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

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한국산 *Cercospora* 및 관련 속의 분류학적 연구(VII)

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ABSTRACT: This paper is the seventh contribution towards taxonomic studies on *Cercospora* and allied genera, and contains ten species of Korean cercosporoid fungi; viz., *Cercospora arcti-ambrosiae, C. cichorii, C. kikuchii, C. subhyalina, Neoramularia koreana, Pseudocercospora ligustri, P. oenotherae, P. rubi, P. zelkowae*, and *Ramularia archangelicae*. Morphological characteristics of taxonomic value are described and illustrated for these species to contribute towards a mycological monograph of Korean cercosporoid fungi.

KEYWORDS: *Cercospora, Neoramularia, Pseudocercospora, Ramularia*, Monograph

Sixty cercosporoid fungi from Korea, comprising 22 *Cercospora*, one *Cercosporella*, one *Distocercospora*, two *Mycovellosiella*, one *Neoramularia*, four *Passalora*, one *Phaeoisariopsis*, one *Phacellium*, one *Phaeoramularia*, 15 *Pseudocercospora*, three *Pseudocercosporella*, and eight *Ramularia* species were treated in previous contributions of this series (Kim and Shin, 1998a, 1998b, 1998c, 1998d, 1999a, 1999b). The present paper deals with ten additional cercosporoid taxa from Korea, namely four *Cercospora*, one *Neoramularia*, 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 arcti-ambrosiae* Halst., in Seym. & Earle, Economic Fungi 296 and 297a (1893), with description on the label. Fig. 1

= *Cercospora arctii* F. Stevens., Bernice P. Bishop Mus. Bull. 19: 154 (1925)

= *Cercosporina lappae* T. Watan. & N. Takah., Usunomiya Agric. Coll. Bull. 1(4): 39 (1934)

Leaf spots amphigenous, scattered to confluent, distinct, subcircular to irregular, 2~10 mm diam., greyish to dark brown without definite margins, centre becoming grey to greyish white with brown to dark brown borders. **Caespituli** amphigenous. **Mycelium** internal, hyphae septate, branched, hyaline, 2.0~3.5 μm wide. **Stromata** lacking to small, rudimentary to slightly developed, composed of several dark brown hyphal cells. **Conidiophores** 3~18 in a divergent fascicle, olivaceous brown or paler upwards, straight to slightly curved, 1~2 times mildly geniculate, not branch-

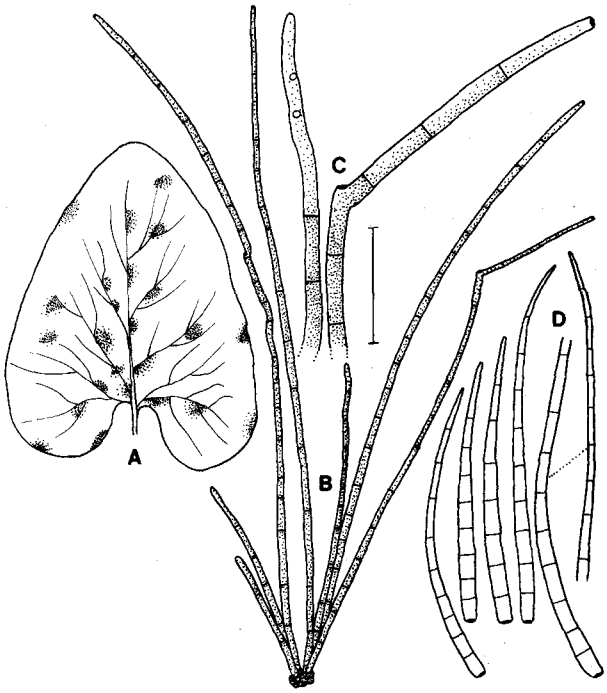

Fig. 1. *Cercospora arcti-ambrosiae*. **(A)** Leaf spots on the upper leaf surface of *Arctium lappa* (0.3×). **(B)** Conidiophores. **(C)** Upper portion of conidiophores showing the apices. **(D)** Conidia. Bar = 30 μm (but 75 μm for B).

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ed, 2~20-septate, some septa at the upper portion not clear, 40~360×3.5~6.0 μm; conidial scars large, 2~3 μm wide, conspicuous, apical or on shoulders of conidiogenous cells caused by geniculation. **Conidia** solitary, acicular, straight to mildly curved, hyaline, 6~24-septate, non-constricted at the septa, subacute to acute at the apex, truncate to subtruncate at the base, much variable in length, 50~240× 3.5~4.5 μm; hilum conspicuously thickened, darkened, and non-protuberant.

Habitat: On living leaves of *Arctium lappa* L. (Compositae).

Specimen examined: SMK 13026 (14 IX 1994, Chongju).

Distribution: China, Japan, Korea, Taiwan, and USA.

Notes: Shin and Braun (1996) first listed this fungus from Korea. Chupp (1954) described branched conidiophores and somewhat narrower conidia, 1.5~3.5 μm wide. Japanese collections (Katsuki, 1965) and Taiwanese specimens (Hsieh and Goh, 1990) did not possess any branched conidiophores. Therefore, the present fungus is in accordance with these previous descriptions, since the features are within the accepted variation of this species. Chupp (1954) recorded this species and *Cercospora ambrosiae* Chupp on *Ambrosia*. *C. ambrosiae* is distinctly different from it as follows: Fructification hypophyllous; conidiophores 0~3-septate, much shorter (only 15~60 μm long); conidia obclavate-cylindric, 1~5-septate, much shorter and wider (20~90×6~10 μm). According to the original description, *C. ambrosiae* may be a member of *Passalora*, since conidia are pigmented, obclavate-cylindric, somewhat wide, and usually with few septate.

