

Additional Hosts of *Sphaerotheca fuliginea* (Schlecht. ex Fr.) Poll. s. lat., a Powdery Mildew Fungus, in Korea

Hyeon-Dong Shin and Yong-Joon La*

Doosan Research Laboratory, Oriental Brewery Co. Ltd., Seoul 150, and *Dept. of Agr.
Biology, College of Agriculture, Seoul National University, Suweon 170, Korea

흰가루病菌 *Sphaerotheca fuliginea*(Schlecht. ex Fr.) Poll. s. lat.의 韓國產 未記錄寄主植物

申 鉉 童·羅 瑢 俊*

東洋麥酒株式會社 斗山研究所·*서울大學校 農科大學 農生物學科

Abstract: *Sphaerotheca fuliginea* (Schlecht. ex Fr.) Poll. has been recorded on 13 plant species in Korea, to which the authors add 10 additional host plants. The taxonomic concept of *S. fuliginea* proposed by Blumer in 1933 was adopted here.

Keywords: *Sphaerotheca fuliginea*, Powdery mildew fungus.

The flora of powdery mildew fungi of Korea has been studied by Lee (1975, 1976) and Lee and Lee (1967, 1969). *Sphaerotheca fuliginea*, a powdery mildew fungus, has been recorded on 13 plant species in Korea. In 1982, a survey of powdery mildew fungi in Suweon was made and we found 10 additional host plants of *S. fuliginea* in Korea.

Materials and Methods

The morphological characteristics of the imperfect state as well as perfect state of powdery mildew fungus were examined for identification. In accordance with Boesewinkel's suggestion (1980), a number of characteristics of the causal fungus were checked and measured. Each microscopic observation and size measurement of the fungus were performed with fresh and well-ripen materials which were water-mounted on clean slide glass.

Results

Observations of Imperfect State

Lactuca indica var. *laciniata*, *Acalypha australis*,

Cosmos bipinnatus, *Coreopsis tinctoria*, *C. lanceolata*, *Calendula arvensis*, *Taraxacum platycarpum*, *T. ohwi-anum*, *T. coreanum*, and *T. officinale* were found to be infected by morphologically similar powdery mildew fungi. Conidial states of the fungi on the above host plants were all in accordance with the descriptions of *Sphaerotheca fuliginea* by other researchers (Boesewinkel 1979, Boesewinkel 1980, Homma 1937, Junell 1966, Kapoor 1967). Leaves, petioles, and young stems of all hosts were severely infected. In case of *Lactuca*, *Cosmos*, and *C. tinctoria*, their inflorescence were also infected.

The conidial characteristics of the fungi on the above 10 species of host plants were as follows: Mycelium hyaline during actively growing season but brown in mass when perithecia formed; mycelial mat persistent and amphigenous, or more dense on upper surface of leaf forming circular to irregular patches; appressoria unlobed and inconspicuous; conidiophores 136-210 × 9.8-10.3 μm in average, straight and slightly swollen at basal part; conidia formed in chains, vacuolated, 29.2-33.3 × 17.1-19.2 μm in average; fibrosin bodies conspicuous in conidia and conidiophores.

Table I. Size measurements of conidia and conidiophores of *Sphaerotheca fuliginea* reported by Homma and Boesewinkel as compared with authors'.

Reporter and host plant	Conidia	Conidiophores
Authors on <i>Lactuca indica</i> var. <i>laciniata</i>	32.1 × 17.6 μm	146.5 × 10.1* μm
on <i>Taraxacum platycarpum</i>	29.2 × 17.1	209.7 × 10.0
on <i>Acalypha australis</i>	31.5 × 18.2	135.9 × 9.8
on <i>Cosmos bipinnatus</i>	32.4 × 18.9	193.8 × 10.0
on <i>Calendula arvensis</i>	33.3 × 19.2	192.1 × 10.1
on <i>Coreopsis tinctoria</i>	31.0 × 18.0	210.0 × 10.3
on <i>C. lanceolata</i>	32.3 × 18.5	199.0 × 10.1
H.J. Boesewinkel (1980)	27~31 × 15~17	115~150 × 10~12.5
Y. Homma (1937)	25~44 × 13~22	Not measured

* Each value for authors' collection is the average of 50 measurements.

Each value of size measurements and morphological characteristics of imperfect state of *S. fuliginea* are shown in Table I and Fig. 1 respectively.

