The moss flora of Mt. Deogyu in Korea

Young Jun Yoon, Chul Hwan Kim, Konstantin V. Gorobets* and Byung-Yun Sun*

Department of Biological Sciences, Chonbuk National University, Jeonju 561-756, Korea
*School of Natural Sciences, Far Eastern Federal University, 8, Sukhanova st., 690950, Vladivostok, Russia
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ABSTRACT: The objective of this study was to discuss the characteristics of the moss flora of Mt. Deogyu located on the border of the Jeonbuk and Kyungnam provinces in Korea. A total of 21 field surveys were carried out at various sites in the mountain area from August 2007 to September 2008. All the collected materials were processed into voucher specimens and were currently deposited in the herbarium at Chonbuk National University (JNU). In this study, we collected and identified 158 moss taxa, which included 156 species, 1 subspecies, and 1 variety of 96 genera and 37 families. Unconfirmed taxa in this study, previously recorded, belonged to 25 taxa, which included 13 families, 19 genera, and 25 species. In addition, 183 taxa were found on Mt. Deogyu, which belonged to 37 families, 101 genera, 1 subspecies, and 1 variety. The habitat of each collection was examined and the classification system of Ignatov et al. (2006) was used. New vernacular names of 6 families and 11 genera were then determined. Six species, formerly thought to be only in North Korea, were shown to be present on Mt. Deogyu, which included Bucklandiella lasta, Anomobryum filiforme var. concinnum, Herzogiella turfacea, Brachythecium rutabulum, Eriocaulon angustifolium and Campylium hispidulum.

Keywords: Mosses, Bryophyte, Moss Flora, Mt. Deogyu National Park

Mosses are the most diverse among the three major groups of nonvascular land plants (mosses, liverworts, and hornworts) and inhabit a great number of ecological niches (Simpson, 2007). Most mosses grow on wet soil, rocks or bark of trees. Mosses (Musci) can be readily distinguished from liverworts (Hepaticae) by capsule and seta that are persistent after spores are shed. Usually, their sporangium (capsule) opens by an apical lid (operculum) that covers the mouth of the capsule and there is a columnella in the center of the capsule, which houses only spores (whereas in liverworts it also contains spore clasters) (Choe, 1980; Simpson, 2007). Mosses are widely distributed and it was reported that they can live in extreme environments where other plants would not be able to exist (Bold et al., 1987). Mosses include approximately 10,000 species of nearly 700 genera (Schofield, 1985). There are about 2,500 species in China (Gao et al., 1999), 1,200 species in Japan (Tomas and Nick, 2000) and 450–650 species in Korea (Choe, 1980; Park, 2007). This number corresponds to nearly 6.5% of all the mosses currently recognized in the world. The first collector of mosses on the Korean Peninsula was Urban Faurie. His collections were identified by Cardot, a French bryologist. Later, in the 1940’s, Japanese botanists including Okamura, Horikawa, Sasaoka, Kasimura, Noguchi, and Osada studied bryophytes of Korea (Song and Yamada, 2001, 2003). Afterwards, Korean botanists began to study Korean bryophytes and the results of their investigations were published in “The bryophytes of Mt. Gwanak with some new additions to the Korean flora (Hong, 1960a), “The moss flora of Mt. Chiri with some new additions to the Korean flora (Hong and Ando, 1961), “The bryophytes of Mt. Soyo with some new additions to the Korean flora (Hong, 1960b), “Illustrated Flora and Fauna of Korea (Choe, 1980), “New list of bryophytes of Korea (Park, 2007)”. One of the main difficulties behind comprehending the moss flora of Korea is that most of the voucher specimens of previous studies were lost and therefore cannot be reexamined currently.

Mt. Deogyu National Park is located in the middle of the Korean peninsula with the high peak Hyangjeokbong (1,614 m). Floristically, this mountain belongs to the southern part of the Korean region where southern and northern elements of plants come together and occupy habitats at high elevations in the mountains. Therefore, this region has great species diversity (Lee, 1978). The vascular flora of Mt. Deogyu was well studied and about 340 taxa were reported (Yook and Ahn, 1972; Yim et al., 1994). However, the moss flora of Mt. Deogyu has never been studied comprehensively till now. There have been only

*Author for correspondence: sunby@jnu.ac.kr
some reports regarding regional distribution of species of the mountain with regards to the general characteristics of moss flora of Korea.

This study intended to comprehend the moss flora of Mt. Deogyu as a part of preparing for the whole moss flora of Korean Peninsula.

**Materials and Methods**

In the course of this study, a total of 21 field surveys were carried out at various sites on the mountain from August 2007 to September 2008 (Fig. 1). All materials collected were processed into voucher specimens and were then deposited in the herbarium at Chonbuk National University (JNU). The taxa were identified using the available literature (Choe, 1980; Crum and Anderson, 1981; Noguchi, 1987, 1988, 1989, 1991, 1994; Hwang, 1991; Gao et al., 1999; Li et al., 2001; We et al., 2002; Cao et al., 2003; Jia et al., 2005; Li et al., 2007; Iwatsuki, 2001; Smith, 2004). The specimens were observed under stereoscopic and optical microscopy. Plant size was measured using a vernier caliper and cells and spores were measured by an eyepiece micrometer on an optical microscope.

