Indian J. Hort. 71(3), September 2014: 437-440

Short communication

Effect of temperature and GA_3 on seed germination and seedling establishment of *Rhododendron purdomii* Rehd. et Wils

B. Zhao*
College of Forestry, Northwest A&F University, Yangling, Shaanxi, P.R. China 712100

ABSTRACT

***Rhododendron purdomii* Rehd. et Wils is an endemic and important ornamental plant species in China. The effect of temperature (20°C, 30°C and 20°C (16 h) /30°C (8h) and GA_3 (0, 200, 400, 600, 800 and 1000 mg/l) on *R. purdomii* seed germination and early seedling establishment were studied. The results showed that there was little difference among the effects of three temperatures on germination time and germination speed, it significantly affected germination percentage, germination vigour and early seedling growth. High temperature had negative effects on seed germination, and the germination vigour at 20°C were significantly higher than those at two other temperature treatments, germination percentage and germination vigour were the lowest at 30°C; and the survival rate and leaf length of the seedlings at 20°C/30°C were far better than those at two other temperature treatments. Treatment with 600 mgl^{-1} GA_3 for 24 h and 20°C/30°C temperature has a much higher survival rate and growth performance. Therefore, the findings from this study would greatly help the *R. purdomii* germplasm propagation, conservation and utilization.**

Key words: *Rhododendron purdomii*, seed germination, germination vigour, temperature.

Rhododendron purdomii Rehd. et Wils., a member of *Ericaceae* family and endemic and evergreen shrub distributed in China. It has higher and more special ornamental value thus can be the most important parental source of *Rhododendron* hybridization. Besides, it also has cold-resistance (Gen, 3). In recent years, *R. purdomii* germplasm has been endangered mainly because of human excessive excavation activities and poor self-renewal capacity. To prevent, *R. purdomii* from the extinction and to maintain its diversity, and select colourful landscape cultivars. There is a growing demand for conservation and breeding projects that require the implementation of active propagation measures. Seed propagation might be preferable to protect germplasm, and enrich genetic diversity of one species (Zhang, 12). More importantly, as to wild resources, the seedlings from seeds are more easily adapted to the new environment than transplanted seedlings directly from mountains. At present, studies on *R. purdomii* are mainly concentrated on chemical component (Liu *et al.*, 6) and morphological variations (Su *et al.*, 9), but few studies were conducted about seed germination and seedling establishment of *R. purdomii.* Some *Rhododendron* species demand higher temperature to germinate (Fan *et al.*, 2; Sajad *et al.*, 10), while low temperature are favorable for germination in some *Rhododendron* species. Hormone concentration is another important factor to affect seed germination. Which can be used for dormancy-breaking, germination requirements of many *Rhododendron* species indicate the seeds have a non-deep, simple, morphphysiological dormancy, but addition of gibberellins was also proved to increase germination percentage of *Rhododendron* species (Tiwari *et al.*,11; Gao *et al.*, 3; Huang *et al.*, 5; Su *et al.*, 10). The objective of the present study was, therefore to explore seed germination responses and seedling establishement of *R. purdomii* to temperature and GA_3 concentration to determine seed propagation requirements.

Ripe capsules of *R. purdomii* were harvested from Niu Beiliang district of Qinling Mountain. The capsules were air-dried at room temperature until the seeds collected and dried and stored in dark place until experimentation. The experiment was designed according to a completely randomized factorial of three temperature regimes (20°, 30° and 20°C (16 h) /30°C (8h) and six GA_3 concentrations (0, 200, 400, 600, 800 and 1000 mg/l). Each treatment was replicated three times and every replication had 100 seeds. Germination tests were performed in incubators (Conviron A1000, Canada) with automatic temperature and light control. First the seeds were immersed in GA_3 for 24 h, then rinsed three times with deionized water and dried on filter paper. Finally 100-seeds were counted on and put inside 12-cm petridish containing absorbent gauze and filter paper. The germination dishes were rearranged

*Corresponding author's E-mail: bingbing2003915@163.com

daily to avoid effects of potential temperature and light differences or gradients in the incubators. The germinated seeds were recorded everyday for 10 d. Seeds were considered to have germinated as soon as radicale broke through seed coats.

