

## Taxonomic Studies on *Cercospora* and Allied Genera in Korea (XII)

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### 한국산 *Cercospora* 및 관련 속의 분류학적 연구(XII)

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**ABSTRACT:** This paper is the twelfth contribution towards taxonomic studies on *Cercospora* and allied genera, and contains ten species of Korean cercosporoid fungi; viz., *Cercospora brunckii*, *C. deutziae*, *C. granuliformis*, *C. hostae*, *Mycovellosiella natrassii*, *Pseudocercospora chrysanthemicola*, *P. geicola*, *P. mississippiensis*, *P. viburni-cylindrici*, and *Ramularia moehringiae*. Morphological characteristics of taxonomic value are described and illustrated for these species to contribute towards a mycological monograph of Korean cercosporoid fungi.

**KEYWORDS:** *Cercospora*, *Mycovellosiella*, *Pseudocercospora*, *Ramularia*, Monograph, Korea

One hundred and ten cercosporoid fungi from Korea, comprising 44 *Cercospora*, one *Cercosporella*, one *Distocercospora*, three *Mycovellosiella*, two *Neoramularia*, five *Passalora*, one *Phaeoisariopsis*, one *Phacellium*, two *Phaeoramularia*, 33 *Pseudocercospora*, four *Pseudocercosporella*, 12 *Ramularia*, and one *Stenella* species were treated in previous contributions of this series (Kim and Shin, 1998a-d, 1999a-g). The present paper deals with ten additional cercosporoid taxa from Korea, namely four *Cercospora*, one *Mycovellosiella*, four *Pseudocercospora*, and one *Ramularia* species that are described and illustrated. The specimens examined are preserved at the mycological herbarium (SMK) of the Department of Agricultural Biology, Korea University, Seoul, Korea.

### Descriptions

1. *Cercospora brunckii* Ellis & Galloway, J. Mycol. 6: 33 (1890) Fig. 1  
= *Cercospora pelargonii* Mend., Philipp. J. Sci. 75: 176 (1941)

**Leaf spots** amphigenous, scattered, circular to irregular, 1~5 mm diam., at first appearing light brown to tan with raised dark brown border lines, later centre becoming greyish brown to dingy grey with somewhat dark brown margins. **Caespituli** amphigenous, but mostly hypophyllous, sometimes minute dots visible when viewed under a hand lens. **Mycelium** internal, hyphae septate, branched, hyaline,

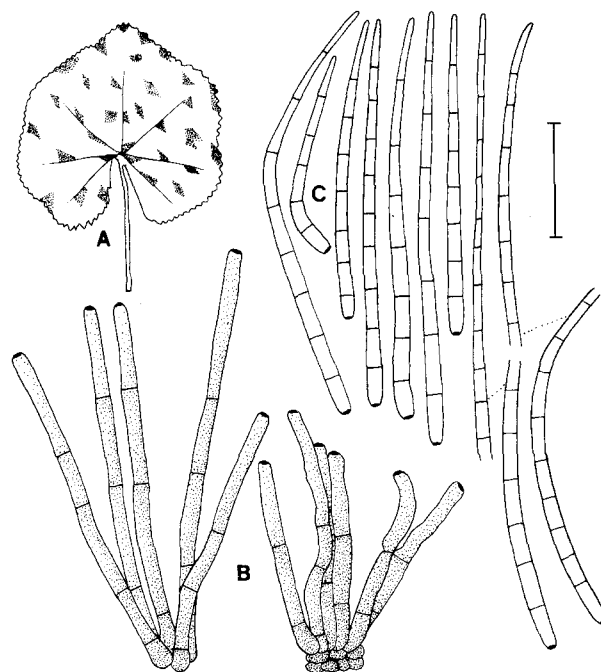


Fig. 1. *Cercospora brunckii*. (A) Leaf spots on the upper leaf surface of *Pelargonium inquinans* (0.7 $\times$ ) (B) Conidiophores. (C) Conidia. Bar = 30  $\mu$ m.

2.0~3.5  $\mu$ m wide. **Stromata** lacking to small, rudimentary to slightly developed, composed of a few swollen hyphal cells. **Conidiophores** 2~15 in a loose fascicle, emerging through stomata or occasionally erumpent through the cuticle, olivaceous brown throughout or paler towards the apex, uniform in width, straight to slightly curved, not geniculate or rarely once geniculate, not branched, truncate to

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subtruncate at the apex, 2~3-septate,  $50\sim150(\sim200)\times3.0\sim4.5\ \mu\text{m}$ ; conidial scars large,  $2.0\sim2.5\ \mu\text{m}$  wide, conspicuous, apical or on shoulders of conidiogenous cells caused by geniculation. **Conidia** solitary, acicular to obclavate, straight to moderately curved, hyaline, 5~20-septate, non-constricted at the septa, acute to subacute at the apex, truncate at the base, much variable in length,  $56\sim290\times3.0\sim4.5\ \mu\text{m}$ ; hilum conspicuously thickened, darkened, and non-protuberant.

**Habitat:** On living leaves of *Pelargonium inquinans* Ait. (Geraniaceae).

**Specimen examined:** SMK 14449 (17 X 1997, Suwon).

**Distribution:** Korea, Philippine, Russia, and USA.

**Notes:** This is the first record of this species from Korea. The cercosporoid fungi on *Geranium* and *Pelargonium* are very complicated. Chupp (1954) listed several *Cercospora* species on *Geranium* and *Pelargonium*. However, *Cercospora brunckii* is the only species comparable with the present collection. He reported *C. brunckii* on *Pelargonium* spp.: Conidiophores  $50\sim200\times4.0\sim5.5\ \mu\text{m}$ ; conidia mostly acicular, truncate at the base,  $50\sim150\times2.5\sim5.0\ \mu\text{m}$ . *C. geranii-sanguinei* Henn. and *C. geranii* Kellerm. & Swingle were revised and redescribed as *Phaeoramularia minutissima* (Desm.) U. Braun (1992) and *Pseudocercospora geraniicola* U. Braun (1993), respectively. *C. ithacensis* Chupp on *Geranium maculatum* is similar to the Korean collection, but this is somewhat different in having much shorter conidiophores ( $10\sim30\ \mu\text{m}$  long) and cylindrical, catenate conidia with short obconic bases. Owing to unthickened conidial scars, Braun (1991) placed *C. ithacensis* in *Pseudocercospora* and discussed the identity of *Pseudocercospora geranii* (W.B. Cooke & C.G. Shaw) U. Braun and *C. ithacensis*. The conidial scars are, however, not quite inconspicuous and the conidia are often catenate. Hence, he (in Braun and Melnik, 1997) referred these species to *Pseudophaeoramularia geranii* (W.B. Cooke & C.G. Shaw) U. Braun. Therefore, the Korean collection can only be referred to *C. brunckii*.

