

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

## Species described by Japanese mycologists (2)

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In the third report of the present series, five species of *Cercospora* sensu lato described by Japanese mycologists were transferred to the genus *Pseudocercospora* after detailed reexamination. They are *Pseudocercospora photiniae*, *P. phrymae*, *P. stephanandrae*, *P. vaccini* and *P. kirishimensis*. *Pseudocercospora photiniae* was retained as an independent species, not regarded as a synonym of *P. eriobotryae*.

Key Words—*Cercospora*; Japanese species; new combination; *Pseudocercospora*; reexamination.

The genus *Cercospora* was established by Fresenius in 1853. The number of species has increased year by year, because most species are plant pathogenic and seem to be monoxenic. In Pollack's annotated compilation of *Cercospora* names (Pollack, 1987), the number of specific epithets once placed in the genus *Cercospora* exceeds 3,000. In recent years, the genus was divided into several genera by Deighton (1967, 1971, 1973, 1974, 1976, 1979, 1983, 1987) based on such criteria as the forms of conidia borne on and separated from the conidiophore, the presence or absence of stroma, external hyphae, and the thickening of separating points of conidia and conidiophores. This paper presents the results of reexamination of five species of *Cercospora* described by Japanese researchers based on Deighton's concept.

1. *Pseudocercospora photiniae* (Fukui) Nakashima et Kobayashi, comb. nov. Figs. 1, 6–a, b

Basionym: *Cercospora photiniae* Fukui, Bull. Mie Imp. Coll. Agr. & For. 3: 12, 1933; Sugimoto and Kitamura, 1973; Katsu, 1974; Kobayashi, 1974b; Matsuda, 1974; Suto, 1974, 1975; Taniguchi and Katsu, 1975; Watabe and Kitamura, 1975; Ogawa, 1976; Nohira and Awano, 1977; Miyata, 1978; Horie and Kobayashi, 1984; Ogawa, 1984; Suto, 1986, 1987.

Leaf spots are distinct, circular, angular to irregular, 1–5 mm in diam, brown. Fruit bodies are amphigenous. Stromata are brown, with external running hyphae on both sides, 25–63  $\mu\text{m}$ . Conidiophores arise from the upper part of stromata as dense fascicles or directly from external hyphae as a single stalk, and are pale brown to pale olive brown, simple, straight, with thin conidial scars, 20–38  $\times$  2.5–5  $\mu\text{m}$ . Conidia are acicular to obla-

vate, straight or curved, hyaline to pale olivaceous, truncate with unthickened basal ends, dull head at the apex, 32–80  $\times$  2.5–3.8  $\mu\text{m}$ , with 3–9 septa.

Host: *Photinia glabra* Max. (Kanamemochi) and *P. serrulata* Lindl. (Okanamemochi).

Disease name: kappan-byo (Fukui, 1933).

Specimens examined: *Photinia glabra* – Shizuoka For. Exp. Sta., Hamakita, Shizuoka Pref., 24 October 1959, by K. Ito (TFM: FPH-564); Kamo, Aira, Kagoshima Pref., 7 February 1977, by Z. Katsu (TFM: FPH-4056); Kanasago, Kuji, Ibaraki Pref., 23 May 1991, by Takao Kobayashi (TK)(TFM: FPH-7323).

Note: On *Photinia*, four species of *Cercospora* and allied genera including *C. photiniae* have been recorded. These are *Cercospora heteromeles* Harkness, *Pseudocercospora eriobotryae* (Enjoji) Goh et Hsieh (Hsieh and Goh, 1990), *C. photiniae-serrulatae* Anazolone et Plakidas and *C. photiniae*. The three species other than *C. heteromeles* are quite similar to each other. The latter is probably a species of *Helminthosporium* (Chupp, 1953). *Cercospora photiniae-serrulatae* was described by Anazolone and Plakidas (1957). The host range was limited to *P. serrulata*, based on an inoculation test on *P. serrulata* and *P. glabra* and field survey of an adjacent nursery cultivating these species (Anazolone and Plakidas, 1957). *Cercospora photiniae* Fukui was treated as a synonym of *Cercospora eriobotryae* Enjoji by Chupp (1953) and Katsuki (1965), but cross-inoculation tests using *Photinia* and *Eriobotrya* plants were not reported. In general, most species of *Cercospora* and allied genera seem to be monoxenic. Although *Photinia* and *Eriobotrya* both belong the family Rosaceae, *Pseudocercospora photiniae* should be treated as an independent species because no distinct evidence for uniting the

two species is obtained.

