



# Scutellinia (Pezizales) In Korea, With A New Species and Eight New Records

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1 *Scutellinia* (Pezizales) in Korea, with a new species and eight new records

2

3 By

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17 With 2 figures

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25 new species and eight new records. – Nova Hedwigia xx: xx-xx.

26

27 **Abstract:** Eleven species of the genus *Scutellinia* (Pyronemataceae, Pezizales) are recognized in  
28 Korea by analysis of macro- and micro-morphological characteristics, substrates and  
29 geographical distributions. Eight species are recorded new to Korea, namely, *S. ahmadiopsis*, *S.*  
30 *badio-berbis*, *S. colensoi*, *S. jilinensis*, *S. nigrohirtula*, *S. olivascens*, *S. setosa* and *S. patagonica*.  
31 Based on the exceptional length of marginal hairs and tuberculate ascospore wall ornamentation,  
32 two Korean specimens occurring on wood are described as a new species. Intraspecific  
33 morphological variations among collections within *S. scutellata* and *S. patagonica* were found.  
34 These are tentative treat as species complexes. The highly questionable occurrence of *S. setosa* in  
35 Asia was confirmed. Descriptions and taxonomic notes of the recognized species of *Scutellinia*  
36 are provided with a taxonomic key, illustrations and photographs of these species from Korea.

37

38 Keywords: Ascomycete, East Asia, *Scutellinia erinaceus*, *S. kerguelensis*, *S. umbrarum*, wall  
39 ornamentation

#### 40 **Introduction**

41 The genus *Scutellinia* (Cooke) Lambotte is one of the genera with the most species in the  
42 Pyronemataceae (Pezizales, Ascomycota). Cooke (1879) first employed the name *Scutellinia* as a  
43 subgenus of *Peziza*; it was elevated to generic rank by Lambotte (1887). The name *Scutellinia*  
44 has a confusing history; many earlier authors used the names *Patella* F.H.Wigg., *Ciliaria* Quél.  
45 ex Boud. or *Lachnea* (Fr.) Gillet for these species. Applying a narrow generic concept Le Gal  
46 (1953) adopted the name *Scutellinia* instead of the invalid *Ciliaria* that had been favored by  
47 many workers. Her restricted concept has been widely adopted in the taxonomic literature (Korf  
48 & Schumacher 1986, Schumacher 1990 and citations referred therein). This cosmopolitan genus  
49 is easily recognized by its shield-like red or orange apothecia, globose to ellipsoidal ascospores  
50 with or without various wall ornamentations, and stiff, long, blackish-brown hairs that arise from  
51 inner cells of the ectal excipulum. In considering the delimitation of species morphological  
52 characters were used as well habitat information and geographic distribution. Among the  
53 characters that have previously been used in defining species, hair morphology and ascospore  
54 shape and ornamentation have been especially emphasized in most keys at the infrageneric and  
55 species level (Bogacheva & Kullman 2006, Donadini 1983, Gamundí 1956, 1975, Hansen &  
56 Knudsen 2000, Kullman 1982, Le Gal 1972, 1974, Mato  
57 ec 2000, Moravec 1974, Schumacher 1979, 1990, Svrček 1971). Two different types of hairs  
58 were distinguished in *Scutellinia* species. Schumacher (1990) termed them “marginal hairs,”  
59 those at or near the margin of apothecia, and “lateral hairs,” those on the receptacle lower down.  
60 In some *Scutellinia* species, the marginal hairs are longer and broader than lateral hairs and have  
61 extensively forked or divided bases. Kullman (1982) and Schumacher (1990) referred to the hairs  
62 as “differentiated” when marginal and lateral hairs could easily be distinguished from one  
63 another and as “not differentiated” when they were too similar to discriminate. We follow their  
64 terminology in our descriptions.

65 Despite considerable taxonomic study of the genus, species delimitation and infrageneric  
66 subdivision within *Scutellinia* have remained problematic. Molecular phylogenetic approaches  
67 have been applied at the species level to other members of the Pyronemataceae, e.g. *Otidea*  
68 (Pers.) Bonord. (Liu & Zhuang 2006), *Chaetothiersia* Perry & Pfister (Perry & Pfister 2008) and  
69 *Geopora* Harkn. (Tamm et al. 2010), but only a scattering of species of *Scutellinia* have been  
70 included in larger level studies (Perry et al. 2007). As a component of our broader work we have  
71 undertaken a molecular phylogenetic study and although this is not presented here in this  
72 regional mycota, it has helped to inform our decisions on the delimitation of species. The  
73 phylogeny will be presented as part of a larger study.

74 Among the approximately 50 species recognized in *Scutellinia* (Schumacher 1988, 1990) four  
75 species have been recorded from Korea prior to work by the present authors: *S. erinaceus*  
76 (Schwein.) Kuntze (Cho & Lee 2002), *S. kerguelensis* (Berk.) Kuntze (Park et al. 1994, Jung  
77 1995), *S. scutellata* (L.) Lambotte (Lee & Cho 1975, Jung 1995) and *S. umbrorum* (Fr.)  
78 Lambotte (Cho et al. 1997). Cho et al. (1997) had reported *S. pseudoumbrorum* J.Moravec, but  
79 this species is now considered a synonym of *S. umbrorum* (see Schumacher 1990). Only in the  
80 case of *S. kerguelensis* and *S. scutellata* (Jung 1995) did these earlier workers provide detailed  
81 information on morphological characters, such as shape and size of hairs and wall ornamentation  
82 of ascospores. Such features are important in identifying species; records that lack such  
83 information are considered questionable.  
84 From 2001 to 2008 fieldwork was conducted in South Korea with a specific emphasis on the  
85 cup-fungi. Many *Scutellinia* specimens were collected from around the country by the first three  
86 authors. The main objective of this study is to document the *Scutellinia* species in Korea based  
87 on these extensive collections. Descriptions, taxonomic and a key are included.

88

## 89 **Materials and methods**

90 About one hundred *Scutellinia* specimens collected between 2001 and 2008 were examined and  
91 identified. Specimens were collected from many locations throughout South Korea. These were  
92 studied in fresh condition to observe color and macroscopic features and dried condition,  
93 primarily to observe and measure structures. Specimens are deposited in the Fungal Herbarium  
94 of Korea University (KUS-F). Microscopic examination was made from hand-free sections in  
95 water or 3% KOH and subsequently stained in Lactofuchsin or Cotton Blue in lactic acid.  
96 Measurements were performed at 1000× for ascospores and at 100-400× for other structures.  
97 Size of ascospores are reported as maxima and minima in parentheses, and the mean plus and  
98 minus for the standard deviation of 50 matured spores.

99 To observe spore wall ornamentation Scanning Electron Microscopy (SEM) was performed on  
100 the following species: *S. ahmadiopsis* W.Y.Zhuang, *S. badio-berbis* (Berk. ex Cooke) Kuntze, *S.*  
101 *colensoi* Masee ex LeGal, *S. olivascens* (Cooke) Kuntze, *S. scutellata* and *S. patagonica* (Rehm)  
102 Gamundí. The quality of available material precluded *S. jejuensis* J.G.Han, Y.J.Choi & H.D.Shin,  
103 *S. jilinensis* Z.H.Yu & W.Y.Zhaung, *S. nigrohirtula* (Svr  
104 ek) LeGal and *S. setosa* (Nees) Kuntze from SEM study. For SEM specimen holders with  
105 double-sided adhesive tape were placed in the middle of a Petri dish bottom that was lined with  
106 wet filter paper. Apothecia were hung upside down above the holders at the middle of a Petri dish  
107 cover. The Petri dish was sealed with Parafilm and incubated at 18°C for one or two days. After  
108 air-drying, the ascospores were coated with platinum with a Hitachi E-1010 ion sputter. The  
109 surface structure of spores was observed at 18 kV and photographed with a Hitachi S-3500N  
110 scanning electron microscope.

111 In the treatment that follows recognized species are arranged alphabetically. New records from  
112 Korea are marked with an asterisk (\*).

