

The Report on the Taxonomic Characters, Ecological Risk and Weed Risk Assessment of Putative Invasive Alien Plants which are Designated in Law by the Ministry of Environment in Korea as Environmentally Harmful Species (IV)

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Abstract - We performed taxonomic reviews and habitat circumstances survey for 41 un-introduced environmentally harmful plants (as designated by the Ministry of Environment, Korea in 2016). And we investigated plant specimens from several herbaria and performed a field survey in the southeastern region of the United States. Based on the result, we presented the most comprehensive results of weed risk evaluation and taxonomic description up to now as well as classification keys for 11 species to apply the regulation management of putative invasive alien species - *Senecio madagascariensis* Poir., *Sphagneticola trilobata* (L.) Pruski, *Ageratina riparia* (Regel) R.M. King & H. Rob. (Asteraceae), *Andropogon gayanus* Kunth (Poaceae), *Echinocystis lobata* (Michx.) Torr. & A. Gray (Cucurbitaceae), *Salvinia minima* Baker (Salviniaceae), *Vincetoxicum rossicum* (Kleopow) Barbar. (Asclepiadaceae), *Asparagus asparagoides* (L.) Druce (Asparagaceae), *Alternanthera pungens* Kunth (Amaranthaceae), *Salpichroa organifolia* (Lam.) Thell., and *Lycium ferocissimum* Miers (Solanaceae).

Key words – Invasive alien species, Putative invasive alien plants, Taxonomic characters, Weed risk assessment

Introduction

The characteristics of species are the result of evolutionary adaptations occurring over many thousands of generations. There are more than 350,000 species of plants worldwide, and also nearly 4,000 indigenous plants to Korea are well adapted to various ecological environments. The importance of biodiversity is well recognized and largely considered an essential factor for human activities as a facilitator of sustainable development. Since the start of the 20th century, the Invasive Alien Species (IAS) have been a key factor affecting biodiversity and ecosystem services (IUCN, 2010). They are possible threats to biodiversity and ecosystem stability and widely held to be responsible for the decline of native species richness and the local extinction of certain

species. In addition to their deleterious impact on biodiversity, the IAS also negatively impact human communities and economies (Gaertner *et al.*, 2009; Hulme, 2009; IUCN, 2014; Pimentel *et al.*, 2005).

Invasive species such as plants, animals, disease agents and other organisms taken beyond their natural range by people, deliberately or unintentionally become destructive to the environment or human livelihoods. The term ‘Invasive alien plants’ that we use in this study is defined as taxa including seeds, roots, rhizomes and stolons listed by the Korean government as the possible causes of serious environmental risk in Korea.

There are 41 species designated as putative invasive alien plants by the Ministry of Environment in 2016 (Ministry of Environment notification 2016-113, 2016), which were caused serious environmental problems in countries with similar climates (Palearctic temperate climate) and environments or

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that are viable and have potential risk in the natural ecosystem upon invade into Korea.

There is a rapidly increasing rate of invasive plants in Korea [for example, 110 species of invasive plants in 1980 (Yim and Jeon, 1980), 181 species in 1995 (Park, 1995), 292 species in 2003, 303 species in 2007, 321 species in 2011 (Korea National Arboretum, 2012) and 334 species in 2019 (National Institute of Ecology, 2019)]. In Korea, various acts and plans put in place by the Ministry of Environment have been designed to protect biodiversity by 1) enhancing invasive alien species control system, 2) expanding conservation regions, and 3) making lists of national biological resources including endangered species (Ministry of Environment, 2014; Ministry of Environment *et al.*, 2017; National Institute of Ecology, 2019). These alien plants have been found all over the South Korea, from Jeju Island to DMZ, Gangwon Province (Kim *et al.*, 2006; NamGung *et al.*, 2019; Sun *et al.*, 2020).

Based on the patterns, characteristics, and status of ecological and agricultural risks that were caused by introduced harmful plants, it is necessary to conduct a technical field survey of putative invasive alien plants and to find out their characteristics and strategy to remove them immediately if introduced. The most important approach is to prevent the inflow of potentially invasive alien species on the border through a strict quarantine process up to now. On the circumstance of global climate change, annual average temperature in Korea has been rising during a hundred years as +0.18°C /10 year (National Institute of Meteorological Sciences,

2018). As a temperate climate region country, annual average temperature of Korean peninsula was 14.1°C in recent 10 years (2011~2017; National Institute of Meteorological Sciences, 2018), and annual precipitation was 1,332 mm (1971~2013) including heavy monsoon in summer (Ministry of Environment, 2015). This study considered climate similarity with several temperate region in USA and Australia which numerous alien plants have been invaded.

This research was conducted as preliminary study for preventing invasive alien species before they cross the border that could be a less cost - high effect method on Korean biosecurity. Then, the main goal of this study is to provide useful basic information of putative invasive alien species in Korea which have been designated as harmful species by the Ministry of Environment in 2016 to prepare the management strategy for prevention. Also we present a detailed taxonomic information including descriptions and keys, agricultural and environmental risk assess analysis of 11 putative invasive alien plant species.

Materials and Methods

To figure out of the putative invasive alien plants of Korea, we investigated the literature, specimens, and other information to suggest a comprehensive reference including seeds morphology. We conducted the field survey of putative invasive alien plants in the southeastern region of the Australia from 15th to 23th of February, 2019 including Melbourne,

Table 1. Investigated plants list in this study

No.	Scientific Name (Korean name by National Institute of Ecology)	Family Name
1	<i>Senecio madagascariensis</i> Poir. (갯솜방망이)	
2	<i>Sphagneticola trilobata</i> (L.) Pruski (미국갯금볼초)	Asteraceae
3	<i>Ageratina riparia</i> (Regel) R.M. King & H. Rob. (강변등골나물)	
4	<i>Andropogon gayanus</i> Kunth (아프리카나도솔새)	Poaceae
5	<i>Echinocystis lobata</i> (Michx.) Torr. & A. Gray (야생오이)	Cucurbitaceae
6	<i>Salvinia minima</i> Baker (좀생이가래)	Salviniaceae
7	<i>Vincetoxicum rossicum</i> (Kleopow) Barbar. (개줄덩굴)	Asclepiadaceae
8	<i>Asparagus asparagoides</i> (L.) Druce (아프리카밀나물)	Asparagaceae
9	<i>Alternanthera pungens</i> Kunth (가시땅비름)	Amaranthaceae
10	<i>Salpichroa organifolia</i> (Lam.) Thell. (덩굴가지)	
11	<i>Lycium ferocissimum</i> Miers (아프리카구기자)	Solanaceae



Fig. 1. Photographs of field survey.

Sydney, Canberra and Brisbane. Through the habitat survey to inquiry the distribution status, ecological characteristics, and weed-risk assessments. The weed-risk assessments was based on an evaluation sheet (Animal and Plant Quarantine Agency notification 2016-68, 2016). This study surveyed eleven of the 41 putative invasive alien species are presented along with descriptions of their natural habitat and taxonomic key with diagnostic characters : *Senecio madagascariensis* Poir., *Sphagneticola trilobata* (L.) Pruski, *Ageratina riparia* (Regel) R.M. King & H. Rob. (Asteraceae), *Andropogon gayanus* Kunth (Poaceae), *Echinocystis lobata* (Michx.) Torr. & A. Gray (Cucurbitaceae), *Salvinia minima* Baker (Salviniaceae), *Vincetoxicum rossicum* (Kleopow) Barbar. (Asclepiadaceae), *Asparagus asparagoides* (L.) Druce (Asparagaceae), *Alternanthera pungens* Kunth (Amaranthaceae), *Salpichroa origanifolia* (Lam.) Thell., *Lycium ferocissimum* Miers (Solanaceae) (Table 1, Fig. 1).

We prepared the photograph of investigated species and habitat. Also we observed the dried voucher specimens from several herbaria in US including UT (Austin), UNC (Chapel-Hill), USNH (Washington DC), UF (Gainesville) and etc.

Results and Discussion

The following information of 11 species are written based on description provided by Kim (2020).

