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Landscape Ecological Study on the Habitats of Three *Thalictrum* Plants and its Distribution

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ABSTRACT

The purposes of this study were to clarify of floristic composition and the landscape structure on the habitats of three *Thalictrum* plants, which were distributed in Daejeon, Korea. Floristic composition of habitats was organized by living in flatten open space needed a lot of sunlight and humidity. Landscape ecological structure of habitats was defined by soils of loamy skeletal mesic, slope between 25 to 30° Vegetation rating was 75 percent of woody coverage at less than 450 m above the sea levels, respectively. Distribution patterns of *Thalictrum* plants in Daejeon were presented on the 1 km X 1 km grid map.

Key words **:** Floristic composition, Habitats, Landscape ecology, Genus *Thalictrum*

INTRODUCTION

The genus *Thalictrum* is one of the important genus of Ranunculaceae. This genus is distributed in temperate regions of the Northern Hemisphere. It is a medium-sized genus of family Ranunculaceae of about 190 species (Jones and Luchsinger, 1987; Tamura, 1995). All of *Thalictrum* species are herbaceous perennials with nectarless, apetalous flowers. The sepals are small and inconspicuous in the majority of species while some hermaphroditic species have larger and colored sepals. Flowers have numerous stamens that are sometimes the most conspicuous part of the flower. The 1- many pistils are simple and uni-ovulate and the fruits are dry achenes. These plants, however, need further study about the way of conservation and preservation because of use of these plants are ornamental, medicinal and edible resources themselves and in most country they were designated for endangered or extinct species in their Red-Data books (Environment Agency of Japan, 2000). Up to date, very few studies, cytological (Jensen *et al.*, 1995; Ro *et al.*, 1997), morphological (Lee, 1980), and nuclear genes (Johansson, 1995; Kosuge *et al.*, 1995; Ro *et al.*, 1997; Ro and McPheron, 1997) have been carried out on the genus *Thalictrum*, and more needs to be known about the pattern of distribution, population structure, preferred habitats, availability and quality of habitats in relation landscape ecology.

Korean *Thalictrum* plants were reported by Lee (1980) as 15 species and 3 varieties totally 18 taxa and among the all of these taxa, 3 speceis were distributed in Daejeon City, those were, T. *aquilegifolium*, T. *filamentosum and T. uchiyamai* (Kim *et al.*, 1995; Lee *et al.*, 1995; Kang *et al.*, 1999; Park *et al.*, 2000). Each species has a different structure of habitat.

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The analysis of species-environment relationship has always been a central issue in ecology (Guisan and Zimmermann, 2000). The quantification of such species-environment relationships represents the core of predictive geographical modeling in ecology. These models are generally based on various hypotheses as to how environmental factors control the distribution of species and community. Beside its prime importance as a research tool in autecology, predictive geographical modeling impact of accelerated land use and other environmental change on the distribution of organisms (Lischke *et al.*, 1998; Kienast *et al.*, 1995; 1996; Guisan and Theurillat, 2000), to test biogeographic hypotheses (Mourell and Ezcurra, 1996; Leathwick, 1998), to improve floristic and faunistic atlases (Hausser, 1995) or to set up conservation priorities (Margules and Austin, 1994).

To remedy localized approach, biological diversity need to be managed on the regional landscape level, at which the size of the landscape units more closely approximates the natural units prior to human disturbance (Grumbine, 1994; Noss and Cooperroder, 1994). An alternative to creating a miniature landscape of contrasting habitats on a small scale is to link all parks in an area in a regional plan so that larger habitat units can be created. Some of these larger habitats units would then be large enough to protect rare species that are not able to tolerate human disturbance (Primack, 1995). The objective of ecosystem management is to ensure a balance between sustainable development and preservation for ecological integrity (Gordon *et al.*, 2001).

This paper presents the distribution patterns about Korean Thalictrum plants and landscape ecological structure of habitats of three taxa in Daejeon and provides basic information for conserve and preserves Ranunculaceae plants.

