

# LEAF-INHABITING FUNGI OF EUCALYPTS IN NEW ZEALAND

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## ABSTRACT

Of the leafspot diseases of eucalypts recorded in New Zealand, only those caused by *Mycosphaerella cryptica* (Cooke) Hansford, *M. nubilosa* (Cooke) Hansford, and *Septoria pulcherrima* Gadgil & Dick are considered to be of any significance. Other fungi reported are *Aulographina eucalypti* (Cooke & Masee) von Arx & Muller, *Cercospora eucalypti* Cooke & Masee, *Hendersonia* spp., *Microthyrium eucalypti* P. Hennings, *Phaeoseptoria eucalypti* Hansford, *Trimmatostrema bifarium* Gadgil & Dick, and *T. excentricum* Sutton & Ganapathi.

## INTRODUCTION

This paper reports the occurrence of the more prominent leaf-inhabiting fungi of eucalypts recorded in New Zealand. With the exception of *Mycosphaerella cryptica*, these fungi have not been rigorously tested for pathogenicity and their status as the cause of a diseased condition is based on their consistent association with the symptoms. Five of the fungi discussed were first recorded in New Zealand within the past 3 years and the effect they may have on their host trees is still a matter of some speculation. Descriptions are based on New Zealand material collected by members of the Forest Health Group of the Forest Research Institute.

## MYCOLOGICAL DESCRIPTIONS

1. *AULOGRAPHINA EUCALYPTI* (Cooke & Masee) von Arx & Muller. *Sydowia* 14: 330-3 (1960)

Anamorph: *Thyrimula eucalyptina* Petrak & Sydow. *Annales Mycologici* 22: 273-4 (1924)

Thyriothecia (Fig. 1) amphigenous, dark brown to black, elongate, often branched, up to 2 mm long, opening by a longitudinal slit, wall of radiating hyphae. Asci (Fig. 2) clavate, bitunicate, 8-spored, irregularly biseriata,  $30-40 \times 10-14 \mu\text{m}$ . Ascospores (Fig. 2) hyaline, 2-celled, constricted at the septum, rounded at both ends,  $12-14 \times 3.5-5.5 \mu\text{m}$ .

Pycnidia (Fig. 3) black, superficial, scutiform, glabrous, 0.3-1.0 mm in diameter. Conidia hyaline, filiform-cylindrical,  $12-30 \times 0.5-1 \mu\text{m}$ .

## 2. *CERCOSPORA EUCALYPTI* Cooke & Masee. *Grevillia* 18: 7 (1889)

Mycelium mostly immersed. Stromata (Fig. 4) of brown thick-walled hyphae, formed in substomatal cavities. Some hyphae traverse the guard cells and a stromatal cushion also develops on the leaf surface. Conidiophores (Fig. 4) caespitose, sub-hyaline to brown, simple or branched, septate, occasionally geniculate,  $18\text{--}32 \times 3\text{--}65 \mu\text{m}$ . Conidia (Fig. 5) hyaline to straw-coloured, filiform, straight or curved, base truncate, tapering to an obtuse apex, 4- to 10-septate, usually  $55\text{--}100 \mu\text{m}$  long but occasional spores greater than  $100 \mu\text{m}$  or shorter than  $50 \mu\text{m}$ ,  $2.5\text{--}4.5 \mu\text{m}$  wide.

Two species of *Cercospora* have been described on eucalypts. *Cercospora epicoccoides* Cooke & Masee is distinguished by having epiphyllous fructifications which are dark brown to black in colour (*Epicoccum*-like). Except for the length and the number of septa of the conidia, the *Cercospora* sp. found in New Zealand conforms to the description of *C. eucalypti*. The conidia of *C. eucalypti* are reported to measure  $20\text{--}60 \times 2\text{--}3.5 \mu\text{m}$  and have 1–3 septa (Chupp 1953).

## 3. *HENDERSONIA* SPP.

Pycnidia (Fig. 6) amphigenous, subepidermal, black, globose, ostiolate, up to  $120 \mu\text{m}$  in diameter, very sparse. Conidiogenous cells formed from the inner cells of the pycnidial wall. Conidia (Fig. 7) pale olivaceous to brown, cylindrical, straight or slightly bent, base truncate, apex obtuse, thick walled, transversely 3-septate,  $22\text{--}46 \times 5\text{--}10 \mu\text{m}$ .

Hansford (1957) described two species of *Hendersonia* on eucalypts; *H. fraseri* on *E. polyanthemus* Schauer with dark brown conidia of  $23\text{--}28 \times 6\text{--}9 \mu\text{m}$ , and *H. eucalyptorum* on *E. leucoxyton* F. Muell. with olivaceous conidia of  $40\text{--}48 \times 5\text{--}6 \mu\text{m}$ . Fripp & Forrester (1981) who studied collections of *Hendersonia* fitting the general description of *H. fraseri* from eight species of eucalypts in Kosciusko National Park of Australia, found that differences in conidial size were consistently related to the host species. Differences in conidial size also occurred when the fungi were cultured on artificial media and the dimensions correlated with the field data. They suggested that there were at least three host-specific races of *Hendersonia* occurring on eucalypts in the region of their study. Burdon *et al.* (1982) followed up this work by analysing soluble proteins of the same *Hendersonia* isolates by polyacrylamide gel electrophoresis. Results confirmed that at least four host-specific races of *Hendersonia* exist on the host species examined. In view of this work and because of the diversity we found both in conidial dimensions and colour between collections, species names cannot at this time be meaningfully applied to the specimens examined in New Zealand.

