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ON THE PLEOMASSARIACEAE (PLEOSPORALES) IN NORTH AMERICA

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SUMMARY

Twenty-four species are recognized and described in three genera, *Asteromassaria*, *Pleomassaria*, and *Splanchnonema*, in the family Pleomassariaceae. The genera are separated by septation and bipolar symmetry or asymmetry of the ascospores. *Splanchnonema clandestinum* and *S. hicoria* are described as new to science. The combinations of *Asteromassaria distincta*, *A. minor*, *A. olivaceohirta*, *Pleomassaria monosperma*, *P. ulmicola*, *Splanchnonema loricatum*, *S. melanterum*, *S. platani*, *S. scoriadeum*, *S. sporadicum*, and *Shearia fusa* are proposed.

The family Pleomassariaceae was erected to accommodate taxa with medium to large (usually 400-1000 μm diam), globose or depressed ascomata, immersed in or erumpent from the periderm of woody dicotyledonous hosts (Barr, 1979b). The pseudoparenchymatous peridium is often thickened at the sides and thinner toward the apex, sometimes thinner at the base, and is usually surrounded by a weft of hyphae. The apex of the ascoma is gently rounded or bears a broad short papilla, and opens by a large pore at maturity; discharged ascospores may cluster around the pore which gives the impression of a stout dark papilla. The oblong or clavate bitunicate asci develop from the entire base and sometimes from the lower sides of the locule; they grow between cellular pseudoparaphyses. The ascospores are large, brown, one- or several-septate or muriform, often distoseptate but sometimes euseptate, and are usually surrounded by a gel coating. The wall surface of ascospores often appears dotted but on close examination these dots are foveolate indentations of the outer wall, ie. punctate, visible in

side view of broken ascospores. Some species have a smooth surface and others are verruculose.

The three genera recognized in the family are separated primarily on the bases of ascospore symmetry, shape, and septation. Ascomata tend to be depressed in species of *Splanchnonema* whereas they are nearly globose in species of *Pleomassaria* and *Asteromassaria*. Other characteristics such as separate, gregarious or grouped ascomata, characteristics of conidiomata or type of septation in conidia of the anamorphic state, do not produce a recognizable pattern within the family. One could argue that similarities among the species are sufficient to include all within a single genus, and in an earlier draft of this manuscript I proposed such a disposition. The recognition of three genera does provide a convenient separation, whereas differences are obscured if only one genus is maintained. The genera are separated in the following key:

1. Ascospores muriform, with slight or distinct bipolar asymmetry, obovoid or ellipsoid fusoid or oblong, primary septum usually submedian.....*Pleomassaria*
1. Ascospores transversely septate.....2
    2. Ascospores with distinct bipolar asymmetry, obovoid, primary septum typically submedian.....*Splanchnonema*
    2. Ascospores with distinct bipolar symmetry, ellipsoid fusoid or oblong, primary septum median..... *Asteromassaria*

Analysis of certain variable character states was attempted, but provided no great insight for rearrangement of species. Presumably, when additional species are recognized and when anamorphs are known for more of the taxa, the added information will clarify relationships among the species. Consideration of characteristics suggests that species with immersed ascomata and asymmetric, one-septate ascospores are the most primitive, i.e. *Splanchnonema ampullaceum*.

The useful variable character states of the teleomorph are utilized in the form of a synoptic key to recognized species of the family. Anamorphic states are known for only a small number of species. Species are numbered sequentually throughout the article so that they conform to numbers used in the synoptic key as well as in the dichotomous keys to species of each genus.

List of species:

1. *Splanchnonema melanterum*
2. *S. scoriadeum*
3. *S. hicoria*
4. *S. semitectum*
5. *S. sporadicum*
6. *S. ampullaceum*
7. *S. loricatum*
8. *S. foedans*
9. *S. pupula*
10. *S. clandestinum*
11. *S. platani*
12. *S. argus*
13. *Pleomassaria carpini*
14. *P. acericola*
15. *P. siparia*
16. *P. monosperma*
17. *P. ulmicola*
18. *P. maxima*
19. *Asteromassaria minor*
20. *A. seriata*
21. *A. pulchra*
22. *A. macrospora*
23. *A. olivaceohirta*
24. *A. distincta*

SYNOPTIC KEY

Ascomata:

Immersed, with rounded base - 6-18, 22-24
Erumpent superficial, with ± applanate base - 1-5, 19-21

Ascospores:

Symmetry (bipolar) and shape:
Asymmetric, ± obovoid - 1-14, 18
Symmetric, ellipsoid fusoid or oblong - 15-17, 19-24

Transverse septation:
Usually 1-septate - 1-3, 6, 19, 20
Usually 2-septate - 7, 8
Usually 3-septate - 4, 9, 21, 22
5- or more septate - 5, 10-18, 23, 24

Longitudinal septation:
Lacking - 1-12, 19-24
One in most cells - 13-15
2-3 or more in most cells - 16-18

Surface of wall:
Smooth - 3, (4?), 12, 16, 19, (20?), 21, 23, 24
Foveolate - 1, 2, 6, 7, 10, 11, (12), 13, 14, 17, 18, 22
Verruculose - 5, 8, 9, 15

Host order and family:

Magnoliales (Magnoliaceae) - 10, 18
Laurales (Lauraceae) - 21
Hamamelidales (Platanaceae) - 4, 5, 11
Urticales (Ulmaceae) - 8, 17; (Moraceae) - 23
Juglandales (Juglandaceae) - 3, 19, 20
Fagales (Betulaceae) - 2, 12, 13, 15, 16; (Fagaceae) - 1, 7, 22
Malvales (Tiliaceae) - 6

Sapindales (Aceraceae) - 9, 14
Dipsacales (Caprifoliaceae) - 24

Splanchnonema Corda in Sturm's Deutschl. Fl. 2(9), Tome 3: 115. 1829.
Stigmatomassaria Munk, Dansk Bot. Ark. 15(2): 126. 1953.

Ascomata immersed beneath periderm, sometimes erumpent superficial at maturity, separate, gregarious or in small groups; medium sized to large, globose or depressed, bases rounded, or depressed and bases applanate; apex gently rounded with low papilla, opening by broad pore; surface dark brown or black, smooth or roughened, tomentose with a weft of brown hyphae or nearly glabrous; peridium of pseudoparenchymatous cells, dark brown externally, light brown to hyaline internally, often broadest at sides, narrowed or nearly equal at base, narrowed toward apical region. Asci developing from basal hymenium, bitunicate, clavate or oblong. Pseudoparaphyses narrow cellular, deliquescent in age. Ascospores hyaline when young, becoming light brown and finally dark brown, with bipolar asymmetry, obovoid, ends obtuse or acute, usually radially asymmetric, inequilateral or slightly curved; with one or several transverse septa, distoseptate, primary septum submedian, constricted; wall thick, surface foveolate, smooth, or verruculose, surrounded by gel coating; contents of lumina guttulate, becoming homogeneous; overlapping biseriate in the ascus.

Anamorphs: Coelomycetous, conidiomata pycnidia, similar in shape and aspect to ascomata, or acervular; conidiogenous cells holoblastic; conidia brown, usually distoseptate, transversely septate or muriform or composed of several transversely septate arms from basal cell.

Saprobes or wound parasites on woody dicotyledonous hosts.

Type species: *S. pustulatum* Corda = *S. foedans* (Fr.) O. Kuntze.

Shoemaker and LeClair (1975) outlined the history of the genus, an old, valid, but little-used name, and recognized the differences between species of *Splanchnonema* and *Massaria*. Munk (1953) erected *Stigmatomassaria* for *Massaria pupula* because he recognized that the species differed from species of *Massaria* (see Barr, 1979a), and was not aware of Corda's genus.

Key to Species of *Splanchnonema*

1. Ascomata erumpent, bases ± applanate, peridium very thin at base 2
1. Ascomata immersed, bases rounded, peridium not notably thin at base 6
   2. Ascospores 1-septate 3
   2. Ascospores 3-7-septate 5
3. Ascospores 32-42 x 13-17 µm, surface foveolate; on *Quercus* ..... 1. *S. melanterum*
3. Ascospores longer 4
   4. Ascospores 48-60(-65) x 15.5-24 µm, surface foveolate, base ± acute; on *Betula* ..... 2. *S. scoriadeum*
   4. Ascospores 38-52 x 16-23 µm, surface smooth, base obtuse; on *Carya* ..... 3. *S. hicoria*
5. Ascospores 3-septate, 33-36 x 11-14 µm; on *Platanus* ... 4. *S. semitectum*
5. Ascospores 3-7-septate, (25-)30-40 x (7.5-)9-11 µm, surface verruculose; on *Platanus* ..... 5. *S. sporadicum*
   6. Ascospores 1-septate (rarely with additional septa), 33-50(-55) x 12-15.5(-20) µm, surface foveolate; on *Tilia* ..... 6. *S. ampullaceum*
   6. Ascospores 2- or more septate 7
7. Ascospores 2-(3-)septate 8
7. Ascospores 3-5- or more septate 9
   8. Ascospores (26-)31-42(-50) x 13-16.5 µm, surface foveolate; on *Fagus* ..... 7. *S. loricatum*
   8. Ascospores (38-)48-55 x (12-)15-18(-23) µm, surface verruculose; on *Ulmus* and *Celtis* ..... 8. *S. foedans*
9. Ascospores 3-(5-6-)septate, 38-58 x 14-20 µm, surface verruculose; on *Acer* ..... 9. *S. pupula*
9. Ascospores (3-)5-6-septate, surface foveolate or smooth. 10
   10. Ascospores with primary septum nearly median and typically two cells per hemispore, 45-60 x 14-20 µm; on *Magnolia* ..... 10. *S. clandestinum*
   10. Ascospores with primary septum submedian and four or five cells in upper hemispore, two or three in lower hemispore 11
11. Ascospores 40-66 x (10-)13-17.5 µm; on *Platanus* ..... 11. *S. platani*
11. Ascospores 40-62(-70) x 10-16 µm; on *Betula*..... 12. *S. argus*

1. *Splanchnonema melanterum* (Ell. & Ev.) Barr, comb. nov.
Basionym: *Amphisphaeria melantera* Ell. & Ev. Bull. Torrey Bot. Club 24: 278. 1897.

Figs. 1, 2

Ascomata erumpent from periderm, appearing superficial, gregarious, depressed globose, 300-400 μm diam, 200-330 μm high, base applanate; surface dull black, roughened by protruding cells; peridium 30-40 μm wide at sides, narrow at base. Asci (60-)88-110 x 24-33 μm. Ascospores 32-42 x 13-17 μm, dark brown, obovoid, ends obtuse or somewhat acute, straight or inequilateral, 1-septate, septum submedian, constricted; surface foveolate, gel coating 2-3 μm wide.

On branches of *Quercus* spp., western North America.

Material examined: Colorado: *Q. undulata*, Ellis & Everhart N.A.F. 3521 (MASS, isotype). Arizona: *Q. gambellii*, Barr 6796 (MASS).

Splanchnonema melanterum is one of those species in the genus whose ascomata are superficial at maturity. Ascospores and asci are typical of the genus. Sivanesan (1975) believed this species was *Microthelia applanata* but it differs in several respects from specimens determined under that name.

2. *Splanchnonema scoriadeum* (Fries) Barr, comb. nov.
Basionym: *Sphaeria scoriadea* Fries, Elenchus Fungorum 2: 87. 1828.
Anthostoma ? scoriadea (Fries) Sacc. Syll. Fung. 1: 302. 1882.
Pteridiospora scoriadea (Fries) Dennis, British Ascomycetes: 407. 1968.

