



## First record of *Sparganium subglobosum* Morong (Typhaceae) from Korea

Chang-Kun Lim<sup>#</sup>, Juhyeon Kim, Young Chul Kim<sup>1</sup>, Chae Eun Lim<sup>2</sup> and Hyosig Won<sup>\*</sup>

Department of Biological Science and Institute of Basic Sciences, Daegu University, Gyeongsan 38453, Korea

<sup>1</sup>Department of Biology, Gangneung-Wonju National University, Gangneung 25457, Korea

<sup>2</sup>National Institute of Biological Resources, Incheon 22689, Korea

<sup>#</sup>Current Address: Green Plant Research Institute, Yongin 16954, Korea

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### 한반도 미기록식물 가는흑삼릉

임창건<sup>#</sup> · 김주현 · 김영철<sup>1</sup> · 임채은<sup>2</sup> · 원효식<sup>\*</sup>

대구대학교 생명과학과, <sup>1</sup>강릉원주대학교 생물학과, <sup>2</sup>국립생물자원관, <sup>#</sup>녹색식물연구소 (현주소)

**ABSTRACT:** We report the distribution of *Sparganium subglobosum* Morong (Typhaceae) for the first time in Korea. *Sparganium subglobosum* is readily distinguishable from other Korea *Sparganium* species by having a short plant height, narrow leaves ( $\leq 4$  mm), thin inflorescence branches, and a ripe fruiting head globose and ca. 1 cm in diam. The species is under great threat of local extinction due to a recent disturbance of one of only two known distribution sites. Further conservation plans for *S. subglobosum* and surveys are needed. We provide a revised key to five *Sparganium* species of Korea, with descriptions, pictures, and figures of *S. subglobosum*.

**Keywords:** unrecorded species, *Sparganium subglobosum*, Typhaceae, endangered, conservation

**적 요:** 부들과에 속하는 한반도 미기록식물인 가는흑삼릉(*Sparganium subglobosum* Morong)을 최초로 보고한다. 가는흑삼릉은 작은 키, 폭 4 mm 이하로 좁은 잎, 1–2회 분지하는 가는 화축, 성숙시 지름 약 1 cm인 구형 두상 화수 등의 특징에 있어 기존에 우리나라에서 보고된 다른 흑삼릉속 식물과 구분된다. 현재까지 확인된 가는흑삼릉의 2개 분포지 중 1 곳은 최근 심하게 교란되어 지역적인 멸종위험에 놓여 있는 상태이다. 가는흑삼릉에 대한 보전 대책 마련 및 추가적인 분포지 확인이 필요하다. 가는흑삼릉의 기재문, 사진 및 도해 외에 우리나라 흑삼릉속 식물의 검색표를 제시한다.

**주요어:** 미기록종, 가는흑삼릉, 부들과, 멸종위기, 보전

*Sparganium* is a genus of  $\pm 14$  aquatic species, distributed in temperate and cool regions of Eurasia and North America, also in Oceania (Cook and Nicholls, 1986, 1987). *Sparganium* species are perennial herbs, emergent from shallow water or wholly submerged and floating, and comprise the most important plants in the riverside and lakeshore wetlands plant communities (Kubitzki, 1998). Also, they provide shelters and food for wildlife, and help reduce erosion of river banks (Cook and

Nicholls, 1986). *Sparganium* species show morphological adaptations common to many other aquatic plant groups, such as monoecy, wind-pollination, floral reduction, seeds capable of long-distance dispersal, and vegetative propagation by rhizomes and stolons (Cook, 1988; Barrett et al., 1993; Santamaria, 2002). *Sparganium* has traditionally been placed in the monogeneric family Sparganiaceae, but recent classification scheme placed both *Typha* and *Sparganium* in Typhaceae (The Angiosperm

\*Author for correspondence: wonhs@daegu.ac.kr

Phylogeny Group, 2016). *Sparganium* is characterized by globose head-like inflorescence, while *Typha* is elongate, cylindrical spike-like (Kubitzki, 1998).

