Ecological Characteristics of *Lycoris radiata* with Habitat Types

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ABSTRACT : The investigation of ecological characteristics of *Lycoris radiata* was carried out in flooding (site I), half flooding (site II) and dry stands (site III). Seasonal change of air temperature showed similar patterns and that of light intensity showed quite difference among three *L. radiata* stands. Seasonal change of soil water content showed a great difference among three *L. radiata* stands. The study area was dominated by *Pinus densiflora*, *P. thunbergii* and *L. radiata* communities. The number of bulb in *L. radiata* increased in September with bulb formation and decreased in January. Bulb weight in *L. radiata* was different from each site. The numbers of blossom were 23, 13 and 9, respectively in site I, II and III. The length of wreath were 17.0, 13.0 and 11.0 cm, respectively, the length of stamen were 7.0, 6.4 and 6.5 cm, respectively and the length of stalk were 60.0, 45.0 and 42.0 cm, respectively in site Ⅰ, Ⅱ and Ⅲ. The leaf of *L. radiata* developed rapidly in site I with sufficient water supply and lower light intensity, the number and the length of rootlets increased considerably in site III with insufficient water supply and higher light intensity, and the ecological characteristics in site II was intermediate between site I and site III. There was no great difference between the numbers of rootlets in site I and site II, which were due to sufficient water supply in two stands.

Key words : Bulb, Ecological characteristics, Leaf, *Lycoris radiata* Herb., Rootlet

INTRODUCTION

Although there are many bulbous plant species adapted in climate and soil of Korea, their importance are not recognized and various bulbous plants such as tulip, daffodil and lily were introduced and supplied from foreign markets. Especially, *Lycoris* species in Amaryllidaceae is not only used for medicinal purposes such as expectorant and abdominal dropsy, but also planted as ornamental plant (Chung 1981, Campbell 1986, Chung 1999). Representative *Lycoris* species in Korea are *L. squamigera* Max., *L. albiflora* Koide, *L. koreana* Nakai, *L. aurea* Herb. and *L. radiata* Herb var. *radiata* (Park *et al.* 1986a). *L. radiata* has 30~55cm tall leafless stalks topped with clusters of brilliant red flowers (Lee 1996). Each of the 5~7 flowers has extremely long anthers, giving the cluster a spider-like appearance. Only after the flowers have withered in a week or two do the narrow, strap-like basal leaves appear. The leaves themselves deteriorate by the following summer and for several weeks. Bulb is poisonous by lycorine and symptoms are abdominal pain, salivation, shivering, nausea, vomiting, and diarrhea (Hsu *et al.* 1994). *L. radiata* is native to Korea, China and Japan and planted widely by monks in the lowland and hills near Buddhist temple, which is the flower symbolizing paradise with lotus blassom in Buddhism (Inariyama 1948, Xu *et al.* 1982, Ji 2000).

In South Korea, *L. radiata* research has focused mainly on artificial propagation (Park *et al.* 1988), allozyme variation (Chung 1999), taxonomy and systematics (Tae and Ko 1996). Little is known about its ecological characteristics in habitats (Park *et al.* 1986a, b).

The objective of the current study was to clarify ecological characteristics and growth environment of *L. radiata* with habitat types in South Korea.

STUDY AREAS AND METHODS

This study was carried out in flooding (site I), half flooding (site II) and dry stands (site III) of *Lycoris radiata* in Mt. Sunwoonsan located in southwestern part of Chollabukdo Province, South Korea (Fig. 1). During the last 10 years (1989~1998) the observations by Gochang meterological station near Mt. Sunwoonsan showed that the annual precipitation is around 1,619 mm, 56% percent of it comes in summer. Mean annual temperature are 15.4 ℃.

