

Unrecorded Liverwort Species from Mt. Deogyu, Korea

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덕유산의 한국산 미기록 태류식물

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ABSTRACT: A total of ten unrecorded liverwort species in the Hepaticae flora of Korea were collected on Mt. Deogyu (1,614 m). The ten species are *Tetralophozia filiformis* (Steph.) Urmí., *Herbertus buchii* Juslén, *Bazzania japonica* (Sande Lac.) Lindb., *Cephaloziella hampeana* (Nees) Schiffner ex Loeske., *Jungermannia japonica* Amak., *Marsupella alpina* (Gott. ex Husn.) Bernet., *Pedinophyllum interruptum* (Nees) Kaal., *Frullania polyptera* Tayl., *Jubula hutchinsiae* ssp. *javanica* (Steph.) Verd., and *Marchantia polymorpha* ssp. *montivagans* Bischl. and Boisselier-Dubayle. They are distributed near streams and/or at the top of a ridge on Mt. Deogyu.

Keywords: Hepaticae, unrecorded liverworts, Mt. Deogyu

적 요: 덕유산 (1614 m)에서 우리나라 미기록 태류식물 10 분류군을 발견하였다. 미기록속인 엄마이끼과의 창이끼 [*Tetralophozia filiformis* (Steph.) Urmí]와 미기록종인 쌍갈고리이끼과의 왕쌍갈고리이끼 [*Herbertus buchii* Juslén], 벼슬이끼과의 선좀벼슬이끼 [*Bazzania japonica* (Sande Lac.) Lindb.], 걸계발이끼과의 산걸계발이끼 [*Cephaloziella hampeana* (Nees) Schiffner ex Loeske.], 망울이끼과의 꼬마망울이끼 [*Jungermannia japonica* Amak.], 은비늘이끼과의 고산양끝통이끼 [*Marsupella alpina* (Gott. ex Husn.) Bernet.], 날개이끼과의 숲누운날개이끼 [*Pedinophyllum interruptum* (Nees) Kaal.], 지네이끼과의 푸른지네이끼 [*Frullania polyptera* Tayl.], 가지지네이끼과의 계곡가지이끼 [*Jubula hutchinsiae* ssp. *javanica* (Steph.) Verd.], 우산이끼과의 고산우산이끼 [*Marchantia polymorpha* ssp. *montivagans* Bischl. and Boisselier-Dubayle.]는 덕유산 계곡 및 능선부에 소수의 개체가 자생하고 있었다.

주요어: 태류식물, 미기록종, 덕유산

The Hepaticae includes approximately 8,000 species in at least 330 genera worldwide (Schofield, 1985). China contains 884 species in 147 genera (Piippo, 1990) and Japan comprises 612 species in 134 genera (Yamada and Iwatsuki, 2006). In Korea, 281 species in 81 genera are known to distribute (Park and Choi, 2007).

The Hepaticae usually grows on wet soil, shaded rocks and barks of trees. Leaves of Hepaticae are generally unistratose and lack a costa (midrib), and leaf cells commonly have complex oil bodies. The sporangium includes spores and elaters, but sporangium does not have peristome and operculum, and the seta elongates

after the sporangium collapses for 2~3 days. The Hepaticae is divided into six orders based essentially on structure of the gametophyte, particularly the gametophore (Schofield, 1985).

A total of ten unrecorded Hepaticae species from Korean flora of Hepaticae were collected in the Mt. Deogyu, which include *Tetralophozia filiformis* (Steph.) Urmí (Scapaniaceae), *Herbertus buchii* Juslén (Herbertaceae), *Bazzania japonica* (Sande Lac.) Lindb. (Lepidoziaceae), *Cephaloziella hampeana* (Nees) Schiffner ex Loeske (Cephaloziellaceae), *Jungermannia japonica* Amak. (Jungermanniaceae), *Marsupella alpina* (Gott. ex Husn.) Bernet. (Gymnomitriaceae), *Pedinophyllum interruptum* (Nees) Kaal.

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(Plagiochilaceae), *Frullania polyptera* Tayl. (Frullaniaceae), *Jubula hutchinsiae* ssp. *javanica* (Steph.) Verd. (Jubulaceae), and *Marchantia polymorpha* ssp. *montivagans* Bischl. and Boisselier-Dubayle (Marchantiaceae).

Descriptions

1. *Tetralophozia filiformis* (Steph.) Urmí, J. Bryol. 12: 394. 1983.
Chandonanthus filiformis Steph., Sp. Hepa. 3: 644. 1909.
Chandonanthus pusillus Steph., Sp. Hepa. 3: 645. 1909.

