Pyrenomycetes of the Great Smoky Mountains National Park.  VI.  
Kretzschmaria, Nemania, Rosellinia and Xylaria (Xylariaceae)

Rogers, J.D.¹, Miller, A.N.²*, and Vasilyeva, L.N.³

¹Department of Plant Pathology, Washington State University, Pullman, Washington 99164-6430, USA
²Illinois Natural History Survey, Section for Biodiversity, Champaign, Illinois 61820-6970, USA
³Institute of Biology & Soil Science, Far East Branch of the Russian Academy of Sciences, Vladivostok 690022, Russia


Keys and descriptions are provided for nineteen taxa of Kretzschmaria, Nemania, Rosellinia and Xylaria collected in the Great Smoky Mountains National Park in Tennessee and North Carolina of eastern United States.

Key words: Ascomycota, Southern Appalachians, taxonomy, temperate forests, Xylariaceae

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*Corresponding author: A.N. Miller, e-mail: amiller@inhs.uiuc.edu

Introduction

This paper represents the 6th contribution to an inventory of pyrenomycetes of the Great Smoky Mountains National Park (GSMNP, see Vasilyeva and Stephenson, 2004, 2005, 2006; Vasilyeva et al., 2007a, b) and includes genera of family Xylariaceae that have not been previously covered. Specimens are deposited in ILLS, WSP, VLA (see address of LNV) and, temporarily, the private collection of JDR. All of the fungi described herein have been previously described from other locations by JDR and others. References cited should be consulted for additional information on described fungi.

General description and key to genera discussed herein

The genera discussed have the following common characteristics; they will not be repeated in discussions and keys. Ascospores of taxa of all genera that have easily observable germ slits have them inserted on the concave (most flat) side of the spore. Perispores of ascospores are not dehiscent in potassium hydroxide (KOH). All taxa discussed herein have eight ascospores per ascus. Stromata lack bright colors and do not release pigments in KOH.

1. Stromata of all known species from GSMNP upright, more or less digitate......................................................Xylaria
   1. Stromata never upright, but pulvinate, applanopulvinate, irregular or perithecioid.................................2

2. Stromata resembling perithecia, occasionally several fused.................................................................Rosellinia
2. Stromata pulvinate, usually containing numerous perithecia.................................................................3

3. Stromata large, several to 10 cm long and 1-several cm thick, containing numerous large (ca. 1 mm diam) perithecia, becoming hollow at maturity..............................Kretzschmaria
3. Stromata usually small, containing numerous perithecia usually less than 1 mm diam and not usually becoming hollow.................................................................Nemania

Key to species of Kretzschmaria, Nemania, and Rosellinia of GSMNP

1. Stromata resembling solitary perithecia.........................2
1. Stromata containing several to many perithecia, seldom resembling solitary perithecia............................3

2. Stromata often embedded in coarse reddish brown subiculum ......................................................... Rosellinia corticium
2. Stromata often embedded in a cream-colored or sulphur yellow subiculum..............................................Rosellinia subiculata

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3. Ascospores 27-35 × 7-9 µm, with germ slit much less than spore-length. Kretzschmaria deusta
4. Ascospores not exceeding 16 µm long (Nemania spp.)

4. Combination of characters different, e.g. ascospores longer or shorter; ascospores pale brown; ascospore germ slit not obvious or apparently lacking; ascus apical ring bluing or not bluing in Melzer’s iodine reagent. Nemania diffusa
5. Ascospores 11-12 × (3-)3.5-4.5 µm, pale brown, with germ ring not bluing in Melzer’s iodine reagent. Nemania aenea
6. Ascospores similar to above in length or shorter. Nemania illita
7. Ascospores 12.5-15 × 6 µm Nemania cf. serpens
8. Ascospores 9.5-12 × 4.5-5 µm Nemania var. colliculosa


Ustulina deusta (Hoffm.: Fr.) Lind, Danish Fungi: 252 (1913).

