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Germination characteristics and Storage behavior of *Codonopsis pilosula* Nannf. seeds

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INTRODUCTION

- ***Codonopsis pilosula* Nannf.** is classified as an endangered species (VU) in Korea.
- Ex situ conservation through long-term storage of seeds is, in principle, possible for a significant proportion of plants.
- However, it is not known whether these seeds are orthodox; that is, if they can survive under long-term storage conditions (-20 °C, 40 % relative humidity (RH) or less) without being damaged.
- We determined the germination characteristics and storage behavior of *C. pilosula*.

Fig 1. *Codonopsis polosula* Nannf.

MATERIALS AND METHODS

- The seeds were collected from plants growing at the Baekdudaegan Arboretum on September 17, 2020. After collection, the equilibrium relative humidity (eRH) of the seeds was measured.

Germination test

- X-ray test
  Filled rate(%) = Filled seeds/ Total number of seeds×100
- Germination test
  GA_3 100, 250ppm (Constant temperature 15, 20, 25℃)
- Germination percentage(%) = the number of germinated seeds/ Total number of seeds ×100

Tetrazolium test

- Use 1% tetrazolium solution
  Determine viable · nonviable seed according to dying status

Desiccation tolerance

- Drying 15,20,30,40,50% relative humidity at 15℃ using LiCl solutuion
- Determine moisture content and viability assay by 15, 20, 30, 40, 50% eRH

Moisture contents

- When the moisture equilibrium is reached, measure the equilibrium relative humidity using a hygrometer and drying 103℃, 17hr method according to the National seed resources seed inspection Guidlines

RESULTS

Table 1.Effect of concentration of GA_3 and constant temperature on germination

Treatment	Temperature(℃)	Germination percentage(%)
Control	15	11.0±3.0
	25	9.0±3.0
	25	1.0±1.0
$GA_3$100	15	60.0±4.1
	20	60.0±7.1
	25	72.5±2.5
$GA_3$250	15	90.0±7.1
	20	90.0±7.1
	25	60.0±9.1

- The average germination percentage (GP) of untreated seeds was below 11 ± 3 %. The highest GP of seeds following GA_3 treatment was 90 ± 0.70 %.

Table 2. Effect of total viability and Moisture contents of *C. pilosula.*

eRH(%)	Moisture content(%)	Germination percentage(%)	Total Viability(%)
15	3.05±0.07	84.0±0.4	88.0±2.8
20	3.24±0.08	84.0±0	91.0±1.0
30	3.92±0.08	72.0±1.7	75.0±6.8
40	4.78±0.09	70.0±5.0	73.0±5.0
50	5.99±0.07	82.0±2.6	90.0±2.6

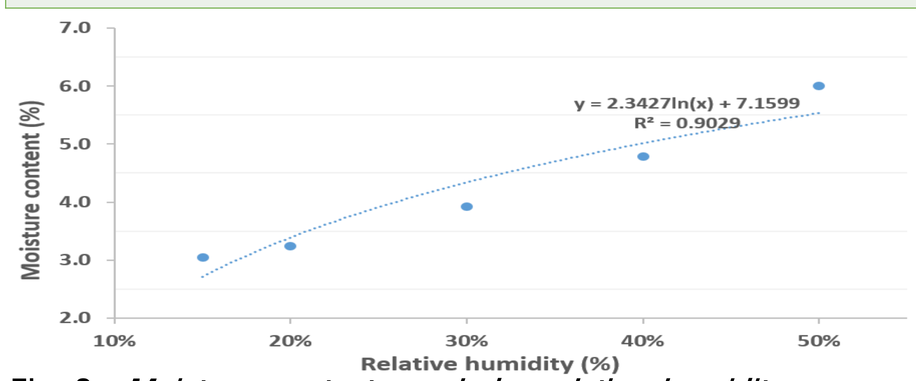

Fig 2. *Moisture content graph by relative humidity*

- The initial seed viability percentage was 90.3 ± 2 %. The highest viability percentage was identified at 91 ± 0.25 % in equilibrium with 20 % (eRH) at 15 ° C with a moisture content of 3.23 % Fresh weight.