Fig. 3

Ascomata erumpent from periderm, appearing superficial, separate or gregarious, depressed globose, 550-1000 μm diam, 300-550 μm high, base applanate; surface dull black, smooth, with sparse hyphal tomentum; peridium 65-100 μm wide at sides, 10-20 μm wide at base. Asci 100-180 x 44-60 μm. Ascospores 48-60(-65) x (15.5-)18-24 μm, dark brown, broadly obovoid, upper end obtuse, basal end more acute, straight or inequilateral, 1-septate, septum submedian, constricted; surface foveolate, gel coating 2.5-6 μm wide.

On *Betula* spp., Europe, eastern North America.

Material examined: Massachusetts: *B. populifolia*, Newton, Dec 1891, W. G. Farlow (MASS); Cambridge, 24 Jan 1894, R. Thaxter (BPI). North Carolina: *B. nigra*, Lake Johnson Natural area, near Raleigh, Wake Co., 25 Sep 1976, M. Diomande, comm. L. Grand (MASS).

The North American specimens agree well with the description and figure of the species provided by Dennis (1968). Another possible epithet is *Otthia ambiens* Niessl (Hedwigia 20: 98. 1881, *Massaria ambiens* (Niessl) v. Hühnel, Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Cl., Abt. 1, 118: 836. 1909), and in fact the Massachusetts specimens were determined as *O. ambiens*. Winter (1887) doubted that *Otthia* was a suitable genus for *O. ambiens* because of the shape of ascomata and ascospores. Von Hühnel (1909) provided more details and noted a similarity to *Massaria loricata*. Petrak (1922) also wrote regarding *O. ambiens;* he believed that the species was lichenized and made no further disposition of it. I was unable to find convincing signs of a thallus in the North American specimens.

3. *Splanchnonema hicoria* Barr, sp. nov. Figs. 4, 5

Ascomata erumpentia-superficialia, gregaria, globoso-depressa 880-1000 μm diametro, 495-550 μm alto; peridium pseudoparenchymaticum. Asci bitunicati, oblongoclavati, 200 x 40-50 μm; pseudoparaphyses cellulosae. Ascosporae 38-52(-60) x 16-23 μm, brunneae, obovoideae, unidistoseptatae; pagina glaber, strato gelatinoso 2-5 μm crasso obductae.

Holotypus in ramulis *Caryae albae* (L.) K. Koch, "Cambridge, Massachusetts, May 1893" a E. A. Burt lecti (BPI).

Ascomata erumpent superficial, gregarious or few in small groups, depressed globose, 880-1000 μm diam, 495-550 μm high; surface black, smooth or roughened; peridium up to 100 μm wide at sides, as very thin layer at base. Asci up to 200 x 40-50 μm. Ascospores 38-52(-60) x 16-23 μm, brown, obovoid, ends obtuse, 1-septate, septum submedian, constricted; surface smooth, gel coating 2-5 μm wide.

On branches of *Carya* spp., eastern North America.

Material examined: Massachusetts: *C. alba*, Cambridge, May 1893, E. A. Burt (holotype) (BPI); *Carya* sp., Arlington, 19 Mar 1893, H. L. Jones (BPI).

Splanchnonema hicoria was originally identified as *Otthia ambiens* and is quite similar to *S. scoriadeum* in aspect and sizes. In addition to substrate, the ascospores of *S. hicoria* are slightly shorter and are quite obtusely rounded at the base, while those of *S. scoriadeum* are more acute at the base. *Splanchnonema hicoria* bears some resemblance to *Asteromassaria seriata* (n. 20) from *Carya* but the description and figures in Shoemaker and LeClair (1975) and the description by Petrak and Sydow (1934) indicate that the

ascospores are symmetric and the primary septum is median in *A. seriata* whereas the ascospores are asymmetric and the primary (and only) septum is submedian in *S. hicoria*. *Asteromassaria minor*, on pericarps of hickory nuts, also differs from *S. hicoria* in symmetric and considerably narrower ascospores.

4. *Splanchnonema semitectum* (Berk. & Curt.) O. Kuntze, Rev. Gen. Pl. 3: 531. 1898.
Sphaeria semitecta Berk. & Curt. Grevillea 4: 147. 1876.
Massaria semitecta (Berk. & Curt.) Sacc. Syll. Fung. 2: 8. 1883.

Ascomata immersed erumpent, depressed globose, ca. 200-300 μm diam, base ± applanate; peridium narrow at base, thickened and forming a rim around the apical pore. Asci from basal hymenium. Ascospores 33-36 x 11-14 μm, hyaline, obovoid, ends obtuse or tapered and acute, 3-septate, primary septum submedian, constricted; wall thick, smooth, surrounded by gel coating.
On branches of *Platanus*, eastern North America.

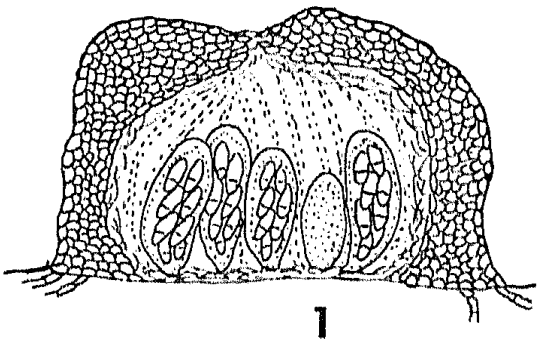
The description is composed from notes and illustrations published by Shoemaker and LeClair (1975), taken from Wehmeyer's notes on the type (K, Berkeley n. 3340, Virginia).

5. *Splanchnonema sporadicum* (Ell. & Ev.) Barr, comb. nov.
Basionym: *Melanomma sporadicum* Ell. & Ev. North Amer. Pyreno. 186. 1892.

Fig. 6

Ascomata erumpent-superficial, scattered or gregarious in rows in wood, depressed globose or nearly globose, (275-)440-550 μm diam, (190-)330-440 μm high, base ± applanate; surface smooth or roughened by protruding groups of cells, sparse brown hyphae in wood tissues at base; peridium 35-45 μm wide at sides, 15-20 μm wide at base. Asci 80-140 x 17-

Figs. 1-10. Species of *Splanchnonema*. 1, 2. *S. melanterum*: 1, ascoma in vertical section; 2, two ascospores. 3. *S. scoriadeum*, ascospore. 4, 5. *S. hicoria*: 4, habit of ascomata; 5, two ascospores. 6. *S. sporadicum*: five ascospores, showing sequence of septum formation. 7, 8. *S. ampullaceum*: 7, ascoma in vertical section; 8, two ascospores. 9. *S. loricatum*, ascospore. 10. *S. foedans*, two ascospores. Standard line = 15 μm for ascospores, 150 μm for ascomata.



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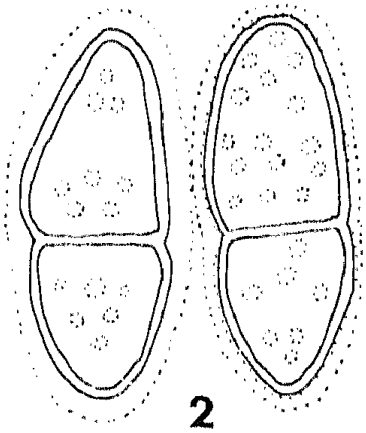

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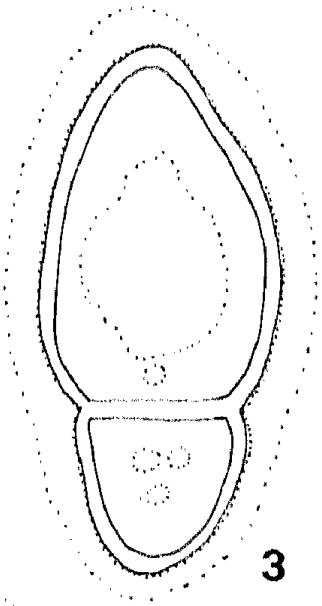

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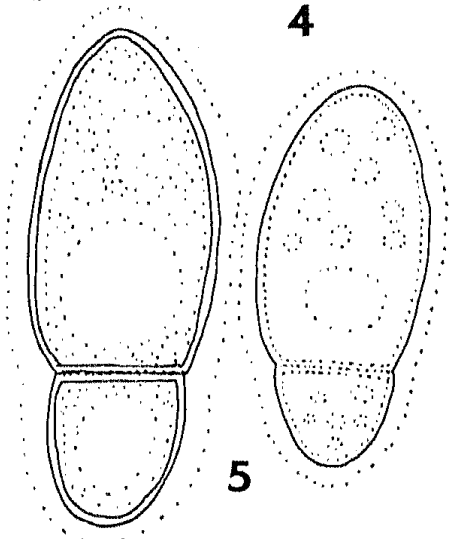

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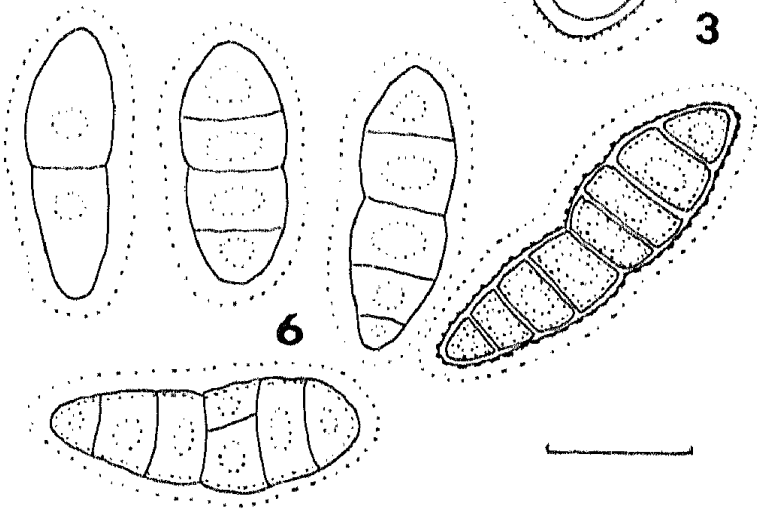

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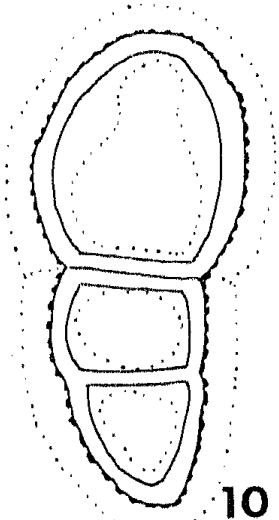

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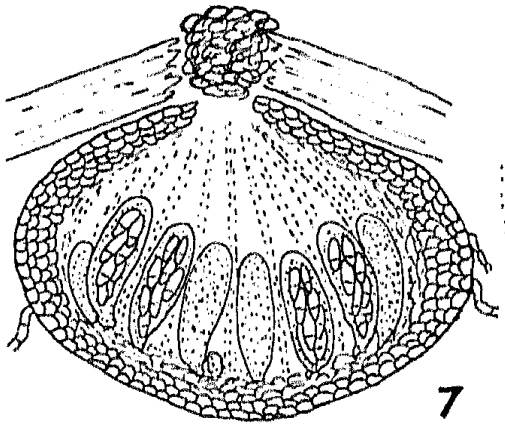