Illustrations: Miller, 1961, figs 119, 147; Rogers and Ju, 1998, figs 6, 41, 42.
Stromata pulvinate, up to 10 cm diam, 0.5-3 cm thick, at first dull brown becoming black with age. Outer part carbonaceous; interior white, soft, disintegrating, with aging stromata becoming hollow. Perithecia up to 1.5 mm diam., ostioles papillate. Asci up to ca. 500 µm long, 10-14 µm broad, the spore-bearing parts up to 210 µm long, with apical ring bluing in Melzer’s iodine reagent, up to 6 µm high. Ascospores brown to dark brown, fusoid-inequilateral with acute ends, smooth, 25-35 × 7-9 µm, with germ slit less to much less than spore-length.

Habitat: On wood, perhaps most commonly on decaying angiospermous stumps.

Localities: Alum Cave Trail; Appalachian Trail; Cades Cove (Gregory Ridge Trail, Gum Swamp); Cosby (Gases Mountain Trail, Low Gap Trail); Grotto Falls (Trillium Gap Trail).

Notes: This fungus is encountered in the north temperate regions of the world. When overmature the stroma is brittle and hollow with perithecia attached as sacs on the inner surface. More data are available in Rogers and Ju (1998).

Rosellinia corticium (Schwein.: Fr.) Sacc., Syll. Fung. 1: 253 (1882).


Rosellinia aquila Fr.: Fr. var. corticium (Schwein.) Fr., Syst. Mycol. 2: 442 (1823).

Byssosphaeria corticium (Schwein.: Fr.) Cooke, Grevillea. 15: 122 (1887).


Illustrations: Petrini, 1993, figs 9e-j. Stromata peritheciod, 1-1.5 mm diam, blackish brown, embedded in reddish brown subiculum (sometimes absent in old material), brittle. Surface more or less smooth. Perithecia 0.5-1 mm diam., flattened at the tops, ostioles papillate. Asci 170-200 µm total length, 8-12 µm broad, the spore-bearing part 140-180 µm long, with large apical ring 8-12 × 5 µm, bluing in Melzer’s iodine reagent. Ascospores brown, ellipsoid-inequilateral, often with a hyaline appendage on one or both ends, smooth, 26-29 × 7-9 µm, with germ slit nearly spore-length.

Habitat: On dead branches of deciduous trees.

Localities: Cosby (Gases Mountain Trail); Greenbrier (Porters Creek Trail).

Notes: This species was already found in North Carolina (Petrini, 1993). It is very similar to Rosellinia aquila (Fr.: Fr.) De Not., but has consistently longer ascospores and a large apical ring in the ascu.
Byssosphaeria subiculata (Schwein.: Fr.) Cooke, Grevillea. 15: 123 (1887).

Illustrations: Petrini, 1993, figs 14 f-k.

Stromata perithecium-shaped, ca. 0.6 mm diam, containing single perithecia, at first brown, blackening with age, brittle, usually surrounded by a sulfur yellow, orange or cream-colored subiculum. Perithecia ca. 0.5 mm diam., ostioles papillate. Asci 90-150 µm total length, 7-9 µm broad, with apical ring bluing in Melzer’s iodine reagent, small. Ascospores brown, ellipsoid, 9-12(-13) × 5-6 µm, with spore-length germ slit.

Habitat: On decayed wood.
Localities: Deep Creek (Indian Creek Trail); Greenbrier (Old Settlers Trail); Oconaluftee (Mingus Creek Trail).

Notes: This fungus is found in various parts of the world. See Petrini (1993) for further information.


Hypoxylon aeneum Nitschke var. aureoluteum L.E. Petrini & J.D. Rogers, Mycotaxon 26: 413 (1986).

Illustrations: Granmo et al., 1999, figs 21, 26.

Stromata pulvinate, irregular in shape and size, up to 2 mm thick, dull black externally and internally, carbonaceous. Perithecia 0.5-0.7 mm diam., ostioles finely papillate. Asci not seen intact; apical ring not bluing in Melzer’s iodine reagent. Ascospores brown, ellipsoid to somewhat inequilateral, smooth, 12-15 × (4.5-5-6) µm, with germ slit obscure, probably shorter than spore-length.

