PIN CHERRY (*PRUNUS PENSYLVANICA*) SEED GERMINATION

G.W. Peterson and A.U. Mallik

INTRODUCTION

Mallik *et al.* (1995) reported that pin cherry (*Prunus pensylvanica* L. f.) seedling regeneration was significantly higher in seven-year-old jack pine (*Pinus banksiana* Lamb.) plantation plots that were treated with Vision® herbicide, compared to untreated control plots. In control plots, vegetative regeneration was the principal mode of reproduction, although the pin cherry produced many seeds. Results of their study of the viable soil seed bank detected no seedling emergence. However, direct pin cherry seed counts collected in soil samples from the field showed a sizeable seed bank. The high rate of seed production yet poor seedling regeneration, and the lack of seedling emergence but the presence of many nongerminated seeds in the soil, raised some questions. Does the pin cherry seed coat inhibit germination, and over time is the inhibitor removed by certain environmental conditions, such as shade or specific temperature and moisture regimes?

The objectives of the present study were to determine whether the pin cherry seed coat acts as a germination inhibitor, and if stratification and gibberellic acid (GA) treatments can improve seed germination.

MATERIALS AND METHODS

Several germination experiments were performed to determine why pin cherry seeds germinated poorly. Pin cherry drupes were collected in July 1993. The pericarps were removed and the seeds were subjected to four different treatments: intact endocarp (control); endocarp scarified with sandpaper to expose the embryo; endocarp removed to reveal the seed coat; and endocarp softened with 9 M sulphuric acid for 8 hours. After treating the endocarp, half the seeds were imbibed for 24 hours in 2.54 mM gibberellic acid (GA_3) and the other half were imbibed in water. Half of the seeds in each imbibition treatment were kept at 4°C and the other half at 22°C. The seeds were placed on water-moistened filter paper in Petri-dishes, and divided into three groups for three temperature treatments: 22°C ± 2°C for one month; 4°C ± 1°C for one month; and stratified at 4°C ± 1°C for one month and then moved to 22°C ± 2°C for one month. Three replicates of 10 seeds were used for each of the 24 treatments. In all cases, the seeds were kept in darkness to simulate being buried beneath the soil. The seeds were observed weekly to note the total number of germinants.

RESULTS

At 22°C, only four different treatments produced germination: endocarp removed, no GA; endocarp removed, with GA; seed coat scarified plus GA; and intact seeds, with GA. Endocarp removal followed by GA treatment produced the best results, with 100% germination after 9

days (Fig. 1). Removal of the endocarp followed by stratification at 4°C resulted in nearly 100% germination, whether treated with GA or not (Fig. 2). The remaining three treatments: endocarp intact plus GA; seed coat scarified plus GA; and seed coat scarified without GA, had less than 25% germination. Seeds in the control and the remaining treatments did not germinate.

DISCUSSION

Three factors may control dormancy in seeds: germination inhibitory chemicals in the seed coat; the mechanical barrier of the endocarp; and the embryo requirement for prechilling to mobilize growth regulators or nutrients (Salisbury and Ross 1992). Prechilling and removing the mechanical barrier were required for pin cherry germination (Schopmeyer 1974). Thus, complete removal of the endocarp and stratification of the seeds under moist conditions induced 100% germination at 22°C. This is six times greater seed germination than for seeds not cold-stratified with endocarp removed. Complete germination (100%) was obtained for seeds that were not stratified, but had the endocarp removed and were treated with GA_3. Cold treatment may stimulate the production of GA in the embryo of pin cherry seeds. Involvement of GA in seed germination was reported by several workers (Gianfanga and Rachmiel 1986, Karssen *et al.* 1989).

There was a strong correlation between percent germination and the amount of endocarp surrounding the embryo. Increasing the amount of endocarp removal increased the percent germination. Although GA treatment increased germination, the endocarp removal was a more

influential factor than GA. Marks (1974) and Marquis (1975) both found that pin cherry seeds do not germinate under a closed canopy. They suggested that the minimal life span of pin cherry seeds in the soil seed bank is in the order of four to five decades. It is reasonable to assume that mechanical dormancy of pin cherry is required to maintain a viable seed bank until a disturbance provides appropriate conditions for germination.

The sulphuric acid treatment should also have stimulated pin cherry germination, as found by Marks (1974). However, Hilton *et al.* (1965) found that acid softening of pin cherry seeds did not have an effect on germination. They suggested that 20 minutes in concentrated sulphuric acid was an insufficient period to soften the hard endocarp. In the present study, the 8 hour treatment with 9 M sulphuric acid probably killed the embryo.