## 2. *Cercospora deutziae* Ellis & Everh. J. Mycol. 4: 5 (1888) Fig. 2

**Leaf spots** amphigenous, scattered to confluent, usually vein-limited, angular to irregular, 2~8 mm diam., or up to 15 mm when coalescing, tan to brown with dark brown margins on the upper surface, pale brown to greyish brown with brown border lines on the lower surface, centre becoming grey to greyish white with dark to reddish brown margins. **Caespituli** amphigenous. **Mycelium** internal, hyphae septate, branched, hyaline, 2~3  $\mu\text{m}$  wide. **Stromata** small to medium, slightly to moderately developed, subglobular to angular, brown to dark brown, 15~35  $\mu\text{m}$

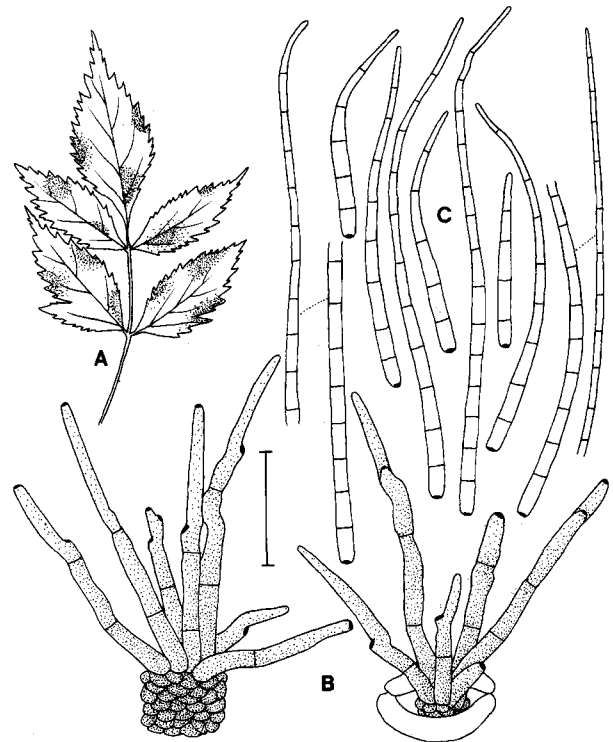


Fig. 2. *Cercospora deutziae*. (A) Leaf spots on the upper leaf surface of *Astilbe chinensis* var. *davidii* (0.6 $\times$ ). (B) Conidiophores. (C) Conidia. Bar = 30  $\mu\text{m}$ .

diam., composed of several swollen, brown hyphal cells. **Conidiophores** 3~15 in a loose fascicle, arising from substomatal stomata or erumpent through the cuticle, olivaceous brown or paler towards the upper portion, irregular in width, straight to undulate, 1~3 times mildly geniculate, not branched, 0~2-septate, non-constricted at the septa,  $12\sim100(\sim150)\times3.0\sim5.5\ \mu\text{m}$ ; conidial scars, medium,  $1.5\sim2.5\ \mu\text{m}$  wide, conspicuous, apical or on shoulders of conidiogenous cells caused by geniculation. **Conidia** solitary, acicular to filiform or somewhat obclavate in shorter ones, hyaline, straight to mildly curved, 4~20-septate, non-constricted at the septa, subacute to subobtuse at the apex, truncate at the base,  $50\sim216(\sim300)\times2.5\sim4.5\ \mu\text{m}$ ; hilum conspicuously thickened, darkened, and non-protuberant.

**Habitat:** On living leaves of *Astilbe chinensis* var. *davidii* Fr. (Saxifragaceae).

**Specimens examined:** SMK 14803 (19 VIII 1998, Chunchon), 15020 (4 IX 1998, Seoul).

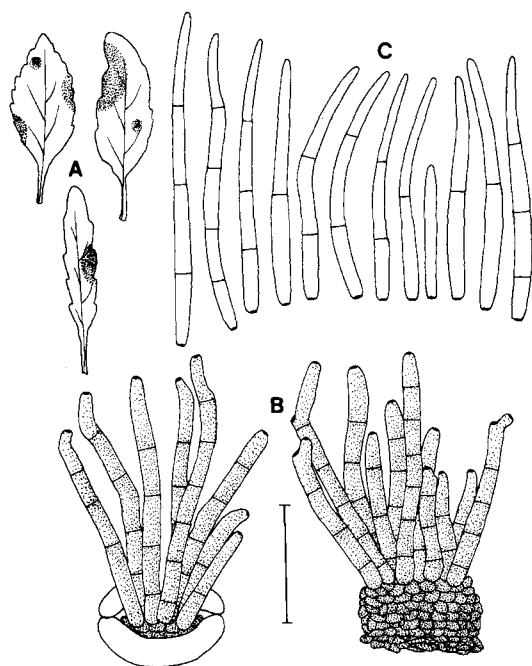
**Distribution:** Japan, Korea, and USA.

