

Unrecorded liverwort species from Korean flora: *Alobiellopsis parvifolius* (Cephaloziaceae), *Calypogeia japonica* (Calypogeiaceae), *Hattoria yakushimensis* (Lophoziaceae), *Nardia subclavata* (Solenostomataceae)

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ABSTRACT: While preparing a floristic study of Korean hepatics, we discovered the 4 unrecorded species *Alobiellopsis parvifolius*, *Calypogeia japonica*, *Hattoria yakushimensis* and *Nardia subclavata*. *A. parvifolius* is often confused with *Solenostoma fusiforme* (Steph.) Amak. in appearance, but the former differs by occasional presence of underleaves and a large hyaline outer cells of stem. *C. japonica* is similar to *C. tosana* (Steph.) Steph. The former, however, is separated from the latter by 2–3 biconcentric oil-bodies per cell compared to 3–5 grape oil-bodies per cell. *H. yakushimensis* is a monotypic genus based on a Japanese species. This genus is characterized by unlobed, closely imbricate leaves with margins distinctly incurved and usually pigmented with a reddish purple color. *N. subclavata* is similar to *N. assamica* (Mitt.) Amakawa in large underleaves and globular oil-bodies. The former, however, is separated from the latter by convex trigones versus concave trigones, smooth cuticles versus smooth to verrucose cuticles, and oil-bodies occurring in each cell versus occurring in approximately half or fewer leaf cells.

Keywords: Marchantiophyta, liverwort, unrecorded hepatics species

Descriptions

1. *Alobiellopsis parvifolius* (Steph.) R.M. Schust., Bull. Natl. Sci. Mus. 12: 679. 1969.

Alobiella parvifolia Steph., Sp. Hepat. 3: 352. 1908.

Nardia parvifolia (Steph.) S. Hatt., J. Hattori Bot. Lab. 5: 77. 1951.

Korean Name : Na-do-ge-bal-i-kki (나도게밭이끼)

Plants 3.0–8.0 × 0.8–1.0 mm, prostrate to ascending, whitish to yellowish green. **Stems** postical intercalary, yellowish green, cross section 0.20–0.25 × 0.15–0.20 mm, cortex cells thin-walled, 25.0–30.0 × 25.0–30.0 μm; inner cells thin-walled, 25.0–37.5 × 25.0–37.5 μm, concave trigones. **Rhizoids** fasciculate at base of underleaves, colorless. **Leaves** contiguous, obliquely subhorizontal inserted, ovate, obliquely orbicular to subquadrate, 0.4–0.6 × 0.4–0.6 mm, margin entire to slightly bilobed. **Cells** in the midleaf 37.5–75.0 × 25.0–37.5 μm with concave trigones; in apex subquadrate 25.0–37.5 × 33.5–50.0 μm with concave

trigones; in base 25.0–75.0 × 25.0–37.5 μm with concave trigones. **Oil bodies** 3–5 per cells, granulate, ovate to elliptical, ca. 10.0–12.5 × 7.5–10.0 μm. **Underleaves** ligulate 0.20–0.25 × 0.10–0.15 mm, margin entire. [**Sexual condition** dioicous. **Androecia** often elongate, with numerous, bilobed, slightly reduced bracts. **Gynoeceia** acrogynous on leading axes, with bilobate bracts slightly larger than leaves. **Perianth** with mouth open, truncate or dentate, bistratose basally (Bakalin, 2007).].

Habitats: Fine-grained soil along the stream in broad-leaved evergreen forest.

Distribution: Korea, Japan, Russia (South Kurils) (Bakalin, 2007)

Specimens examined: Is. Heuksan-do, Heuksan-myeon, Sinan-gun, Jeollanam-do, Korea. N34°40'03.7'' E 125°25'29.9'' Alt. 20 m, 24 Jul. 2008 S.-S. Choi 8-1-7 (JNU; NIBR).

