

# Addition and reexamination of Japanese species belonging to the genus *Cercospora* and allied genera II

## Species described by Japanese mycologists (1)

Chiharu Nakashima<sup>1)</sup>, Takuya Nishijima<sup>2)</sup> and Takao Kobayashi<sup>3)</sup>

<sup>1)</sup> Department of Agricultural Science, Graduate School of Agriculture, Tokyo University of Agriculture, 1–1–1, Sakuragaoka, Setagaya, Tokyo 156–8502, Japan

<sup>2)</sup> Shizuoka Tea Experiment Station, Kurasawa 1706–11, Kikukawa, Ogasa, Shizuoka 439–0002, Japan

<sup>3)</sup> Department of International Agricultural Development, Faculty of International Agriculture and Food Studies, Tokyo University of Agriculture, 1–1–1, Sakuragaoka, Setagaya, Tokyo 156–8502, Japan

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In this second report of the present series, six species of *Cercospora* described in Japan were transferred to the genus *Pseudocercospora* after detailed reexamination. They are *Pseudocercospora abeliae*, *P. chionanthi-retusi*, *P. corylopsidis*, *P. ehretiae*, *P. naitoi* and *P. paulowniae*.

Key Words—*Cercospora*; Japanese species; *Pseudocercospora*.

The purpose of the present study was stated in the introduction of the first paper of this series (Kobayashi et al., 1998). This paper presents the results of reexamination of six species of *Cercospora* described by Japanese mycologists.

1. *Pseudocercospora abeliae* (Katsuki) Nishijima, Nakashima et Kobayashi, comb. nov. Figs. 1, 4a–c  
Basionym: *Cercospora abeliae* Katsuki, Ann. Phytopathol. Soc. Jpn. 20: 71, 1955.

Synonym: *Cercospora abeliae* Plakidas, Mycologia 48: 382, 1956a.

Leaf spots are angular, brown to dark brown, 2–5 mm in diam, and many olive gray sooty masses are produced on both surfaces of the spot. Stromata are amphigenous, mainly epiphyllous, olive brown, 20–50 µm, with external hyphae. Conidiophores usually arise from the upper cells of stroma as dense fascicles, olive brown, not branched, 10–35 × 2.5 µm. Conidial scars on them are unthickened. Often a single conidiophore arises from the external hyphae, breaking through the epidermis and running over the surface of spots. Conidia are holoblastic, sympodial, pale olive, obclavate, smooth, straight or slightly curved, 25–65 × 2–3.8 µm, truncate with unthickened scars at the base, slightly tapering at the apex, with many septa poorly defined, grayish green and powdery in mass.

Hosts: *Abelia chinensis* R. Br. (Shina-tsukubane-utsugi), *A. glandiflora* (Hanazono-tukubane-utsugi), *A. serrata* Sieb. et Zucc. (Ko-tsukubane-utsugi), *A. spathulata* Sieb. et Zucc. (Tsukubane-utugi).

Disease name: Hanten-byo (Yamamoto and Maeda, 1960).

Specimens examined: *Abelia glandiflora* – Sano, Tochigi Pref., 4 September 1998, by Takao Kobayashi (TK); Oarai, Higashi-ibaragi, Ibaraki Pref., 24 September 1979, by TK (TFM: FPH-5007); FFPRI, Kukisaki, Inashiki, Ibaraki Pref., 15 October 1981, by TK (TFM: FPH-5472); Tsukuba Medical Plant Research Station, Tsukuba, Ibaraki Pref., 9 October 1997, by TK & Chiharu Nakashima (CN); Iwai, Ibaraki Pref., 10 September 1998, by Takao & Yoshiko Kobayashi; Fukuda, Kisaradzu, Chiba Pref., 20 September 1974, by TK (TFM: FPH-4243); Jindaiji, Chofu, Tokyo., 25 September 1974, by TK (TFM: FPH-4346); Tokyo University of Agriculture, Setagaya, Tokyo., 6 October 1998, by CN; Fruit Park, Miyakoda, Hamamatsu, Shizuoka Pref., 1 November 1996, by TK, CN & Takuya Nishijima (TN); Fukuoka For. Exp. Stn., Kuroki, Yame, Fukuoka Pref., 20 September 1974, by Seiji Ogawa (SO) (TFM: FPH-4191).

*Abelia chinensis* – Kyushu Univ., Fukuoka, Fukuoka Pref., 15 September, 1954, by Shigetaka Katsuki (SK) (Holotype).