2. *Cercospora cichorii* Davis, Trans. Wis. Sci. Art. Lett. 19: 715 (1919) Fig. 2

= *Cercospora cichorii-intybi* Woron., Trav. Mus. Bot. Acad. Sci. USSR 21: 233 (1927)

Leaf spots amphigenous, scattered to confluent, subcircular to angular, 1~6 mm diam., or up to 10 mm when confluent, sometimes vein-limited, pale greyish brown to brown with dark brown border lines, centre becoming grey to pale brown, occasionally with concentric rings. **Caespituli** amphigenous, but abundantly epiphyllous. **Mycelium** internal, hyphae septate, branched, hyaline, 2~3 μm wide. **Stromata** lacking to small, rudimentary to slightly developed, dark brown, subglobular to angular, 8~20 μm diam., composed of a few swollen, brown hyphal cells. **Conidiophores** 3~16 in a loose fascicle, emerging through stomata or erumpent through the cuticle, olivaceous brown throughout, irregular in width, straight to slightly curved, 1~5 times mildly or abruptly geniculate, not branched, usually aseptate, but occasionally 1~2-septate in long ones, 12~112(~150)×3.0~5.5 μm; conidial scars large, 2~3 μm wide, conspicuous, apical or on shoulders of conidiogenous cells caused by geniculation. **Conidia** solitary, acicular to filiform, sometimes shorter ones cylindric-obclavate, straight to slightly curved, hyaline, 3~12-septate, non-constricted at the septa, subacute to subobtuse at the apex, truncate to subtruncate at the base, 40~145×3.0~4.5 μm; hilum conspicuously thickened, darkened, and non-protuberant.

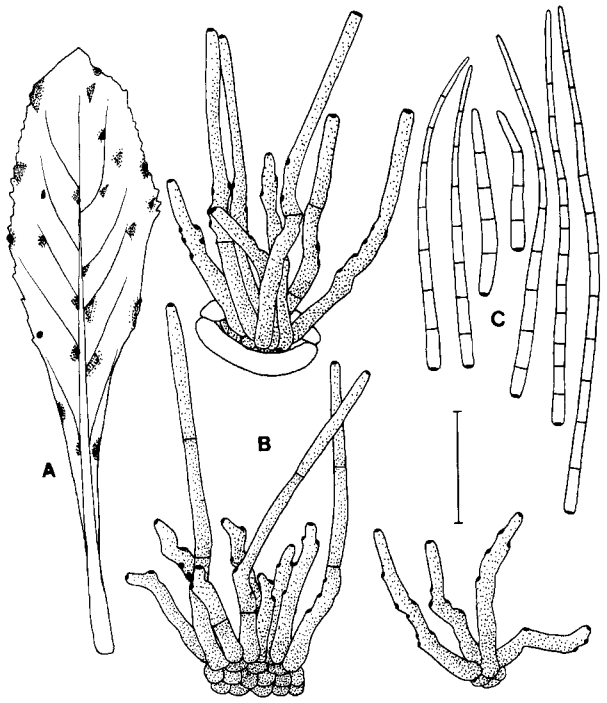

Fig. 2. *Cercospora cichorii*. **(A)** Leaf spots on the upper leaf surface of *Cichorium endiva* (0.5×). **(B)** Conidiophores. **(C)** Conidia. Bar = 30 μm.

Habitat: On living leaves of *Cichorium endiva* L. and *C. intybus* L. (Compositae).

Specimens examined: On *Cichorium endiva*, SMK 13341 (5 XI 1997, Suwon); on *C. intybus*, SMK 14431 (17 X 1997, Suwon).

Distribution: Worldwide where the plant is cultivated, including India and Korea.

Notes: Shin and Braun (1996) first listed this fungus from Korea on *Cichorium endiva*. In SMK 13341, the conidiophores are usually once geniculate, 1~2-septate and the conidia are somewhat longer, wider and sometimes even obclavate. In SMK 14431, conidiophores are usually aseptate, but occasionally uniseptate in long ones, and somewhat shorter on the lower surface. Chupp (1954) described the features of this fungus as follows: Conidiophores 1~3 times mildly geniculate, 10~50×4~6 μm; conidia acicular to cylindric, 50~175×3~5 μm. This species resembles *Cercospora lactucae-sativae* Sawada, described from Korea by Kim and Shin (1998b), but somewhat differs as follows: Caespituli hypophyllous, conidiophores arranged in

a divergent fascicle or somewhat borne solitary; conidia somewhat longer and wider (30~250×4.0~5.5 μm). Therefore, the present fungus is very close to *C. cichorii.*

3. *Cercospora kikuchii* T. Matsumoto & Tomoy., Annals Phytopath. Soc. Japan 1(6): 1 (1925) Fig. 3

Leaf spots amphigenous, scattered to confluent, subcircular to angular, 1~4 mm diam., or up to 10 mm when confluent, initially appearing pale brown, later becoming tan to dingy grey, finally centre turning greyish white to light grey with reddish brown or purplish brown border lines. **Caespituli** amphigenous, also on stems and pods. **Mycelium** internal, hyphae septate, branched, hyaline, 2.0~3.5 μm wide. **Stromata** small to medium, slightly to moderately developed, dark brown to blackish brown, subglobular to globular, 15~40 μm diam. **Conidiophores** 2~20 in a loose fascicle, arising from substomatal cavities and emerging through the cuticle, olivaceous brown throughout, irregular in width, straight to slightly curved, 1~5 times mildly geniculate, not branched, 2~6-septate, 20~200×3.5~5.5 μm; conidial scars large, 2.0~3.5 μm wide, conspicuous, apical or on shoulders of conidiogenous cells caused by geniculation. **Conidia** solitary, acicular to filiform, straight to slightly curved, hyaline, 5~22-septate, non-constricted at the septa, obtuse to subacute at the apex, truncate at the base, 55~220×3.0~4.0 μm; hilum conspicuously thickened, darkened, and non-protuberant.

