

# Effect of pre-sowing treatment on seed germination of *Ixora coccinea* L.

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## ABSTRACT

*Ixora coccinea* L. is ornamentally and medicinally important coastal plant also associated with mangroves of Sindhudurg and Ratnagiri district. In the present study, seeds of *I. coccinea* were treated with cold water, 50°C hot water, germinator solution, and also 100, 200, and 500 ppm gibberellic acid (GA). Germination percentage was measured everyday until no germination was observed. Data were analyzed using analysis of variance and the significant mean difference in pair of treatments was analyzed using *t*-test. Seeds of *I. coccinea* treated with 100 ppm GA showed highest germination percentage, i.e., 90% followed by hot water treated seeds and it showed 85% germination. Seeds were treated with GA, hot water, germinator, and soaking in cold water showed significant difference in between treatments ( $P < 0.05$ ). Overall, the results suggest that 100 ppm GA and hot water treatment used for enhance the germination of *I. coccinea* seeds.

**KEY WORDS:** Gibberellic acid, hot water treatment, *Ixora coccinea*, seed germination

## INTRODUCTION

*Ixora coccinea* L. belongs to family Rubiaceae. Commonly, it is called as pendkul in Konkan region and also known as a flame of woods. Many species of *Ixora* are cultivated for ornamental purpose. *I. coccinea* L. is found in the coastal region, ghat region, and also associated with mangroves of Sindhudurg and Ratnagiri district. The flowers are scarlet red, therefore cultivated in tropical and subtropical areas for ornamental purpose (Kirtikar and Basu, 1935; Latha *et al.*, 2001). Flowers are used in the treatment of dysentery and eruption. Roots of this plant are used to cure ulcer, fever, hiccough, and nausea (Alam, 2014). In Indian villages and tribal areas, fruits are eaten by children's, local folks, and tribes (Nazarudeen, 2010). *I. coccinea* L. possesses a number of medicinal properties. Flowers, leaves, stem, and roots of this plant are used in Ayurveda, in folk medicines, and in the traditional system of medicine. Regular consumption of fruits is helpful to people having problem of diabetes and obesity (Baliga and Kurian, 2012). Focusing on medicinal potential of *I. coccinea*, germination studies were undertaken to obtain maximum seed germination. Seeds were treated with different chemicals for various period. Treatment of distilled water, cold water, hot water, and gibberellic acid (GA) was compared for best results.

## MATERIALS AND METHODS

Fruits of *I. coccinea* were collected from Achara, Sindhudurg district of Maharashtra. Fruits are berry type single fruit contains two seeds. Seeds are small and endospermic (Plates 1 and 2). Fruits are collected in May 2014 and weighted dried under natural sunlight. Healthy dried seeds were selected for the experiment. Healthy seeds were subjected to viability test through the floating method, in which floated seeds were considered as unviable, and the seeds were discarded. The experiment was carried out during June 2014 to December 2014 and after soaking seed germination studies were continued up to 45 days.

Experimental trials were standardized as follows:

Healthy seeds of *I. coccinea* were selected for experiment and sterilized with 0.1% HgCl<sub>2</sub> for 10 min, then washed thoroughly with distilled water and treated with different treatments.

1. Soaking seeds in water for 1 and 2 days (Khosh-Khui and Kaviani, 2006)
2. Hot water treatment
3. Seeds were treated with germinator solution: 40% of germinator solution was used for the soaking, and after 6 h, the seeds were thoroughly washed with tap water and placed for germination



Plate 1: Fruits of *Ixora coccinea* L.



Plate 2: Seeds of *Ixora coccinea* L.

4. Treatment of GA (Thomas, 1994)
5. Control: Set of control seeds was maintained separately. These experiments were conducted in sterilized glass Petri plates which were filled with 10 mL distilled water. To avoid fungal infection, the filter paper and media were changed frequently after 1 or 2 days (Thomas, 1994), each Petri plate having 20 seeds and repeated in triplicates. A seed was considered sprouted when it discharges radical of 2 mm (Sayar *et al.*, 2010). The daily observation was recorded, the results were compiled separately, and the percentage germination was calculated separately.

