Use of Gibberellic Acid in the Stratification of Peach Seeds

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ABSTRACT

Peach seeds, variety Missour, were stratified at 5°C in peat moss moistened with distilled water, $GA_3$100 ppm, $GA_3$200 ppm, and $GA_3$400 ppm, until they germinated in the peat moss. Though statistically insignificant, increasing the concentration of GA_3 was observed to induce higher percent of peach seeds germination, up to a GA_3 concentration of 400 ppm. Levels of endogenous growth substances, as statistically analyzed, were unaffected by GA_3 treatments.

No differences in growth substances levels, were detected in germinated and non-germinated seeds within each treatment.

A conclusion has been drawn, that a factor or factors other than growth substances as they were analyzed in this study, might have been responsible for inducing the germination of peach seeds.

INTRODUCTION

Peach seeds, variety Missour have been recently introduced to Libya in order to be used for the production of nematode resistant rootstocks. The objective of this work was to study the germination and response of peach seeds to treatment with gibberellic acid, GA_3, and the effect of GA_3 on the endogenous growth regulators of seeds.

Many attempts have been made to enhance germination of peach and stone fruit seeds by chemical treatments, particulary gibberellic acid (4,5,8,11). Reports and findings on the use of gibberellins in germinating stone seeds were conflicting and most confusing.

Said *et al.* (9) were able to improve germination of peach stones by soaking for 72 hours in cold water, but dipping in concentrated HCL for 10 minutes totally inhibited germination. Kawecki (3) and Sinska and Lewak (11) found that high concentration of GA_3 accelerated germination of stratified apple, peach, and apricot seeds. Better response to treatments was obtained when shells were removed (6).

On the other hand a negative response to gibberellins was reported. Proctor and Dennis (7) detected no differences in gibberellin-like substances between dormant and fully after-ripened *Prunus* seeds. This was confirmed by Wanick *et al.* (13) who found that treatment with GA during stratification of apple seeds did not shorten the time to

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germinate. Salac (10) added that *Prunus* seeds treated with GA showed a reduction in germination, however, this was significantly declined by the addition of kinetin or maleic hydrazide.

Analysis of stratified Italian plum seeds showed that gibberellin-like substances increased and abscisic acid decreased during stratification, on the other hand intact unstratified seeds failed to germinate when treated with gibberellic acid (4). The levels of gibberellins were reduced when apple and peach seeds were treated with abscisic acid (2,8). A suggestion was made that gibberellins are converted from one form to another during stratification of seeds (5,11).

MATERIALS AND METHODS

Peach seeds, variety Missour obtained from Ministry of Agriculture in Libya, were used in this study. Seventy seeds for each treatment, were mechanically scarified and stratified at 5°C using perforated plastic bags and peat moss. Peat moss was saturated with $GA_3$100 ppm, $GA_3$200 ppm, $GA_3$400 ppm representing each treatment. Peat moss saturated with distilled water was used as check. The seeds were left in a refrigerator until a good portion of them have germinated in the peat moss, and percentage of germination was determined. Five germinated seeds and five non-germinated seeds from each treatment were used to compare the levels of endogenous growth substances. Seeds were crushed in a porcelain mortar then extracted with three 50 ml changes of absolute methanol, each for half an hour and the last change of methanol was left overnight. Combined methanol extracts were filtered, then evaporated to dryness under vacuum and low temperature 45°C using a flash evaporator. Samples were transferred into 5 ml volumetric flask using methanol. Three hundred μl of this extract were streaked on thin layer chromatography (T.L.C.) plates and developed in isobutanol-methanol-water (80 : 5 : 15 v/v). Solvent was allowed to ascend 10 cm. After plates were dried out, each Rf factor was bioassayed using *Lepidium* seed germination test as described by Ahmed (1). Bioassay was run in two replicates for each of the germinated and non-germinated peach seeds, and the percent of *Lepidium* seeds germination was expressed as percent of check.

Percents of peach seeds germination for the treatments and levels of the growth substances as detected by *Lepidium* seed bioassay, were statistically analyzed using the linear regression and the analysis of variance, respectively, as described by Steel and Torrie (12).

RESULTS AND DISCUSSION

Data on the effect of GA_3 on the germination of Missour peach seeds, and on the levels of endogenous growth substances is represented in Fig. 1, and Table 1, respectively.