***Senecio madagascariensis* Poir., Encycl. [J. Lamarck & al.] Suppl. 5. 130 (1817)**

Korean Name : Gaet-som-bang-mang-i (갯솜방망이; National Institute of Ecology, 2020)

Common Name : Fireweed, Madagascar ragwort, Madagascar fireweed, warible groundsel

Taxonomic description and distribution characteristics

Taxonomic description: A short-lived perennial, annual or biennial herb. Stem erect, usually 0.1~0.5 m; up to 0.7 m tall, arising from a shallow taproot. Leaves sessile, becoming auriculate upwards, undivided, narrow-elliptic to linear or rarely with 1~3 coarse teeth on each side, mostly 3~10 cm long up to 12 cm, up to 2.5 cm wide; margins denticulate. Inflorescences of 2 - 20 capitula; capitula radiate; involucre campanulate, (7~)12~25 mm wide; bracts ca. 20; bracteoles present. Ray florets ca. 13, yellow, ligules 8~14 mm long; disc florets 80 - 150, yellow. Flowers and fruits year-round, commonly in April to September, especially flowers bloom in spring, Fruits in late spring. 50~150 achenes in a flower. Cypselas cylindric, 1.5 - 2.2 mm long, with flattened ribs, papillose hairs in bands; pappus of slender hairs 3 - 5 mm long (Fig. 2). Chromosome number $2n=20$ in Australia, rarely $n=20$ in Argentina.

Growing conditions: In South Africa, native to the country of origin, it appears to grow well in the wastelands, among which it grows better in the well drilled and rich soil.

Origin: This species is native to South Africa (Cape, Nakal, Kranes) and Madagascar.

Invaded areas: Since its accidental introduction in the 19th century, this species spread rapidly to southeastern Australia and Argentina, and has also been naturalized in Hawaii and Japan.

Current state of designations: This species is designated as a Invasive Alien Species (IAS) in Japan and United States, and also designated as a Toxic Weed in Hawaii. It is included

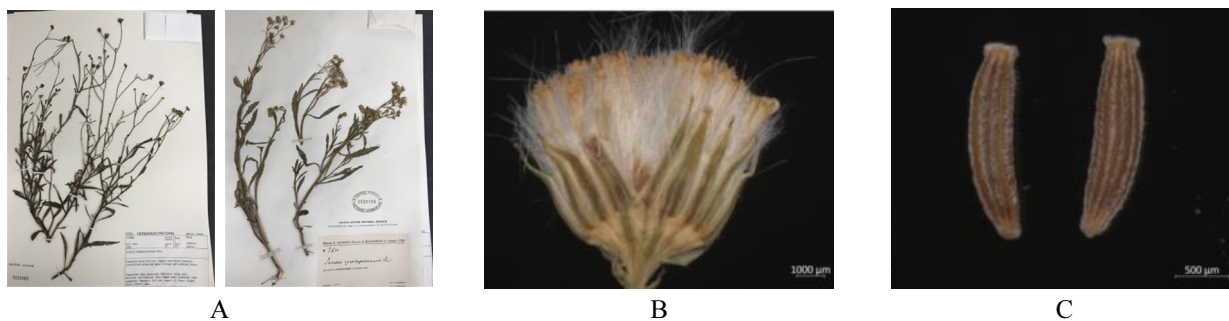


Fig. 2. Details of *Senecio madagascariensis*. A: Herbarium specimen, B: Capitulate fruits, C: Achenes.

in the Reject List in Australia.

Specimens observed

[United States National Herbarium] 1529101 (L. H. Humbert, 1928.. Madagascar) 32414122 (D. P. Phillipson, 1990. 2. 22. Madagascar)

Key compared with Korean similar species (Korean name)

1. Capitula with only tubular flowers
..... *S. vulgaris* (개쭈갓)
1. Capitula with both tubular and ray flowers 2
2. Inflorescences umbel
..... *S. integrifolius* var. *spathulatus* (솜방망이)
2. Inflorescences corymb 3
3. Leaves pinnatisect to pinnatipartite, achenes glabrous ·
..... *S. argumensis* (쭈방망이)
3. Leaves not lobed, achenes pubescent
..... *S. madagascariensis* (갯솜방망이)

Harmfulness and characteristics of weeds

This species produces an acrolid toxin in every part of the plant called pyrrolizidine, causing damage to the liver and nervous system of livestock. It produces an average of 1,000 seeds per each plant. It can be easily reproduced by nutrient breeding or plant cutting under natural conditions. The growth period required for seed production is less than a year. It can be spread by the wind and through attachment and movement of people or livestock. If this plants would be introduced in Korea, it is possible to spread throughout the central and southern regions except for parts of mountainous areas in Gangwon and North Gyeongsang provinces.

Weed risk assessment

By the result of weed risk assessment criteria (Animal and Plant Quarantine Agency in Korea), degree of risk is 70.5% (Table 2). We suggest that this species could be treated as an need to be controlled weed.

Sphagneticola trilobata (Linnaeus) Pruski, Mem. New York Bot. Gard. 78: 114 (1996)

Korean Name : Mi-guk-gaet-geum-bul-cho (미국갯금불초; National Institute of Ecology, 2020)

Common Name : Creeping ox-eye, singapore daisy, trailing daisy, wedelia.

Taxonomic description and distribution characteristics

Taxonomic description: A creeping, mat-forming perennial herb; 15~30 cm, up to 70 cm tall, climbing a short distance up trees or over other vegetation. Stem rounded and solid; few hairs, rooting at the nodes; the flowering portions erect. Opposite phyllotaxis, Leaves fleshy, subglabrous, usually 5~18 cm long, 1.5~8 cm wide, irregularly toothed or serrate. Capitula flowers solitary, peduncles 3~10 cm long; involucre campanulate-hemispherical, ca. 10~15 mm high; chaffy bracts lanceolate, rigid; ray florets often 8~13 per head, rays 6~15(20) mm long with finely toothed tips; disk corollas 3.5~6 mm long; yellow-orange. Flowers and fruits year-round. Achenes tuberculate, brown-black, 5 mm long. Pappus a crown of short fimbriate scales (Fig. 3). Chromosome number 2n=60.

Growing conditions: Generally coastal plants, but well-grown on low-lying roadsides or slopes, waste land and arable land, natural grasslands and wastelands within 700 meters above sea level. has a very wide ecological tolerance range, and seems to be equally suited to dry and moist sites, and can

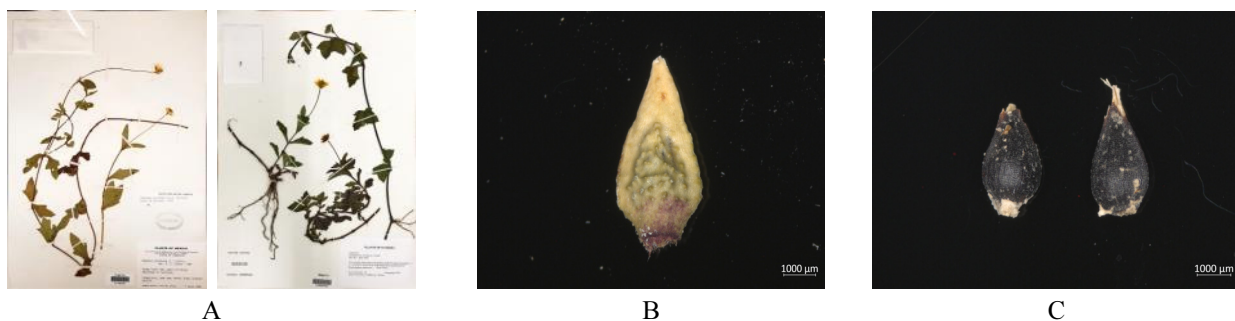


Fig. 3. Details of *Sphagneticola trilobata*. A: Herbarium specimen, B: Achene, C: Seeds.

grow even during dry periods. It seems to prefer and do best in sunny sites, but it survives very well in shady sites.

Invaded areas: This species has been introduced in the United States (including Hawaii), Australia (Queensland, New South Wales), Colombia, Costa Rica, Ecuador, Europe (Germany, Spain), Asia (Japan, China, Hong Kong, Taiwan, Singapore, Indonesia, Sri Lanka), Fiji and Guam.

Current state of designations: This species is one of the 100 of the world's worst invasive alien species designated by IUCN and is listed on the Global Invasive Species Database (GISD). In the United States, the Florida Extra Special Plant Fest Council designates Category II intrusions. Queensland, Australia, also handles major environmental weeds.

