A new species of *Huperzia* (Lycopodiaceae) from Jeju Island, Korea: *Huperzia jejuensis*

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한국(제주도)의 1신종: 긴다람쥐꼬리

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ABSTRACT: A new species belonging to Lycopodiaceae Mirb. *Huperzia* Bernh. s.l. is described and illustrated: *Huperzia jejuensis* B.-Y. Sun & J. Lim. *H. jejuensis* has been considered conspecific with *H. integrifolia* (Matsuda) B. Øllg. ex Z. Satou, but it is clearly distinguished by the characteristics of linear-lanceolate leaves with parallel margins from the base to the mid-part, minute dentate margins from the mid-part to the end of the leaf, and cuspidate gemma apex. Because the habitat of the new species was confined to Jeju Island, '*jejuensis*' was chosen as the specific epithet of the scientific name of the new taxon.

Keywords: Lycopodiaceae, *Huperzia*, new species, *H. jejuensis*, *H. integrifolia*

적 요: 석송과 뱀톱속에 속하는 신종 긴다람쥐꼬리(*H. jejuensis* B.-Y. Sun & J. Lim.)를 기재하고 도해하였다. 긴다람쥐꼬리는 현재까지 *H. integrifolia* (Matsuda) B. Øllg. ex Z. Satou로 취급되어 왔으나 기부(base)에서 중간부까지 가장자리가 평행한 선상피침형의 잎, 잎의 중간부에서 상부까지 존재하는 미세한 치아상거치, 무성아의 정단은 예철두인 점에 의해 뚜렷이 구분되었다. 학명의 종소명은 신종의 생육지가 제주도인 점을 고려하여 '*jejuensis*'로 신칭하였다.

주요어: 석송과, 뱀톱속, 신종, 긴다람쥐꼬리, *H. integrifolia*

More than 300 species in the genus *Huperzia* Bernh. s.l. belonging to Lycopodiaceae Mirb. are recognized worldwide, mostly in the tropics (Wikström and Kenrick, 1999; Sun, 2007). Bernhardt (1801) segregated *Huperzia* as a distinct genus from *Lycopodium* L. based on sporangium born at the axil of leaves instead of producing strobilus.

Yabe (1903) first reported the distribution of *Lycopodium serratum* Thunb. ex Murray [= *Huperzia serrata* (Thunb. ex Murray) Trevis.] and *L. miyoshianum* Makino [= *H. miyoshiana*

(Makino) Ching] from Mt. Geumgang in Korea, and six species have been recognized in Korea (Sun, 2007): *H. serrata*, *H. integrifolia* (Matsuda) B. Øllg. ex Z. Satou, *H. miyoshiana*, *H. selago* (L.) Bernh. ex Schrank & Mart., *H. cryptomeriana* (Maxim.) R. D. Dixit, and *H. sieboldii* (Miq.) Holub.

Of these, *H. integrifolia* has been regarded as an endemic species that grows naturally on Jeju Island, Korea (Nakai, 1952).

Matsuda (1911) reported a new variety, *Lycopodium serratum* var. *integrifolium* Matsuda, based on a specimen collected at Lu-shan, Kiang-si Province, China by a Japanese collector Inami (Fig. 1), mentioning that the serration of leaves of the new variety is obscure or almost absent, and many specimens of the type variety from different localities in Japan

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have distinct serrations. Although Latin description was not provided for this new variety, the name can be treated as valid according to ICN Art. 39.1. Subsequently, Nakai (1914) published the name *L. integrifolium* (Matsuda) Matsuda et Nakai with a Latin diagnosis and description, raising *L. serratum* var. *integrifolium* to the specific level. He cited a specimen collected from Jeju Island (Mt. Halla at 700 m, Nakai 1081) and indicated the distribution range of this species as China and Korea (Jeju island). However, much earlier than Nakai, Goldie (1822) published a new species, *L. integrifolium* Hook. ex Goldie based on specimens collected in Montreal, Canada, describing the new species as a relative of *L. clavatum* L., which is apparently a different species to *L. integrifolium* (Matsuda) Matsuda et Nakai. Therefore, *L. integrifolium* (Matsuda) Matsuda et Nakai is a later homonym and hence illegitimate. Satou (1997) transferred *L. integrifolium* (Matsuda) Matsuda et Nakai to *Huperzia* as *H. integrifolia*.

In this study, we examined and compared the morphology of the original specimen collected by Inami in Lushan, China, and the specimens collected on Jeju Island. We found that these two taxa are fundamentally different enough to be treated as different species. Therefore we described the taxon distributed on Jeju Island as a new species, *H. jejuensis* B.-Y. Sun & J. Lim.

Fig. 1. Holotype of *Huperzia integrifolia* (Matsuda) Satou.

Taxonomic Treatment

Huperzia jejuensis B.-Y. Sun & J. Lim, sp. nov. (Figs. 2, 3)

TYPE: Korea. Jeju Island: Mt. Halla, Seongpanak hiking trail, in forests beside the trail, 33° 22' N, 126° 33' E, elev. 1568 m. 8 Aug. 2010. C.-H. Kim, J. Lim, N.-R. Yun and S.-S. Choi 50803. (Holotype, KB; Isotype, KB).