Habitat: Angiosperm bark.
Localities: Cosby (Gabes Mountain Trail).

Notes: This seems to be the first report of N. aenea var. aureolutea from North America. However, var. macrospora is fairly common in northwestern United States (Ju and Rogers, 2002; unpublished data).
Figs 1-11. Stromata of Kretzschmaria, Nemania, Rosellinia, and Xylaria from GSMNP. 1. Kretzschmaria deusta. 2. Rosellinia subiculata. 3. Nemania illita. 4. Nemania diffusa, cut in lower left part to expose perithecia. 5. Xylaria corniformis. 6. Xylaria cubensis, cut near stipe to expose perithecia. 7. Xylaria hypoxylon. 8. Xylaria liquidambar. 9. Xylaria longipes. 10. Xylaria multiplex. 11. Xylaria polymorpha. Scale bars: Fig. 4 = 2 mm; Figs 2, 3 = 3 mm; Fig. 10 = 5 mm; Figs 1, 6 = 10 mm; Figs 5, 9 = 11 mm; Fig. 7 = 14 mm; Figs 8, 11 = 20 mm.
Notes: This is among the most distinctive species of *Nemania*. It can be easily identified on the morphology of its ascospores. It is collected sporadically in Europe and North America.


For complete synonymy see Ju and Rogers, 2002.

Illustrations: Granmo et al., 1999, figs 55, 56; 65, 66.

**Stromata** pulvinate, up to 5 cm long, 1 cm broad, less than 1 mm thick, dull blackish grey, interior brownish, soft. Perithecia 0.3-0.5 mm diam., ostioles finely papillate. *Asci* long-stipitate, ca. 130 µm total length, ca. 7 µm broad, the spore-bearing part ca. 80 µm, with apical ring bluing lightly or not at all in Melzer’s iodine reagent, 4.5 µm high, 3 µm broad. *Ascospores* brown, ellipsoid-inferior-lateral, smooth, (10.5-)12-15 × 4.5-6 µm, with germ slit obscure.

**Habitat:** On wood of *Quercus rubra* and *Betula* sp.

**Localities:** Alum Cave Trail, Purchase Knob.

Notes: Concepts of *N. serpens* vary somewhat, especially as to whether the ascus apical ring becomes blue in iodine (amyloid reaction), reddish in iodine (dextrinoid reaction), or does not become colored at all (Granmo et al., 1999; Petrini and Rogers, 1986, as *Hypoxylon serpens*).

*Sphaeria colliculosa* Schwein.: Fr., Syst. Mycol. 2: 341 (1823).

Fungal Diversity

The synonymy of this taxon is highly complicated. See Ju and Rogers, 2002.

Illustrations: Granmo et al., 1999, figs 28, 30, 40, 41 (as *Nemania colliculosa*); Petrini, Rogers, 1986, fig. 7 (as *Hypoxylon atrorupureum var. brevistipitatum*).

**Stromata** pulvinate, up to 5 mm diam, 1 mm thick, black externally and internally, carbonaceous. *Perithecia* 0.3-0.43 mm diam., ostioles finely papillate. *Asci* long-stipitate, not seen intact, with ascus ring bluing in Melzer’s iodine reagent, 3 µm high, 2 µm broad. *Ascospores* brown, ellipsoid-inferior-lateral, smooth, 9.5-11 × 4.5-5 µm, with germ slit obscure, but probably shorter than spore-length.

**Habitat:** Decayed wood.

**Localities:** This taxon has a complicated taxonomic and nomenclatural history. It is discussed in Ju and Rogers (2002) and Granmo et al. (1999).

**Key to Xylaria of GSMNP**

1. Fungus specific to a particular host.................. 2
2. Fungus not highly associated with a particular host.... 3
3. Stromata always on fruits of *Liquidambar styraciflua*. Ascopore germ slit spiraling .......... *X. liquidambar* .................................
4. Stromata always on fruits of *Magnolia*. Ascopores pale yellow with germ slit obscure on one or both ends. ..... *X. polymorpha*
5. Ascopores usually not exceeding 22 µm long, with germ slits various.......................... 5
6. Ascopores 16-22(-25) µm long with germ slit much less than spore-length. Stromata often caespitose........ *X. cornu-damae* .......................... 5
7. Ascopores similar in length to above or shorter. Germ slits not spiraling, straight........................ 7
7. Ascospores 12-16 × 5-6.5 µm, with nearly spore-length slit ........................................ Xylaria hypoxylon
8. Ascospores shorter. Germ slit morphology various...

