Asian Journal of Chemistry Vol. 19, No. 2 (2007), 1098-1102

Effect of Jasmonic Acid on Germination Dormant and Nondormant Apple Seeds

KENAN YILDIZ*, CENK YAZICI† and FERHAD MURADOGLU†
Department of Horticulture, Faculty of Agriculture
University of Gaziosmanpasa, Tokat, Turkey
E-mail: ky66@yyu.edu.tr; kyildiz@gop.edu.tr; kenyildiz@hotmail.com

Jasmonic acid clearly stimulated germination of dormant apple seeds. However, in the seeds stratified for 30 and more days, some concentration of jasmonic acid seemed as inhibiting, generally, jasmonic acid was found ineffective. The treatment of seeds with jasmonic acid not only increased germination level, but also accelerated germination of dormant seeds according to control seeds. On the other hand, jasmonic acid delayed the germination of seeds stratified for particular period. The retarding effect of jasmonic acid on germination was clearer in seeds stratified for 90 d. Although jasmonic acid stimulated germination some degree, but it did not found as effective as stratification under cold condition in removal of dormancy in apple seeds.

Key Words: Apple seed, Germination, Jasmonic acid.

INTRODUCTION

Generally, the concentration of growth inhibiting substance such as abscisic acid (ABA) increase as the seed/fruits mature, while the growth concentration of promoting substance such as GAs decrease. Once fruits are shed from the plant, the seeds of many temperate tree species require a period of moist love temperature treatment (stratification) to break dormancy before they are capable of germinating[1].

Stratification act on dormancy-controlling mechanism, changing the concentration of plant growth substances in seeds. The concentration of growth inhibiting substances decreases during stratification period, while the concentration of growth promoting substances increases in seeds[2].

Removal of dormancy in apple seeds requires several months of afterripening under conditions of cold stratification[3]. In maintenance and removal of dormancy in the seeds of apple several endogenous regulatory factors are involved. Hormones such as gibberellins, abscisic acid, cytokinins and ethylene are present in apple seed and their levels differ in dormant and stratified seed[2,4,5].

†Department of Horticulture, Faculty of Agriculture, University of Yüzüncü Yil, Van-65080, Turkey.

Methyl jasmonate (MeJA) and jasmonic acid (JA) have been isolated from many species of plant and have been shown to affect many aspects of plant growth, including seed germination and seedling growth[6]. Recently, it has been reported that the levels of jasmonic acid and its conjugates change in seeds during stratification[7,8]. Jasmonic acid interacts with other plant growth regulators in the control of the germination of dormant apple embryos[9]. Jasmonates have been shown to inhibit the germination of non-dormant seeds[10-12]. In the studies on effect of jasmonates on apple germination, it have been reported that jasmonates inhibit germination of non-dormant apple seeds, while promoting germination of dormant seeds[7,13-15].

In present investigation, the effect of jasmonates on germination of apple seeds is examined and the embryo isolated from seeds have been used. In this study, the intact seeds has been used to determine whether or not jasmonic acid could be used practically to remove dormancy of apple seeds.

EXPERIMENTAL

The experiment was carried out on apple (*Malus communis* L) seeds harvested in year 2003 and supplied by High School of Agriculture in Van, Turkey. A partition of seeds, without stratification (dormant), was imbibed in different concentration (1, 1.5, 2 mM) of jasmonic acid and distilled water for control for 12 h. Then, they were placed in plastic mesh bags in vermiculite and cultured in a chamber at 22ºC. The other part of seeds was stratified in moist sand for different periods at 4ºC. The seeds of different periods of stratification were placed in plastic mesh bags in vermiculite in a chamber at 22ºC after treating with different concentration of jasmonic acid. The criterion for judging the germination of apple seeds was the protrusion of the cotyledon from the vermiculite. For each treatment, the number of germinated seed was recorded every 5 d.

The experiment was designed as completely randomized plot with three replicates, each plot having twenty seeds.

RESULTS AND DISCUSSION

Fig. 1 indicates that germination level increased with being prolonged stratification period. The highest germination level (64.2 %) occurred in apple seeds that had been stratified for 90 d. Germination of non-stratified seeds was stimulated by jasmonic acid. On the other hand, germination of seeds stratified for 30 and more days was not affected or inhibited by jasmonic acid.

