HENDERSONULA AGATHI n.sp., THE CAUSE OF LEAF CAST OF KAURI PINE IN QUEENSLAND.

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SUMMARY.

"Leaf cast" disease of kauri pine is described and shown to be caused by a sphaeropsid fungus which has a Torula stage.

The fungus is compared with Hendersonula toruloidea and shown to be a different species.

The name Hendersonula agathi is proposed for the fungus and a diagnosis is given.

INTRODUCTION.

In 1936, kauri pine (*Agathis palmerstoni* F.v.M.) in forest nurseries and plantations in northern Queensland was found to be affected by a fungous disease which caused injury to the leaves and twigs and resulted in severe defoliation, as shown in the accompanying plate.

Bordeaux mixture (4–4–40) was used as a fungicide in the nurseries and complete control of the disease was established. In plantations control is uneconomical and in any case the disease causes severe injury there only in isolated areas where kauri pine grows weakly because of unfavourable site factors. The same disease was observed causing unimportant injury on naturally occurring *A. palmerstoni* in rain-forest in northern Queensland. The disease was later found on indigenous *Agathis robusta* C. Moore in southern Queensland and has appeared on nursery stock of this species with sufficient severity to warrant the application of control measures. It has also been observed on the same species of kauri pine in plantations. Isolations of the same fungus have been made from similar lesions on *Agathis australis* Salisb. in southern Queensland.

The disease is first manifested by a necrosis and wilting of the leaves, which eventually die and are shed. The leaves are marked by progressively enlarging necrotic areas with well defined edges. The lesions may eventually cover the whole leaf or may in less severe cases be restricted to irregular patches on the leaves. In very severe cases the twigs and smaller branches are also affected and wilt and die.

Black pycnidia occur on the upper surfaces of dead leaf tissue and also on the bark of twigs affected by the disease. On the diseased twigs elongate-oval "blisters" with longitudinal fissures are sometimes found. The blister cavity is filled with black thallospores.

Plate 1.

Agathis palmerstoni affected with leaf-cast disease in a northern Queensland plantation.

CAUSE OF THE DISEASE.

Isolations from affected tissues and cultures from spores obtained from the pycnidia and blisters in all cases yielded a dark hyphomycete which in culture on kauri pine tissue formed typical pycnidia. Inoculations of potted plants of *Agathis robusta* in the glasshouse with pure cultures of the organism resulted in typical leaf-cast disease and the same fungus was isolated from the affected tissues.

DESCRIPTION OF CAUSAL FUNGUS.

In culture on potato dextrose agar the fungus grows readily and forms a white woolly mat which after several days changes colour to a dark olive green and eventually becomes olive black. No pycnidia were developed on agar media.

On sections of sterile kauri pine branches in tubes the fungus grows profusely over the surface and in three months pycnidia develop partly immersed in mycelial aggregates on the surface of the bark.

The pycnidia occur singly, are spherical in shape and about 300μ in diameter with a short ostiole. Sometimes the pycnidia are irregularly shaped and may be laterally compressed.

In the pycnidia all the spores are hyaline and measure 13 to 18 $\times$ 5 to 6μ. After extrusion the majority are three-celled and measure 13 to 20 $\times$ 6 to 8μ; the central cell is brown and the end cells hyaline. Occasionally the spores are four-celled with two central brown cells, and very occasionally all cells of the three-celled spores are uniformly brown. The various spore types are shown in the accompanying figure.