MATERIALS AND METHODS

Description of Study area

This study was conducted at Daejeon, Korea during March to November 2000. Daejeon is located between 127°16'4"-127°18'36" east of longitude and 36°16'44"-36°26'14" of north of latitude at the center of the Korean Peninsula. Daejeon is an important transportation network center in Korea because national railroads, expressways, and highways converge here. Daejeon is situated in a valley that is located in the northwest part of the Noryeong Mountain Range. Mts. Shikjang (508 m), Bomoon (457 m), Mt. Kyejok (429 m), and Koobong (264 m) surround Daejeon. These mountains give the appearance of a folding screen surrounding Daejeon City. The Kapchon (35.2 km), Yudungchon (15.7 km), and the Daejeon streams (7.7 km) flow from south to north and join the Kum Kang (River). Daejeon is a comfortable and cozy place with low hills, open fields, and numerous rivers.

Daejeon has four distinct seasons. The average annual temperature is 12.1°C; the temperature variance between summer and winter is 27.8°C with the hottest summer average monthly temperature of 25.5°C in August and the coldest winter average monthly temperature of -2.3°C in January. The average annual precipitation is 1,360 mm. Fifty-five percent of the total precipitation falls in the summer season due to the influence of high-pressure systems from the northern Pacific Ocean.

Methods

This study was conducted landscape ecological structure of *Thalictrum* plants through phytosociological method from March to November 2000. Surveyed area were all territories of Daejeon. Surveyed items were character of habitats, and their community species. Based on these results detailed soil map (1:25,000; Office of Rural Development, 1974), geography

(1:25,000; National Geography Institute, 1996) and satellite photo were over-laid. Then distribution sites were showed on the 1 km × 1 km grid map. The grid size of 1km × 1km was already tested and its efficacy and limit were reported in Korea (Kim and Lee, 1997) and Japan (Nakagoshi *et al.*, 1998). Korean name and scientific name of plants were according to Lee (1980).

RESULTS AND DISCUSSION

Information on the habitat requirement of the rare plants was synthesized and formalized through the development of the models. These syntheses and models greatly improve the availability of information and habitat assessment tools to involved in conservation and development planning. The processes of model development and application help to identify knowledge and data gaps to guide future research and provide a framework for improving habitat assessment with new knowledge grained in the future (Wu and Smeins, 2000).

Landscape ecological structure of each habitat

Distribution patterns of each taxon were shown Fig. 1. Out of the 541 grids, *Thalictrum aquilegifolium* were observed at twenty-four grids, T. *filamentosum* and T. *uchiyamai* were observed at twenty-six grids, respectively. Species composition and landscape ecological structure of each habitat are as follows:

Thalictrum aquilegifolium L.

T. auilegifolium is a perennial plant of Ranunculaceae, which is easily found in Korean Peninsula. The habitat of this species is 240-450 m above sea level of north and northwest slope. *T. aquilegifolium* is a companion species of *Weigela subsesilis* subcommunity (Yee and Song, 2000), and its profile is tree layer 8-15 m (50-85%), shrub layer 6-8 m (40-70%) and herb layer 0.8 m (15-55%), respectively. The dominance species of this community are tree layer, *Quercus mongolica, Q. serrata, Carpinus laxiflora, Picrasma quassioides,* shrub layer *Sapium japonicum, Weigela subsessilis, Styrax japonica, Acer palmatum* and herb. layer *Pseudistellaria palibiniana, Potentilla fragarioides, Viola mandshurica, Oplismenus undulatifolius, Disporum smilacinum* and *Asarum sieboldii.* The important companion plants of this community are *Astillbe chinensis* var. *davidii, Athyrium yokoscense, Disporum smilacinum, Fraxinus rhynchopylla, Ainsliaea acerfolia, Acer mono, Lespedeza bicolir, Pseudostellaria palibiniana, Rhododendron schlippenbachii, Solidago virga-aurea* var. *asiatica, Carex siderosticta, Artemisia keiskeana, Dryopteris austriaca, Magnolia sieboldii, Dryopteris bissetiana, Carex lanceolata, Cornus contioversa, Atractylodes japonica, Kalopanax pictus, Sorbus alnifolia, Acer pseudo-sieboldianum, Betula ermani, Euonyumus oxyphyllus, Paris verticillata, Tilia amurensis, Viburnum wrightii, Viola diamantica, Acer mandshuricum, A. mono* for. *rubripes, A. tegmentosum, Actinidia arguta, Angelica anomala, Aristolochia contorta, Artemisia sylvatica, Aruncus dioicus* var. *kamtschaticus, Carpinus cordata, Corylus heterophylla, Meehania urticifolia, Ostericum melanotilingia, Picea jezoensis, Pinus koraiensis, Prunus maximowiczii, Sasa borealis, Sedum aizoon, Spodiopogon sibiricus, Vicia unijuga.*