Alobiellopsis is the only species of Cephaloziaceae with unlobed leaves found in Korean flora. This genus is characterized by (1) unlobed leaves, (2) presence of reduced or vestigial

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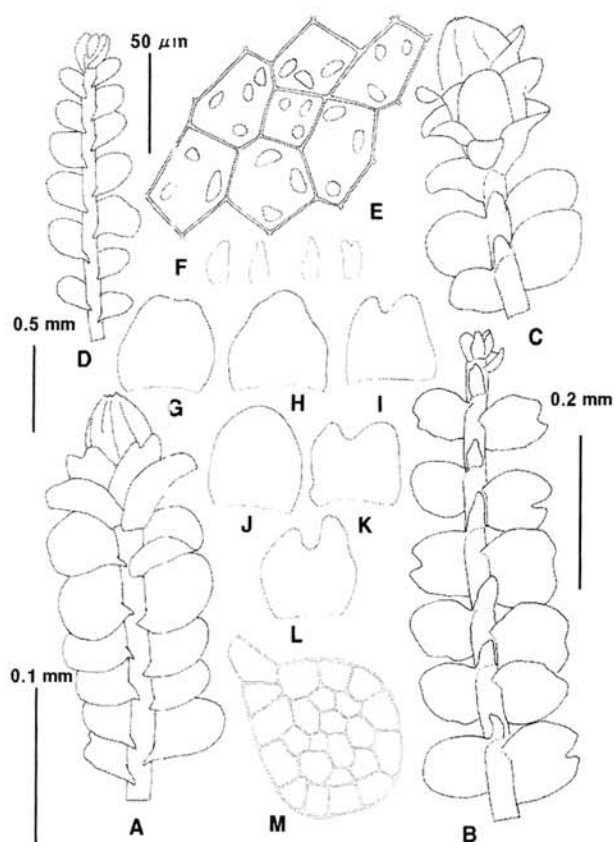


Fig. 1. *Alobiellopsis parvifolius* (Steph.) R.M. Schust. A, D. plant (dorsal view); B, C. plant (ventral view); E. oil-bodies in the midleaf; F. underleaves; G-L. leaves; M. cross section of stem. Scale bars: 0.1 mm for A-D; 0.5 mm for F-L; 50 μm for E; 0.2 mm for M.

underleaves, (3) presence of gemmae, and (4) perianths develop on leaf branches of normal size (Schuster, 1969).

This species is often confused with *Solenostoma fusiforme* (Steph.) Amak. in appearance, however, the former differs by (1) at least occasional presence of underleaves (2) large hyaline outer cells of stem (Bakalin, 2007).

New Korean name is given as 'Na-do-ge-bal-i-kki', is based appearance of plant.

2. *Calypogeia japonica* Steph., Sp. Hepat. 6: 448. 1924.

Korean Name : Gye-gok-mok-geol-i-i-kki (계곡목걸이이끼)

Plants 10.0–20.0 \times 1.0–1.5 mm, prostrate to ascending, yellowish green to brownish green. **Stems** postical intercalary branched, brownish green, cross section 0.15–0.20 \times 0.20–0.25 mm, cortex cells thin-walled, 37.5–50.0 \times 20.0–25.0 μm ; inner cells thin-walled, 25.0–37.5 \times 25.0–37.5 μm , with concave trigones. **Rhizoids** fasciculate at base of underleaves, colorless. **Leaves** closely imbricate, imbricate inserted, broadly ovate, triangular-ovate,