### Data Analysis

The set of experiment was arranged in complete randomized design and consist of three replicates. The data were subjected to statistical analysis of variance (ANOVA) and *t*-test for testing significant difference in pair of treatments using Microsoft Excel. ANOVA two

factors without replication were carried out to analyze the data and determine most appropriate pre-treatment method for higher germination percentage in *I. coccinea* seeds.

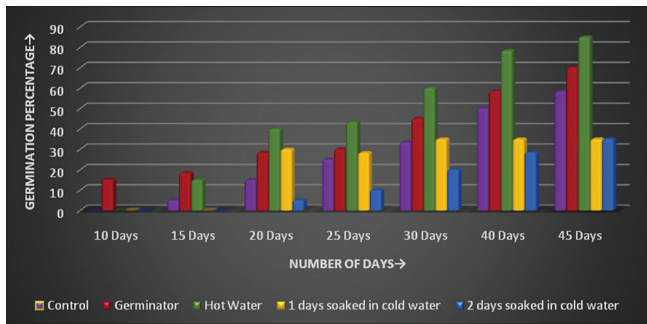
## RESULTS AND DISCUSSION

### Germination Percentage (%) of *I. coccinea* to Different Treatments

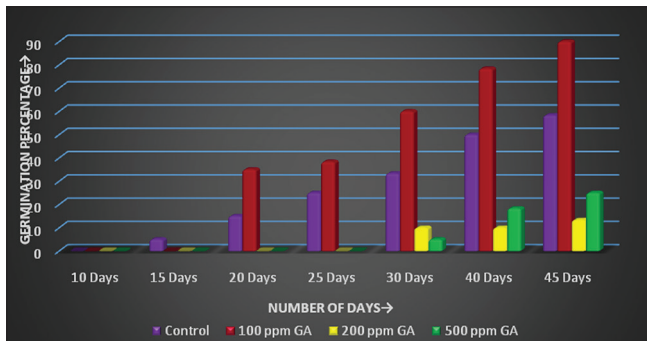
Seeds of *I. coccinea* treated with germinator solution, hot water treatment 1 day, 2 days soaked in cold water, and germination percentage were represented in Figure 1.

ANOVA was done from the values of Figure 1 using Microsoft Excel. The obtained values of *F* statistics as  $F_{3, 6} = 22.45$ . Calculated *F* is  $22.45 \geq$  table *F* 3.15 and *P* value is smaller than 0.05 and also for a number of days *F* statistics as  $F_{3, 6} = 7.40$  and calculated *F* is  $7.40 \geq 2.66$  table *F* and *P* value is smaller than 0.05, this rejects the null hypothesis.  $H_0$ : There is significant difference in treatment effects. *t*-test was done for testing significant difference in pair of treatments in between control to germinator and hot water for testing range of higher germination. Absolute  $|t| = -4.519$  is greater than critical value 2.44, and also *P* value is smaller than 0.05, so there is significant difference between germinator and control.  $|t| = -4.803$  is greater than critical value 2.44, and also *P* value is smaller than 0.05, so there is significant difference between hot water and control. The average values of control 26.67, germinator 36.67, and hot water 45.71. From the above values, it is concluded that hot water treated seeds showed higher germination percentage.

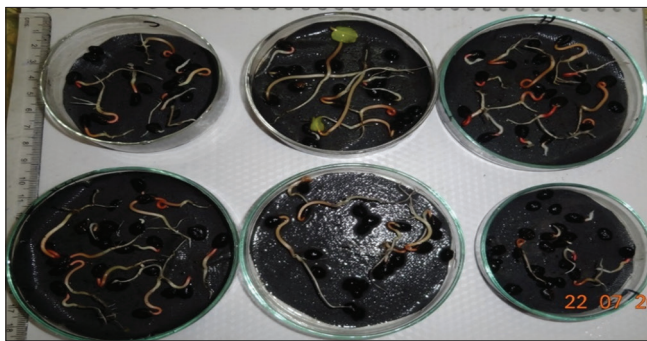
Seeds of *I. coccinea* soaked in germinator showed early germination as compared to other treatments and control. Hot water treated seeds showed germination after 14 days and also showed higher germination percentage after 45 days (85%). Seeds of *Ixora* treated with germinator solution germinate after 9 days and 70% germination after 45 days. Seed germination under different soaking period gave fair germination percentage (35%), this was not significant within the treatments. 1 and 2 days soaking in water treatment showed lower germination percentage than control, these results were similar to pre-treatment to *Azadirachta indica* seeds (Amusa, 2011), and control treatment showed higher germination percentage because over soaking seeds of *Jubaeopsis caffra* in water reduce germination through oxygen deficiency (Robertson and Small, 1977). However, Owonubi *et al.* (2005) suggested that seeds of *Azadirachta indica* soaked in cold water for 1 and 12 h showed an increasing rate of seed germination.



