



Floristic study of bryophytes in Hangyeong Gotjawal (Cheongsu-ri), Jejudo Island

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ABSTRACT: Recently, it has become known that Gotjawal terrain is an important area, therefore the study on this area has conducted in the geological, ecological, and cultural aspects. The studies on bryophytes of Gotjawal, however, have not been sufficiently performed. This study presents a survey on the bryophytes of the evergreen broad-leaved forest of Cheongsu-ri at Hangyeong Gotjawal in the southwestern part of Jejudo Island, Korea. A total of 72 taxa belonging to the Bryophyta (18 families 43 genera 55 species) and Marchantiophyta (11 families 13 genera 17 species) were determined and the liverwort index was 23.6%. Predominant life-form was weft. The rates of the bryophytes dominating in mesic to hygric sites were higher than the bryophytes mainly observed in xeric habitats. These values indicate that the forests are widespread and dense in this study area. Upon an investigation of the substrates, the bryophytes on rocks were most diverse. The results appear to stem from the fact that volcanic rock masses of various sizes lay scattered over the study area, offering numerous micro-habitats for bryophyte due to one of the characteristics of Gotjawal. We suggest that more detailed studies should be conducted at the regional scale to establish the bryophyte flora of Gotjawal and the evergreen broad-leaved forests on Jejudo Island.

Keywords: bryophyte, Hangyeong Gotjawal, liverwort index, life-form

Jejudo Island was formed by volcanic activities and has the unique topological and geological features. In this unique volcanic terrain, forests established on lava flow are scattered around the island, known as “Gotjawal,” which is a newly coined compound word and comes from dialects spoken on Jejudo Island (Jeju Special Self-Governing Province, 2009; Yoon, 2014). It is difficult to access Gotjawal and use it for agricultural purpose, as the trees and vines are dense, rocks of various sizes are scattered randomly, and the depth of soil is shallow in Gotjawal. Therefore, thus far it has only been used for grazing cattle, making charcoal or as a firewood source and is commonly recognized as useless land (Jeon et al., 2012; Jeong, 2012, 2015; Yoon, 2014). Recently, however, it has become known that Gotjawal is an area inhabited by various plants and animals where unique and various ecosystems are also sustained; the area serves as a natural waterway of the type necessary to create underground water, and it has high

preservation values (Jeon et al., 2012; Kang et al., 2013; Yoon, 2014; Jeong, 2015). In addition, its cultural importance has also emerged. Therefore, the scientific studies of Gotjawal have been conducted to examine geological, ecological, and cultural aspects (Jeong et al., 2013; Jeon et al., 2015). However, a floristic study of bryophytes has not been conducted, except for that Dongbaek-dongsan at Seonheul Gotjawal in the northeastern part by Yim et al. (2013) and Subtropical Forest of Nabeup-ri at Aewol Gotjawal in the southwestern part by Yim and Hyun (2018).

The area and range of Gotjawal terrain have not been yet established (Jeon et al., 2015). According to Song (2000), Gotjawal can be divided into four major terrains, i.e., Gujwa-Seongsan, Jocheon-Hamdeok, Hangyeong-Andeok, and Aewol. Among them, Hangyeong-Andeok Gotjawal terrain is divided into Doneori Gotjawal lava flow and Byeongak Gotjawal lava flow. Doneori Gotjawal lava flow begun from

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the vicinity of Doneri Oreum (439 m above sea level) and branched off into Wollyeong-ri, Hallim-eup and Yeongnak-ri, Daejeong-eup. Its flow distance is 12.5 km, which is longest of the Gotjawal lava flows. Byeongak Gotjawal lava flow was erupted from Byeongak Oreum (418 m above sea level). The distance is 9 km and wide is 2–3 km (Song, 2003a, 2003b).