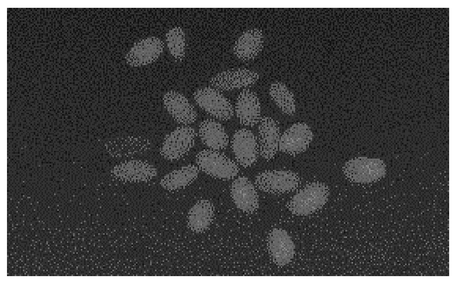

Fig 3. X-ray *C. polosula* Nannf.

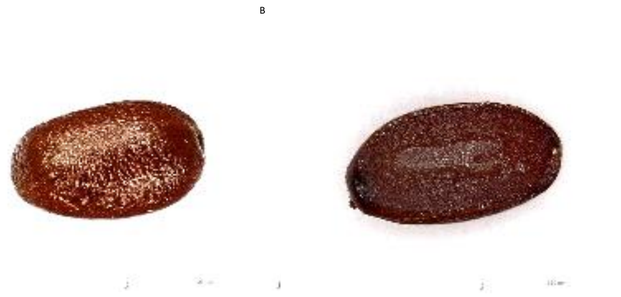

Fig 4. Morphology of *C. polosula* Nannf.

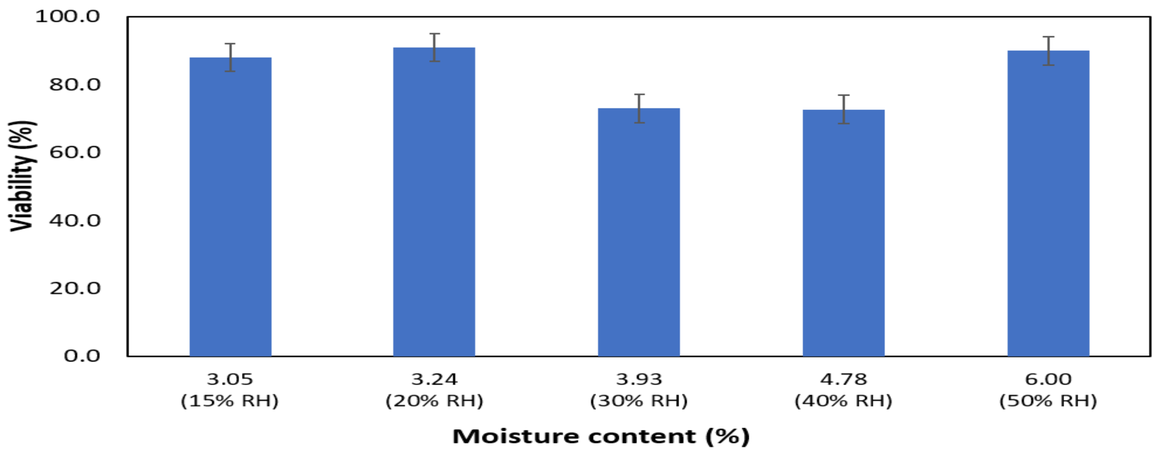

Fig 5. Viability graph of Moisture content

- *C. polosula* seeds showed a low germination rate of less than 11±3% in the untreated condition, and it was confirmed that the GA3 treatment improved by 90±7.1% in the 250ppm condition. The seeds of ginseng are presumed to be physiologically dormant seeds.
- The collected seeds showed a statistically significant difference as a result of the vitality test after confirming the moisture balance of the seeds under the conditions of 15, 20, 30, 40, and 50% RH.
- *C. polosula* shows the behaviours of orthodox seeds, and long-term storage conditions after drying. It was confirmed that it can be stored at (-20℃, RH40% or less).

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