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Improvement in Germination through Seed Pre-treatment in Ghingaru (*Pyracantha crenulata* (D. DON) M. ROEMER): An Important Wild Edible Ethno-medicinal Plant

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Ghingaru (*Pyracantha crenulata* (D. DON) M. ROEMER) is an important thorny Himalayan wild edible shrub. Fruits of the plant are rich source of anti-oxidants and used in preparation of cardio-tonic. However, scant scientific information is available on it mass propagation through seeds. The present study reports effect of chemical seed pre-treatments with sodium chloride, potassium nitrate, thio-urea along with hydro-priming on seed germination in ghingaru. Results revealed significant ($P \leq 0.05$) improvement in germination of the stored ghingaru seeds through pre-treatment with potassium nitrate (300 or 400 mM) than the control and other treatments. The findings may be useful in mass propagation of the important plant as a source of nutrient rich food, medicines and other uses.

Key words: *Pyracantha crenulata*, Indian Hawthorn, Seed treatment, Potassium nitrate, Propagation

Introduction

Ghingaru (*Pyracantha crenulata* (D. DON) M. ROEMER) is an important Himalayan thorny wild edible shrub belonging to Rosaceae family. The plant is also popularly known as Indian Hawthorn. Fruits are rich in nutrients, antioxidants and are helpful in maintaining blood pressure and reduction in cholesterol.[1,2] Little research efforts have been made to standardize mass propagation required for systematic plantation for product development at commercial scale.[3] Earlier studies reported effect of seed pre-treatments with GA3 (250 ppm) or water soaking on seed germination and vigour in ghingaru.[4,5] However, the improvement in seed germination was little (up to 68.0%) with requirements for longer seed treatments (12–24 h). Therefore, the present study was designed to further improve seed germination through various chemical pre-treatments for standardization of mass propagation in ghingaru.

Materials and methods

Seed material

Matured fruits were harvested from plants being grown at DIBER Field Station Pithoragarh (29.5829° N, 80.2182° E) in Uttarakhand state of India in the month of September 2015. The processed seeds (100 seeds weight 0.35 g) were stored at room temperature till experiment conducted in April 2016.

Seed pre-treatments and germination

Seeds (60 per replicate; n=5) were treated with thio urea-TU (200 ppm), potassium nitrate-PN (300 mM) or sodium chloride-NA (50 mM) for 6 h at 25^{o}C with agitation at the speed of 75 rpm. For hydro-priming (HYP), seeds were soaked similarly in water for 6 h. Control seeds did not receive any soaking treatment (US). Seeds after the treatments were washed to remove the traces of chemicals and then dried in shed for 24 h on blotting paper. Treated and control seeds were germinated in Petri dishes lined with paper towel at room temperature (25 $\pm$ 3^{o}C). Data on initiation of radicle protrusion was recorded daily for up to 15 days. Per cent seed germination was calculated as (Number of seeds germinated/Total number seeds) x 100. Rate of seed germination was calculated in terms of modified Timson's index of germination velocity using formula: $\sum$ (Germination per cent at an interval of a day / total period of germination in days.

The germination experiment was repeated in the month of September 2016 to study the effect of

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various concentrations of potassium nitrate (100, 200, 300, 400 mM) using the same seed lot as described earlier. Observations on radicle protrusion were recorded for up to 30 days from date of placing the seeds for germination. Germinating seeds were further transferred to nursery bags filled with potting mix for further growth.

Statistical analysis

CropStat program developed at IRRI, Philippines was used for ANOVA of experiments laid out in a completely randomized design. Further, the mean values were compared for statistical significance based on DNMRT (Duncan's New Multiple Range Test) at $P \leq 0.05$.

Results and Discussion

Initiation of seed germination was observed on five days after placing the seeds for germination in control and treatments. Significantly ($P \leq 0.05$) higher germination (94.27%) was observed in seeds treated with potassium nitrate (300 mM) solution for six hours than the control and rest of the treatments (Figs 1, 2). Seed germination in the other treatments was at par with that of in control (76.87%). The rate of seed germination (Timson's index) was also significantly higher in seeds treated with potassium nitrate (72.65) than the control (51.71) and the rest of the treatments (Fig. 1). Thus, the results suggest improved seed germination and its rate in response to potassium nitrate treatment in stored seeds of ghingaru. Effects of seed pre-treatments with these chemicals have been widely studied in other plants[3], but such reports are not available in ghingaru. Earlier study[4] reported higher germination (68%) and vigour in response to seed pre-treatment with GA3 (250 ppm) for 24 h in ghingaru. Another study by Daudi and Pandey[5] revealed improvement in seed germination (60 %) through water soaking treatment for 12 h. Thus, the findings of the current study report advantage over the earlier studies in terms of higher seed germination (94.27%) through comparatively shorter seed pre-treatment of six hours with potassium nitrate.

