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Original Article

Vascular plants of Mt. Dosolsan in the Demilitarized Zone Civilian Control Line



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This study is aimed at identifying the distribution of vascular plants growing at Mt. Dosolsan in Yanggu-gun, Gangwon-do. Field surveys were conducted for each season from March 2014 to November 2016. The flora of study area is found to consist of 516 taxa, 91 families, 296 genus, 455 species, four subspecies, 50 varieties, and seven forma. Rare plants were found to be of 31 taxa. Among them, rare plant species consisted of critically endangered species (CR degree): 2 (Lilium dauricum Ker Gawl., Cypripedium macranthos Sw.), endangered species (EN degree): 5 (Loranthus tanakae Franch. & Sav. etc.), vulnerable species (VU degree): 7 (Dryopteris laeta (Kom.) C.Chr. etc.), and least concerned (LC degree): 17 (Botrychium virginianum (L.) Sw. etc.). In all the surveyed areas, a total of 20 taxa (Pseudostellaria setulosa Ohwi etc.) were found to be endemic to Korea. The floristic special plants found in the surveyed areas were two taxa of grade V, 24 taxa of grade IV, and 31 taxa of grade III. The naturalized plants were identified as 15 taxa and included Chenopodium album L., Lotus corniculatus L., Robinia pseudoacacia L. etc.

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Introduction

The Korea Demilitarized Zone (DMZ) is a buffer zone created by an agreement or treaty to maintain a constant distance to prevent a direct military collision. The DMZ is established to end conflicts or prevent recurrence of war, and its characteristics vary depending on historical backgrounds or the aspects of conflicts. The DMZ is 4 km wide and 248 km long with the total area of approximately 907.3㎢. The DMZ region is known as an excellent treasure trove of ecosystems to the world due to no human interference for over 60 years; and it is the most important area to preserve the ecosystem in the Korean peninsula, as one of the three key ecological axes together with Baekdudaegan mountain range and island/coastal areas ([Korea National Arboretum 2014a,b](#page1)).

Yanggu-gun, Gangwon-do, where Mt. Dosolsan is located, represent different flora from the southern area, in that it is situated



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near Mt. Geumgangsan and Mt. Seoraksan that connect northern plants and Southern Limit Line, and geographically very important endemic plants, such as Echinosophora koreensis, that are distrib-uted only in Yanggu and some other areas, are reported to be distributed in this area ([Min et al 2000](#page1)). Mt. Dosolsan is a mountain area located adjacent to Mt. Daeamsan where Yongneup Swamp is situated, which is the only high moor in Korea registered as a Ramsar wetland. Therefore future vegetation succession and plant distribution changes are expected to be quite important as the mountain is located in a geographically very important area.

Mt. Dosolsan (1,148m), the target area of this study, is situated between Mt. Daeamsan (1,304m) and Gachilbong Peak in the whole area of Punchbowl-ro, Haean-myeon, Yanggu-gun, Gangwon-do; at 38 140 north latitude and 128 05 east longitude, geographically.

According to the last 5 years (2012w2016) general weather conditions in Inje-gun, where the weather station closest to Mt. Dosolsan is located, the average temperature is 10.8 C; average maximum temperature is 17 C; highest temperature is 30.8 C; average low temperature is 5.6 C; lowest temperature is 12 C; average precipitation is 999.3mm; relative humidity is 67.1%; and average wind speed is 1.8㎧ ([Korea Meteorological Administration](#page1) [2017](#page1)).

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Most of the previous studies on vegetation and flora in Mt. Dosolsan turned out to be those reported together with neigh-boring mountain areas, such as Mt. Daeamsan, Gachilbong Peak, and Mt. Daeusan ([Choi and Koh 1989; Kang and Kwak 2000; Min](#page1) [et al 2000; Kim et al 2005; Choi and Heo 2009; Choung et al](#page1) [2009; Byeon et al 2014](#page1)); however, studies that surveyed Mt. Dos-olsan or those included Mt. Dosolsan were found inadequate ([An](#page1) [et al 2016; Kim et al 2014; Choi et al 2005](#page1)). Mt. Dosolsan was surveyed only as a part of a specific survey area, and not directly, because of its geographical characteristics, as it is situated at the center of Mt. Daeamsan and Mt. Daeusan ([Kim et al 2005](#page1)).

Accordingly, this study aims to survey vascular plants in Mt. Dosolsan, where studies on vegetation and flora have been so far inadequate, and to provide preliminary data on the distribution of northern plants as well as on the future distribution of plants and vegetation succession in Mt. Dosolsan.

Materials and methods

This study surveyed 15 times in total from March 2014 to November 2016, targeting Mt. Dosolsan situated within the DMZ Civilian Control Line ([Figure 1](#page1), [Table 1](#page1)).

Surveys on vascular plants were based on collection of all taxa in three mountain areas and preparation of field books as a rule; and species were identified in the field or, if difficult to identify, in a lab after collection.

Classification and identification were conducted using studies published by [Lee (2003a, b), Lee (2006a, b)](#page1) and identification of some ferns, by [Korean Fern Society (2005)](#page1). The collected plant samples were held by the DMZ Botanic Garden, a branch of the Korea National Arboretum. A list of plants was prepared, consisting of only identified species, such as evidence samples and digital photos, and arrangements of taxa were prepared according to the Engler system ([Melchior 1964](#page1)).