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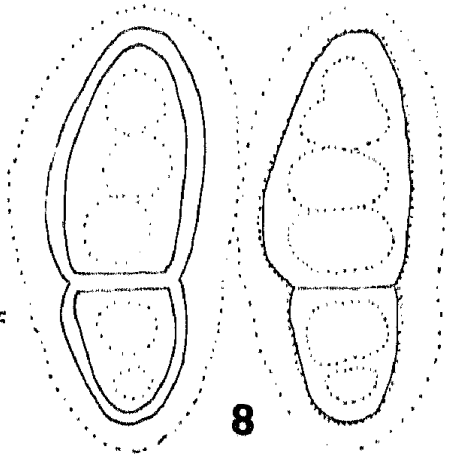

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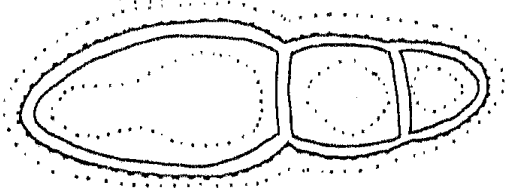

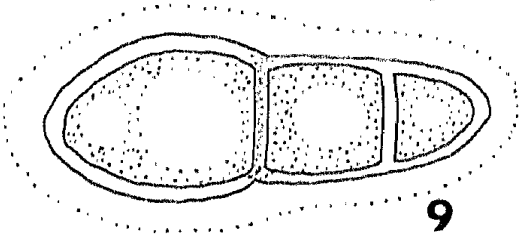

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30 µm. Ascospores (22-)30-40 x (7-)9-11 µm, dark brown, obovoid, straight, inequilateral or slightly curved, (3-4-)5-7-(8-)septate, constricted at the slightly submedian primary septum, occasionally a longitudinal septum in one cell; surface verruculose, gel coating 2-5 µm wide.

On decorticated wood of *Platanus* sp., eastern North America.

Material examined: Ontario: Ellis & Everhart N.A.F. 2753 (isotype, MASS). District of Columbia: Ellis & Everhart's Fungi Col. 1426 (MASS).

Splanchnonema sporadicum deviates from species of *Melanomma* in the large-celled pseudoparenchymatous peridium, the centrum of cellular pseudoparaphyses and broad asci, and the asymmetric, dark brown ascospores. This taxon belongs in the series of species whose ascomata are erumpent and have a ± applanate base. From *S. semitectum*, also described from *Platanus*, *S. sporadicum* differs notably in darker and narrower ascospores with additional septa.

6. *Splanchnonema ampullaceum* (Pers. ex Fries) Shoemaker & LeClair, Canad. J. Bot. 53: 1570. 1975.
   Sphaeria ampullacea Pers. ex Fries, Syst. Mycol. 2: 486. 1823.
   (*Sphaeria ampullacea* Pers. Syn. Meth. Fung. 41. 1801.)
   Massaria ampullacea (Pers. ex Fries) Petrak, Ann. Mycol. 36: 46. 1938.
   Massaria curreyi (as *Curreii*) Tul. & Tul. Sel. Fung. Carp. 2: 231. 1863.
   Pteridiospora curreyi (Tul. & Tul.) Müller in Müller & von Arx, Beitr. Kryptogamenfl. Schweiz 11(2): 281. 1962.
   Massariella curreyi Tul. & Tul. var. *americana* Peck, Rep. New York State Mus. 47: 24. 1894.
   (*Sphaeria tiliae* auct. non Pers. ex Fries, Syst. Mycol. 2: 485. 1823; Currey, Trans. Linn. Soc. London 22(4): 327. 1859.)
   (*Phorcys tiliae* Schroeter in Cohn, Kryptogamenfl. Schles. 3(2), Pilze 2: 381. 1908; as (Currey) Schroeter)
   (*Massaria tiliae* Petrak, Ann. Mycol. 21: 195. 1923; as (Currey) Petrak)

Figs. 7, 8

Ascomata immersed, gregarious or in small groups, depressed globose, 250-825 µm diam, 250-500 µm high, base rounded; surface tomentose with brown hyphae; peridium

20-30 μm wide at base, 38-44 μm wide at sides. Asci 90-160 x 30-44 μm. Ascospores 33-50(-55) x 12-15.5(-20) μm, dark brown, broadly obovoid, 1-septate, septum submedian, constricted, rarely three or four septa formed in upper hemispore and one or two in lower hemispore; surface foveolate, gel coating 2-3.5(-7.5) μm wide.

On branches of *Tilia* spp., Europe, North America.

Material examined: Maine: Barr 5846C (MASS); Massachusetts: Barr 5603 (MASS); Cambridge, 9 Apr, 13 Apr 1908, A. P. D. Piquet (BPI); New York: Selkirk, Jun 1893, C. H. Peck (holotype of *Massariella curreyi* var. *americana*) (NYS); Michigan: Barr 985 (MASS); District of Columbia: Washington, 21 Feb, 17 Apr 1906, C. L. Shear (BPI); Georgia: Athens, 22 Jan 1938, J. H. Miller (BPI). Extralimital: England: St. Ives, 26 Aug 1930, C. L. Shear (BPI).

The synonymy cited for *S. ampullaceum* was taken from Shoemaker and LeClair (1975), where the position of this species was clarified. Peck's var. *americana* does not differ sufficiently from European material to be recognized as a separate entity. Ascospores of *S. ampullaceum* are typically one-septate, and Petrak (1923) used the name *Massaria tiliae* for forms with three-septate ascospores. Otherwise typical collections often contain ascospores that become three, five, or six-septate.

Tonolo (1956) obtained a "*Phoma* type" (spermatial?) state in cultures of *S. ampullaceum* (as *Massariella curreyi*).

7. *Splanchnonema loricatum* (Tul. & Tul.) Barr, comb. nov.
   Basionym: *Massaria loricata* Tul. & Tul. Sel. Fung. Carp. 2: 230. 1863.
   Massaria foedans Fries f. *faginea* Sacc. Michelia 1: 40. 1876.
   Splanchnonema kicksii (West.) O. Kuntze, Rev. Gen. Pl. 3: 531. 1898, comb. illegit.

Fig. 9

Ascomata immersed, separate or grouped, globose depressed, up to 1000 μm diam, up to 500 μm high; peridium ca. 100 μm wide. Asci 110-240 x 24-32 μm. Ascospores (26-)31-42 (-50) x 13-16.5 μm, brown, obovoid, ends obtuse or upper end acute, straight, 2-(3-)septate, constricted at submedian primary septum, secondary septum in lower hemispore, rarely secondary septum in upper hemispore; surface foveolate, gel coating 2-9 μm wide.

On branches of *Fagus* spp., Europe, North America.

Material examined: Vermont: *F. grandifolia*, Barr 4342 (MASS).

O. Kuntze (1898) supposed that *Stilbospora kicksii* West. was the anamorph of *Massaria loricata* and made the illegal transfer to *Splanchnonema* as *S. kicksii*. There is no clear evidence for the presence of an anamorph with this species, although Tulasne and Tulasne (1863) illustrated a pycnidial state that produced transversely septate conidia. Tonolo (1956) obtained only mycelium in culture from ascospores of *S. loricatum*.

Berlese (1894) cited *Massaria fagi* Fuckel (Jahrb. Nass. Ver. Naturk. 25/26: 302. 1871) as an additional synonym of *M. loricata*. Shoemaker and LeClair (1975) published Wehmeyer's description and illustration for a Swiss collection made by Morthier and cited by Fuckel. Shoemaker and LeClair were doubtful that this was indeed *M. fagi*, because Fuckel had described the ascospores as three septate, whereas the Morthier specimen had only two-septate ascospores. In the sole North American specimen studied here, a few ascospores had three septa, and such variability is noted too in collections of *S. foedans*. The two species are quite similar in all respects; they may be separated on the bases of substrate and somewhat smaller sizes of ascospores with punctate walls in *S. loricatum*.

8. *Splanchnonema foedans* (Fries) O. Kuntze, Rev. Gen. Pl. 3: 530. 1898.
Sphaeria foedans Fries, Syst. Mycol. 2: 480. 1823.
Massaria foedans (Fries) Fries, Summa Veget. Scand. 396. 1849.
Splanchnonema pustulatum Corda in Sturm's Deutschl. Fl. 2(9); Tome 3: 115. 1829.
Sphaeria (Obtectae) amblyspora Berk. & Br. Ann. & Mag. Nat. Hist., Ser. 2, 9: 322. 1852.
Massaria amblyspora (Berk. & Br.) Fresenius, Beitr. Mykol. 60. 1852.

Fig. 10

Ascomata immersed, depressed globose, 495-1000 µm diam, 385-600 µm high; peridium 35-45 µm wide. Asci 130-170 x 40-48 µm. Ascospores 38-55 x (12-)15-20 µm, dark brown, broadly obovoid, 1-2-(3-)septate, primary septum slightly submedian, secondary septum formed in lower hemispore and only occasionally formed in upper hemispore; surface verruculose, gel coating 3-5 µm wide.

On branches of *Ulmus* spp., occasionally on *Tilia*, Europe; on *Ulmus* and *Celtis*, North America.

Material examined: Massachusetts: Newton, Mar 1893, 1894, W. G. Farlow, Rel. Farlowianae 52 (BPI) (on *Ulmus*); Kansas: Ellis & Everhart N. A. F. 3326 (BPI, MASS); Rooks

Co., 24 May 1895, E. Bartholomew (BPI) (on *Celtis*). Extralimital: Herb. Barbey-Boissier 93; Krieger, F. sax. 233; Thümen, Mycotheca univ. 2061; Cavara, F. Longobardiae Exs. 237 (on *Tilia*); Petrak, Mycotheca generalis 593; Tranzschel et Serebrianikow Mycotheca Rossica 71; D. Saccardo, Mycotheca ital. 301 (on *Tilia*) (all BPI).

Shoemaker and LeClair (1975) provided the synonymy and addressed the complications of nomenclature for this, the type species of the genus. In contrast to most other species of *Splanchnonema*, the second septum most often forms in the lower, somewhat smaller cell of the ascospore before a third septum is formed.

9. *Splanchnonema pupula* (Fries ex Fries) O. Kuntze, Rev. Gen. Pl. 3: 531. 1898.
Sphaeria pupula Fries ex Fries, Syst. Mycol. 2: 484. 1823.
Hercospora pupula (Fries ex Fries) Fries, Summa Veget. Scand. 397. 1849.
Massaria pupula (Fries ex Fries) Tul. & Tul. Sel. Fung. Carp. 2: 225. 1863.
Stigmatomassaria pupula (Fries ex Fries) Munk, Dansk Bot. Arkiv. 15(2): 127. 1953.

Fig. 11

Ascomata immersed beneath periderm, separate or in small groups, depressed globose, 550-715 μm diam, 330-440 μm high, surrounded by brown hyphal tomentum; peridium 35-40 μm wide at base, up to 60-70 μm wide at sides, 25-30 μm wide near apical pore. Asci 130-180 x 30-45 μm. Ascospores 38-58 x 14-20 μm, dark brown, obovoid, 3-(5-6-)septate, primary septum submedian, constricted, with one to three septa in upper hemispore and one or rarely two in lower hemispore; surface verruculose, gel coating 3-4 μm wide.

Anamorph: *Stegonsporium pyriforme* (Hoffm. ex Fries) Corda. Conidiomata acervular; paraphyses present; conidiogenous cells annellidic; conidia 31-38 x 14-18 μm, brown, obovoid, distoseptate with four transverse and one to three longitudinal septa, gel coating present.