Park & Keane (1982a) found that *H. eucalyptorum* is the imperfect stage of an undescribed species of *Mycosphaerella* on *Eucalyptus globoidea* Blakely and *E. obliqua* L'Herit. No such association has been observed in New Zealand.

## 4. *MICROTHYRIUM EUCALYPTI* P. Hennings. *Hedwigia* 40: 352 (1901)

Thyriothecia (Fig. 8) amphigenous, dark brown, discrete or aggregated, circular and hemispherical, margin crenate, ostiole sunken,  $80\text{--}240 \mu\text{m}$  in diameter. Asci (Fig. 9) clavate, stipitate, bitunicate, 8-spored,  $50\text{--}90 \times 15\text{--}22 \mu\text{m}$ . Ascospores (Fig. 9) fusiform,

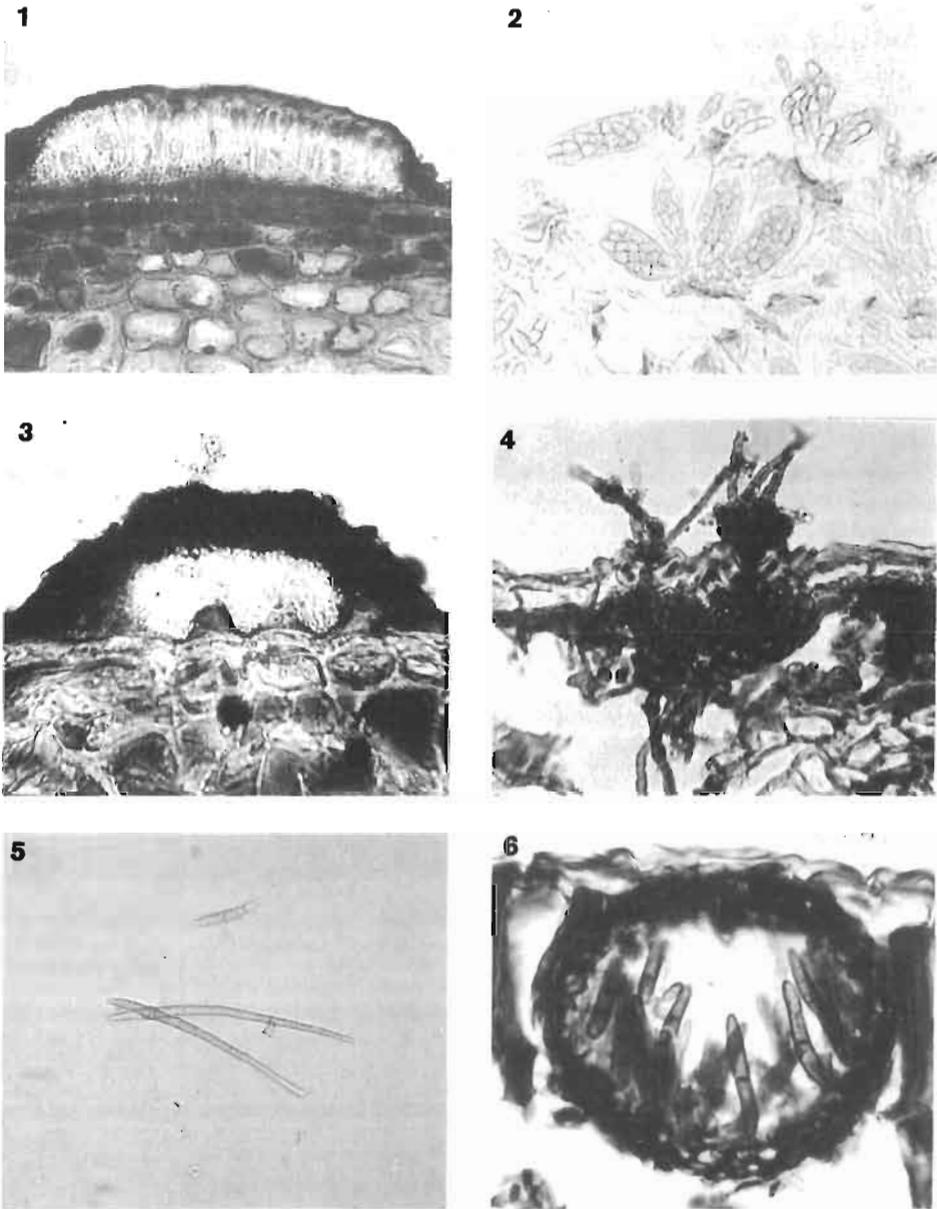


FIG. 1—Thyriothecium of *Aulographina eucalypti* (transverse section) ( $\times 200$ ).