**Notes:** This is the first record of this species from Korea. A literature review reveals only one species of *Cercospora* was described on *Astilbe*. But *Cercospora astibes* Togashi is clearly different from the Korean collection by having hypophyllous fructification, very shorter (15~40  $\mu\text{m}$  long) conidiophores, and obclavate-cylindric and very

much shorter (17–42  $\mu\text{m}$  long) conidia. Several species of *Cercospora* were listed on the host family, Saxifragaceae. *C. deutziae* is the only species comparable with the present collection. Chupp (1954) provided the following morphological data of North American material for *C. deutziae* on *Deutzia gracilis* and *D. scabra*: Conidiophores fasciculate, uniform in colour, 40–200  $\times$  3.5–6.0  $\mu\text{m}$ ; conidia acicular, 50–125(–300)  $\times$  2.5–4.0  $\mu\text{m}$ . Though the conidiophores of Korean collection are shorter, the present collections are very close to *D. deutziae*. However, Braun (personal communication, 1999) treated this fungus as a synonym of *C. apii* s. lat. (Ellis, 1971; Pons and Sutton, 1988). *C. apii* s. lat. is a polyphageous species with very wide host range, occurring on many hosts of the Apiaceae, Fabaceae, Solanaceae, Malvaceae, Hydrangeaceae, etc. Furthermore the whole complex is very complicated, and cercosporoid fungi, although morphologically similar, are highly host specific. Hence, at present, it seems to be the best way to treat *C. apii* as occurring on *Apium* only.

**3. *Cercospora granuliformis*** Ellis & Holway, J. Mycol. 1: 6 (1885) Fig. 3  
= *Cercospora sororiae* Tehon, Mycologia 40: 323 (1948)

**Leaf spots** amphigenous, scattered, distinct, subcircular to irregular, large, 4–10 mm diam., at first appearing as indistinct discolourations, later becoming tan to dingy grey



**Fig. 3.** *Cercospora granuliformis*. (A) Leaf spots on the upper leaf surface of *Viola tricolor* (0.7 $\times$ ). (B) Conidiophores. (C) Conidia. Bar = 30  $\mu\text{m}$ .

without distinct margins, finally centre turning greyish brown to greyish white with or without distinct border lines. **Caespituli** amphigenous, punctiform to subeffuse, minute black dots visible when view under a hand lens. **Mycelium** internal, hyphae septate, branched, hyaline, 2.5–4.0  $\mu\text{m}$ . Stromata small to large, dark brown to brown, subglobular to globular, 15–35  $\mu\text{m}$  diam., composed of several swollen, brown hyphal cells. **Conidiophores** 5–20 arranged in a loose to dense fascicle, arising from stromata, emerging through the stomata or erumpent through the cuticle, olivaceous brown to brown or paler towards the apex, straight to slightly curved, 0–1 time geniculate, not branched, 1–6-septate, 10–70  $\times$  3.0–5.0  $\mu\text{m}$ ; conidial scars large, 1.5–2.5  $\mu\text{m}$  wide, conspicuous, apical or on shoulders of conidiogenous cells caused by geniculation. **Conidia** solitary, obclavate to subcylindric-obclavate, straight to mildly curved, hyaline to subhyaline, (0–)1–3 (–4)-septate, non-constricted at the septa, subobtuse to obtuse at the apex, truncate to subtruncate at the base, 20–90  $\times$  3.0–4.0  $\mu\text{m}$ ; hilum conspicuously thickened, darkened, occasionally somewhat refractive, and non-protuberant.

**Habitat:** On living leaves of *Viola tricolor* L. (Violaceae).

**Specimen examined:** SMK 16285 (12 VII 1999, Seoul).

**Distribution:** Brazil, China, Korea, and USA.

**Notes:** This is the first record of this species from Korea. Several *Cercospora* spp. were recorded on the genus *Viola*, viz., *C. granuliformis*, *C. marcospora* Osterw., *C. murina* Ellis & Kellerm., and *C. violae* Sacc. *C. murina* is easily distinguished from the present collection by having hypophyllous fruiting, non-fasciculate and branched conidiophores, and pigmented conidia. *C. marcospora* on pansy (*V. tricolor*) reported from North America possesses hyaline conidia with appendage, and is a synonym of *Mycocentrospora acerina* (Hartig) Deighton. *C. violae* reported in a previous paper (Kim and Shin, 1999b) is clearly different by having acicular conidia. *C. granuliformis* is the only species comparable with the present fungus. Although North American material (Chupp, 1954) of *C. granuliformis* possesses somewhat shorter conidiophores (10–40  $\mu\text{m}$  long) and conidia (15–60  $\mu\text{m}$  long), these differences are within the variation of the species, and are little taxonomic value. Therefore, the Korean collection is referred to *C. granuliformis*.

**4. *Cercospora hostae*** Hori, Ann. Phytopath. Soc. Japan 1: 66 (1921) Fig. 4

**Leaf spots** amphigenous, scattered to confluent, 2–10 mm diam., or up to 20 mm when coalescing, at first appearing greyish brown to brown on the upper surface, later becoming greyish brown with reddish brown border

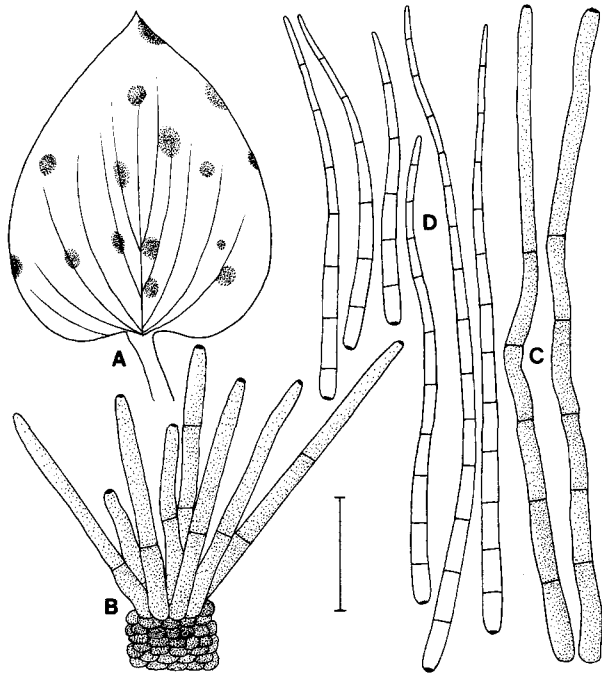


Fig. 4. *Cercospora hostae*. (A) Leaf spots on the upper leaf surface of *Hosta plantaginea* (0.7×). (B) and (C) Conidiophores. (D) Conidia. Bar = 30  $\mu\text{m}$ .

