

Two new species of powdery mildew fungi from Japan

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The following two new species of powdery mildew fungi were found on *Stephania cephalantha* (Menispermaceae) and *Viburnum opulus* var. *calvescens* (Caprifoliaceae) in Japan:

1. *Erysiphe stephaniae* on *S. cephalantha* has smaller cleistothecia and more asci present in the cleistothecium, which include remarkably larger ascospores, than *Erysiphe pisi*, which has been previously described on the same host plant from Taiwan.

2. *Microsphaera shinanoensis* on *V. opulus* var. *calvescens* is easily distinguishable from *Microsphaera alni*, hitherto known on this plant, and other *Microsphaera* fungi on *Viburnum* plants by the shape of its appendages and the numbers of its asci and ascospores.

Key Words—*Erysiphe stephaniae*; *Microsphaera shinanoensis*; powdery mildew.

I. A new species of the genus *Erysiphe* on *Stephania cephalantha*

In autumn 1984, I found the anamorph of a powdery mildew fungus on *Stephania cephalantha* Hayata (Fam. Menispermaceae) grown at a medicinal plant garden in Kanagawa Prefecture. The plant is a liana native to Taiwan and has been often cultivated for use as a crude drug from old times in Japan.

The genus *Stephania* includes about thirty-five species in the world, most of them distributed in the tropics. However, powdery mildews have been only recorded on a few species in some countries of Asia (Amano, 1986). Until now, *S. cephalantha* has been reported as a host of *Erysiphe pisi* DC. (*Ischnochaeta pisi* Sawada) and *Microsphaera pseudoloniceriae* (Salmon) Blumer [*Microsphaera alni* (DC.) Winter] in Taiwan (Sawada, 1959; Wada and Hirata, 1977; Tsai, 1991).

In autumn 1987, Dr. T. Fukuda found numerous cleistothecia on the leaves of this plant at Tokyo Metropolitan Medicinal Plant Garden, and he kindly sent me materials of the affected leaves. In its morphological characteristics, the fungus on *S. cephalantha* resembled *E. pisi*; but it also showed certain characters that distinguish it from *E. pisi* and do not appear in the descriptions of other species of *Erysiphe* that have been found on hosts of other families. Therefore, we regarded this fungus as a new species of *Erysiphe*.

Erysiphe stephaniae Tanda et T. Fukuda, sp. nov. Fig. 1 Mycelium amphigenum in foliis, plerumque epiphyllum, album vel demum griseum, persistens vel evanescens. Cleistothecia gregaria vel sparsa, depresso-blobosa vel subglobosa, atro-brunnea, (82-)89-110(-125) μm diametro, cellulis peridii irregulariter polygonalibus, 14-25 \times 11-18 μm . Appendices 8-20, simplices, curvatae,

flexuosae vel raro rectae, 1-3 septatae, raro aseptatae, brunneae, atro-brunneae vel apicem versus hyalinae, 196-445 μm longae, prope apicem 4.9-7.0 μm et prope basin 5.2-7.7 μm latae. Asci 4 vel 5, ovati vel subglobosi, sessiles vel brevistipitati, 43-75 \times 32-46(-53) μm . Ascospores 4-7, ellipsoideae vel ovatae, 19-36 \times 11-17 μm . Conidia singularia, ovata vel ellipsoidea, 34-54 \times 17-26 μm . Conidiophora recta vel interdum leviter curvata.

Holotypus: In foliis vivis *Stephaniae cephalanthae* Hayata (tamazaki-tsuzurafuji), Hortus Plantarum Medicinalis Tokyoensis, Kodaira-shi, Tokyo, 8 Oct. 1989, leg. T. Fukuda (TUAMH4229). Anamorph specimen: The Medicinal Plant Garden of Kitasato University, Sagami-hara-shi, Kanagawa-Pref., 8 Nov. 1984, leg. S. Tanda (TUAMH2546).