Specimens observed

[United States National Herbarium] 3482632 (K. M. Redden, 2002. 7. 24. Costa Rica) 3659539 (W. C. Allen, 2012. 9. 8. United States) 3362101 (R. M. King, 1998. 3. 20. United States)

Key compared with Korean similar species (Korean name)

- 1. Leaves not 3-lobed 2
- 2. Leaf margin serrate, pappus of fused scales, coroniform - *Wedelia prostrata* (갯금불초)
- 2. Leaf margin entire, sparsely mucronulate-serrulate, pappus obscure, sometimes cup-shaped
..... *Wedelia chinensis* (긴갯금불초)
- 1. Leaves 3-lobed, pappus of fused scales, coroniform
..... *Sphagneticola trilobata* (미국갯금불초)

Harmfulness and characteristics of weeds

This species is spreading more easily because it is useful as a

aromatic, ground-cover plants. it escapes from the garden and quickly spread to roadside and vegetation, covering the ground and encroaching on other plant species. In natural conditions, it produces an average of 1,000 seeds per individual. Seeds appear to remain in the soil for more than five years. But seed production is low and generally does not reproduce prolifically via seed. It can be easily reproduced by vegetative reproduction, that new plants arise from nodes that root at the soil surface. The growth period required for seed production is less than a year. It can be spread by people, intentionally and unintentionally, through things in gardens, etc. and naturally spread by livestock or other animals. If this plants would be introduced in Korea, it is possible to spread warm areas on southern parts of peninsula and the coast of Jeju Island.

Weed risk assessment

By the result of weed risk assessment criteria (Animal and Plant Quarantine Agency in Korea), degree of risk is 62% (Table 2). We suggest that this species could be treated as an need to be controlled weed.

***Ageratina riparia* (Regel) R.M. King & H. Rob., Phytologia 19: 216 (1970)**

Korean Name : Gang-byeon-deung-gol-na-mul (강변등골나물; National Institute of Ecology, 2020)

Common Name : Mistflower, Creeping crofton weed, Hamakua pamakani (Hawaii), Cat’s paw, Catspaw, River eupatorium, White weed, William Taylor, Spreading snakeroot

Taxonomic description and distribution characteristics

Taxonomic description: A perennial herb or low-growing shrub; 40~60 cm up to 1 m tall. Numerous stems relatively weak, often reddish or purplish, sparsely pubescent; lower branches produce roots at nodes; Branches decumbent or ascending. Opposite phyllotaxis, petioles 5~15 mm long; narrowly-ovate or lanceolate, prominently veined; Leaves 3~15 cm long and 0.8~4 cm wide, glabrous, acute apices, serrated. Capitula flower small and white, tubular florets surrounded by greenish bracts 4~5 mm long; Tiny tubular florets white, ca. 5 mm long. Several of these flower-heads into terminal corymbose inflorescences. Flowers in August to October (late winter to late spring in Australia). Fruits in August to November. Achenes slender, blackish-brown, 1~2 mm long, 4~5 hairy ridges longitudinally, pappus, several larger whitish hairs 3~4 mm long (Fig. 4). Chromosome number $2n=51(3n; n=17)$

Growing conditions: Generally grown in humid or wet areas of tropical and subtropical regions. It spreads rapidly in waterways, lakes, ponds, riversides, waste lands, pasture lands, rain forests, and forest edges.

Origin: This species is native to tropical and subtropical regions of North America, Central America, and South America, including Mexico, Cuba and Jamaica.

Invaded areas: This species was introduced into the South Africa, tropical Asia, Australia and New Zealand, Hawaii, Peru and Sri Lanka.

Current state of designations: In the United States, federal or state governments within Hawaii listed this species on toxic weeds, seeds for removal and control. Australia's Queensland state is included this in the list of 25 invasive weeds.

Specimens observed

[U. of Texas Herbarium] 00208981 (H.L. & A. L. Moldenke, 1974. 1. 29. Sri Lanka) [United States National Herbarium] 2410539 (L. N. H. Krauss, 1963. Portugal)

Key compared with Korean similar species (Korean name)

1. Phyllaries 1-seriate, leaf blade cordate, broadly ovate ·
..... *A. altissima* (서양등골나물)
1. Phyllaries 2-seriate, leaf blade lanceolate, ovate-lanceolate
..... *A. riparia* (강변등골나물)

Harmfulness and characteristics of weeds

It was introduced for landscaping and gardening and is also cultivated for the ground-cover on slopes for soil stability and for fertilizer. A single individual rapidly creates clusters through its roots. It can produce 10,000 to 100,000 seeds a year, easily dispersed by wind and readily float on water, attached to animals, clothing, machinery, or contaminated agricultural produce. If this plants would be introduced in Korea, it is possible to spread in warm areas below 800 meters above sea level with an average annual temperature of 16.9°C on Jeju Island.

Weed risk assessment

By the result of weed risk assessment criteria (Animal and Plant Quarantine Agency in Korea), degree of risk is 46% (Table 2). We suggest that this species could be treated as an ordinary weed.

Andropogon gayanus Kunth, Revis. Gramin. I. 163 (1829)

Korean Name : Africa-na-do-sol-sae (아프리카나도솔새);

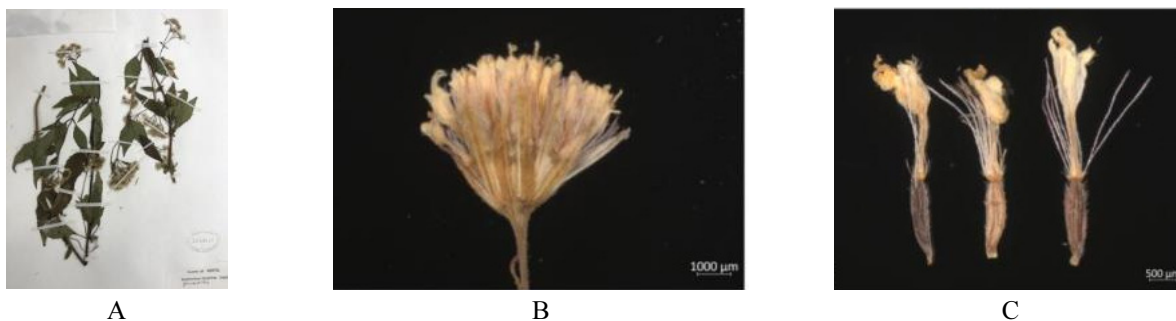


Fig. 4. Details of *Ageratina riparia*. A: Herbarium specimen, B: Capitulae, C: Cypselae.

National Institute of Ecology, 2020)

Common Name : Gamba grass, Bluestern, Rhodesian andropogon, Rhodesian bluegrass, Tambuki grass

Taxonomic description and distribution characteristics

Taxonomic description: A very large, perennial grass; usually 1.5~2.5 m, up to 4 m tall. Forms large, dense, tussocks up to 1 m across. Erect culms, stem robust, relatively fine pubescent; short creeping rhizomes and internodes, branch readily. Lamina up to 1 m long, 1.5~5 cm wide; prominent midrib; entire margins; The leaf sheath pubescent, acute apex; membranous ligule. Synflorescence up to 6 groups of branches, each 2~18 small branches; branches filiform, 5~8 cm long, spatheoles 6~8 cm long, end in elongated racemes pairs; Raceme clusters 4~9 cm long, ca. 10~14 joints, each node hairy flower spikelets; The flower spikelets sessile or 4~5 mm long pedicel; The stalkless or sessile spikelet 7~9 mm long, bisexual, 1~4 cm long, bent and twisted awn; The stalked or pedicellate spikelet 5~8 mm long, unisexual and sterile, 1~10 mm long straight and relatively small awn. Flowers in April to August (autumn to winter in Australia). Fruits in April to August (autumn to winter in Australia). Caryopsis light brown, brownish-black; ca. 2~3 mm long, 1 mm wide, enclosed in a pair of inner palea, lemma and outer glumes (Fig. 5). Chromosome number 2n=20.

Growing conditions: Generally grown in low-lying tropical or subtropical regions, especially in interfermented, overgrown, or natural grasslands. it is well invading various conditions along the banks of the roadside or waterway.

Origin: This species is mainly distributed in the Sahara region of Africa including Sudan, Tanzania, Uganda, Cameroon,

Jaire, Burkina Faso, Zambia, Ghana, Liberia, Nigeria, Segal, Togo, Malawi, Mozambique, Zimbabwe, Namibia, etc.

Invaded areas: This species was naturalized throughout Australia and in South America including Brazil, Venezuela, etc.

