

Standardization of growing temperature and Bijamrita concentration for seed germination and seedling vigor in foxglove (*Digitalis purpurea* L.)

Estandarización de la temperatura de crecimiento y la concentración de Bijamrita para la germinación de semillas y el vigor de las plántulas en dedalera (*Digitalis purpurea* L.)

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ABSTRACT

Plants had been used for treating various ailments in various systems of medicine for a long time. Having varied agro-climatic conditions India has rich medicinal flora. Foxglove or tilpushpi, botanically known as *Digitalis purpurea* L. is one of the medicinally and economically important plant species due to the presence of cardiac glycosides used in life-saving medicines. Present study was carried out with different concentrations of bijamrita (an organic seed treatment) (12.5%, 25%, 37.5%, 50%, 62.5%, 75%, 87.5% and 100%) in petridish under two different temperatures *i.e.* 15°C and 25°C to assess the germination percent and seedling vigor. It was found that, per cent germination, speed of germination, mean daily germination and germination value were highest in 75% concentration and peak value and seedling vigor index I were found highest in 100% concentration under 25°C temperature whereas, seedling vigor index II was highest in 87.5%. Per cent germination, mean daily germination, peak value, germination value and seedling vigor index I were found highest under 100% of bijamrita whereas, speed of germination and seedling vigor index II were found highest in 87.5% concentration of bijamrita at 15°C temperature. Under both the temperature condition higher concentration of bijamrita *i.e.* 75%, 87.5% and 100% were found best for major traits in both the methods. So, from this experiment it can be concluded that higher concentration of bijamrita increases the germination % as well as helps in the healthy growth of seedlings.

Keywords: Biopriming, Bijamrita, Foxglove, Seed Germination, *Digitalis purpurea*

RESUMEN

Las plantas se han utilizado para tratar diversas dolencias en varios sistemas de medicina durante mucho tiempo. Al tener variadas condiciones agroclimáticas, la India tiene una rica flora medicinal. La dedalera o tilpushpi, conocida botánicamente como *Digitalis purpurea* L., es una de las especies de plantas de importancia médica y económica debido a la presencia de glucósidos cardíacos utilizados en medicamentos

que salvan vidas. El presente estudio se llevó a cabo con diferentes concentraciones de bijamrita (un tratamiento orgánico de semillas) (12,5 %, 25 %, 37,5 %, 50 %, 62,5 %, 75 %, 87,5 % y 100 %) en placas de Petri a dos temperaturas diferentes, es decir, 15 ° C y 25 ° C para evaluar el porcentaje de germinación y el vigor de las plántulas. Se encontró que, el porcentaje de germinación, la velocidad de germinación, la germinación media diaria y el valor de germinación fueron más altos en una concentración del 75 % y el valor máximo y el índice de vigor de las plántulas I se encontraron más altos en una concentración del 100 % a una temperatura de 25 ° C, mientras que el índice de vigor de las plántulas II fue mayor en 87,5%. El porcentaje de germinación, la germinación media diaria, el valor máximo, el valor de germinación y el índice de vigor de las plántulas I se encontraron más altos con el 100 % de bijamrita, mientras que la velocidad de germinación y el índice de vigor de las plántulas II se encontraron más altos con una concentración del 87,5 % de bijamrita a una temperatura de 15 ° C. . En ambas condiciones de temperatura, se encontró que la concentración más alta de bijamrita, es decir, 75%, 87,5% y 100%, era la mejor para los rasgos principales en ambos métodos. Entonces, de este experimento se puede concluir que una mayor concentración de bijamrita aumenta el % de germinación y ayuda al crecimiento saludable de las plántulas.

Palabras clave: Biopriming, Bijamrita, Foxglove, Germinación de semillas, *Digitalis purpurea*

INTRODUCTION

Foxglove botanically known as *Digitalis purpurea* is a biennial herbaceous medicinally important plant belongs to family Plantaginaceae (Annon. 2018). The plant is valued for cardenolides extracted from the dried leaves of the plant namely digitoxin, digoxin and lantaoside C which are best-known products to strengthen cardiac diffusion and to regulate heart rhythm (Patil *et al.*, 2012). Since the chemical synthesis of these cardenolides is not economically viable so, plant is the only source. At present they do not play major role in the current cardiovascular market but they play a major role in other diseases such as cancer and viral infection (Kreis, 2017). The glycosides content is about 0.2-0.4% present in the leaves (Kumar, 2010). Use of chemical fertilizers deteriorates the quality of medicinal and aromatic plants (Aishwath and Tarafdar, 2008). Seeds of foxglove being viable having low germination indicate that seeds of foxglove possess some kind of dormancy (Patil *et al.*, 2012). Various factors such as light, water, temperature and growing medium affect the germination (Gairola *et al.*, 2011). Therefore, the current study was conducted to enhance seed germination with organic seed treatment. Organic seed treatment not only enhances the seed germination and seedling quality but also protect seedling against fungal infections (Jandaik *et al.*, 2015).

