
New species of *Lembosia* and *Lembosina* from Australia

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Lembosia araucariae sp. nov., *Lembosia syzygii* sp. nov., *Lembosina alyxiae* sp. nov., *Lembosina diospyrosi* sp. nov. and *Lembosina eucalypti* sp. nov. on leaves of *Araucaria*, *Syzygium*, *Alyxia*, *Diospyros* and *Eucalyptus* respectively are described and illustrated from Australia. *Lembosia hosagoudari* nom. nov. is proposed to accommodate *Lembosia syzygiicola* Hosag. which is a later homonym of *Lembosia syzygiicola* (Hansf.) Deighton.

Key words: ascomycetes, *Alyxia*, *Araucaria*, *Diospyros*, *Eucalyptus*, foliicolous fungi, *Lembosia*, *Lembosina*, new species, *Syzygium*, taxonomy.

Introduction

The asterinaceous genera *Lembosia* and *Lembosina* are common and widespread and many species have been described on the basis of the identity of the host plant (Müller and Arx, 1962; Reed and Farr, 1993; Mibey and Hawksworth, 1997). In Australia, four species of *Lembosia*, *Lembosia ardua* Syd. (1937a), *Lembosia canthii* (Hansf.) Arx in Müller and Arx (1962), *Lembosia capnoides* Syd. (1937b) and *Lembosia graphioides* Sacc. & Berl., *Revue de Mycologie* 7: 6, 1885, and one species of *Lembosina*, *Lembosina persooniae* H.J. Swart (1972) are currently recognised. Two other Australian species of *Lembosia*, *Lembosia micrasca* Syd. (1937a) and *Lembosia notolaea* Hansf. (1957), both found on *Notolaea*, are later synonyms of *Lembosia graphioides* according to the annotated notes left by John Walker (formerly at Herb. DAR) in the type packets. Walker suggested that the host of *Lembosia graphioides* was misidentified as *Olea paniculata* and it belongs to *Notolaea*. We agree with the observations made by Walker and consider *Lembosia micrasca* and *Lembosia notolaea* to be synonyms of *Lembosia graphioides*.

The new species described below are based partly on host identity together with comparison to closely related species on the same host or other host genera in the same family. *Lembosia* is distinguished from *Lembosina* only by the presence of hyphopodia (appressoria) on the mycelium. *Lembosina* lacks hyphopodia.

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Materials and methods

Observations and measurements were made from dried herbarium specimens. Sections were cut using a freezing microtome, mostly at a thickness of 10 μm , mounted in lactofuchsin and observed using brightfield and Nomarski differential interference contrast microscopy. Photomicrographs were taken using a digital camera (Leica DC 200 with IM 1000 Multifocus Module).

Taxonomy

Lembosia araucariae Sivan. & R.G. Shivas, **sp. nov.** (Figs. 1-6)

Etymology: based on *Araucaria*, the name of the host genus.

Mycelia superficialia ex hyphae brunneae, septatae, usque 2 μm latae, dissitus, hyphopodiatae. *Hyphopodia* aseptata, brunnea, lateralis, alternata, globosa, laeves, usque 3 μm lata. *Hysterothecia* 100-300 μm longa, 60-100 μm lata, lineares vel Y-forma, epigena, solitaria, superficialia, nigra, dispersa, fissurum ostiole pariete exiliore longitudinali aperientis. *Paraphysoids* filiformes, hyalinae, ramosae, septatae, usque 1.5 μm latae. *Asci* 19-27 \times 9.5-16 μm , sessiles vel brevipedicellati, saccati cylindrici vel ovoidei, bitunicati, octospori. *Ascospores* 9.5-11 \times 3.5-4 μm , fusiformes, mediano uniseptatae, constrictae, hyalinae, guttulate, brunneae ad maturitatem, laeves.

Mycelia superficial composed of brown, septate, branched, up to 2 μm thick hyphopodiate hyphae. *Hyphopodia* aseptate, brown, lateral, alternate, globose, smooth, up to 3 μm wide. *Hysterothecia* 100-300 μm long, 60-100 μm wide, linear, rarely Y-shaped, epigenous, solitary, scattered, black, superficial, opening by a longitudinal slit. In section, the upper wall is 9-12 μm thick, black, indistinct and melanized. *Paraphysoids* filiform, hyaline, septate, branched, up to 1.5 μm thick. *Asci* 19-27 \times 9.5-16 μm , sessile to short-stalked, bitunicate, saccate cylindrical to ovoid, 8-spored. *Ascospores* 9.5-11 \times 3.5-4 μm , fusiform, 1-septate in the middle, constricted, hyaline, guttulate, becoming brown when mature, smooth.