Mycelia amphigenous, usually epiphyllous, developing whitish or afterwards grayish patches, margin obscure, often covering on whole surface of leaves, persistent or evanescent; conidia solitary, ovate or ellipsoidal, vacuolate, 34-54 \times 17-26 (av. 41.8 \pm 0.97 \times 22.4 \pm 0.40) μm [31-51 \times 17-23 (av. 40.3 \pm 1.9 \times 19.5 \pm 0.69) μm in TUAMH2546]; conidiophores erect, 1-3-septate, straight or curved, foot-cells cylindric, straight or often geniculate near the base, 40-75 \times 7-9 (av. 58.3 \pm 3.3 \times 8.2 \pm 0.22) μm ; cleistothecia gregarious, often scattered, depressed globose or subglobose, dark brown, (82-)89-110(-125) (av. 100.3 \pm 1.1) μm diam, wall cells irregularly polygonal, 14-25 \times 11-18 (av. 20.2 \pm 1.3 \times 15.0 \pm 0.79) μm ; appendages produced 8-20 (av. 12.5 \pm 0.87) in the lower half part of the cleistothecium, simple, curved, flexuous or rarely straight, usually 1-3-septate, rarely aseptate, brown or dark brown throughout or from the middle downward, 196-445 (av. 253.7 \pm 30.8) μm long, 4.9-7.0 (av. 5.42 \pm 0.21) μm wide at the upper part, 5.2-7.7 (av. 7.02 \pm 0.28) μm wide near the base; asci 4 or