**Figure 1:** Germination percentage of seeds of *Ixora coccinea* L. to different treatments



**Figure 2:** Germination percentage of seeds of *Ixora coccinea* treated with gibberellic acid



**Plate 3:** Germination percentage of *Ixora coccinea* to different treatments, (1) Control, (2) germinator, (3) hot water treatment, (4) 100 ppm, (5) 1 day soaked in water, (6) 2 days soaked in water

Okonwu and Eboh (2017) reported that *C. verrucosa* seeds treated with HCl, sodium nitrate, and hot water showed higher germination percentage as compared to control. Usman *et al.* (2010) reported that seeds *Acacia senegal* treated with hot water for 10 min showed best results in higher germination percentage. Sanyang *et al.* (2008) concluded that seeds of *A. senegal* treated with hot water for 10 min showed early germination. Seeds of *Albizia julibrissin* treated with hot water, soaking in warm water at 40°C and 50°C, and soaking period were 1-6 h. Seeds soaking in 40°C and 50°C showed 86-91% germination (Merou, 2011). *Ixora* seeds treated with hot water and showed 85% germination, this result close to *Albizia* results.

ANOVA was done from the values of Figure 2 using Microsoft Excel. The obtained values of  $F$  statistics as  $F_{3, 6} = 16.99$ . Calculated  $F$  is  $16.99 \geq$  table  $F_{3, 28}$  and  $P$  value is smaller than 0.05 and calculated  $F$  is greater than table  $F$ , so again, here rejected the null hypothesis. There is significant difference in treatments. By applying,  $t$ -test for testing significant difference in pair of treatments.  $t_{11} = -3.469$  is greater than critical value 2.57 and  $P$  value is smaller than 0.05. Therefore, from average values, it is said that 100 ppm GA showed higher germination percentage.

Seeds of *I. coccinea* treated with GA start germination after 19 days, but untreated seeds showed early germination and started germination after 14<sup>th</sup> days. 100 ppm GA treated seeds showed higher germination percentage, and it was 90% (Figure 2). Seeds treated with 200 ppm GA showed lower germination percentage 13.33% as compared to control (Plate 3). Singh and Murthy (1987) reported that GA at higher concentration increases germination percentage in of *Cassia obtusifolia*. Gunasekarn *et al.* (2001) concluded that 100 ppm GA showed higher germination of nutmeg, these results tandem with present investigation. GA plays an important role to stimulate germination and lower down the difference in onset and final germination which promote to increase the hydrolytic activity (Joshi and Dhar, 2003; Manjkhola *et al.*, 2003). Shivanna *et al.* (2007) have noticed that GA and indole-3-acetic acid showed higher germination. In process of seed germination, gibberellins are played an important role to stimulate the growth of embryo (Hedden, 2017).

## CONCLUSION

The best method for *I. coccinea* seed germination is 100 ppm GA. The maximum percentage was obtained in the treatment of hot water and germinator solution. However, among all the methods, 100 ppm GA and hot water treatment are found to be suitable for *I. coccinea* seeds for better results with maximum germination. For mass propagation and conservation point of view, hot water treatment is more suitable. Furthermore, without any chemicals, the plantlets of *Ixora* can be raised and domesticated. Thus, the eco-friendly protocol has been developed for *I. coccinea*.

## REFERENCES

- Alam MK. Medical etanobotany of the Marma tribe of Bangladesh. *Econ Bot* 2014;46:330-5.
- Amusa TO. Effects of three pre-treatment techniques on dormancy and germination of seeds of *Afzelia africana* (Sm. Ex pers). *J Hortic Forestry* 2011;3:96-103.