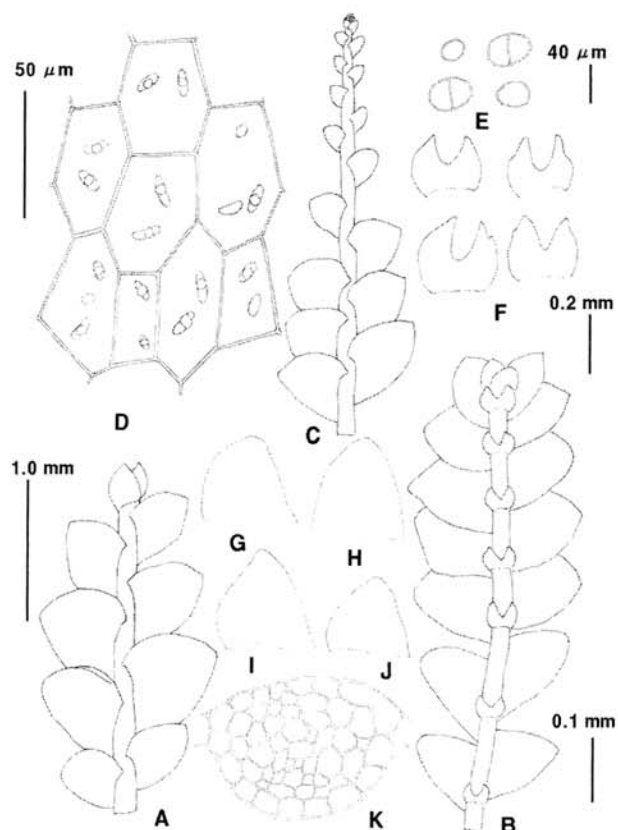


Fig. 2. *Calypogeia japonica* Steph. A, C. plant (dorsal view); B. plant (ventral view); D. oil-bodies in the midleaf; E. gemmae; F. underleaves; G-J. leaves; K. cross section of stem. Scale bars: 1.0 mm for A-C, G-J; 50 μm for D; 40 μm for E; 0.2 mm for F; 0.1 mm for K.

0.8–1.1 \times 0.8–1.0 mm, margin entire with acute to obtuse apex. **Cells** in the midleaf 50.0–62.5 \times 32.5–37.5 μm with concave trigones; in apex subquadrate 25.0–37.5 \times 50.0–62.5 μm with concave trigones; in base 75.0–87.5 \times 32.5–37.5 μm with concave trigones. **Oil bodies** 2–3 per cells, biconcentric, granulate, ovate to elliptical, ca. 10.0–12.5 \times 5.0–7.5 μm . **Underleaves** broadly ovate, 0.25–0.30 \times 0.4–0.5 mm, bilobed 1/2–3/4 of length, sinus V-shaped, lobes triangular, acute, subacute, obtuse tooth on margin. **Specialized asexual reproduction** by gemmae abundant on tips of apical leaves, 1–2 celled, yellowish green, spherical to elliptical, 37.5–50.0 \times 25.0–30.0 μm .

Habitat: On shaded wet rocks near the stream in broad-leaved deciduous forest.

Distribution: Korea, Japan (Iwatsuki, 2001)

Specimens examined: Mt. Naejang-san, Naejang-dong, Jeongeup-si, Jeonbuk, Korea. N 35°29'16.2'' E 126°53'46.3'' Alt. 250 m, 16 Mar. 2009 S.-S. Choi 3471 (JNU; NIBR).

This species is similar to *C. tosana* (Steph.) Steph. The former, however, is separated from the latter by 2–3 biconcentric oil-bodies per cell versus 3–5 grape oil-bodies per cell (Iwatsuki, 2001).

New Korean name is given as ‘Gye-gok-mok-geol-i-i-kki’, is based on habitats of plant.

3. *Hattoria yakushimensis* (Horik.) R.M. Schust., Rev. Bryol. Lichénol. 30: 70. 1961.

Anastrophyllum yakushimense Horik., J. Sci. Hiroshima Univ., Ser. B, Div. 2, Bot. 2: 149. 1934.

Korean Name : Ha-nunl-i-kki (하늘이끼)

Plants 10.0–20.0 × 0.5–0.7 mm, prostrate, yellowish green to pigmented with reddish purple. **Stems** sparsely branched, brown, cross section 0.10–0.13 × 0.15–0.18 mm, cortex cells thick-walled, smaller, 10.0–17.5 × 10.0–17.5 μm with brown; inner cells thick-walled, 12.5–25.0 × 12.5–25.0 μm, with concave trigones. **Rhizoids** numerous, colorless. **Leaves** densely imbricate,