Korean name: Gin-da-ram-jwi-kko-ri 긴다람쥐꼬리

Plant evergreen herb, terrestrial. Stems erect or ascending, subterranean stems decumbent, 1–2(–4) dichotomously branched, 15–25 cm tall, together with leaves 1.2–1.9 cm wide, clustered at base without main stem; annual constrictions present. Gemmiferous branchlets present in 1–2 pseudowhorl at the end of each annual growth cycle, zygomorphic, comprising 6 lobes, with 1 large central lobe (outer), 1 small central lobe (inner), and 2 pairs small lateral lobes, each lobe linear to lanceolate, large central lobe 3–4 mm long; gemmae eliminated after maturity, obtriangular, 3–5 × 3–4 mm, zygomorphic, comprising 5 leaves, 1 central leaf, 2 large lateral leaves with

Fig. 2. Holotype of *Huperzia jejuensis* B.-Y. Sun & J. Lim.

apex cuspidate, $3-5 \times 3-4$ mm, and 1 abaxial, 1 adaxial leaf. Leaves monomorphic or dimorphic, attached at right angles or slightly angled downward with stem, densely spirally arranged, green, herbaceous, glabrous; vein only midrib, stomates on both sides. Trophophylls linear-lanceolate, straight in lower half or slightly narrowing from middle toward apex, $6-8 \times 0.7-1.2$ mm, apex acute, margins irregularly and minutely dentate or papillate above middle, teeth 1–10. Sporophylls linear-lanceolate, $4-7.5 \times 0.7-1.1$ mm, slightly smaller than trophophyll, margins entire or irregularly and minutely dentate above middle, teeth 0–5, not forming distinct cones. Sporangia reniform, $0.7-1.0 \times 1.1-1.6$ mm, axillary of sporophylls, sessile, yellowish; spores trilete with truncate lobes, or irregular shape.

Additional specimens examined: Korea. Jeju-do: Mt. Halla, Seongpanak hiking trail, elev. 1681 m. 8 Aug. 2010. C.-H. Kim, J. Lim, N.-R. Yun and S.-S. Choi 50850; Gwaneumsa hiking trail, elev. 1916 m. 8 Aug. 2010. C.-H. Kim, J. Lim, N.-R. Yun and S.-S. Choi 50823; Yeongsil hiking trail, elev. 1496 m. 17

June 2010. C.-H. Kim, J. Lim and N.-R. Yun 50435.

Habitat: Terrestrial in shaded conifer forests and mixed forests, moist areas covered with many mosses, above 800 m high in Mt. Halla (Fig. 4)

Distribution: Korea (Jeju Island), endemic to Korea.

Etymology: The specific epithet is derived from Jeju Island where this new species is distributed.

Note: The plant described as a new species here, *Huperzia jejuensis*, has been recognized as *H. integrifolia* (Sun, 2007). However, our results show that, *H. jejuensis* should be treated as a distinct species. In comparison of leaf morphology, the two species show considerable differences that are sufficient to treat them as different species (Table 1). Specifically, *H. integrifolia* has narrowly elliptic leaves with the middle part being the widest and irregularly serrate margins. In addition, gemma apex of *H. integrifolia* is mucronate. In contrast, *H. jejuensis* has linear-lanceolate leaves with margins parallel from the base to the mid-part and a minute dentate margin restricted from the middle part to the end of the leaves. In addition,

Fig. 3. *Huperzia jejuensis* B.-Y Sun & J. Lim. A. Habit; B. Upper part of stem; C. Sporophyll; D. Trophophylls; E. Gemmiferous branchlets; F. Sporangia; G. Gemma.

Fig. 4. Photograph of *Huperzia jejuensis* B.-Y Sun & J. Lim at the natural habitat in Mt. Halla.

gemma apex of *H. jejuensis* is cuspidate. Regarding the spore shape, *H. integrifolia* has normal triangular spores, whereas *H. jejuensis* has many spores with irregular shapes that may be indicative of hybrid origins (Fig. 5).

Regarding interspecific relationships, *H. jejuensis* seems to be more closely related to *H. miyoshiana* than *H. serrata* by

leaf shapes and stomate distribution patterns (Table 1). Nakai (1914) also suggested that *H. integrifolia* habitating in Jeju Island is more similar to *H. miyoshiana* than *H. serrata* in terms of external morphology. *H. jejuensis* is clearly distinguished from *H. serrata* which is characterized by the narrowly elliptical or oblanceolate leaves, leaves narrowed toward the base, and stomata distributed only on the lower surface of the leaves, but shares common features of linear-lanceolate leaves, stomata distributed on both sides of the leaf, and cuspidate gemma apex with *H. miyoshiana*.

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Fig. 5. Spores of *Huperzia jejuensis* (A) and *H. integrifolia* (B).

Table 1. Comparison of some diagnostic characters among *H. jejuensis*, *H. serrata*, *H. integrifolia* and *H. miyoshiana*.

Character	<i>H. jejuensis</i>	<i>H. serrata</i>	<i>H. integrifolia</i>	<i>H. miyoshiana</i>
Leaf shape	linear-lanceolate	narrowly elliptic, oblanceolate	narrowly elliptic	linear-lanceolate
Broadest part of leaf	same width except leaf tip	at or above mid-part	at mid-part	at base, narrowed from base to apex
Leaf margin	irregularly minutely dentate	irregularly serrate, serration large	irregularly serrate, serration small	entire
Distribution of Serration	above middle part	whole part	whole part	absent
Apex of gemmae	cuspidate	mucronate	mucronate	cuspidate
Distribution of stomata on leaf	both surfaces, more on lower side	lower surface only	both surfaces, more on lower side	both surfaces, similar number on both sides
Spores	trilete with frequent misshapes	trilete	trilete	trilete

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