High likelihood landscape ecological structure (Table. 1) of T. *aquilegifolium* was soils of loamy skeletal, mesic, under 450 m above the sea level steep slope areas more than 60° slope. Vegetation rating was high woody cover (50-85 %).

Thalictrum filamentosum Max. and T. *uchiyamai* Nakai

T. filamentosum and *T. uchiyamai* are perennial plants. These species build a communiy with *Quercus mongolica, Astillbe chinensis* var. *davidii, Athyrium*

Table 1. Landscape ecological structure of three *Thalictrum* species.

Classification	Structure		
	T. aquilegifolium	*T. filamentosum*	*T. uchiyamai*
Soil rating			
3. High likelihood	Loamy skeletal , mesic	Loamy skeletal , mesic	Coarse loamy, mesic
2. Medium likelihood	Coarse loamy, mesic	Coarse loamy, mesic	
1. Low likelihood	Coarse loamy, mixed, mesic Fine silty, mixed, nonacid, mesic	Fine loamy, mixed, nonacid Sandy skeletal, mesic	
Land form rating			
3. High likelihood	< 450 m steep areas (slope > 60°)	< 450 m; 25 < slope <30°)	< 450 m; 30 < slope <60°)
1. Low likelihood	> 450 m flat upland (slope < 60°)	> 450 m; slope > 30°)	> 580 m
Vegetation rating			
3. High likelihood	High woody canopy cover (50-85%)	High woody canopy cover (>75%)	High woody canopy cover (>75%)
2. Medium likelihood	Medium to high woody cover (30-50%)	Medium to high woody cover (15-75%)	Medium to high woody cover (15-75%)
1. Low likelihood	Spare woody cover (< 30%)	Spare woody cover (<15%)	Spare woody cover (<15%)

yokoscense, Disporum smilacinum, Fraxinus rhynchopylla, Ainsliaea acerfolia, Asarum sieboldii, Acer mono, Lespedeza bicolir, Pseudostellaria palibiniana, Rhododendron schlippenbachii, Solidago virga-aurea var. *asiatica, Artemisia keiskeana, Carex siderosticta, Dryopteris austriaca, Magnolia sieboldii, Dryopteris bissetiana, Carex lanceolata, Cornus contioversa, Atractylodes japonica, Kalopanax pictus, Sorbus alnifolia, Acer pseudo-sieboldianum, Betula ermani, Euonyumus oxyphyllus, Paris verticillata, Tilia*