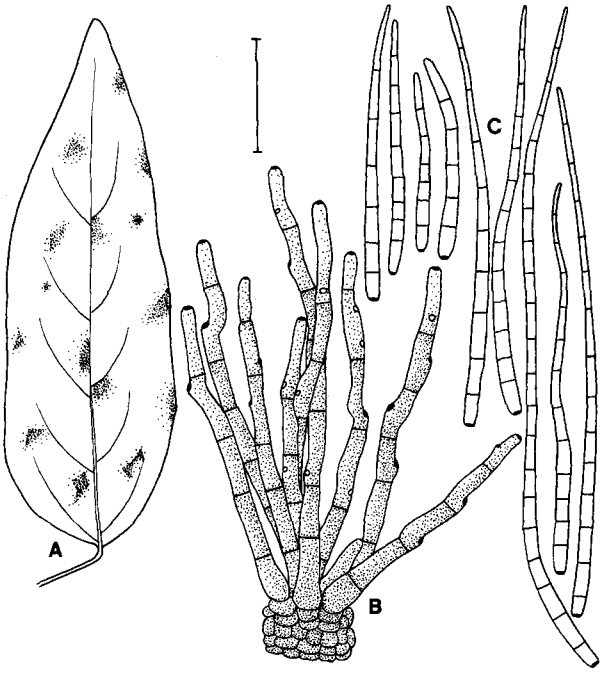

Fig. 3. *Cercospora kikuchii.* **(A)** Leaf spots on the upper leaf surface of *Glycine max* (0.6×). **(B)** Conidiophores. **(C)** Conidia. Bar = 30 μm.

Habitat: On living leaves of *Glycine max* (L.) Merr. (Leguminosae).

Specimens examined: SMK 13279 (30 X 1994, Kangnung), 15294 (1 X 1998, Suwon).

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

Notes: Nakata and Takimoto (1928), Park *et al.* (1978) and Oh and Kwon (1981) listed this fungus from Korea. In previous reports (Kim and Shin, 1998a, 1998b), *Passalora sojina* (Hara) H.D. Shin & U. Braun (≡ *Cercspora sojina* Hara) and *Cercospora canescens* Ellis & G. Martin were described and illustrated on *Glycine max* and *Phaseolus angularis*, respectively. Chupp (1954) recorded several *Cercospora* species on *Glycine* and related host genera. *Passalora sojina* is clearly distinguishable. *Cercospora canescens* is morphologically very akin to the present fungus, but different from it by having conidiophores arranged in dense fascicles and amphigenous caespituli. *Pseudocercospora cruenta* (Sacc.) Deighton (Deighton, 1976) differs from this species as follows: Fructification mostly hypophyllous; conidiophores rarely branched, 0~3-septate, 10~70×3.0~6.0 μm; conidia obclavate to cylindric, 40~150×2.5~5.0 μm. *P. glycines* (Cook) Deighton differs from this fungus in many respects: Fructification abundantly epiphyllous; conidiophores arranged in very dense fascicle, 0~1-septate, 10~25×1.5~3.0 μm; conidia narrowly obclavate, 30~100×1.5~2.5 μm.

4. *Cercospora subhyalina* H.D. Shin & U. Braun, in Braun, A Monograph of *Cercosporella, Ramularia* and Allied Genera (Phytopathogenic Hyphomycetes) I: 120 (1995) Fig. 4

Leaf spots amphigenous, scattered to confluent, distinct, subcircular to irregular, size variable, 1~35 mm diam., brown to dark brown with narrow dark margins or sometimes indefinite border lines. **Caespituli** amphigenous, later appearing greyish brown due to heavy fungal fructification. **Mycelium** internal, hyphae septate, branched, hyaline, 2~4 μm wide. **Stromata** lacking to small, rudimentary to poorly developed, 10~20 μm diam., composed of a few brown hyphal cells. **Conidiophores** 2~16 in a loose fascicle or occasionally solitary, emerging through stomata or erumpent through the cuticle, uniformly subhyaline to hyaline, straight to mildly sinuous, usually 0~1-septate, but occasionally 2-septate, 1~5 times slightly geniculate, not branched, 20~55×2.5~4.5 μm; conidial scars minute, 1.0~1.5 μm wide, but conspicuous, apical or on shoulders of conidiogenous cells caused by geniculation. **Conidia** solitary, subcylindric to narrowly obclavate, straight to mildly curved, hyaline to subhyaline, 1~5-septate, non-constricted at the septa, obtuse to subobtuse at the apex, subtruncate to trun-

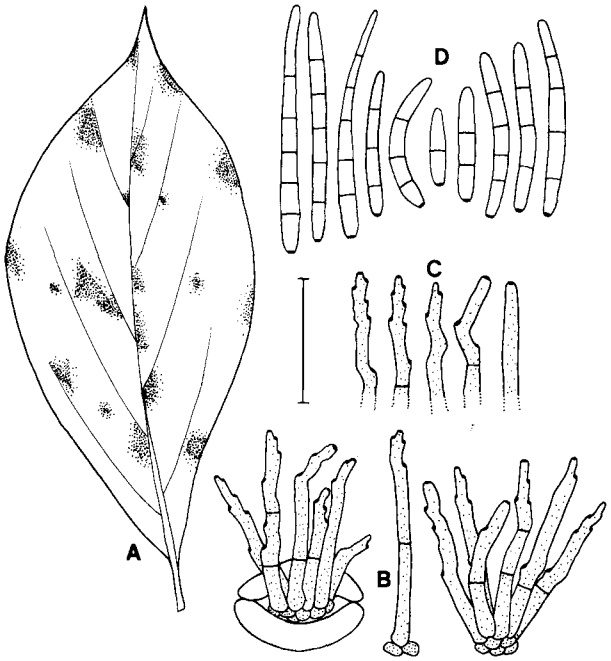

Fig. 4. *Cercospora subhyalina.* **(A)** Leaf spots on the upper leaf surface of *Brachybotrys paridiformis* (0.7×). **(B)** Conidiophores. **(C)** Upper portion of conidiophores showing the apices. **(D)** Conidia. Bar = 30 μm.

cate at the base, 30~64×2.0~4.0 μm; hilum minute, slightly thickened, darkened, and non-protuberant.

