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Vegetation and flora of *Hibiscus hamabo* inhabited naturally in Soan Island

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Hibiscus hamabo, called "Hwang-geun", growing about 3m in height is a deciduous shrub or subtree of Malvaceae. Because the number of these species is very limited in the world, the Ministry of Environment has designated *H. hamabo* as a preserved plant. The Korea Forest Service also protects it strictly by law since *H. hamabo* is an out-of-the-way plant and possibly may be exterminated soon in Korea. Investigation for distribution and ecological characteristics of the habitat for *H. hamabo* was carried out on Soan Island. Two wild *H. hamabo* were found at the forest edge (34° 11'35.4"N, 126° 38'55.9"E) along the sea coast located in the southern part of Soan Island and this was the first report in the Korean academic world. These two wild *H. hamabos* were growing in a naturally inhibited area. The diameters at the base were 12cm and 15cm. The Tree heights were 150cm and 210cm and the number of branches of each wild *H. hamabo* was 4 and 7. However, the present condition of these plants was not good. Environmental conditions of the naturally inhibited area of *H. hamabo* were very mild because it is located at the edge of the forest and is always sunny during the daytime since the slope of the inhibited area is facing South. The ground drained very well since the soil was made of gravels and sand. Because the percent of vegetation of the subtree layer where *H. hamabo* was growing was 40%, the cover degree and sociability of *Ilex crenata* trees and *Eurya japonica* were found to be high. In the naturally inhibited area of *H. hamabo*, a dominant value of *Rubus parvifolius* in the lower part of the herb layer was very high and many plants in Compositae, such as *Artemisia princeps* var. *orientalis* and *Erigeron annuus*, were also present. A dominant value of liana, such as *Vitis thunbergii* var. *sinuata*, *Rosa multiflora*, *Clematis terniflora* and *Hedera rhombea*, and Gramineae plants that rhizomes were well developed and aggressively propagated, such as *Miscanthus sinensis* var. *purpurascens*, *Phragmites communis*, *Spodiopogon cotulifer* and *Oplismenus undulatifolius* which were surveyed as high, too. These results imply that *H. hamabo* might be exterminated soon through a natural selection if the proper management of the naturally inhibited area of *H. hamabo* is not conducted continually.

Key words : *Hibiscus hamabo*, Habitat, Out-of-the-way plant, Soan Island

1. Introduction

Hibiscus hamabo, called "Hwang-geun" in Korean, which is rarely populated in specific areas, such as Jeju Island and other islands in South sea of Korea, is a deciduous shrub or subtree in Malvaceae[1]. It grows about 3m in height and has beautiful pale yellow flowers blooming in August, but has weak cold hardness in winter[2]. It belongs to *Hibiscus* genus, same as the Rose of Sharon (*Hibiscus syriacus*), a national flower of Korea, and some of them are populated in South Honsu and Okinawa in Japan. *Hibiscus* species are mostly evergreen or deciduous woody or herbaceous plants. According to previous studies[3], about 200 species, mainly populated in tropical regions through temperate zones, have been found. Four *Hibiscus* species with the rose of *H. hamabo* have been populated in Korea. They are commonly cultivated as ornamental plants because they are easy to cultivate and

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their flowers are very beautiful. The Korea Forest Service[4] and the Ministry of Environment[5] have designated *H. hamabo* as a preserved plant since the number of these species is very limited in the world. Because *H. hamabo* is very rare in Korea and could possibly be exterminated soon, the Korea Forest Service protects it by law. Various studies, including the ecological characteristics of the naturally inhabited areas for a few wild plants, have been accomplished. But any study, such as geographical distribution conditions, or ecological and physiological characteristics of *H. hamabo*, has not been tried yet. At the present time, however, a few studies in the characteristics of the naturally inhabited areas and present conditions for *H. hamabo* by Ahn are going on (data not shown). It is very important to understand the characteristics[6] of the naturally inhabited areas[7] for the wild plant in order to develop a cultivated plant from the wild condition[8]. *H. hamabo* is a valuable landscape plant in the southern part of Korea because its flowers are very beautiful and it has a long flowering period. *H. hamabo* is a Korean native plant and a valuable genetic resource, so it is expected to be used to improve the flower color of the Rose of Sharon because the flower color of the Rose of Sharon is not diverse. Therefore, it is necessary to study systematically the environmental conditions[9] and the vegetation[10] in the naturally inhabited areas of *H. hamabo* in order to develop a valuable cultivated plant.