Scientific and Korean names of the plants were listed according to the Korean Plant Names Index ([Korea National Arboretum](#page1) [2014a,b](#page1)). Rare plants were listed according to [Korea National](#page1)

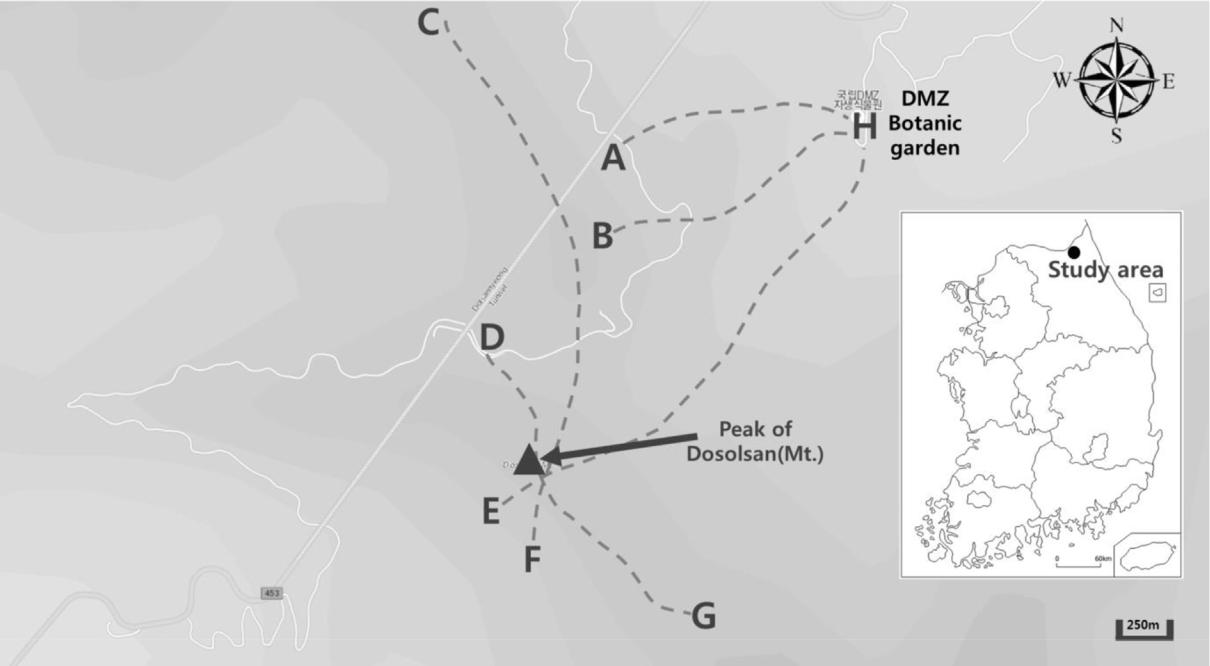


Table 1. Investigation routes (refer figure 1) and date of Mt. Dosolsan.

|  |  |  |  |
| --- | --- | --- | --- |
| No. | Date | | Investigation route |
|  |  |  |  |
| 1 | 19 | March 2014 | H/E,H/B |
| 2 | 08 | April 2014 | H/A,H/E |
| 3 | 11 | April 2014 | D/G,H/A |
| 4 | 16 | April 2014 | H / B |
| 5 | 08 | May 2014 | D/G,E/H |
| 6 | 13 May 2014 | | H / A |
| 7 | 17 | May 2014 | H/B,H/E |
| 8 | 20 | May 2014 | F/C,E/H |
| 9 | 24 | May 2014 | D/G,B/H |
| 10 | 28 May 2014 | | H / A |
| 11 | 05 | June 2014 | E / H |
| 12 | 08 | July 2014 | B/H,D/G |
| 13 | 16 | July 2014 | E / H |
| 14 | 07 | August 2014 | C/F,D/G |
| 15 | 22 | August 2014 | F/C,H/A |
| 16 | 03 | April 2015 | H/B,A/H |
| 17 | 14 May 2015 | | E / H |
| 18 | 20 May 2015 | | D / G |
| 19 | 25 May 2015 | | B / H |
| 20 | 10 | June 2015 | E/H,H/A |
| 21 | 19 | June 2015 | D / G |
| 22 | 06 | July 2015 | E/H,B/H |
| 23 | 30 | July 2015 | A / H |
| 24 | 10 | August 2015 | D/G,B/H |
| 25 | 03 | September 2015 | F / C |
| 26 | 16 | September 2015 | E/H,A/H |
| 27 | 22 | September 2015 | F / C |
| 28 | 17 | March 2016 | H/E,B/H |
| 29 | 21 | April 2016 | H/A,D/G |
| 30 | 13 | June 2016 | E/H,B/H |
| 31 | 25 | August 2016 | D/G,A/H |
| 32 | 29 | September 2016 | H / B |
|  |  |  |  |

[Arboretum (2009)](#page1), endemic plants according to [Chung et al](#page1) [(2017)](#page1), floristic special plants according to [Kim (2000)](#page1), and natu-ralized plants according to [Lee et al (2011)](#page1). In particular, naturalized plants were classified by place of origin, degree of naturalization, and period of introduction according to [Lee et al (2011)](#page1). Degrees of naturalization were defined according to the study published by

Figure 1. Location of studied area and main investigated routes.