Habitat: On living leaves of *Brachybotrys paridiformis* Max. (Boraginaceae).

Specimen examined: SMK 12928 (2 VII 1994, Pyongchang) (holotype).

Distribution: Known only from the type locality, Korea.

Notes: Shin and Braun (1996) first recorded this fungus as *Cercospora* species from Korea. Braun (1995) described the following characters of this species: Caespituli hypophyllous; conidiophores occasionally solitary or arranged in a small fascicle, hyaline to subhyaline, 20~50× 2~5 μm; conidia acicular or subcylindric-filiform, 30~50× 1.5~4.5 μm. Shin and Braun (1996) distinguished it from all known *Cercospora* species by its hyaline to subhyaline, and occasionally solitary conidiophores. *Ramularia lappulae* (Davis) Davis on *Brachybotrys* is confusable to the present fungus, but differs in having catenate, ellipsoid-ovoid to subcylindric-fusiform, and 0~1-septate conidia.

5. *Neoramularia koreana* H.D. Shin & U. Braun, Mycotaxon 58: 161 (1996) Fig. 5

Leaf spots amphigenous, scattered, usually not confluent, distinct, subcircular to irregular, 2~5 mm diam., initially appearing as small purplish brown spots, later centre becoming yellowish brown with dark purplish margins. **Caespituli** amphigenous. **Mycelium** internal, hyphae sep-

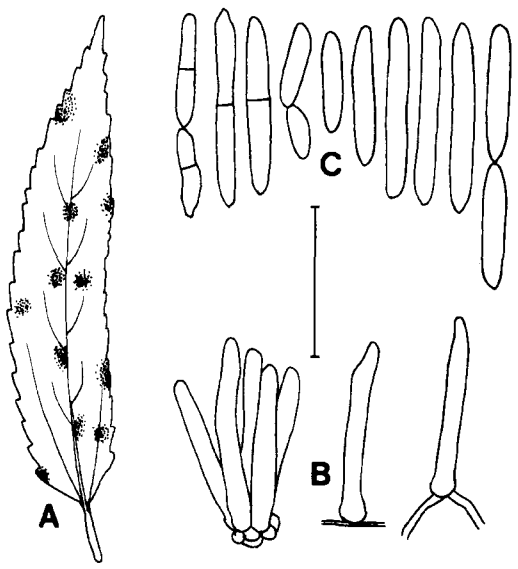

Fig. 5. *Neoramularia koreana.* **(A)** Leaf spots on the upper leaf surface of *Stachy riederi* var. *japonica* (0.7×). **(B)** Conidiophores. **(C)** Conidia. Bar = 30 μm.

tate, branched, hyaline, 2~3 μm wide. **Stromata** absent. **Conidiophores** solitary or occasionally 2~5 in a small loose fascicle, erumpent through the cuticle or rarely arising from stomata, hyaline, straight, not geniculate, not branched, aseptate, 15~40×2.0~3.5 μm; conidial scars very small, inconspicuous. **Conidia** solitary or in short (2~3) unbranched chains, cylindric, hyaline, 0~1-septate, non-constricted at the septa, pointed at both ends, 10~40×2.0~3.5 μm; hilum unthickened, not darkened.

Habitat: On living leaves of *Stachys riederi* var. *japonica* Miq. (Labiatae).

Specimens examined: SMK 13053 (22 IX 1994, Kangnung) (holotype), 15401 (9 X 1998, Suwon).

Distribution: Known only from the type locality, Korea.

Notes: Shin and Braun (1996) first recorded this fungus as new species from Korea, and described the following characters in detail: Conidiophores solitary or arranged in small groups, 16~32×ca. 2 μm; conidia cylindric, 14~32× 2.0~2.8 μm; conidial scars small, inconspicuous. The other Korean specimen (SMK 15401) is in agreement with the holotype (SMK 13053), though the conidiophores and conidia are somewhat wider. *Ramularia bullata* (Ellis & Everh.) U. Braun (Braun, 1998) also occurs on *Stachys* spp. but differs in the following characters: Caespituli hypophyllous, conidiophores arranged in a dense fascicle, conidial scars somewhat thickened, conidia subglobose to ovoid and rather wider (5~12 μm wide). *Ramularia bresadolae* U. Braun (Braun, 1998) is distinguished from the present fungus by having septate conidiophores, somewhat thickened conidial scars, ellipsoid-ovoid, and verruculose conidia. The Korean collections are distinguishable from all known *Neoramularia* species by mostly solitary coni-

diophores, erumpent through the cuticle.

6. *Pseudocercospora ligustri* (Roum.) Deighton, Mycol. Papers 140: 78 (1976) Fig. 6

≡ *Cercospora ligustri* Roum., Rev. Mycol. 5: 177 (1883)

Leaf spots amphigenous, scattered, distinct, circular to subcircular, 3~10 mm diam., pale brown to reddish brown, centre becoming greyish brown with definite purplish brown raised margins. **Caespituli** amphigenous, but abundantly hypophyllous. **Primary mycelium** internal, hyphae septate, branched, hyaline, 2.5~4.0 μm wide. **Secondary mycelium** usually not developed, but rarely developed from the hypophyllous fascicle, hyphae septate, branched, olivaceous brown, 2~4 μm wide. **Stromata** large, well-developed, globular to subglobular, dark brown to blackish brown, 40~80 μm diam., composed of some swollen hyphal cells. **Conidiophores** 5~30 in a dense fascicle, emerging through stromata or erumpent through the cuticle, pale olivaceous brown at the basal portion or paler towards the apex, substraight to mildly sinuous, usually not geniculate, but sometimes once slightly geniculate above in the upper portion, not branched, slightly bulbous near the base, aseptate or uniseptate, 25~56×4.0~6.0 μm; conidial scars inconspicuous. **Conidia** solitary, cylindric to obclavate-cylindric, straight to mildly curved, subhyaline due to minute oil drops, guttulate, 0~4-septate, usually non-constricted, but occasionally slightly constricted at the septa, obtuse at the apex, truncate to subtruncate at the base, 30~108×4.0~6.0 μm; hilum unthickened, not darkened.