As mentioned above, the conidial scars on conidiophores and basal ends of conidia are unthickened. *Cercospora photiniae* was transferred to the genus *Pseudocercospora* mainly for this reason.

*Pseudocercospora photiniae* has been recorded only in Japan, from Gifu (Nohira and Awano, 1977), Aichi (Horie and Kobayashi, 1984), Mie (Fukui, 1933; Sugimoto and Kitamura, 1973; Watabe and Kitamura, 1975), Kochi (Miyata, 1978), Shimane (Suto, 1974, 1975, 1986, 1987), Ehime (Matsuda, 1974), Fukuoka (Ogawa, 1976, 1984) and Kagoshima (Katsu, 1974; Taniguchi and Katsu, 1975) Prefectures.

2. *Pseudocercospora phrymae* (Naito) Nakashima et Kobayashi, comb. nov. Fig. 2

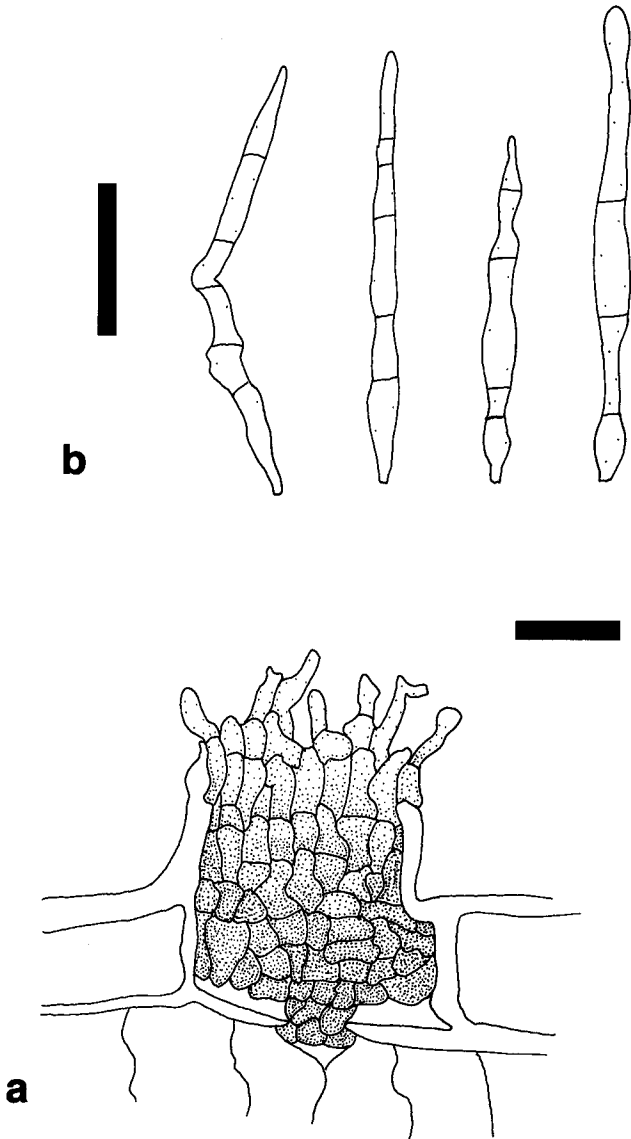


Fig. 1. *Pseudocercospora photiniae*.  
a: Stroma and conidiophores, b: Conidia. (Scale bars: 20  $\mu\text{m}$ )

Basionym: *Cercospora phrymae* Naito, Bull. Kagoshima Agr. Coll. Japan 15: 36, 1949; Katsuki, 1965.

Synonym: *Pseudocercospora phrymae* Liu et Guo, in Guo and Liu, Mycosystema 4: 108, 1991; Guo and Hsieh, 1995.