CONCLUSIONS

1. The hard endocarp of pin cherry acts as a mechanical barrier to germination.
2. Pin cherry seeds remain dormant until the endocarp is eroded or softened by post-harvest conditions of light and temperature.
3. Pin cherry seeds require a cold stratification period to germinate. This treatment can be replaced by seed pretreatment with gibberellic acid.

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LITERATURE CITED

Gianfanga, T.J.; Rachmiel, S. 1986. Changes in gibberellin-like substances of peach seed during stratification. Physiol. Plant. 66:154-158.

Hilton, R.J.; Jaswal, A.S.; Teskey, B.J.E., Barabas, B. 1965. Rest period studies on seeds of *Amelanchier, Prunus,* and *Sorbus*. Can. J. Plant Sci. 45:79-85.

Karssen, C.M.; Zagórski, S.; Kępczyński, J.; Groot, S.P.C. 1989. Key role for endogenous gibberellins in the control of seed germination. Ann. Bot. 63:71-80.

Mallik, A.U.; Peterson, G.W.; Bell, F.W. 1995. Vegetative and seedling regeneration of pin cherry (*Prunus pensylvanica*): efficacy of herbicide treatment. NODA tech. note (__), Can. For. Serv., Ontario Region, Sault Ste. Marie, ON. (__)p.

Marks, P.L. 1974. The role of pin cherry (*Prunus pensylvanica* L.) in the maintenance of stability in northern hardwood ecosystems. Ecol. Monogr. 44:73-88.

Marquis, D.A. 1975. Seed storage and germination under northern hardwood forests. Can. J. For. Res. 5:478-484.

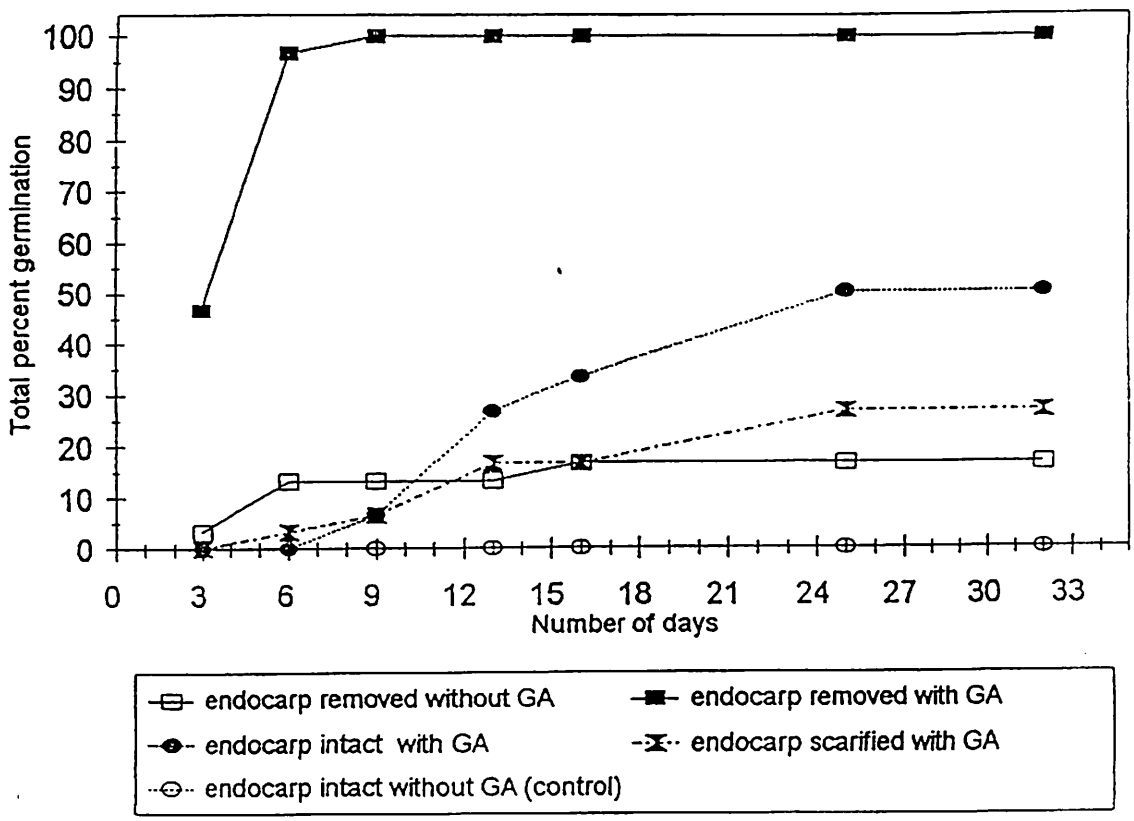
Salisbury, F.B.; Ross, C.W. 1992. Plant physiology (4th ed.), Wordsworth Publishing Co., California. (#p.)