Korean name: Chang-i-kki (창이끼)

Plants pale green or green. Stems 10–15 mm long, ca. 0.07 mm in diameter, 0.3–0.4 mm wide with leaves. Leaves contiguous to imbricate, transversely inserted, 0.25–0.3 mm long, 0.4–0.5 mm wide, nearly equally (3)–4 lobed, sinus descending 6/7 the leaf length, narrow, middle lobes more large than border lobes; lobes narrow lanceolate, convex adaxially with reflexed margins, subacute to acuminate, 0.14–0.23 mm long, 0.03–0.06 mm wide, with 2–3 marginal teeth at base; cells of the leaf apex 20–25 × 7.5–10.0 μm, of the middle 12.5–15.0 × 5.0–7.5 μm, trigones large. Oil-bodies 3–5 per cells, spherical, granulate, 3–5 × 2.5 μm. Underleaves deeply (3/4) 2-lobed, lobes subacute to acuminate, with 2–3 marginal teeth at base, 0.20–0.25 mm long, 0.23 mm wide at base. [Plants dioecious. Perianth 1/2–emergent, ovoid, deeply 5-plicate to the base (Kitagawa, 1965).]

Habitats On rocks or cliffs along stream in broad-leaved forest. In pure mats or with *Blepharostoma minus* Horik. and *Herbertus aduncus* (Dicks.) S. Gray, along the route from Deokgok stream to Hyangjeokbong.

Specimen examined Mt. Deogyu, Anseong-myeon, Muju-gun, Jeollabuk-do, Korea, 1 Jul. 2008, S.S. Choi 10958 (JNU, NIBR).

Distribution Korea, Japan, Taiwan, China, Nepal, India, Bhutan, Malaysia, Russia (Siberia), Spain, British Columbia (Kitagawa, 1965; Konstantinova, 2002; Bakalin et al., 2008).

Tetralophozia (R.M. Schust.) Schljakov of Scapaniaceae Mig. is characterized by underleaves usually half of leaf, leaves nearly equally (3)–4 lobed, and sinus descending 6/7 the leaf length. This genus seems to be related to *Anastrophyllum* (Spruce) Steph., *Tritomaria* Schiffner ex Loeske and *Barbilophozia* Loeske, however, the latter differ in having small underleaves or not, sinus of leaves descending 1/7–3/7 the leaf length. The *Tetralophozia* also distinguished from *Plicanthus* R. M. Schust. in nearly equally (3)–4 lobed versus very unequally 3-lobed leaves (Kitagawa, 1965). This genus is a very natural taxon consisting of only four species.

T. filiformis is similar to *Tetralophozia setiformis* (Ehrh.) Schljakov from Holarctic regions, however, the latter differs in the large size of plant, 0.8–1.0 mm wide with leaves, acute at apex, triangular-ovoid in lobes, and cells of the middle 13–18 μm (Schuster, 1969; Kitagawa, 1965).

New Korean name is given as ‘Chang-i-kki’ based on the slender form of plants and deeply equally (3)–4 lobed leaves.

2. *Herbertus buchii* Juslén, Ann. Bot. Fennici 43: 416. 2006.

Korean name: Wang-ssang-gal-go-ri-i-kki (왕쌍갈고리이끼)

Plants orange brown. Stems 3–7 cm long, cross-section oval, 0.4–0.6 mm in diameter. Leaves imbricate, straight or falcate and almost symmetrical, nearly 3/4 lobed, 0.8–1.2 mm long, 0.2–0.4 mm wide, length-width ratio 2.6–2.7; lobes acute at apex; cells of the leaf apex 20.0 × 15.0 μm, with 1–4 uniseriate cells and 4 rows below apex 2 cells wide; vitta bifurcating near base of lamina or well below mid basal lamina; vitta cells 32.5–67.5 × 15.0 μm in mid basal lamina; basal lamina cells ca. 10 × 10 μm, with large trigones. Underleaves near 3/4 lobed, smaller, 0.8–1.0 mm long, 0.2–0.4 mm wide.

Habitats On dry rocks covered with thin soils, rock outcrops in full sun, broad-leaved forest with admixture of conifers and shrubs cover, along the route from Hyangjeokbong to Dongyeopyeong at elevation of 1,437–1,584 m.

Specimens examined Mt. Deogyu, Anseong-myeon, Muju-gun, Jeollabuk-do, Korea, 25 Jun. 2008, V.A. Bakalin and S.S. Choi 10682, V.A. Bakalin and S.S. Choi 10686, V.A. Bakalin and S.S. Choi 10714 (JNU, NIBR).

Distribution Korea, Russia Amur region (Juslén, 2006).

In 2006, Juslén newly described this species from Amur region of Russia. It was previously thought to be distributed at only type locality. This species is similar to *Herbertus dicranus* (Taylor) Trevis., however, the latter differs in having straight leaves. The *H. buchii* also related to *H. aduncus* (Dicks.) Gray. The latter, however, is separated from the former by the vitta bifurcating in mid or above basal lamina, and by leaf length-width ratio of 1.8–4.0 (Juslén, 2006).

New Korean name is given as ‘Wang-ssang-gal-go-ri-i-kki’, because plants are larger than other species in genus.

3. *Bazzania japonica* (Sande Lac.) Lindb., Acta Soc. Sci. Fenn. 10: 224. 1872.

Mastigobryum japonicum Sande Lac., Ann. Mus. Bot. Lugduno-Batavum. 1: 303. 1863.