MATERIALS AND METHODS

The seeds of *Digitalis purpurea* were collected from the plants grown at College of Horticulture, Bharsar (Pauri Garhwal) Uttarakhand India. The seeds were sterilized with 0.1% HgCl₂ solution for 5 minutes followed by several washings with distilled water. The surface-sterilized seeds were treated with different concentration of bijamrita and are tested for germination. The bijamrita solution was prepared by using *Palekar* method (Karuppaswamy and Perumal, 2013). The seeds were soaked with different concentrations of

bijamrita (viz. T₁- 12.5%, T₂- 25%, T₃- 37.5%, T₄- 50%, T₅- 62.5%, T₆- 75%, T₇- 87.5%, T₈- 100%) for 24 hours. The treated seeds were kept under two different temperature conditions (i.e. 15°C and 25°C) with appropriate control for both the conditions in a temperature-controlled seed germinator. The observations were recorded daily.

The data recorded was utilized to calculate the following parameters as follows:

- a) Seed Germination Per Cent (Gairola *et al.*, 2011)

$$\text{Germination Per Cent} = \frac{\text{Total number of germinated seeds}}{\text{Total number of seeds}}$$

- b) Mean Germination Time (Gairola *et al.*, 2011)

$$\text{Mean Germination Time} = (n_1 \times d_1) + (n_2 \times d_2) + (n_3 \times d_3) + \dots$$

Where, n = number of germinated seed and d = number of days

- c) Speed of Germination (Gairola *et al.*, 2011)

$$\text{Speed of Germination} = \left(\frac{n_1}{d_1}\right) + \left(\frac{n_2}{d_2}\right) + \left(\frac{n_3}{d_3}\right) + \dots$$

Where, n = number of germinated seed and d = number of days

- d) Mean Daily Germination (Gairola *et al.*, 2011)

$$\text{Mean Daily Germination} = \frac{\text{Total number of germinated seeds}}{\text{Total number of days}}$$

- e) Peak Value (Gairola *et al.*, 2011)

$$\text{Peak Value} = \frac{\text{Highest Seed germinated}}{\text{Number of days}}$$

- f) Germination Value (Gairola *et al.*, 2011)

$$\text{Germination Value} = \text{Peak Value} \times \text{Mean Daily Germination}$$

- g) Seedling Vigor Index I (Abdul Baki and Anderson, 1973)

$$\text{Seedling Vigor Index I} = \text{Seedling Length} \times \text{Germination Percent}$$

- h) Seedling Vigor Index II (Abdul Baki and Anderson, 1973)

$$\text{Seedling Vigor Index II} = \text{Seedling Dry Weight} \times \text{Germination Percent}$$

The data was analysed by analysis of variance to detect significant difference between mean at 5% probability level by using Microsoft Excel and statistical software OPSTAT. Variability in data has been expressed otherwise as mean \pm standard error (SE).

RESULTS AND DISCUSSION

Seed germination and seedling growth is greatly affected by growing conditions. The seeds grown in 20°C temperature show higher germination percent, early germination and healthy seedlings in comparison to

seed-grown under 15°C temperature. The germination percent, mean daily germination and germination value were found highest in T9 and T7 under 15°C and 20°C respectively (Table-1 and Table-2). The highest speed of germination was found highest in T7 and T8 for both the temperature condition (15°C and 20°C respectively). Seedling vigor index-I and peak value for both the temperature condition was found highest in T9 and seedling vigor index-II in T8 (Table-1 and Table 2). The results obtained signify that the favorable temperature for early and the higher germination is 20°C and higher concentration of organic treatment increases the germination percent significantly. The higher percent of bijamrita also enhances the germination in legume crops significantly (Vyankatrao 2019). Organic seed priming with cow urine results in higher germination and vigorous seedlings in compare to water as control in cluster bean and cotton (Ambika and Balakrishnan, 2015; Jayanth et al., 2017). Papaya seeds on bioprimering with cow urine enhance the plant growth by increasing seedling height, stem diameter, fresh weight of shoot and leaf area and have better result than GA₃ for these characters (Desai et al., 2017)