8. Ascospores 9-10 × 5-6.5 µm, with germ slit obscure. Stroma light brown, up to 1 cm diameter, smooth except for ostiolar papillae ..................... X. cubensis
8. Ascospores similar in length to above, but with obvious germ slit .........................................................9

9. Ascospores (8-)9-10(-11) × (3.5-)4.5-6 µm. Stroma dark brown to blackish, often wrinkled, up to 1 cm diameter ........................................... X. corniformis
10. Stromata at first whitish, becoming black at maturity, solitary to caespitose. Often associated with Quercus wood and bark ........................................... X. longiana
10. Stromata at first dark brown to blackish with paler brown shredding outer layer that is obvious with a hand lens. Usually densely caepitose........ X. multiplex

Xylaria corniformis Fr.: Fr., Summa Veg. Scand.: 381 (1849). (Fig. 5)

Illustrations: Rogers, 1983 (as X. curta), figs 3-6; 18-20; 34-35.

Stromata clavate on short or long concolorous stipes, up to 5 cm high, 8 mm broad, dull blackish brown at maturity with minute tan scales at 10 X magnification, white inside, woody to carbonaceous. Surface roughened with minute wrinkles and ostioles. Perithecia 0.3-0.5 mm diam., ostioles minutely papillate. Asci long-stipitate, ca. 225 µm total length, 5-7 µm broad, the spore-bearing part ca. 100 µm long, the apical ring bluing in Melzer’s iodine reagent, ca. 4 µm high, 3 µm broad. Ascospores brown, ellipsoid-inquilateral, sometimes crescentic, smooth, 17-21 × 5-6 µm, with short, straight germ slit.

Habitat: Wood.

Localities: Big Creek (Baxter Creek Trail).

Notes: This species is encountered throughout the eastern United States. There is no evidence that it occurs off of the North American continent. In stature and color it resembles X. hypoxylon. Rogers (1984) discusses X. cornu-damae in detail.

Xylaria cubensis (Mont.) Fr., Nova Acta Regia Soc. Sci. Upsal., Ser. 3, 1: 126 (1851). (Fig. 6)


Illustrations: Rogers, 1984, figs 1-3; 10-15; 27, 28.

Stromata erect, cylindric-clavate, up to 5 cm high, 8 mm broad, with short concolorous stipe from pannose base, copper-colored to blackish brown with interior white or becoming hollow, carbonaceous. Surface smooth except for tiny cracks around ostioles (feels like fine sandpaper to the touch). Perithecia ca. 0.5 mm diam., ostioles finely papillate. Asci stipitate, 88-133 µm total length, 7 µm broad, the spore-
bearing part ca. 60 µm long, with apical ring bluing in Melzer’s iodine reagent, cylindrical, 3 µm high, 2 µm broad. **Ascospores** brown, ellipsoid-inequilateral, smooth, 9-10.5 × 4.5-5 µm, with germ slit apparently absent to slightly discernible.

**Habitat:** Wood.

**Localities:** Cades Cove (Methodist Church); Elkmont; Greenbrier (Porters Creek Trail); Oconaluftee; Sugarlands (Old Sugarlands Trail).

**Notes:** The taxonomic limits of *X. cubensis* are somewhat unclear. Taxa under this name occur in various parts of the world. One of the specimens was cultured and produced the distinctive *Xylocoremium* anamorph (see Rogers, 1984). Care must be taken not to misidentify *X. cubensis* as *X. corniformis*. They are easily separable on surface features of mature stromata (see descriptions herein).

*Xylaria hypoxylon* (L.: Fr.) Grev., Fl. Edin.: 355 (1824). (Fig. 7)


Xylotphaera hypoxylon (L.) Dumort., Comm. Bot.: 91 (1822).