Korean name: Sun-jom-byeo-seul-i-kki (선좁벼슬이끼)

Plants olive-green, prostrate to ascending. Stems 20–50 mm long, 0.25–0.30 mm in diameter, 1.3–1.7 mm wide with leaves, postical flagella abundant, frequently branched. Leaves imbricate, triangular ovate, more or less falcate, 1.1–1.3 mm long, 0.8–0.9 mm wide near base, apex narrowed and truncate-tridentate, teeth triangular; cells of the apex $20.0 \times 12.5 \mu\text{m}$, of the middle rectangular-rotundate, $37.5 \times 22.5 \mu\text{m}$. Underleaves quadrate-rotundate, twice as wide as the stems, usually connate at base with leaves, slightly wider than longer, 0.6–0.7 mm long, 0.4–0.5 mm wide, apex mostly strongly recurved, irregularly dentate or denticulate, cells of the middle $25.0 \times 12.5 \mu\text{m}$. [Oil-bodies homogeneous 4–10 per cells, orbicular, ovate or oblong, $5.0\text{--}10.0 \times 5.0 \mu\text{m}$, smaller towards marginal cells (Hattori and Mizutani, 1958).]

Habitats On decaying woods and humus soils in broad-leaved forest with admixture of conifers and shrubs cover, around Hyangjeokbong and Mt. Namdeogyu area at elevation of 1,430–1,480 m.

Specimens examined Mt. Deogyu, Anseong-myeon, Muju-gun, Jeollabuk-do, Korea, 24 Jun. 2008, *V.A. Bakalin and S.S. Choi 10632* (JNU, NIBR); Mt. Namdeogyu, Seosang-myeon, Hamyang-gun, Gyeongsangnam-do, Korea, 30 Oct. 2008, *V. A. Bakalin and S.S. Choi 1093-1, S.S. Choi 11124, S.S. Choi 11129* (JNU, NIBR).

Distribution Korea, Japan, China, Indonesia (Sumatra) (Hattori and Mizutani, 1958; Piippo. 1990).

Bazzania Gray of Lepidoziaceae is characterized by stems of furcately branched in appearance. This genus seems to be related to *Lepidozia* (Dumort.) Dumort., however the latter differs in having pinnately branched stem (Hattori and Mizutani, 1958).

This species is similar to *B. bidentula* (Steph.) Steph. ex Yasuda, however, the former differs from the latter in apex of leaves normally tridentate versus apex of leaves normally bidentate. *B. japonica* also related to *B. ovistipula* (Steph.) Abeyw. The latter, however, is separated from former by not recurved underleaves and usually not connected at base with leaves (Hattori and Mizutani, 1958).

New Korean name is given as ‘Sun-jom-byeo-seul-i-kki’, because apex of underleaves are mostly strongly recurved.

4. *Cephaloziella hampeana* (Nees) Schiffner ex Loeske, Moosfl. Har. 92. 1903.

Jungermannia hampeana Nees, Naturgesch. Eur. Leberm. 3: 560. 1838.

Korean name: San-geot-ge-bal-i-kki (산걸계발이끼)

Plants pale green and green, prostrate. Stems 5–8 mm long, 0.07–0.08 mm in diameter, 0.28–0.32 mm wide with leaves, sometimes branched. Leaves quadrate-rotundate, 2-lobed, sinus descending 1/2–2/3 the leaf-length, 0.10–0.15 mm long, 0.10–0.13 mm wide; lobes acute, triangular, symmetric; cells of the apex quadrate $10.0 \times 7.5 \mu\text{m}$, of the middle quadrate $12.5\text{--}15.0 \times 7.5\text{--}10.0 \mu\text{m}$, trigones wanting. Underleaves triangular, 3–5 cells or wanting. Rhizoids few, colorless. Oil-bodies 2–4 per cells.

Habitats Shaded cliffs and rocks in *Quercus* forest, along the road from Ansong area to Chilyeon Waterfall and Mt. Namdeogyu area, Satgatgoljae area at elevation of 650–1,400 m.

Specimens examined Mt. Deogyu, Anseong-myeon, Muju-gun, Jeollabuk-do, Korea, 27 Jun. 2008, *V.A. Bakalin and S.S. Choi 10801* (JNU, NIBR); Mt. Deogyu, Buksang-myeon, Geochang-gun, Gyeongsangnam-do, Korea, 30 Jun. 2008, *V.A. Bakalin and S.S. Choi 10867* (JNU, NIBR); Mt. Namdeogyu, Seosang-myeon, Hamyang-gun, Gyeongsangnam-do, Korea, 30 Oct. 2008, *S.S. Choi 11127, S.S. Choi 11117, S.S. Choi 11121* (JNU, NIBR); 15 Apr. 2009, *S.S. Choi 13487, S.S. Choi 13491* (JNU, NIBR).

Distribution Korea, Japan, China, Europe, North America (Schumaker and Váña, 2000).

The genus *Cephaloziella* (Spruce) Schiffner is related to *Cephalozia* (Dumort.) Dumort. *Cephaloziella* is characterized by (1) oil-bodies present in leaves, (2) cells of the middle 5–15 μm in leaves (3) 4 inner cells and 4 epidermal cells in cross section of the seta, but *Cephalozia* is characterized by (1) oil-bodies absent in leaves, (2) cells of the middle 15–40 μm in leaves (3) 4 inner cells and 8 epidermal cells in cross section of the seta (Schumaker and Váña, 2000).