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[Kariyama and Kobatake (1988)](#page1), and northern plants were listed according to the [Korea National Arboretum (2010)](#page1). Naturalized index (NI) and urbanized index (UI) were analyzed according to the study published by [Yim and Jeon (1980)](#page1). The effectiveness analysis of resource plants were prepared and classified according to [Lee](#page1) [(1976)](#page1).

Results

Vascular plants

As for vascular plants in Mt. Dosolsan, located in the DMZ Civilian Control Line, there appeared a total of 516 taxa comprised of 91 families, 296 genera, 455 species, four subspecies, 50 varieties, and seven formas. Also, there appeared nine families, 20 genera, 28 species, three varieties, and 31 taxa (6%) of pteridophytes; two families, three genera, three species, and three taxa (0.6%) of gymnosperms; 70 families, 215 genera, 333 species, four subspe-cies, 37 varieties, five forma, and 379 taxa (73.4%) of angiosperms and dicotyledons; and 10 families, 58 genera, 92 species, nine va-rieties, two forma, and 103 taxa (19.9%) of monocotyledons ([Table 2](#page1)). When classified by family, 52 taxa of Compositae (10%) appeared, followed by 35 taxa of Rosaceae (6.8%); 33 taxa of Lil-iaceae (6.4%); 30 taxa of Ranunculaceae (5.8%); 27 taxa of Graminae (5.2%); 22 taxa of Cyperaceae (4.2%); 20 taxa of Leguminosae (3.9%); and 17 taxa of Aspidiaceae (3.3%) ([Appendix 1](#page1)).

The vegetation of Mt. Dosolsan, the target area of this study, was identified as mostly Quercus mongolica colony; the trail from the Old Dolsallyeong Road toward the top was surveyed to be mostly rocky areas ([Kim et al 2014](#page1)). On the south-facing slope of Mt. Dosolsan is a plantation of Korean Pines, Larix kaempferi, and birches. Most of the flora and vegetation studies conducted tar-geting Mt. Dosolsan also include studies including Mt. Daeamsan, Gachilbong Peak, Mt. Daeusan. Among flora studies conducted targeting Mt. Dosolsan, 89 families, 281 genera, 437 species, and 510 taxa were reported by [Kim et al (2014)](#page1).

Compared to the existing literature, this study identified addi-tional 182 taxa, including Aconitum macrorhynchum Turcz., Cypri-pedium macranthos Sw., Acer tegmentosum Maxim., Rosa davurica Pall., Sasa borealis (Hack.) Makino, etc. It, however, could not identify 173 taxa, including Gentiana wootchliana W.K.Paik, Najas graminea Delile, Hemerocallis hakuunensis Nakai, Pyrrosia linear-ifolia (Hook.) Ching, Poa radula Franch. & Sav., etc., even though they were reported in the existing literature.

Rare plants

The rare plants identified in Mt. Dosolsan were 19 families, 29 genera, 29 species, two varieties, and 31 taxa, including Lilium dauricum Ker Gawl., Cypripedium macranthos Sw., Loranthus tana-kae Franch. & Sav., etc([Table 3](#page1)). Among them, two taxa of critically endangered species (CR) were identified, such as L. dauricum Ker Gawl. and Cypripedium macranthos Sw., and five taxa of endangered

Table 2. Classification of vascular plants distributed in Mt. Dosolsan.

Table 3. List of rare plants in Mt. Dosolsan.