Table 1:- Effect of bijamrita on seed germination parameters of foxglove (*Digitalis pupurea* L.) 20°C

| Treatment | G% | MGT | SG | MDG | PV | GV | SVI-I | SVI-II |
|------------|--------------|--------------|-------------|-------------|-------------|-------------|--------------|-----------|
| T1-Control | 47.40 ± 1.96 | 244.3 ± 17.3 | 2.17 ± 0.05 | 0.98 ± 0.04 | 0.46 ± 0.04 | 0.45 ± 0.05 | 239.8 ± 12.2 | 0.39±0.01 |
| T2- 12.5% | 56.29 ± 1.48 | 322.3 ± 5.7 | 2.35 ± 0.15 | 1.16 ± 0.01 | 0.26 ± 0.04 | 0.30 ± 0.03 | 293.1 ± 6.6 | 0.25±0.01 |
| T3-25% | 62.22 ± 1.28 | 346.0 ± 6.6 | 2.88 ± 0.08 | 1.23 ± 0.01 | 0.44 ± 0.03 | 0.54 ± 0.04 | 342.4 ± 2.5 | 0.25±0.01 |
| T4-37.5% | 57.78 ± 1.28 | 323.6 ± 12.2 | 2.67 ± 0.09 | 1.09 ± 0.02 | 0.31 ± 0.03 | 0.33 ± 0.04 | 336.1 ± 5.7 | 0.43±0.03 |
| T5-50% | 70.37 ± 0.74 | 356.3 ± 2.3 | 3.48 ± 0.01 | 1.55 ± 0.04 | 0.40 ± 0.05 | 0.63 ± 0.09 | 454.3 ± 1.6 | 0.81±0.02 |
| T6-62.5% | 70.37 ± 1.95 | 350.6 ± 20.9 | 3.33 ± 0.02 | 1.46 ± 0.05 | 0.39 ± 0.06 | 0.56 ± 0.07 | 430.1 ± 6.8 | 0.65±0.03 |
| T7-75% | 83.70 ± 0.74 | 384.3 ± 4.6 | 4.59 ± 0.08 | 2.06 ± 0.08 | 0.57 ± 0.06 | 1.17 ± 0.14 | 476.9 ± 3.4 | 0.72±0.03 |
| T8-87.5% | 77.78 ± 1.28 | 384.3 ± 19.7 | 4.20 ± 0.05 | 1.94 ± 0.03 | 0.39 ± 0.06 | 0.75 ± 0.12 | 527.5 ± 7.3 | 0.99±0.02 |
| T9-100% | 77.78 ± 1.28 | 359.0 ± 5.1 | 3.97 ± 0.14 | 1.94 ± 0.03 | 0.59 ± 0.07 | 1.15 ± 0.15 | 596.8 ± 12.8 | 0.94±0.03 |
| C.D. | 4.37 | 38.7 | 0.25 | 0.12 | 0.13 | 0.23 | 23.4 | 0.07 |
| SE(m) | 1.44 | 12.8 | 0.08 | 0.04 | 0.04 | 0.07 | 7.7 | 0.023 |
| SE(d) | 2.04 | 18.1 | 0.12 | 0.06 | 0.06 | 0.10 | 10.9 | 0.032 |
| C.V. | 3.73 | 6.5 | 4.36 | 4.89 | 17.24 | 20.39 | 3.3 | 6.486 |

Values are calculated at p=0.05 level of significance

G%: Germination Per cent

MGT: Mean Germination Time

SG: Speed of Germination

MDG: Mean Daily Germination

PV: Peek Value

GV: Germination Value

SVI-I: Seedling Vigor Index-I

SVI-II: Seedling Vigor Index-II

Table 2:- Effect of bijamrita on seed germination parameters of foxglove (*Digitalis pupurea* L.) at 15°C.