The list of identified taxa was compiled according to the classification system proposed by Ignatov et al. (2006). In addition, their distribution in Korea and in the world as well as habitat characteristics is also provided.

**Results and Discussion**

A total of 183 moss taxa which included 181 species, subspecies and 1 variety were identified as belonging to 16 genera, 37 families, 13 orders, and 3 classes (Table 1). This number corresponds to 28.4% of the total number of mosses (645 taxa) currently recognized from the Korean peninsula.

Of the 183 taxa, 102 taxa were first recorded from Mt. Deogyu in this study and the remaining 81 taxa were reported by Park and Choi (2007) in their check list “New list of bryophyte of Korea”. However, 25 taxa were reported in previous studies. Only regarding the number of moss species distributed in Mt. Jiri, Hong and Ando (1961) reported 132 taxa of 79 families in our study, 183 taxa were found to be distributed in the mountain district of Mt. Deogyu.

Thus, the species diversity in the studied area was high. These species included Climacium japonicum Lindb., which collected on a semi-shady slope of Gucheondong valley above the Baekryeon Temple and on a rock covered with humus soil.
Table 1. Number of taxa recognized on Mt. Deogyu.

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<td>101</td>
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on a semi-shady spot of Deokgok Valley. At present, the three taxa, *C. americana* Brid., *C. dendroides* (Hedw.) F. Weber and D. Mohr. and *C. japonica* Lindb. were shown to be present in the Korean Peninsula, and *C. japonica* Lindb. was reported to grow on Mt. Deogyu by Choe (1980). This species is characterized by an upright tree-like growth form and can reach...
about 5–10 cm in height. In addition, this moss species is of very high ornamental value. Until now, *Bucklandiella heterosticha* (Hedw.) Bednarek-Ochyra and Ochyra has only been known to be present in the mountains of North Korea, but during our research this species was collected on an exposed rock in the mountainous district of Mt. Deogyu. *Didymodon rigidulus* Hedw. collected in the same area was recorded in the New List of Bryophytes of Korea (Park, 2007), but its related literature and specimens could not be confirmed, and its location was indicated just as Korea. However, in this study, it was shown to be present on Mt. Deogyu. *Brachythecium rutilatum* (Hedw.) Schimp. was previously believed to be only on Mt. Baekdu (Mt. Changbai); however, in this study, this species was also found on Mt. Deogyu. Based on the above results, this region was found to contain a more abundant diversity of mosses than the neighboring Mt. Jiri National Park, and species previously thought to be present in North Korea only, were found on Mt. Deogyu. High level of species diversity found on Mt. Deogyu can be explained by the presence of a great number of large and small moist valleys and many rock bed exposed areas, which are characteristic of the peaks and plateaus located over 1,000 m above sea level.

**Distribution pattern**

The numbers of taxa collected on different kinds of substrates along the valleys and ridges of Mt. Deogyu are presented in the Table 2. Most species grow in several habitats with no limitations to the property of substrate, but *Grimmia* Hedw. and *Hedwigia ciliata* (Hedw.) P. Beauv. mostly grow only on specific substrates. They mainly grow on exposed rocks in the mountainous district.

The representatives of Polytrichaceae Schwgr. mostly grow on soil that can be penetrated by rhizomes or on rocks covered with humus soil or gaps between rocks filled with soil. *Pylaisia clapa torus* (Bruch & Schimp. ex Sull.) W. R. Buck and *Fauriella temu*s (Mitt.) Cardot were collected mostly on trees, and remaining taxa were usually distributed throughout the ridges and valleys areas. Especially, *Entodon concinnus* (De Not.) Paris and *Pohlia elongata* Hedw. were distributed at only ridge of high elevations. Thus, it is clear that several species are restricted to the ridge area at high altitudes.

**Species new to South Korea**

Six taxa that were previously distributed only in North Korea were discovered on Mt. Deogyu in South Korea for the first time. These species included *Bucklandiella laeta* (Besh. and Cardot) Bednarek-Ochyra and Ochyra, *Anomobryum filiforme* var. *concinnatum* (Spruce) Loeske, *Herzogia turcsza* (Lindb.) Z. Iwats., *Brachythecium rutilatum* (Hedw.) B. S. G. Earle, *Hygrobiis angustifolia* (Broth.) T. J. Kop., and *Campyllum hispidulum* (Brud.) Ochyra. Previously, collection site of *Psychotria dentata* (Mitt.) A. Jaeger and *Didymodon rigidulus* Hedw. were noted as “Korea” with no indication of any particular location. In this study, we found them in Mt. Deogyu.

Following are the brief characteristics of these taxa.

1) *Bucklandiella laeta* (Besh. and Cardot) Bednarek-Ochyra and Ochyra 삼감정산시리기 : This species was distributed in both the valley and ridge areas and collected on rocks. This species was larger in size than *B. heterosticha* (Hedw.) Bednarek-Ochyra and Ochyra and its laminal cells are rectangular or quadratate.

