Sparganium glomeratum (Typhaceae): A new record from South Korea

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ABSTRACT: In this study, we report a new record of the clustered bur-reed Sparganium glomeratum (Laest. ex Beurl.) Beurl., from Yongneup Moor of Daemsan Mt. in Gangwon-do, Korea. This species is distributed in the cool temperate and circumboreal regions of the Northern Hemisphere. As we recorded this species in a high-altitude wetland, we named it “Du-me-heuk-sam-neung” after the Korean word that translates to “Sparganium found in deep mountains.” We provide descriptions of the morphological characteristics, photographs, and detailed illustrations of S. glomeratum, as well as a key to allied taxa in Korea.

Keywords: clustered bur-reed, Sparganium, Typhaceae, Yongneup, Daeamsan Mt., unrecorded species

Since the mid-1800s, when the exploration of floristic diversity of the Korean Peninsula started, a total of 3,777 native vascular plant taxa were documented in this region (Chang et al., 2015; Korea National Arboretum, 2017). Although most taxa are well recognized and revised via several approaches (i.e., Asteraceae, Ranunculaceae, Cyperaceae, etc.) (Lee, 2018), some plant groups still need to be explored to catalogue the plant biodiversity of the Korean Peninsula.

One of such uninvestigated plant groups is the genus Sparganium (Typhaceae), which includes approximately 14–19 species occurring mainly in the Northern Hemisphere, though some species’ ranges extend to some parts of Oceania (Cook and Nicholls, 1986, 1987; Sun and Simpson, 2010). Because this genus comprises a small number of species that are continuously widely distributed in the Northern Hemisphere, there are no local or regional endemic species, with a few controversial exceptions in China. Monographic studies for Sparganium were first conducted by Cook and Nicholl (1986, 1987) who divided this genus into two subgenera (i.e., Xanthosparganium and Sparganium) based on some morphological characteristics of the perianth. Recently, however, a phylogenetic study of Sparganium was conducted and the classification of this genus was rearranged (Sulman et al., 2013).

Until recently, three Sparganium species (S. erectum L., S. japonicum Rothert, and S. hyperboreum Laest. ex Beurl.) were reported to inhabit the Korean Peninsula (Lee, 1980, 1996a, 1996b; Kim and Choi, 2007). In the last decade, as more taxonomic studies and field surveys were conducted, three more species, S. fallax (Kim et al., 2010), S. subglobosum (Lim et al., 2017), and S. coreanum (Ha et al., 2019), were documented in this area. However, there is still a possibility of more unrecorded species inhabiting the Korean Peninsula. Furthermore, Cook and Nicholls (1986) suggested that S. glomeratum (Laest. ex Beurl.) Beurl. and S. emersum Rehmann also occur in Korea, but more surveys are needed to confirm this.

In 2017, during the project of the Illustrated flora of Korea (Juncaceae, Eriocaulaceae, and Typhaceae), we conducted a field expedition to Yongneup Moor of Daemsan Mt. (Yanggu city), located in the middle part of the Korean Peninsula, and found an unidentified and unrecorded population of Sparganium. For the exact identification of this species, we visited this location several times in order to examine flowers and fruits, which are important characteristics for the identification of Sparganium species. However, we were unable
to find any flowers or fruits for two years and this seems due partly to a thick peat layer of Yongneup Moor, which made a harsh environment for *Sparganium* species. We collected a few individuals of this species as living collections and grew them in the greenhouse of the Korea National Arboretum. In June 2019, we were able to examine the reproductive morphological characteristics of this species and identified it as *S. glomeratum*. In addition, we conducted phylogenetic analyses of *Sparganium* species using nrDNA internal transcribed spacer, and the analyses included the population from this study, other *Sparganium* species in Korea, and data of Sulman et al. (2013). The results showed that Yongneup population was embedded in the *S. glomeratum* clade (maximum likelihood bootstrap [ML BS] = 99%, Bayesian inference posterior probability [BI PP] = 1) and this clade was sister to the clade of *S. emersum* with moderate supporting value (ML BS = 63%, BI PP = 0.93) (Gil et al., 2018). In this study, we recorded *S. glomeratum* in the South Korea for the first time and we presented the description of its morphological characteristics, illustrations, and photographs of this species, along with a key to this and allied taxa in Korea.

**Taxonomic Treatment**

*Sparganium glomeratum* (Laest. ex Beurl.) Beurl., Arsberätt. Bot. Arbeten Upptäckter 1851: 221, 1855 (Figs. 1, 2).

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**Fig. 1.** Photographs of *Sparganium glomeratum*. A. Habitat. B. Habit. C. Inflorescence stem. D. Male heads. E. Female head. F. Fruit. G. Endocarp.
**Sparganium erectum** var. **glomeratum** Laest. ex Beurl., Arsberätt. Bot. Arbeten Uppättäcker 1850 (Bih. 1): 2, 1853.

**Sparganium glehnii** Meinsh., Bull. Acad. Imp. Sci. Saint-Péi. Saint-36: 34, 1895.

**Sparganium glomeratum** var. **angustifolium** Graebn., Pflanzenr. IV, 10: 20, 1900.

**Sparganium manshuricum** D. Yu, Bull. Bot. Res., Harbin 12: 255, 1992.

**Description:** Plants 50–70 cm tall, robust, erect, emergent, floating or submerged in deep water. Rhizomes creeping. Leaves linear, erect or floating, emergent or submerged, 29–55 cm long, 5–11 mm wide, abaxially carinate, triangular toward the base, sheathed at the base with membranous margin. Inflorescence axis erect, 11–23 cm long, non-branched; 1–2 male heads compacted on the upper part, 5–7 female heads on the lower part. Male head ca. 14 mm in diameter at anthesis.