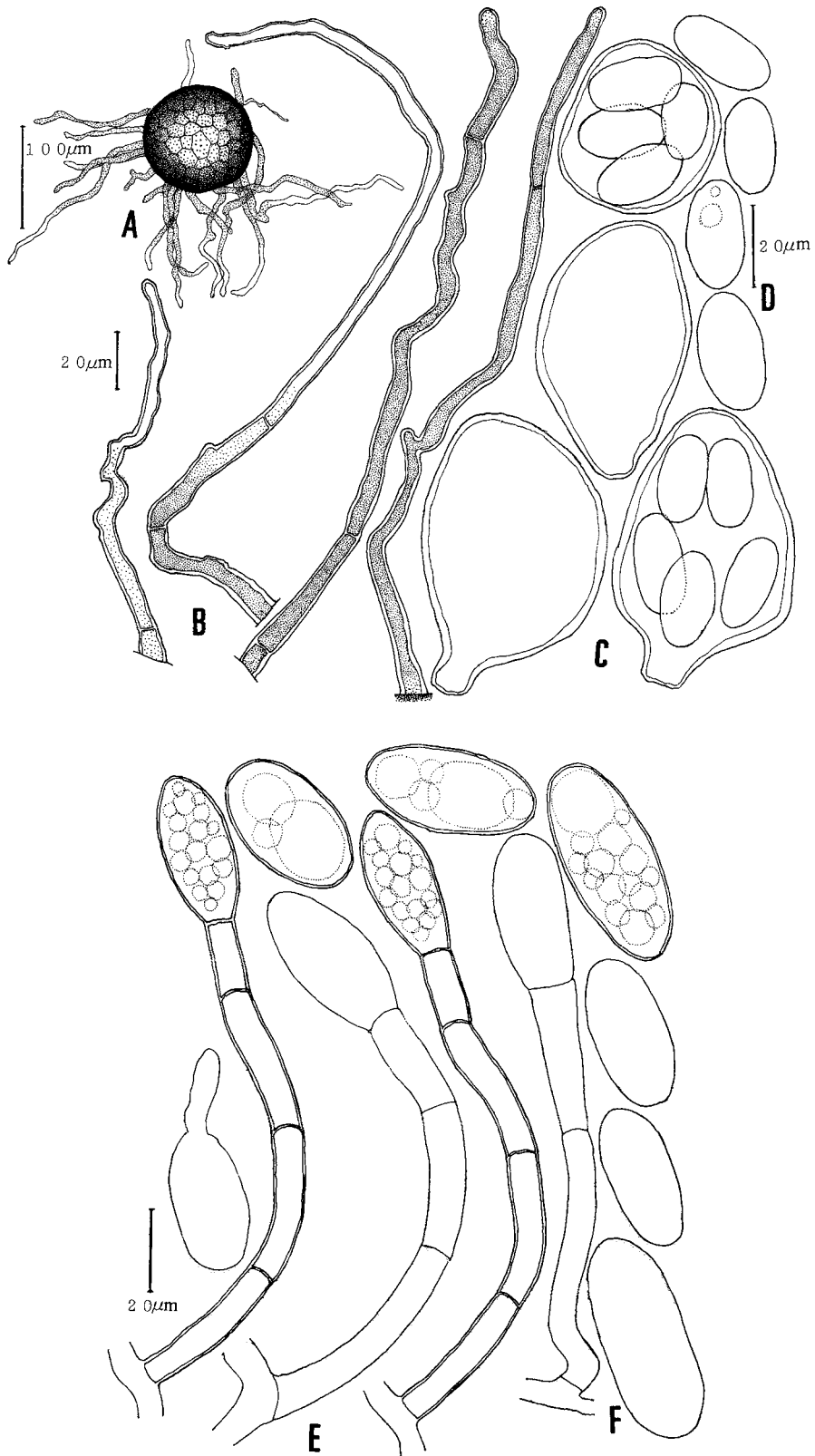


Fig. 1. *Erysiphe stephaniae*. A: Cleistothecium; B: Appendages; C: Asci and ascospores; D: Ascospores; E: Conidia and conidiophores; F: Conidia.

5, ovate or subglobose, sessile or short pedicellate, $43-75 \times 32-46(-53)$ (av. $62.0 \pm 1.2 \times 39.0 \pm 0.58$) μm ; ascospores 4-7 (av. 5.8 ± 0.48), ellipsoidal or ovate, light yellow, $19-36 \times 11-17$ (av. $31.5 \pm 0.84 \times 15.6 \pm 0.26$) μm .

Remarks: As mentioned, two powdery mildew fungi, *E. pisi* and *M. pseudolonicerae*, are hitherto known on *S. cephalantha*. The present fungus clearly belongs to the genus *Erysiphe*, based on the morphology of the cleistothecial appendage, and is not a species of *Microsphaera*. It belongs to sect. *Erysiphe* of the genus *Erysiphe* as defined in Braun's monograph, namely, it forms single conidium and has lobed appressoria on its hyphae. *Erysiphe pisi* is one species in sect. *Erysiphe*. However, the present fungus is different from *E. pisi* in its cleistothecial morphology: it has smaller cleistothecia, with fewer and larger ascospores than the latter fungus.

The fungus is characterized as follows; few ascospores; small cleistothecia; several, long, brown appendages; and many large ascospores formed in an ascus. No fungus having these characters mentioned has yet been described. Therefore, we suggested that the fungus is a new species.

II. A new species of *Microsphaera* on *Viburnum opulus* var. *calvescens*

Viburnum opulus L. var. *calvescens* Hara (Fam. Caprifoliaceae) is a deciduous tree that is widely distributed across northeast Asia. It has been described as a host of *Microsphaera alni* by Shirai and Miyake (1917). Wada and Hirata (1977) recorded *Microsphaera* sp. on this tree from the Hokuriku district of Japan. However, neither work describes the morphological characteristics of these fungi.

Early in October 1987, cleistothecia of a powdery mildew fungus were found on a few leaves of the tree in a mountainous district of Nagano Prefecture. The teleomorphic characteristics of the fungus clearly differed from those of *M. alni* collected from a number of different woody plants in Japan, which has been described by Salmon (1900), Homma (1937) and many others.

Several species of *Microsphaera* are known on about thirty species of the genus *Viburnum* in the world (Amano, 1986). Recently, Braun (1981) published notes on the taxonomy of *Microsphaera* on *Viburnum* plants, and in this laborious work, he recognized two valid taxa, *Microsphaera hedwigii* Lév. and *M. sparsa* Howe, out of the many species of the *Microsphaera* fungi which had been described on *Viburnum* spp.