**Illustrations:** Dennis, 1977, plate 11, B.

**Stromata** cylindric to irregular, several often originating from common base, often branched and flattened toward apex, with short or long concolorous stipes, up to 8 cm high, 2-7 mm broad, at first white, becoming dull black, interior white, woody to carbonaceous. Surface fairly smooth or roughened from distinct perithecial elevations. **Perithecia** 0.2-0.3 mm diam., ostioles slightly papillate. **Asci** stipitate, ca. 170 µm total length, 6-7 µm broad, the spore-bearing part ca. 110 µm long, with apical ring bluing in Melzer’s iodine reagent, cylindric, ca. 3 µm high, 1.5 µm broad. **Ascospores** brown, ellipsoid-inequilateral to somewhat crescentic, smooth, (10-)12-15 × 4-6.5 µm, with spiraling germ slit.

**Habitat:** Known only from fruits of *Liquidambar styraciflua* on the ground.

**Localities:** Big Creek (Baxter Creek Trail); Greenbrier.

**Notes:** This fungus was long considered to be *Xylaria persicaria*. It is discussed in detail by Rogers et al. (2002).


**Illustrations:** Rogers and Chacko, 1981, p. 422, fig. 20 (as *X. hypoxylon ”small-spored collection” in culture.*).

**Stromata** much as described for *X. hypoxylon* herein. **Ascospores** ca. 9-11 × 4-5 µm, otherwise as in *X. hypoxylon*.

**Habitat:** Wood, probably *Quercus*.

**Locality:** Alum Cave Trail.

**Notes:** This taxon has often been considered as a small-spored form of *X. hypoxylon*. It seems to be most commonly collected from *Quercus* wood and bark.
Xylaria longipes Nitschke, Pyren. Germ.: 14 (1867).

Illustrations: Rogers, 1983, figs 7-9; 24-33.

Stromata subcylindric to clavate, with short to long concolorous stipe from swollen pannose base, up to 5 cm high, 8 mm diam, dull blackish brown with light brown scales, white internally, carbonaceous. Surface roughened by wrinkles and ostiolar papillae. Perithecia ca. 0-5 mm diam., ostioles papillate. Ascii stipitate with ascospores often in partially biseriate arrangement, 133-150 µm total length, 7-9 µm broad, with spore-bearing part 70-80 µm long, with apical ring bluing in Melzer’s iodine reagent, ca. 3 µm high, 2 µm broad. Ascospores brown, ellipsoid-inequilateral, smooth, (9-)13-14(-15) × 5-6 µm, with germ slit spiralizing around spore.

Habitat: Wood.

Locality: Greenbrier.

Notes: This is one (of two) Xylaria species in GSMNP with spiral ascospore germ slits, the other being X. liquidambar. The latter species is specific for Liquidambar fruits. Xylaria longipes is often associated with Acer spp. in northeastern USA and in Europe (Rogers, 1983). With only one collection from GSMNP we have no additional data to add to host range.


Illustrations: Rogers, 1979, figs 1-3; 10-12.

Stromata long conic, tapering to acute apex, branched or unbranched, up to 12 cm long, up to 5 mm diam at base, somewhat tomentose to glabrous, arising from pannose base, brown to dull black, woody. Surface usually roughened by perithecial elevations. Perithecia ca. 0.3 mm diam., ostioles finely papillate or basically umbilicate. Ascii stipitate, 90-120 µm total length, 6-8 µm broad, the spore-bearing part ca. 50-70 µm, with apical ring bluing in Melzer’s iodine reagent, inverted hat-shaped, 2 µm high, 1.5 µm broad. Ascospores pale yellow, ellipsoid-inequilateral to crescentic, smooth, 11-15(-17) × 3-5(-6) µm, with germ slit apparently lacking.

Habitat: Magnolia fruits.

Localities: Big Creek (Chestnut Branch Trail); Grotto Falls.

Notes: Xylaria magnoliae is common in the United States and apparently is restricted to Magnolia fruits (Rogers, 1979).


