Taxonomic entity and distribution of Korean *Fimbristylis fimbristyloides* (Cyperaceae)

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ABSTRACT: *Fimbristylis fimbristyloides* (F. Muell.) Druce (Cyperaceae) belonging to *Fimbristylis* sect. *Fuscae* Ohwi, which has been ambiguous in terms of its distribution and taxonomic substance in Korea, was found on Amtae-do Island, Sinan-gun, Jeollanam-do in Korea. *F. fimbristyloides* is a small species that is approximately 5–15 cm tall and differs greatly from most taxa in that the spikelets are laterally compressed. In particular, *F. fimbristyloides* is similar to *F. ovata* but is distinguished by the height of the plants, falcated leaves, the number and size of spikelets per inflorescence, glabrous styles, the size of the achenes, and the presence of achene stalks. A description, differences from related species, a key to the taxa and photographs of Korean *F. fimbristyloides* are provided in this paper.

Keywords: *F. fimbristyloides*, *Fimbristylis* sect. *Fuscae*, Cyperaceae, Korea, distribution, taxonomic entity

The genus *Fimbristylis* Vahl (Cyperaceae Juss.) is composed of about 300 taxa and is distributed in the tropic, subtropic and temperate zones of the south and northern hemisphere with mainly center of distribution in SE Asia (Govaerts and Simpson, 2007; Govaerts, 2010; Zhang et al., 2010). The Korean *Fimbristylis* is known to be distributed 21 taxa, including the *F. drizae* J. H. Kim & M. Y. Kim and *F. jindoensis* J. H. Kim & M. Y. Kim, which were recently described as two new species (Kim and Kim, 2013, 2015a, 2015b, 2018). *Fimbristylis* is similar to the *Scirpus* L., *Bulbostylis* Kunth, and *Eleocharis* R. Br. However, this genus is distinguished from other related genera of the family by having inflated styles at bases (Vahl, 1805) and styles easily falling from achenes (Brown, 1810). *Fimbristylis* has traditionally been set up with many section including series based on the characteristics of ligules, inflorescences, spikelets, scales, styles, and achenes (Ohwi, 1944; Kern, 1974). According to Kim and Kim (2018), most Korean *Fimbristylis* are known to belong to *F.* sect. *Fimbristylis*, sect. *Mischospora* (Boeckeler) Camus, sect. *Trichelostylis* (T. Lestib.) Benth., where scales of spikelets are arranged spirally, while only *F. ovata* belongs to *F.* sect. *Abildaardia* (Vahl) Benth., which has spikelet at bases with

distichously arranged scales.

Recently, a national survey of the natural environment confirmed that *F. fimbristyloides* is distributed in Amtae-do Island, Sinan-gun, Jeollanam-do in Korea. After it was first recorded as being distributed in Korea by Koyama (1961), Flora Malesiana (Kern, 1974) and Flora of China (Zhang et al., 2010) are also following his view. However, until this time, not only its distribution has not been confirmed in Korea, but species entity is also unknown. Therefore, we would like to report the *F. fimbristyloides*, which is no different from the unrecorded Korean plant, based on the specimen collected from habitat through this paper.

Taxonomic Treatment

Fimbristylis sect. *Fuscae* Ohwi, J. Jap. Bot. 14: 571, 1938.

Type species: *F. fusca* (Nees) C. B. Clarke; *Abildaardia fusca* Nees; *Iria fusca* (Nees) Kuntze.

Korean name: 납작하늘지기철(Nap-jak-ha-neul-ji-gi-jeol).

Inflorescences with several spikelets. Spikelets compressed, axes persistent. Scales distichously arranged, acropetally

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deciduous. Styles 3-sided; stigmas 3. Achenes obovate to orbicular, 3-sided, much smaller, smooth or verruculose.

Fimbristylis sect. *Fuscae* was described by Ohwi (1938)

in that it has dark brownish puberulent-scabridulous hairs on glossless scales of spikelets, and much smaller achenes, while *F.* sect. *Abildgaardia* (Vahl) Benth. has glossy but hairless

Fig. 1. *Fimbristylis fimbristylodes* a new record in the Korean flora. **A.** Habit with curved leaves to right side. **B.** Subcompound inflorescence having several spikelets. **C.** Laterally compressed spikelet with distichously scales. **D.** Lanceolate scales. **E.** White ovary with basally enlarged style. **F.** Whitish obovate achene. **G.** Open and wet habitat within plant community of *Pinus thunbergii* (photos by J.H. Kim and S.S. Choi).

scales. This section is characterized by having several spikelets per inflorescence, and much smaller and obovate achenes with smooth or verruculose surfaces. However, sect. *Abildgaardia* differs from sect. *Fuscae* in that it has only one (very rarely two) spikelets per inflorescence, and larger and nearly globose achenes with tuberculate surfaces (Kern, 1955, 1974). In addition, sect. *Fuscae* is distinguished from other sections in the genus except sect. *Abildgaardia* with somewhat chubby spikelets with spirally arranged scales by having compressed spikelets with distichously arranged scales.