113

#### 114 **Taxonomy**

115 \* *Scutellinia ahmadiopsis* W.Y.Zhuang, Fung. Diversity 18: 216 (2005) (FIGS. 1 A-D)

116 APOTHECIA sessile, 3–8(–15) mm diam, discoid, disc irregularly undulate to round, with an  
117 indistinct margin covered by very short, pale brown hairs; hymenium orange or dull orange when  
118 fresh. ECTAL EXCIPULUM of *textura globulosa* to *textura angularis*, individual cells 20–80 µm  
119 diam, hyaline to subhyaline, elongated toward the margin. MEDULLARY EXCIPULUM of *textura*  
120 *intricata*, hyaline. SUBHYMENIUM indistinct. HAIRS not differentiated, pale brown, mostly  
121 ventricose, slightly bent, 100–320 µm long, 10–22 µm wide, 2–6 septate, walls thick up to 3–5  
122 µm, apex pointed or sometimes obtuse, bases simple or bifurcate. ASCI hyaline, cylindric, 8–  
123 spored, 190–255 × 14–20 µm, apex rounded, about two thirds occupied with ascospores.  
124 ASCOSPORES ellipsoid to broadly ellipsoidal, (18.5–)19.6–21.8(–23.5) (av. 20.7) µm long, (11–  
125 )12.8–14.1(–14.5) (av. 13.5) µm wide, l/w ratio (1.35–)1.46–1.62(–1.70) (av. 1.54), containing  
126 mostly one large guttule in dry material, but often two or many small guttules; wall  
127 ornamentation low and irregularly verrucose; warts irregular in shape and size, 0.3–1.2(–1.5) µm  
128 wide, 0.2–0.6 µm high, often interconnected; wall not loosening in heated lactic acid.  
129 PARAPHYSES filiform, straight, hyaline, 6–7 septate, 2–4 µm wide, not or branched 1–2 times in  
130 lower part, even with or slightly longer than the asci; apical cell clavate, 30–45 µm long, 6–10  
131 µm wide.

132 *Specimens examined.* SOUTH KOREA: Pocheon, National Arboretum, 19 Jul 2001 (KUS-  
133 F50040); as above, 24 Aug 2001 (50171); Pyeongchang, Korea Botanic Garden, 6 Jun 2002  
134 (50534, 50535); Chuncheon, Haekgol, 28 Jun 2002 (50560); Gangneung, Eoheul-ri, 1 Jul 2002  
135 (50586); Hongcheon, Experimental Forest of Kangwon National University, 23 Sept 2005  
136 (50874); Guri, Donggureung, 12 Oct 2007 (51938).

137 *Habitat.* On damp rotting woods, branches or twigs

138 *Notes.* Based on undifferentiated short marginal hair, ellipsoidal to broadly ellipsoidal  
139 ascospores and verrucose wall ornamentation, the present material agrees well with *S.*  
140 *ahmadiopsis* (Zhuang 2005), although marginal hairs are longer in the Korean specimens (up to  
141 320 µm) than in its original description from China (up to 205 µm). A similar species with short  
142 marginal hairs and low warts, *S. hyalohirsuta* W.Y.Zhuang, has recently been introduced  
143 (Zhuang & Yang 2008), but this species could be distinguished from *S. ahmadiopsis* by broader  
144 ascospores (14.7–17.6 µm) and more finely warted ascospore. Many morphological  
145 characteristics of this species are similar to *S. superba* (Velen.) LeGal that is recorded mainly  
146 from Europe. But, *S. ahmadiopsis* possesses spore walls that do not loosen in heated lactic acid;  
147 a clearly loosened wall is present in *S. superba*. Additionally, these species are found on different

148 substrates; *S. ahmadiopsis* is collected on rotten woods or duff (Zhuang 2005, this work) and *S.*  
149 *superba* is found on sandy soil on the forest floor and along river beds (Schumacher 1990, Korf  
150 & Zhuang 1991, Yao & Spooner 1996, Hansen & Knudsen 2000). Based on microverrucose wall  
151 ornamentation, this species is somewhat similar to *S. kerguelensis*, but the latter species differs  
152 by longer marginal hairs (130–480  $\mu\text{m}$ ) and larger ascospores (21.8–28.2  $\times$  14.4–21.8  $\mu\text{m}$ ).

153

154 \* *Scutellinia badio-berbis* ([Berk. ex Cooke](#)) Kuntze, Revis. Gen. Pl. 2: 869 (1891) (FIGS. 1 E-H)

155 APOTHECIA scattered to gregarious, sessile, discoid, 2–6(–10) mm diam, disc round or slightly  
156 undulate; hymenium orange when fresh, with a distinct margin covered by long and short hairs.

157 ECTAL EXCIPULUM of *textura globulosa* to *textura angularis*, individual cells 25–75  $\mu\text{m}$  diam,  
158 subhyaline, outermost cells mostly smaller, 15–30  $\mu\text{m}$  wide. MEDULLARY EXCIPULUM of *textura*

159 *intricata*, hyphae 12–18  $\mu\text{m}$  wide, individual cells ca. 200  $\mu\text{m}$  long, hyaline, thin-walled.

160 SUBHYMENIUM of *textura prismatica*, individual cells 10–17.5  $\mu\text{m}$  diam, hyaline, thin-walled.

161 HAIRS clearly differentiated; marginal hairs stiff, brown to dark brown, of uneven length, 400–

162 1600(–2000)  $\mu\text{m}$  long, (20–)30–50  $\mu\text{m}$  wide, (5–)13–25 septate, thick-walled of (4–)5–8  $\mu\text{m}$ ,

163 apex pointed or rarely blunt, with a bi-, tri- to multi-furcate rooting base; lateral hairs shorter

164 than marginal hairs, less than 500  $\mu\text{m}$ , paler brown than marginal hairs, apex pointed; hyphoid

165 hairs hyaline, 1–2(–3) celled, less than 100  $\mu\text{m}$ , with obtuse apex. ASCI cylindrical, 8-spored, 180–

166 260  $\times$  13–15(–18)  $\mu\text{m}$ , about three fifths occupied with ascospores. ASCOSPORES ellipsoid, (16.0–

167 )18.8–21.6(–24.0) (av. 20.2)  $\mu\text{m}$  long, (9.5–)11.0–12.4(–13) (av. 11.7)  $\mu\text{m}$  wide, l/w ratio (1.50–

168 )1.65–1.85(–1.95) (av. 1.75), with slightly pointed ends, containing one or two large and several

169 small internal guttules; wall ornamentation clearly pustulo-cristate; warts 1.2–3.0(–4.0)  $\mu\text{m}$  wide,

170 0.8–1.2(–2.4)  $\mu\text{m}$  high, most prominent and protruding around the poles, often connected to

171 neighbouring ones, formed short ridges; wall not loosening in heated lactic acid. PARAPHYSES

172 filiform, straight, hyaline, 4–5 septate, 2.5–3.5  $\mu\text{m}$  wide, simple or branched at the base, slightly

173 exceeding the asci; apical cell spadiciform, not sinuous, 5.5–10  $\mu\text{m}$  wide, often shorter than the

174 lower cells, (18–)24–40  $\mu\text{m}$  long.

175 *Specimens examined.* SOUTH KOREA: Jeju, Seogwipo, a mushroom farm near Hallasan

176 National Park, 14 Aug 2001 (KUS-F50134, 50145, 50149); Gangneung, Eoheul-ri,

177 Daegwanryeong Recreational Forest, 5 Oct 2001 (50293); as above, 19 Oct 2001 (50376), as

178 above, 6 Jun 2002 (50539); Juju, Seogwipo, Yeongsil, 13 Sept 2002 (50671, 50674, 50676);

179 Hongcheon, near Yeonhwa Temple, 23 Sept 2005 (50885); Danyang, Youngbuwon-ri, Sobaeksan

180 National Park, 20 Oct 2005 (50955); Yeongju, Sobaeksan National Park, Oknyeobong

181 Recreational Forest, 21 Oct 2005 (50968); Hongcheon, near Yeonhwa Temple, 16 Jun 2006

182 (51101); Namyangju, Jinjeop-eup, Gwangneung, 12 Aug 2006 (51240).