Observations of Perfect State

Perfect state was not formed on *Calendula arvensis* and *Acalypha australis* until the hosts died in early winter. On other 8 species of host plants, perithecia began to form in the late September and were fully ripen by October. The morphological characteristics

of the perithecial state of the fungi on the 8 host plants were all in accordance with the description of *S. fuliginea* by other researchers (Homma 1937,

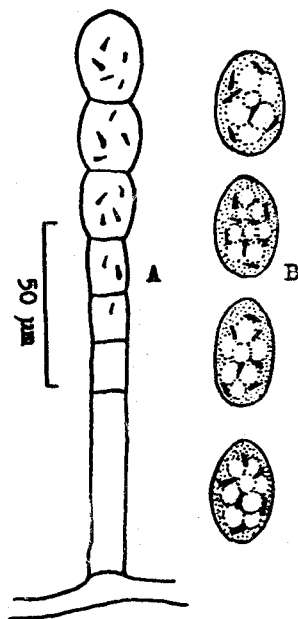


Fig. 1. Imperfect state of *S. fuliginea*.
A : Conidiophore B : Conidia

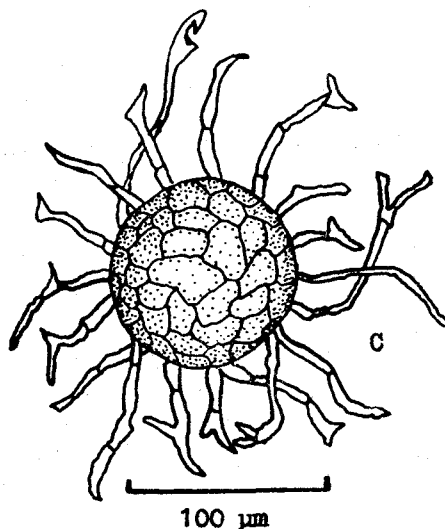
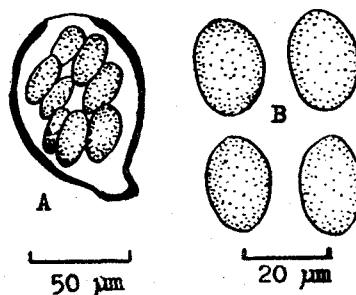


Fig. 2. Perfect state of *S. fuliginea*.
A : Ascus B : Ascospores C : Perithecium

Table II. Size measurements of perfect state of *Sphaerotheca fuliginea* on different host plants reported by other researchers as compared with authors' value.

Reporter and host plants	Diameter of perithecium μm	Cells of perithecium μm	Appendage		Ascus μm	Ascospore μm
			Number	Length μm		
Authors	μm	μm	Number	Length μm	Diameter μm	Ascospore μm
on <i>Lactuca indica</i> var. <i>lacinata</i>	95.3*	38.4 × 25.9	11	66.2	5.6	21.4 × 15.7
on <i>Taraxacum platycarpum</i>	81.4	36.5 × 22.0	11	60.2	5.2	21.3 × 15.7
on <i>Cosmos bipinnatus</i>	102.0	36.8 × 21.2	11	62.4	5.6	22.5 × 15.7
on <i>Coreopsis tinctoria</i>	101.4	34.0 × 21.6	13	70.2	5.5	22.2 × 15.5
on <i>Coreopsis lanceolata</i>	96.5	34.5 × 22.4	12	68.1	5.8	22.5 × 16.2
Homma (1937)						
on many host plants	70-112	19-55 × 11-36	5-21	—**	—	14.4-25.2 × 10.8-18
Raabe (1964)						
on <i>Heuchera sanguinea</i>	85.7	39.7 × 21.5	—	—	—	20.4 × 17.0
Jhooty (1965)						
on <i>Zinnia elegans</i>	88.4	—	—	—	—	20.1 × 15.3
Lee and Lee (1967)						
on <i>Impatiens balsamina</i>	91.6-176.9	—	—	long	—	14.2-23.8 × 7-12.4
on <i>Zinnia elegans</i>	84.2-152.4	—	—	72-252.7	7-11.2	21-35 × 10.4-12.6
Lee and Lee (1969)						
on <i>Aster tataricus</i>	52.5-121.5	—	—	long	—	10.1-24.6 × 4.7-14.2
on <i>Dahlia variabilis</i>	72.1-143.6	—	—	long	—	6.7-12.6 × 4.0-7.9
on <i>Helianthus annuus</i>	32.1-86.1	—	—	long	—	14.4-26.8 × 6.1-11.5
Lee (1975)						
on <i>Arctium lappa</i>	36.9-95.1	—	—	long	—	9.5-13.6 × 8.1-12.9
on <i>Petasites japonicus</i>	52.5-112.5	—	—	long	—	8.5-37.0 × 7.6-9.9
on <i>Phaseolus vulgaris</i>	41.6-89.4	—	—	long	—	18.5-27.7 × 14.6-20.5
Lee (1976)						
on <i>Corchorus capsularis</i>	90.2-186.1	—	—	62.1-267.7	5.2-7.9	12.7-20.6 × 7.0-12.4

* Each value for authors' collection is the average of 50 measurements.