For Korean flora, four *Sparganium* species have been recognized, such as *S. erectum* L., *S. japonicum* Rothert, *S. fallax* Graebn., and *S. hyperboreum* Laest. ex Beurl. (Lee, 1980; Lee, 1996; Lee, 2006; Kim and Choi, 2007; Kim et al., 2010). Im (2000) reported three *Sparganium* species for Korea, i.e., *S. stoloniferum* (Buch.-Ham. ex Graebn.) Buch.-Ham. ex Juz. (= *S. erectum*, according to Cook and Nicholls [1987]), *S. simplex* Huds. (= *S. emersum* Rehmman, according to Cook and Nicholls [1986]), and *S. japonicum* Rothert. Cook and Nicholls (1986, 1987), in their revision of *Sparganium* species in the world, suggested the presence of *S. erectum* subsp. *stoloniferum*, *S. eurycarpum* subsp. *coreanum*, *S. hyperboreum*, *S. emersum* subsp. *emersum*, *S. japonicum*, and *S. glomeratum* in Korea, but mostly in northern part of Korea.

While working on DNA barcoding of Korean Typhaceae, including both *Sparganium* and *Typha*, we have recognized a *Sparganium* species new to flora of Korea, distinct from other Korean taxa both in overall morphology and sequence characteristics (data not shown). The new *Sparganium* species was identified as *S. subglobosum* Morong. Although Sun and Simpson (2010) suggested the presence of *S. subglobosum* in Korea, no one has ever reported or provided evidence proving the presence of *S. subglobosum* so far. Here we are presenting a description and diagram of *S. subglobosum*, and a revised key to *Sparganium* species in Korea.

## Taxonomic Treatment

*Sparganium subglobosum* Morong, Bull. Torrey Bot. Club 15: 81, 1888.—TYPE: New Zealand, Bay of Islands, U.S. Exploring Expedition under Command of Capt. Wilkes (holotype: GH, not seen). Figs. 1 & 2.

*Sparganium angustifolium* var. *latifolium* Benth., Fl. Austral. 7: 161, 1878.

*Sparganium stenophyllum* Maxim. ex Meinsh., Bull. Soc. Imp. Naturalistes Moscou, n.s., 3: 171, 1890.

*Sparganium antipodum* Graebn., Allg. Bot. Z. Syst. 4: 33, 1898.

*Sparganium nipponicum* Makino, Fl. Japan: 523, 1925.

**Vernacular name:** 가는흑삼릉 (Korean, Ka-neun-heuk-sam-reung), ヒメミクリ (Japanese, Himemikuri), 狭叶黑三稜 (Chinense, Xia-ye-hei-san-leng), burr-reed, maru (New Zealand).