183 *Habitat.* On damp rotting wood

184 *Notes.* This is the first record in Korea of *S. badio-berbis*, a tropical to subtropical species with  
185 worldwide distribution excluding Europe. The long marginal hairs and ellipsoidal ascospores  
186 with large, coarsely pustulo-cristate sculpturing characterize this species. The Korean materials  
187 showed a minor difference from the description of Schumacher (1990) in possessing somewhat  
188 smaller asci ( $180\text{--}260 \times 13\text{--}15\text{--}(18) \mu\text{m}$  vs.  $230\text{--}280 \times 15\text{--}18.6 \mu\text{m}$ ) and lower warts ( $0.8\text{--}1.2\text{--}$   
189  $2.4$ ) vs. up to  $3.2 \mu\text{m}$ ). Some earlier workers recorded slightly larger ascospores than we found  
190 and those reported by Schumacher (1990) of  $18.2\text{--}23.2 \times 9.6\text{--}13.2 \mu\text{m}$ , e.g.  $22\text{--}28 \times 14\text{--}17 \mu\text{m}$   
191 by Le Gal (1953),  $19.2\text{--}25 \times 11\text{--}14.4 \mu\text{m}$  by Gamundí (1975) and av.  $23.2 \times 13.2 \mu\text{m}$  by  
192 Kullman (1982). Some of these measurements may include the height of warts that are about 2  
193  $\mu\text{m}$  high.

194

195 \* *Scutellinia colensoi* Masee ex Le Gal, Bull. Soc. Mycol. Fr. 83: 356 (1967) (FIGS. 1 I-L)  
196 APOTHECIA sessile, discoid, 2–5(–8) mm diam, disc round or slightly undulate, with a distinct  
197 margin covered with long, blackish hairs of uneven length; hymenium orange to red when fresh,  
198 but fading to brownish orange in dried specimens. ECTAL EXCIPULUM of *textura globulosa* to  
199 *textura angularis*, individual cells 25–120  $\mu\text{m}$  diam, towards the margin elongated, hyaline to  
200 subhyaline. MEDULLARY EXCIPULUM of dense *textura intricata*, individual hyphae 5–12  $\mu\text{m}$   
201 wide. SUBHYMENIUM of densely packed mostly isodiametric cells, 5–10  $\mu\text{m}$  wide. HAIRS clearly  
202 differentiated; marginal hairs stiff, brown to dark brown, uneven in length, 300–1700  $\mu\text{m}$  long  $\times$   
203 24–48 (av. 36)  $\mu\text{m}$  wide near the base, apex pointed, 10–20 septate, walls 3–5  $\mu\text{m}$  thick, with a  
204 bi-, tri- to multi-furcate prominent base, individual rootlets relatively short and thin; lateral hairs  
205 shorter than marginal hairs, 120–350  $\mu\text{m}$ , paler than marginal hairs, often flexuous, with a  
206 bifurcated or unbranched base, apex pointed or obtuse; hyphoid hairs mostly 2-celled, mostly  
207 less than 100  $\mu\text{m}$  long, pale yellow or hyaline. ASCI cylindric, 8-spored,  $180\text{--}240 \times 10\text{--}15 \mu\text{m}$ ,  
208 with a short base, apex rounded, about three fifths occupied by ascospores. ASCOSPORES  
209 ellipsoid, (16.0–)17.1–19.4(–20.0) (av. 18.3)  $\mu\text{m} \times$  (9.5–)10.1–11.3(–12.0) (av. 10.7)  $\mu\text{m}$ , l/w  
210 ratio (1.50–)1.61–1.81(–2.00) (av. 1.71), with obtuse ends, containing one or two large internal  
211 guttules or several smaller ones; wall ornamentation clearly pustulo-cristate, warts large, up to  
212 3.2  $\mu\text{m}$  wide, up to 1.2  $\mu\text{m}$  high, sometimes confluent to give a pseudo-reticulum; wall not  
213 loosening in heated lactic acid. PARAPHYSES filiform, straight, hyaline, 5–6 septate, 2.5–3.5  $\mu\text{m}$   
214 wide, simple or 1–2 times branched from midpoint, slightly exceeding the asci, containing  
215 orange pigment granules throughout when fresh; apical cell spadiciform, lanceolate or slightly  
216 enlarged towards tip, sinuous, irregular in width, only slightly wider than other cells, 4–7(–8)  $\mu\text{m}$   
217  $\times$  (20–)30–50 (av. 40)  $\mu\text{m}$ .

218 *Specimens examined.* SOUTH KOREA: Pocheon, National Arboretum, 29 Aug 2002 (KUS-  
219 F50643); Dongducheon, Mt. Soyo, 6 Sept 2002 (50649, 50653, 50655, 50657).

220 *Habitat.* On damp rotting wood

221 *Notes.* The long marginal hairs and conspicuous pustulo-cristate ornamentation with large warts  
222 characterize this species. The asci of the Korean specimens are smaller than those given by  
223 Schumacher (1990) ( $210\text{--}280 \times 14\text{--}19 \mu\text{m}$ ), but are similar to other records:  $180\text{--}230 \times 11\text{--}15$   
224  $\mu\text{m}$  from Zhuang & Wang (1998b) and  $175\text{--}215 \times 11\text{--}15 \mu\text{m}$  from Douanla-Meli & Langer  
225 (2005). Among the ten *Scutellinia* species with this type of wall sculpturing *S. colensoi* is most  
226 similar to *S. badio-berbis*. Other species with this type of wall ornamentation are: *S. badio-*  
227 *berbis*, *S. balansae*, *S. colensoi*, *S. cubensis*, *S. erinaceus*, *S. cejpui*, *S. geneospora*, *S.*  
228 *inexpectata*, *S. jungneri* and *S. nigrohirtula*. Previously, *S. badio-berbis* and *S. colensoi* often  
229 were confused because of their similar morphological characteristics, overlapping geographic  
230 distribution and their occurrence on damp rotting wood (Le Gal 1953, Gamundí 1975,  
231 Schumacher 1990). As a result, Kullman (1982) treated *S. colensoi* as a synonym of *S. badio-*  
232 *berbis*. In the present study, on the contrary, *S. badio-berbis* is clearly different from *S. colensoi*  
233 by its more massive and higher warts on the ascospores. This is in agreement with previous  
234 findings by Otani (1971), Moravec (1978) and Schumacher (1990). It is the case that the width of  
235 the warts was too similar to distinguish between the two species. Additionally, the ascospore  
236 dimension of *S. colensoi* ( $17.1\text{--}19.4 \times 10.1\text{--}11.3 \mu\text{m}$ ) are also somewhat smaller than that of *S.*  
237 *badio-berbis* ( $18.8\text{--}21.6 \times 11.0\text{--}12.4 \mu\text{m}$ ) and are similar to measurements given by Schumacher  
238 (1990),  $17.2\text{--}20.3 \times 9.8\text{--}11.6 \mu\text{m}$  vs.  $18.2\text{--}23.2 \times 9.6\text{--}13.2 \mu\text{m}$ . Le Gal (1953) and Schumacher  
239 (1990) say that *S. colensoi* has obtuse ellipsoidal spores rather than pointed ellipsoidal spores as  
240 in the latter species. In our study *S. badio-berbis* more often has pointed ellipsoidal spores than  
241 does *S. colensoi*, but these two ascospore shapes co-existed even in a single apothecium. Spore  
242 shape seems not to be a clear character to distinguish these species. The reports that *S. colensoi*  
243 has longer and thicker marginal hairs than *S. badio-berbis* (Le Gal 1953, Kullman 1982) could  
244 not be confirmed here since their size ranges varied according to specimens and often the  
245 measurements overlapped. Instead, we found that *S. colensoi* could be characterized by sinuous  
246 apical cells of paraphyses, which are also longer and narrower than those of *S. badio-berbis*. The  
247 height of warts on ascospores and shape of the apical cell of the paraphyses seem to be the most  
248 useful to differentiate the two species; these differences were constantly found among many  
249 specimens. Previously the morphology of paraphyses was not considered to be relevant for  
250 species delimitation of the *Scutellinia*. As a result, many morphological investigations have  
251 provided only the width and shape of apical cells without attributing any taxonomic value.  
252 However, the present study highlights the potential taxonomic importance of this character,  
253 which thus should be observed carefully and characteristics should be reported in species  
254 descriptions.

255 *Scutellinia colensoi* is widely distributed in subtropical to warm temperate regions. This is the  
256 first record from Korea. It seems to be widely distributed in Asian countries, including Japan,



257 Pakistan, Thailand (Schumacher 1990), China (Zhuang & Wang 1998a), and Russia (Bogacheva  
258 & Kullman 2006) but has not been reported from North America.