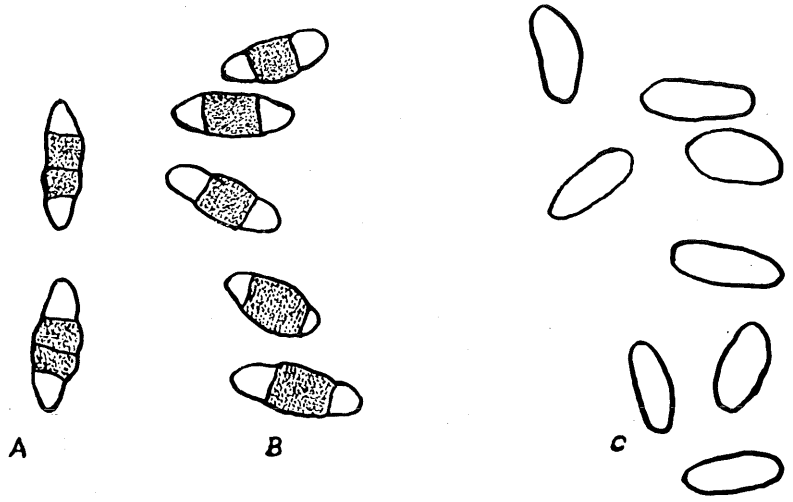

Figure 1.

Tracing of projection of pycnospores of *Hendersonula agathi* n.sp. A, 4-celled extruded spores; B, 3-celled extruded spores; C, 1-celled hyaline non-extruded spores.

TORULA STAGE.

In addition to pycnospores the fungus sometimes produces chains of thallospores in fruiting bodies on diseased twigs. Pure cultures obtained from thallospore isolations gave rise to the same fungus as do pycnospore cultures and inoculations of kauri pine with the thallospore isolations cause typical leaf-cast disease. No thallospores were produced in pure culture.

The thallospores measure 3·5μ in diameter, and may be globose to oblong, measuring 8 $\times$ 3·5μ. Uniseptate forms of the latter shape are sometimes seen. The thallospores are at first hyaline and become dark brown with age.

SYSTEMATIC POSITION OF THE FUNGUS.

Only one pycnidial fungus whose spores are hyaline and non-septate in the pycnidium and become two-septate on extrusion with the middle cell brown has been previously recorded. This was described under the name of *Hendersonula toruloidea* Nattrass (Trans. Brit. Mycol. Soc., XVIII, p. 197,

1933; Rev. Appl. Mycol. XIII, p. 382, 1933). This was isolated from stone-fruit trees and apple trees and was shown to be associated with dieback and gummosis of the former. It was also recorded from the orange in Rhodesia. The same fungus was later recorded (Nattrass, Rev. Appl. Mycol., XIV, p. 83, 1935) from lemon trees in Cyprus associated with gummosis, and also from mature *Populus nigra* trees which had died. It was also found on figs and walnuts.

The present fungus is not *Hendersonula toruloidea*, as a comparison of the salient characters of the two fungi shows (see Table 1), but must be referred to the same genus.

Table 1.

COMPARISON OF CHARACTERS OF HENDERSONULA TORULOIDEA AND HENDERSONULA N. SP.

—	*H. toruloidea.*	*H.* n. sp.
Pycnidia	120–195μ	300μ
Hyaline pycnospores	10·5–14 x 4·5–5·5μ	13–18 x 5–6μ
Extruded pycnospores	12–13·5 x 4–5·5μ	13–20 x 6–8μ
Extruded pycnospores	3–celled	3–celled, sometimes 4–celled
Extruded pycnospores	Middle cell brown	Middle cell brown or 3 cells brown ; 2 middle cells brown in 4–celled form
Stromata	Eventually compound	Uniloculate
Thallospores	10 x 4μ	8 x 3·5μ

The fungus causing leaf-cast disease of kauri pine is proposed as a new species of the genus Hendersonula with the following diagnosis.

Hendersonula agathi sp. nov.

Stromatibus solitariis, immersis vel erumpentibus, unilocularibus, nigris. Loculis immersis vel protuberantibus, globosis vel e latere compressus vel irregularibus. Sporophoris hyalinis, teretibus, totos loculos vestientibus, o-septatis. Pycnosporis oblongis vel ovalibus, primo hyalinis, o-septatis 13–18 $\times$ 5–6 μ: dein saepe 2-septatis, fusco centrali cellulo praeditis, interdum fusco omnibus 13–20 x 6–8μ subinde 3-septatis, fuscis centralibus cellulis. Hyphis primo hyalinis, septatis, ramosis, in moniliformes, globosus (3–5μ dia.) vel oblongus (8 $\times$ 3·5μ), vel cuneatus, fuscus o-vel rariter 1-septatis thallosporas, secedentibus.

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