This genus is similar to *Cylindrocolea* R.M. Schust, however, the former differs from the latter in having denticulate bracts versus entire bracts, and not flagellar form versus flagellar form respectively (Iwatsuki, 2001).

This species is distinguished from *Cephaloziella divaricata* (Sm.) Warnst in having small or lacking underleaves, whereas the latter species usually have conspicuous underleaves. Also, this species is distinguished from *Cephaloziella rubella* (Nees) Warnst. in (4–) 6–10 (–12) cells at base of lobes versus (3–) 4–6 (–9) cells at base of lobes of latter species (Schumaker and Váña, 2000; Iwatsuki, 2001).

New Korean name is given as ‘San-geot-ge-bal-i-kki’, because material was collected in mountain.

5. *Jungermannia japonica* Amak., J. Hattori Bot. Lab. 22: 41. 1960.

Korean name: Kko-ma-mang-ul-i-kki (꼬마망울이끼)

Plants small, pale green, yellowish green, creeping or ascending. Stems 4–6 mm long, 0.10–0.15 mm in diameter, 0.6–0.8 mm wide with leaves, rarely branched at base. Leaves obliquely spreading, slightly concave, ovate, 0.3–0.4 mm long, 0.2–0.3 mm wide, 2-lobed, sinus descending 1/4–1/3 the leaf length, apex of lobe obtuse or rounded; cells of the apex 12.5–25.0 × 25.0–37.5 μm, of the middle 25.0–37.5 × 25–32.5 μm, thin wall, trigones small. Underleaves absent. Rhizoids few, purple. Oil-bodies ovate-fusiform, 2–4 per cells. [Plants dioecious, Male inflorescence terminal, bracts 2–3 pairs, smaller than stem leaves, saccate, antheridia solitary. Perianth hidden within bracts, subconical, 0.5 mm long, 0.8 mm wide, with indistinct plicae, perigynium erect, twice as long as perianth, bracts 2 pairs (Amakawa, 1960).]

Habitats Wet cliffs along stream in broad-leaved forest, along the route from Toyokdong stream to Mt. Namdeogyu area, Satgatgoljae at elevation of 1,060 m.

Specimens examined Mt. Namdeogyu, Gyebuk-myeon, Jangsungun, Jeollabuk-do, Korea, 14 May 2009, S.S. Choi 13593 (JNU, NIBR).

Distribution: Korea, Japan (Amakawa, 1960).

Jungermannia L. belonging to Jungermanniaceae is distinguished from *Jamesoniella* (Spruce) Carrington and *Nardia* Gray in underleaves entirely wanting versus underleaves present and bracteole lacking versus bracteole always present (Amakawa, 1959).

This genus is divided in four subgenera based on form of perianth, colors and form of rhizoids and present or absent of perigynium. This species belongs to subgenus *Plectocloea* (Mitt.) Amak. by fusiform-subconical and deeply 3–7 plicated perianth. This subgenus is similar to subgenus *Luridae* Spr., however, the latter differs in clavate-fusiform perianth and lack of perigynium. *J. japonica* is most closely related to *J. cephalozoides* Amak. in bilobed leaves, however, the latter differs in acute apex of lobe (Amakawa, 1960).

New Korean name is given as 'Kko-ma-mang-ul-i-kki' because of the small size of plants.

6. *Marsupella alpina* (Gottsche ex Husn.) Bernet, Cat. Hép. Suisse 29. 1888.

Sarcocypnos alpinus Gottsche ex Husn. Hepaticol. Gall. 13. 1875.

Korean name: Go-san-yang-kkeut-tong-i-kki (고산양끝통이끼)

Plants brownish-red, deep green, procumbent. Stems 3–5 mm long, 0.12–0.15 mm in diameter, 0.7–1.0 mm wide with leaves, branched at base. Leaves somewhat obliquely inserted, shortly decurrent, broadly ovate, 0.5–0.7 mm long, 0.4–0.6 mm wide,

2-lobed, sinus descending 1/6–1/5 the leaf length, sinus acute, apex of lobe obtuse; cells of the apex 5.0–7.5 × 5.0–7.5 μm, of the middle 12.5–15.0 × 7.5–10.0 μm, oblong, orbicular, trigones large and bulging, of the base 25.0–37.5 × 7.5–10.0 μm, oblong. Rhizoids purple. Oil-bodies 24 per cells, 5 × 4 μm, orbicular or elliptical. [Plants dioecious. Female bracts much larger than leaves, erect, densely overlapping. Perianth rather rudimentary, irregularly lobed. Spores 10 μm, smooth. Elaters 10 μm, thick, with 3–4 spirals (Kitagawa, 1963).]

Habitats Shaded cliffs and rocks on the northern slopes in *Quercus* forest, with *Marsupella commutata* (Limpr.) Bernet and *Anastrophyllum assimile* (Mitt.) Steph. Top of Mt. Namdeogyu area, at elevation of 1,400 m.