Fimbristylis fimbristyloides (F. Muell.) Druce, Rep. Bot. Soc. Exch. Club Brit. Isles 4: 623, 1917 (Fig. 1).

Abildgaardia fimbristyloides F. Muell., Fragn. 8: 273, 1874; *Iria fimbristyloides* (F. Muell.) Kuntze, Revis. Gen. Pl. 2: 753, 1891.

Korean name: 바람개비하늘지기(Ba-ram-gae-bi-ha-neul-ji-gi).

Annuals dwarf, with fibrous roots. Rhizomes absent. Culms tufted and ribbed, ca. 5–15 cm tall, slightly upwardly scabrous at least at top including inflorescence. Leaves linear, with

about half size of culms, 3.0–5.0 cm × 1.0–2.0 mm, distinctly curved or falcate to left or right direction, margins upwardly scabrous, apices acute or short acuminate; ligule absent. Inflorescences simple or subcompound, with about 3–10 spikelets, up to 4 cm long, upwardly scabrous; primary branches 3–5, obliquely erect, scabrous, up to 3 cm long; secondary branches very short; involucre bracts 2–5, much shorter than inflorescence, 0.5–2.0 cm × 0.8–1.0 mm, margins scabrous, apices acuminate. Spikelets solitary, lanceolate, strongly laterally compressed, ca. 6–12-flowered, apices acute, 3.0–7.0 × 1.5–2.0 mm, brown; scales distichously equitant, membranous, lanceolate to ovate, 2.2–3.0 × 1–1.5 mm, minutely scabrous at midnerves and margins, prominently midkeeled, apices mucronate. Stamens 2 or 3; anthers yellow, oblong, ca. 0.5 mm long. Ovaries white; styles 3 angled, basally inflated, glabrous, ca. 2 mm long; stigmas 3. Achenes obovate, dully 3-sided, nearly whitish, truncate at bases, 0.6–0.9 × 0.4–0.6 mm, smooth or verruculose, nearly sessile.

Flowering: Aug.–Sep.

Habitat: There are about 100 individuals in open and wet areas on mountain's foot within plant community of *Pinus*

Table 1. Comparison of characteristics between *Fimbristylis fimbristyloides* and *F. ovata*

Characters		<i>F. fimbristyloides</i>	<i>F. ovata</i>
Plant	Habit	Annual	Perennial
	Height (cm)	5–15	15–40
Leaf	Length	ca. 1/2 as long as culm	ca. 1/2 to 2/3 as long as culm
	Width (mm)	1.0–2.0	0.5–1.0
	Incurvation	Falcated in one direction	Not curved and straighted
Inflorescence	Type	Simple to subcompound	Simple
	No. of spikelets	ca. 3–10	1 (very rarely 2)
Spikelet	Shape	Compressed and lanceolate	Compressed and ovate
	Size (mm)	3.0–7.0 × 1.5–2.0	6.0–9.5 × 3.0–4.0
Scale	Shape	Lanceolate to ovate	Ovate
	Arrange	All distichously equitant	Basally distichously and apically spirally
	Hair	Present	Absent
	Size (mm)	2.2–3.0 × 1.0–1.5	3.7–5.5 × 3.3–4.4
Ovary	Color	White	Unknown
Style	Hair	Absent	Present
Stigma	No.	3	3
Achene	Size (mm)	0.6–0.9 × 0.4–0.6	2.0–2.5 × 1.3–1.5
	Base	Truncate	Somewhat decurrent
	Color	Whitish	Grayish brown
	Stalk (mm)	Nearly sessile	ca. 0.5 long

thunbergii and *Eurya japonica* near the coastal lines.

Distribution: N Australia, Bhutan, China (southern provinces including Guangdong and Zhejiang), India, Indonesia, Japan (Ryukyu Islands), Korea (southern island in province Jeollanam-do), Malaysia, Myanmar, Nepal, Papua New Guinea, Thailand, Vietnam (from Kern, 1974; Zhang et al., 2010).