Current state of designations: This species, as a serious threat to the Savannah region of northern Australia, is treated as an environmental weed in western, northern Australia and Queensland. The status of designation in Australia is as follows, Queensland (Class 2) and Western Australia (P1).

Specimens observed

[U. of Texas Herbarium] 00208979 (G. Vargas C. 1989. 5. 24. Bolivia) [United States National Herbarium] 3063176 (R. D. De Oliveya, 1997. 6. 19. Brazil)

Key compared with Korean similar species (Korean name)

- 1. 50~120 cm tall, leaves 10~30 cm long, awn 6~21 mm long, pedicelled spikelet sometimes has no floral parts
..... *A. virginicus* (나도솔새)
- 1. 150~250 (max. 400) cm tall, leaves 100 cm long, awn 10~40 mm long, pedicelled spikelet always has floral parts
..... *A. gayanus* (아프리카나도솔새)

Harmfulness and characteristics of weeds

This species was introduced for feeding and roofing, but spread out of the pasture and caused problems in the ecosystem. It could spread rapidly and grow up to 4 meters, covering young trees and native plants. It subtracted soil nutrients and water, increasing ammonium concentration in soil and decreasing nitrate and total nitrogen concentration. In addition, the area around residences and temples can be damaged by fire that this inflammable species caused. It can

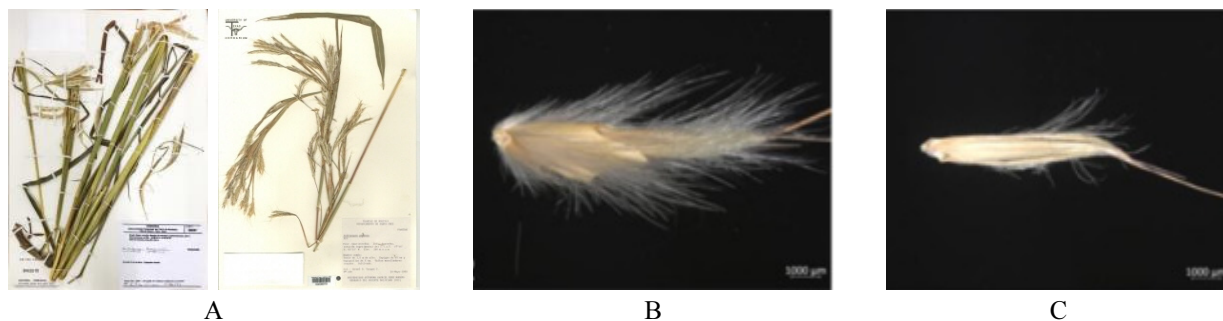


Fig. 5. Details of *Andropogon gayanus*. A: Herbarium specimen, B: Fruit, C: Caryopsis.

produce about 240,000 seeds a year, and the seed production capacity is about 30 kilograms per ha. Seeds are spread by wind, water and livestock, contaminated by agricultural machinery, etc. If this plants would be introduced in Korea, it is possible to invade warm areas below 300 meters above sea level in Jeju Island.

Weed risk assessment

By the result of weed risk assessment criteria (Animal and Plant Quarantine Agency in Korea), degree of risk is 49% (Table 2). We suggest that this species could be treated as an ordinary weed.

Echinocystis lobata (Michaux) Torrey & A. Gray, Fl. N. Amer. 1: 542 (1840)

Korean Name : Ya-saeng-o-i (야생오이; National Institute of Ecology, 2020)

Common Name : Wild cucumber, Balsam-apple; Mock cucumber; Mock-apple; Prickly cucumber; Wild balsam-apple; Wild balsam-apple; Wild mock cucumber

Taxonomic description and distribution characteristics

Taxonomic description: A creeping annual herb; 6~8 m up to 12 m in length. Roots strongly branching; Stems creating numerous clinging and branching tendrils, sparsely hairy stem. Petioles 1~4 cm long; lamina ovate, 2~8(12) cm long; 5(3~7) sharply-triangular lobes; pointed, margins lightly lobed and/or toothed; sparsely hairy. Erect inflorescences racemes or panicles; 50~200 male flowers occur on upright, branching panicles in the leaf axils, 8~14 cm long, 3 united

stamens, anthers 3; the female flowers occur singly or up to 3, followed by unusual spiky green fruits resembling small cucumbers. with 6 white to greenish-white corolla, 6 calyx that the petals or the sepals fused into a cup. Flowers in May to October. Fruits in June to October. Cucumber-like fruits, ellipsoid to cylindrical 3~5 cm in length, armed with weak 4~6 mm long prickles; 4 Achenes flattened, brown, 15 mm long (Fig. 6). Chromosome number $2n=32$ (in North America).

Growing conditions: Generally grown low-lying groves and forests, riverside, swamps and swamp edges, bushes in pasture, ditches, lakeside and railroad banks and dunes. But it grows well up to 2,000 meters above sea level.

Origin: This species is native to North America included Canada and 40 states of U.S.

Invaded areas: This species was introduced sporadically into western parts of the United States, and also spread across Europe, except Britain and Ireland, invade into the Asian border.

Current state of designations: This species is an invasive plant that spreads rapidly in many parts of central Europe. It is also known to be on the alert species list in many countries, such as Hungary and Poland.

Specimens observed

[U. of Florida Herbarium] 123206 (V. H. Chase, 1949. 8. 13. United States) 21444 (G. F. Weber, 1939. 8. 28. United States) 238799 (D. Goldman, 2005. 8. 24. United States)

Key compared with Korean similar species (Korean name)

1. Leaves pentagonoid or shallowly 5-lobed, female flowers globose cluster of 8~20 flowers, fruits 1~1.5 cm long,

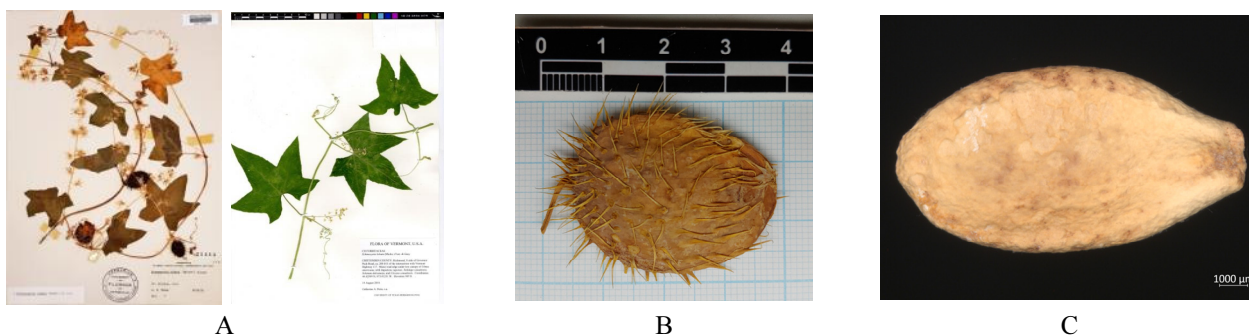


Fig. 6. Details of *Echinocystis lobata*. A: Herbarium specimen, B: Fruit, C: Seed.

- containing 1 seed *Sicyos angulatus* (가시박)
- 1. Leaves deeply 5(3~7)-lobed, female flowers 1(~3), fruits 3~5 cm long, containing 4 seeds
- *Echinocystis lobata* (야생오이)

- salvinia, Aquarium watermoss, Butterfly fern, Eared watermoss, Floating moss, Salvinia, Water salvinia

Harmfulness and characteristics of weeds

This plant has been used as a cure for rheumatism, and is sometimes grown in arboretums. Introduced for decorative and medicinal purposes in the European region, it is concentrated in a population that distributed to inhibit and disrupt the growth of natural vegetation. In winter, the dead part of this species remains intact, which interferes with the growth of native plants. There is some toxicity to the human and livestock that avoids eating. Seeds survive for more than five years in the soil and produce more than 500 of seeds per individual. The seeds spread out by attaching to livestock, human and agricultural machinery, and mixed into agricultural products. If this plants would be introduced in Korea, it is possible to invade regions with an annual average temperature of 3 to 22 °C, every parts of peninsula.

Weed risk assessment

By the result of weed risk assessment criteria (Animal and Plant Quarantine Agency in Korea), degree of risk is 68.8% (Table 2). We suggest that this species could be treated as an need to be controlled weed.