When cotyledon developed, the seedlings were moved to the greenhouse. Total 48 germinated seedlings in the same development stage at even temperature were randomly selected from all the different germination treatments, planted in the box contained humus and perlite in the farm under natural conditions and were watered regularly. Two months later, the growth index such as the survival rate, plant height, leaf number, leaf length and leaf width of the seedlings were measured. The germination and seedling growth characteristics were subjected to analysis of variance followed by Duncan's multiple range test using SPSS 11.5 software (SPSS Inc., Chicago, IL) and Excel 2003 (Microsoft Inc. Redmond, WA). The germination starting time under three temperatures were all at the 8th or 9th day. The germination period of *R. purdomii* was about 10-11-day and came to the maximum germination percentage at the 10th-11th day after seeding, which is far shorter than other *Rhododendron* species such as *R. delavayi* (Duan *et al*., 1).

There was significant difference among the three temperatures on germination percentage and germination vigour (Table 1). The germination percentage and germination vigour at 30°C 24 h was far lower than that of at 20°C 24 h and 20°C 8 h/ 30°C 16 h (Table 1). However, the germination study of *Cynanchum bungei* Decne (Zhang, 12). and *R. delavayi* (Duan *et al*., 1) showed that the higher the temperature, the earlier seeds began to germinate (Zhang, 12).

Table 1. Effect of temperature and GA_3 concentration on germination time, germination percentage and germination vigour of *R. purdomii*.

Factor	Germination (%)	Gemination vigour (%)
Temp.	**	**
20°C	80.50 ± 4.57a	77.82 ± 3.34a
30°C	70.54 ± 2.90b	58.02 ± 2.09b
20°C /30°C	75.62 ± 1.68c	71.69 ± 4.11c
GA_3 conc. (mg l^{-1})	**	**
0	0.56 ± 0.07a	0.00 ± 0.00a
200	75.75 ± 3.37b	65.83 ± 4.88b
400	97.29 ± 0.11cd	92.22 ± 3.07d
600	93.53 ± 1.26c	89.68 ± 2.66cd
800	94.00 ± 0.41c	85.75 ± 4.51cd
1000	92.19 ± 2.23c	81.58 ± 1.07c

**Different letter(s) has significant difference at 0.01 level.

The germination percentage and germination vigor at 20°C were significantly higher than those of other two temperature treatments, which showed that *R. purdomii* seeds prefer lower temperature to germinate. While high temperature makes biochemical process and respiration of seeds vigorous, storage life was seriously depleted, leading the lower germination percentage. This result is in agreement with the germination traits of *R. molle* (Shi *et al*., 9), *R. pizewalskii* (Li *et al*., 6), but contradictory results were obtained for *R. irroratum* Franch (Fan *et al*., 2).

Compared with the control group, after soaked 24 h with different concentration GA_3, germination percentage and germination vigour were all dramatically enhanced, the highest germination percentage and germination vigour were gained when GA_3 treatment was 400 mgl^{-1} (Table 1). Compared with control, the seeds with GA_3 treatments had higher germination percentage and germination vigour.

The performance of seedling growth were observed after transplanted for two months, The results showed that there was significant difference among the effects of three temperatures on the survival rate of seedling, plant height, leaf length, leaf width and leaf number. The survival rate and leaf length at 20°/30°C were significantly higher than that of other two temperature treatments, and 30°C has the lowest survival rate and growth indexes value (Table 2, Fig. 2 & 3). Meanwhile, plant height, leaf number and leaf width at 20°C were higher than those at 20°/30°C, but the difference was not significant. The growth performance of the seedlings at 20°/30°C and 20°C were better than that at 30°C.

There was significant difference among the effects of different GA_3 concentration on the seedling vigour. The seedlings with 600 mgl^{-1} GA_3 treatment had much higher survival rate and growth indices (Table 2), which showed that GA_3 treatment not only can lead to high germination percentage and germination vigour, but also has a positive effect on the seedling growth.

ACKNOWLEDGEMENTS

This research was conducted in Woody Ornamental Plants Lab, University of Georgia, America. Funding for this research was provided by National Natural Science Foundation of China (k305021110) and Shaanxi Natural Science Foundation (2012JQ3008) and construction project of Forestry Department of Shaanxi Province (Shan 2011(70).

Table 2. Survival rate of plant (SR), plant height (PL), leaf number (LN), leaf length (LL) and leaf width (LW) of *R. purdomii* at different regimes under 24 h continuous light.