Herbs, perennial, monoecious, 60–100 cm tall, glabrous,

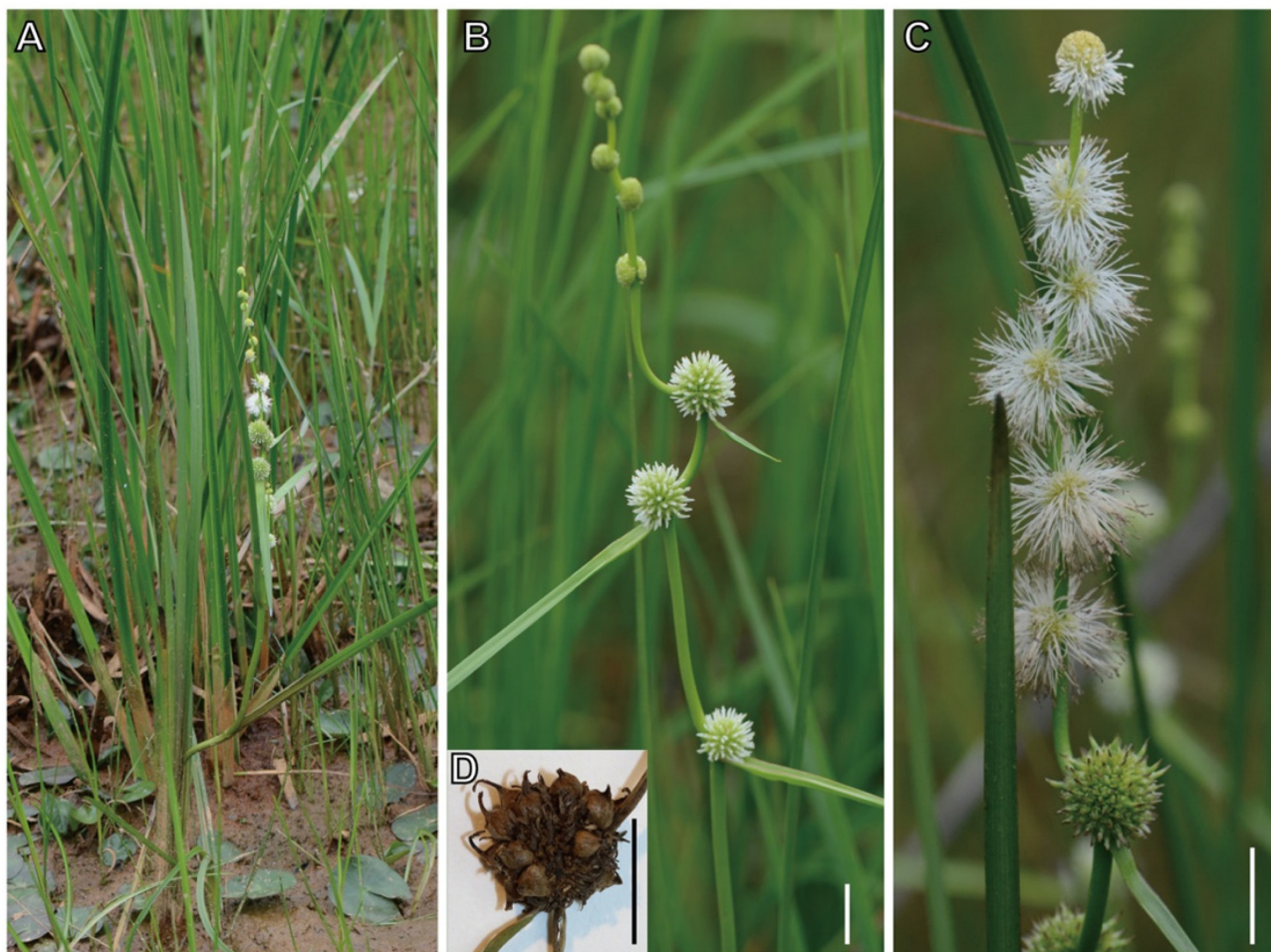
aquatic; rhizome creeping; stems simple or branched, slender. Leaves alternate, distichous, emergent or floating, sheathed at base, linear, 40–80 cm long, 3–4 mm wide, flat adaxially, keeled abaxially, basally triangular. Inflorescence globose, unisexual heads on upper part of stems, inflorescence axis one or two; main inflorescence axis ca. 20 cm long, 2 mm in diam., with basal 3 to 4 female heads and 6–7 male heads above; lateral inflorescence axillary, ca. 7 cm long, with one or two basal female heads and 3 to 4 male heads above; heads usually sessile, except the one at lateral inflorescence; female heads diam. ca. 1 cm; male heads diam. 5–6 mm, 11–13 mm when anthers mature; bracts leaf-like, spreading to descending-spreading, basal one 15–16 cm long. Flowers minute, unisexual, densely crowded in globose heads; male flowers: perianth segments 3 to 4, spatulate, ca. 2 mm long, stamens 3 or more, filaments ca. 4 mm long, anthers basifixed, white, oblong, ca. 0.7 mm long, 0.2 mm wide, longitudinally dehiscent, caducous; female flowers bracteolate; perianth segments spatulate, ca. 2 mm long; ovary sessile, narrowly fusiform, ca. 4 mm long, 1-loculed; styles simple, 0.5 mm long, with a unilateral stigma, ca. 1.2 mm long; ovule 1, pendulous. Fruit nutlike, obovoid, ca. 4 mm long, indehiscent. Seed 1 per fruit, ovoid, ca. 1.5 mm long.