FIG. 2—Asci and ascospores of *A. eucalypti* ( $\times 350$ ).

FIG. 3—Pycnidium of *Thyrynula eucalyptina* (t.s.) ( $\times 100$ ).

FIG. 4—Stroma and conidiophores of *Cercospora eucalypti* (t.s.) ( $\times 200$ ).

FIG. 5—Conidia of *C. eucalypti* ( $\times 200$ ).

FIG. 6—Pycnidium of a *Hendersonia* sp. (t.s.) ( $\times 500$ ).

hyaline, medianly 1-septate, sometimes slightly constricted at the septum,  $18-26 \times 4-6 \mu\text{m}$ .

Ascospores, asci, and thyrtothecia of *Microthyrium amygdalinum* Cooke & Masee (the other species of *Microthyrium* recorded on eucalypts) are all reported to be smaller than those of *M. eucalypti*. Thyrtothecia are black with a smooth margin.

5. *MYCOSPHAERELLA CRYPTICA* (Cooke) Hansford. *Proceedings of the Linnean Society of New South Wales* 81: 35 (1956)

Anamorph: *Colletogloeum nubilosum* Ganapathi & Corbin. *Transactions of the British Mycological Society* 72(2): 237-44 (1979)

Pseudothecia amphigenous, black, globose, glabrous, closely crowded, subepidermal, ostiolate, partially erumpent, up to  $130 \mu\text{m}$  in diameter. Asci obclavate to subsaccate, bitunicate, thick-walled, 8-spored,  $32-45 \times 10-15 \mu\text{m}$ . Ascospores 2- to 3-seriate or irregularly arranged in the ascus, hyaline, ellipsoidal with rounded ends, 1-septate, slightly constricted at the septum,  $12-16 \times 2.5-5 \mu\text{m}$ .

Spermagonia amphigenous, subepidermal, globose, dark brown,  $40-55 \mu\text{m}$  in diameter, formed on immature lesions. Spermata rod-shaped, hyaline,  $4.5 \times 1-2 \mu\text{m}$ .

Acervuli amphigenous on leaves, also on twigs, dark brown to black, subcuticular becoming erumpent. Basal stroma up to 1 cm long,  $150 \mu\text{m}$  wide and  $100-200 \mu\text{m}$  high. Conidiogenous cells short cylindrical, holoblastic, subhyaline,  $5-10 \times 4-7 \mu\text{m}$ . Conidia aseptate, subhyaline, cylindrical, straight or slightly curved, apex obtuse, base truncate with a small frill,  $9-18 \times 4-6 \mu\text{m}$ .

The fungus described here was recorded in New Zealand (Weston 1957) as *Mycosphaerella nubilosa* (Cooke) Hansford. However the characters fit more closely Hansford's description of *M. cryptica* than that of *M. nubilosa*. *Mycosphaerella cryptica* has ascospores which are slightly constricted at the septum and amphigenous pseudothecia, whereas *M. nubilosa* has hypophyllous pseudothecia. Keane *et al.* (1981) found that this feature – the position of the pseudothecia – was consistent on a wide range of eucalypt species from different subgenera. The conidial state *Colletogloeum nubilosum*, described by Ganapathi & Corbin (1979), is consistently found on lesions with amphigenous pseudothecia.

Park & Keane (1982b) examined the paratype specimens of the *M. nubilosa* on *E. delegatensis* R.T. Bak. from New Zealand, compared them with the types of both *M. cryptica* and *M. nubilosa*, and found the pseudothecial state identical with that of the type *M. cryptica*. It is apparent that the New Zealand material is in fact *Mycosphaerella cryptica* (Cooke) Hansford.

Colonies on artificial media are pale to dark green in colour, usually deeply folded, and growth is very slow. Often a reddish pigment is observed in the agar. Ascospores germinated on water agar readily produce conidia identical to *C. nubilosum*.

6. *MYCOSPHAERELLA NUBILOS*A (Cooke) Hansford. *Proceedings of the Linnean Society of New South Wales* 81: 36 (1956)

Pseudothecia (Fig. 10) hypophyllous, black, globose, glabrous, closely scattered, subepidermal, ostiolate, partially erumpent, up to  $150 \mu\text{m}$  in diameter. Asci (Fig. 11)

ellipsoid to subsaccate, bitunicate, rounded and slightly thickened at the apex, 8-spored,  $40\text{--}50 \times 16\text{--}20 \mu\text{m}$ . Ascospores (Fig. 11) 2- to 3-seriate or irregularly arranged, hyaline, ellipsoid with rounded ends, 1-septate,  $12\text{--}17 \times 2.5\text{--}4.5 \mu\text{m}$ .

No conidial state has been found in New Zealand or elsewhere associated with this fungus, either on plant material or in culture. Growth rate in culture is faster than that of *M. cryptica*, colonies are a deeper green in colour, and they do not produce the reddish pigmentation in the agar.