The evergreen broad-leaved forest of Cheongsu-ri, which is a branch of Doneori Gotjawal lava flow of Hangyeong-Andeok Gotjawal terrain located in the southwestern part of Jeju Island, is also known as Sanyang Gotjawal. This area consists of dense evergreen broad-leaved forests where *Quercus glauca* Thunb., *Castanopsis sieboldii* (Makino) Hatus., *Neolitsea sericea* (Blume) Koidz., and *Machilus japonica* Siebold & Zucc. etc. are distributed on thwide rock fields. In addition, various ferns such as *Asplenium ritoense* Hayata and *A. varians* Wall. ex Hook. & Grev. etc. are inhabit and form a unique landscape. The rare plants, *Maesa japonica* (Thunb.) Moritz & Zoll. and *Neocheiropteris ensata* (Thunb.) Ching etc. are also inhabit. *M. japonica* is an evergreen shrub recently reported as unrecorded plants (Moon et al., 2006), and are known to be distributed only in this area and its environs. In addition, *N. ensata* forms the largest population in Korea. From these reasons, this area is considered very important region from an academic point of view. The area is adjacent to the village, and has been damaged by the grazing cattle, making

charcoal, or as a firewood source in the past. The vegetation is currently restored. Plants, animals, and stones etc., however, can be collected without permission due to its easy access. Moreover, since it is managed jointly by the village, there is a possibility of serious damage if conservation measures are not taken. Therefore, it is necessary to investigate natural resources to enhance the value of the area, come up with specific management measures for the preservation of species and natural habitat, and induce the development of the area as an ecotourism destination that also contributes to improving the income level of local residents.

The purpose of this study was to establish a bryophyte flora of the evergreen broad-leaved forest of Cheongsu-ri at Hangyeong Gotjawal. Furthermore, this study aims to contribute to studies of the bryophyte flora of Gotjawal and the evergreen broad-leaved forests on Jeju Island on a regional scale and to provide basic data for selecting relevant indicator species.

Materials and Methods

Field surveys

Field surveys were carried out in the evergreen broad-leaved forest of Cheongsu-ri at Hangyeong Gotjawal with an area of approximately 501,223 m² (Fig. 1), a total of 7 times from August 2011 to September 2018.

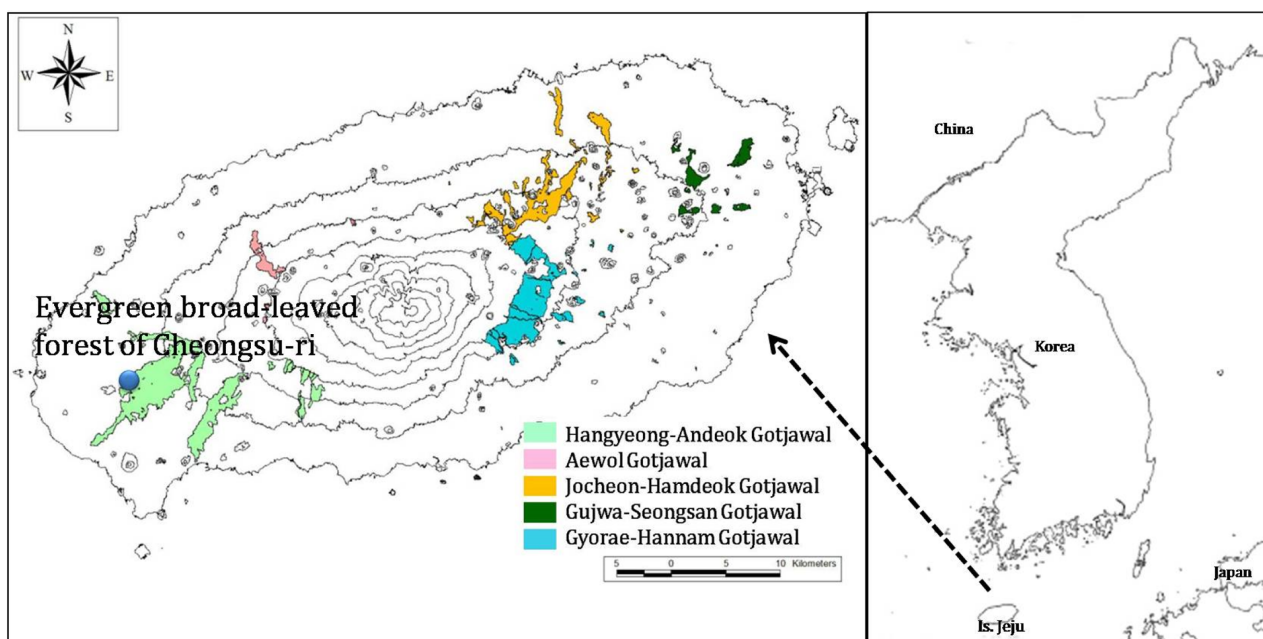


Fig. 1. The map showing the location of Evergreen broad-leaved forest of Cheongsu-ri and distribution of Gotjawal terrain, Jeju Island, Korea. Gotjawal terrain designated by the Jeju Special Self-Governing Province (1997) are represented by colored areas.