The *Microsphaera* on *V. opulus* var. *calvescens* is morphologically unrelated to the foregoing two *Microsphaera* spp. Rather, it resembles *Microsphaera lonicerae* (DC.) Winter var. *lonicerae*, which is parasitic on many species of the genus *Lonicera*, a member of Caprifoliaceae. However, differences were found in the numbers of asci and ascospores of these two fungi. Cleistothecia of *M. lonicerae* var. *lonicerae* contain two to eight asci, each containing three to six, mostly four or five, ascospores (Braun, 1987). But cleistothecia of the present

fungi always contain three asci, and ascospores usually number eight, rarely up to six. Since such a distinct form does not appear in the descriptions of the members of *Microsphaera*, I regarded it as a new species.

Microsphaera shinanoensis Tanda, sp. nov. Fig. 2

Mycelium amphigenum in foliis, evanescent. Cleistothecia sparsa, globosa vel subglobosa, atro-brunnea, (71-)78-88(-99) μm diametro, cellulis peridii irregulariter polygonalibus, 11-21 \times 7-14 μm . Appendices 3-10, prope aequatorem cleistothecii exorientes, flaccidae vel curvatae, tenuitunicatae, hyalinae vel ad basim pallide brunneae, 0-1-septatae, superne (3-)4-6 irregulariter dichotome ramosae, ramulis ultimis rectis, (113-)141-205(-226) μm longae, prope basim 4.1-7.9 μm latae. Asci 3, subglobosi vel late ovati, sessiles vel brevistipitati, 42-56 \times 32-46 μm . Ascosporae 8, raro 6, ellipsoideae vel ovatae, hyalinae, 17-20 \times 10-12 μm .

Holotypus: in foliis vivis *Viburni opuli* L. var. *calvescentis* Hara (kanboku), Miasa-mura, Kitaazumi-gun, Nagano-Pref. 1 Oct. 1987. leg. S. Tanda (TUAMH3879).

Mycelia amphigenous, evanescent; cleistothecia scattered, globose or subglobose, dark brown, (71-)78-88(-99) (av. 83.2 ± 0.76) μm diam, wall cells irregularly polygonal, 11-21 \times 7-14 (av. $16.1 \pm 1.3 \times 10.2 \pm 0.71$) μm ; appendages produced 3-10 (av. 6.0 ± 0.27) near the equatorial part of the cleistothecium, flaccid or loosely curved, thin walled, hyaline throughout or light brown at the base, usually aseptate, rarely 1-septate, (3-)4-6 (av. 4.8 ± 0.11) times somewhat irregularly and dichotomously branched at the apex, apex of the ultimate branches straight, (113-)141-205(-226) (av. 175.8 ± 3.4) μm long, 4.1-7.9 (av. 5.58 ± 0.37) μm wide near the base, usually same thickness or somewhat wide toward the apex; asci always 3, subglobose or broadly ovate, short pedicellate or sessile, 42-56 \times 32-46 (av. $51.8 \pm 0.53 \times 40.2 \pm 0.51$) μm ; ascospores usually 8, rarely up to 6, ellipsoidal or ovate, hyaline, 17-20 \times 10-12 (av. $18.2 \pm 0.36 \times 10.8 \pm 0.22$) μm .

Remarks: The present fungus clearly belongs to genus *Microsphaera* based on the morphology of the cleistothecial appendage. Among the powdery mildew fungi on plants of the Caprifoliaceae, ten species of *Microsphaera* are recognized by Braun (1987). Of these fungi, *Viburnum* spp. are affected by two species of *Microsphaera*, namely, *M. sparsa* and *M. hedwigii* (Braun, 1981, 1987).

The present fungus is included in sect. *Microsphaera* of the genus *Microsphaera*, because the ultimate branchlets of appendages are neither long nor flexuous (Otani, 1988). Moreover, the tips of ultimate branchlets of appendages on the cleistothecium are straight in this fungus, unlike in *M. sparsa* and *M. hedwigii*, which form recurved tips of ultimate branchlets.