7. *PHAEOSEPTORIA EUCALYPTI* Hansford. *Proceedings of the Linnean Society of New South Wales* 82: 225–6 (1957)

Pycnidia (Fig. 12) hypophyllous, scattered, subepidermal but becoming partially erumpent, black, up to  $150 \mu\text{m}$  in diameter, ostiolate, conidia exuded in a brown cirrus. Conidia (Fig. 13) brown, cylindrical, tapering slightly to the paler obtuse apex, base subtruncate with a small marginal frill, with 3–7 transverse septa, conidial wall minutely roughened,  $30\text{--}55 \times 3\text{--}6 \mu\text{m}$ .

8. *SEPTORIA PULCHERRIMA* Gadgil & Dick. *New Zealand Journal of Botany* 21(1): 49–52 (1983)

Pycnidia (Fig. 14) immersed, subepidermal, globose to subglobose, discrete or aggregated, amphigenous,  $65\text{--}120 \times 60\text{--}95 \mu\text{m}$  in diameter. Pycnidial walls of *textura angularis*, brown. Conidiogenous cells arising from cells of the wall, doliform or ampulliform, hyaline to pale brown, simple, up to  $5 \mu\text{m}$  long. Conidia (Fig. 15) hyaline to pale brown, simple, up to  $5 \mu\text{m}$  long. Conidia (Fig. 15) hyaline to pale brown, smooth, elongated cylindrical, base truncate, tapering slightly to an obtuse apex, 0- to 2- but predominantly 1-septate, flexuous,  $30\text{--}60 \times 3\text{--}4 \mu\text{m}$ . Conidia exuded in a pale brown cirrus.

9. *TRIMMATOSTROMA BIFARIUM* Gadgil & Dick. *New Zealand Journal of Botany* 21(1): 49–52 (1983)

Mycelium superficial, repent. Hyphae brown, septate,  $2\text{--}4 \mu\text{m}$  wide. Sporodochia (Fig. 16) amphigenous, dark brown to black, pulvinate, often arranged in circular groups, up to  $350 \mu\text{m}$  diameter. Conidiophores micronematous, short, aggregated, brown. Conidia (Fig. 17) formed in basipetal chains, fragmenting, brown, 6- to 10-celled when mature, consisting of 2 parallel rows of cells with a common thickened transverse base and obtuse apices,  $12\text{--}24 \times 6\text{--}14 \mu\text{m}$ .

10. *TRIMMATOSTROMA EXCENTRICUM* Sutton & Ganapathi. *New Zealand Journal of Botany* 16: 529–33 (1978)

Mycelium superficial, repent. Hyphae brown, septate,  $2\text{--}4 \mu\text{m}$  wide. Sporodochia amphigenous, dark brown to black, pulvinate, often arranged in circular groups, up to  $350 \mu\text{m}$  in diameter. Conidiophores micronematous, short, aggregated, brown. Conidia (Fig. 18) formed in basipetal chains, fragmenting, brown, 4-celled with 2 primary basal cells separated by a thick brown septum and 2 secondary cells,  $11\text{--}14 \times 7\text{--}9 \mu\text{m}$ .

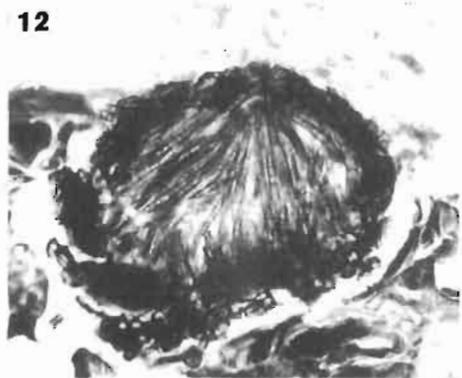
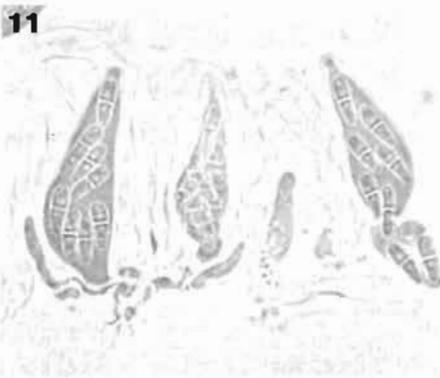
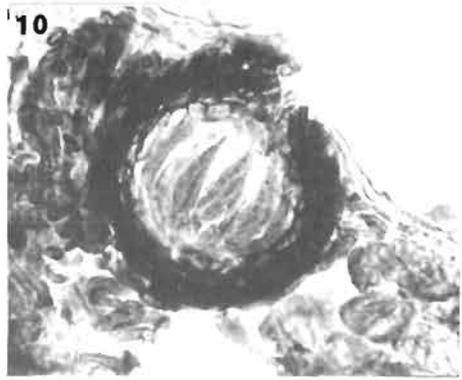
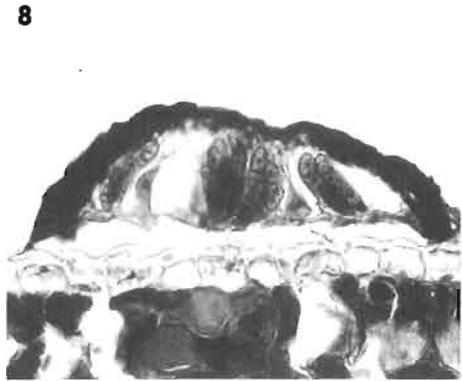
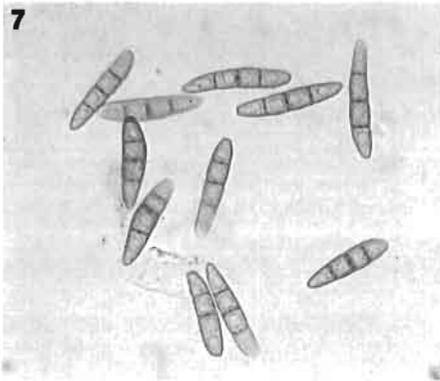