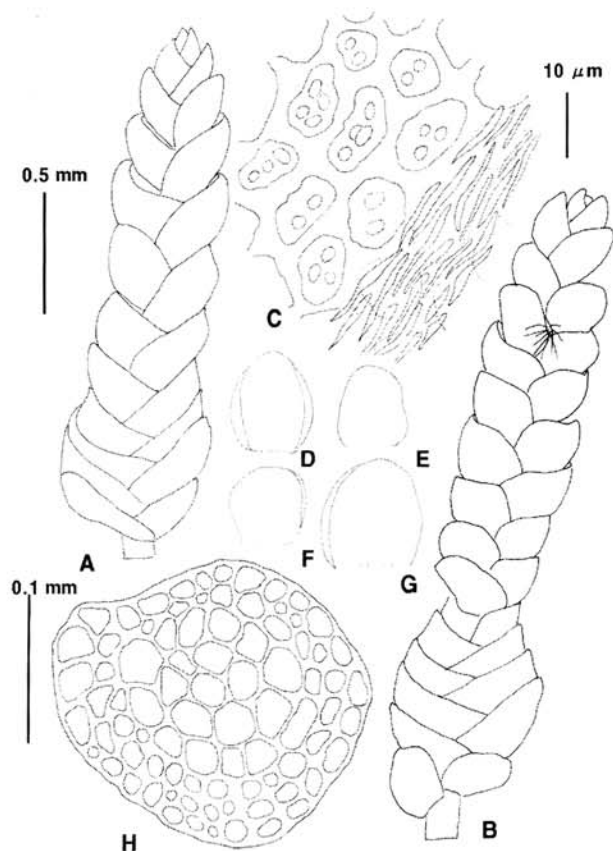


Fig. 3. *Hattoria yakushimensis* (Horik.) R.M. Schust. A. plant (dorsal view); B. plant (ventral view); C. oil-bodies with cuticles in the midleaf; D-G. leaves; H. cross section of stem. Scale bars: 0.5 mm for A-B, D-G; 10 μm for C; 0.1 mm for H.

second dorsally, transversely inserted, strongly concave, incurved along margin, not decurrent antically, bordered with hyalin, cordate to subcircular, 0.6–0.7 × 0.5–0.8 mm, margin entire with round apex. **Cells** in the midleaf thick-walled 12.5–17.5 × 10.0–12.5 μm, thick-walled with convex trigones; in apex 10.0–12.5 × 10.0–12.5 μm with concave trigones; in base 22.5–27.5 × 10.0–15.0 μm with convex trigones. **Oil bodies** 2–4 per cells, granulate, ovate to elliptical, ca. 3.0–5.0 × 3.0 μm. [**Sexual condition** dioicous. **Androecia** bracts intercalary, 3–4 pairs. **Gynoecia** bracts larger than leaves of the same stem. **Perianth** oblong to ovate, deeply pluriplicate above, mouth crenulate (Kitagawa, 1966).]

Habitat: On shaded cliffs and granitic rocks on the northern slopes in broad-leaved deciduous forest.

Distribution: Korea, China, Japan (Kitagawa, 1966)

Specimens examined: Mt. Gaya-san, near peak (Chibulbong), Gaya-myeon, Hapcheon-gun, Gyeongsangnam-do, Korea. N 35°49'14.8" E 128°07'27.5", Alt. 1313 m, 8 Sep. 2009 S.-S. Choi 4385 (JNU; NIBR).

Hattoria is a monotypic genus based on a Japanese species. This genus is characterized by unlobed, closely imbricate leaves with margins distinctly incurved and usually pigmented with a reddish purple color (Kitagawa, 1966).

This species is endemic to East Asia with narrow distribution and is listed in The 2000 IUCN World Red List of Bryophytes as Vulnerable (VU), based on the small area of occupancy and the less than five localities, main threat is logging of evergreen forest in the vicinity of the site and subsequent changes, such as alteration of air humidity and light conditions (Schuster, 1983; Tan *et al.*, 2000; Yi and Gao, 1998).

New Korean name is given as ‘Ha-nunl-i-kki’, is based on altitude of habitat.

4. *Nardia subclavata* (Steph.) Amak., Jour. Jap. Bot. 32: 40. 1957.

Jungermannia subclavata Steph., Spec. Hepat. 6: 93. 1917.

Plectocolea subclavata (Steph.) Hatt., Bull. Tokyo Sci. Mus. 11: 38. 1944.

