

Vegetation Structure of *Peucedanum japonicum* Thunb. Community in Southern Coast of Korea

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ABSTRACT: This study was conducted to evaluate the vegetation structure of the *Peucedanum japonicum* community by the phytosociological method of floristic composition table and cluster analysis on the southern coast of Korea. The vegetation of the *Peucedanum japonicum* community was classified mainly into 2 communities such as the *Miscanthus sinensis* community and the *Lysimachia mauritiana*-*Rosa wichuraiana* community. The *Carex boottiana* and *Sedum oryzifolium* community were classified as the lower rank of *Miscanthus sinensis* community. On level 1 of the cluster analysis of plant species, they were classified into *Lysimachia mauritiana* and *Rosa wichuraiana* group, also *Miscanthus sinensis*, *Carex boottiana* and *Sedum oryzifolium* in *Peucedanum japonicum* community, which is similar to the community classification shown in the synoptic table. On level 1 of the cluster analysis of relev, inland coast with Jejudo was *Lysimachia mauritiana* and *Rosa wichuraiana* of group such as level 1 of the cluster analysis of plant species, and island coast with Geomundo was *Miscanthus sinensis* *Carex boottiana* and *Sedum oryzifolium* of group such as cluster analysis of plant species.

Key words : *Peucedanum japonicum* Thunb., vegetation structure, community, synoptic table, cluster analysis

INTRODUCTION

The Korean Peninsula is close to the East, the West and the South sea and has many coastal dunes and sea cliffs. There are many coastal plants growing and adaptable to their geological features and topography. *Peucedanum japonicum* is one of them growing on sea cliffs. It provides valuable materials for edible and medicinal use.

Peucedanum japonicum Thunb. is a perennial plant belonging to the Umbelliferae family and grows naturally at the coast in East Asia such as Taiwan, Philippines, Japan and China (Ohwi, 1984; Fu *et al.*, 2001). This plant is important and useful. Its young stems and leaves are used as vegetables and its roots are used to make medicinal herbs together with *Glehnia littoralis* Fr. Schm. in traditional oriental medicine (Seo & Ryu, 1976; Song, 1998).

Research on *Peucedanum japonicum* conducted till now were partially done for its pharmacognosy and ingredients (Nam & Ryu, 1975; Ikeshiro *et al.*, 1994; Lee *et al.*, 2004; Zheng *et al.*, 2005) and for cultivation (Chung *et al.*, 1994; Park *et al.*, 1995). Also Kim *et al.* (2005) clarified geographical native distribution and environmental characteristics on the habitats of *Peucedanum japonicum*. Recently, the vegetation of this plant community was studied on the eastern and western coast by Kim *et al.* (2006ab), whereas it has not been studied on the southern coast of Korea.

This research was aimed to clarify the habitat vegetation structure of *Peucedanum japonicum* community using a floristic composition table and cluster analysis on the southern coast so that we could present basic information about the native growing situation of *Peucedanum japonicum*.

INVESTIGATION AND METHODS

Investigation areas of *Peucedanum japonicum* community for this research were to the south between the area west of Mokpo (34° 40' N) and east of Yangsan (35° 10' N) in South Korea. Investigation was conducted 10 times per year from September 2005 to September 2006. 56 habitats (relevs), where *Peucedanum japonicum* were growing homogeneously were sampled randomly by their physiognomy. Sample sizes of them were 2 × 2 m, 2 × 3 m, and 3 × 3 m in each habitats.

Vegetation investigation for the floristic composition table in *Peucedanum japonicum* community was conducted for the degree of dominance and sociability by the method of Braun-Blanquet (1964). Analysis of the community system was investigated by the hand-sorting method (Ellenberg, 1956; Muella-Dombois & Ellenberg, 1974), which is the traditional sampling process of Zurich-Montpellier School. Plants showing a low value in this analysis were excluded from the synoptic table (Zechmeister & Mucina, 1994).

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Cluster analysis was conducted to clarify type classification in natural distribution. For analysis of these materials, the degree of dominance of Braun-Blanquet (1964) was converted to the degree of vegetation ranks (1, 2, 3, 4, 5, 6, 7, 8, 9) of Van der Maarel (1979).