|  |  |  |  |
| --- | --- | --- | --- |
| Family name | Scientific and Korean name | Kim et al. | Grade |
|  |  | (2014) |  |
|  |  |  |  |
| Liliaceae | Allium microdictyon Prokh. 산마늘 | B | CR |
|  | Lilium dauricum Ker Gawl. 날개하늘나리 | B |  |
| Orchidaceae | Cypripedium macranthos Sw. 복주머니란 |  |  |
| Loranthaceae | Loranthus tanakae Franch. & Sav. 꼬리겨 |  | EN |
|  | 우살이 |  |  |
| Ranunculaceae | Megaleranthis saniculifolia Ohwi 모데미 |  |  |
|  | 풀 |  |  |
| Saxifragaceae | Saxifraga octopetala Nakai 구실바위취 |  |  |
| Boraginaceae | Trigonotis radicans (Turcz.) Steven 거센 |  |  |
|  | 털꽃마리 |  |  |
| Liliaceae | Polygonatum robustum (Korsh.) Nakai 왕 |  |  |
|  | 둥굴레 |  |  |
| Dryopteridaceae | Dryopteris laeta (Kom.) C.Chr. 바위틈고 |  | VU |
|  | 사리 |  |  |
| Taxaceae | Taxus cuspidata Siebold & Zucc. 주목 |  |  |
| Paeoniaceae | Paeonia japonica (Makino) Miyabe & |  |  |
|  | Takeda 백작약 |  |  |
| Rubiaceae | Galium boreale L. 긴잎갈퀴 |  |  |
| Caprifoliaceae | Lonicera caerulea var. edulis Turcz. ex | B |  |
|  | Herder 댕댕이나무 |  |  |
| Campanulaceae | Codonopsis pilosula (Franch.) Nannf. 만 |  |  |
|  | 삼 |  |  |
|  | Hanabusaya asiatica (Nakai) Nakai 금강 | B |  |
|  | 초롱꽃 |  |  |
| Compositae | Leontopodium japonicum Miq. 왜솜다리 | B |  |
| Liliaceae | Trillium tschonoskii Maxim. 큰연영초 | B |  |
| Orchidaceae | Orchis cyclochila (Franch. & Sav.) | B |  |
|  | Maxim. 나도제비란 |  |  |
| Ophioglossaceae | Botrychium virginianum (L.) Sw. 늦고사 |  | LC |
|  | 리삼 |  |  |
| Ranunculaceae | Anemone koraiensis Nakai 홀아비바람꽃 | B |  |
|  | Clematis koreana Kom. 세잎종덩굴 | B |  |
|  | Eranthis stellata Maxim. 너도바람꽃 | B |  |
| Saxifragaceae | Rodgersia podophylla A.Gray 도깨비부채 | B |  |
| Violaceae | Viola albida Palib. 태백제비꽃 | B |  |
|  | Viola diamantiaca Nakai 금강제비꽃 | B |  |
| Primulaceae | Lysimachia coreana Nakai 참좁쌀풀 | B |  |
| Oleaceae | Syringa wolfii C.K.Schneid. 꽃개회나무 | B |  |
| Gentianaceae | Gentiana triflora var. japonica (Kusn.) H. | B |  |
|  | Hara 과남풀 |  |  |
| Labiatae | Salvia chanryoenica Nakai 참배암차즈기 | B |  |
| Valerianaceae | Patrinia saniculaefolia Hemsl. 금마타리 | B |  |
| Compositae | Parasenecio firmus (Kom.) Y.L.Chen 병풍 | B |  |
|  | 쌈 |  |  |
| Liliaceae | Allium senescens L. 두메부추 | B |  |
|  | Lilium distichum Nakai ex Kamib. 말나리 | B |  |
|  | Lloydia triflora (Ledeb.) Baker 나도개감 | B |  |
|  | 채 |  |  |
|  | Streptopus ovalis (Ohwi) F.T.Wang & | B |  |
|  | Y.C.Tang 금강애기나리 |  |  |
|  | Trillium kamtschaticum Pall. ex Pursh 연 |  |  |
|  | 영초 |  |  |
| Iridaceae | Iris ensata var. spontanea (Makino) | B |  |
|  | Nakai 꽃창포 |  |  |
| Alismataceae | Sagittaria sagittifola subsp. leucopetala | B | DD |
|  | (Mig.) Hartog 벗풀 |  |  |
|  |  |  |  |

CR, critically endangered; EN, endangered; LC, least concern; VU, vulnerable; DD, data deficient.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Taxon | Family | Genera | Species | Subspecies | Varieties | Forma | Total |
|  |  |  |  |  |  |  |  |
| Pteridophyta | 9 | 20 | 28 | 0 | 3 | 0 | 31 |
| Gymnospermae | 2 | 3 | 3 | 0 | 0 | 0 | 3 |
| Angiospermae | 80 | 273 | 424 | 4 | 47 | 7 | 482 |
| Dicotyledoneae | 70 | 215 | 333 | 4 | 37 | 5 | 379 |
| Monocotyledoneae | 10 | 58 | 91 | 0 | 10 | 2 | 103 |
| Total | 91 | 296 | 455 | 4 | 50 | 7 | 516 |
|  |  |  |  |  |  |  |  |

|  |  |
| --- | --- |
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Table 4. List of Korean endemic plants in Mt. Dosolsan.

|  |  |  |  |
| --- | --- | --- | --- |
| Family name | Scientific and Korean name | Kim et al. | This study |
|  |  | (2014) | (2017) |
|  |  |  |  |
| Salicaceae | Salix koriyanagi Kimura 키버들 |  | 0 |
| Caryophyllaceae | Pseudostellaria setulosa Ohwi 숲개별 |  | 0 |
|  | 꽃 |  |  |
| Ranunculaceae | Aconitum pseudolaeve Nakai 진범 |  | 0 |
|  | Anemone koraiensis Nakai 홀아비바 |  | 0 |
|  | 람꽃 |  |  |
|  | Clematis brachyura Maxim. 외대으 |  | 0 |
|  | 아리 |  |  |
|  | Clematis trichotoma Nakai 할미밀망 |  | 0 |
|  | Megaleranthis saniculifolia Ohwi 모 |  | 0 |
|  | 데미풀 |  |  |
| Aristolochiaceae | Asarum versicolor (K.Yamaki) |  | 0 |
|  | Y.N.Lee 무늬족도리풀 |  |  |
| Fumariaceae | Corydalis grandicalyx B.U.Oh & | 0 |  |
|  | Y.S.Kim 갈퀴현호색 |  |  |
|  | Corydalis lineariloba Siebold & Zucc. 0 | |  |
|  | 선현호색 |  |  |
|  | Corydalis maculata B.U.Oh & Y.S.Kim | 0 |  |
|  | 점현호색 |  |  |
| Crassulaceae | Sedum latiovalifolium Y.N.Lee 태백기 0 | |  |
|  | 린초 |  |  |
| Saxifragaceae | Chrysosplenium pilosum var. fulvum |  | 0 |
|  | (N.Terracc.) H. Hara 흰괭이눈 |  |  |
|  | Saxifraga octopetala Nakai 구실바위 | 0 | 0 |
|  | 취 |  |  |
| Leguminosae | Vicia chosenensis Ohwi 노랑갈퀴 | 0 |  |
| Umbelliferae | Ostericum praeteritum Kitag. 강활 |  | 0 |
| Primulaceae | Lysimachia coreana Nakai 참좁쌀풀 |  | 0 |
| Gentianaceae | Gentiana wootchliana W.K.Paik 고산 0 | |  |
|  | 구슬붕이 |  |  |
| Labiatae | Salvia chanryoenica Nakai 참배암차 | 0 |  |
|  | 즈기 |  |  |
| Scrophulariaceae | Scrophularia koraiensis Nakai 토현삼 |  | 0 |
| Caprifoliaceae | Lonicera subsessilis Rehder 청괴불나 |  | 0 |
|  | 무 |  |  |
| Valerianaceae | Patrinia saniculaefolia Hemsl. 금마타 |  | 0 |
|  | 리 |  |  |
| Campanulaceae | Adenophora racemosa J.Lee & S.Lee | 0 |  |
|  | 외대잔대 |  |  |
|  | Hanabusaya asiatica (Nakai) Nakai |  | 0 |
|  | 금강초롱꽃 |  |  |
| Compositae | Cirsium setidens (Dunn) Nakai 고려 |  | 0 |
|  | 엉겅퀴 |  |  |
|  | Ligularia fischeri var. spiciformis | 0 |  |
|  | Nakai 한대리곰취 |  |  |
|  | Saussurea calcicola Nakai 사창분취 |  | 0 |
|  | Saussurea macrolepis (Nakai) Kitam. |  | 0 |
|  | 각시서덜취 |  |  |
| Liliaceae | Heloniopsis koreana Fuse, N.S.Lee & |  | 0 |
|  | M.N. Tamura 처녀치마 |  |  |
|  | Hemerocallis hakuunensis Nakai 백 | 0 |  |
|  | 운산원추리 |  |  |
| Cyperaceae | Carex erythrobasis H.Lev. & Vaniot | 0 |  |
|  | 한라사초 |  |  |
|  |  |  |  |