***Salvinia minima* Baker, J. Bot 24: 98 (1886)**

Korean Name : Jom-saeng-i-ga-lae (좀생이가래; National Institute of Ecology, 2020)

Common Name: Water spangles, Floating fern, Common

Taxonomic description and distribution characteristics

Taxonomic description A floating, aquatic, perennial fern; deep-green, 1 to 4cm long. Rootless. Stems to ca. 6 cm; dark hairs. Floating leaves orbicular to elliptic; 1~1.5 cm long; base rounded to cordate, apex obtuse, abaxially with stiff hairs, 4 separated branches; adaxially brown, pubescent with slender unbranched hairs. Sporocarps in clusters of 4~8, proximal sporocarps with up to 25 megasporangia, distal sporocarps with numerous microsporangia (Fig. 7) Chromosome number $2n=4x=36$, $2n=6x=54$.

Growing conditions: Generally grown in low-flow areas and grows in the side of swamps, lakes, ponds and ditches. Especially, it grows well in places where have high organic matter concentrations or 4~7 ppt salt concentrations.

Origin: This species is native to tropical and temperate regions of South and Central America and West Indies.

Invaded areas: This species is known as spreading by ships in the 1920s in Florida, United States, and has been widely naturalized through the northwest, to Puerto Rico.

Current state of designations: This species is recognized internationally as an invasive species so that is included in the list of Global Invasive Species Database. It is designated and managed as a harmful weed in Texas, USA (code : SAVRO) that prohibited personal possession or transportation.

Specimens observed

[U. of Florida Herbarium] 234609 (J. R. Abbott, 2007. 11. 4.

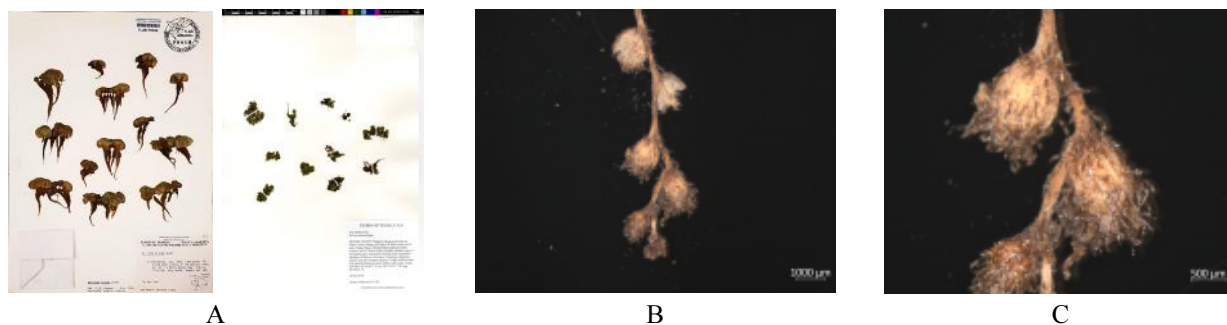


Fig. 7. Details of *Salvinia minima*. A: Herbarium specimen, B: Sporocarps.

United States) 216904 (C. C. Jacono, 2002. 10. 29. United States) P5132 (E. S. Ford, 1959. 12. 14. United States) P8849 (J. C. Easterday, 1981. 4. 30. United States) [U. of Texas Herbarium] GY18-129 (G. Yatskiyevych, 2018. 6. 22. United States)

Key compared with Korean similar species (Korean name)

- 1. 7~10 cm tall, floating fronds hairy in abaxial and adaxial surfaces, tips of branched hairs hold together *S. natans* (생이가래)
- 1. 6 cm tall, floating fronds hairy in adaxial surfaces, tips of branched hairs separated *S. minima* (좁생이가래)

Harmfulness and characteristics of weeds

This plant has been introduced as a horticultural plant in some aquariums, but it rapidly spread in a freshwater environment. It disrupted the growth of native aquatic plants and animals by covering surface and decreasing the amount of dissolved oxygen. It poses a serious threat to biodiversity, that reduced food sources for birds and predators. It not only interfered with rice cultivation and waterflow, but also adversely affected commercial activities such as recreation and aquaculture industry. It can be easily reproduced by vegetative reproduction, a plant segment can fall off and form a new individual. It can be invaded and spread through the bottom of a ship, water tank, channel, or carried by birds and animals. If this plants would be introduced in Korea, there is a high possibility of invasion of rice paddies and wetlands in Jeju Island except for the some areas that fall below 0°C.

Weed risk assessment

By the result of weed risk assessment criteria (Animal and

Plant Quarantine Agency in Korea), degree of risk is 38% (Table 2). We suggest that this species could be treated as an ordinary weed.

***Vincetoxicum rossicum* (Kleopow) Barbar., Vyzn. Rosl. Ukr. 345 (1950)**

Korean Name : Gae-jul-deong-gul (개줄덩굴; National Institute of Ecology, 2020)

Common Name : Dog-stangling vine, Swallowwort, Pale swallowwort

Taxonomic description and distribution characteristics

Taxonomic description: A creeping perennial herb. 60 to 200 cm in length. Root pale, fibrous, fleshy. Stem suberect, twining vine. Opposite phyllotaxis; Leaves 9~12 cm long and 5~7 cm wide, glossy, dark green, ovate-lanceolate to elliptic; margins entire or pubescent; petioles 0.5~1 cm long. Inflorescence umbelliform cymes contained 5~20 flowers; peduncles pubescent, 1~5 cm long; sepals slender, 1~1.5 mm long; petals fleshy, 2.5~5 mm long, 1.25~2.5 mm wide, glabrous with translucent margins; corona distinctly-lobed, orange or yellow. The gynostegium pale, green or yellow-green. flower buds conical. Flowers in July to September. Fruits in August to October. Seeds light or dark brown, oblong or obovoid, smooth or wrinkly, 4~6.5 mm wide, 2.4~3.1 mm long (Fig. 8). Chromosome number 2n=22.

Growing conditions: Generally grown in the steppe with shrubs or grazing land. In native environment, it grows well on rich calcium or carbonate soil in the Black Sea region of southwestern Ukraine and Russia.

Origin: This species is native to Ukraine, southeastern Russia.

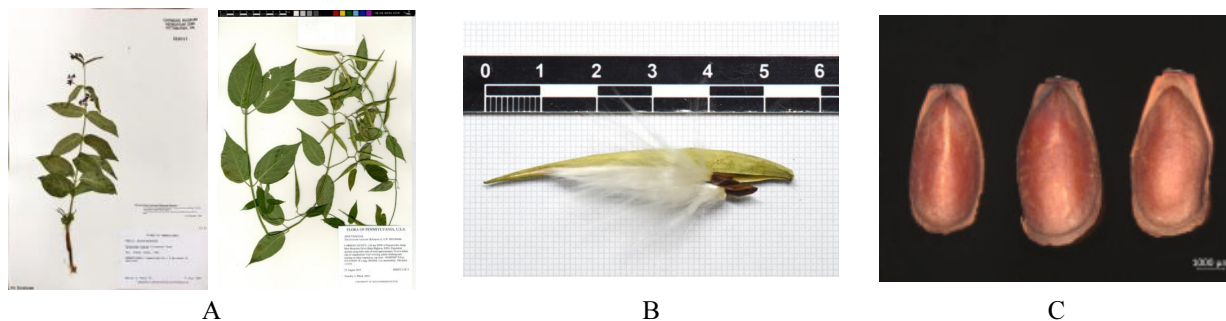


Fig. 8. Details of *Vincetoxicum rossicum*. A: Herbarium specimen, B: Fruit and seeds, C: Seeds.

Invaded areas: This species was introduced into North America (U.S., Canada), Europe (Norway, Germany), Asia, etc.

Current state of designations: This species is designated as a Invasive species in United States.

Specimens observed

[Carnegie Museum Herbarium] 352011 (W. A. Zanol, 1990. 7. 4. United States) [U. of Texas Herbarium] TAB 6963 (T. A. Block, 2018. 8. 23. United States)

Key compared with Korean similar species (Korean name)

- 1. Peduncles absent, pedicels 3~4 mm long, leaf blades 1~3 cm wide, petioles 2~4 mm long
..... *Cynanchum nipponicum* (덩굴박주가리)
- 1. Peduncles 2~5 cm long, pedicels ca. 10 mm long, leaf blades 5~7 cm wide, petioles 5~10 mm long
..... *Vincetoxicum rossicum* (개줄덩굴)

Harmfulness and characterisitcs of weeds

This perennial vine has been introduced as decorative plant in North America, it has been extensively invaded in the Lake Ontario basin, especially including the United States and Canada. It highly disrupted the growth of native plants. A single plant had been reported to produce up to 1,000 seeds per individual, that survive more than five years in soil. The growth period required for seed production is less then a year. The seeds can be spread by the wind, mixing into crops and through attachment and movement of people or livestock. scattered by the wind or mixed into crops, or attached to livestock and agricultural machinery to spread. It is highly spread in the 10~32°C region of North America. If it is invaded by South Korea, it can spread throughout the country.