Anamorph: unknown.

Host: *Araucaria heterophylla* (Salisb.) Franco.

Known distribution: Australia.

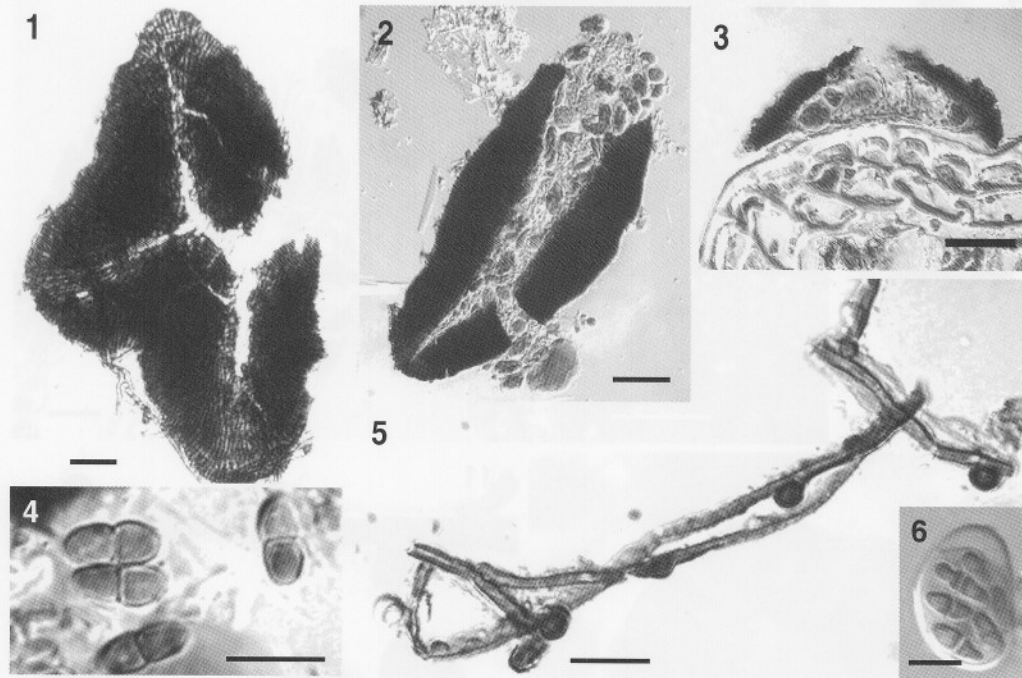
Holotype: AUSTRALIA, Norfolk Islands, on leaves of *Araucaria heterophylla*, 5 Nov. 1980, B.N. Brown, P 9063 (BRIP 27843).

Notes: *Lembosia agathidis* Hansf. (1954) is the only species described on *Agathis* (*Araucariaceae*) from Sulawesi (formerly Celebes), Indonesia. It has brown ascospores measuring 16-18 \times 8 μm .

Lembosia syzygii Sivan. & R.G. Shivas, **sp. nov.** (Figs. 7-12)

Etymology: based on *Syzygium*, the name of the host genus.