Note: As described above, this fungus has distinct stromata, thin basal ends of conidia, and thin conidial scars on conidiophores. Therefore, it was transferred to the genus *Pseudocercospora* as *P. abeliae*. The present species was first described by Katsuki (1955) based on material collected at Fukuoka Pref. As the presumable teleomorph of the fungus, a *Mycosphaerella* state was observed on the overwintered fallen leaves by Kawabe and Kobayashi (1982). However, they did not present experimental evidence to prove genetic relationship between *C. abeliae* and *Mycosphaerella* sp. This species has been recorded from Kanto, Chugoku, and Kyushu Districts of Japan (Yamamoto and Maeda, 1960), name-

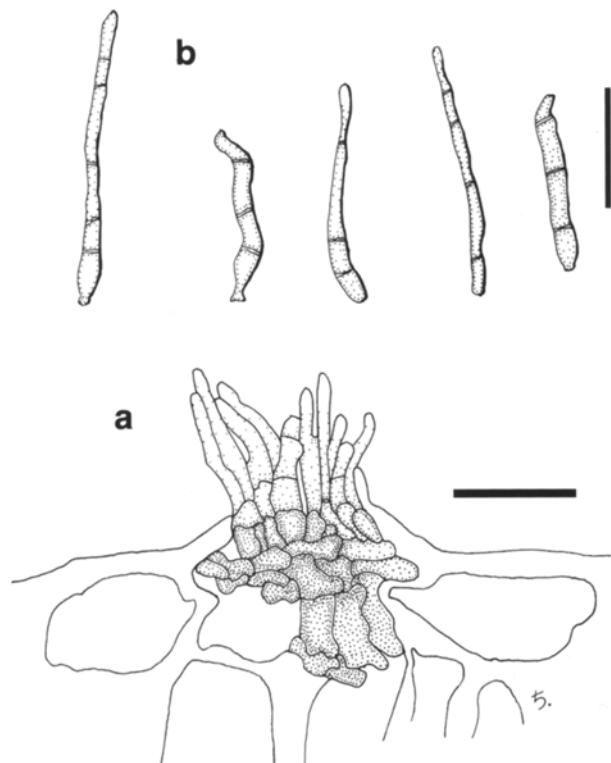


Fig. 1. *Pseudocercospora abeliae*.  
a: Stroma and conidiophores, b: Conidia. (Scale bars: 20  $\mu\text{m}$ )

ly, from Ibaraki, Chiba, Tokyo, Shimane, and Fukuoka (Horie and Kobayashi, 1983; Horie et al., 1975; Kaki-shima et al., 1979; Katsuki, 1955, 1965; Kobayashi, 1975; Nishijima and Kobayashi, 1995; Ogawa, 1984; Ogawa and Hagiwara, 1975; Suto, 1987; Tanda, 1983). However, it seems to be distributed everywhere the host has been planted in Japan.

*Cercospora abeliae* Plakidas, which is treated as a synonym of the present species (Katsuki, 1965; Plakidas, 1956b), has also been recorded from the USA (Farr et al., 1989; Plakidas, 1956a, 1956b). No other species belonging to *Cercospora* and allied genera has been found on *Abelia*.

2. *Pseudocercospora chionanthi-retusi* (Togashi et Katsuki) Nishijima, Nakashima et Kobayashi, comb. nov. (non. *P. chionanthi-retusi* Goh et Hsieh, 1990)

Figs. 4d–f

Basionym: *Cercospora chionanthi-retusi* Togashi et Katsuki, Sci. Rept. Yokohama Nat. Univ. Sec. II. 1: 1, 1952b.

Leaf spots are angular to irregular, 1–6 mm in diam, grayish brown on the upper surface, brown on the lower surface, sometimes coalesce. Fruit bodies are amphigenous, mainly epiphyllous, with external hyphae on lower surface. Stromata are olive-brown, up to 85  $\mu\text{m}$  in diam. Conidiophores arise from the upper part of stromata as dense fascicles and singly from the external hypha, simple, straight or geniculate, pale brown, 20–50

$\times 2.5$ –3  $\mu\text{m}$ . Conidia are obclavate, pale to pale brown, slightly curved, with truncate but unthickened basal end, 20–53  $\times$  2.5–3  $\mu\text{m}$  having multiple and unclearly defined septa.

Host: *Chionanthus retusus* Lindl. et Paxton (Hitotsu-ba-tago).

Disease name: Hanten-byo (Yamamoto and Maeda, 1960).

Specimens examined: FFPRI, Kukisaki, Inashiki, Ibaraki Pref., 15 September 1998, by TK; Fukuoka For. Exp. Stn, Kuroki, Yame, Fukuoka Pref., 20 October 1977, by SO (TFM: FPH-4772).