Identification, nomenclature, and arrangement of taxa

The samples collected in the investigated area were identified at species level with macroscopic morphology and microscopic features using relevant literatures (Iwatsuki and Mizutani, 1972; Inoue, 1974, 1976; Choe, 1980; Noguchi, 1987, 1988, 1989, 1991, 1994; Gao et al., 1999; Iwatsuki, 2001; Li et al., 2001; Wu et al., 2002; Cao et al., 2003). The voucher specimens were deposited in Warm Temperate and Subtropical Forest Research Center in Korea (WFRC). Only one collection number for each taxon were cited to avoid repetition in the floristic list. The nomenclature and arrangement of taxa are followed the system which is proposed by Goffinet et al. (2009) and Crandall-Stotler et al. (2009) for the mosses and liverworts respectively.

Life-forms and substrates

The life-forms of bryophytes in the study area have been estimated using Mägdefrau (1982), and also they are given in the floristic list for each taxon. The records of substrates for each taxon were included in this list.

Number of bryophyte taxa and liverwort index

We compared the number of taxa and liverwort index of the evergreen broad-leaved forest of Cheongsu-ri at Hangyeong Gotjawal with other localities based on revealed literatures [i.e., Taebaeksan Mt. (Papp, 2008), Deogyusan Mt. (Choi et al., 2010; Yoon et al., 2011), Dongbaek-dongsan (Yim et al., 2013), Gayasan Mt. (Sin, 2016a), Sobaeksan Mt. (Sin, 2016b), and Subtropical Forest of Nabeup-ri (Yim and Hyun, 2018)]. The liverwort index, which is based on the character that the liverworts and hornworts tend to prefer more humid conditions than mosses, was calculated as follow (Nakanishi, 2001):

$$\text{Liverwort index (\%)} = \frac{\text{No. of liverworts} + \text{No. of hornworts}}{\text{The total No. of bryophytes}} \times 100$$

Results and Discussion

The number of taxa and liverwort index

In this study, a total of 72 taxa belonging to the Bryophyta (18 families 43 genera 55 species) and Marchantiophyta (11 families 13 genera 17 species) were determined (Appendix 1).

The comparison result for the number of taxa presented that evergreen broad-leaved forest of Cheongsu-ri at Hangyeong Gotjawal contained rich diversity of bryophytes for the area (Table 1). This is one of the characteristics of Gotjawal area, which is highly biodiversity despite its narrow area and altitude above sea level range.

The liverwort index, which is based on the character that the liverworts and hornworts tend to prefer more humid conditions than mosses. Therefore, it is useful to compare air humidity between different sites (Nakanishi, 2001). The liverwort index of the evergreen broad-leaved forest of Cheongsu-ri was 23.6% and this value indicates that the air humidity of investigated area was relatively lower than Sobaeksan Mt. (41.9%), Deogyusan Mt. (40.8%), Gayasan Mt. (37.6%), Subtropical Forest of Nabeup-ri (30.2%), Taebaeksan Mt. (29.2%), and Dongbaek-dongsan (27.0%) (Table 1). The liverwort index of the study area is the lowest in the Gotjawal area. Seonheul Gotjawal is a wet forest where wetlands and caves have developed due to pahoehoe lava, and where *Castanopsis sieboldii* (Makino) Hatus. and *Quercus acuta* Thunb. are relatively abundant. The western Gotjawal is mostly distributed on aa lava that a dry environment is maintained due to its high permeability, and *Quercus glauca* Thunb. dominated and *Arachniodes aristata* (G. Forst.) Tindale inhabits widely. However, Subtropical Forest of Nabeup-ri is small in area but very well-conserved forest for a long time. Whereas the trees of Hangyeong Gotjawal were considered to have been frequently

Table 1. Comparison to the bryophyte species richness levels and liverwort indexes of evergreen broad-leaved forest of Cheongsu-ri at Hangyeong Gotjawal and other localities.