In *L. radiata* stands air temperature was determined by mercury thermometer and light intensity was determined by lux meter. After

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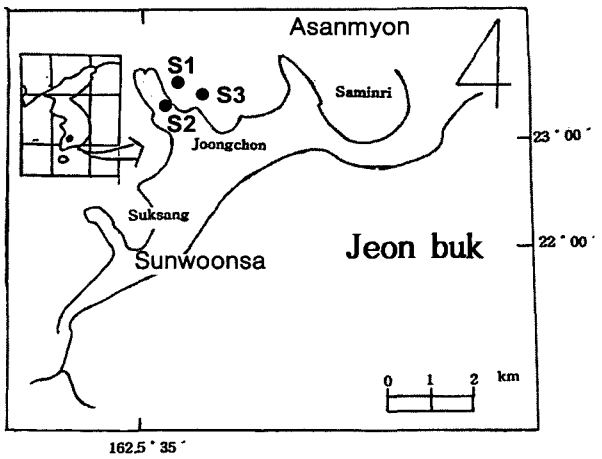

Fig. 1. The map showing investigated areas of three sites on the Mt. Sunwoon Lycoris radiata Herb. is growing

S1 : flooding area under a pine tree forest

S2 : a half flooding area with a mountain's slope

S3 : dry area

fresh soil samples were taken at a depth of 10 cm from the surface, soil moisture content was measured by finding the difference in weight between fresh soil and the same sample oven-dried at 98℃.

In order to examine the ecological characteristics of *L. radiata*, number and growth of bulb, time of flowering, leaf growth and mortality were measured in 1 m×1 m quadrats in three stands. The morphological characteristics of *L. radiata* were investigated monthly in each stand from March 2000 to April 2001. Bulb diameter, number and length of roots and leaves were determined in 10 replicates.

RESULTS AND DISCUSSION

Seasonal change of air temperature in three *L. radiata* stands showed similar patterns and ranged from 20℃ to 35℃ in May to October (Fig. 2). Seasonal change of light intensity showed quite difference among three *L. radiata* stands from May to October (Fig. 3). Maximum light intensity were 18,500, 14,200 and 6000 Lux in site I, II and III, respectively. Such difference is due to topological effect and seasonal change of plant canopy among each stand. Seasonal change of soil water content showed a great difference among three *L. radiata* stands throughout the study period, which is due to difference in light intensity and topography among the stands (Fig. 4).

The ecological and morphological characteristics of *L. radiata* were measured in site I, II and III with different habitat types.

The number of bulb in *L. radiata* increased in September with bulb formation and decreased in January (Fig. 5). Bulb weight in *L.*

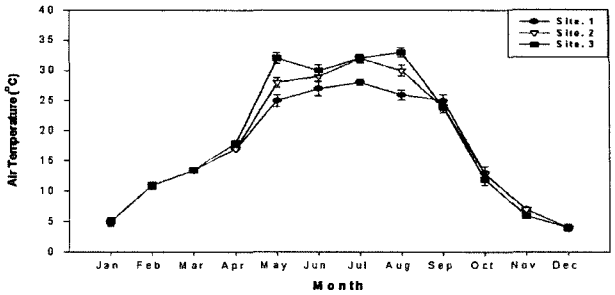

Fig. 2. Comparison of temperature at the three sites.

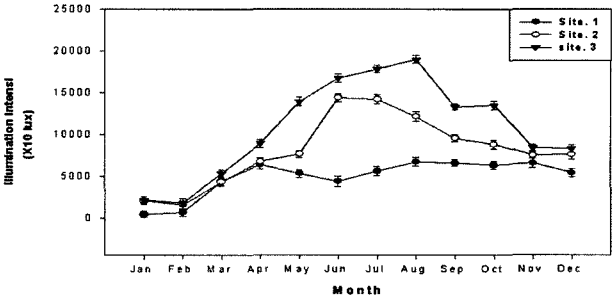

Fig. 3. Change of illustration intensity at the three sites.