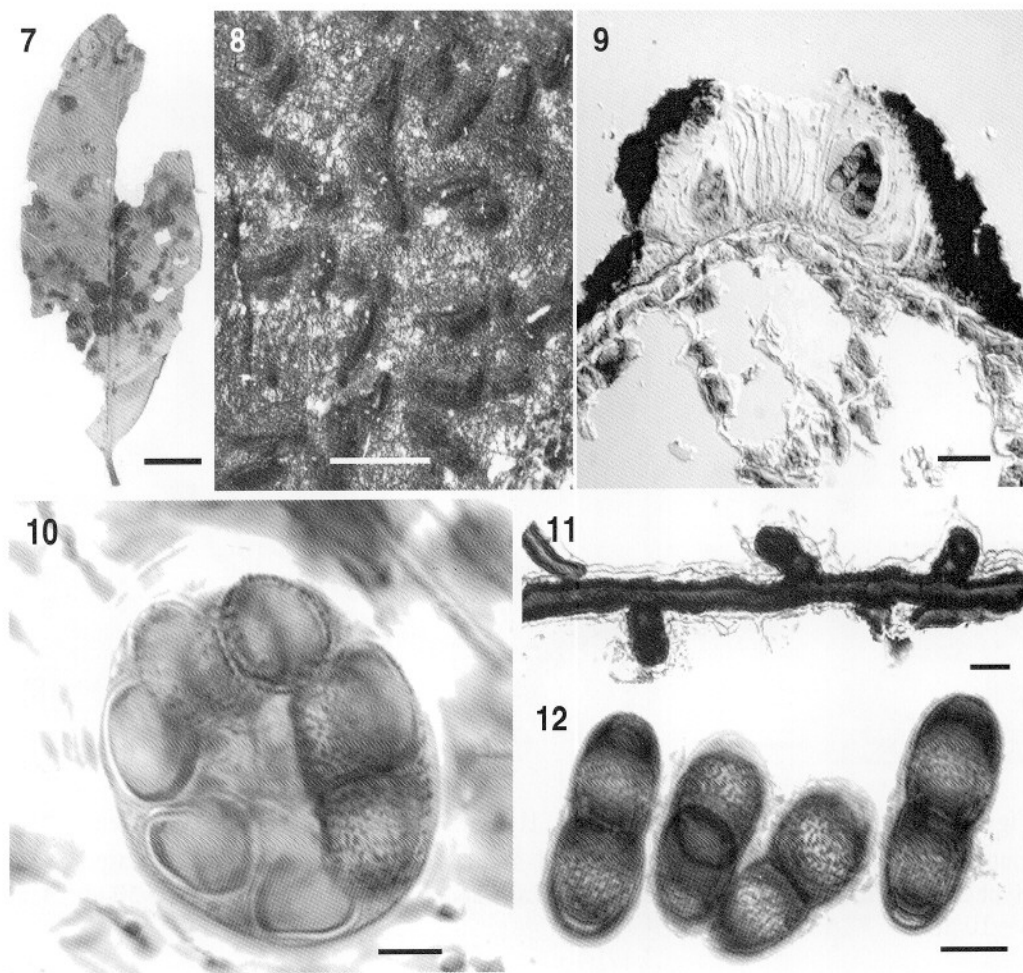
Coloniae nigrae, epigenae, rotundatae vel irregulariter rotundatae, usque 1 cm diam. *Mycelium* ex *hyphis* atrobrunneis, 4-6 μm latis, irregulariter laxe reticulatis, ramosis,



Figs. 1-6. *Lembosia araucariae* (holotype) 1. Hysterothecium. 2. Hysterothecium opening by a longitudinal split showing asci. 3. Vertical section of hysterothecium. 4. Ascospores. 5. Hyphopodiate hyphae. 6. Ascus and immature ascospores. Bars: 1, 3 = 20 μm ; 2 = 50 μm ; 4, 5, 6 = 10 μm .

hyphopodiatis. *Hyphopodia* 1-septata, alternata, sparsa, recta vel curvata, laeves, subantrorsa, 14-16 \times 5-7.5 μm , cellula basali cylindrica, 3.5-5 \times 4-6 μm , cellula apicali subglobosa vel ovoidea, 9-12 \times 6-7.5 μm . *Hysterothecia* superficialia, nigra, epigena, arcte aggregata, plerumque lineares, raro Y-forma, aliquando coalescentes, margine leviter fimbriatum, usque 1 mm longa, fissurum ostiole pariete exiliore. Parietis superno hysterothecii nigris haud indistinctis, 28-38 μm lati. *Paraphysoids* filiformes, numerosae, septatae, hyalinae, ramosae, usque 2 μm latae. *Asci* late ellipsoideae, crassitunicati, bitunicati, octospori, sessiles, 50-72 \times 42-53 μm . *Ascospores* ellipsoideae, atrobrunneae, mediano uniseptatae, constrictae, verruculosae, conglobatae, 32-35 \times 13-15 μm