lines, finally centre turning greyish white to white with reddish brown to dark brown margins and pale yellow haloes on both surfaces. **Caespituli** amphigenous. **Mycelium** internal, hyphae septate, branched, hyaline, 2.5–4.0  $\mu\text{m}$  wide. **Stromata** small to large, well-developed, subglobose to globose, 20–60  $\mu\text{m}$  diam., dark brown to blackish brown, composed of several swollen, brown cells. **Conidiophores** 3–20 in a divergent to dense fascicle, emerging through stomatal opening, or erumpent through the cuticle, straight to slightly curved, olivaceous brown or paler towards the apex, uniformly in width, usually not geniculate or sometimes once geniculate, not branched, 0–5-septate, 62–245  $\times$  3.5–5.0  $\mu\text{m}$ ; conidial scars large, 2–3  $\mu\text{m}$  wide, conspicuous, apical or on shoulders of conidiogenous cells caused by geniculation. **Conidia** solitary, acicular-filiform to slightly obclavate, hyaline, straight to mildly curved, 5–14-septate, non-constricted at the septa, subacute to subobtuse at the apex, truncate to subtruncate at the base, 80–190  $\times$  2.5–4.0  $\mu\text{m}$ ; hilum conspicuously thickened, darkened, and non-protuberant.

**Habitat:** On living leaves of *Hosta plantaginea* Achers (Liliaceae).

**Specimen examined:** SMK 14371 (4 X 1997, Seoul).

**Distribution:** China, Japan, and Korea.

**Notes:** This is the first record of this species from Korea. Katsuki (1965) described the characters for *Cercospora hostae* on *Hosta* sp. as follows: Fructification amphigenous; conidiophores arranged in moderately dense

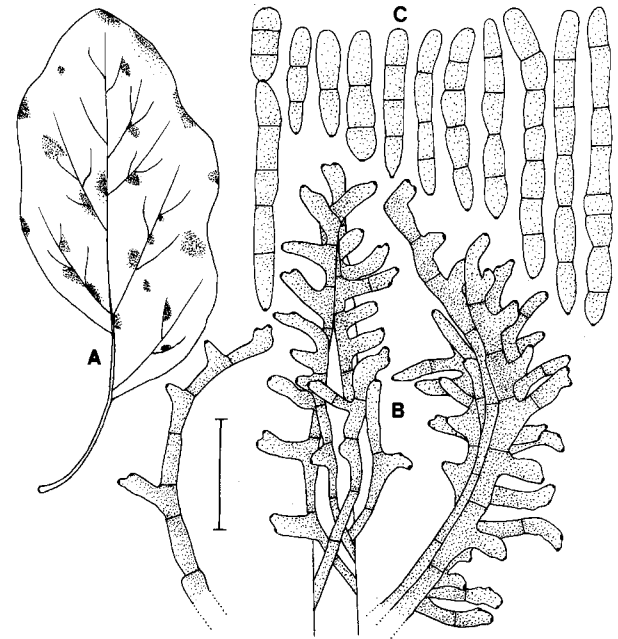


Fig. 5. *Mycovellosiella natrassii*. (A) Leaf spots on the lower leaf surface of *Solanum melongena* (0.3×). (B) Superficial secondary mycelium climbing on the leaf hair. (C) Conidia. Bar = 30  $\mu\text{m}$ .

fascicles, straight to geniculate, 80–112  $\times$  4.0–5.0  $\mu\text{m}$ ; conidia acicular to cylindric-obclavate, 62–155  $\times$  4.0–5.0  $\mu\text{m}$ . The Korean collection is in accordance with his description, though the conidiophores and conidia are somewhat longer. The epiphyllous conidiophores in the Korean collection are usually shorter than hypophyllous ones in the Korean collection.

5. *Mycovellosiella natrassii* Deighton, Mycol. Papers 137: 17 (1974)

Fig. 5

**Leaf spots** amphigenous, scattered to confluent, circular to subcircular, 2–8 mm diam., or up to 15 mm when coalescing, initially appearing as chlorotic discolorations, later becoming pale yellow to yellowish brown without definite margins on the upper surface, finally brown to dark brown on the lower surface. **Caespituli** amphigenous, but mostly hypophyllous, effuse, velutinous, greyish brown to dirty grey due to heavy fungal fructification. **Primary mycelium** internal, hyphae septate, branched, hyaline, 2–3  $\mu\text{m}$  wide. **Secondary mycelium** external, hyphae septate, branched, subhyaline to pale olivaceous brown, 2.5–4.5  $\mu\text{m}$  wide, often forming ropes or climbing leaf hairs. **Stromata** lacking. **Conidiophores** borne singly as lateral branches from the superficial secondary mycelium, pale olivaceous to olivaceous brown, straight to slightly curved, 0–2 times geniculate, not or rarely once branched, 0–1-septate, non-constricted at the septa, 5–25  $\times$  3.5–7.5  $\mu\text{m}$ ; conidial scars minute, 1.0–1.5  $\mu\text{m}$  wide, conspicuous, apical or

on small shoulders of conidiogenous cells caused by geniculation. **Conidia** solitary to catenate, in short (1~2) unbranched chains, cylindrical-obclavate to obclavate, straight to substraight, very pale olivaceous brown to pale olivaceous brown, slightly attenuated at the apex, 1~7-septate, often mildly to moderately constricted at the septa,  $20\sim 80\times 4.5\sim 7.5\ \mu\text{m}$ ; hilum somewhat thickened, darkened, somewhat refractive, and slightly protuberant.