259

260 *Scutellinia jejuensis* J.G.Han, Y.J.Choi, H.D.Shin, Mycotaxon 112: 48 (2010)

261 For a description of this recently described species the original publication (Han et al. 2010)  
262 should be consulted.

263 *Specimen examined.* SOUTH KOREA: Jeju, Hallasan National Park, near Mulchat-oreum, 5  
264 Nov 2008 (KUS-F52411).

265 *Habitat.* on shaded, damp soil

266 *Notes.* Han et al. (2010) introduced this species that has subglobose to globose ascospores and  
267 aculeolate-reticulate ornamentation. Most of the *Scutellinia* species in Asia have ellipsoid spores  
268 (Otani 1971, Kaushal et al. 1983, Zhuang 1989, 1994, 1997, 1998); this is the only species with  
269 subglobose spores so far collected in South Korea. *Scutellinia jejuensis* and *S. sinensis* M.H.Liu  
270 from China (Liu & Peng 1996) are the confirmed species with subglobose to globose spores in  
271 Asia.

272

273 \* *Scutellinia jilinensis* Z.H.Yu & W.Y.Zhuang, Mycotaxon 75: 404 (2000)

274 APOTHECIA scattered to gregarious, sessile, discoid, 1.5–6(–8) mm diam, disc round or slightly  
275 undulate, with a distinct margin covered by long marginal hairs; hymenium orange to red when  
276 fresh but often brown in dried specimens. ECTAL EXCIPULUM of *textura globulosa* to *textura*  
277 *angularis*, individual cells 30–70 µm diam, subhyaline to pale yellow, outermost cells mostly  
278 smaller and longer, 15–30 µm wide. MEDULLARY EXCIPULUM of *textura intricata*.  
279 SUBHYMENIUM of *textura prismatica*, individual cells 10–20 µm diam, hyaline, thin-walled.  
280 HAIRS clearly differentiated; marginal hairs stiff, brown to dark brown, of uneven length, 300–  
281 1600 µm long, (20–)30–50 µm wide, 3–8(–13) septate, thick walls, (4–)5–8 µm, apex pointed or  
282 rarely blunt, with a (bi-)tri- to multifurcate rooting base; lateral hairs shorter than marginal hairs,  
283 mostly 150–360 µm, paler brown than marginal hairs, with a simple or bifurcate rooting base,  
284 apex pointed; hyphoid hairs hyaline to pale yellow, 1–2-celled, less than 100 µm long, 14–23 µm  
285 wide. ASCI cylindric, 8-spored, 200–280 × 12–18 µm, apex mostly rounded, about three fifths  
286 occupied with ascospores. ASCOSPORES broadly ellipsoid to ellipsoid, (14–)15.6–18.0(–21) (av.  
287 16.8) µm long, (10–)10.2–11.6(–12) (av. 10.9) µm wide, excluding the height of warts, l/w ratio  
288 (1.40–)1.47–1.64(–1.80) (av. 1.55), containing mostly one large but rarely two or several small  
289 internal guttules; wall ornamentation pustulo-cristate or partially reticulated; warts large, variable  
290 in size and shape, 1–2.5(–3.5) µm wide, 0.8–1.2(–1.5) µm high, isolated or confluent, often  
291 forming short ridges to give a pseudoreticulate pattern; wall not loosening in heated lactic acid.  
292 PARAPHYSES filiform, straight, hyaline, 4–5 septate, 2.5–4.0 µm wide, simple or branched at the

293 base, slightly exceeding the asci; apical cell enlarged to (6–)8–11  $\mu\text{m}$  wide, irregular in width,  
294 often shorter than the cells below, 16–35  $\mu\text{m}$  long.

295 *Specimens examined.* SOUTH KOREA: Gangneung, Eoheul-ri, 1 Jul 2002 (KUS-F50576);  
296 Dongducheon, Mt. Soyo, 6 Sept 2002 (50659); Jeju, Seogwipo, Yeongsil, 13 Oct 2002 (50675).

297 *Habitat.* On damp rotting wood

298 *Notes.* The three Korean collections listed here are close to *S. badio-berbis* having long marginal  
299 hairs, broadly ellipsoid ascospores with pustulo-cristate or partially reticulate ornamentation, but  
300 they have smaller ascospores (15.6–18.0  $\times$  10.2–11.6 vs. 18.8–21.6  $\times$  11.0–12.4  $\mu\text{m}$ ) than that  
301 species. Five *Scutellinia* species have similar morphological characteristics to specimens referred  
302 here to *S. jilinensis*. *Scutellinia chiangmaiensis* T.Schumach. and *S. cubensis* have broader  
303 ascospores (15.3–18.0  $\times$  11.0–13.0 and 15.6–18.5  $\times$  11.2–14.4  $\mu\text{m}$ ) and shorter marginal hair (up  
304 to 950 and 600–1100  $\mu\text{m}$ ) (Schumacher 1990); *S. pennsylvanica* is distinguished by more  
305 conspicuous reticulate pattern on ascospore walls and somewhat larger ascospores (16.2–22.8  $\times$   
306 11.2–13.6  $\mu\text{m}$ ) (Schumacher 1990). The wall ornamentation and size of ascospores are close to *S.*  
307 *fujianensis* J.Z.Cao & J.Moravec (Cao & Moravec 1988), but the latter species differs from the  
308 present specimens in its shorter and narrower marginal hairs of 130–540(–700)  $\times$  10–27  $\mu\text{m}$ ,  
309 higher warts of 2–3.7(–4.5)  $\mu\text{m}$  and in its occurrence on soil. The morphological characteristics  
310 of the present species agree well with *S. jilinensis* (Yu et al. 2000), although its ascospores are  
311 slight broader (10.2–11.6 vs. 10–12.7  $\mu\text{m}$ ) and the warts are more interconnected. *Scutellinia*  
312 *jilinensis* was originally recorded from the Changbai Mountains, also known as the Baekdu  
313 Mountains in Korea, on the border between [North Korea](#) and [China](#). It was also collected on  
314 rotting woods like the Korean specimens. This is the first record of it from Korea, and it seems to  
315 be distributed widely in East Asia, as referred to by Zhuang (2005).

316

317 \* *Scutellinia nigrohirtula* (Svrček) Le Gal, Bull. Soc. Mycol. Fr. 80: 123 (1964)

318 APOTHECIA sessile, discoid, 3–10(–15) mm diam, disc round or undulate, with a distinct margin  
319 densely clothed with dark brown hairs; hymenium reddish to orange when fresh. ECTAL  
320 EXCIPULUM of *textura globulosa* to *textura angularis*, individual cells 30–100  $\mu\text{m}$  diam, towards  
321 the margin elongated. MEDULLARY EXCIPULUM of *textura intricata*, hyphae 6–12  $\mu\text{m}$  wide,  
322 hyaline, thin-walled. SUBHYMENIUM of densely packed, angular, short-celled hyphae. HAIRS not  
323 differentiated; marginal hairs stiff, mostly straight but rarely slightly flexuous, ventricose, brown  
324 to pale brown, 200–420  $\mu\text{m}$  long, 18–30  $\mu\text{m}$  wide, apex pointed or rarely obtuse, 3–6 septate,  
325 thick-walled of up to 8  $\mu\text{m}$ , with a simple or bifurcate base; lateral hairs shorter than marginal  
326 hairs, often flexuous, apex pointed or rarely obtuse, with mostly unbranched rooting bases;  
327 hyphoid hairs were observed. ASCI cylindric, hyaline, 8-spored, (160–)200–260  $\times$  18–23(–28)  
328  $\mu\text{m}$ , apex slightly rounded, about two thirds occupied with ascospores. ASCOSPORES hyaline,  
329 ellipsoid to broadly ellipsoidal, (20.0–)21.7–26.3(–29.0) (av. 24.0)  $\mu\text{m}$  long, (13.5–)14.2–16.0(–

330 16.5) (av. 15.1)  $\mu\text{m}$  wide, l/w ratio (1.35–)1.46–1.67(–1.80) (av. 1.57), containing one or two  
331 large guttules; wall ornamentation verrucose or low pustulo-cristate, composed of small warts,  
332 irregularly distributed, often confluent and forming sinuate line, commonly 0.4–0.8  $\mu\text{m}$  wide but  
333 when interconnected up to 1.5  $\mu\text{m}$ , less than 0.4  $\mu\text{m}$  high; wall not loosening in heated lactic  
334 acid. PARAPHYSES filiform, straight, hyaline, 5–6 septate, 3–4  $\mu\text{m}$  wide, simple or sometimes  
335 branched below, slightly exceeding the asci; apical cell clavate, enlarged to 8–12  $\mu\text{m}$  wide, 30–  
336 40  $\mu\text{m}$  long.