Soan Island where *H. hamabo* is naturally populated belongs to Soanmyun, Wandokun, Chunnam, and is a national sea park in the South Sea of Korea. The total area is 2,864h and composed of 4 inhabited and 7 uninhabited islands[11]. Mt. Gahag (356 latitude) is located in the middle of Soan Island and various evergreen broad-leaved forests have been developing on the island because it has a mild oceanic climate and proper air humidity. This study was conducted to investigate the distribution and ecological characteristics of the naturally inhabited area for *H. hamabo* in Soan Island and to provide a preservation plan since *H. hamabo* is an out-of-the way plant and could possibly be exterminated soon.

2. Materials and Methods

Our ecological investigation of the habitat for *H. hamabo* was carried out in the evergreen broad-leaved forests on Soan Island from July 2003 to August 2003 (Fig. 1). Based on knowledge from former investigations on Jeju Island, most of the investigation was conducted mainly in a seacoast forest where there was a high possibility of finding a habitat for *H. hamabo*. Exact coordinates, azimuth and altitude of each habitat for *H. hamabo* were measured by a global positioning system (GPS, GPSIII Plus, USA) and a digital altimeter (Pretel, Alti-D2, USA). The degree of slope and the light conditions of the naturally inhibited area of *H. hamabo* were determined by a gradient detector (Suunto PM-5, Japan) and a portable photometer (Delta, OHM HD-8366, France)[7,8].

A Survey of the flora in the natural habitat of *H. hamabo* was conducted by a phyto-socialogical method of Braun-Blanquet [12]. The surveyed plot was a designed 5 x 6m quadrat in the naturally inhabited area. The cover degree and sociability of the specific plant genera emerging in each quadrat was surveyed[13]. In each quadrat, a tree layer, a subtree layer, a shrub layer and an herb layer were divided first, and then the percent of vegetation of each layer was investigated, and a cross-sectional view of each community was made[14]. To evaluate the

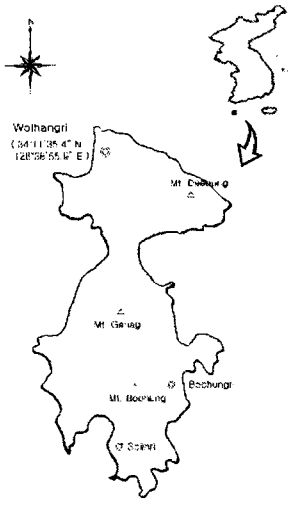


Fig. 1. Location map of *Hibiscus hamabo* habitat in Soan Island.

vegetative group in the surveyed area, the degree of diversity and the aspects of an ecological propagation of each genus were analyzed. To investigate the flora, the plant species appearing in a 20 x 20m^2 around the surveyed plot was classified based on Lee's method[2] for classification and recorded. The annual climatic condition for the natural habitat of the wild *H. hamabo* in south Soan Island between 1971 to 2002 was shown on a climatic chart based on the data (2003) from the Wando meteorological observatory[15].

3. Results and Discussion

According to the floristic (plant) geography, Soan Island. located in the Aegean Sea of Chunnam. belongs to a region of Holarctic in the Sino-Japanese region with Jeju Island[15]. Because Soan Island is located on the border between the floral regions of the north part of the East Siberian plant and the south part of Indomalaysian plant, it is a region showing floral characters of the temperate evergreen broad-leaved forest in the Korean peninsula. It is also known as an island where an unusual flora has appeared even though it is small due to a mild oceanic climate and proper air humidity. The climatic chart for Soan Island is shown in Figure 2. According to climatic data for of the past 31 years, the annual temperature is 16.4℃, and the annual precipitation amounts to 1456.9mm. Because the daily mean temperature in January is -0.5℃ and the absolute lowest temperature is -10.7℃, the climate of this island is shown to have the characteristic and typical southern subtropical climate of Korea.