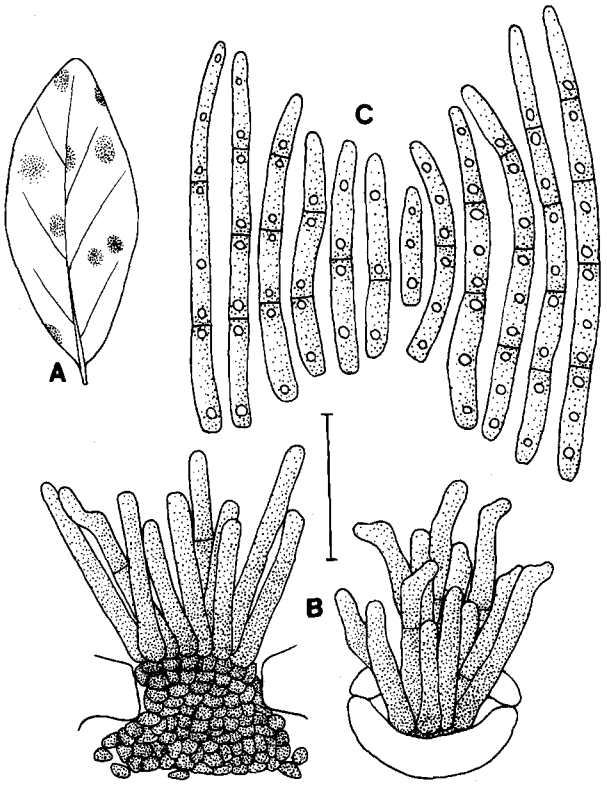

Fig. 6. *Pseudocercospora ligustri.* **(A)** Leaf spots on the lower leaf surface of *Ligustrum obtusifolium* (0.7×). **(B)** Conidiophores. **(C)** Conidia. Bar = 30 μm.

Habitat: On living leaves of *Ligustrum obtusifolium* S. & Z. (Oleaceae).

Specimens examined: SMK 12338 (29 X 1992, Kangnung), 13357 (8 XI 1994, Kangnung), 15049 (8 IX 1998, Suwon), 15143 (18 IX 1998, Jinju), 15600 (28 X 1998, Namyangju).

Distribution: Korea and North America (USA).

Notes: Shin and Braun (1993) first listed this fungus from Korea, and Shin (1995) provided a brief morphological description. In SMK 15049, the leaf spots are smaller than those of other specimens. They are brown to grey in the centre with definite margins, but without any purplish colour. The secondary mycelia are particularly developed. In SMK 15600, the conidia are usually guttulate, but occasionally eguttulate. Caespituli are entirely hypophyllous. Chupp (1954) published the following characters of *Cercospora ligustri*: Fructification chiefly epiphyllous; conidiophores arranged in loose fascicles or often single stalks, not branched; conidia cylindric to spindle-shaped and 1~3-septate. However, Deighton (1976) reduced *C. ligustri* to synonymy with *Pseudocercospora ligustri*. He described the characters of the latter species as follows: Stromata large, 50~80 μm; external secondary mycelium arising from base of the conidiophore fascicles; conidiophores branched at the basal portion; conidia very pale olivaceous brown in colour, 1~8-septate. In all Korean collections, secondary mycelium was not observed or only poorly developed, and conidial scars could not be observed, but the apices of conidiophores were denticulate. Deighton (1976) stated that the secondary mycelia of North America collections are well-developed and the conidial scars are rarely displaced at the apex. These differences are within the accepted variation of this species. Therefore, the present fungus is in accordance with Deighton's description. *Thedognia ligustrina* (Boerema) B. Sutton (Sutton, 1973) is clearly different from it as follows: Conidia in disarticulating chains, subcylindric-obclavate, and conidiophores hyaline.

7. *Pseudocercospora oenotherae* (Ellis & Everh.) X.J. Liu & Y.L. Guo, Acta Mycol. Sinica 11: 297 (1992) Fig. 7

≡ *Cercospora oenotherae* Ellis & Everh., Proc. Acad. Nat. Sci. Philad. 46: 380 (1894)

Leaf spots amphigenous, scattered to confluent, circular to subcircular, concentric, sometimes partly vein-limited, 3~10 mm diam., sometimes covering the half of the leaf

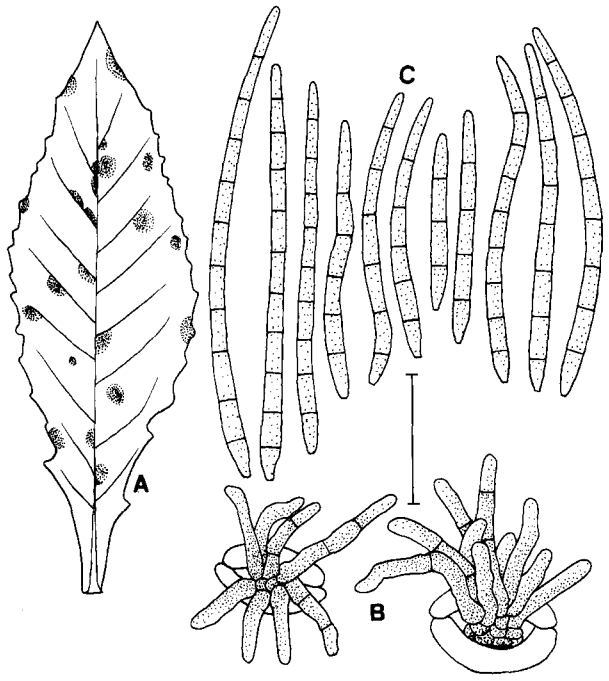

Fig. 7. *Pseudocercospora oenotherae.* **(A)** Leaf spots on the lower leaf surface of *Oenothera odorata* (0.6×). **(B)** Conidiophores. **(C)** Conidia. Bar = 30 μm.