2) *Didymodon rigidulus* Hedw. 금관고등이기 : This species was found on rocks in the valley area of Southern Deogyu Mountain (Mt. Nam-Deogyu). This species is characterized with acute apex, 2- or 3-stratose margins, transparent rectangular cells of the leaf base and asexual reproduction by axillary, ovate to elliptic or globose, multicellular gemmae.

3) *Anomobryum filiforme* var. *concinnatum* (Spruce) Loeske 치러길은이기 : It was collected in semi-shady spots on rocks and sandy soil of the Chilyeon and Myeongseong Valleys. On rocks and sandy soil. It was found on rocks and sandy soil. It can be distinguished by the costal lengths of the leaves and gemmae on axils of leaves.

4) *Herzogia turcsza* (Lindb.) Z. Iwats. 누운이기주목기 : It was collected in several valleys, including the Kucheondong and Songgye Valleys. It grows on soil and rocks covered with fine soil. Previously, its collection site was noted as “Korea” with no indication of any particular location.

5) *Brachythecium rutilatum* (Hedw.) Schimp. 강백암양이기 : This species was collected in Kucheondong Valley and in Mt. Nam-Deogyu valley areas. It was present on rocks. Previously,
it had only been found on Mt. Baekdu.

6) Euryhynchium angustirete (Broth.) T. J. Kop. 산서리아키 : This species was collected in Gucheondong Valley and Mt. Nam-Deogyu valley areas, where it was found on rocks.

7) Campylidium hispidulum (Brid.) Ochrya 바람병디아키 : The species was collected on rocks in the Gucheondong Valley. The species was previously only found in North Korea.

8) Pychonotrium dentatum (Mitt.) A. Jaeger. 돌가슴서리아키 : This species was collected near Inwoldam, Songgye and Wolseong Valleys, where it grow on semi-dry and moist rocks. Mt. Deogyu is the only locality where this species has been reported in the Korea peninsula.

Acknowledgement

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Literature Cited


Appendix 1. The list of the moss species collected from Mt. Deogyu

**Polytrichaceae (울버리과)**

1. *Atrichum flavissimum* Mitt. 낙은주름속이끼; *Yoon Y. J. 10007, 10025, 10064 (JNU)*

2. *Atrichum rhytostyphum* (Mitt. Hal.) Paris 아기주름속이끼; *Yoon Y. J. 10624, 10678, 10863 (JNU)*

3. *Pogonatum inflexum* (Lindb.) Sande L. 아기들솔이끼; *Yoon Y. J. 10012, 10048, 10075 (JNU)*

4. *Poratium spinulosum* Mitt. 갈들솔이끼; *Yoon Y. J. 10001, 10143, 10857 (JNU)*

5. *Pogonatum urinigerum* (Hedw.) P. Beauv. 산들솔이끼; *Yoon Y. J. 11664, 11681, 12019 (JNU)*

6. *Polytrichastrum formosum* (Hedw.) G. L. Sm. 콘솔이끼; *Yoon Y. J. 10672, 11218, 11241 (JNU)*

7. *Polytrichum commune* Hedw. 속이끼; *Yoon Y. J. 10347, 10481 (JNU)*

**Tetradiaceae (델지아파)**

8. *Tetraphis pellicida* Hedw. 데리아파; *Yoon Y. J. 10612, 12807 (JNU)*

**Diphysciaceae (꼬리알이과)**

9. *Diphyscium lorifolium* (Card.) Magombo 껍이끼; *Yoon Y. J. 0847, 11821, 12053 (JNU)*

**Funariaceae (문거나과)**

10. *Funaria hygrometrica* Hedw. 문구바끼; *Yoon Y. J. 10327, 12401, 12441 (JNU)*

11. *Physcomitrium japonicum* (Hedw.) Mitt. 농가과끼; *Yoon Y. J. 10809 (JNU)*

**Bryoxiphyiaceae (배우끼과)**

12. *Bryoxiphium norwegicum* (Brid.) Mitt. subsp. japonicum (Berggr.) A. Lye and D. Lye 배우끼바끼; *Yoon Y. J. 12637 (JNU)*

**Grimmiaceae (고람바위과)**

13. *Bucklandiella heterosticha* (Hedw.) 검정서리끼; *Yoon Y. J. 13019, 13023, 13039 (JNU)*

14. *Bucklandiella leota* (Besh. and Cardot) Bednarek-Ochyra 산검서리끼; *Yoon Y. J. 10146, 10148, 10327 (JNU)*

15. *Codiophorus anomodontoides* (Cardot) Bednarek-Ochyra와 Ochyra 갈백서리끼; *Yoon Y. J. 10002, 10016, 10020 (JNU)*

16. *Codiophorus carinatus* (Cardot) Bednarek-Ochyra와 Ochyra 청검서리끼; *Yoon Y. J. 10852, 12043, 12048 (JNU)*

17. *Codiophorus fascicularis* (Hedw.) Bednarek-Ochyra와 Ochyra 런 서리끼; *Yoon Y. J. 11635, 12229, 12419 (JNU)*