TWINSPAN (two-way indicator species analysis) was conducted by the methods of DECORANA and TWINSPAN of Hill (1994), and PC-ORD of McCune & Mefford (1999) for cluster analysis.

RESULTS AND DISCUSSION

Vegetation structure of *Peucedanum japonicum* community by synoptic table

The synoptic table of the *Peucedanum japonicum* community on the southern coast of Korea presented can be seen in Table 1. The main plant communities on southern coast were classified into the *Miscanthus sinensis* community and *Lysimachia mauritiana*-*Rosa wichuraiana* community. Also, as a lower rank community in the *Miscanthus sinensis* community was the *Carex boottiana* community and *Sedum oryzifolium* community. This vegetation structure seemed similar to *Miscanthetia sinensis* Miyawaki et Ohba 1970 reported in Japan, namely, it belongs to the *Lysimachietalia mauritanae* Nakanishi et H. Suzuki 1975 and *Peucedanion japonica* Ohba 1971 as a lower rank *Miscanthetia sinensis* Miyawaki et Ohba 1970 (Suzuki, 1979; Miyawaki, 1981).

Geographical distribution of the *Miscanthus sinensis* community (A, serial number 1, 2) was inhabited on island coastal areas such as Gomundo, Chujagundo and Jejudo, whereas *Lysimachia mauritiana*-*Rosa wichuraiana* community (B, serial number 3) was inhabited in inland coastal areas such as Haenam, gohung, Sacheon, Kimyoung, Aewuol and Jejudo. Therefore, the plant community by geographical distribution was classified into the inland and island coastal area, and Jejudo was included in the inland coastal area.

Plant species growing naturally with *Peucedanum japonicum* were such species as *Miscanthus sinensis*, *Carex boottiana*, and *Sedum oryzifolium* in island coastal areas, while there were *Rosa wichuraiana*, *Setaria viridis* var. *pachystachys*, *Heteropappus arenarius* and *Cyrtomium falcatum* in inland coastal areas. They seemed similar to vegetation structure of the west coast reported by Kim *et al.* (2006ab).

Companion plant species of *Peucedanum japonicum* were *Aster spathulifolius*, *Melandryum oldhamianum* var. *roseum* and *Calystegia soldanella*. Among them, *Aster spathulifolius* was highly appeared and made dense communities in eastern and western coastal areas (Kim *et al.*, 2006ab), but it was rarely distributed in southern coastal areas.

Table 1. Synoptic table of *Peucedanum japonicum* Thunb. community in southern coast of Korea.

Serial number	1	2	3
Mean area of relev (m ²)	6.9	6.8	6.3
Number of relev	23	11	22
Mean of coverage (%)	66.2	65.1	65.7
Mean of altitude (m)	9.6	10.0	8.9
Mean number of species per relev	13.0	12.5	12.7
Total number of showed plants	60	36	49
Community type	A		B
	A-a	A-b	

Peucedanum japonicum Thunb. community

Mean of coverage (%)	16.3	20.0	16.7
<i>Peucedanum japonicum</i> Thunb.	V (+-2)	V (+-3)	V (+-2)

Differential species of community

<i>Miscanthus sinensis</i> Ander.	V (+-2)	IV (+-2)	
<i>Carex boottiana</i> Hook. et Arno.	IV (+-2)	I (+)	I (2-2)
<i>Sedum oryzifolium</i> Mak.		IV (+-2)	I (+-2)
<i>Lysimachia mauritiana</i> Lam.	I (+-1)	II (+-2)	V (+-2)
<i>Rosa wichuraiana</i> Crep.	II (+-1)	I (+-1)	V (+-1)
<i>Setaria viridis</i> var. <i>pachystachys</i> Mak. et Nemo.	I (+-2)		V (+-2)
<i>Heteropappus arenarius</i> Kita.	I (+-2)		V (+-2)
<i>Cyrtomium falcatum</i> Presl	I (+)	I (+)	IV (+)
<i>Artemisia capillaris</i> Thunb.	I (+-2)	I (+)	III (+-2)