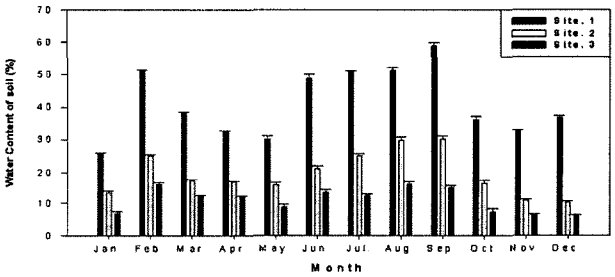

Fig. 4. Soil moisture content at the three sites.

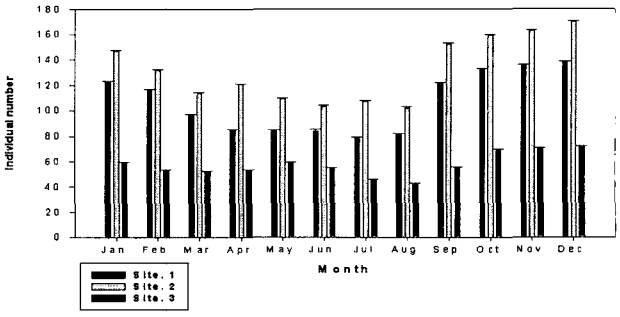

Fig. 5. Individual number within the quadrate at the three sites.

radiata was different from each site (Fig. 6). The results is consistent with that of Park (1986a). The number of blossom was 23, 13 and 9, respectively in site I, II and III. The length of wreath was 17.0, 13.0 and 11.0 cm, respectively, the length of stamen was 7.0,

5.4 and 6.5 cm, respectively and the length of stalk was 60.0, 45.0 and 42.0 cm, respectively in site Ⅰ, Ⅱ and Ⅲ(Fig. 7). Therefore, the site I was more suitable growth environment of *L. radiata* than other sites.

The bulb diameter (Fig. 8) tends to decrease from September, but there was no great difference between bulb diameters before and after the formation of new bulbs due to simultaneous bulb growth with bulb formation (Heaton 1934, Fujikas 1964, Park *et al.* 1986a). However, the number of rootlets tends to decrease with bulb formation (Fig. 9). There is no great difference between the number of rootlets in site I and site II, which is due to sufficient water supply in two stands.

The length of rootlets tends drastically to decrease with bulb formation in September (Fig. 10), but it increases rapidly in July and August due to high light intensity and evaporation as well as high precipitation in summer of Korea (Fletcher *et al.* 1965). The number of leaves increased from September to October and decreased after December and its difference among stands was about 2.0~6.6 (Fig. 11). The leaf began to elongate after death of stalk in September, and then grew rapidly in October to November. About 2 cm of leaf length decreased in December due to new bulb formation. The difference of leaf length among stands was about 2.7~6.6 cm (Fig. 12).

As a result, the *L. radiata* leaves developed rapidly in site I with sufficient water supply and lower light intensity, the number and the length of roots developed considerably in site III with insufficient

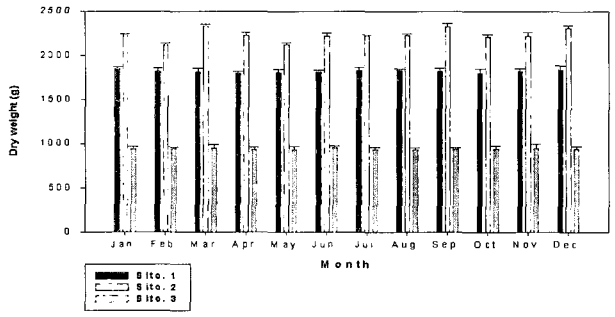

Fig. 6. Bulb weight within the quadrate at the three sites.