Leaf spots are angular to irregular, 5–10 mm in diam, vein limited, dark brown. Stromata consist of several large brown cells, hypophyllous, up to 50  $\mu\text{m}$ , with well-developed external hyphae on the lower surface. Conidiophores are 10–38  $\times$  2.5–3.8  $\mu\text{m}$ , pale brown, mildly curved. Conidial scars are unthickened. Conidia are cylindrical to obclavate, smooth, hyaline to pale olivaceous, straight to slightly curved, 27–55  $\times$  2.5–3.8  $\mu\text{m}$ , multiseptate. Basal ends of conidia are truncate but unthickened.

Host: *Phryma leptostachya* L. var. *asiatica* Hara (Haedokuso)

Specimen examined: Kamihonami, Kaho, Fukuoka Pref., 20 July 1946, by I. Doi.

Note: On *Phryma*, as shown in Table 1, three species of *Cercospora* and allied genera are known. Naito (1949) was noted on *Cercospora exilis* Davis (Davis, 1915) in comparison with *C. phrymae* Naito. But the present species, which has large conidia, thin conidial scars and basal ends of conidia, distinct stroma and pigmented conidiophores, differs from the genus *Cercospora*. It belongs to the genus *Pseudocercospora* on the basis of its morphological characteristics.

*Pseudocercospora phrymae* Liu et Guo was described as a new species from China (Guo and Liu,

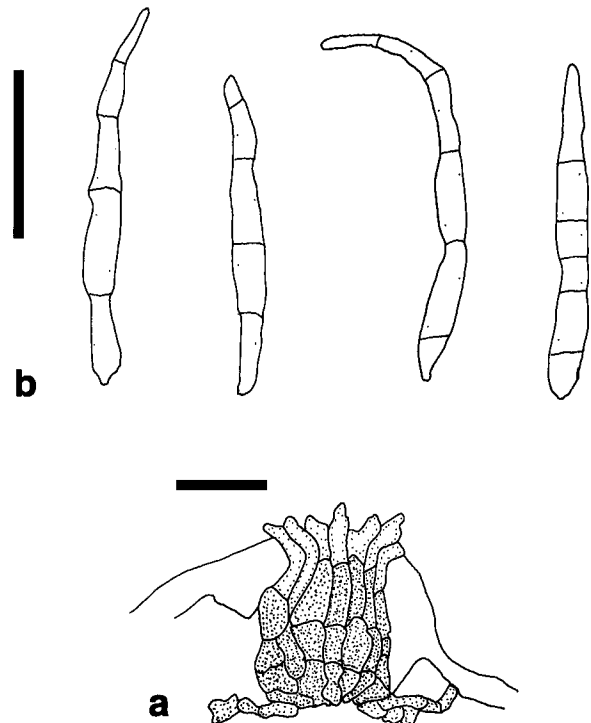


Fig. 2. *Pseudocercospora phrymae*.  
a: Stroma and conidiophores, b: Conidia. (Scale bars: 20  $\mu\text{m}$ )

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

Fungus	Host	Leaf spot (mm)	Stroma ( $\mu\text{m}$ )	Conidiophore		Conidium		Reference
				( $\mu\text{m}$ ) (scar)	Size ( $\mu\text{m}$ ) (scar)	Septum		
<i>Pseudocercospora phrymae</i> (Naito) Nakashima et Kobayashi	<i>Phryma leptostachya</i> L. var. <i>asiatica</i> Hara	angular to irregular, dark brown, vein limited (5–10)	present or consisting of several large brown cells (up to 50)	pale brown, slightly curved, thin (10–37.5 $\times$ 2.5–3.8) (unthickened)	hyaline to pale olivaceous (27.5–55 $\times$ 2.5–3.8) (thin)	multi-septate	The authors	
<i>Cercospora phrymae</i> Naito	<i>P. longifoliae</i>	internerves, irregular or subrounded, dark brown (5–8)	loose	pale brown, contorted (15–40 $\times$ 3–3.5)	pale brown (25–85 $\times$ 2.5–3)	2–5(–8)	Naito, 1949	
<i>P. phrymae</i> Guo et Liu	<i>P. leptostachya</i> var. <i>asiatica</i>	subcircular, center pale olivaceous brown to grayish brown, with brown border (1–4)	none or consisting of few pigmented cells (15–32)	pigmented, straight or slightly curved (5–43 $\times$ 3–4) (denticulate)	pale olivaceous (30–86.5 $\times$ 3–4)	3–9	Guo and Hsieh, 1995	
<i>Cercosporella exilis</i> Davis	<i>P. leptostachya</i>	round to angular, limited by the veinlets, often confluent, brown (2–5)	— <sup>a)</sup>	hyaline, seldom branched (10–20 $\times$ 2.5–3.5)	hyaline (20–40 $\times$ 1–2)	— <sup>a)</sup>	Davis, 1915	