Two wild *H. hamabo* were found at the forest edge (34. 11'35.4"N, 126. 38'55.9"E) in the sea coast located in the south part of Wolhangri, Soanmyun, Wandokun. Because this finding of the naturally inhabited area of wild *H. hamabo* has not been reported in the academic world yet, it is thought that this would be very valuable study of the wild *H. hamabo*. This sea coast forest is a second evergreen broad-leaved forest that shows flora including broad and shining- leaved evergreens such as Pittospor*um tobira* and *Ligustrum japonicum* and vascular woody plants such as

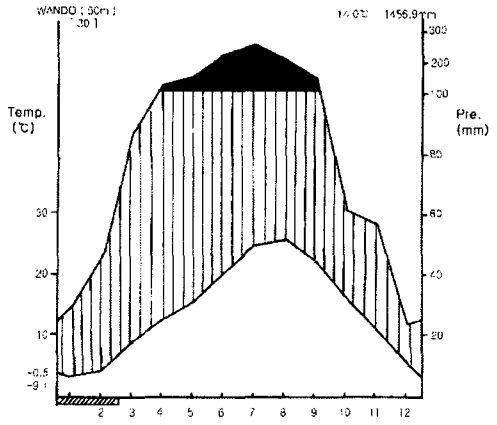


Fig. 2. Climate diagram of the Wando meteorological station.

Poncirus trifoliata[16]. Environmental conditions of a naturally inhibited area of *H. hamabo* were very mild because it is located at the edge of the forest, always sunny during the daytime since the slope of the inhibited area is faced to the South, and protected from the cold northwestern wind by tall trees in the forest. The ground drained very well since soil was made of gravels and sand, but it could keep the proper air humidity due to the sea.

The naturally inhibited area of *H. hamabo* was located on the side of a ridge used for a farm road between rice fields. Many *Poncirus trifoliata* planted artificially were growing as a subtree layer at the back of the naturally inhibited area, and *Vitis thunbergii* var. *sinuata* covered over *Poncirus trifoliata* and the front part of the shrub layer (Table 1). Because the percent of vegetation of the subtree layer where *H. hamabo* was growing was 40%, the cover degree and sociability of *Ilex crenata* and *Eurya japonica* were surveyed high. Besides of these trees, *Ligustrum obtusifolium*, *Rosa multiflora* and *Clematis terniflora* were also present. In the naturally inhibited area of *H. hamabo*, a dominant value of *Rubus parvifolius* in the lower part of the herb layer was very high and Compositae such as *Artemisia princeps* var. *orientalis* and *Erigeron annuus* was also present. A dominant value of aggressively propagated plants which rhizomes were developed as well, such as *Vitis thunbergii* var. *sinuata*, *Rosa multiflora*, *Clematis terniflora* and *Hedera rhombea*, and were surveyed high, too. Our

Table 1. Floristic composition table *Hibiscus hamabo* habatat in Soan Island

Study area : Soan Island Wando gun Chunnam
Date : 2003. 9. Jul. Slope degree(∘) : 15
Altitude(m) : 16m Quadrat size(sq, m) : 30 Latitude : 34° 11' 35.0" N
Slope aspect : S Number of species : 19 Longitude : 126° 38' 55.9" E

Layer	Tree	Subtree	Shrub	Herb
Height(m)	6	4	2	1
Coverage(%)	5	10	50	60
Ligustrum japonicum	+			
Poncirus trifoliata		2.2		
Eurya japonica		1.1		
Vitis thunbergii var. *sinuata*		3.3	1.1	
Elaeagnus macrophylla			2.2	
Ilex crenata			3.3	
Pittosporum tobira			2.2	
Hibiscus hamabo			1.1	
Ligustrum obtusifolium			+	
Rosa multiflora			+	
Clematis terniflora			+	
Rubus parvifolius				3.3
Artemisia princeps var. *orientalis*				2.2
Erigeron annuus				1.1
Phragmites communis				1.1
Hedera rhombea				1.1
Oplismenus undulatifolius				1.1
Plantago major for. *yezomaritima*				+
Zoysia sinica				2.2

results imply that *H. hamabo* might be exterminated soon through a natural selection if the proper management of the naturally inhibited area of *H. hamabo* is not conducted continually[17].