18. *Grimmia pilifera* P. Beauv. 청달고람바위끼; *Yoon Y. J. 10013, 10022, 10206 (JNU)*

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19. **Niphotrechium canescens** (Hedw.) Bednarek-Ochyra and Ochyra 서리이끼; Yoon Y. J. 10348, 11052, 11058 (INU)
20. **Schistochila apocarpa** (Hedw.) Bruch and Schimp. 고개이끼; Yoon Y. J. 10428, 10853, 11077 (INU)

**Ptychomitriaceae** (습식이끼과, New)
21. **Ptychomitrium dentatum** (Mitt.) A. Jaeger 무생균이끼; Yoon Y. J. 10530, 10844, 10862 (INU)
22. **Ptychomitrium linearifolium** Reimers and Sakurai 독주로생이끼; Yoon Y. J. 10043, 10046, 10050 (INU)

**Leucobryaceae** (흰털이끼과)
23. **Brothera lecania** (Sull.) Mill. Hall 사리이끼; Yoon Y. J. 10344, 10469, 10484 (INU)
24. **Campylopus japonicus** Broth. 뾰족이끼; Yoon Y. J. 10017, 10149, 10150 (INU)
25. **Leucobryum glaucum** (Hedw.) Aengstr. 흰털이끼; Yoon Y. J. 10821, 10829, 10835 (INU)
26. **Leucobryum juniperoides** (Brid.) Mell. Hal 가는흰털이끼; Yoon Y. J. 10301, 10358, 10351 (INU)

**Brachiaiceae** (두두이끼과, New)
27. **Trematodon longicollis** Mielx. 두두이끼; Yoon Y. J. 10304, 10323, 10325 (INU)

**Dicranaceae** (꼬리이끼과)
28. **Dicranella heteromalla** (Hedw.) Schimp. 뾰족이끼; Yoon Y. J. 10019, 10024, 10138 (INU)
29. **Dicranum nipponense** Besch. 큰꼬리이끼; Yoon Y. J. 10479, 10483, 10657 (INU)
30. **Dicranum scoparium** Hedw. 비꼬리이끼; Yoon Y. J. 10312, 10353, 10357 (INU)

**Rhabdoweisaceae** (주름꼬리이끼과, New)
31. **Dicksonia pellucida** (Hedw.) Schimp. 갈꼬리이끼; Yoon Y. J. 11661 (INU)
32. **Onchorhynchus crispifolius** (Mitt.) Lindb. 뾰족이끼; Yoon Y. J. 10147, 10350, 10466 (INU)
33. **Rhabdoweisia crispata** (Dicks. ex With.) Lindb. 주름꼬리이끼; Yoon Y. J. 13618, 14004 (INU)

**Ditrichaceae** (금실이끼과)
34. **Ceratodon purpureus** (Hedw.) Brid. 지붕바랭이끼; Yoon Y. J. 11063, 11005, 11006 (INU)
35. **Ditrichum pallidum** (Hedw.) Hampe 금실이끼; Yoon Y. J. 11239, 11834, 12446 (INU)

**Pottiaceae** (심고모이끼과)
36. **Barbula unguiculata** Hedw. 참고모이끼; Yoon Y. J. 10828 (INU)
37. **Bryophyllum recurvirostre** (Hedw.) Chen. 뽀죽이끼; Yoon Y. J. 10680 (INU)
38. **Didymodon rigidulus** Hedw. 긴.CASCADE이끼; Yoon Y. J. 10034 (INU)
39. **Hyophila involuta** (Hook.) A. Jaeger 접발닭배이끼; Yoon Y. J. 10017, 10436, 10450 (INU)
40. **Hyophila propagulifera** Broth. 접발닭배이끼; Yoon Y. J. 10417, 10420 (INU)
41. **Oxystegus tenunniosus** (Hook. and Taylor) A. J. E. Sm. 접발닭배이끼; Yoon Y. J. 10027, 10097, 11222 (INU)
42. **Weissia controversa** Hedw. 접발닭배이끼; Yoon Y. J. 10326, 10681, 10815 (INU)
43. **Weissia longifolia** Mitt. 접발닭배이끼; Yoon Y. J. 11090 (INU)
44. **Weissia planifolia** Dixon 접발닭배이끼; Yoon Y. J. 11423 (INU)

**Fissidentaceae** (동방이끼과)
45. **Fissidens bryoides** Hedw. 접발닭배이끼; Yoon Y. J. 10458, 10461 (INU)
46. **Fissidens dubius** P. Beauv. 접발닭배이끼; Yoon Y. J. 10110, 10221, 10226 (INU)
47. **Fissidens gymnogynus** Besch. 접발닭배이끼; Yoon Y. J. 10077, 10235, 10242 (INU)
48. **Fissidens taxifolius** Hedw. 접발닭배이끼; Yoon Y. J. 10067, 10076, 10082 (INU)