FIG. 7—Conidia of a *Hendersonia* sp. ( $\times 400$ ).

FIG. 8—Thyriothecium of *Microthyrium eucalypti* (t.s.) ( $\times 250$ ).

FIG. 9—Asci and ascospores of *M. eucalypti* ( $\times 350$ ).

FIG. 10—Pseudothecium of *Mycosphaerella nubilosa* (t.s.) ( $\times 250$ ).

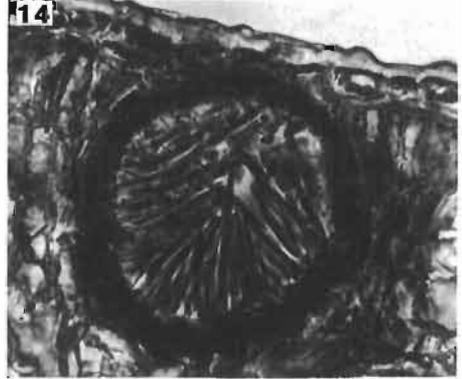
FIG. 11—Asci and ascospores of *M. nubilosa* ( $\times 650$ ).

FIG. 12—Pycnidium of *Phaeoseptoria eucalypti* (t.s.) ( $\times 300$ ).

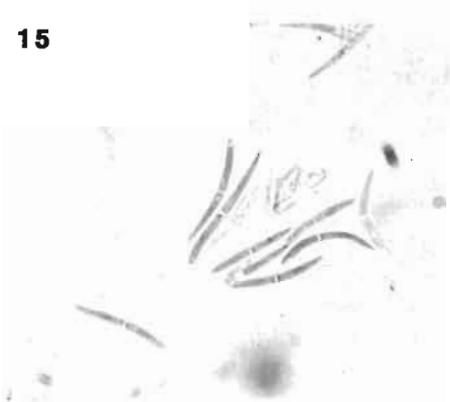
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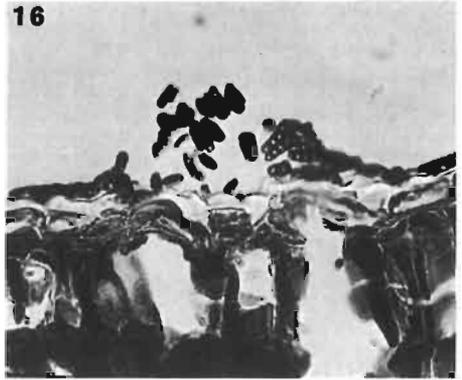
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FIG. 13—Conidia of *Phaeoseptoria eucalypti* ( $\times 250$ ).  
FIG. 14—Pycnidium of *Septoria pulcherrima* (t.s.) ( $\times 400$ ).  
FIG. 15—Conidia of *S. pulcherrima* ( $\times 300$ ).  
FIG. 16—Sporodochium of *Trimmatostroma bifarium* (t.s.) ( $\times 275$ ).  
FIG. 17—Conidia of *T. bifarium* ( $\times 350$ ).  
FIG. 18—Conidia of *T. excentricum* ( $\times 300$ ).

## SYMPTOMS AND DISTRIBUTION

### *Aulographina eucalypti*

**Symptoms:** Lesions are brown, approximately circular, 2–15 mm in diameter, and frequently with a raised corky area in the centre. Lesions can occur on either upper or lower leaf surfaces but seldom develop right through the leaf because of the formation of a cork cambium barrier in the healthy tissue below the necrotic spot. A dark margin to the lesion frequently forms. Development of thyriothecia follows that of pycnidia, the fruit bodies intermingling. The conidia have not been seen to germinate and their function is unknown. Lesions also occur on leaf petioles and bark.

**Hosts:** *Eucalyptus delegatensis*, *E. fastigata* Deane & Maid., *E. fraxinoides* Deane & Maid., *E. nitens* (Deane & Maid.) Maid., *E. regnans* F. Muell.

**Distribution:** The fungus has been recorded from the central North Island forests of N.Z. Forest Products Ltd and from Kaingaroa and Pureora State Forests; and in Westland from Maimai, Mawhera, and Hochstetter State Forests and Lake Ahaura.