**Habitat:** On living leaves of *Solanum melongena* L. (Solanaceae).

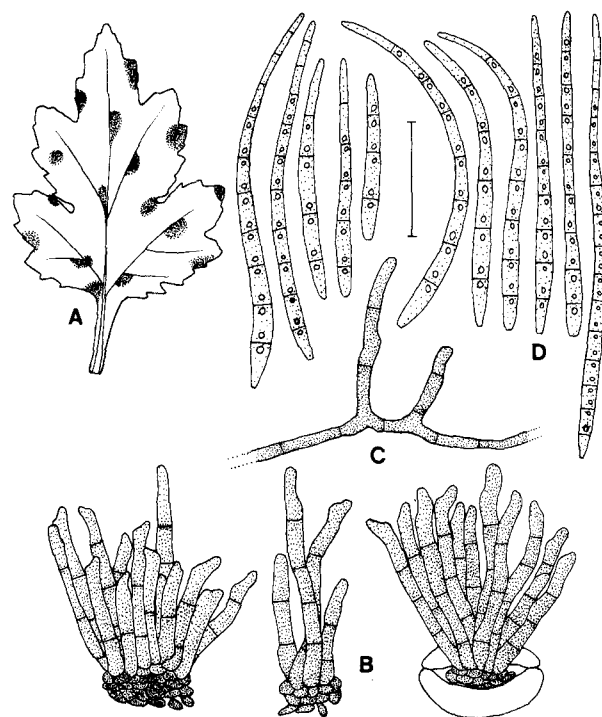
**Specimen examined:** SMK 15923 (29 V 1999, Seoul).

**Distribution:** Worldwide where the host is cultivated, including China and Korea.

**Notes:** Cho *et al.* (1997) listed this fungus from Korea with short note. Deighton (1974) described the following characters of *Mycovellosiella natrassii*: Sporulations epiphyllous; secondary mycelium sparingly branched, often forming ropes or climbing the leaf hairs; conidiophores borne terminally or arising as lateral branches of the secondary mycelium; conidial scars conspicuous; conidia subcylindrical, catenate, often constricted at the septa. Chinese collection on *Solanum melongena* possesses hypophyllous fructification (Liu and Guo, 1988). Therefore, the present collection agrees well with *M. natrassii*. Some minor differences are observed in the Korean collection, but these are within the variation of this species, and only of little taxonomic value. Several *Mycovellosiella* spp. have been described on *Solanum*. *M. concors* (Casp.) Deighton, *M. costeroana* (Casp.) Deighton and *M. solani-torvi* (Frag. & Cif.) Deighton are easily distinguishable from *M. natrassii*. The conidia of *M. tarra* collected from the Republic of Sudan on *Solanum melongena* and *S. cerasiferum*, are somewhat similar to those of *M. natrassii*, but the conidiophores are longer and much narrower,  $13\sim 130\times 2.5\sim 4.0\ \mu\text{m}$ , and are not crowded on the mycelial hyphae. Muntañola (1960) published *M. verbasifolii* on *S. verbasifolium* as a new species. According to the original description, the characters of this species were hardly distinguishable from those of *M. solani-torvi* except that the conidia are somewhat shorter,  $7.5\sim 37.5\times 3.1\sim 5.0\ \mu\text{m}$ . Liu and Guo (1988) studied four specimens of *M. verbasifolii* from China, one of them is on *S. torvum*, the others are on *S. verbasifolium*. They are morphologically indistinguishable from *M. solani-torvi*. Hence, *M. verbasifolii* may be synonymous with *M. solani-torvi*.

**6. *Pseudocercospora chrysanthemicola*** (J.M. Yen) Deighton, Mycol. Papers 140: 141 (1976) Fig. 6

**Leaf spots** amphigenous, scattered to confluent, subcircular to angular, usually 3~7 mm diam., up to 15 mm when coalescing, initially appearing as yellowish blotches,



**Fig. 6.** *Pseudocercospora chrysanthemicola*. (A) Leaf spots on the upper leaf surface of *Chrysanthemum morifolium* (0.7 $\times$ ). (B) Conidiophores. (C) External hyphae bearing secondary conidiophores as lateral branches. (D) Conidia. Bar = 30  $\mu\text{m}$ .

later becoming brown to dark brown on the upper surface, finally centre turning greyish brown with dark brown margins on the lower surface. **Caespituli** amphigenous. **Primary mycelium** internal, hyphae septate, branched, hyaline, 1.5~2.5  $\mu\text{m}$  wide. **Secondary mycelium** slightly developed, external, creeping on the leaf surface, hyphae septate, pale olivaceous brown, 2~3  $\mu\text{m}$  wide. **Stromata** small to medium, moderately to well-developed, dark brown, subglobular to angular, 15~35  $\mu\text{m}$  diam. **Conidiophores** 2~25 in a loose to dense fascicle, emerging through stomatal opening and erumpent through the cuticle, sometimes arising singly as side branches from superficial secondary mycelium, olivaceous brown throughout, uniform in width, substraight to slightly curved, not branched, 0~2 times geniculate at the apical portion, 1~4-septate,  $20\sim 56\times 3.0\sim 5.0\ \mu\text{m}$ ; conidial scars inconspicuous. **Conidia** solitary, obclavate-cylindrical to subcylindrical, very pale olivaceous brown to pale olivaceous brown, substraight to moderately curved, obtuse to subobtuse at the apex, slight obconically truncate to subtruncate, guttulate, non-constricted at the septa, 3~14-septate,  $40\sim 120\times 3.0\sim 5.0\ \mu\text{m}$ ; hilum unthickened and not darkened.

**Habitat:** On living leaves of *Chrysanthemum morifolium* Ram. (Compositae).

**Specimen examined:** SMK 16383 (20 VII 1999, Namyangju).

**Distribution:** China, Japan, Korea, Singapore, and Taiwan.

**Notes:** This is the first record of this species from Korea. Hsieh and Goh (1990) described the characters of *Pseudocercospora chrysanthemicola* as follows: Conidiophores very rarely branched,  $20\text{--}50 \times 3.0\text{--}5.0 \mu\text{m}$ ; conidia obclavate or obclavate-cylindric, straight to mildly curved,  $30\text{--}115 \times 3.0\text{--}5.0 \mu\text{m}$ . Though the minor differences have been observed in the Korean collection, they are within the variation of this species. *Cercospora chrysanthemi* Heald & Wolf (Chupp, 1954) was reported on *Chrysanthemum* spp., but this is not related the present collection. Therefore, the Korean collection belongs to *P. chrysanthemicola*.

7. *Pseudocercospora geicola* U. Braun, Nova Hedwigia 53: 294 (1991) Fig. 7

≡ *Pseudocercospora gei* (Fuckel) Y.L. Guo & X.J. Liu (1986), comb. illeg.!

= *Cercospora gei* Fuckel, in Chupp (1954: 477) (unpublished name!)