Colonies black, epigenous, rounded to irregularly rounded, up to 1 cm diam. *Mycelium* is composed of dark brown, irregularly and loosely branched reticulate, hyphopodiate, 4-6 μm thick hyphae. *Hyphopodia* 1-septate, alternate, sparse, straight to curved, 14-16 \times 5-7.5 μm , smooth, subantorse, basal cell cylindrical, 3.5-5 \times 4-6 μm , apical cell subglobose to ovoid, slightly curved or erect, 9-12 \times 6-7.5 μm . *Hysterothecia* superficial, black, epigenous, closely grouped together, mostly linear, rarely Y-shaped, sometimes fusing with each other, fimbriate at the margin, up to 1 mm long with a central longitudinal ostiolar slit. In section, conical to hemispherical or linear, 75-100 μm high, with a black, indistinct, melanized, 28-38 μm thick upper wall, basal wall very thin and applanate. Hyphae originate from the basal wall and



Figs. 7-12. *Lembosia syzygii* (holotype) 7. Leaf spots. 8. Hysterothecia on leaf. 9. Vertical section of hysterothecium. 10. Ascus. 11. Hyphopodia. 12. Ascospores. Bars: 7 = 2 cm; 8 = 1 mm; 9 = 20 μ m; 10-12 = 10 μ m.

penetrate the cuticle invading the epidermal cells where they form small bands of closely grouped fungal cells. *Paraphysoids* numerous, filiform, septate, hyaline, branched, up to 2 μ m thick. *Asci* broadly ellipsoidal, thick-walled, bitunicate, 8-spored, sessile, 50-72 \times 42-53 μ m. *Ascospores* ellipsoidal, dark brown, 1-septate in the middle, distinctly verruculose, constricted, conglobate, 32-35 \times 13-15 μ m.

Anamorph: unknown.

Host: *Syzygium suborbiculare* (Benth.) T. Hartley & Perry.

Known distribution: Australia.

Holotype: AUSTRALIA, Queensland, Cardwell, on leaves of *Syzygium suborbiculare*, 10 July 1981, J.H. Simmonds (BRIP 10037a).

Notes: Nine species of *Lembosia* have been described on host genera in the *Myrtaceae*, namely *Eugenia*, *Syzygium* and *Tristaniopsis*. Of these nine, only *Lembosia javensis* Hansf. (1954) has ascospores which are not smooth

(Stevens and Ryan, 1939; Deighton, 1978; Hosagoudar, 1995). The ascospores of *Lembosia javensis* are unequally 1-septate, granulose and measure $34\text{--}38 \times 16\text{--}18 \mu\text{m}$. *Lembosia syzygii* can be easily distinguished by its characteristic verruculose ascospores. *Lembosia syzygiicola* Hosag. (1995) is a later homonym of *Lembosia syzygiicola* (Hansf.) Deighton (1978). The ascospores are smooth and $21\text{--}28 \times 9\text{--}12.5 \mu\text{m}$ in the former and $30\text{--}32 \times 15\text{--}17 \mu\text{m}$, slightly unequally 1-septate, and minutely punctate when mature in the latter. They are therefore not conspecific. Unfortunately a new name has to be provided for the species described by Hosagoudar (1995) according to article 64 of the International Code of Botanical Nomenclature.

***Lembosia hosagoudari* Sivan. & R.G. Shivas, nom. nov.**

= *Lembosia syzygiicola* Hosag., Indian Journal of Forestry 18: 276, 1995 non *Lembosia syzygiicola* (Hansf.) Deighton, Transactions of the British Mycological Society 71: 518, 1978.

***Lembosina alyxiae* Sivan. & R.G. Shivas, sp. nov.**

(Figs. 13-18)