On branches of *Acer* spp., Europe, North America.

Material examined: Pennsylvania: North East, 7 May 1906, C. L. Shear (BPI, on holotype of *Pleomassaria acericola*). Extralimital: Denmark: Haveselskabets Havn, Århus, 2 Jan 1908, Ø. Winge (BPI, on *Calosporella platanoides* specimen). France: Ambert (Puy-de Dome), L. Breviere (BPI). Czechoslovakia: pr. Ratschitz, Moravia, spring, Niessl; Mährr-Weisskirchen, F. Petrak (BPI).

Splanchnonema pupula is not infrequent in Europe, but I have seen only the one collection from North America. Evidently, neither Petrak nor Shear observed this species, not remarkable because superficially it could be taken for *Pleomassaria acericola*. The ascospores of the two species differ markedly in shape and septation, as well as in the wall surface.

Stegonsporium pyriforme has been found in association with *Splanchnonema pupula* and has been considered to be its anamorph. Tonolo (1956) obtained and illustrated (as *Prosthemium* sp.) muriform conidia from ascospores, so there is confirmation for the connection. Van Warmelo and Sutton (1981) did not indicate a teleomorph in their revision of *Stegonsporium*, where they accepted *S. pyriforme* and *S. acerinum* Peck as the two valid species in the genus, and provided full descriptions and illustrations of these taxa.

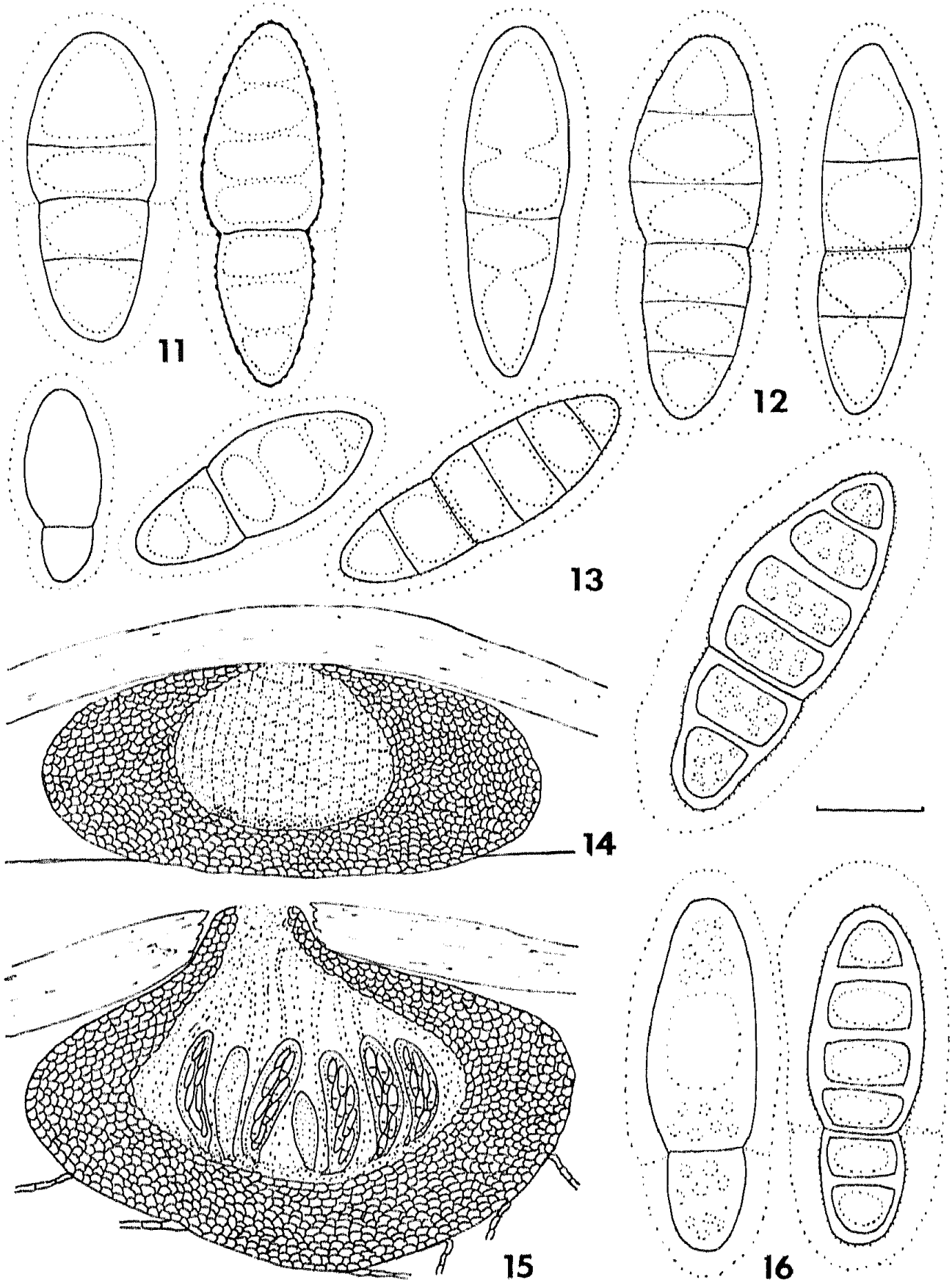
10. *Splanchnonema clandestinum* Barr, sp. nov. Fig. 12

Ascomata immersa gregaria globosodepressa 600-800 μm diametro, 385-550 μm alto; peridium pseudoparenchymaticum. Asci bitunicati, oblongoclavati, 150-200 x 35-40 μm; pseudoparaphyses cellulosae. Ascosporae 45-60 x 14-20 μm, brunneae, obovoideae, (1-)3-5-distoseptatae; pagina foveolata, strato gelatinoso ca. 3.5 μm crasso obductae.

Holotypus in ramulis *Magnoliae acuminatae* L., "West Chester, Pennsylvania, Jun 1883," Everhart et Haines lecti (Ellis N.A.F. 1176 pro parte) (MASS).

Ascomata immersed beneath periderm, gregarious, globose depressed, 600-880 μm diam, 385-550 μm high, with sparse brown hyphae; peridium up to 65 μm wide at base and sides, narrowed to ca. 30 μm wide in upper regions. Asci 150-200 x 35-40 μm. Ascospores 45-60 x 14-20 μm, brown, becoming nearly opaque at maturity, obovoid, ends obtuse, straight or inequilateral, (1-)3-4-5-septate, primary septum slightly submedian, constricted, each hemispore usually containing two septa; surface foveolate, gel coating up to 3.5 μm wide.

Figs. 11-16. Species of *Splanchnonema*. 11. *S. pupula*, two ascospores. 12. *S. clandestinum*, three ascospores. 13. *S. platani*, four ascospores showing sequence of septum formation. 14-16. *S. argus*: 14, immature ascoma in vertical section; 15, mature ascoma in vertical section; 16, two ascospores. Standard line = 15 μm for ascospores, 150 μm for ascomata.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This taxon is described from ascomata on a single twig (separated from N.A.F. 1176 of *Steganosporium formosum* Ell. & Ev., i.e., *Pleomassaria maxima*) to draw attention to the presence of a second species of the Pleomassariaceae on *Magnolia*. The ascomata are depressed and the peridium is not thickened in a ringlike fashion as it is in *P. maxima*. The ascospores are smaller also and lack the longitudinal septa of *P. maxima*. Additional collections are needed to determine the precise relationships of *S. clandestinum*, but they are clearly with other species of *Splanchnonema* rather than with *P. maxima*.

11. *Splanchnonema platani* (Ces.) Barr, comb. nov.
Sphaeria (Massaria) platani Ces. in Klotzsch-Rabenhorst Herb. mycol. Edit. 1: 1842. 1854.
Massaria platani Ces. in Rabenh. Fungi eur. 323. 1861.
Massaria atroinquinans Berk. & Curt. Grevillea 4: 156. 1876.
Splanchnonema atroinquinans (Berk. & Curt.) O. Kuntze, Rev. Gen. Pl. 3: 531. 1898.
Splanchnonema desmazieri (Mont.) O. Kuntze, Rev. Gen. Pl. 3: 531. 1898 (nom. illeg.).

Fig. 13

Ascomata immersed, scattered or gregarious, depressed globose, 500-900 µm diam, 400-600 µm high; surface black, with weft of dark brown hyphae; peridium 45-50(-100) µm wide at base and sides. Asci (110-)150-200(-250) x 27-35 µm. Ascospores 40-66 x (10-)13-17.5 µm, dark brown, obovoid, ends obtuse or nearly acute, straight or inequilateral, (1-, 3-)5-(6-)septate, primary septum submedian, constricted, one to three septa in upper hemispore, one in lower hemispore; surface foveolate, gel coating 2-6.5 µm wide.

Anamorph: *Macrodiplodiopsis desmazieresii* (Mont.) Petrak Conidiomata pycnidial, similar in appearance to ascomata, often more prominent; conidiogenous cells holoblastic, annelidic, arising from inner peridium; conidia 32-44 x 13-18 µm, brown, obovoid, 3-septate, wall thick, surface verruculose, gel coating broad.

On branches of *Platanus* spp., Europe, North America.

Material examined: North America: Ontario: London, Jun 1891, J. Dearness (BPI); Ellis & Everhart N.A.F. 2756 (MASS); Fungi Col. 720 (BPI). Massachusetts: Barr 2871 (MASS); Cambridge, 6 Jun 1890, W. G. Farlow (Slide, BPI, FH). Michigan: East Lansing, May 1892, G. H. Hicks (BPI). Maryland: near Plummers Island, 22 Oct 1911, C. L. Shear (BPI). District of Columbia: Washington, 3 Feb 1903 and 15 Apr 1904, C. L. Shear (BPI); 25 May 1939 (BPI). Virginia:

Clarendon, 11 Mar 1923, J. R. Weir (BPI). South Carolina: Ravenel, Fungi Carol. Fasc. IV, 65; Fungi Amer. Exs. 660 (BPI). Iowa: Mt. Pleasant, 29 Jan 1906, F. J. Seaver (BPI). California: Los Angeles, 5 Feb 1903, O. A. Plunkett (BPI); Riverside, 9 Apr 1945, D. J. Smith (BPI). Extralimital: Klotzsch-Rabenhorst Herb. mycol. Edit. 1: 1842 (BPI); Herb. Barbey-Boissier 92 (BPI); Herb. Mycol. Romanicum (BPI).

The anamorph has long been assumed to be part of the life cycle of *S. platani* and O. Kuntze (1898) made the illegitimate combination of *Splanchnonema desmazieri* for this reason. It is usually associated with the teleomorph on collections. Shear and Davidson (1936) obtained single-spore cultures from ascospores and conidia. Both produced similar colonies, and after five to seven weeks both produced pycnidia and the typical conidia. Sutton (1980) illustrated *M. desmazieresii*.

The European and North American collections have usually been given different epithets, but they are identical, as Ellis and Everhart (1892) and Berlese (1894) observed. The specimen of Herb. mycol. 1842 in BPI contains the anamorph and aged ascomata, but the descriptions make it clear that the teleomorph was present on other copies. Comparison of this material with Ravenel's exsiccati from the typical locality of *Massaria atroinquinans* shows no specific difference.