Misapplied name: *Cercospora gei* Bubák (1908) (= *Ramularia gei*).

**Leaf spots** amphigenous, scattered to confluent, sub-circular to irregular, 2–8 mm diam., or up to 15 mm when coalescing, initially appearing brown to dark greyish brown, later centre becoming greyish white with dark purplish red or yellowish haloes on the upper surface, finally turning brown to greyish white on the lower surface. **Caespituli** amphigenous, blackish dots observed when view under a hand lens. **Mycelium** internal, hyphae septate, branched, subhyaline to hyaline, 2–3  $\mu\text{m}$  wide. **Stromata** large, well-developed, subglobular to globular,

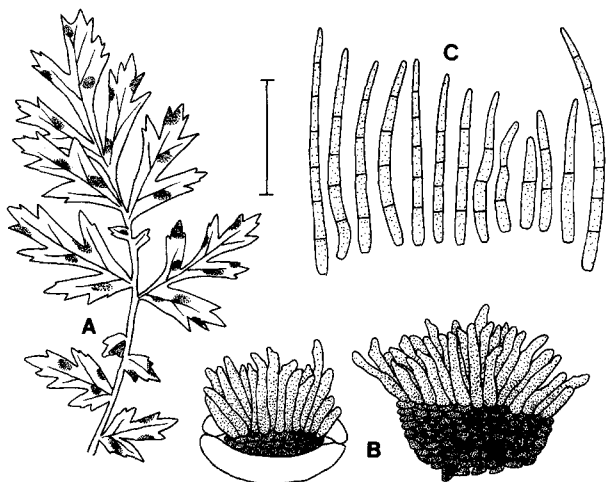


Fig. 7. *Pseudocercospora geicola*. (A) Leaf spots on the lower leaf surface of *Geum japonicum*. (0.5 $\times$ ). (B) Conidiophores. (C) Conidia. Bar = 30  $\mu\text{m}$ .

brown to dark brown, 20–60  $\mu\text{m}$  diam., composed of a several swollen hyphal cells. **Conidiophores** 20–50 in a very dense fascicle, arising from substomatal stomata, emerging through stomata, and erumpent through the cuticle, olivaceous brown or paler towards the apex, irregular in width, straight to substraight, not geniculate, not branched, aseptate, subobtuse to subtruncate or occasionally obconic at the apex,  $10\text{--}28 \times 2.5\text{--}3.5 \mu\text{m}$ ; conidial scars inconspicuous. **Conidia** solitary, subcylindric to acicular-filiform, straight to mildly curved, sometimes somewhat attenuated at the apex, subhyaline to very pale olivaceous, 1–6-septate, non-constricted at the septa, obtuse to subobtuse at the apex, truncate to subtruncate at the base,  $10\text{--}70 \times 2.0\text{--}3.5 \mu\text{m}$ ; hilum unthickened and not darkened.

**Habitat:** On living leaves of *Geum japonicum* Thunb. (Rosaceae).

**Specimen examined:** SMK 15912 (29 V 1999, Chunchon).

**Distribution:** Austria, China, Denmark, France, Korea, Russia, Sweden, and USA.

**Notes:** This is the first record of this species from Korea. The taxonomy of cercosporoid taxa on *Geum* spp. is very complicated. Chupp (1954) used the name *Cercospora gei* Fuckel as synonymous with *Acrotheca gei* Fuckel. Hughes (1958) and Braun (1990) examined the original material of *A. gei* and stated that this species belongs to *Ramularia*. Guo and Liu (in Guo, 1986) published the new combination, *Pseudocercospora gei* based on *A. gei*. But the chinese fungus was a true *Pseudocercospora*, agreeing with Chupp's (1954) description and illustration. Therefore, Braun (1991) suggested the new name, *Pseudocercospora geicola*, and described as follows: Conidiophores aseptate; conidia subhyaline, acicular, 1–4-septate. The conidiophores of *Ramularia gei* (Ellis) Lindr. are sometimes pigmented, especially at the very base. They are, however, easily distinguishable by the structure of conidial the scars which are conspicuous in the latter species and inconspicuous in *P. geicola*. Furthermore, the conidia in *R. gei* are catenate. Therefore, the Korean collection agrees well with *P. geicola*.

8. *Pseudocercospora mississippiensis* (Tracy & Earle) Castañeda & U. Braun, Cryptog. Bot. 1: 52 (1989) Fig. 8

≡ *Cercospora mississippiensis* Tracy & Earle, Bull. Torrey Bot. Club 22: 179 (1895)

**Leaf spots** amphigenous, scattered to confluent, circular to angular, 1–5 mm diam., initially appearing pale brown to brown, later centre becoming tan to greyish brown with brown to pale brown border lines. **Caespituli** amphigenous, but chiefly hypophyllous, minute black dots visible when viewed under a hand lens. **Mycelium** internal,

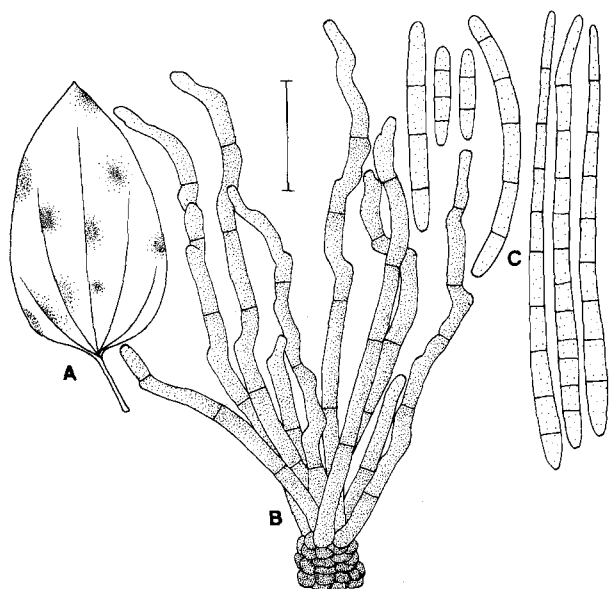


Fig. 8. *Pseudocercospora mississippiensis*. (A) Leaf spots on the upper leaf surface of *Smilax riparia* var. *ussuriensis* (0.7 $\times$ ). (B) Conidiophores. (C) Conidia. Bar = 30  $\mu$ m.

