wide.

No details of the symptoms of the deteriorating *Nothofagus* or photographs of individual trees or of the dead patches are as yet available. It is stated, however (pers. comm. from Mr J. E. N. Smith, Regional Forest Officer), that there appears to be immediate regrowth of as yet unidentified species in the patches.

Also, no information is to hand regarding the rate of deterioration of the patches, if indeed they are deteriorating. However, aerial photographs* of the region, taken in 1959 at 25,000 ft (approximately 7625 m), are available, and these have been studied stereoscopically by the senior author. No sign could be detected on the 1959 aerial photographs of any break in the canopies at positions approximating to Localities 1, 3, 4, 6, 7 and 8 as designated in this paper; there may be a slight break in the canopy at Locality No. 2. A comparison could not easily be made of Locality No. 5, which is in areas of broken canopy shown in the 1959 aerial photos, which are interpreted as "grassland and regrowth" on relatively large-scale maps of the vegetation produced by the Department of Forests. Locality No. 5 is at the lowest altitude sampled and the nearest to the irregular interface of the forest and the artificial grassland of the high plains surrounding the mountain.

* Reference C. A. J. 121-5050 Mt Giluwe 5044-5065 (Run 3, taken on 18.6.1959 at 25,000 feet.

What is required is another aerial reconnaissance at 25,000 ft, so that a direct comparison can be made of the canopies of stands of *Nothofagus* and other tree species on the mountain, as shown in the aerial photographs of 1959 and the present day. This would reveal the occurrence of dead patches which did not occur in 1959, or the enlargement of patches, or regrowth of patches present in 1959. Allied with this, investigations will need to be carried out on the ground to determine which if any patches may be man-made.

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