Note: On *Chionanthus*, three species of *Cercospora* and allied genera are known. *Cercospora chionanthi-retusi* Togashi et Katsuki is different from *Cercospora chionanthi* Ellis et Everhart in its dense, short conidiophores and short, slender conidia. As mentioned above, *Cercospora chionanthi-retusi* has distinct stromata, and clear but thin-walled scars and basal ends on conidiophores and conidia. Therefore, it was transferred to the genus *Pseudocercospora* as *P. chionanthi-retusi* (Togashi et Katsuki) Nishijima et al.

From Taiwan, a specimen identified as *Pseudocercospora chionanthi-retusi* Goh et Hsieh was described by Hsieh and Goh in 1990. The two fungi bearing the same species epithet have similar morphological characteristics except for the site of conidial production. In Japanese specimens of *P. chionanthi-retusi*, fruit bodies are mostly epiphyllous. On the other hand, the Taiwanese specimen has hypophyllous fruit bodies. The host plant is same. If the two fungi are the same, the Taiwanese species should be included as a synonym of the Japanese species. If they are different, *P. chionanthi-retusi* Goh et Hsieh will require a new species name. Comparative study of both specimens is necessary to solve this problem.

3. *Pseudocercospora corylopsidis* (Togashi et Katsuki)

Nakashima et Kobayashi, comb. nov. Fig. 4g–i

Basionym: *Cercospora corylopsidis* Togashi et Katsuki, Bot. Mag. (Tokyo) 65: 20, 1952a.

Leaf spots are circular to irregular, 0.5–3 mm in diam, gray to brown. Fruit bodies are amphigenous, mainly epiphyllous, with external hyphae. Stromata are pale brown, 22–45  $\mu\text{m}$  in diam. Conidiophores are dense, unbranched, pale brown, geniculate, 7–15  $\times$  1.5–2.5  $\mu\text{m}$ . Conidia are cylindrical to obclavate, straight or slightly curved, smooth, pale to pale olive, basal end truncate but unthickened, 17–53  $\times$  2–3  $\mu\text{m}$ , with 2–6 septa.

Host: *Corylopsis pauciflora* Sieb. et Zucc. (Hyugamizuki), *Corylopsis spicata* Sieb. et Zucc. (Tosa-mizuki).

Disease name: Hanten-byo (Yamamoto and Maeda, 1960).

Specimens examined: *Corylopsis pauciflora* – Tsukuba Botanical Garden, Tsukuba, Ibaraki Pref., October 1996, by TK; Jindai Bot. Park, Chofu, Tokyo., 25 October 1974, by TK (TFM: FPH-4848); Jindai Bot. Park, Chofu, Tokyo., 7 November 1998, by CN & Imaizumi, Erika (EI); Todori, Hachioji, Tokyo., 12 October 1979, by Manabu Kusunoki (TFM: FPH-6152); Kagoshima Univ.

Bot. Gard., Kagoshima, Kagoshima Pref., 26 October 1949, by SK (Holotype).

*Corylopsis spicata* – Jindai Bot. Park, Chofu, Tokyo., 7 November 1998, by CN & EI.

Note: The above specimens including the holotype of *Cercospora corylopsidis* Togashi et Katsuki were identical to each other in their morphological characteristics. However, because they have distinct stromata, conidiophores with unthickened conidial scars, and conidia with thin basal ends, the present species was transferred to the genus *Pseudocercospora*.

This fungus is known only from Japan (Chupp, 1953; Yamamoto and Maeda, 1960), namely, from Tokyo, Aichi, and Kagoshima (Horie and Kobayashi, 1983, 1984; Horie et al., 1975; Katsuki, 1965; Kobayashi, 1975; Togashi and Katsuki, 1952a).

4. *Pseudocercospora ehretiae* (Togashi et Katsuki) Nakashima et Kobayashi, comb. nov. (non *P. ehretiae* (Sawada) Goh et Hsieh, 1989) Figs. 2, 5a, b

Basionym: *Cercospora ehretiae* Togashi et Katsuki, Bot. Mag. (Tokyo) 65: 20, 1952a.

Leaf spots are amphigenous, dark brown to grayish brown on the upper surface, grayish brown on the lower surface, border unclear, sometime coalesce and extend over a whole leaf. Fungal bodies are amphigenous. Stromata are brown, 22–35  $\mu\text{m}$ . Conidiophores are simple, pale brown, with thin conidial scars, 12–18  $\times$  2.5  $\mu\text{m}$ . Conidia are cylindrical to obclavate, with thin and truncate basal ends, slightly pointed at the tip, pale colored, 22–43  $\times$  2.5–3.8  $\mu\text{m}$ , with 1–4 septa.

