The Spatial Distribution of *Quercus mongolica* and Its Association with Other Tree Species in Two *Quercus mongolica* Stands in Mt. Jiri, Korea

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**ABSTRACT:** Stand structure and spatial associations of the dominant tree species in *Quercus mongolica* stands were investigated to understand interspecific relationships and the persistent dominance of *Q. mongolica*. We examined the species composition, DBH (diameter at breast height) distribution, and spatial distribution of trees (≥ 2.5 cm DBH) in two permanent 100 m x 100 m plots in *Q. mongolica*-dominant stands on the western part of Mt. Jiri. Ripley’s K-function was used to characterize the spatial patterns and associations of dominant tree species. *Q. mongolica* showed a continuous and reverse-J shaped DBH distribution with clumped spatial distribution in both study sites. *Q. mongolica* and *Abies koreana* exhibited a negative association implying potential interspecific competition. The positive spatial association between *Q. mongolica* and *Alnus hirsuta* var. *sibirica* and *Fraxinus sieboldiana* were affected by site characteristics: limited habitat conditions with a large proportion of rock surface. Our results suggest that interactions among species were complex and ranged from positive to negative. Differences in stand and site characteristics and regeneration mechanisms among the species play an important role in regulating their spatial distribution patterns, while competition between individuals also contributes to spatial patterning of these communities. The high density and the early developmental stage of spatial distribution and structural characteristics of *Q. mongolica* and the relatively low importance values of other species in the stands imply that *Q. mongolica* will remain dominant in the study sites in the near future.

**Key words:** clumped distribution, interspecific association, stand structure, sprouting

**INTRODUCTION**

Knowledge about the spatial relationships among species in a stand can help researchers to understand inter- and intraspecific relationships and to develop management plans that mimic natural processes (Salas et al. 2006). Accordingly, the spatial distribution patterns of species are a topic of interest among ecologists and forest managers (Anderson 1992, Yang and Kim 2002, Monzeglio and Stoll 2005). With the increasing use of statistics in biology, many methods for interpreting the spatial distributions of species have been introduced and developed, such as the Clark and Evans (1954) test, Pielou’s (1960) index of non-randomness, the contiguous

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environments.

*Quercus mongolica* Fisch. ex Ledeb. is a representative deciduous species in temperate forests in Northeast Asia. *Q. mongolica* is widely distributed across Korea and dominates Korean deciduous forests, especially on ridges and upper slopes. The topographical distribution of *Q. mongolica* on upper slopes and ridge areas may indicate that this species is adapted to dry soils and cold weather conditions. *Q. mongolica* individuals live for 100-300 years, and dominate the upper canopy layer (Abrams et al. 1999). They regenerate both by seeds and sprouts. In South Korea, more than 70% of *Q. mongolica* seedlings in natural forests were found to have originated from sprouts (Suh and Lee 1998). Their ability to sprout enables them to quickly reoccupy areas after catastrophic disturbances, especially fires, while their acorns are favored animal foods and make a relatively low contribution to *Q. mongolica* emergence. Although sprouting allows the species to reoccupy an area faster than other species due to its rapid early growth after a disturbance, it limits the spatial dispersion of the species to within the boundaries of the root distribution and competition with neighboring species has a substantial influence on *Q. mongolica* survival. Therefore the spatial relationships between *Q. mongolica* and neighboring species are important factors in *Q. mongolica* stands, especially stands with trees from sprout origin. However, little information is available about the spatial relationships of *Q. mongolica* with neighbor species despite the fact that *Q. mongolica* in Korean forests has been a major research subject. Our study aims to examine stand structural characteristics and the spatial relationship of *Q. mongolica* with neighboring woody species and to estimate the probability of persistence of this species in the study areas.

**MATERIALS AND METHODS**

**Study sites**

This study was conducted in two *Q. mongolica* stands on the western part of Mt. Jiri, which is located in the southern part of Korea. Mt. Jiri is the second highest mountain in South Korea with most ridges and peaks reaching altitudes over 1000 m asl. *Q. mongolica* is found at altitudes above 850 m asl on Mt. Jiri (Yim and Kim 1992, Korea National Park Service 2008). One study site (the Simwon study site) was located at the lower altitudinal limit of the *Q. mongolica*-dominant area and...