**Orthotrichaceae** (선주름이끼과)
49. **Macromitrium ferreii** Cardot et Th. 접발닭배이끼; Yoon Y. J. 13621 (INU)
50. **Macromitrium japonicum** Dozy and Molk. 접발닭배이끼; Yoon Y. J. 10037, 10496 (INU)
51. **Orthotrichum consobrinum** Cardot 접발닭배이끼; Yoon Y. J. 10003, 10078 (INU)
52. **Ulota crispa** (Hedw.) Brid. 접발닭배이끼; Yoon Y. J. 10845, 12803 (INU)

**Hedwigaceae** ( omdatii가과)
53. **Hedwigia ciliata** (Hedw.) P. Beauv. 옷가이끼; Yoon Y. J. 10008, 10044, 10202 (INU)

**Bryaceae** (오렌지가과)
54. **Anomodon juliaeum** var. congrinatum (Spruce) J.E. Zetterst. (A. filiforme var. congestum (Spruce) Loeske) 접발닭배이끼; Yoon Y. J. 10289, 12602 (INU)
55. **Brachymenium nepalense** Hook. 접발닭배이끼; Yoon Y. J. 10204, 10210, 10442 (INU)
56. *Bryum argenteum* Hedw. 옥이끼; *Yoon Y. J.* 10023, 10433, 11091 (INU)
57. *Bryum capillare* Hedw. 철사이끼; *Yoon Y. J.* 10804, 11015, 11016 (INU)
58. *Bryum cyclophyllum* (Schwgr.) Bruch et al. 고양철가줄 사이끼; *Yoon Y. J.* 13606 (INU)

*Mielichhoferiaceae* (수세미까과, New)
59. *Pohlia campytrachela* (Renaud and Cardot) Broth. 돌수세미끼; *Yoon Y. J.* 11238, 11651 (INU)
60. *Pohlia elongata* Hedw. 긴수세미끼; *Yoon Y. J.* 10311, 14020, 14023 (INU)
61. *Pohlia longicollis* (Hedw.) Lindb. 긴목수세미끼; *Yoon Y. J.* 10865, 12817 (INU)
62. *Pohlia proligerata* (Kindb.) Broth. 흉등수세미끼; *Yoon Y. J.* 10336, 10337, 10601 (INU)

*Mniaceae* (초롱이끼과)
63. *Mnium laevinerve* Cardot 남각목초롱이끼; *Yoon Y. J.* 10058, 10102, 10314 (INU)
64. *Plagiomnium confertifolium* (Lindb. and Arnell) T. J. Kop. 주름당초롱이끼; *Yoon Y. J.* 13230, 13239 (INU)
65. *Plagiomnium acutum* (Lindb.) T. J. Kop. 아기털당강초롱이끼; *Yoon Y. J.* 10094, 10113, 10129 (INU)
66. *Plagiomnium cuspidatum* (Hedw.) T. J. Kop. 돌NgModule가루초롱이끼; *Yoon Y. J.* 10015, 10047, 10119 (INU)
67. *Plagiomnium japonicum* (Lindb.) T. J. Kop. 긴잎당강초롱이끼; *Yoon Y. J.* 12429, 13227 (INU)
68. *Plagiomnium mazzimoviczii* (Lindb.) T. J. Kop. 닭NgModule가루초롱이끼; *Yoon Y. J.* 10274, 10293, 10297 (INU)
69. *Plagiomnium vesicatum* (Besh.) T. J. Kop. 큰잎당강초롱이끼; *Yoon Y. J.* 11248, 11249, 11403 (INU)
70. *Rhizomnium striatum* (Mitt.) T. J. Kop. 줄미선초롱이끼; *Yoon Y. J.* 10052, 10087, 10475 (INU)
71. *Trachycystis flagellaris* (Sull. and Lesq.) Lindb. 달아기 초롱이끼; *Yoon Y. J.* 12831, 13013, 13247 (INU)
72. *Trachycystis usturiense* (Maek and Regel) T. J. Kop. 고양이기초롱이끼; *Yoon Y. J.* 12825 (INU)

*Bartramia* (구슬이끼과)
73. *Bartramia pomiformis* Hedw. 구슬이끼; *Yoon Y. J.* 11075, 11828, 11838 (INU)
74. *Philonitis fulcata* (Hook.) Mitt. 납물가기끼; *Yoon Y. J.* 10866 (INU)
75. *Philonitis thwaitesii* Mitt. 잔달가기끼; *Yoon Y. J.* 10510, 13631 (INU)

*Hookeriaceae* (기름종이끼과)
76. *Hookeria acutifolia* Hook. and Grev. 기름종이끼; *Yoon Y. J.* 10269, 10294, 11656 (INU)

*Plagiotheciaceae* (산주목이끼과)
77. *Herzogia turcica* (Lindb.) Z. Iwats. 누운가기주목이끼; *Yoon Y. J.* 10126, 10231, 10803 (INU)
78. *Plagiothecium denticulatum* (Hedw.) Schimp. 가는잎산주목이끼; *Yoon Y. J.* 10619, 10683, 12802 (INU)
79. *Plagiothecium neckeroides* Schimp. 큰산주목이끼; *Yoon Y. J.* 10806 (INU)
80. *Plagiothecium nemore (Mitt.) A. Jaeger 산주목이끼; *Yoon Y. J.* 10011, 10065, 10609 (INU)