a) —: not described.

1991). In their symptoms and morphological characteristics, the Japanese and Chinese species are identical with one another. *Cercospora phrymae* Naito has priority over *P. phrymae* Liu et Guo. Therefore the latter is treated as a synonym of *P. phrymae* (Naito) Nakashima et Kobayashi

### 3. *Pseudocercospora stephanandrae* (Kobayashi et Horie) Nakashima et Kobayashi, comb. nov.

Figs. 3, 6–c, d, e, f

Basionym: *Cercospora stephanandrae* Kobayashi et Horie, in Kobayashi et al. Trans. Mycol. Soc. Japan 20: 331, 1979; Horie and Kobayashi, 1983.

Leaf spots are angular to irregular, 3–10 mm in diam, pale brown to brown on the upper leaf surface, grayish brown on the lower leaf surface. Stromata are amphigenous, mainly epiphyllous, brown, 15–28  $\mu\text{m}$  in diam. Conidiophores are pale brown, simple, straight, fascicles dense, 10–23  $\times$  2–3.8  $\mu\text{m}$ . Conidial scars are unthickened. Conidia are cylindrical to obclavate, straight to slightly curved, hyaline to pale olivaceous, truncate with thin basal ends, 15–60  $\times$  2–3.8  $\mu\text{m}$ .

Host: *Stephanandra incisa* Zabel (Kogome-utsugi)

Disease name: kappan-byo, brown leaf spot (Kobayashi et al., 1979)

Specimen examined: Jindai Bot. Park, Tokyo, Chofu, Tokyo, 26 October 1974, by Hiromichi Horie (HH)(TFM: FPH-4411, Type); 21 October 1976, by TK and HH (TFM: FPH-4712); 7 November 1998, by Chiharu Nakashima (CN) and Erika Imaizumi; Bot. Garden Univ. Tokyo, Nikko, Tochigi Pref., 3 September 1998, by TK and CN; Tsukuba Botanical Garden, National Science Museum, Tsukuba, Ibaraki Pref., 11 September 1998, by TK and CN.

Note: This species is transferred to the genus *Pseudocercospora* on the basis of its thin conidial scars on conidiophores and basal ends of conidia. Although it

has only been recorded from Tokyo (Horie and Kobayashi, 1983; Kobayashi et al., 1979), collections of this species were newly added from Ibaraki and Tochigi Prefectures in a recent field survey.