Specimens examined Mt. Namdeogyu, Seosang-myeon, Hamyang-gun, Gyeongsangnam-do, Korea, 30 Oct. 2008, S.S. Choi 11097 (JNU, NIBR).

Distribution Korea, Japan (Honshu), Alaska, Europe (Kitagawa, 1963).

Marsupella Dumort. and *Gymnomitrium* Corda. belong to Gymnomitriaceae H. Klinggr. *Marsupella* is distinguished from *Gymnomitrium* Corda. in (1) plants greenish to reddish brown versus plants silvery gray or reddish brown (2) leaves rather coarsely imbricate and more or less spreading versus leaves very densely imbricate and very closely appressed to stem (3) perianth usually present versus perianth absent or rudimental (4) female bracts usually well developed versus female bracts reduced (Kitagawa, 1963).

This species is similar to *M. commutata* (Limpr.) Bernet in shape of leaves and remarkably large trigones. The latter, however, is separated from former by not shiny, not decurrent leaves and colorless rhizoids (Kitagawa, 1963).

New Korean name is given as 'Go-san-yang-kkeut-tong-i-kki', is based on distribution on high elevation.

7. *Pedinophyllum interruptum* (Nees) Kaal., Nyt Mag. Naturvidensk. 33: 190. 1893.

Jungermannia interrupta Nees, Naturgesch. Eur. Leberm. 1: 165. 1833.

Korean name: Sup-nu-un-nal-gae-i-kki (순누운날개이끼)

Plants pale green, procumbent. Stems 5–10 mm long, 0.1–0.2 mm in diameter, 0.6–1.0 mm wide with leaves, branched at base. Leaves obliquely inserted with the line insertion curved semicircularly upward, extending approximately 1/2 of the Stems width, ovate-oblong, 0.7–1.0 mm long, 0.5–0.7 mm wide, margin

entire, rarely with 1–3 weak teeth near apex; cells of the apex $17.5\text{--}22.5 \times 10.0\text{--}20.0 \mu\text{m}$, of the middle $17.5\text{--}25.0 \times 12.5\text{--}22.5 \mu\text{m}$, oblong-orbicular, trigones small. Underleaves rudimentally or occasionally filiform. Rhizoids numerous, colorless. Oil-bodies 3–7 per cells, ellipsoid to spherical. [Plants dioecious. Male inflorescence intercalary on branches, bracts usually 4–6 pairs. Female inflorescence terminal on main stems with 1–2 innovation. Perianth broadly ovate, laterally compressed in upper portion, 1.5–1.7 mm long, 0.8–1.1 mm wide, mouth truncate to semicircularly arched (Inoue, 1958).]

Habitats Shaded cliffs and wet rocks in broad-leaved forest with admixture of conifers and shrubs cover, along the route from Hyangjeokbong to Jungbong at elevation of 950 m.

Specimens examined Mt. Deogyu, Anseong-myeon, Mujugun, Jeollabuk-do, Korea, 27 Jun. 2008, *V.A. Bakalin and S.S. Choi 10858* (JNU, NIBR)

Distribution Korea, Europe, Russia, East-North America (Inoue, 1974).

Plagiophilaceae is composed of *Pedinophyllum* (Lindb.) Lindb. and *Plagiochila* (Dumort.) Dumort. in Korean peninsula. *Pedinophyllum* is distinguished from *Plagiochila* in (1) stem prostrate versus stem ascending (2) rhizoids usually numerous on ventral side of stem throughout versus rhizoids usually few or absent (3) cortical cells of stem not differentiated from interior cells versus cortical cells of stem clearly differentiated from interior cells (Inoue, 1958).

Pedinophyllum includes four morphologically very similar species worldwide (Inoue, 1966). Two of them, *P. interruptum* and *P. truncatum* Inoue, occur in northeast Asia. Their differences are rather small and *P. truncatum* frequently treated as subspecies of *P. interruptum* (Inoue, 1958). According to Bakalin (2008), these two species can be separated each other only based on living materials with oil bodies, but even in this case not always. *P. interruptum* is distinguished from *P. truncatum* in (1) oil bodies 4–8 per median cells versus oil bodies 8–14 per median cells, (2) spores $12.0\text{--}15.0 \mu\text{m}$ in diameter versus spore $9.0\text{--}12.0 \mu\text{m}$ in diameter and (3) elaters $180\text{--}200 \times 15 \mu\text{m}$ versus elaters ca. $90 \times 9\text{--}10 \mu\text{m}$.

New Korean name is given as ‘Sup-nu-un-nal-gae-i-kki’, is based on the growth habit in forest.

8. *Frullania polyptera* Tayl., London Jour. Bot. 5: 401. 1846.