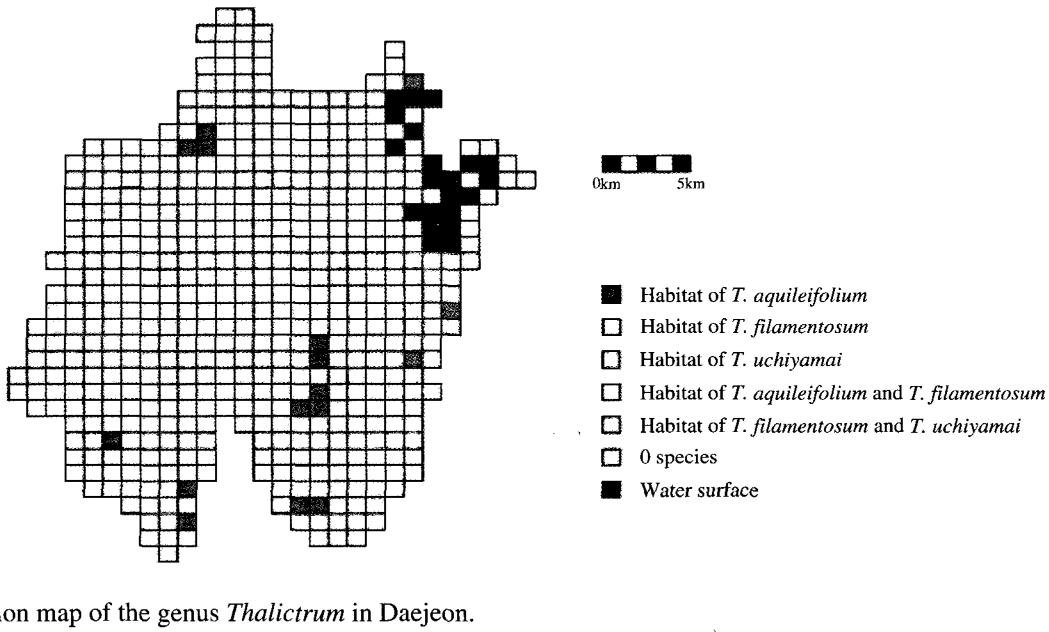

Fig. 1. Distribution map of the genus *Thalictrum* in Daejeon.

amurensis, Viburnum wrightii, Viola diamantica, Acer mandshuricum, A. mono for. *rubripes, A. tegmentosum, Actinidia arguta, Angelica anomala, Aristolochia contorta, Artemisia sylvatica, Aruncus dioicus* var. *kamtschaticus, Carpinus cordata, Corylus heterophylla, Meehania urticifolia, Ostericum melanotilingia, Picea jezoensis, Pinus koraiensis, Prunus maximowiczii, Sasa borealis, Sedum aizoon, Spodiopogon sibiricus, Vicia unijuga*. *T. filamentosum and T. uchiyamai* are important companion members of *Drypterido-Quercetum coryletosum thunbergii* (Kim, 1992), and its profile is T1 layer, 25 m (75%), T2 layer, 13 m (60%), shrub layer 5 m (65%) and herb layer 0.5 m (80%), respectively. This community was found at 400-450 m above sea level, south and southwestern 25-30° slope. Distribution pattern of these plants were showed on the Fig. 1.

High likelihood landscape ecological structure (Table 1) of *T. filamentosum and T. uchiyamai* were soils of loamy skeletal, mesic, under 450 m steep slope areas with 25-30° slope and vegetation rating was high woody cover (75 %).

Form the viewpoint of species composition; habitat structure is almost same between *T. filamentosum* and *T. uchiyamai*. *Quercus mongolica* is the most abundant species in the habitat with some *Carex* and *Persicaria* spp. While species composition of habitat of *T. aquilegifolium* is different from other two species. Species composition of habitat of *T. filamentosum* and *T. uchiyamai* are more closer than *T. aquilegifolium*.

The common features of landscape structure among three species were under 450 m above the sea level. Vegetation structures were 50-85% woody cover in vegetation rating was also the same among these taxa. The habitats of these taxa were distributed in the slope of high mountain. However, a lot of landscape elements of Daejeon has been changed every year (Kang *et al*., 2000). Habitat loss and modification are the most important cause of endangered species (Foin *et al*., 1998). It is essential for rare plant conservation to incorporate habitat assessment into development planning to minimize destruction of their habitats and maximize the effectiveness of mitigation efforts (Dale *et al*., 1998; Cuperus *et al*., 1999).

We have shown that these three species differ considerably in their small landscape scale environmental distribution. Our results suggest and support that environmental heterogeneity is an important determinant of interspecific distribution patterns in the forest understory not just for common species (Bratton, 1976; Crozier and Boerner, 1984; Beatty, 1985), but also for relatively infrequent species within a functional group (Vellend *et al*., 2000).

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