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# Effects of gibberellic acid and temperature on germination of *Amygdalus scoparia* Spech seeds

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**SUMMARY –** *Amygdalus scoparia* is native to Iran. This species has an important role in fighting desertification and yielding human consumption products. The experimental method used was a factorial design. The effects of temperature (7 and 22°C) and $GA_3$ (0,125, 250 and 500 ppm) were tested. Germination percentages showed no significant differences at the tested $GA_3$ at 7°C, but were significantly at 22°C. Significant differences were observed between the control and 500 ppm $GA_3$. The highest seed germination percentage was observed with 125 ppm $GA_3$ at 7°C. Effects of $GA_3$ treatments on seedling root lengths were not significant at either temperature tested but temperature itself had a highly significant effect. The maximum seedling lengths were observed with 250 ppm $GA_3$ and 22°C temperature. Effects of $GA_3$ treatments on seedling lengths were significant but temperature had no effect on stem elongation. Treatment with $GA_3$ up to 250 ppm doses increased plant length.

**Key words:** *Amygdalus scoparia*, germination, gibberellic acid, temperature.

***RESUME –*** *"Effets de l'acide gibbérellique et de la température sur la germination des semmences de* Amygdalus scoparia *Spech".* Amygdalus scoparia *est une plante pérenne originaire de l'Iran. D'une manière générale, l'espèce végétale a un rôle important dans la lutte contre la désertification et dans la production des produits de consommation humaine. Dans cette étude, la méthode expérimentale utilisée était un plan factoriel. Les traitements étaient la température (7°C et 22°C) et l'$AG_3$ (0,125, 250 et 500 ppm). Cependant, il n'y a pas eu de différences significatives entre les pourcentages de germination avec $AG_3$ à 7°C. Mais, par contre, des différences significatives ont été observées à 22°C. En outre, des différences significatives ont été révélées entre le témoin et $AG_3$ à 500 ppm. Le pourcentage de germination le plus élevé des graines a été observé avec l'$AG_3$ à 125 ppm et à 7°C. Concernant les effets du traitement $AG_3$ sur la longueur des racines, il a été démontré que ces effets sur les jeunes plants étaient non significatifs pour chacune des températures testées, bien que la température avait révélé un effet hautement significatif dans le test. Les longueurs maximales des jeunes plants ont été observées avec l'$AG_3$ à 250 ppm et à la température de 22°C, indiquant que les effets du traitement $AG_3$ sur les longueurs des jeunes plants étaient significatifs, mais la température n'avait pas d'effet sur l'élongation de la tige. En définitive, le traitement à l'$AG_3$ jusqu'à la dose de 250 ppm, a provoqué une augmentation de la longueur du plant.*

***Mots-clés :*** Amygdalus scoparia*, germination, acide gibbérellique, température.*

## Introduction

*Amygdalus scoparia* is native to Iran. It occupies large areas in many parts of the country and in other neighbouring countries. It has an important role in fighting desertification and providing human consumption products. This species is also used as a rootstock for commercial almond production. Successful seed germination depends on numerous internal and external factors. There are several methods to release seeds from dormancy and initiate early growth, such as stratification, scarification, growth regulators etc. Gibberellic acid ($GA_3$) and moist chilling have been used for promoting germination of many kinds of seeds belonging to peach, plum, apricot, cherry, apple, grape and pistachio. Moreover, $GA_3$ can largely replace cold and light requirements, and scarification needed by some seeds for germination. The present study was undertaken to investigate the effects of $GA_3$ and temperature on (breaking) dormancy of wild almond seeds.