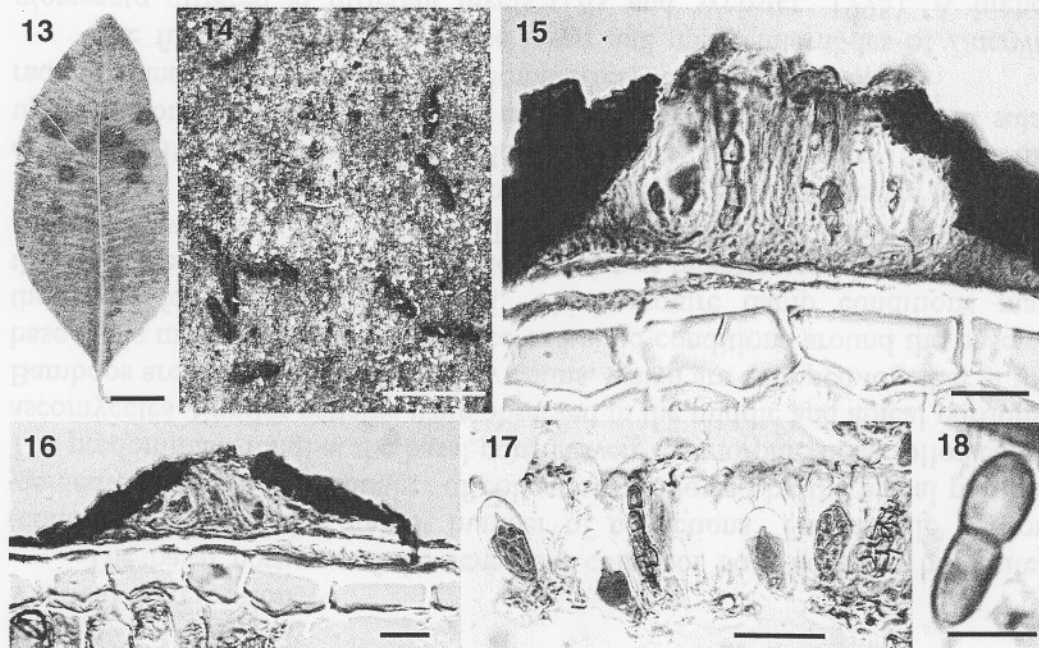
Etymology: based on *Alyxia*, the name of the host genus.

Maculae atrobrunneae vel brunneae, epigenae, discretus vel raro confluentibus, non morbescentes, rotundatae, usque 5 mm diam. *Hyphae* superficiales, brunneae, septatae, ramosae, laeves, usque 5 μm latae. *Hysterothecia* lineares vel Y-forma, epigena, recta vel curvata, dispersa, superficialia, 200-475 μm longa, 75-135 μm lata, fissurum ostiole pariete exiliore. Paries hysterothecii pariete superioris 20-38 μm latae, nigris, haud distinctus, basalis applanatis. *Paraphysoids* filiformes, hyalinae, simplices vel ramosae, septatae, apicibus tumidis, usque 2.5 μm latae. *Asci* ovoidei, bitunicati, octospori, sessiles vel brevipedicellati, 20-32(-38) \times 9.5-15 μm . *Ascospores* fusiformes, mediano uniseptatae, constrictae, hyalinae, maturae brunneae, laeves, aliquando asperatae, imbricate pluriseriatae, 9.5-12.5 \times 3.5-4 μm .

Leaf spots dark brown to brown, epigenous, discrete, rarely confluent, rounded, not necrotic, up to 5 mm diam. *Hyphae* superficial, brown, septate, branched, smooth, up to 5 μm thick. *Hysterothecia* linear, sometimes Y-shaped, epigenous, straight to curved, scattered, superficial, 200-475 μm long, 75-135 μm wide, opening by a central longitudinal slit. In section, conical with an applanate base, upper wall 20-38 μm thick is composed of black, indistinct, melanized cells. *Hyphae* from the basal wall penetrate the cuticle and form haustoria of brown, clumped hyphal cells in the epidermal cells of the host. *Paraphysoids* filiform, thin-walled, hyaline, simple or branched near the apex with swollen tips, septate, up to 2.5 μm thick. *Asci* ovoid, bitunicate, 8-spored, sessile to short-stalked, 20-32(-38) \times 9.5-15 μm , parallel on the basal layer of the hysterothecia. *Ascospores* fusiform, 1-septate in the middle, constricted, hyaline becoming brown at maturity, smooth, sometimes roughened in mature spores, overlapping pluriseriate, 9.5-12.5 \times 3.5-4 μm .

Anamorph: unknown.

Host: *Alyxia spicata* R. Br.



Figs. 13-18. *Lembosina alyxiae* (holotype) 13. Leaf spots. 14. Hysterothecia on leaf. 15, 16. Vertical sections of hysterothecium. 17. Asci arranged linearly. 18. Mature ascospore. Bars: 13 = 1 cm; 14 = 1 mm; 15-17 = 20 μ m; 18 = 5 μ m.

Known distribution: Australia.