Specimens examined: KOREA. Jeollanam-do: Sinan-gun, Amtae-do Island, 17 Oct 2018, S.S. Choi VP1810001 (2 sheets, JNU); 12 Oct 2019, S.S. Choi VP1910001 (2 sheets, JNU).

This taxon was recombined by Druce (1917) into the genus *Fimbristylis* based on *Abildgaardia fimbristylodes* F. Muell., a species described from Rockingham-bay in Queensland, a northeast tropical region of Australia (Mueller, 1874). It is small plant, mainly distributed in tropical and subtropical regions of SE Asia, and is known to grow in China's Zhejiang and Guangdong provinces and in the open damp areas of Japan's Ryukyu Islands. Koyama (1961) first revealed that *F. fimbristylodes* is distributed in Korea based on the specimen (KYO) collected by M.K. Park in Mt. Jirisan, but we did not actually see the voucher. However, considering the distribution range of this species in the worldwide, it seems somewhat doubtful that it grows in Mt. Jirisan. Meanwhile, the species is not recorded in the domestic Korean literature, and there is no specimen in any herbaria in Korea, making it unclear about their distribution in Korea. Recently, during a national survey of the natural environment we found a population of *F. fimbristylodes*, consisting of about 100 individuals on Amtae-do Island, Jeollanam-do, Korea.

Fimbristylis fimbristylodes is similar to the *F. ovata* (*F. sect. Abildgaardia*) in that they have laterally compressed spikelets, at least lower scales of spikelets distichously arranged, 3-sided styles, and 3-stigmas. However, they differ greatly from *F. ovata* in that the plant size is relatively small, the leaves curved to the right or left like a sickle or pinwheel, with several spikelets in one inflorescence, all the scales of spikelets arranged distichously, hairless on the styles, obovate achenes less than 1 mm in length, and nearly stalkless on the achenes (Table 1). The Korean name of *F. fimbristylodes* was given as a “Ba-ram-gae-bi-ha-neul-ji-gi” based on the characteristics of the leaf bending in one direction like a pinwheel, and the Korean name of the section including this species was named as a “Nap-jak-ha-neul-ji-gi-jeol” considering the fact that all the spikelets were compressed shape. Key to the species of *F. fimbristylodes* and the closely related species *F. ovata* are as follows.

Key to the *F. fimbristylodes* and related Korean taxa

1. Spikelets somewhat laterally compressed, all or lower scales distichously equitant at bases.
2. Culms 5–15 cm tall; leaves distinctly curved or falcate to right or left direction, 1–2 mm wide; inflorescences with ca. 3–10 spikelets; spikelets lanceolate; styles glabrous; achenes less than 1 mm long, nearly sessile-
..... *F. fimbristylodes* 바람개비하늘지기
2. Culms 15–40 cm tall; leaves straight and not curved, less than 1 mm wide; inflorescences with 1 (very rarely 2) spikelets; spikelets ovate; styles hairy; achenes ca. 2–3 mm long, distinctly and shortly stalked *F. ovata* 쇠하늘지기
1. Spikelets terete; scales spirally imbricate
..... all other taxa of Korean *Fimbristylis*

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Conflict of Interest

The authors declare that there are no conflicts of interest.

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바람개비하늘지기(사초과)의 한국 내 분포 및 분류학적 실체

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적 요: 그동안 한국 내 분포 및 분류학적 실체가 모호했던 식물, 납작하늘지기절(*F. sect. Fuscae*)의 바람개비하늘지기 [*Fimbristylis fimbristylodes* (F. Muell.) Druce] (사초과)를 전라남도 신안군 암태도의 바닷가 주변의 산자락 습한 곳에서 발견하였다. 바람개비하늘지기는 1년생으로 줄기는 5–15 cm 정도에 불과한 작은 식물로 소수가 옆으로 납작한 점에서 속내 대부분의 식물들과 크게 다르다. 특히, 바람개비하늘지기는 쇠하늘지기과 비슷하지만 식물체의 높이, 엽신, 화서당 소수의 수와 크기, 화주의 털 유무, 수과의 크기 및 자루의 유무 등에 의해 구별된다. 바람개비하늘지기에 대한 기재, 근연종과 차이점, 검색표 및 사진 등을 제시하였다.

주요어: 바람개비하늘지기, 납작하늘지기절, 사초과, 한국, 분포, 분류학적 실체