- Baliga MS, Kurian PJ. *Ixora coccinea* Linn.: Traditional uses, phytochemistry and pharmacology. *Chin J Integr Med* 2012;18:72-9.
- Gunasekarn M, Prasath D, Krishnasamy V. Effect of chemical treatment on germination of nutmeg (*Myristica fragrans* Houtt.) seeds. *J Species Aromat Crops* 2001;10:57-8.
- Hedden P. Gibberellins reference module in life sciences. *Encyclopedia Appl Plant Sci* Second Ed 2017;1:411-20.
- Joshi M, Dhar U. Effect of various pre-sowing treatments on seed germination of *Haracleum candicans* Wall. ex. Dc: A high value medicinal plant. *Seed Sci Technol* 2003;31:737-43.
- Khosh-Khui M, Kaviani K. Investigation and a sexual propagation of chin berry (*Melia azedarach* L.). *J Plant Sci* 2006;1:31-5.
- Kirtikar KR, Basu BD. *Indian Medicinal Plants*. Allahabad, India: Lalit Mohan Basu; 1935.
- Latha PG, Panikkar KR, Suja SR, Abraham A, Rajasekharan S. Chemistry, pharmacognosy, pharmacology and botany of *Ixora coccinea* - A review. *J Med Aromat Plant Sci* 2001;23:670-6.
- Manjkhola S, Dhar U, Rawal R. Treatments to improve seed germination in *Arnebia benthami*: An endangered medicinal herb of high altitude Himalaya. *Seed Sci Technol* 2003;31:571-7.
- Merou T, Takos I, Konstantinidou E, Galatsidas S, Varsamis G. Effect of different pre-treatment methods on germination of *Albizia julibrissin* seeds. *Seed Sci Technol* 2011;39:248-52.
- Nazarudeen A. Nutritional composition of some lesser known fruits used by the ethnic communities and local folks of Kerala. *Indian J Tradit Knowl* 2010;9:398-402.
- Okonwu K, Eboh IG. Effects of Seed treatment on the germination of *Crotalaria verrucosa* L. *Int J Appl Life Sci* 2017;10:1-8.
- Owonubi JJ, Otegbeye GO, Nwokedi C. Development of pregermination technique for *Azadirachta indica*: Preliminary investigation. In: Popoola L, Mfon P, Oni PI, editors. *Sustainable Forest Management in Nigeria: Lessons and Prospects* (Proceedings of the 30<sup>th</sup> Annual Conference of the Forestry Association of Nigeria, Held in Kaduna, Kaduna State; 2005. p. 29-38.
- Robertson BI, Small JG. Germination of *Jubaeopsis caffra* seeds. *Principles* 1977;21:114-22.
- Sanyang SE, Kabura BH, Huang WC. Effects of some seed pre-treatments on emergence of *Acacia senegal* (L.). *World J Agric Sci* 2008;4:213-9.
- Sayar R, Bchini H, Mosbahi M, Khemira H. Response of Durum wheat (*Triticum durum* Dest) growth to salt and drought stresses. *Czech J Genet Plant Breed* 2010;2:54-63.
- Shivanna H, Balachandra HC, Suresha L. Influence of growth regulators and pre-sowing chemicals on germination and growth parameters of *Prosopis cineraria* (L) Druce. *Karnataka J Agric Sci* 2007;20:328-9.
- Singh C, Murthy YS. Effect of some growth regulators on the seed germination and seedling growth of *Cassia obtusifolia*. *Acta Bot Indica* 1987;15:17-79.
- Thomas G. A Study on Germination, Growth and Metabolism of *Cassia sophera* L. and on the Rooting of *Spilanthes Ciliate* H. B. K.: Two Medicinal Plants, Ph.D. Thesis Submitted to Faculty of Sciences. Kottayam: Mahatma Gandhi University; 1994.
- Usman A, Sotannde OA, Mbaya YP, Musa Y. Effects of hot and cold water pre-treatments on emergence of *Acacia senegal* seeds in the nursery. *J Res Forestry Wildl Environ* 2010;2:207-13.