12. *Splanchnonema argus* (Berk. & Br.) O. Kuntze, Rev. Gen. Pl. 3: 531. 1898.
Sphaeria (Subtectae) argus Berk. & Br. Ann. & Mag. Nat. Hist. Ser. 2, 9: 322. 1852.
Massaria argus (Berk. & Br.) Fresenius, Beitr. Mykol. 2: 59. 1852.
Massaria niessleana Rehm, Hedwigia 21: 84. 1882.
Splanchnonema niessleanum (Rehm) O. Kuntze, Rev. Gen. Pl. 3: 531. 1898.

Figs. 14-16

Ascomata immersed, depressed globose, 880-1000 µm diam, 550 µm high, hyphae forming sparse brown weft; peridium up to 80 µm wide at base and sides, thinner toward apex. Asci 220-230 x 32-36 µm. Ascospores 45-62(-70) x (10-)15-17 µm, brown, obovoid, straight or inequilateral, ends obtuse, 5-6-septate, primary septum submedian, constricted, three or four septa in upper hemispore and one (or two) in lower hemispore; surface smooth or foveolate, gel coating 2-6 µm wide.

Anamorph: (associated) *Myxocyclus polycistis* (Berk. & Br.) Sacc. Conidiomata acervular, erumpent, 530 μm diam or larger; conidiogenous cells holoblastic, hyaline, elongate, 1-2-septate; conidia 35-50 x 15-17.5 μm, dark brown, obovoid, distoseptate, 5-6 transverse and one longitudinal septa, wall thick, surface verruculose, gel coating thick.

On branches of *Betula* spp., Europe, eastern North America.

Material examined: Massachusetts: Barr 6425, 6529 (MASS); Dedham, 19 Dec 1900, A. F. Blakeslee (BPI). Pennsylvania: Ellis N.A.F. 757 (as *Stegonosporium muricatum*) (MASS). Extralimital: Herb. Barbey-Boissier 183; Krieger, Fungi saxonici 2316; Petrak, Mycotheca generalis 588, 1548 (all BPI).

Saccardo (1908) noted the association between *Myxocyclus* and *S. argus*. Tonolo (1956) obtained only a "Phoma type" state in culture from ascospores of *S. argus*. Sutton (1975) described and illustrated *Myxocyclus polycistis* and provided synonymy for the name. My observations agree with his, and were made from a collection (Barr 6529) that bore numerous young and mature ascomata (Figs. 14, 15) as well as the anamorph.

The original illustrations of ascospores of *Sphaeria siparia* and *S. argus* (Berkeley and Broome, 1852) indicate the main differences between these two species on *Betula*. *Sphaeria siparia* (n. 625) has nearly symmetric oblong ascospores whose primary septum is nearly median; each hemispore contains two, three, or four septa and longitudinal septa extend through the middle cells. *Sphaeria argus* (n. 626) has asymmetric, obovoid ascospores whose primary septum is submedian and quite strongly constricted; the upper hemispore contains three or four septa and the lower hemispore one or two. The anamorphs associated with the two differ in conidium shape and septation: that of *Pleomassaria siparia* has several-armed conidia that are transversely septate and that of *Splanchnonema argus* has muriform conidia. Where the host species are known, in Europe *Betula alba* supports both species, but in North America *B. papyrifera* is the substrate for *P. siparia* whereas *B. lenta* is the substrate for *S. argus*.

Pleomassaria Speg. Anales Soc. Sci. Argentina 9: tab. post p. 192. 1880.

Ascomata medium sized to large, immersed beneath periderm, separate, gregarious or in small groups, depressed globose or nearly globose, bases rounded; surface dark brown or black, smooth or tomentose with slight or ample weft of brown hyphae; apex gently rounded, with low papilla usually not persistent, opening by broad pore; peridium of pseudoparenchymatous cells, dark brown externally, light brown to hyaline internally, equal or narrowed at base and toward apical region. Asci developing from basal or lateral hymenium, bitunicate, clavate or oblong. Pseudoparaphyses narrow cellular, at times deliquescent with age. Ascospores hyaline when young, finally dark brown, with bipolar symmetry and oblong or ellipsoid or asymmetry and obovoid, ends obtuse or acute, often with radial asymmetry and inequilateral; distoseptate, with several transverse septa and one or several longitudinal septa, longitudinal septa not usually extending into end cells; wall thick, surface foveolate, smooth, or verruculose, surrounded by gel coating; contents of lumina guttulate or homogeneous; overlapping biseriate in the ascus.

Anamorphs: Coelomycetous, conidiomata pycnidia similar in shape and aspect to ascomata, or acervular; conidiogenous cells holoblastic; conidia brown, distoseptate, muriform or composed of several transversely septate arms from basal cell.

Saprobes or wound parasites on woody dicotyledonous hosts.

Lectotype species: *P. siparia* (Berk. & Br.) Sacc.

Shoemaker and LeClair (1975) briefly characterized the genus and noted the acceptability of the lectotype selected by Clements and Shear (1931). The ascospores of species in *Pleomassaria* are more nearly symmetric than those in *Splanchnonema* but less symmetric than those in *Asteromassaria*. Occasional ascospores of *Splanchnonema* may contain a longitudinal septum in one or two cells, but the ascospores of all species in *Pleomassaria* have one or more longitudinal septa in several cells, usually in all but the end cells.

Pleomassaria holoschista (Berk. & Br.) Sacc. from *Alnus* would be likely to occur in North America but has not yet been reported. The species is related to *P. siparia* by the nearly symmetric ascospores and the anamorph and is separable by smaller sizes as well as by substrate.

Key to species of *Pleomassaria*

1. Ascospores one, rarely two per ascus, 104-140 x 24-36 µm, with up to 35 transverse septa, surface smooth; on *Betula*.....16. *P. monosperma*
1. Ascospores usually eight per ascus, smaller, with less transverse septa 2
   2. Ascospores 5-7-9-transversely septate, one (occasionally two) longitudinal septa in mid cells 3
   2. Ascospores 8-11-15-transversely septate, one, two or three longitudinal septa in most cells, surface foveolate 5
3. Ascospores (30-)35-52 x 13-20 µm, surface foveolate; on *Carpinus* .....13. *P. carpini*
3. Ascospores usually longer and relatively narrower 4
   4. Ascospores (35-)50-64 x (10-)15-18 µm, surface foveolate; on *Acer* .....14. *P. acericola*
   4. Ascospores 40-70(-90) x 13-16(-21) µm, surface verruculose; on *Betula* .....15. *P. siparia*
5. Ascospores 38-48 x 11-16.5 µm; on *Ulmus* .17. *P. ulmicola*
5. Ascospores 65-80(-94) x 20-26 µm; on *Magnolia* ..... 18. *P. maxima*

13. *Pleomassaria carpini* (Fckl.) Sacc. Syll. Fung. 2: 240. 1883.
Massaria carpini Fuckel, Jahrb. Nass. Ver. Naturk. 23/24: 153. 1870.

Fig. 20

Ascomata immersed beneath periderm, separate or gregarious, depressed globose, 385-825 µm diam, 275-550 µm high; surface black, with abundant brown hyphae; peridium 50-70 µm wide, up to 100 µm wide at base. Asci (100-)140-195 x 25-40 µm. Ascospores (30-)35-52 x 13-20 µm, brown, obovoid, straight or inequilateral, (4-)5-9-septate, primary septum submedian, constricted, two to five septa in upper hemispore and two or three septa in lower hemispore, with one or two longitudinal septa in all but end cells; surface foveolate, gel coating 2-3 µm wide.

Anamorph (associated): *Shearia* sp.: Conidiomata pycnidial, grouped, immersed, up to 800 µm diam, up to 550 µm high; conidiogenous cells holoblastic, apparently annelidic, short, lining peridium; conidia 40-50 x 15-20 µm, brown, obovoid, with several transverse and one or two longitudinal septa; surface smooth, gel coating indistinct.

On branches of *Carpinus* spp., Europe, eastern North America.

Material examined: Ontario: London, Apr 1890, J.Dearness

(NY under *Thyridium ambleium*); Arboretum, Ottawa, 27 Aug 1936, J. W. Groves (FH); New Durham, 25 May 1943, R. F. Cain (BPI). New York: Lyndonville, 24 May 1890, C. E. Fairman 124 (NY). Extralimital: Petrak, Fungi polonici exs. 498 (BPI); Petrak, Mycotheca generalis 1571 (BPI); Krypt. exs. 2215 (BPI); Petrak, Flora Bohemi et Moraviae exs. 52 (FH); Krieger, Fungi saxonici 234 (BPI); Königstein, Aug 1882, Krieger (BPI).

The North American specimens have somewhat smaller ascospores than do the European ones, i.e., for North America 35-45 x 13-15.5 μm, for Europe 45-52 x 15-20 μm, as Ellis and Everhart (1892) observed. Asci tend also to be smaller. The aspects of ascomata, asci, and ascospores are so similar that a contemplated separation into two subspecies seems unnecessary.

The associated anamorph was noted on two of the European specimens, Krypt exs. 2215 and Krieger's Aug 1882 collection in BPI. Fuckel (1870) described an associated pycnidial fungus with yellowish, one to seven transversely septate conidia, 52 x 14 μm, which was named as *Hendersonia carpini* Sacc. (Syll. Fung. 3: 440. 1884.)

14. *Pleomassaria acericola* Petrak, Sydowia 6: 10. 1952. Fig. 21

Ascomata immersed in periderm, gregarious or few in small groups, depressed globose, 600-660 μm diam, 440-500 μm high, surrounded by brown hyphae; peridium ca. 52 μm wide, thinner toward apex. Asci 200-260 x 30-40 μm. Ascospores (35-)50-64 x (10-)15-18 μm, rather light brown, narrowly elongate obovoid, 5-8-septate, primary septum submedian, two to five septa in upper hemispore and one or two in lower hemispore, longitudinal septa in one or several mid cells; surface foveolate, gel coating 2-3 μm wide.

Anamorph (associated): *Shearia acericola* Petrak: Pycnidia intermixed with ascomata, similar in structure; conidiogenous cells short; conidia elongate-ovoid or obovoid, 40-50 x 15-18(-20) μm, dark brown, 5-8-septate, one (two) longitudinal septa in mid cells, surface finely foveolate, gel coating indistinct.

On branches of *Acer* sp., eastern North America.

Material examined: Pennsylvania: North East, 7 May 1906, C. L. Shear (holotype, BPI).

Petrak (1952, p. 11) described the associated anamorph which has conidia similar in size to those of the *Shearia* species associated with *P. carpini*; in both species the

conidia are smaller and have less cells than in the *Shearia* state of *P. maxima* (n. 18). Petrak noted that the specimen was rather young, and provided smaller measurements for the structures (noted above in parentheses) than those I found. *Splanchnonema pupula* (n.9) is also present on the branches.

15. *Pleomassaria siparia* (Berk. & Br.) Sacc. Syll. Fung. 2: 239. 1883.
Sphaeria siparia Berk. & Broome, Ann. & Mag. Nat. Hist. Ser. 2, 9: 321. 1852.
Massaria siparia (Berk. & Br.) Tul. & Tul. Sel. Fung. Carp. 2: 232. 1863.

Figs. 17, 18

Ascomata immersed, separate or gregarious, depressed globose, 550-1100 μm diam, 300-495 μm high; surface dark brown, with sparse hyphal weft; peridium 10-20 μm wide. Asci (110-)140-230 x (30-)40-70 μm. Ascospores 43-77(-90) x 11.5-16(-21) μm, dark brown, oblong, ends obtuse, 5-7-(9-) septate, primary septum nearly median, two or three (four) septa in each hemispore, one (rarely two) longitudinal septa in several cells; surface verruculose, gel coating 2-4 μm wide.