Among *Microsphaera* spp. on Caprifoliaceae, those with straight tips of the branchlets of appendages are *Microsphaera vanbruntiana* Gerard on *Sambucus* spp. and *M. lonicerae* var. *lonicerae* on *Lonicera* spp. (Braun, 1987). The present fungus is readily distinguished from *M. vanbruntiana* by the cleistothecial diameter and the

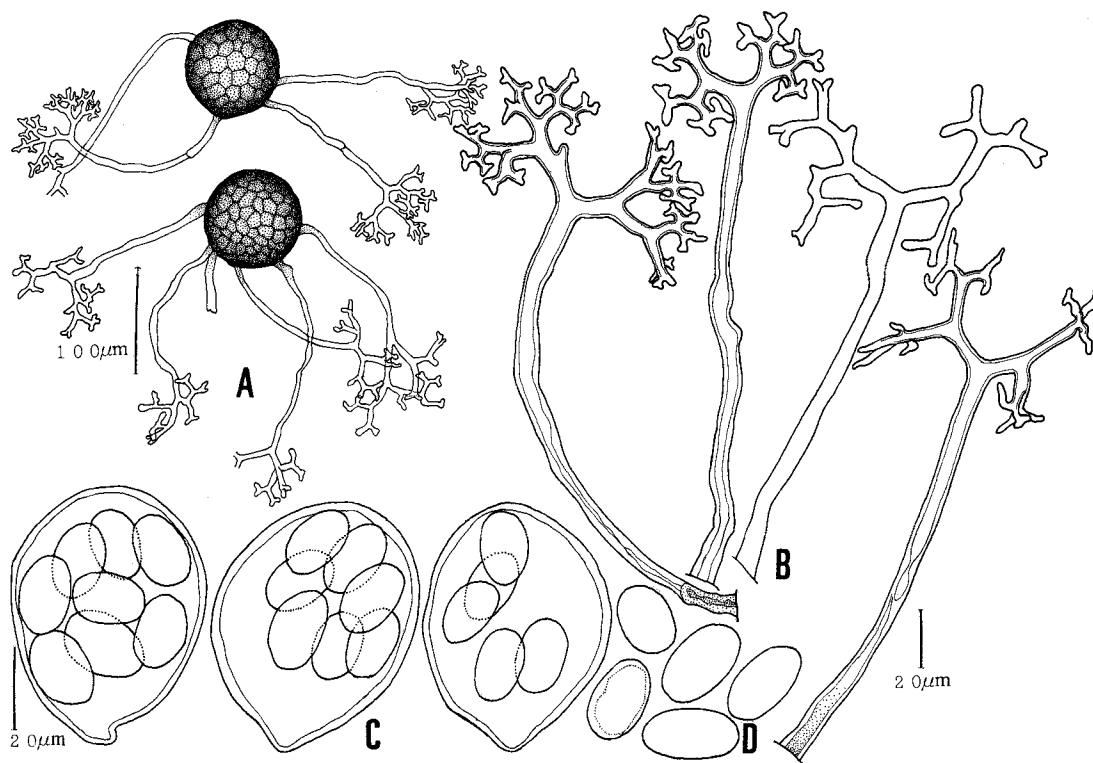


Fig. 2. *Microsphaera shinanoensis*. A: Cleistothecia; B: Appendages; C: Asci and ascospores; D: Ascospores.

numbers of appendages, asci and ascospores. It is similar to *M. lonicerae* var. *lonicerae*, which has straight branchlets or a few tips occasionally recurved, and parasitizes many species of the genus *Lonicera* in Caprifoliaceae; but it differs in the numbers of asci and ascospores.

The present fungus is characterized as follows; few asci in a cleistothecium; many ascospores in an ascus; and peculiar shape of the appendages.

The type materials are kept in the Mycological Herbarium of the Tokyo University of Agriculture, Tokyo, Japan (TUAMH).

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