Pathogenicity of this species has been confirmed

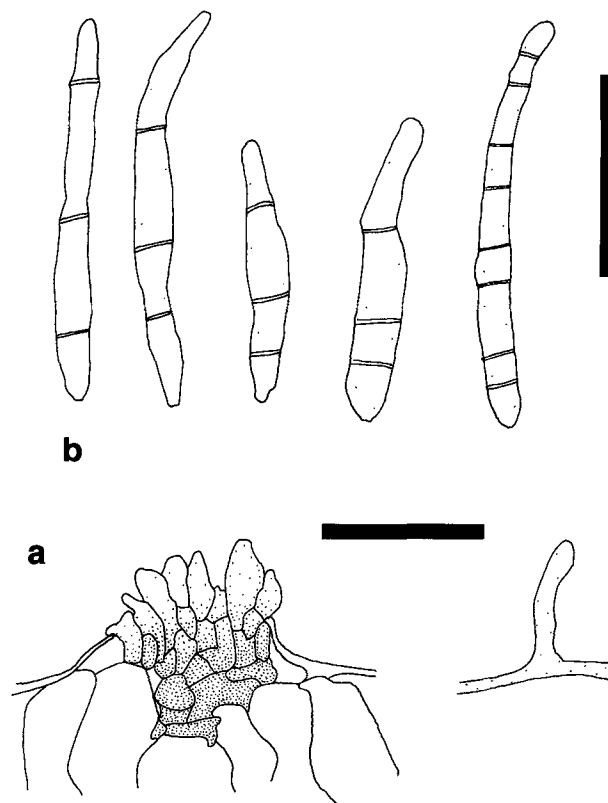


Fig. 3. *Pseudocercospora stephanandrae*. a: Stroma and conidiophores (right: a conidiophore on an external running hypha), b: Conidia. (Scale bars: 20  $\mu\text{m}$ )

through cross-inoculation tests using *Stephanandra incisa* and allied plants in the same subfamily Spiraeae of the Rosaceae (Kobayashi et al., 1979). The present fungus was pathogenic only on *Stephanandra incisa*.

4. *Pseudocercospora vaccini* (Katsuki et Kobayashi) Nakashima et Kobayashi, comb. nov. Figs. 4, 6-g, h  
Basionym: *Cercospora vaccini* Katsuki et Kobayashi, Trans. Mycol. Soc. Japan 16: 3, 1975; Suto, 1975.

Leaf spots are angular, scattered,  $5-7 \times 4-5 \mu\text{m}$ , amphigenous, primary brown, later gray with pale brown border. Fruit bodies are amphigenous. Stromata are distinct, but occasionally none, brown to olivaceous brown with external hyphae,  $42-75 \mu\text{m}$ . Conidiophores are pale to pale olivaceous, fascicles dense, straight,  $22-53 \times 2.5-3.8 \mu\text{m}$ . Conidia are hyaline to pale olivaceous, cylindrical to obclavate, straight, smooth or rough,  $27-70 \times 2.5-3.8 \mu\text{m}$ , with 2-9 septa. Basal ends of conidia are unthickened.

Host: *Vaccinium bracteatum* Thunb. (Shashanbo) and *Vaccinium oldhami* Miq. (Natsu-haze).

Disease name: hammon-byo (Kobayashi, 1974a)

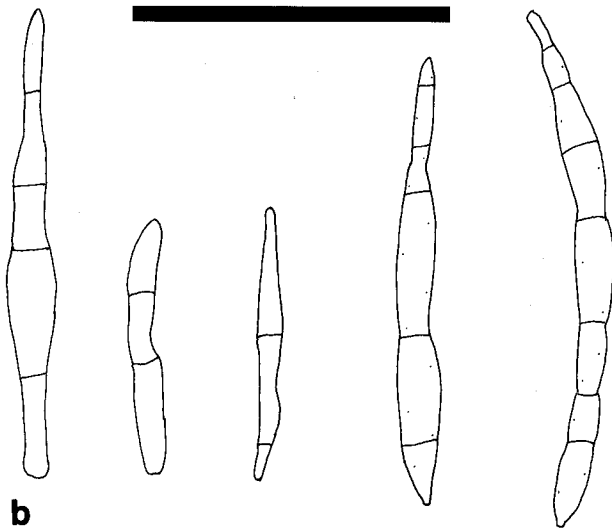


Fig. 4. *Pseudocercospora vaccini*.  
a: Stroma and conidiophores, b: Conidia. (Scale bars:  $20 \mu\text{m}$ )

Specimen examined: *Vaccinium bracteatum* - Taisha, Hikawa, Shimane Pref., 13 November 1973, by TK (TFM: FPH-4074, Type); Nishikawadzu, Matsue, Shimane Pref., 14 November 1973, by TK (TFM: FPH-3959).

*Vaccinium oldhami* - Nishikawadzu, Matsue, Shimane Pref., 14 November 1973, by TK (TFM: FPH-3960).

Note: Reexamination of the type specimen confirmed the presence of thin conidial scars on conidiophores and on basal ends of conidia. Therefore, this species was transferred to the genus *Pseudocercospora* from *Cercospora*.