Factor	Plant survival (%)	Plant height (cm)	Leaf No. (cm)	Leaf length (cm)	Leaf width (cm)
Temp.	**	**	**	**	**
30°C	53.47a	1.0833 ± a	4.6389 ± a	0.8667 ± a	0.5500 ± a
20°C /30°C	93.75b	1.8389 ± b	7.4667 ± b	1.4944 ± b	0.8000 ± b
20°C	70.00c	2.0400 ± b	9.2667 ± c	1.4800 ± b	0.8067 ± b
GA_3 conc. (mg l^{-1})	**	**	**	**	**
0	50.00a	1.0000a	1.4000a	0.7500a	0.5500a
200	66.67bc	1.4667b	6.4444b	1.0222b	0.5889b
400	62.50b	1.6778bc	7.6111bc	1.4556c	0.7333c
600	79.17c	2.2111d	8.4444d	1.5778cd	0.8778d
800	58.33b	1.5222b	8.0000cd	1.1889b	0.7667cd
1000	77.78c	1.7000c	8.2222d	1.3444bc	0.7111c

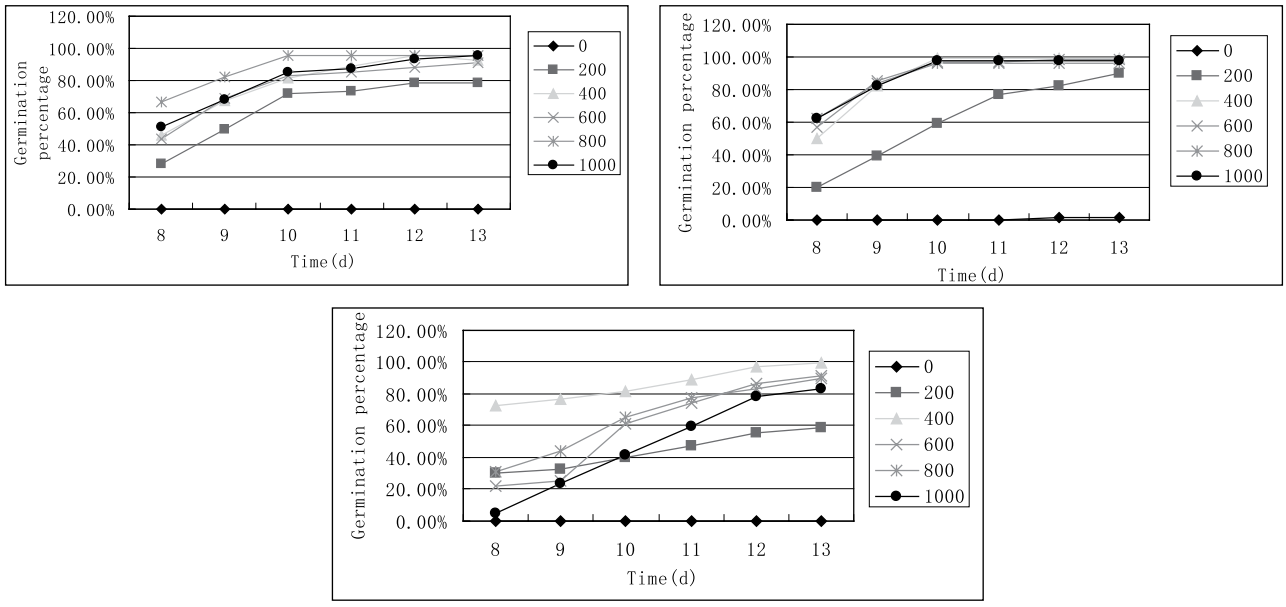

Fig. 1. Effect of GA_3 concentration under three temperature regimes on germination of *R. purdomii* seeds.

REFERENCES

1. Duan, X., Chen, X. and Zhao, Y.Y. 2007. Study of the seed germination of *Rhododendron Delavayi. J. Anhui Agric. Sci*. **35**: 9199-9200.

2. Fan, C.L. Che, X. and Xing, J.N. 2011. Effects of different treatments on seeds germination of *Rhododendron*. *Seed*, **30**: 106-8.

3. Gao, G.L., Long, X.Q., Hu, X.J., Lu, X.L. and Chen, X. 2010. Effect of GA on two species Alpine *Rhododendron* seeds germination. *Seed*. **5**: 22-25.

4. Gen, Y.Y. 2008. The Interpretation of *Rhododendron* in China.

5. Huang, C. L., Zhou, H.J., Chen, X. and Gao, G.L. 2010. Effect of GA_3 immersion on germination of seeds of *Rhododendron decorum*. *Plant Physiol. Comm.* **46**: 793-96.