Only two wild *H. hamabos* were growing in the naturally inhibited area. The diameters at the base were 12cm and 15cm. Tree heights were 150cm and 210cm, and the number of branches on each wild *H. hamabo* was 4 and 7. Since the diameter at the base was more than 10cm, it is assumed that an original wild *H. hamabo* would be a subtree with more than 15cm in diameter at the base and 3m tree height. However, farmers probably removed the original wild H. hamabo during the development of farmlands. Because the naturally inhibited area of *H. hamabo* was located near farmlands and the wild *H. hamabo* interrupted farmers' workings and movement, sprouts of two wild *H. hamabos* currently growing were faced with a danger of being removed. Therefore, these wild *H. hamabos* might be exterminated very soon if the farm road is not changed and the proper management is not accomplished. Especially, sprouts developed from the cutting area of the *H. hamabo*'s base were confronted with a crisis because of aggressive vegetation around them.

According to the survey of flora around the naturally inhibited area of these wild *H. hamabos*, deciduous species such as *Carpinus coreana*, *Prunus persica* and *Celtis sinensis*, and evergreen species such as *Rosa davurica*, *Eurya emarginata*, *Pittosporum tobira* and *Mallotus japonicus* were growing (Table 2). Because the surveyed area was always sunny during the daytime, however, a dominant value of light loving plants such as *Rubus crataegifolius*, *Artemisia princeps* var. *orientalis*, *Erigeron annuus* and *Melandryum oldhamianum* for *roseum* was high. Especially, dominant values of *Rosa multiflora*, *Vitis thunbergii* var. *sinuata*, *Smilax china*, *Hedera rhombea* and *Euonymus fortunei* var. *radicans* were shown to be very

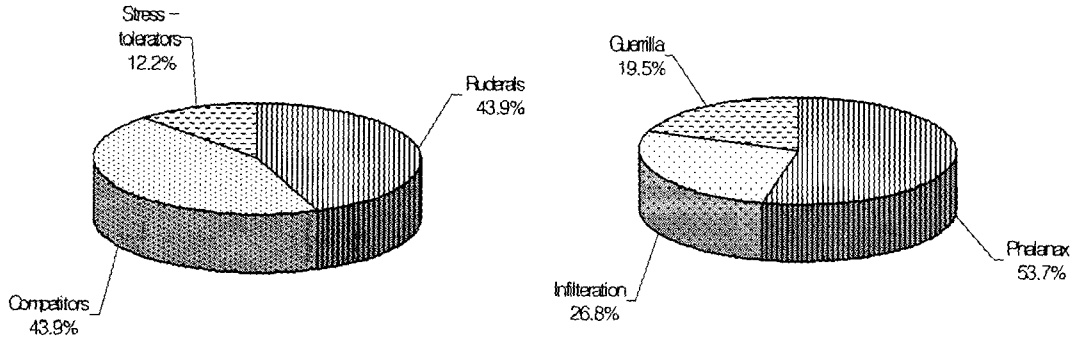
Table 2. The list of plants in *Hibicus hamabo* habitat