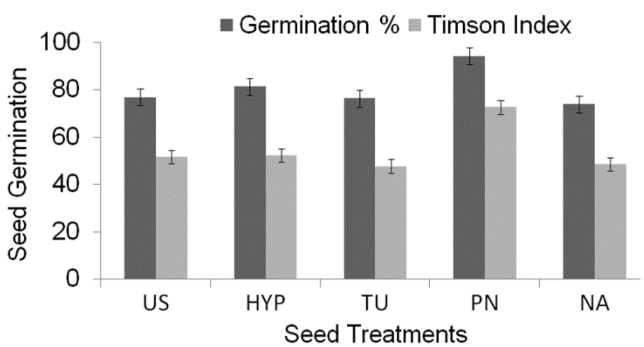

Fig. 1 — Effect of seed treatments on germination (%) and rate of seed germination (Timson's Index) in ghingaru. Error bars indicate SE (M)

The experiment was repeated after five months with different concentrations of potassium nitrate using the same seed lot. Germination in control seeds reduced to 40% which was at par with that in hydro-priming treatment (45.9%). The reduced germination with the stored seeds indicates loss of seed viability. The seed germination was significantly higher in all the potassium nitrate treatments than the control (Fig. 3). Among the potassium nitrate treatments, significantly higher germination was recorded in seeds pre-treated with higher (300 or 400 mM) than the lower concentration of 100 mM. Similarly, the speed of germination was significantly higher in case of 300 or 400 mM potassium nitrate treated seeds than the control, water soaking or treatment with lower concentrations of potassium nitrate. Further, the germinating seeds survived successfully after transfer to potting mixture and healthy seedlings were obtained.

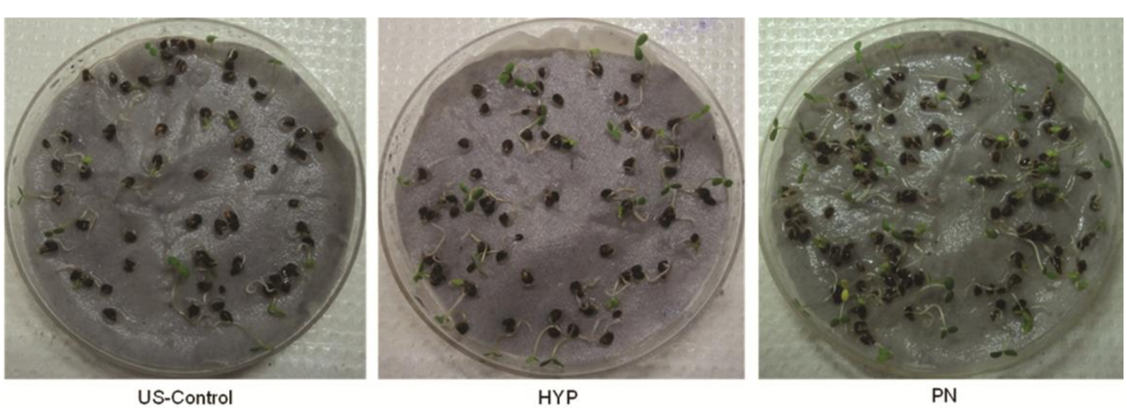

Fig. 2 — Effect of seed treatments on germination in ghingaru. Photographs were taken on 15 days after placing seeds for germination

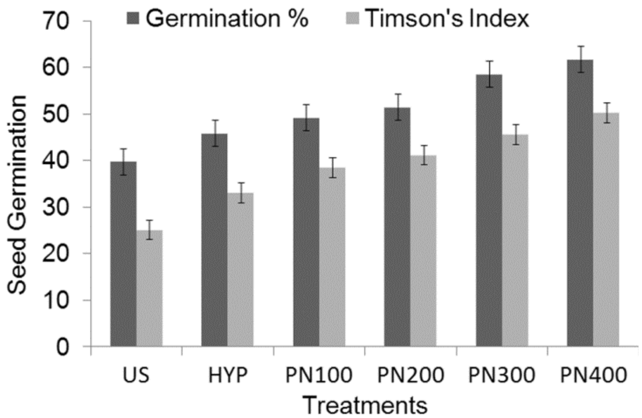

Fig. 3 — Effect of seed pre-treatments on germination (%) and rate of seed germination (Timson's Index) in a repeat experiment with ghingaru seeds stored further for five months. Error bars indicate SE (M)

Conclusions

The findings of the present study recommend pre-treatment with 300 mM potassium nitrate for propagation of ghingaru through seeds. The results may be applicable for propagation of the important plant for further its plantation and utilization as a food, medicines and as a phyto-fence in addition to prevent soil erosion on hill slopes.

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