337 *Specimen examined.* SOUTH KOREA: Gangneung, Eoheul-ri, 19 Oct 2001 (KUS-F50377); as  
338 above, 1 Jul 2002 (50584).

339 *Habitat.* On damp rotting woods

340 *Notes.* This is the first record of this species from Korea. The undifferentiated short marginal  
341 hairs and ellipsoidal to broadly ellipsoidal ascospores with verrucose ornamentation are in  
342 agreement with *S. nigrohirtula* as described by Gamundí (1975), Hirsch (1985) and Schumacher  
343 (1990). The short hairs and large ascospores of *S. nigrohirtula* are most like *S. kerguelensis*, but  
344 it is easily distinguishable by a higher l/w ratio of ascospores and somewhat visible spore  
345 sculpturing in profile. *S. nigrohirtula* has ellipsoid ascospores up to 17  $\mu\text{m}$  wide (13.8–16.6  $\mu\text{m}$   
346 in Schumacher (1990), 14–17  $\mu\text{m}$  in Zhuang (1994) and 14–16.5  $\mu\text{m}$  in Hansen & Knudsen  
347 (2000)), while *S. kerguelensis* has broadly ellipsoid to subglobose spores up to 20–22  $\mu\text{m}$   
348 (Schumacher 1979, 1990, Yao & Spooner 1996, Hansen & Knudsen 2000). *Scutellinia*  
349 *nigrohirtula* is often found in boreo-temperate regions of Europe and South America  
350 (Schumacher 1990). The records from Japan (Schumacher 1990) and China (Zhuang 1994,  
351 Zhuang & Yang 2008), as well as Korea (this study) indicate that this species is also commonly  
352 distributed in Asia.

353

354 \* *Scutellinia aff. olivascens* (Cooke) Kuntze, Rev. Gen. Pl. 2: 869 (1891) (FIGS. 1 M-P)

355 APOTHECIA sessile, 3–10(–20) mm diam, discoid, disc round or irregular undulate, with a distinct  
356 margin covered by short blackish brown hairs; hymenium orange to red when fresh. ECTAL  
357 EXCIPULUM of *textura globulosa* to *textura angularis*, individual cells 30–110  $\mu\text{m}$  diam.  
358 MEDULLARY EXCIPULUM of *textura intricata*, hyphae 5–8(–11)  $\mu\text{m}$  wide, hyaline. SUBHYMENIUM  
359 indistinct. HAIRS not differentiated, stiff, densely crowded, brown, 180–480(–850)  $\mu\text{m}$  long, 12–  
360 30(–35)  $\mu\text{m}$  wide, 3–10 septate, with walls 3–5  $\mu\text{m}$  thick, apex pointed or obtuse, base bi- or  
361 trifurcate, distinct, mostly unforked, deeply rooting. ASCI hyaline, cylindric, 8-spored, 200–280  $\times$   
362 14–20  $\mu\text{m}$ , apex slightly flattened, about three fifths occupied with ascospores. ASCOSPORES  
363 ellipsoid, with slightly narrow ends, (20.0–)21.2–24.5(–27.5) (av. 22.8)  $\mu\text{m}$  long, (12.0–)12.5–  
364 14.5(–16.0) (av. 13.5)  $\mu\text{m}$  wide, l/w ratio (1.45–)1.62–1.83(–2.00) (av. 1.73), containing mostly  
365 one or two large but rarely numerous small guttules; wall ornamentation low and irregularly  
366 verrucose or pustulo-cristate; warts irregularly distributed, often confluent and merged, forming

367 crests, variable in shape and size, 0.4–1.0 µm wide, 0.4–0.6(–1.0) µm high; wall not loosening in  
368 heated lactic acid. PARAPHYSES filiform, straight, hyaline, 5–6 septate, 2.5–4 µm wide, simple or  
369 branched at the base, slightly exceeding the asci; apical cell enlarged, clearly clavate, 40–55 µm  
370 long, 8–10(–12) µm wide.

371 *Specimens examined.* SOUTH KOREA: Pyeongchang, Yongpyeong-myeon, Mt. Gaebang, 11 Jul  
372 2002 (KUS-F50624, 50627); Hoengseong, Mt. Cheongtae, 11 Jul 2002 (50625); Hongcheon,  
373 near Yeonhwa Temple, 11 Jun 2007 (51627).

374 *Habitat.* On damp rotting wood

375 *Notes.* This is the first record of *S. olivascens* in Korea. The short hairs and large ascospores are  
376 similar to *S. nigrohirtula* and *S. kerguelensis*, although it has a higher l/w ratio of ascospores.  
377 Additionally, *S. olivascens* is easily distinguished from these two species by the possession of  
378 rare longer hairs (up to 850 µm) and somewhat more visible spore sculpturing. Schumacher  
379 (1990) and Hansen & Knudsen (2000) noted that broad marginal hairs to 45–50 µm could  
380 characterize this species, but the Korean specimens showed narrower ones (up to 35 µm). This  
381 range fits well with the descriptions of *S. ampullacea* and *S. lusatae*, which were synonymised  
382 under *S. olivascens* by Schumacher (1990); for the former species 22–36 µm (Le Gal 1966) and  
383 18–36 µm (Schumacher 1979) and for the latter species 19–26 µm (Gamundí 1956).

384

385 \* *Scutellinia orientalis*, Y.J.Choi, H.D.Shin & Pfister, **sp. nov.** (FIGS. 2)

386 MycoBank MB 801278

387 *Etymology.* This name refers to biogeographical region, Korea and possibly China and Mongolia  
388 where the fungus was collected.

389 APOTHECIA gregarious to scattered, sessile, discoid, 2–5(–7) mm diam, disc rounded or slightly  
390 undulated with a distinct margin covered by blackish brown hairs which are stretched inward and  
391 outward, hymenium orange to reddish orange. ECTAL EXCIPULUM of *textura globulosa* to *textura*  
392 *angularis*, individual cells 30–150 µm diam, hyaline to subhyaline. MEDULLARY EXCIPULUM of  
393 *textura intricata*, hyaline, thin-walled. SUBHYMENIUM of *textura prismatica*. HAIRS slightly  
394 differentiated; marginal hairs stiff, brown to dark brown, of uneven length of (280–)480–1000(–  
395 1500) µm long, 20–35(–42) µm wide, broader at base, thick-walled, 7.5–10 µm, 11–20(–32)  
396 septate, apex pointed, with a bi-, tri- to multifurcate base; lateral hairs shorter, 140–300 µm long,  
397 15–20 µm wide, mostly straight, apex pointed, with mostly bifurcate, but rarely unbranched or  
398 trifurcate rooting base. ASCI cylindric, 8-spored, apex slightly flattened, 180–220 × 13–18 µm,  
399 about two thirds occupied with ascospores. ASCOSPORES broadly ellipsoid to ellipsoid, (16–  
400 )16.9–19.3(–21) (av. 18.1) µm long, (10.5–)11.4–12.6(–13.0) (av. 12.0) µm wide, l/w ratio  
401 (1.35–)1.44–1.58(–1.65) (av. 1.51), containing a single large or several small internal guttules;  
402 wall ornamentation tuberculate; warts irregularly and densely distributed on the surface, 0.3–0.8  
403 µm wide, 0.2–0.4(–0.6) µm high, rounded, isolated but often inter-connected between

404 neighboured ones, especially in immature spores. PARAPHYSES filiform, straight, hyaline, 2.5–4  
405  $\mu\text{m}$  wide, 5–6 septate, simple or branched at the base, exceptionally branched in upper part;  
406 apical cell clavate, 26–54  $\mu\text{m}$  long, 6.5–9  $\mu\text{m}$  wide.