Companions of community

<i>Aster spathulifolius</i> Max.	III (+-2)		II (+-2)
<i>Melandryum oldhamianum</i> var. <i>roseum</i> Nak.	I (+)	II (+-2)	III (+-2)
<i>Calystegia soldanella</i> Roem. et Schult.	I (+)	II (+)	I (+)
<i>Eurya emarginata</i> Mak.	I (+-1)	I (1-2)	II (+-1)
<i>Tetragonia tetragonoides</i> O. Kunt.	I (+)	I (+)	II (+-1)
<i>Farfugium japonicum</i> Kit.	I (+-2)	I (+)	II (+)
<i>Imperata cylindrica</i> var. <i>koenigii</i> Dur. et Sch.	I (1-2)	I (2-2)	II (1-2)
<i>Ischaemum antheophoroides</i> Miq.	I (+)	II (+-2)	I (+)
<i>Chenopodium album</i> var. <i>centrorubrum</i> Mak.	I (+)	I (+)	
<i>Pittosporum tobira</i> Ait.	I (+-1)	I (+-1)	
<i>Rhaphiolepis umbellata</i> Mak.	I (1-1)	I (+)	II (+)
<i>Asparagus cochinchinensis</i> Merr.	I (+)	I (+)	I (+)
<i>Chrysanthemum zawadskii</i> var. <i>latilobum</i> Kita.	I (+-2)		I (+-2)

Miscanthus sinensis community

The *Miscanthus sinensis* community includes such species as *Miscanthus sinensis*, *Carex boottiana*, and *Sedum oryzifolium*. *Sedum oryzifolium* is a different species in the lower rank

community. The number of plots, average area, average coverage and average growing number of species of relevin *Miscanthus sinensis* community (A) totaled 34.0 plots, 6.9 m², 65.7% and 12.8 taxa, respectively. the average number of species that were growing and the average altitude of the *Miscanthus sinensis* community were 48.0 taxa and 9.8m, respectively.

In the lower rank community, the number of plots, average area, average coverage and average growing number of species of relevin *Carex boottiana* community (A-a, serial number 1) totaled 23.0 plots, 6.9 m², 66.2% and 13 taxa, respectively. The average number of species that were growing and the average altitude of *Carex boottiana* community were 60.0 taxa and 9.6 m, respectively.

In another lower rank community, the number of plots, average area, average coverage and average growing number of species of relevin *Sedum oryzifolium* community (A-b, serial number 2) totaled 11.0 plots, 6.8 m², 65.1%, and 12.5 taxa, respectively. The average number of species that were growing and the average altitude of *Sedum oryzifolium* community were 36.0 taxa and 10 m, respectively.

Lysimachia mauritiana-*Rosa wichuraiana* community

Different species in the *Lysimachia mauritiana*-*Rosa wichuraiana* community were such as *Lysimachia mauritiana*, *Rosa wichuraiana*, *Setaria viridis* var. *pachystachys*, *Heteropappus arenarius*, *Cyrtomium falcatum* and *Artemisia capillaris*. The number of plots, average area, average coverage and average growing number of species of relevin the *Lysimachia mauritiana*-*Rosa wichuraiana* community (B) totaled 22.0 plots, 6.3 m², 65.7%, and 12.7 taxa, respectively. The average number of species that were growing and the average altitude of the *Lysimachia mauritiana*-*Rosa wichuraiana* community were 49.0 taxa and 8.9 m, respectively.

Different species in the *Lysimachia mauritiana*-*Rosa wichuraiana* community grow closely with *Peucedanum japonicum* in natural habitats of Kyushu region (33°N) in Japan, which is similar latitude to Jeju in Korea (Nakanishi, 1979). Also, it showed a similar growing pattern both for the southern coastal areas in Korea and southern areas in Japan.

Cluster analysis of *Peucedanum japonicum* community

Cluster analysis, which makes much of similarity and differences of plant community is useful to decide family relationship and vegetation structure of plant communities. Also, cluster analysis is necessary in order to compare community classifications by a floristic composition table and factor analysis of DCA ordination. Fig. 1 and Fig. 2 are the results of TWINPAN classification of 15 species and 56 relevs of *Peucedanum japonicum* community on the southern coast of Korea.