6. Li, C.H., Sun, H.Q., Yang Y.W. and He, J.Z. 1998. A study on germination percentage for *Rhododendron przewalskii* seeds. *J. Qing Hai Univ.* **16**: 15-17.

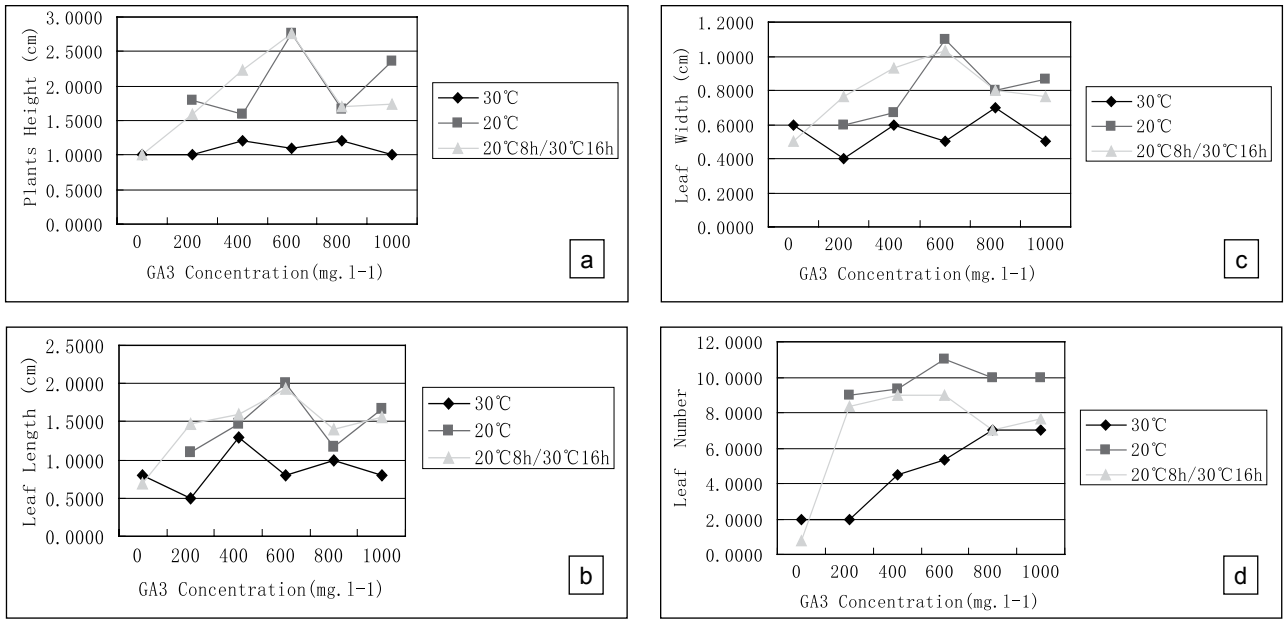

Fig. 2. The effects of three temperature regimes on (a) plant height, (b) leaf length, (c) leaf width and (d) number of *R. purdomii*.

7. Liu, X., Gao, J.D. and Zhao, L. 2009. Studies on chemical component of *Rhododendron purdomii. Chinese Herbal Med.* **11**: 1723-25.

8. Sajad, R., Shailesh, P. and Nautiyal, S. 2012. Studies of seed germination in four *Rhododendron* species of Garhwal Himalayas. *Indian Forester*, **138**: 284-88.

9. Shi, D.H. and Chen, X. 2010. Effect of different treatments on *Rhododendron molle* G. Don seed germination. *Seed*, **9**: 91-94

10. Su, J.L., Chen, L., Liu, X.Q., Chen S.P. and He, L.S. 2011. Effects of different pretreatment methods on seed germination of *Rhododendron aureum* and *R. parvifolium*. *J. Plant Resour. Env.* **20**: 64-69.

11. Tiwari, O.N. and Chauhan, U.K. 2007. Seed germination studies in *Rhododendron maddenii* Hook.f. and *Rhododendron niveum* Hook.f. *Indian J. Plant Physiol*. **12**: 50-56.

12. Zhang, H.Y. 2012. Seed germination and early seedling growth of *Cynanchum bungei* Decne (Asclepiadaceae) in response to photoperiod, temperature, and seed size. *Hortsci*. **47**: 1338-41.

Received: November, 2013; Revised: June, 2014;
Accepted: July, 2014