**Notes:** During the spring of 1974, over 4200 ha of 120- to 180-year-old *E. nitens* in East Gippsland, Australia, were moderately to severely defoliated by a complex of leaf pathogens of which *A. eucalypti* was thought to be the principal causal agent (Neumann & Marks 1976). According to Marks *et al.* (1982) the disease causes serious defoliation only when the petioles are infected and leaves are killed by girdling of the petiole. To date, the disease, first recorded near Lake Taupo in February 1980, does not appear to be of any economic importance in New Zealand as infection occurs primarily in the lower crown and levels of the disease are generally low.

### *Cercospora eucalypti*

**Symptoms:** Lesions are light brown, 2–8 mm in diameter, discrete or confluent, and frequently of angular outline as they may be confined by leaf veins (Fig. 19). Straw-coloured conidiophores are formed on both upper and lower leaf surfaces and are visible under a hand lens.

**Hosts:** *Eucalyptus delegatensis*, *E. fastigata*, *E. nitens*, *E. regnans*.

**Distribution:** In the central North Island area the fungus is widely distributed in the forests of N.Z. Forest Products Ltd and in their nursery at Kinleith. It is widespread in Kaingaroa and Rotoehu State Forests, and has also been recorded from Lismore State Forest near Wanganui and Te Wera State Forest in Taranaki.

**Notes:** Although there have been incidences of severe leaf-spotting of *E. regnans* in some stands of N.Z. Forest Products Ltd, no assessment has been made of any possible effect of the disease on tree growth.

### *Hendersonia* spp.

**Symptoms:** Lesions are very small, scattered over the leaf lamina, usually discrete but occasionally confluent, with a distinct purple-red margin 1–3 mm in diameter (Fig. 19).

**Hosts:** *Eucalyptus delegatensis*, *E. fastigata*, *E. fraxinoides*, *E. globulus* Labill., *E. johnstonii* Maid., *E. pauciflora* Spreng., *E. regnans*.

**Distribution:** *Hendersonia* species are common in the South Island and have been recorded from Beaumont, Longwoods, and Slopedown State Forests and Edendale

Nursery in Southland; from Craigieburn, Mayfield, Lyttelton, and the Clarence River mouth in Canterbury; and from Mawhera State Forest in Westland. In the North Island they have been recorded from Karioi, Esk, and Rotoaira State Forests, and on the central plateau from N.Z. Forest Products Ltd plantations.

**Notes:** Disease associated with *Hendersonia* spp. rarely occurs to an extent great enough to limit growth of a tree and has not been known to cause mortality.

*Microthyrium eucalypti*

**Symptoms:** Thyriothecia resemble fly specks on the leaf surface and are frequently arranged in concentric circles or semicircles. The entire lamina of affected leaves may become a paler green, or distinct purple blotches may develop in association with the fruiting bodies.

**Hosts:** *Eucalyptus delegatensis*, *E. fastigata*, *E. fraxinoides*, *E. johnstonii*, *E. regnans*.

**Distribution:** The fungus has been recorded from Kaingaroa, Pureora, and Rotoaira State Forests, from Tarawera Forest, and throughout the forests of N.Z. Forest Products Ltd in the central North Island. It has also been recorded from Karioi and Esk State Forests and Kohitere Forest of the Wellington region; Harihari, Hochstetter, and Mawhera State Forests in Westland; and Longwoods State Forest in Southland.

**Notes:** *Microthyrium eucalypti* may be more widely distributed than records show. It commonly occurs in the lower crown on older leaves and thus attracts little attention. Economically it is of no importance.

*Mycosphaerella cryptica*

**Symptoms:** Lesions are circular to irregular, discrete or confluent, red-brown in colour when young (Fig. 19) and frequently with a prominent purple margin, becoming dark-grey as the pseudothecia mature. Occasionally lesions are delimited by prominent, raised, callus tissue. Necrotic tissue may drop out leaving the leaf lamina riddled with holes. Leaves are often badly distorted and those with extensive infection are readily abscised. The fungus also attacks petioles, shoots, and young twigs. Cankers up to 25 mm long develop, the bark splits longitudinally, and gum exudation may occur. Die-back follows girdling of twigs, the resultant thin crowns and dead tops becoming apparent in badly affected trees. Acervuli and conidia commonly develop on the stem cankers.

**Hosts:** *Eucalyptus delegatensis*, *E. fastigata*, *E. fraxinoides*, *E. nitens*, *E. obliqua*, *E. ovata* Labill., *E. regnans*.

**Distribution:** The fungus has not been reported in Southland, Otago, South Canterbury, or South Westland. However, it is very well distributed throughout forests, small plantations, and nurseries in the rest of New Zealand where the susceptible host species are grown. In Northland, where the only records are from Woodhill and Waipoua State Forests, the major *Eucalyptus* species grown is *E. saligna* Sm. which is not a host of *M. cryptica*.

**Notes:** Both conidia and ascospores of *M. cryptica* can initiate infection. Conidia are produced on young lesions and are present mainly from December to March; mature ascospores are present throughout the year. However, as only young expanding leaves

are susceptible, the infection period runs from spring (October–November) until autumn (April–May). After establishment of infection, initial symptoms take 3–4 weeks to appear and it is another 5–8 weeks before fully mature spores are produced. The optimum temperature for infection ranges from 18° to 24°C (Ganapathi 1979).