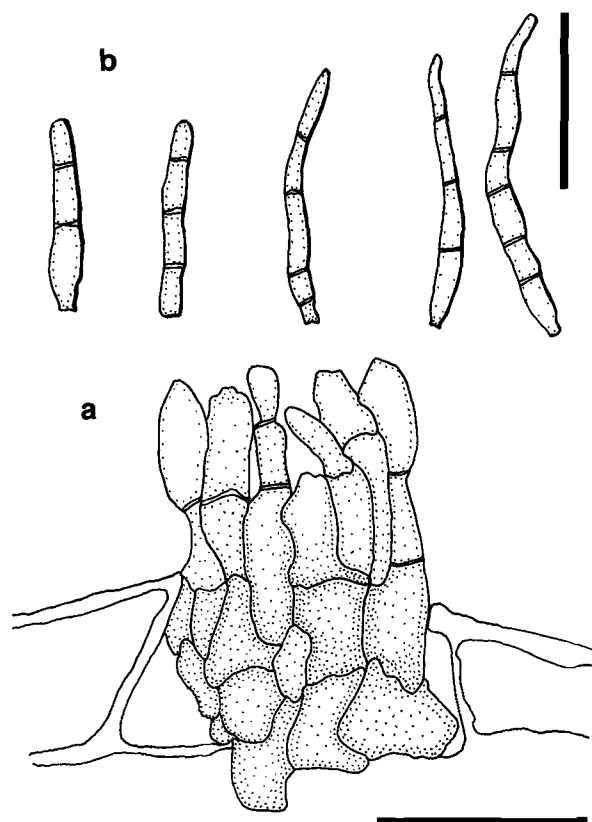


Fig. 2. *Pseudocercospora ehretiae*. a: Stroma and conidiophores, b: Conidia. (Scale bars: 20  $\mu\text{m}$ )

Table 1. Morphological characteristics of *Cercospora* and allied genera on *Ehretia*.

Fungus	Leaf spot (mm)	Stroma ( $\mu\text{m}$ )	Conidiophore ( $\mu\text{m}$ )(scar)	Conidium		
				( $\mu\text{m}$ )(scar)	Septum	
<i>Pseudocercospora ehretiae</i> (Togashi et Katsuki) Nakashima et Kobayashi	dark brown to grayish brown on upper surface, grayish brown on lower surface	amphigenous, 22–35 $\mu\text{m}$ .	simple, pale brown, 12–18 $\times$ 2.5 $\mu\text{m}$ (unthickened)	pale color, 22–43 $\times$ 2.5–3.8 (unthickened)	1–4	a)
	dark brown to grayish brown on upper surface, grayish brown on lower surface, 5–8	amphigenous, subglobular, external hyphae none, up to 100	simple, not geniculate, grayish brown, 14–25 $\times$ 2.5–3	38–56 (–70) $\times$ 2.5	1–3	b)
<i>P. ehretiae</i> (Sawada) Goh et Hsieh	none or distinct	stromata absent, secondary mycelium external	10–20 $\times$ 4–5 (unthickened)	pale olivaceous, 20–150 $\times$ 4–4.5 (unthickened)	1–11	c)
	irregular, yellowish brown		branched 6–20 $\times$ 4.5	hyaline 55–183 $\times$ 4–5	1–7	d)
<i>P. ehretiae-thyrsiflorae</i> Goh et Hsieh	pale grayish brown at the center, with a narrow dark brown margin, 1.5–6	absent, secondary mycelium external	6–30 $\times$ 2–3 (small but unthickened)	subhyaline, 20–80 $\times$ 1.5–2 (unthickened)	1–9	e)
	center pale grayish brown, margin surrounded by dark brown, olivaceous brown on the lower surface, 1.5–6	stromata none hypogenous, secondary mycelium external	5–30 $\times$ 2–3 (unthickened)	subhyaline, 20–80 $\times$ 1.5–2.5 (unthickened)	1–9	f)

a) The authors, on *Ehretia ovalifolia*; b) Togashi and Katsuki (1952), on *E. thyrsiflora*; c) Hsieh and Goh (1990), on *E. dicksonii* var. *typica*; d) Sawada (1959), *E. dicksonii* var. *typica*; e) Hsieh and Goh (1990), on *E. thyrsiflora*; f) Guo and Hsieh (1995), on *E. thyrsiflora*.

Host: *Ehretia ovalifolia* Hassk. (Chishanoki).

Disease name: Susukabi-hanten-byo (Yamamoto and Maeda, 1960).

Specimen examined: Hojo, Takawa, Fukuoka Pref., 16 November 1949, by SK (Holotype); Fukuoka, Fukuoka Pref., 24 October 1948, by SK.

