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Note

Occurrence of Goat's-Beard Powdery Mildew Caused by *Podosphaera ferruginea* in Korea

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Powdery mildew symptoms were frequently on plants of goat's-beard (*Aruncus dioicus* var. *kamtschaticus*) found cultivated in the island Ulleungdo in June 2008. The symptoms appeared as powdery mycelial colonies and dark brown cleistothecia on leaves, petioles, stems and budding flowers of the plant. Incidence of the disease was as high as 50-80% in the goat's-beard fields. Specimens of the diseased plants were collected and examined for morphological characteristics of the causal fungus. On the basis of morphological characteristics of the conidial stage and the teleomorph, the fungus was identified as *Podosphaera ferruginea*. This is the first report of goat's-beard powdery mildew caused by *Podosphaera ferruginea* in Korea.

Keywords : *Aruncus dioicus* var. *kamtschaticus*, Goat's-beard, Powdery mildew, *Podosphaera ferruginea*

Goat's-Beard [*Aruncus dioicus* (walter) Fernald var. *kamtschaticus* (Maxim.) H. Hara] grows naturally in alpine regions in Korea. The plant is also one of popular vegetables or medicinal crops in the country. Powdery mildew symptoms were found frequently on leaves and stems of goat's-beard grown in the island Ulleungdo, Korea, in June 2008 during a survey of plant diseases. The symptoms appeared as white powdery mycelial colonies on the leaves, petioles, stems and budding flowers of the plant (Fig. 1). Also infected leaves and stems were twisted, and finally blighted (Fig. 1B, C and E). Yellowish or dark brown cleistothecia of the fungus were observed on the plants under stereomicroscope. Incidence of the disease was as high as 50-80% in eight fields of goat's-beard investigated.

Morphological characteristics of the conidial stage and the teleomorph of the powdery mildew fungus of Goat's-

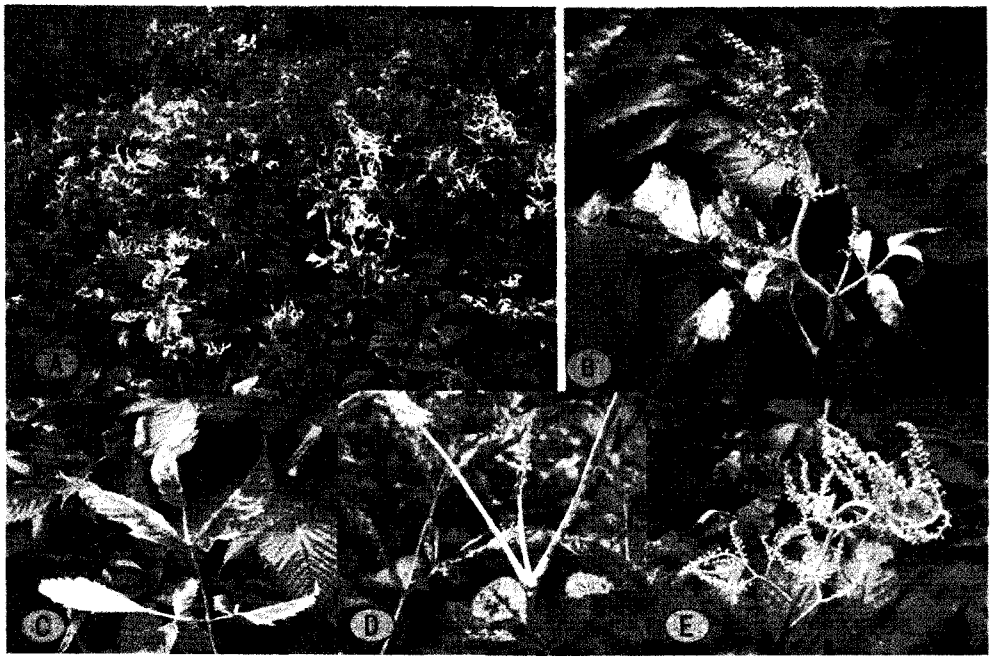

Fig. 1. Powdery mildew symptoms on goat's-beard plants observed in the fields. A, infected plants in the fields; B, symptoms on leaves, petioles, stems and budding flowers; C, leaves; D, stems; E, budding flowers.