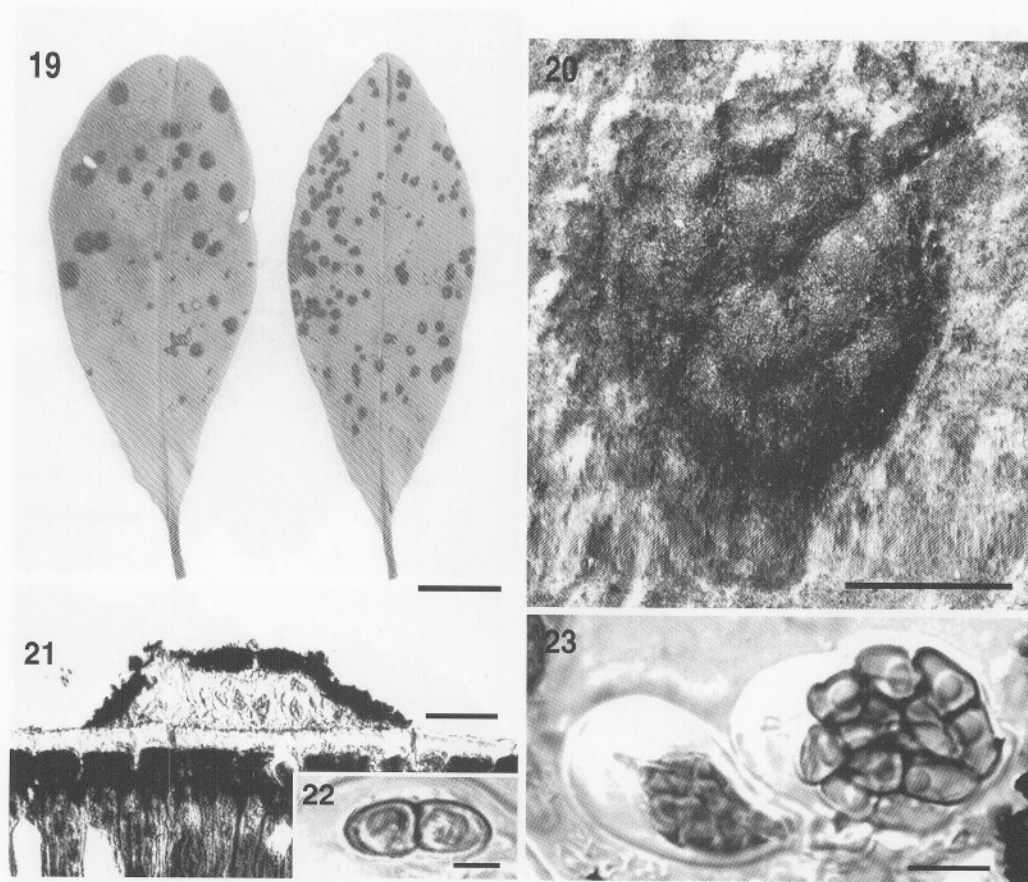
Holotype: AUSTRALIA, Queensland, Cape York Peninsula, Doublemouth Creek, on leaves of *Alyxia spicata*, 11 Mar. 1992, J.W. Cribb (BRIP19913).

Notes: *Lembosina acocantherae* (Doidge) Arx (Müller and Arx, 1962) is the only species reported on *Acocanthera* and *Carissa* in the *Apocynaceae*. It has ascospores measuring 13-18 \times 6-7 μ m which are significantly larger than those of *Lembosina alyxiae*.

***Lembosina diospyrosi* Sivan. & R.G. Shivas, sp. nov.** (Figs. 19-23)

Etymology: based on *Diospyros*, the name of the host genus.

Maculae epigenae, nigrae, rotundatae, dispersae, usque 0.5 cm diam. vel plures. *Mycelium* ex hyphis atrobrunneis, ramosis, septatis, laeves, usque 3.5 μ m latis. *Hysterothecia* nigra, superficialia, arcte aggregata, epigena, 120-190 μ m longa, 47-60 μ m lata, ad fissurum ostiole pariete exiliore, ad margine leviter fimbriatus. In sectione vadose conica, superficialia, haustoria formantia, peridium pariete superioris ex indistincto stratum atrarum compositum, 11.5-19 μ m crassum. *Paraphysoids* filiformes, hyalinae, septatae, ramosae, usque 1.5 μ m latae. *Asci* ovoidei, saccati clavati vel globosi, bitunicati, octospori, sessiles vel brevipedicellati, 40-72 \times 17-19 μ m, parallelis in strato basali peridii. *Ascosporae* oblongae, mediano uniseptatae vel modo superno septatae, constrictae, primum hyalinae demum pallide vel atrobrunneae, conglobatae vel imbricate pluriseriatae, 15-17 \times 5.5-7.5 μ m.