hyphae septate, branched, hyaline, 2–3  $\mu$ m wide. **Stromata** small, slightly developed, subglobular to globular, brown to dark brown, 10–20  $\mu$ m diam., composed of a few swollen hyphal cells. **Conidiophores** 5–20 in a divergent fascicle, mostly arising from substomatal stromata, olivaceous brown to brown, irregular in width, slightly curved to sinuous or tortuous, 1–5 times geniculate, not branched, 1–5-septate, obconic to subobtuse, 55–220  $\times$  3.5–5.5  $\mu$ m; conidial scars mostly inconspicuous but sometimes somewhat conspicuous, apical or very small shoulders of conidiogenous cells cause by geniculation, minute, ca. 1  $\mu$ m wide. **Conidia** solitary, obclavate to obclavate-cylindric, straight to mildly curved, subhyaline to hyaline or rarely very pale olivaceous, obtuse to subobtuse at the apex, obconically truncate to subtruncate, 2–11-septate, non-constricted at the septa, 25–120  $\times$  4.0–6.5  $\mu$ m; hilum mostly unthickened or sometimes slightly thickened and not darkened.

**Habitat:** On living leaves of *Smilax riparia* var. *ussuriensis* Hara & T. Koyama (Liliaceae).

**Specimen examined:** SMK 14181 (15 IX 1997, Chunchon), 15201 (24 IX 1998, Pochon), 16327 (20 VII 1999, Pochon).

**Distribution:** Korea and USA.

**Notes:** This is the first record of this species from Korea. Several species of *Cercospora* have been reported earlier on the genus *Smilax* (Chupp, 1954). He treated *C. miyakei* Henn. as a *Helminthosporium* for some of the older conidia show thick wall and pronounced septa. Deighton (1976) placed *C. pallidissima* Chupp into *Pseudocercospora*, but it is clearly deferent from the present fungus.

The type material of *C. smilacis* Peck and numerous additional specimens were examined (Braun and Melnik, 1997). The conidial scars are conspicuous, slightly thickened and somewhat darkened, and the conidia are more or less obclavate and pigmented. Hence, it was transferred as *Passalora smilacis* (Peck) U. Braun. *C. pycnidoides* Chupp collected from Brazil is allied to the Korean collection. It is evident that *C. pycnidoides* is different from the present species by having much shorter conidiophores (10–60  $\mu$ m long) and somewhat shorter (20–85  $\mu$ m long), pigmented conidia. Chupp (1954) described the characters of *C. mississippiensis* ( $\equiv$  *Pseudocercospora mississippiensis*) as follows: Conidiophores curved to tortuous, 0–5 times abruptly geniculate, 30–300  $\times$  4.0–6.0  $\mu$ m; conidia obclavate, pigmented, 35–165  $\times$  4.0–5.5  $\mu$ m. Since these characters are within the variation of the species, the Korean collection is referred to *P. mississippiensis*. In Korean collections, the conidial scars on conidiophores are sometimes somewhat conspicuous, but hardly thicker than the lateral walls. Therefore this species is an intermediate type between *Cercospora* and *Pseudocercospora*.

9. *Pseudocercospora viburni-cylindrici* (F.L. Tai) U. Braun, Nova Hedwigia 55: 219 (1992) Fig. 9

$\equiv$  *Cercospora viburni-cylindrici* F.L. Tai, Syll. Fung. Sinicorum, p. 907 (1979)

$\equiv$  *Pseudocercospora viburni-cylindrici* (F.L. Tai) Y.L. Guo & W.Y. Zhao, Acta Mycol. Sinica 12:198 (1993)

$\equiv$  *Cercospora viburnicola* F.L. Tai, Lloydia 11: 54 (1948), non *Cercospora viburnicola* Ray, (1941)

**Leaf spots** amphigenous, scattered to confluent, distinct, subcircular to subcircular to angular, even irregular, 3–10

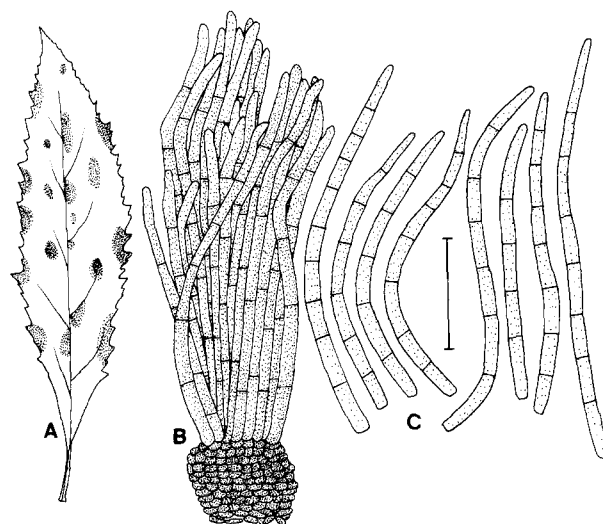


Fig. 9. *Pseudocercospora viburni-cylindrici*. (A) Leaf spots on the upper leaf surface of *Viburnum erosum* var. *taquetii* (0.7 $\times$ ). (B) Conidiophores. (C) Conidia. Bar = 30  $\mu$ m.

mm diam., or up to 15 mm when coalescing, initially appearing brown to dark brown, later centre becoming greyish brown to grey with brown to dark brown margins, finally centre turning whitish grey with raised brown border lines. **Caespituli** hypophyllous. **Mycelium** internal, hyphae septate, branched, hyaline, 2–3  $\mu\text{m}$  wide. **Stromata** small to large, well-developed, subglobular to globular, dark brown, 16–32  $\mu\text{m}$  diam., composed of several swollen, brown hyphal cells. **Conidiophores** up to 30 in a dense fascicle to coremioid, olivaceous brown to brown, paler towards the apex, uniform in width, not geniculate or geniculate-sinuuous, not branched, 3–8-septate, 60–120  $\times$  3.0–4.0  $\mu\text{m}$ ; conidial scars inconspicuous. **Conidia** solitary, cylindrical to cylindrical-filiform, substraight to moderately curved, subhyaline to very pale olivaceous, 3–12-septate, non-constricted at the septa, obtuse at the apex, truncate to subtruncate at the base, 50–130  $\times$  2.5–4.0  $\mu\text{m}$ ; hilum unthickened and not darkened.