Note: The present species, *Cercospora ehretiae* Togashi et Katsuki, has distinct stromata, unthickened conidial scars, and thin-walled basal ends of conidia. Therefore, it was transferred to the genus *Pseudocercospora* as *P. ehretiae* (Togashi et Katsuki) Nakashima et Kobayashi. On *Ehretia*, three species of *Cercospora* and allied genera are known, as shown in Table 1. The present species is distinguished from *P. ehretiae* (Sawada) Goh et Hsieh (1989) and *P. ehretiae-thyrsiflorae* Goh et Hsieh by its different symptoms, distinct stromata without external hyphae, unbranched conidiophores, and the size of conidia, which are smaller than in the former species and thicker than in the latter.

By transferring *Cercospora ehretiae* Togashi et Katsuki (1952a) to the genus *Pseudocercospora*, two different fungi having the same species epithet were included in the genus *Pseudocercospora*. However, *Cercosporella ehretiae* Sawada (1959) and *Pseudocercospora ehretiae* (Sawada) Goh et Hsieh are invalid names without Latin descriptions as pointed out by Braun (1995). *Pseudocercospora ehretiae* (Sawada) Goh et Hsieh must be given a new species epithet. *Cercospora ehretiae* Togashi et Katsuki (1952a) naturally has priority over *Cercosporella ehretiae* Sawada (1959).

The present species has been recorded only from Kyushu District of Japan (Katsuki, 1965; Togashi and Katsuki, 1952a, 1952b).

5. *Pseudocercospora naitoi* (Togashi) Nakashima et Kobayashi, comb. nov. Fig. 5c-f

Basionym: *Cercospora naitoi* Togashi, Trans. Sapporo Nat. Hist. Soc. 17: 101, 1942.

Synonym: *Cercospora mate* sensu Naito non Spegazzini, Mem Coll. Agr. Kyoto Imp. Univ. 47: 49-50, 1940.

Leaf spots are amphigenous, circular to irregular, 3-10 mm in diam, black or reddish brown on the upper surface, gray on the lower surface. Fungal bodies are amphigenous, but mainly hypophyllous. Stromata are olive, 22-43  $\mu\text{m}$ . Conidiophores are simple, olive, straight, short, 7-33  $\times$  2.5  $\mu\text{m}$ , with thin conidial scars. Conidia are cylindrical to obclavate, pale olivaceous, with truncate and thin basal ends, slightly pointed at the tip, 3-11 septa, 30-85  $\times$  1.3-2.5  $\mu\text{m}$ .

Hosts: *Ilex oldhami* Miq. (Nanamenoki), *I. serrata* Thunb. (Umemodoki), *I. serrata* var. *argutiduns* (Miq.) Rehd. (Inu-umemodoki).

Disease name: Hanten-byo (Yamamoto and Maeda, 1960), *Cercospora* leaf spot.

Specimens examined: *Ilex oldhami* - Shogun-zizo, Kyoto Pref., 20 September 1924, by T. Nojima; Mukomashi, Kyoto pref., 10 October 1935, by N. Naito; Kaiinji, Kyoto Pref., 3 December 1935, by N. Naito; Kuroki, Yame, Fukuoka Pref., 5 August 1976, by SO (TFM: FPH-4643).

*I. serrata* Thunb. - Flower Park, Hamamatsu, Shizuoka Pref., 22 August 1986, by TK & K. M. Old (TFM: FPH-6619); Kaminogi, Matsue, Shimane Pref., 14 November 1973, by TK (TFM: FPH-4006); Mizuwake, Fukuoka Pref., 11 October 1951, by SK; Kuroki, Yame, Fukuoka Pref., 19 September 1974, by SO (TFM: FPH-4187); Mori, Oita Pref., 27 September 1951, by H. Yoshii; Ariake, Higashitakaku, Nagasaki Pref., 22 August 1974, by Yukio Takizawa (TFM: FPH-4192).

*I. serrata* var. *argutiduns* - Flower park, Hamamatsu, Shizuoka Pref., 1 November 1996, by TK & CN.

Note: The present species has been recorded from western Japan other than the Nansei Islands, namely, from Kyoto, Shimane, Fukuoka, Nagasaki, and Oita (Chupp, 1953; Katsuki, 1965; Kobayashi, 1976; Naito, 1940; Ogawa, 1984; Ogawa and Hagiwara, 1975; Suto, 1974, 1975, 1987; Togashi, 1942; Yamamoto and Maeda, 1960).