| Treatment | G% | MGT | SG | MDG | PV | GV | SVI-I | SVI-II |
|------------|--------------|--------------|-------------|-------------|-------------|-------------|----------------|-------------|
| T1-Control | 49.63 ± 0.74 | 374.3 ± 15.1 | 1.55 ± 0.15 | 0.78 ± 0.01 | 0.29 ± 0.04 | 0.23 ± 0.03 | 251.01 ± 6.70 | 0.41 ± 0.01 |
| T2- 12.5% | 49.63 ± 0.74 | 384.3 ± 16.4 | 1.48 ± 0.09 | 0.81 ± 0.01 | 0.16 ± 0.02 | 0.13 ± 0.01 | 258.41 ± 4.10 | 0.22 ± 0.01 |
| T3-25% | 57.78 ± 1.28 | 435.0 ± 4.7 | 1.79 ± 0.07 | 1.00 ± 0.02 | 0.33 ± 0.03 | 0.33 ± 0.03 | 318.33 ± 11.50 | 0.23 ± 0.01 |
| T4-37.5% | 60.00 ± 1.28 | 452.3 ± 30.9 | 1.80 ± 0.05 | 0.96 ± 0.02 | 0.16 ± 0.01 | 0.15 ± 0.01 | 349.27 ± 10.30 | 0.45 ± 0.03 |
| T5-50% | 63.70 ± 1.96 | 539.0 ± 13.6 | 1.79 ± 0.07 | 0.98 ± 0.03 | 0.19 ± 0.02 | 0.19 ± 0.02 | 411.29 ± 12.80 | 0.73 ± 0.01 |
| T6-62.5% | 71.85 ± 0.74 | 596.0 ± 5.8 | 2.09 ± 0.04 | 1.11 ± 0.01 | 0.21 ± 0.03 | 0.24 ± 0.02 | 439.59 ± 9.80 | 0.66 ± 0.02 |
| T7-75% | 72.59 ± 0.74 | 555.0 ± 4.6 | 2.37 ± 0.09 | 1.18 ± 0.01 | 0.21 ± 0.01 | 0.24 ± 0.01 | 413.83 ± 9.10 | 0.62 ± 0.01 |
| T8-87.5% | 73.33 ± 1.28 | 529.0 ± 17.4 | 2.59 ± 0.06 | 1.27 ± 0.04 | 0.21 ± 0.02 | 0.26 ± 0.03 | 497.38 ± 7.80 | 0.93 ± 0.02 |
| T9-100% | 74.07 ± 0.74 | 529.7 ± 4.4 | 2.54 ± 0.11 | 1.35 ± 0.01 | 0.45 ± 0.09 | 0.60 ± 0.12 | 568.22 ± 3.20 | 0.89 ± 0.01 |
| C.D. | 3.55 | 44.156 | 0.25 | 0.06 | 0.12 | 0.154 | 27.9 | 0.04 |
| SE(m) | 1.17 | 14.603 | 0.08 | 0.02 | 0.04 | 0.051 | 9.2 | 0.01 |
| SE(d) | 1.66 | 20.651 | 0.12 | 0.03 | 0.05 | 0.072 | 13.1 | 0.02 |
| C.V. | 3.20 | 5.180 | 7.17 | 3.76 | 27.37 | 33.024 | 4.1 | 4.39 |

CONCLUSION

Temperature being an important factor for the seed germination it is important that sowing time should be selected considering the temperature during the period of germination. The low temperature conditions will lead in the late and low germination with weak seedlings. As results signify that, organic treatment had resulted in higher and early germination along with healthy seedlings. Some studies also shows that the organic priming methods are significantly better than the chemical treatments. Therefore bijamrita and other bioprimering methods provides best alternative to synthetic chemicals. So, it can be explored for further studies in order to access its impact on the productivity of the crop and its impact on cardenolides present in plant.

Author's Contribution and Competing Interests

Conducted research as a part of doctoral research and there are no competing interests.

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REFERENCES

AbdulBaki A, Andreson JD. (1973). Vigor determination in soybean seeds by different criteria. Crop Sci. 13(6): 630-633.

- Aishwath OP, Tarafdar JC. (2008). Organic farming for medicinal and aromatic plants. *Organic Agriculture*. 181-218.
- Ambika S, Balakrishnan K. (2015). Enhancing germination and seedling vigour in cluster bean by organic priming. *Sci Res Essays*. 10(8): 298-301.
- Anonymous. (2018). www.theplantlist.org
- Desai A, Panchal B, Trivedi A, Prajapati D. (2017). Studies on seed germination and seedling growth of papaya (*Carica papaya* L.) CV. Madhubindu as influenced by media, GA₃ and cow urine under net house condition. *J Pharmacogn Phytochem*. 6(4): 1448-1451.
- Gairola KC, Nautiyal AR, Dwivedi AK. (2011). Effect of temperatures and germination media on seed germination of *Jatropha curcas* Linn. *Adv Biores*. 2(2): 66-71.
- Jandaik S, Thakur P, Kumar V. 2015. Efficacy of cow urine as plant growth enhancer and antifungal agent. *Adv Agric*. 2(2): 1-7.
- Jayanth PK Chaurasia AK Bara BM. (2017). Effect of organic priming on germination and vigour of cotton (*Gossypium hirsutum* L.) seed. *J Pharmacogn Phytochem*. 6(3): 815-819.
- Karuppaswamy CD, Perumal M. (2013). Analysis of Biochemical Parameters of *Amaranthus tristis* during Seed Germination using CaCl₂, Bijamrita and Cyanospray. *Global Journal of Science Frontier Research Biological Sciences*. 10(2): 11-20.
- Kreis W. (2017). The Foxgloves (*Digitalis*). *Planta Medica*. 83: 962–976.
- Kumar N. (2010). *Digitalis*. Introduction to spices, plantation crops, medicinal and aromatic plants. Oxford and IBH publishing Co. Pvt. Ltd. New Delhi. 19.06-19.08
- Patil JG, Ahire ML, Nikam, TD. (2012). Influence of plant growth regulators on in vitro seed development and seedling development of *Digitalis purpurea* L. *The Asian and australasian journal of plant science and biotechnology*. 6(1): 12-18.
- Vyankatrao NP. (2019). Effect of Bijamrita and other organic liquid treatments on seed germination and seedling growth of legume crops. *Online International Interdisciplinary Research Journal*. 09(3):59-68.