Korean endemic plants

In all surveyed areas, a total of 20 taxa were found to be endemic plants of Korea which included Pseudostellaria setulosa Ohwi, Eleutherococcus divaricatus var. chiisanensis (Nakai) C.H.Kim & B.Y.Sun, Lonicera subsessilis Rehder, etc.([Table 4](#page1)). This accounts for 8.3% of the 360 endemic plant taxa ([Chung et al (2017)](#page1)). Compared to the 21 taxa reported in the existing studies ([Kim et al 2014](#page1)), this study identified additional nine taxa, including P. setulosa Ohwi, Clematis brachyura Maxim., and M. saniculifolia Ohwi. Compared with the existing studies, this study could not identify 11 taxa, including Corydalis grandicalyx B.U.Oh & Y.S.Kim, Sedum lat-iovalifolium Y.N.Lee, and Vicia chosenensis Ohwi.

Floristic special plants

Floristic special plants are a list of plants proposed to identify and determine the excellence of the natural environment and species conservation priority in a specific area or space and are classified from Class V to Class I in the order of highest to lowest conservation value by [Kim (2000)](#page1). In this study area, 130 taxa were identified in total as floristic special plants ([Table 5](#page1)). For Class V, two taxa were identified including M. saniculifolia Ohwi and L. dauricum Ker Gawl; for Class IV, 24 taxa, including Dryopteris laeta (Kom.) C.Chr., Anemone amurensis (Korsh.) Kom., Rosa davurica Pall., etc.; and for Class III, 31 taxa, including Taxus cuspidata Siebold & Zucc., Clematis koreana Kom., Scabiosa tschiliensis Gruning, etc.

Naturalized plants

Fifteen taxa of the naturalized plants were identified in this study, including Chenopodium album L., Lotus corniculatus L. and Robinia pseudoacacia L., etc([Table 6](#page1)). Among surveyed naturalized plants, two taxa of Ambrosia artemisiifolia L. and Aster pilosus Willd. were identified as ecosystem-disturbing wild plants designated by the Ministry of Environment ([Ministry of Environment 2015](#page1)). After classified by place of origin, degree of naturalization, and period of introduction according to [Lee et al (2011)](#page1), as for place of origin, seven taxa turned out to be originated from North America, ac-counting for the largest share, followed by four taxa of Europe, and three taxa of EuropeeAsia. As for degree of naturalization, 11 taxa of Class 5 were identified, including R. pseudoacacia L., etc., and ac-counting for the largest share and for period of introduction, 9 taxa of Stage 1 were identified, followed by 1 taxa of Stage 2 and 5 taxa of Stage 3, respectively. According to the analysis of NI and UI proposed by [Yim and Jeon (1980)](#page1), NI was 2.9% and UI was 4.7%, which appeared to be quite lower than the average NI of 10.3 ([Koh](#page1) [et al 1995](#page1)).

Useful plants

species (EN), such as L. tanakae Franch. & Sav., Megaleranthis sani-culifolia Ohwi, and Saxifraga octopetala Nakai, were identified. In addition, as vulnerable species (VU), seven taxa were identified, including Dryopteris laeta (Kom.) C.Chr., Taxus cuspidata Siebold & Zucc., and Paeonia japonica (Makino) Miyabe & Takeda, etc., seven taxa, including least concerned (LC) Botrychium virginianum (L.) Sw., Anemone koraiensis Nakai, Gentiana triflora var. japonica (Kusn.) H. Hara, etc., were identified.