Anamorph: *Prosthemium betulinum* Kunze. Conidiomata acervular, erumpent; conidiogenous cells holoblastic, hyaline, elongate. Conidia brown, composed of 3-5-(6) arms, each arm 2-5 transversely euseptate, 30-40(-55) x 10-12(-16) μm.

On branches of *Betula* spp., Europe, eastern North America.

Material examined: Ontario: ex DAOM 37680, 141475-77, 141480, 141534 (BPI); Toronto, 15 May 1936 and 12 Apr 1932, H. S. Jackson (BPI). Maine: Barr 3668C (MASS). Extralimital: Herb. Barbey-Boissier 194, 192 (as *Karstenula rhodostoma*), 182 (as *Massaria argus*) (BPI); Petrak, Fungi polonici exs. 499; Mycotheca carpatica 139 (BPI); Mycotheca generalis 1580, Flora Bohemi et Moraviae 2190; Weese, Eumycetes sel. exs. 707 (BPI); Bubak, Fungi bohemici, 12 Mar 1905, 18 Mar 1907, 9 Mar 1914 (BPI); near Silkeborg, Denmark, 21 Jan

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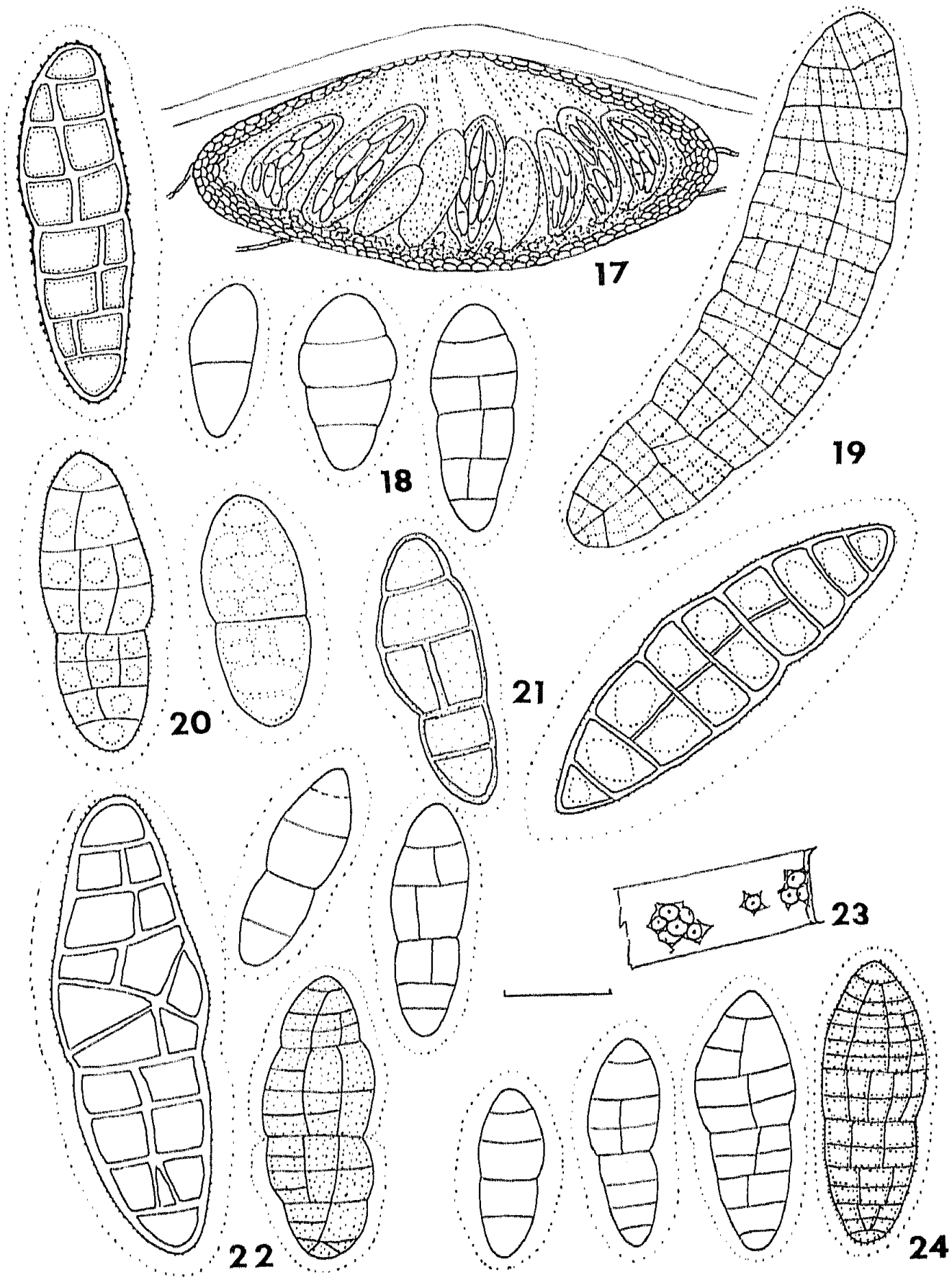
Figs. 17-24. Species of *Pleomassaria*. 17, 18. *P. siparia*: 17, ascoma in vertical section; 18, four ascospores, the three lower ones showing sequence of septum formation. 19. *P. monosperma*, ascospore. 20. *P. carpini*, two ascospores. 21. *P. acericola*, two ascospores. 22. *P. maxima*, four ascospores, showing sequence of septum formation. 23, 24. *P. ulmicola*: 23, habit of ascomata; 24, four ascospores showing sequence of septum formation. Standard line = 15 μm for ascospores, 150 μm for ascomata.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1954, A. Munk (BPI).

A comparison between *P. siparia* and *Splanchnonema argus* is made under the latter species (n. 12). Tonolo (1956) obtained and illustrated the typical several-armed conidia of *Prosthemium betulinum* in cultures from ascospores of *Pleomassaria siparia*. These were illustrated earlier by Tulasne and Tulasne (1863).

16. *Pleomassaria monosperma* (Peck) Barr, comb. nov.
Basionym: *Sphaeria monosperma* Peck, Rep. New York State Mus. 28: 79. (for 1874) 1876.
Julella monosperma (Peck) Sacc. Syll. Fung. 2: 289. 1883.

Fig. 19

Ascomata immersed beneath periderm, scattered, depressed globose, 500-900 μm diam, 350-500 μm high; surface brown, glabrous or nearly so; peridium 30-40 μm wide at base, 60-90 μm wide at sides, narrowed toward apex. Asci 112-150 x 30-36 μm, 1-(2-)spored. Ascospores 104-140 x 24-36 μm, yellowish brown, oblong, ends obtuse, inequilateral, up to 35-septate, 7-8 longitudinal septa in most cells; surface smooth, gel coating (2-)6-8 μm wide.

On *Betula* sp., eastern North America.

Material examined: New York: Forestburgh, Sep, C. H. Peck (holotype, NYS).

The large, multiseptate ascospores, typically one per ascus, are most impressive. This species could be regarded as a monstrosity of *P. siparia*, but is retained as a separate taxon because the sole collection shows no ascomata with smaller, less-septate ascospores.

17. *Pleomassaria ulmicola* (Fckl.) Barr, comb. nov.
Basionym: *Cucurbitaria ulmicola* Fuckel, Jahrb. Nass. Ver. Naturk. 23/24: 172. 1870.
Gibberidea ulmicola (Fckl.) O. Kuntze, Rev. Gen. Pl. 3: 481. 1898.

Figs. 23, 24

Ascomata immersed beneath periderm, in small groups or separate, globose, 350-650 μm diam; surface black, smooth or irregularly roughened, hyphae sparse; peridium 40-60 μm wide. Asci 200-270 x 24-28 μm. Ascospores 38.5-48.5 x 11-16.5 μm, oblong or obovoid, ends obtuse, inequilateral, 8-13-septate, with 5-7 septa in upper hemispore, 3-5(6) in lower hemispore, 2-3 longitudinal septa; surface foveolate, gel coating 2.5-4.5 μm wide.

On branches of *Ulmus* spp., Europe, eastern North America.
Material examined: Ontario: Ellis & Everhart N.A.F. 2815 (MASS).

The nearly globose ascomata are similar in shape to those of *P. maxima*, but do not have the peridium as strongly thickened in the upper regions. Immature ascospores show clearly the affinity of this species to others in *Pleomassaria*. Neither Welch (1926) nor Mirza (1968) accepted the species in *Cucurbitaria*. Fuckel (1870) described smaller ascospores (36 x 14 µm) than are recorded in the North American collection. He also described an associated "Sporidesmium" with ellipsoid, yellow-brown, muriform conidia, stipitate (? elongate conidiogenous cells) and apically appendaged. No such state was observed in the material at hand.

18. *Pleomassaria maxima* Ell. & Ev. Bull. Torrey Bot. Club 25: 505. 1898.
Massaria magnoliae Ell. & Ev. in Millspaugh & Nuttall, Publ. Field. Col. Mus. Bot. 1: 141. 1896.
Pleomassaria magnoliae Shear, Bull. Torrey Bot. Club 29: 455. 1902.

Fig. 22

Ascomata immersed beneath periderm, gregarious, globose or depressed, 500-800 µm diam, 385-550 µm high; surface blackish, with few hyphae; peridium 60-70 µm wide at base, up to 100 µm wide at upper sides as thickened rim, thinner toward apex, ca. 32 µm wide. Asci 150-260 x 35-64 µm. Ascospores 65-80(-94) x 20-26 µm, dark brown, opaque in age, obovoid, usually inequilateral, (3-5-)7-9-11-septate, primary septum somewhat submedian, constricted, up to six septa in upper hemispore and three or four septa in lower hemispore, one or two longitudinal septa in all but end cells; surface foveolate, gel coating 3-4.5 µm wide.
Anamorph: *Shearia fusa* (Berk. & Curt.) Barr, comb. nov.
Basionym: *Sporidesmium fusus* Berk. & Curt. Grevillea 30: 50. 1874.
Stegonosporium formosum Ell. & Ev. Bull. Torrey Bot. Club 10: 76. 1883.
Shearia formosa (Ell. & Ev.) Petrak, Sydowia 15: 217. 1962 (1961).
Camarosporium magnoliae Shear, Bull. Torrey Bot. Club 29: 455. 1902.
Shearia magnoliae (Shear) Petrak, Ann. Mycol. 22: 180. 1924.
Conidiomata pycnidial, similar in size and shape to

ascomata, accompanying ascomata; conidiogenous cells holoblastic, arising from cells of inner peridium; conidia 80-112 x 24-28 µm, brown, obovoid, 11-13-distoseptate, one to three longitudinal septa in all but end cells; surface smooth or foveolate; conidiogenous cells and bases of conidia surrounded by gel sheath.

On branches of *Magnolia* spp., eastern North America.