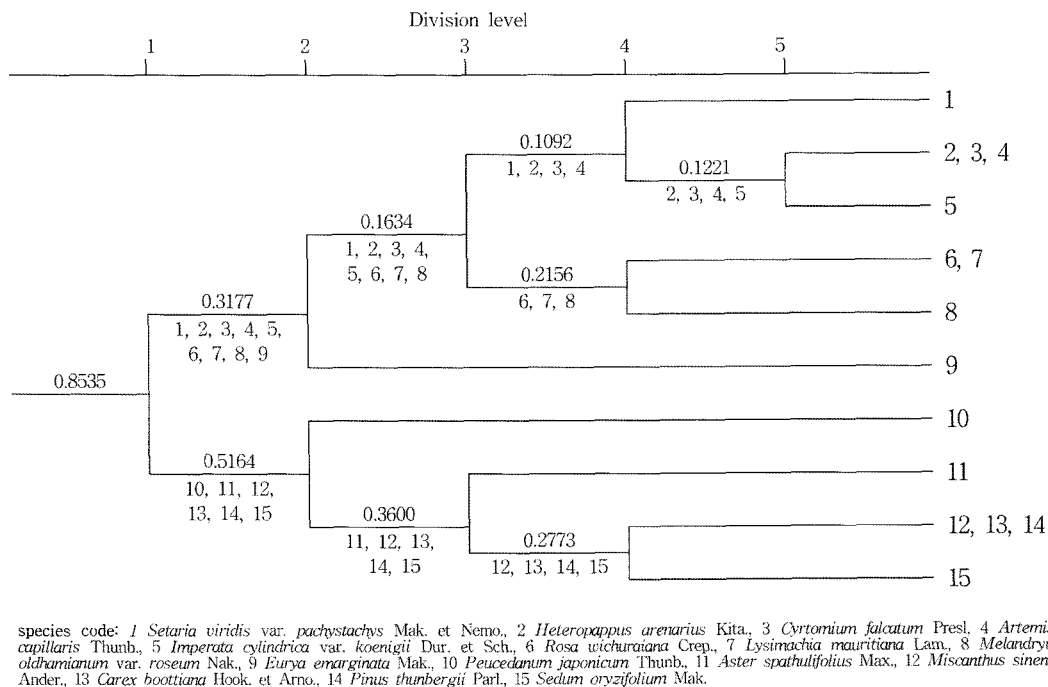


Fig. 1. Dendrogram of cluster analysis on 15 species and 5 level for divisions of *Peucedanum japonicum* Thunb. community in southern coast of Korea by use of TWINPAN. The numbers under the lines and right of dendrogram are species code, and the numbers on the lines are eigenvalues for the divisions.