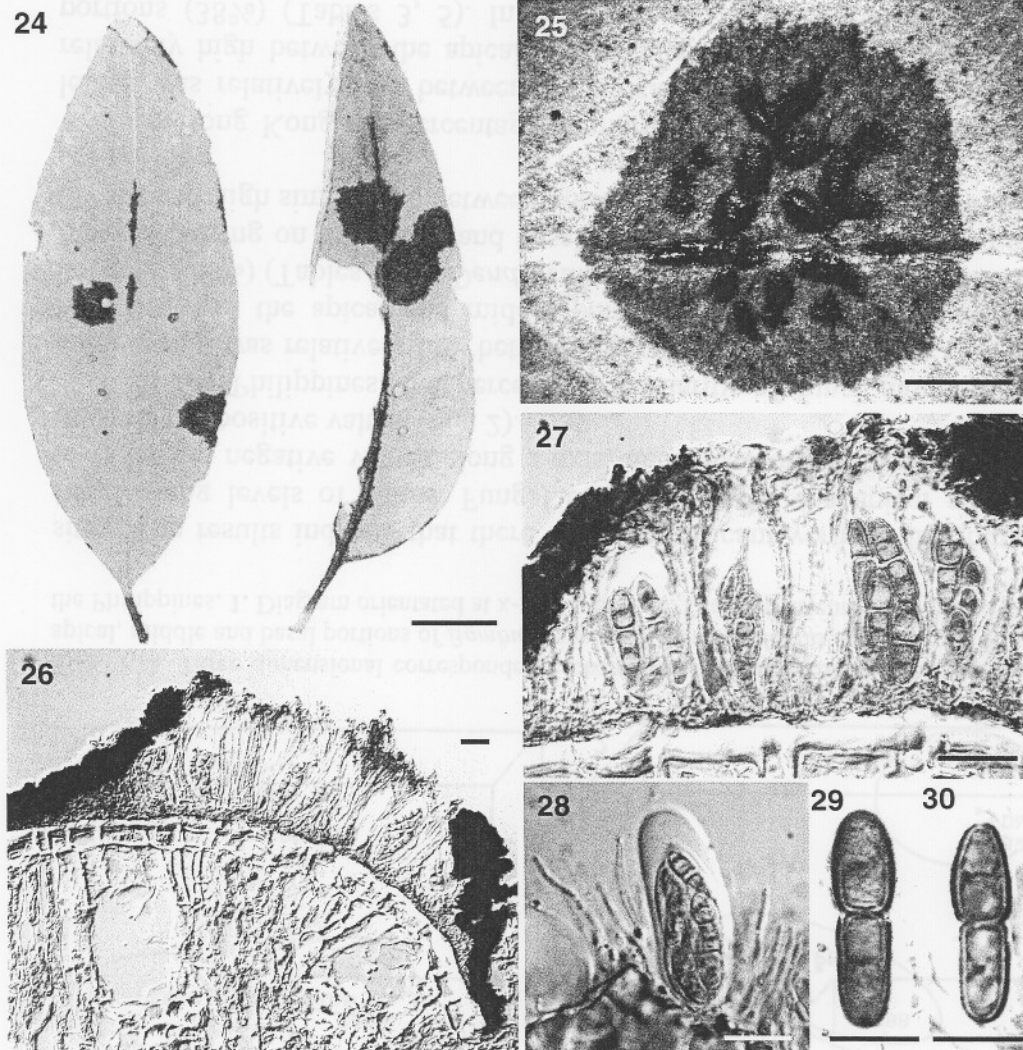


Figs. 19-23. *Lembosina diospyrosi* (holotype) 19. Leaf spots. 20. Hysterothecia on leaf. 21. Vertical section of hysterothecium. 22. Ascospore. 23. Asci. Bars: 19 = 1 cm; 20 = 1 mm; 21 = 50 μ m; 22 = 5 μ m; 23 = 10 μ m.

