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Effects of Sodium Hydroxide and Sulfuric Acid on the Embryo Growth of Ginseng Seed (*Panax ginseng* C. A. Meyer)

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NaOH 및 H_2SO_4 處理가 人蔘 種子의 胚生長에 미치는 影響

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ABSTRACT

Endorcarp inhibited the embryo growth of ginseng seeds. This inhibition is not due to impermeability to water, but is probably caused by mechanical resistance. The embryo growth rate was enhanced by endocarp injury by soaking for 10 to 30 minutes in 2.5% solution of sodium hydroxide. But sulfuric acid did not affect on the embryo growth of ginseng seed.

INTRODUCTION

Ginseng seed will not germinate until the second season, or about eighteen months after harvested in natural conditions because it has two kinds of dormancy, morphological and physiological, and morphological marturity is slow. The embryo growth is affected by the moisture, temperature and oxygen. The practical method known for acceleration the embryo growth is to stratify the seed for approximately 100 days before seeding to germinate next spring after it has been harvested. The ginseng seed is wrapped with pulp and covered with hard endocarp. Therefore, it has a probability that germination will be inhibited by endocarp. Several authors have disscussed the influence of the endocarp on seed germination for the other crops. According to the Velasco and Gutierrez (1974), Went (1957) the endocarp delays germination in the coffee seeds, Toole *et al.* (1964) in peanut seeds and Ibrahim (1982) in groundnut seeds.

The aim of this work is to study the influence of the endocarp on the embryo growth of ginseng seeds.

MATERIALS AND METHODS

Ginseng seeds were harvested from four year old ginseng plants at the experimental field of the Korea Ginseng and Tobacco Research Institute in 1981 and 1982.

To investigate the influence of endocarp on the embryo growth, cut of the one thirds of endocarp by razor in 1981 and removal of endocarp in 1982 were done. The seeds treated were mixed with wet sand as a ratio of 1:3 in each year. After mixing, hundred seed were placed in a petri dish and strati-

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fied in a dark low temperature incubator (Model 818 Precision Co., U.S.A.) at 15°C for 90 days from August 10 to November 10, 1982, replicated three times. Each petri dish was covered with vinyl film to prevent evaporation. For measuring the water uptake, twenty seeds were inbibed in a petri dish lined with two layers of filter paper (Whatman No. 1) wetted with 10ml of distilled water at the room temperature. Moisture contents were measured by dring at 95°C for 24 hours.

A second trial was also conducted to investigate the effect of chemical injury to the endocarp on the embryo growth. Fifty seeds per replication were treated and replicated three times. The seeds were soaked in 1, 2.5 and 5% sodium hydroxide solutions for 10, 20, 30 and 60 minutes and rised for three hous with running tap water. For using the sulfuric acid, the concentrations were 1, 5 and 10%, and soaking times were 1 and 3 hours. The seeds were stratified in a plastic pot (20 x 20 x 25cm) by the general method.

RESULTS AND DISCUSSION

The presence of endocarp drastically inhibited the embryo growth of ginseng seed, and standard deviation of embryo growth was greater in the case of endocarp intacted seeds than that of endocarp removed (Fig. 1). Toole, et al. (1964) mentioned that the inability of freshly harvested groundnut seeds to germinate is due to an influence of the seed coat. Franco (1956) concluded that the endocarp delays germination through mechanical action by his experimental results that when coffee seeds were in soil the endocarp has no effect on germination, but when sown on filter paper in sand or vermiclite the endocarp delayed or even inhibited germination. The present results are in agreement with those of Toole, *et al.* (1964) and Franco (1956).

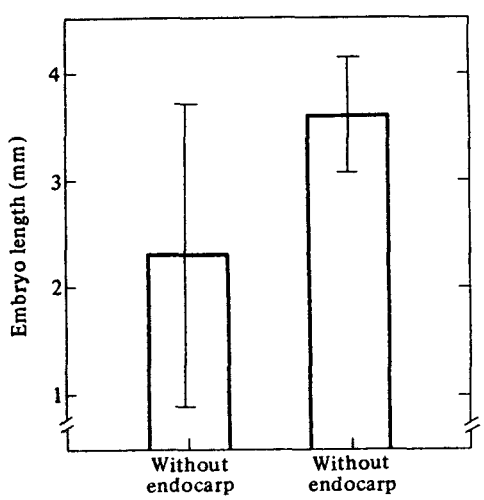

Fig. 1. Embryo growth of ginseng seed with and without endocarp after 90 days stratification at 15°C.

There was, however, no difference in water uptake of seeds with or without the endocarp since 2 days after imbibition. Maximum water content in the seeds was increased only 3% of fresh weight comparing to that of harvested time (Fig. 2). These findings suggested that the endocarp did not restrict the uptake of water which is necessary for growth of the embryo and the water content in the seeds at harvest might be enough to the embryo growth. The cut of the endocarp enhanced also the embryo growth (Table 1).