## Materials and methods

The present study was conducted at the Laboratory of Tropical and Subtropical Agriculture and

Ethnobotany, Faculty of Agricultural and Applied Biological Science at Gent University during 2002-2003. Seeds of *Amygdalus scoparia* were obtained from natural areas near Shahrekord Natural Resources Institute in Chaharmahal-Bakhtiari province, Iran. Experimental method used was a factorial design with CRD as basic design and three replications. In this study, temperature (7 and 22°C) and $GA_3$ (0,125, 250 and 500 ppm) were treatments. At first, nuts were opened by hammer and kernels subsequently soaked in 4 different $GA_3$ solutions: 0 (control), 125, 250 and 500 ppm for 24 h. Then, tested kernels were transferred to refrigerator or incubator and kept at temperatures of 7 or 22°C, respectively. After germination, seeds were planted in pots containing propagational soil No. 4 (50%) and heavy soil (clay and peat) (50%), and maintained in greenhouse under environmental conditions of 27°C day and 20°C night temperatures, RH 60% (±25%) and additional light in day time.

## Measurements

In this research, germination percentage, seedling root length and hypocotylous seedling length were measured. Data were statistically analysed using a factorial design by SPSS programme and mean results were compared by LSD test (5%).

## Results

Germination percentage – Germination rates of wild almond seed are presented in Table 1.

Table1. Mean percentage of wild almond seed germination in different $GA_3$ concentrations at 7°C and 22°C temperature (%)

| Concentration | Temperature | | |
|---|---|---|---|
| | 7°C | 22°C | Average (7°C and 22°C) |
| Control (0 ppm) | 91.67 a | 51.67 a | 71.67 a |
| 125 ppm | 100.00 a | 66.67 a | 83.33 ab |
| 250 ppm | 75.00 a | 68.33 ab | 71.67 a |
| 500 ppm | 87.50 a | 71.67 b | 79.58 b |
| Average | 88.54 | 64.59 | 76.56 |

According to the results, germination percentages showed no significant differences at tested $GA_3$ at 7°C, but were significantly at 22°C. Significant differences were observed between control and 500 ppm $GA_3$. The highest germination percentage (83.3%) was obtained with 125 ppm $GA_3$. Overall, the low temperature tested had high significant effect on seed germination and at 7°C germination was higher than at 22°C (Fig. 1). The highest seed germination percentage was observed with 125 ppm $GA_3$ at 7°C.

Seedling root length – Influence of $GA_3$ and temperature on seedling root length of wild almond is shown in Table 2.

Effects of $GA_3$ treatments on seedling root lengths were not significant at any of the temperatures tested but temperature itself had highly significant effect: seedling root length at 7°C was higher than at 22°C (Fig. 2).

Seedling length – Maximum seedling lengths were observed with 250 ppm $GA_3$ and 22°C temperature (Table 3).

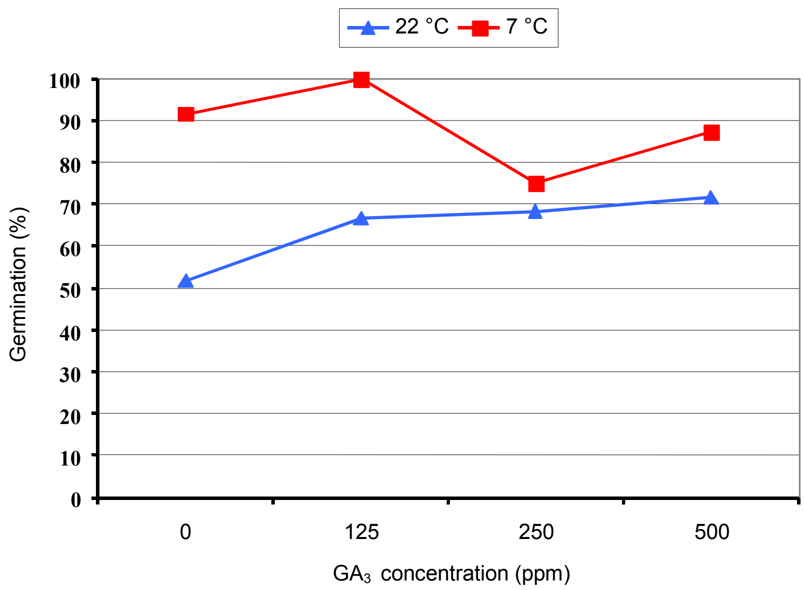


Fig. 1. Mean percentage of seed germination at different $GA_3$ concentrations and temperatures.