*Leucodontaceae* (죽목이끼과)
81. *Leucodon sapporensis* Besch. 죽목이끼; *Yoon Y. J.* 10444, 10495, 12448 (INU)

*Hypnaceae* (털깃털이끼과)
82. *Hypnum erecticulum* Sull. and Lesq. 편평털깃털이끼; *Yoon Y. J.* 10608 (INU)
83. *Hypnum oldhamii* (Mitt.) A. Jaeger 가는털깃털이끼; *Yoon Y. J.* 10279, 10319, 10485 (INU)
84. *Schwetscheopsis fibrosa* (Schwgr.) Broth. 가늘깃털이끼; *Yoon Y. J.* 10068, 10092, 10228 (INU)
85. *Schwetscheopsis robustula* (Broth.) Ando. 큰털깃털이끼; *Yoon Y. J.* 11630 (INU)
86. *Taxiphyllum aomoriense* (Besch.) Z. Iwats. 검진죽목이끼; *Yoon Y. J.* 10118 (INU)
87. *Taxiphyllum taxiramenum* (Mitt.) M. Fleisch. 주목이끼; *Yoon Y. J.* 10053, 10098 (INU)

*Entodontaceae* (운이끼과)
88. *Entodon flavescens* (Hook.) A. Jaeger 가지운이끼; *Yoon Y. J.* 10036, 10063, 10256 (INU)
89. *Entodon calcicola* Cardot 가지운이끼; *Yoon Y. J.* 10623 (INU)
90. *Entodon challengeri* (Paris) Cardot 빛은잎운이끼; *Yoon Y. J.* 10004, 10039, 10207 (INU)
91. *Entodon conchum* (De Not.) Paris 동근잎운이끼; *Yoon Y. J.* 13004 (INU)
92. *Entodon diversinervis* Cardot 긴잎운이끼; *Yoon Y. J.* 13419 (INU)
93. *Entodon scabridens* Lindb. 진운이끼; *Yoon Y. J.* 10122, 13001, 13002 (INU)
94. *Entodon sullivantii* (Mill. Hal) Lindb. 가지운이끼; *Yoon Y. J.* 10009, 10010, 10018 (INU)

*Pylaisiadelphaceae* (털깃운이끼과, New)
95. *Fauriella tenuis* (Mitt.) Cardot 한국운이끼; *Yoon Y. J.*
10621, 10625, 10636 (JNU)
96. Pylasiadelpha ternstroemii (Bruch and Schimp. ex Sull.) W. R. Buck
  Gapa-flatui; Yoon Y. J. 10014, 10033, 10049 (JNU)
97. Pylasiadelpha triostriovibris (Broth.) Afonina, Tsubota and
   Ignatova 삼첩갑염기; Yoon Y. J. 10638, 10668, 12409 (JNU)

Anomodontaceae (경장주식아과)
98. Anomodon abbreviatus Mitt. 삼만주식아; Yoon Y. J. 10511, 10514 (JNU)
99. Anomodon giraldii Mill. Hal. 큰경주식아; Yoon Y. J. 10074, 10096, 10105 (JNU)
100. Anomodon rugelii (Mill. Hal.) Keissl. 곱슬경주식아; Yoon Y. J. 10073, 10222, 10366 (JNU)
101. Anomodon solbergii Laz. 복잡주식아; Yoon Y. J. 13202 (JNU)
102. Haploleynium longinerve (Broth.) Broth. 길𝐈溱마위
   심아; Yoon Y. J. 13655 (JNU)
103. Haploleynium sieboldii (Dozy and Molk.) Dozy and
   Molk. 갈잎마위심아; Yoon Y. J. 10124, 10360, 13018 (JNU)
104. Haploleynium triste (Ces.) Kindb. 바위심아; Yoon Y. J. 10079, 10123, 10144 (JNU)
105. Herpetoclinum toccae (Sull. and Lesq.) Cardot 나선
   이끼; Yoon Y. J. 10127, 10133, 10419 (JNU)

Neckeraceae (남작아과)
106. Forststromia cryptophaeoides Cardot 가는실방울아; Yoon Y. J. 10078, 11436, 13648 (JNU)
107. Forststromia japonica (Bash.) Paris 실방울아; Yoon Y. J. 13222, 13805, 13836 (JNU)
108. Forststromia neckeroides Broth. 간방울아; Yoon Y. J. 10510 (JNU)
109. Homalota trichomanoides (Hedw.) Schimp. 은남작아; Yoon Y. J. 10234, 10236, 10240 (JNU)
110. Neckera pennisula Hedw. 낙개남작아; Yoon Y. J. 12821, 13642 (JNU)
111. Thamnoziyrum coreanum (Cardot) Nog. and Z. Ivats. 
   고라대호로아; Yoon Y. J. 13415 (JNU)
112. Thamnoziyrum plicatum (Sandt. Lauc.) Z. Ivats. 고라
   대호로아; Yoon Y. J. 10339, 10408, 10414 (JNU)

Climaciaceae (나무아과)
113. Climacium japonicum Lindb. 나무아; Yoon Y. J. 10664, 10671, 13224 (JNU)