On *Ilex*, seven species of *Cercospora* and allied genera are known (Chupp, 1953). From observations of these species including type specimens, the present fun-

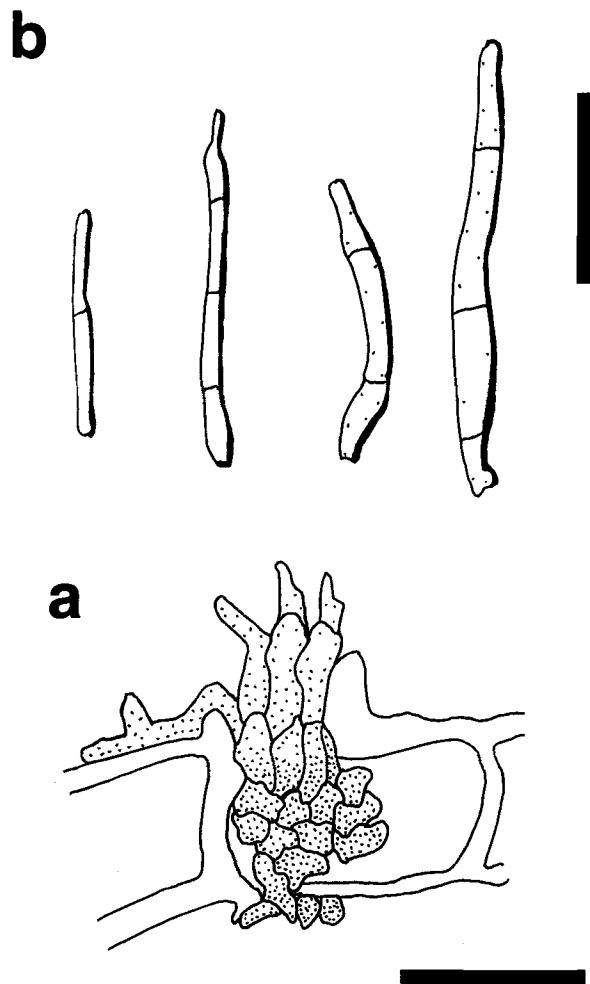


Fig. 3. *Pseudocercospora paulowniae*. a: Stroma and conidiophores, b: Conidia. (Scale bars: 20  $\mu\text{m}$ )