Table2. Influence of $GA_3$ and temperature on seedling root length (means) (cm)

| Concentration | Temperature | | |
|---|---|---|---|
| | 7°C | 22°C | Average (7°C and 22°C) |
| Control (0 ppm) | 3.66 a | 2.36 a | 3.01 a |
| 125 ppm | 3.67 a | 2.01 a | 2.84 a |
| 250 ppm | 3.03 a | 1.95 a | 2.49 a |
| 500 ppm | 2.97 a | 1.82 a | 2.39 a |
| Average | 3.33 | 2.03 | 2.68 |

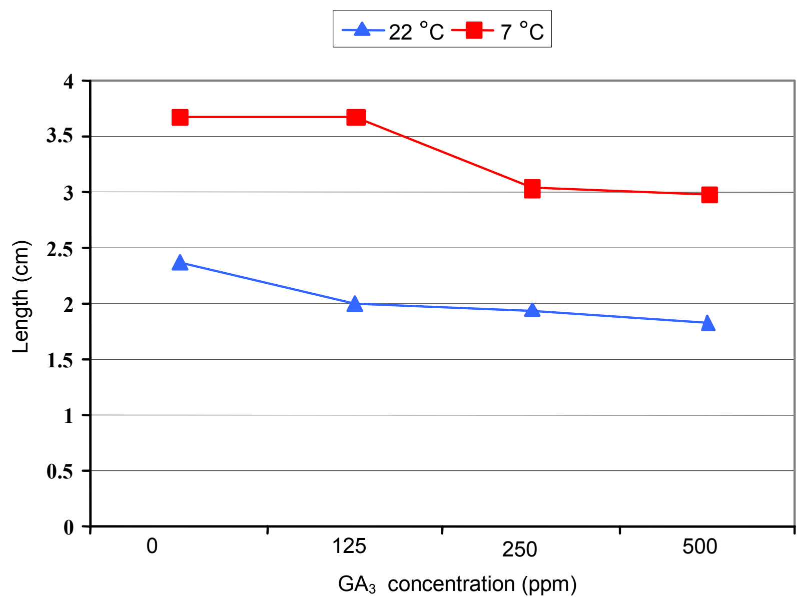


Fig. 2. Influence of $GA_3$ and temperature on seedling root length.

Table 3. Influence of $GA_3$ and temperature on the seedling length (means) at 30 days sowing (cm)

| Concentration | Temperature | | |
|---|---|---|---|
| | 7°C | 22°C | Average (7°C and 22°C) |
| Control (0 ppm) | 13.63 ab | 12.87 a | 13.25 a |
| 125 ppm | 16.24 a | 13.07 a | 14.65 ab |
| 250 ppm | 11.93 b | 19.23 b | 15.58 b |
| 500 ppm | 12.83 b | 8.93 c | 10.88 c |
| Average | 13.66 | 13.52 | 13.59 |

Effect of $GA_3$ treatments on seedling lengths was significant but temperature had no effect on stem elongation. Treatment with $GA_3$ up to 250 ppm doses increased plant length. At 500 ppm, however, seedling growth was depressed (Fig. 3).

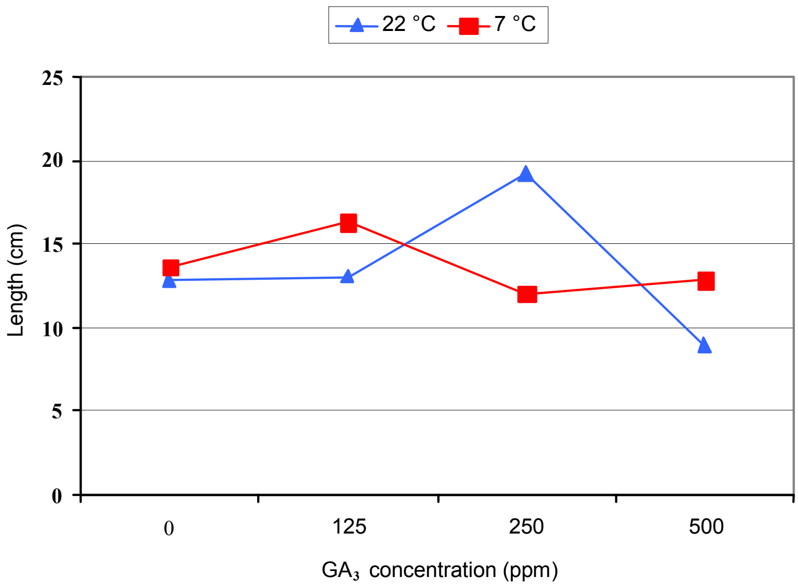


Fig. 3. Influence of $GA_3$ and temperature on seedling length at 30 days often sowing.