The disease can have a marked effect on the growth and form of highly susceptible hosts. Cankering and dieback of shoots and twigs result in stunted growth, multi-leadering, and a bushy habit. There is a pronounced difference in susceptibility to infection between different provenances of *E. delegatensis* (which is the most severely affected of the hosts grown in New Zealand) and *E. regnans* (Wilcox 1982), and planting the more resistant provenances can markedly reduce the disease incidence. Chemical control may be necessary in nurseries where there is an inoculum source nearby.

#### *Mycosphaerella nubilosa*

**Symptoms:** Lesions are irregular in outline, often confluent, up to 25 mm in diameter, creamy-yellow to pale brown in colour on the upper surface (Fig. 19) and becoming grey-black on the under surface owing to the presence of pseudothecia. Symptoms have been observed only on juvenile foliage of the affected species.

**Hosts:** *Eucalyptus cypellocarpa* L. Johnson, *E. globulus*, *E. globulus* ssp. *bicostata* (Maid et al.) Kirkp., *E. globulus* ssp. *maidenii* (F. Muell.) Kirkp.

**Distribution:** *Mycosphaerella nubilosa* has been recorded from Tarawera Forest and from a number of locations in N.Z. Forest Products Ltd forests on the central plateau of the North Island.

**Notes:** The foliage of *E. globulus* is particularly susceptible to this disease and if persistent defoliation occurs it can hinder growth. In a plantation of *E. globulus* at Nowa Nowa (Victoria, Australia) Park & Keane (1982c) found that *M. nubilosa* caused almost complete defoliation of juvenile leaves. However, because of its apparent inability to attack mature foliage and its limited host range (only a few species of the subgenus *Symphomyrtus*), *M. nubilosa* has little potential for causing major disease outbreaks in New Zealand.

Park & Keane (1982c) found in inoculation experiments that symptoms take 4–8 weeks to appear and that mature pseudothecia developed within 12 weeks. Leaves are most susceptible to infection when they are just fully expanded.

#### *Phaeoseptoria eucalypti*

**Symptoms:** Lesions are irregular deep purple blotches, separate or confluent, up to 7 mm across. Only one specimen has been examined.

**Hosts:** *Eucalyptus saligna*.

**Distribution:** Waipoua State Forest, Northland.

**Notes:** This fungus, first recorded in New Zealand in September 1982, is, to date, of no economic importance in this country. Walker (1962) reported that *P. eucalypti* caused severe damage to seedlings of *Eucalyptus macarthurii* Deane & Maid., *E. maculata* Hook., and *E. sideroxylon* Woolls at West Pennant Hills Nursery near Sydney and was also found on leaf spots of *E. saligna* at Canberra.