407 *Holotype*. SOUTH KOREA, Pocheon, National Arboretum, on damp rotting wood, 27 Sept  
408 2001, Y.J. Choi & H.D. Shin (KUS-F50264)

409 *Specimens examined*. As above, 29 Aug 2002, Y.J. Choi & H.D. Shin (KUS-F50641).

410 *Habitat*. On damp rotten wood

411 *Notes*. Regarding the tuberculate wall ornamentation of ascospores and uneven length of  
412 marginal hairs, this species is most close to *S. subhirtella* Svr

413 ek and *S. patagonica*. By having much longer and wider marginal hairs with more septa (FIG. 2

414 C&D) and multi-rooted base (FIG. 2 E) the Korea specimens of *S. orientalis* can be easily

415 differentiated from these two species based on the marginal hairs of 150–600  $\times$  15–30  $\mu\text{m}$

416 (Svrček 1971) and 200–1050  $\times$  15–48  $\mu\text{m}$  (Schumacher 1990), respectively. Additionally, the

417 ascospores are somewhat smaller, and the warts are more often connected (FIG. 2 F–J; see Fig. 1.

418 S&T for *S. patagonica*). Substrate differences also offer evidence for discriminating between *S.*

419 *subhirtella* and the present species. *Scutellinia subhirtella* is mostly found on humid soil or very

420 rarely on plant or surrounding wood debris (Schumacher 1979, 1990, Hansen & Knudsen 2000),

421 but the collections of *S. orientalis* were made on damp wood, that was not in direct contact with

422 the soil. Sequence comparisons show that *S. orientalis* and two specimens of *S. subhirtella* from

423 Europe are phylogenetically distant thus adding support for the recognition of this species. The

424 specimens used by us in phylogenetic comparisons and identified as *S. subhirtella* were those

425 included in Perry et al. (2007) and one that was from TAAM redetermined by us as *S.*

426 *subhirtella*.

427 In China and Mongolia, a few studies (Zhuang 1994, 1997, Zhuang & Wang 1998b, Yu et al.

428 2000) found several *S. subhirtella*-like specimens occurring on the rotten wood. Interestingly,

429 Zhuang (1994) and Yu et al. (2000) also noted that some specimens possess exceptionally long

430 marginal hairs (up to 1600  $\mu\text{m}$ ), that are much longer than other *Scutellinia* species with

431 tuberculated ascospores and those of *S. subhirtella*, but are similar to *S. orientalis*. Yu et al.

432 (2000) temporarily treated it as *S. cfr. subhirtella*. The Chinese and Mongolian collections seem

433 to be identical to those from Korea.

434

435 \* *Scutellinia aff. patagonica* (Rehm) Gamundí, Lilloa 30: 318 (1960) (FIGS. 1 Q–T)

436 APOTHECIA scattered to gregarious, sessile, discoid, 3–8(–14) mm diam, disc round or slightly

437 undulate, with a distinct margin densely clothed by blackish brown hairs of uneven length;

438 hymenium orange or reddish orange when fresh. ECTAL EXCIPULUM of *textura globulosa* to

439 *textura angularis*, individual cells 45–130  $\mu\text{m}$  diam, towards the margin elongated, outer most

440 cells up to 35  $\mu\text{m}$  with hyaline walls. MEDULLARY EXCIPULUM of densely interwoven *textura*

441 *intricata*, hyphae 6–9 µm wide, hyaline, thin-walled. SUBHYMENIUM of dense *textura prismatica*.  
442 HAIRS not or slightly differentiated; marginal hairs stiff or slightly flexuous, ventricose to broad  
443 at base, dark brown to brown, uneven 150–800(–1000) µm long, 20–40(–45) µm wide, apex  
444 pointed or rarely blunt, 1–6 septate, thick-walled of 3.5–6 µm, with mostly a bifurcate,  
445 prominent deeply rooting base; lateral hairs shorter than marginal hairs, 80–150(–300) µm,  
446 ventricose, flexuous, 16–28 µm wide, apex pointed or rarely blunt, with mostly unbranched but  
447 rarely bifurcate bases. ASCI cylindric, 8-spored, (190–)220–260 × (14–)16–20 µm, apex rounded,  
448 about three fifths occupied with ascospores. ASCOSPORES ellipsoid to broadly ellipsoid, (17.5–  
449 )18.7–21.3(–23.5) (av. 20) µm long, (11–)11.6–13.5(–14.5) (av. 12.8) µm wide, l/w ratio (1.35–  
450 )1.50–1.67(–1.75) (av. 1.59), containing 1–2 large or several small guttules; wall ornamentation  
451 tuberculate; warts evenly distributed on the spore surface but variable in size 0.4–1.0(–2.0) µm  
452 wide, 0.2–1.2 µm high, mostly isolated but rarely connected between neighboured ones when  
453 ascospores are collapsed; wall not loosening in heated lactic acid. PARAPHYSES filiform, straight,  
454 hyaline, 5–6 septate, 3–4 µm wide, containing orange or yellowish orange pigment granules  
455 throughout when fresh, simple or sometimes branched below, slightly exceeding the asci; apical  
456 cell clavate, 20–46 µm long, 7–10 µm wide.

457 *Specimens examined*. SOUTH KOREA: Donghae, Cheongok-dong, near Donghae Gymnasium,  
458 29 Aug 2001 (KUS-F50193); *as above*, 20 Oct 2001 (50383); *as above*, 7 Jun 2002 (50547); *as*  
459 *above*, 30 Aug 2002 (50646); Chungju, Sangmo-myon, 13 Jun 2002 (50558).

460 *Habitat*. On mostly humid soil but very rarely on rotten wood in areas of fruiting.

461 *Notes*. *Scutellinia patagonica* is mainly recognized by medium sized rooting hairs, broadly  
462 ellipsoidal ascospores, distinctly tuberculate ornamentation and rounded to angular warts on the  
463 ascospore wall surface (Schumacher 1979 1990). Morphological characteristics of the Korean  
464 specimens are mostly in agreement with other descriptions of this species, but the ascospores (av.  
465 12.8 µm) are somewhat narrower, 13.4–18.5 µm in Schumacher (1990), 14.4–18.6 µm in  
466 (Gamundí 1975) and 13.8–18.5 µm in Hansen & Knudsen (2000). The ellipsoidal ascospores are  
467 the most close in size to those of *S. subhirtella*, another tuberculate-walled species. The spores  
468 of that species are 12–14(–15) µm wide in Svrček (1971) and 12.0–14.8 µm in Schumacher  
469 (1990). Variable sized warts (generally 0.8 µm, but occasionally 2.0 µm wide), a typical  
470 character of *S. patagonica*, were often observed in the Korean specimens (see Fig. 1. S & T).  
471 This is quite different than *S. subhirtella* that has even small warts usually less than 1.2 µm wide.  
472 The Korean specimens might be treated an undescribed species, but we treat it here as a member  
473 of a complex of taxa around *S. patagonica*. Our expanded molecular phylogenetic study of  
474 *Scutellinia* world-wide (in prep.) included specimens identified as *S. patagonica* by Schumacher.  
475 The collections reported here from Korea are most close to those collections. The exact identities  
476 of these taxa remain to be fully resolved.