Weed risk assessment

By the result of weed risk assessment criteria (Animal and Plant Quarantine Agency in Korea), degree of risk is 61% (Table 2). We suggest that this species could be treated as an need to be controlled weed.

Asparagus asparagoides (L.) Druce, Bot. Exch. Club Brit. Isles Rep. 3(5): 414 (1914)

Korean Name : Africa-mil-na-mul (아프리카밀나물; National Institute of Ecology, 2020)

Common Name : African asparagus fern, Bridal creeper, Bridal-veil creeper, Gnarboola, Smilax asparagus

Taxonomic description and distribution characteristics

Taxonomic description: A creeping perennial herb. Roots with fleshy tubers. Annual stems to ca. 1.5 m in length; no central crown but with an extensive mat of rhizomes; branchlets spreading to reflexed; young stems simple, slender. Leaves scale-like; 1~2 mm long. Cladodes 1 in each axil, ovate, mostly 15~35 mm long, 5~20 mm wide; flattened, glabrous, many-veined. Flowers 1~3(4)per axil; pedicels 3~8 mm long, jointed in lower half; Flowers 5~7 mm, drooping, perianth spreading to reflexed, greenish white. Flowers in winter to early spring (Australia), spring to summer (North America); Fruits in late spring to late summer (Australia). Berry-like fruits; globose, 6~10 mm diam, green to red; 1~4 seeds (Fig. 9). Chromosome number 2n=20.

Growing conditions: In particular, it causes damage by spreading widely, such as forest edges, arable land, grazing fields, grave yards, orchards, garbage dumps, coastal lowlands, open forests and roadside areas, include grow up to 100 meters above sea level.

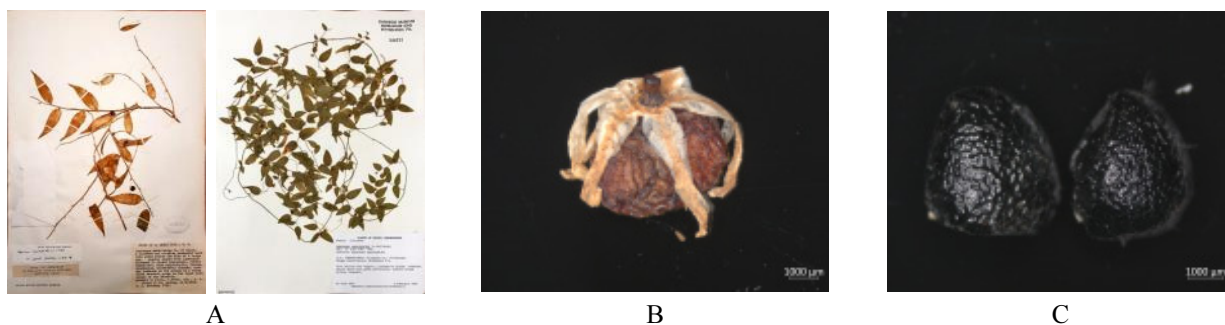


Fig. 9. Details of *Asparagus asparagoides*. A: Herbarium specimen, B: Fruit, C: Seeds.

Origin: This species is native to South Africa (Tropical Africa).

Invaded areas: This species is widely naturalized in temperate regions such as South Africa, Asia, Australia, New Zealand, U.S. (California) and southern Europe.

Current state of designations: This species is included in the Reject List in Australia and New Zealand (Australian Plant Quarantine legislation; Plants Biosecurity Index in New Zealand).

Specimens observed

[U. of Florida Herbarium] 137887 (K. D. Parkins, 1979. 1. 28. United States) [U. of Texas Herbarium] DK36081 (D. Keil 2019. 8. 10. United States)

Key compared with Korean similar species (Korean name)

1. Phylloclades (leaf-like stem) acicular or linear, tepals not turned backward
Asparagus in Korea [아스파라거스, 방울비짜루, 비짜루, 천문동]
1. Phylloclades widely lanceolate, tepals turned backward *A. asparagoides* (아프리카밀나물)

Harmfulness and characteristics of weeds

This species is used for flower decoration such as bride bouquet, and its roots are also used to treat eye diseases. As the plant grows with vines, it climbs up the surrounding shrubs and trees and covers the water pipes to kill leaves and objects. Plant shoots can form dense mats that limit light levels and then die back in the summer, creating a fire hazard. Plant colonies may also form a dense tuberous mat underground, preventing other plants from accessing soil moisture and nutrients. The seeds produce more than 1,000 fruits per square meter and contain two to three seeds per fruit. It also breeds with roots and stems and can be regenerated by root stems even if the ground is dead. The seeds are spread by excretion after eating by birds and animals. The annual average rainfall is 800 mm and the average annual temperature is around 9~20°C, which can be spread throughout Korea.

Weed risk assessment

By the result of weed risk assessment criteria (Animal and

Plant Quarantine Agency in Korea), degree of risk is 51% (Table 2). We suggest that this species could be treated as an ordinary weed.

Alternanthera pungens Kunth in Humboldt & Bonpland, Nov. Gen. Sp. 2:206 (1818)

Korean Name : Ga-si-ttang-bi-leum (가시땅비름; National Institute of Ecology, 2020)

Common Name : Khaki weed, Creeping chaffweed, Khaki burr

Taxonomic description and distribution characteristics

Taxonomic description: A prostrate perennial herb; up to 60 cm in length. Stems prostrate, pubescent, reddish appearance with adventitious roots at the nodes. Opposite phyllotaxis; Leaves 8~60 mm long and 6~30 mm wide, ovate to elliptic, obtuse apices, sub-sessile; margins entire. Small globular clustered flowers per axils, 8~12 mm long and 6~10 mm wide, greenish-yellow to greenish, each 5 perianth segments or tepals, 4 or 5 stamens, capitate stigma. Flowers in spring through to autumn or May (in China). Fruits in July (in China). Fruits utricle, ca. 1 mm long, truncate apex; Seeds yellowish or orange, glossy (Fig. 10). Chromosome number no data.

Growing conditions: Generally grown in roadsides and in other highly disturbed sites. However, it occasionally invades native pastures on sandy soils, where it out-competes most other species with its mat-forming habit.

Origin: This species is native to South America (Venezuela, Brazil, Ecuador, Peru).

Invaded areas: This species is widely naturalized in Asia (China, India), Europe (Belgian, Spain), Queensland, Australia, etc.

Current state of designations: This species is designated as an environmental weed in five natural resource management areas throughout Australia. The status of designation in Australia is as follows, New South Wales (Class 4); Northern Territory (B, C); South Australia (1@Class 1c); Victoria (P3, C1).

Specimens observed

[U. of Texas Herbarium] GY18-192 (G. Yatskievych, 2018. 8. 9. United States) [U. of S. Florida Herbarium] 17566 (A. H. Liogier, 1970. 10. 10. Dominica)

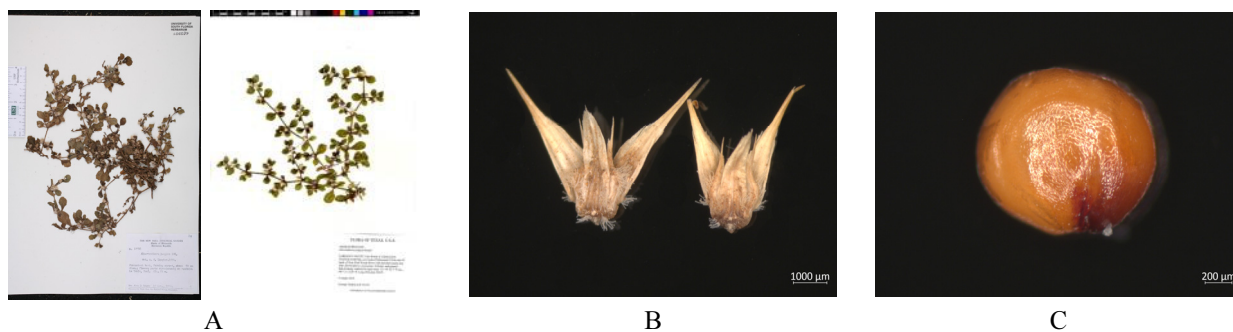


Fig. 10. Details of *Alternanthera pungens*. A: Herbarium specimen, B: Fruits, C: Seeds.