Locality	Area (km ²)	No. of species	Liverwort index
Gotjawal area			
Evergreen broad-leaved forest of Cheongsu-ri (Hangyeong Gotjawal)	0.501	72	23.6
Dongbaek-dongsan (Seonheul Gotjawal)	1.420	85	27.0
Subtropical Forest of Nabeup-ri (Aewol Gotjawal)	0.034	63	30.2
Mountain area			
Sobaeksan Mt.	322.011	236	41.9
Deogyusan Mt.	232.000	311	40.8
Gayasan Mt.	76.256	173	37.6
Taebaeksan Mt.	17.440	144	29.2

used by local residents in that they have small diameter at breast height and developed coppice shoots and branches. Therefore, we think that formation of patches that maintain bright and dry environment affects the composition and distribution of bryophytes. In the forest within study area, the mosses mainly occurred in sunny and dry habitats such as *Racomitrium japonicum* Dozy & Molk., *Ptychomitrium sinense* (Mitt.) A. Jaeger, and *Hypnum plumaeforme* Wilson were confirmed. Since a floristic study of bryophytes of Korea has not been sufficiently conducted, it is difficult to compare and analyze the liverwort index data. Therefore, we suggest that more detailed studies on the bryophyte flora of Korea should be conducted at the regional scale.

Remarkable species

We think that *Plagiochila furcifolia* Mitt. (Bi-ja-nal-gae-i-kki) inhabits in this area is worthy of special mention. This liverwort is distributed in Japan (Iwatsuki and Mizutani, 1972), China (So, 2001), India (Singh and Barbhuiya, 2012), and Vietnam (Shu et al., 2017). In Korea, this species was found from Bijarim Forest at Gujwa-Seongsan Gotjawal for the first time (Choi, 2013) and from Subtropical Forest of Nabeup-ri at Aewol Gotjawal for the second time (Yim and Hyun, 2018). In case of Japan, this bryophyte species is categorized as 'near threatened species' in Hyogo Prefecture and as 'vulnerable species' in Osaka Prefecture (EnVision Conservation Office, 2018.). The species that its distributions of Korea are not known except Gotjawal area in Jeju Island and the range of distribution is also narrow until now. However, it is hard to recognize this liverwort as species limitedly distributed in Jeju Island and assess its rarity or conservation status. Because, in the case of Korea, the bryophyte flora is an unexplored field which has studied by a few researchers aiming mainly at Jeju Island and not been investigated yet at a regional scale. Therefore, we suggest that a comprehensive research on the bryophyte flora of Korea should be conducted continuously.

Life-forms

We estimated the life-forms for each taxon in the study area and presented in the Table 2. Predominant life-form was weft (22 species, 30.6%), followed by mat (18 species, 25.0%), tall turf (15 species, 20.8%), short turf and fan (5 species, 6.9%, each of them), and tail and cushion (3 species, 4.2%, each of them). We analyzed the results based on the relationship between the adaptive strategy and life-form of bryophytes according to Kürschner (2004), Uyar et al. (2007), and Glime (2017). As a result, the rates of mostly pleurocarpous bryophytes (the life-forms of mat, weft, fan, and tail) dominating in mesic to hygric sites were 66.7%, whereas

mostly acrocarpous bryophytes (the life-forms of tall turf, short turf, cushion, and Annual) mainly observed in xeric habitats were 33.3% (Table 2, Appendix 1). These values indicate that the forests are widespread and dense in the study area. It is meaningful that the rates of bryophytes of mesic to hygric site type in this area are lower than in Dongbaek-dongsan (70.6%) and Subtropical Forest of Nabeup-ri (76.2%) and identical to the data of liverwort index (Yim et al., 2013; Yim and Hyun, 2018). These values supported that the subtropical forest of

Table 2. The number of taxa and percentage composition according to the life-forms of bryophytes in the study area.

Life-forms	No. of taxa	Percentage
Xeric habitat type	24	33.3
Annuals	1	1.4
Cushions	3	4.2
Short turfs	5	6.9
Tall turfs	15	20.8
Mesic to hygric site type	48	66.7
Tails	3	4.2
Fans	5	6.9
Mats	18	25.0
Wefts	22	30.6
Total	72	100.0

Table 3. The number of taxa according to the substrate in the study area.