Hylocomiaceae (수들아과)
114. Hylocomisstrum pyrenaicum (Spruce) M. Fleisch. 비봉
   수들아; Yoon Y. J. 10627, 13226, 13828 (JNU)
115. Hylocomioptis obtipracpa (Bash.) Cardot 아기호랑고
   라이끼; Yoon Y. J. 10626, 10682, 13009 (JNU)
116. Hylcomioptis himalayum (Mitt.) A. Jaeger 활수들아
   기끼; Yoon Y. J. 10660 (JNU)
117. Loeselioptis brevirostre (Bash.) M. Fleisch. 큰비록수
   들아끼; Yoon Y. J. 10646, 12657, 13250 (JNU)
118. Rhytidadiaelphus squarrosus (Hedw.) Warnst. 갈잎운
   이끼; Yoon Y. J. 13234, 13241, 13246 (JNU)

Lembophyllaceae (호랑꼬리아과)
119. Dolichonotioris diversiforme (Mitt.) Nog. 갈로한
   꼬리아끼; Yoon Y. J. 10489, 12811, 12827 (JNU)

Meteoriaceae (누문근아과)
120. Meteoria subpolytrichum (Bash.) Broth. Yoon Y. J. 11083 (JNU)

Brachytheciaceae (양 geil 아과)
121. Brachythecium buchananii (Hook.) A. Jaeger 삼양기
   길아; Yoon Y. J. 10137, 10243, 10324 (JNU)
122. Brachythecium helminthochilum Broth. and Paris 삼양기
   길아; Yoon Y. J. 10813 (JNU)
123. Brachythecium moriense Besch. 삼양길아; Yoon Y. J. 10268 (JNU)
124. Brachythecium rivulare Schimp. 삼알길아; Yoon Y. J. 10059, 10473, 10647 (JNU)
125. Brachythecium rutabulum (Hedw.) Schimp. 삼방기
   길아; Yoon Y. J. 10145, 10497, 10679 (JNU)
126. Brynia novae-angliae (Sull. and Lesq.) Grout 구슬세
   모양길아; Yoon Y. J. 10662, 10411, 12091 (JNU)
127. Cirripodium pilliferum (Hedw.) Grout 갈근길아; Yoon Y. J. 13414 (JNU)
128. Eurhynchium angustirete (Bash.) T. J. Kop. 삼간길아
   길아; Yoon Y. J. 10109 (JNU)
129. Myuroclaceae maximovitae (GG Borsch.) Steere and W.B. 
   Schofield 퀸모로아; Yoon Y. J. 10099, 10104, 10409 (JNU)
130. Okamuroae hakanisensis (Mitt.) Broth. 갈양길아; Yoon Y. J. 10432, 11031, 11231 (JNU)
131. Oxyrhynchium hiart (Hedw.) Loeske 물가참길아; Yoon Y. J. 10057, 10859 (JNU)
132. Rhytidostegium palidifolium (Mitt.) A. Jaeger 삼양
   결박길아; Yoon Y. J. 10055, 10085, 10244 (JNU)
133. Rhytidostegium riparioides (Hedw.) Cardot 물가길
   리아끼; Yoon Y. J. 10320, 10478, 10838 (JNU)
134. Sciuro-hyphnum brotheri (Paris) Ignatov and Huttunen
   삼양길아; Yoon Y. J. 10265, 10266 (JNU)
135. Sciuro-hyphnum plumulosum (Hedw.) Ignatov and 
   Huttunen 삼알길아; Yoon Y. J. 10070, 10211, 10214 (JNU)
136. Sciuro-hypnum populeum (Hedw.) Ignatov and Huttunen 양탈이끼; *Yoon Y. J. 10227, 10421, 10423 (INU)*

**Pylaisiaceae (평주가리과, New)**

137. Calliostomum haidalianum (Grev.) H. A. Crum 평주받이끼; *Yoon Y. J. 13213, 13217, 14014 (INU)*
138. Calligera bellii (Mitt. Hedens) 율하단털이끼; *Yoon Y. J. 11216, 12210, 12220 (INU)*
139. Gollania rugosa (Mitt.) Broth 주름사슴썰이끼; *Yoon Y. J. 10238, 10263, 10280 (INU)*
140. Pylaisia brevistyla Besch. 평주가리; *Yoon Y. J. 10493 (INU)*
141. Stereodon dieckii (Renauld and Cardot) Broth. 고산털깃타이끼; *Yoon Y. J. 12816, 13006, 13033 (INU)*
142. Stereodon planiformis (Wilson) Mitt. 밀털깃타이끼; *Yoon Y. J. 10203, 10209, 10212 (INU)*
143. Stereodon sakuraii (Sakurai) Broth. 묵은털깃타이끼; *Yoon Y. J. 13831, 13838 (INU)*

**Leskeaceae (고말갈가리과)**

144. Myxinea fruticella (Mitt.) Broth. 고말갈가리; *Yoon Y. J. 10909, 10067, 10151 (INU)*
145. Pseudesleskeopsis zippelii (Dozy and Molk.) Broth. 물바위끼; *Yoon Y. J. 11411, 11641, 12023 (INU)*