** No data available.

Junell 1966, Kapoor 1967). The perithecial characteristics of the fungi on the above 8 species of host plants were as follows: Perithecia aggregated or scattered, sometimes densely aggregated near midrib of lower surface of leaf and petiole, 81-102 μm in average; wall cells evident, large 34.0-38.4 \times 21.2-25.9 μm in average; appendages 11-13 in number, shorter than diameter of perithecia, mycelial, aseptate or 1-3 septate, not rarely branched (not dichotomously), 60.2-70.2 \times 5.2-5.8 μm in average; ascus 1 per perithecium, 64.9-79.4 \times 50.8-59.2 μm in average, broadly ovate or subglobose, with stalk; ascospores 6-8 in number, mostly 8, subglobose to ellipsoidal, 21.3-22.5 \times 15.5-16.2 μm in average.

Each value of size measurements and morphological characteristics of perfect state of the fungus are shown in Table II and Fig. 2 respectively.

Discussion

The genus *Sphaerotheca* is characterized by perithecia with only one ascus each and mycelial or irregularly (not dichotomously) branched appendages. Salmon accepted five species of *Sphaerotheca*. Of these, four species infect a limited number of taxonomically related host species. The fifth, *S. humuli* DC. ex Burr. has a very wide host spectrum. In the last species, he distinguished a var. *fuliginea* (Schlecht. ex Fr.) Salmon, characterized by the distinctly larger cells of the perithecial wall. Pollacci (1905) raised a variety *fuliginea* to the rank of species, i.e., *Sphaerotheca fuliginea* (Schlecht. ex Fr.) Poll.

After a few decades, *S. fuliginea* sensu Salmon was splitted by Blumer (1933) into the following four species: *S. alpina* Blumer, *S. delphinii* (Karst.) Blumer, *S. fuliginea* (Fr.) Poll., and *S. fusca* (Fr.) Blumer. *S. fuliginea* (Fr.) Poll. was later revised into *S. fuliginea* (Schlecht. ex Fr.) Poll. by Junell (1965) according to the International Code of Botanical Nomenclature (1961). Thus the current broad concept of *S. fuliginea* sensu Blumer was settled.

Recently, Junell (1966) had recognized and suggested a number of species formerly included within *S. fuliginea* mainly on the basis of morphological

characters correlated with host specificity.

Her concept restricted *S. fuliginea* to only *Veronica* spp. In this study, however, Junell's species concept was not met with the authors' observation in Korean *Sphaerotheca* spp. According to Junell's revision, *Sphaerotheca* sp. on *Calendula* and *Cosmos* were included into *S. xanthii* (Cast.) L. Junell n. comb. The present authors did not find any distinct morphological differences of imperfect and perfect state of *Sphaerotheca* sp. found on 10 different host plants. Therefore, the broad concept of *S. fuliginea* sensu Blumer was adopted in this research. This also correspond with Boesewinkel's concept (1979).

On the other hand, *S. fuliginea* was already described in Korea by Lee and Lee (1967, 1969) and Lee (1975, 1976) as shown in Table 2. Their morphological descriptions, however, were incomplete and the size measurements did not correspond with the original as well as other researchers' measurements (Boesewinkel 1979, 1980; Homma 1937; Junell 1965, 1966, 1967; Kapoor 1967). Therefore the present authors made here the mycological descriptions and correct size measurements of *S. fuliginea* (Schlecht. ex Fr.) Poll. s. lat. in Korea.

摘 要

Sphaerotheca fuliginea (Schlecht. ex Fr.) Poll.의寄主植物로 韓國에서는 13種이 記錄되었다. 著者들은 여기에 10種의 韓國産 未記錄寄主植物을 追加한다. 本研究에서 *S. fuliginea*의 分類는 Blumer의 方式을 따랐다.

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