Key compared with Korean similar species (Korean name)

- 1. Stem erect, leaves alternate
..... genus *Amaranthus* (비름속)
- 1. Stem much-branched, creeping, leaves opposite
..... *Alternanthera pungens* (가시망비름)

Harmfulness and characteristics of weeds

This species is suspected of poisoning sheep and pigs, and causing digestive disturbances and skin ailments in cattle. Horses that graze on areas containing large amounts of this species have developed a form of staggers, and its burrs can contaminate lucerne hay and other stock feeds. This species is also a nuisance because of the trouble that the prickly seed bracts cause to humans and animals. It is often very troublesome in mown sites in towns and urban areas, such as lawns, parks and along footpaths. It reproduces by seeds and produces an average of 1,000 seeds per individual. This plant reproduces mainly by seed, though stem fragments may also take root after being dislodged from a plant. The seeds are contained inside a burr which readily becomes attached to animals, clothing and other objects. They may also be dispersed by water movement and in contaminated agricultural produce. Stem fragments can be spread by machinery, livestock or cultivation. The growth period required for seed production is less than one year. As it is distributed in warm areas with 24 to 32°C, it is possible to invade and spread the area in the southern islands and the coast of Jeju Island.

Weed risk assessment

By the result of weed risk assessment criteria (Animal and Plant Quarantine Agency in Korea), degree of risk is 64%

(Table 2). We suggest that this species could be treated as an need to be controlled weed.

Salpichroa organifolia (Lam.) Thell., Mem. Soc. Sci. Nat. Math. Cherbourg 38: 452 (1912)

Korean Name : Deong-gul-ga-ji (덩굴가지; National Institute of Ecology, 2020)

Common Name : Cock’s eggs, lily of the valley vine, pampas lily of the valley

Taxonomic description and distribution characteristics

Taxonomic description: A woody vine or creeping perennial herb; semi-upright stems up to 3 m in length. Woody rootstock, numerous young stems erect, green colored, rounded, sparsely to densely pubescent; older stems quadrangular, prostrate or scrambling. Leaves 5~50 mm long and 5~35 mm wide, ovate or elliptic, puberulent; petioles 5~25 mm long; entire margins. Flowers 1~2 per axils, 6~10 mm long, white or cream-colored, tubular with five reflexed petal lobes; peduncles 7~10 mm long. Flowers in year-round, but is most common during summer. Fruits in year-round, but is most common during summer to autumn. Fruit berry-like, ovoid, 10~20 mm long and 7~8 mm wide, yellow or whitish. Seeds ca. 2 mm across, brown to pale yellow, flattened, rounded in shape (Fig. 11). Chromosome number 2n=24.

Growing conditions: Generally grown in coastal in temperate, semi-arid and sub-tropical environments. It can be spreaded in gardens, roadsides, urban bushland, waste areas, disturbed sites near fences (Argentina, Uruguay).

Invaded areas: This species is naturalized in more than 10 states in Africa, Australia, New Zealand, Europe (Britain,

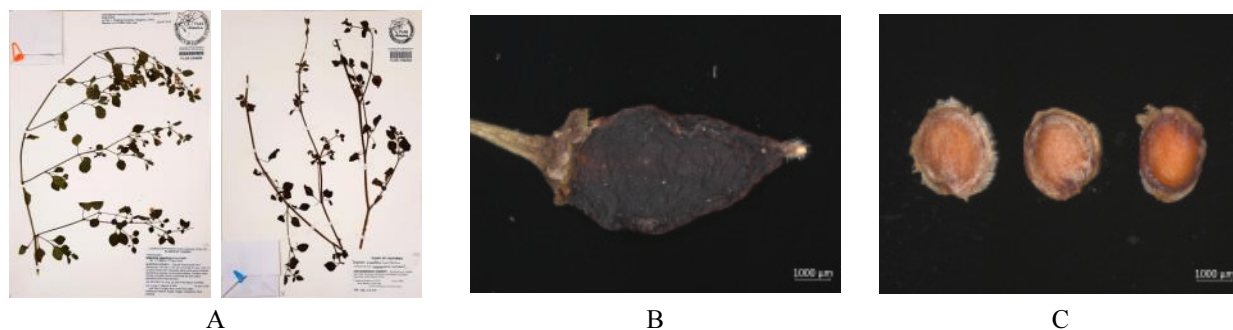


Fig. 11. Details of *Salpichroa origanifolia*. A: Herbarium specimen, B: Fruits, C: Seeds.

Italy), North America, and Central and South America.

Current state of designations: This species is designated poisonous weeds in in USA (US code : SAOR4) and Australia such as Victoria, Tasmania, and South Australia.

Specimens observed

[U. of Florida Herbarium] 224096 (L. C. Majure, 2008. 4. 12. United States) [U. of Texas Herbarium] DK36097 (D. Keil 2019. 8. 17. United States)

Key compared with Korean similar species (Korean name)

1. Woody plant, fruit turn red as they mature, flowers funnellform, purple, leaves alternate, fasciculated leaves 2~4 구기자나무 (*L. chinense*)
1. Herbaceous plant, fruit turn cream-coloured or whitish, flowers campanulate, whitish or creamy, leaves alternate or borne in pairs at node *S. origanifolia* (덩굴가지)

Harmfulness and characteristics of weeds

This species used in popular medicine for its pharmacological properties, also fruits are sweet and edible (Afroz *et al.*, 2020). As the plant grows with vines, it climbs up the surrounding shrubs and trees and covers the water pipes to prevent photosynthesis and hinder the growth of native plants. This species reproduces by seeds and vegetatively from creeping underground rhizomes and suckering roots. The seed survives for more than 10 years in dry condition. It produces about 2000 seeds per plant which are dispersed by soil and plant movement and animals that eat the fruits of this plant like rodents, horses, mules, birds, rats, mice and ants. The distribution limit is found along drainage channels in areas 60 to 1,500

meters above sea level and the average precipitation is 380 to 760 meters.

If it is invaded by South Korea, it can spread throughout the country except the northern part of Gangwon provinces because its succulent root damaged by frost.

Weed risk assessment

By the result of weed risk assessment criteria (Animal and Plant Quarantine Agency in Korea), degree of risk is 41% (Table 2). We suggest that this species could be treated as an ordinary weed.

Lycium ferocissimum Miers, Ann. Mag. Nat. Hist. ser. 2, 14(81): 187 (1854)

Korean Name : Africa-gu-gi-ja (아프리카구기자; National Institute of Ecology, 2020)

Common Name : African boxthorn, Boxthorn, Cape boxthorn

Taxonomic description and distribution characteristics

Taxonomic description: A spiny shrub. Stem erect, 2~3 m up to 6 m tall, light brown to grey or brown, glabrous. Young stems much-branched. Spines ca. 1.3~2 cm up to 15 cm long. Leaves 10~40 mm long and 6~20 mm wide, glabrous, semi-succulent, obovate or ovate to elliptic; petioles 1~10 mm long; entire margins. Flowers 1~2 per axils, 8~12 mm across and 10~13 mm long, white or pale lilac colored, fragrant, tubular; petals reflexed, petal lobes fi5 or sometimes 4; 5 prominent stamens; pedicels 5~16 mm long. Flowers in year-round, but is most abundant during spring and summer, May to August. Fruits in year-round, during summer to autumn, August to November.

Fruits berry-like, ovoid or globose, 5~12 mm long and 5~10 mm wide, glossy, green to orange-red or bright red, calyx persistent fused. Seeds 20~70 per fruit, 2.5 mm long and 1.5 mm wide, light brown or yellow (Fig. 12). Chromosome number $2n=24$ (in *Lycium* genus).

Growing conditions: Generally grown in semi-arid and arid regions and dry sub-tropical and temperate environments. It spreaded pastures, grasslands, open woodlands, roadsides, railways, disturbed sites, waste areas, coastal and inland waterways.

Origin: This species is native to South Africa (Cape Province, Orange Free State).

Invaded areas: This species is naturalized in Australia and New Zealand.