**Habitat:** On living leaves of *Viburnum erosum* var. *taquetii* Rehder (Caprifoliaceae).

**Specimen examined:** SMK 14126 (4 IX 1997, Kwachon).

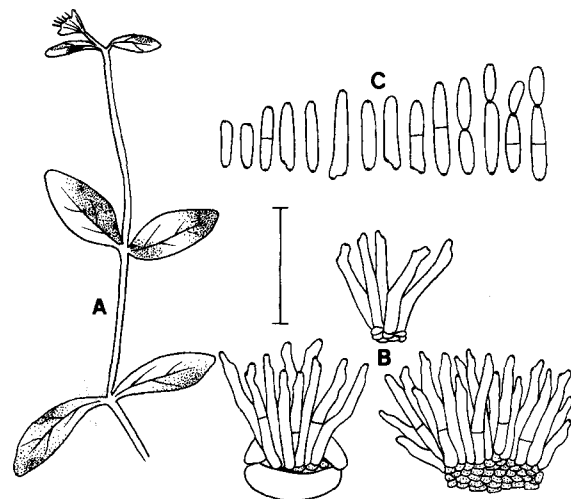
**Distribution:** China and Korea.

**Notes:** This is the first record of this species from Korea. Guo and Zhao (1993) published the characters of *Pseudocercospora viburni-cylindrici* as follows: Fructification hypophyllous; conidiophores densely fasciculate to coremioid, 50–150  $\times$  3.0–4.0  $\mu\text{m}$ , blunt at the apex; conidia cylindrical to obclavate-cylindric, obconically truncate at the base, 2–5-septate, 25–75  $\times$  2.5–4.0  $\mu\text{m}$ . Although the Korean collection possesses somewhat longer and 3–12-septate conidia with truncate base, these features are within the variation of this species. Therefore, the Korean collection agrees with *P. viburni-cylindrici*. *Pseudocercospora varia* (Peck) J.K. Bai & M.Y. Cheng on *Viburnum sagentii* described by Kim and Shin (1999f) clearly differs from it by much shorter conidiophores (10–72  $\mu\text{m}$  long) and somewhat broader conidia (3.5–5.5  $\mu\text{m}$  wide).

**10. *Ramularia moehringiae*** Lindr., Acta Soc. Fauna Fl. Fenn. 23(3): 13 (1902) Fig. 10

= *Ramularia arenariae* A.L. Smith & Ramsb., Trans. Brit. Mycol. Soc. 4(2): 327 (1914)

**Leaf spots** amphigenous, scattered to sometimes confluent, 1–5 mm diam., or up to 10 mm when coalescing, at first appearing pale green to greenish yellow with indefinite margins, later becoming greenish grey to grey with dark grey border lines, finally centre turning greyish white. **Caespituli** hypophyllous, punctiform or occasionally subeffuse, greyish white. **Mycelium** internal, hyphae



**Fig. 10.** *Ramularia moehringiae*. (A) Leaf spots on the upper leaf surface of *Arenaria serpyllifolia* (0.7 $\times$ ). (B) Conidiophores. (C) Conidia. Bar = 30  $\mu\text{m}$ .

septate, branched, hyaline, 2–4  $\mu\text{m}$  wide. **Stromata** small to large, slightly to moderately developed, colourless to subhyaline, 10–30  $\mu\text{m}$  diam., composed of somewhat swollen hyphal cells. **Conidiophores** 2–20 in a loose to dense fascicle, arising from substomatal stromata, straight to slightly curved or geniculate-sinuuous, hyaline, once geniculate at the upper portion, not branched, 0–1-septate, 13–36  $\times$  2.5–4.5  $\mu\text{m}$ ; conidial scars minute, ca. 1  $\mu\text{m}$  wide, somewhat conspicuous, apical or on small shoulders of conidiogenous cells caused by geniculation. **Conidia** catenate, in short (1–2) unbranched or branched chains, cylindrical to subcylindric-fusiform, straight, hyaline, 0–1-septate, non-constricted at the septa, obtuse to subobtuse at both ends, 8–25  $\times$  2.0–4.5  $\mu\text{m}$ ; hilum somewhat thickened, darkened, and non-protuberant.

**Habitat:** On living leaves of *Arenaria serpyllifolia* L. (Caryophyllaceae).

**Specimen examined:** SMK 14464 (26 IV 1998, Nonsan).

**Distribution:** Bulgaria, Estonia, Finland, France, Germany, Great Britain, Hungary, Korea, Poland, Rumania, and Sweden.

**Notes:** This is the first record of this species from Korea. Braun (1998) described the characters of *Ramularia moehringiae*: Caespituli hypophyllous, conidiophores in loose to dense fascicles, 0–1-septate; conidial scars somewhat thickened; conidia catenate, ellipsoid-ovoid, subcylindric-fusiform, 0–1-septate, hyaline. Therefore, the Korean collection is in accordance with his description.

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## 적 요

본 연구는 1990년부터 국내에서 채집하여 고려대학교 농생물학과 진균표본보관소(SMK)에 보존하고 있는 *Cercospora* 및 관련 속의 진균을 대상으로 분류학적 연구를 실시한 결과의 열두 번째 보고이다. 이번 보고에서는 *Cercospora* 4종, *Mycovellosiella* 1종, *Pseudocercospora* 4종 및 *Ramularia* 1종에 대한 균학적 특징을 기재 묘사하였다. 제라늄에서 *Cercospora brunckii*, 노루오줌에서 *C. deutziae*, 삼색제비꽃(팬지)에서 *C. granuliformis*, 옥잠화에서 *C. hostae*, 가지에서 *Mycovellosiella natrassii*, 국화에서 *Pseudocercospora chrysanthemicola*, 땀무에서 *P. geicola*, 밀나물에서 *P. mississippiensis*, 가새덜평나무에서 *P. viberni-cylindrici*, 그리고 벼룩이자리에서 *Ramularia moehringiae*를 각각 동정하였다.

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