Material examined: Massachusetts: *Magnolia* sp. (cult.) Brookline, Apr 1893, H. L. Jones 30 (holotype of *P. maxima*, NY); *M. acuminata* (as *M. cordata*), Newton, Apr 1893, W. G. Farlow (FH), also distributed as Reliquiae Farlowianae 73 (BPI, NY); same locality, 10 Jun 1893, W. G. Farlow (FH). Pennsylvania: *M. acuminata*, West Chester, Jun 1883, Everhart & Haines, Ellis N.A.F. 1176 part (isotype of *Stegonosporium formosum*, MASS). District of Columbia: *M. obovata*, Washington, 12 Mar 1902, C. L. Shear 1035 (holotype of *Pleomassaria magnoliae*, BPI); also distributed as Fungi Col. 1635 (BPI, MASS, NY); same locality and collector, Feb 1903, 11 May 1903, 13 Mar 1913, 1920, Sep 1935 (BPI); Takoma Park, 3 Dec 1899, C. L. Shear (BPI); Washington, Spring 1909, C. L. Shear 1577; 18 Apr 1904, C. L. Shear 1576 (BPI, FH); Washington Apr 1904, C. L. Shear (FH). Virginia: *M. acuminata*, "Mts Virg^{ae}", Jun 1857 (isotype of *Sporidesmium fusus*, n. 533, Curtis Herb. in FH). West Virginia: *M. acuminata*, Fayette Co., 24 Apr 1895, L. W. Nuttall (holotype of *Massaria magnoliae*, NY, isotype, BPI). Louisiana: Monroe, 18 Mar 1945, C. L. Shear (BPI).

Between 1893 and 1902, this spectacular fungus was collected from several localities and described three times, and Farlow's unpublished name *Pleomassaria fusa* is in FH. The first description, from West Virginian material, was misleading because ascospores were said to be one-(two-, four-) septate, but the holotype in NY showes characteristic longitudinal septa. Ellis's notes and sketches included with the holotype indicate that he observed ascospores with up to seven transverse and two longitudinal septa, but he chose to describe the younger stages of development. The *Shearia* anamorph is present on both the holotype in NY and the isotype in BPI. The Massachusetts specimens were all collected in 1893, the collection of H. L. Jones sent to Ellis, who based *P. maxima* on it, those of W. G. Farlow deposited in FH. Farlow recognized that *Sporidesmium fusus* was identical with *Stegonosporium formosum*, and specimens and drawings are deposited in FH as *P. fusa*. The earlier epithet for the anamorph calls for still one more combination in *Shearia*.

Sutton (1980) illustrated the anamorph. Parts of Farlow's collection were distributed as Reliquae Farlowianae n. 73, under the name *P. maxima*. *Pleomassaria magnoliae* was recognized as being the same fungus (Thaxter, 1922). Shear (unpublished notes, BPI) obtained the anamorph (as *Camarosporium magnoliae*) in culture from single ascospores; his collections were from Washington and vicinity. Although *Massaria magnoliae* Ell. & Ev. provides the earliest epithet for this species, Shear's name prevents its use in combination in *Pleomassaria*. Consequently, the next earliest epithet, *P. maxima* Ell. & Ev., is the correct one.

Asteromassaria v. Höhnel, Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Cl., Abt. 1, 126: 368. 1917.

Ascomata medium sized to large, immersed beneath or in periderm, becoming erumpent or superficial at times, separate, gregarious, or few in small groups; globose or depressed, bases rounded or ± applanate; surface dark brown to black, smooth, glabrous or surrounded by tomentum of brown hyphae; apex rounded, with low papilla, opening by broad pore; peridium of pseudoparenchymatous cells, dark brown externally, light brown to hyaline internally, usually even in thickness at base and sides, thinner toward apex, at times thin at base. Asci developing from basal or lateral hymenium, bitunicate, clavate or oblong. Pseudoparaphyses narrow cellular, deliquescent with age. Ascospores hyaline when young, becoming light brown or dark brown, with bipolar symmetry, ellipsoid fusoid, ends obtuse or acute, radially symmetric and straight or asymmetric and inequilateral; one or several transversely septate, distoseptate or euseptate, primary septum median, often constricted; wall thick, surface smooth, foveolate or verruculose, surrounded by gel coating; contents of lumina homogeneous or guttulate; overlapping biseriate in the ascus.

Anamorph: Coelomycetous, two described for *A. macrospora*, see details under n. 21.

Type species: *A. macrospora* (Desm.) v. Höhnel

Key to species of *Asteromassaria*

1. Ascomata erumpent, bases ± applanate, peridium thin or occasionally lacking at base 2
1. Ascomata immersed, bases rounded, peridium not notably thin at base 4

2. Ascospores 44-50.5 x 10-11 μm, 1-septate, surface smooth; on pericarps of *Carya* nuts .....19. *A. minor*
2. Ascospores broader, 15 μm wide or more 3
3. Ascospores 36-45(-50) x 15-18(-21) μm, 1-(3-)septate; on *Carya* .....20. *A. seriata*
3. Ascospores 48-75 x 21-25.5 μm, 1-3-septate, surface smooth; on *Umbellularia* .....21. *A. pulchra*
4. Ascospores 3-septate, (26-)31-56 x 13-20 μm, surface foveolate; on *Fagus* .....22. *A. macrospora*
4. Ascospores 5-septate, surface smooth 5
5. Ascospores 50-72 x 15-23 μm; on *Morus* ..... 23. *A. olivaceohirta*
5. Ascospores 56-72 x 18-26 μm; on *Sambucus* ..... 24. *A. distincta*

19. *Asteromassaria minor* (Peck) Barr, comb. nov.
Basionym: *Caryospora minor* Peck, Bull. New York State Mus. 44: 141. (for 1890) 1891.

Fig. 28

Ascomata erumpent superficial, gregarious, globose, 400-600 μm diam, 380-450 μm high, bases ± applanate; surface bearing scattered short brown hyphae; peridium 40-60 μm wide at sides, 24-30 μm wide at base. Asci 110-132 x 20-25 μm. Ascospores 44-50.5 x 10-11 μm, light dull brown, narrowly ellipsoid fusoid, ends obtuse, 1-septate, slightly constricted, contents often separated into one large and one small portion in each hemispore (incipiently 3-septate); surface smooth, no gel coating visible.

On pericarps of hickory (*Carya*) nuts, northeastern North America.

Material examined: New York: Albany, C. H. Peck (holotype, NYS).

This species differs in centrum characters as well as in ascospores from *Caryospora putaminum* (Schw. ex Fr.) de Not., and Barr's (1979a) suggestion that it might belong in *Trematosphaeria* (Melanommatales) was incorrect. In *Asteromassaria, A. minor* evidently is related to *A. seriata*; the relatively broader and darker brown ascospores of the latter are sufficient to separate the species.

20. *Asteromassaria seriata* (Cooke) Shoemaker & LeClair, Canad. J. Bot. 53: 1591. 1975.
Massaria (Massariella) seriata Cooke, Grevillea 17: 92. 1889.
Massariella seriata (Cooke) Sacc. Syll. Fung. 9: 739. 1891.

Ascomata immersed erumpent, much depressed, 250-500 μm diam, 60-100 μm high, base ± applanate; peridium thin at base, 10-20 μm, thickened above to 30 μm. Asci 80-110 x 40-60 μm. Ascospores 36-50 x 15-21 μm, brown, ellipsoid fusoid, ends acute, 1-(3-)septate, septum median, constricted; wall thick, gel coating present.

On branches of *Carya* sp., eastern North America.

This description is composed from notes and illustrations published by Shoemaker and LeClair (1975), taken from Wehmeyer's notes on the type (K, Cooke No. 1763, South Carolina), supplemented from the detailed description published by Petrak and Sydow (1934).

21. *Asteromassaria pulchra* (Harkness) Shoemaker & LeClair, Canad. J. Bot. 53: 1588. 1975.
Massaria pulchra Harkness, Bull. California Acad. Sci. 1(1): 44. 1884.
Splanchnonema pulchrum (Harkness) O. Kuntze, Rev. Gen. Pl. 3: 531. 1898.

Fig. 29

Ascomata immersed erumpent, separate or grouped, globose depressed, 700-925 μm diam. 385-460 μm high, bases ± applanate; peridium up to 65 μm wide, narrower at base. Asci 105-195 x 45-48 μm. Ascospores 48-75 x 21-25.5 μm, yellowish, dark brown after discharge, ellipsoid fusoid, ends obtuse, inequilateral, (1-)3-septate, constricted at primary septum, secondary septa formed near ends; surface smooth, gel coating 3-4.5 μm wide.

On *Umbellularia californica*, western North America.

Material examined: California: Sausalito, Aug 1884, H. W. Harkness (NYS).

22. *Asteromassaria macrospora* (Desm.) v. Höhnel, Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Cl., Abt. 1, 126: 368. 1917.
Sphaeria macrospora Desm. Ann. Sci. Nat. Bot., Ser. 3, 10: 350. 1848.
Cucurbitaria macrospora (Desm.) Ces. & de Not. Comm. Soc. Critt. Ital. 215. 1863.
Massaria macrospora (Desm.) Sacc. Syll. Fung. 2: 10. 1883.
Gibberidea macrospora (Desm.) Schroet. in Cohn, Kryptogamenfl. Schlesien 3(2), Pilze 2: 315. 1908.
Gibberinula macrosppra (Desm.) O. Kuntze, Rev. Gen. Pl. 3: 481. 1898.
Splanchnonema macrosporum (Desm.) O. Kuntze, Rev. Gen.

Pl. 3: 531. 1898.

Figs. 25-27

Ascomata immersed in small groups, globose or somewhat depressed, 715-1000 μm diam, 550-880 μm high, surface glabrous or covered by brown interwoven hyphae; peridium 40-50 μm wide. Asci 110-260 x 24-40 μm. Ascospores (26-)38-50 (-56) x 13-20 μm, dark brown, ellipsoid fusoid, ends obtuse or acute at times, (1-)3-septate, constricted at the primary septum, secondary septa near ends; surface smooth or foveolate, gel coating 2-10 μm wide.

On branches of *Fagus* spp., Europe, eastern North America.

Material examined: Maine: Barr 5902C (MASS). Massachusetts: Barr 5607 (MASS). Extralimital: Krieger, Fungi saxonici 2019; Herbier Boissier 740; Petrak, Flora Bohemi et Moraviae exs. 1176; Kabat, Fungi bohemici (all BPI).

Some questions still exist about the anamorphic state of *A. macrospora*. Tulasne and Tulasne (1863) and Berlese (1894) indicated that *Sporidesmium vermiforme* Riess (= *Scolecosporium macrosporium* (Berk.) Sutton; but combination made by O. Kuntze, Rev. Gen. Pl. 3: 481. 1898) formed part of the life cycle, and the conspicuous, elongate, multiseptate conidia frequently are associated with grouped ascomata. Von Höhnel (1917) postulated a sequence in development: *Asterosporium asterospermum* (Pers. ex Gray) Hughes (as *A. Hoffmanni* Kunze) develops beneath the periderm and the staurosporous conidia germinate in place to form hyaline mycelium; in small plectenchymatous regions of the mycelium the conidia of the *Scolecosporium* state (as *S. fagi* Lib.) are produced; around the margin of older acervuli small white sclerotial bodies form and develop into the *Asteromassaria* ascomata; during their development, the germinated and empty conidia of the *Asterosporium* disappear and only the *Scolecosporium* conidia remain. Archer (1924) made a detailed study of conidium development of the *Asterosporium* from material in culture, but gave no indication that any other state developed. Fischer (1944) from nature and culture connected *Coryneum macrosporum* Berk. (= *Scolicosporium*) and *Asteromassaria macrospora*, but not the conidia of

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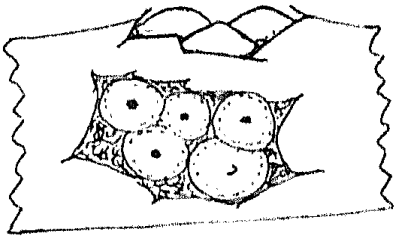
Figs. 25-31. Species of *Asteromassaria*. 25-27. *A. macrospora*: 25, habit of ascomata; 26, ascoma in vertical section; 27, two ascospores. 28. *A. minor*, two ascospores. 29. *A. pulchra*, ascospore. 30. *A. olivaceohirta*, two ascospores. 31. *A. distincta*, two ascospores. Standard line = 15 μm for ascospores, 150 μm for ascomata.