477

478 *Scutellinia scutellata* (L.) Lambotte, Fl. Mycol. Belge, Suppl. 1: 299 (1887) (FIGS. 1 U-X)  
479 APOTHECIA scattered to gregarious, sessile, 2–10(–17) mm diam, discoid or slightly concave  
480 with a distinct margin, disc mostly round but sometimes undulate at the margin, densely covered  
481 with brownish black hairs of uneven length; hymenium orange or reddish orange when fresh.  
482 ECTAL EXCIPULUM of *textura globulosa* to *textura angularis*, cells 20–95 µm diam, toward the  
483 margin and in the outermost excipulum becoming elongated and clavate with hyaline to  
484 subhyaline walls. MEDULLARY EXCIPULUM of dense *textura intricata*, cells 5–13 µm wide,  
485 hyaline, thin-walled. SUBHYMENIUM indistinct. HAIRS clearly differentiated; marginal hairs stiff,  
486 rarely bent, brown to dark brown, of uneven length, 400–1000(–1800) µm long, 22–45 µm wide,  
487 broader toward the base, apex pointed or rarely blunt, 8–15(–24) septate, thick-walled of 3.5–7.5  
488 µm, with mostly a bi- or trifurcate base; lateral hairs shorter than marginal hairs, flexuous, paler  
489 brown or hyaline, 100–560 µm long, 12–26 µm wide, often constricted at the septa, apex pointed  
490 or sometimes blunt, base mostly unbranched but rarely bi-trifurcate; superficial hairs interspersed  
491 among the marginal hairs, variable in shape, clavate or bulbous, pale yellowish to hyaline, 30–  
492 100 µm long, 0–2 septate, apex rounded, with simple base. ASCI cylindric, 8-spored, (160–)200–  
493 240 × 12–15(–18) µm, apex somewhat flattened, about two thirds occupied with ascospores.  
494 ASCOSPORES ellipsoid, variable in shape and size, (16.5–)17.4–20.2(–24) (av. 18.8) µm long,  
495 (10.4–)10.7–12.2(–14) (av. 11.5) µm wide, l/w ratio (1.45–)1.53–1.70(–1.75) (av. 1.62), with  
496 obtuse to pointed ends, containing one or two large or several small guttules; spore sculpturing  
497 composed of minute verrucose warts, 0.2–0.8(–1.2) µm wide, mostly less than 0.5 µm high,  
498 often confluent, forming an incomplete reticulate; wall not loosening in heated lactic acid.  
499 PARAPHYSES filiform, straight, hyaline, 5–6 septate, 2.5–3 µm wide, containing orange or  
500 yellowish orange pigment granules throughout when fresh, simple or rarely branched at the base,  
501 slightly exceeding the asci; apical cell clavate, 7–10 µm wide, generally shorter than cells below,  
502 (16–)25–40 µm long.

503 *Specimens examined.* SOUTH KOREA: Gangneung, Eoheul-ri, Daegwanryeong Recreational  
504 Forest, 6 Jun 2002 (KUS-F 50543); Gangneung, Eoheul-ri, 1 Jul 2002 (50577, 50580, 50590);  
505 Pocheon, National Arboretum, 24 Jun 2002 (50394); as above, 8 May 2002 (50494); as above, 4  
506 Jul 2002 (50602); Nonsan, Gyeryongsan National Park, near Gab Temple, 17 May 2002 (50519);  
507 Wonju, Chiaksan National Park, 3 Jun 2002 (50521, 50522, 50523); as above, 27 Aug 2004  
508 (50722); as above, 30 Sept 2005 (50902); Pyeongchang, Korean Botanic Garden, 6 Jun 2002  
509 (50533); Pyeongchang, Yongpyeong-myeon, Mt. Gaebang, 11 Jul 2002 (50604, 50626);  
510 Gangneung, Eoheul-ri, 6 Jun 2002 (50542); as above, 6 Jun 2002 (50546); as above, 1 Jul 2002  
511 (50579, 50581, 50591, 50592); Gangneung, Eoheul-ri, Daegwanryeong Recreational Forest, 7  
512 Jun 2002 (50548); Hongcheon, Hwajeon-ri, 24 Sept 2005 (50893); Hoengseong, Hoengseong  
513 Recreational Forest, 22 Jun 2006 (51122); Inje, Seoraksan National Park, near Baekdam Temple,  
514 28 Sept 2006 (51405); Chuncheon, Goeun-ri, 11 Nov 2005 (50976).

515 *Habitat.* on damp rotting wood

516 *Notes.* Lee & Cho (1975) and Jung (1995) previously recorded this species in Korea. The long  
517 marginal hairs and the small ellipsoidal ascospores with verrucose ornamentation characterize  
518 this species. The morphological characteristics, geographic distribution and substrates are too  
519 similar to *S. crinita* to separate them by the species boundaries of Schumacher (1990).  
520 Previously, the species delimitation has been highly controversial among various authors  
521 (Denison 1959, Le Gal 1966, Svrček 1971, Moravec 1978, Kullman 1982, Schumacher 1990,  
522 Korf & Zhuang 1991, Zhuang 1994). Later Yao & Spooner (1996) suggested that *S. crinita*  
523 should be considered a synonym of *S. scutellata*. In the Korean collections, the ascospores with  
524 broadly rounded ends or slightly pointed ends were simultaneously observed in a single  
525 apothecium, although it believed that this character serves to differentiate *S. scutellata* and *S.*  
526 *crinita*.

527 Among about a hundred collections examined, 31 specimens are morphologically similar to *S.*  
528 *scutellata*, suggesting it is evidently common all over South Korea, but within them, an  
529 infraspecific morphological variation was found. Five specimens (50543, 50577, 50580, 50590,  
530 50626) possess many superficial brown to yellowish hairs and thick wall of 3.5–4  $\mu\text{m}$ , but in  
531 remaining specimens such hairs are rarely present and walls are thin, less than 2  $\mu\text{m}$ . Also, under  
532 the light microscope, somewhat higher warts of ascospores could be also discerned the five  
533 collections from other specimens with minutely warted ascospores. Interestingly, a specimen  
534 KUS-F50519, has remarkably large apothecia of 5–12(–20) mm diam, although other  
535 morphological characteristics agree with *S. scutellata*. We treat all Korean specimens at least  
536 temporarily as members of the *S. scutellata* complex.

537

538 \* *Scutellinia setosa* (Nees) Kuntze, Rev. Gen. Pl. 2: 869 (1891)

539 APOTHECIA sessile, gregarious, discoid, 1–2(–3) mm diam, disc round, with an indistinct margin  
540 covered by short, dark brown hairs; hymenium light orange to yellowish when fresh. ECTAL  
541 EXCIPULUM of *textura globulosa* to *angularis*, individual cells 20–80  $\mu\text{m}$  diam, hyaline to  
542 subhyaline, elongated toward the margin. MEDULLARY EXCIPULUM of *textura intricata*, hyaline.  
543 SUBHYMENIUM thin, distinct. HAIRS not differentiated, densely crowded, mostly straight, brown  
544 to dark brown, (200–)400–800(–1000)  $\mu\text{m}$  long, 18–32  $\mu\text{m}$  wide, 3–6 septate, thick-walled of  
545 4.5–7(–8)  $\mu\text{m}$ , apex pointed or sometimes obtuse, with a bi- to multi-furcate base. ASCI hyaline,  
546 cylindric, 8-spored, 130–230  $\times$  (10–)12–16  $\mu\text{m}$ , apex rounded, with short base. ASCOSPORES  
547 ellipsoid to oblong, (17.0–)18.1–20(–22) (av. 19.1)  $\mu\text{m}$  long, (9–)10.0–12.1(–13.5) (av. 11.1)  $\mu\text{m}$   
548 wide, l/w ratio (1.50–)1.60–1.75(–1.80) (av. 1.67), containing many small guttules; ascospore  
549 walls smooth; wall not loosening in heated lactic acid. PARAPHYSES filiform, straight, hyaline, 4–  
550 6 septate, 2–3  $\mu\text{m}$  wide, not or branched 1–2 times in lower part, even or slightly longer than the  
551 asci; apical cell very slightly clavate, 4–7(–8)  $\mu\text{m}$  wide, 30–52  $\mu\text{m}$  long.



552 *Specimen examined.* SOUTH KOREA: Gangneung, Eoheul-ri, 19 Oct 2001 (KUS-F50363).

553 *Habitat.* On damp rotting wood

554 *Notes.* This species is easily recognized by small apothecia gregariously distributed on damp  
555 rotting wood and the smooth ascospore walls. The Korean specimen is well in agreement with a  
556 description of *S. setosa* by Schumacher (1990). This species was often regarded to be identical  
557 with *S. erinaceus* (Schwein.) Kuntze or *S. setosissima* LeGal. Earlier authors (Denison 1959,  
558 Svrček 1971, 1981) wrongly used the name *S. erinaceus* for the specimens with smooth  
559 ascospores, possibly representing *S. setosa*, as LeGal (1966, 1968) and Schumacher (1990)  
560 pointed out that *S. erinaceus* has a coarsely verrucose-spored taxon. *Scutellinia setosissima*  
561 appears smooth under optic microscopy, but this species indeed has minutely verrucose  
562 ascospores when they are observed under SEM (Schumacher 1990).