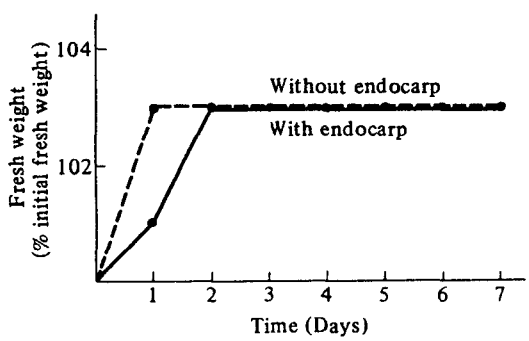

Fig. 2. The time course of water uptake by ginseng seeds with and without endocarp (under the room temperature)

Table 1. Effect of cutting endocarp on the embryo growth of ginseng seed.

Treatment	Embryo length (mm)	
	Mean	Standard deviation
Control	2.30	1.3
Cutting endocarp	3.20	0.8

The chemical injury of endocarp with sodium hydroxide solution enhanced the embryo growth. The soltion of 2.5% sodium hydroxide was most effective. And soaking time was good from 10 to 30 minutes. The standard deviations of embryo growth in the seeds of sodium hydroxide treated were smaller than that of untreated ones (Table 1). Therefore, uniform germination can be expected. Seed decay by sodium hydroxide treatment was not showing any tendency among the soaking times with 1 and 2.5% sodium hydroxide, but severe seed decay was observed with 5% treated more than 20 minutes (Table 2). Treatment of sulfuric acid did not affect on the embryo growth and there

Table 2. Effect of cocentration and soaking time of sodium hydroxide on the embryo growth of ginseng seed.

	1.0%				2.5%				5.0%				
	10*	20*	30*	40*	10*	20*	30*	40*	10*	20*	30*	40*	Control
Embryo length (mm)	2.94	2.83	2.83	2.97	3.50	3.56	3.50	3.34	2.85	3.17	2.96	2.83	2.25
Standard deviation (mm)	0.8	0.9	0.8	0.7	0.6	0.8	0.8	0.6	0.9	0.9	0.8	0.9	1.4
Seed decay (%)	2	0	9	8	6	2	3	8	3	13	15	18	0

*minutes.

was no seed decay at all (Table 3). Dehgan and Schutzman (1983) mentioned that average number of days to germination of *Zamia furfurcea* was reduced by H_2SO_4 treatment. In this result, it appeared that H_2SO_4 did not weaken the endocarp of ginseng seed which was composed with 22.2% hemicellulose and 43.6% cellulose (Chung and Park, 1982).

Table 3. Effect of concentration and soaking time of sulfuric acid on the embryo growth of ginseng seed.

	1.0%		5.0%		10.0%		Control
	1*	3*	1*	3*	1*	3*	
Embryo length (mm)	2.17	2.20	2.38	2.29	2.20	2.30	2.25
Standard deviation (mm)	1.3	1.4	1.5	1.3	1.4	1.3	1.4
Seed decay (%)	0	0	0	0	0	0	0

*Hours

These results confirmed that embryo growth was inhibited with the intact endocarp at initial stage of embryo growth. The mechanism was similar to the result of Lee et al. (1982), that is, when the seeds were stratified with sand the abundant microflora decomposed the endocarp fast enough to avoid and embryo growth delay, however, the embryo growth was inhibited when the seeds were treated with captan before statification because fungi was not alive on the surface of the endocarp, therefore, did not weaken the endocarp. Choi (1977) found the presence of the germination inhibitor in the endocarp of ginseng seeds. However, probably this inhibitor was not inventory because embryo growth rates were enhanced with chemical injury of endocarp and by the cut of endocarp. We can conclude that the endocarp inhibit the embryo growth of ginseng seeds through mechanical action. In other plants, the seed coat also seems to act as a mechanical barrier thereby restraining the germination. This is case in *Alisma plantages* (Crocker and Davis, 1914) and groundnut (Ibrahim, 1982, and Velasco and Gutirres, 1974). These results suggest that although removal of the endocarp is an effective means of enhancing the embryo growth, it is too much time consuming to be commercially feasible. Chemical damage of the endocarp by soaking for 10 to 30 minutes at 2.5% solution of sodium hydroxide is an effective means of stimulating the embryo growth of ginseng seeds.

摘　　要

人蔘種子의 內果支는 胚生長을 현저히 抑制시켰다 이 抑制作用은 內果支에 依한 水分吸收 때문이 아니라 機械的인 것으로 推測되어졌다.

水酸化나트리움 2.5% 溶液에 人蔘種子를 10分 내지 30分 浸積시키므로써 胚生長을 促進시킬 수 있었으나 黃酸處理는 人蔘種子의 胚生長에 影響을 주지 못했다.

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