Korean Name : Pa-ran-bi-neul-kki (파란비늘이끼)

Plants 5.0–10.0 × 1.0–1.5 mm, prostrate to ascending, green to brownish green. **Stems** sparsely branched, yellowish green, cross section 0.15–0.20 × 0.20–0.25 mm, cortex cells thin-walled,

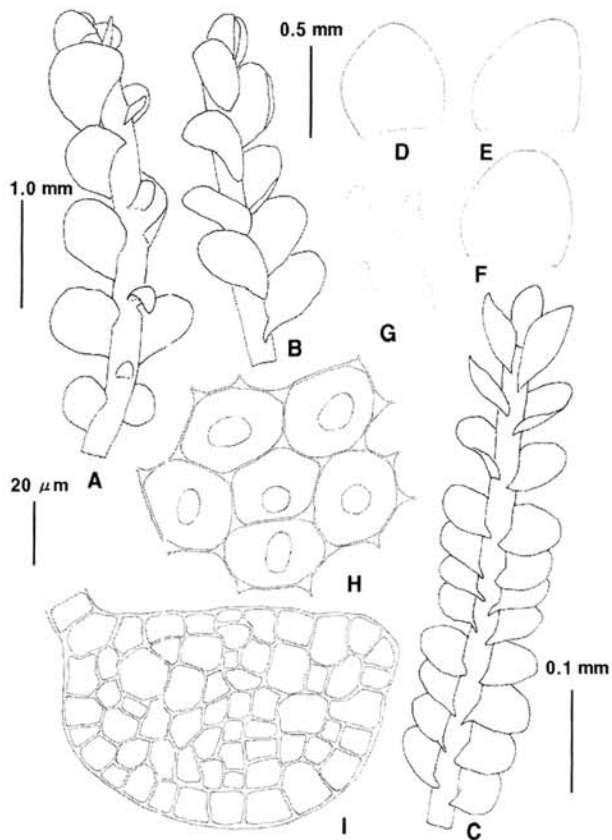


Fig. 4. *Nardia subclavata* (Steph.) Amak. A. plant (ventral view); B, C. plant (dorsal view); D-F. leaves; G. underleaves; H. oil-bodies in the midleaf; I. cross section of stem. Scale bars: 1.0 mm for A-C; 0.5 mm for D-G; 20 μ m for H; 0.1 mm for I.

25.0–37.5 \times 25.0–37.5 μ m with pale green; inner cells thin-walled, 12.5–37.5 \times 12.5–37.5 μ m, concave trigones with colorless. **Rhizoids** sparse, colorless. **Leaves** contiguous, obliquely spreading, concave, obliquely ovate, 0.5–0.8 \times 0.5–0.8 mm, margin entire with round apex. **Cells** in the midleaf 17.5–27.5 \times 17.5–27.5 μ m with triangular trigones; in apex 20.0–25.0 \times 20.0–25.0 μ m with triangular trigones; in base 17.5–27.5 \times 17.5–27.5 μ m with triangular trigones. **Oil bodies** 1(2) per cells, granulate, ovate to elliptical, ca. 10.0–12.5 \times 7.5–10.0 μ m, consisting of numerous globules. **Underleaves** triangular ovate, 0.20–0.30 \times 0.10–0.15 mm, margin entire with obtuse apex, recurved, united at base with one or both sides to leaves. [**Sexual condition** dioicous. **Androecia** bracts in 2–5 pairs, larger than leaves. **Gynoecia** bracts in 2–3 pairs, larger than leaves, margin undulate. **Perianth** subconical, ca. 1.0 \times 0.9 mm (Amakawa, 1959).]

Habitat: On shaded wet rocks near the stream in broad-leaved deciduous forest.

Distribution: Korea, Japan, China, Russia (Kamchatka, Kuriles)

(Amakawa, 1959).

Specimens examined: Mt. Daedun-san, Surak valley, Beolgok-myeon, Nonsan-si, Chungcheongnam-do, Korea. N 36°08'12.8'' E 127°18'18.0'', Alt. 343 m, 31 Mar. 2009 S.-S. Choi 3371 (JNU; NIBR).

This species is similar to *N. assamica* (Mitt.) Amakawa since it has large underleaves and globules oil-bodies. The former, however, is separated from latter by (1) convex trigones versus concave trigones, (2) smooth cuticle versus smooth to verrucose cuticle, and (3) oil-bodies occurring in each cells versus oil-bodies occurring in approximately half or fewer leaf cells (Amakawa, 1959).

New Korean name is given as 'Pa-ran-bi-neul-kki', is based on color of plant.

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