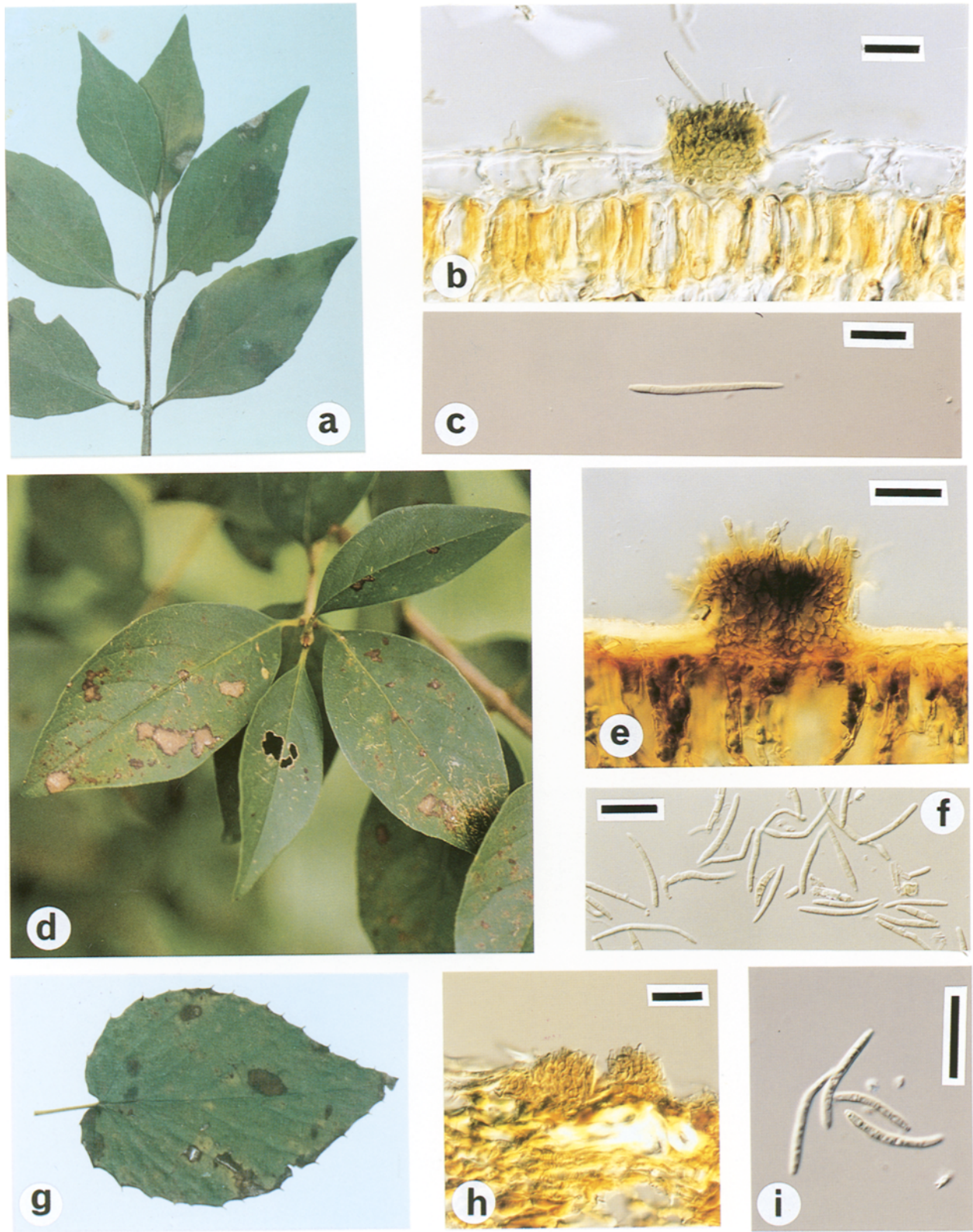


Fig. 4. *Pseudocercospora abeliae* (a–c); *Pseudocercospora chionanthi-retusi* (d–f); *Pseudocercospora corylopsiidis* (g–i). a, d, g: Symptoms; b, e, h: Stromata and conidiophores; c, f, i: Conidia. Scale bars: 20  $\mu$ m.