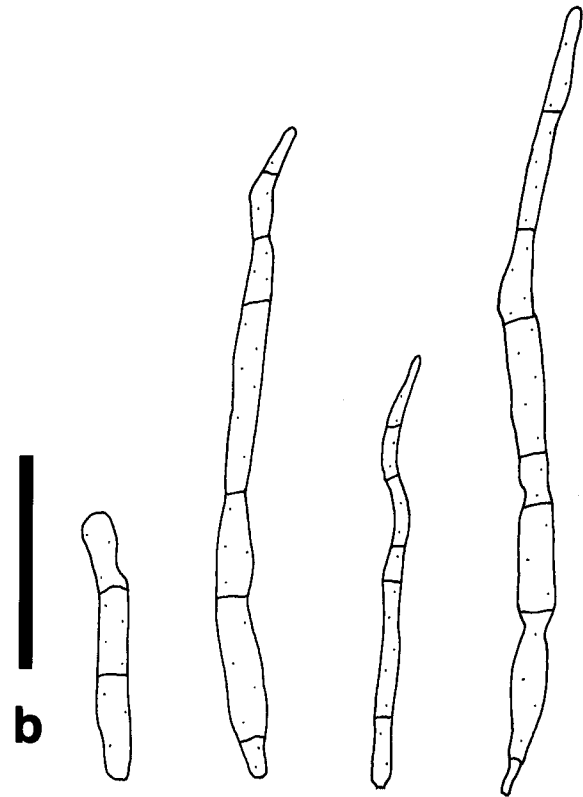


Fig. 5. *Pseudocercospora kirishimensis*.  
a: Stroma and conidiophores, b: Conidia. (Scale bars:  $20 \mu\text{m}$ )