Family name	Scientific name	A[z]	B[y]
Gramineae	*Miscanthus sinensis*	3	2
	Oplismenus undulatifolius	3	2
	Spodiopogon cotulifer	3	2
	Setaria viridis var. *pachystachys*	3	2
	Phragmites communis	2	2
Commelinaceae	*Commelina communis*	3	2
Liliaceae	*Smilax china*	1	3
Orchidaceae	*Cymbidium goeringii*	1	2
Betulaceae	*Carpinus coreana*	1	1
Moracerae	*Morus bombycis*	1	1
Caryophyllaceae	*Stellaria media*	3	2
	Melandryum oldhamianum for. *roseum*	3	1
Ranunculaceae	*Clematis terniflora*	1	3
Menispermaceae	*Sinominium acutum*	3	3
Pittosporaceae	*Pittosporum tobira*	1	1
Rosaceae	*Rosa multiflora*	1	2
	Rubus hirsutus	3	2
	Rubus crataegifolius	3	2
	Rubus parvifolius	3	2
	Prunus persica	1	1
Leguminosae	*Robinia pseudo-acacia*	3	2
Rutaceae	*Poncirus trifoliata*	3	2
Euphorbiaceae	*Mallotus japonicus*	1	1
Anacardiaceae	*Rhus chinensis*	1	1
Aquifoliaceae	*Ilex crenata*	1	1
Celastraceae	*Euonymus fortunei* var. *radicans*	1	3
Vitaceae	*Vitis thunbergii* var. *sinuata*	1	3
	Ampelopsis heterophylla	1	3
Malvaceae	*Hibiscus hamabo*	2	2
Theaceae	*Eurya japonica*	1	2
Elaeagnaceae	*Elaeagnus macrophylla*	1	1
Araliaceae	*Hedera rhombea*	1	3
Umbelliferae	*Peucedanum japonicum*	2	1
	Caucalis scabra	3	2
Oleaceae	*Ligustrum obtusifolium*	1	1
Convolvulaceae	*Calystegia soldanella*	3	3
Verbenaceae	*Vitex rotundifolia*	2	2
Plantaginaceae	*Plantago asiatica*	3	2
	Plantago major for. *yezomaritima*	2	2
Compositae	*Artemisia princeps* var. *orientalis*	3	2
	Erigeron annuus	3	2

[z]Ecological strategy

[y]Reptoduct strategy

high. Gramineae plants which rhizomes were developed, such as *Miscanthus sinensis* var. *purpurascens*, *Phragmites communis*, *Spodiopogon cotulifer* and *Oplismenus undulatifolius* were also growing. *Robinia pseudo-acacia* trees, their seeds seemed to come from the outside, were growing too. There is a high possibility that wild *H. hamabo* will be exterminated by natural selection because those plants could attack the wild *H. hamabo* above the ground or through the underground of the naturally inhibited area. So it is necessary to manage this naturally inhibited area of *H. hamabo* properly and continually with other plant species so that aggressive plant species cannot invade this area. From analysis of a propagation strategy[18] of plant species growing around wild *H. hamabo*, phalanax plant species were 45%, infiltrative plant species were 30%, and guerrilla plant species were 25%. Ahn and Choi[8] have reported that 12.8% of guerrilla plant species, which are mainly climbing plants, appeared in the naturally vegetative *Rhapontica uniflora* habitat located at the side of the road where servere



a) Ecological strategy b) Reproductive strategy

Fig. 3. Style of plants around *Hibiscus hamabo* habitat.

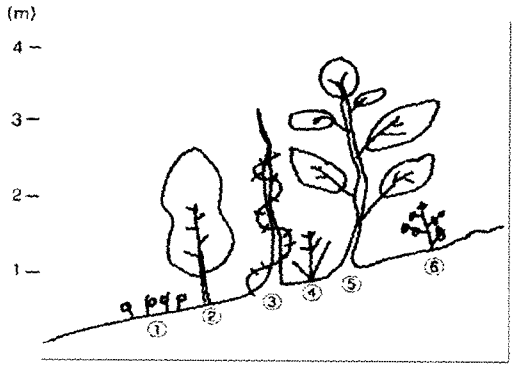


Fig. 4. Vegetation profile of *Hibiscus hamabo* habitat.
① : *Rubus parvifolius*
② : *Hibiscus hamabo*
③ : *Vitis thunbergii var. sinuata*
④ : *Phragmites communis*
⑤ : *Ilex crenata*
⑥ : *Pittosporum tobira*

artificial disturbance has been occurring(Fig. 3). According to Ahn and Choi[8], the surveyed area is thought to be a place where a servere environmental disturbance has been occurring[19]. At the present time, many *H. hamabo* were propagated and planted indiscreetly by local residents in Soan Island. It is suggested that the government should control the management of vegetation around the naturally inhibited area and create a genetic verification or selection for vegetation of an artificially propagated plant.

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