Current state of designations: This species is designated as hazardous weeds in Australia and the United States (US code: LYFE4), especially California, Oregon (Q-Quarantine), Florida (NW-Noxiousweeds), Alabama, North Carolina, Vermont (CAW-Class A noxious weeds), Miami (P-Prohibited), Minnesota (PNW-Prohibited Noxious Weed) and South Carolina (PP-Plant pest).

Specimens observed

[United States National Herbarium] 02821704 (R. D. A. Bayliss, 1971. 9. 23. United States) 02821691 (E. A. Mearns, 1909. 6. 23. United States)

Key compared with Korean similar species (Korean name)

- 1. Fruit oblong, 1.5~2.5 mm long, flowers purple, fasciculated leaves 2~4 구기자나무 (*L. chinense*)
- 1. Fruit globose or ovoid, ca. 10 mm long, flowers whitish,

sometimes with mauve markings, fasciculated leaves 5~12 *L. ferocissimum* (아프리카구기자)

Harmfulness and characteristics of weeds

This species introduced in Australia and New Zealand for pollinator and fencing purposes, but is now rarely used. It disturbed growth of native species, had the toxicity of the fruit causes addiction. Many thorns can hurt people or cause tire punctures. In general, it blooming in summer but sufficient moisture condition makes it bloom year-round, so the spread occurs quickly during intrusion. It is also germinable throughout the year, and its roots grow very fast, enabling to compete with nearby plants. This species reproduces mostly by seed, which are commonly dispersed when the fruit are eaten by birds and other animals. Seeds may also be spread by water, machinery and in dumped garden waste or contaminated soil. Suckers are sometimes produced from root fragments and shoots may rarely also be produced from stem fragments. It can produce 5,000 seeds in single plant (Agriculture Victoria, 2020), spread by birds and small animals. It is resistant to a wide range of climate and soil conditions, but it prefers light sandy soil and is resistant to salty soil and wind. So If this plants would be introduced in Korea, it is possible to spread coastal areas and islands throughout the country.

Weed risk assessment

By the result of weed risk assessment criteria (Animal and Plant Quarantine Agency in Korea), degree of risk is 47.5% (Table 2). We suggest that this species could be treated an ordinary weed.

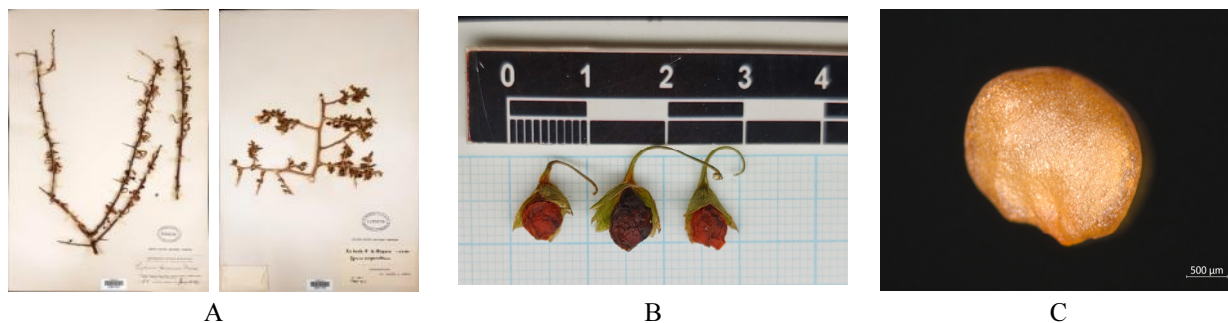


Fig. 12. Details of *Lycium ferocissimum*. A: Herbarium specimen, B: Fruits, C: Seeds.

Table 2. Result of weed risk assessment for 11 target species (Notice 2016-68, Animal and Plant Quarantine Agency)

evaluation criteria	element	max.	sp. 1 ^z	sp. 2 ^y	sp. 3 ^x	sp. 4 ^w	sp. 5 ^v	sp. 6 ^u	sp. 7 ^t	sp. 8 ^s	sp. 9 ^r	sp. 10 ^q	sp. 11 ^p
			score	score	score	score	score	score	score	score	score	score	score
1	1-1	2	2	2	-1	2	2	-1	2	2	2	-1	-1
	1-2	1	1	1	1	1	1	1	1	1	1	0	0
2	2-1	3	3	3	1	1	3	1	3	3	3	3	3
	2-2	1	1	1	1	1	1	1	1	1	1	1	1
	2-3	1	1	1	1	1	1	1	1	0	1	1	1
	2-4	1	1	1	1	1	1	1	-1	-1	1	1	1
3	3-1	3	3	3	2	2	3	2	3	3	3	3	3
	3-2	3	3	3	0	0	3	2	3	3	3	0	0
	3-3	3	3	3	2	2	3	0	3	3	3	3	3
4	4-1	3	0	0	0	0	0	0	0	0	0	0	0
	4-2	3	0	0	0	0	2	0	0	0	2	0	3
	4-3	3	3	0	2	0	2	0	0	0	0	0	2
	4-4	2	2	2	0	2	0	0	0	2	0	0	0
	4-5	2	0	0	0	0	2	2	0	0	2	0	0
	4-6	2	0	0	0	0	2	0	2	2	0	2	0
	4-7	2	0	0	0	0	0	0	0	0	0	0	0
	4-8	1	0	0	0	0	0	0	1	0	0	0	0
	4-9	1	0	0	0	0	1	0	1	0	1	0	1
	4-10	1	0	0	0	0	1	0	0	0	0	0	0
5	5-1	1	0	0	1	0	0	1	0	0	0	0	0
	5-2	1	0	1	1	0	0	0	0	0	0	0	0
	5-3	1	1	1	0	1	1	1	1	1	1	0	1
	5-4	1	1	1	1	1	0	1	1	1	1	1	0
	5-5	1	1	1	1	1	1	0	1	1	1	1	0
	5-6	0	0	0	0	0	0	0	0	0	0	0	-1
6	6-1	1	1	1	1	1	1	-1	1	1	1	1	1
	6-2	2	2	2	2	1	1	2	2	2	1	0	1
	6-3	1	1	1	1	0	1	0	1	0	1	1	1
	6-4	1	1	1	1	1	0	1	1	0	0	1	1
	6-5	1	1	1	1	1	1	1	1	1	1	-1	0
7	7-1	1	1	1	1	1	1	1	1	1	1	1	1
	7-2	1	1	1	1	1	1	1	1	0	1	0	1
	7-3	1	1	1	1	1	1	0	1	0	1	0	0
	7-4	1	1	1	1	1	0	0	1	0	0	0	0
	7-5	1	1	1	1	1	1	1	0	0	0	1	1
	7-6	1	1	1	1	1	1	1	1	0	1	0	0
	7-7	1	0	0	1	1	0	0	0	1	0	1	1
	7-8	1	1	1	1	1	1	1	1	1	1	1	1
8	8-1	0	0	-1	-1	-1	-1	-1	-1	-1	0	0	-1
	8-2	0	0	-2	-1	-1	-1	-1	-1	-1	0	0	0
9	9-1	2	2	2	0	0	2	2	2	2	2	2	2
	9-2	2	2	2	2	2	2	2	2	2	2	2	2
sum		61	43	38	28	30	42	23	37	31	39	25	29
degree of risk (%)			70.5	62	46	49	68.8	38	61	51	64	41	47.5
evaluation result			need to be controlled	need to be controlled	ordinary	ordinary	need to be controlled	ordinary	need to be controlled	temporary need to be controlled	need to be controlled	ordinary	ordinary

^zsp. 1 *Senecio madagascariensis* Poir., ^ysp. 2 *Sphagneticola trilobata* (Linnaeus) Pruski, ^xsp. 3 *Ageratina riparia* (Regel) R.M. King & H. Rob., ^wsp. 4 *Andropogon gayanus* Kunth, ^vsp. 5 *Echinocystis lobata* (Michx.) Torr. & A. Gray, ^usp. 6 *Salvinia minima* Baker, ^tsp. 7 *Vincetoxicum rossicum* (Kleopow) Barbar., ^ssp. 8 *Asparagus asparagoides* (L.) Druce, ^rsp. 9 *Alternanthera pungens* Kunth, ^qsp. 10 *Salpichroa origanifolia* (Lam.) Thell., ^psp. 11 *Lycium ferocissimum* Miers.

Acknowledgement

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Conflicts of Interest

The authors declare no conflict of interest.

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