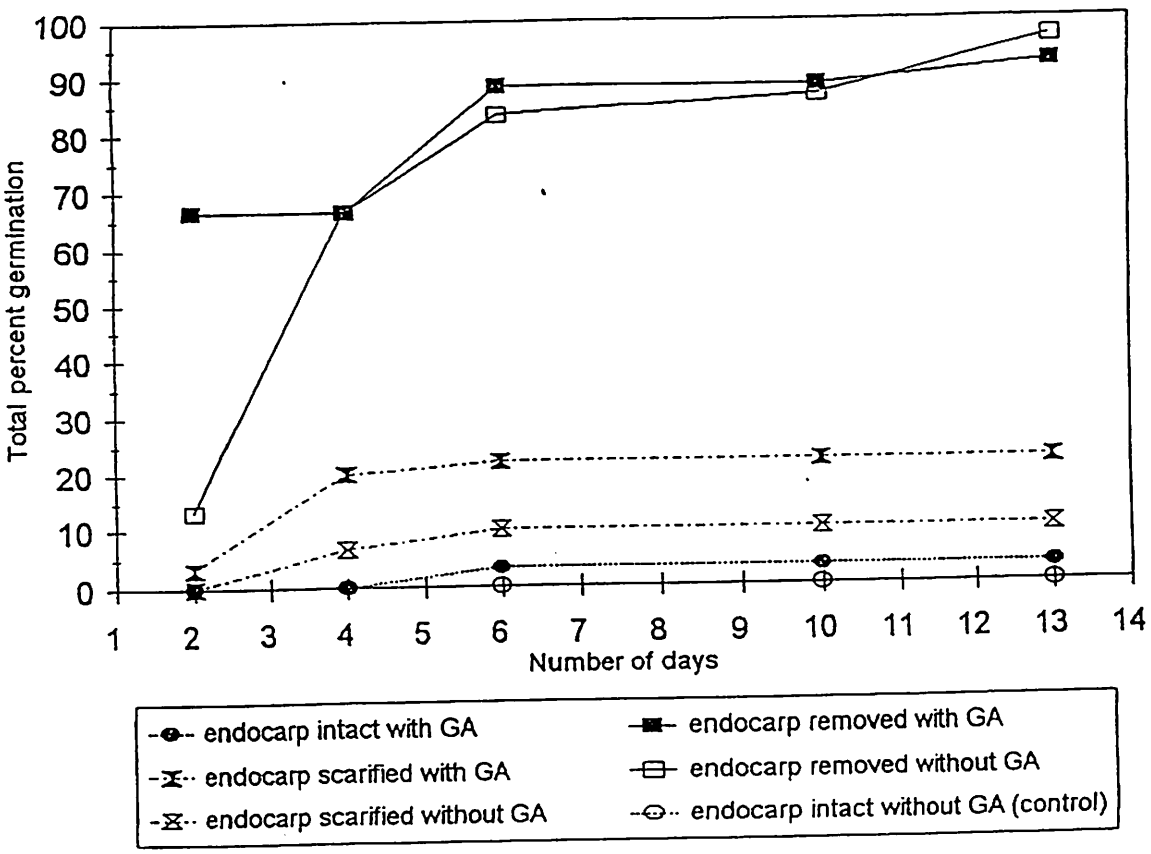
Schopmeyer, C.S. 1974. Seeds of woody plants in the United States. U.S.D.A., For. Serv. Agri. Hdbk No. 450.(#p.)

Figure captions

Figure 1. Effects of endocarp removal, partial scarification, and GA treatment on seed germination of pin cherry at 22°C.

Figure 2. Effects of endocarp removal, partial scarification, and GA treatment on seed germination of pin cherry at 4°C.


Total percent germination
100
90
80
70
60
50
40
30
20
10
0
0
3
6
9
12
15
18
21
24
27
30
33
Number of days
endocarp removed without GA
endocarp removed with GA
endocarp intact with GA
endocarp scarified with GA
endocarp intact without GA (control)


100
90
80
70
60
50
40
30
20
10
0
Total percent germination
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Number of days
endocarp intact with GA
endocarp scarified with GA
endocarp scarified without GA
endocarp removed with GA
endocarp removed without GA
endocarp intact without GA (control)