Korean name: Pu-reun-gi-ne-i-kki (푸른지네이끼)

Plants olive-brown, olive-green, on bark of trees. Stems

$10.0\text{--}15.0 \text{ mm}$ long, $0.7\text{--}1.0 \text{ mm}$ in diameter, $1.5\text{--}1.8 \text{ mm}$ wide with leaves, irregularly pinnately branched, branches obliquely spreading. Leaves divided in lobe and lobule; lobes slightly imbricate, usually incurved apex, ovate-orbicular, apex rounded, $0.5\text{--}0.8 \text{ mm}$ long, $0.4\text{--}0.6 \text{ mm}$ wide, cells of the apex $15\text{--}20 \times 20\text{--}25 \mu\text{m}$, of the middle $17.5\text{--}25.0 \times 17.5\text{--}25.0 \mu\text{m}$, trigones large, intermediate thickenings; lobules cucullate, somewhat explanate, apex rounded, mouth truncate, $0.2\text{--}0.3 \text{ mm}$ long, $0.15\text{--}0.25 \text{ mm}$ wide, longer than wide, beak undeveloped, stylus small, filiform. Underleaves obcuneate, $0.27\text{--}0.33 \text{ mm}$ long, $0.25\text{--}0.32 \text{ mm}$ wide, usually as long as wide, $1/4\text{--}1/5$ bifid, sinus acute to subacute, insertion transverse. Rhizoid initial area at the middle of underleaves, short, fasciculate. [Plants dioecious. Male plant fewer-branched, androecial branched short, lateral on stem. Gynoecia terminal on stem and long branched, usually with innovation below, bract-lobe elliptical, ca. 1 long, with apex obtuse, Perianth pyriform, $1.3\text{--}1.8 \text{ mm}$ long, $0.9\text{--}1.3 \text{ mm}$ wide, 2 or rarely 3 ventral keels, and 0 or rarely 1–3, smaller dorsal keels, keels crispate-angulate or subdentate, apex subtruncate and with small beak (Hattori, 1974).]

Habitats On bark of broad-leaved tree in broad-leaved forest, Chilyeon waterfall area at elevation of 720 m.

Specimens examined Mt. Deogyu, Anseong-myeon, Mujugun, Jeollabuk-do, Korea, 27 Jun. 2008, *S.S. Choi 10837* (JNU, NIBR), 27 Jun. 2008, *V.A. Bakalin Kor-14-3-08* (VLA).

Distribution Korea, India, Nepal, Himalayas, Ceylon, Malay Pen., Thailand, China (Hattori, 1974; Hattori and Lin, 1985).

This species is polymorphic and closely related to *F. muscicola* Steph. However, this species has high-cucullate leaf-lobules longer than wide, whereas in *F. muscicola* the lobules are wider than long or as wide as long (Hattori, 1974).

New Korean name is given as ‘Pu-reun-gi-ne-i-kki’, is based on colors of plants.

9. *Jubula hutchinsiae* subsp. *javanica* (Steph.) Verd., Ann. Cryptog. Exot. 1: 216. 1928.

Jubula javanica Steph., Sp. Hepat. 4: 688. 1911.

Korean name: Gye-gok-ga-si-i-kki (계곡가시이끼)

Plants deep green, green, usually brown in herbarium. Stems $20\text{--}40 \text{ mm}$ long, ca. 0.15 mm in diameter, $1.5\text{--}1.8 \text{ mm}$ wide with leaves, irregularly pinnate branched. Leaves divided in lobe and lobule. Lobes imbricate, widely spreading, $0.9\text{--}1.1 \text{ mm}$ long, $0.7\text{--}0.8 \text{ mm}$ wide, more or less convex, ovate, apex mostly incurved, apiculate to toothed, margin entire or with 1–3 teeth; cells of the apex $12.5\text{--}25.0 \times 20.0\text{--}25.0 \mu\text{m}$, of the middle $25.0\text{--}32.5 \times$

20.0–25.0 μm , oblong-orbicular, trigones small; lobules nearly parallel to the stems, very narrowly attached to the lobe, usually helmet, galeate-shape, somewhat flattened, 0.25–0.3 mm long, 0.2 mm wide; cells of the middle 25.0–30.0 \times 12.5–17.5 μm . Underleaves ovate, orbicular, 2–3 times as wide as the stems, sinuate inserted and decurrent, ca. 0.5 mm long, 0.5 wide, bilobed, sinus descending 1/2 the leaf length, sinus obtuse, lateral margin entire or occasionally with 2–3 small spine at both sides. Rhizoids few. [Oil bodies 6–10 per cells, ovoid-ellipsoidal or spindle-shape, mostly 7–9 \times 4 μm , consisting of numerous, minute globules, often brownish. Plants monoecious, Male inflorescence constituting a lateral branch, oblong, bracts in 5–7 pairs. Female inflorescence terminal on the stems or lateral branch, subfloral innovations usually 2. Perianth about 1/2–emergent, obovoid, about 0.5 mm long, 0.85 mm wide, smooth, keels 3 (2 lateral, 1 ventral), shortly beaked (Kamimura, 1961).]

Habitats Very wet and shaded rocky wall in small grotto in broad-leaved forest, along the route from Uelsung stream area to Mt. Namdeogyu and Chilyeon waterfall area at elevation of 600–680 m.