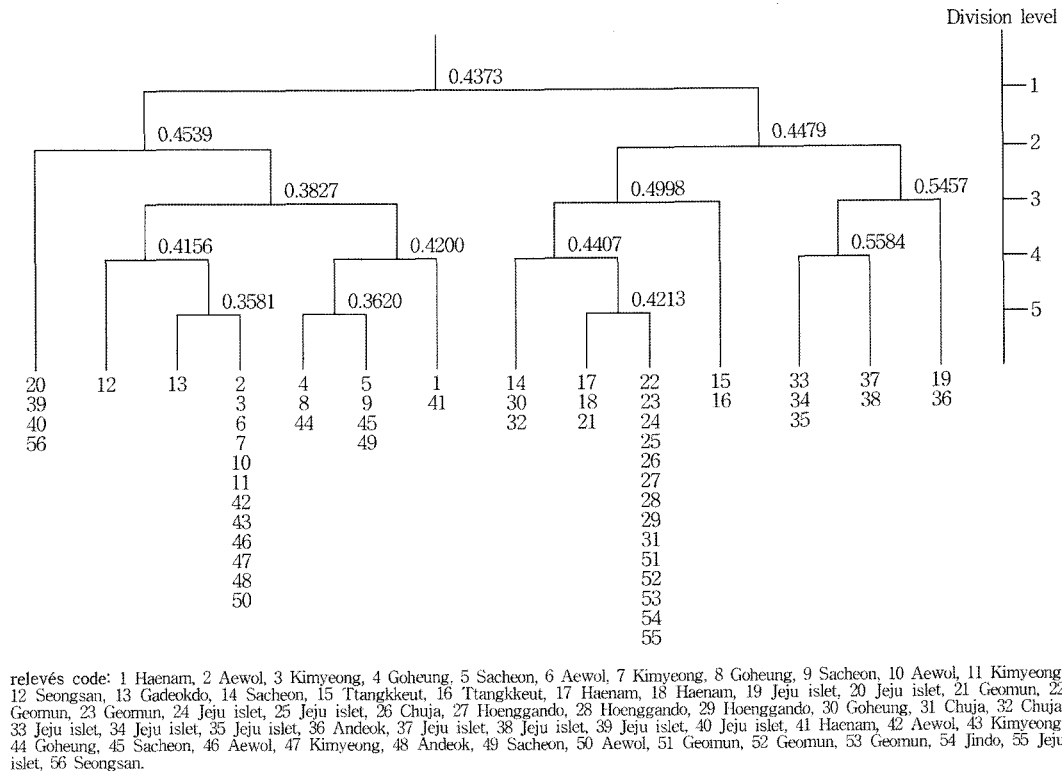


Fig. 2. Dendrogram of cluster analysis on 56 relevés and 5 level for divisions of *Peucedanum japonicum* Thunb. community in southern coast of Korea by use of TWINPAN. The numbers under of dendrogram are relevés code, and the numbers on the lines are eigenvalues for the divisions.

In cluster analysis of plant species by TWINPAN classification on 15 species, it was divided into two groups at level 1 of eigenvalue 0.8535, four groups at level 2, six groups at level 3, nine groups at the level 4, and ten groups at level 5 (Fig. 1).

Similar groups among plant species in *Peucedanum japonicum* community were classified into such as the *Lysimachia mauritiana*, *Rosa wichuraiana* groups and, such as the *Miscanthus sinensis*, *Carex boottiana* and *Sedum oryzifolium* groups at the level 1. This is similar to synoptic table of Table 1.

Especially, in eigenvalue of 0.2773 at level 4, it is classified into such as the *Miscanthus sinensis* and *Carex boottiana* groups, and such as the *Sedum oryzifolium* group. This well reflected the community classification at the lower rank of the *Miscanthus sinensis* community.

In cluster analysis of plant species, *Peucedanum japonicum* has high affinity with *Aster spathulifolius* and *Sedum oryzifolium* growing in rocky areas, *Miscanthus sinensis* growing in sunny places, *Carex boottiana* growing in sandy loam soil, and *Pinus thunbergii* growing at the edge of the forest. This expressed that the range of native distribution of *Peucedanum japonicum* is exceedingly wide on the southern coast of Korea.

In cluster analysis of relevés by TWINPAN classification on 56 relevés, it was classified into two groups at level 1 of the eigen-

value 0.4373, four groups at level 2, seven groups at level 3, eleven groups at level 4, and it was also classified into fourteen groups at level 5 (Fig. 2).

At level 1 of the cluster analysis of relevé, island coast such as Jejudo provides good growing conditions for *Lysimachia mauritiana*, *Rosa wichuraiana*, *Setaria viridis* var. *pachystachys*, *Heteropappus arenarius* and *Cyrtomium falcatum* groups as shown by level 1 of cluster analysis of plant species in Fig. 1. Also, it was similar for *Lysimachia mauritiana*-*Rosa wichuraiana* community (B) in community classification by floristic composition table of Table 1. Island coast with Geomundo was good for *Miscanthus sinensis*, *Carex boottiana*, *Sedum oryzifolium* and *Aster spathulifolius* of groups such as those in the cluster analysis of plant species in Fig. 1. Also, it was similar for such as *Miscanthus sinensis* community (A) in community classification by floristic composition table of Table 1.

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