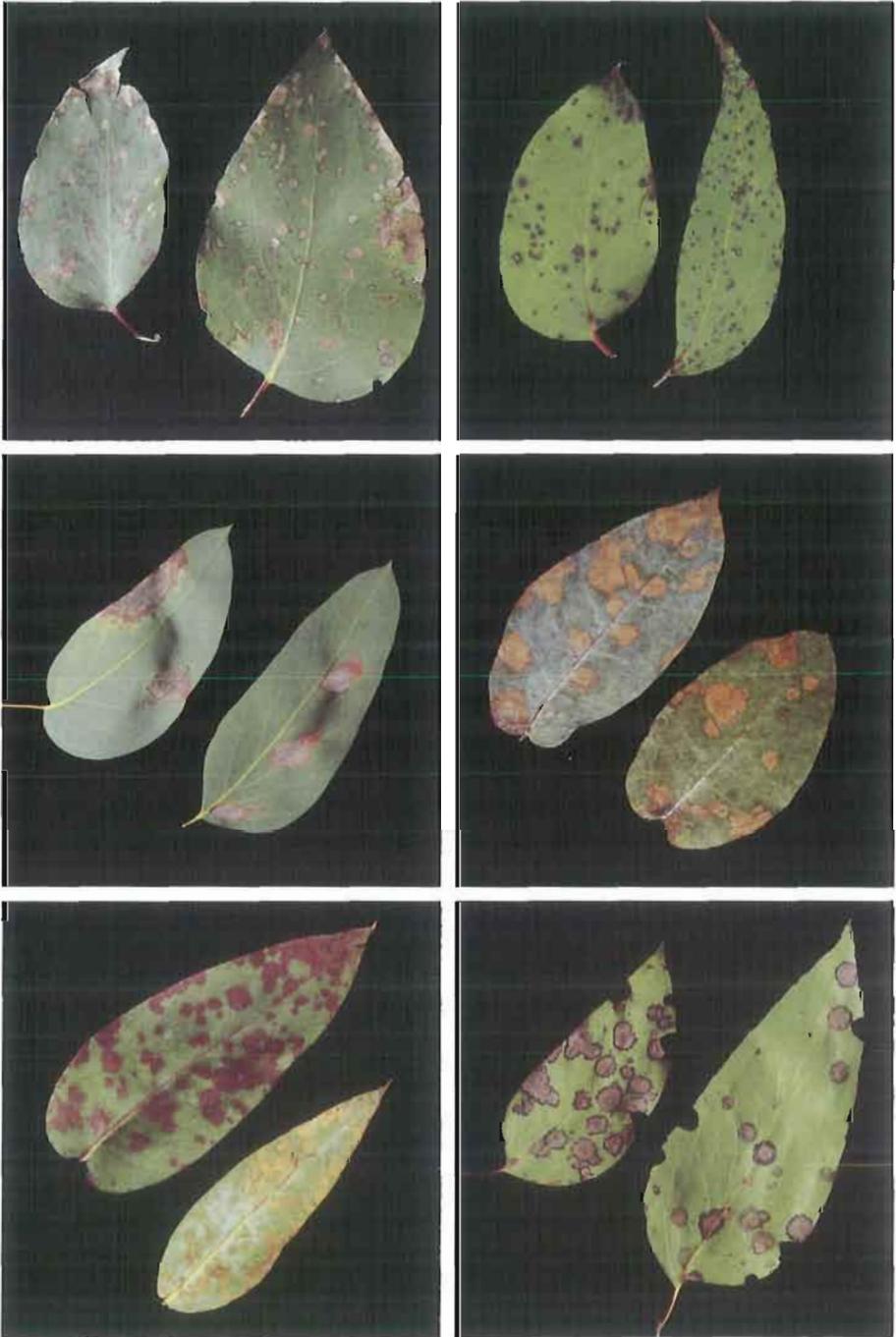


FIG. 19—Top left: *Cercospora eucalypti* on *E. regnans*; top right: *Hendersonia* sp. on *E. delegatensis*; middle left: *Mycosphaerella cryptica* on *E. delegatensis*; middle right: *Mycosphaerella nubilosa* on *E. globulus*; bottom left: *Septoria pulcherrima* on *E. nitens*; bottom right: *Trimmatostroma bifarium* on *E. regnans*.

*Septoria pulcherrima*

**Symptoms:** Leaf spots are at first pale yellow, rapidly turning a distinctive carmine red (Fig. 19) before the tissue finally becomes brown and necrotic. The irregularly shaped lesions spread and coalesce and may almost cover the leaf petiole. Badly infected leaves are readily cast.

**Hosts:** The disease is restricted to some members of the Section Maidenaria of the subgenus *Symphomyrtus*. In New Zealand it has been found on *Eucalyptus cephalocarpa* Blakely, *E. cypellocarpa*, *E. dalrympleana* Maid., *E. globulus*, *E. gunnii* Hook. f., *E. nitens*, *E. ovata*, and *E. viminalis* Labill.

**Distribution:** Symptoms were first recorded in New Zealand in February 1981 in a mixed *Eucalyptus* spp. plantation near Tokoroa. It is now widely present in N.Z. Forest Products Ltd forests in the central North Island and has been recorded in Kaingaroa and Rotoehu State Forests and in Rotorua.

**Notes:** The disease appears to be the same as that reported in Australia by Heather (1962) under the name *Septoria normae*, a nomen nudum. He found the host range limited to two species, *E. dalrympleana* and *E. viminalis*.

In New Zealand *S. pulcherrima* has been associated with spectacular damage, particularly on *E. nitens*. However, planting of this species has already been reduced as its adult foliage is badly defoliated by the eucalyptus tortoise beetle *Paropsis charybdis* Stål.

*Trimmatostroma bifarium*

**Symptoms:** Lesions are brown, roughly circular, discrete or confluent, 2–15 mm in diameter (Fig. 19). Larger lesions are frequently composed of concentric rings of differing shades of brown. The centre of the lesion may be raised and crusty.

**Hosts:** *Eucalyptus delegatensis*, *E. fastigata*, *E. regnans*, *E. sieberi* L. Johnson.

**Distribution:** *Trimmatostroma bifarium* has been found in the central North Island throughout the forests of N.Z. Forest Products Ltd and in Lake Taupo and Rotoehu State Forests. It has also been recorded from the Waiwhero block of Baigents Forest in Nelson and from Mawhera State Forest in Westland.

**Notes:** Infection levels are greatest in the lower crown of affected trees and the disease is generally of no economic significance.

*Trimmatostroma excentricum*

**Symptoms:** Leaf spots are brown, approximately circular, discrete or confluent, 2–10 mm in diameter. The centre of the lesion is often raised and crusty.

**Hosts:** *Eucalyptus delegatensis*, *E. regnans*, *E. sieberi*.

**Distribution:** *Trimmatostroma excentricum* has been reported from Kaingaroa, Karioi, Lake Taupo, and Tarawera State Forests, and from N.Z. Forest Products Ltd forests in the central North Island area; from Kohitere Forest in the Manawatu, and Hochstetter State Forest in Westland.

**Notes:** Lesions caused by this fungus are very similar to those caused by *Trimmatostroma bifarium* and the two cannot be distinguished macroscopically. The disease is generally of no economic significance.

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