## Discussion

In this research, the effect of $GA_3$ on wild almond seed germination was investigated. According to Table 1, germination percentage was not significantly influenced by $GA_3$ at 7°C. Because seeds exposed to low temperature removed chilling requirement and probably increased endogenous $GA_3$ level. Therefore, application of exogenous $GA_3$ had no clear effects (Ross, 1984; Villiers, 1972).

Application of $GA_3$ at 22°C was significant probably because exogenous $GA_3$ replaced chilling requirement and enhanced endogenous $GA_3$ level which is necessary for germination. Seeds treated with $GA_3$ results in earlier germination and increased germination uniformity in comparison to control (Bulard and Page-Degivry, 1985; Hartmann *et al.,* 1997).

According to Table 2, $GA_3$ treatment had no significant effect on seedling root length.

Finally, according to Table 3, seedling lengths were notably influenced by $GA_3$ but temperature had no significant effects on stem elongation. We suggest seed treatment with $GA_3$ up to 250 ppm increased plant length by promoting internode's cell elongation but at 500 ppm inhibited cell elongation perhaps due to toxic effect of high $GA_3$ concentration (Davies, 1987).

These results are consistent with previous studies in pistachio (Ak *et al.*, 1995) and peach (Hartmann *et al.,* 1997).

## Conclusions

Totally, high germination percentage and seedling length of wild almond (*Amygdalus scoparia*) seeds obtained in 125 ppm $GA_3$ (Fig. 4). Therefore we suggest this $GA_3$ level in nursery management to increase uniformity in nursery and earlier seed germination.

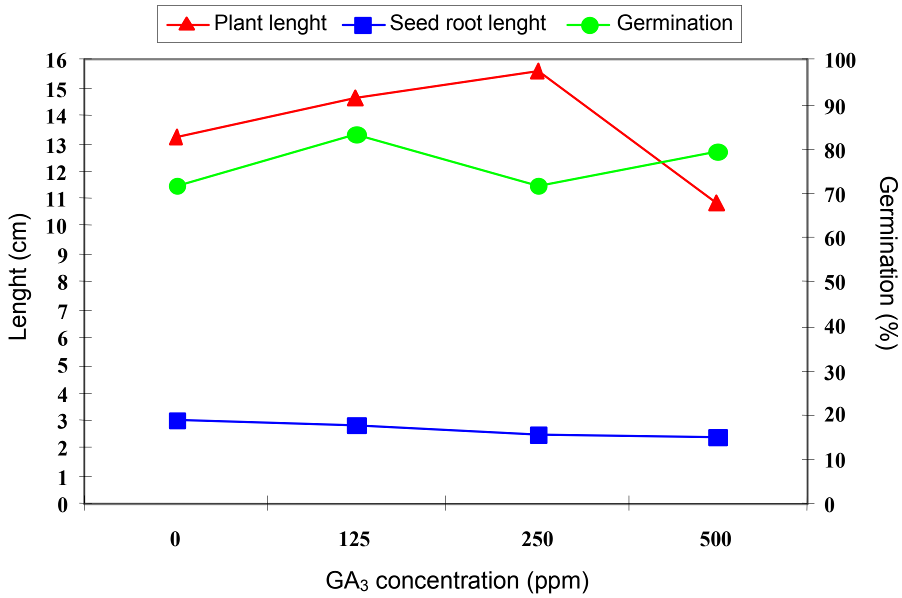


Fig. 4. Effects of $GA_3$ on germination, seedling root length and seedling length.

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