**Phenology:** flowering June–August and fruiting July–September.

**Distribution:** Korea, China, Japan, Russia (Far East), Vietnam; New Guinea, Australia, New Zealand.

**Specimen examined:** KOREA. Gangwon-do: Goseong-gun, Ganseong-eup, Ha-ri, Bukcheon, at Bukcheon Bridge, 38°23'4.4"N, 128°27'29"E, alt. 10 m, 4 Sep 2009, *J. D. Jung & H. R. 0909124-1* (KB), *0909124-3* (KB); Goseong-gun, Toseong-myeon, Bongpo-ri, Lake Cheonjin, south inlet of the lake, 38°15'07.7" N, 128°33'15.7"E, alt. 19 m, 23 Jun 2013, *H. Won 9655* (DGU); Goseong-gun, Toseong-myeon, Bongpo-ri, Lake Cheonjin, south inlet of the lake, 38°15'07.4"N, 128°33'15.0"E, alt. 19 m, 7 Jul 2014, *H. Won et al. 11234* (DGU); Goseong-gun, Toseong-myeon, Bongpo-ri, Lake Cheonjin, 18 Jun 2011, *J.-S. Kim CJH1054* (KB); Goseong-gun, Toseong-myeon, Bongpo-ri, Lake Cheonjin, 38°15'09.5"N, 128°33'16.84"E, 7 Sep 2012, *J.-S. Kim CJH1006* (KB).

JAPAN. Hokkaido: Akan-gun, Tsurui-mura, Moor-Onnenai, in intermediate moor, 17 Aug 1981, *K. Takita 824* (KYO). Honshu: Chiba Pref., Ichikawa City, Junsai-numa, in 1894, *T. Makino s.n.* (KYO); Chiba Pref., Chosei-gun, Ichinomiya-cho, Ichimatsu, 11 Jul 1937, *T. Makino s.n.* (KYO); Hyogo Pref., en route from Monobe to Orotani, Sumoto City, 34°20'N, 135°54'E, alt. 20–80 m, 29 Jul 1994, *N. Kurosaki & S. Miyake*