Compared to the existing literature ([Kim et al., 2014](#page1)), this study identified additional 13 taxa, including Trigonotis radicans (Turcz.) Steven, L. tanakae Franch. & Sav., and M. saniculifolia Ohwi. It, however, could not identify seven taxa, including Orchis cyclochila (Franch. & Sav.) Soo, Lonicera caerulea var. edulis Turcz. ex Herder, Allium senescens L., etc.

After classified according to the economic value standards of useful plants ([Lee, 1976](#page1)), the 519 taxa of vascular plants identified in this study appeared to include 193 taxa for food (37.2%), followed by 184 taxa for grass (35.5%), 151 taxa for medicinal use (29.1%), 57 taxa for ornamental purpose (11%), two taxa for timber purposes (4.2%), 14 taxa for dye (2.7%), three taxa for fiber (0.6%), and two taxa for industrial use (0.4%). 132 taxa of plants (25.4%) appeared to have no identified use([Table 7](#page1)).

Discussion

As for vascular plants in Mt. Dosolsan, located in the DMZ Civilian Control Line situated in Yanggu-gun, Gangwon-do, total 91 families, 296 genera, 455 species, four subspecies, 50 varieties,

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
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| Table 5. List of floristic special plants in Mt. Dosolsan. | |  |  | Table 6. List of naturalized plants in Mt. Dosolsan. | | | | | | |  |  |  |  |  |  |
|  |  |  |  |  |  |  | | | |  |  |  |  |  |  |  |
| Family name | Scientific and Korean name | Grade | |  | Family name | Scientific and Korean name | | | |  |  | Origin | N.D. | | Int.-p. |  |
|  |  |  |  |  |  | | | | | |  |  |  |  |  |  |
| Ranunculaceae | Megaleranthis saniculifolia Ohwi 모데미풀 | V | |  | Chenopodiaceae Chenopodium album L. 흰명아주 | | | | | |  | Eu-As | 5 |  | 1 |  |
| Liliaceae | Lilium dauricum Ker Gawl. 날개하늘나리 |  |  |  | Leguminosae | Lotus corniculatus L. 서양벌노랑이 | | | | |  | Eu | 1 |  | 3 |  |
| Dryopteridaceae | Dryopteris laeta (Kom.) C.Chr. 바위틈고사리 | IV | |  |  | Robinia pseudoacacia L. 아까시나무 | | | | |  | nA | 5 |  | 1 |  |
| Ulmaceae | Ulmus macrocarpa Hance 왕느릅나무 |  |  |  |  | Trifolium repens L. 토끼풀 | | | |  |  | Eu-Af | 5 |  | 1 |  |
| Loranthaceae | Loranthus tanakae Franch. & Sav. 꼬리겨우살이 |  |  |  | Onagraceae | Oenothera biennis L. 달맞이꽃 | | | | |  | nA | 5 |  | 1 |  |
| Ranunculaceae | Anemone amurensis (Korsh.) Kom. 들바람꽃 |  |  |  | Compositae | Ambrosia artemisiifolia L. 돼지풀 | | | | |  | nA | 5 |  | 2 |  |
|  | Anemone koraiensis Nakai 홀아비바람꽃 |  |  |  |  | Aster pilosus Willd. 미국쑥부쟁이 | | | | |  | nA | 5 |  | 3 |  |
|  | Anemone reflexa Steph. &Willd. 회리바람꽃 |  |  |  |  | Bidens frondosa L. 미국가막사리 | | | | |  | nA | 5 |  | 3 |  |
| Saxifragaceae | Rodgersia podophylla A.Gray 도깨비부채 |  |  |  |  | Carduus crispus L. 지느러미엉겅퀴 | | | | |  | Eu-As | 3 |  | 1 |  |
| Rosaceae | Rosa davurica Pall. 생열귀나무 |  |  |  |  | Conyza canadensis (L.) Cronquist 망초 nA | | | | | | | 5 |  | 1 |  |
|  | Sorbus amurensis Koehne 당마가목 |  |  |  |  | Erigeron annuus (L.) Pers. 개망초 | | | | |  | nA | 5 |  | 1 |  |
|  | Waldsteinia ternata (Stephan) Fritsch 나도양지꽃 |  |  |  |  | Erigeron strigosus Muhl. 주걱개망초 | | | | | | Eu | 2 |  | 3 |  |
| Leguminosae | Trifolium lupinaster L. 달구지풀 |  |  |  |  | Hieracium caespitosum Dumort. | | | | |  | Eu | 1 |  | 3 |  |
| Aceraceae | Acer pictum subsp. mono (Maxim.) Ohashi |  |  |  |  | 유럽조밥나물 | | |  |  |  |  |  |  |  |  |
|  | 고로쇠나무 |  |  |  |  | Taraxacum officinale Weber | | | |  |  | Eu | 5 |  | 1 |  |
|  | Acer tegmentosum Maxim. 산겨릅나무 |  |  |  |  | 서양민들레 | |  |  |  |  |  |  |  |  |  |
| Umbelliferae | Aegopodium alpestre Ledeb. 왜방풍 |  |  |  | Gramineae | Dactylis glomerata L. 오리새 | | | |  |  | Eu-As | 5 |  | 1 |  |
| Primulaceae | Lysimachia coreana Nakai 참좁쌀풀 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | N.D., naturalized degree; Int.-p., introduced period; Eu-As, Europe-Asia; Eu, Europe; | | | | | | | | | | | |  |
| Oleaceae | Syringa wolfii C.K.Schneid. 꽃개회나무 |  |  |  |
|  |  | nA, north America; Eu-Af, Europe-Africa. | | | | |  |  |  |  |  |  |  |  |
| Rubiaceae | Galium boreale L. 긴잎갈퀴 |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Caprifoliaceae | Lonicera chrysantha Turcz. 각시괴불나무 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Campanulaceae | Codonopsis pilosula (Franch.) Nannf. 만삼 |  |  | Table 7. Usefulness of vascular plants in Mt. Dosolsan. | | | | | | |  |  |  |  |  |  |
|  | Hanabusaya asiatica (Nakai) Nakai 금강초롱꽃 |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Compositae | Leontopodium japonicum Miq. 왜솜다리 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | Use | E | P | M | O | T | S | F | R | | U |  |
|  | Parasenecio firmus (Kom.) Y.L.Chen 병풍쌈 |  |  |  |  |
|  | Saussurea calcicola Nakai 사창분취 |  |  |  | Taxa (No.) | 193 | 184 | 151 | 57 | 22 | 14 | 3 | 2 |  | 132 |  |
| Orchidaceae | Cypripedium macranthos Sw. 복주머니란 |  |  |  |  |  |
|  |  |  | Ratio (%) | 37.2 | 35.5 | 29.1 | 11 | 4.2 | 2.7 | 0.6 | 0.4 |  | 25.4 |  |
| Ophioglossaceae | Botrychium virginianum (L.) Sw. 늦고사리삼 | III | |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| E: edible, P: pasture, M: medicinal, O: ornamental, T: timber, S: stain, F: fiber, R: | | | | | | | | | | | |  |
| Taxaceae | Taxus cuspidata Siebold & Zucc. 주목 |  |  |  |
| Salicaceae | Populus maximowiczii A.Henry 황철나무 |  |  | industrial raw material, U: unknown use. | | | | |  |  |  |  |  |  |  |  |
| Ulmaceae | Ulmus davidiana Planch. 당느릅나무 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Ranunculaceae | Clematis koreana Kom. 세잎종덩굴 |  |  | population due to the risk of suppression of herbaceous plants, | | | | | | | | | | | |  |