Substrate	No. of taxa
Specific to only one substrate	
Epilithic	33
Epiphytic	1
Epixylous	1
On the soil	8
Common to two or more substrates	
Epilithic and epiphytic	15
Epilithic and on the soil	3
Epilithic and epixylous	1
Epiphytic and epixylous	1
Epixylous and on the soil	2
Epilithic, epiphytic and epixylous	1
Epilithic, epiphytic and on the soil	2
Epilithic, epixylous and on the soil	2
Epilithic, epiphytic, epixylous and on the soil	2
Total	72

Nabeup-ri and Dongbaek-dongsan are relatively more humid than the study area.

Distribution pattern

We estimated the substrates for each taxon to investigate the distribution pattern. The number of taxa according to the substrate are presented in the Table 3. Upon investigation into substrates, the bryophytes on the rocks were most diverse as 59 taxa followed by soil (19 taxa), decayed tree (10 taxa), and bark (22 taxa). The results seem to be caused by that the volcanic rock masses of various sizes lay scattered over the study area offering a lot of micro-habitats for bryophytes due to one of the characteristics of Gotjawal, where the rocks of various sizes are scattered randomly.

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Conflict of Interest

The authors declare that there are no conflicts of interest.

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Appendix 1. Floristic list of the evergreen broad-leaved forest of Cheongsu-ri at Hangyeong Gotjawal in Korea.

Taxa	Korean name	Life form	Substrate	Voucher No. (Eun-Young Yim-)
Bryophyta Schimp. 선류식물문				
Polytrichaceae Schwägr. 솔이끼과				
<i>Atrichum undulatum</i> (Hedw.) P. Beauv.	주름솔이끼	Tall turfs	L	SYG006
<i>Pogonatum inflexum</i> (Lindb.) Sande Lac.	아기들솔이끼	Tall turfs	S	SYG062
Funariaceae Schwägr. 표주박이끼과				
<i>Physcomitrium sphaericum</i> (C. Ludw.) Fürnr.	아기풍경이끼	Short turfs	L	SYG085
Grimmiaceae Arn. 고깔바위이끼과				
<i>Grimmia pilifera</i> P. Beauv.	흰털고깔바위이끼	Cushions	L	SYG049
<i>Racomitrium japonicum</i> Dozy & Molk.	늦은서리이끼	Tall turfs	S	SYG198
Fissidentaceae Schimp. 봉황이끼과				
<i>Fissidens dubius</i> P. Beauv.	벼슬봉황이끼	Tall turfs	L	SYG328
<i>Fissidens gymnogynus</i> Besch.	작은봉황이끼	Tall turfs	L	SYG030
Ptychomitriaceae Schimp. 곱슬이끼과				
<i>Ptychomitrium dentatum</i> (Mitt.) A. Jaeger	물가곱슬이끼	Cushions	L	SYG069
<i>Ptychomitrium sinense</i> (Mitt.) A. Jaeger	곱슬이끼	Cushions	L	SYG070
Ditrichaceae Limpr. 금실이끼과				
<i>Ditrichum pallidum</i> (Hedw.) Hampe	금실이끼	Short turfs	S	SYG109
Pottiaceae Hampe 꼬마이끼과				
<i>Weissia controversa</i> Hedw.	꼬마이끼	Short turfs	S	SYG110
Bryaceae Schwägr. 은이끼과				
<i>Brachymerium nepalense</i> var. <i>clavulum</i> (Mitt.) Ochi	아기노란참외이끼	Short turfs	LP	SYG012
<i>Pohlia longicollis</i> (Hedw.) Lindb.	긴목수세미이끼	Tall turfs	S	SYG074
<i>Rosulabryum capillare</i> (Hedw.) J.R. Spence	철사이끼	Short turfs	L	SYG011
Mniaceae Schwägr. 참이끼과				
<i>Mnium ambiguum</i> H. Müll.	납작맥초롱이끼	Tall turfs	L	SYG311
<i>Plagiommium acutum</i> (Lindb.) T. J. Kop.	아기들덩굴초롱이끼	Tall turfs	LS	SYG159
<i>Trachycystis microphylla</i> (Dozy & Molk.) Lindb.	아기초롱이끼	Tall turfs	LP	SYG134
Bartramiaceae Schwägr. 구슬이끼과				
<i>Philonotis thwaitesii</i> Mitt.	아기물가이끼	Tall turfs	L	SYG089
<i>Philonotis turneriana</i> (Schwägr.) Mitt.	큰물가이끼	Tall turfs	L	SYG080
Hedwigiaceae Schimp. 툫이끼과				
<i>Hedwigia ciliata</i> (Hedw.) P. Beauv.	툫이끼	Tall turfs	L	SYG015
Thuidiaceae Schimp. 깃털이끼과				
<i>Anomodon viticulosus</i> (Hedw.) Hook. &	굽은명주실이끼	Tails	L	SYG019
<i>Claopodium aciculium</i> (Broth.) Broth.	가시이끼	Wefts	L	SYG052
<i>Haplocladium angustifolium</i> (Hampe & Müll. Hal.) Broth.	침작은명주실이끼	Wefts	LPXS	SYG154
<i>Haplocladium microphyllum</i> (Hedw.) Broth.	작은명주실이끼	Wefts	LP	SYG142
<i>Haplohymenium pseudotriste</i> (Müll. Hal.) Broth.	꼬마바위실이끼	Wefts	LP	SYG120
<i>Herpetineuron toccocae</i> (Sull. & Lesq.) Cardot	나선이끼	Tails	LP	SYG199