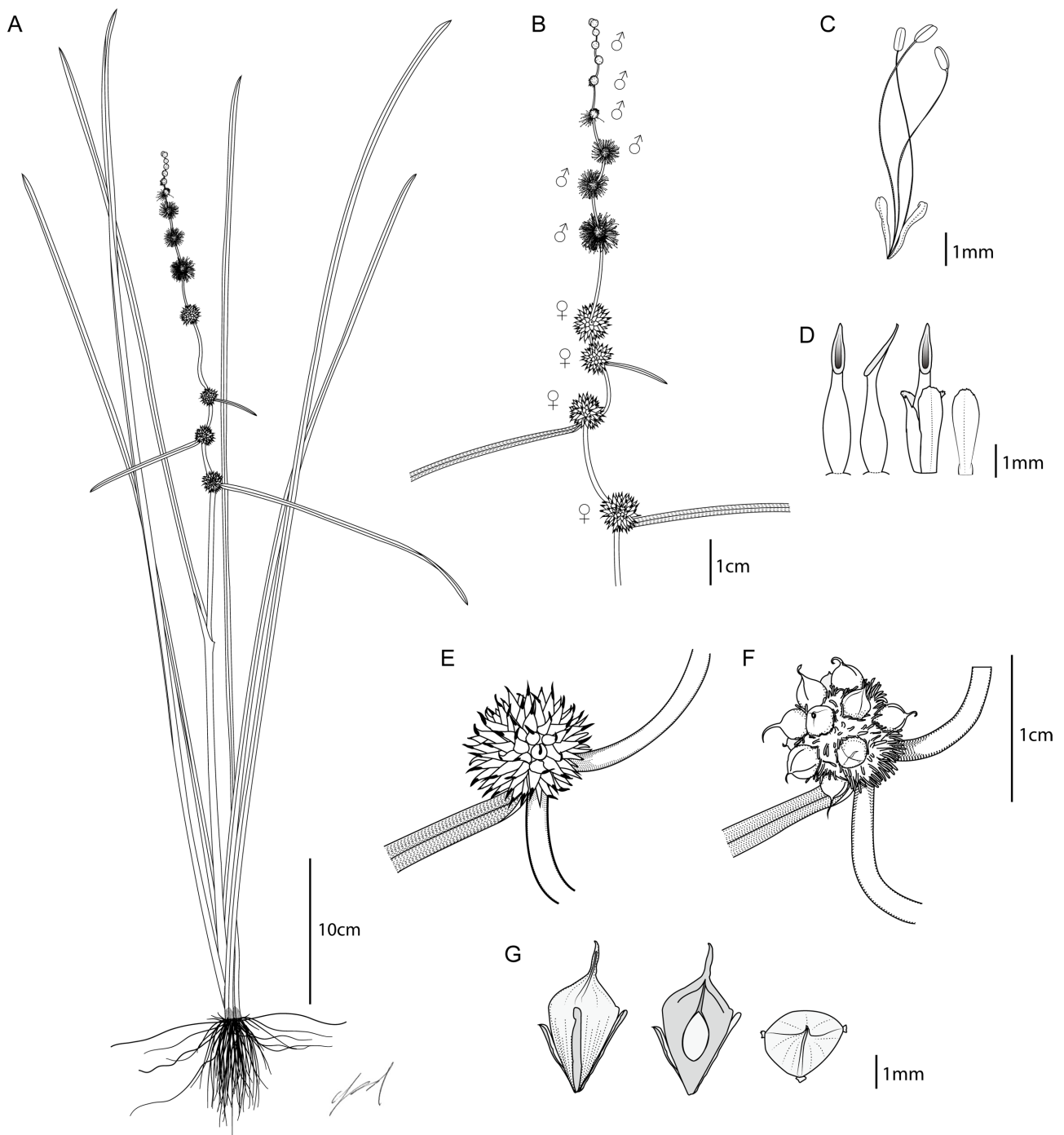


**Fig. 1.** Habit and morphology of *S. subglobosum* Morong (Typhaceae). **A.** Habit. **B.** Inflorescence with matured female head (Jun 2013). **C.** Matured male heads (Jul 2014). **D.** Matured nutlike fruit (Sep 2011). Scale bars = 1 cm.

1460 (MAK); Miyagi Pref., Miyagi-gun, Rihu-machi, Akanuma, 19 Aug 1973, *T. Naito s.n.* (KYO); Nagano Pref., Kitaazumi-gun, Hakuba-mura, Oyemi-moor, alt. 500–600 m, 15 Aug 1979, *E. Kinoshita 1011* (KYO); Nagano Pref., Shimoina Co., Tonobayashi, Omura, Anan Town, 35°21'N, 137°45'E, alt. 810 m, 11 Aug 1957, *K. Asano 111721* (MAK); Osaka Pref., Shijonawate-shi, around Muroike Ponds, alt. ca. 300 m, 1 Aug 1992, *K. Seto 38791* (TNS); Osaka Pref., Ibaraki-shi, Sendaiji, 14 Sep 2007, *T. Sawada et al. 787* (TNS); Wakayama Pref., Higashi-muro-gun, Koza-cho, en route from Tawara to Sabe, 33°32'35"–50"N, 135°51'50"–52'10"E, alt. 0 m, 7 Aug 2004, *S. Fujii 10237* (KYO [2 sheets], MAK [2 sheets]). Kyushu: Saga Pref., Karatsu-shi, Nanayamakebaru, Kashihara Shitsugen Moor, 33°25'00"N, 130°09'27"E, alt. 590 m, 27 Jul 2009, *C. Sato 3433* (KYO); Kumamoto Pref., Aso-shi, Ichinomiya-machi, Kiotoshi Stock Farm, 33°01'N, 131°07'E, alt. 780 m, 1 Aug 2009, *C. Sato 3455* (MAK).

Based on the gross morphology, we initially assigned this unrecorded *Sparganium* species to *S. japonicum*. Upon closer examination, however, it was clear that the obovoid fruits of unrecorded species did not match *S. japonicum* (fusiform) (Cook and Nicholls, 1987). The narrower leaves and smaller size of the species is unique among other Korean *Sparganium* species, except *S. hyperboreum*. Thus we named *S. subglobosum* as Ka-neun-heuk-sam-reung (가는흑삼릉), although Chinese vernacular name is 狭叶黑三棱, also meaning narrow leaved *Sparganium*, to avoid confusion with the Korean name of *S. hyperboreum*, Jop-eun-ip-heuk-sam-reung (좁은잎흑삼릉).