The use of GA_3 in the stratification of peach seeds had an apparent effect on the percent of seed germination. Percentages of seed germination were 80%, 87.43%, 95.43%, and 92.14% for the control (distilled water), $GA_3$100 ppm, $GA_3$200 ppm, and $GA_3$400 ppm, respectively. GA_3 at 200 ppm and 400 ppm had forced more peach seeds to germinate, compared with $GA_3$100 ppm and with the control. Although no statistical significant differences were shown between these four treatments, an upward trend in the percentages of germination was noticed when concentrations of GA_3 were increased. However, an opposite trend was noticed at GA_3 concentration of 400 ppm (Fig. 1).

The use of GA_3 in the stratification of peach seeds, had improved the percent of seed

Table 1 *Lepidium* seed germination test showing mean squares of percent of seeds germination in extracts of peach seeds eluted from Rf zones of thin layer chromatography plates developed in isobutanol-methanol-water (80:5:15 v/v) solvent.

Sources of variation	df	Mean Squares of Rf Zones										F .05 value tabulated[1]
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
Treatments	3	656.75	629.06	298.75	471.73	494.17	709.90	722.25	358.56	185.40	261.17	
Contrast (Experimental error)	4	477.62	427.81	111.87	268.31	527.62	600.06	225.75	610.69	781.94	42.62	6.59 3.84
Sampling error	8	398.87	321.19	343.00	660.56	218.62	160.31	534.75	433.19	424.19	146.44	

[1]Significant at 0.05 level of probability.

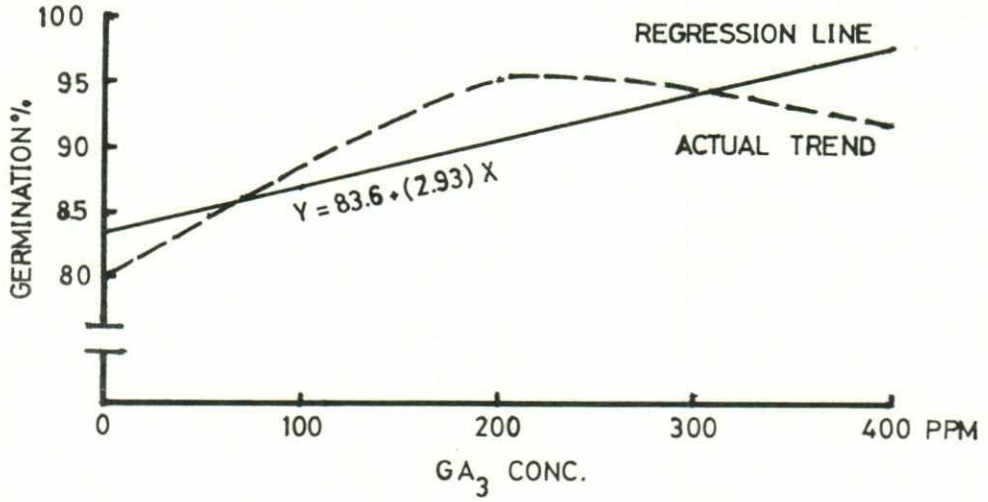

Fig. 1. Actual and expected values of peach seeds germination percentages at GA_3O,100,200, and 400 PPM. B* = 100/80, t. Cal. $= \frac{b - B^*}{S_b}$, and t. Tab. α 0.05 dfn $- 2 = 4.303$.

germination. However, upon investigating the effect of GA_3 on growth substances, it was found that GA_3 had no bearing on the levels of endogenous growth substances present in the seeds at the time of chemical analysis. Statistical analysis of the data revealed that the growth substances separated at each Rf of the thin layer chromatography plate for each treatment were not significantly different at 0.05 level of probability (Table 1). Chemical analysis of the germinated and non-germinated peach seeds within each treatment failed to show any significant statistical differences at the 0.05 level of probability.

It might be concluded that, the use of GA_3 in the process of Missour peach seeds stratification had progressively improved the percent of seeds germination up to a GA_3 concentration of 400 ppm. This increment, however, might have been due to a factor or factors other than the endogenous growth substances present in the seeds at the time of analysis, and as they were extracted and separated in this study. Differences of growth substances in germinated and non-germinated seeds within and between treatments, were statistically insignificant at the 0.05 level of probability.

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