

## Effect of Temperature on Seed Germination and Seedling Growth of *Peucedanum japonicum* Thunberct

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### ABSTRACT

The objective of this study is to investigate morphological characteristics of seeds and effects of environmental factors such as light and temperature on the germination and seedling growth of *Peucedanum japonicum* Thunberct, Which belongs to Umbelliferae and useful for on oriental medicine materials. Seed shape of *Peucedanum japonicum* Thunberct is ovate. Color of seed coats varied from yellow to dark brown. Seed size is 5.3mm in length, 4.2mm in width. One thousand-seed weight of *Peucedanum japonicum* Thunberct is 4,010mg. Optimum temperatures for seed germination and seedling growth range from 20 to 25 ℃.

**Key words** : *Peucedanum japonicum* Thunberct, Morphological characteristics, seeds, germination

### INTRODUCTION

Increasing concerns about human's health with improvement of their living standard, consumption of oriental medicinal stuffs is continually increased and their import from China also is steadily increased. In most recent, statistical data indicated that most of the imported medicinal stuffs belong to Umbelliferae medicinal plants.

Umbelliferae medicinal crops have low germination under natural condition. The plants grow naturally throughout the temperate area of the Northern Hemisphere. Nearly 125 genus and 2,900 species of Umelliferae are distributed the world over (Lee et al., 1997), and about 34 genus 85 species of them are found in the Korean peninsula. The best known of these and

probably most abundant are *Peucedanum japonicum* Thunberct, *Saposhnikovia divaricata* Schischkin, *Glehina littoralis* Fr. Schmidt et Miquel and *Peucedanum terebinthaceum* Fischer et Reichenbach.

Germination capacity of seeds is strongly influenced by environmental factors such as temperature and water stress, which may interact in their effect (McGinnies, 1960; Tadmor et al., 1969). Light is required in some cases. Germination of most of plant was better at alternating temperature than at constant temperature. However, some crop plants have similar germination under alternating and constant temperature.

The purpose of this study was to determine optimum temperature for improving seed germination and early seedling growth of *Peucedanum japonicum* Thunberct. Little information is available for environmental

influences on germination of *Peucedanum japonicum* Thunberct in Umbelliferae plants.

## MATERIALS AND METHODS

### Morphological characteristics of seeds in medicinal plants of umbelliferae.

*Peucedanum japonicum* Thunberct, *Saposhnikovia divaricata* Schischkin, *Glehina littoralis* Fr. Schmidt et Miquel and *Peucedanum terebinthaceum* Fischer et Reichenbach were used as test plants. Morphological characteristics including size, length, width, shape, 1000-seed weight, color, and pattern were measured.

### Seed germination and growth variation of *Peucedani Radix* by environmental stress.

Effect of temperature on seed germination and seedling growth seeds of *Peucedanum japonicum* Thunberct, *Glehina littoralis* Fr. Schmidt et Miquel and *Peucedanum terebinthaceum* Fischer et Reichenbach were obtained from a field near Hamyang Medicinal Plant Experiment Station of Kyungnam Agricultural Research and Extension Services in October 2001 and 2002 and then stored at 4°C until used. Two layers of Whatman No.1 filter paper were placed in petri dish then 3ml of distilled water were pipetted onto the filter paper. Seeds were imbibed in distilled water for 24 hours at 20°C and rinsed in new tap water at 12hour

intervals. One hundred seeds were evenly placed on the wetted paper in each 9cm petri dish. The petri dishes were separately placed in growth chambers programmed at different temperatures. Temperatures tested were 5, 10, 15, 20, 25, 30, 35, and 40 °C, respectively. Number of germinated seeds was determined at 8 weeks after seeding and transformed to percent germination for analysis. Plant height and number of leaf were measured at 8 weeks after germination and represented as 'bad', 'moderate', 'good', and 'excellent' on the basis of the data. Germination experiments were conducted following the procedure of "Research Investigation Standard of Agriculture" provided by Rural Development Administration. The experiment was conducted with 3 replicates.

## RESULTS AND DISCUSSION

### Morphological characteristics of seeds in medicinal plants of umbelliferae

Seed shape of *Angelica gigas* and *Angelica acutilobu* are ovate. The results were supported by earlier report of Lee et al. (1997) that Umbelliferae plants forms 2 seeds as a schizocarp and their seeds are elliptic, oblong or ovate.

Color of seed coats varied from yellow to brown. Seed size was ranged from 6.5 to 4.8mm in length and

Table 1. Morphological characteristics of seeds in medicinal plants of umbelliferae.

Species	Shape	Color	Length (mm)	Width (mm)	1,000-seed weight(mg)
<i>Peucedanum japonicum</i> Thunberct,	Ovate	Yellowish brown	5.3	4.2	4,010
<i>Peucedanum terebinthaceum</i> Fischer et Reichenbach	Ovate	Brown	6.5	4.5	4,135
<i>Glehina littoralis</i> Fr. Schmidt et Miquel	Oblong	Yellowish brown	4.8	3.7	3,765
<i>Saposhnikovia divaricata</i> Schischkin	Elliptic	Brown	5.1	4.1	4,150

Table 2. Effect of temperature on seed germination of medicinal plants.

Medicinal plants	Germination(%)							
	5℃	10℃	15℃	20℃	25℃	30℃	35℃	40℃
<i>Peucedanum japonicum</i> Thunberct,	31a*	61a	78a	92a	94a	89a	82a	30a
<i>Peucedanum terebinthaceum</i> Fischer et Reichenbach	30a	60a	70ab	88ab	90ab	85a	74ab	25ab
<i>Glehina littoralis</i> Fr. Schmidt et Miquel	28a	59a	62b	81b	83b	71b	68b	21b

\*Means followed by the same letters indicate are not significantly different at the 5% level.