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**Fig. 2.** Illustrations of *Sparganium glomeratum*. A. Habit. B. Flowering inflorescence stem. C. Fruiting inflorescence stem. D. Cross sections of distal, middle, and proximal part of leaf. E. Male head. F. Male flower. G. Female head. H. Female flower, pistil, and perianth. I. Fruit with perianth, fruit, and perianth. J. Endocarp and its longitudinal (middle) and transversal (right) section.
female heads adjacent to male heads, sessile, but the lowermost
1–2 female heads pedunculate, ca. 11 mm in diameter at
anthesis. Male flowers with 3 perianths, spathulate, ca. 2 mm
long. Stamens 3 or more, anthers 0.7–0.9 mm long, filaments
5–6 mm long. Female flowers with 3–6 perianths, oblong to
spathulate, transparent, 2–3 mm long; carpels 1; ovaries
lanceolate or narrow fusiform; stigmas 0.6–0.8 mm long. Fruits
fusiform, 3.5–5 mm long, 1–2 mm diameter; exocarp fleshy,
endocarp hard, smooth surface with longitudinal lines,
pedunculate. Seeds ovate, ca. 2 mm long.

Phenology: Flowering Jun–Jul and fruiting Aug–Oct.

Distribution: Korea, Japan, China, Tibet, Russia, Norway,
Sweden, Finland, Canada

Vernacular name: 두메흑삼릉 (Du-me-heuk-sam-neung,
Korean), clustered bur-reed (English).

Voucher specimens: KOREA. Gangwon-do: Inje-gun,
Seohwa-myeon, Seohwa-myeon, Seoheung-ri, Daeamsan Mt.,
cultivated at KNA, 11 Jul 2019, Hee-Young Gil GIL 2990
(KH); 1 Aug 2019, Hee-Young Gil GIL2995 (KH).

Taxonomic notes: Sparganium glomeratum is distributed
in the cool temperate and circumboreal regions of the
Northern Hemisphere. Although the species is mainly
distributed in Northern Europe and Eastern Asia, it also
sporadically occurs in Russia, Tibet, and Canada (Cook and
Nicholls, 1986; Grebenjuk, 2018). The known habitat of this
species are small ponds and streams, and the species was
rarely recorded on marginal parts of big lakes (Cook and
Nicholls, 1986; Sun and Simpson, 2010). The presence of S.
glomeratum in North Korea was suggested by Cook and
Nicholls (1986), but this has not been confirmed to date as
this species has never been documented in the Korean flora.
During the field survey of Yongneup Moor located at the top
of Daeamsan Mt., we found a population of S. glomeratum.
Yongneup Moor (1,280 m a.s.l.) is well known as the first
Korean wetland registered in the Ramsar List of Wetlands of
International Importance in 1997. It is a rare and valuable
ecosystem because of its unique environmental conditions,
including barren soil, cold temperature, and high humidity.
A total of 227–294 vascular plant species were documented
on this high altitude moor based on recent floristic surveys
(Lee et al., 2007; Oh et al., 2013; Cho, 2016). This
Sparganium population, however, has been identified as
different species depending on the survey team [e.g., S.
stoloniferum (= S. erectum) (Lee et al., 2003, 2007), S.
hyperboreum (Cho, 2016), S. stenophyllum (= S.
subglobosum) (Lee, 1969)]. S. glomeratum can be well
distinguished from other Sparganium species in Korea by
several morphological characteristics (Table 1). The species
that is morphologically most similar to S. glomeratum could
be S. japonicum or S. fallax because of certain common
characteristics shared among these three species, such as non-
branched inflorescence axis, length of the lowermost bract,
leaves width. However, S. glomeratum differs from S.
japonicum or S. fallax by the number of males heads and
absence of gap between male and female heads. As S.
glomeratum was found at a high altitude, we designated it
with the Korean vernacular name Du-me-heuk-sam-neung (두
메흑삼릉), meaning Sparganium found in deep mountains.

A key to Sparganium glomeratum and
related taxa in Korea

1. Inflorescence axis 3–5 branched; stigmas and ovary
locules 1–2; stigmas longer than ovary; endocarps with
longitudinal ridges and without stalks .................... 2
2. The lowermost inflorescence branch with male and
female heads; stigmas 3–4 mm long; fruits 3.5–4.5 mm
wide .................................................. S. erectum (흑삼릉)
2. The lowermost inflorescence branch with single female head; stigmas 6–9 mm long; fruits 6–10 mm wide.

1. Inflorescence axis never branched or rarely 1-branched (S. subglobosum); stigmas and ovary locules 1; stigmas shorter than ovary; endocarps without longitudinal ridges and with stalks ........................................ 3

3. The lowermost inflorescence bract shorter than or equal to inflorescence axis; female heads never pedunculated .......................... S. subglobosum (가늘은흑삼릉)

4. Plants usually erect and emergent; leaves non-carnate (flat); width of leaves 1–3 mm ................................................................. S. hyperboreum (좁은잎흑삼릉)

5. Female heads adjacent to male heads; number of male heads 1–3 ................................................................. S. glomeratum (두메흑삼릉)

6. Female heads axillary; inflorescence bracts ascending or spreading ................................................................. S. japonicum (가는잎흑삼릉)

6. Female heads supra-axillary; inflorescence bracts erect ................................................................. S. fallax (남تكون흑삼릉)

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Conflict of Interest

The authors declare that there are no conflicts of interest.
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