Appendix 1. Continued.

Taxa	Korean name	Life form	Substrate	Voucher No. (Eun-Young Yim-)
<i>Hylocomiopsis ovicarpa</i> (Besch.) Cardot	아기호랑꼬리이끼	Wefts	L	SYG038
<i>Pelekium versicolor</i> (Hornsch. ex Müll. Hal.) Touw	아기깃털이끼	Wefts	LPXS	SYG119
<i>Thuidium cymbifolium</i> (Dozy & Molk.) Dozy & Molk.	물개깃털이끼	Wefts	L	SYG076
<i>Thuidium kanedae</i> Sakurai	깃털이끼	Wefts	LS	SYG124
Brachytheciaceae Schimp. 양털이끼과				
<i>Brachythecium brotheri</i> Paris	큰양털이끼	Wefts	L	SYG104
<i>Brachythecium buchananii</i> (Hook.) A. Jaeger	긴양털이끼	Wefts	L	SYG098
<i>Brachythecium plumosum</i> (Hedw.) Schimp.	날개양털이끼	Wefts	LP	SYG184
<i>Brachythecium populeum</i> (Hedw.) Schimp.	양털이끼	Wefts	LXS	SYG138
<i>Bryhnia novae-angliae</i> (Sull. & Lesq.) Grout	세모양털이끼	Wefts	L	SYG267
<i>Cirriphyllum piliferum</i> (Hedw.) Grout	걸끈양털이끼	Wefts	L	SYG274
<i>Eurhynchium savatieri</i> Schimp. ex Besch.	가는부리이끼	Wefts	LPS	SYG139
<i>Rhynchostegium pallidifolium</i> (Mitt.) A. Jaeger	아기양털부리이끼	Wefts	LP	SYG227
Hypnaceae Schimp. 털깃털이끼과				
<i>Homomallium connexum</i> (Cardot) Broth.	쌍끝양털이끼	Wefts	PX	SYG230
<i>Hypnum oldhamii</i> (Mitt.) A. Jaeger	가는털깃털이끼	Wefts	L	SYG055
<i>Hypnum plumaeforme</i> Wilson	털깃털이끼	Wefts	XS	SYG394
<i>Isopterygium minutirameum</i> (Müll. Hal.) A. Jaeger	걸주목이끼	Wefts	L	SYG122
<i>Pseudotaxiphyllum pohliaecarpum</i> (Sull. & Lesq.) Z. Iwats.	빨간걸주목이끼	Mats	LS	SYG354
<i>Pylaisiadelpha tenuirostris</i> (Bruch & Schimp. ex Sull.) W. R. Buck	무성아실이끼	Mats	P	SYG017
<i>Taxiphyllum taxirameum</i> (Mitt.) M. Fleisch.	주목이끼	Mats	LPX	SYG004
Plagiotheciaceae M. Fleisch. 산주목이끼과				
<i>Plagiothecium nemorale</i> (Mitt.) A. Jaeger	산주목이끼	Mats	LP	SYG128
Entodontaceae Kindb. 윤이끼과				
<i>Entodon challengerii</i> (Paris) Cardot	넓은잎윤이끼	Wefts	L	SYG061
<i>Entodon sullivantii</i> (Müll. Hal.) Lindb.	가는윤이끼	Wefts	LXS	SYG151
Sematophyllaceae Broth. 나무실이끼과				
<i>Sematophyllum subhumile</i> (Müll. Hal.) M. Fleisch.	나무실이끼	Mats	X	SYG022
Neckeraceae Schimp. 납작이끼과				
<i>Homalia japonica</i> Besch.	꼬리윤납작이끼	Fans	L	SYG078
<i>Homalia trichomanoides</i> (Hedw.) Schimp.	윤납작이끼	Fans	LP	SYG079
<i>Neckeropsis nitidula</i> (Mitt.) M. Fleisch.	리본납작이끼	Fans	LP	SYG130
<i>Pseudanomodon giraldii</i> (Müll. Hal.) Ignatov & Fedosov	큰명주실이끼	Tails	L	SYG029
<i>Thamnobryum plicatulum</i> (Sande Lac.) Z. Iwats.	그늘대호꼬리이끼	Fans	L	SYG135
<i>Thamnobryum subseriatum</i> (Mitt. ex Sande Lac.) B. C. Tan	대호꼬리이끼	Fans	XS	SYG003
Marchantiophyta Stotler & Crand. -Stotl. 태류식물문				
Marchantiaceae Lindl. 우산이끼과				
<i>Marchantia polymorpha</i> L.	우산이끼	Mats	S	SYG090
Aytoniaceae Cavers 삿갓우산이끼과				