|  | Eranthis stellata Maxim. 너도바람꽃 |  |  |  |
| Crassulaceae | Meterostachys sikokiana (Makino) |  |  | including Miscanthus sinensis, etc. M. saniculifolia Ohwi classified as | | | | | | | | | | | |  |
| Saxifragaceae | Nakai 난쟁이바위솔 |  |  | endangered species (EN) were identified to be distributed as a large | | | | | | | | | | | |  |
| Chrysosplenium pseudofauriei H.Lev. 선괭이눈 |  |  | colony in the valley part of the east-facing slope of the Mt. Dos- | | | | | | | | | | | |  |
| Rosaceae | Filipendula palmata (Pall.) Maxim.단풍터리풀 |  |  |  |
|  |  | olsan. Even though the natural habitats of M. saniculifolia Ohwi are | | | | | | | | | | | |  |
|  | Potentilla centigrana Maxim. 좀딸기 |  |  |  |
|  | Sorbaria sorbifolia var. stellipila Maxim. 쉬땅나무 |  |  | not trails, the population therein is decreasing a bit due to damage | | | | | | | | | | | |  |
|  | Spiraea chamaedryfolia L. 인가목조팝나무 |  |  | and over collection by increasing herb gatherers and mineral spring | | | | | | | | | | | |  |
|  | Spiraea chinensis Maxim. 당조팝나무 |  |  | users/visitors. It is deemed that M. saniculifolia Ohwi should be | | | | | | | | | | | |  |
|  | Spiraea fritschiana C.K.Schneid. 참조팝나무 |  |  |  |
|  |  |  | thoroughly preserved, by installing guide signs, such as entry fence, | | | | | | | | | | | |  |
| Aceraceae | Acer barbinerve Maxim. 청시닥나무 |  |  |  |
|  | Acer komarovii Pojark. 시닥나무 |  |  | etc., in their natural habitats. Some of L. dauricum Ker Gawl., a | | | | | | | | | | | |  |
| Violaceae | Viola diamantiaca Nakai 금강제비꽃 |  |  | endangered species designated by the Ministry of Environment | | | | | | | | | | | |  |
| Umbelliferae | Angelica gigas Nakai 참당귀 |  |  | were identified to grow naturally on the ridge of Mt. Dosolsan as | | | | | | | | | | | |  |
| Oleaceae | Syringa reticulata var. mandshurica (Maxim.) H. |  |  | specified in the existing literature ([Kim et al 2014](#page1)). The trails on the | | | | | | | | | | | |  |
|  | Hara 개회나무 |  |  |  |
|  |  |  | top of Mt. Dosolsan are controlled by military units. However, as the | | | | | | | | | | | |  |
| Boraginaceae | Trigonotis radicans (Turcz.) Steven 거센털꽃마리 |  |  |  |
| Scrophulariaceae | Scrophularia koraiensis Nakai 토현삼 |  |  | natural habitats of L. dauricum Ker Gawl., are exposed to the risk of | | | | | | | | | | | |  |
| Caprifoliaceae | Lonicera tatarinowii var. leptantha (Rehder) |  |  | threats or damage due to recently increasing vegetable gatherers | | | | | | | | | | | |  |
|  | Nakai 흰괴불나무 |  |  | and hikers, trail boundaries, or guide signs should be installed to | | | | | | | | | | | |  |
|  | Lonicera vesicaria Kom. 구슬댕댕이 |  |  |  |
|  |  |  | preserve the natural habitats. 15 taxa of naturalized plants were | | | | | | | | | | | |  |
| Dipsacaceae | Scabiosa tschiliensis Gruning 솔체꽃 |  |  |  |
|  |  | surveyed including C. album L., etc. and NI and UI appeared to be | | | | | | | | | | | |  |
| Compositae | Cirsium schantarense Trautv. & Mey. 도깨비엉겅퀴 |  |  |  |
| Liliaceae | Lloydia triflora (Ledeb.) Baker 나도개감채 |  |  |  | 2.9% and 4.7%, respectively. Among them, 2 taxadAmbrosia arte- | | | | | | | | | | |  |
|  | Maianthemum bifolium (L.) F.W.Schmidt 두루미꽃 |  |  |  | misiifolia L. and | | Aster | pilosus | Willd.dwere | | | identified | | | as the |  |
|  | Trillium kamtschaticum Pall. ex Pursh 연영초 |  |  |  | ecosystem-disturbing wild plants designated by the Ministry of | | | | | | | | | | |  |
|  | Veratrum maackii Regel 긴잎여로 |  |  |  |  |
|  |  |  |  | Environment. The number of naturalized plants surveyed in this | | | | | | | | | | |  |
| Araceae | Symplocarpus nipponicus Makino 애기앉은부채 |  |  |  |  |
| Cyperaceae | Carex phacota Spreng. 비늘사초 |  |  |  | study appeared to be smaller compared to the existing literature | | | | | | | | | | |  |
|  |  |  |  |  | ([Kim et al 2014](#page1))). This difference is deemed caused by differences in | | | | | | | | | | |  |
|  |  |  |  |  |
|  |  |  |  |  | survey areas or time. Most of the naturalized plants in Mt. Dosolsan | | | | | | | | | | |  |
| seven forma, and 516 taxa were identified. Among them, 31 taxa of | | | |  | were identified to be distributed in the old Dolsallyeong roads and | | | | | | | | | | |  |
| rare plants appeared including L. tanakae Franch. & Sav., etc., and 20 | | | |  | entrance of the trail of Mt. Dosolsan. Mt. Dosolsan is a nearby | | | | | | | | | | |  |
| taxa of endemic plants were distributed, including Pseudostellaria | | | |  | mountain area including Punch Bowl Dulle-gil recently established | | | | | | | | | | |  |
| setulosa Ohwi, etc. Among them, L. tanakae Franch. & Sav., classified | | | |  | in the whole area of Punchbowl-ro, Haean-myeon, Yanggu-gun. | | | | | | | | | | |  |
| as rare plants were identified to be distributed in a small amount | | | |  | Accordingly, as the area is exposed to the risk of inflow and | | | | | | | | | | |  |
| near the DMZ Botanic Garden on the north-facing slope of Mt. | | | |  | spread of naturalized plants due to recently increasing vegetable | | | | | | | | | | |  |
| Dosolsan. |  |  |  |  | gatherers and visitors, population increase and spread, etc. should | | | | | | | | | | |  |
| Three individuals of Cypripedium macranthos Sw. were distrib- | | | |  | be closely monitored. | | |  |  |  |  |  |  |  |  |  |
| uted in the north-facing slope of Mt. Dosolsan; they need to be | | | |  | Although this study showed no significant difference in the | | | | | | | | | | |  |
| protected, such as by transplantation to alternative habitats of the | | | |  | number of taxa to those reported by [Kim et al (2014)](#page1), some species | | | | | | | | | | |  |