Specimens examined Mt. Deogyu, Buksang-myeon, Geochang-gun, Gyeongsangnam-do, Korea, 19 Mar. 2008, S.S. Choi 10277, S.S. Choi 10299, S.S. Choi 10280 (JNU, NIBR); Mt. Deogyu, Buksang-myeon, Geochang-gun, Gyeongsangnam-do, Korea, 2 Apr. 2008, S.S. Choi 10359, S.S. Choi 10360 (JNU, NIBR); Mt. Deogyu, Anseong-myeon, Muju-gun, Jeollabuk-do, Korea, 27 Jun. 2008, V.A. Bakalin and S.S. Choi 10797 (JNU, NIBR).

Distribution Korea, Japan, Taiwan, India, Java, Sumatra, Philippine, Hawaii, Samoa, New Guinea (Kamimura, 1961; Mizutani, 1961).

Jubulaceae H. Klinggr. is similar to Frullaniaceae Lorch and Lejeuneaceae Cas.-Gil in lobe and lobule (Kamimura, 1961; Mizutani, 1961). The former, however, is separated from Frullaniaceae by (1) plants mostly green to olive-yellow versus plants mostly reddish brown (2) androecium arising by the *Radula*-type branching versus androecium arising by the *Frullania*-type branching, (3) gynoecium with 2 innovations of the *Radula*-type branching versus gynoecium without innovation or with 1 of the *Frullania*-type branching, (4) bracts in 1 pair versus bracts in 4–5 pairs (5) seta 4 cells thick versus seta 8 or more cells thick (Kamimura, 1961; Mizutani, 2001), and is separated from Lejeuneaceae by (1) plants deep green to reddish or purplish brown versus plants yellow, pure-green to whitish green (2) leaves divided virtually to base, the keel vestigial, the lobules free from stem, sac-like versus leaves not divided to base, a distinct keel uniting lobule to lobe, the lobule connate to stem,

not sac-like (3) lobules external surface formed from adaxial leaf surface versus lobules external surface formed by abaxial leaf surface (Schuster, 1984).

This species is similar to *J. japonica* Steph. The former, however, is separated from latter by (1) leaf-lobes with ca. 1–3 teeth, or occasionally entire versus leaf-lobes usually densely ca. 10–12 spinose, (2) underleaves twice as wide as stem, the margin entire or with 1–2 lateral teeth, the insertion on the stem arching upward about 1/3 the underleaves length versus underleaves 3–4 times as wide as the stem spinose, the insertion on the stem arching upward about 1/4 the underleaves length, (3) oil bodies often brownish versus oil bodies colorless (Kamimura, 1961; Mizutani, 1961).

J. hutchinsiae ssp. *javanica* was first recorded in Mt. Deogyu and further recorded in Mt. Naejang, Mt. Naebyeon, Mt. Daedun, Mt. Duryun and Mt. Wolchul.

New Korean name is given as ‘Gye-gok-ga-si-i-kki’, is based on the growth habit in valley.

10. *Marchantia polymorpha* ssp. *montivagans* Bischl. and Boisselier-Dubayle, J. Bryol. 16: 364. 1991.

Marchantia polymorpha for. *alpestris* Nees, Naturgesch. Eur. Leberm. 4: 70. 1838.

Marchantia polymorpha var. *alpestris* (Nees) Gottsche, Lindenb. and Nees, Syn. Hepat. 524. 1846.

Marchantia alpestris (Nees) Burgeff, Genet. Stud. Marchantia 33. 1943.

Korean name Go-san-woo-san-i-kki (고산우산이끼)

Thallus yellowish-green, pale green, green; usually growing prostrate, frequently dichotomous, 2–7 cm long, 6–17 mm wide, margins usually crenulate, usually without distinct dark median band of dorsal side; epidermal cells oblong-pentagonal, hexagonal, ca. 45 \times 40 μm . Ventral scale adaxial rows, crescent-shaped; appendages of median scales sharply toothed. Plants dioecious. Antheridiophore stalk 2–4 cm tall, orbicular, cleft, shallowly or crenate-lobed. Archegoniophore stalk 3–5 cm tall, disk umbrella skeleton. Gemma receptacles cup-shaped, orbicular, margins usually toothed. Spore yellowish, ca. 15 μm . Elaters 2–spiral. [Gemmae with 50–55 marginal oil-cells, 7–9 of disk (Schuster, 1992).]

Habitats Fine-grained soil along roadside in broad-leaved forest, along the road from Hyangjeokbong to Baegryeonsa at elevation of 950 m.

Specimens examined Mt. Deogyu, Seolcheon-myeon, Muju-gun, Jeollabuk-do, Korea, 24 Jun. 2008, V.A. Bakalin and S.S. Choi 10656, V.A. Bakalin and S.S. Choi 10671 (JNU, NIBR).