Appendix 1. Continued.

Taxa	Korean name	Life -form	Substrate	Voucher No. (Eun-Young Yim-)
<i>Reboulia hemisphaerica</i> (L.) Raddi	삿갓우산이끼	Mats	S	SYG097
Conocephalaceae Müll. Frib. ex Grolle 패랭이우산이끼과				
<i>Conocephalum conicum</i> (L.) Dumort.	패랭이우산이끼	Mats	L	SYG091
Ricciaceae Rehb. 발등근이끼과				
<i>Riccia fluitans</i> L.	물긴가지이끼	Annuals	S	SYG415
Metzgeriaceae H. Klinggr. 리본이끼과				
<i>Metzgeria lindbergii</i> Schiffn.	리본이끼	Mats	LP	SYG118
Porellaceae Cavers 세줄이끼과				
<i>Porella ulophylla</i> (Steph.) S. Hatt.	주름세줄이끼	Mats	LX	SYG180
<i>Porella vernicosa</i> Lindb.	가시세줄이끼	Mats	L	SYG157
Radulaceae Müll. Frib. 부채이끼과				
<i>Radula japonica</i> Gottsche ex Steph.	부채이끼	Mats	LP	SYG178
Frullaniaceae Lorch 지네이끼과				
<i>Frullania ericoides</i> (Nees) Mont.	초록지네이끼	Mats	LP	SYG028
Lejeuneaceae Cavers 작은귀이끼과				
<i>Lejeunea japonica</i> Mitt.	작은귀이끼	Mats	LPS	SYG156
<i>Trocholejeunea sandvicensis</i> (Gottsche) Mizut.	둥근귀이끼	Mats	LP	SYG027
Lophocoleaceae Müll. Frib. ex Vanden Berghen 두끝벼슬이끼과				
<i>Heteroscyphus argutus</i> (Nees) Schiffn.	아기비늘이끼	Mats	L	SYG126
<i>Heteroscyphus planus</i> (Mitt.) Schiffn.	비늘이끼	Mats	LP	SYG132
<i>Lophocolea heterophylla</i> (Schrad.) Dumort.	두끝벼슬이끼	Mats	L	SYG127
Plagiochilaceae Müll. Frib. 날개이끼과				
<i>Plagiochila furcifolia</i> Mitt.	비자날개이끼	Tall turfs	L	SYG121
<i>Plagiochila ovalifolia</i> Mitt.	둥근날개이끼	Tall turfs	L	SYG117
<i>Plagiochila sciophila</i> Nees ex Lindenb.	아기날개이끼	Tall turfs	L	SYG141

L, epilithic; P, epiphytic; X, epixylous; S, on the soil.