|  |  |
| --- | --- |
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were found to be different. In this study, 69 species of northern plants were distributed among them is Trifolium lupinaster L. The plants are known to be distributed in Jeju island, but in this study, they were distributed in Mt. Dosolsan ridge part, and it was confirmed that Prunus salicina Lindl., which is the basic species of Prunus salicina Lindl. is distributed in valley area of north side in Mt. Dosolsan. The Prunus salicina Lindl. is an unrecorded species in Korea, its conservation measures should be ensured for conserva-tion of native habitats. Polygonatum robustum (Korsh.) Nakai on the other hand is known to be distributed in Ulleung island, but in this study, some individuals were distributed in the valley area of northeast side in Mt. Dosolsan. It will be necessary to identify and confirm the additional habitats in the future.

Along with Mt. Daeamsan, Mt. Dosolsan is a plant-geographically very important area where northern plants and southern plants coexist. In addition, Mt. Dosolsan is a plant-geographically very important area where a number of rare plants and endemic plants designated by the Korea Forest Service are distributed, such as M. saniculifolia Ohwi, S. octopetala Nakai, Hanabusaya asiatica (Nakai) Nakai, etc. Also, Mt. Dosolsan has numerous areas with restricted access as it is located in the Civilian Control Line and military zone. Therefore, many important plants, not yet identified, should be explored and preserved by expanding the survey scope through efficient cooperation with military units in the future.

Conflicts of interest

The authors declare that there is no conflicts of interest.

Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.japb.2018.02.008>.

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