Leaf spots epigenous, black, rounded, scattered, up to 0.5 cm diam. or more. *Mycelium* composed of dark brown, branched, septate, smooth, up to 3.5 μ m thick hyphae. *Hysterothecia* black, superficial, closely aggregated together, epigenous, 120-190 μ m long, 47-60 μ m wide, with a central, longitudinal ostiolar slit, margin slightly fimbriate. In section, somewhat shallowly conical to linear, forming haustoria comprising of thick-walled, dark brown fungal cells in the epidermis and hyphal elements penetrating the cells below. *Peridium* of the upper wall 11.5-19 μ m thick is composed of indistinct, black layer of melanized cells. *Paraphysoids* hyaline, filiform, septate, branched, up to 1.5 μ m thick. *Asci* ovoid, saccate or somewhat clavate to globose, bitunicate, 8-spored, sessile to short-stalked, 40-72 \times 17-19 μ m, parallel on the basal thin layer of the wall. *Ascospores* oblong, 1-septate in the middle or slightly unequally septate just above the middle, deeply constricted, initially hyaline becoming dark brown at maturity, conglobate to overlapping pluriseriate, 15-17 \times 5.5-7.5 μ m.

Anamorph: unknown.

Host: *Diospyros ferrea* (Willd.) Bakh.



Figs. 24-30. *Lembosina eucalypti* (holotype) 24. Leaf spots. 25. Hysterothecia on leaf. 26, 27. Vertical sections of hysterothecia. 28. Ascus and paraphysoids. 29, 30. Ascospores. Bars: 24 = 1 cm; 25 = 1 mm; 26-28 = 20 µm; 29, 30 = 10 µm.

Known distribution: Australia.

Holotype: AUSTRALIA, Queensland, Torres Strait, York island, on leaves of *Diospyros ferrea*, 2 June 1981, J.L. Alcorn 81109 (BRIP 13756).

Notes: No species of *Lembosina* has been reported on *Diospyros*. Two species of *Lembosia*, *L. ardua* Syd. (1937a) and *L. diospyri* Mibey in Mibey and Hawksworth (1997), have been described from Australia and Kenya respectively. These two species can be distinguished by their hyphopodiate mycelium.

***Lembosina eucalypti* Sivan. & R.G. Shivas, sp. nov.** (Figs. 24-30)

Etymology: based on *Eucalyptus*, the name of the host genus.

Maculae amphigenae, atrobrunneae vel nigrae, dense dispersae, superficialiae, irregulariter rotundatae, usque 8 mm diam. *Hyphae* brunneae, septatae, superficialia, ramosae, laeves, usque 2 μm latae. *Hysterothecia* lineares vel Y-forma, superficialia, amphigena, nigra, 300-450 μm longa, 75-115 μm alta, rima longitudinem dehiscenti instructa. Paries hysterothecii pariete superioris nigris, haud indistinctus, 19-22 μm latis, basalis applanatis. *Paraphysoids* filiformes, hyalinae, simplices vel ramosae, septatae, usque 2 μm latae. *Asci* late ellipsoidei vel obclavati, octospori, sessiles vel brevipedicellati, bitunicati, 40-60 \times 15-25 μm . *Ascospores* fusiformes, hyalinae vel brunneae, mediano uni, septatae, constrictae, laeves vel echinulatae, guttulate, conglobatae, 20-32 \times 5.5-7.5 μm .

Leaf spots amphigenous, dark brown to black, superficial, irregularly rounded, densely scattered, up to 8 mm diam. *Hyphae* brown, septate, superficial, sparse, branched, smooth, up to 2 μm thick. *Hysterothecia* linear to rarely Y-shaped, superficial, amphigenous, black, 300-450 μm long, 75-115 μm high, opening by a central longitudinal slit. In section, conical in shape, the upper wall black, heavily melanised and indistinct, 19-22 μm thick, basally applanate. Paraphysoids filiform, hyaline, simple or branched, septate, up to 2 μm thick. *Asci* broadly ellipsoidal to obclavate, bitunicate, 8-spored, sessile to short-stalked, 40-60 \times 15-25 μm . *Ascospores* fusiform, hyaline to brown, 1-septate in the middle, constricted, smooth to echinulate, guttulate, conglobate, 20-32 \times 5.5-7.5 μm .

Anamorph: unknown.

Host: *Eucalyptus* sp.

Known distribution: Australia.

Holotype: AUSTRALIA, Queensland, Coen, on leaves of *Eucalyptus* sp., 18 July 1999, R.G. Shivas and M. Gunther H 0052 (BRIP 25821).

Notes: *Aulographina eucalypti* (Cooke & Masee) Arx & E. Müll. (Müller and Arx, 1962) is the most common species found on *Eucalyptus* in Australia. This species has subcuticular hypostroma and hyaline 1-septate ascospores.

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