Table 3. Effect of temperature on seedling growth of medicinal plants

Medicinal plants	Degree of early growth							
	5℃	10℃	15℃	20℃	25℃	30℃	35℃	40℃
<i>Peucedanum japonicum</i> Thunberct,	+ <sup>n)</sup>	++	++	+++	++++	++++	++	+
<i>Peucedanum terebinthaceum</i> Fischer et Reichenbach	+	++	++	+++	++++	+++	++	+
<i>Glehina littoralis</i> Fr. Schmidt et Miquel	+	++	++	+++	++++	+++	++	+

<sup>n)</sup> +: bad, ++: moderate, +++: good, ++++: excellent

from 4.5 to 3.7mm in width.

One thousand-seed weight of *Peucedanum japonicum* was 4,010mg and *Peucedanum terebinthaceum* was 4,135mg. The results were supported by earlier report of Choi and Chon(2000) that Umbelliferae plants of seeds 1000-seed weight of *Buplerum falcatum* was lowest and *Angelica gigas* highest.

#### Germination degree

Germination rate of *Peucedanum japonicum* was 94%(highest) at 25℃, over 90% between 20 and 25℃, and minimum by 31%(lowest) at 5℃. This result indicates that optimum temperature for seed germination of was between 20 and 25℃. Germination percent for *peucedanum terebinthaceum* and *Glehina littoralis* were similar to *Peucedanum japonicum*.

They were well germinated between 20 and 25℃ but were poorest germination at 5℃. Choi and Lee (1994)

reported that temperatures ranged from 20 to 25℃ improved seed germination of Umbelliferae plants. However, it is thought that more in-depth experiments on effects of alternating temperatures would needed.

#### Early seedling growth

Plant height and number of leaf of medicinal plants tested were adversely affected at very low temperature. Seedling growth of *Peucedanum japonicum* Thunberct, was poorest at 5℃, intermediate between 15 and 20℃, and optimized at 25 and 30℃, respectively. Early seedling growth of Umbelliferae plants was maximized at 25℃. Choi and Yun (2002) reported that temperatures ranged from 20 to 25℃ and improved seedling growth of *Angelica acutilobu* in Umbelliferae plants. Maximum growth for *peucedanum terebinthaceum* and *Glehina littoralis* occurred between 20 and 25℃ and at 30℃. However their growth was poor at 5℃.

Therefore it is assumed that optimum temperature for seed germination and seedling growth of *Peucedanum japonicum* Thunberct in Umbelliferae plants ranged from 20 to 30℃ and especially temperature at 25℃ improved seeding growth. However, it was thought further detail researches on effects of other environmental factors such as light including light intensity, light quality, and photoperiod, and fertilization.

## REFERENCES

- Choi, S.K. and Lee, J.I. 1994, A study on utilization of medicinal herb as vegetable by Hydroponics. 1. The effect of light and temperature on the seed germination of medicinal herb. Korean J. oriental medicine resources 7(2) :138~141.
- Choi Seong kyu and Sang uk Chon. 2000. Temperature Effect on Seed Germination and Seedling Growth of Medicinal Umbelliferae Plants. Korean J. Plant. Res. 3(1) 66~70.
- Choi Seongkyu and Kyeong Won Yun 2002. Temperature Effect on Seed Germination and Seedling Growth of *Angelica acutilobu*. Korean J. Plant. Res. 5(3) 192~195.
- Huang H.C. and Liu S.H. 1987. Studies on the Improvement of Seed Germination of *Buplerum falcatum* L.J. Agri. Res. China 36(3):258~266.
- Lee E.I. 1996. Seed characteristics and germination of several medicinal plants In *Umbelliferae*. Ph. D. thesis. Dept. of Agronomy, College of Agriculture, Gyeong sang National University, Chinju, Korea. p.989
- Lee I.L., Ko Y.O., Choi C.H., Lee J.K. and Kim S.H. 1997. Morphological Characteristics of Seeds in Medicinal Plants of *Umbelliferae*. Korean J. Crop. Sci, 42(4) : 429~434.
- Lee E.I., Choi C.H., Lee J.K. and Kim S.H. 1997, Factors Involved in Promoting Seed Germination of *Foniculum Vulgare*. Korean J. Crop. Sci. 42(4) : 435~445
- McGinnies, W.J. 1960. Effects of moisture stress and temperature on germination of six range grasses. Agron. J. 52:159~162
- Momonoki Y, Hasegawa J. Ota Y, Tanabe T, Suzuki T and Kaneki Y. 1979. Studies on the germination of seeds of *Bupleurum falcatum* L. V. physiological properties of dormant *Bupleurum falcatum* seeds(2). Japan J. Crop Sci. 48(1): 46~51
- Moore R.P. 1976. Tetrazolium seed testing developments in North, American J. Seed Tech. 1:17~30.
- Rural Development Administration. 1989. Research investigation standard of agriculture (medicinal crop).
- Seung J. D. and Suh H.S. 1991. Research on improving germination of *Bupleurum falcatum*. Yeongnam Crop Exp. Sta. Report, Milyang. pp.597~599.
- Takahashi R and Ogawara K. 1980. A study of seed germination of *Coptis japonica* Makino. Japan. J.Crop Sci. 49(2):323~329.
- Tadmor, N.H., Y. Cohen and Y. Harpaz. 1969. Interactive effects of temperature and osmotic potential on the germination of range plants. Crop Sci. 9:771~774.

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