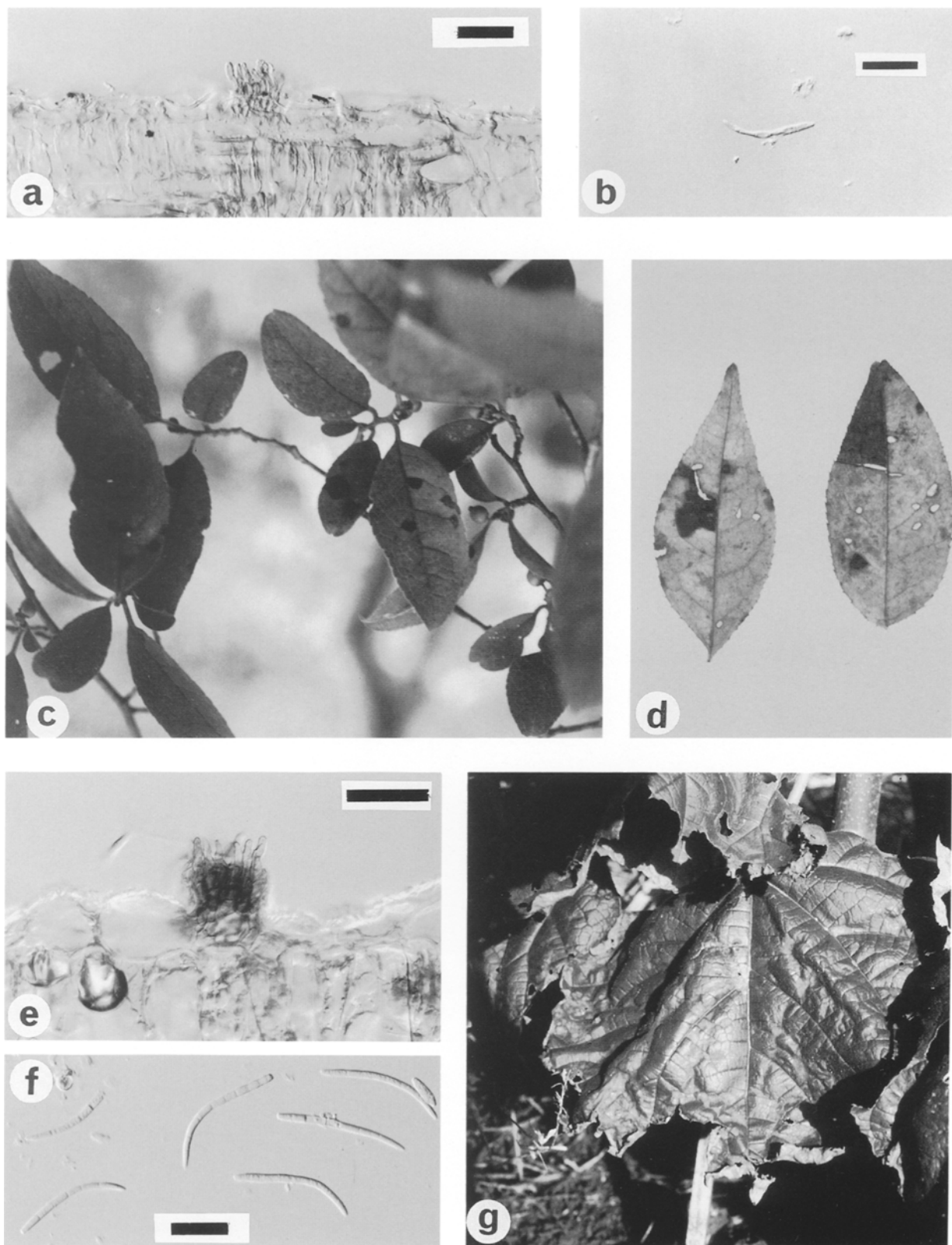


Fig. 5. *Pseudocercospora ehretiae* (a, b); *Pseudocercospora naitoi* (c–f); Leaf spot on *Paulownia taiwaniana* in Philippine was caused by *Pseudocercospora paulowniae* (g). a, e: Stromata and conidiophores; b, f: Conidia; c, g: Symptoms; d: Magnified, symptoms of c. Scale bars: 20 μm.

gus differs from the other *Cercospora* species and allied genera in having small stromata, short conidiophores, and narrow and small hyaline to pale olive conidia. As noted above, this species is transferred to the genus *Pseudocercospora* as it has unthickened conidial scars on conidiophores and thin basal ends of conidia.

6. *Pseudocercospora paulowniae* (Hori) Nakashima et Kobayashi, comb. nov. Figs. 3, 5g

Basionym: *Cercospora paulowniae* Hori, Hara, Jikken-jumoku-byogai-hen (Manual of Tree Diseases 116, 1927).

Synonym: *Cercospora imperiales* Miura, Rept Akita Pref. Agr. Exp. Sta. 8: 62, 1957.

Leaf spots are circular to irregular, 2–15 mm in diam, brown to grayish brown or grayish, sometimes coalesce. Fruit bodies are amphigenous, with external hyphae. Stroma is absent. Conidiophores arise from external hyphae, simple, pale olive brown to pale brown, with unthickened conidial scars, 20–107.5 × 2.5–5 µm. Conidia are obclavate, pale to pale brown, truncate and unthickened at the basal end, tip obtuse, 15–55 × 2.5–3.8 µm, with 3–5 septa.

Hosts: *Paulownia fortunei* Hesml. (Taiwan-Giri), *P. taiwaniana* Hu et Chung (Usuba-Giri), *P. tomentosa* (Thunb.) Steud. (Kiri), *Paulownia* sp.

Disease name: Hanten-byo (Nambu, 1915), Leaf spot.

Specimens examined: *Paulownia tomentosa* – For. Exp. Stn., Meguro, Tokyo., 30 October 1950, by Osamu Chiba (TFM: FPH-288).

*Paulownia taiwaniana* – Sta. Maria, Bulacan, Luzon Is., Philippines, 12 February 1981, by TK (TFM: FPH-5644).

Note: The conidia of the specimen from Tokyo are smaller and brownish, and those of the specimen from the Philippines are narrower and longer (40–83 × 2–2.5 µm) than Katsuki's (1965) and Miura's descriptions (Miura, 1957). However, the morphological characteristics are identical with Hara's description (1927). Therefore, the above specimens are identified as *Cercospora paulowniae* Hori. This species has external hyphae, unthickened conidial scars and thin-walled basal ends of conidia. Therefore, it was transferred to the genus *Pseudocercospora* as *P. paulowniae*.

On *Paulownia*, a specimen identified as *Pseudocercospora paulowniae* was described by Goh and Hsieh (1990) from Taiwan. *P. paulowniae* Goh et Hsieh was distinguished from *Cercospora paulowniae* Hori by epigenous and hyaline fruit bodies, small stromata and obclavate conidia. In the present observations, the Japanese and Philippine species formed colored fruit bodies on both sides and obclavate conidia. Further, stromata of the Philippine species were up to 63 µm. Therefore, the Taiwanese species should be included as a synonym of *P. paulowniae* (Hori) comb. nov. If it is different, *P. paulowniae* Goh et Hsieh should be given a new species epithet. Comparative study of both specimens is necessary to solve this problem.

The present species has been recorded from Brazil

(Hino and Tokeshi, 1978), China (Hino and Tokeshi, 1978; Guo and Hsieh, 1995), the Philippines (Kobayashi and Guzman, 1985, 1986, 1988), Taiwan (Sawada, 1959) and Japan, namely, Akita, Ishikawa, and Fukuoka (Anonymous, 1955; Katsuki, 1949, 1965; Miura, 1957; Nambu, 1915).

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