by coalescing of the lesions, brown to greyish brown with dark reddish definite margins. **Caespituli** amphigenous, but mostly hypophyllous. **Mycelium** internal, hyphae septate, branched, hyaline, 1.5~2.0 μm wide. **Stromata** small to medium, well-developed, subglobular to globular, 15~30 μm diam., brown to dark brown, composed of some brown hyphal cells. **Conidiophores** 5~20 in a divergent fascicle, emerging through stomatal openings or the cuticle, pale olivaceous brown, uniform in colour, irregular in width, straight to slightly curved, usually not geniculate, but sometimes once geniculate, not branched, 0~2-septate, but usually aseptate, 10~50×3.0~4.5 μm; conidial scars inconspicuous. **Conidia** solitary, cylindric-obclavate to filiform, shorter ones usually obclavate, subhyaline to very pale greenish, straight to mildly curved, 3~10-septate, non-constricted at the septa, subobtuse to obtuse at the apex, obconically truncate to subtruncate at the base, 35~120× 2.5~4.5 μm; hilum unthickened, not darkened.

Habitat: On living leaves of *Oenothera odorata* Jacq. (Onagraceae).

Specimens examined: SMK 13738 (30 X 1996, Suwon), 14454 (23 X 1997, Suwon), 14735 (30 VII 1998, Seoul).

Distribution: China, Japan, Korea, and USA.

Notes: This is the first record of this fungus from Korea. Chupp (1954) described this species under *Cercospora oenotherae* as follows: Fructification amphigenous; conidiophores aseptate, not branched; conidia pale olivaceous. Katsuki (1965) mentioned that caespituli are amphigenous, but mostly epiphyllous; conidiophores are uniseptate; conidia are elongate-obclavate. Guo and Hsieh (1995) treated *C. oenotherae* as a synonymy of *Pseudocercospora oenotherae* and added the following features of this fungus in detail: Secondary mycelium external; conidiophores rarely branched, 0~3-septate, 6.5~55×2.5~4.0 μm; conidia cylindric-obclavate, 25~120×2.0~4.0 μm. The Korean agree well with *P. oenotherae*, though the secondary mycelium has not been observed in all Korean collections. *Passalora oenotherae* U. Braun (Braun, 1994) has resemblance to this species, but is distinguished by conspicuous conidial scars and faintly yellowish-green coloured and uniseptate conidia. *Ramularia oenotherae-biennis* Iwanoff [≡ *Entylomella oenotherae-biennis* (Iwanoff) Cif.] from Russia is very similar to it, but differs from latter species in having somewhat shorter, narrower and 0~1-septate, catenate conidia, 9~17×1~2 μm, and seems to be an anamorph of *Entyloma* (Braun, 1998).

8. *Pseudocercospora rubi* (Sacc.) Deighton, Mycol. Papers 140: 152 (1976) Fig. 8

≡ *Cercospora rubi* Sacc., Nuovo. Giorn. Bot. Ital. 8: 188 (1876)

= *Cercospora septorioides* Ellis & Everh., Field Columb. Mus. Bot. Ser. 1: 194 (1896)

= *Cercospora garbiniana* C. Massal., Atti Mem. Acad. Agric. Sci. Lett. Verona Ser. 4. 3: 147 (1902)

Teleomorph: *Mycosphaerella confusa* F.A. Wolf, Mycologia 28: 45 (1936)

Leaf spots amphigenous, scattered to confluent, subcircular to irregular, 2~10 mm diam., when confluent becoming large patches, greyish brown to blackish brown, centre appearing greyish white to greyish brown with purplish brown or reddish brown margins on the upper surface, greyish brown to grey on the lower surface. **Caespituli** amphigenous, but chiefly epiphyllous. **Mycelium** internal, hyphae septate, branched, hyaline, 2~4 μm wide. **Stromata** medium to large, well-developed, subglobular, dark brown, 20~60 μm diam., composed of several brown hyphal cells. **Conidiophores** 15~40 in a dense fascicle, arising from substomatal stromata or emerging through the cuticle, olivaceous brown throughout, sometimes irregular in width, straight to slightly curved, not geniculate, not branched, 0~3-septate, 13~50×2.5~4.0 μm; conidial scars inconspicuous. **Conidia** solitary, obclavate to obclavate-cylindric, straight to mildly curved, subhyaline to very pale olivaceous brown, 3~11-septate, non-constricted at the septa, obtuse to subacute at the apex, obconically truncate to subtruncate at the base, 30~132×2.5~4.0 μm; hilum unthickened, not darkened.

Habitat: On living leaves of *Rubus coreanus* Miq. and

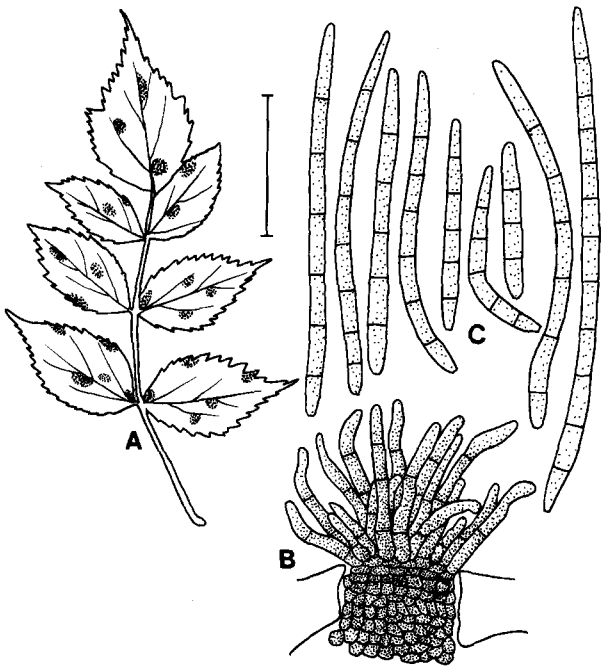

Fig. 8. *Pseudocercospora rubi.* **(A)** Leaf spots on the upper leaf surface of *Rubus coreanus* (0.4×). **(B)** Conidiophores. **(C)** Conidia. Bar = 30 μm.