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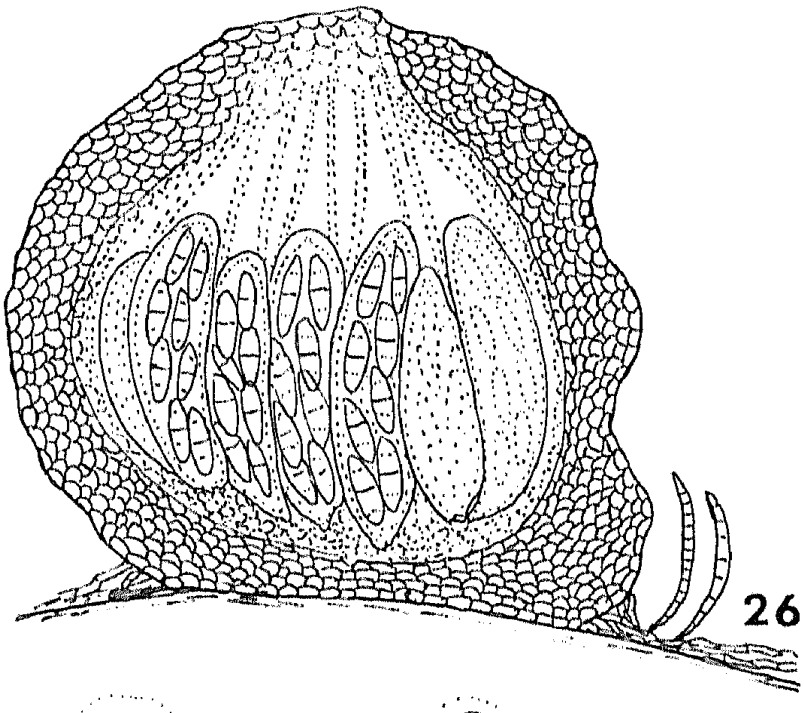

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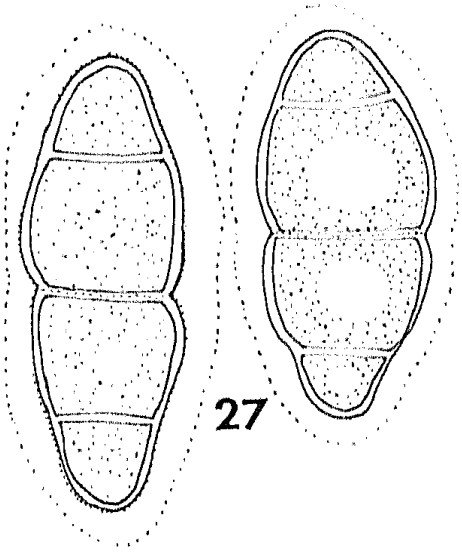

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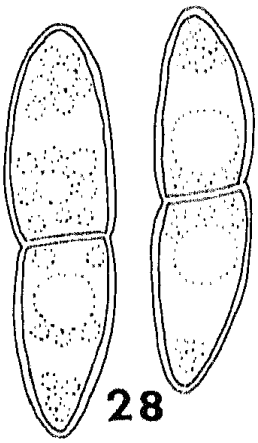

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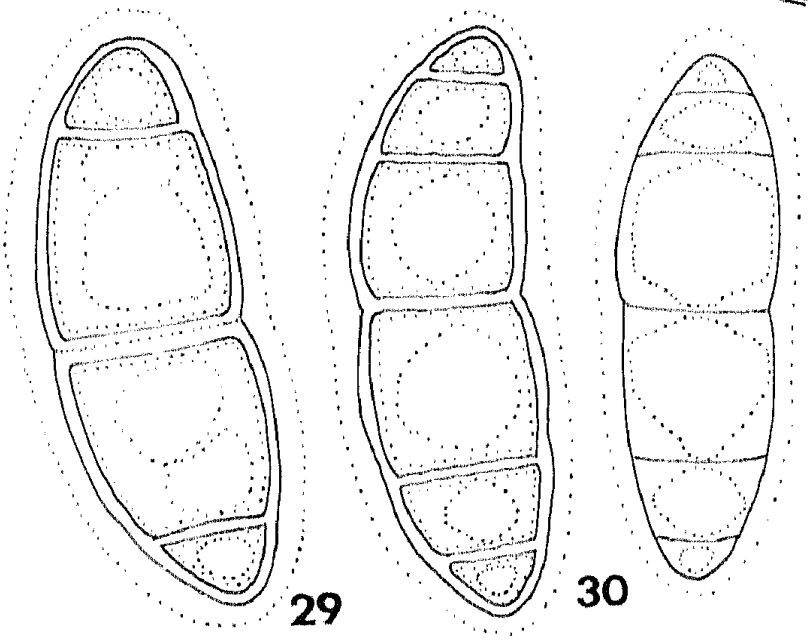

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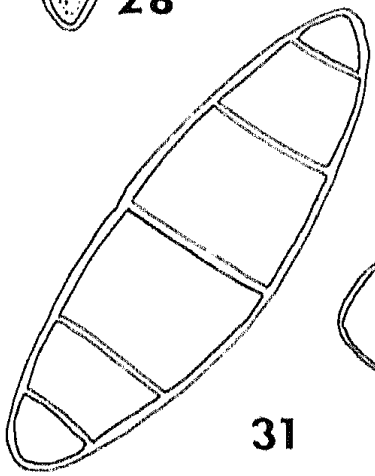

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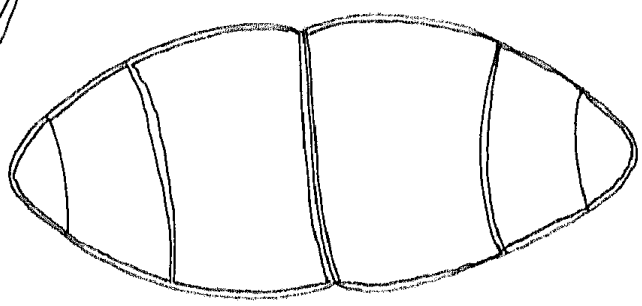

Asterosporium. Sutton (1980) observed that *Scolecosporium macrosporium* grows in conidiomata of *Asterosporium asterospermum* and *Stegonsporium pyriforme*.

23. *Asteromassaria olivaceohirta* Barr, comb. nov.
Basionym: *Sphaeria olivaceo-hirta* Schweinitz, Trans. Amer. Philos. Soc. 4 n.s.: 217. 1832.
Massaria olivaceo-hirta (Schw.) Cooke (as *M. olivacea* Cooke) Grevillea 17: 92. 1889.
Splanchnonema olivaceohirtum (Schw.) O. Kuntze, Rev. Gen. Pl. 3: 531. 1898.
Massaria epileuca Berk. & Curt. Grevillea 4: 156. 1876.
Splanchnonema epileucum (Berk. & Curt.) O. Kuntze, Rev. Gen. Pl. 3: 531. 1898.
Trematosphaeria epileuca (Berk. & Curt.) Shoemaker & LeClair, Canad. J. Bot. 53: 1578. 1975.
Massaria denigrans Saccardo, Mycotheca veneta 1: 83. 1874, nom. nud.

Fig. 30

Ascomata immersed, depressed globose, 450–770 µm diam, 300–550 µm high, surface bearing dense brown hyphal weft; peridium 20–30 µm wide at base, up to 40–60 µm wide at upper sides. Asci (100–)130–260 x 30–50 µm. Ascospores 50–72 x 15–23 µm, light or dark brown, end cells often paler than mid cells, ellipsoid fusoid, straight or inequilateral, (1–, 3–)5-septate, primary septum constricted, secondary septa formed near ends and large mid cells becoming septate later; surface smooth, gel coating 3–3.5 µm wide.

On branches of *Morus* spp., Europe, Asia, eastern and middle North America.

Material examined: New Jersey: Newfield, Nov 1877, J. B. Ellis (BPI). Pennsylvania: Bethlehem, 1826, L. v. Schweinitz (holotype, PH); same data, Collins Collection n. 318 (PH); Ellis N.A.F. 884 (BPI). Maryland: Berlin, 30 Oct 1938, W. J. Jeffers (BPI). Virginia: Mt. Vernon, 10 May 1936, C. L. Shear (BPI). Indiana: Greencastle, 6 May 1914, H. J. Banker (NY); Mississippi: Starkville, 13 May 1896, S. M. Tracy (3 packets, NY). Kansas: Rooks Co., 11 Jan and 11 Dec 1895, E. Bartholomew (BPI). Oklahoma: Barr 6631 (MASS). Alabama: Ellis & Everhart's Fungi Col. 1543 pro parte (MASS, BPI). Extralimital: Europe: Saccardo, Mycotheca veneta n. 83 (isotype of *M. denigrans*, BPI); D. Saccardo, Mycotheca italica 641 (BPI). Asia: Pakistan: Changa Manga, 21 Feb 1965, S. Ahmad; Lahore, 25 Apr 1969, S. Ahmad (BPI).

Five-septate ascospores are typical of the species. In the Schweinitz specimens, although the asci have collapsed, the ascomata and ascospores are identical with the fungus usually named *Massaria epileuca*. Berlese (1894) had suggested that the two names applied to the same fungus.

24. *Asteromassaria distincta* (Schw.) Barr, comb. nov.
Basionym: *Sphaeria distincta* Schweinitz, Trans. Amer. Philos. Soc. 4 n.s.: 217. 1832.
Massaria distincta (Schw.) Cooke, Grevillea 17: 92. 1889.
Splanchnonema distinctum (Schw.) O. Kuntze, Rev. Gen. Pl. 3: 531. 1898, as "(Cke.) O. Kuntze."

Fig. 31

Ascomata immersed, separate, gregarious or in small groups, depressed globose, ca. 550–600 μm diam, 385 μm high; peridium crumbling, surrounded by brown hyphae. Asci no longer visible. Ascospores 56–72 x 18–26 μm, dark brown, ellipsoid fusoid, 5-septate, often constricted at the primary septum; surface smooth, no gel coating visible.

On branches of *Sambucus pubens* Michx. (= *S. racemosa* L.) eastern North America.

Material examined: Pennsylvania: Bethlehem, L. v. Schweinitz (holotype, PH).

Only the rather old and sparse holotype of this species has been seen, but it is included so that other material may be identified and more details of anatomy observed. *Asteromassaria distincta* is quite closely related to *A. olivaceohirta*, and differs on present information only by the broader ascospores and different host. In the arrangement of host orders and families included in the synoptic key (from Cronquist, 1979), this species on *Sambucus* (Caprifoliaceae, Dipsacales) seems quite out of place. Hutchinson's (1969) arrangement of the Caprifoliaceae in the Araliales is obviously of merit to aid in resolution of this problem. The Araliales are placed by Hutchinson as a climax order on a side branch close to the Hamamelidales, whereas both authors place the Dipsacales distant from the other host orders of the members of Pleomassariaceae.

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