Fig. 2 shows the time course of the germination of dormant (non-stratified) apple seeds treated with various concentration of jasmonic acid. The germination of dormant apple seeds was accelerated by jasmonic acid. While appearing 35th days in seeds treated with 2 mM of jasmonic acid, the first germination was appeared 65th days in control seeds.

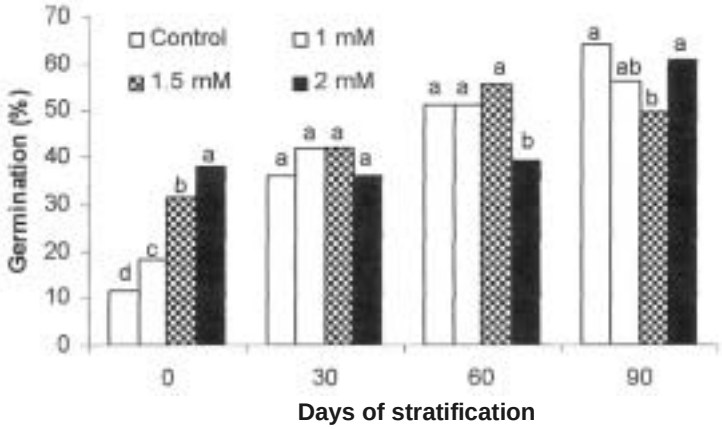

Fig. 1. Effects of different concentration jasmonic acid on germination of apple seeds after different periods of stratification. The differences between means shown the same latter are not significant at 0.05 level

Contrary to dormant seeds, germination of apple seeds stratified for 30 or more days was delayed by jasmonic acid. In the seeds stratified for 30 d, effect of 2 mM concentration of jasmonic acid was clearer than that of other concentration. Germination of the seeds treated with 2 mM jasmonic acid started 20 d later according to control and other concentration (Fig. 3).

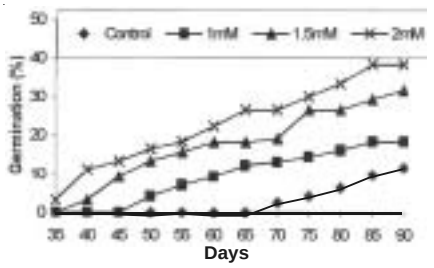

Fig. 2. Times course of the germination of non-stratified apple seeds treated with diffrent concentration of jasmonic acid

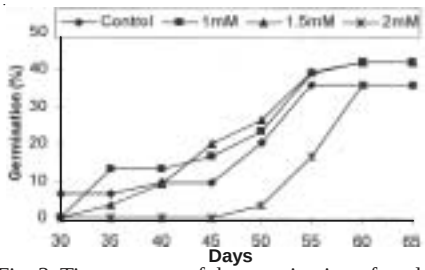

Fig. 3. Times course of the germination of apple seeds treated with diffrent jasmonic acid after startification for 30 d

In the seeds stratified for 60 and 90 d, all concentration of jasmonic acid using in this experiment delayed distinguishably germination compare with control. This delaying effect of jasmonic acid was clearer in the seed stratified for 90 d (Figs. 4 and 5).

Jasmonic acid have been reported to inhibit germination of some seeds[10,11,16-18], to have not any effect on other[11] and to promote germination of dormant seeds of *Acer tataricum* and *A. platanoides*[19] and dormant apple embryos[13]. Ranjan *et al.*[7] pointed out that the stimulation of the germination of embryo isolated from dormant seeds, jasmonic acid had not any effect on germination of embryo from isolated seeds stratified for 30 or

more days. Likewise, in this study carried out by using intact seeds, it was clearly observed that jasmonic acid increased germination level of dormant apple seeds. In the seeds stratified for 30 and more days, although some concentration of jasmonic acid seemed as inhibiting, generally jasmonic acid did not affects germination level (Fig. 1).