R. oldhamii Miq. (Rosaceae).

Specimens examined: On *Rubus coreanus*, SMK 15137 (19 IX 1998, Jinju); on *R. oldhamii*, SMK 13939 (7 VI 1997, Jongsun), 14180 (15 IX 1997, Yangku).

Distribution: Bermuda, China, Europe, India, Japan, Korea, North and South America.

Notes: Shin (1997) first listed this fungus on *Rubus oldhamii* from Korea. In some Korean specimens, SMK 13939 and 14180, the conidiophores are short (only 12~26 μm long), 0~1-septate. Chupp (1954) described the following characters of *Cercospora rubi*: Fructification chiefly epiphyllous; conidiophores sometimes branched; conidia rarely guttulate, 25~75×2~4 μm. Deighton (1976) transferred *C. rubi* into *Pseudocercospora*. Japanese collections (Katsuki, 1965) possessed epiphyllous fructification, branched conidiophores. Based on the Chinese collections, Guo and Hsieh (1995) described somewhat long conidiophores (10~95 μm in length) and obclavate-cylindric conidia. However, these differences fall within the accepted variation of this species. Therefore, the Korean collections are in agreement with these previous descriptions. *Pseudocercospora rubicola* (Th m.) X.J Liu & Y.L. Gou (Guo and Hsieh, 1995) is very close to the present fungus, but differs from it in having only epiphyllous fructification, and somewhat wider conidia (4.0~6.5 μm wide). *Pseudocercosporella arcuata* S.K. Singh, S. N. Singh & K. Bhalla on *Rubus ellipticus* from Nepal is similar to this species, but distinguished from the latter by colourless much shorter and somewhat narrower conidiophores (10~20×1.5~4.0 μm) and 1~4-septate, colourless cylindric conidia. *Pseudocercospora rubi* var. *subhyalina* H.D. Shin & U. Braun (Shin and Braun, 1996) is morphologically alike to this fungus, but different by having abundantly hypophyllous caespituli, and subhyaline conidiophores.

9. *Pseudocercospora zelkowae* (Hori) X.J. Liu & Y.L. Guo, Acta Mycol. Sinica 12: 33 (1993) Fig. 9
≡ *Cercospora zelkowae* Hori, in Nambu., J. Plant Prot. 8: 492 (1921)

Leaf spots amphigenous, scattered to confluent, distinct, angular to irregular, 3~10 mm diam., up to 15 mm when coalescent, vein-limited, greyish brown to brown without definite margins on the lower surface, brown to dark brown with yellowish brown haloes on the upper surface. **Caespituli** amphigenous. **Mycelium** internal, hyphae septate, branched, hyaline, 2~3 μm wide. **Stromata** large, well-developed, dark brown to blackish brown, globular to subglobular, 25~40 μm diam., composed of several swollen, brown hyphal cells. **Conidiophores** 15~30(~50) in a very dense fascicle, arising from stromata through stomata, and emerging through the cuticle, olivaceous brown throughout, straight to slightly curved, rarely once geniculate, not branched, 0~1(~2)-septate, 12~38×3.0~4.0 μm; conidial scars inconspicuous. **Conidia** solitary, obclavate to obclavate-cylindric, substraight to moderately curved, subhyaline to very pale greenish due to a few oil drops guttulate, 1~7-septate, non-constricted at the septa, obtuse at the apex, obconically truncate to subtruncate at the base, 30~70×3.0~4.0 μm; hilum unthickened, not darkened.

Habitat: On living leaves of *Zelkowa serrata* Makino (Ulmaceae).

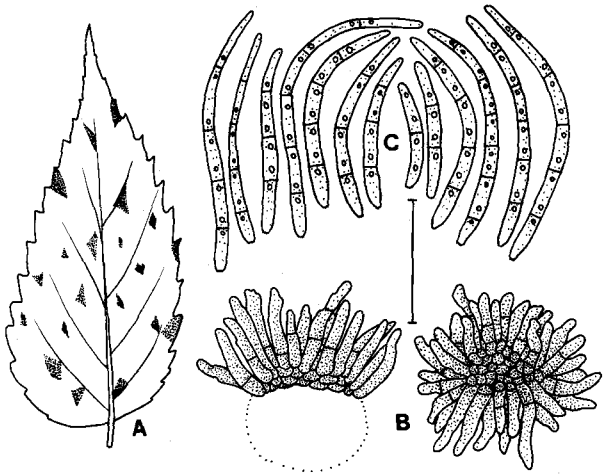

Fig. 9. *Pseudocercospora zelkowae.* **(A)** Leaf spots on the upper leaf surface of *Zelkowa serrata* (0.7×). **(B)** Conidiophores. **(C)** Conidia. Bar = 30 μm.

Specimen examined: SMK 15033 (4 IX 1998, Seoul).

Distribution: China, Japan, and Korea.