Illustrations: Dennis, 1956, fig. 20.

Stromata cylindric, up to 3 cm high, 1-2 mm diam, caespitose, dull blackish brown with remains of light brown peeling layer, interior white, soft to woody. Surface undulate from slight perithecial elevations, with some tomentum on fertile part and base. Perithecia ca. 0.3 mm diam., ostioles slightly papillate. Ascii in intact condition not seen; ascus apical rings bluing in Melzer’s iodine reagent, 3 µm broad. Ascospores brown, ellipsoid-inequilateral, smooth, 9.5-11 × 4.5-5 µm, with germ slit spore-length or slightly less.

Habitat: Quercus wood.

Locality: Big Creek.

Notes: This little Xylaria has been reported from various parts of the world. Our concept of the species follows Dennis (1956).


Illustrations: Rogers and Callan, 1986, figs 1-10.

Stromata long cylindric-clavate to irregular, often on a long stipe that is buried in soil, ca. 10 cm high, 1 cm broad, the stipe often ca. ½ total height, dull brown to blackish brown, white inside, woody to carbonaceous. Surface wrinkled and minutely warted. Perithecia 0.5-1 mm diam., ostioles papillate, usually not obvious among surface warts. Ascii long-stipitate, 160-230 µm total length, 6-14 µm broad, the spore-bearing part 90-145 µm long, with apical ring bluing in Melzer’s iodine
reagent, urn-shaped, 4-6 µm high, 3-4 µm broad. *Ascospores* brown, ellipsoid-inequilateral, with narrowly rounded to acute ends, 20-28 × 6-8 µm, with short straight to slightly oblique germ slit.

*Habitat*: Wood, sometimes buried in soil.

*Locality*: Abrams Creek (Rabbit Creek Trail).

*Notes*: Various *Xylaria* species are misidentified as *X. polymorpha*, most frequently, perhaps, *X. longipes* and *X. corniformis*. In our experience, *X. polymorpha* is infrequently encountered. Our material corresponds to the form of *X. polymorpha* that seems most common in the southern and southeastern United States (see Rogers and Callan, 1986).

*Xylaria tentaculata* Berk. & Broome, Grevillea. 4: 48 (1875).

*Illustrations*: Callan and Rogers, 1990, figs 66-71.

*Stromata* subcylindric, up to 4 cm high. The fertile part ca. 2 mm diam, from abrupt narrow concolorous stipe, dull blackish brown, interior white, soft. Surface rough from strong perithecial elevations and prominent ostiolar papillae. *Perithecia* 0.7-1 mm diam., ostioles conspicuously papillate. *Asci* stipitate with ascospores arranged in partially biseriate manner, ca. 135 µm total length, ca. 10 µm broad, the spore-bearing part ca. 105 µm, with apical ring bluing in Melzer’s iodine reagent, urn-shaped, 9 µm high, 4.5 µm broad. *Ascospores* dark brown, ellipsoid-inequilateral to crescentic, often with a cellular appendage on one end and a mucilaginous appendage on the other end, the spore body without appendages 19-22 × 7.5-9 µm, with germ slit slightly less than spore-length.

*Habitat*: Forest floor.

*Localities*: Cades Cove.

*Notes*: This fungus has a distinctive anamorphic state in which elongated processes extend from the apical part of an upright rachis in a floral or stellate arrangement; thus the epithet *tentaculata*. No trace of the anamorphic state is usually seen on the mature stroma. The fungus is discussed by Brown (1913) and Callan and Rogers (1990).

**Prospects for additional records of xylariaceous fungi in GSMNP**

There are undoubtedly additional xylariaceous fungi to be recorded from GSMNP. Moreover, some of the taxa described herein are represented by only one or several collections. The publications of Hanlin (1963, 1964) on the ascomycetes of Georgia and a host index to the ascomycetes of Georgia, respectively, are useful in predicting the occurrence of taxa that have not yet been reported from GSMNP. The names of many of the fungi therein, however, have been changed and the collector must go to more recent literature for citations. Likewise, the publication of Rogers (1986) can be useful in tentative identifications.

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