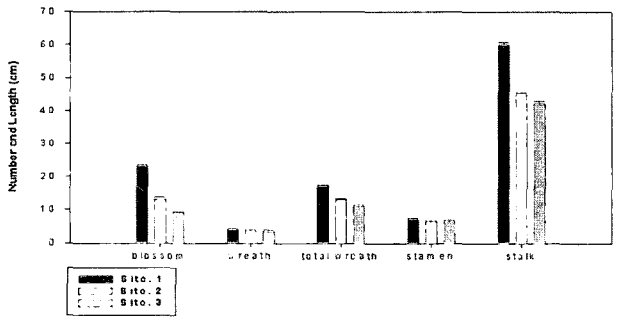

Fig. 7. Flowering pattens at the three sites.

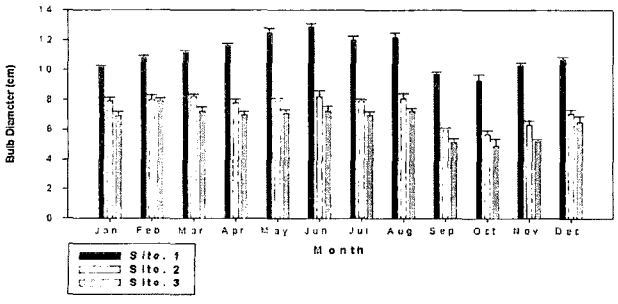

Fig. 8. Bulb diameter at the three sites.

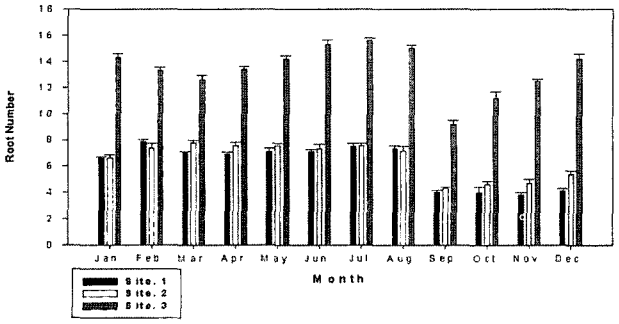

Fig. 9. Root number at the three sites.

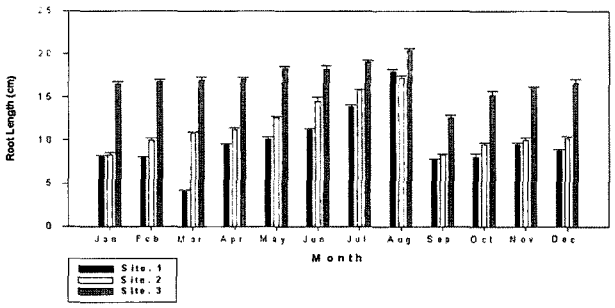

Fig. 10. Root length at the three sites.

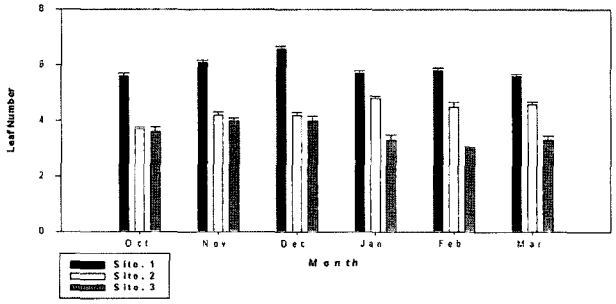

Fig. 11. Leaf number at the three sites.

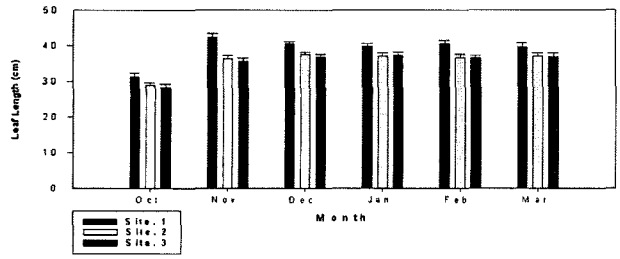

Fig. 12. Leaf length at the three sites.

water supply and higher light intensity, and ecological characteristics in site II is intermediate between site I and site III.

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