**Thuidiaceae (깃털이끼과)**

146. Bouleya mittenii (Broth.) Cardot 아기가방이끼; *Yoon Y. J. 12248, 13040, 13604 (INU)*
147. Brynogenia molkenboeri (Sande Lac.) Z. Iwats. and Inoue 깃털끼끼; *Yoon Y. J. 10929, 11040, 11060 (INU)*
148. Haplocarpon angustifolium (Hampe and Mill. Hal.) Broth. 천적은명주실끼끼; *Yoon Y. J. 10038, 10040, 10042 (INU)*
149. Haplocarpon microphyllum (Hedw.) Broth. 작은명주실끼끼; *Yoon Y. J. 10032, 10036, 10060 (INU)*
150. Haplocarpon strictissimum (Cardot) Reimers 돌기름명주실끼끼; *Yoon Y. J. 10006, 10029, 10035 (INU)*
151. Pelekiaum versicolor (Mitt. Hal.) Touw 큰깃털끼끼; *Yoon Y. J. 10107, 10213, 10216 (INU)*
152. Ranierella fujisawa (Paris) Reimers 절이기방이끼끼; *Yoon Y. J. 10121, 10132, 10136 (INU)*
153. Thuidium delicatulum (Hedw.) Schimp. 작은잎깃털끼끼; *Yoon Y. J. 10100, 13214, 13235 (INU)*
154. Thuidium kaneaei Sakurai 깃털끼끼; *Yoon Y. J. 10051, 10246, 10288 (INU)*
155. Thuidium pristocarpy (Mitt. Hal.) A. Jaeger 작은깃털끼끼; *Yoon Y. J. 10833, 13032, 13207 (INU)*
156. Thuidium submicrotis Cardot 깃털끼끼; *Yoon Y. J. 10995, 10114, 10130 (INU)*

**Amblystegiaceae (바들이끼과)**

157. Campyliadelphus chrysophyllus (Brid.) R. S. Chopra 가는노랑바들이끼; *Yoon Y. J. 10271, 11012, 11250 (INU)*
158. Campyliadum hispidulum (Brid.) Ochyra 바들이끼; *Yoon Y. J. 10676 (INU)*

**Appendix 2. The list of plants that were not found in this study but recorded in literatures.**

**Polystichaceae (솔이끼과)**

1. Atrichium undulatum (Hedw.) P. Beauv. 주름솔이끼
2. Bartramia leptocarpa (James.) Kindb. 풍랑솔이끼
3. Pogonatum japonicum Sull. and Lesq. 콘돌솔이끼
4. Polystichum alpinum (Hedw.) G. L. Sm. 산솔이끼

**Dicranaceae (고마리과)**

5. Dicranum flagellare Hedw. 처리고마리
6. Dicranum majus Tumer 고산고마리
7. Dicranum mayri Broth. 곰솔고마리
8. Dicranum viride (Sull. and Lesq.) Lindb. 빨고마리

**Rhabdoweissiaceae (주름모모이끼과, New)**

9. Oncophorus wahlenbergii Brid. 산복로이끼

**Mniaceae (초롱이끼과)**

10. Rhizosolenium punctatum (Hedw.) T. J. Kop 미선초롱이끼
11. Trachyphycis microphylla (Dozy and Molk.) Lindb. 아기초롱이끼

**Orthotrichaceae (선주름이끼과)**

12. Orthotrichum sordidum Sull. and Lesq. 선주름이끼

**Neckeraceae (낭주름이끼과)**

13. Thamnolobryum alopeccum (Hedw.) Nieuw. ex Gangelée 아주모모이끼
14. Thamnolobryum suberectum (Mitt. ex Sande Lac.) B. C. Tan. 대호모모이끼

**Climaciaceae (나무이끼과)**

15. Pleurozium ruthenicum (Weinm.) Kindb. ex E. Britton 깃털나무이끼

**Lembophyllaceae (호랑고마리과)**

16. Isothecium subsessiforome Broth. 알박호랑고마리

**Leskeaceae (고말갈가리과)**

17. Rigodiadelphus robustus (Lindb.) Nog. 아주미끼

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18. *Entodon lucidus* (Griff.) A. Jaeger 불가용이끼

**Hypnaceae** (뒷頂き이끼과)
19. *Hypnum fukiyamae* (Broth.) Paris 왕갈말頂き이끼
20. *Hypnum picatum* (Lindb.) A. Jaeger 주름말頂き이끼

**Pylaisiaceae** (영주이끼과, New)
21. *Pylaisia cristata* (Cardot) Z. Iwats. and Nog. 버슬영주이끼

22. *Pylaisia intricata* (Hedw.) Grout 용단영주이끼

**Hylocomiaceae** (수풍이끼과)
23. *Hylocomium splendens* (Hedw.) Schimp. 수풍이끼
24. *Pleurozium schreberi* (Willd. ex Brid.) Mitt. 길창발이끼
25. *Rhytidium rugosum* (Ehrh. ex Hedw.) Kindb. 곰은이끼