Notes: This species (under *Cercospora zelkowae*) was previously reported on the same host species from Korea with a short note (Anonymous, 1991). Chupp (1954) and Katsuki (1965) recorded this fungus as *C. zelkowae* and provided full descriptions. However, this species must be placed in *Pseudocercospora* (Guo and Liu, 1993), as the conidial scars are inconspicuous. Guo and Liu (1993) described the features of *Pseudocercospora zelkowae* as follows: Fructification amphigenous; secondary mycelium well-developed, 2.0~2.5 μm wide; conidiophores densely to very densely fasiculate or solitary arising from creeping secondary hyphae, 0~2-septate; conidia cylindric to obclavate, eguttulate. Therefore, the present description agrees well with that based on the Chinese collections.

10. *Ramularia archangelicae* Lindr., Acta Soc. Fauna Fl. Fenn. 23(3): 22 (1902) Fig. 10

= *Ramularia angelicae* H hn., Hedwigia 42: 178 (1903)

= *Cylindrosporium vaccarianum* Sacc., Nuovo Giorn. Bot. Ital. N.S., 24: 41 (1917)

= *Ramularia grantii* Dearn., Mycologia 21: 326 (1929)

= *Septocylindrium angelicae* Katsuki, Kyushu Agric. Res. XI: 42 (1953)

= *Ramularia angelicae* Clem., Cryptog. Form. Colorad. 262, nom. nud.!

Leaf spots amphigenous, scattered to confluent, angular to irregular, often vein-limited, 2~5 mm diam., or up to 10 mm when coalescent, pale brown to yellowish brown or reddish brown with narrow dark brown margins, centre becoming greyish white, surrounded by dark borders. **Caespituli** amphigenous, but abundantly hypophyllous. **Mycelium** internal, hyphae septate, branched, hyaline, 1.5~3.0 μm wide. **Stromata** lacking to small, rudimentary to slightly developed, colourless, subglobular, 5~15 μm diam., composed of swollen hyphal cells. **Conidiophores** 3~20 in a divergent to moderately dense fascicle, emerging through stomata or erumpent through the cuticle, hyaline throughout, straight to slightly curved, 1~5 times repeatedly geniculate at the apical portion, not branched, 1~3-septate, 12~60(~112)×2.5~4.0 μm; conidial scars very small, 0.5~1.0 μm wide, conspicuous, apical or on shoulders of conidiogenous cells caused by geniculation. **Conidia** solitary, sometimes in short (1~2) unbranched or branched chains, cylindric to ellipsoidal, hyaline, straight to mildly curved, 0~3-septate, but usually 0~1-septate, subobtuse to somewhat attenuated at both ends, 10~42×3.0~5.5 μm; hilum slightly thickened, darkened, and non-protuberant.

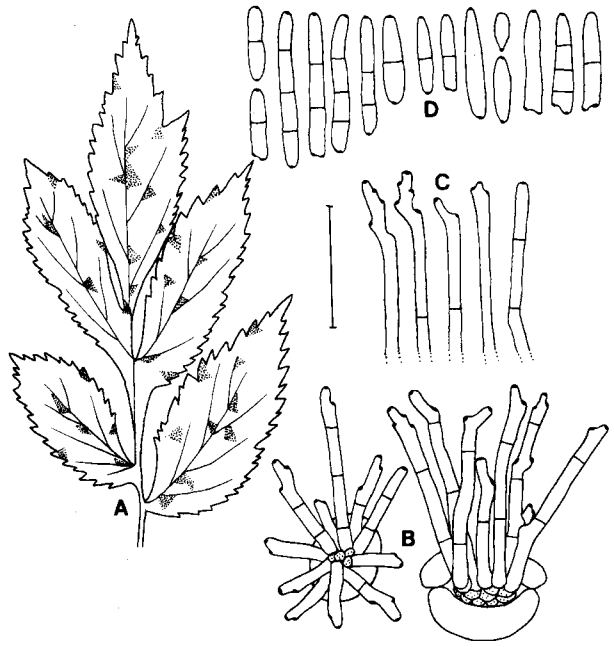

Fig. 10. *Ramularia archangelicae.* **(A)** Leaf spots on the lower leaf surface of *Angelica dahurica* (0.5×). **(B)** Conidiophores. **(C)** Upper portion of conidiophores showing the apices. **(D)** Conidia. Bar = 30 μm.

Habitat: On living leaves of *Angelica dahurica* (Fisch.) Benth. & Hooker f. (Umbelliferae).

Specimen examined: SMK 13132 (2 X 1994, Yangku).

Distribution: Asia (Korea) and Europe.

Notes: Shin and Braun (1996) first listed this fungus from Korea. Braun (1998) published the characters of this species as follows: Caespituli mostly hypophyllous; conidiophores arranged in divergent to moderately dense fascicles, 5~50×2.0~5.5 μm; conidia smooth to rough. Therefore, the Korean collection agrees well with Braun's description. *Cercospora thaspii* Ellis & Everh. on *Angelica hirsuta* is distinguished from it by having pigmented conidiophores, and cylindric-obclavate and much longer (35~120 μm long) conidia. *C. angelicae* Chupp on *Angelica* species differs from the present species in having pigmented, shorter conidiophores (only 5~20 μm long) and acicular, multiseptate conidia.

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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 일곱 번째 보고이다. 이번 보고에서는 *Cer-*

cospora 4종, *Neoramularia* 1종, *Pseudocercospora* 4종, 그리고 *Ramularia* 1종에 대한 균학적 특징을 기재 · 묘사하였다. 우엉에서 *Cercospora arcti-ambrosiae*, 꽃상추와 치코리에서 *C. cichorii*, 콩에서 *C. kikuchii*, 당개지치에서 *C. subhyalina*, 석잠풀에서 *Neoramularia koreana*, 쥐똥나무에서 *Pseudocercospora ligustri*, 달맞이꽃에서 *P. oenotherae*, 복분자딸기와 줄딸기에서 *P. rubi*, 느티나무에서 *P. zelkowae*, 그리고 구릿대에서 *Ramularia archangelicae*를 각각 동정하였다.

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