563 During studies between 2001 and 2008, this species only was collected once; thus, it seems to be  
564 rare in Korea. The presence of *S. setosa* in Asian regions has not been confirmed. When Zhuang  
565 (1994) examined the specimens referred to this species collected from China, she found it to be  
566 different than *S. setosa* s.str. from North America because of the minute makings on ascospore  
567 surface. The collections were later treated as a new species, *S. sinosetosa* (Zhuang & Wang  
568 1998b). To verify our identification, a sequence comparison of rDNA was performed to compare  
569 the Korean and North American specimens. This has supported the identity of the Korean  
570 specimens as *S. setosa*. Therefore, this is considered new to Asia.

571

572

### 573 **Key to the species of the genus *Scutellinia* in Korea**

- 574 1. Ascospores with smooth wall..... *S. setosa*  
575 1. Ascospores with visible wall ornamentation ..... 2  
576 2. Ascospores subglobose to globose, with aculeolate-reticulate ornamentation ... *S. jejuensis*  
577 2. Ascospores ellipsoidal to broadly ellipsoidal, with confluent or tuberculate ornamentation  
578 ..... 3  
579 3. Marginal hairs often more than 800 µm long, differentiated from lateral hairs ..... 4  
580 3. Marginal hairs less than 800 µm long, not differentiated from lateral hairs ..... 7  
581 4. Wall ornamentation tuberculate; warts mostly isolated but rarely interconnected ..... *S.*  
582 *orientalis*  
583 4. Wall ornamentation verrucose or pustule-cristate, warts often confluent ..... 5  
584 5. Warts on wall surface less than 1.2 µm high ..... *S. scutellata* complex  
585 5. Warts on wall surface more than 1.2 µm high ..... 6  
586 6. Ascospores broadly ellipsoidal, less than 18 x 11 µm; warts more often confluent .... *S.*  
587 *jilinsensis*  
588 6. Ascospores ellipsoidal, more than 18 x 11 µm ..... 8

- 589 7. Ascospores av. 20.2 x 11.7  $\mu\text{m}$ ; warts often more than 1.2  $\mu\text{m}$  high; apical cell of paraphyses  
590 spadiceiform and uniform in width ..... *S. badio-berbis*  
591 7. Ascospores av. 18.3 x 10.7  $\mu\text{m}$ ; warts mostly less than 1.2  $\mu\text{m}$  high; apical cell of paraphyses  
592 sinuous and not enlarged ..... *S. colensoi*  
593 8. Marginal hairs mostly 400–800  $\mu\text{m}$  ..... 9  
594 8. Marginal hairs less than 400  $\mu\text{m}$  ..... 10  
595 9. Wall ornamentation tuberculate; warts rounded, isolated ..... *S. aff.*  
596 *patagonica*  
597 9. Wall ornamentation verrucose; warts variable in shape, often confluent ..... *S. aff.*  
598 *olivascens*  
599 10. Marginal hairs mostly less than 300  $\mu\text{m}$ ; ascospores less than 22  $\mu\text{m}$  long ..... *S.*  
600 *ahmadiopsis*  
601 10. Marginal hairs often longer than 300  $\mu\text{m}$ ; ascospores more than 22  $\mu\text{m}$  long ..... *S.*  
602 *nigrohirtula*

603  
604

605 **Excluded species and questionable records**

606 *Scutellinia erinaceus* (Schwein.) Kuntze, Rev. Gen. Pl. 2: 869 (1891)

607 Cho & Lee (2002) recorded this species for the first time in Korea, but the record is questionable.  
608 They did not describe the wall ornamentation of the ascospores, one of the most important  
609 features for species delimitation in *Scutellinia*. Besides, the diameter of apothecia, size and shape  
610 of ascospores and occurrence on wood are more similar to those characters as described for *S.*  
611 *setosa* than for *S. erinaceus*. Schumacher (1990) describes *S. erinaceus* with apothecia of 5–6  
612 mm diam, 2–3 mm wider than in the Korean material. The ascospore size (19.1–24.6 x 13.0–16.8  
613  $\mu\text{m}$ ) of *S. erinaceus* is also clearly larger than those from Korea (17.5–20 x 10–12.5  $\mu\text{m}$ ). In  
614 addition, this species has been found only in USA (Schumacher 1990), and the specimens  
615 reported from China of *S. erinaceus* were indeed morphologically near to *S. subhirtella* (see  
616 Zhuang 1994).

617

618 *Scutellinia kerguelensis* (Berk.) Kuntze, Rev. Gen. Pl. 2: 869 (1891)

619 Previously Park *et al.* (1994) and Jung (1995) recorded this species with significantly smaller  
620 ascospores (17.5–20 x 11–12.5  $\mu\text{m}$  and 18–24.5 x 11–13.5  $\mu\text{m}$ , respectively) than described by  
621 Schumacher (1990) (21.8–28.2 x 14.4–21.8  $\mu\text{m}$ ). Interestingly, Zhuang (1994, 2005) noted that  
622 *S. kerguelensis* from China has smaller ascospores (19–24 x 12–15  $\mu\text{m}$ ), for which a new variety,  
623 *S. kerguelensis* var. *microspora*, was introduced (Zhuang 2005). Morphological characteristics of  
624 the Korean specimens of *S. kerguelensis* (Park *et al.* 1994, Jung 1995) agree well with the  
625 description of the new variety. The variety was found in China (Zhuang & Korf 1989, Zhuang

626 1994, 2005) and similarly *S. kerguelensis* reported from India (Waraitch 1977) also has smaller  
627 ascospores of 17.5–20.5 x 10–13 µm. This suggest that this variety might be common in Asia  
628 countries.

629

630 *Scutellinia umbrorum* (Fr.) Lambotte, Fl. Mycol. Belge, Suppl. 1: 300 (1887)

631 This species has been reported just once in Korea by Cho et al. (1997). But, the small ascospores  
632 of 16–19 x 11–12 µm reported and fine wall ornamentation differ from those of *S. umbrorum*  
633 (16.8–25.2 x 12.7–17.2 µm and clearly tuberculate) (see Schumacher 1979, 1990). Moreover,  
634 this species was mainly found on soil and geographically is limited to Europe, but the Korean  
635 specimen was collected from wet rotten wood.

636

637 *Scutellinia pseudoumbrarum* J. Moravec, Česká Mykol. 25: 199 (1971)

638 This species is now considered a synonym of *S. umbrorum* (Schumacher 1990). Cho et al. (1997)  
639 recorded *S. pseudoumbrarum* for the first time in Korea, but their identification is questionable.  
640 In their line drawing, the ascospores possess aculeolate-reticulate wall sculpturing, while both *S.*  
641 *pseudoumbrarum* and *S. umbrorum* have remarkably tuberculated spores (Moravec 1971,  
642 Kullman 1982, Schumacher 1990). The description of Cho et al. (1997) suggests that their  
643 fungus is more similar to another Korean species, *S. jejuensis* (Han et al. 2010), in possessing  
644 aculeolate-reticulate ascospore ornamentation and its occurrence on soil in the southern regions of  
645 Korea.

646

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650

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#### 758 FIGURE CAPTIONS

759

760 Fig. 1. Ascomata and ascospores (SEM) of *Scutellinia* species recognized in Korea. A–D: *S.*  
761 *ahmadiopsis*, E–H: *S. badio-berbis*, I–L: *S. colensoi*, M–P: *S. aff. olivascens*, Q–T: *S. aff.*  
762 *patagonica*, U–X: *S. scutellata*. First and second column: ascomata, third and fourth columns:  
763 ascospores (scale bar = 10 µm).

764

765 Fig. 2. *Scutellinia orientalis* (KUS-F50264 - holotype). A–B: fresh apothecia on damp wood, C:  
766 dried apothecia with long marginal hairs, D: marginal and lateral hairs, E: multi-furcated base of  
767 marginal hairs. F–H: broadly ellipsoidal to ellipsoidal ascospores sculpturing tuberculate  
768 ornamentations stained on Cotton Blue in lactic acid, note on mostly isolated but rarely  
769 interconnected tubercles, F–H: ascospores in SEM. Scale bars = 5 mm for A–C, 500 µm for D,  
770 20 µm for E, and 10 µm for F–J.

771