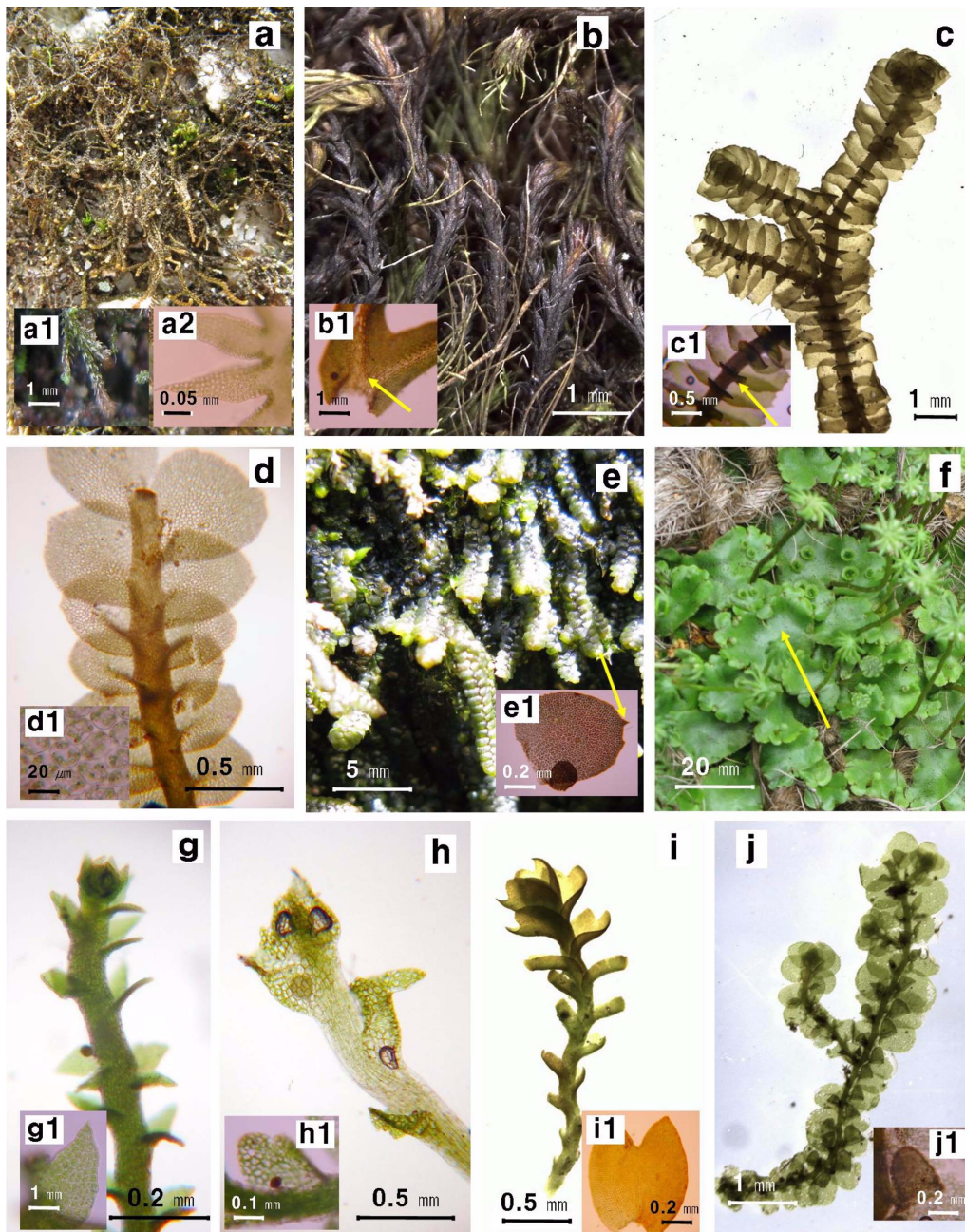


Fig. 1. Unrecorded taxa for Korean Hepaticae flora. a. *Tetralophozia filiformis* (Steph.) Urmí (a1. plants, a2. leaf); b. *Herbertus buchii* Juslen (b1. leaf); c. *Bazzania japonica* (Sande Lac.) Lindb. (c1. underleaves); d. *Pedinophyllum interruptum* (Nees) Kaal. (d1. median cells of leaf); e. *Jubula hutchinsiae* ssp. *javanica* (Steph.) Verd. (e1. leaf); f. *Marchantia polymorpha* ssp. *montivagans* Bischl. and Boisselier-Dubayle.; g. *Cephaloziella hampeana* (Nees) Schiffner ex Loeske. (g1. leaf); h. *Jungermannia japonica* Amak. (h1. leaf); i. *Marsupella alpina* (Gott. ex Husn.) Bernet. (i1. leaf); j. *Frullania polyptera* Tayl. (j1. lobule).

Distribution Korea, Russia, North America, Europe (Schljakov, 1982; Schuster, 1992; Schumacker and Váňa, 2000).

Marchantia L. is similar to *Preissia* Corda. The former, however, is separated from latter by thallus bearing cup-shaped receptacle

versus thallus without gemma-receptacles (Schumacker and Váňa, 2000).

This species is most closely related to *M. polymorpha* L. subsp. *polymorpha*, however, it differs by (1) thallus without a distinct dark median band on dorsal side versus thallus with a conspicuous

dark median band on dorsal side, (2) marginal usually crenulate versus marginal usually entire (3) epidermal cells longer (42–43 length) versus epidermal cells short (ca. 34 length), (4) appendages of median scales sharply toothed versus margins of appendages of median scales entire or nearly so (Schljakov, 1982; Schuster, 1992; Schumacker and Vána, 2000).

New Korean name is given as ‘Go-san-woo-san-i-kki’, is based on the high elevation of distribution.

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