*Sparganium subglobosum* was first described from the collections made by the U.S. Exploring Expedition to Bay of Islands, New Zealand (Morong, 1888). This species is one of only two *Sparganium* species appears in Southern Hemisphere in Australia and New Zealand, showing disjunct distribution



**Fig. 2.** *Sparganium subglobosum* Morong (Typhaceae). **A.** Habit. **B.** Detailed part of inflorescence. **C.** Male flower. **D.** Female flowers. **E, F.** Female heads. **E.** Female head at anthesis. **F.** Female head at fruiting. **G.** Nutlike fruit.

from Eastern Asia (Far Eastern Russia, northern China, Korea, Japan) to New Zealand, discontinuously occurring in Yunnan, Vietnam, and New Guinea (Cook and Nicholls, 1987). The other species appearing in Southern Hemisphere is *S. erectum*, but probably introduced recently (Cook and Nicholls, 1987).

We have collected *S. subglobosum* from inlet of Lake Cheonjin, Goseong-gun, Gangwon Prov., where other endangered flowering plants, such as *Nymphaea pygmaea* var. *minima* and *Brasenia schreberi*, are also distributed. The other collection is made from wetland of Buk River (Bukcheon) near



Bukcheon Bridge in Ganseong-eup, Ganseong-gun, Gangwon-do, where *S. erectum* and *S. japonicum* is also collected. The two collection sites strongly suggest that *S. subglobosum* may distributed in wetlands along the eastern coast of Korea. Unfortunately, collection of *S. subglobosum* was only made from Lake Cheonjin during the 2010-2014 floristic survey project on the lagoon areas on the eastern coast of Korean Peninsula by National Institute of Biological Resources (NIBR), whose results presented in Kim et al. (2017) (also see Specimen examined). The inlet of Lake Cheonjin has recently been reclaimed by landowner and most of the habitat has been disappeared. Dr. Jin-Seok Kim at NIBR (pers. comm.) was able to find only a few individuals of *S. subglobosum* surviving this year. Although the Lake Cheonjin is very important and only habitat for several endangered plant species of Korea and the threat of disturbance has been expected, no serious measures and conservation action has been taken so far. Thus, conservation plans need to be prepared and enacted immediately, to protect the endangered species. Also, further survey of the coastal wetlands need to be done, to identify new distribution sites of *S. subglobosum*.

### Key to the *Sparganium* species of Korea

1. Inflorescence paniculate. Female heads born on axillary branches with distinct axillary peduncle. Style mostly bifid. .... *S. erectum* 흑삼릉
1. Inflorescence branching one or two times only. Female heads mostly born on sessile on main axis. Style not branching.
  2. Plants robust, 1–2 m high. Leaves wider than 5 mm.
    3. Proximal part of leaves triangular-flat in cross section, distal part flat. Inflorescence bracts spreading or ascending-spreading. Female heads usually axillary, long-pedunculate and upper ones approximate. Anthers 0.7–1 mm long. .... *S. japonicum* 긴흑삼릉
    3. Proximal part of leaves keeled, distal part keeled-triangular. Inflorescence bracts erect. Female heads usually supra-axillary and widely spaced. Anthers 1–2 mm long. .... *S. fallax* 남흑삼릉
  2. Plants slender, shorter than 1 m. Leaves narrower than 4 mm.
    4. Plant with mostly erect and emergent or rarely floating leaves. Leaves usually longer than inflorescence, with distinct midrib and a keel abaxially. Stigmas 0.6–1 mm long. Beak 1–2 mm long. .... *S. subglobosum* 가는흑삼릉

4. Plants submerged or floating. Leaves flat, without distinct midrib and without a keel. Inflorescence simple, 2.5–4.5 cm long. Stigmas 0.3–0.5 mm long. Beak absent or nipple-like. .... *S. hyperboreum* 좁은잎흑삼릉

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