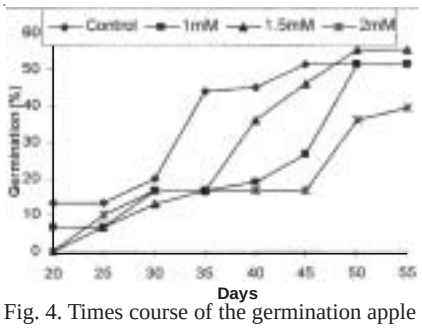

Fig. 4. Times course of the germination apple seeds treated with different concentration jasmonic acid after startification for 60 d

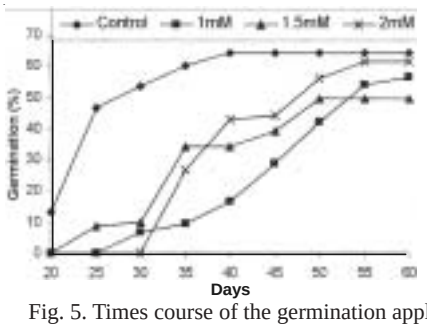

Fig. 5. Times course of the germination apple seeds treated with diffrent concentration jasmonic acid after startification for 90 d

Daletskaya and Sembdner[11] reported that under cold condition, treating perikarp-free seeds of two maple species with jasmonic acid reliably accelerated the emergence of seeds from dormancy and stratification was shortened by 2 months. On the contrary, in the present study, jasmonic acid delayed germination of apple seeds stratified for 30 and more days (Figs. 3-5). On the other hand, germination of dormant seeds (without stratified) was accelerated by jasmonic acid (Fig. 2).

Consequently, jasmonic acid clearly stimulated germination of dormant apple seeds. However, jasmonic acid did not found as effective as stratification under cold condition in removing from dormancy in apple seeds.

REFERENCES

1. L.C. Lukwill, *J. Hort. Sci.*, **27**, 53 (1952).
2. I. Sinska and R.J. Gladon, *Hort. Sci.*, **19**, 73 (1984).
3. D. Wyzinska and St. Lewak, *Biol. Plant*, **20**, 53 (1978).
4. B. Borkowska and R.M. Rudnicki, *Fruit Sci. Rep.*, **2**, 1 (1975).
5. A. Halinska and S. Lewak, *Physiol. Plant*, **69**, 523 (1987).
6. R.A. Creelman and J.E. Mullet, *Ann. Rev. Plant Physiol.*, **48**, 355 (1997).
7. R. Ranjan, O. Miersch, G. Sembdner and St. Lewak, *Physiol. Plant*, **90**, 548 (1994).
8. P.S. Blake, J.M. Taylor and W.E. F.-Savage, *J. Plant Growth Regul.*, **37**, 119 (2002).
9. R. Ranjan and St. Lewak, *J. Plant Growth Regul.*, **14**, 159 (1994).
10. F. Corbineau, R.M. Rudnicki and D. Come, *Plant Growth Regul.*, **7**, 157 (1988).
11. T.V. Daletskaya and G. Sembdner, *Sov. Plant Physiol.*, **36**, 901 (1989).
12. M.N.-Asghari and K. Ishizawa, *J. Plant Growth Regul.*, **17**, 13 (1998).
13. R. Ranjan and St. Lewak, *Physiol. Plant*, **86**, 355 (1992).
14. R. Ranjan and St. Lewak, *Physiol. Plant*, **93**, 421 (1995).

15. R. Bogatek, D. Come, F. Corbineau, R. Ranjan and St. Lewak, *Plant Physiol. Biochem.*, **40**, 167 (2000).
16. H. Yamane, H. Takagi, H. Abe, T. Yokota and N. Takahashi, *Plant Cell Physiol.*, **22**, 698 (1981).
17. R.W. Wilen, G.J.H.V. Rooijen, D.W. Pearce, R.P. Pharis, L.A. Holbrook and M.M. Moloney, *Plant Physiol.*, **95**, 399 (1991).
18. J. Kepczynski and B. Bialecka, *Plant Growth Regul.*, **14**, 211 (1994).
19. V. Berestetzky, W. Dathe, T. Daletskaya, L. Musatenko and G. Sembdner, *Biochem. Physiol. Pflanz.*, **187**, 13 (1991).

(*Received*: 28 October 2005; *Accepted*: 21 August 2006) AJC-5060