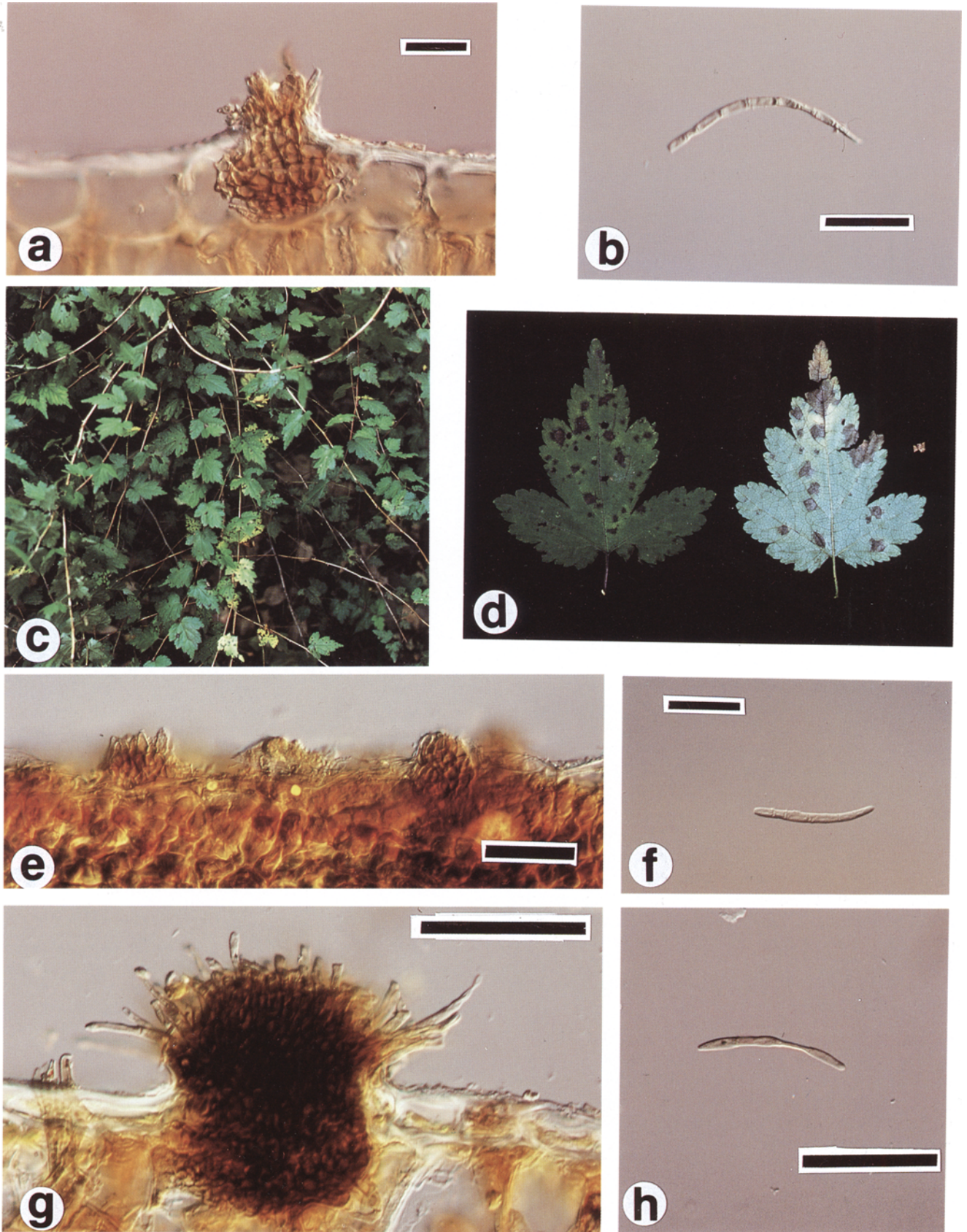


Fig. 6. *Pseudocercospora photiniae* (a, b); *Pseudocercospora stephanandrae* (c-f); *Pseudocercospora vaccini* (g, h). a, e, g: Stromata and conidiophores; b, f, h: Conidia; c: Symptoms; d: Magnified symptoms of c. Scale bars: 20  $\mu\text{m}$ .

This species is known only from Shimane Pref. (Katsuki and Kobayashi, 1975; Kobayashi, 1974a; Suto, 1975). According to Katsuki and Kobayashi (1975), the type specimen number was listed as FES (TFM: FPH)-4047. However, it was given as FPH-4074 in the Forest Mycology and Pathology Herbarium of FFPRI.

**5. *Pseudocercospora kirishimensis*** (Naito) Nakashima et Kobayashi, comb. nov. Fig. 5

Basionym: *Cercospora kirishimensis* Naito, Bull. Kagoshima Agr. Coll. Japan 15: 36, 1949; Katsuki, 1965.

Synonym: *Cercospora perillulae* Togashi et Katsuki, Bot. Mag. Tokyo 65: 24, 1952; Chupp, 1953; Yamamoto and Maeda, 1960.

*Pseudocercospora perillulae* (Togashi et Katsuki) Liu et Guo, in Guo and Liu, Acta Mycol. Sinica 11: 297, 1992.

Leaf spots are scattered, subcircular to irregular, 2–4 mm in diam, grayish brown on the upper surface, pale brown on the lower surface, occasionally confluent. Fruit bodies are amphigenous. Stromata pale brown to brown, up to 40  $\mu\text{m}$ , with external hyphae on both side. Conidiophores are simple, straight or slightly geniculate, pale brown, fascicles loose, 5–45  $\times$  2.5–3.8  $\mu\text{m}$ . Conidial scars are slightly denticulate. Conidia are acicular, cylindrical to obclavate, smooth, pale to pale olivaceous, (10–)25–90  $\times$  2.5–3  $\mu\text{m}$ , with thin truncate basal ends.

Host: *Perillula reptans* Maxim. (Suzukouju).

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

Specimen examined: Kosugidani, Yaku Is., Kagoshima Pref., 16 October 1949, by SK (Co-type of *C. perillulae*).

Note: *Cercospora kirishimensis* Naito is transferred to the genus *Pseudocercospora* as *P. kirishimensis* based on its thin conidial scars on conidiophores and unthickened basal ends of conidia.

*Cercospora perillulae* Togashi et Katsuki was treated as a synonym of *C. kirishimensis* by Katsuki (1965). Therefore, *Pseudocercospora perillulae* was treated as synonym of *P. kirishimensis*, although Guo and Liu (1992) transferred *C. perillulae* Togashi et Katsuki to the genus *Pseudocercospora* as *P. perillulae* (Togashi et Katsuki) Liu et Guo.

Naito (1949) noted that *C. kirishimensis* differs from *C. perillae* Nakata.

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