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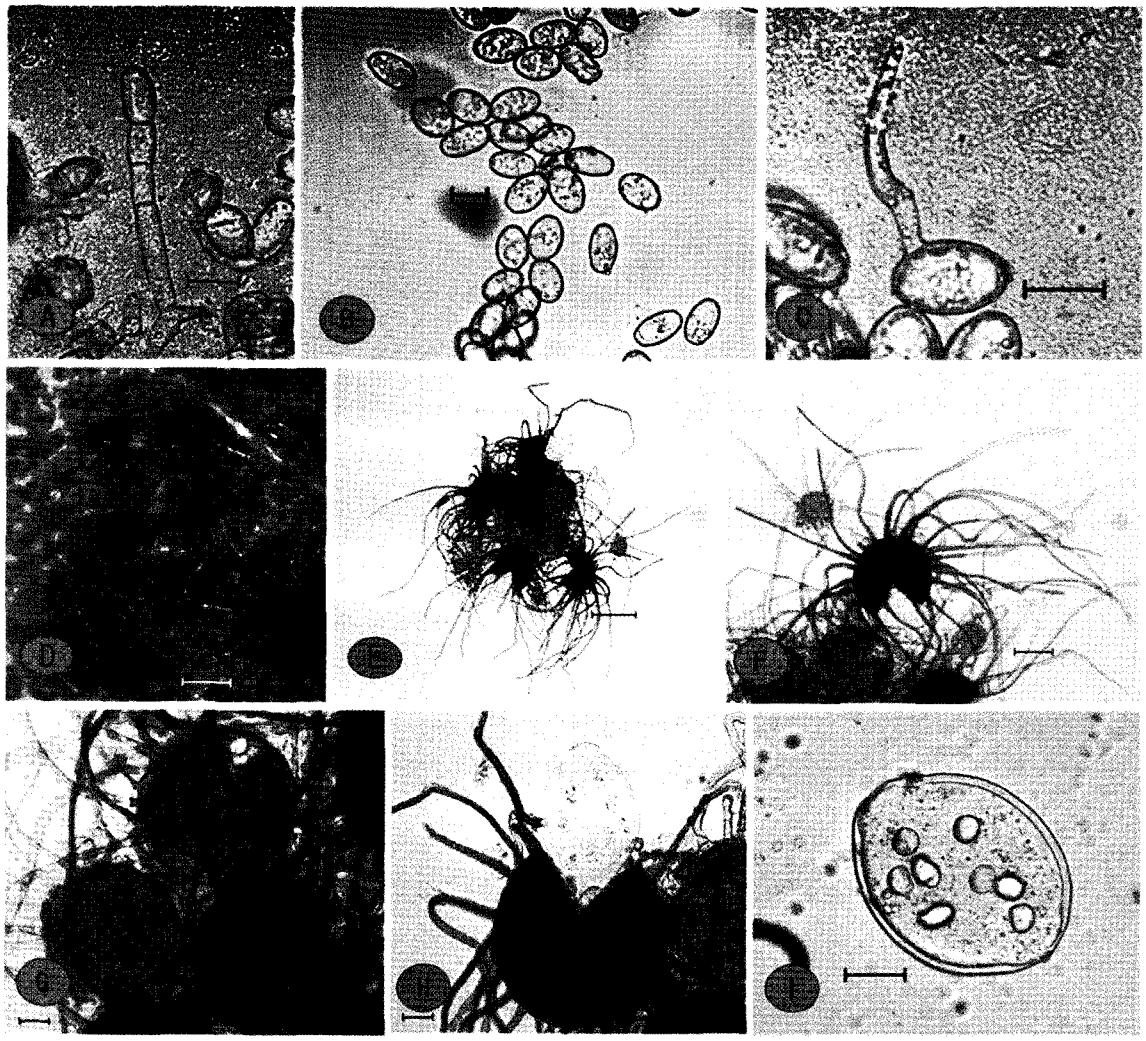

Fig. 2. Morphological characteristics of *Podosphaera ferruginea* isolated from goat's-beard plants. A, a conidiophore and conidia (scale bar=20 μm); B, ellipsoid to elongate-ellipsoid conidia with fibrosin bodies (scale bar=10 μm); C, germinated conidium with simple germ tube (scale bar=20 μm); D, several ascomatas (scale bar=100 μm); E, ascomatas with appendages (scale bar=100 μm); F, ascomata with appendages (scale bar=50 μm); G, wall cells on the ascomata (scale bar=20 μm); H, an ascus in an acoma (scale bar=20 μm); I, an ascus with 8 ascospores (scale bar=20 μm).

Beard were examined by light microscope for identification. Conidia with fibrosin bodies were oval, occasionally ellipsoid, 22.8~33.2×14.6~21.0 μm in size and formed in chains with crenate edge (Fig. 2A and 2B). Conidiophores were erect on superfical mycelia, 100-240 μm in length and straight in foot cells (Fig. 2A). Germ tubes from conidia were simple and unbranched (Fig. 2C). Dark brown ascomata were observed on upper and lower leaves of the plant. Cleistothecia were globose or subglobose with 94.5-104.3 μm in diameter (Fig. 2D). Wall-cells were polygonal to subrounded with 16.1-31.7 μm wide, and the number of appendages was 13-30 (Fig. 2E and 2F). There was one ascus in an ascoma, which was olivaceous brown with 71.0~91.3×59.8~68.8 μm in size (Fig. 2G). Asci were oval, and an ascus had eight ascospores (Fig. 2H and 2I). Ascospores were 12.0~14.7×11.9~13.7 μm in size (Fig. 2I).

On the basis of morphological characteristics of the conidial stage and the teleomorph, the fungus was identified as *Sphaerotheca ferruginea* (Schlecht.:Fr.) Junell. which were consistent with those described by the previous workers (Braun, 1987; Nomura, 1997; Shin, 2000). It has been reported that *S. fuligenea* (Schltdl.) Pollacci and *S. humuli* (DC.) Burr. caused powdery mildew on *Aruncus dioicus* var. *kamtschaticus* (David, 1989) and on *Aruncus sylvester* Kostel. var. *americana* Maxim. (Homma, 1937), respectively.

But *S. ferruginea* (Schlecht.:Fr.) Junell. was reclassified as *Podosphaera ferruginea* (Schltdl.) U. Braun & S. Takam. (Braun, U. and Takamatsu, S., 2000). These powdery mildew fungi are known to be distributed in Europe,

Table 1. Comparative morphological characteristics between previously reported *Sphaerotheca ferruginea* and the powdery mildew fungi on goat's-beard

Characteristics	Powdery mildew fungi isolated from goat's-beard	*Sphaerotheca ferruginea* (Braun, 1987)	*Sphaerotheca ferruginea* (Shin, 2000)
Conidia			
Length×width (μm)	25.5~38.7×16.7~22.5 (av.33.0×19.2)	25~30×14~18	26~36×14~20
Shape	Ellipsoid to ovoid or elongate ovoid	–	Oval occasionally ellipsoidal
Formation	Chain	Chain	Chain
Fibrosin bodies	Present	Present	Present
Conidiophores			
No. of cells	2~4 (av.3)	–	2~3
Length (μm)	100~240×10~11	–	110~250×9~10 (-11)
Erection	Straight	Straight	Straight
Foot-cell	Cylindric	Cylindric	–
Length (μm)	36.7~47.0×10~11 (av.42.3×10.3)	–	–
Appressoria	Absent	–	Absent or poorly developed
Cleistothecia	Present	Present	Present
Size (μm)	94.5~104.3	75~100 (-105)	73~88
Wall cells (μm)	16.1~31.7×11.0~20.1 (-27.5) (av.22.4×16.1)	11~25 (-30)	12~20
No. of asci	1	–	1
Asci (μm)	71.0~91.3×59.8~64.2 (av.80.7×64.2)	50~80×40~70	88~107×65~73
No. of ascospores	8	(6-) 8	8
Ascospores Length×width (μm)	12.0~14.7×11.9~13.7 (av.14.0×13.1)	(16-) 18~28 (-30)×11~20	26~36×14~18
Appendages			
No.	13~30	Numerous	12~20 (-30)
Length (μm)	126.2~268.3	1~6 (-7.5) times of ascoma	(1) 2~6 (-8) times of ascoma
Width (μm)	5.0~9.5	(4-) 5~10	4~6
No. of septate	2~5	Septate	2~5

Asia, North America, Balearic Islands, Canary Islands (Braun, 1987; Shin, 2000). This is the first report that *P. ferruginea* causes powdery mildew of goat's-beard in Korea.

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